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FORESTRY PLANNING & DEVELOPMENT PROJECT

Final Technical Feasibility Report
and
Executive Summary

(draft)

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I Executive Summary and List of Recommendations

A.Executive Summary

This report evaluates the technical feasibility of 7 activities proposed by USAID for inclusion in a $16.2 million project amendment which would extend the scope, level of funding and LOP of the current Pakistan Forestry Planning and Development Project, (FP&D), (391-0481).

All 7 activities evaluated are recommended for inclusion in the project amendment.

Five of the proposed activities represent extensions of existing project components and two activities are new components. The activities are listed below by project components as defined in the USAID project amendment concept paper. Costs shown for each component indicates additional USAID funds required in the amendment.

COMPONENT	ACTIVITY	COST $(000's)
1. Institutional and Manpower Development		
	a. Construction of provincial training facilities	1465
	b. Construction of a women's hostel	250
2. Farm and Energy Forestry Research		
	a. Construction of research facilities, training and technical assistance	4157
3. Farm and Energy forestry Operational programs		
	a. Sind demonstration program	2503
	b. Punjab demonstration program	3966
4. Operational Program Subgrants		1200
5. Integrated Forestry-watershed demonstration (Murree-Kahuta)		2429
Contingency		300
	Total	$16270

Sind and Punjab Demonstrations

Currently operational farm and energy forestry activities addressing deforestation and rural energy problems are being

implemented on private lands in the barani, on private irrigated lands in Baluchistan and on government lands in Sind. The Proposed Sind and Punjab demonstrations will extend on-farm forestry activities to irrigated private lands (6600 acres in Sind and 19800) in Punjab) increasing the demonstration effect and fuelwood production impact of the project substantially. In Punjab the project will include the 22 canal-irrigated districts and encompass about 19,000 farms. In Sind the project will be implemented in the districts of Sanghar, Jacobabad and Khairpur and include about 5250 farms. Outreach, training and nursery production programs are the principal activities in both demonstrations. These operational scale demonstrations will be implemented in both provinces by the provincial forestry departments. The agroforestry models, designed for on-farm use, are based largely on existing technology and reflect current species preferences and planting practices of some farmers in the region. These models will produce varying mixtures of fuelwood, fodder, poles and small timbers Economic analysis of these models suggests that attractive rates of return can be obtained from small woodlots and linear plantations on marginal agriculture lands. Women's participation in the project will be encouraged through recruitment of Forester's wives to be trained and work with their husbands as outreach specialists and through income generating opportunities made available to farm wives producing tree seedlings in home nurseries.

Integrated Forest-Watershed Management Demonstration in the Murree-Kahuta Region

The proposed Murree-Kahuta (M-K) demonstration is designed as an operational scale demonstration like the previously described Punjab and Sind components. The M-K demonstration will encompass 8034 acres in 5 subcatchments and include 2678 acres of private land and 5356 acres of public land. These catchments contain 22 villages and 86,000 inhabitants. It extends the reforestation and rural energy initiatives ongoing in the current project and adds emphasis to the Mission's environmental initiative by addressing the twin watershed management problems of soil erosion and slope stability. The project will be implemented by the Murree-Kahuta Development Authority, a newly formed provincial organization, given broad powers by the Government of Punjab to coordinate development in the region. Project activities will include training, outreach, nursery production and treatment of erosion and slope stability problems using vegetation and minor structural works such as ditches, checkdams etc. Agroforestry systems emphasizing fuelwood, fodder and small timber production have been combined with watershed rehabilitation measures in illustrative models for both public land and private farms. These models applied to substantial portions of the subcatchments will have a significant impact on overall fuelwood productivity and watershed stability. An economic

evaluation of these models shows their internal rates of return to be low, less than 2.5 percent. This is a result of the $120.00 per acre watershed rehabilitation cost included in each model. Given the environmental objectives of the demonstration, those would seem acceptable. In the same manner as described above in the Sind an Punjab demonstrations, women's participation will be encouraged in the M-K program.

Construction of Provincial Training, and Research Facilities and a Women's Hostel at PFI

Institutional and Manpower Development are important aspects of the present project and need to be emphasized in the project amendment.

Construction of small 10-scientist forestry research laboratories in the provinces of Sind, Baluchistan and the provision of additional technical assistance and commodities to all four provinces and PFI will add badly needed additional capability in the area of forestry research. Because of the shortage of well trained forestry scientists and the proposed development of new facilities, the long term training component for advanced degrees has also been augmented. The 11 advanced degree recipients programed under the current project are insufficient in numbers and skills to meet the research needs and goals established under the project.

Provincial training programs needed for the current and proposed operational components require improved facilities, and additional commodities to give the outreach program personnel adequate inservice training and motivation. Hostels and small classroom centers will be constructed in Baluchistan, Sind and Punjab provinces to provide the needed capability and lend focus to the inservice training programs. These facilities will permit the delivery of quality outreach training programs to the project personnel on a continuing basis throughout the LOP. Skills learned/enhanced in these programs, e.g. communication, nursery management, extension methods, and the opportunity to share ideas and provide motivation are critical to the overall project success.

Opportunities for women will be enhanced in the project's operational components by the recruitment of women foresters to serve as outreach specialists and by the provision of money generating activities such as seedling production in home nurseries. Opportunities for professionally trained women presently now occur primarily in the area of research where they serve as scientists or laboratory workers. To encourage consideration an enlarged roles for Pakistani women, specifically as forest officers, a 15-person hostel will be constructed on the PFI campus for th exclusive use of women. Women research workers and foreign female students now attending PFI will be the initial beneficiaries of this

initiative. But it is hoped that the provision of culturally acceptable housing, providing a high degree of personal security will, remove one of the impediments to recruitment of professional women in forestry.

Operation Program Grants to NGO/PVOs

Operational Program Grants (OPGs) offer an opportunity to encourage NGO/PVOs to address environmental concerns complimentary to USAIDs program objectives. A stratified survey of 10 NGO/PVOs in Pakistan suggests that there are organizations which have potential for work in the environmental-conservation field but most have limited experience. This OPG component will seek to work with interested NGO/PVOs using the Technical Assistance Team and providing initial short-term technical assistance to prepare grant proposals which after USAID review would be implemented by the grantee. This component will broaden the scope of environmental issues which can be addressed under the project.

Implementation

Support for the above activities would be provided by the technical assistance team. The present team would require two additional long-term expatriot personnel and 2 Pakistani nationals.

B. List of Recommendations

Component 1: Institutional and Manpower Development

A. Women's Hostel

1. Construct a hostel for women at the Pakistan Forest Institute (PFI) to provide a culturally acceptable residence (a) to encourage the recruitment of women into the professional forestry officer cadre and (b) provide comfortable and secure housing for women research workers and foreign women students now enrolled.

2. Assure that the hostel can effectively serve the needs of women for privacy and security, by requiring a covenant providing for the exclusive use of the facility by women students, employees, visiting faculty, or guests for a period of 10 years or more or until USAID agrees to a change in usage.

3. Utilize the services of a woman architect in the planning and design phase of the project construction of a women's hostel will complement other efforts to improve the professional education of forestry officers. It will also facilitate women's use of the additional classrooms proposed for construction to enhance inservice and other training.

B. Construction/Improvement of Training facilities

1. Construct a 10-room hostel and classroom center at or near Quetta to provide facilities for inservice training. It is recommended that the facility be a part of a small administrative research and training complex. A small 10-person research station has also been recommended. Location of the CCF's offices, the hostel and classroom center and research offices in the same area will facilitate the use of operational and research personnel in the training program.

2. Construct a 20-room hostel and classroom center at Gotwala (near Faisalabad) in the Punjab to provide facilities for inservice training. This facility would be associated with the new laboratory constructed by the Government of Punjab and would encourage the participation of Forest Department scientists and faculty from Faisalabad University in the training programs.

3. Construct a 20-room hostel and classroom center at Hyderabad or another suitable location. The center should be near the proposed research facility also

proposed for Hyderabad (see Appendix I p. 13 for further discussion)

Component 2: Farm and Energy Forestry Research

This section contains recommendations on research facilities training and technical assistance. Additional background on these recommendations appears on pages 10 - 13 of Appendix I.

A. Facilities

1. Baluchistan

A small 10-scientist research office-laboratory complex should be constructed in or near Quetta in conjunction with the CCF's offices. The small research station planned by the GOP for Nasirabad can serve effectively as a satellite station for the Quetta facility.

2. N.W.F.P.

Additional construction for research is not recommended at this time; commodity and technical assistance is recommended to support the small research laboratory at D.I. Khan scheduled for construction by the GOP (PC - 1, p. 5). This laboratory will function as a satellite station to the National Laboratory, PFI, at Peshawar.

3. Punjab

A library and data processing facility for research purposes along with supporting commodities and technical assistance are recommended. The new research station just constructed by the Government of Punjab at Gotwala is of moderate size but sufficient to meet laboratory and office requirements for some years.

4. Sind

Construction of a 10-scientist research laboratory is recommended for Hyderabad or another suitable urban location. New construction at Miani is not recommended because of the threat of dacoits and the lack of adequate schools for the scientists families. The small research building at Miani, now being remodeled by the GOP, can function as a satellite field station.

B. Training

1. Augment the present plan (11 trainees) by adding 20 additional trainees, 10 at the Phd level and 10 at the M.Sc level. Recruitment of agricultural scientists already having doctorate level training in appropriate

fields, e.g. extension, statistics, economics, should also be pursued to increase the total number of additional scientists to 30 or more.

2. Give priority to candidates pursuing degrees in social and quantitative sciences as well as areas more directly supporting FP & D.

3. Establish 20 6-month internships at U.S. forestry institutions affiliated with USDA-FS Forestry Experiment Stations which would permit M.Sc level Pakistani scientists to study statistical and research methods and participate in operational research planning and reviews with fellow US scientists.

4. Provide at least 5 workshops for 40 or more scientists in such areas as applied economics, rural sociology, and outreach, as well as in computer modeling and statistical and economic analysis.

C. Technical Assistance

a. Provide 8 scientists for 1.5 months each to work with Pakistani counterparts to develop and deliver workshops on social science and quantitative research methods.

1. Provide five 2-scientist facility planning teams to PFI and the 4 provincial research stations.

2. Provide support for graduate research and return travel to Pakistan and provide a consultancy for their US advisors to visit the student's home research institution.

D. Commodities

Provide:

1. 10 additional vehicles to facilitate scientist access to field plots.

2. 12 additional computers to encourage use of quantitative methods in research design and analysis.

3. library equipment and technical publications to permit scientists to keep abreast of developments in their fields.

4. furnishings for new laboratories to permit state-of-the-art experiments.

Component 3: Farm & Energy Forestry Operations.

A. Sind

1. A forestry demonstration project on irrigated private lands in Sind is recommended to show the economic and biological feasibility of silvicultural systems producing fuel wood, fodder and other specialized forest products for established regional markets.

2. Silvicultural systems detailed in Appendix I are recommended as alternative cropping systems for farmland where (1) water for irrigation is limited so that a farmer's entire acreage cannot be put under agricultural crops and (2) soils are marginal for agricultural production.

3. The project area should be limited to the districts of Sanghar, Jacobabad and Khairpur and encompass approximately 6600 acres of private irrigated farmland.

4. A minimum of 5250 farms in 210 (10 percent) villages throughout the three districts should be included in the demonstration. This is about 2.5 percent of all farms within irrigated districts. Plantation sizes should nominally range from 0.5 to 1.5 acres.

5. Farmers meeting predetermined qualifications (interest, land and water availability) should be provided with appropriate technical information and free seedlings and encouraged to adopt one of the plantation models illustrated in the preceding analysis. The primary incentive for participation in the program should be the anticipated return from the sale of the crop, not "upfront" subsidies in the form of materials or services provided.

6. The project should be implemented by the Sind Forestry Department in an outreach program. A substantial training program is recommended for forestry personnel to enhance organizational, communication and other outreach skills. The Department should be encouraged to adopt the use of husband and wife farm forestry teams as a mechanism for reaching farm wives. USAID should underwrite the per diem costs of training the new female farm foresters. Motorcycles or scooters should be provided to as many farm foresters as possible to increase their efficiency and effectiveness.

7. On-farm seedling production by farmer's wives should be encouraged as a means of providing supplemental income for farm families. The Forestry Department should provide training, supplies and guaranteed sales

of seedling production to encourage this private sector participation as a part of the outreach program.

8 Alternatives to traditional methods of planting seedlings, such as direct seeding, should be studied immediately. Direct broadcast seedling methods now used by farmers planting hurries appear to have been effective and certainly have economic merit.

9. Responsibility for coordinating the previously proposed research program, training activities and the above described operational program should rest with the CCF, Sind.

10. Motivators should be employed to increase the spread effect of the program and to enhance the communication impact of the outreach foresters. The motivators should be paid a monthly wage for about a 2-year period.

B. Punjab

1. A forestry demonstration project on irrigated private lands in the Punjab is recommended to show the economic and biological feasibility of silvicultural systems producing fuelwood, fodder, small timbers and raw materials (leaves) for sericulture.

2. Silvicultural systems based on small woodlots or line/courtyard plantings are recommended for farmland where (1) soils are marginal for agricultural production due to salinity and/or waterlogging or (2) lands are not currently in production.

3. The project area should include the 22 canal-irrigated districts and encompass approximately 19800 acres of private irrigated farmland.

4. About 19,000 farms in 1900 villages throughout the irrigated districts should be included in the demonstration. This is about 1.0 percent of all farms within the irrigated districts. Acreage should nominally range from 0.5 to 1.5 acres.

5. Farmers meeting predetermined qualifications (interest, land and water availability) should be provided with appropriate technical information and free seedlings and encouraged to adopt one of the plantation models illustrated in the preceding analysis. The primary incentive for participation in the program should be the anticipated return from the sale of the crop not "upfront" subsidies in the form of materials or services provided. Rewards in the form of prizes for the best quality seedlings, the greatest or

fastest rate of tree growth etc. as used in the Punjab's previous planting programs should be continued for both incentive and publicity.

6. The project should be implemented by the Extension and Publicity Wing of the Punjab Forestry Department as an outreach program. While personnel in the Wing have experience in outreach, additional training is recommended to further enhance organizational, communication and other outreach skills. The Department should be strongly encouraged to adopt the use of husband and wife farm forestry teams as vehicles for reaching farm wives. USAID should underwrite the costs of recruiting and training the new female farm foresters. Motorcycles or scooters should be provided to farm foresters to increase their efficiency and effectiveness.

7. On-farm seedling production by farmers' wives should be encouraged as a means of providing supplemental income for farm families. The Forestry Department should provide training, supplies and guaranteed sales of seedling production to encourage this private sector participation as a part of the outreach program.

8. Special care should be taken to assure the production and distribution of vigorous young seedlings. Older, larger, planting stock is frequently less vigorous and certainly more costly to produce. Farmers should be encouraged to try closer spacings (consistent with economics of seedling costs) to enhance the fuelwood volumes resulting from thinnings.

9. Responsibility for coordinating the previously proposed research program, training activities and the above described operational program should rest with the CCF, Punjab

10. Success of this project will generate substantial new volumes of forest products. Farmers will be seeking markets and distribution channels within a few years. And they will be seeking to fill the markets for the higher value products. Based on experience in other countries as much as 50 percent of the timber volumes produced may go to the small timber, pole, pulpwood etc. markets. It is imperative that these markets be analyzed and developed early in the program so that the momentum established in the outreach and production phase is not lost due to lack of market opportunity. Exploitation of farmers in a glutted buyer's market is a sure recipe for failure.

11. Motivators should be employed to increase the spread effect of the program and to enhance the

communication impact of the outreach foresters. The motivators should be paid a monthly wage for about a 2-year period.

Component 4: Operational Program Subgrants

1. Operational Program Grants (OPGs), or subgrants to promote forest conservation practices and public awareness, are recommended for inclusion in the project amendment.

2. The grant program should be overseen by the Technical Assistance Team (TAT) with the bulk of the effort provided by the grantee supplemented by short-term technical assistance, as necessary, in the design phase.

3. TAT expertise should be augmented on a short-term basis with an individual who has extensive experience in working with NGO/FVOs and preferably knowledge of environmental issues and organizations in Pakistan.

Component 5: Murree-Kahuta Integrated Forest Watershed Management Demonstration.

1. Integrated forestry-watershed management demonstrations should be implemented on 5 subcatchments, totaling .8034 (2678 private, 5356 public) acres, in the Murree-Kahuta area. This includes 3 watersheds in Murree and 2 in Kahuta.

2. Demonstration programs should be implemented only on subcatchments where the probability of major slope failure is small and the residents show willingness to participate in substantial numbers (50 percent or more).

3. An analysis of slope hydrology and stability and a comprehensive rehabilitation plan should be made for each subcatchment prior to the initiation of conservation activities. The analysis and the plan should:

a. determine the general extent of soil and slope stability, hydrologic and land use problems, needed treatments and their probable effectiveness and

b. estimate the willingness and ability of farmers and union councils to participate individually and collectively in the program.

4. Soil and slope stabilization measures in the form of revegetation and minor structures should be applied to

reduce existing and potential damage within each catchment.

5. The demonstration should be implemented by the Murree-Kahuta Development Authority. The Authority should as a condition precedent develop a staffing plan showing that appropriate numbers of staff can be obtained from cooperating agencies or by direct hire.

6. Limit incentives to free technical assistance and seedlings and up to 10 fruit trees per farm or, in Model 2, one or two stock reservoirs per village.

7. Include income generation opportunities for farmers wives through home nursery production programs.

8. Involve women in the operational program (by recruiting the wives of Forest Department Foresters assigned to the program) as foresters working as outreach specialists. Provide per diem costs for women forester trainees.

II. Introduction

The purpose of this report is to evaluate the technical feasibility of various activities or components proposed by USAID for inclusion in a project amendment which would extend the scope, level of funding and LOP of the current Pakistan Forestry and Development project (FP&D) (391-0481).

At the suggestion of the Mission, the report has been organized by project components as presented in the Mission's concept paper. Components 1-3, Institutional and Manpower Development, Farm and Energy Foresty Research and Farm and Energy Operational Programs are part of the existing FP&D project and activities discussed under these headings are viewed as complimentary extensions of the current program. Components 4 and 5, Use of Operational Program Subgrants and Integrated Forestry-Watershed Management Demonstration in Murree-Kahuta, are new initiatives. If implemented, they would compliment the current project activities and increase the breadth of environmental protection issues which could be addressed.

The report utilizes information and recommendations compiled by the FP&D Amendment Design Team, contained in Appendixes I, II, and III. Recommendations in this report are those of the Design Team Leader, Dr. G. H. Belt. Appendix IV contains tabular summaries of budget and cost information derived from the team reports, USAID and other sources. These tables were compiled from spreadsheets using Lotus 123 and are available on diskettes.

III COMPONENT 1: INSTITUTIONAL AND MANPOWER DEVELOPMENT

A. WOMEN'S HOSTEL AT PFI

1. Current Project Activity

An important aspect of the FP&D project is to encourage the participation of women in forestry activities and mobilize them to help reverse the deforestation and rural energy problems now facing Pakistan. To date, little tangible progress has been made in this direction.

2. Recommendations:

a. Construct a hostel for women at the Pakistan Forest Institute (PFI) to provide a culturally acceptable residence (a) to encourage the recruitment of women into the professional forestry officer cadre and (b) provide comfortable and secure housing for women research workers and foreign women students now enrolled.

b. Assure that the hostel can effectively serve the needs of women for privacy and security, by requiring a covenant providing for the exclusive use of the facility by women students, employees, visiting faculty, or guests for a period of 10 years or more or until USAID agrees to a change in usage.

c. Utilize the services of a woman architect in the planning and design phase of the project.

Construction of a women's hostel will complement other efforts to improve the professional education of forestry officers which to date has included shortcourses, overseas training for faculty, introduction of computers, and assistance in curriculum development. It will also facilitate women's use of the additional classrooms proposed for construction to enhance inservice and other training.

3. Rationale

Institutional and manpower development is a key component of the current FP&D project and should continue to be emphasized in the project extension. The construction of a women's hostel at the Pakistani Forest Institute constitutes a small but significant step in increasing the opportunity for women to enter the professional officer ranks of forestry. Further it will assist the small number of Pakistani women now employed by PFI as research workers and foreign women students now enrolled for training at the institute. While as discussed below, construction of a women's hostel will not remove all barriers to their

enrollment, it could help provide focus and momentum to increased involvement of women.

Under the proposed project extension women's involvement will be enhanced at the local level as described in component 3 by enabling farm women to earn extra income through the production of seedlings and recruiting the wives of male foresters to also be trained as foresters and work with their husbands as outreach specialists. Because of Islamic customs, male forestry personnel are restricted in their ability to communicate with rural women as part of outreach activities. Increasing opportunities for women at the professional level will provide role models for sub professional women officers and ultimately facilitate forestry department communication with rural women.

4. Technical Analysis

The Pakistani Forest Service has traditionally been a male profession since its formation after Partition. Several women now serve as research workers at PFI but no women have been trained or are currently in training as forest officers. While there are no legal constraints to women becoming forest officers, a combination of educational, employment and cultural factors combine to reduce the opportunity for women to join the profession.

a. Educational Requirements

To join a provincial forest department as an officer, a candidate must possess a BSc degree, pass qualifying examinations and then be nominated by the provincial government for training at the federally operated Pakistan Forest Institute located in Peshawar. There are adequate numbers of female BSc graduates so that this requirement is not a problem. Physical training as a part of the MSc program is theoretically a problem for women. However there are women with adequate upper body strength and endurance to meet these requirements. But a more practical approach would be to modify these requirements as has already been done for women entering the security services.

b. Employment

The required number of Professionally trained foresters is relatively small. There essentially is no private sector market for trained foresters in Pakistan and given the size (approximately 1200) and rate of turnover among the current federal and provincial cadre of forest officers, the public sector demand is low. Much of the recent increase in personnel has been as a result of the need to staff programs supported by donor agencies. Thus given the relatively few officers nominated by the provincial governments and entering the PFI program each year, normally about 20,

there is no difficulty in finding interested candidates. This is not surprising in a country with serious unemployment and underemployment problems and more than sufficient numbers of BSc degree holders, male and female.

C. Culture

(1) Attitudes of Male Professionals

Informal discussions with federal and provincial officers regarding the recruitment of women suggests most forest officers accept in principle the concept of women as forest officers, but feel that their recruitment is premature at this time. Frequently raised arguments against women as forest officers is the the need for forester officers to travel and work in remote locations, physical demands of the job, lack of acceptance by other men of women in this role, lack of facilities, lack of women candidates and the unwillingness of provincial governments to nominate women. Some of these same officers suggest that women could fill roles in research.

Discussions at FFI suggest that (1) if women were nominated by the provincial governments that they would be accommodated and (2) there would probably be greater and more rapid acceptance of women as research officers than as operational personnel.

(2) Facilities

The accepted standard for women's housing facilities at Pakistani institutions of higher learning is a separate hostel for women. While as pointed out in Appendix III, there are hostels for women at the Peshawar University which adjoins FFI and in Peshawar City, these residences are "off-campus" and require a substantial walk from FFI to the University and some form of public transportation for access to hostels within the city. As a matter of custom and personal safety women in Pakistan prefer not to travel alone. As a matter of efficiency a women's hostel on the FFI campus is desirable. As a matter of security in an area which is virtually an armed camp as a result of the war in Afghanistan and the heavy influx of male combatants and refugees, a hostel is a necessity.

D. Summary

From the above discussion it is clear that construction of a hostel will not remove all constraints to the movement of women into the forest officer cadre. Yet it could encourage movement in this direction by providing a focus for women's activity and involvement on campus. The present role of women researchers and the presence of foreign women forestry students if nurtured could well raise expectations and

underscore the question of why Pakistani women were not enrolled as officer trainees. It should also increase the attractiveness of PFI employment to women research workers. Provision of the women's hostel at this time could be a key step in establishing a role for women at PFI. It is a view of the proverbial glass of water as half-full while failure to do so takes the half-empty perspective.

5. Implementation

Design and construction of a women's hostel should proceed as rapidly as possible. It is important that the architect meet with women already on campus and determine their specific needs as to type of accommodations. Use of a woman architect would be an advantage, or alternatively, employment of a female short-term consultant to make initial contacts and facilitate discussions between women now on campus, PFI faculty and a male architect would be desirable. Selection of an appropriate location on the PFI campus is particularly important both as a matter of convenience and propriety. The standard hostel arrangement of rooms plus communal dining may not be appropriate or practical for a small number (approximately 15) of women. A number of "efficiency" apartments, consisting of bedrooms with cooking facilities and a bath shared between two apartments, might be more suitable, for example.

To assure that the hostel can effectively serve the needs of women for privacy and security, a covenant should be required providing for the exclusive use of the facility by women students, employees, visiting faculty, or guests for a period of 10 years or more or until USAID agrees to a change in usage.

6. Budget

A total of $250,000 has been budgeted for a 15-person hostel. This amount should be adequate, however, if after the design phase, it is determined that additional funds are desirable, these should be made available from contingency funds.

B. Construction & Improvement of Provincial Training Facilities

1. Current Project Activity

Training programs are currently underway in support of FP&D project activities in barani areas in Sind. The Mid-Term Evaluation Report (August 1987) underscores the need for outreach training and states that "some of the outreach/training tasks forseen...are on target and laudable." The report recommends that TAT efforts focus on planning and training of trainers rather than organization and conduct of training courses and programs. In terms of physical facilities, the project is supporting the construction of a hostel for male students at the Pakistan Forest Institute, (PFI), and has been asked to provide funds for additional classrooms at the same institution. USAID has provided computers, vehicles, laboratory equipment and other commodities to PFI and the provincial research organizations in support of training and research.

2. Recommendations

1. Construct a 10-room hostel and classroom center at or near Quetta to provide facilities for inservice training.

It is recommended that the facility be a part of a small administrative research and training complex. A small 10-person research station has also been recommended. Location of the CCF's offices, the hostel and classroom center and research offices in the same area will facilitate the use of operational and research personnel in the training program.

2. Construct a 20-room hostel and classroom center at Gotwala (near Faisalabad) in the Punjab to provide facilities for inservice training.

This facility would be associated with the new laboratory constructed by the Government of Punjab and would encourage the participation of Forest Department scientists and facilities from Faisalabad University in the training program.

3. Construct a 20-room hostel and classroom center at Hyderabad or another suitable location. The center should be near the proposed research facility also proposed for Hyderabad (see Appendix I, page 13 for further discussion).

3. Rationale

Operational programs currently underway in the FP&D project and the three additional operational scale demonstrations proposed in this amendment require effective outreach personnel. This requirement can best be met through the development of quality training, personnel, programs and facilities. Provision for inservice training, further curriculum developmenet and training of trainers is included under the technical assistance components of the operational programs for Sind, Murree-Kahuta and Punjab. Further discussions of training needs and programs can be found in Appendix III, pages 10-22. This component addresses the need for physical plant which will provide capability and incentive for further evolution of training programs.

4. Technical Analysis

Existing facilities for inservice training, where they exist, are deficient in quality and capability and are presently used for other types of professional training, making scheduling a problem. In several cases the existing facilities are not centrally located. Obtaining qualified and motivated instructors who are available is frequently a problem. Use of private sector facilities is realatively expensive and does not provide a program focus conductive to evolution of continuing annual training cycles. The establishement of training staff and training facilities gives momentum to continuation of such programs.

To keep training in the mainstream of operational activity, the training hostels and classroom centers should be located with the research facilities and/or in conjunction with the provincial administrative offices. This will also help ensure avaliability of staff since research and operational personnel would also be available to augment the instructional staff.

The hostels and classroom centers proposed are scaled to anticipated needs. For example, the smaller 10-person hostel recommended for Baluchistan reflects the smaller number of personnel in that province. Also, it should be recognized that the proposed centers will be designed for various uses in addition to outreach training. They will also provide a basis for conferences and various kinds of professioal training courses and seminars. Funding provided is adequate for construction of quality buildings. The hostels and classrooms are not intended to provide luxury, but comfort adequate to productive training and personal motivation. An illustrative budget showing space and costs for a 20-room hostel appear in Appendix IV, Table 9.

5. Implementation

a. Technical Assistance

Technical assistance required should be provided by the TAT augmented by a Pakistani architect/engineer. The architect/engineer should be hired by the TAT for a period of two years to work on both the training and research facilities in cooperation with USAID A/E staff. This work should begin as soon as possible with funding coming from the current FD&D budget.

b. Training

No training is recommended in relation to the construction.

c. Commodities

Commodities to furnish and equip the hostel and training center are included in the operational program commodities list (Appendix IV) for Punjab Table 7E, for Sind Table 6E and for Balushistan Table 10.

6. Budget

Costs for the training centers and furnishings are shown in Appendix IV, Table 4.

IV. Component 2: Farm & Energy Forestry Research; Research Facilities

A. Relationship to Current Project Activity

Research identified in the FP&D PP focuses on farm and energy problems in the areas of economics, sociology and anthropology and farm-forestry (agroforestry) systems. The goal of the research component is to identify alternative "approaches to enhancing agricultural productivity through on-farm tree crop management". Of the total $1.7 million programmed for research, $164,000 or less than 10 percent, was allocated operational research. Emphasis was placed on training ($ 404,000), expatriate technical assistance ($1.1 million) and purchase of commodities. No monies have been expended for construction of laboratories by USAID.

B. Recommendations

This section contains recommendations on research facilities, training and technical assistance. Additional background on these recommendations appears on pages 10-13 of Appendix I.

1. Facilities

a. Baluchistan

A small 10-scientist research office-laboratory complex should be constructed in or near Quetta in conjunction with the CCF's offices. The small research station planned by the GOP for Nasirabad can serve effectively as a satellite station for the Quetta facility.

b. NWFP

Additional construction for research is not recommended at this time; commodity and technical assistance is recommended to support the small research laboratory at D.I. Khan scheduled for construction by the GOP (PC-1, p. 5). This laboratory will function as a satellite station to the National Laboratory, PFI, at Peshawar.

c. Punjab

A library and data processing facility for research purposes along with supporting commodities and technical assistance are recommended. The new research station just constructed by the Government of Punjab at Gotwala is of moderate size but sufficient to meet laboratory and office requirements for some years.

d. Sind

Construction of a 10-scientist research laboratory is recommended for Hyderabad or another suitable urban location. New construction at Miani is not recommended because of the threat of dacoits and the lack of adequate schools for the scientists' families. The small research building at Miani, now being remodeled by the GOP, can function as a satellite field station.

proposed objectives

10 (3) Feasibility of proposal in terms of time, personnel, funds, skills, etc. to meet the proposed objectives.

40 (4) Recommendations of USAID funded design team based on experience with NGO/PVO in developing concept paper.

Proposal Criteria

Criteria for the final proposal are those listed for tl concept paper but with the weights shown below

Weight	Criteria
30	1
20	2
40	3
10	4

4. Technical Assistance

The program has been designed to minimize the need for direct USAID technical assistance. Ten months of technical assistance is anticipated to cover the design and evaluation, steps 1,2 and 6. If the Mission desires assistance in step 4, proposal evaluation, and an additional 2 months may be required. Maximum technical assistance requirements are 12 mos.

The design team should have two persons providing expertise in the areas of NGO/PVO organization and management, and natural resource management/forestry. An /ironmentalist/generalist is not recommended for the latter osition unless their training includes a degree in some ea of resource management, e.g., forestry, range or atershed management.

Training

aining is not anticipated except through the informal interaction of consultants and NGO/PVO staff in step 1. However, training will likely be a part of the grant program and defined in the proposals received.

5. Commodities

Commodities may be authorized under the grants subject to USAID procurement regulations, but are expected to be less than 10 percent of grant costs.

VII. Component 5: Integrated Forestry-Watershed Management Demonstration in Murree-Kahuta

A. Relationship to Current Project Activity

The Murree-Kahuta (M-K) demonstration is a logical extension of the reforestation and rural energy initiatives ongoing in the barani and proposed in component 3 for irrigated private land in Sind and Punjab. These components and the M-K demonstration have common activities, e.g. training for outreach staff, outreach, nursery construction and seedling production, use of motivators, etc. An important difference is that the land to be treated in the Murree region is mountainous with a high degree of slope instability. Land treated in the other components is either rolling or flat in the case of the irrigated areas. The extension of the project to steep slopes and the introduction of the watershed rehabilitation activity requires that the catchment be treated as a unit and activities planned in it on a unit basis. This in turn requires a high participation level and added cooperation between the implementing agency, farmers and Union Councils which is not required in the activities on flater lands. A second difference between the M-K demonstration and other components is use of a broader based, but newly formed implementing agency, the M-K Development Authority.

B. Recommendations:

1. Integrated forestry-watershed management demonstrations should be implemented on 5 subcatchments, totaling 8034 (2678 private, 5356 public) acres, in the Murree-Kahuta area. This includes 3 watersheds in Murree and 2 in Kahuta.

2. Demonstration programs should be implemented only on subcatchments where the probability of major slope failure is small and the residents show willingness to participate in substantial numbers (50 percent or more).

3. An analysis of slope hydrology and stability and a comprehensive rehabilitation plan should be made for each subcatchment prior to the initiation of conservation activities. The analysis and the plan should:

a. determine the general extent of soil and slope stability, hydrologic and land use problems, needed treatments and their probable effectiveness and

b. estimate the willingness and ability of farmers and union councils to participate individually and collectively in the program.

4. Soil and slope stabilization measures in the form of revegetation and minor structures should be applied to reduce existing and potential damage within each catchment.

5. The demonstration should be implemented by the Murree-Kahuta Development Authority. The Authority should as a condition precedent develop a staffing plan showing that appropriate numbers of staff can be obtained from cooperating agencies, or by a direct hire.

6. Limit incentives to free technical assistance and seedlings and up to 10 fruit trees per farm or, as in Model 2, one or two stock reservoirs per village.

7. Include income generation opportunities for farmers' wives through home nursery production programs.

8. Involve women in the operational program (by recruiting the wives of Forest Department Foresters assigned to the program) as foresters working as outreach specialists. Provide per diem costs for women Forester Trainees.

C. Rationale

Soil erosion and slope instability due to removal of timber, cultivation of unstable slopes and overgrazing are critical environmental problems in the hill regions of the subcontinent. Hence integrated forestry and watershed treatments which are successful in the Murree-Kahuta region should in principle have wide application.

The Murree-Kahuta (M-K) region is a net importer of fuelwood; shortages are so pressing that the government presently transports fuelwood from the plains to supply the local population and relieve pressure on the grossly overused residual forests. Labor is scarce in the region due to the absence of males working in the Middle East and Europe. This has increased the feasibility of extensively managed forest crops which provide fuelwood, fodder, poles and timbers in agroforestry systems. The area is also subject to severe landslides and soil erosion and has been since the colonial period.

The M-K demonstration is a new component for the FP&D project, which addresses these problems and builds on outreach, training and technical forestry experience gained from the existing project activities now in progress in the barani region. It addressses the same project goals of energy self-sufficiency and reversal of deforestation as the current project and adds considerable emphasis to environmental protection through the integrated forestry-watershed management approach.

D. Technical Analysis

1. Major Slope Stability Problem

The Murree area has steep topography with slopes approaching 100 percent in some areas. River channels are deeply incised and flows from heavy seasonal rainfalls periodically erode the base of slopes creating major slope instability in some subcatchments. This natural situation has been exacerbated by overgrazing, removal of timber, construction of roads

and other human activities. Since the colonial period these activities have reduced the natural ability of slopes to handle rainfall and caused substantial losses of soil and increased slope instability. As a result, there are periodic tragedies due to massive landslides which involve costly losses of life and property. Solution of these major slope instability problems, which occur only in some catchments, is beyond the scope of this project. Addressing these problems would require heavy investment, engineering structures and changes in land use, and the outcome would even then be questionable.

2. Problem Addressed

The problem to be addressed in this demonstration is that of deforestation and environmental degradation caused by loss of vegetative cover and surficial problems of soil and slope stability which also contribute to the fuelwood shortages previously noted. The goals of the M-K demonstration are two fold:

a. demonstrate the effectiveness of selected agroforestry treatments particularly in the production of fuelwood, fodder, poles and small timbers.

b. reduce the general level of environmental degradation through watershed treatments such as revegetation, stabilization of minor slumps and drainage improvements to trails and roads.

For the demonstration, five subcatchments were identified using criteria listed in Appendix II, page 9. The five subcatchments for the program encompass a total area of 8708 acres and range in size from 600 to 3324 acres. The watersheds average 30 percent in private ownerships, include 31 villages and 86,000 people.

Land in these catchments is a mixture of bare land, low brush and trees, small agricultural fields, orchards and terraced pasture land. There are also stands of trees varying from a few acres to several hundred acres, mostly on the steeper upper slopes.

3. Agroforestry Models

As detailed in Appendix II, pages 14-20, five models covering both private and public land ownerships have been formulated to illustrate possible treatments.

Model 1, for example proposed for the 1500 acre Tret-Ghorgali watershed in Murree, prescribes for private landowners having areas as small as 1/8 of an acre, block plantations of broad leaved species planted in a 3' x 3' spacing on a 10 year rotation. For adjoining public lands, block plantations planted 6' x 6' would be managed on a 50 year rotation by the forest department. Farmers would be encouraged to control grazing for the first three years of the project in return for access to improved fodder supplies on the public lands, seedlings supplied by the forest department and assistance in watershed rehabilitation. In contrast, Models 4 & 5 are agroforestry systems utilizing row or boundary plantings with fruit or vegetable crops.

Species for these models will be selected primarily from those naturally occuring in the area. These would include black locust (Robinia pseudo acacia), willow (Salix), deodar (Cedrus), Mulberry (Morus alba) and at lower elevations Albizzia procera. Eucalyptus camaldulensis would also be considered for the lower elevations.

4. Nursery & Seedling Production

Annual requirements for nursery stock are shown in Appendix II, page 22. An estimated 20 million seedlings will be provided in 10 nurseries operated by the M-K Authority over the 5-year LOP. An objective of the outreach program is to encourage farmers' wives to raise seedlings for sale at guaranteed prices. This will be encouraged as a means of income generation (see Appendix II, page 46). Production targets for the Authority nurseries would be decreased proportionally as expected levels of production from private nurseries increased.

5. Watershed Rehabilitation

Watershed treatments on public land would consist of erosion control measures, such as correction of minor drainage problems on trails or roads and channel improvements, e.g. bank stabilization through plantings. Limited treatment of surficial land slopes at key locations would also be undertaken. Rehabilitation treatments on public land are expected to average Rs. 2000/acre. Private landowners would be given technical advice on erosion control and drainage improvements and receive free seedlings. An average of 2000 Rs. per acre would also be available for watershed treatments on private land as prescribed in the comprehensive subcatchment plan. A total of 1 million dollars has been budgeted for watershed rehabilitation for the five demonstration watersheds.

. Economic Analysis

An economic analysis for the five models is summarized on pages 8-30 of Appendix II. Internal rates of return for these models were low, less than 2.5 percent for models 1, 2 and 3 and almost 12 percent for models 4 and 5, where land rent was inappropriate. Considering all models carried the 2000 Rs./acre cost for watershed rehabilitation measures, these rates are considered acceptable given the environmental demonstration objective of the project.

. Implementation

The outreach, nursery and rehabilitation programs will be implemented by the M-K Development Authority using personnel assigned to the Authority from other agencies or employed directly. Staffing requirements are listed in Appendix III, page 20.

1. Technical Assistance

Technical assistance required by type of expertise and year is shown in Appendix IV, Table 8D. Consultants brought to work on this project e.g., nursery specialists, economists, social scientist/outreach specialists etc. could also be utilized on the existing barani programs and the Sind and Punjab demonstrations. Expertise in slope stability/geology and hydrology may be used for other components but are needed primarily for the M-K demonstration. Funds for technical assistance are available from existing project funds. The total technical assistance requirement is 24 person months over 3 years.

2. Training

Inservice training required to implement the M-K demonstration is shown in Appendix IV, Table 8C. Note that the initial training period is longer and followed by shorter annual training cycles. These programs will be used principally to build expertise in outreach methods, review problems encountered in the field and introduce new technologies. Initial year training might also include verbal communication skills, audio visual techniques, an introduction to rural sociology and survey methods. Regular Forest Department courses will be used for women who are to be trained as foresters. USAID will provide per diem costs for this training. A total of 20 motivators will also be provided training annually to increase their effectiveness.

3. Commodities

Commodities required for the program include 4 vehicles, 10 motorcycles to be used in the outreach program, nursery seed storage and processing equipment, computers and audio visual equipment. Total cost is $168,000. The commodity list appears in Appendix IV, Table 8E.

F. Budget

The USAID budget for the M-K demonstration component is summarized below

	Current Project Funds ($ 000's)	Ammendment Funds ($ 000's)
Technical Assistance	375.00	
Training		65.22
Commodities		168.00
Other Costs		
Watershed Rehabilitation		1000.00
Nursery		1175.60
Motivators		17.00
	375.00	2429.53

GRAND TOTAL = $2804.53

VIII Design Options

A. Ranking of Project Components

Based on potential to contribute to project objectives of reversing deforestation and reducing rural energy shortages, risk of failure, complexity of implementation, the relative ranking of components is :

1. Sind and Punjab demonstrations

2. Training facilities

3. Research facilities

4. M-K demonstration

5. Operational subgrants

6. Women's hostel

1. Sind and Punjab Demonstrations

The Sind and Punjab Demonstrations are judged to be high potential and low risk components with moderate complexity and implementation requirements for the reasons discussed below. The components could stand alone but would benefit appreciably from the availability of training and research facilities also proposed.

The Sind and Punjab demonstrations are similar in concept and design to the ongoing programs in the barani. Introduction of the program to irrigated private land does not introduce significant or new technical forestry problems. Rather it increases the potential for success since the growth rates under the irrigated conditions and hence the financial return to the farmer on investment can be expected to be greater. The fact that the Forestry departments in both provinces are already involved with the project and evidenced a strong interest in increasing this involvement is a strong plus. The proposed design calls for an substantial training effort, recruitment of women to be trained as foresters thereby enhancing the ability to recruit farm women and the use of motivators at the village level. These measures should help popularize the program and obtain the desired participation level. Also, the provision of motorcycles to Foresters to increase their efficiency in the outreach program is expected to be a significant factor in increasing participation levels.

The fact that the USAID program in the Punjab will follow a related Punjab government activity has two substantial benefits. First the Punjab government program has had considerable publicity and the proposed USAID effort will likely benefit from demand created by it. Secondly, existing infrastructure can be

2. Training

a. Augment the present plan (11 trainees) by adding 20 additional trainees, 10 at the Phd level and 10 at the MSc level. Recruitment of agricultural scientists already having doctorate level training in appropriate fields, e.g. extension, statistics, economics, should also be pursued to increase the total number of additional scientists to 30 or more.

b. Give priority to candidates pursuing degrees in social and quantitative sciences as well as areas more directly supporting FP&D.

c. Establish 20 6-month internships at U.S. forestry institutions affiliated with USDA-FS Forestry Experiemnt Stations which would permit MSc level Pakistani scientists to study statistical and research methods and participate in operational research planning and reviews with fellow US scientists.

d. Provide at least 5 workshops for 40 or more scientists in such areas as applied economics, rural sociology, and outreach, as well as in computer modeling and statistical and economic analysis.

3. Technical Assistance

a. Provide 8 scientists for 1.5 months each to work with Pakistani counterparts to develop and deliver workshops on social science and quantitive research methods.

b. Provide five 2-scientist facility planning teams to PFI and the 4 provincial research stations.

c. Cooperative Reasearch Consultancies

Provide support for graduate research and return travel to Pakistan and provide a consultancy for their US advisors to visit the students' home reasearch institution.

4. Commodities

provide:

a. 10 additional vehicles to facilitate scientist access to field plots.

b. 12 additional computers to encourage use of quantitative methods in research design and analysis.

c. library equipment and technical publications to permit scientists to keep abreast of developments in their fields.

d. furnishings for new laboratories to permit state-of-the-art experiments.

C. Rationale

Research is needed to answer many questions about farm forestry and how to design and implement a successful development program. Because the bulk of forestry research effort over the past 35 years has been directed at the silviculture and management commercial species rather than fuelwood species (there is some overlap) and industrial scale plantation forestry, there are many unanswered questions regarding silvicultural aspects of farm forestry. Information on agroforesty systems in Pakistan is severely limited. Similarly, there is a dearth of research on economics and marketing and the sociological aspects of farm forestry. The current farm and energy research program is attempting to address these issues. Augmentation of facilities, which here is defined as laboratory construction, additional training, technical assistance and commodities, is necessary and appropriate to permit the research program to make a significant contribution to the overall project objectives.

D. Technical Analysis

This analysis examines research facilities and staff at the Pakistan Forest Institute (PFI) and provincial research facilities and staffing. PFI is a federal institute, but as the largest forest research organization and the primary trainer of forest officers, is a key institution in terms of provincial research capability. For this reason, it has been included in considerations of "provincial research facilities".

1. Facilities & Staffing

a. Facilities

By international standards, research facilities at PFI are substantial in number but modest in quality and generally equipped at functional but minimal levels. Specialized, quality laboratory space is lacking. Holdings in the main library at PFI are very dated and the number of current technical periodicals is limited. The main library is supplemented by several small departmental libraries consisting primarily of standard works and references. Desk-top computer systems have been purchased by FAO and USAID and supplemental funding for the library are being provided by USAID under the current project. Unfortunately these recent equipment acquisitions supported by USAID and other donors in addition to the GOP contributions are significant but do not change the basic status.

New provincial research facilities have been constructed at the Punjab Forest Research Institute by the Government of Punjab at Gotwala near Faisalabad. This laboratory and office complex is well designed with about 50 percent of its space currently utilized. Laboratory equipment is limited and the library is relatively new, but consists primarily of standard references. Technical periodicals have been carefully selected but are few. The facility has been provided with some equipment for soils, watershed and tissue culture laboratories. The first lot of research equipment, including an IBM computer, has been received from the FP&D project.

The small research facility at the Sind Silvicultural Research ivision (Miani) is to be remodeled under funding from the current roject. Unfortunately the remodeling is primarily a stop-gap measure and ill not provide adequate space for future program development. The space s too small, the equipment is modest and the library is very limited. An BM computer has been received from the FP&D project and the first lot of esearch equipment is expected shortly form USAID.

Plans for construction of research stations at D.I. Khan and asirabad are now being formulated with support from the FP&D project. hese stations will support 6 or less scientists each.

. Staffing

The research program at PFI is headed by Director General and ncludes about 73 professionals with graduate degrees and a like number of upport staff. The research staff at PFI includes 9 Phd scientists. The emaining 64 scientists have foreign degrees. Also, significant numbers f PFI staff have had additional specialized non-degree training in their pecialities.

The Punjab Forest Research Institute at Gotwala has an authorized omplement of 17 scientists; currently 10 of these positions are filled. ost of the current staff have MSc degrees. A range scientist from the nstitute is now enrolled for doctorate studies at NM State University.

The Sind Silvicultural Research Institute has a small staff of four fficers trained at the MSc level.

. Technical Assistance

. Research

Technical assistnace for research is provided on a long-term basis by he Winrock Technical Assistance Team (TAT) members. This support onsists primarily of field research in the social science areas described bove and assistance in the design and administration of research.

. Training

Training under the current project supports operational program, esearch and instructional needs. Of the 11 overseas MSc training pportunities identified in the PP, 3 are presently being utilized, 2 dditional candidates have approval for their departure and 2 others have een identified by the GOP. How many of these educational opportunities ill eventually be utilized by personnel with research responsibilities is ot clear.

3. Priorities

The basic theme and emphasis of the current FP&D project "Manpower and Institutional Development" is still valid and appropriate. A recent (1987) review of forestry education, training and research made by the Subcommittee on Forestry and Wildlife of the Pakistani Agricultural Commision, stated the major constraint as "the shortage of qualified and motivated scientists to deliver the goods". The central conclusion of this writer with regard to research is that greater fiscal resources need to be made available for manpower development and that facilities and commodities, while important and in need of improvement, should be given second priority.

Development of scientific manpower is needed specifically to overcome the following problems:

a. Commonality of Training and Experience

The substantial majority of forestry researchers in Pakistan have obtained their graduate scientific training at PFI as a part of a program designed to produce forest officers. This commonality of training does not generate the diversity of ideas and approaches which forest scientists in other ocuntries, trained in many differing disciplines and academic institutions, bring to their organizations.

b. Paucity of Phd level Scientists

The fact that PFI, the senior forest research institution in Pakistan, does not offer doctorate level training provides a serious constraint to development of research programs at both the national and provincial levels. There are a number of competent doctoral level scientists in Pakistan; unfortunately many of these are serving in administrative capacities and too few have accepted the lesser financial incentives of academia. There are also a substantial number of Pakistani researchers with MSc degrees or other specialized training obtained overseas. These individuals constitute the backbone of Pakistan's current forest research cadre. Unfortunately, a substantial amount of this training was obtained 15-20 years ago and consequently is dated. Opportunities for these scientists to update their skills should also continue to be provided.

c. Shortage of Social and Quantitative Scientists

The shortage of Phd scientists is further complicated by the shortage of social scientists, particularly economists and extension specialists and quantitative specialists, e.g., statisticians and computer scientists in the current forestry scientific community.

d. Need for Enhanced Skills in Research Planning & Administration

From requests made by Pakistani research administrators and as a result of revising forest research experiments and publications, it is evident that both the scientists and their administrators could profit from the opportunity to study statistical based experimental designs and research procedures, such as preparation of study plans.

E. Implementation

1. Training

Both non-degree and degree training overseas are included as well as in-country workshops and student research. Details of the proposed training are found on page 10 of Appendix I and costs are shown in Table 3 of Appendix IV.

2. Technical Assistance

Technical assistance will be provided in the form of instructors for workshops, research facility planning teams and research consultancies as described on page 11 of Appendix I. Costs for these activities appear in Table 3 of Appendix IV.

3. Commodities

Commodities in support of research include vehicles, computers, laboratory equipment and technical publications. Costs for these are listed in Appendix IV, Table 3.

Component 3: Farm and Energy Forestry Operations

A. Current Project Activity

Operational programs under the current project include on-farm forestry outreach programs in the Punjab and NWFP. In the barani and sailaba regions of these provinces about 26300 ha of private farm and rangeland are targeted for fuelwood production. In Baluchistan an additional 5300 acres of irrigated farmland are being converted to fuelwood production. In Sind, 2200 ha of irrigated and degraded forest plantations are being improved. Note that the program in Sind is presently confined to public lands and the program in Punjab to the less populated barani and sailaba regions. These operational programs are supported by training and research components.

B. Recommendations

1. Punjab

1. An operational scale forestry demonstration project is recommended on irrigated private lands in the Punjab to show the economic and biological feasibility of silvicultural systems producing fuelwood, fodder, and small timbers.

2. Silvicultural systems based on small woodlots or line/courtyard plantings are recommended for farmland where (1) soils are marginal for agricultural production due to salinity and/or waterlogging or (2) lands are not currently in production.

3. The project area should include the 22 canal-irrigated districts and encompass approximately 22,000 acres of private irrigated farmland.

4. About 19,000 farms in 1900 villages throughout the irrigated districts should be included in the demonstration. This is about 1.0 percent of all farms within the irrigated districts. Acreage should nominally range from 0.5 to 1.5 acres.

5. Farmers meeting predetermined qualifications (interest, land and water availability) should be provided with appropriate technical information and free seedlings and encouraged to adopt one of the plantation models illustrated in the preceding analysis. The primary incentive for participation in the program should be the anticipated return from the sale of the crop not "upfront" subsidies in the form of materials or services provided. Rewards in the form of prizes for the best quality seedlings, the greatest or fastest rate of tree growth etc. as used in the Punjab's previous planting programs should be continued for both incentive and publicity.

. The project should be implemented by the Extension and Publicity Wing f the Punjab Forestry Department as an outreach program. While personnel n the Wing have experience in outreach, additional training is ecommended to further enhance organizational, communication and other utreach skills. The Department should be strongly encouraged to adopt the se of husband and wife farm forestry teams as vehicles for reaching farm ives. USAID should underwrite the costs of recruiting and training the ew female farm foresters. Motorcycles or scooters should be provided to arm foresters to increase their efficiency and effectiveness.

. On-farm seedling production by farmers' wives should be encouraged as means of providing supplemental income for farm families. The Forestry epartment should provide training, supplies and guaranteed sales of eedling production to encourage this private sector participation as a art of the outreach program.

. Special care should be taken to assure the production and distribution f vigorous young seedlings. Older, larger, planting stock is frequently ess vigorous and certainly more costly to produce. Farmers should be ncouraged to try closer spacings (consistent with economics of seedling osts) to enhance the fuelwood volumes resulting from thinnings.

. Responsibility for coordinating the previously proposed research rogram, training activities and the above described operational program hould rest with the CCF, Punjab.

. Success of this project will generate substantial new volumes of orest products. Farmers will be seeking markets and distribution hannels within a few years. And they will be seeking to fill the markets or the higher value products. Based on experience in other countries as uch as 50 percent of the timber volumes produced may go to the small imber, pole, pulpwood etc. markets. It is imperative that these markets e analyzed and developed early in the program so that the momentum stablished in the outreach and production phase is not lost due to lack f market opportunity. Exploitation of farmers in a glutted buyers' arket is a sure recipe for failure.

. Motivators should be employed to increase the spread effect of the rogram and to enhance the communication impact of the outreach oresters. Motivators should be paid a monthly wage for about a 2-year eriod.

. Sind

. A forestry demonstration project on irrigated private lands in Sind is ecommended to show the economic and biological feasibility of ilvicultural systems producing fuel wood, fodder and other specialized orest products for established regional markets.

Silvicultural systems as previously described are recommended as lternative cropping systems for farmland where (1) water for irrigation s limited so that a farmer's entire acreage cannot be put under gricultural crops and (2) soils are marginal for agricultural production.

3. The project area should be limited to the districts of Sanghar, Jacobabad and Khairpur and encompass approximately 6600 acres of private irrigated farmland.

4. A minimum of 5250 farms in 210 (10 percent) villages throughout the three districts should be included in the demonstaration. This is about 2.5 percent of all farms within irrigated districts. Plantation sizes should nominally range from 0.5 to 1.5 acres.

5. Farmers meeting predetermined qualifications (interest, land and water availability) should be provided with appropriate technical information and free seedlings and encouraged to adopt one of the plantation models illustrated in the preceding analysis. The primary incentive for participation in the program should be the anticipated return from the sale of the crop, not "upfront" subsidies in the form of materials or services provided.

6. The project should be implemented by the Sind Forestry Department in an outreach program. A substantial training program is recommended for forestry personnel to enhance organizational, communication and other outreach skills. The Department should be encouraged to adopt the use of husband and wife farm forestry teams as a mechanism for reaching farm wives. USAID should underwrite the costs of recruiting and training the new female farm foresters. Motorcycles or scooters should be provided to farm foresters to increase their efficiency and effectiveness.

7. On-farm seedling production by farmers' wives should be encouraged as a means of providing supplemental income for farm families. The Forestry Department should provide training, supplies and guaranteed sales of seedling production to encourage this private sector participation as a part of the outreach program.

8. Alternatives to traditional methods of planting seedlings, such as direct seeding, should be studied immediately. Direct broadcast seeding methods now used by farmers planting hurries appear to have been effective and certainly have economic merit.

9. Responsibility for coordinating the previously proposed research program, training activities and the above described operational program should rest with the CCF, Sind.

10. Motivators should be employed to increase the spread effect of the program and to enhance the communication impact of the outreach foresters. Motivators should be paid a monthly wage for about a 2-year period.

C. Rationale

Expansion of operational programs in the Sind and Punjab will extend the FP&D demonstration potential to private lands in the Sind and to the more populated region of the Punjab. With the current shortages of energy in rural areas and the continued expansion of population, it is important to increase the size of the on-farm fuelwood production effort. In both provinces mentioned there are circumstances which favor fuelwood

production on marginal farm land. In the PUnjab it is the increasing number of acres of land which is marginal for continued agricultural use because of salinity and/or waterlogging. As much as 20 percent of the land in the 22 irrigated districts of Punjab now fall into this classification. Similar problems exist in Sind where the shortage of irrigation water frequently limits productivity on marginal agricultural land. The operational scale demonstrations proposed under this extension will help the Forestry Departments in these two provinces mobilize the private sector for on-farm production of fuelwood, fodder and poles and expand the current program to a significantly greater segment of the population. As will be shown below, on-farm foresty is attractive financially as an alternative cropping system and consequently the "spread-effect" of the program should be rapid.

D. Technical Analysis

1. Punjab

This component will motivate farmers and their families to produce trees on their private irrigated lands supported by outreach activities of the Provincial Forest Department. Seedlings will be produced in nurseries in the 22 districts and made available to farmers at their doorsteps free of cost so that they contribute to one or more of the following products: (i) fuelwood (ii) fodder for cattle (iii) small timber for farm activities (iv) soil improvement and water conservation (v) raw material for subsidiary vocations like sericulture, apiculture, milk production. Free technical advice will also be provided on planting, tending, spacing, marketing etc. throughout the growing period. Operations like preparation of site (clearing & leveling), construction of irrigation channels, weeding, pruning, protection etc. will be done by the farmers themselves as a token of their interest in the farm forestry program.

a. Project Area, Location & Size

The proposed project encompassing 19,800 treated areas would expand the present Forestry Planning & Development Project from the 7 barani districts to the 22 irrigated districts of the Punjab. This would bring demonstration of farm forestry to an additional target area of 11 million ha. or 94% of the Province's total cultivated area. Since the on-going government funded project, Farm Forestry in Punjab, extends over 22 districts (canal irrigated), the Punjab Government indicated a strong preference for expansion of the proposed project over the same 22 districts. This is attractive because farm forestry demonstrations would potentially reach an additional 19000 villages (out of a total of 25000 villages in the Punjab when including the barani farms) with approximately 2.0 million farm families (out of a total of 2.5 million farm families). An analysis of demographic data suggested that:

1. A minimum of 10 farm families per village should participate to create a sufficient demonstration impact at the village level. Similarly, if 10% of the villages per district could be involved, this would amount to 1.0% participation of all farm families on the irrigated farm lands in the Punjab.

2. If the average farm family participating in the project were provided with 1000 seedlings (amounting to a 1 acre "block equivalent" forest), the project would have to provide 10,000 seedlings per involved village. This is about 90 x 10000 = 0.9 million seedlings over a 5 year period per district or 20 million seedlings over the total 5 year period.

3. These nursery production rates are technically feasible and the 1.0% participant level sufficient to create a demonstration impact. Financial calculations showed that this was also economically feasible.

b. Agroforesty Models

As detailed in Appendix I, pages 28-39, the two models below will be used in the Punjab demonstration.

1. Woodlots

Compact woodlots will be established by farmers on marginal lands/rangelands and/or on saline and water logged lands. About one acre per participating farm family will be planted.

2. Line/Courtyard Planting

Line planting is a common practice in the Punjab. Field analysis suggests that until the 4th year, the row of trees has no appreciable effect on crop yields. If the fields are on the South or South West side of the rows, there is minimal reduction in the grain yields. The optimum number of trees per row depends upon the locality and the specie. However, for the purpose of converting line plantings to area, 1000 trees will be taken equal to one acre.

In addition to these spatial arrangements, climatic zones will also be considered. The Punjab generally is considered to have 3 zones, but for illustration purposes 2 zones will be used. These are:

- Marginal irrigated land with less than 8" annual precipitation. = Zone 1
- Marginal irrigated land with more than 8" annual precipitation. = Zone 2

Species is another variable considered in the models. Some species provide multiple products, e.g. fuelwood, timbers, green fodder or food for human consumption. Other leguminous species can improve the soil through nitrogen fixation. Species also differ in their rate of water consumption and tolerance to saline soils or water logging. Keeping all these factors in mind as well as the species preference of farmers, suggested species for the models are:

Species	Potential use	Salt tolerance	Water needs
Dalbergia sissoo	Furniture/Fuelwood	Low	Average
Acacia nelotica	Fuelwood/pitprops	High	Very low
Leucaenia leucocephla	Fuelwood/pitprops	High	Low
Morus alba	Silk/Fuelwood	Low	High
Eucalyptus Camaldulensis	Fuelwood/pitprops	Average	Average

Finally, two different spacings will be considered: 6'x 6' and 3'x 3'. Both of these are considerably denser than those commonly employed by the Forest Department (at 6'x 10' or 10'x 10'). They were selected because they reflect current agroforestry practice. For planning purposes it has been assumed that 80 percent of the total area will be planted at 6' x 6' spacing (1200 seedlings/acre and 20 percent at 3' x 3' or 4800 seedlings/acre.

In summary, the following agroforestry models are proposed as being illustrative, realistic and representative:

MODEL	ZONE	SPECIES	SPACING	CONFIGURATION
1	I (Arid)	Acacia nelotica	6'x 6'	Block
2	-do-	Leucaena leucocephla	3'x 3'	Block
3	-do-	E. Camaldulensis	6'x 6'	Row
4	-do-	Dalbergia sissoo	6'x 6'	Block
5	II (Semi Arid)	Dalbergia sissoo	3'x 3'	Block
6	-do-	Acacia nelotica	3'x 3'	Block
7	-do-	Morus alba	6'x 6'	Block
8	-do-	E. Camaldulensis	3'x 3'	Row

Approximate acreages to be planted per year are shown in Appendix I, Table 6, page 31.

c. Nursery & Seedling Production

Annual requirements for nursery stock are shown in Appendix I, page 30. An estimated 48 million seedlings will be provided from a combination of Forest Department and private nurseries. To provide income generating opportunities for farmers' wives, outreach personnel will encourage establishement of home nurseries. Seedlings produced by the home nurseries will augment Forest Department production.

d. Economic analysis

An economic analysis of the 8 illustrative models described in section b. above is detaied on pages 40-41 of Appendix I. Internal rates of return ranged from 6.0 to 29.0 percent. Revenues, costs, IRR and B/C ratios are summarized by model in Appendix I, page 41. At a discount rate of 15, percent only the 2 row plantations were feasible, primarily because of the land rent charged. Using a 12 percent discount rate, 4 other models, 1, 4, 5 and 7 are feasible even with the land rent. No benefits were assumed for cow dung saved (by availability of fuelwood) and diverted to use as fertilizer. These returns are considered adequate financial incentives to encourage farmers to adopt the models for marginal lands.

2. Sind

This component will also enlist farmers and their families for the production of trees on their private irrigated lands. This program, placing marginal agricultural land into production, will be guided by an outreach program implemented by the Forestry Department. Seedlings will be produced in nurseries operated by the Forest Department and in home nurseries. These will be provided at no cost to farmers at their doorsteps for the production of fuelwood, forage and small timbers. There is a very good market in Sind for small timbers to be used as pit props in the mining of coal in Baluchistan. Technical advice at no charge will be provided to the farmer regarding planting, tending and harvesting operations over the LOP. These operations will be done by the farmers as their contribution to production.

a. Project Area, Location and Size

A total of 6600 acres will be planted as an operational scale demonstration. The project area will be limited to 3 districts, Sanghar district where previous work by PFI has been working to popularize the concept of farm forestry, Jacobabad district which is adjacent to the Nasirabad district of Baluchistan where the current project is being implemented and Khairpur district in central upper Sind for geograohical breadth. Limiting the demonstration effort to three districts was preferred because 1) no major effort in farm forestry has been undertaken by the Sind provincial forest service in contrast to the Punjab. Thus relatively more effort will have to be expended to get a program started. 2) the proposed project is limited to 6,600 acres of demonstration plantations in Sind compared with 19,800 in the Punjab. Also, the existing Sind project covers government owned block plantations, an aspect excluded in the Punjab. Spreading these demonstrations over all districts with irrigated lands in Sind would decrease the percentage of farmers included below 1% which is considered inadequate. A participation level greater than 1 percent is needed to create a sufficient demonstration effect. Thus if 25 families per village and 10% of the villages per district could be recruited, 2.5% of all the farm families in the irrigated farmlands of the Sind would be participants.

b. Agroforestry Models

As described in Appendix I, pages 68-79, four illustrative models are proposed for the Sind demonstration. Models 1 and 2 are based on the indigenous "hurries" system utilized by farmers for short rotation cash timber crops for many years.

Since the average farm size in Sind is considerably larger than that of the Punjab, and the soil poorer, a larger percentage of the irrigated land can be considered marginal for agriculture. Hence, it is reasonable to limit the illustrative models to block plantations and woodlots rather than included line plantations as another model (as was done in the PUnjab proposal).

Model 1: Hurrie Production of Fuelwood and Pitprops Established by Direct Seedling

Because of the historical long-term success of the hurrie, one of its many variations is proposed. Under this model a block of irrigated land is selected and broadcast seeded with Acacia nelotica. Thinnings begun after the first year provide fuelwood and fodder and continue to until the fifth year when the entire stand can be sold on the stump. Irrigation water is provided when available, and not required by agricultural crops. This model is favored by the farmers, and requires only an extensive form of management (little capital investment, low and flexible labor requirements, early and good returns).

Model 2: Hurrie Production of Fuelwood and Larger Timbers Established Using Seedlings at 3' x 3' Spacing

Acacica nelotica is planted in blocks, spaced 3' x 3'. It differs from Model 1 in that it is more management intensive, has higher initial investment costs and, with a slightly longer rotation of eight years, produces somewhat larger dimension timbers. It still produces fodder and early fuelwood through thinnings and loppings.

Model 3: Fuelwood, Furniture Stock and Forage Production Established Using Seedlings at 6' x 6' Spacing

Daldergia sissoo will be planted in blocks, spaced 6' x 6', on an eight year rotation. This species is a favorite in Karachi and Hyderabad for furniture manufacturing and therefore commands a higher price than Babul as timber. Fuelwood will be produced through thinnings and fodder should be more plentiful in the first few years because of the wider spacing.

Model 4: Fuelwood, Furniture Stock and Forage Production Established Using Seedlings under Limited Irrigatior

This model consists of 3' x 3' planting of Dalbergia sissoo. It differs from Model 3 in that irrigation water supply is assumed to be limiting, thus producing slower growth and less fodder. Dalbergia was selected because it is more prone to drought/stress than Acacia, and thus yield impacted more when water is limited.

The number of trees that would be grown per woodlot depends on the species selected and the needs of the farmer. Since the objective is to produce fuelwood, poles, pit props and small timbers, all of which have an established market both in Sind and adjacent Baluchistan, Acacia nelotica (Babul), and Dalbergia sissoo (Shisham) would be the main species. Acacia is particularly recommended for general application as it is tolerant to saline soils. In villages where soil and water conditions are more favorable and winter frost is likely to be severe, Dalbergia sissoo should be conidered.

It is estimated that three-fourths of the total area will be planted with Acacia nelotica at a spacing of 3' x 3' (to be thinned after the third growing season and clear/felled after the eighth year) and the remaining area with Dalbergia sissoo at a spacing of 6' x 6'. Approximate acreages to be planted per year are shown in Appendix 1, Table 4, page 74.

c. Nursery and Seedling Production

Annual requirements for nursery stock are shown in Appendix 1, Table 4, page 73. Approximately 33 million seedlings will be produced from a combination of Forest Deparment and on-farm nurseries.

d. Economic Analysis

An economic analysis of the four illustrative models described in section b. above is presented in Appendix I, pages 79-81. Internal rates of return ranged from 48.1 percent for Model 1 to 9.8 percent for Model 4. Benefit-cost ratios @ 15% ranged from 2.35 for Model 1 to 1.10 for Model 4. Detailed summaries of revenues, costs, IRR and B/C ratios appear in Appendix I, Table 9, page 81. Model 1, the "hurries" model, shows why farmers have been using this system for a century or more. It returns in gross benefits 16,000 Rs. per 5 year rotation with an internal rate of return of 48 percent. This average annual return of Rs. 3,200 per year for 5 years is far superior to cotton crops which return Rs. 1,000 per six months (and due to nutrient requirements can be cropped only once per year).

Models 2, 3, and 4 are less attractive because of the impact of the 1,000 Rs. land rent charged and, in the case of Model 4, because of lowered growth rates assumed, due to lack of irrigation. Note that no benefits were assumed due to increased agricultural productivity when cow dung was diverted to use as fertilizer under the assumption of increased fuelwood availability. These returns are considered adequate financial incentives to encourage farmers to adopt the models for marginal lands.

E. Implementation

1. Punjab

a. Staffing

The project will be implemented by the Extension and Publicity wing of the Punjab Forest Department. The Extension and Publicity Circle is headed by a Conservator of Forests (CF) who reports to the CCF, central zone. The CF, E&P has two staff officers, the DFO for publicity and the DFO for Extension both stationed at Lahore. The DFO Extension has line authority for the field staff consisting of 9 Sub Divisional Forest Officer (SDFO's), 25 Range Forest Officers (RFO's), 92 Farm Foresters (FF) and 92 Forest Guards (FG). (The FF's will serve as outreach specialists and the Forest Guards have reponsibility for production and distribution of seedlings).

These field staff are not currently fully utilized for farm forestry activities. Therefore, it would be possible for the Extension Circle to take on the proposed activities under the planned USAID project extension with only a few additional positions added. Specifically the number of farm foresters needs to be increased from 92 to 120 to accomodate the additional level of farm training which is planned. This provides about one FF per 160 families or 16 villages. Motivators, 1 per village in 620 villages, will be utilized to increase participation in selected villages.

To reach and involve farm women in the production of seedlings, it is proposed that the 28 additional forester positions be filled with women married to currently employed FF's. After receiving training, husband and wife teams would be formed giving the extension circle a more effective means of communicating with rural families. To facilitate acceptance of this pilot program by the Government of Pakistan USAID should provide per diem for the women during the training period.

b. Technical Assistance

Technical assistance required by type of extertise and year is shown in Appendix IV, Table 7D. Outreach specialists, nursery management, training (curricular development) and marketing expertise totaling 14 person months is suggested. These personnel could also be utilized on the Sind and M-K components.

c. Training

Inservice training in support of the outreach program is shown in Appendix IV, Table 7C. Note the extended initial training cycle and the shorter annual cycles. Training programs will emphasize practical outreach skills, sharing of problems and experience and motivation. Women foresters will be provided training in Forest Department courses. Training will also be provided for the 620 motivators who will be recruited. A hostel and classroom center will be built to support this program.

d. Commodities

Commodity requirements are listed in Appendix IV, Table 7E and consist primarily of vehicles, computers, seed storage and processing equipment and audio-visual (training) equipment.

. Sind

. Staffing

The project will be implemented by the Sind Forestry Department. The urrent USAID FP&D Project in Sind is headed by a Project Director with he Rank of Conservator of Forests (CF). The CF reports to the Chief onservator of Forests, CCF Sind, and directs three Divisional Forest fficers (DFO's) who are responsible for work at the district level. hree additional Sub DFO's would be added to this structure to direct the roposed demonstration outreach effort in the three new districts. The ield staff will consist of 12 RFO's, 36 FF's (18 husband & wife teams) nd 36 forest guards. This staffing level provides approximately 1 FF per 60 families or six villages.

. Technical Assistance

Technical assistance required by type of expertise and year is shown n Appendix IV, Table 6D. Fourteen person months of short-term assistance ill be required. Expertise needed includes specialists in outreach ethods, nursery management training (curriculum development), economics nd marketing. These personnel schedules, permitting, may be utilized on he Punjab and Murree-Kahuta components as well.

. Training

Inservice training needed to support the outreach program is shown in ppendix IV, Table 6C. Two training cycles are indicated, the longer, nitial year, "basic" training and the shorter annual cycle. The training rograms will teach practical outreach skills such as communication and otivation and will serve as motivational sessions for the field ersonnel.

Training will also be provided for the 349 motivators who will be ecruited by the Forest Department and the 18 women to be trained as resters. A new hostel and classroom center will be built to provide cilities for this program.

VI COMPONENT 4: NGO/PVO OPERATIONAL SUBGRANT PROGRAM

A. Relationship to Current Project Activities

Component 3 of the current FP&D project focuses on the environmental issues of deforestation and rural energy shortages, through operational programs of aforestation on barani and irrigated provincial lands. The amendment proposes to extend these efforts to marginal private lands in the more populous irrigated regions. Component 5 of this proposed amendment is designed to further address environmental issues by demonstrating integrated forestry and watershed management treatments to ameliorate soil and minor slope stability problems in the Murree-Kahuta region. Operational Subgrants will permit NGO/PVOs to undertake activites directly in support of these initiatives and to address other environmental issues compatible with broader USAID legislative mandates.

B. Recommendations

1. Operation Program Grants (OPGs), or subgrants to promote forest conservation practices and public awareness, are recommended for inclusion in the project amendment.

2. The grant program should be overseen by the Technical Assistance Team (TAT) with the bulk of the effort provided by the grantee supplemented by short-term technical assistance, as necessary, in the design phase.

3. TAT expertise should be augmented on a short-term basis with an individual who has extensive experience in working with NGO/PVOs and preferably knowledge of environmental issues and organizations in Pakistan

C. Rationale

Pakistan's natural resource and environmental problems are complex and interrelated. The present project addresses a number of these problems in a framework emphasizing manpower and institutional development, research and operational farm forestry outreach programs. Activities proposed under the amendment fit well into this same framework. Introduction of the subgrant component will utilize this framework but extend the range of enviromental issues addressed. Specifically, OPGs would be used to increase the projects capacity to address widespread environmental problems such as deforestation, soil erosion, siltation of rivers and related problems of ecological deterioration.

Operational Program Grants described in Handbook 13 under Section 122(d) Grants, provides the opportunity to fund NGOs

and PVOs in program areas supportive of USAID's legislative priorities. This component will utilize OPG subgrants to encourage selected NGO/PVOs to develop and implement programs addressing a range of environmental issues supportive of USAID environmental and conservation goals.

D. Technical Analysis

1. Current NGO/PVO Capability

A survey of NGO/PVOs in Pakistan (see Annex III, p23) indicates that many of these organizations currently emphasize urban rather than rural concerns. Many of these organizations are small with specific goals and little technical or managerial expertise outside their selected field. Of the 10 organizations contacted, 3 focused on women's issues, 2 were concerned with rural development, 1 emphasized media campaigns and 4 were concerned with wildlife, conservation, forestry and agriculture. A single forestry NGO was found and contacted. Unfortunately, this organization had minimal experience and was orientated primarily toward mechanized commercial planting operations and had little interest in development. Several NGOs concerned with environmental issues were found and contacted which possesses broader expertise, e.g., the International Union for Conservation of Nature and Natural resources based in Karachi and the World Wildlife Fund with offices in Lahore. Since the initial contact, the IUCN has expressed interest in the possibility of using OPG funding to work with the Sind Arid Zone Development Authority to develop a proposal addressing the aforestation/desertification problems in the Tharparker region of Sind Province. While this particular initiative may not be central to USAID concerns, the mechanism of utilizing a PVO to assist a provincial organization illustrates the type of "leverage" which the OPG could produce. Finally other organizations working in the environmental and conservation area such as the Aga Khan Foundation were identified as having potential for contribution to a USAID initiatives.

2. NGO/PVO Effectiveness

The overall effectiveness of NGO/PVOs is difficult to determine because program evaluations are frequently made "in-house" and/or are not available at all. This is not to suggest that these organizations are ineffective, only that objective documentation is often lacking. The more-than-adequate supply of donor funding over the past several years also makes the evaluation process more difficult. However, based on data in Appendix III, and other available evidence it is clear that considerable potential exists within the present NGO/PVO community to address environmental issues in the context of USAID/OPGs.

3. Anticipated Roles for Grantees

Two potential roles for NGO/PVOs were considered in the design of the FP&D amendment. The first role considered was that of complimentary programs working with the implementing agency and supporting some facet of the operational activities proposed under components 3 and 5 of the amendment. This type of activity is proposed in illustrative model 3 in Appendix III. The second role considered for NGO/PVOs, and the one strongly advocated here, is that of an independent agent pursuing broader environmental and conservation objectives complimentary to USAID legislative mandates in general and supportive of the FP&D project objectives in particular. The aforestation/desertification problem in Sind suggested by the IUCN is an example of this type of activity.

4. Description of Program

The OPG program will consist of designing, implementing and evaluating 5-7 grants ranging in amount from 200 to 500 thousand dollars and 2-4 years duration. USAID through the TAT will provide technical assistance in the design phase. Grant activities will be implemented by the grantee and an evaluation will be made jointly by the grantee and USAID supported consultants.

D. Implementation

1. Operational Strategy

Substantial differences exist in funding, staff capabilities and experience among Pakistani NGO/PVOs and international NGO/PVOs working in Pakistan. In order to accommodate both types of organization within the OPG program, grants will be made and funded initially based on USAID acceptance of a brief concept paper developed by the prospective grantee with USAID technical assistance provided under the current FP&D project if required.. (Criteria for acceptance of these concept papers are shown below.) The initial funding will permit preparation of a detailed proposal either by current NGO/PVO staff or additional experts hired by the grantee. Upon acceptance of the proposal by USAID, (see criteria listed below) the NGO/PVO will commence grant activities. Finally, USAID will evaluate the program at its conclusion based on monitoring data and reports prepared by the grantee. The 6-step OPG implementation process summarized below, will require 1-4 years depending on the duration of the grant activities and oversight by the Technical Assistance Team.

2. Steps in Implementation

STEP 1 Identify NGO/PVOs and Issues

Design team contacts previously identified NGO/PVOs and identifies other participants during first month. Team works with NGO/PVOs to develop concept paper as basis for USAID review during second month.

STEP 2 Evaluation of Concept Paper and Grant Award

USAID staff with design team evaluate concept papers and award OPGs enabling full development of proposals using grant funds.

STEP 3 NGO/PVO Proposal Preparation

NGO/PVOs, now grantees, prepare proposal using their own staff or other experts hired using the grant funds.

STEP 4 Proposal Acceptance Release of Implementation Funds

USAID reviews proposal and releases funds for NGO/PVOs to implement grant activities. Proposals may be review by USAID staff, additional consultants or PP&D TAT members, depending on the nature of the proposals and personnel availability.

STEP 5 Grant Implementation

NGO/PVO implements grant activities.

STEP 6 Monitoring and Evaluation

Grantee monitoring requirements are to be specified in the proposal and should be in the form of previously agreed upon statistics or qualitative accomplishments. Monitoring data should be contained in the final evaluation report provided to USAID. An evaluation should be made during the last quarter of the project. The evaluation should include participants from the NGO/PVO and USAID staff or short term consultants. The evaluation report submitted to USAID should emphasize the degree to which the grant objectives were met and the contribution of the project to ameliorating the specific environmental or conservation issue addressed.

3. Criteria for Acceptance of the Concept Paper & Proposal

Weight	Concept Paper Criteria
30	(1) Significance of the proposed environmental activities to USAID program objectives and funds available
20	(2) Experience and capability of the prospective grantee in implementation of past programs and/or ability to expand personnel and activities to meet

used. Punjab Forest Department staff with experience in the earlier program will be assigned responsibility for implementation of the USAID component. Finally the Punjab CCF and staff see the USAID component as enabling them to follow-through on the existing initiatives and are anxious to maintain continuity of effort.

In Sind, a more substantial effort will be required to develop the infrastructure and popularize the program. The Forestry Department staff will need to be increased and trained in outreach methods and a well organized effort to raise public awareness will be required. To off-set these factors the scale of proposed operations has been limited to 6600 acres in 3 provinces and the participation level targets set for 2.5 percent of families as opposed to 19000 acres in 22 provinces and 1 percent participation level in Punjab. Fortunately the proposed Sind demonstration will also benefit from from management by administrators with experience in the current USAID program.

Implementation of these program components is not dependent in a technical sense of the completion or success of the barani programs. Certainly experience gained will be useful but completion of the barani program should not be viewed as a prerequisite to initiation the components on irrigated private lands. The new demonstrations are technically and economically feasible and primarily significant in their ability to reach larger numbers of farm families and to put marginal farm land into production.

The major challenges <u>and opportunities</u> associated with the Punjab and Sind components are in building an effective outreach program and in the case of the Punjab implementing the program in all 22 irrigated districts. The opportunity to increase women's roles and to evaluate the utility of motivators are also important.

<u>2. Training facilities</u>

This component is considered to be high potential, low risk and a requirement for support of the operational demonstration programs. Training could be carried out in existing facilities or in commercial locations. However the quality of such training and the reduced flexibility of scheduling would detract appreciably to training program effectiveness. Hostel and classroom centers will provide focal points and emphasis to training programs. Complexity of implementation is judged to be relatively low as is risk of failure.

Training facilities proposed here are intended to support both the new and existing project components. As suggested above in the discussion of the Sind an Punjab demonstrations, training of operational personnel in outreach method. is a key skill requirement for the operational components. Training needs are recurrent in that after initial "basic" training outreach

personnel need the opportunity, annually, to come together, discuss field problems, learn additional skills, and renew their enthusiasm. Well staffed and equipped hostels and classroom centers will encourage quality outreach programs. Obviously the centers will also be used to meet other continuing education objectives and it is anticipated that these centers will be of significant general benefit to the overall forestry program. This construction will require additional TAT staffing to coordinate A/E activities and to develop programming. The assistance of a Pakistani, engineer or architect on the TAT working in support of this activity and the research laboratory construction is necessary.

7. Research Facilities

The provincial research facilities component could be viewed as a separate, "stand-alone" component;it should not be. The component is designed increase the effectiveness of the current infrastructure and increase the potential of the provincial research cadre to contribute to the success of on-farm forestry operations.

Research is an integral part of the current project and should be continued under the amendment. Basic research is normally a high potential, high risk undertaking; applied research more often is high to moderate in potential and moderate to low risk. The applied research objectives specified in the PP are appropriate to the goals of the project and basically of moderate potential and low risk. Accomplishing these objectives does not in general depend on "super-scientists", "breakthroughs" or large amounts of "high tech" equipment. Meeting these objectives or making respectable progress towards them in a reasonable period of time utilizing sound scientific methodology does require a cadre of competent, well trained and equipped scientists. Applying an "international standard" to Pakistan's forestry research programs indicates that they are only at the lower margin of this standard at this time. The technical assistance, training and commodities supplied or programmed in the current project are appropriate but insufficient to the need. The recommendations under this project amendment, particularly in regard to Phd level training and construction of provincial laboratories are designed to help further remedy basic deficiencies. The construction program will significantly increase the oversight load on the technical assistance team. Although technical assistance in the form of facility design teams will reduce the burden of planning, considerable effort and coordination will be required to field these teams and follow-up with A/E personnel. A Pakistani with relevant experience in engineering or architecture would be an asset to the TAT in executing these activities.

4. Murree-Kahuta Integrated Forestry-Watershed Demonstration

The M-K component is a "stand-alone" operational scale demonstration with high potential for success, low to moderate risk and moderate to high complexity of implementation. The problems addressed are the same deforestation and rural energy shortages concerns considered in the Sind and Punjab components. However the watershed stabilization initiative included in the M-K objectives which adds breadth to the scope of environmental issues considered, also increases the complexity of the the project by requiring higher levels of participation/cooperation on a community or subcatchment basis. Additionally the periodic occurrence of landslides in some of the more unstable catchments adds an element of physical risk and the much greater risk, from a public relations angle, that these sometimes massive slope stability problems may be "solved" by project activities. It should be emphasized that the landslide problems occur on only a small fraction of the acreage involved. Consequently it should be relatively easy to identify the 6000+ acres small stable catchments to be treated as an operational scale demonstration. Finally it should be noted that the use of the M-K Development Authority as an implementing agency with its power to bring together personnel from various government agencies and coordinate their efforts is an innovative and positive step. While at the same time the need to acquire personnel and establish a substantially larger organization adds complexity to the implementation process. This component will require substantial oversight by the TAT and an additional staff member with expertise in watershed management would be required.

5. Operational Subgrants

The operational subgrant component is judged to have moderate to high potential, moderate risk and low complexity. As detailed in Appendix III, the Pakistani NGO/PVOs have definite potential for contribution to project objectives but as a group have relatively little experience in environmental activities. The subgrant program is expected to benefit the proposed operational activities but should be viewed as a stand alone component requiring only modest input from the TAT

6. Women's hostel

Construction of a women's hostel at the Pakistan Forest Institute is a high potential, high risk undertaking with low complexity. The goal of having women forest officers in the Pakistan Forest Service is a complex issue that will not be resolved by the construction of a hostel. However, the hostel could help to create acceptance of a role for women officers through facilitating their activity in research and creating a focus and opportunity for further participation. Overview of this component is well within the capability of the TAT given the recruitment of the Pakistani engineer or architect. described above.

B Options

Option 1: The recommended option: Maximize potential by including all components.

All components are recommended for inclusion in the amendment. This will fully utilize the funding available and and require 3 additional TAT members, A long-term US consultant and 2 Pakistani professionals.

Option 2: Minimize risk and complexity

Include only the Sind and Punjab demonstrations supported by the research and training facilities components. This would utilize about 2/3 of funding available and could be implemented by present TAT staff with the addition of one or two Pakistani professionals.

Option 3 : Maximum emphasis on support initiatives and increased emphasis on environment and women's issue

Include the Murree-Kahuta component, the operational subgrant program, the training facilities component and the women's hostel. This would require TAT team expansion of a additional long term US consultant and preferably a Pakistani professional.

Technical Assistance Team

The current project utilizes a technical assistance team consisting of a Chief of Party/Forester, training and research specialists an outreach specialists and American and Pakistani anthropologists. Two implement the activities in the amendment the staff should be augmented by two US professionals bringing additional skills in watershed management and forestry and at least two Pakistani professionals to assist with construction and with other implementation details.

IX. Budget

SUMMARY OF FP&D AMENDMENT FUNDING BY USAID & GOP SOURCES

PROJECT COMPONENT	CURRENT FP&D PROJECT $ (000's)	FP & D AMENDMENT $ (000's)	GOP $ (000's)	TOTAL $ (000's)
1 Research Facilities				
Technical Assistance	330.00			330.00
Training		1357.00		1357.00
Commodities		1330.00		1330.00
Construction & A&E @ 40%				
Sind		500.00		500.00
Punjab		50.00		50.00
Baluchistan		500.00		500.00
A&E costs		420		420.00
subtotal	330.00	4157.00		4487.00
2 Field Operations				
Technical Assistance	775.00			775.00
Training		704.33		704.33
Commodities		802.00		802.00
Other Costs				
Sind		1883.30		1883.30
Punjab		2780.80		2780.80
Murree-Kahuta		2175.40		2175.40
Operational expense			1700.00	1700.00
Salary			620.30	620.30
Motivators		548.57	548.57	1097.14
Housing & Furinshings			800.00	800.00
subtotal	775.00	8894.40	2520.30	12209.70
3 Operational Subgrants				
Technical Assistance	150.00			150.00
Grants		1200.00		1200.00
subtotal	150.00	1200.00		1350.00
4 Provincial Training Facilities				
Sind		365.00		365.00
Punjab		365.00		365.00
Baluchistan		245.00		245.00
A&E design costs @ 40%		390.00		390.00
Commodities-Furnish&Equip	200.00	100.00	200.00	500.00
Contingency	150.00			150.00
subtotal	350.00	1465.00	200.00	2015.00
5 FFI Women's Hostel		250.00		250.00
subtotal		250.00		250.00
Contingency		300.00	200.00	
GRAND TOTAL	1625.00	16266.40	2920.30	20811.70

APPENDIX IV

TABLE 1 Summary of FP&D Ammendment Funding by USAID and GOP Sources

TABLE 2 Summary of USAID Funding for the FP&D Project by Year

TABLE 3 Summary of Research "Facilities" Costs (laboratories, training, technical assistance and commodities)

TABLE 4 Summary of Instructional Facility Costs

TABLE 5 Summary of Pay and Allowances for GOP Personne

TABLE 6 Summary of Costs for Sind Demonstration

A. Budget
B. Nursery Costs
C. Inservice Training Costs
D. Technical Assistance Costs
E. Commodities
F. Motivators

TABLE 7 Summary of Costs for Punjab Demonstration

A. Budget
B. Nursery Costs
C. Inservice Training Costs
D. Technical Assistance Costs
E. Commodities
F. Motivators

TABLE 8 Summary of Costs for M-K Demonstration

A. Budget
B. Nursery Costs
C. Inservice Training Costs
D. Technical Assistance Costs
E. Commodities
F. Motivators

TABLE 9 Costs for Training Center, Hostel & Research C

TABLE 10 Cost of Commodities for Baluchistan

TABLE 1

SUMMARY OF FP&D AMENDMENT FUNDING BY USAID & GOP SOURCES

	PROJECT COMPONENT	CURRENT FP&D PROJECT $ (000's)	FP & D AMENDMENT $ (000's)	GOP $ (000's)	TOTAL $ (000's)
1	Research Facilities				
	Technical Assistance	330.00			330.00
	Training		1357.00		1357.00
	Commodities		1330.00		1330.00
	Construction & A&E @ 40%				
	Sind		500.00		500.00
	Punjab		50.00		50.00
	Baluchistan		500.00		500.00
	A&E costs		420		420.00
	subtotal	330.00	4157.00		4487.00
2	Field Operations				
	Technical Assistance	795.00			795.00
	Training		704.33		704.33
	Commodities		802.00		802.00
	Other Costs				
	Sind		1683.30		1683.30
	Punjab		2780.80		2780.80
	Murree-Kahuta		2175.40		2175.40
	Operational expense			1900.00	1900.00
	Salary			620.30	620.30
	Motivators		548.57	548.57	1097.14
	Housing & Furinshings			800.00	800.00
	subtotal	795.00	8394.40	2520.30	12209.70
3	Operational Subgrants				
	Technical Assistance	150.00			150.00
	Grants		1200.00		1200.00
	subtotal	150.00	1200.00		1350.00
4	Provincial Training Facilities				
	Sind		365.00		365.00
	Punjab		365.00		365.00
	Baluchistan		245.00		245.00
	A&E design costs @ 40%		390.00		390.00
	Commodities-Furnish&Equip	200.00	100.00	200.00	500.00
	Contingency	150.00			150.00
	subtotal	350.00	1465.00	200.00	2015.00
5	PFI Women's Hostel		250.00		250.00
	subtotal		250.00		250.00
	Contingency		300.00	200.00	
	GRAND TOTAL	1625.00	16266.40	2920.30	20811.70

TABLE 2

SUMMARY OF USAID FUNDING FOR THE FP&D PROJECT BY YEAR

PROJECT COMPONENT	Year 1 $ (000's)	Year 2 $ (000's)	Year 3 $ (000's)	Year 4 $ (000's)	Year 5 $ (000's)	TOTAL FP&D Amendment $ (000's)	Current FP&D TOTAL $(000)
Research Facilities							
Technical Assistance	30.00	100.00	80.00	80.00	40.00		330.00
Training	100.00	200.00	500.00	300.00	257.00	1357.00	
Commodities	200.00	500.00	400.00	130.00	100.00	1330.00	
Construction & A&E @ 40%							
Sind	400.00	100.00	0.00	0.00	0.00	500.00	
Punjab	40.00	10.00	0.00	0.00	0.00	50.00	
Baluchistan	0.00	400.00	100.00	0.00	0.00	500.00	
A&E costs	176.00	204.00	40.00	0.00	0.00	420.00	
subtotal	946.00	1514.00	1120.00	510.00	397.00	4157.00	330.00
Field Operations							
Technical Assistance	450.00	180.00	165.00	0.00	0.00		795.00
Training	346.05	87.57	87.57	87.57	87.57	704.33	
Commodities	399.00	214.00	118.00	44.00	27.00	802.00	
Other Costs							
Sind	357.50	367.00	367.70	396.10	404.50	1893.30	
Punjab	190.10	327.87	603.43	754.26	905.14	2780.80	
Murree-Kahuta	412.50	428.60	429.50	441.40	463.40	2175.40	
Motivators	131.66	177.74	239.18	0.00	0.00	548.57	
subtotal	2286.81	1784.78	2012.38	1715.33	1889.61	8874.40	795.00
Operational Subgrants							
Technical Assistance	60.00	60.00	0.00	0.00	30.00		150.00
Grants	150.00	250.00	300.00	300.00	200.00	1200.00	
subtotal	210.00	310.00	300.00	300.00	230.00	1200.00	150.00
Provincial Training Facilities							
Sind	290.00	75.00	0.00	0.00	0.00	365.00	
Punjab	270.00	75.00	0.00	0.00	0.00	365.00	
Baluchistan	0.00	0.00	190.00	55.00	0.00	245.00	
A&E design costs @ 40%	232.00	60.00	75.00	23.00	0.00	390.00	
Commodities-Furnish&Equip	0.00	200.00	0.00	100.00	0.00	100.00	200.00
Contingency	50.00	50.00	0.00	50.00	0.00		150.00
subtotal	862.00	460.00	265.00	228.00	0.00	1465.00	350.00
PFI Women's Hostel	0.00	190.00	60.00	0.00	0.00	250.00	
subtotal						250.00	
Contingency						300.00	
GRAND TOTAL						16266.40	1625.00

TABLE 3

RESEARCH "FACILITIES"
SUMMARY OF COSTS

Quantity	Item	Cost/unit $ (000's)	Total Cost $ (000's)
Number			
	Commodity		
10	Vehicles	14	140
12	Computers	10	120
17	Sci. Equip. & Lab	50	850
22	Tech. Pub.	10	220
		subtotal	1330
	Facilities		
2	10 Science labortories	500	1000
1	1 Research library & Computer Ctr. Complex	50	50
	A&E @ 40%		420
		subtotal	1470
Months			
	Training		
360	Phd	1.8	648
240	MSc	1.8	432
60	Non-degree	3.5	210
10	Workshops, Pakistan	0.7	7
20	Student, research	0.5	10
		subtotal	1307
	Technical Assistance		
22	Existing FP&D project funds	0	0
		subtotal	0
		GRAND TOTAL	4107

TABLE 4

SUMMARY OF INSTRUCTIONAL FACILITY COSTS

No.	Facilities	Unit Cost $ (000's)	Total Cost $ (000's)
1	10-room Hostel & Classroom Ctr (Baluchistan)	245.00	245.00
1	20-room Hostel & Classroom Ctr (Punjab)	365.00	365.00
1	20-room Hostel & Classroom Ctr (Sind)	365.00	365.00
		subtotal =	975.00
	A/E cost @ 40 percent		390.00
		total =	1365.00
1 lot	Furnishings (Baluchistan)	100.00	100.00
1 lot	Furnishings (Punjab)	200.00	200.00
1 lot	Furnishings (Sind)	200.00	200.00
		total =	500.00
		GRAND TOTAL	1865.00

TABLE 5

EXPANSION OF FARM FORESTRY DEMONSTRATION TO IRRIGATED FARMLANDS OF SIND
ADMINISTRATIVE COSTS -- STATEMENT OF PAY & ALLOWANCES (Rs 000's)

Post	Additional Posts Required	Basic Pay Scale	Year 1		Year 2		Year 3		Year 4		Year 5		Total	
			GOP	USAID	GOP	USAID	GOP	USAID	GOP	USAID	GOP	USAID	GOP	USAID
A. PAY														
1. Sub-divisional forest officers	3	17	74.34		79.92		85.50		91.08		96.66		427.50	
2. Range forest officers	12	16	194.40		210.96		226.08		241.20		256.32		1128.96	
3. Farm foresters-husband/wife	36	9	179.28	179.28	186.41	186.41	387.07		413.28		415.38		1581.62	
4. Forest guards	36	1	216.00		221.61		227.23		232.85		238.46		1136.15	
B. ALLOWANCES														
1. Sub-divisional forest officers	3	17	36.00		37.00		38.00		39.00		40.00		190.00	
2. Range forest officers	12	16	108.00		110.00		112.00		114.00		116.00		560.00	
3. Farm foresters-husband/wife	36	9	86.40	86.40	95.04	95.04	209.08		229.99		253.00		873.51	
4. Forest guards	36	1	97.20		106.90		117.59		129.34		142.27		593.30	
C. TOTAL			991.62	265.68	1047.84	281.45	1402.55	0.00	1490.74	0.00	1558.29	0.00	6471.04	0.00

TABLE 5 (CONT)

INTEGRATED DEMONSTRATION PROJECT FOR MURREE-KAHUTA
ADMINISTRATIVE COSTS -- STATEMENT OF PAY & ALLOWANCES (Rs 000's)

Post	Additional Posts Required	Basic Pay Scale	Year 1		Year 2		Year 3		Year 4		Year 5		Total	
			GOP	USAID	GOP	USAID	GOP	USAID	GOP	USAID	GOP	USAID	GOP	USAID
A. PAY														
1. Conservator of forest														
2. Divisional forest officer														
3. Subdivisional forest officer														
4. Range forest officer	2	16	32.40		34.92		37.44		39.96		40.08		184.80	
5. Outreach farm forester	16	9	159.36		165.7		172.03		178.37		184.7		860.16	
6. Nursery forest guards	10	1	60		61.56		63.12		64.68		66.24		315.60	
B. ALLOWANCES														
1. Conservator of forest														
2. Divisional forest officer														
3. Subdivisional forest officer														
4. Range forest officer	2	16	18.00		18.50		19.00		19.50		20.00		95.00	
5. Outreach farm forester	16	9	76.80		84.48		92.92		102.21		112.43		468.84	
6. Nursery forest guards	10	1	27.00		23.00		29.00		30.00		31.00		145.00	
C. TOTAL			373.56		393.16		413.51		434.72		454.45		2069.40	

TABLE 5 (CONT)

EXPANSION OF FARM FORESTRY DEMONSTRATION TO IRRIGATED FARMLANDS OF PUNJAB
ADMINISTRATIVE COSTS -- STATEMENT OF PAY & ALLOWANCES (Rs 000's)

Post	Additional Posts Required	Basic Pay Scale	Year 1		Year 2		Year 3		Year 4		Year 5		Total	
			GOP	USAID	GOP	USAID	GOP	USAID	GOP	USAID	GOP	USAID	GOP	USAID
A. PAY														
1. Farm foresters (Women)	28	9		278.88		289.97	301.06		312.14		323.23		936.43	568.85
B. ALLOWANCES														
1. Farm foresters (Women)	28	9		151.20		154.56	157.92		161.28		164.64		483.84	305.76
C. TOTAL			0.00	430.08	0.00	444.53	458.98	0.00	473.42	0.00	487.87	0.00	1420.27	874.61

GRAND TOTAL = 10855.32 Rs. = 620.304 $

TABLE 6A.

SIND BUDGET

	Current Project Funds ($ 000's)	Ammendment Funds ($ 000's)
Technical Assistance	210.00	
Training		193.05
Commodities		235.00
Other Costs		
Nursery		1882.84
Motivators		191.45
	210.00	2502.92

GRAND TOTAL = $2712.92

TABLE 6B

SIND NURSERY PRODUCTION & CONSTRUCTION COSTS

DEFINITIONS			
SCR =	Seedling production cost (Rs)	=	1.00
TA =	Total acres planted	=	6600.00
PCT33 =	Percent TA planted 3' x 3'	=	0.75
PCT66 =	Percent TA planted 6' x 6'	= 1-PCT33	0.25
ST33 =	No trees per acre planted 3' x 3'	=	4800.00
ST66 =	No trees per acre planted 6' x 6'	=	1200.00
NSPA =	Nursery seedlings produced/acre	=	100000.00
N =	No years of nursery production	=	5.00
NCR =	Nursery construction cost(Rs/Acre)	=	12040.00

NURSERY PRODUCTION COST				Cost in $
T33 =	Total seedlings 3' x 3' spacing	= TA*PCT33*ST33	23760000.00	
T66 =	Total seedlings 6' x 6' spacing	= TA*PCT66*ST66	1980000.00	
TS =	Total seedlings required for TA	= T33+T66	25740000.00	
TS =	TS increased by 25% for restock	= TS*1.25	32175000.00	
TSCR =	Total seedling cost (Rs)	= TS*SCR	32175000.00	
TSC$ =	Total seedling cost for TA ($)	= TSCR/17.5		1838571.43
PCA$ =	Cost/acre for production ($)	= TSC$/TA		273.57

NURSERY CONSTRUCTION COST				Cost in $
TAN =	Total area in nurseries (acres)	= TS/NSPA	321.75	
PAN =	Per annum nursery area required(AC)	= TAN/N	64.35	
TNC =	Total nursery construction cost(Rs)	= NCR*PAN	774774.00	
TNC$ =	Total nursery construction cost($)	= TNC/17.5		44272.80
CCA$ =	Cost/acre for construction ($)	= TNC$/TA		6.71

TC =	TOTAL PRODUC. & CONSTRUC. COSTS	= TSC$+TNC$	1882844.23

TABLE 6B (CONT)

ACRES TO BE PLANTED BY YEAR

	Area	Project Year 1	2	3	4	5	Total acres
SIND	Per district	400.00	420.00	440.00	460.00	480.00	2200.00
	Whole province	1200.00	1260.00	1320.00	380.00	1440.00	6600.00
	As percent	0.18	0.19	0.20	0.21	0.22	1.00

NURSERY COSTS BY YEAR ($)

		Project Year 1	2	3	4	5	Total Costs
SIND	Production	330942.86	349328.57	367714.29	386100.00	404485.71	1838571.43
	Construction	26563.68	17709.12	0.00	0.00	0.00	44272.80
	TOTAL	357506.54	367037.69	367714.29	386100.00	404485.71	1882844.23

TABLE 6C

I. INSERVICE TRAINING--SIND

A. Initial (1st Year)	$/day	# Persons	Course (mos) Duration	Course Per Year	# Years	Months Total	$ Month (26 days)	$ Total
DFO's, SDFO's & RFO's	30	18	0.5	1	1	9	780	7020
Foresters, Farm	20	36	1	1	1	36	520	18720
Forest Guards	10	36	1	1	1	36	260	9360
Motivators	5	349	0.23	1	1	80.27	130	10435.1

TOTAL = 45535.1

B. Annually (Years 2-5)	$/day	# Persons	Course (mos) Duration	Course Per Year	# Years	Months/Year Total	$ Month (26 days)	$ Total
DFO's, SDFO's & RFO's	30	18	0.25	1	4	18	780	14040
Foresters, Farm	20	36	0.5	1	4	72	520	37440
Forest Guards	10	36	0.5	1	4	72	260	18720
Motivators-Training&Farm tour	5	349	0.12	1	4	167.52	130	21777.6

TOTAL = 91977.6

GRAND TOTAL= 137512.7

INITIAL SERVICE TRAINING

Women Foresters	No.	Per/diem Cost/Year	Salary $	Total Cost/ Trainee
Sind	18	2800	315	56070
Punjab	28	2800	315	87220
Murree-Kahuta	8	2800	315	24920

TOTAL = 168210

TABLE 6D

Technical Assistance Costs

YEAR	AREA	EXPERTISE	MONTHS	$/MOS (000's)	TOTAL COST $ (000's)
	SIND				
1		Outreach/Social Scientist	2	15	30
		Nursery management	2	15	30
		Curriculum development	2	15	30
		Economist/Marketing	1	15	15
2		Outreach/Social Scientist	2	15	30
		Nursery management	2	15	30
		Curriculum development	1	15	15
3		Outreach/Social Scientist	1	15	15
		Economist/Marketing	1	15	15
		TOTAL	14		210

AREA	COMMODITIES	QUANTITY	UNIT PRICE $ (000's)	TOTAL COST $ (000's)
SIND				
	26-passenger buses, Toyata	2	20	40
	Computer systems	2	10	20
	Nursery/Seed storage & process	2	30	60
	Jeeps	2	12	24
	Pick-up trucks	3	12	36
	Motorcycles	25	1	25
	Audio-Visual equipment	1	30	30
			TOTAL =	235

TABLE 6F

NUMBER OF MOTIVATORS ADDED BY YEAR

	1	2	3	4	5	TOTAL No.
Punjab	145	194	281	0	0	620
Sind	87	119	143	0	0	349
NK	8	11	12	0	0	31
GRAND TOTAL						1000

MOTIVATOR COSTS (@ Rs 800/mos for 24 mos)

	1	2	3	4	5	TOTAL Rs	TOTAL $
Punjab	2784000.00	3724800.00	5395200.00	0.00	0.00	11904000.00	680228.57
Sind	1670400.00	2284800.00	2745600.00	0.00	0.00	6700800.00	382902.86
NK	153600.00	211200.00	230400.00	0.00	0.00	595200.00	34011.43
Total	4608000.00	6220800.00	8371200.00	0.00	0.00	19200000.00	1097142.86
in $	263314.29	355474.29	478354.29				
GRAND TOTAL						19200000.00	1097142.86

TABLE 7A

PUNJAB BUDGET

	Current Project Funds ($ 000's)	Ammendment Funds ($ 000's)
Technical Assistance	210.00	
Training		445.53
Commodities		399.00
Other Costs		
Nursery		2780.82
Motivators		340.11
	210.00	3965.47

GRAND TOTAL = $4175.47

TABLE 7B

PUNJAB NURSERY PRODUCTION & CONSTRUCTION COSTS

DEFINITIONS				
SCR =	Seedling production cost (Rs)	=		1.00
TA =	Total acres planted	=		19000.00
PCT33 =	Percent TA planted 3' x 3'	=		0.20
PCT66 =	Percent TA planted 6' x 6'	=	1-PCT33	0.80
ST33 =	No trees per acre planted 3' x 3'	=		4800.00
ST66 =	No trees per acre planted 6' x 6'	=		1200.00
NSPA =	Nursery seedlings produced/acre	=		100000.00
N =	No years of nursery production	=		5.00
NCR =	Nursery construction cost(Rs/Acre)	=		12040.00

NURSERY PRODUCTION COST					Cost in $
T33 =	Total seedlings 3' x 3' spacing	=	TA*PCT33*ST33	19008000.00	
T66 =	Total seedlings 6' x 6' spacing	=	TA*PCT66*ST66	19008000.00	
TS =	Total seedlings required for TA	=	T33+T66	38016000.00	
TS =	TS increased by 25% for restock	=	TS*1.25	47520000.00	
TSCR =	Total seedling cost (Rs.)	=	TS*SCR	47520000.00	
TSC$ =	Total seedling cost for TA ($)	=	TSCR/17.5		2715428.57
PCA$ =	Cost/acre for production ($)	=	TSC$/TA		137.14

NURSERY CONSTRUCTION COST					Cost in $
TAN =	Total area in nurseries (acres)	=	TS/NSPA	475.20	
PAN =	Per annum nursery area required(AC)	=	TAN/N	95.04	
TNC =	Total nursery construction cost(Rs)	=	NCR*PAN	1144281.60	
TNC$ =	Total nursery construction cost($)	=	TNC/17.5		65387.52
CCA$ =	Cost/acre for construction ($)	=	TNC$/TA		3.30

TC =	TOTAL PRODUC. & CONSTRUC. COSTS	=	TSC$+TNC$	2780816.09

TABLE 7B (CONT)

ACRES TO BE PLANTED BY YEAR

	Area	Project Year 1	2	3	4	5	Total acres
PUNJAB	Per district	50.00	100.00	200.00	250.00	300.00	900.00
	Whole province	1100.00	2200.00	4400.00	5500.00	6600.00	19800.00
	As percent	0.06	0.11	0.22	0.28	0.33	1.00

NURSERY COSTS BY YEAR ($)

		Project Year 1	2	3	4	5	Total Costs
PUNJAB	Production	150857.14	301714.29	603428.57	754285.71	905142.86	2715428.57
	Construction	39232.51	26155.01	0.00	0.00	0.00	65387.52
	TOTAL	190089.65	327869.29	603428.57	754285.71	905142.86	2780816.09

TABLE 7C

II. INSERVICE TRAINING--PUNJAB

A. Initial (1st Year)	$/day	# Persons	Course (mos) Duration	Course Per Year	# Years	Months Total	$ Month (26 days)	$ Total
DFO's, SDFO's & RFO's	30	36	0.5	1	1	18	780	14040
Foresters, Farm	20	120	1	1	1	120	520	62400
Forest Guards	10	92	1	1	1	92	260	23920
Motivators	5	620	0.23	1	1	142.6	130	18538
							TOTAL =	118898

B. Annually (Years 2-5)	$/day	# Persons	Course (mos) Duration	Course Per Year	# Years	Months/Year Total	$ Month (26 days)	$ Total
DFO's, SDFO's & RFO's	30	36	0.25	1	4	36	780	28080
Foresters, Farm	20	120	0.5	1	4	240	520	124800
Forest Guards	10	92	0.5	1	4	184	260	47840
Motivators-Training&Farm tour	5	620	0.12	1	4	297.6	130	38688
							TOTAL =	239408

GRAND TOTAL= 358306

NITIAL SERVICE TRAINING

...een Foresters		Per/diem Cost/Year	Salary $	Total Cost/ Trainee
...nd	18	2800	315	56070
...jab	28	2900	315	87220
...rree-Kamuta	8	2800	315	24920
			TOTAL =	168210

TABLE 7D

Technical Assistance Costs

YEAR	AREA	EXPERTISE	MONTHS	$/MOS (000's)	TOTAL COST $ (000's)
	PUNJAB				
1		Outreach/Social Scientist	2	15	30
		Nursery management	2	15	30
		Curriculum development	2	15	30
		Economist/Marketing	1	15	15
2		Outreach/Social Scientist	2	15	30
		Nursery management	2	15	30
		Curriculum development	1	15	15
3		Outreach/Social Scientist	1	15	15
		Economist/Marketing	1	15	15
		TOTAL	14		210

TABLE 7E

AREA	COMMODITIES	QUANTITY	UNIT PRICE $ (000's)	TOTAL COST $ (000's)
PUNJAB				
	46-passenger bus	1	55	55
	Computer systems	3	10	30
	Nursery/Seed storage & process	2	60	120
	Jeep	4	12	48
	Pick-up trucks	3	12	36
	Motorcycles	80	1	80
	Audio-Visual equipment	1	30	30
			TOTAL =	399

TABLE 7F

NUMBER OF MOTIVATORS ADDED BY YEAR

	1	2	3	4	5	TOTAL No.
Punjab	145	194	281	0	0	620
Sind	87	119	143	0	0	349
NWF	8	11	12	0	0	31
GRAND TOTAL						1000

MOTIVATOR COSTS (@ Rs 500/mos for 24 mos)

	1	2	3	4	5	TOTAL Rs	TOTAL $
Punjab	2784000.00	3724800.00	5395200.00	0.00	0.00	11904000.00	680228.57
Sind	1670400.00	2284800.00	2745600.00	0.00	0.00	6700800.00	382902.86
NWF	153600.00	211200.00	230400.00	0.00	0.00	595200.00	34011.43
Total	4608000.00	6220800.00	8371200.00	0.00	0.00	19200000.00	1097142.86
In $	263314.29	355474.29	478354.29				
GRAND TOTAL						19200000.00	1097142.86

TABLE 8A

M-K BUDGET

	Current Project Funds ($ 000's)	Ammendment Funds ($ 000's)
Technical Assistance	375.00	
Training		65.22
Commodities		168.00
Other Costs		
Watershed Rehabilitation		1000.00
Nursery		1175.60
Motivators		17.00
	375.00	2429.53

GRAND TOTAL = $2804.53

TABLE 8B

MURREE-KAHUTA #1 NURSERY PRODUCTION & CONSTRUCTION COSTS

DEFINITIONS				
SCR =	Seedling production cost (Rs)	=		1.00
TA =	Total acres planted	=		1500.00
PCT33 =	Percent TA planted 3' x 3'	=		0.33
PCT66 =	Percent TA planted 6' x 6'	=	1-PCT33	0.67
ST33 =	No trees per acre planted 3' x 3'	=		4000.00
ST66 =	No trees per acre planted 6' x 6'	=		1000.00
NSPA =	Nursery seedlings produced/acre	=		100000.00
N =	No years of nursery production	=		5.00
NCR =	Nursery construction cost(Rs/Acre)	=		12040.00

NURSERY PRODUCTION COST					Cost in $
T33 =	Total seedlings 3' x 3' spacing	=	TA*PCT33*ST33	1998000.00	
T66 =	Total seedlings 6' x 6' spacing	=	TA*PCT66*ST66	1000500.00	
TS =	Total seedlings required for TA	=	T33+T66	2998500.00	
TS =	TS increased by 25% for restock	=	TS*1.25	3748125.00	
TSCR =	Total seedling cost (Rs.)	=	TS*SCR	3748125.00	
TSC$ =	Total seedling cost for TA ($)	=	TSCR/17.5		214178.57
PCA$ =	Cost/acre for production ($)	=	TSC$/TA		142.79

NURSERY CONSTRUCTION COST					Cost in $
TAN =	Total area in nurseries (acres)	=	TS/NSPA	37.48	
PAN =	Per annum nursery area required(AC)	=	TAN/N	7.50	
TNC =	Total nursery construction cost(Rs)	=	NCR*PAN	90254.85	
TNC$ =	Total nursery construction cost($)	=	TNC/17.5		5157.42
CCA$ =	Cost/acre for construction ($)	=	TNC$/TA		3.44

TC =	TOTAL PRODUC. & CONSTRUC. COSTS	=	TSC$+TNC$	219335.99

MURREE-KAHUTA #2 NURSERY PRODUCTION & CONSTRUCTION COSTS

DEFINITIONS				
SCR =	Seedling production cost (Rs)	=		1.00
TA =	Total acres planted	=		1200.00
PCT33 =	Percent TA planted 3' x 3'	=		0.33
PCT66 =	Percent TA planted 6' x 6'	=	1-PCT33	0.67
ST33 =	No trees per acre planted 3' x 3'	=		4000.00
ST66 =	No trees per acre planted 6' x 6'	=		1000.00
NSPA =	Nursery seedlings produced/acre	=		100000.00
N =	No years of nursery production	=		5.00
NCR =	Nursery construction cost(Rs/Acre)	=		12040.00
RC =	12 stock reservoirs @ 1200 Rs each	=		14400.00

NURSERY PRODUCTION COST					Cost in $
T33 =	Total seedlings 3' x 3' spacing	=	TA*PCT33*ST33	1598400.00	
T66 =	Total seedlings 6' x 6' spacing	=	TA*PCT66*ST66	800400.00	
TS =	Total seedlings required for TA	=	T33+T66	2398800.00	
TS =	TS increased by 25% for restock	=	TS*1.25	2998500.00	
TSCR =	Total seedling cost (Rs.)	=	TS*SCR	2998500.00	
TSC$ =	Total seedling cost for TA ($)	=	TSCR/17.5		171342.86
PCA$ =	Cost/acre for production ($)	=	TSC$/TA		142.79

NURSERY & RESERVOIR CONSTRUCTION COST					Cost in $
TAN =	Total area in nurseries (acres)	=	TS/NSPA	29.99	
PAN =	Per annua nursery area required(AC)	=	TAN/N	6.00	
TNC =	Total nursery construction cost(Rs)	=	NCR*PAN	72203.89	
TNC$ =	Total nursery & reservoir cost ($)	=	(TNC+RC)/17.5		4948.79
CCA$ =	Cost/acre for construction ($)	=	TNC$/TA		4.12

TC =	TOTAL PRODUC. & CONSTRUC. COSTS	=	TSC$+TNC$	176291.65

MURREE-KAHUTA #3 NURSERY PRODUCTION & CONSTRUCTION COSTS

DEFINITIONS				
SCR =	Seedling production cost (Rs)	=		1.00
TA =	Total acres planted	=		3324.00
PCT33 =	Percent TA planted 3' x 3'	=		0.33
PCT66 =	Percent TA planted 6' x 6'	=	1-PCT33	0.67
ST33 =	No trees per acre planted 3' x 3'	=		4000.00
ST66 =	No trees per acre planted 6' x 6'	=		1000.00
NSPA =	Nursery seedlings produced/acre	=		100000.00
N =	No years of nursery production	=		5.00
NCR =	Nursery construction cost(Rs/Acre)	=		12040.00

NURSERY PRODUCTION COST					Cost in $
T33 =	Total seedlings 3' x 3' spacing	=	TA*PCT33*ST33	4427568.00	
T66 =	Total seedlings 6' x 6' spacing	=	TA*PCT66*ST66	2217108.00	
TS =	Total seedlings required for TA	=	T33+T66	6644676.00	
TS =	TS increased by 25% for restock	=	TS*1.25	8305845.00	
TSCR =	Total seedling cost (Rs.)	=	TS*SCR	8305845.00	
TSC$ =	Total seedling cost for TA ($)	=	TSCR/17.5		474619.71
PCA$ =	Cost/acre for production ($)	=	TSC$/TA		142.79

NURSERY CONSTRUCTION COST					Cost in $
TAN =	Total area in nurseries (acres)	=	TS/NSPA	83.06	
PAN =	Per annua nursery area required(AC)	=	TAN/N	16.61	
TNC =	Total nursery construction cost(Rs)	=	NCR*PAN	200004.75	
TNC$ =	Total nursery construction cost($)	=	TNC/17.5		11428.84
CCA$ =	Cost/acre for construction ($)	=	TNC$/TA		3.44

TC =	TOTAL PRODUC. & CONSTRUC. COSTS	=	TSC$+TNC$	486048.56

MURREE-KAHUTA #4 NURSERY PRODUCTION & CONSTRUCTION COSTS

DEFINITIONS				
SCR =	Seedling production cost (Rs)	=		1.00
TA =	Total acres planted	=		1410.00
PCT33 =	Percent TA planted 3' x 3'	=		0.33
PCT66 =	Percent TA planted 6' x 6'	=	1-PCT33	0.67
ST33 =	No trees per acre planted 3' x 3'	=		4000.00
ST66 =	No trees per acre planted 6' x 6'	=		1000.00
NSPA =	Nursery seedlings produced/acre	=		100000.00
N =	No years of nursery production	=		5.00
NCR =	Nursery construction cost(Rs/Acre)	=		12040.00

NURSERY PRODUCTION COST					Cost in $
T33 =	Total seedlings 3' x 3' spacing	=	TA*PCT33*ST33	1878120.00	
T66 =	Total seedlings 6' x 6' spacing	=	TA*PCT66*ST66	940470.00	
TS =	Total seedlings required for TA	=	T33+T66	2818590.00	
TS =	TS increased by 25% for restock	=	TS*1.25	3523237.50	
TSCR =	Total seedling cost (Rs.)	=	TS*SCR	3523237.50	
TSC$ =	Total seedling cost for TA ($)	=	TSCR/17.5		201327.86
PCA$ =	Cost/acre for production ($)	=	TSC$/TA		142.79

NURSERY CONSTRUCTION COST					Cost in $
TAN =	Total area in nurseries (acres)	=	TS/NSPA	35.23	
PAN =	Per annum nursery area required(AC)	=	TAN/N	7.05	
TNC =	Total nursery construction cost(Rs)	=	NCR*PAN	84839.56	
TNC$ =	Total nursery construction cost($)	=	TNC/17.5		4847.97
CCA$ =	Cost/acre for construction ($)	=	TNC$/TA		3.44

TC =	TOTAL PRODUC. & CONSTRUC. COSTS	=	TSC$+TNC$	206175.83

TABLE 8B (CONT)

MURREE-KAHUTA #5 NURSERY PRODUCTION & CONSTRUCTION COSTS

DEFINITIONS			
SCR = Seedling production cost (Rs)	=		1.00
TA = Total acres planted	=		600.00
PCT33 = Percent TA planted 3' x 3'	=		0.33
PCT66 = Percent TA planted 6' x 6'	=	1-PCT33	0.67
ST33 = No trees per acre planted 3' x 3'	=		4000.00
ST66 = No trees per acre planted 6' x 6'	=		1000.00
NSPA = Nursery seedlings produced/acre	=		100000.00
N = No years of nursery production	=		5.00
NCR = Nursery construction cost(Rs/Acre)	=		12040.00

NURSERY PRODUCTION COST				Cost in $
T33 = Total seedlings 3' x 3' spacing	=	TA*PCT33*ST33	799200.00	
T66 = Total seedlings 6' x 6' spacing	=	TA*PCT66*ST66	400200.00	
TS = Total seedlings required for TA	=	T33+T66	1199400.00	
TS = TS increased by 25% for restock	=	TS*1.25	1499250.00	
TSCR = Total seedling cost (Rs.)	=	TS*SCR	1499250.00	
TSC$ = Total seedling cost for TA ($)	=	TSCR/17.5		85671.43
PCA$ = Cost/acre for production ($)	=	TSC$/TA		142.79

NURSERY CONSTRUCTION COST				Cost in $
TAN = Total area in nurseries (acres)	=	TS/NSPA	14.99	
PAN = Per annum nursery area required(AC)	=	TAN/N	3.00	
TNC = Total nursery construction cost(Rs)	=	NCR*PAN	36101.94	
TNC$ = Total nursery construction cost($)	=	TNC/17.5		2062.97
CCA$ = Cost/acre for construction ($)	=	TNC$/TA		3.44

TC = TOTAL PRODUC. & CONSTRUC. COSTS = TSC$+TNC$ 87734.40

TABLE 8B (CONT)

ACRES TO BE PLANTED BY YEAR

	Area	Project Year 1	2	3	4	5	Total acres
KK	Murree-Kahuta	1380.00	1500.00	1614.00	1710.00	1830.00	8034.00
	As percent	0.17	0.19	0.20	0.21	0.23	1.00

NURSERY COSTS BY YEAR ($)

		Project Year 1	2	3	4	5	Total Costs
KK	Production	36789.45	39988.53	43027.66	45586.93	48786.01	214178.57
Model	Construction	3094.45	2062.97	0.00	0.00	0.00	5157.42
# 1	TOTAL	39883.90	42051.50	43027.66	45586.93	48786.01	219335.99

NURSERY COSTS BY YEAR ($)

		Project Year 1	2	3	4	5	Total Costs
KK	Production	29128.29	32555.14	34268.57	35982.00	39408.86	171342.86
Model	Construction	2969.28	1979.52	0.00	0.00	0.00	4948.79
# 2	TOTAL	32097.56	34534.66	34268.57	35982.00	39408.86	176291.65

NURSERY COSTS BY YEAR ($)

		Project Year 1	2	3	4	5	Total Costs
KK	Production	80685.35	90177.75	94923.94	99670.14	109162.53	474619.71
Model	Construction	6857.31	4571.54	0.00	0.00	0.00	11428.84
# 3	TOTAL	87542.66	94749.28	94923.94	99670.14	109162.53	486048.56

NURSERY COSTS BY YEAR ($)

		Project Year 1	2	3	4	5	Total Costs
KK	Production	34225.74	38252.29	40265.57	42278.85	46305.41	201327.86
Model	Construction	2908.78	1939.19	0.00	0.00	0.00	4847.97
# 4	TOTAL	37134.52	40191.48	40265.57	42278.85	46305.41	206175.83

TABLE 8B (CONT)

NURSERY COSTS BY YEAR ($)

		Project Year 1	2	3	4	5	Total Costs
NK Model # 5	Production	14564.14	16277.57	17134.29	17991.00	19704.43	85671.43
	Construction	1237.78	825.19	0.00	0.00	0.00	2062.97
	TOTAL	15801.92	17102.76	17134.29	17991.00	19704.43	87734.40

TOTAL FOR ALL MODELS

Project Year 1	2	3	4	5	Total Costs
212460.56	228629.68	229620.03	241508.92	263367.23	1175586.43

NK SUMMARY NURSERY PRODUCTION & CONSTRUCTION COSTS

Model	Cost $ (000's)
1	219335.99
2	176291.65
3	186048.56
4	206175.83
5	87734.40
Total	1175586.43

WATERSHED REHABILITATION COSTS

Model	Acres	Cost/Acre (Rs)	Total Cost ($)
1	1500	2000	171428.57
2	1200	2000	137142.86
3	3324	2000	379885.71
4	1410	2000	161142.86
5	600	2000	68571.43
Total	8034	2000	918171.43
contingency			81828.57
TOTAL			1000000.00

TABLE 8C

III. INSERVICE TRAINING--MK

A. Initial (1st Year)	$/day	# Persons	Course (mos) Duration	Course Per Year	# Years	Months Total	$ Month (26 days)	$ Total
DFO's, SDFO's & RFO's	30	4	0.5	1	1	2	780	1560
Foresters, Farm	20	16	1	1	1	16	520	8320
Forest Guards	10	10	1	1	1	10	260	2600
Motivators	5	31	0.23	1	1	7.13	130	926.9

TOTAL = 13406.9

B. Annually (Years 2-5)	$/day	# Persons	Course (mos) Duration	Course Per Year	# Years	Months/Year Total	$ Month (26 days)	$ Total
DFO's, SDFO's & RFO's	30	4	0.25	1	4	4	780	3120
Foresters, Farm	20	16	0.5	1	4	32	520	16640
Forest Guards	10	10	0.5	1	4	20	260	5200
Motivators-Training&Farm tour	5	31	0.12	1	4	14.88	130	1934.4

TOTAL = 26894.4

GRAND TOTAL= 40301.3

INITIAL SERVICE TRAINING

Women Foresters	No.	Per/diem Cost/Year	Salary $	Total Cost/ Trainee
Sind	18	2800	315	56070
Punjab	28	2800	315	87220
Murree-Kahuta	8	2800	315	24920

TOTAL = 168210

TABLE 8D

Technical Assistance Costs

YEAR	20396.70 AREA	EXPERTISE	MONTHS	$/MOS (000's)	TOTAL COST $ (000's)
	MK				
1		Watershed management planner	3	15	45
		Soil erosion control	2	15	30
		Slope stability/Geologist	2	15	30
		Social Scientist/Outreach	3	15	45
		Nursery specialist	3	15	45
		Hydrologist	1	15	15
		Audio-Visual equipment	1	30	30
2		Social Scientist/Land use planner	2	15	30
3		Watershed management/ General	3	15	45
		Hydrologist	1	15	15
		Economist	1	15	15
		Social Scientist/Outreach	2	15	30
		TOTAL	24		375

TABLE 8E

AREA	COMMODITIES	QUANTITY	UNIT PRICE $ (000's)	TOTAL COST $ (000's)
MK				
	Computer systems	2	10	20
	Nursery/Seed storage & process	1	60	60
	Jeep	2	12	24
	Pick-up trucks	2	12	24
	Motorcycles	10	1	10
	Audio-Visual equipment	1	30	30
			TOTAL =	168

TABLE 8F

NUMBER OF MOTIVATORS ADDED BY YEAR

	1	2	3	4	5	TOTAL No.
Punjab	145	194	281	0	0	620
Sind	87	119	143	0	0	349
NK	8	11	12	0	0	31
				GRAND TOTAL		1000

MOTIVATOR COSTS (@ Rs 800/mos for 24 mos)

		1	2	3	4	5	TOTAL Rs	TOTAL $
Punjab		2784000.00	3724800.00	5395200.00	0.00	0.00	11904000.00	680228.57
Sind		1670400.00	2284800.00	2745600.00	0.00	0.00	6700800.00	382902.86
NK		153600.00	211200.00	230400.00	0.00	0.00	595200.00	34011.43
	Total	4608000.00	6220800.00	8371200.00	0.00	0.00	19200000.00	1097142.86
	in $	263314.29	355474.29	478354.29				
					GRAND TOTAL		19200000.00	1097142.86

TABLE 9

INSERVICE TRAINING CENTER & HOSTEL (20 ROOM).

No.	Unit	ft2/unit	total/ft2	Cost/ft2 Rs.	Total Cost Rs.	Total Cost in $
20	Room & bath (12x10)	240	4800	350.00	1620000.00	96000.00
2	Classrooms (25x30)	750	1500	350.00	525000.00	30000.00
2	Seminar room (20x20)	400	800	350.00	280000.00	16000.00
4	Offices	120	480	350.00	168000.00	9600.00
1	Equipment store	150	150	350.00	52500.00	3000.00
1	Common room/Library (20x30)	600	600	350.00	210000.00	12000.00
1	Dining Rm & Conference Hall (50x60)	3000	3000	350.00	1050000.00	60000.00
1	Kitchen & Storage (20x30)	600	600	350.00	210000.00	12000.00
1	Reception area	400	400	350.00	140000.00	8000.00
1	Infirmary	400	400	350.00	140000.00	8000.00
	Add 40% area for circulation & wall space		5092	350.00	1784236.80	101956.39
	GRAND TOTAL		12730.00		6239736.80	356556.39

10-SCIENTIST PROVINCIAL RESEARCH CENTER

No.	Unit	ft2/unit	total/ft2	Cost/ft2 in Rs.	Total Cost in Rs.	Total Cost in $
20	Offices (10x15)	150	3000	400.00	1200000.00	68571.43
8	Labs (15x25)	375	3000	700.00	2100000.00	120000.00
10	Storage Room (10x12)	120	1200	300.00	360000.00	20571.43
1	Library (40x50)	2000	2000	400.00	800000.00	45714.29
1	Computer & Data storage room (25x20)	500	500	600.00	300000.00	17142.86
1	Conference room (25x30)	750	750	400.00	300000.00	17142.86
20	Garages	150	3000	200.00	600000.00	34285.71
1	Vehicle maintainance shop	300	300	200.00	60000.00	3428.57
1	Receiving & Storage area	300	300	300.00	90000.00	5142.86
1	Seed processing & Storage facility (20x40)	800	800	600.00	480000.00	27428.57
	Add 40% area for circulation & wall space		7140	350.00	2499000.00	142[illegible]
	GRAND TOTAL		21990.00		8789000.00	502228.57

TABLE 10

COMMODITIES FOR BALUCHISTAN

AREA	COMMODITIES	QUANTITY	UNIT PRICE $ (000's)	TOTAL COST $ (000's)
BALUCHISTAN				
	26-Passenger bus	1	20	20
	Computer Systems	2	10	20
	Jeeps	2	12	24
	Audio-Visual Equipment (1 lot)	1	36	36
			TOTAL =	100

FINAL DRAFT

EXTENSION

of the
FORESTRY PLANNING AND DEVELOPMENT PROJECT

Willingness and Ability of Ministries to
Support Proposed Activities

Provincial Research Facilities
and Training Needs

On-Farm Forestry Demonstrations in Punjab and Sind

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RONCO CONSULTING CORPORATION

July 1987

This report was prepared under USAID IQC contract No. PDC-1096-I-13-4164-00, Work/Delivery order No. 13, with RONCO Consulting Corporation. It addressed issues defined in the work order relative to extension of the present USAID Forestry Planning and Development Project (391-0481). Specifically it is an assessment of the technical feasibility of activities under sections A-1 and A-2 of the work order.

This report assesses:

a. Willingness and Ability of Federal and Provincial Ministries to Support Proposed Activities

b. Provincial Research Facilities and Training Needs

c. On-Farm Forestry Demonstrations in Punjab and Sind

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I. WILLINGNESS AND ABILITY OF MINISTRIES TO SUPPORT PROPOSED ACTIVITIES.

A. [illegible]

Discussions were held at both the Federal and Provincial levels. Discussions at the federal level were with representatives of the Ministry of Agriculture. Contacts were made with the Ministries of Agriculture, Forestry, Finance and Planning in each province when and where they were available. Names and titles of government of Pakistan representatives and provincial officers who met with the team are listed in the discussions below. The purposes of the meetings were to (1) present and explain the concept and proposed components of the project extension (2) determine the general level of support for activities proposed under the extension and (3) solicit suggestions as to additional activities.

B. [illegible]

While the general topics of discussions centered in the same areas listed above the level of detail varied appreciably depending on whether the officials had been briefed on our visit or were familiar with the current FFHD Project. All meetings were cordial, frank and informative. The general tenor of the responses was supportive of the project extension, however, in two cases substantive questions were raised about the ability of extending proposed activities. In three provinces we were encouraged to increase the scale of activities proposed, i.e., planting [illegible] and in several provinces we [illegible] officers. We and the Forestry Department [illegible] accompanied [illegible] that there would have to be formal [illegible] if we [illegible].

[illegible]

1. [illegible]

Four General officials were contacted, The IGF, Forestry, Mr. Fazlullah Jan, The Secretary for Agriculture, Mr. M. Zahid Chaudhry and the Special Assistant to the Prime Minister for Agriculture M. Farhaj Aziz. All three men were [illegible] of the project goals and encouraged the speed of the project extension. Mr. Jan, was also very helpful in planning our itinerary and provided suggestions on our presentation. He also commented on difficulties the GOF encountered in operating projects on a reimbursable basis. He suggested that the method of funding the extension be viewed by USAID with the objective of

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easing the cash flow problems of the GOP. Mr. [illegible] underscored the need for further training particularly in extension and expressed concern about the GOP's ability to continue reforestation programs should donor funding end. He was also interested in community forestry as a means of helping the landless. In summary there seems to be awareness and concern at the federal level of the types of problems the current project (and the extension) will address and support for the USAID's extension of the project.

2. Provincial Level

a. NWFP

Support for the project extension in the NWFP was somewhat less than enthusiastic. While Yar Mohammad Khan, the CCF and Mr. Faqir Mohammed Khan, the Secretary of Forestry both endorsed the project, their support, particularly the CCF's, was not convincing. The CCF requested continued support particularly for training, but emphasized his difficulty in obtaining funds from the GOP. He related that he needed Rs 5 million and had only been able to obtain Rs 2.1 million and that he also had not yet received the Rs 3.9 million programmed in 1981 for office construction. He suggested that he preferred working with the Dutch and other donor agencies where it was easier to obtain commodities and the funding process was less cumbersome. Finally he indicated a clear preference for operational planting aspects of the project as opposed to the institutional and manpower development activities. The Secretary of forestry stated his support for the project but clearly had little knowledge of the program even though he is by training a forester. In fairness to the secretary, he was preoccupied by a civil [illegible] that was raising problems and took the time to [illegible] for project when more pressing matters needed to be addressed. The CCF, despite his reservations, made a "[illegible]" to help [illegible] through palace lines to make our [illegible] presentation. Unfortunately, because of this [illegible], an appointment with the Secretaries of Finance and Planning and Development were cancelled.

b. Punjab

The Punjab Forestry Department was very interested and supportive of the proposed demonstration project. The CCF, Mr. Ilyas [illegible], and several of his staff reviewed past and ongoing social forestry projects in the Punjab. The CCF explained that while the Department had experience in on-farm forestry (partly as a result of the existing FP&D project) they would welcome the USAID demonstration project on irrigated lands (1) because further outreach training for the staff would be useful, particularly in reaching the small farmer (2) the government of Punjab funding for the

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current project would end this year and substantial demand had been created and (3) as a result the new USAID supported project could be implemented with existing staff.

Mr. Mohammed Ashraf, Secretary for Forestry, Wildlife and Tourism also endorsed the extension to irrigated lands pointed out that participants in the previous Punjab funded social forestry effort had been predominantly the larger land owners who expected (and received) significant subsidies. The Secretary also endorsed use of the Murree-Kahuta Development Authority for implementation of the proposed watershed/forestry demonstration. He gave assurance that the Authority would receive sympathetic response from the Forestry Department in meeting its staffing needs. In summary, Forestry Department support for the irrigated private land component and the watershed/forestry component was enthusiastic.

The Planning and Development Secretariat, through their Chief Economist, Dr. Bashir, expressed an entirely different perspective. Dr. Bashir felt the proposed extension to irrigated areas was premature and that success of the USAID funded project in the barani should be evaluated before an additional effort was undertaken. He stated that the government did not want to encourage replacement of agricultural crops with fuelwood or other forest products in irrigated areas and felt that the additional manpower needed would be difficult to justify. Dr. Bashir also noted that social forestry had been undertaken in the irrigated Punjab for a number of years and that there were "too many" projects being undertaken in the irrigated areas. In contrast, he was quite supportive of the integrated forestry/watershed component proposed for the Murree-Kahuta area.

c. Sind

Support for extension of the project to private irrigated lands in Sind was uniformly high among Forestry, Finance and Planning and Development officials interviewed. Mr. T. A. Ansari, Secretary, Wildlife and Forestry requested that USAID consider providing support sufficient for 5,000 acre demonstrations in each of three districts. Mr. Ansari stated that "politicians do not feel that training is sufficient" and consequently larger planting targets are preferred. The Secretary in the Finance Department, Mr. Nazir Mohammed Shaik underscored the same point emphasizing the need to reach the largest possible number of farmers. Mr. Syed Azizuddin, Chief Economist with the Planning and Development Department stressed the need to prepare a new PC-1 but emphasized support in principal for the proposed project extension. He also suggested that a meeting or seminar to discuss any dispersal problems anticipated by USAID would be welcomed. Mr. Bahuddin Sirhindi, CCF and his staff

indicated that the proposed demonstration on private lands was needed but that some additional staff would be required. None of the officials mentioned above indicated that there would be any problem for the government of Sind to provide its share of fiscal or personnel resources.

d. Baluchistan

Discussions with the Planning and Development Ministry, Additional Chief Secretary, Mr. Fateh Khan and the Secretary of Planning Mr. Sardar M. Sharif centered on proposed research and training facilities. Both men were supportive of the proposed project extension. Mr. Khan was familiar with the current FF&D program at Nasirabad and suggested this should be extended to the adjoining district. He also advanced the idea that flood waters might be stored for use in irrigating plantations. Mr. Sharif strongly preferred that any research/training facilities constructed be "outside" Quetta preferably in a forested area.

Mr. Mukhtar Gul, Secretary Forest and Wildlife Department and Mr. Muhammad Rafiq, CCF were also very supportive of the proposed project extension. The CCF noted the planned construction (FC-1) of a laboratory in Nasirabad and requested that a laboratory facility also be made available in/near Quetta so that he might utilize his existing staff of both administrative and training/research functions. Mr. Gul also supportive of the existing project and the facilities development, emphasized the desire to develop a strong research program in Baluchistan. He acknowledged the importance of on-going research in the irrigated areas but then presented a strong and elegant plea for assistance in ameliorating the impact of Afghan refugees on the forest, watershed and range resources in the dry areas of the province. He provided the team with 3 draft proposals totaling $30 million for which he was seeking donor assistance.

D. ANALYSIS AND CONCLUSION

The discussions described above provided an excellent opportunity to present the concept and scope of the proposed project extension and in a number of cases to inform newly appointed officials about the existing project. The discussions were frank and we were provided sufficient time to effectively communicate. A number of the ideas and concerns expressed by the officials were substantive but well beyond the scope of the project extension, e.g., amelioration of refugee impacts on the arid uplands of Baluchistan. Many other suggestions were quite relevant and are reflected in the various team reports.

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Federal and Provincial level "Willingness" to support the project extension is generally high with the exceptions noted in the previous sections. The reservations of the CCF, in NWFP and the P&D Chief Economist in Punjab no doubt reflect very real administrative concerns, but do not necessarily reflect negatively on either the project concept or its extension.

"Capability" of governmental units to support the project extension primarily in terms of fiscal and personnel resources is difficult to judge because the team presented only a preliminary concept to the officials. None of the officials with whom we met expressed reservations about the availability of Pakistani resources, except as noted above. When the question of timely action by Pakistani government agencies in making appointments or releasing funds was raised in discussions, the response was normally, "This can be a problem, but we will do everything possible to minimize the difficulties." Finally the question emphasized by the IGF, Mr. Jan, regarding disbursement problems deserves further review by USAID. Delay in the receipt of funds at various operational levels of the GOP has apparently been a significant problem in implementing the current project and could also influence the success of the extension.

<u>In conclusion, the GOP at federal and provincial levels has indicated both willingness and ability to support the FP&D project extension.</u>

II PROVINCIAL RESEARCH FACILITIES AND TRAINING

A. Overview of the Current FP&D Project

1. Goals and Strategy

The goal of the research component of the current FP&D project is to identify alternative "approaches to enhancing agricultural productivity through on-farm tree crop management". It is intended to be a "comprehensive, long-range" program supported by technical assistance and training activities with research "carefully coordinated" with the operational components of the project. (PP p70.) Of the total $1.7 million programmed for research in the PP only $164,000 or less than 10 percent, was allocated operational research. Emphasis was placed rather on training ($404,000), expatriate technical assistance ($1.1 million) and purchase of commodities. The training funds augmented by $98,000 in GOP funding provides for eleven, 2-yr MSc. level trainees to study abroad.(p105).

2. Planned Research Activities

Research identified in the FP&D PP focuses on farm and energy problems in the areas of economics, sociology and anthropology and farm-forestry (agroforestry) systems. The economics research is designed to look at fuelwood supply and demand, marketing and utilization patterns and forest inventories. The goal of sociological/anthropological research is to (1) identify the constraints or impacts of land tenure, social structure, women's roles, demographics, poverty etc on farm-forestry in general and fuelwood production in particular and (2) identify methods for organizing local farmers and involving them in project management. Farm forestry systems research addresses problems of combining tree and row crops in agroforestry systems intended for fuelwood production and strategies for reclaiming degraded lands, eg. saline or waterlogged soils, for fuelwood production. Research on appropriate species for fuelwood and seed production was also included in this area. Additionally research on site ecology including site classification, "hydrological studies" addressing soil salinity and irrigation scheduling in relation to tree crops was targeted.

B. Assessment of the Current Situation

1. Basis of Assessment

A comprehensive research program evaluation is not a part of the design teams responsibility. (An independent project evaluation team is scheduled to begin its work in late July.) However, a preliminary assessment of the status of the research program was necessary in order to determine facility needs at the provincial stations. Because of the accepted coordinating role of the Pakistani Forest Institute in providing leadership, training etc. in forestry research, some of its needs are also included in the following discussions. The following comments are therefore preliminary but substantiated by (1)

discussions with Federal forestry officials in Islamabad, a 2-day visit with the Director General and his staff at PFI and consultations with the provincial CCF's and their research staffs at Lahore, Faisalabad, Peshawar, Miani and Quetta (2) review of GOP documents provided by Federal and Provincial officers (3) discussions with the Winrock/USAID TAT and a review of their reports and (4) personal knowledge gained through a 2-month consultancy by the senior author at PFI in 1986.

Finally it should be emphasized that the following analysis and recommendations are preliminary, and based on rapid appraisals for planning purposes. And further that a more detailed analysis of specific institutional research needs and goals, existing programs, personnel requirements, laboratory locations, etc. are required before the recommendations can be implemented.

2. Facilities and Staffing

a. Facilities

By international standards, research facilities at PFI are substantial in number but modest in quality and generally equipped at functional but minimal levels. Specialized, quality laboratory space is lacking. Holdings in the main library at PFI are very dated and the number of current technical periodicals is limited. The main library is supplemented by several small departmental libraries consisting primarily of standard works and references. Desk top computer systems have been purchased by FAO and USAID and supplemental funding for the library and lab provided to USAID under the current project. Unfortunately these recent equipment acquisitions supported by USAID and other donors in addition to the GOP contributions are significant but do not change the basic status.

New provincial research facilities have been constructed at the Punjab Forest Research Institute by the Government of Punjab at Gotwala near Faisalabad. The laboratory and office complex is well designed with about 30 to 40% of the space currently utilized. Laboratory equipment is limited and the library is relatively new but consists primarily of standard references. Technical periodicals have been carefully selected but are few. The facility has been provided with some equipment for soils, watershed and tissue culture laboratories. The first lot of research equipment, including an IBM computer have been received from the FP&D project.

The small research facility at the Sind Silvicultural Research Division (Miani) is to be remodeled under funding from the current project. Unfortunately the remodeling is primarily a stop-gap measure and will not provide adequate space for future program development. The space is too small, the equipment is modest and the library is very limited. An IBM computer has been received from the FP&D project and the first lot of research equipment is expected shortly from USAID.

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Plans for construction of research stations at D I Khan and Nasirabad are now being formulated with support from the FF&D project. These stations will support 6 or less scientists each.

c. Staffing

The research program at FFI is headed by Director General and includes about 17 professionals with graduate degrees and a large number of support staff. The research staff at FFI includes 5 PhD scientists. The remaining professionals generally are trained at the MSc. level and a number have foreign degrees. Also significant numbers of FFI staff have had additional specialized non-degree training in their specialties.

The Punjab Forest Research Institute at Gotwala has an authorized complement of 17 scientists; currently 10 of these positions are filled. Most of the current staff have MSc. degrees. A range scientist from the Institute is now enrolled for doctorate studies at NM State University.

The Sind Silvicultural Research Institute has a small staff of four officers trained at the MSc. level.

7. Technical Assistance

a. Research

Technical assistance for research is provided on a long-term basis by the Winrock Technical Assistance Team (TAT) members. This support consists primarily of field research in the social science areas described above and assistance in the design and administration of research. Technical Assistance Team anthropologists are actively engaged in research fundamental to the successful execution of the project and a silvicultural specialist is serving as a technical advisor for research executed by Pakistani scientists. Other US assistance is available on a short-term basis at the request of the GOP.

b. Training

Training under the current project supports operational program, research and instructional needs. Of the 11 overseas MSc. training opportunities identified in the PP, 3 are presently being utilized, 2 additional candidates have approval for their departure and 2 others have been identified by the GOP. How many of these educational opportunities will eventually be utilized by personnel with research responsibilities is not clear.

7. [illegible] RECOMMENDATIONS

The following recommendations compliment the basic theme and emphasis of the current FF&D project "Manpower and Institutional Development" which I [illegible] fully and appropriate. For example in a recent (1987) review of long-term education, training and research made by the

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Subcommittee on Forestry and Wildlife of the Pakistan Agricultural Commission, one major constraint was stated as " the shortage of qualified and motivated scientists to deliver the goods". The centre conclusion of this writer with regard to research is that greater fiscal resources need to be made available for manpower development and that facilities & commodities while important and in need of improvement should be given second priority. The following recommendations reflect this premise.

1. Training

a. Problems in Training

i. Commonality of Training and Experience

The substantial majority of forestry researchers Pakistan have obtained their graduate scientific training at PFI as a part of a program designed to produce forest officers. This fact coupled with their common experience gained as field officers after graduation, ironically provides one of the systems greater strengths and fundamental weaknesses. Most forest scientists share strong knowledge of field problems, prior issues and conditions and consequently are sensitive to applied research needs. This is an important strength. Conversely this same commonality of training and experience does not generate the diversity of ideas and approaches which forest scientists in other countries, trained in many differing disciplines and academic institutions, bring to their organizations.

ii. Paucity of Phd Level Scientists

The fact that PFI, the senior forest research institution in Pakistan, does not offer doctorate level training provides a serious constraint to development of research programs at both the national and provincial levels. The Director General at PFI and the forestry establishment in general seems to to perform at "international standards". The shortage of Phd scientists at PFI seriously limits the opportunity and practice of research undertaken. It should be noted that there are a number of important doctoral level scientists in Pakistan who are in the main or there are working in administrative posts and have accepted the lower financial incentives of academia. Finally it is important to emphasize that there are a substantial number of Pakistani researchers with MSc degrees or other specialized training obtained overseas. These individuals constitute the backbone of Pakistan's current forest research cadre. Unfortunately a substantial amount of this training was obtained 15-20 years ago and consequently, is dated. Opportunities for these scientists to update their skills should also continue to be provided.

iii. Paucity of Social and Quantitative Scientists

The shortage of Phd scientists is further complicated by the shortage of social scientists, particularly, economists and extension specialists, and quantitative specialists, e.g., statisticians and computer scientists in the current forestry scientific community.

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[illegible]. Support Personnel

The shortage on scientists is made more acute by the lack of graduate students who are the lubricant of many research organizations operating at the international standard. To a degree this is offset by the greater availability of less skilled technicians and the inexhaustible suppl. of manual help.

[illegible]. Need for [illegible] in Research Planning and Administration.

[illegible]. From [illegible] with [illegible] Pakistani research administrators and as a result of reviewing forest research experiments and publications, it is evident that both the scientists and their administrators could profit by the opportunity to study statistical based experimental designs and research procedures such as preparation of study plans.

b. Recommendations

i. Training

(a) Increase the Number of Trained Scientists

Augment the present plan (11 trainees) by adding 20 additional trainees, 10 at the PhD level and 10 at the MSc level. Recently the FP&D Technical Assistance Team was successful in encouraging the USAID NARI project to provide funding for 4 PhD trainees in forestry. This type of arrangement plus the recruitment of agricultural scientists already having doctorate level training in appropriate fields, e.g. extension, statistics, economics, should be pursued to increase the total number of additional scientists to 30 or more.

Areas of specialization for graduate study should continue to be in [illegible] complimentary to the planning and farm and energy [illegible], [illegible] as described on pages 110-111 of the FP&D PP. [illegible] should be given in the areas described below.

(b) Knowledge Training in the Social and Quantitative Sciences

Give priority to [illegible] obtaining degrees in social and quantitative sciences as well as areas more directly supporting FP&D. All students receiving academic training should be required to become computer literate, i.e. to personally operate a PC and to appreciate its potential applications to their fields of specialization.

(c) Research Planning and Experimental Design Internships.

Establish 20 [illegible] month internships at U.S forestry institutions affiliated with USDA-FS Forestry Experiment Stations which would permit MSc level Pakistani scientists to study statistical and research methods and participate in operational research planning and reviews with fellow US scientists.

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(d) Workshops on Social Science and Quantitative Research Methodologies in Pakistan

Provide at least 5 workshops for 40 or more scientists in several of the following areas: applied economics, rural sociology, outreach as well as in computer modeling and statistical and economic analysis methods. Utilize instructional teams consisting of U.S instructors and Pakistani counterparts and require that the presentations and examples utilize farm forestry practices and data in examples and assignments to the extent possible.

ii. Short-Term Technical Assistance

The current FP&D project has a substantial pool of technical assistance (months of consultant time) through which the GOP can request expert assistance. This mechanism should be continued with increased effort to encourage provincial research institutions to avail themselves of this resource. The following activities are intended to meet some of the needs expressed by the provincial research organizations or identified by the design team to utilize the pool. These activities will require 72 months of consultant time of which it is estimated that 50 can be drawn from the existing pool.

(a) Workshops on Social Science and Quantitative Research Methodologies

Provide 8 scientists for 1.5 months each to work with Pakistani counterparts to develop and deliver the course. For example a U.S. consultant might be allocated 2 weeks in U.S. to gather materials and develop an instructional plan, 2-weeks in Pakistan working with the counterpart to refine instructional examples, field trips , set up equipment etc. and provide two or three 3-5 day workshops at the same or different locations during the remaining two weeks.

(b) Research Facility Planning teams

Provide five 2-scientist facility planning teams to PFI and the 4 provincial research stations. U.S planning team members would join with Pakistani staff at the stations to identify research needs, program goals and priorities and to define, training and equipment needed to conduct the research program. The role of the teams would be twofold. First, on an advisory basis, they would make scarce professional expertise and experience in research planning and evaluation available to the Pakistani research administrators and second they would generate site specific construction, training, and commodity procurement plans for implementation under the project extension.

(c) Cooperative Research Consultancies

Make graduate research programs benefit the Pakistani research institution by encouraging students to do their graduate research in Pakistan. Provide support for the student's research and return travel to Pakistan and provide a consultancy for their US advisors for

travel to Pakistan to work with the student at the home institution. Require that personnel from the home Pakistani research institution participate on the graduate committee so that the students research experience is shared by, and has utility for, the home institution.

iii. Facilities

Construction or remodeling of several research facilities has been scheduled by the GOP in the PC-1, p5. Specifically new laboratories are planned in support of on-going research at Nasirabad and D. I. Khan (Rataculachi) and a remodeling of the Miani station is anticipated. Also the Government of Punjab has recently completed construction of a large laboratory at Gotwala near Faisalabad. Following the rationale described above giving priority to training over facility development, the following recommendations are intended to meet current needs and provide for expansion of the research program at a pace commensurate with manpower development. Also in developing these recommendations the fact that scientists work more effectively in locales where there is an opportunity to communicate effectively with the scientific community and where amenities suitable for families are available, was weighted heavily.

a. Baluchistan

It is recommended that a small 10-scientist research office-laboratory complex be constructed in or near Quetta in conjunction with the CCF's offices. The small research station planned by the GOP for Nasirabad can serve effectively as a satellite station for the Quetta facility. The combined research and operational facility at Quetta will permit the use of professional staff (which are in short supply) for several functions, e.g. research and planning. Forestry research facilities in Baluchistan are minimal; the research need is great. The FP&D project area in Nasirabad where research is now underway is remote, lacks housing and electricity and in general is not a desirable site for a substantial research facility. Initially this will permit the small existing research and planning staffs to work together and provide a base for researchers working in Nasirabad. Most importantly it will provide a focus for future research program a staff development.

b. NWFP

Additional construction for research is not recommended at this time; commodity and technical assistance is recommended to support the small research laboratory at D.I. Khan scheduled for construction by the GOP (PC-1, p 5.) This laboratory will function as a satellite station to the National Laboratory, PFI, at Peshawar.

c. Punjab

A library and data processing facility for research purposes along with supporting commodities and technical assistance are recommended. The new research station just constructed by the Government of Punjab

at Gotwala is of moderate size but sufficient to meet laboratory and office requirements for some years.

d. Sind

Construction of a 10-scientist research laboratory is recommended for Hyderabad or another suitable urban location. The Miani site has merit, further particularly its established field research program. However, new construction at Miani is not recommended because of the threat of decay. Efforts housing at Miani are now unnecessary because of the availability of facilities at Tando Jam. The small research building at Miani now being remodeled by the GOS, can function as a satellite field station. The training facility at Miani will probably remain functional as a training site for male foresters.

e. Research and Training Facility Centers

Construction of hostels to support in-service and outreach training in conjunction with existing or new research facilities is recommended. Research personnel should be encouraged to contribute to the training programs both research programs and the scientists could profit from a regular interchange of ideas with field personnel. The site for the proposed research facility in Baluchistan should also be the site for a hostel and training complex and similarly a hostel-classroom complex should be established at an appropriate research station site in Sind. In Punjab a hostel-classroom complex should be constructed at Satwala. In the NWFP, the facilities at PTI, which are to be improved under the current project, should be utilized for the same reasons.

iv. Commodities

Commodity requirements were difficult to determine because of uncertainties among provincial personnel as to which (and when) project commodities would actually be supplied under the current PC-[illegible]. A current need appraisal was the the lack of sufficient numbers of vehicles to support field work. Whether this was a real shortage or a distribution problem is unclear. However, additional vehicles will be provided as a priority, if not sufficient, vehicles to support field work. The current PC-[illegible] project provides 30 computers. These are to be utilized in the operational planning, instructional and research aspects of the project. Given the effort now being made to increase computer literacy among project personnel, no projected increase in the numbers of personnel, certainly additional computers will be required. Also new and improved software, e.g. "desk-top" publishing and statistical analysis packages should be made available to increase productivity, publications and to put to use newly acquired quantitative skills. The studies and offices constructed under the project extension will require furniture, scientific equipment and library materials. These needs are outlined in more detail below.

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v. Summary of Facilities, Training, Technical Assistance and Commodity Needs (see cost summary in section vi below.)

Training

Type or Location	Participants	Months	Total Months	
Overseas				
Long-term				
Phd	10	36	360	
MSc	10	24	240	
Short-term non-degree internships	10	6	60	
		Overseas Total		660
Incountry				
Workshops	40	0.25	10	
Student research	20	6	120	
		Incountry Total		130

Technical Assistance

Research Facility Planning Teams (5)	10	2	20	
Cooperative Research Consultancies	20	2	40	
Workshop Instructors Social & Quantitative Methods	8	1.5	12	
		Total Technical Assistance		72

Facilities Construction

Location	Type	No.
Baluchistan (Quetta)	10-scientist Lab	1
	20-person Hostel & Classroom Center	1
Punjab (Gotwala)	Research Library & Computer complex	1
Sind	10-scientist Lab	1
	40-person Hostel & Classroom Ctr	1

Commodities

Location	Type	Qty
Baluchistan		
	Jeep/Pajero	2
	Computers	2
	Sci. Equip. & Lab. Furnishings	3 lots
	Library Equip & Technical Pub.	3 lots
Punjab		
	Jeep/Pajero	4
	Computers	4
	Sci. Equip. & Lab. Furnishings	5 lots
	Library Equip & Technical Pub.	3 lots
Sind		
	Jeep/Pajero	2
	Computers	2
	Sci. Equip. & Lab. Furnishings	3 lots
	Library Equip & Technical Pub.	3 lots
NWFP		
	Jeep/Pajero	2
	Computers	2
	Sci. Equip. & Lab. Furnishings	2 lots
	Library Equip & Technical Pub.	3 lots
PFI		
	Computers	2
	Sci. Equip. & Lab. Furnishings	4 lots
	Library Equip & Technical Pub.	10 lots

vi. Summary of Costs

No.	Commodity	Cost/unit $(000's)	Total cost $(000's)
10	Vehicles	14	140
12	Computers	10	120
17	Sci. Equip. & Lab Furnishings	50	850
22	Lib. Equip. & Tech. Pub.	10	220
		Total Commodities	1330

Months	Training	Cost/month $ (000's)	Total cost $(000's)
360	Phd	1.8	648
240	MSc	1.8	432
60	Non-degree	3.5	210
10	Workshops, Pakistan	.7	7
20	Student, research	.5	10
		Total Training	1357

Months	Technical Assistance	Cost/month $ (000's)	Total cost $(000's)
22	as shown above	15	330
		Total T.A.	330

(Note that an additional 50 months is expected to be available from current project)

Number	Facilities	Cost/unit $ (000's)	Total cost $(000's)
2	10-scientist Labortories	500	1000
3	Hostel & Classroom Ctr	300	900
1	1 Research Library & Computer Ctr. Complex	50	50
		Total Facilities	1950
		GRAND TOTAL	4967
			or $ 5.0 million

II. On-farm Forestry Demonstration in Punjab

i. Introduction

1. Background Information

a. General

The Punjab occupies about 25% of the land area of Pakistan and is riculturally the most productive province of the country. It is also the st populous province with 54 million people, of whom about 72% live in the ral areas. The labor force makes up 28% of the population; more than half dependent upon agriculture. Average per capita income is estimated to be 90 (US) with some 30 percent of the population having an annual income below e absolute poverty level of $140 (US) per capita.

b. Climate

The Province is located in the temperate zone. The climate ranges from id to semi-arid. Temperatures in most of the cultivated areas allow for ar-round cropping, provided water is not the limiting factor. Average annual infall varies from 100 mm in southern areas to over 1500 mm in northern -montaneous regions. Although annual variations are large, about 60% of rainfall occurs during the monsoon period (July to September) and another between January and April. Pan evaporation varies from 1200 mm to 2800 mm ing irrigation an essential requirement for agricultural and tree duction.

c. Irrigation

The main source of irrigation is the Indus River, which provides water the province's predominantly irrigated agriculture. The annual inflow of system is about 150 million acre feet; this is supplemented by 33 lion acre feet of ground water pumped from 0.2 million private and public ls.

d. Soils

Soils range from silt and sandy loam types in the southern and central oded plains to heavier clay types in the highlands. Lighter soils have remely low organic matter content and are mostly calcareous with high salt tent. The Ph runs between 8.0 to 8.5 with Nitrogen and Phosphorus content erally low and Pottassium in ample supply. The land capability sification of the canal irrigated area is given in Table 1.

TABLE 1
Land Capability in Canal Irrigated Areas

Class	Capability class	Area under this classification (million ha.)	
I	Very Good	3.62	40.6%
II	Good	3.56	40.0%
III	Moderate	1.22	13.7%
IV	Poor	0.40	5.7%
	Total:	8.80	100.0%

Source: Soil Survey Directorate of Pakistan, Lahore

e. Land Ownership

The Province has a land area of 17.0 million hectares, of which 11.6 million (57%) are cultivated and 11.0 million (94%) are irrigated, (67% by canals, and 27% by wells and other minor irrigation sources). The overall cropping intensity is about 98%, ranging from 46% in the rainfed areas to 116% in the irrigated areas.

There are about 2.5 million farms in the province of which 70% are less than 5 hectares (average size is 2.2 hectares). These small farms account for only 34% of the Province's total cultivated area. The cultivated area according to farm size is shown in Table 2. Of the farms, 54% are operated exclusively by their owners, 25% by owner-tenants and 21% by tenants.

Table 2
Farm Size and Cultivated Area

Farm size (ha.)	% of Total Farms	% of Cultivated Area
0.0 - 2.0	31	6
2.0 - 5.0	39	28
5.0 - 10.0	19	27
10.0 - 20.0	7	19
20.0 & above	3	18

Source: Agriculture Census of Pakistan(1982)

2. Forestry Sector in Punjab

A survey of the forestry sector in the Punjab underscores the crucial contribution of its forests to economic activity. In addition to providing wood based products such as poles, pitprops etc, it also provides a high proportion of energy, particularly in the rural areas. Consumption of industrial forest products is significantly lower than other countries of Asia; even so, domestic production is currently meeting only 45% of consumption. The more important deficit, however, is in fuelwood, which probably accounts for 90% of the wood consumed. The acute shortage of fuelwood is leading to serious encroachment of forested areas. This shortage and the need for fodder are the principal causes of environmental degradation threatening the Province.

a. Area Under Forests

The Provincial Forest Department administers an area totalling 3.4 million hectares or 32% of Pakistan's 10.7 million forested acres. This is 20% of the total area of the Province. Productive forests, however, constitute only 3.7% of the land area; this area is inadequate to meet the timber and fuelwood requirements of a growing economy. Table 3 shows forest and rangelands controlled by the Forest Department.

TABLE 3

Forest and Rangelands Controlled by the Punjab Forest Department by Vegetation Type (June 1984)

Vegetation Type	Area controlled by Forest Department (000 hectares)
1. Coniferous forests	95
2. Irrigated plantations	148
3. Riverain forests	53
4. Scrub forests	323
5. Linear plantations	13
6. Rangelands	2806
Total:	3438

Source: State of Forestry in Pakistan (1984) by Forest Economics Branch of P.F.I. Peshawar

b. Production of Timber & Fuelwood

Estimates of timber and fuelwood production from Government controlled forests for 1983-84 amount to 33,000 cubic meters of timber (7000 cubic meters Coniferous and 26000 cubic meters of hardwood species) and 107,000 cubic meters of solid fuelwood. This equals an average annual cut of about 0.016 million hectares.

In addition to the recorded forest area, there are many trees scattered on farms (4-5 trees per acre in the irrigated and 1-2 trees per acre in the barani farmland) throughout the country. These consist mainly of indigenous hardwood species used locally for farm timber and fuelwood. Currently, these trees contribute about half of the domestic, commercial, timber supply and over 80% of the fuelwood supply. Their contribution to energy needs is extremely important, far surpassing that of the publicly owned Government lands.

c. Consumption of Wood Products

Household energy requirements in the Province vary with climate, cooking habits, family size, and fuel availability. The World Bank has estimated that approximately 20 cubic feet of fuelwood per capita per year are needed for the Pakistani population living in non-hilly areas. Based on this estimate, fuelwood requirements in the Punjab are 1080 million cubic feet of dry fuelwood annually. This means about 1.1 acres is needed to provide the annual per capita fuelwood requirement on a sustained basis.

Although the estimated fuelwood requirements of 1080 million cubic feet annually is approximate, it does not seem unreasonable. With the projected sharp future increases in population, the demand for domestic fuelwood will also increase sharply. Within the next decade, the province will be hard pressed to meet these increased needs and substantially increased pressure will be placed on farmlands to produce fuelwood. In the last decade the price of fuelwood has risen about 1.2% faster than the general price index (The State of Forestry in Pakistan, 1984. PFI 1986).

3. Social Forestry for Rural Energy

Recently, planners and administrators have begun to appreciate and pay more attention to the forestry sector. More specifically, the importance of the private farmers in producing timbers and fuelwood has been recognized and efforts have begun to further increase this role. This has increased interest in farm, agro, and social forestry concepts. There is great opportunity to combine agriculture and forestry practices to provide employment, food, shelter and energy to alleviate poverty.

a. Past Efforts in the Field of Farm Forestry

In the Punjab, trees on farmlands have made a significant contribution towards supplementing the supply of timber and fuelwood. However, the removal of trees has not been accompanied by a consistent effort to plant new ones. The result is a depleted resource. In addition, the erroneous notion that trees substantially reduce agricultural productivity has been a contributing factor in the further elimination of trees in rural areas.

The necessity of organizing forestry on private lands in the Punjab was recognized in the mid seventies. Two projects were conceived and implemented between 1975 and 1987.

i. Promotion of Tree Plantations in the Punjab:

This program began in 1975. The main features were: public motivation through publicity, establishment of 204 acres of nurseries (over 204 acres) and distributing 3.3 million seedlings annually to the farmers at a nominal price. Results were mixed. Some awareness was created among the farmers, but large scale planting of trees on the farmlands did not occur.

ii. Farm Forestry in the Punjab:

This 3 year pilot project was implemented in 6 districts during the period 1981-84. Districts included were Jhang, Mianwali, Bhakkar, Jhelum, Multan and Bahawalpur. The objective was to promote tree planting on private farmlands and areas under the control of other Government Departments by supplying nursery stock at the rate of Rs.0.10 per stump and advisory services free of cost.

Subsequently these projects were combined and continued through 1984-85. Although no evaluation was carried out, reports indicate that they created considerable awareness among the farmers, particularly those who were absentee landlords and wanted to avoid friction with their tenants.

Encouraged with the results of previous efforts, the Punjab Forest Department formulated another program called "Farm Forestry in the Punjab" to cover the entire irrigated tract of the Province in a period of 3 years from 1985-88. The objective is to promote tree planting on irrigated farmlands through motivation and education. Program activities include creation of woodlots of over 1850 ha. of private land, establishment of 575 ha. of nurseries, and distribution of plants to the farmers at the rate of 10 million per year. Part of the costs of raising compact woodlots by the farmers is to be borne by the Government. Table 4 indicates annual expenditures divided between farmers and the Government.

TABLE 4

Annual Expenditures shared by the Farmers and the Gov't

Year	Farmer's Contribution (Rs. per acre)	Gov't Share	Total
1	3225.00	650.00	38750.00
2	2200.00	350.00	25500.00
3	2225.00	200.00	24250.00
Total per acre:	7650.00	1200.00	88500.00

Source:- PCI Scheme on Farm Forestry in the Punjab

Another program, known as "Afforestation of Marginal Private Lands in the Irrigated Tract of the Punjab" has been proposed to cover the salinity affected areas of the Province during the period 1987-88 to 1990-91. Pending evaluation of the on-going Farm Forestry program by the Punjab Economic Research Institute, this new project may be approved by the Planning & Development Department. Another program, which covers only the barani areas and is partly funded by the USAID, has been approved by the E.C.N.E.C. for implementation during 1984-1991. This program is called "Forestry Planning & Development to Expand Energy Plantations Mainly on Private Lands".

b. Forestry Planning & Development Project

This project, effectively begun in 1986, aims to:

1. strengthen the capability of the Federal, Provincial & local institution to design, implement and evaluate policies & programs for increasing th production of fuelwood in the country so as to achieve self-sufficiency i energy;

2. demonstrate the social, economic and technical feasibility of producin tree crops on privately owned farm and rangelands in Barani areas (Rawalpindi Attock, Jhelum, Gujrat, Sialkot and Soan-Sakesar Tehsil of Khushab Dist.) and to reverse the process of deforestation;

3. strengthen institutional arrangements for developing research an training programs to achieve the objectives of increased energy and woo production.

The project, when completed, will cover 26300 ha. of Barani and Sailab areas of the Punjab and NWFP, 5300 ha. of irrigated farmland in the Nasiraba district of Baluchistan and 2200 ha. of state owned irrigated forest land i the Sind. About 60% of the expenditure will be for technical assistance training and research while the remaining 40% will be spent on buildings commodities and operational demonstrations.

B. The Proposed Project

1. Reasons for Proposed Project Expansion

Most of the rural population in the Punjab lives on farm lands which ar irrigated, rather than on barani lands, with which the present project i concerned. The needs of the farm population for fuelwood, farm timbers an fodder are as great on the irrigated private lands as they are on baran lands. Operations carried out by the Provincial Forest Department wit farmers on the irrigated farm lands are largely, if not exclusively restricted to farms 20 ha. or larger. Needs of small landowners and tenan farmers are not being met by the present project funded by the Provincia Government. Yet as shown in Table 2, 97 percent of farmers own farms of 2 acres or less. Finally, there appears to be a need (in view of the success o the present project on the barani farms) to evaluate the potential of a far forestry project using the same incentives of free seedlings and technica information for the farmers working on irrigated lands. As can be seen fro Table 4, these incentives are less generous than the ones used in the projec funded by the province. Finally, a baseline study performed by Dove showe that Punjab farmers on irrigated lands were more interested in farm forestr as defined by the Forestry Planning and Development Project than farmers o barani lands. In view of the positive reception of this project on baran lands, successful expansion of the project to irrigated lands seems likely In view of this and after consultation with Provincial authorities, extensio of the project to irrigated farm lands seems appropriate.

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2. Location & Size

The proposed project would expand the present Forestry Planning Development Project from the 7 barani districts to the 22 irrigated distric of the Punjab. This would bring demonstration of farm forestry to additional target area of 11 million ha. or 94% of the Province's tot cultivated area. Since the on-going government funded project, Farm Forest in Punjab, extends over 22 districts (canal irrigated), the Punjab Governme stated a strong preference for expansion of the proposed project over the sa 22 districts. The design team carefully considered this suggestion. It attractive because the farm forestry demonstrations would potentially reach additional 19000 villages (out of a total of 25000 villages in the Punjab wh including the barani farms) with approximately 2.0 million farm families (o of a total of 2.5 million farm families). An analysis of demographic da showed that:

1. a) Total Districts in Punjab = 29
   b) Total number of Tehsils in Punjab = 97
   c) Total number of villages = 25,000
   d) Total number of farm families = 2.6 million

2. Total barani districts (covered by the present Forestry Planning & Development Project). = 7

3. a) Total irrigated districts (covered by the present and future proposed & Provincially funded farm forestry project in the Punjab). = 22
   b) Number of Tehsils in these 22 distts. (or about 4 per district). = 87
   c) Number of villages in these 22 distts. = 19,000
   d) Number of farm families in these 22 districts. = 2.0 million
   e) This means there are on average 900 villages/districts and about 100 families/village.

4. A minimum of 10 farm families per village should participate to create sufficient demonstration impact at the village level. Similarly, if 10% the villages per district could be involved, this would amount to 1. participation of all farm families on the irrigated farm lands in the Punjab.

5. If the average farm family participating in the project were provided wi 1000 seedlings (amounting to a 1 acre "block equivalent" forest), the proje would have to provide 10,000 seedlings per involved village. This is about 90 x 10000 = 0.9 million seedlings over a 5 year period per district or million seedlings over the total 5 year period.

6. These nursery production rates are technically feasible and the 1. participant level sufficient to create a demonstration impact. Rough financi calculations (see later) showed that this was also economically feasible.

3. Criteria for Selection of Areas for Farm Forestry Demonstration

Criteria for block, row, or strip planting are:

(1) Land used should normally be submarginal or marginal for agricultural use.

(2) A market for wood products should be near by.

(3) Farmers should be interested in on-farm tree crop management and willing to do land development, irrigation, weeding and protection etc.

(4) Sufficient intermittent irrigation should be available so that planting/restocking can be done all year round.

(5) Women and children should be interested in additional income generating activities based on trees and tree products such as fodder, fuelwood etc.

(6) Land holdings should be small, not exceeding 10 ha. (as far as possible).

4. Project Objectives

Reasons for a proposed project expansion have been discussed in III. B. 1. Within the broader goals of increasing resources for rural ener and reversing the process of deforestation the project has the following ma objectives:

a. Long-term Objectives:

(1) Demonstrate the social and economic feasibility of producing tree crops on privately owned irrigated lands.

(2) Establish that the trees are not only complimentary to agriculture, but can also supplement farm income.

(3) Increase production of timber and fuelwood so that it is possible for the farmer to divert cow dung and agricultural residues to improve soil fertility.

(4) Create a more diverse biological ecosystem and improve the rural landscape.

(5) Serve as a transition model for future farm forestry projects that could be effectively replicated.

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b. Short-term Objectives:

(1) Establish farm nurseries of about 1/2 to 1.0 acres each per district in all 22 irrigated districts in the Punjab. This amounts to 1 nursery per Tehsil. Each nursery should be capable of producing 50,000 - 100,000 seedlings per year. Half of the nurseries should be established in the first project year, the other half by the end of the second project year.

(2) Encourage farmers to establish nurseries on their own lands by providing them a guaranteed market for the duration of the project (5 years) for up to 50,000 seedlings at a price of 1 Rupee each. It is intended that women will be involved in establishing and operating the nurseries.

(3) Provide the 900 cooperating farmers per district (identified using criteria enumerated earlier) with the planting stock required to reach the annual planting targets. This will involve a careful scheduling of nursery work and transportation of seedlings during appropriate planting times.

(4) Provide training for farmers/tenants and their wives in nursery work, planting and caring for the plantations.

5. Operational Strategy

The project is intended to motivate farmers and their families to produce trees on their private irrigated lands supported by outreach activities of the Provincial Forest Department. Seedlings will be produced in nurseries in the 22 districts and made available to farmers at their doorsteps free of cost so that they contribute to one or more of the following products: (i) fuelwood (ii) fodder for cattle (iii) small timber for farm activities (iv) soil improvement and water conservation (v) raw material for subsidiary vocations like sericulture, apiculture, milk production. Free technical advice would also be provided on planting, tending, spacing, marketing etc. throughout the growing period. Operations like preparation of site (clearing & leveling), construction of irrigation channels, weeding, pruning, protection etc. will be done by the farmers themselves as a token of their interest in the farm forestry program.

C. Institutional Arrangements

1. Organization

The Punjab Forest Deparment has 3 Chief Conservator of Forests (CCF) heading operations in the North, central, and Southern zones. This demonstration will be implemented by the Extension & Publicity (E&P) Circle of the Punjab Forestry Department Headquartered at Lahore in the central zone. The Extension and Publicity Circle is headed by a Conservator of Forests (CF) who reports to the CCF, central zone. The CF, E&P has two staff officers, the DFO for publicity and the DFO for Extension both stationed at Lahore. The DFO Extension has line authority for the field staff consisting of 9 Sub Divisional Forest Officer (SDFO's), 25 Range Forest Officers (RFO's), 92 Farm Foresters (FF) and 92 Forest Guards (FG). (The FF's will serve as outreach specialists and the Forest Guards have reponsibility for production and distribution of seedlings). Unfortunately the DFO's authority is shared with the Territorial CF's who are responsible for the 6 geographical divisions in the Punjab. Given the fact that these staff are located in the field, away from Lahore and under the more immediate authority of the territorial DFO, the DFO, Extension's ability to direct program is significantly reduced. The situation suggests an inability to alter the line and staff organizational structure to fully accomodate the farm forestry extension role. Based on discussions with the CCF, central division, this situation while undesirable appears unlikely to change in the near future.

2. Staffing Requirements

On the positive side it appears that these field staff are not currently fully utilized for farm forestry activities. Therefore, it would be possible for the Extension Circle to take on the proposed activities under the planned USAID project extension with only a few additional positions added. Specifically the number of farm foresters needs to be increased from 92 to 120 to accomodate the additional level of farm training which is planned. This provides about one FF per 160 families or 16 villages. Motivators, 1 per village, or 1900 will be required.

3. Women Farm Foresters

In order to effectively reach and involve farm women in the production of seedlings, it is proposed that these additional forester positions be filled with women married to currently employed FF's. After receiving training, husband and wife teams would be formed giving the extension circle a more effective means of communicating with rural families. To facilitate acceptance of this pilot program by the Government of Pakistan USAID should provide training costs and salary for the women for the first two years of the program

4. Interest and Experience

Discussions with the senior CCF of the Punjab Mr. Khanzada and the Secretary of Forestry & Wildlife, Mr. Ashraf indicated strong support for the proposed demonstration project. Both men appreciated the institutional and manpower development emphasis in the current project and accepted the idea of continued emphasis in this area along with the involvement of women as described above. Similarly both encouraged the team to increase the target acreage in Punjab if possible. This support is in part a result of positive reaction to the on-going USAID program in barani areas and partly due to the inability of the Department to meet all demands by farmers created by its own program in the irrigated areas. Because of the departments involvement in these two programs a significant amount of knowledge has accrued among its personnel both in technical forestry, and in outreach. This knowledge is a decided advantage in establishing the proposed program.

D. Economic Analysis

1. Suggested Agroforestry Models

As shown in Table 8, these models described below produce fuelwood, timbers and forage in differing quantities.

a. Woodlots

Compact woodlots will be established by farmers on marginal lands/rangelands and/or on saline and water logged lands. About one acre per participating farm family will be planted.

b. Line/Courtyard Planting

Line planting is a common practice in the Punjab. Field analysis suggests that until the 4th year, the row of trees has no appreciable effect on crop yields. If the fields are on the South or South West side of the rows, there is minimal reduction in the grain yields. The optimum number of trees per row depends upon the locality and the specie. However, for the purpose of converting line plantings to area, 1000 trees will be taken equal to one acre.

In addition to these spatial arrangements, climatic zones will also be considered. The Punjab generally is considered to have 3 zones, but for illustration purposes 2 zones will be used. These are:

- Marginal irrigated land with less than 8" annual precipitation. = Zone 1
- Marginal irrigated land with more than 8" annual precipitation. = Zone 2

Species is another variable considered in the models. Some species provide multiple products, e.g. fuelwood, timbers, green fodder or food for human consumption. Other leguminous species can improve the soil through nitrogen fixation. Species also differ in their rate of water consumption and tolerance to saline soils or water logging. Keeping all these factors in mind as well as the species preference of farmers, suggested species for the models are:

Species	Potential use	Salt tolerance	Water needs
Dalbergia sissoo	Furniture/Fuelwood	Low	Average
Acacia nelotica	Fuelwood/pitprops	High	Very low
Leucaenia leucocephla	Fuelwood/pitprops	High	Low
Morus alba	Silk/Fuelwood	Low	High
Eucalyptus Camaldulensis	Fuelwood/pitprops	Average	Average

Finally, two different spacings will be considered: 6'x 6' and 3'x 3'. Both of these are considerably denser than those commonly employed by the Forest Department (at 6'x 10' or 10'x 10'). They were selected because they reflect current agroforestry practice. The reasons farmers use closer spacings (than those used by the Forest Department) are believed to be:

- Farmer are more interested in deriving multiple products from their plantations because they are able to use them (e.g., thinnings for fodder and fuelwood during the first 3 years).

- What may not be economical for the Forest Depatment (having to pay for thinnings over the first 3-5 years) may be imminently attractive to a farmer who will do the work and whose labor opportunity cost may be zero.

The optimum number of trees which can be grown in woodlots on private farms has been a well debated issue. The number depends on the species being raised, the market requirements of the farmers, water availability etc. When the objective is maximum production for fuelwood purposes, Acacia nelotica, Dalbergia sissoo and Morus alba are not only recommended by the Forest Department but are also widely accepted by the farmers. In recent years the demand for Eucalyptus camaldulensis has increased and some farmers have become very interested in planting it. It is a fast growing species used extensively for crates by the cardboard and chipboard industries. Keeping soil and climate factors in mind, it is anticipated that Eucalyptus camaldulensis will be planted with traditional species at spacings of 6'x 6' or 3'x 3'.

In summary, the following agroforestry models are porposed as being illustrative, realistic and representative:

MODEL	ZONE	SPECIES	SPACING	CONFIGURATION
1	I (Arid)	Acacia nelotica	6'x 6'	Block
2	-do-	Leucaena leucocephla	3'x 3'	Block
3	-do-	E. Camaldulensis	6'x 6'	Row
4	-do-	Dalbergia sissoo	6'x 6'	Block
5	II (Semi Arid)	Dalbergia sissoo	3'x 3'	Block
6	-do-	Acacia nelotica	3'x 3'	Block
7	-do-	Morus alba	6'x 6'	Block
8	-do-	E. Camaldulensis	3'x 3'	Row

2. Project Outputs:

a. The annual requirements of nursery stock are given in the table below:

TABLE 5
ANNUAL REQUIREMENTS OF NURSERY STOCK

Year	Number of nurseries to be established per district	Planting material* required per district	Planting material required for 22 districts	Nursery stock expected from the farmers
1	2	96,000	2.11 million	-
2	2	192,000	4.22 million	10%
3	-	384,000	8.44 million	15%
4	-	480,000	10.55 million	20%
5	-	556,000	12.66 million	25%
TOTAL:		1,708,000	37.98 million	
- Add 25% for restocking		=	9.49 million	
		GRAND TOTAL:	47.47 million	
			or say 48.0 million	

* Note: We presume that 4/5th of the area would be planted at a spacing of 6'x 6' (1200 seedlings/acre) and the remaining 1/5th at 3'x 3' or 4800 seedlings/acre.

b. Area and number of farmers involved:

TABLE 6
AREA TO BE PLANTED ANNUALLY (IN ACRES)

	PROJECT YEAR 1	2	3	4	5	Total Acres
Per district	50	100	200	250	300	[illegible]
For the whole province	1100	2200	4400	5500	6600	19800

TABLE 7
APPROXIMATE NUMBER OF FARMERS PARTICIPATING IN THE PROJECT.

	PROJECT YEAR 1	2	3	4	5	Total Acres
Per district	50	100	200	250	300	900
For the whole province	1100	2200	4400	5500	6600	19800

c. Fuelwood Produced

On completion, the project would produce 4.4 million cu. ft. of fuelwoo from cleanings, 8.8 million cu. ft. from thinnings and 4.8 million cu. ft from clear felling, thereby giving a total production of 60 million cu. ft. o fuelwood. For details see Table 8.

d. Small Timber Produced

The project is also expected to yield small timber/poles equivalent t 1.1 million cubic feet, which can be used either on the farm or sold in th market for mining props or for the manufacture of sports goods/furniture. Fo details see Table 8.

e. Forage (grass and loppings) Produced

The plantations would produce forage (lops and tops) equivalent to 0.1 million headloads of grass in addition to grazing for 5000 animal units. I would also produce mulberry leaves for rearing silk worms. For details see Table 8.

TABLE 8

PUNJAB MODEL OUTPUTS AND REVENUES PER ACRE

MODEL	YEAR		OUTPUT	QUANTITY	RATE PER UNIT (RS.)	VALUE IN (RS.)
1	1		Forage	9 HL	7.00	63.00
Acacia	2		-do-	9 HL	7.00	63.00
nelotica	3	i)	Forage	9 HL	7.00	63.00
6' x 6'		ii)	Cleanings	200 cft. F/W	3.o/cuft	600.00
	4		Forage	6 HL	7.00	42.00
	5		-do-	6 HL	7.00	42.00
	6	i)	Forage	6 HL	7.00	42.00
		ii)	Thinnings	400 cft. F/W	3.o/cuft	1200.00
	7		Grazing	2 animal units	10.00	20.00
	8		-do-	-do-	10.00	20.00
	9		-do-	-do-	10.00	20.00
	10	i)	Grazing	-do-	10.00	20.00
		ii)	Final	(a) 4000 cuft F/W	6.0/cuft	24000.00
				(b) 140 cft. small timber	20.00 per cuft	2800.00

HL = Headload
F/W = Fuelwood
cuft = Cubic feet

TABLE 8

PUNJAB MODEL OUTPUTS AND REVENUES PER ACRE

MODEL	YEAR		OUTPUT	QUANTITY	RATE PER UNIT (RS.)	VALUE IN (RS.)
2	1		Forage	5 HL	7.00	35.00
	2		-do-	5 HL	7.00	35.00
L.leuco-	3	i)	Forage	5 HL	7.00	35.00
cephla		ii)	Cleanings	500 cft. F/W	2.00/cuft	1000.00
3' x 3'	4		Forage	5 HL	7.00	35.00
	5		-do-	5 HL	7.00	35.00
	6	i)	Forage	6 HL	7.00	42.00
		ii)	Thinnings	1500 cft. F/W	2.00/cuft	3000.00
	7		Grazing	2 animal units	10.00	20.00
	8		Grazing	-do-	10.00	20.00
	9		-do-	-do-	10.00	20.00
	10	i)	Grazing	-do-	10.00	20.00
		ii)	Final Felling	6000 cft. F/W	4.0/cuft	24000.00

MODEL	YEAR		OUTPUT	QUANTITY	RATE PER UNIT (RS.)	VALUE IN (RS.)
3	1		Forage	9 HL	7.00	63.00
Eucaly-	2		-do-	9 HL	7.00	63.00
ptus	3	i)	Forage	9 HL	7.00	63.00
camaldu-		ii)	Cleanings	200 cft. F/W	2.0/cuft	400.00
lensis	4		Forage	6 HL	7.00	42.00
6' x 6'	5		-do-	6 HL	7.00	42.00
	6	i)	Forage	6 HL	7.00	42.00
		ii)	Thinnings	400 cft. F/W	2.0/cuft	800.00
	7		Grazing	2 animal units	10.00	20.00
	8		-do-	-do-	10.00	20.00
	9		-do-	-do-	10.00	20.00
	10	i)	Grazing	-do-	10.00	20.00
		ii)	Final Fellings	(a) 4000cuft F/W	4.0/cuft	16000.00
				(b) 150 cft. small timber	20.00/ cuft	3000.00

TABLE 8

PUNJAB MODEL OUTPUTS AND REVENUES PER ACRE

MODEL	YEAR	OUTPUT	QUANTITY	RATE PER UNIT (RS.)	VALUE IN (RS.)
4	1	Forage	9 HL	7.00	63.00
D.Sissoo	2	-do-	9 HL	7.00	63.00
6' x 6'	3	i) Forage	9 HL	7.00	63.00
		ii) Cleanings	200 cft. F/W	3.0/cuft	600.00
	4	Forage	6 HL	7.00	42.00
	5	-do-	6 HL	7.00	42.00
	6	i) Forage	6 HL	7.00	42.00
		ii) Thinnings	400 cft. F/W	3.0/cuft	1200.00
	7	Grazing	2 animal units	10.00	20.00
	8	-do-	-do-	10.00	20.00
	9	-do-	-do-	10.00	20.00
	10	i) Grazing	-do-	10.00	20.00
		ii) Final Fellings(a)	4000 cft. F/W	6.0/cuft	24000.00
		(b)	150 cft.small timber	20.0/cuft	3000.00

MODEL	YEAR	OUTPUT	QUANTITY	RATE PER UNIT (RS.)	VALUE IN (RS.)
5	1	Forage	5 HL	7.00	35.00
Dalber-	2	-do-	5 HL	7.00	35.00
gia	3	i) Forage	5 HL	7.00	35.00
sissoo		ii) Cleanings	500 cft. F/W	3.0/cuft	1500.00
3' x 3'	4	Forage	4 HL	7.00	28.00
	5	-do-	4 HL	7.00	28.00
	6	i) Forage	4 HL	7.00	28.00
		ii) Thinnings	1000 cft. F/W	3.0/cuft	3000.00
	7	Grazing	2 animal units	10.00	20.00
	8	-do-	-do-	10.00	20.00
	9	-do-	-do-	10.00	20.00
	10	i) Grazing	-do-	10.00	20.00
		ii) Final Fellings(a)	6000 cft. F/W	6.0/cuft	36000.00
		(b)	160 cft.small timber	20.0/cuft	3200.00

TABLE 8

PUNJAB MODEL OUTPUTS AND REVENUES PER ACRE

MODEL	YEAR	OUTPUT	QUANTITY	RATE PER UNIT (RS.)	VALUE IN (RS.)
6 Acacia nelotica 3' x 3'	1	Forage	5 HL	7.00	35.00
	2	-do-	5 HL	7.00	35.00
	3	i) Forage	5 HL	7.00	35.00
		ii) Cleanings	500 cft. F/W	3.0/cuft	1500.00
	4	Forage	4 HL	7.00	28.00
	5	-do-	4 HL	7.00	28.00
	6	i) Forage	4 HL	7.00	28.00
		ii) Thinnings	800 cft. F/W	3.0/cuft	2400.00
	7	Grazing	1 animal unit	10.00	10.00
	8	-do-	-do-	10.00	10.00
	9	-do-	-do-	10.00	10.00
	10	i) Grazing	-do-	10.00	10.00
		ii) Final Fellings	(a) 5000 cft. F/W	6.0/cuft	30000.00
			(b) 150 cft.small timber	20.0/cuft	3000.00

MODEL	YEAR	OUTPUT	QUANTITY	RATE PER UNIT (RS.)	VALUE IN (RS.)
7 Morus alba 6' x 6'	1	Forage	9 HL	7.00	63.00
	2	-do-	9 HL	7.00	63.00
	3	i) Forage	9 HL	7.00	63.00
		ii) Cleanings	200 cft. F/W	2.5/cuft	500.00
	4	Forage	6 HL	7.00	42.00
	5	-do-	6 HL	7.00	42.00
	6	i) Forage	6 HL	7.00	42.00
		ii) Thinnings	360 cft. F/W	2.5/cuft	900.00
	7	Grazing	2 animal units	L.S.	100.00
	8	-do-	-do-	L.S.	100.00
	9	-do-	-do-	L.S.	100.00
	10	i) Grazing	-do-	L.S.	100.00
		ii) Final Fellings	(a) 2000 cft. F/W	500.00	10000.00
			(b) 30 cft.small timber	20.0/cuft	600.00

TABLE 8

PUNJAB MODEL OUTPUTS AND REVENUES PER ACRE

MODEL	YEAR		OUTPUT	QUANTITY	RATE PER UNIT (RS.)	VALUE IN (RS.)
8	1		Forage	5 HL	7.00	35.00
Eucalyptus	2		-do-	5 HL	7.00	35.00
camaldul-	3	i)	Forage	5 HL	7.00	35.00
ensis		ii)	Cleanings	500 cft. F/W	2.0/cuft	1000.00
3' x 3'	4		Forage	4 HL	7.00	28.00
	5		-do-	4 HL	7.00	28.00
	6	i)	Forage	4 HL	7.00	28.00
		ii)	Thinnings	1200 cft. F/W	2.0/cuft	2400.00
	7		Grazing	1 animal unit	10.00	10.00
	8		-do-	-do-	10.00	10.00
	9		-do-	-do-	10.00	10.00
	10	i)	Grazing	-do-	10.00	10.00
		ii)	Final Fellings	(a)5300 cft. F/W	4.0/cuft	21200.00
				(b)3000 cft. small timber	30.0/cuft	9000.00

3. Project Inputs

Project costs consist of monies required for raising nurseries, transportation of seedlings to planting sites, preparation of land for planting, transplanting of seedlings, irrigation, weeding, restocking, cleaning maintenance, thinnings and fellings etc. Details regarding the establishment of nurseries and the production, cost of seedlings etc. are given in Table 1, Appendix I. Annual per acre cost estimates for plantation establishment and management are also given in Appendix I. Based on these estimates, inputs and their costs for each model, on per acre basis, are tabulated below in Table 9. Note that an annual per acre land rent of 1000 Rupees is applicable.

TABLE 9
MODEL INPUTS AND COSTS PER ACRE

MODEL	YEAR	ACTIVITY	INPUTS	COSTS IN RS.
1 (6'x 6')	1	As per details given in Appendix I, Table 2		2,310.00
	2	-do-		60.00
	3	-do-		90.00
	4	-do-		30.00
	5	-do-		30.00
	6	-do-		240.00
	7	-do-		30.00
	8	-do-		30.00
	9	-do-		30.00
	10	-do-		690.00
2 (3'x 3')	1	As per details given in Appendix I, Table 3		8,820.00
	2	-do-		90.00
	3	-do-		120.00
	4	-do-		30.00
	5	-do-		30.00
	6	-do-		300.00
	7	-do-		30.00
	8	-do-		30.00
	9	-do-		30.00
	10	-do-		750.00

TABLE 9

MODEL INPUTS AND COSTS PER ACRE

MODEL	YEAR	ACTIVITY INPUTS	COSTS IN RS.
3 (6'x 6')	1	As per details given in Appendix I, Table 2	2,310.00
	2	-do-	60.00
	3	-do-	90.00
	4	-do-	30.00
	5	-do-	30.00
	6	-do-	240.00
	7	-do-	30.00
	8	-do-	30.00
	9	-do-	30.00
	10	-do-	690.00
4 (6'x 6')	1	As per details given in Appendix I, Table 2	2,310.00
	2	-do-	60.00
	3	-do-	90.00
	4	-do-	30.00
	5	-do-	30.00
	6	-do-	240.00
	7	-do-	30.00
	8	-do-	30.00
	9	-do-	30.00
	10	-do-	690.00
5 (3'x 3')	1	As per details given in Appendix I, Table 3	8,820.00
	2	-do-	90.00
	3	-do-	120.00
	4	-do-	30.00
	5	-do-	30.00
	6	-do-	300.00
	7	-do-	30.00
	8	-do-	30.00
	9	-do-	30.00
	10	-do-	750.00

TABLE 9
MODEL INPUTS AND COSTS PER ACRE

MODEL	YEAR	ACTIVITY INPUTS	COSTS IN RS.
6 (3'x 3')	1	As per details given in Appendix I, Table 3	8,820.00
	2	-do-	90.00
	3	-do-	120.00
	4	-do-	30.00
	5	-do-	30.00
	6	-do-	300.00
	7	-do-	30.00
	8	-do-	30.00
	9	-do-	30.00
	10	-do-	750.00
7 (6'x 6')	1	As per details given in Appendix I, Table 2	2,310.00
	2	-do-	60.00
	3	-do-	90.00
	4	-do-	30.00
	5	-do-	30.00
	6	-do-	240.00
	7	-do-	30.00
	8	-do-	30.00
	9	-do-	30.00
	10	-do-	690.00
8 (3'x 3')	1	As per details given in Appendix I, Table 3	8,820.00
	2	-do-	90.00
	3	-do-	120.00
	4	-do-	30.00
	5	-do-	30.00
	6	-do-	300.00
	7	-do-	30.00
	8	-do-	30.00
	9	-do-	30.00
	10	-do-	750.00

4. Economic Calculations

The internal rate of return for each of the 8 illustrative models was calculated. Net discounted present values (NDPV's) and benefit/cost ratios were also calculated using discount rates of 0, 10, 12 and 15%. The rotation for each model was set at 10 years. Finally, the calculations for each model were carried out, with and without, a 1000 Rupee annual land rent. Note that the 1000 Rupee annual land rent does not apply where row plantations are used (Models 3 and 8).

Results of these calculations are summarized, by model, in Table 10. Internal rates of return range from 6.0 to 29.0 percent. At discount rates of 15% only the 2 row plantation models are viable (because no land rents are charged). Using a 12% discount rate, 4 other models, 1, 4, 5 and 7 are feasible even with the land rent charge. In general, denser plantations are more attractive economically than plantations with wider spacings. This is interesting because, in general, Forest Departments favor wide spacings while the farmers prefer and practice closer spacings. This must be interpreted carefully. What may not be economical for the Forest Department may be attractive to the farmer because of higher utilization rates of the products produced on a given acre.

The economic calculations use fairly reliable (hard) cost estimates. The output and revenue estimates are more uncertain. See the discussion of the economic calculations for the Murree-Kahuta for a more extensive discussion of the uncertainties involved. Finally, no "benefits" are assumed for the cow dung "saved" and available for fertilization. Again, see the observations on this issue for the Murree-Kahuta.

TABLE 10
SUMMARY OF ECONOMIC RESULTS

MODEL 1 (Acacia nelotica 6' x 6')

IRR (%)	NDPV @ 15% Rs./Acre	Benefit/Cost @ 15%
15.8	301.43	1.04

Year	Revenues	Costs	Year	Revenues	Costs
1	63	3310	6	1242	1240
2	63	1060	7	20	1030
3	663	1090	8	20	1030
4	42	1030	9	20	1030
5	42	1030	10	26820	1690

MODEL 2 (Leucena leucocephala 3' x 3')

IRR (%)	NDPV @ 15% Rs./Acre	Benefit/Cost @ 15%
6.0	-6167.23	.53

Year	Revenues	Costs	Year	Revenues	Costs
1	35	9820	6	3028	1300
2	35	1090	7	20	1030
3	1035	1120	8	20	1030
4	23	1030	9	20	1030
5	3028	1030	10	20000	1750

MODEL 3 (Eucalyptus camaldulensis 6' x 6')

IRR (%)	NDPV @ 15% Rs./Acre	Benefit/Cost @ 15%
29.0	3087.72	2.26

Year	Revenues	Costs	Year	Revenues	Costs
1	63	2310	6	842	240
2	63	60	7	20	30
3	463	90	8	20	30
4	42	30	9	20	30
5	42	30	10	19000	690

MODEL 4 (Dalbergia sissoo 6' x 6')

IRR (%)	NDPV @ 15% Rs./Acre	Benefit/Cost @ 15%
15.9	350.86	1.05

Year	Revenues	Costs	Year	Revenues	Costs
1	63	3310	6	1242	1240
2	63	1060	7	20	1030
3	463	1090	8	20	1030
4	42	1030	9	20	1030
5	42	1030	10	27020	1690

MODEL 5 (Dalbergia sissoo 3' x 3')

IRR (%)	NDPV @ 15% Rs./Acre	Benefit/Cost @ 15%
12.7	-1586.90	0.88

Year	Revenues	Costs	Year	Revenues	Costs
1	35	9820	6	3028	1300
2	35	1090	7	20	1030
3	1535	1120	8	20	1030
4	28	1030	9	20	1030
5	28	1030	10	37220	1750

MODEL 6 (Acacia nelotica 3' x 3')

IRR (%)	NDPV @ 15% Rs./Acre	Benefit/Cost @ 15%
10.6	-2898.81	0.78

Year	Revenues	Costs	Year	Revenues	Costs
1	35	9820	6	2428	1300
2	35	1090	7	10	1030
3	1535	1120	8	10	1030
4	28	1030	9	10	1030
5	28	1030	10	33010	1750

MODEL 7 (Morus alba 6' x 6')

IRR (%)	NDPV @ 15% Rs./Acre	Benefit/Cost @ 15%
12.7	790.22	0.89

Year	Revenues	Costs	Year	Revenues	Costs
1	63	3310	6	1042	1240
2	63	1060	7	100	1030
3	563	1090	8	100	1030
4	42	1030	9	100	1030
5	42	1030	10	22700	1690

MODEL 8 (Eucalyptus camaldulensis 3' x 3')

IRR (%)	NDPV @ 15% Rs./Acre	Benefit/Cost @ 15%
16.9	1101.08	1.13

Year	Revenues	Costs	Year	Revenues	Costs
1	35	8820	6	2428	300
2	35	90	7	10	30
3	1035	120	8	10	30
4	28	30	9	10	30
5	28	30	10	30210	750

E. Recommendations

Based on field observations and the preceding analysis the following recommendations are made:

1. A forestry demonstration project on irrigated private lands in the Punjab is recommended to show the economic and biological feasibility of silvicultural systems producing fuelwood, fodder, small timbers and raw materials (leaves) for sericulture.

2. Silvicultural systems based on small woodlots or line/courtyard plantings are recommended for farmland where (1) soils are marginal for agricultural production due to salinity and/or waterlogging or (2) lands are not currently in production..

3. The project area should include the 22 canal-irrigated districts and encompass approximately 22,000 acres of private irrigated farmland.

4. About 19,000 farms in 1900 villages throughout the irrigated districts should be included in the demonstration. This is about 1.0 percent of all farms within the irrigated districts. Acreage should nominally range from 0.5 to 1.5 acres.

5. Farmers meeting predetermined qualifications (interest, land and water availability) should be provided with appropriate technical information and free seedlings and encouraged to adopt one of the plantation models illustrated in the preceding analysis. The primary incentive for participation in the program should be the anticipated return from the sale of the crop not "upfront" subsidies in the form of materials or services provided. Rewards in the form of prizes for the best quality seedlings, the greatest or fastest rate of tree growth etc. as used in the Punjab's previous planting programs should be continued for both incentive and publicity.

6. The project should be implemented by the Extension and Publicity Wing of the Punjab Forestry Department as an outreach program. While personnel in the Wing have experience in outreach, additional training is recommended to further enhance organizational, communication and other outreach skills. The Department should be strongly encouraged to adopt the use of husband and wife farm forestry teams as vehicles for reaching farm wives. USAID should underwrite the costs of recruiting and training the new female farm foresters. Motorcycles or scooters should be provided to farm foresters to increase their efficiency and effectiveness.

7. On-farm seedling production by farmers' wives should be encouraged as a means of providing supplemental income for farm families. The Forestry Department should provide training, supplies and guaranteed sales of seedling production to encourage this private sector participation as a part of the outreach program.

8. Special care should be taken to assure the production and distribution of vigorous young seedlings. Older, larger, planting stock is frequently less vigorous and certainly more costly to produce. Farmers should be encouraged to try closer spacings (consistent with economics of seedling costs) to enhance the fuelwood volumes resulting from thinnings.

9. Responsibility for coordinating the previously proposed research program, training activities and the above described operational program should rest with the CCF, Sind.

10. Success of this project will generate substantial new volumes of forest products. Farmers will be seeking markets and distribution channels within a few years. And they will be seeking to fill the markets for the higher value products. Based on experience in other countries as much as 50 percent of the timber volumes produced may go to the small timber, pole, pulpwood etc. markets. It is imperative that these markets be analyzed and developed early in the program so that the momentum established in the outreach and production phase is not lost due to lack of market opportunity. Exploitation of farmers in a glutted buyers' market is a sure recipe for failure.

Appendix I

TABLE 1
NURSERY CONSTRUCTION AND PRODUCTION COSTS
(Half Acre Model)

(a) Construction

Item	Units	Rs./Unit	No.	Cost Rs.
Rental value of 1/2 acre land	acre	1000	1	1000.00
Clearing, levelling	manday	30	20	700.00
Construction of irrigation channels	manday	30	17	510.00
Barbed wire	Kg	20	100	2000.00
Poles, erected	each	40	40	1600.00
Fitting wire	manday	30	7	210.00
			Total:	6020.00

(b) Production

Ploughing, breaking clods	(contract)			3360.00
Laying out, preparing beds	manday	30	80	2400.00
Filling polythene bags	manday	30	64	1920.00
Sowing in bags	manday	30	100	3000.00
Watering, weeding, roof pruning	manday	30	320	9600.00
Sowing in bags	manday	30	20	600.00
Lifting, strmping, packing plants	manday	30	40	1200.00
Watchmen	manday	30	400	12000.00
Seed				1500.00
Pesticides, insecticides, fertilizers				1400.00
Misc., including water supply, contingencies and in the case of private nurseries, profit				17000.00
			Total:	60000.00
		Plants produced		60000.00
		Cost per plant, Rs.		1.00

APPENDIX I

TABLE 2
PER ACRE PLANTATION ESTABLISHMENT AND MANAGEMENT
COST ESTIMATE FOR 6' x 6' SPACING

Year	Step	Operation	Units	No.	Unit cost	Cost-Rs.
1	1	Identification & survey of site; formation planning (project staff)				
	2	Plantation layout 6' x 6'	manday	1	30.00	30.00
	3	Digging planting 1 1/2' x 1 1/2 ' x 2	manday	12	30.00	360.00
	4	Seedlings	plants	1200	1.00	1200.00
	5	Planting	manday	10	30.00	300.00
	6	Irrigation: 4 times	manday	1	30.00	30.00
	7	Filling blanks	manday	1	30.00	30.00
	8	Seedlings @ 25%	nos	300	1.00	300.00
	9	Weeding twice	manday	2	30.00	60.00
			TOTAL YEAR 1:	27		2310.00
2	10	Irrigation: 4 times	manday	1	30.00	30.00
	11	Weeding once	manday	1	30.00	30.00
			TOTAL YEAR 2:	2		60.00
3	12	Irrigation: 4 times	manday	1	30.00	30.00
	13	Pruning/Cleaning	manday	2	30.00	60.00
			TOTAL YEAR 3:	3		90.00
4	14	Irrigation: 4 times	manday	1	30.00	30.00
			TOTAL YEAR 4:	1		30.00
5	15	Irrigation: 4 times	manday	1	30.00	30.00
			TOTAL YEAR 5:	1		30.00
6	16	Irrigation: 4 times	manday	1	30.00	30.00
	17	Thinnings	manday	6	30.00	180.00
	18	Maintainance of irrigation channels	manday	1	30.00	30.00
			TOTAL YEAR 6:	8		240.00
7	19	Irrigation: 4 times	manday	1	30.00	30.00
			TOTAL YEAR 7:	1		30.00
8	20	Irrigation: 4 times	manday	1	30.00	30.00
			TOTAL YEAR 8:	1		30.00
9	21	Irrigation: 4 times	manday	1	30.00	30.00
			TOTAL YEAR 9:	1		30.00
10	22	Final felling	manday	20	30.00	600.00
			TOTAL YEAR 10:	20		600.00
		TOTAL MANDAYS, YEARS 1 - 10		68		3540.00

TABLE 3

PER ACRE PLANTATION ESTABLISHMENT AND MANAGEMENT COST ESTIMATE FOR 3' x 3' SPACING

Year	Step	Operation	Units	No.	Unit cost	Cost-Rs.
1	1	Identification & survey of site; formation planning (project staff)				
	2	Plantation layout 3' x 3'	manday	1	30.00	30.00
	3	Digging planting 1 1/2' x 1 1/2 ' x 2	manday	48	30.00	1440.00
	4	Seedlings	plants	4800	1.00	4800.00
	5	Planting	manday	40	30.00	1200.00
	6	Irrigation: 3 times	manday	1	30.00	30.00
	7	Filling blanks	manday	2	30.00	60.00
	8	Seedlings @ 25%	nos	1200	1.00	1200.00
	9	Weeding twice	manday	2	30.00	60.00
		TOTAL YEAR 1:		94		8820.00
2	10	Irrigation: 3 times	manday	1	30.00	30.00
	11	Weeding once	manday	2	30.00	60.00
		TOTAL YEAR 2:		3		90.00
3	12	Irrigation: 3 times	manday	1	30.00	30.00
	13	Pruning/Cleaning	manday	3	30.00	90.00
		TOTAL YEAR 3:		4		120.00
4	14	Irrigation: 3 times	manday	1	30.00	30.00
		TOTAL YEAR 4:		1		30.00
5	15	Irrigation: 3 times	manday	1	30.00	30.00
		TOTAL YEAR 5:		1		30.00
6	16	Irrigation: 3 times	manday	1	30.00	30.00
	17	Thinnings	manday	8	30.00	240.00
	18	Maintainance of irrigation channels	manday	1	30.00	30.00
		TOTAL YEAR 6:		10		300.00
7	19	Irrigation: 3 times	manday	1	30.00	30.00
		TOTAL YEAR 7:		1		30.00
8	20	Irrigation: 3 times	manday	1	30.00	30.00
		TOTAL YEAR 8:		1		30.00
9	21	Irrigation: 3 times	manday	1	30.00	30.00
		TOTAL YEAR 9:		1		30.00
10	22	Final felling*	manday	25	30.00	750.00
		TOTAL YEAR 10:		25		750.00
		TOTAL MANDAYS, YEARS 1 - 10		141		10140.00

*covers felling, cross cutting and extraction

APPENDIX II

PUNJAB

MODEL 1 - ACACIA NELOTICA INPUTS AND COSTS PER ACRE PRESENT VALUES PRESENT VALUES

Year	Activity	Input	Cost-Rs.	Present Value- 0	Present Value-10	Present Value-12	Present Value-15	Cost-Rs. +1000	Present Value- 0	Present Value-10	Present Value-12	Present Value-15
1	As per details		2310	2310	2100.000	2062.500	2008.696	3310	3310	3009.091	2955.357	2878.261
2	given in		60	60	49.587	47.832	45.369	1060	1060	876.033	845.026	801.512
3	Appendix II		90	90	67.618	64.060	59.176	1090	1090	818.933	775.840	716.693
4			30	30	20.490	19.066	17.153	1030	1030	703.504	654.584	588.906
5			30	30	18.628	17.023	14.915	1030	1030	639.549	584.450	512.092
6			240	240	135.474	121.591	103.759	1240	1240	699.948	628.223	536.086
7			30	30	15.395	13.570	11.278	1030	1030	528.553	465.920	387.215
8			30	30	13.995	12.116	9.807	1030	1030	480.503	416.090	336.709
9			30	30	12.723	10.818	8.528	1030	1030	436.821	371.428	292.790
10			690	690	266.025	222.162	170.557	1690	1690	651.568	544.135	417.742
		TOTAL =	3540	3540	2699.935	2590.738	2449.238	13540	13540	8844.502	8240.962	7468.006

PUNJAB

MODEL 1 - ACACIA NELOTICA OUTPUTS AND REVENUES PER ACRE PRESENT VALUES

Year	Output	Quantity	Rate/Unit	Value-Rs.	Present Value- 0	Present Value-10	Present Value-12	Present Value-15
1	Forage	9 HL	7	63	63	57.273	56.25	54.783
2	Forage	9 HL	7	63	63	52.066	50.223	47.637
3	Forage	9 HL	7	63	63	47.333	44.842	41.424
3	Clearings-F/W	200 cuft	300/100cuft	600	600	450.789	427.068	394.510
4	Forage	6 HL	7	42	42	28.667	26.692	24.014
5	Forage	6 HL	7	42	42	26.079	23.832	20.381
6	Forage	6 HL	7	42	42	23.708	21.279	18.158
6	Thinnings	400 cuft	300/100cuft	1200	1200	677.369	607.957	518.793
7	Grazing	2 animal	10	20	20	10.263	9.047	7.519
8	Grazing	2 animal	10	20	20	9.330	8.078	6.536
9	Grazing	2 animal	10	20	20	8.482	7.212	5.685
10	Grazing	2 animal	10	20	20	7.711	6.429	4.944
10	Final Fell-F/W&Tim	2000/140	600/100-F/W	26800	26800	10332.560	8628.883	6624.550
			TOTAL =	28995	28995	11731.647	9917.562	7769.435

BEST AVAILABLE DOCUMENT

NET BENEFITS

Year	Benefit	Cost	Net Benefit	Benefit	Cost +1000/yr	Net Benefit
1	63	2310	-2247	63	3310	-3247
2	63	60	3	63	1060	-997
3	663	90	573	663	1090	-427
4	42	30	12	42	1030	-988
5	42	30	12	42	1030	-988
6	1242	240	1002	1242	1240	2
7	20	30	-10	20	1030	-1010
8	20	30	-10	20	1030	-1010
9	20	30	-10	20	1030	-1010
10	26820	690	26130	26820	1690	25130

IRR GUESS = 6

Costs as are, IRR= 0.354 = 35.4%

Costs +1000, IRR= 0.158 = 15.8%

MODEL I ECONOMIC CALCULATIONS

DISCOUNT RATE	(costs as are) NDPV	BENEFIT/ COST
0	25455.000	8.191
10	9031.714	4.345
12	7327.064	3.828
15	5320.197	3.172

MODEL I ECONOMIC CALCULATIONS

DISCOUNT RATE	(costs + 1000) NDPV	BENEFIT/ COST
0	15455.000	2.141
10	2887.147	1.326
12	1676.84060	1.203
15	301.428	1.040

MODEL 2 - L. LEUCEPTILA INPUTS AND COSTS PER ACRE PRESENT VALUES PRESENT VALUES

Year	Activity	Input	Cost-Rs.	Present Value-0	Present Value-10	Present Value-12	Present Value-15	Cost-Rs.	Present Value-0	Present Value-10	Present Value-12	Present Value-15
1	As per details		3820	3820	3812.182	3775.[illegible]	3763.525	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2	Given in		90	90	74.380	71.747	68.050	1090	1090	900.326	868.341	824.197
3	Appendix III		120	120	90.158	85.414	78.902	1120	1120	841.473	797.194	736.416
4			70	70	[illegible]	[illegible]	[illegible]	1070	1070	703.504	654.504	588.976
5			30	30	18.625	[illegible]	14.415	1030	1030	639.549	594.450	531.092
6			300	300	169.742	151.389	129.698	1300	1300	735.816	655.620	562.026
7			30	30	15.785	13.678	11.278	1030	1030	538.553	466.933	385.215
8			30	30	13.995	11.116	8.897	1030	1030	480.502	416.010	334.719
9			30	30	12.723	10.818	8.533	1030	1030	436.821	371.428	292.793
10			750	750	287.157	241.480	185.789	1750	1750	674.791	563.453	433.577
		TOTAL =	10230	10230	9722.450	9499.124	8193.282	20230	20230	14867.017	14148.447	12212.056

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MODEL 2 - L. LEUCEPTILA OUTPUTS AND REVENUES PER ACRE PRESENT VALUES

Year	Output	Quantity	Rate/Unit	Value-Rs.	Present Value-0	Present Value-10	Present Value-12	Present Value-15
1	Forage	5 ML	7	35	35	31.815	31.25	30.435
2	Forage	5 ML	7	35	35	28.926	27.902	26.465
3	Forage	5 ML	7	35	35	26.296	24.912	23.013
4	Clearings-F/W	500 cuft	200/100cuft	1000	1000	751.315	711.780	657.516
5	Forage	4 ML	7	28	28	19.124	17.775	16.067
6	Forage	4 ML	7	28	28	17.386	15.888	13.921
8	Forage	4 ML	7	28	28	15.805	14.186	12.105
9	Thinnings	1500 cuft	200/100cuft	3000	3000	1677.422	1519.875	1276.983
7	Grazing	2 animal	10	20	20	10.282	9.147	7.517
8	Grazing	2 animal	10	20	20	9.326	8.078	6.533
9	Grazing	2 animal	10	20	20	8.462	7.212	5.685
10	Grazing	2 animal	10	20	20	[illegible]	6.429	4.944
10	Clear Felling	6000 cuft	400/100cuft	20000	[illegible]	[illegible]	1437.465	4943.194
			TOTAL =	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

BEST AVAILABLE DOCUMENT

NET BENEFITS

Year	Benefit	Cost	Net Benefit	Benefit	Cost +1000/yr	Net Benefit
1	35	8820	-8785	35	9820	-9785
2	35	90	-55	35	1090	-1055
3	1035	120	915	1035	1120	-85
4	28	30	-2	28	1030	-1002
5	28	30	-2	28	1030	-1002
6	3028	300	2728	3028	1300	1728
7	20	30	-10	20	1030	-1010
8	20	30	-10	20	1030	-1010
9	20	30	-10	20	1030	-1010
10	24020	750	23270	24020	1750	22270

IRR GUESS = 5

Costs as are. IRR= 0.147 = 14.7%

Costs +1000. IRR= 0.06 = 6.0%

MODEL 2 ECONOMIC CALCULATIONS

DISCOUNT RATE	(costs as are) NPV	BENEFIT/ COST
0	14037.000	2.372
10	1608.273	1.184
12	335.623	1.037
15	-1143.461	0.860

MODEL 2 ECONOMIC CALCULATIONS

DISCOUNT RATE	(costs + 1000) NPV	BENEFIT/ COST
0	4037.000	1.209
10	-4536.274	0.695
12	-5314.6001	0.624
15	-6167.230	0.573

BEST AVAILABLE DOCUMENT

PLANT

MODEL I — INPUTS AND COSTS PER ACRE — PRESENT VALUES — PRESENT VALUES

Year	Activity	Input	Cost-Fa.	Present Value-0	Present Value-10	Present Value-12	Present Value-15	Cost Fa.	Present Value-0	Present Value-10	Present Value-12	Present Value-15
1	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0	0	0	0	0
2	[illegible]		[illegible]	[illegible]	49.537	[illegible]	[illegible]	0	0	0	0	0
3	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0	0	0	0	0
4			[illegible]	[illegible]	20.490	[illegible]	[illegible]	0	0	0	0	0
5			[illegible]	[illegible]	13.028	[illegible]	[illegible]	0	0	0	0	0
6			240	240	125.474	[illegible]	[illegible]	0	0	0	0	0
7			[illegible]	[illegible]	15.795	[illegible]	[illegible]	0	0	0	0	0
8			[illegible]	[illegible]	10.995	[illegible]	9.267	0	0	0	0	0
9			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0	0	0	0	0
10			490	490	[illegible]	[illegible]	[illegible]	0	0	0	0	0
		TOTAL =	2540	2540	2699.935	2530.758	2449.205	0	0	0.000	0.000	0.000

PLANT

MODEL I — OUTPUTS AND REVENUES PER ACRE — PRESENT VALUES

Year	Output	Quantity	Rate/Unit	Value-Fa.	Present Value-0	Present Value-10	Present Value-12	Present Value-15
1	Forage	[illegible] HL	-	63	63	[illegible]	[illegible]	54.783
2	Forage	[illegible] HL	-	63	63	[illegible]	[illegible]	[illegible]
3	Forage	[illegible] HL	-	63	63	47.333	[illegible]	41.424
4	Clearings	200 acre	200/100acre	400	400	[illegible]	[illegible]	[illegible]
5	Forage	3 HL	-	42	42	28.167	[illegible]	24.214
6	Forage	3 HL	-	42	42	26.377	[illegible]	20.881
7	Forage	3 HL	-	42	42	[illegible]	[illegible]	18.159
8	Thinnings	400 cu.ft	100 [illegible]cu.ft	800	800	[illegible]	[illegible]	[illegible]
9	Grazing	2 animal	10	20	20	19.260	[illegible]	[illegible]
10	Grazing	2 animal	10	20	20	[illegible]	[illegible]	[illegible]
11	Grazing	2 animal	10	20	20	3.482	[illegible]	5.655
12	Grazing	2 animal	10	20	20	[illegible]	[illegible]	[illegible]
13	Fire Relief W-Pol	[illegible]	[illegible]/100-HL	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

BEST AVAILABLE DOCUMENT

NET BENEFITS

Year	Benefit	Cost	Net Benefit	Benefit	Cost * 1000	Net Benefit
1	63	2310	-2247	63	0	0
2	63	60	3	63	0	0
3	463	90	373	463	0	0
4	42	30	12	42	0	0
5	42	30	12	42	0	0
6	842	240	602	842	0	0
7	20	30	-10	20	0	0
8	20	30	-10	20	0	0
9	20	30	-10	20	0	0
10	19020	690	18330	19020	0	0

IRR GUESS = 7

Costs as are, IRR= 0.290 = 29.0%

Costs *1000, IRR= ERR = No answer

MODEL 3 ECONOMIC CALCULATIONS

DISCOUNT RATE	(costs as are) NDFV	BENEFIT/ COST
0	17055.000	5.919
10	5648.424	3.092
12	4470.654	2.726
15	3037.722	2.261

MODEL 3 ECONOMIC CALCULATIONS

DISCOUNT RATE	(costs * 1000) NDFV	BENEFIT/ COST
0	0.000	ERR
10	0.000	ERR
12	0.000	ERR
15	0.000	ERR

BEST AVAILABLE DOCUMENT

MODEL 4 - DALBERGIA SISSOO INPUTS AND COSTS PER ACRE PRESENT VALUES PRESENT VALUES

Year	Activity	Input	Cost-Rs.	Present Value-0	Present Value-10	Present Value-12	Present Value-15	Cost Rs.	Present Value-0	Present Value-10	Present Value-12	Present Value-15
1	-6 per details		2510	2510	2100.000	2062.593	2002.696	2510	2510	2009.051	2955.257	2878.261
2	Plant 10		60	60	49.587	47.372	45.069	1060	1060	876.033	845.025	811.512
3	Appendix II		70	70	57.618	54.060	50.176	1070	1070	819.933	775.640	715.692
4			30	30	20.470	19.126	17.152	1030	1030	703.534	654.584	588.906
5			30	30	18.623	17.[illegible]	14.915	1030	1030	639.549	584.450	512.092
6			240	240	135.474	121.571	103.759	1240	1240	699.948	628.223	536.036
7			30	30	15.095	13.570	11.578	1030	1030	523.552	465.920	397.215
8			30	30	13.995	12.116	9.307	1030	1030	480.503	416.000	319.709
9			30	30	12.722	10.216	8.522	1030	1030	436.821	351.438	292.790
10			690	690	266.025	222.162	179.557	1690	1690	651.569	544.135	439.742
		TOTAL =	3540	3540	2699.975	2599.778	2449.238	10540	10540	8344.532	8040.962	7468.006

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MODEL 4 - DALBERGIA SISSOO OUTPUTS AND REVENUES PER ACRE PRESENT VALUES

Year	Output	Quantity	Rate/Unit	Value-Rs.	Present Value-0	Present Value-10	Present Value-12	Present Value-15
1	Forage	2 ML	7	60	60	57.[illegible]	56.25	54.[illegible]
2	Forage	2 ML	7	60	60	52.[illegible]	50.[illegible]	47.[illegible]
3	Forage	2 ML	7	60	60	47.[illegible]	44.642	41.424
7	Clearings-F/W	200 cuft	200/100cuft	600	600	450.789	427.068	394.510
4	Forage	6 ML	7	42	42	28.657	26.652	24.914
5	Forage	6 ML	7	42	42	26.[illegible]	23.832	20.891
6	Forage	6 ML	7	42	42	[illegible]	21.279	18.[illegible]
8	Thinnings	400 cuft	200/100cuft	1200	1200	677.[illegible]	607.[illegible]	518.[illegible]
7	Grazing	2 animal	10	20	20	13.[illegible]	9.647	7.515
8	Grazing	2 animal	10	20	20	9.[illegible]	8.078	6.[illegible]
9	Grazing	2 animal	10	20	20	8.[illegible]	7.[illegible]	5.[illegible]
10	Grazing	2 animal	10	20	20	[illegible]	[illegible]	5.[illegible]
10	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
				[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

BEST AVAILABLE DOCUMENT

NET BENEFITS

Year	Benefit	Cost	Net Benefit	Benefit	Cost +1000/yr	Net Benefit
1	63	2310	-2247	63	3310	-3247
2	63	60	3	63	1060	-997
3	663	90	573	663	1090	-427
4	42	30	12	42	1030	-988
5	42	30	12	42	1030	-988
6	1242	240	1002	1242	1240	2
7	20	30	-10	20	1030	-1010
8	20	30	-10	20	1030	-1010
9	20	30	-10	20	1030	-1010
10	27020	690	26330	27020	1690	25330

IRR GUESS = 6

Costs as are, IRR= 0.355 = 35.5%

Costs +1000, IRR= 0.159 = 15.9%

MODEL 4 ECONOMIC CALCULATIONS

DISCOUNT RATE	(costs as are) NDPV	BENEFIT/ COST
0	25655.000	8.247
10	9108.823	4.374
12	7391.458	3.853
15	5369.634	3.192

MODEL 4 ECONOMIC CALCULATIONS

DISCOUNT RATE	(costs + 1000) NDPV	BENEFIT/ COST
0	15655.000	2.156
10	2964.256	1.335
12	1741.23525	1.211
15	350.865	1.047

BEST AVAILABLE DOCUMENT

MODEL 5 - [illegible] INPUTS AND COSTS PER ACRE PRESENT VALUES PRESENT VALUES

Year	Activity	Input	Cost-Rs.	Present Value-	Present Value-10	Present Value-12	Present Value-15	Cost-Rs. 1+1000	Present Value- 0	Present Value-10	Present Value-12	Present Value-15
1	[illegible]		3320	3320	3110.130	3075.340	3069.565	3320	3320	3027.273	3767.857	3579.130
2	[illegible]		70	70	74.380	71.747	69.053	1090	1090	903.826	868.941	834.197
3	Appendix III		120	120	93.158	85.414	78.382	1120	1120	841.473	771.134	706.418
4			70	70	[illegible]	59.666	57.150	1070	1070	700.534	654.584	585.906
5			70	70	63.623	57.022	54.915	1030	1030	637.549	534.450	512.992
6			300	300	169.342	151.939	129.678	1300	1300	733.816	658.620	562.026
7			30	30	15.395	13.570	11.278	1030	1030	529.553	465.920	387.215
8			30	30	12.795	10.116	7.907	1030	1030	480.593	416.060	336.709
9			30	30	10.700	8.318	6.526	1030	1030	436.821	371.428	291.730
10			750	750	397.157	241.480	165.389	1750	1750	674.701	563.453	472.573
		TOTAL =	10230	10230	8722.450	8498.224	8197.288	21230	21230	14867.017	14148.447	13210.056

PLANTS

MODEL 5 - [illegible] OUTPUTS AND REVENUES PER ACRE PRESENT VALUES

Year	Output	Quantity	Rate/Unit	Value-Rs.	Present Value- 0	Present Value-10	Present Value-12	Present Value-15
1	Forage	5 HL	*	75	75	[illegible]	[illegible]	70.435
2	Forage	5 HL	*	75	75	68.182	67.002	65.465
3	Forage	5 HL	*	75	75	62.396	59.912	57.417
4	Clearings-F/W	500 cu.ft	300/100cu.ft	1500	1500	1126.872	1067.670	986.274
5	Forage	4 HL	*	20	20	16.124	15.795	16.009
6	Forage	4 HL	*	20	20	14.736	13.999	13.021
7	Forage	4 HL	*	20	20	13.315	12.136	10.115
8	Thinnings	1000 cu.ft	300.100cu.ft	3000	2100	1671.422	1519.893	1296.783
9	Grazing	2 animal	10	20	20	[illegible]	7.147	7.519
10	Grazing	2 animal	10	20	20	9.079	8.078	6.528
11	Grazing	2 animal	10	20	20	8.482	7.211	5.685
12	Grazing	2 animal	10	20	20	[illegible]	6.437	4.944
	[illegible]	[illegible]	300/100cu.ft	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
			TOTAL =	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

BEST AVAILABLE DOCUMENT

NET BENEFITS

Year	Benefit	Cost	Net Benefit	Benefit	Cost +1000/yr	Net Benefit
1	35	8820	-8785	35	9820	-9785
2	35	90	-55	35	1090	-1055
3	1535	120	1415	1535	1120	415
4	28	30	-2	28	1030	-1002
5	28	30	-2	28	1030	-1002
6	3028	300	2728	3028	1300	1728
7	20	30	-10	20	1030	-1010
8	20	30	-10	20	1030	-1010
9	20	30	-10	20	1030	-1010
10	37220	750	36470	37220	1750	35470

IRR GUESS = 6

Costs as are, IRR= 0.205 = 20.5%

Costs +1000, IRR= 0.127 = 12.7%

MODEL 5 ECONOMIC CALCULATIONS

DISCOUNT RATE	(costs as are) NDFV	BENEFIT/ COST
0	31737.000	4.105
10	9615.295	1.988
12	6229.453	1.733
15	3431.874	1.417

MODEL 5 ECONOMIC CALCULATIONS

DISCOUNT RATE	(costs + 1000) NDFV	BENEFIT/ COST
0	31737.000	2.075
10	2470.728	1.166
12	579.227681	1.041
15	-1596.834	0.880

BEST AVAILABLE DOCUMENT

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MODEL 3 - ACACIA NILOTICA INPUTS AND COSTS PER ACRE PRESENT VALUES PRESENT VALUES

Year	Activity	Input	Cost-Rs.	Present Value-5	Present Value-10	Present Value-12	Present Value-15	Cost-Rs. *1000	Present Value-5	Present Value-10	Present Value-12	Present Value-15
1	As per details		8820	8820	8818.182	7875.000	7669.565	8820	8820	8727.273	8787.857	8575.101
2	Given in		90	90	74.380	71.747	68.853	1080	1080	900.926	868.941	826.197
3	Appendix III		120	120	90.153	85.414	78.942	1120	1120	841.477	797.194	736.419
4			30	30	20.490	19.066	17.157	1030	1030	703.584	654.584	588.906
5			20	20	13.628	12.623	11.315	1020	1020	694.549	643.459	576.197
6			700	700	464.242	431.989	389.698	1700	1700	1127.816	1049.123	946.326
7			20	20	12.395	11.570	10.278	1020	1020	631.580	589.920	523.215
8			30	30	17.995	16.116	13.807	1030	1030	480.593	430.069	368.369
9			30	30	16.722	14.818	12.522	1030	1030	446.821	395.928	334.795
10			750	750	389.157	341.480	285.389	1750	1750	674.791	592.453	494.873
		TOTAL =	10230	10230	9721.450	8498.224	8193.268	20230	20230	14867.017	14148.447	13011.656

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MODEL 3 - ACACIA NILOTICA OUTPUTS AND REVENUES PER ACRE PRESENT VALUES

Year	Output	Quantity	Rate/Unit	Value-Rs.	Present Value-5	Present Value-10	Present Value-12	Present Value-15
1	Forage	5 AL	7	35	35	31.818	31.25	30.435
2	Forage	5 AL	7	35	35	28.926	27.902	26.465
3	Forage	5 AL	7	35	35	26.296	24.912	23.112
4	Clearings-F W	500 Cart	200/100cu-ft	1500	1500	1126.972	1067.679	986.274
5	Forage	4 AL	7	28	28	19.124	17.735	15.909
6	Forage	4 AL	7	28	28	17.386	15.935	13.921
7	Forage	4 AL	7	28	28	15.805	14.156	12.105
8	Thinnings	300 Cart	200/100cu-ft	2400	2400	1354.737	1216.715	1027.595
9	Grazing	1 animal	10	10	10	5.102	4.522	3.751
10	Grazing	1 animal	10	10	10	4.635	4.073	3.263
11	Grazing	1 animal	10	10	10	4.241	3.636	2.847
12	Grazing	1 animal	10	10	10	3.855	[illegible]	[illegible]
	Last Year of Rot.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

BEST AVAILABLE DOCUMENT

MCI BENEFITS

Year	Benefit	Cost	Net Benefit	Benefit	Cost +1000/yr	Net Benefit
1	35	8820	-9785	35	9820	-9785
2	35	90	-55	35	1090	-1055
3	1535	120	1415	1535	1120	415
4	28	30	-2	28	1030	-1002
5	28	30	-2	28	1030	-1002
6	2428	300	2128	2428	1300	1128
7	10	30	-20	10	1030	-1020
8	10	30	-20	10	1030	-1020
9	10	30	-20	10	1030	-1020
10	32010	750	32260	32010	1750	30260

IRR GUESS = 5

Costs as are, IRR= 0.184 = 18.4%

Costs +1000, IRR= 0.105 = 10.5%

MODEL 6 ECONOMIC CALCULATIONS

DISCOUNT RATE	(costs as are) NPV	BENEFIT/ COST
0	26397.000	3.627
10	6527.436	1.761
12	4551.293	1.536
15	2121.757	1.257

MODEL 6 ECONOMIC CALCULATIONS

DISCOUNT RATE	(costs + 1000) NPV	BENEFIT/ COST
0	16877.000	1.875
10	474.967	1.033
12	-1072.4247	0.923
15	-2876.610	0.781

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MODEL 7 INPUTS AND COSTS PER ACRE PRESENT VALUES PRESENT VALUES

Year	Activity	Input	Cost-Rs.	Present Value- 0	Present Value-10	Present Value-12	Present Value-15	Cost-Rs. *1000	Present Value- 0	Present Value-10	Present Value-12	Present Value-15
1	As per details		2310	2310	2100.000	2062.500	2008.696	3310	3310	3009.091	2955.357	2878.261
2	given in		60	60	49.587	47.832	45.369	1060	1060	876.033	845.026	801.512
3	Appendix II		90	90	67.618	64.060	59.176	1090	1090	818.933	775.840	716.693
4			30	30	20.490	19.066	17.153	1030	1030	703.504	654.584	588.906
5			30	30	18.628	17.023	14.915	1030	1030	639.549	584.450	512.092
6			240	240	135.474	121.591	103.759	1240	1240	699.948	628.223	536.086
7			30	30	15.395	13.570	11.278	1030	1030	528.553	465.920	387.215
8			30	30	13.995	12.116	9.807	1030	1030	480.503	416.000	336.709
9			30	30	12.723	10.818	8.528	1030	1030	436.821	371.428	292.790
10			690	690	366.025	222.162	170.557	1690	1690	651.568	544.135	417.742
		TOTAL =	3540	3540	2699.935	2590.738	2449.238	13540	13540	8844.502	8240.362	7468.006

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MODEL 7 OUTPUTS AND REVENUES PER ACRE PRESENT VALUES

Year	Output	Quantity	Rate/Unit	Value-Rs.	Present Value- 0	Present Value-10	Present Value-12	Present Value-15
1	Forage	9 HL	7	63	63	57.273	56.25	54.783
2	Forage	9 HL	7	63	63	52.066	50.223	47.637
3	Forage	9 HL	7	63	63	47.333	44.842	41.424
3	Clearings-F/W	200 cuft	250/100cuft	500	500	375.657	355.890	328.758
4	Forage	6 HL	7	42	42	28.687	26.692	24.014
5	Forage	6 HL	7	42	42	26.079	23.832	20.881
6	Forage	6 HL	7	42	42	23.708	21.279	18.158
6	Thinnings/Leaves	300 cuft	250/100cuft	1000	1000	564.474	506.631	432.328
7	Mulberry Leaves	2	L-S	100	100	51.316	45.235	37.594
8	Mulberry Leaves	2	L-S	100	100	46.651	40.338	32.690
9	Mulberry Leaves	2	L-S	100	100	42.410	36.061	28.426
10	Mulberry Leaves	2	L-S	100	100	38.554	32.197	24.718
10	Clear/Fell-F/W&T	2000/20	500/100-F/W	22600	22600	8713.278	7276.595	5586.374
			TOTAL =	24815	24815	10047.435	8516.116	6677.785

NET BENEFITS

Year	Benefit	Cost	Net Benefit	Benefit	Cost +1000/yr	Net Benefit
1	63	2310	-2247	63	3310	-3247
2	63	60	3	63	1060	-997
3	563	90	473	563	1090	-527
4	42	30	12	42	1030	-988
5	42	30	12	42	1030	-988
6	1042	240	802	1042	1240	-198
7	100	30	70	100	1030	-930
8	100	30	70	100	1030	-930
9	100	30	70	100	1030	-930
10	22700	690	22010	22700	1690	21010

IRR GUESS = 6

Costs as are, IRR= 0.326 = 32.6%

Costs +1000. IRR= 0.127 = 12.7%

MODEL 7 ECONOMIC CALCULATIONS

DISCOUNT RATE	(costs as are) NDPV	BENEFIT/ COST
0	21275.000	7.010
10	7367.550	3.727
12	5925.377	3.287
15	4228.547	2.726

MODEL 7 ECONOMIC CALCULATIONS

DISCOUNT RATE	(costs + 1000) NDPV	BENEFIT/ COST
0	11275.000	1.833
10	1222.983	1.138
12	275.154018	1.033
15	-790.222	0.894

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FUNCAB

MODEL 3 INPUTS AND COSTS PER ACRE PRESENT VALUES PRESENT VALUES

Year	Activity	Input	Cost-Rs.	Present Value-09	Present Value-10	Present Value-12	Present Value-15	Cost-Rs. #1000	Present Value-09	Present Value-10	Present Value-12	Present Value-15
1	As per details		3820	3820	3818.182	3777.778	3558.696	0	0	0.000	0.000	0.000
2	given in		70	70	74.260	71.747	63.052	0	0	0.000	0.000	0.000
3	Appendix III		120	120	90.158	85.414	73.962	0	0	0.000	0.000	0.000
4			20	20	20.490	19.166	17.152	0	0	0.000	0.000	0.000
5			30	30	13.628	17.223	14.915	0	0	0.000	0.000	0.000
6			300	300	169.042	151.989	127.698	0	0	0.000	0.000	0.000
7			30	30	15.095	13.577	11.278	0	0	0.000	0.000	0.000
8			30	30	17.995	12.116	9.937	0	0	0.000	0.000	0.000
9			30	30	12.722	11.819	9.828	0	0	0.000	0.000	0.000
10			750	750	229.157	241.460	185.739	0	0	0.000	0.000	0.000
		TOTAL =	5230	5230	8722.453	8498.224	8171.233	0	0	0.000	0.000	0.000

FUNCAB

MODEL 3 OUTPUTS AND REVENUES PER ACRE PRESENT VALUES

Year	Output	Quantity	Rate/Unit	Value-Rs.	Present Value-09	Present Value-10	Present Value-12	Present Value-15
1	Forage	5 ML	7	35	35	31.818	31.25	30.435
2	Forage	5 ML	7	35	35	28.926	27.902	26.468
3	Forage	5 ML	7	35	35	26.296	24.912	22.932
4	Clearings-F w	500 cu-ft	200/100cuft	1000	1000	751.315	711.797	637.916
5	Forage	4 ML	7	28	28	19.124	17.705	15.[illegible]
6	Forage	4 ML	7	28	28	17.356	15.882	13.921
7	Forage	4 ML	7	28	28	15.805	14.516	12.[illegible]
8	Thinnings	1200 cu-ft	200 /100cuft	2400	2400	1854.777	1615.915	1327.636
9	Dressing	1 animal	10	10	10	8.172	7.577	6.789
10	Dressing	1 animal	10	10	10	7.429	6.888	6.172
11	Dressing	1 animal	10	10	10	6.754	6.261	5.611
12	Dressing	1 animal	10	10	10	6.140	5.692	5.101
	Total Value of Outputs			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

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NET BENEFITS

Year	Benefit	Cost	Net Benefit	Benefit	Cost *1000/yr	Net Benefit
1	35	6820	-6785	35	0	0
2	35	90	-55	35	0	0
3	1035	120	915	1035	0	0
4	28	30	-2	28	0	0
5	28	30	-2	28	0	0
6	2429	300	2129	2429	0	0
7	10	30	-20	10	0	0
8	10	30	-20	10	0	0
9	10	30	-20	10	0	0
10	30210	750	29460	30210	0	0

IRR GUESS = 6

Costs as are, IRR= 0.167 = 16.7%

Costs *1000, IRR= ERR = No answer

MODEL 8 ECONOMIC CALCULATIONS

DISCOUNT RATE	(costs as are) NPV	BENEFIT/ COST
0	23577.000	1.[illegible]
10	5184.258	1.594
12	3700.783	1.329
15	1761.484	1.174

MODEL 2 ECONOMIC CALCULATIONS

DISCOUNT RATE	(costs * 1000) NPV	BENEFIT COST
0	0.000	ERR
10	0.000	ERR
12	0.000	ERR
15	0.000	ERR

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IV. On-farm Forestry Demonstration in Sind

A. Introduction

1. Background Information

a. General

Sind is agriculturally one of the most productive provinces in Pakistan, second only to the Punjab. It is also the second most populous province, with almost 22 million people in 1987, of whom 57% live in rural areas. The labor force represents 28% of the total population, a vast majority of which derives its livelihood from agriculture.

b. Land and Irrigation

The land area is almost 35 million acres, of which 13.5 million acres are potentially cultivable and about 8 million acres (57% of the cultivable area) are irrigated by canals (84%) and tubewells. Of the irrigated area, about 1.3 million acres are double cropped, with the average cropping intensity being 130%. Irrigtion water is often inadequate; only about 50% of the area is classified as canal irrigated. Farmers with land at the end of the canals frequently suffer water shortages. Ground water is generally not suitable for irrigation because of high salt content. The province has about 19,000 tubewells located primarily on the narrow strip of land along the Indus river.

c. Climate

Sind is arid, but the climate is suitable for year-round agriculture and forestry. Annual rainfall varies from about 60mm in the north to slightly above 160mm in the south. About 80% of this occurs between June and September, making irrigation water a necessary prerequisite for the growth of agricultural and tree crops.

d. Soils

Most of the arable land lies in the Indus basin where topography is flat. Soils are alluvial, often poorly drained and subject to water logging and salinity. The pH generally varies from 8.0 to 8.5. Soil texture varies quite considerably, but silty and sandy loam types with low organic matter and nitrogen contents are predominant.

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e. Land Ownership

The province has about 0.8 million farms, 77% of which are 5 hectare or less (the average holding being 2.6 hectares). They account for 46% c the cultivated area. Cultivated area according to farm size is given i the following table:

TABLE 1
Cultivated Area and Farm Size

Farm Size (Ha)	% of Total Farms	% of Cultivated Area
0.0 - 2.0	26	7
2.0 - 5.0	51	39
5.0 - 10.0	17	25
10.0 - 20.0	5	14
20.0 & above	2	14

Source: Agricultural Census of Pakistan 1981

About 49% of the farms in Sind are operated by tenants, 41% are operate exclusively by the owners and the remaining 10% are classified a owner-tenant operated.

2. Forestry Sector in Sind

a. Area Under Forests

There are 14.09 million hectares of land reported in Sind. Th Forest Department administers 0.68 million hectares of forest and 0.4 million hectares of rangeland (or about 4%). The following table give the area of productive and protective forests under the control of th Forest Department by type of vegetation:

TABLE 2
Area under the Control of the Forest Department
by Type of Vegetation

Type of Vegetation	Area under Control of the Forest Department (000 Ha)		
	Productive	Protective	Total
1. Irrigated Plantations	10	72	82
2. Riverain Forests	138	103	241
3. Scrub Forests	-	10	10
4. Coastal Forests	-	345	345
Total	148	530	678
5. Rangeland	-	490	490
Grand Total	148	1020	1168

Source: State of Forestry in Pakistan (1984) by P.F.I. Peshawar

b. Type of Forests

Irrigated plantations and riverain forests are regarded as the mos important source of timber for the furniture industry of Karachi an mining pit props of Baluchistan. The main species in the irrigate plantations are Dalbergia sissio (Shisham) and Morus alba (Mulberry). I the riverain forests, the main species are Acacia nelotica (Babul) Populus euphratica (Bhan), Prosopis spicigera (Jand) and Tamarix spp With a decrease in seasonal flooding of riverain areas, a considerabl part of the Babul forest has become less productive. The mangrove forest of the Coastal Zone are comprised primarily of Avicennia officinalis. A a result of fuel wood harvesting, they have little potential for timbe production.

c. Production of Timber and Fuelwood

Estimates of timber and fuelwood production from government manage forests indicate an output of 110,000 Cu. meters of timber and 170,000 Cu meters of fuelwood in 1983-84.* Compared with well-stocked normal forest of temperate/subtropical zones, this is an exceptionally low output Nearly half of the timber and fuelwood produced in the province finds it way to Baluchistan while the remainder is consumed within the province.

Privately owned farm lands provide about three fourths of th province's total fuelwood production and more than half of its timber This results from trees that have sprung up randomly as well as from tree planted in hedgerows.

3. Social Forestry in Sind

a. Past Efforts in the Field of Social Forestry

Little information is available regarding the introduction o agroforestry/social forestry as a part of the land-use system of Sind However, tree planting campaigns organized by the Forest Department twic a year have had a positive influence on farmers' receptiveness to th introduction of trees on agricultural lands. Government sponsore roadside and canalside afforestation during the Sixties and the Seventie also favorably influenced promotion of tree plantations in rural areas. Recently, as part of its research program, the Pakistan Forest Institut at Peshawar has also tried to reach progressive Sind farmers t demonstrate how agriculture and forest crops could complement each other The effort, however, was confined to a very small area.

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* These figures are given in The Project Paper on Forestry Planning an Development (391-0481) in Pakistan. Another publication by The Economic' Branch of the P.F.I. gives the following figures:

Timber = 24,000 Cu. meters/acre
Fuelwood = 59,000 Cu. meters/acre

b. Hurries

In response to the rising prices of fuel wood and poles, some farmer have begun to plant short-rotation trees as a cash crop on margina lands. These plantations are termed "hurries". Although research data c hurries is not available from the Forestry Department, an exchange c views with the local field staff and farmers indicated that a gros revenue of Rs. 16,000 per acre after a period of 5 years can be realize from the sale of Babul crops raised in hurries. This compares with Rs 1,000 per acre per annum realized from cotton crops. From availab evidence, the hurries appear to be an appropriate model for widespre replication. Research is needed to further substantiate this conclusion.

c. Forestry Planning & Development Project

Under the Forestry Planning & Developmen. Project, partly funded USAID, about 2160 hectares (5400 acres) of government plantations irrigated land are to be upgraded. This is to be done through improvemen in the irrigation system and silvicultural treatment during the peri 1984-1991. This does not constitute a demonstration of farm forest techniques on private irrigated farmlands. The goal of the Forest Planning and Development Project extension is to encourage farm forest among private individuals in irrigated areas. In the years to come, it expected that farmers will include farm forestry as a part of the agricultural system.

B. The Proposed Project

1. Reasons for Proposed Project Expansion

The proposed project will extend the on-going "Forestry Planning a Development Project" to irrigated farmlands in selected districts Sind. The reasons for expansion are:

a. Most of the rural population lives in the canal-irrigated tracts which make up 57% of the potentially cultivable area of the province. The needs of this population with respect to fuelwood, farm timber and fodde are mounting year by year because of rapid growth of both the human and livestock populations. These needs cannot b met by existing government plantations, even though their productivity is enhanced through improved management.

b. Efforts to increase production of fuelwood and timber are presently confined to government forests which do not serve as a demonstration to small landholders scattered over 8 million hectares of irrigated land (this was an anomaly in the existing project since in all other provinces demonstrations are confined to the private lands the very sector excluded in the Sind).

c. The upward trend in market prices for fuel wood and poles has stimulated large landholders to practice farm forestry as a cash crop. This trend can benefit the small farmers as well.

d. There is a need to convince small farmers in energy short areas about the economic viability of woodlots side by side with agriculture through actual demonstration.

e. About 20% of the irrigated farmlands in Sind are marginal or submarginal for agriculture but suitable for tree growth.

2. Location of the Project Area

The proposed project is the first systematic attempt of its kind t invlove farm families in forestry operations. The Government of Sin suggests this program be limited to 3 - 5 districts which cover one fift of the irrigated farmlands in the province. The design team selected th following three districts:

District	Reasons for Suggestion
Sanghar district	PFI has been working in the district to popularize the concept of farm forestry. It therefore would be easier for the out-reach staff to motivate the farmers in this district.
Jacobabad district	Farm forestry operations have already begun in the Nasirabad district of Baluchistan under the current Project. Hence, it would be easier for the outreach staff to convince the farmers of the adjacent district Jacobabad about the usefulness of the program.
Khairpur district	This district is situated in Central/Upper Sind, and gives geographical breadth to the project.

The same strategy employed in the Punjab (having demonstrations i all districts with irrigated farmlands) was considered for Sind. Limitin the demonstration effort to three districts was preferred because 1) n major effort in farm forestry has been undertaken by the Sind provincia forest service in contrast to the Punjab. Thus relatively more effor will have to be expended to get a program started. 2) the propose project is limited to 5,000 acres of demonstration plantations in Sin compared with 15,000 in the Punjab. Also, the existing Sind projec covers government owned block plantations, an aspect excluded in th Punjab. Spreading these deomonstrations over all districts with irrigate lands in Sind would decrease the percentage of farmers included below th 1% deemed advisable for the Punjab.

The three districts selected have the following land use profile:

TABLE 3

Land Use in the Proposed Districts

District	Villages/ *Hamlets	Total Area	Cultivated Area	Irrigated Area	Farms/Farm Families	Remarks
		(in Hectares)				
1. Sanghar (4 Talukas)	785	310696	260351	260204	76698	93% of the farms with 66% land are between 0-10 hectares
2. Jacobabad (4 Talukas)	670	255576	219637	204117	64342	96% of the farms with 77% land are between 0-10 hectares
3. Khairpur (4 Talukas)	642	212376	199183	197447	63005	80% of the farms with 52% land are between 0-10 hectares
Total	2097	778648	679171	661768	204045	

Source: Agricultural Census of Pakistan 1980
*Source: Local Government and Rural Development Govt. of Sind

Note that of the total area of Sind:
---the cultivated area of these three districts comprises 12.6%,
---the irrigated area of these three districts covers 19.4%,
and ---the number of farm families in these three districts constitutes 23% of all farm families in Sind.

3. Size of the Project Area

The Provincial Forest Department does not now have an active outreach program. Hence, on an average, a higher participation level is needed to create a sufficient demonstration effect. Thus if 25 families per village and 10% of the villages per district could be recruited, 2.5% of all the farm families in the irrigated farmlands of the Sind would be participants. A 2.5 percent participation level would necessitate a project area size of 2640 hectares (6600 acres).

The total number of participating farm families would number 5250 as shown below:

Total No. of villages in the three districts	=	210
No. of families to be involved (210x25 familes)	=	5250
Area to be planted by a family to obtain 180 Cu.ft. of fuelwood for average family self-sufficiency (based on MAI of Babul in arid area)	=	1.25 acres
Total area to be planted (5250 x 1.25)	=	6600 acres

4. Criteria for Selection of Project Area

See section III. B. 3. on the Punjab.

5. Project Objectives

See section III. B. 4. on the Punjab.

C. Institutional Arrangements

1. Organization & Staffing

The current USAID FP&D Project in Sind is headed by a Project Director with the Rank of Conservator of Forests (CF). The CF reports to the Chief Conservator of Forests, CCF Sind, and directs three Divisional Forest Officers (DFOs) who are responsible for work at the district level. Unlike the Punjab, the Sind at present has no separate wing to handle farm forestry and outreach. This is due to the fact that the only projects in the area are block plantations on irrigated government lands. Consequently, three additional sub DFOs would be added to this structure to direct the proposed demonstration out-reach effort in the three new districts. The field staff will consist of 12 RFOs, 36 FFs (18 husband and wife teams) and 36 forest guards (the FFs would be responsible for outreach and the forest guards for production and distribution of seedlings). This staffing level provides approximately 1 FF per 160 families or six villages.

2. Women Farm Foresters

To more effectively involve farm women in the project, it is proposed that 18 women, wives of FFs, be hired and trained as foresters to work with their husbands. To facilitate acceptance of this program by the Government of Sind, USAID should provide training costs and salaries for the women for the initial two years of the program.

3. Interest & Experience

The Secretary of the Wildlife & Forestry Department, Sind, Mr. T.A. Ansari, and the CCF, Sind, Mr. B. Sirhindi, were both supportive of the proposed private land component. In fact, the design team encountered a very high level of awareness of the existing project as well as an impressive level of coordination between the provincial government

agencies in matters concerning the project. The Secretary requested the area be expanded to 15,000 acres to "get the politicians attention." The CCF, who has only recently assumed his office, was less vocal but clearly interested. Neither individual anticipated problems in providing the needed Government of Sind financial or staff resources.

D. Economic Analysis

1. Illustrative Models

Four models are proposed for the irrigated farm lands of Sind. Sin the average farm size in Sind is considerably larger than that of t Punjab, and the soil poorer, a larger percentage of the irrigated land c be considered marginal for agriculture. With the historical success hurries, it is reasonable to limit the illustrative models to blo plantations and woodlots rather than include line plantations as anoth model (as was done in the Punjab proposal).

Model 1: Hurrie Production of Fuelwood and Pitprops Established by Direct Seeding

Because of the historical long-term success of the hurrie, one of its many variations is proposed. Under this model, the farmer or tenant selects a block of irrigated land, rips the ground open along linear lines 2' or 3' apart and broadcasts seeds of Acacia nelotica. Thinnings begun after the first year provide fuel wood and fodder and continue to until the fifth year when the entire stand can be sold on the stump. Cattle ea the acacia pods periodically, even after the stand closes. Irrigation water is provided when available, and not required by agricultural crops. This model is favored by the farmers, and requires only an extensive form of management (little capital investment, low and flexible labor requirements, early and good returns).

Model 2: Hurrie Production of Fuelwood & Larger Timbers Established Using Seedlings at 3' x 3' Spacing

Acacia nelotica is planted in blocks, spaced 3' x 3'. It differs from Model 1 in that it is more management intensive, has higher initial investment costs and, with a slightly longer rotation of eight years, produces somewhat larger dimension timbers. It still produces fodder and early fuel wood through thinnings and loppings.

Model 3: Fuelwood, Furniture Stock and Forage Production Established Using Seedlings at 6' x 6' Spacing

Dalbergia sissoo will be planted in blocks, spaced 6' x 6' on an eight year rotation. This species is a favorite in Karac and Hyderabad for furniture manufacturing and therefore command a higher price than babul as timber. Fuel wood will be produce through thinnings and fodder should be more plentiful in the first few years because of the wider spacing.

Model 4: Fuelwood, Furniture Stock and Forage Production Established by Using Seedlings under Limited Irrigation

This model consists of 3' x 3' planting of Dalbergia sissoo. It differs from Model 3 in that irrigation water supply is assumed to be limiting, thus producing slower growth and less fodder. Dalbergia was selected because it is more prone to drought/stress than Acacia, and thus yield is impacted more when water is limited.

2. Project Activities

Based on the models proposed and the targeted 2.5% farm-famil participation level, the following activities are required:

a. Woodlots: Compact woodlots will be raised by the farmers o marginal lands/rangelands over an area of 6600 acres in a period of years. The appropriate acreage to be planted each year is given below:

TABLE 4
Approximate Acreage to be Planted Each Year

Location/ Project Year	Area in Acres					
	1	2	3	4	5	Total
Per district	400	420	440	460	480	2200
Entire Project Area	1200	1260	1320	1380	1440	6600

The number of farm families that would join the program each year i indicated in the following table:

TABLE 5
Number of Farm Families Expected to Join the Project Each Year

Location/ Project Year	Number of Farm Families					
	1	2	3	4	5	Total
Per district	300	325	350	375	400	1750
Entire Project Area	900	975	1050	1125	1200	5250

The number of trees that would be grown per woodlot depends on the species selected and the needs of the farmer. Since the objective is t produce fuel wood, poles, pit props and small timbers, all of which hav an established market both in Sind and adjacent Baluchistan, Acaci nelotica (Babul), and Dalbergia sissoo (Shisham) would be the mai species. Acacia is particularly recommended for general application as i is tolerant to saline soils. In villages where soil and water condition are more favorable and winter frost is likely to be severe, Dalbergi sissoo should be considered.

It is estimated that three-fourths of the area will be planted wit Acacia nelotica at a spacing of 3' x 3' (to be thinned after the thir growing season and clear/felled after the eighth year) and the remainin area with Dalbergia sissoo at a spacing of 6' x 6'.

b. Nurseries

The requirements for nursery seedlings for the 6600 acre project area year is shown in Table 6.

TABLE 6
Requirements of Nursery Seedlings during the Project Period

Year	Area to be planted up in acres		No. of seedlings per acre		No. Seedlings per district	
	Babul	Shisham	Babul (3'x3')	Shisham (6'x6')	Babul	Shisham
1	300	100	4800	1200	1440000	120000
2	315	105	4800	1200	1512000	126000
3	330	110	4800	1200	1584000	132000
4	345	115	4800	1200	1656000	138000
5	360	120	4800	1200	1728000	144000
Total	1650	550			7920000	660000

Total = 8,580,000 = 8.58 millic

---No. of plants required for three districts = 25.74 million
---Seedlings required for restocking 25% = 6.44 million
---Total nursery stock required during project = 32.18 million
or 33 milli

3. Project Outputs

The project will produce the following:

a. A demonstration of tree crop management opportunities on approximately 2640 hectares (6600 acres) of land in three irrigated districts of Sind as shown below:

1st year	=	480 hectares	(1200 acres)
2nd year	=	504 hectares	(1260 acres)
3rd year	=	528 hectares	(1320 acres)
4th year	=	552 hectares	(1380 acres)
5th year	=	576 hectares	(1440 acres)
Total	=	2640 hectares	(6600 acres)

b. 15 million Cu.ft. of fuel wood and 0.6 million Cu.ft. of small timber by the end of the project.

c. Knowledge and experience in raising tree plantations along with agricultural crops to supplement income for 5250 farm families.

d. Green fodder from loppings for small livestock and supplemental income for women from the production of seedlings in home nurseries.

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TABLE 7

MODEL OUTPUTS AND REVENUES PER ACRE

MODEL	YEAR	OUTPUT	QUANTITY	RATE/UNIT	VALUE-RS.
1	1	Forage	3 HL	7.00	21.00
	2	Forage	5 HL	7.00	35.00
Hurries	2	Cleaning firewood	400 cuft.	1.00	400.00
	3	Forage/Pods	5 HL	7.00	35.00
	3	Thinning firewood	900 cuft.	1.00	900.00
	4	Forage/Pods	5 HL	7.00	35.00
	4	Thinning firewood	1000 cuft.	1.00	1000.00
	5	Forage/Pods	3 HL	7.00	21.00
	5	Final cut	n.a.		16000.00
2	1	Forage	3 HL	7.00	21.00
	2	Forage	5 HL	7.00	35.00
Acacia	3	Pruning/Cleaning	500 cuft.	3.0/cuft	1500.00
nelotica	3	Forage/Pods	5 HL	7.00	35.00
	4	Forage/Pods	5 HL	7.00	35.00
(3' x 3')	5	Thinning	800 cuft.	3.0/cuft	2400.00
	5	Grazing	2 animal	10.00	20.00
	6	Grazing	2 animal	10.00	20.00
	6	Grazing	2 animal	10.00	20.00
	7	Grazing	2 animal	10.00	20.00
	8	Sale of Pods	L-S	L-S	300.00
	8	Final fellings	5000cuft FW	6.0/cuft	30000.00
	8	Final fellings	150cuft Tim	20.00	3000.00

HL = headload
FW = fuelwood
Tim = timbers

TABLE 7 (Cont)

MODEL OUTPUTS AND REVENUES PER ACRE

MODEL	YEAR	OUTPUT	QUANTITY	RATE/UNIT	VALUE-RS.
3	1	Grass cutting	8 HL	7.00	56.00
	2	Grass cutting	8 HL	7.00	56.00
Hurries	3	Grass cutting	8 HL	7.00	56.00
	3	Pruning/Cleaning	200 cuft FW	3.0/cuft	600.00
Dalbergia	4	Grass cutting	5 HL	7.00	35.00
sissoo	5	Thinning	400 cuft FW	3.0/cuft	1200.00
(6' x 6')	5	Grazing	2 animal	10.00	20.00
	6	Grazing	2 animal	10.00	20.00
Irrigation	7	Grazing	2 animal	10.00	20.00
water is	8	Final fellings	4000cuft FW	6.0/cuft	24000.00
adequate	8	Final fellings	150cuft Tim	20/cuft	3000.00
4	1	Forage	Nil	Nil	Nil
	2	Forage	5 HL	7.00	35.00
Acacia	3	Forage	3 HL	7.00	35.00
nelotica	3	Prunning/Cleaning	450 cuft FW	3.0/cuft	1350.00
	4	Forage	3 HL	7.00	21.00
(3' x 3')	5	Thinning	800 cuft.	3.0/cuft	2400.00
	5	Grazing	2 animal	10.00	20.00
	6	Grazing	2 animal	10.00	20.00
	7	Grazing	2 animal	10.00	20.00
	8	Final fellings	5000cuft FW	6.0/cuft	30000.00
	8	Final fellings	140cuft Tim	20.00	2800.00

4. Project Inputs

The project costs consist of raising nurseries, transportation of seed/seedlings to planting sites, transplanting, irrigation, weeding, cleaning, thinning and final fellings etc. Details about the establishment of nurseries and production cost of seedlings are given in Appendix I. Annual estimates for the establishment of plantations and their management are also given in Appendix I. Based on these estimates, model inputs and their costs per acre are given below. Note also an annual land rent of 1000 Ruppees/acre is applicable.

TABLE 8
MODEL INPUTS AND COSTS PER ACRE

MODEL	YEAR	ACTIVITY	INPUT	COST IN RUPEES
1	1	Ripping soil, seed & water	Labor	150
	2	Cleaning/cutting & water	Labor	500
	3	Cleaning/cutting & water	Labor	60
	4	Cleaning/cutting & water	Labor	60
	5	Cleaning & water	Labor	30
2	1	As per details given		8880
	2	in Appendix I		30
	3			120
	4			30
	5			300
	6			30
	7			30
	8			780
3	1	As per details given		2370
	2	in Appendix I		30
Dalbergia	3			90
sissoo	4			30
(6' x 6')	5			240
	6			30
Irrigation	7			30
water is	8			630
adequate				

TABLE 8 (Cont)

MODEL	YEAR	ACTIVITY	INPUT	COST IN RUPEES
4	1	As per details given		8880
	2	in Appendix I		30
Dalbergia	3			120
sissoo	4			30
(3' x 3')	5			300
Irrigation	6			30
water is	7			30
inadequate	8			780

5. Economic Calculations

Internal rates of return were calculated for each of the four illustrated models. Net discounted present values and benefit/cost ratios were also calculated using discount rates of 0, 10, 12, and 15%. These values along with yearly cash flows are summarized in Table 9. Detailed summaries of the economic calculations for each model appear in Appendix II. The reader is referred to the report on the Murree-Kahuta area for a discussion of variables and uncertainties in the input (cost) and output (benefit) calculations.

Models 2, 3 and 4 have internal rates of return (see Table 9, p. 17) of 15.6, 24.4 and 9.8% respectively, when land rent is charged. As could be expected, the last model provides the lowest rate because of the relative unavailability of water. Only this model may be unattractive at current interest rates.

Finally, no major costs or benefits were omitted in these calculations though, as mentioned in the first paragraph, there is uncertainty about the exact size of the benefits and costs. Specifically, the "benefit" of preventing cow dung from being burned is not being used (see again the Murree-Kahuta Report for reasons why).

Analysis of the hurries model (model 1) shows why farmers have been using this system for a century or more. It returns in gross benefits 16,000 Rs. per 5 year rotation with an internal rate of return of 48 percent. This average annual return of Rs. 3200 per year for 5 years is far superior to cotton crops which return Rs. 1000 per 6 months (and due to nutrient requirements can be cropped only once per year). While the hurries analysis is based on information from a small number of farmers, their data on revenues, costs, and rotations was clear and convincing. Similarly, the economic utility of the hurries system is clear and convincing. From an economic point of view, the utility of the hurries system is not profound. It is the result of extensive management, low capital investment (use of seeding rather than expensive planting) optimal use of growing space and early and repeated yields.

TABLE 9

SUMMARY OF ECONOMIC RESULTS

MODEL	Yearly Cash Flow (Rs/Ac) Year	Revenue	Costs	IRR @15%	NDPV @15%	Benefit/Cost @15%
1	1	21	1150			
	2	435	500			
	3	935	1060	48.1%	5467.58	2.35
	4	1035	1060			
	5	16021	1030			
2	1	21	9880			
	2	35	1030			
	3	1535	1120			
	4	35	1030	15.6%	423.00	1.03
	5	2420	1300			
	6	20	1030			
	7	20	1030			
	8	33300	1780			
3	1	56	3370			
	2	56	1030			
	3	656	1090			
	4	35	1030	24.4%	2994.73	1.43
	5	1220	1240			
	6	20	1030			
	7	20	1030			
	8	27000	1630			
4	1	0	9880			
	2	35	1030			
	3	1371	1120			
	4	21	1030	9.8%	125.45	1.01

E. Recommendations

Based on field observations and the preceding analysis the following recommendations are made:

1. A forestry demonstration project on irrigated private lands in Sind is recommended to show the economic and biological feasibility of silvicultural systems producing fuel wood, fodder and other specialized forest products for established regional markets.

2. Silvicultural systems as previously described are recommended as alternative cropping systems for farmland where (1) water for irrigation is limited so that a farmer's entire acreage cannot be put under agricultural crops and (2) soils are marginal for agricultural production.

3. The project area should be limited to the districts of Sanghar, Jacobabad and Khairpur and encompass approximately 6600 acres of private irrigated farmland.

4. A minimum of 5250 farms in 210 (10 percent) villages throughout the three districts should be included in the demonstaration. This is about 2.5 percent of all farms within irrigated districts. Plantation sizes should nominally range from 0.5 to 1.5 acres.

5. Farmers meeting predetermined qualifications (interest, land and water availability) should be provided with appropriate technical information and free seedlings and encouraged to adopt one of the plantation models illustrated in the preceding analysis. The primary incentive for participation in the program should be the anticipated return from the sale of the crop, not "upfront" subsidies in the form of materials or services provided.

6. The project should be implemented by the Sind Forestry Department in an outreach program. A substantial training program is recommended for forestry personnel to enhance organizational, communication and other outreach skills. The Department should be encouraged to adopt the use of husband and wife farm forestry teams as a mechanism for reaching farm wives. USAID should underwrite the costs of recruiting and training the new female farm foresters. Motorcycles or scooters should be provided to farm foresters to increase their efficiency and effectiveness.

7. On-farm seedling production by farmers' wives should be encouraged as a means of providing supplemental income for farm families. The Forestry Department should provide training, supplies and guaranteed sales of seedling production to encourage this private sector participation as a part of the outreach program.

8. Alternatives to traditional methods of planting seedlings, such as direct seeding, should be studied immediately. Direct broadcast seeding methods now used by farmers planting hurries appear to have been effective and certainly have economic merit.

9. Responsibility for coordinating the previously proposed research program, training activities and the above described operational program should rest with the CCF, Sind.

APPENDIX I

TABLE 1
NURSERY CONSTRUCTION AND PRODUCTION COSTS
(HALF ACRE MODEL)

(a) Construction

Item	Units	Rs./Unit	No.	Cost-Rs.
Rental value of 1/2 acre land	acre	1000	1	1000.00
Clearing, levelling	manday	30	20	700.00
Construction-irrigated channels	manday	30	17	510.00
Barbed wire	Kg	20	100	2000.00
Poles, erected	each	40	40	1600.00
Fitting wire	manday	30	7	210.00
			TOTAL:	6020.00

(b) Production

Ploughing, breaking clods (contract)				3360.00
Laying out, preparing beds	manday	30	80	2400.00
Filling polythene bags	manday	30	64	1920.00
Sowing in bags	manday	30	100	3000.00
Watering, weeding, roof pruning	manday	30	320	9600.00
Sowing in beds	manday	30	20	600.00
Lifting, straping, packing plants	manday	30	40	1200.00
Watchmen			400	12000.00
Seed				1500.00
Pesticides, insecticides, fertilizers				1400.00
Misc. including water supply, contingencies and in the case of private nurseries, profit.				17000.00
			TOTAL:	60000.00
		Plants produced		60000.00
		Cost per plant	Rs.	1.00

APPENDIX I

TABLE 2
PER ACRE PLANTATION ESTABLISHMENT AND MANAGEMENT
COST ESTIMATE FOR 3' x 3' SPACING

Year	Step	Operation	Units	No.	Unit cost	Cost-Rs.
1	1	Identification & survey of site; formation planning (project staff)				
	2	Plantation layout 3' x 3'	manday	1	30.00	30.00
	3	Digging planting 1 1/2' x 1 1/2 ' x 2	manday	48	30.00	1440.00
	4	Seedlings	plants	4800	1.00	4800.00
	5	Planting	manday	40	30.00	1200.00
	6	Irrigation: 3 times	manday	1	30.00	30.00
	7	Filling blanks	manday	2	30.00	60.00
	8	Seedlings @ 25%	nos	1200	1.00	1200.00
	9	Weeding twice	manday	4	30.00	120.00
			TOTAL YEAR 1:	96		8880.00
2	10	Irrigation: 3 times	manday	1	30.00	30.00
			TOTAL YEAR 2:	1		30.00
3	11	Irrigation: 3 times	manday	1	30.00	30.00
	12	Pruning/Cleaning	manday	3	30.00	90.00
			TOTAL YEAR 3:	4		120.00
4	13	Irrigation: 3 times	manday	1	30.00	30.00
			TOTAL YEAR 4:	1		30.00
5	14	Irrigation: 3 times	manday	1	30.00	30.00
	15	Thinnings	manday	8	30.00	240.00
	16	Maintainance of irrigation channels	manday	1	30.00	30.00
			TOTAL YEAR 5:	10		300.00
6	17	Irrigation: 3 times	manday	1	30.00	30.00
			TOTAL YEAR 6:	1		30.00
7	18	Irrigation: 3 times	manday	1	30.00	30.00
			TOTAL YEAR 7:	1		30.00
8	19	Irrigation: 3 times	manday	1	30.00	30.00
	20	Final felling	manday	25	30.00	750.00
			TOTAL YEAR 8:	26		780.00
		TOTAL MANDAYS, YEARS 1 - 8		140		9660.00

APPENDIX I

TABLE 3
PER ACRE PLANTATION ESTABLISHMENT AND MANAGEMENT
COST ESTIMATE FOR 6' x 6' SPACING

Year	Step	Operation	Units	No.	Unit cost	Cost-Rs.
1	1	Identification & survey of site; formation planning (project staff)				
	2	Plantation layout 6' x 6'	manday	1	30.00	30.00
	3	Digging planting 1 1/2' x 1 1/2 ' x 2	manday	12	30.00	360.00
	4	Seedlings	plants	1200	1.00	1200.00
	5	Planting	manday	10	30.00	300.00
	6	Irrigation: 4 times	manday	1	30.00	30.00
	7	Filling blanks	manday	1	30.00	30.00
	8	Seedlings @ 25%	nos	300	1.00	300.00
	9	Weeding twice	manday	4	30.00	120.00
			TOTAL YEAR 1:	96		2370.00
2	10	Irrigation: 4 times	manday	1	30.00	30.00
			TOTAL YEAR 2:	1		30.00
3	11	Irrigation: 4 times	manday	1	30.00	30.00
	12	Pruning/Cleaning	manday	2	30.00	60.00
			TOTAL YEAR 3:	4		90.00
4	13	Irrigation: 4 times	manday	1	30.00	30.00
			TOTAL YEAR 4:	1		30.00
5	14	Irrigation: 4 times	manday	1	30.00	30.00
	15	Thinnings	manday	6	30.00	180.00
	16	Maintainance of irrigation channels	manday	1	30.00	30.00
			TOTAL YEAR 5:	10		240.00
6	17	Irrigation: 4 times	manday	1	30.00	30.00
			TOTAL YEAR 6:	1		30.00
7	18	Irrigation: 4 times	manday	1	30.00	30.00
			TOTAL YEAR 7:	1		30.00
8	19	Irrigation: 4 times	manday	1	30.00	30.00
	20	Final felling	manday	20	30.00	600.00
			TOTAL YEAR 8:	26		630.00
		TOTAL MANDAYS, YEARS 1 - 8		65		3450.00

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MODEL 1 - HURRIES - INPUTS AND COSTS PER ACRE

Year	Activity	Input	Cost-Rs.	Present Value- 0	Present Value-10	Present Value-12	Present Value-15	Cost Rs. 41-65	Present Value- 0	Present Value-10	Present Value-12	Present Value-15
				PRESENT VALUES					PRESENT VALUES			
1	Ripping Sol	Labor	150	150	136.364	133.929	130.435	1150	1150	1045.455	1026.786	1000.000
1	Seed		500	500	454.545	446.429	434.783	500	500	454.545	446.429	434.783
2	Clearing/Cutting	Labor	60	60	49.587	47.832	45.369	1060	1060	876.033	845.026	801.512
3	Clearing/Cutting	Labor	60	60	45.077	42.717	39.451	1060	1060	796.394	754.487	696.967
4	Clearing/Cutting	Labor	60	60	40.981	38.131	34.305	1060	1060	723.994	673.649	606.058
5	Clearing	Labor	30	30	18.628	17.023	14.915	1030	1030	639.549	584.450	512.092
		TOTAL =	860	860	745.187	726.049	699.257	5860	5860	4535.970	4330.826	4051.412

SIND

MODEL 1 - HURRIES - OUTPUTS AND REVENUES PER ACRE

Year	Output	Quantity	Rate/Unit	Value-Rs.	Present Value- 0	Present Value-10	Present Value-12	Present Value-15
					PRESENT VALUES			
1	Forage	3 HL	7	21	21	19.091	18.75	18.261
1	Forage	5 HL	7	35	35	28.926	27.902	26.465
2	Clearing Firewood	400 cuft	100	400	400	330.579	318.878	302.457
2	Forage/Pods	5 HL	7	35	35	26.296	24.912	23.013
3	Thinning&Firewood	900 cuft	100	900	900	676.183	640.602	591.765
4	Forage/Pods	5 HL	7	35	35	23.905	22.243	20.011
4	Thinning&Firewood	1000 cuft	100	1000	1000	683.012	635.518	571.753
5	Forage/Pods	3 HL	7	21	21	13.039	11.916	10.441
5	Final Cut	n.a.	n.a.	16000	16000	9934.741	9078.830	7954.828
			TOTAL =	18447	18447	11735.77	10779.55	9519.994

BEST AVAILABLE DOCUMENT

NET BENEFITS

Year	Benefit	Cost	Net Benefit	Benefit	Cost + 1000	Net Benefit
1	21	650	-627	21	2650	-2629
2	435	60	375	435	1060	-625
3	935	60	875	935	1060	-125
4	1035	60	975	1035	1060	-25
5	16021	30	15991	16021	1030	14991

IRR GUESS = 15

Costs as are, IRR= 1.670 = 167%

Costs +1000, IRR= 0.481 = 48.1%

MODEL 1 ECONOMIC CALCULATIONS

DISCOUNT RATE	(costs as are) NDPV	BENEFIT/ COST
0	17587	21.45
10	10990.59	15.749
12	10053.50	14.847
15	8819.736	13.613

MODEL 1 ECONOMIC CALCULATIONS

DISCOUNT RATE	(costs + 1000) NDPV	BENEFIT/ COST
0	12587	3.148
10	7199.803	2.587
12	6448.725	2.489
15	5467.581	2.350

MODEL 2 - ACACIA MELOTICA INPUTS AND COSTS PER ACRE PRESENT VALUES PRESENT VALUES

Year	Activity	Input	Cost	Present value 0	Present value 5	Present value 10	Present value 15	Present value 0	Present value 5	Present value 10	Present value 15
1	Ploughing		3000	3000	8072.727	7720.571	7721.759	3000	1000	5721.910	332.423	8571.284
2	Cover		20	20	24.792	17.915	22.654	20	1500	851.240	821.116	773.828
3	Fertilizer		120	120	96.159	85.414	73.902	120	1050	841.477	797.194	736.418
4			20	20	16.490	19.026	17.120	20	1260	710.504	654.564	593.966
5			200	200	156.276	170.228	149.102	200	1050	867.195	707.655	646.530
6			20	20	16.974	15.199	12.970	20	1050	58..478	521.830	445.297
7			20	20	15.795	13.570	11.278	20	1050	523.552	465.920	387.215
8			780	780	250.876	715.629	254.905	1750	1750	831.260	719.912	581.885

TOTAL = 10200.000 10200.000 8790.659 8570.993 9269.862 18830.000 9870.000 14125.576 10523.622 12756.184

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MODEL 2 - ACACIA MELOTICA OUTPUTS AND REVENUES PER ACRE PRESENT VALUES

Year	Output	Quantity	Rate/Unit	Value-Rs.	Present Value- 0	Present Value-10	Present Value-12	Present Value-15
1	Forage	2 HL	7	21	21	19.091	18.75	18.261
2	Forage	5 HL	11	55	55	28.926	27.512	25.455
3	Fruitings/Clearings	500 cuft	300	1500	1500	1126.972	1057.27	961.274
3	Forage/Pods	5 HL	7	35	35	26.296	24.912	22.217
4	Forage/Pods	5 HL	7	35	35	23.905	22.142	20.111
5	Thinnings	800 cuft	300	2400	2400	1490.211	1361.824	1190.124
5	Grazing	2 animal	10	20	20	12.413	11.349	9.944
6	Grazing	2 animal	10	20	20	11.289	10.172	8.847
7	Grazing	2 animal	10	20	20	11.267	9.647	7.519
8	Sale of Pods	L-S	L-S	300	300	159.952	121.165	93.071
8	Final Felling-F/W	5000 cuft	600	30000	30000	12995.221	12116.497	9807.453
8	Final Felling-P/T	150 cuft	20	3000	3000	1299.522	1211.650	980.745
			TOTAL =	37780	37780	18284.063	16997.141	13179.127

BEST AVAILABLE DOCUMENT

NET BENEFITS

Year	Benefit	Cost	Net Benefit	Benefit	Cost + 1000	Net Benefit
1	21	9880	-9859	21	9820	-9859
2	35	30	5	35	1030	-995
3	1535	120	1415	1535	1120	415
4	35	30	5	35	1030	-995
5	2420	300	2120	2420	1300	1120
6	20	30	-10	20	1030	-1010
7	20	30	-10	20	1030	-1010
8	32000	780	31220	32000	1780	31220

IRR GUESS = 12

Costs as are, IRR= 0.242 = 24.2%

Costs +1000, IRR= 0.156 = 15.6%

MODEL 2 ECONOMIC CALCULATIONS

DISCOUNT RATE	(costs as are) NCPV	BENEFIT/ COST
0	27136	3.665294
10	9492.418	2.080
12	7432.143	1.967
15	4916.324	1.594

MODEL 2 ECONOMIC CALCULATIONS

DISCOUNT RATE	(costs + 1000)	BENEFIT/ COST
0	27716	3.866
10	4159.492	1.294
12	2464.509	1.182
15	423.0029	1.053

BEST AVAILABLE DOCUMENT

MODEL 3 - DALBERGIA SISSOO INPUTS AND COSTS PER ACRE PRESENT VALUES PRESENT VALUES

Year	Activity	Input	Cost-Rs.	Present Value- 0	Present Value-10	Present Value-12	Present Value-15	Cost-Rs. #1000	Present Value- 0	Present Value-10	Present Value-12	Present Value-15
1	As per details		2370	2370	2154.545	2116.071	2060.870	3370	1150	3063.636	3008.929	2930.425
2	Given in		30	30	24.793	23.916	22.684	1030	1000	851.240	821.110	778.828
3	Appendix III		90	90	67.618	64.060	59.176	1090	1060	818.533	775.840	716.697
4			30	30	20.490	19.066	17.153	1030	1060	703.504	654.584	588.906
5			240	240	149.021	136.182	119.322	1240	1060	767.942	703.609	616.499
6			30	30	16.934	15.199	12.970	1030	1030	591.408	521.830	445.297
7			30	30	15.395	13.570	11.276	1030	1030	528.553	465.920	387.215
8			630	630	293.900	254.446	205.948	1630	1780	760.407	658.330	532.858
		TOTAL =		3450.000	2742.697	2642.511	2509.401	11450.000	9670.000	8077.624	7610.151	6996.727

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MODEL 3 - DALBERGIA SISSOO OUTPUTS AND REVENUES PER ACRE PRESENT VALUES

Year	Output	Quantity	Rate/Unit	Value-Rs.	Present Value- 0	Present Value-10	Present Value-12	Present Value-15
1	Grass Cutting	8 HL	7	56	56	50.909	50	48.696
2	Grass Cutting	8 HL	7	56	56	45.281	44.643	42.744
3	Grass Cutting	8 HL	7	56	56	42.674	39.860	36.621
3	Prunnings/Clearings	200 cuft	300	600	600	450.789	427.068	394.519
4	Grass Cutting	5 HL	7	35	35	23.905	22.242	20.011
5	Thinnings	400 cuft	300	1200	1200	745.106	690.912	596.612
5	Grazing	2 animal	10	20	20	12.418	11.549	9.944
6	Grazing	2 animal	10	20	20	11.289	10.105	8.647
7	Grazing	2 animal	10	20	20	10.263	9.647	7.519
8	Final Felling-F/W	4000 cuft	600	24000	24000	11196.177	9897.197	7845.643
8	Final Felling-T	150 cuft	20	3000	3000	1399.522	1211.650	980.705
		TOTAL =		31.[illegible]	29[illegible]	13986.774	12203.[illegible]	9991.451

BEST AVAILABLE DOCUMENT

NET BENEFITS

Year	Benefit	Cost	Net Benefit	Benefit	Cost * 1000	Net Benefit
1	56	2370	-2314	56	3370	-3314
2	56	30	26	56	1030	-974
3	456	90	366	456	1090	-634
4	35	30	5	35	1030	-995
5	1220	240	980	1220	1240	-20
6	20	30	-10	20	1030	-1010
7	20	30	-10	20	1030	-1010
8	27000	630	26370	27000	1630	25370

IRR GUESS = 15

Costs as are, IRR= 0.465 = 46.5%

Costs *1000, IRR= 0.244 = 24.4%

MODEL 2 ECONOMIC CALCULATIONS

DISCOUNT RATE	(costs as are) NDPV	BENEFIT/ COST
0	25613	8.424
10	11246.03	5.100
12	7557.570	4.617
15	7482.049	3.792

MODEL 3 ECONOMIC CALCULATIONS

DISCOUNT RATE	(costs * 1000) NDPV	BENEFIT/ COST
0	17293	2.005
10	5911.119	1.732
12	4597.950	1.603
15	2994.727	1.429

BEST AVAILABLE DOCUMENT

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MODEL 4 - CALIFORNIA SIESCO INPUTS AND COSTS PER ACRE PRESENT VALUES PRESENT VALUES

Year	Activity	Input	Cost-Re.	Present Value-0	Present Value-5	Present Value-10	Present Value-15	Cost-Re. 1-1000	Present Value-0	Present Value-5	Present Value-10	Present Value-15
1	As per details		8350	8350.	8171.727	7920.671	7721.739	9850	1150	978.5.3	8821.429	8571.204
2	Seed 47		30	30	24.793	21.916	21.684	1030	1500	951.240	821.110	778.829
3	Application II		120	120	93.158	85.414	78.912	1120	1060	841.472	797.154	756.415
4			30	30	20.496	19.066	17.157	1030	1060	783.504	654.534	588.996
5			330	300	186.276	170.228	145.157	1300	1060	807.198	777.655	646.773
6			30	30	16.524	15.189	12.976	1030	1060	531.413	521.830	445.257
7			30	30	15.795	10.573	11.278	1030	1060	528.557	465.920	387.215
8			780	780	363.876	315.439	254.983	1780	1780	831.383	719.912	581.895

TOTAL = 10203.000 10201.000 8790.650 8570.973 9268.862 10200.000 9470.000 4115.576 10539.672 10756.184

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MODEL 4 - CALIFORNIA SIESCO OUTPUTS AND REVENUES PER ACRE PRESENT VALUES

Year	Output	Quantity	Rate/Unit	Value-Re.	Present Value-0	Present Value-10	Present Value-12	Present Value-15
1	Forage	0	0	0	0	0.000	0	0.000
2	Forage	5 HL	7	35	35	22.926	27.982	26.465
3	Forage	3 HL	7	21	21	15.375	14.947	13.309
3	Plantings/Clearings45% ex+	300		1350	1350	1[illegible]4.275	9[illegible].903	837.847
4	Forage	3 HL	7	21	21	14.340	13.746	12.007
5	Plantings	800 ex+	300	2400	2400	1[illegible]70.214	1761.024	1[illegible]70.224
6	Grazing	2 animal	10	20	20	12.416	11.239	7.944
6	Grazing	2 animal	10	20	20	11.239	11.100	6.647
7	Grazing	2 animal	10	20	20	11.260	8.047	7.819
8	Fire, Tillage-Fall	5 ac ex+	60	300.0	300.0	1[illegible].95.[illegible]	1[illegible].6.897	92[illegible]
8	Fire, Tillage-Spring	140 ex+	20	25.0	20.0	1[illegible].121	1[illegible].[illegible]	[illegible]

TOTAL = [illegible]

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NET BENEFITS

Year	Benefit	Cost	Net Benefit	Benefit + 1000	Cost + 1000	Net Benefit
1	0	8880	-8880	56	9880	-9824
2	35	30	5	56	1030	-974
3	1271	120	1151	456	1120	-664
4	21	30	-9	35	1030	-995
5	2420	300	2120	1270	1300	-80
6	20	30	-10	30	1030	-1010
7	20	30	-10	20	1030	-1010
8	32900	780	[illegible]	[illegible]	1780	[illegible]

IRR GUESS - 11

Costs as are, IRR= 0.278 = 27.8%

Costs +1000, IRR= 0.038 = 3.8%

MODEL 4 ECONOMIC CALCULATIONS

DISCOUNT RATE	(costs as are) NPV	BENEFIT/COST
0	26487	2.527
10	7169.275	2.026
12	7035.923	1.927
15	4613.775	1.558

MODEL 4 ECONOMIC CALCULATIONS

DISCOUNT RATE	(costs + 1000) NPV	BENEFIT/COST
0	27017	2.294
10	7315.267	1.267
12	2118.189	1.155
15	125.454	1.010

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FINAL DRAFT

EXTENSION

of the
FORESTRY PLANNING AND DEVELOPMENT PROJECT

Murree-Kahuta Integrated
Forestry-Watershed Demonstration

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I. Background

A. General

Murree and Kahuta are two tehsils in the district of Rawalpindi in the province of the Punjab. They are located between the 32 and 34 North latitude, just north of the cities of Rawalpindi and Islamabad. The area is quite hilly, ranging in elevation from about 2000' to 8000' and draining into the Jhelum river, a tributary of the Indus. The total area is about 450,000 acres. Rawalpindi is one of the districts selected by the existing Forestry Planning and Development Project to demonstrate the social, economic and technical feasibility of producing tree crops on privately owned farm and rangelands in barani areas. The Kahuta tehsil consists of 19 union councils and 240 villages, the Murree tehsil of 19 union councils and 90 villages.

B. Climate

The climate, of course, varies with the elevation. Mean monthly temperatures range from around freezing in January to the upper eighties in June. Frost occurs regularly in winter, with snow on the ground; in June the temperature can rise to 115 F. The region is sub-humid, with rainfall ranging from 33" to 70". Over 50% of the rain falls in July and August, another 25% during December-March. Elevation is not the only variable influencing temperature and precipitation: windward slopes receive much more rain than leeward slopes, and south facing slopes are much more difficult to revegetate than north facing slopes because of solar radiation.

C. Geology and Soils

The Murree Kahuta watershed is submountainous to mountainous, consisting of numerous hills, ridges and narrow valleys. Slopes range from moderate to very steep, but generally are steep to very steep. Level ground is virtually nonexistent. The parent rock is mainly tertiary, consisting of steeply tilted sand stones and arenaceous clay, with occasional limestone (see Revised Working Plan for the Murree Kahuta forests, 1965-85). These rocks produce soils of varying depth and quality but, in general, the soil is a shallow clayish loam of low productivity. On the southern and western facing slopes and where the slopes are steep, the soil tends to be very thin and sterile. Already in the earliest forest management plans of 1888, extensive areas of bare sheet rock were found to exist. Some of the lower parts of this watershed have deeper soils, mostly formed of alluvial deposits with deep beds of gravel and clay.

When the design team visited this watershed, extensive areas were denuded and some slopes demonstrated spectacular signs of mass slumping and movement. Not all the erosion and movement of slopes are man-caused some of the young, steep slopes consisting of sheet rock appear to be naturally unstable. Presently, about 125 active land slides are said to exist in this area (personal communication with the Murree-Kahuta development authority). About 25,000 acres are presently said to be bare. Land slides have displaced 14,000 people just last year (number derived from application for help).

D. Population, Employment, Income and Consumption

Population pressure is tremendous, obviously visible on steep and unstable slopes where recently built houses and villages cling tenaciously to the land (and, on closer inspection, along roads and trails showing clearly that battles with erosion have been lost or will be lost shortly). The population numbers tell the story: 60,000 in 1887, 120,000 in 1951, 250,000 in 1961 and over 600,000 in 1987, increasing at a rate of 3.7% per year.

The population distribution over the area is quite uneven. In the more level areas of Kahuta and on the plateaus, the people live in fairly compact settlements. In the hilly and steeper areas, they are quite scattered; in Charehan, for example, about 15,000 people are scattered over 15 square miles.

People like to live in this area because of its mild climate and its scenery. Even when no employment or land is available, forcing the breadearner to go outside the area for extended periods of 3-5 years and more, they tend to return, often having saved enough money to buy some land and build a home. Employment statistics are as follows:

Employment	%
Office and resort employment	40
Armed forces	18
Business and crafts	15
Agriculture	14
Other	3
Overseas (Mideast, Western Europe, U.S.A.)	10

Source: Murree-Kahuta Development Authority

The literacy rate is below the average of Pakistan at 26% for men and 7% for women. The region has been declared to be backward by the government because of its high percentage of people in the lowest income range.

Income (monthly) in rupees	% of Families
0 - 300	53
300 - 600	26
600 - 900	7
900 - 1200	7
1200 +	7

Women are largely confined to the house or to nearby field work (including tree nursery, fuel collection and collection of lopped branches and grass). Because of the employment outside the region (Rawalpindi and Islamabad and the Mideast) as well as because of the trend toward paid employment (with one male per household working for cash), there appears to be a trend away from a barter and closed economy toward a monetary economy; more importantly and paradoxically, there appears to be an effective shortage of male labor for farming and land development.

The area is a net importer of goods. People are poor and the climate allows only one crop per year. About 95% of the food grains needed are imported and 60% of all basic requirements. One of the most pressing needs in the watershed is energy for heating and cooking. Fuels include wood, cow dung, coal, oil, gas (bottled) and electricity. But wood and oil provide 98% of the needs, with wood probably accounting for 90% since oil and gas cannot be supplied to the remote rural areas. Energy problems are so severe that in 1986 60,000 maunds of firewood were being supplied to Murree alone from other forests in the Punjab (from as far away as Lahore). This fuel wood is supplied at the normal rate of 40 rupees per maund, meaning that the government subsidises the transportation.

No major industries exist in the area. The resort business and military service offer important employment opportunities, while cattle farming is important for women. In addition, there are considerable numbers of fruit trees in the area, especially apples and apricots; most fruit trees are in poor shape because of insect attacks and neglect. In addition, on some of the alluvial deposits and on some of the terraced lands, people raise maize, potatoes and vegetables. Finally, there is considerable poultry farming in the area, one of the few export crops of the region.

E. Land Holding

Land holdings are very small. A typical family of 5-7 may own 1 marla to 1 kanal of land. Another way of showing the immense pressure on the land is provided by the following numbers:

	Cultivated Land in Acres/Capita	Population/Cultivated Acre
Region	0.35	2.85
Murree Tehsil	0.20	5.01
Kahuta Tehsil	0.47	2.13

Since World Bank and other sources estimate that about 1-1.5 acres are needed per family to provide for the fuel wood needs on a sustainable basis, the import statistics for fuel wood into the region given in section D. become understandable.

F. Summary Conclusions

Murree Kahuta, a 450,000 acre watershed, ranging in elevation from 2000' to 8000', now has a population of over 600,000 which is increasing rapidly. The topography is submountainous, with slopes ranging from moderately steep to very steep and with very little level land. Steep hills are geologically young and unstable; and mass slope movement is taking place, some of it probably natural. Soils tend to be shallow and of low fertility. Land holdings are very small, in average less than one acre. Obviously, taken as a whole, this area should be used for forestry since it tends to be marginal and submarginal for agriculture. Multiple use forest management may be the ultimate destination, especially since the area is well suited for and in fact already used for resort/recreational purposes. But at the present, the population pressure is tremendous and the needs far surpass the carrying capacity of the land. Fuelwood is imported (as are food and other basic necessities). Given the

potential of the area for sustained forest production, forestry crop appear to be the main produce in which the area can hope to becom self-sufficient, given proper management and incentives. This woul include fuel wood, small poles, mine props and construction size timber coupled with some forage and lopping for fodder.

II. Forest Resources in the Murree-Kahuta

A. Land Use

The following numbers indicate the forest land use pattern in thi watershed in acres (Source: MK development authority).

Status of Land Use	Murree	Kahuta	Total
Reserved forest	42700	32500	75200
Protected forest	27500	19100	46600
Guzara forest	41600	59400	101000
Mulkiat land	41600	37000	78600
Municipal forest	3600	-	3600
Cantonment forest	2100	-	2100
Total forest use			307100
Other uses (of which 48000 is agriculture, some submarginal, and 90000 is low productivity shrubbery or maquis)			140000

It is estimated that about 25,000 acres of the reserved and protecte forest are bare and/or in need of reforestation due to overuse by th population and grazing. In addition, the Guzara forests and Malkiat land need large-scale reforestation. Finally, the design team noticed numerou terraced areas lying fallow and abandoned; it was told that these wer formerly used for agriculture, but with the effective shortage of labo for farming and land development (see section I. D.), these were not bein farmed anymore. It appears that activities where return to labor is hig (not the case in forestry and agriculture) and/or those that can us seasonally underemployed people or provide work at the convenience o people, very flexible harvesting times and are relatively less labo intensive than annual crops (all requirements amply fulfilled by forestry would have considerable promise.

Grazing is allowed free in almost all the forests. In fact, th people residing in the villages, especially the remote ones, depen largely on the above forest categories (including reserved and protecte forests) for grazing, grass cutting, leaf fodder, fuel and timber. Thes demands are met through the exercise of the rights and concessions grante liberally by past governments. These rights now greatly exceed availabl resources as heirs to these rights increased exponentially, doubling, redoubling and reredoubling with the population increase.

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Some forest lands have become completely denuded in the process of satisfying the right holders. In short, these rights and uses are the main causes of the depletion of the forests. They cannot be taken away, but possibly could be channeled into less destructive uses. People are reportedly becoming aware of the cause and effect relations, primarily because many have lost land and home to erosion, and are amenable to curtailment or channeling of their existing rights (measures to prohibit removal of stones and the importation of goats seemed to have gained some acceptance).

Resin is one of the minor forest products in the area. Another one is the rearing of silkworm eggs.

Access in the watershed is varied. It is served by a relatively good primary paved road network (partly maintained for defense purposes) and an extensive network of trails and dirt roads (kacha and pacca roads). Hence, extraction of even large trees prevent no major problems. Erosion and mass slumping, however, are major problems even for the primary roads; these necessitate expensive and seemingly continuous road repairs (of which the design team saw many). In fact, roads and trails themselves are major causes of landslides.

Forest fires are a problem in the region, especially during May and June. However, they do not appear to be a major one. Frost and drought are problems for some species, and so is snow breakage.

3. Species

Oaks are natural to this area, but have largely disappeared because they were unable to reproduce through coppice shoots or seedlings due to heavy grazing, lopping and illegal felling. Pinus willichiana (Kail) grows at higher elevations over 6000'. At lower elevations, Pinus roxburgii (chir) occur from 3000' to 6000'. Scrub forests consisting of Olea cuspidata and Accacia modesta occur also at lower and hotter/dryer elevations. Other species include horse chestnut (Aesculus indica), walnut (Juglans regia), willow (Salix), black locust, deodar (Cedrus), mulberry (in the lower elevations), Robinia and Albizzia procera. These species are all attractive to very attractive from a utilization point of view.

The design team observed some very nice pine stands of over 50 or even 100 years of age. Most of those were lopped, leaving a very small crown; this is indicative of the pressure for fire wood.

The design team also observed numerous (small) areas which were fenced to keep cattle out. Invariably these areas showed ample and vigorous regeneration. This may be one of the cheapest and most economical ways to restock certain slopes, if socially acceptable.

. Water

There are numerous springs at higher elevations but the water supply tends to be insufficient for the local population. Both in summer and in winter there may be spot water shortages, even in the lower elevations because of the precipitation pattern. There is also considerable interest in water storage for cattle.

D. Summary Conclusions

Murree-Kahuta is primarily a forestry area, both actually ar potentially. The emerging market economy and labor shortage further poir toward forestry activities which are less labor intensive and more flexible time wise than traditional agricultural activities. However, th system of legal rights on different forest classes combined with th exploding number of right holders, have led to overuse and depletion c the forest resources. Water supply is a problem in some areas, but acces is good; forest fires are a problem, but not a major one. Finally, som very useful tree species can be and are grown in the area.

III. Forestry Programs in Murree-Kahuta

A. Past Projects

The Murree-Kahuta area has seen several forest management plans, th oldest dating back to 1887. A recurring theme through all these plan update is the increasing encroachment and population pressure on th hills, slopes and forested areas.

More recently in 1964 , the Punjab Forest Department started th Bhurban watershed management project in the Murree hills; this projec reportedly included terracing of agricultural fields, planting of fruit fodder and timber trees and even the supply of cooking stoves and kerosen to the people living in the project area to reduce the pressure on tree cut for heating and cooking. Although the evaluation criteria could no be constructed, the project was judged to be a productive one (Source draft policy statement of the Federal Forest Service, chapter 4) Certainly, the planting of fruit trees has been a phenomenal success judging from the large number of apple trees found in the area.

Another project aimed at rehabilitating land is known under the nam Ghoragali project. It ran from 1967-72. Finally, in 1980, yet anothe watershed improvement and forest extension project was started in th Murree Hills and reportedly is still being implemented. Specific measure included the stopping of all kinds of fellings in the Murree Hill forests. Also, to further check illegal removals and the misuse o haqdaries (rights) from the guzara forests for individual profits, al such sales are supposed to be controled by the Forest Department. An finally, for Murree thesil alone, 60,000 maunds of firewood are annually brought in from the plains and sold locally on a no profit basis.

The results of these projects, from an effective watershed protectio and reforestation point of view, must be minimal as judged from 2 or visits by the design team to the area. A World Bank Mission in 198 concluded with the impression that in the Punjab there is comparativel little tangible interest in effective watershed protection an reforestation (Source: draft policy statement of the Federal Forest Service, chapter 4).

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B. The Forestry Planning and Development Project

This project, which was effectively started in 1986, did not include any reference to integrated watershed management approaches, but it did cover the Rawalpindi district and Kahuta as part of its demonstration effort in the Punjab. For the objectives of this project and its activities, reference is made to the project documents and the PC-1. The design team was asked to evaluate and design a possible expansion of this project which would add an integrated watershed management component to the existing project in the Murree-Kahuta area.

IV. The Proposed Project

A. Reasons for the Proposed Project Expansicn

The existing Forestry Planning and Development Project has a strong institutional and manpower development component, as well as stated goals of energy self-sufficiency and a reversal of the process of deforestation. Viewed from this vantage, a possible expansion of the project to include a large scale integrated demonstration of fuel wood, poles and timber production, watershed management and environmental protection on both private and public lands in the Murree-Kahuta area would fit very well with the original objectives. The original project had a main (but not exclusive) focus on private lands. To tackle watershed problems of the kind encountered on the Murree Kahuta, one certainly cannot divorce public from private lands: a holistic approach is needed.

As mentioned before, Murree-Kahuta is a net importer of fuel wood; in fact, fuel wood shortages have become so pressing that the government transports fuel wood from the plains free of charge to supply the population and to relieve the already grossly overutilized forests. Certainly the market for fuel wood is there and will be there in the foreseeable future. Also, the economy in the area is becoming more of a market economy, with many people finding employment outside the area (as far away as the Mideast and the developed countries of Europe and the U.S.A.) or in nonagricultural employment; this means that labor is becoming scarce in the sense that it demands more remunerative employment than agriculture (or forestry) can offer or that it requires employment suitable for the off-season or off-regular-time employment. Forestry, which can accomodate involvement at times which can be very flexibly left to the individual (no rigorous harvest, tending etc. times) is ideally suited to this situation. Also, absent wage earners coming back have money to spend, want to start families, build homes; thus the demand for building materials, for poles and timber products, is guaranteed.

Finally, and perhaps most exciting, the government has realized that a piecemeal solution to the very pressing and real problem of forest degradation, erosion, mass slumping and general degradation of the land requires an approach, an organization which transcends the individual

services and branches of government. It recreated six months ago the Murree Kahuta Development Authority to provide the needed integrated approach and to attack the very serious problems of the region. There are, admittedly, some sceptics: why would this authority work, while the previous one did not. Another is defense of turf by the several services and branches of government. But the very act of recreating this authority seems to indicate not only the willingness of the government to tackle the problems of the region (see chapter 1 and 2), but in fact the over riding need of this integrated approach. These are the reasons which the design team found to be valid and very relevant for expanding the existing project to include this integrated approach to environmental, watershed and forestry problems.

B. Criteria for Selection of the Demonstration Areas

As was mentioned in chapters I and II, the land holdings in the watershed are very small. Due to loss of soil and the origin of the area, soil fertility is very low. Many people are employed and live outside the watershed areas. Agriculture is becoming increasingly unremunerative. Fuelwood, poles and timbers are in high demand. The area is by and large overgrazed, with little control of the cattle.

Watershed management is a problem of many facets and the approach to solve these problems has to be a multidisciplinary and integrated one. A central watershed management authority which can take charge of the whole set of watershed works needed has been set up: the Murree-Kahuta Development Authority. The design team found this authority a relatively ideal institution, interested and willing to work on a possible expansion of the project.

The design team is also of the opinion that, while it is necessary that natural resource and watershed management is coordinated at the whole watershed level, a more practical approach is to develop a productive activity, such as forestry, which is both fundamental to watershed management and yet is urgently required for its economic benefits. Reforestation either on public lands or on private lands through agro forestry schemes will provide fuel and timber thus alleviating the pressures on the land which is important for watershed protection. If schemes can be found which are acceptable and even attractive to the population, a beginning to control the grazing of animals can be made; again, forestry plantations can provide a perennial source of fodder for livestock if species are selected judiciously. This would further enhance the control of livestock. Tree cultivation has further advantages: they are less labor intensive than annual crops and the needed work can be scheduled more flexibly; also, the soil is cultivated fewer times and thus is less exposed to erosion and loss of organic matter.

With this, in mind, the design team proposes the following criteria for the selection of demonstration areas.

1. Areas selected should be at the subwatershed area or slope level, small enough to be workable but big enough to be a holistic ecological unit.

2. Given the scope of the project and the available funds, the areas selected should be doable. This means that a high degree of success should be assured. Areas which show signs of massive soil movements (either natural or man-induced) should be excluded from consideration. Slopes should be moderate. No earthwork, terracing or dam building should be needed since those activities are outside the scope of the project.

3. The subwatershed to be selected ideally should have a mixed ownership pattern between the provincial forest service and the private owners.

4. Given the size of the needed ecological units (subwatersheds or slopes), it is expected that several villages will be involved. Obviously a fairly high degree of willingness to engage in the demonstration project by a majority of the farmers of a village as well as a high degree of cooperation between the villages participating, has to be present.

5. The subwatersheds selected should be distributed somewhat over the watershed to increase the watershed wide impact and to provide a variety of ecological and social conditions (south facing slopes, north facing slopes, villages growing vegetables versus those more heavily engaged in fruit tree etc.).

6. The areas should be seasonally accessible for public motivation and demonstration.

C. Location and Size

With the criteria enumerated in section B in mind, the following areas have been identified by the design team in consultation with the Murree Kahuta Development Authority as possible areas for the expansion project.

SUGGESTED AREAS FOR KAHUTA

LOCATION	VILLAGES INCLUDED	AREA (ACRES)	POPULATION BENEFITED	POSSIBL CROPS
Nara Mator	Nara, Beor, Mator Palot, Jan Hatal Guzara and Salgaran	1108*	15,000	Forestr
Guff	Tarear, Guff Bagh Bootian	305	5,000	Forestr
Kallar Syedan Duberon	Nallah Muslemanan Kanwal, Duberon, Kallar Syedan, Dhumali	470*	6,500	Forestr
Kahuta	Mowara, Dupri, Hothla Pothla, Kahuta, Channi	165	24,000	Forestr
Rajgarh	Rajgarh, Beor, Prindla	50	6,000	Forestr
*Total selected for project:	9	1578	21,500	

SUGGESTED AREAS FOR MURREE

LOCATION	VILLAGES INCLUDED	AREA (ACRES)	POPULATION BENEFITED	POSSIBLE CROPS
Tret, Ghoragali	Arukas, Broha, Dleh, Nandkot, Hoterari, Becharagh, Sambli Tajjal, Ghoragali, Pithli, Numb Behramal, Dhar Jawa	500*	24,458	Forestry
Rewat, Dewal	Rewat, Mohra Eswal, Malote Dhondan, Aucha, Bandi, Kahiah, Osia, Dewal, Numb Budhrial	600	20,665	Fruit trees & forestry on marginal land
Dhagwari, Aliot, Sehrbagla	Dehla, Phagwari, Namb Romal, Fetote, Beargran, Sehr Bagla, Hukra Keri, Ghoi, Aliot, Kohatti, Potha, Sihana	800	31,512	Vegetable farming, fruit trees & forestry
Kerore	Korere	200*	13,554	Vegetable farming & forestry on marginal land
Malote Sattian, Santh Saroola, Kotli Sattian	Malote Sattian, Jawa, Anwali, Santh Saroola, Bhan, Kurina, Kalan, Dharnohian, Burhad, Kotli, Sermandel, Balawera	500	33,596	Forestry
Wagel, Ghel, Chejjana	Wagel, Chalawera, Dherkot, Dhangran, Ghel, Deghal, Mehwala, Bhanathi, Chujjana	400*	26,442	Forestry
*Total selected for project:	22	1100	64,454	

D. Project Objectives

The goals and objectives of the expansion project to t Murree-Kahuta watershed are of course subject to the over-all objectiv spelled out for the Forestry Planning and Development Project: increase energy self-sufficiency and to reverse the process deforestation. The three principal components of the project ar institutional and manpower development, farm and energy forestry researc and farm and energy forest operations. In the case of Murree-Kahuta, t accent will be on the large scale integrated deomonstration of fuel woo poles and timber production, watershed management and environment protection on both private and public lands. Participation of women these activities is to be actively pursued. The integrated activities a to be pursued through the newly constituted Murree-Kahuta Developme Authority, possibly with the involvement of PVO and NGO.

V. Institutional Arrangements

A. Organization

The Murree-Kahuta Development Authority (the Authority) w established by the Punjab Assembly in January, 1987. The Authority empowered to "prepare, implement and enforce schemes for developme of...agriculture industry, forest conservation and development...landsli management...environmental improvement...etc." The Authority, in additi to the Chief Minister as Chairman, includes among its members t Secretaries of Planning & Development, Finance, Forestry, Wildlife an Tourism, Housing and Communications. The Authority is headed by Director General who reports to the Chief Minister.

B. Powers

It is established as a "body corporate" with the rights to hold a transfer property, enter contracts, conduct studies and surveys, and ord special changes in land use. It also may alter or remove buildi structures, appoint officers, advisors, consultants or employees necessa to perform its functions and prepare and execute development schemes. T Authority may also, with assembly approval, level "betterment fees" borrow money, issue bonds and accept foreign or local loans. T Authority can administer an "Authority Fund" where Punjab Governme grants, international grants and loans and fees received by the Authori can be utilized.

C. Staffing

Currently the Authority has a Director General, an Administrativ Officer and Accounting staff, three seconded DFOs from the Forestr Department, an Engineering Cell with a senior engineer and three suppo staff and an Area Director for Murree and Kahuta. These staff a supported by office personnel and drivers.

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The Authority has the ability to execute projects because it is empowered (after Government of Punjab approval) to require any other government agency in its jurisdiction to:

1. work with the Authority
2. work on behalf of the Authority
3. enforce regulations on behalf of the Authority

This effectively permits the Authority to draw any needed staff from other agencies. This power, coupled with the ability to directly hire personnel, provides in theory considerable flexibility in acquiring staff. In practice, the Authority must either have the funds to employ personnel or have the Punjab Assembly approve transfer of personnel from other agencies to its staff. Thus the potential for staff salary is there, but the availability of significant numbers of personnel, for example a farm-forestry wing, may be questionable.

D. Interest & Experience

The Authority is headed currently by a charismatic and energetic retired Pakistani Brigadier, Mohammad Taj. The Brigadier exudes confidence and enthusiasm and in the approximate eight months since the Authority was gazetted, has established rapport with the leadership in a number of villages. In discussions with the design team he expressed profound interest in the proposed USAID project and has assisted the team in various ways in its work. Discussions with the Punjab Secretary of Forestry, Wildlife & Tourism, Mr. Ashraf, who serves as Chairman of the Authority's board, indicated that he and the other members of the board would be supportive of the type of project being proposed by USAID. The Secretary also assured the team that sufficient Forestry Department Staff would be made available on deputation to implement the project.

To date, the Authority has received most of its funding through the Punjab and Federal Governments. Approximately $1.2 million in federal funds have been allocated to the Authority for 1986-87. An additional $1.7 million was received from the Government of Punjab. These funds were for various development schemes ranging from tourism and water supply to health, landslide abatement, road improvements and forestry. As of May 1, 1987, 50% of the federal monies and 20% of the provincial funds have been utilized. The forestry scheme was physically 80% complete and the landslide program was finished. This is a reasonable record for a newly formed organization.

In summary, the Authority, while relatively new and with only a short record of accomplishment, has the necessary legal power and staffing capabilities to implement this USAID project component described above.

VI. Economic Analysis

A. Suggested Models

At present the area has a mixture of bare lands, areas with low shrubbery and trees(maquis), small to very small agricultural plots (some terraced), few fruit trees to small orchards (mostly apple trees and many sadly neglected and diseased), rows of trees or terraced pasture lands along field boundaries, trails or roads, small clumps of trees or individual trees and some very nice pine stands of several acres to a few hundred acres on the steeper slopes and higher elevations. Most trees, whether individual, in clumps, rows or stands, have been heavily lopped for firewood and fodder.

Using the criteria proposed, five subwatersheds (of the 10 suggested for the Murree and Kahuta areas) are to be selected so that one of the five following illustrative models can be tried out on the most suitable subwatershed. The design team suggests that about 1 million dollars be used by the Murree-Kahuta Development Authority to carry out activities on each of the five subwatersheds which are needed as part of the integrated approach to the solution of the watershed problems, but which do not benefit any one farmer or any one village in particular. The design team proposes that this money be used to carry out such activities on the subwatersheds as remedying gullies, absolutely minor earth work and channel building, absolutely minor road and trail network improvements, etc; possibly part of this money should be used to buy some light tractors and bulldozers. These activities are needed from an over-all subwatershed management point of view as part of the package of incentives in the demonstration projects to induce farmers and villages to participate and cooperate.

The following five illustrative models are proposed by the design team as a result of its discussions with the Murree-Kahuta Development Authority personnel, field visits and the considerations presented in the previous sections and chapters.

Model 1

Block plantation of fast growing broad leaved species at 3' x 3' spacing on areas as small as 1/8 of an acre on private lands with short rotations of up to 10 years, integrated with block plantation on public lands with rotations up to 50 years (presently the Provincial Forest Service uses 80-120 year rotations; these appear unduly long). Farmers will be asked to perform the ground preparation and planting in exchange for free seedlings and free technical advice and information. Farmers will be encouraged to control grazing for the first 3 years of the project, but will be allowed to collect fodder from the plantation (grass and loppings); it is speculated that women will have an active role in the collection of the fodder. To guide the activities, a forester from the Murree-Kahuta Development Authority should develop a master plan for the subwatershed to assure an integrated and coordinated approach. The first subwatershed suggested for Murree could serve this model, covering 500 acres, 12 villages and 25,000 people (Tret and Ghoragali).

Model 2

This proposed model is identical to Model 1 with one important difference. As an added inducement to the cooperating villages, one or two small water holding reservoirs of about 10-25,000 gallons per village would be provided. These would be used primarily to supply water to livestock and should be viewed as having the advantage of providing a grazing control mechanism. The Wagel, Ghel and Chejjana subwatershed of 400 acres with 9 villages and 400 acres in Murree could be used for this model.

Model 3

This model is similar to Model 1 except that the public block plantations and forest stands would be managed in such a way as to provide generous amounts of cattle fodder and grass which the farmers could collect at certain times during the year (as determined by the master plan for the subwatershed). The Nara Mator area with 1108 acres, 5 villages and 15,000 people in Kahuta could be used.

Model 4

This model integrates orchard management and row planting of trees at 6' spacings along boundaries of orchards, trails or courtyards. Free seedlings and technical information would be provided to the farmer along with a maximum of 10 fruit trees per farmer. The fruit trees would provide an inducement to keep the livestock out of the plantations. Villagers would be allowed to gather grass and loppings from the orchards, line trees and public forests. The public lands would be planted with block plantations. Again, to ensure an integrated approach, a forester from the Murree-Kahuta Development Authority would prepare a master plan to guide the activities. The Kallar Syedan Duberon area in Kahuta with 470 acres, 4 villages and 6,500 people could be used.

Model 5

This model is identical to Model 4, except that the integrated crops are not fruit trees and trees but agricultural crops such as maize, potatoes and vegetables with row trees at 6' intervals along boundaries etc. Free seedlings and technical advice would be provided to the participating farmers together possibly with some free seeds. Public lands, again, will be planted in block form with fodder collection permitted. The Kerore area in Murree with 200 acres, 1 village and 14,000 people could be used for this model.

B. Project Inputs

MURREE-KAHUTA INTEGRATED MANAGEMENT DEMONSTRATION

Model Inputs and Cost Estimates Per Acre

MODEL	YEAR	STEP	OPERATION	UNITS	NO.	UNIT COST	COST Rs
1	1	1	Rehabilitation of land	L-S			2000.00
		2	Plantation layout 3' x 3'	Manday	1	30.00	30.00
		3	Digging of 4000 holes (1 1/2 x 1 1/2 x 2') (Rounded off because of terrain)	Manday	40	30.00	1200.00
Block plantation of broad-leaved species 3' x 3' apart on private lands integrated with block plantation on 6' x 6' apart on public lands.		4	Seedlings	Plants	4000	1.00	4000.00
		5	Planting 4000 tube seedlings	Manday	25	30.00	750.00
		6	Handwatering 6X	Manday	20	30.00	600.00
		7	Restocking	Manday	2	30.00	60.00
		8	Seedlings for restocking @ 25%	Plants	1000	1.00	1000.00
500 private acres+		9	Weedings 2 No.	Manday	4	30.00	120.00
1000 public acres	2	10	Weedings 1 No.	Manday	2	30.00	60.00
= 1500 acres	3	11	Pruning/Cleaning	Manday	3	30.00	90.00
	4-5		Nil	-	-	-	-
	6	12	Thinnings	Manday	6	30.00	180.00
	7		Nil	-	-	-	-
	8		Nil	-	-	-	-
	9		Nil	-	-	-	-
	10	13	Final Fellings	Manday	30	30.00	900.00

MURREE-KAHUTA INTEGRATED MANAGEMENT DEMONSTRATION

Model Inputs and Cost Estimates Per Acre

MODEL	YEAR	STEP	OPERATION	UNITS	NO.	UNIT COST	COST Rs
2	1	1	Rehabilitation of land	L-S			2000.00
		2	Water reservoir	L-S			1200.00
		3	Plantation layout 3' x 3'	Manday	1	30.00	30.00
		4	Digging of 4000 holes (1 1/2 x 1 1/2 x 2') (Rounded off because of terrain)	Manday	40	30.00	1200.00
Block plantation of broad-leaved species 3' x 3' apart on private lands integrated with block plantation on 6' x 6' apart on public lands with the provision of 1-2 water reservoirs per village.		5	Seedlings	Plants	4000	1.00	4000.00
		6	Planting 4000 tube seedlings	Manday	25	30.00	750.00
		7	Handwatering 6X	Manday	20	30.00	600.00
		8	Restocking	Manday	2	30.00	60.00
		9	Seedlings for restocking @ 25%	Plants	1000	1.00	1000.00
		10	Weedings 2 No.	Manday	4	30.00	120.00
	2	11	Weedings 1 No.	Manday	2	30.00	60.00
	3	12	Pruning/Cleaning	Manday	3	30.00	90.00
400 private acres + 800 public acres = 1200 acres	4-5		Nil	-	-	-	-
	6	13	Thinnings	Manday	6	30.00	180.00
	7		Nil	-	-	-	-
	8		Nil	-	-	-	-
	9		Nil	-	-	-	-
	10	14	Final Fellings	Manday	30	30.00	900.00

MURREE-KAHUTA INTEGRATED MANAGEMENT DEMONSTRATION

Model Inputs and Cost Estimates Per Acre

MODEL	YEAR	STEP	OPERATION	UNITS	NO.	UNIT COST	COST Rs
3	1	1	Rehabilitation of land	L-S			2000.00
		2	Plantation layout 3' x 3'	Manday	1	30.00	30.00
		3	Digging of 4000 holes (1 1/2 x 1 1/2 x 2') (Rounded off because of terrain)	Manday	40	30.00	1200.00
Block plantation of broad-leaved species 3' x 3' apart on private lands integrated with block plantation on 6' x 6' apart on public lands with generous facilities to collect grass from public lands		4	Seedlings	Plants	4000	1.00	4000.00
		5	Planting 4000 tube seedlings	Manday	25	30.00	750.00
		6	Handwatering 6X	Manday	20	30.00	600.00
		7	Restocking	Manday	2	30.00	60.00
		8	Seedlings for restocking @ 25%	Plants	1000	1.00	1000.00
		9	Weedings 2 No.	Manday	4	30.00	120.00
	2	10	Weedings 1 No.	Manday	2	30.00	60.00
	3	11	Pruning/Cleaning	Manday	3	30.00	90.00
	4-5		Nil	-	-	-	-
1108 private acres + 2216 public acres = 3324 acres	6	12	Thinnings	Manday	6	30.00	180.00
	7		Nil	-	-	-	-
	8		Nil	-	-	-	-
	9		Nil	-	-	-	-
	10	13	Final Fellings	Manday	30	30.00	900.00

MURREE-KAHUTA INTEGRATED MANAGEMENT DEMONSTRATION

Model Inputs and Cost Estimates Per Acre

MODEL	YEAR	STEP	OPERATION	UNITS	NO.	UNIT COST	COST Rs
4	1	1	Rehabilitation of land	L-S			2000.00
		2	Plantation layout 6' apart	Manday	1	30.00	30.00
		3	Digging of 1000 holes (1 1/2 x 1 1/2 x 2') (Rounded off because of terrain)	Manday	10	30.00	300.00
ow planting of							
rees 6' apart							
ilong boundaries							
of orchards, trails		4	Seedlings	Plants	1000	1.00	1000.00
ind courtyards,		5	Planting 1000 tube seedlings	Manday	6	30.00	180.00
ntegrated with							
lock plantation		6	Handwatering 6X	Manday	5	30.00	150.00
n public lands.		7	Restocking	Manday	1	30.00	30.00
		8	Seedlings for restocking @ 25%	Plants	250	1.00	250.00
70 private		9	Weedings 2 No.	Manday	2	30.00	60.00
cres + 940	2	10	Weedings 1 No.	Manday	1	30.00	30.00
ublic acres	3	11	Pruning/Cleaning	Manday	1	30.00	30.00
1410 acres	4-5		Nil	-	-	-	-
	6	12	Thinnings	Manday	2	30.00	60.00
	7		Nil	-	-	-	-
	8		Nil	-	-	-	-
	9		Nil	-	-	-	-
	10	13	Final Fellings	Manday	12	30.00	360.00

MURREE-KAHUTA INTEGRATED MANAGEMENT DEMONSTRATION

Model Inputs and Cost Estimates Per Acre

MODEL	YEAR	STEP	OPERATION	UNITS	NO.	UNIT COST	COST Rs
5	1	1	Rehabilitation of land	L-S			2000.00
		2	Plantation layout 6' apart	Manday	1	30.00	30.00
		3	Digging of 1000 holes (1 1/2 x 1 1/2 x 2') (Rounded off because of terrain)	Manday	10	30.00	300.00
Row planting of trees 6' apart along boundaries of agricultural/ vegetable crops integrated with block plantation on public lands.		4	Seedlings	Plants	1000	1.00	1000.00
		5	Planting 1000 tube seedlings	Manday	6	30.00	180.00
		6	Handwatering 6X	Manday	5	30.00	150.00
		7	Restocking	Manday	1	30.00	30.00
		8	Seedlings for restocking @ 25%	Plants	250	1.00	250.00
200 private acres + 400 public acres = 600 acres		9	Weedings 2 No.	Manday	2	30.00	60.00
	2	10	Weedings 1 No.	Manday	1	30.00	30.00
	3	11	Pruning/Cleaning	Manday	1	30.00	30.00
	4-5		Nil	-	-	-	-
	6	12	Thinnings	Manday	2	30.00	60.00
	7		Nil	-	-	-	-
	8		Nil	-	-	-	-
	9		Nil	-	-	-	-
	10	13	Final Fellings	Manday	12	30.00	360.00

C. Project Outputs

1. Area and Number of Farmers Involved

The area to be covered under the project and the farm families that would participate in the demonstration program are given in the following tables:

Area to be Planted Annually (in acres)

Sl. No.	Tehsil/ Year	1		2		3		4		5		Total	
		Pub.	Pri.	Pub.	Pri.	Pub.	Pri.	Pub.	Pri.	Pub.	Pri.	Pub.	Pri.
1.	Kahuta	360	180	400	200	440	220	480	240	520	260	2200	1100
2.	Murree	560	280	600	300	636	318	660	330	700	350	3156	1578
	Total:	920	460	1000	500	1076	538	1140	570	1220	610	5356	2678

Grand Total = 8034 acres

Approximate Number of Farmers Participating in the Program

Sl. No.	Tehsil	Project Year 1	2	3	4	5	Total
1.	Kahuta	720	800	880	960	1040	4400
2.	Murree	1150	1200	1350	1400	1500	6600
	Total:	1870	2000	2230	2360	2540	11000

2. Nursery Stock

The annual requirements of nursery stock have been worked out on t basis of 3' x 3' spacing on private lands and 6' x 6' spacing on publ lands. The following table gives the approximate number of plants th the nurseries would have to produce during the project period:

Annual Requirements of Nursery Stock

Year	Area to be planted up (acres) Murree Pub.	Murree Pri.	Kahuta Pub.	Kahuta Pri.	No. of plants required (mil) Murree Pub.	Murree Pri.	Kahuta Pub.	Kahuta Pri.	Tota
1	360	180	560	280	0.36	0.72	0.56	1.12	2.7
2	400	200	600	300	0.40	0.80	0.60	1.20	3.0
3	440	220	636	318	0.44	0.88	0.64	1.27	3.2
4	480	240	660	330	0.48	0.96	0.66	1.32	3.4
5	520	260	700	350	0.52	1.04	0.70	1.40	3.6
Total:	2200	1100	3156	1578	2.20	4.40	3.16	6.31	16.0
Restocking @ 25%									4.0
Grand Total:									20.0
									or 20 millio

Note: For 6' x 6' spacing, the number of seedlings required per acre are 1200. Since the terrain is uneven and undulating, they have been rounded off to 1000. Similarly for 3' x 3' spacing, they have been rounded off to 4000 per acre. We also assume 10 nurseries (2 per subwatershed), some of which may be run by an individual farmer.

3. Fuel Wood Produced

On completion, the project would produce 16.6 million cuft. of fue wood from private holdings. Since the public forests would be managed o longer rotation primarily for timber production, it is expected that abou 4.0 million cuft. of fuel wood would become available as a result o pruning and cleaning of undergrowth/underwood from these areas.

4. Small Timber Produced

The species suggested for planting on private farmlands are thos which are more suitable for fuel wood and fodder. Because of this, th output tables do not show any yield of small timber. The public land which are managed for timber production and poles are expected to produc 0.1 million cuft. of small timber from hard-wood species and 0.2 millio cuft. of poles from soft-wood species.

5. Forage (Grass and Loppings)

The project is expected to produce 5,000 tonnes of grass from private farmlands and grazing facilities for 40,000 animal units in a period o five years.

MURREE-KAHUTA INTEGRATED MANAGEMENT DEMONSTRATION

Model Outputs With Yearly Estimates of Revenues Per Acre

MODEL	YEAR	OUTPUT	QTY PER ACRE	UNIT COST	REVENUE Rs.
1	1	Grass cutting-private/public	10 H/L	7.00	70.00
Block plantation	2	-do-	10 H/L	7.00	70.00
of broad-leaved	3	Pruning/Cleaning	400 cuft Green F/W	300.00/ 100 cuft	1200.00
species 3' x 3'					
apart on private	3	Forage	10 H/L	7.00	70.00
lands integrated	4	Grass cutting	10 H/L	7.00	70.00
with block plant-	5	Forage from lopping & grass cutting-Pub	12 H/L	7.00	84.00
ation on 6' x 6'					
apart on public	6	Thinnings	800 cuft Green F/W	300.00/ 100 cuft	2400.00
lands.					
	6	Grazing on Lop&Top	2 animal	10.00	30.00
500 private acres	7	Grazing	2 animal	10.00	20.00
+ 1000 public	8	-do-	-do-	10.00	20.00
acres	9	-do-	-do-	10.00	20.00
= 1500 acres	10	Final fellings	5000 cuft Green F/W	400.00/ 100 cuft	20,000.00
	10	Grazing on Lop&Top	3 animal	10.00	30.00

MURREE-KAHUTA INTEGRATED MANAGEMENT DEMONSTRATION

Model Outputs With Yearly Estimates of Revenues Per Acre

MODEL	YEAR	OUTPUT	QTY PER ACRE	UNIT COST	REVENUE Rs.
2	1	Grass cutting-private/public	10 H/L	7.00	70.00
Block plantation	2	-do-	10 H/L	7.00	70.00
of broad-leaved	3	Pruning/Cleaning	400 cuft Green F/W	300.00/ 100 cuft	1200.00
species 3' x 3'					
apart on private	3	Grass cutting	10 H/L	7.00	70.00
lands integrated	4	Grass cutting	10 H/L	7.00	70.00
with block plant-	5	Forage from lopping & grass cutting-Pub	12 H/L	7.00	84.00
ation on 6' x 6'					
apart on public	6	Thinnings	800 cuft Green F/W	300.00/ 100 cuft	2400.00
lands with					
provision of 1-2	6	Grazing on Lop&Top	2 animal	10.00	20.00
water reservoirs	7	Grazing	2 animal	10.00	20.00
per village.	8	-do-	-do-	10.00	20.00
	9	-do-	-do-	10.00	20.00
400 private acres	10	Final fellings	5000 cuft Green F/W	400.00/ 100 cuft	20,000.00
+ 800 public acres					
= 1200 acres	10	Grazing on Lop&Top	3 animal	10.00	30.00

MURREE-KAHUTA INTEGRATED MANAGEMENT DEMONSTRATION

Model Outputs With Yearly Estimates of Revenues Per Acre

MODEL	YEAR	OUTPUT	QTY PER ACRE	UNIT COST	REVENUE Rs.
3	1	Grass cutting-private/public	20 H/L	7.00	140.00
Block plantation	2	-do-	25 H/L	7.00	175.00
of broad-leaved	3	Pruning/Cleaning	400 cuft Green F/W	300.00/ 100 cuft	1200.00
species 3' x 3'					
apart on private	3	Grass cutting	10 H/L	7.00	70.00
lands integrated	4	Grass cutting	20 H/L	7.00	140.00
with block plant-	5	Forage from lopping & grass cutting-Pub	20 H/L	7.00	140.00
ation on 6' x 6'					
apart on public	6	Thinnings	800 cuft Green F/W	300.00/ 100 cuft	2400.00
lands with generous					
facilities to	6	Grazing on Lop&Top	3 animal	10.00	30.00
collect grass	7	Grazing	2 animal	10.00	20.00
from public lands	8	-do-	-do-	10.00	20.00
	9	-do-	-do-	10.00	20.00
1108 private	10	Final fellings	5000 cuft Green F/W	400.00/ 100 cuft	20,000.00
acres + 2216 public					
acres= 3324 acres	10	Grazing on Lop&Top	3 animal	10.00	30.00

MURREE-KAHUTA INTEGRATED MANAGEMENT DEMONSTRATION

Model Outputs With Yearly Estimates of Revenues Per Acre

MODEL	YEAR	OUTPUT	QTY PER ACRE	UNIT COST	REVENUE Rs.
4	1	Grass cutting-public only	5 H/L	7.00	35.00
Row planting of trees 6' apart along boundaries of orchards, trails and court-yards integrated with block plant-ations on public lands	2	-do-	5 H/L	7.00	35.00
	3	Pruning/Cleaning	200 cuft Green F/W	300.00/ 100 cuft	600.00
	3	Grass cutting	5 H/L	7.00	35.00
	4	Grass cutting	5 H/L	7.00	35.00
	5	Forage from lopping & grass cutting-Pub	6 H/L	7.00	42.00
	6	Thinnings	400 cuft Green F/W	300.00/ 100 cuft	1200.00
	6	Grazing on Lop&Top	2 animal	10.00	20.00
470 private acres + 940 public acres = 1410 acres	7	Grazing	1 animal	10.00	10.00
	8	-do-	-do-	10.00	10.00
	9	-do-	-do-	10.00	10.00
	10	Final fellings	2000 cuft Green F/W	400.00/ 100 cuft	8,000.00
	10	Grazing on Lop&Top	2 animal	10.00	20.00

MURREE-KAHUTA INTEGRATED MANAGEMENT DEMONSTRATION

Model Outputs With Yearly Estimates of Revenues Per Acre

MODEL	YEAR	OUTPUT	QTY PER ACRE	UNIT COST	REVENUE Rs
5	1	Grass cutting-public only	5 H/L	7.00	35.00
Row planting of	2	-do-	5 H/L	7.00	35.00
trees 6' apart	3	Pruning/Cleaning	200 cuft Green F/W	300.00/ 100 cuft	600.00
along boundaries of agricultural/	3	Grass cutting	5 H/L	7.00	35.00
vegetable crops	4	Grass cutting	5 H/L	7.00	35.00
integrated	5	Forage from lopping & grass cutting-Pub	6 H/L	7.00	42.00
with block plant-ations on public	6	Thinnings	400 cuft Green F/W	300.00/ 100 cuft	1200.00
lands	6	Grazing on Lop&Top	2 animal	10.00	20.00
200 private acres	7	Grazing	1 animal	10.00	10.00
+ 400 public	8	-do-	-do-	10.00	10.00
acres	9	-do-	-do-	10.00	10.00
= 600 acres	10	Final fellings	2000 cuft Green F/W	400.00/ 100 cuft	8,000.00
	10	Grazing on Lop&Top	2 animal	10.00	20.00

D. Economic Calculations

For each model the internal rate of return was calculated. Also ne discounted present values and benefit/cost ratios were calculated usir discount rates of 0, 10, 12, and 15%. The rotation for each model was se at 10 years (much lower than that of the forest service at 80-120 years and more in conformity with what the farmers use, although theirs is very variable rotation). The economic calculations were carried out wit nominal values; inflation is assumed to cancel out price and cos increases. As was remarked, over the last 10 years fuel wood prices hav increased a bit more than 1% faster than the general price index while th prices for poles and small timbers have increased about 1% slower. Also the calculations were made using fuel wood prices without the fre transport subsidy of the Governemnt. Finally, the calculations for eac model were carried out with and without a 1000 Ruppees annual land rent and with a 2000 Ruppees per acre charge in the first year as an overhea cost for rehabilitation of the subwatershed. It should be noted that th 1000 Ruppees land rent charge should not be levied (in this author' opinion) where the row plantation mode is used (models 4 and 5), while th 2000 Ruppees overhead charge is debatable from an economic point of view.

The results are presented in table form by model and ar self-explanatory. Internal rates of return are low for the first thre proposed models, less than 2.5% if the land rent is charged and less tha 11.3% without the rent. For the row models 4 and 5, the internal rate o return is almost 12%. These rates have to be viewed in light of th rehabilitation and integrated demonstration approach objectives of th project and should be acceptable.

A final observation concerns the inputs (costs) and output (revenues) used to make those calculations. The input and cost figure can be considered as relatively reliable, except for the rehabilitatio overhead charge. However, questions can be raised about the revenues. A is true in many other countries in the world, including the U.S., growt and yield tables developed by foresters generally start for ages whe there is thought to be a harvestable (and more easily measurable) yiel per acre, i.e. anywhere from 15 - 25 years. When interest in the U.S begun in growing wood for energy (so called energy plantations or farms) it became quickly apparent that a simple extrapolation beyond the range o the data was not possible because of the curvi-line ar nature of the earl production (or growth and yield) functions. Some trees are fast starters others slow starters (forming tap roots). The same problems arise i Pakistan, so some educated guesses had to be made. In addition conversion factors to move from cubic feet to maunds and from cubic fee on the stump to cubic feet when harvested are notoriously variable fo very small (and very large) dimensions. Again, the team used its bes judgement. The farmer, of course, is happily unconcerned by thes vagaries. Finally, unlike the original project, no "benefits" wer assumed to accrue because of dung saved and presumably used a fertilizer. It was thought that this was a debatable benefit at best

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erroneous at worst (some publications on farm forestry indicate that farmers continue to burn the cow dung for a variety of reasons). On the other hand, some very real but nonmarketable benefits were not accounted for: the enhancement of scenic and recreational benefits of rehabilitated subwatersheds, the decrease in erosion-run off-siltation and the long term enhanced productive value of the land. In the team's opinion these benefits are very real, though perhaps not highly valued in a developing country possessed by the drive for survival. However, the author was impressed by the buses loaded with people on the weekends going to the Murree-Kahuta area on day trips, as well as by the number of hospitals and sanatoria (at least two) in the area. What this means is that though the costs may be somewhat undervalued in some cases because rehabilitation charges may be higher, the revenue side would definitely tend to be undervalued.

SUMMARY OF ECONOMIC RESULTS

MODEL	YEARLY CASH FLOW-RS./ACRE YEAR	REVENUE	COST	IRR @ 15%	NDPV @ 15%	BENEFIT/COST @ 15%
1	1	70	12160			
	2	70	1060			
	3	1270	1090			
	4	70	Nil			
	5	84	Nil	2.5%	-6019.87	.54
	6	2430	1180			
	7	20	Nil			
	8	20	Nil			
	9	20	Nil			
	10	20030	1900			
2	1	70	15960			
	2	70	1060			
	3	1270	1090			
	4	70	Nil			
	5	84	Nil	1.4%	-9324.22	0.43
	6	2430	1180			
	7	20	Nil			
	8	20	Nil			
	9	20	Nil			
	10	20030	1900			
3	1	140	19960			
	2	175	1060			
	3	1270	90			
	4	70	Nil			
	5	140	Nil	1.7%	-11297.35	0.39
	6	2430	180			
	7	20	Nil			
	8	20	Nil			
	9	20	Nil			
	10	20000	900			
1 & 5	1	35	4000			
	2	35	60			
	3	635	30			
	4	35	Nil			
	5	42	Nil	11.9%	-623.23	0.83
	6	1220	60			
	7	10	Nil			
	8	10	Nil			
	9	10	Nil			
	10	8020	360			

VII. Recommendations

Based on discussions of the design team with personnel of the Murree-Kahuta Development Authority on three visits to the field and on the materials presented in Chapters I-VI, including the economic calculations, the design team makes the following recommendations.

A. Based on the criteria suggested in Chapter IV, five subwatersheds are proposed as examples where project demonstrations could be carried out. These subwatersheds (2 in Kahuta and 3 in Murree) would involve 2678 acres and 86,000 people (about 11,000 families) divided over 31 villages. The design team strongly recommends that in the final selection of the subwatersheds, those that have massive erosion problems and/or are steep to very steep be avoided.

B. The design team recommends that about 1 million dollars be used to carry out activities on each of the 5 subwatersheds, which are needed as part of the integrated approach to the solution of the watershed problems, but which do not benefit any one farmer or village in particular.

C. The design team recommends that the Murree-Kahuta Development Authority be used as the main institution to carry out the project. While relatively new, the team found that the Authority has the necessary legal powers and staffing capabilities as well as the willingness to implement the USAID component.

D. The design team recommends that for each subwatershed a comrehensive master plan be developed before any activities are undertaken. This plan should include a careful review of the area and a detailed integrated approach listing the activities to be carried out.

E. The design team recommends that for the demonstration plantations the same incentives be used which were found to be successful in the existing project in the Punjab, i.e. providing the farmers with free seedlings. Two minor variations of this scheme are proposed for evaluation when needed: the provision of up to 10 fruit trees free of charge per farmer or the provision of 1 or 2 water reservoirs of 10000-25000 gallons capacity per village.

F. The design team also recommends that both the block plantation scher and the row plantation mode be used, the choice depending on the interes and needs of the farmer. Since average land holdings are very small th woodlots will be small, perhaps as small as 1/8 acre.

G. The design team recommends that the following short term consultant be made available:

Year	Number of man months	Expertise
1	3	Watershed management
	2	Soil rehabilitation/ Erosion control
	2	Slope stability specialist
	3	Social scientist-not economis
	3	Nursery specialist
	1	Geologist
	2	Expert in small structures
2	2	Social scientist with expertise in land use planning
3	3	Watershed management/ Generalist
	2	Expert in small structures
	2	Hydrologist
	1	Economist (Economic Analysis)
	2	Sociologist
Total:	28	

H. The design team recommends that a major effort be undertaken t reduce the cost of seedlings and to determine the best type of seedlings The design team feels that, at present, the seedlings which are used i the social forestry program and by the forest service are too old an often have very poor root systems. In visits to nurseries, most plants i their plastic bags had root systems which were badly cramped and ballc up. In visits to woodlots, the trees showed tremendous variability i growth not due to irregular availability of irrigation water; thi variability could be partly due to soil conditions, but invariably th slow growing trees, when pulled out, showed a very poor root system. Th team recommends that bare root planting of much younger trees be tried.

I. If seedling costs can be cut in half, much denser plantations woul be tried. The farmers seem to prefer much closer spacings than the forest service, probably because these yield more and earlier products (such as fuel wood). What may not be economical for the forest service may be quite attractive to the farmers. Rather than do more research on spacing, the team recommends that existing woodlots planted by farmers be reviewed and analysed with an open mind as to their biological, social and economic viability.

J. The economic analysis shows zero to 2.5% rates of return for those models that use a 1000 Ruppees a year rent (higher when this rent is excluded). This is, of course, not surprising since the cost of rehabilitating the land (1 million dollars prorated over 2700 acres) is written off over the rotation of 10 years. The design team considers this return adequate in view of the objectives of the project.

MODEL 1 - BLOCK BROAD-LEAVED INPUTS AND COSTS PER ACRE

Year	Activity	Input	Cost-Rs.	Present Value- 0	Present Value-10	Present Value-12	Present Value-15	Cost-Rs. +1000/yr	Present Value- 0	Present Value-10	Present Value-12	Present Value-15
				PRESENT VALUES					PRESENT VALUES			
1	1 Rehabilitate Land	L -	2000	2000	1818.182	1785.714	1739.130	3000	3000	2727.273	2678.571	2608.696
1	2 Plantation Layout	1 manday	30	30	27.273	26.786	26.087	30	30	27.273	26.786	26.087
1	3 Dig Holes	40 manday	1200	1200	1090.909	1071.429	1043.478	1200	1200	1090.909	1071.429	1043.478
1	4 Seedlings	4000 plants	4000	4000	3636.364	3571.429	3478.261	400	400	363.636	357.143	347.826
1	5 Planting	25 manday	750	750	681.818	669.643	652.174	1750	1750	1590.909	1562.500	1521.739
1	6 Handwater 6I	20 manday	600	600	545.455	535.714	521.739	1600	1600	1454.545	1428.571	1391.304
1	7 Restocking	2 manday	60	60	54.545	53.571	52.174	1060	1060	963.636	946.429	921.739
1	8 Seedlings above)	1000 plants	1000	1000	909.091	892.857	869.565	2000	2000	1818.182	1785.714	1739.130
1	9 Weeding	4 manday	120	120	109.091	107.143	104.348	1120	1120	1018.182	1000.000	973.913
2	10 Weeding	2 manday	60	60	49.587	47.832	45.369	1060	1060	876.033	845.026	801.512
3	11 Prunning/Clearing	3 manday	90	90	67.618	64.060	59.176	1090	1090	818.933	775.840	716.693
6	12 Thinning	6 manday	180	180	101.605	91.194	77.819	1180	1180	666.079	597.825	510.147
10	13 Final Felling	30 manday	900	900	346.989	289.776	222.466	1900	1900	732.532	611.749	469.651
		TOTAL =	10990.000	10990.000	9438.527	9207.147	8891.787	17390.000	17390.000	14148.123	13687.583	13071.916

MUFREE KAHUTA

MODEL 1 - BLOCK/BROAD-LEAVED OUTPUTS AND REVENUES PER ACRE

Year	Output	Quantity	Rate/Unit	Value-Rs.	Present Value- 0	Present Value-10	Present Value-12	Present Value-15
					PRESENT VALUES			
1	Grass Cut-Pri/Pub	10 HL	7	70	70	63.636	62.5	60.870
2	Grass Cut-Pri/Pub	10 HL	7	70	70	57.851	55.803	52.930
3	Prunnings/Clearings	400 cuft	300/100cuft	1200	1200	901.578	854.136	789.019
3	Forage	10 HL	7	70	70	52.592	47.825	46.026
4	Grass Cutting	10 HL	7	70	70	47.811	44.486	40.023
5	Forage (public)	12 HL	7	84	84	52.157	47.664	41.763
6	Thinnings	800 cuft	300/100cuft	2400	2400	1354.737	1215.915	1037.586
6	Grazing-lopttop	3 animal	10	30	30	16.934	15.199	12.970
7	Grazing	2 animal	10	20	20	10.263	9.047	7.519
8	Grazing	2 animal	10	20	20	9.570	8.078	6.538
9	Grazing	2 animal	10	20	20	8.482	7.212	5.685
10	Final Fellings	50% cuft	400/100cuft	20000	20000	7710.866	6439.465	4943.634
11	Grazing-lopttop	3 animal	10	30	30	11.565	9.659	7.416
			TOTAL =	24064	24064	10297.985	8819.787	7052.029

BEST AVAILABLE DOCUMENT

NET BENEFITS

Year	Benefit	Cost	Net Benefit	Benefit	Cost + 1000	Net Benefit
1	70	9760	-9690	70	10760	-10690
2	70	60	10	70	1060	-990
3	1270	90	1180	1270	1090	180
4	70	0	70	70	1000	-930
5	84	0	84	84	1000	-916
6	2430	180	2250	2430	1180	1250
7	20	0	20	20	1000	-980
8	20	0	20	20	1000	-980
9	20	0	20	20	1000	-980
10	20030	900	19130	20030	1900	18130

IRR GUESS = 5

Costs as are, IRR= 0.113 = 11.3%

Costs +1000, IRR= 0.025 = 2.5%

MODEL 1 ECONOMIC CALCULATIONS

DISCOUNT RATE	(costs as are) NDPV	BENEFIT/ COST
0	13094	2.191
10	859.278	1.091
12	-388.158	0.958
15	-1839.748	0.793

MODEL 1 ECONOMIC CALCULATIONS

DISCOUNT RATE	(costs + 1000) NDPV	BENEFIT/ COST
0	6694	1.385
10	-3850.318	0.728
12	-4868.5936	0.644
15	-6019.877	0.539

MODEL 2 - BLOCK/BROAD-LEAVED INPUTS AND COSTS PER ACRE PRESENT VALUES PRESENT VALUES

Year	Activity	Input	Cost-Rs.	Present Value- 0	Present Value-10	Present Value-12	Present Value-15	Cost-Rs. +1000/yr	Present Value- 0	Present Value-10	Present Value-12	Present Value-15
1	1 Fell Land/WatRes	2000/1200	3200	3200	2909.091	2857.143	2782.609	4200	4200	3818.182	3750.000	3652.174
1	2 Plantation Layout	1 manday	30	30	27.273	26.786	26.087	30	30	27.273	26.786	26.087
1	3 Dig Holes	40 manday	1200	1200	1090.909	1071.429	1043.478	200	200	181.818	178.571	173.913
1	4 Seedlings	4000 plants	4000	4000	3636.364	3571.429	3478.261	4000	4000	3636.364	3571.429	3478.261
1	5 Planting	25 manday	750	750	681.818	669.643	652.174	1750	1750	1590.909	1562.500	1521.739
1	6 Handwater 6X	20 manday	600	600	545.455	535.714	521.739	1600	1600	1454.545	1428.571	1391.304
1	7 Restocking	2 manday	60	60	54.545	53.571	52.174	1060	1060	963.636	946.429	921.739
1	8 Seedlings (above)	1000 plants	1000	1000	909.091	892.857	869.565	2000	2000	1818.182	1785.714	1739.130
1	9 Weeding	4 manday	120	120	109.091	107.143	104.348	1120	1120	1018.182	1000.000	973.913
2	10 Weeding	2 manday	60	60	49.587	47.832	45.369	1060	1060	876.033	845.026	801.512
3	11 Prunning/Clearing	3 manday	90	90	67.618	64.060	59.176	1090	1090	818.933	775.840	716.693
6	12 Thinning	6 manday	180	180	101.605	91.194	77.819	1180	1180	666.079	597.825	510.147
10	13 Final Felling	30 manday	900	900	346.989	289.776	222.466	1900	1900	732.532	611.749	469.651
		TOTAL =	12190	12190	10529.436	10278.576	9935.265	21190	21190	17802.669	17080.440	16376.263

MURREE-KAHUTA

MODEL 2 - BLOCK/BROAD-LEAVED OUTPUTS AND REVENUES PER ACRE PRESENT VALUES

Year	Output	Quantity	Rate/Unit	Value-Rs.	Present Value- 0	Present Value-10	Present Value-12	Present Value-15
1	Grass Cut-Pri/Pub	10 HL	7	70	70	63.636	62.5	60.870
2	Grass Cut-Pri/Pub	10 HL	7	70	70	57.851	55.804	52.930
3	Prunrings/Clearings	400 cuft	300/100cuft	1200	1200	901.578	854.136	789.0.9
3	Forage	10 HL	7	70	70	52.592	49.825	46.026
4	Grass Cutting	10 HL	7	70	70	47.811	44.486	40.023
5	Forage (public)	12 HL	7	84	84	52.157	47.664	41.763
6	Thinnings	800 cuft	300/100cuft	2400	2400	1354.727	1215.915	1037.586
6	Grazing-lopstop	3 animal	10	30	30	16.934	15.199	12.970
7	Grazing	2 animal	10	20	20	10.263	9.047	7.519
8	Grazing	2 animal	10	20	20	9.330	8.078	6.536
9	Grazing	2 animal	10	20	20	8.482	7.212	5.685
13	Final Fellings	5000 cuft	4000/100cuft	20000	20000	7710.266	6439.465	4943.694
10	Grazing-lopstop	3 animal	10	30	30	11.565	9.659	7.411
			TOTAL =	24084	24084	10297.815	8518.935	7152.173

BEST AVAILABLE DOCUMENT

NET BENEFITS

Year	Benefit	Cost	Net Benefit	Benefit	Cost + 1000	Net Benefit
1	70	10960	-10890	70	11960	-11890
2	70	60	10	70	1060	-990
3	1270	90	1180	1270	1090	180
4	70	0	70	70	1000	-930
5	84	0	84	84	1000	-916
6	2430	180	2250	2430	1180	1250
7	20	0	20	20	1000	-980
8	20	0	20	20	1000	-980
9	20	0	20	20	1000	-980
10	20030	900	19130	20030	1900	18130

IRR GUESS = 5

Costs as are, IRR= 0.097 = 9.7%

Costs +1000, IRR= 0.014 = 1.4%

MODEL 2 ECONOMIC CALCULATIONS

DISCOUNT RATE	(costs as are) NDPV	BENEFIT/ COST
0	11874	1.975
10	-231.631	0.978
12	-1459.587	0.958
15	-2863.227	0.710

MODEL 2 ECONOMIC CALCULATIONS

DISCOUNT RATE	(costs + 1000) NDPV	BENEFIT/ COST
0	2874	1.137
10	-7304.864	0.585
12	-8261.4508	0.516
15	-9324.225	0.431

MURREE-KAHUTA

MODEL 3 - BLOCK/BROAD-LEAVED INPUTS AND COSTS PER ACRE — PRESENT VALUES — PRESENT VALUES

Year	Activity	Input	Cost-Rs.	Present Value- 0	Present Value-10	Present Value-12	Present Value-15	Cost-Rs. +1000/yr	Present Value- 0	Present Value-10	Present Value-12	Present Value-15
1	1 Rehab Land/WatRes	2000/1200	3200	3200	2909.091	2857.143	2782.609	4200	4200	3818.182	3750.000	3652.174
1	2 Plantation Layout	1 manday	30	30	27.273	26.786	26.087	1030	1030	936.364	919.643	895.652
1	3 Dig Holes	40 manday	1200	1200	1090.909	1071.429	1043.478	2200	2200	2000.000	1964.286	1913.043
1	4 Seedlings	4000 plants	4000	4000	3636.364	3571.429	3478.261	5000	5000	4545.455	4464.286	4347.826
1	5 Planting	25 manday	750	750	681.818	669.643	652.174	1750	1750	1590.909	1562.500	1521.739
1	6 Handwater 6I	20 manday	600	600	545.455	535.714	521.739	1600	1600	1454.545	1428.571	1391.304
1	7 Restocking	2 manday	60	60	54.545	53.571	52.174	1060	1060	963.636	946.429	921.739
1	8 Seedlings (above)	1000 plants	1000	1000	909.091	892.857	869.565	2000	2000	1818.182	1785.714	1739.130
1	9 Weeding	4 manday	120	120	109.091	107.143	104.348	1120	1120	1018.182	1000.000	973.913
2	10 Weeding	2 manday	60	60	49.587	47.832	45.369	1060	1060	876.033	845.026	801.512
3	11 Prunning/Clearing	3 manday	90	90	67.618	64.069	59.176	90	90	67.618	64.069	59.176
6	12 Thinning	6 manday	180	180	101.605	91.194	77.819	180	180	101.605	91.194	77.819
10	13 Final Felling	30 manday	900	900	346.989	289.776	222.466	900	900	346.989	289.776	222.466
		TOTAL =	12190	12190	10529.436	10276.576	9935.265	22190	22190	19537.700	19111.484	18517.498

MURREE-KAHUTA

MODEL 3 - BLOCK/BROAD-LEAVED OUTPUTS AND REVENUES PER ACRE — PRESENT VALUES

Year	Output	Quantity	Rate/Unit	Value-Rs.	Present Value- 0	Present Value-10	Present Value-12	Present Value-15
1	Grass Cutting	20 HL	7	140	140	127.273	125	121.739
2	Grass Cutting	25 HL	7	175	175	144.628	139.509	132.325
3	Prunnings/Clearings	400 cuft	300/100cuft	1200	1200	991.578	954.136	789.019
3	Grass Cutting	10 HL	7	70	70	52.592	49.825	46.026
4	Grass Cutting	10 HL	7	70	70	47.811	44.486	40.023
5	Forage (public)	20 HL	7	140	140	86.929	79.440	69.605
6	Thinnings	800 cuft	300/100cuft	2400	2400	1354.737	1215.915	1037.586
6	Grazing-lop&top	3 animal	10	30	30	16.934	15.199	12.970
7	Grazing	2 animal	10	20	20	10.263	9.047	7.519
8	Grazing	2 animal	10	20	20	9.330	8.078	6.538
9	Grazing	2 animal	10	20	20	8.482	7.212	5.685
10	Final Fellings	5000 cuft	400/100cuft	20000	20000	7710.666	6439.465	4945.694
10	Grazing-lop&top	3 animal	10	30	30	11.566	9.659	7.416
			TOTAL =	24315	24315	10482.990	8936.979	7220.145

NET BENEFITS

Year	Benefit	Cost	Net Benefit	Benefit	Cost + 1000	Net Benefit
1	140	10960	-10820	140	11960	-11820
2	175	60	115	175	1060	-885
3	1270	90	1180	1270	1090	180
4	140	0	140	140	1000	-860
5	140	0	140	140	1000	-860
6	2430	180	2250	2430	1180	1250
7	20	0	20	20	1000	-980
8	20	0	20	20	1000	-980
9	20	0	20	20	1000	-980
10	20030	900	19130	20030	1900	18130

IRR GUESS = 5

Costs as are, IRR= 0.100 = 10.0%

Costs +1000, IRR= 0.017 = 1.7%

MODEL 3 ECONOMIC CALCULATIONS

DISCOUNT RATE	(costs as are) NDPV	BENEFIT/ COST
0	12125.000	1.995
10	-46.446	0.996
12	-1281.605	0.875
15	-2715.120	0.727

MODEL 3 ECONOMIC CALCULATIONS

DISCOUNT RATE	(costs + 1000) NDPV	BENEFIT/ COST
0	2125.000	1.096
10	-9054.711	0.537
12	-10114.513	0.471
15	-11297.351	0.390

MEE-KAHUTA

MODEL 4 - ROW PLANTING INPUTS AND COSTS PER ACRE PRESENT VALUES PRESENT VALUES

Year	Activity	Input	Cost-Rs.	Present Value- 0	Present Value-10	Present Value-12	Present Value-15	Cost-Rs. *1000	Present Value- 0	Present Value-10	Present Value-12	Present Value-15
1	1 Rehabilitate Land	L-S	2000	2000	1818.182	1785.714	1739.130	0	0	0	0	0
1	2 Plantation Layout	1 manday	30	30	27.273	26.786	26.087	0	0	0	0	0
1	3 Dig 1000 Holes	10 manday	300	300	272.727	267.857	260.870	0	0	0	0	0
1	4 Seedlings	1000 plants	1000	1000	909.091	892.857	869.565	0	0	0	0	0
1	5 Planting	6 manday	180	180	163.636	160.714	156.522	0	0	0	0	0
1	6 Handwater 6X	5 manday	150	150	136.364	133.929	130.435	0	0	0	0	0
1	7 Restocking	1 manday	30	30	27.273	26.786	26.087	0	0	0	0	0
1	8 Seedlings (above)	250 plants	250	250	227.273	223.214	217.391	0	0	0	0	0
1	9 Weeding	2 manday	60	60	54.545	53.571	52.174	0	0	0	0	0
2	10 Weeding	2 manday	60	60	49.587	47.832	45.369	0	0	0	0	0
3	11 Prunning/Clearing	1 manday	30	30	22.539	21.353	19.725	0	0	0	0	0
6	12 Thinning	2 manday	60	60	33.868	30.398	25.940	0	0	0	0	0
10	13 Final Felling	12 manday	360	360	138.796	115.910	88.986	0	0	0	0	0
		TOTAL =	4510	4510	3881.154	3786.922	3658.281	0	0	0	0	0

MURREE-KAHUTA

MODEL 4 - ROW PLANTING OUTPUTS AND REVENUES PER ACRE PRESENT VALUES

Year	Output	Quantity	Rate/Unit	Value-Rs.	Present Value- 0	Present Value-10	Present Value-12	Present Value-15
1	Grass Cut (public)	5 HL	7	35	35	31.818	31.25	30.435
2	Grass Cut (public)	5 HL	7	35	35	28.926	27.902	26.465
3	Prunnings/Clearings	200 cuft	300/100cuft	600	600	450.789	427.068	394.510
3	Grass Cut (public)	5 HL	7	35	35	26.296	24.912	23.013
4	Grass Cut (public)	5 HL	7	35	35	23.905	22.243	20.011
5	Forage-top grass	6 HL	7	42	42	26.079	23.832	20.851
6	Thinnings	400 cuft	300/100cuft	1200	1200	677.369	607.957	518.793
6	Grazing-lopstop	2 animal	10	20	20	11.299	10.133	8.647
7	Grazing	1 animal	10	10	10	5.132	4.523	3.759
8	Grazing	1 animal	10	10	10	4.665	4.039	3.269
9	Grazing	1 animal	10	10	10	4.241	3.686	2.843
10	Final Fellings	2000 cuft	400/100cuft	8000	8000	3084.346	2575.736	1977.478
10	Grazing-lopstop	2 animal	10	20	20	7.711	6.429	4.944
			TOTAL =	[illegible]	[illegible]	[illegible]	[illegible]	2855.047

NET BENEFITS

Year	Benefit	Cost	Net Benefit	Benefit	Cost + 1000	Net Benefit
1	35	4000	-3965	0	0	0
2	35	60	-25	0	0	0
3	635	30	605	0	0	0
4	35	0	35	0	0	0
5	42	0	42	0	0	0
6	1220	60	1160	0	0	0
7	10	0	10	0	0	0
8	10	0	10	0	0	0
9	10	0	10	0	0	0
10	8020	360	7660	0	0	0

IRR GUESS = 5

Costs as are, IRR= 0.119 = 11.9%

Costs +1000, IRR= ERR No Answer

MODEL 4 ECONOMIC CALCULATIONS

DISCOUNT RATE	(costs as are) NDPV	BENEFIT/ COST
0	5542.000	2.229
10	501.412	1.129
12	-17.231	0.995
15	-623.234	0.830

MODEL 4 ECONOMIC CALCULATIONS

DISCOUNT RATE	(costs + 1000) NDPV	BENEFIT/ COST
0	0.000	0.000
10	0.000	0.000
12	0.000	0.000
15	0.000	0.000

MURREE-KAHUTA

MODEL 5 - ROW PLANTING INPUTS AND COSTS PER ACRE PRESENT VALUES PRESENT VALUES

Year	Activity	Input	Cost-Rs.	Present Value- 0	Present Value-10	Present Value-12	Present Value-15	Cost-Rs. '+1000	Present Value- 0	Present Value-10	Present Value-12	Present Value-15
1	1 Rehabilitate Land	L-S	2000	2000	1818.182	1785.714	1739.130	0	0	0	0	0
1	2 Plantation Layout	1 manday	30	30	27.273	26.786	26.087	0	0	0	0	0
1	3 Dig 1000 Holes	10 manday	300	300	272.727	267.857	260.870	0	0	0	0	0
1	4 Seedlings	1000 plants	1000	1000	909.091	892.857	869.565	0	0	0	0	0
1	5 Planting	6 manday	180	180	163.636	160.714	156.522	0	0	0	0	0
1	6 Handwater 6I	5 manday	150	150	136.364	133.929	130.435	0	0	0	0	0
1	7 Restocking	1 manday	30	30	27.273	26.786	26.087	0	0	0	0	0
1	8 Seedlings (above)	250 plants	250	250	227.273	223.214	217.391	0	0	0	0	0
1	9 Weeding	2 manday	60	60	54.545	53.571	52.174	0	0	0	0	0
2	10 Weeding	2 manday	60	60	49.587	47.832	45.369	0	0	0	0	0
3	11 Prunning/Clearing	1 manday	30	30	22.539	21.353	19.725	0	0	0	0	0
6	12 Thinning	2 manday	60	60	33.868	30.398	25.940	0	0	0	0	0
10	13 Final Felling	12 manday	360	360	138.796	115.910	88.986	0	0	0	0	0
		TOTAL =	4510	4510	3881.154	3786.922	3658.281	0	0	0	0	0

MURREE-KAHUTA

MODEL 5 - ROW PLANTING OUTPUTS AND REVENUES PER ACRE PRESENT VALUES

Year	Output	Quantity	Rate/Unit	Value-Rs.	Present Value- 0	Present Value-10	Present Value-12	Present Value-15
1	Grass Cut (public)	5 HL	7	35	35	31.818	31.25	30.435
2	Grass Cut (public)	5 HL	7	35	35	28.926	27.902	26.465
3	Prunnings/Clearings	200 cuft	300/100cuft	600	600	450.789	427.068	394.510
3	Grass Cut (public)	5 HL	7	35	35	26.296	24.912	23.013
4	Grass Cut (public)	5 HL	7	35	35	23.905	22.243	20.011
5	Forage-top&grass	6 HL	7	42	42	26.079	23.832	20.881
6	Thinnings	400 cuft	300/100cuft	1200	1200	677.369	607.957	518.793
6	Grazing-top&top	2 animal	10	20	20	11.289	10.133	8.647
7	Grazing	1 animal	10	10	10	5.132	4.522	3.759
8	Grazing	1 animal	10	10	10	4.665	4.039	3.269
9	Grazing	1 animal	10	10	10	4.241	3.606	2.843
10	Final Fellings	2000 cuft	400/100cuft	8000	8000	3084.346	2575.786	1977.478
10	Grazing-top&top	2 animal	10	20	20	7.711	6.439	4.944
			TOTAL =	10052	10052	4232.566	3769.691	3035.047

NET BENEFITS

Year	Benefit	Cost	Net Benefit	Benefit	Cost * 1000	Net Benefit
1	35	4000	-3965	0	0	0
2	35	60	-25	0	0	0
3	635	30	605	0	0	0
4	35	0	35	0	0	0
5	42	0	42	0	0	0
6	1220	60	1160	0	0	0
7	10	0	10	0	0	0
8	10	0	10	0	0	0
9	10	0	10	0	0	0
10	8020	360	7660	0	0	0

IRR GUESS = 5

Costs as are, IRR= 0.112 = 11.2%

Costs *1000, IRR= ERR No Answer

MODEL 5 ECONOMIC CALCULATIONS

DISCOUNT RATE	(costs as are) NDFV	BENEFIT/ COST
0	5542.000	2.229
10	501.417	1.129
12	-17.231	0.995
15	-523.224	0.930

MODEL 5 ECONOMIC CALCULATIONS

DISCOUNT RATE	(costs * 1000) NDFV	BENEFIT/ COST
0	0.000	0.000
10	0.000	0.000
12	0.000	0.000
15	0.000	0.000

BEST AVAILABLE DOCUMENT