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FORESTRY PLANNING & DEVELOPMENT PROJECT

A RECOMMENDED M.Sc. FORESTRY CURRICULUM
FARM AND ENERGY FORESTRY

A REPORT TO THE

DIRECTOR GENERAL
PAKISTAN FOREST INSTITUTE
PESHAWAR, NWFP

GOVERNMENT OF PAKISTAN
US AID
WINROCK INTERNATIONAL

Forestry Planning and Development Project

Government of Pakistan
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E X E C U T I V E S U M M A R Y

This report details an MSc level curriculum in "Farm and Energy Forestry" to be offered at the Pakistan Forest Institute (PFI), Peshawar, for Provincial Forest Officers. The curriculum has been developed in collaboration with the PFI faculty in response to a recognized need by the GOP to assist farmers to increase their productivity in forest products, particularly fuelwood for energy.

According to 1985 FAO statistics, natural forest lands and plantations managed by the Provincial Forest Departments represent only four percent of Pakistan's land area. It is estimated that thirty percent of the industrial wood produced comes from these lands with the balance coming from Tribal Areas and farms. How much farm land is devoted to production of forest products is unknown but it is estimated that ninety percent of the fuelwood used in the country comes from farms. While it is obviously desirable to increase the productivity of the government controlled lands, it is also clear that the role of the private sector, farmers and farm forests, are critical to increased productivity and energy availability.

The curriculum detailed in the report and supporting recommendations listed below are intended to assist the Pakistan Forest Institute in educating forest officers to work effectively with farmers in an outreach mode. In developing the curriculum it was clear that there were four basic requirements: 1) providing the technical forestry instruction and information base appropriate for farm forestry, 2) developing the communication and motivational skills necessary for outreach, 3) assuring that the curriculum also provided basic training appropriate to a young officer in the Provincial Forest Department, and 4) producing a curriculum compatible with existing PFI programs and complimentary to other areas of specialization. In working with the PFI it was also clear that a rigorous academic program was desired, one that would meet an "international standard".

The strategy adopted by the three-man Curriculum Development Team was to build upon existing PFI courses, revising some courses and adding new courses. Course revisions were made as necessary to include Farm and Energy Forestry material and to strengthen them to an international standard. Six new course were designed and three others were revised so substantially as to constitute new courses. Three other courses were revised to a lesser degree. The body of the report contains the details of of the curriculum analysis, the Farm and Energy Forestry Curriculum, supporting syllabi, recommended texts, and reference materials.

Recommendations, regarding the Farm and Energy Forestry Curriculum, and related issues are listed below:

1. Admission to the Farm and Energy Forestry specializ tion should be limited to students holding B.Sc. Forestry or B.Sc. Agric (Hon) degree from one of the three Agricultural Universities in Pakistan,or equivalent from elsewhere. Requir a prior B.Sc. Forestry is unnecessary, and would eliminate to many excellent candidates.

2. The Farm and Energy Forestry specialization should include the courses listed in Table 2 and 3 of this report, including the new and revised courses for which syllabi are provided.

3. Since the recommended curriculum specialization involves subject matter not now taught at PFI, and in fact is in some cases so new that textbooks are not available, the faculty of PFI identified as the instructors for these new and revised courses should be provided with in-service education or academic development before being asked to pursue these new assignments.

4. The essential facilities for instruction including the development of a computer teaching laboratory and audio visual teaching equipment should be provided to PFI. While the task of the Curriculum Study Team was specifically limited to the development of a Farm and Energy Forestry specialization the Team felt very strongly that the introduction of a new specialization could only be justified if it added to the strength of PFI in all of its activities and its curricula specializations. It would be wrong to undertake a new specialization if it were at the expense of the older more established programs or of other specializations. Curricula specializations should be mutually reinforcing, not competitive. We believe that the F&EF curriculum we recommend meets these criteria.

5. Finally, in the course of this study we identified with our colleagues from PFI a number of features of the B.Sc. Forestry and M.Sc. Forestry programs that need to be studied further. They are outside of the purview of a Farm & Energy Forestry specialization but represent academic deficiencies within the context of a world class program. We hope that these issues will be examined soon for the benefit of the students, the Institution and the Provincial Forestry Departments.

e

Forestry Planning and Development Project

Government of Pakistan
US AID

7 July, 1986.

Mr. Mohammad Iqbal Sheikh,
Director General,
Pakistan Forest Institute,
Peshawar.

Dear Director General,

It is my pleasure to submit to you, as Director General, the recommendations to establish a specialization in Farm and Energy Forestry. Within the curriculum for an M.Sc. in Forestry.

As you know, the recommendations incorporate the work and thoughts of many people. Foremost among them were the faculty of the Pakistan Forest Institute with the consultancy team, but important direct contributions were also made by members of the Office of the Inspector General of Forests, USAID, the provincial forest departments, and the Winrock technical assistance team.

I trust you will keep us informed of ways we can be of assistance in promoting or implementing the Farm and Energy Forestry specialization.

Sincerely,

C. Buford Briscoe
Chief of Party
Winrock International

CBB/kn

Winrock International

Farm & Energy Foresters
Anthropologist, Sociologist

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Forestry Planning and Development Project

Winrock International
Pakistan Forest Institute
Peshawar, NWFP

TO : Dr. C. B. Briscoe.,
Project Manager
Forestry Development Project
Islamabad, Pakistan

FROM : Dr. James S. Bethel,
Team Leader
Curriculum Development Team

SUB : Report of the Curriculum Development Team

In behalf of Dr. Bell, Dr. Medema, and myself, I have the pleasure of submitting to you the final report of the Curriculum Development Team. We acknowledge the assistance and professional contributions of the Director General and faculty of the Pakistan Forestry Institute, members of the Winrock International Technical Assistance Team and the USAID Project Manager in the development of this report. We appreciate the support and good will of many of those we worked with during this mission including forest officers of the Provincial Forest Departments, the Office of the Inspector General of Forests, the Vice Chancellor of the NWFP Agricultural University and the TIPAN Team. We particularly wish to recognize the major assistance provided by William Hart of Winrock and Anthony Kerber of TIPAN.

James S Bethel

INTRODUCTION

Traditional Forestry

Forestry in Pakistan has its roots in British colonial forestry. Professional forestry education in Pakistan has roots in the same tradition. Senior forestry officers in Pakistan at the time of partition were largely graduates of the educational arm of the Indian Forest Research Institute and College (FRI&C) at Dehra Dun. This institution, established by the British in 1905, was designed to serve the Indian Forest Service in the same way as the military academy at Sandhurst served the British army. The Pakistan Forest Institute (PFI), including its Forest Education Division was patterned after the FRI&C at Dehra Dun. PFI's primary mission now, as then, is to prepare forest officers for the Provincia Forest Departments and to conduct research in forestry.

Forestry in Pakistan since 1947 has until very recently continued the tradition of focusing upon conserving and protecting designated government owned forest reserves. Management of these forest reserves has consisted primarily of maintaining protective custody of the reserves and of harvesting the mature commercial components of the natural forest under a very conservative selection system. The Provincial Forests of Pakistan are classified into three categories. Lanly (1982) defines the legal status and management of these forests as Reserved Forests, Protected Forests and Unclassified Forests.

Reserved Forests are properly demarcated and notified under the Pakistan Forest Act. They are free from private rights, but concessio of grazing, passage and collection of dry fuelwood for domestic use are granted. These are the forests most controlled by the Forest Departments.

Protected Forests are similar to the reserved forests but the rights of local residents are recognized e.g., timber cutting, grazing, firewood and fodder collecting, etc. These forests are somewhat less controlled by the Forest Departments.

Unclassified Forests are awaiting gazetting as protected or reserved forest. Until such declaration, Forest Departments exercise a lower degree of control.

Other categories of forests in Pakistan are cantonment and municipal forests and private forests. The cantonment and municipal forests are located around cities and towns and are owned by these political entities. They are managed by the Forest Departments for the local political jurisdictions. The private forests are owned by individuals or by communities and are foun mainly in the hill region. Some private forest land and some communal forest land is managed by the Provincial Forest Departments. Of the recognized forests about 91.1 percent are

BEST AVAILABLE DOCUMENT

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in

F A R M A N D E N E R G Y F O R E S T R Y

for the

Pakistan Forest Institute
Peshawasr, NWFP

Prepared by:

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April 1986

state owned. 0.1 percent are cantonment and municipal, 7.2 percent are private forests and 1.8 percent are privately owned forest lands managed by the Provincial Forestry Departments. The recognized forest lands represent approximately four percent of the 77,972,000 hectares total land area of Pakistan. The FAO (1985) estimates the total area of woody vegetation in Pakistan in 1983 to be 3,575,000 hectares which includes 345,000 hectares of mangrove forest, 510,000 hectares of upland hardwoods, 1,296,000 hectares of conifer, 286,000 hectares of mixed forest/grassland and 1,426,000 hectares of shrub formation.

Opportunities and Need for Farm & Energy Forestry

In addition to this natural forest, FAO estimates that there are 195,000 hectares of plantations. These forest areas represent the forests that have traditionally been the object of managerial attention by the professional foresters of the country who are essentially all employed by the provincial Forest Departments. In addition to these recognized forests, many farms have trees in numbers ranging from a few around the farm house to substantial farm woodlots.

The areas on farms occupied by trees are unknown, but they must be much greater than the areas occupied by recognized forests. The forests managed by the provincial Forest Departments do not provide the major components of wood products used in Pakistan. It is estimated that government managed forests yield about thirty percent of the industrial wood produced in the country and that the remainder is produced in Tribal Areas and on farms. More than ninety percent of the nation's fuelwood is produced on farms.

It is not known how much privately owned farm land is devoted to the production of forest products and how much additional farm land is potentially available for the production of forest products. Efforts have been made during the last several years to increase the productive capacity of the government managed forests and while these efforts have been reasonably effective it is clear that they will not provide for the needs of the people of Pakistan in either the short or the long run. Pakistan is a net importer of industrial wood and its external wood purchases represent a drain on its foreign exchange reserves. According to the FAO (1985), this trade deficit was over twenty million U. S. dollars in 1983. Inadequate supplies of fuelwood result in a very high price in the market place and one that is increasing very rapidly. The price of industrial wood is also high and increasing drastically. If the limited government managed forests cannot satisfy the demands of Pakistan society, an alternative is to try to achieve an increase in the output of forest products from the private sector. This essentially means the farms.

For farm forestry to succeed, as required if the country's needs for forest products are to be met, farmers must

believe that growing trees on some fraction of their land is profitable given the alternatives that are available to them for the use of their land.

There is substantial evidence to suggest that this is often the case. Indeed many farmers are already profitably engaged in growing trees. However, far more farmers will have to engage in farm forestry if the supply of wood products is to be adequate. They will need to be provided with advice and guidance, and in some cases, training in the subject matter of professional forestry. In Pakistan most farms are small and it is clear that they could not afford to employ the services of professional foresters. If professional forestry service are to be provided to farmers to help them establish farm forest installations and to efficiently and profitably operate those installations to achieve greater output of forest products, then those services will probably have to be provided either by the government or by the wood using industries. This is the pattern that has proved to be successful in the U.S. and in a number of European countries. Since the wood using industries of Pakistan are, for the most part, quite small and since consumers of forest products in Pakistan are individuals, the option of having the buyer provide the services is probably not viable. Government provision of the services seems to be the only reasonable course of action. This, however, represents a whole new dimension of professional forestry practice in Pakistan and requires that the professionals engaged in this practice have additional knowledge and skills beyond that included in traditional forestry education.

Practice of Forestry on Government vs Private Land

Some of the important differences between the practice of forestry by Provincial foresters managing government forest land and by Provincial foresters providing consulting services to farmers pursuing forestry on privately owned farm lands are the following:

1. Foresters employed by the provinces to manage government forests are in direct decision making roles. Foresters practicing in the field of farm forestry provide professional services, consultive and otherwise, to private land owners who ultimately make the managerial decisions.

2. Government forests tend to be large properties either occurring in unbroken blocks or in long linear roadside or irrigation canal plantings. Often they are relatively low in per acre productivity. In contrast, while private owners often have relatively small farms and small farm forest areas, the per acre site productivity is sometimes quite high. Farm forest plantings may be small woodlots, block plantations, marginal plantings on the edges of fields or irrigation canals, individual trees near farm buildings, and widely spaced trees in pastures.

3. Government forests are typically operated to produce higher value commercial products derived from endemic species on long rotations. Private forests often must produce more utilitarian products on short rotations and frequently utilize exotic species.

4. Government forests are operated solely for the purpose of providing forestry goods and services and management decisions are directed at optimizing of the supply of these goods and services. Farm forestry must be integrated into a general farm system that includes food crops, animals, and humans. In some cases the integration occurs within the forest component when trees are selected and grown to provide both forest products and food products; i.e., nuts and fruits. But decisions in the domain of farm forests must focus upon optimizing the total output of the farm, not simply the forest component.

There are other differences between the management of governmen forests and farm forests, but these illustrate some of the contrasts in professional forestry practices. The consultive service role of the professional in farm forestry is especially significant. In this role the professional forester is required to develop effective interpersonal relationships with farmers, farm workers, farm community leaders, and others in the agriculture sector.

Because of the varied and sometimes ambiguous state of control exerted over public forest lands by government foresters, the role of the professional forester in Pakistan has in the past been strongly custodial in character and has emphasized enforcement of laws and regulations and protection of land, trees, and other forest components. This has sometimes resulted in the development of an adversarial relationship between the foresters and the rural community. Forestry decisions taken in what may be perceived by foresters to be in the national interest may have been seen by local citizens to violate their common property rights or it may seem to be in conflict with customary and traditional uses of nearby public forest land.

Farm and Energy Forestry as a Component of Social Forestry

Recognition of some of these problems has led to an increasing interest in social forestry, a term normally including both community forestry and farm forestry and often other forestry programs where the public welfare is the primary objective and forest production the vehicle. The term is also useful in describing the relationships of forests and forest officers to the society in which they live. Social forestry should involve an opening of communications between forestry officers, farmers and rural communities. Such dialogue is the basis for an effective management process and a necessary prerequisite to achieving public understanding and support. In this sense, social forestry ought to be a component of all

forestry.

It is even more important as a component of farm forestry than of more traditional forestry. Here rapport with the public is of crucial importance. In farm forestry the public, i.e., private farm land owners are the decision makers. The consultant-client relationships require that the forestry professional understand the objectives of the owner. The emergence of an interest in the societal aspects of forestry requires the inclusion of more social science and communication skills in professional forestry curricula. Similarly development of farm forestry will require that this social forestry material be included in the courses of study of farm forestry students.

PROFESSIONAL FORESTRY EDUCATION IN PAKISTAN

The Pakistan Forest Institute (PFI), while institutionally a federal agency, is defacto the research and education arm of the collective Provincial Forestry Departments. Its principal emphasis is on research and especially on meeting the research needs of the Provincial Forestry Departments. Its Forestry Education Division is responsible for training professional foresters to staff the provincial departments. It is not a university, but, in the field of higher education, it assumes some of the roles of a college within a university. Its degrees of BSc and MSc are granted by Peshawar University but, in the courses of study and conduct of the education programs, PFI seems to be quite independent. In many ways, PFI is more of a service academy than a college or university. The Provincial Forest Departments expect that a graduate of PFI will be prepared to assume a professional forestry post and to perform in that post with considerable independence immediately upon graduation. As a consequence the curriculum includes a considerable number of practicums emphasizing field exercises.

Analysis of the Current Curricula

BSc Forestry Curriculum.

The BSc Forestry Curriculum at PFI is a two-year curriculum open to students with twelve years of education through the FSc certificate. The candidate must have passed the Intermediate Science examination in not less than second division of the University of Peshawar or any Board of Secondary Education with one or more than the following subjects: mathematics, physics, chemistry, botany, or zoology (or an equivalent or higher examination from a recognized institution with the same subject). It is also provided, that in exceptional cases, the Syndicate University of Peshawar may relax the condition of second division for Baluchistan and other less developed areas.

A nationwide examination is given to applicants to develop a roster of acceptable candidates. From this roster, each province selects a number of candidates equal to the number of sub-professional posts that it will have two years hence. Candidates selected are then sent to PFI for two years of education financed by the province.

The PFI BSc Forestry program is intended to be equal to the final two years of university baccalaureate education in Pakistan. While precise comparison is difficult due to differences in subject matter scheduling and objectives, this does not appear to be true. University baccalaureate training in the sciences, engineering and agriculture represent four years of study beyond FSc degree. The BSc Forestry degree is awarded for two years of study beyond the FSc. It may be argued that because PFI

students attend school for twelve months instead of nine months, that two years at PFI is the equivalent of four years at a university. The team found little evidence to support this argument. By comparison most BSc Forestry programs in North America would involve about 120 weeks of instruction of on campus lectures and laboratories. In addition they would include another eight weeks of examination periods and four to eight weeks of field practicums.

According to the PFI Bulletin of the "Statutes, Ordinances and Regulations for BSc Forestry 1972 Onwards", the PFI program includes fifty weeks of class lectures, fourteen weeks of tours, nine weeks of special field courses, two weeks of term papers and drafting of a working plan, eleven weeks of preparatory leave and examinations, and four weeks each of vacation and annual sports. This is a demanding two-year program by any standard. However, while all of the traditional forestry subjects are taught, examination of the syllabi suggest that frequently the subject matter is not as comprehensive as that offered students in four year baccalaureate programs. Further it is clear from the introductory material and amount of review found in some syllabi that the students preparation in underlying science, mathematics and technology courses is weak. For comparison purposes Supplement III presents a synthesis of fourteen North American BSc Forestry Curricula.

MSc Forestry Curriculum.

The MSc Forestry Curriculum at PFI is a two-year post baccalaureate program. Students holding a BSc Forestry from PFI as well as students with baccalaureates in science, engineering and agriculture from Pakistan universities can apply for and be admitted to a competitive examination for admission to the MSc Forestry program. There is provision for relaxing these admission requirements under certain circumstances. Commonly, students holding MSc degrees in subjects other than forestry are admitted to the MSc Forestry program. Since these students from non-forestry baccalaureate programs have typically had no instruction in forestry, they are taught what are essentially the same courses offered to the BSc Forestry student. For the BSc Forestry graduates who pursue an MSc Forestry degree, the forestry coursework is essentially a review. As in the case of BSc Forestry applicants the provinces select their own candidates from a roster in numbers equal to the number of professional posts projected for two years hence. Those selected are seconded to PFI by the respective provinces and supported by the provinces for the two year courses of study.

Entrance Requirements and the Standard two-yr Curricula.

The MSc Forestry Curriculum has had to accommodate a mix of students who are generally at the same baccalaureate level but whose undergraduate courses of study varied across a broad academic spectru A consequence, instruction in forestry has been based upon to common denominator among candidates. This insured that the subject matter coverage was essentially the same as that included in the final two years of the BSc Forestry program. PFI faculty note that the coursework in the MSc Forestry sequence probes to greater depth than is the case for the BSc Forestry sequence. Nonetheless, for the BSc Forestry graduate entering the MSc Forestry Curriculum there is considerable repetition of subject matter. The BSc with a non-forestry background is not subjected to this repetition but presumably brings to the program more strength in some of the underlying disciplines. Since all students must be matriculated for the same two-year period, the ultimate level of achievement of forestry education under the general forestry curriculum is substantially lower than comparable programs in contemporary North American institutions.

Specialization.

A second problem at the MSc level has been that all students were educated for essentially the same career ladder. Today the body of forestry knowledge is too great to be mastered by all. That is, of course, is not a problem unique to Pakistan. American and Canadian forestry professions confronted it forty years ago and after much deliberation the present array of majors in separate fields emerged.

The MSc Forestry Curriculum at PFI was originally a uniform general forestry program that all students followed. Historically it consisted of a single two-year curriculum made up of forestry courses and of courses in the sciences underlying forestry. Under this system, the only way that a student could specialize was through the thesis requirement. The thesis effort is supervised by a specialist in the subject matter represented by the thesis topics. The specialist was generally a member of the professional teaching or research staff of PFI.

Recently PFI developed specialized curricula by substituting advanced courses in the subject matter of the specialty for some of the courses in the general curriculum. This substitution was done on a mark for mark and semester for semester basis. The first such specialization that was approved and included in the current College Bulletin was one in Forest Products and Engineering. A second one has been completed. The University of Peshawar has approved this second specialization in the field of Watershed Management. The current bulletin lists six such specializations. These include, in addition to the two already mentioned, one each in Range Management,

TABLE 1: MSc Curricula - Current Specializations

SEM	COURSE	MARKS	F Mgmt	FP&E	W Mgmt	F&EF	Ag	F&EF	For
1	Geology-Soils	100	*	*	*				
1	Biology	75	*	*	*				
1	Mathematics	75	*	*	*				
1	Statistics	50	*	*	*				
1	Biometrics	100	*	*	*	*			
1	Principles-Economics	50	*	*	*				
1	Tour	25	*	*	*	*			
2	General Silviculture	100	*	*	*	*			
2	Forest Ecology	100	*	*	*	*			
2	Protection(A)	75	*						
2	Protection(B)	75	*						
2	Surveying	100	*	*	*	*			
2	Engineering(A)	75	*	*	*				
2	Photo Interpretation	75	*	*	*	*			
2	Exploitation	75	*	*	*	*			
2	Plant Taxonomy	75	*		*	*			
2	Fish & Wildlife Mgmt	50	*		*				
2	Silviculture Seminar	50	*	*	*	*			
2	Tour(For Types)	75	*	*	*	*			
2	Tour(Chir&Tem Zone)	75	*	*	*	*			
3	For Mgmt	100	*	*	*	*			
3	Resource Economics	75	*	*	*	*			
3	Range Mgmt	125	*		*	*			
3	Watershed Mgmt	125	*	*	*	*			
3	Engineering(B) Roads	75	*	*	*				
3	For Genetics	50	*			*			
3	For Law & Policy	100	*	*	*	*			
3	Tbr Tech & For Ind	100	*	*	*	*			
3	Field Engr	50	*	*	*	*			
3	Rec & Park Mgmt	50	*		*				
3	Soil-Plant-Water-Rel	50	*			*			
3	Tour	100	*	*	*	*			
4	Res & Res Methods	50	*	*	*	*			
4	Soc,Pub Adm & Ext	50	*	*	*				
4	For Mgmt Plan	100	*	*	*	*			
4	Specialization	200	*	*	*	*			
2	Applied Mechanics	75		*					
2	Work Study & Lab Sci	75		*					
2	Wood Wrk & Sawmill	75		*					
2	Machinery in For	50		*					
3	Tree Harv & Trans	125		*					
3	Wood Struct & Ident	50		*					
3	Wood Test & Proc	50		*					
3	Composite Wood Prod	50		*					
3	Engineering(C)	125		*					
2	For Meteorology	75			*				
2	Des Soil Cons Wks	75			*				
3	For & Range Hydro	50			*				
3	Wtshd Plan & Anal	50			*				
	Protection(C)	75				*		*	
	For Sociology	75				*		*	
	Energy as For Prod	75				*		*	
	Agroforestry	75				*		*	
	Extension	75				*		*	
	Comp Methods in For	75				*		*	
	Pub Adm	75				*		*	
	F & E F Mgmt	75				*		*	
	F & E F Plan	50				*		*	

Farm Forestry, Silviculture and Forest Management. Presumably the Forest Management specialization is the original general forestry curriculum. Thus, the MSc Forestry program is evolving into a core curriculum with a major represented by a small fraction of the courses. In the Forest Products and Engineering Curriculum, nine specialized courses have substituted for nine of the courses in the general curriculum. In the case of the Watershed Management Curriculum four, specialized courses have been substituted for an equal number of courses in the general curriculum. The data in Table 1 illustrates the development of specialized curricula. This pattern of developing majors in one of several subject matter specialties seems to be an appropriate response to an increasing diversity in the demand being made upon the forestry profession in Pakistan. It is not a unique response to such changes and as previously noted, it is in fact the same response that was made to similar challenges in the U.S., Canada, Europe, and in many other areas of the world.

Need for a Core Curriculum and a Comprehensive Program Evaluation

The evolution of specialization presents the PFI staff and the clientele organizations with some problems which must be confronted and which, to a degree, have already been recognized. The two specializations now approved have already resulted in an increase of thirteen in the number of courses that have to be taught. As additional specializations emerge this number will increase. The demand on the PFI staff to accommodate this additional teaching will be significant not only in terms of total time required but in diversity of teaching talent needed. The precise make up of the core curriculum to be taken by all MSc Forestry students has not been defined though both the PFI staff and provincial forestry officers have suggested that the content of the core curriculum is important. Development of specializations using the substitution process will, in the long run, define the core curriculum by default as more and more courses are substituted for to make space for new courses. Ultimately, the question of defining the core curriculum and examining the whole MSc Forestry Curriculum structure ought to be undertaken. This might include an assessment of total time needs as well as allocation of staff resources across both BSc Forestry and MSc Forestry programs.

Since most of the students admitted to the MSc program have had no prior education in forestry, the two year constraint is very limiting in attempting to pursue a MSc Forestry program comparable to European or North American Programs. This is, of course, not a part of the task of the Farm Forestry Curriculum Development Team but we would be remiss if we did not point out that our efforts represent an additional increment in the process that leads ultimately to the need for a comprehensive program evaluation involving consideration of all specializations.

Our strategy for implementing a Farm and Energy Forestry specialization does, in fact, propose some revisions in existing MSc

courses in addition to the new courses needed for the Farm & Energy Forestry MSc Curriculum. These revisions are significant but do not alter the need for a more in-depth review.

Strengthening Curricula: Parity at the International Level

The Director General of PFI has stated that the MSc Forestry education program at PFI should develop and maintain parity with international-class, masters-level forestry programs. If this goal is to be achieved, the course of study must be broadened in scope and made more flexible to accommodate the variation in preparation of the incoming students from Pakistan and elsewhere and the differing career avenues available to the outgoing students. All PFI graduates may no longer be posted with Provincial Forest Departments but instead return to their home countries for employment. At this point in time, we are assuming two major parameters with respect to the creation of an MSc level course of study in Farm and Energy Forestry: namely that the maximum time available to complete the course of study is two years and that the international-class quality of the program is represented by the outgoing student competence. These parameters represent real constraints on curriculum synthesis at PFI. PFI is a unique institution of higher education in Pakistan. It represents the only faculty in the country that is organized and academically equipped to offer advanced education in the various forest resource fields. As the time parameter increasingly becomes a critical constraint, this specialized faculty will need to concentrate upon those fields of study in which they are uniquely qualified and for which they have sole academic responsibility in Pakistan. It becomes more and more important that education in the basic sciences and mathematics be provided to potential forestry students before they matriculate in the MSc Forestry program. It should be emphasized that this does not mean that it is necessary to reduce the fundamental training needed to be a forest officer in the Provincial Forestry Departments.

It is worth noting that the institutional goal of developing MSc Forestry programs that are comparable in stature to those in first class forestry schools throughout the world adds an additional challenge to PFI that goes beyond its traditional role. Historically, PFI has had the mission of training professional foresters in conventional forestry to met the needs of the Provincial Forest Departments in Pakistan. In this effort it has had no competition. It has been a monopoly. As PFI undertakes to become a world class forestry graduate school, to attract students from other countries to its MSc Forestry degree programs and to prepare students for ready admission to PhD forestry programs abroad it is no longer in a monopoly position. It must compete effectively with many other forestry schools in Asia as well as Latin America, Africa, North America, and Europe that are engaged in the same activity. In the international arena, PFI has some competitive advantages in terms of the nature of its forest environment and its forestry problems. But success in this competition will, in the long run,

be based upon the quality of student output. At the same time that PFI is engaging in an effort to meet international forestry education standards, it must continue to serve the needs of its Pakistan constituency; namely the Provincial Forest Departments whose needs are also expanding. Again these objectives are not mutually exclusive nor are they in conflict.

Strengthening Faculty Skills and Clarification of Responsibilities Between Teaching and Research

An obvious limitation on the development of a Farm and Energy Forestry specialization (and other specializations) is the availability of competent faculty. Faculty with appropriate types and levels of skill must be available either from existing PFI faculty, new faculty appointed to PFI, or faculty hired on a part-time basis. Later in this report recommendations are made regardin formal education and continuing education needs for the PFI facult and staff designated to teach the new courses proposed.

It is appropriate to note a major constraint on instruction at the MSc level in PFI particularly as that instruction relates to specializations. Much of the instruction in specialized courses falls upon staff members who are employed primarily to do research. The task of meeting classes often conflicts with their pursuit of a research program particularly in the various areas where field work is required. This leads, we were told, to situations in which the instruction program is temporarily neglected in the interest of pursuing a program of research. Unlike the case in most university forestry programs, there seems to be little or no obligation on the part of the research worker to insure that his teaching responsibilities are met when research demands require that he miss regularly scheduled classes. This conflict between organized instruction and research is likely to increase as specializations are added and research programs expand. This conflict of responsibilities is a serious administrative matter in terms of program priorities and must be dealt with effectively to insure the integrity of the Institutes academic programs.

SYNTHESIS OF THE FARM AND ENERGY CURRICULUM

Task of the Curriculum Development Team

The task of the Curriculum Development Team was to propose a course of study for a specialization in the MSc Forestry program for Farm and Energy Forestry. This required a thorough review of the existing curricula, an analysis of relevant syllabi and gaining a general understanding of the instructional and research framework at PFI. After consultation with the PFI administration and with the help of the faculty (see later section on workshops and working groups) a curriculum development strategy was selected. This involved design of new courses, modification of several existing courses and differentiation between curricula based on previous training of the entering students.

The general rationale used for curriculum development was based upon an assessment of the role of the farm and energy forestry professional and the information base required to meet such responsibilities. A particularly important consideration was the fundamental need for communication and motivational skills, to augment technical forestry expertise.

There were two additional factors. Farm and energy Forestry specialists obviously must operates at the interface between forestry and agriculture and consequently must have an understanding of both disciplines. The Curriculum Development Team started with the given that instruction in Farm & Energy Forestry was to be provided at PFI, a forestry institution. The agricultural components of the education would have to be provided at PFI or required prior to admission or both. Finally, because Farm & Energy Forestry was to be pursued by provincial forest officers, the curriculum had to also contain a professional forestry core that was adequate to career service in the Provincial Departments.

Key Elements in Farm & Energy Forestry Curriculum

The key elements in the Farm and Energy Forestry Curriculum are a series of courses in Agroforestry Systems, Farm and Energy Forestry Management, and Farm and Energy Forestry Planning. These are courses in the domain of forest technology. They are based upon advanced courses in Pest Management, Fire, Animal Damage, and Weed Control, Rural Sociology, Energy as a Forest Product, Outreach in Forestry, and Computational Methods in Forestry. They utilize existing courses in Resource Economics, Silviculture, Forest Management and Forest Management Planning. Some additional material has been proposed to be added to the basic courses in Statistical Methods in Forestry, Forest Biometry, Public Administration, Resource Policy and Law, and Resource Economics.

Duplication of BSc and MSc Coursework

A major problem for the professional staff of PFI is represente by the necessity of duplicating instruction at the BSc and the MSc levels. This presumably comes about because some of the MSc Forestry candidates have their baccalaureate preparation in fields other than forestry. This means that the PFI staff must duplicate instruction in almost every forestry course.

This problem has become increasingly acute with the advent of specializations and the accompanying requirements that a significant number of new courses be added to the total curriculum. The overload arises not only from the physical necessity of teaching more classes but of the even larger burden of preparing and assembling new course materials. In many cases the faculty member teaching the new course must himself engage in additional scholarship in new and advanced fields of science and technology.

If it is difficult to allocate enough new resources to the teaching function of PFI to accommodate these new requirements, then they may have to be obtained by improving efficiency in the use of some currently allocated resources. One of the obvious sources of such increased efficiency is reduction in duplication in instruction.

Impact of Academic Preparation on the Time Required for the MSc, the Cost to the Provincial Departments and the Quality of Education

The duplication in instruction has its origin in the great diversity of academic preparation in the students entering the MSc Forestry program at PFI. Figure 1 illustrates the several academic routes available to a student pursuing an MSC Forestry degree.

Route A portrays the case of the student who enters PFI as a candidate for the BSc Forestry degree and later re-enters the MSc Forestry program after experience in a Provincial Forest Department. This student enters professional forestry education with an FSc certificate and obtains the MSc Forestry degree after a total of sixteen years of education. Much of the subject matter that this student covers in the two year MSc Forestry program duplicates material that he has already studied in his BSc Forestry Program. Supplement II illustrates this clearly by comparing the course content of the two curricula on a subject by subject basis. The student that pursues this route to the MSc Forestry is supported by the Provincial Forest Department for four years on a stipend. In general, while he has covered all of the forestry disciplines fully, he has a weak general academic background in the basic arts and sciences, and no background in agriculture.

Figure 1 : Routes To MSc For

Yrs	Route A	Route B	Route C	Route D	Route E
1					
2					
3					
4					
5					
6					
7					
8					
9					
10	Certificate	Certificate	Certificate	Certificate	
11					
12	FSc	FSc	FSc	FSc	HS Dipl
13					
14	BSc For				
15					
16	MSc For	BSc AG	BSc Sci	BSc Sci	BSc For
17					
18		MSc FOR	MSc For	MSc Sci	MSc For
19					
20				MSc For	

Route B represents the progress toward an MSc Forestry degree by a student who enters PFI for the first time as a candidate for the MSc degree. He brings to this course of study a background of a BSc Honors degree in Agriculture. He will have had sixteen years of education prior to entering the MSc Forestry program and eighteen years education upon its completion. While he will not have studied forestry courses at the baccalaureate level, he will have studied many of the underlying science and mathematics courses included in the BSc Forestry Curriculum and will have pursued some in far greater depth then the BSc Forestry graduate. In addition, the BSc Agriculture (Hon) student will have completed at the baccalaureate level some materials now included in MSc Forestry course of study and will have a strong background in Agriculture.

This student will have studied all of the required forestry material upon completion of the MSc Forestry program and, because of his more extensive prior education, he should be superior academically to his Route A "batch" mate. It is financially significant that, upon completion of his MSc Forestry degree, the Provincial Forest Department will have invested only two years of financial support in the student pursuing route B .

Route C represents the education of a student who enters the MSc Forestry program after completion of a baccalaureate in any field of science or engineering other then forestry or agriculture. . As was the case for the student prepared initially in agriculture, these students will finish the MSc Forestry program after eighteen years of education and will have been financially supported by the Provincial Forestry Department for two years. Academically these students are likely to be the equivalent of those who pursue route B and superior to those who pursue route A. However, their prior preparation in forestry related subjects or agriculture would be inferior to that of the students following routes A and B.

Route D is similar to route C with the exception that the student has both a baccalaureate and masters degree in agriculture, engineering, mathematics or one of the sciences. This route is similar to route C except that the additional degree means that the graduates of this curriculum are likely to be more advanced in general education.

For comparison purposes route E illustrates a typical North American program.

We are proposing that students be permitted to matriculate in the Farm & Energy Forestry specialization following either route A or B. We strongly believe that route B should be preferred. We therefore recommend that route B be given preference by PFI. Accepting students for the MSc Forestry program specializing in Farm & Energy Forestry with a previous BSc Agriculture (Hon) will reduce costs, provide more broadly trained officers, and permit the PFI faculty to be more efficient.

Modifications of Existing MSc Forestry Coursework

Existing Courses.

Courses listed below were modified by the addition or deletion of subject matter with the objective of enhancing their content relative to the Farm & Energy Forestry Curriculum. In several cases subject matter was removed from one course and added to another which strengthened both.

1. Statistical Methods in Forestry

The MSc course has been augmented principally in the are of experimental design.

2. Forest Biometry

This course was changed only by the addition of mensurational techniques appropriate to the evaluation of whole-tree volume and whole-tree biomass have added to the course.

3. Resource Economics

This course remains nearly unchanged except for new material added to update the subject matter content and increase its applicability to an expanded forestry role in the agriculture sector in Pakistan.

4. Resource Policy and Law

This course has been reviewed with significant additions and deletions of material. The course reviews the current status of forest policy and critically analyzes the policy formation and implementation processes in Pakistan.

New courses.

Courses listed below are new to the MSc Forestry curriculum or have been so substantially revised as to effectively be new courses. The courses in Farm and Energy Forestry Management, Agroforestry Systems, Farm and Energy Forestry Planning and Energy as a Forest Product, are new and original syntheses of subject matter. The remaining courses, particularly the Outreach in Forestry, Rural Sociology, and Public Administration courses reflect expanded curricular emphasis and addition of material relevant to Pakistan and the Farm & Energy Forestry specialization.

1. Farm and Energy Forestry Management

Farm and Energy Forestry Management is the "capstone" course in the Farm & Energy Forestry Curriculum. It addresses the problems of farm management integrating agroforestry, management,

economics and outreach. It emphasizes the decision making processes in farm operations and examines the basis for decisions in a multi-product farm context. (Prerequisites: Agroforestry Systems, Resource Economics, Outreach in Forestry)

2. Farm and Energy Forestry Planning

This is a practicum associated with the Farm and Energy Forestry Management course. Students are required to develop one or more management plans for specific farms that incorporate forestry in their activities. Plans will critique the present status of forestry decisions in farm management and propose improvements where feasible. (Concurrent or Prerequisite: Farm & Energy Forestry Management)

3. Rural Sociology

This course introduces the student to sociology within the context of the rural communities of Pakistan including farm, tribal and rural village social systems. It provides the background for an understanding of the social basis for a professional client relationship in a farm forestry setting.

4. Energy as a Forest Product

This course, which considers energy as a major forest product, provides an understanding of the role of wood in national, provincial, regional and local energy budgets. It deals with the nature of wood as a fuel and its evaluation as a fuel. The financial aspects of fuelwood production and marketing are also reviewed. (prerequisite: Forest Biometry, Exploitation of Fores Products)

5. Agroforestry Systems

This course examines agroforestry in a systems context emphasizing interactions between the biological elements i.e., field crops, trees, and animals, and the soil. Agroforestry systems currently found in Pakistan and abroad are described and critically reviewed. The ICRAF Diagnosis and Design methodology is presented as a tool and the Farming Systems Research Methodology is introduced. (Prerequisite: General Silviculture, Forest Ecology)

6. Outreach Forestry

This course introduces outreach methods and stresses motivation and communication processes to prepare students to work more effectively in rural communities and with individual farmers. The course overviews current outreach and rural development activities in Pakistan and introduces methodology for program planning, development and evaluation. (Prerequisite: Rural Sociology)

7. Computational Methods in Forestry

Students in this course are introduced to computers and their use with particular reference to microcomputers. Included too is an introduction to BASIC programming language and to the

use of software packages that have proved to be useful in forestry. The methods of systems analysis that are applied to the solution of forestry management problems are taught using examples of forestry applications.(Prerequisites: Forest Biometry, Statistical Methods in Forestry)

8. Public Administration

This course is designed to enhance the administrative and management skills important to a successful career in the Provincial Forestry Departments of Pakistan. Included in the course are an examination to the scope and philosophy of public administration in Pakistan, an introduction to basic concept of management and personnel administration and the procedures and practices of of governmental offices. The course also reviews the role responsibilities and authority provided under law for a forest officer.

9. Pest Management, Fire, Animal Damage and Weed Control

The protection course builds upon the material in the entomology, pathology and silviculture and focuses on technologies for control of tree and forest destroying organisms including insect, fungi and bacterial pathogens, as well as wildlife and domestic animals and fire. (Prerequisites: Forest Protection "A", Forest Protection "B")

Recommended Farm & Energy Forestry Curricula

The recommended Farm & Energy Curriculum with the BSc Agriculture (Hon) is given in Table 3. This is the preferred route B option. This student, being deficient in a forestry background, would have to take traditional forestry courses in addition to the courses designed specifically with the Farm & Energy Forestry specialization in mind.

An alternative option, route A, is given in Table 2. With a strong background in forestry, the student could concentrate on the courses designed for the Farm & Energy Forestry specialization.

The recommended course marks are also included. These marks were developed using twenty-five marks as equivalent to a one semester credit hour, the basis for U.S. educational institutions.

While it is outside the mandate of the Curriculum Development Team, it suggested in final discussions with the PFI staff, that the courses in Outreach in Forestry, Rural Sociology, Public Administration and Computational Methods in Forestry, be included in the core curriculum for the MSc Forestry program, therefore, be required of all specializations. We think this is an excellent idea. If this was achieved, a third option for implementing the Farm & Energy Forestry specialization on an interim basis would be possible. This would involve substitution of the courses Farm and Energy Forestry Management, Energy as a Forest Product, and Agroforestry Systems for

TABLE 2: MSc F&EF Specialization

BSc For (Route A)

Marks	BSc	Marks	MSc
50	Silviculture I	75	Res Econ
50	Protection I	100	Tbr Tec & Ind
125	Geol & Soils	50	Soil, Pl,Wtr Rel
75	Ecology I	75	Comp Math
75	Mensuration I	75	Agroforestry
75	Utilization I	75	F & E F Mgmt
50	Wtshd Mgmt	75	Photo Inter
50	Tour	75	Protection (C)
	Tour (Gen)	75	Rural Soc
75	Silviculture II	75	Energy
75	Protection II	75	Outreach
75	Mensuration II	75	F & E F Plan
50	Plant Taxonomy	75	Pub Adm
50	Ecology II		
100	Wtsd Mgmt		
100	Surveying		
25	Genetics		
50	Tour		
125	Range Mgmt		
100	Statistics		
125	Engineering		
75	Forest Mgmt		
75	Economics		
75	Law & Policy		
100	Utilization II		
50	Field Engr		
25	Tour		
50	Tour		
50	Soc,PA, & Ext		
50	Recreation		
50	Fish & Wldlf		
25	Term Paper		
50	Bot & Zoo		
100	Mgmt Scheme		

TABLE 3: MSc F&EF Specialization

BSc Ag(Hon) (Route B)

Marks	MSc
100	Biometrics
25	Tour
75	Res Econ
75	Comp Math
50	For Gen
75	Agroforestry
100	Tbr Tech & Ind
100	Genl Silviculture
100	Forest Ecology
50	Surveying
75	Photo Inter
75	Protection (C)
75	Energy
75	Tour
75	Tour
100	Forest Mgmt
125	Wtshd Mgmt
50	Field Engr
100	Tour
75	For Law & Policy
75	F & E F Mgmt
50	Res & Res Methods
100	Forest Mgmt Plan
200	Specialization
75	Outreach
75	F & E F Plan
75	Exploitation
75	Plant Taxonomy
50	Silv Seminar
125	Range Mgmt
50	Soil,Plant,Wtr Rel
75	Rural Soc
75	Pub Adm

Plant Taxonomy, Fish and Wildlife Management and Soil-Plant-Water relations in the curriculum. This alternative has merit as an interim measure, but would still be inferior to the Curriculum Development Team's primary recommendation.

RECOMMENDATIONS FOR TRAINING OF INSTRUCTIONAL PERSONNEL

With the rapid increases of knowledge in all areas of science and technology including forestry, faculty members and hence course materials, can rapidly become out of date. Clearly, if a teacher is to remain current in his field, he must have opportunities for professional advancement and renewal on a regular and frequent basis. In a county like Pakistan, where there is only one institution engaged in academic research and education in forestry, this renewal must involve deliberate contacts with the academic forestry community outside of the country. It is important to avoid inbreeding. Nowhere does the need for professional renewal become more obvious and more critical than at a time when there is to be a major expansion or revision of the academic curriculum. This is certainly the case with the proposed new specialization in Farm and Energy Forestry at PFI.

The field of Farm & Energy Forestry is new and emerging in many areas of the world. Development of meaningful curriculum specialization in Farm & Energy Forestry requires that faculty expertise be augmented in a number of the fields of forestry and in related areas as well.

Faculty renewal can be achieved in a variety of ways. All of them should be used to enhance the instructional competence or the PFI staff. This should be done expeditiously so that the specialization can be implemented by next fall in a preliminary way and fully implemented within two years.

Mechanisms for faculty improvement that might be used are the following:

1. employment of new faculty who are already trained in the essential disciplines,
2. employment of new faculty who need additional education at MSc or PhD level in forestry disciplines not available in Pakistan and subsequent education is these disciplines, and,
3. short-term in-service education of existing faculty, who need to augment their present skill in their discipline.

These forms of in-service education may be obtained via:

1. study periods of one to three months at a foreign institution where the discipline is represented,
2. study opportunities created by collaboration with foreign scholars brought to Pakistan for a few months to introduce new disciplines material, and
3. participation in short courses established in Pakistan using either Pakistan or foreign instructors to provide general training in a new discipline area.

Because the decisions regarding responsibility for instruction in the new materials anticipated by the Farm & Energy Forestry

specialization have not been taken, we cannot be specific regarding individual instructors and their renewal needs. We will be as specific as possible with respect to the disciplines.

Quantitative Courses

There is a need to develope some new dimensions in the applicatio of quantitative methods in forestry to the solution of forestry problems in Pakistan including problems in the domain of Farm & Energy Forestry. These quantitative areas are statistics, biometry, modelling and the use of micro-computers to implement these disciplines. This general subject matter area needs to be strengthene not only in the faculty of PFI but among professionals already in service in Pakistan who will have to carry the burden of Farm & Energy Forestry in the field until a new group of professionals can be graduated. We recommend that a short course or series of short courses be convened to cover the new materials proposed in the courses in statistics, biometrics and computational methods and that these be participated in by selected officers of the Provincial Forestry Departments and several of the faculty of PFI responsible for teaching in these subject matter areas.

In addition we recommended that at least one member of the PFI staff be sent for a graduate program involving the use of analytical forestry models. Such graduate programs are offered by the Center for Quantitative Sciences in Forestry, Fisheries and Wildlife of the University of Washington.

Biological Courses

The biological components of the Farm & Energy Forestry specialization are probably better represented in the current PFI course offerings than are any of the other components. The two areas that require strengthening are forest protection and agroforestry. In the area of forest protection the conventional education in forest pathololgy and forest entomology needs to be augmented with some coverage of integrated pest management techniques including animal damage and fire damage. A number of the current PFI staff should sent abroad to obtain an MSc degree in forest protection.

The field of agroforestry is developing rapidly and what constitutes agroforestry in Africa or Latin America may be quite different from what will constitute agroforestry in Pakistan. Nonetheless, some basic principles are emerging that have general applicability. One of the forest biology faculty members with strength in silviculture ought to go to one of the institutions that now have programs in agroforestry or social forestry. Among these are Kasetsart University, Bangkok; The University of the Philippines. Los Banos; the University of Idaho, Moscow; and CATIE, San Jose. ICRAF, in Nairobi, also offers short course training in this field. In addi ion to the education of the principle faculty member, a short course in agroforestry ought to be organized in Pakistan so that other faculty

in the forest biology area can obtain some advanced training and so that Professional staff of the Provincial Forest Departments now engaged in Farm & Energy Forestry can receive essential in-service training.

Social Science Courses

The course in Rural Sociology will require a teacher specifically educated in this field. It is recommended that a potential teacher be recruited and sent to a university in the U.S. that offers a graduate specialty in Rural Sociology. These include the University of Idaho, the University of Washington and Yale University. The same individual could simultaneously obtain advanced education in Resource Economics and thus, be prepared to teach both courses.

In the field of public administration a faculty member should be provided a semester's training at a U.S. university in personnel management, public administration, accounting and business management. This should also be followed by a three month internship with the USDA/FS Office of Personnel Management. Upon return to Pakistan, the faculty member should attend the Staff Academy at Lahore for courses offered to senior forest officers.

Forest Technology Courses

The areas of forest technology that require strengthening at the instruction level are Aerial Photography, Energy as a Forest Product and Farm and Energy Forest Management. The Forest Photo Interpretation course needs to be augmented with some materials in the area of remote sensing. The teacher responsible for instruction in Photo Interpretation should be sent to an institution that is fully equipped to offer instruction in remote sensing as applied to forestry. This can be on a short course basis. There are several institutions at Bangkok and Delhi as well as at several universities in the U.S. that regularly offer such short courses.

Energy as a forest product can be taught to potential instructors in the forest products division through a short course offered in Pakistan. This short course should also be made available to Farm & Energy Forestry professionals in the Provincial Forest Departments as well. Graduate programs in this field are offered at the University of Washington.

In-service education in Farm & Energy Forestry Management can be provided in the same way. Consideration might be given to combining in-service education in Agroforestry Systems with that in Energy as a Forest Product and Farm & Energy Forestry.

Finally it is our observation that the PFI teaching staff could benefit from a series of teaching methodology seminars. These seminars can enhance faculty's skills in organizing, presenting and evaluating materials in the classroom. They are also useful in recognizing the

importance of the teaching function and stimulating renewed interest The University of Idaho presents such seminars for its faculty and could also provide some to PFI.

CONCLUSIONS AND RECOMMENDATIONS

The task of implementing a specialization in Farm and Energy Forestry is a formidable one. Other specializations like forest products, watershed management, range management and forest recreation have been developed elsewhere and textbooks, reference materials and model curricula are available. Farm and Energy Forestry, on the other hand is in an early stage of development and much less well defined. While it is related to such fields as social forestry, community forestry, and agroforestry, it is not the same thing. Its basic elements are a focus upon private land, small plot intensive culture and integration with farming.

Where forestry in Pakistan has traditionally concentrated on large land areas that are owned and managed by the state, the transition to Farm and Energy Forestry represents a major change in direction and program thrust not only in education, but in the professional activities engaged in within the forestry profession. As with most innovations of this sort, the burden of providing the leadership falls upon the shoulders of the research and teaching community.

Clearly the major change in educational emphasis represented by this curriculum specialization cannot be instantaneously implemented. It involves a reexamination of the criteria for student admission. Emphasizing, as it does, the provision of firewood for domestic use as well as the on-farm culture of crops, all activities involving women, implementation of a Farm and Energy Forestry specialization may suggest the need to bring women into what has traditionally been exclusively a male profession. Implementation of this specialization also involves developing within the teaching faculty, some skills and academic expertise not required to teach the more traditional forestry subjects. The task of preparing PFI to recruit and admit a different student mix and to provide for the necessary faculty replenishment will take time. Accordingly, the Curriculum Development Team fully recognized that the task of implementation would not be an instantaneous one, but one that would extend over a period of time. The team also recognized that just as the proposed curriculum specialization was not the first step it was also not the last. Curriculum synthesis is a continuing exercise that the Curriculum Development Team was able to participate in for a relatively short period of time. Nonetheless, it appeared to us to be wise and prudent to devise a curriculum specialization that could be implemented in a reasonable period of time if the PFI administration and staff were dedicated to the task and if the resources needed were made available to them. On these assumptions we have made the following conclusions:

1. Admission to the Farm and Energy Forestry specialization should be limited to students holding a BSc Agriculture (Hon) degree from one of the Agricultural Universities in Pakistan.

2. The Farm and Energy Forestry specialization should

include the courses listed in Table 3 of this report including the new and revised courses for which syllabi are provided.

3. Until such time as PFI is prepared to offer the Farm & Energy Forestry Curriculum described, an interim program based upon a BSc Forestry degree might be undertaken. This is viewed by the Curriculum Development Team as a distinctly inferior option that ought to be initiated only if it is viewed as an intermediate step in implementation of the preferred option and not as an end in itself. Also less than optimum, but readily implementable is the substitution of the Farm & Energy Forestry courses for existing courses in the MSc Forestry Curriculum.

4. Since the recommended curriculum specialization involves subject matter not now taught at PFI, and in fact is in some cases so new that textbooks are not available, the faculty of PFI identified as the instructors in these new and revised courses should be provided with in-service education or academic development before being asked to pursue these new assignments.

5. The essential facilities for instruction including the development of a computer teaching laboratory and audio visual teaching equipment should be provided to PFI.

While the task of the Curriculum Development Team was specifically limited to the development of a Farm and Energy Forestry specialization,we felt very strongly that the introduction of a new specialization could only be justified if it added to the strength of PFI in all of its activities and curricula specializations. It would be wrong to undertake a new specialization if it was at the expense of the older more established programs or of other specializations. Curricula specializations should be mutually reinforcing not competitive. We believe that the Farm & Energy Forestry Curriculum we recommend meets these criteria.

In the process of research for developing the course syllabi, the Team made use of PFI's library on several occasions. While the staff was accommodating, we found the content and organization of the library very much below standards. If faculty are to engage in serious scholarship and research, the collections must be enhanced, up dated, and organized in a more effective manner. The existing situation is not satisfactory for the present much less the future.

Given the small size of the present collections, cataloging should begin in using a new system suitable for computer entry. This would enable the librarians to run the customized subject matter searches as well as more routing functions such as determining overdue books, inventory, cataloging, etc.

We recommend that a librarian familiar with computer based library technology and preferably forestry be brought to PFI to review the situation and develop detailed recommendations.

A more organized and enhanced Library would be of great value to PFI faculty in keeping their course syllabi and lectures current.

We have referred to the use of continuing education as one method of achieving faculty development but this function has a much broader role at the graduate level. New courses and curricula specializations added to the graduate program at PFI reflect important additions to the body of forestry knowledge. Just as it is important that these new materials be added to the intellectual tools provided to the new professional, so it is also important that it be added to the intellectual tool kit of the practicing professional. The device for achieving this is continuing education. Regular in-service training is an important dimension of a graduate program in Farm & Energy Forestry and in any other specialization. Offering such programs to the practicing professional is an important role for PFI.

Finally, in the course of this study we identified with our colleagues from PFI a number of features of the BSc Forestry and MSc Forestry programs outside of the purview of an Farm & Energy Forestry specialization that represent academic deficiencies within the context of a world class program that need to be studied further. We hope that these issue will be examined soon for the benefit of the students, the Institution and the Provincial Forestry Departments.

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S Y L L A B U S

Farm and Energy Forestry Management

I. INTRODUCTION

A. Definition of farm and energy forestry

1. Social forestry defined (the umbrella term)

Give definitions by Srivastra & Paut, 1979; FAO 1978; Wiersum, 1984; Lantican, 1982; and Olofson, 1982.
(Note: See attachment of Schematic #1)

2. Examples of definitions of other types of forestry

(Note: See attachment of schematic #2)

3. Participatory forestry

"Forest management is planned by professional forestry services in which popular participation is encouraged but prime responsibility for management still rests with forestry professionals (usually on publicly owned lands)."
Cite examples: (e.g., Taungya systems)

4. Village/community forestry

"Small scale management of forests and tree resources practiced by non-professionally trained people. Professional foresters may have a consultative role, but not an executory one. Planning and execution of forest management rest on private persons or by some private persons or by some form of cooperative or communal effort."
Cite examples: (e.g., Maharashtra, South Korea)

5. Use oriented forestry

While forestry always involves multiple use in some sense this does not imply all uses nor does it imply equality among uses. A part of the task of engaging in the management of a forestry system is decision making with respect to a rational allocation of priorities

among uses given the objectives of the system. Forestry systems that are characterized by a particular dominant use are often identified with that dominant use; for example:

a. Industrial forestry - This term is used to define a forestry system where the primary objective is to produce industrial raw material, such as saw logs, veneer logs, pulpwood, etc.

b. Energy forestry - The term energy forestry has come to be identified with forestry systems, organized primarily to produce energy as a product in the form of fuelwood, charcoal, bio-gas, methonol, etc.

c. Farm forestry - Where forestry goods and services are produced on farms with other agricultural crops either for on-farm use or sale .

Clearly, there can be many terms devised to describe and identify forestry systems. Where there are paired or multiple objectives, terms used often reflect these combinations of objectives and the systems that combine them. Agroforestry, aqua-forestry, silva-pastoral forestry are examples of such special system identities. Undoubtedly there are many others in use and still others will be invented as the need arises. Farm and energy forestry is one such descriptive term that is useful to describe a system which undertakes to produce energy as a product on privately owned farm land.

6. Contrast between social forestry and energy forestry

a. In the Philippines social forestry, as it is referred in the curriculum specialization, means:

"Social forestry has been viewed as the application of the social sciences in understanding and resolving some of the problems confronting forestry. It is a relatively new concept in the forestry profession to promote natural resources development. In the Philippines it evolved principally out of the need to seek solutions to persistant problems of environmental degradation in the upland."

b. FAO in referring to Forestry Education in the Asia-Pacific states:

"The emerging goal then of forestry development in the region is to enrich this natural resource to uplif the quality of life of the rural poor. Implied in this goal is the philosophy that 'Forestry is not about trees but rather how trees can serve people' (Westoby, 1972). Thus, terms like 'forestry for local community development' or 'social forestry' evolved and are now widely used in the region."

This commentary also points out that:

"Likewise, the energy crisis that confronts not only the region, but the whole world as well, makes it imperative to regard the forests as potential sources of alternative energy. Forestry, therefore, now assumes both economic and social responsibilities to fulfill the goals of promoting social equity, maximizing forest productivity and creating ecological stability."

c. Ignoring the fact that these three goals are inherently inconsistent, it is clear that Prof. Lantican, the author of the FAO study, views "social forestry" and "energy forestry" as distinct and different activities.

d. In writing about "social forestry" for the East-West Center Wiersum defines it:

"Social forestry refers to all professional forestry activities that aim specifically at the participation of local people in forest management and at the fulfillment of the forest-related needs and aspirations of these people."

Wiersum argues that agro forestry and social forestry are not synomyous and that social forestry does not refer to a management objective but rather to a special set of management techniques incorporating trees, agriculture, and/or animals. In apparent agreement with Lantican, Wiersum says with respect to energy forestry:

"The stimulation of private forestry by individual farmers for commercial purposes without any redistribution benefits for the less-well-off population segments should not be considered as social forestry. However, it may be a legitimate form of extension forestry."

B. Importance of F&EF to Pakistan

1. The importance of wood as an energy source

2. The importance of private farms as a source of wood

3. Supplementary products

4. Fuelwood as a means of development

C. Farm and energy forestry management

1. Forest management (traditional):

   Management of the government forest lands to achieve the objectives of the forestry department.

2. Farm management:

   Management of the privately owned farm lands to meet the objective of the owners/tenants.

3. Farm and Energy Forestry Management:

   Production of fuel and other tree products as an integrated part of overall farm management

D. Farm and energy forestry management systems

1. The nature of farm forestry decisions

   a. Should forest products be part of the farm product output?
   b. If forest products are included in the farm product mix which forest products are selected?
      1) What are on farm forest product needs?
      2) What local forest products markets are accessible to the farmer.
   c. How much of the farm property is to be dedicated to forestry use?
   d. Which areas of the farm property are to be dedicated to forestry use?
   e. What service role can forest trees contribute to the farm?
      1) Shade for humans and livestock
      2) Wind protection
      3) Hedges and fences (i.e. living fence posts)
      4) Fruits and nuts
      5) Forage for livestock
      6) Storage of energy and capital
   f. What species should be selected?
   g. What is the appropriate rotation age?
      1) Fertilization
      2) Irrigation
      3) Spacing
      4) End products from trees desired (fodder, fuelwood, posts & poles, etc.)
   h. Mensuration technology
      1) Whole tree biomass
      2) Annual harvest of fruit, nuts, forage, and fuel
   i. Conversion technology
      1) On-farm conversion to various fuel forms
      2) Conversion to timbers, poles, piling, props, etc.
      3) Cooperative conversion and marketing

II. FARM AND ENGERGY FORESTRY MANAGEMENT: AN OVERVIEW

A. The project as the basis of planning

1. Definition of a project
[Note: See Gittinger (1982). pp. 1 - 12]

2. The individual farm as the basic unit of analysis

B. The stages of a project

1. Project identification

a. Selection of candidate farms to meet forestry department objectives
b. Criteria for selection

2. Project preparation and analysis (detailed later)

3. Project appraisal (detailed later)

4. Project implementation

a. Use of outreach techniques
b. No implementation without farmer's acceptance and cooperation

5. Project monitoring and evaluation

III. PROJECT PREPARATION AND ANALYSIS

A. Analytical components

1. The basic tenet of the analytical approach is that the farm is an integrated system. The components of the different crops, animals, labor and capital are interwoven in such a way that the use of any one cannot be understood and adopted in isolation from the other components (emphasize and cite examples of the systems approach to management). Underlying the integration of the farm components are the elements of the technical aspects, the institutional-organizational-management aspects, the social aspects, commercial aspects, financial aspects, and, in terms of analyzing aggregate farm projects or viewing individual farm projects from a governmental perspective, economic aspects. All aspects are important and the success of farm and energy forestry is only as strong as its weakest link.

B. Technical Aspects

1. Defined: concerns the project's inputs (supplies) and outputs (production) of real goods and services - is the "production function" [Note: Review the theory of production functions from Resource Economics and note the inverse in axes from traditional economic production function to production function of yields of outputs over time used in capital theory]

2. Variables: Include as inputs: soils, water availability, crops and varieties, livestock, physical inputs, mechanization, pest control, product yields, cropping patterns and frequency, storage facilities, and processing systems; include as outputs: traditional farm produce and tree crops [Note: Review the complications of multiple output production functions]

3. Technical material (including the production functions of agroforestry systems)is covered in the agroforestry course (the use of diagnosis and design principles)

4. Agronomically more efficient or more productive techniques does not guarantee their adoption by farmers

C. Institutional-organizational-management aspects

1. Variables include: communication/outreach systems, use of local institutions (e.g., cooperatives, associations, etc.) management ability of farmers, government and agency policies, credit contracting arrangements,

and land tenure and holdings

2. Material covered in resource policy and law, public adminstration, and rural sociology courses

D. Social aspects

1. Variables include: income distribution, job creation, regional development, disruptive social effects, improving rural living, rates of acceptance of programs, farmers customs and culture, and social patterns and practices of farmers

2. Material covered in resource economics and rural sociology courses

E. Commercial aspects: include the arrangements for marketing the output produced and the arrangements for the supply of inputs needed (detailed later)

F. Financial aspects: include the actual costs and benefits accruing to the individual farmer (detailed later)

G. Economic aspects: include the financial aspects and the

"off- farm" impacts accruing to others: (detailed later)

IV. COMMERCIAL ASPECTS OF PROJECT ANALYSIS
[Note: See Gittinger (1982). p.16]

A. Market and demand forecasts

B. Marketing systems

1. Inputs - supply of adequate factors of production

2. Outputs - sufficient demand per outputs of production

3. Financing - if necessary, is financing available

C. Pricing policies

1. Government

2. Market

V. FINANCIAL ASPECTS OF PROJECT ANALYSIS

A. Definition of costs and benefits: in project analysis, the objective of the analysis is to provide the standard against which costs and benefits are defined. A cost is anything that reduces the objective, a benefit is anything that contributes to the objective.

B. Identifying project costs and benefits

1. Costs [Note: See Gittinger (1982), pp. 43-47, 52-55]

a. Physical goods
b. Labor
c. Land
d. Contingency allowances
e. Taxes
f. Debt services
g. Sunk costs
h. Potential reduction in traditional agricultural crops

2. Benefits [Note: See Gittinger (1982), pp.56-59]

a. Increased production and site productivity
b. Quality improvement
c. Losses avoided
d. Changes in time of sale
e. Diversification of output
f. Use of submarginal agricultural lands

3. "With" and "without" comparisons
   [Note: See Gittinger (1982), pp. 47-52]

C. Pricing project costs and benefits [Note: See Gittinger (1982), Chapter 3]

1. Market price as a measure of value

2. Finding market prices

3. Predicting future values

   a. Changes in relative value
      1) Relative scarcity of products (fuelwood and other farm produce)
      2) Substitution with other forms of energy
      3) Demand elasticity
   b. Inflation

D. Farm investment analysis
   [Note: See Gittinger (1982), Chapter 4; Brown (1979)]

1. Objectives of financial analysis

   a. Assessment of financial impact
   b. Assessment of incentives
   c. Provisions of sound financial plan

2. Elements of farm investment analysis

   a. Farm resource use
      1) Land use (land use calendar) - includes crops planted (interplanted) by average over the duration of the project planning horizon
      2) Labor use - includes annual labor requirement per acre by crop and operation
         a) Farmer's labor
         b) Hired labor
   b. Farm production
      1) Crops - yields (including trees) and carrying capacity
      2) Livestock-yields
      3) Valuation of yields
         a) Farm-gate prices, stumpage
         b) Value of production
      4) Incremental residual value - increased value of assets at end of project planning period
   c. Farm inputs
      1) Investment - money spent for capital improvements during the project that can be depreciated
      2) Operating expenditure - money spent for items that cannot be depreciated (e.g., labor, operation and maintenance of equipment, etc.)

3) Incremental working capital

d. Farm budget: The objective is an estimate of the incremental net benefit arising on the farm as a result of the project

1) Net benefit without project
2) Net benefit with project
   a) Before financing
   b) Debt service (if appropriate)
   c) After financing
3) Net incremental benefit
4) Costs of family labor
5) Costs of land
6) Computing debt service (if applicable)

E. Comparison of project costs and benefits

1. Cash flow comparisons [Note: Review discounting and compounding formulae found in resource economics course]

2. Decision criteria [Review decision criteria from the resource economics course]

F. The project plan

1. Importance of a well prepared plan

2. Format of the plan report

G. Plan implementation

H. Utilization exercises with MULBUD - a computer package for the analysis of multi-period and multi-enterprise budgets [This excercise requires the use of computers and instruction to the students on how to run the mode (and interpret results)]

VI. THE DUAL ROLE OF THE FARM AND ENERGY FORESTRY SPECIALIST

A. Service to the forestry department

1. Promote national/provincial departmental objectives

2. Technical expert in forest management of government owned forest lands

B. Service to farmers

1. Serve farmer's objectives

2. Technical advisor/outreach capacity

C. A conflict of interest?

1. Farmers objectives may be inconsistent with forestry department objectives - since the forestry department's perspective, being a government agency, is more global than an individual farmer, the sum of the parts (pursuing individual farmer's objectives) may not equal the whole (pursuing the forestry department objectives) [Note: An example can be found in Seth (1981)]

2. Forest management techniques may be inconsistent with farm and energy forest management techniques.

   a. Mono-culture long term timber crops versus short term multipurpose tree species integrated into the farm's agricultural system
   b. Large block plantations versus alternative cropping systems on small ownerships
   c. Degree of participation and involvement of people (farmers) is required in traditional forest management

D. Explanatory note:

The farm and energy forestry specialist is a professional forester who is especially trained to bring the power and the strength of the science and technology of forestry to bear upon the management of farms where one of the farm production objectives is to produce energy as a forest product. The farm and energy forester must serve in the role of a consultant to the farmer-client to assist him to use sound forestry practices in his farm management. He must, therefore know more about farm management systems and the basis for farm decisions than a forester is usually required to know. As a professional the farm and energy forester has an obligation to his farmer client and a responsibility to him. Even though farm and energy foresters serve private clients they are usually employed by government agencies. Accoringly they have responsibilities to the employing agency as well. Since government is paying for the consulting service it is to be expected that there will be a social motivation for the undertaking that may go beyond just assistance to the individual farmers. Such motivations might be to increase on farm income, increase on farm employment, reduce dependency on imported energy products, etc. The farm and energy forester may then have the additional role of a teacher or salesman or promotor of a government policy.

VII. ECONOMIC ASPECTS OF PROJECT ANALYSIS

[Note: See Gillenger (1982), Chapter 7; Gregersen and Contreras (1979); and Bruce (1979)]

A. Similarities to financial analysis

B. Differences from financial analysis

1. Identifying costs and benefits

   a. Secondary costs and benefits
      [Note: See Gittinger (1982), pp.59-61]
   b. Intangible costs and benefits
      [Note: See Gittinger (1982), pp.61-62]

2. Valuing costs and benefits

   a. Determining the premium on foreign exchange
   b. Adjusting financial prices to economic values:
      1) Direct transfer payments
      2) Price distortions
   c. Valuing intangible costs and benefits

C. Aggregating projects

VIII. CASE STUDIES IN PROJECT SUCCESSES

A. The hurri plantations in Sind [Note: See Sheikh (in press for FAO)]

B. Others [Note: Cite research and projects in Pakistan if available; if not, use case studies from other countries as examples to emphasize points to be made]

IX. CASE STUDIES IN PROJECT FAILURES

A. Problems of project design and implementation

   1. Inappropriate technology
   2. Infrastructure and support systems
   3. Failure to appreciate the social environment
   4. Administrative problems
   5. Policy environment

B. Problems of poor project analysis

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ILLUSTRATIVE TOPICS FOR TERM PAPERS AND SPECIAL PROJECTS

1. A study of fuelwood markets in Peshawar: what species are sold, the prices paid, the sources of the wood, the transportation and net-working system.

2. A study of the elasticity of fuelwood: price, income, and cross elasticity with other energy sources.

3. Determining the fuelwood rotation ages for a farm plantation with a mix of end products (fuelwood, fodder, poles).

4. A description of the existing tax system and its effects on farm forestry.

5. The financial potentiial of charcoal production in Pakistan.

6. A financial comparison of agricultural cropping systems versus block forest plantations in the Barani.

S Y L L A B U S

FARM AND ENERGY FORESTRY PLANNING

INTRODUCTION

This course is a practicum associated with the Farm and Energy Forestry Management course. Completion of the course is based upon submission of one or more management plans including, but not limited to, the material presented below. The plans are to be based on "logical" land units, which may be a single farm, several farms, or other rational land units. The plans should be analytical and prescriptive not merely descriptive.

I. CURRENT STATUS

A. Ownership/land tenure

B. Site characteristics

C. System(s) of management

D. Costs

E. Revenues

F. Farm budget

II. ANALYSIS

A. Farm management objectives and family requirements

B. Potential products, markets and prices

C. Constraints to management

1. Biological and edaphic

2. Financial/ budgeting

3. Manpower

4. Social/political

5. Legal & other

6. Institutional

D. Alternative agroforestry/field cropping systems which are technically feasible

E. Recommended cropping system(s) based on management objectives and family requirements

III. PROPOSED MANAGEMENT SCHEME

A. General description of proposed system(s)

B. Use of farm resources, e.g.:

1. Land

2. Labor

3. Capital

C. Expected yields and production rates

D. Expected costs

E. Expected Revenues

F. Proposed farm budget

G. Financial analysis

H. Economic analysis

I. Non-market and intangible benefits

IV. IMPLEMENTATION PLAN

A. Outreach assistance required

B. Financial requirements

C. Monitoring and evaluation schedule

D. Scheduling and managerial requirements

E. Other

V. SUMMARY

REFERENCE MATERIALS AND COMMENTS

1. The instructor should provide the students with illustrative plans demonstrating the type of analysis and synthesis required.

2. The Diagnosis and Design Methodoloy presented in the Agroforestry Systems Course and the MULBUD computer program introduced in the Farm and Energy Forestry Management course should be utilized where appropriate.

S Y L L A B U S

AGROFORESTRY SYSTEMS

I. INTRODUCTION

A. Explain the purpose and scope of course

B. Discuss course organization, emphasis, and subject matter in relation to silviculture, farm forestry, range management, and extension courses

C. State instructional objectives of the course:

Upon completion of this course students will be able to:

1. Understand agroforestry as a practical but evolving discipline with wide application

2. Identify, describe, and classify agroforestry systems used in Pakistan and abroad

3. Explain key agroforestry system components and interactions

4. Use the systems approach as a tool in the analysis of agroforestry practices.

5. Design or improve agroforestry systems using the "Diagnosis and Design" methodology

II. OVERVIEW OF AGROFORESTRY

A. Define agroforestry and explain its importance to both user groups and management agencies

B. Review the historical background of agroforestry

C. Clarify the purpose/role of agroforestry in relation to industrial forestry and agriculture

D. Explain agroforestry as a strategy in economic development (relate to social forestry, farm forestry, etc.)

E. Discuss the state of knowledge regarding agroforestry identify useful journals and sources of agronomic data and services

III. DEFINE AGROFORESTRY IN SYSTEMS CONTEXT

A. Introduce general systems theory and illustrate its wide application through examples in engineering, agriculture (farming systems as example), military logistics, etc.

B. Introduce forestry as a system; define components and interelationships, including, land, capital, biota, organizational infrastructure, etc.

C. Introduce agricultural systems; discuss components, interrelationships, boundaries, inputs, outputs, and resources within

D. Define agroforestry systems and contrast with traditional agriculture, range management, and forestry

E. Agroforestry systems classification by:

1. Major components

2. Temporal and spatial character

3. Function or application

IV. ECOLOGY OF AF SYSTEMS

A. Describe interactions between plant and soil components of the system

1. Site quality, spacial arrangement and rotation period

2. Competition between plant components

a. Light/shade
b. Nutrients
c. Soil water
d. Root development
e. Plant exudates

3. Complementary relationships between plant-soil component

a. N-fixation
b. Shading, microclimate modification
c. Protection: wind and water erosion
d. Soil structure enhancement
e. Weed reduction

4. Adverse relationships

a. Disease
b. Insects

B. Discuss interactions as a result of the addition of domestic animals to the plant-soil system

1. Complementary relationships

   a. Soil fertility improvement
   b. Reduction of understory competition due to browsing
   c. Increased soil micro-organisms

2. Adverse relationships

   a. Soil compaction and erosion
   b. Export of site nutrient capital
   c. Damage to reproduction

3. Influence of forest components on field crop yields

   a. Research results in Pakistan
   b. Research abroad

V. Describe and analyze illustrative types of agroforestry systems

A. Discuss currently used Pakistani agroforestry systems highlighting establishment, cultural, and harvest techniques

1. Rotation systems: (Hurri) Acacia nilotica with wheat/cotton or other cash crop on 6-year rotation (Sind)

2. Permanent tree and field crop systems:

   a. Line plantings of Populus spp., Dalbergia sisso and Euclyptus spp. along bunds of irrigated fields (Punjab, Sind and NWFP)
   b. Widely spaced Poplar, Bamboo, or fruit trees intercropped with wheat, maize, or Trifolium spp. (Punjab and NWFP)

3. Tree-pasture systems: Broad-leaved and conifer species with grass and other forage species with domestic animals (variations on a system common throughout Pakistan)

4. "Minor" forest product systems are natural forest areas producing timbers, fuelwood, and fodder in addition to:

   a. Medicinal plants
   b. Fruit
   c. Spices

5. Sericulture systems:

6. Apiculture systems:

7. Lac system:

B. Illustrate and analyze the key attributes of representative Latin American, African, and Asian agroforestry systems

1. Rotation systems, e.g., tree fallow/swidden

2. Intercropping, e.g.,

3. Permanent tree and field Crop, e.g., coffee with nurse species

4. Tree and aquatic, e.g., Mangrove and shrimp

5. Tree, forage, e.g., forest grazing

6. Miscellaneous forest products, medicinal plants, etc.

7. Kitchen gardens

VI AGROFORESTRY SYSTEMS: IMPROVING THE OLD, DESIGNING THE NEW

A. Explain land capability classifications and their application to design of agroforestry

B. Describe the Farming Systems Research (FSR) methodology explaining:

1. The farm as a system combining animal, field, tree and pastoral crops

2. Use as an analytical tool and for outreach program

3. Procedural steps:

a. Characterization and analysis of system
b. Planning and design of improvements
c. Generation/evaluation of technologies
d. Information accumulation and analysis of improved farm system
e. Re-evaluation of technology and dissemination via extension

C. Introduce the Diagnosis and Design Method (D&DM) &and explain

1. Objectives of method and design criteria

2. Use as iterative design and implementation process

3. Procedural steps:

a. Description

b. Diagnosis
c. Technology design
d. Implementation planning

3. Relationship to farming systems approach

D. Illustrate the D&D method by presenting a case study directed at improving an existing Pakistani tree/farm system.

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ILLUSTRATIVE TOPICS FOR TERM PAPERS AND SPECIAL PROJECTS

1. Describe agroforestry systems practiced in your home district and suggest alternative field crops or trees which might improve the system. If agroforestry is not common in your home district, describe systems which might be introduced and technical and/or economic barriers to doing so.

2. Review literature in the PFI library on nitrogen fixing trees and indicate which would be suitable for the various provinces. Compare the N-fixing species with local "fast" growing and/or more commercially valuable species in terms of fuel and fodder. Discuss applications to local farms and identify "trade-offs".

3. Review the the biological and commercial bases for lac or silk production and determine if these products are potentially feasible for agroforestry systems in students' home province. Describe the technical skills and level of investment required by a farmer beginning such production.

4. Visit a nearby urban market and survey commercial sales of firewood. Sample the costs and volumes/weights of firewood being sold by species. Based on published BTU values and weighted averages compare the cost of energy supplied with wood with that supplied by kerosene and electricity in the same area.

5. Review selected agroforestry systems involving both plants and animals and identify the role of the animal in terms of bio- and energy conversion and economic function.

6. Design an agroforestry system to maximize fodder production on saline soils.

S Y L L A B U S

ENERGY AS A FOREST PRODUCT

I. THE ROLE OF WOOD IN NATIONAL, REGIONAL, AND LOCAL ENERGY BUDGETS.

A. Assessment of wood based energy use

1. Domestic use

a. Per-household consumption
b. Relationship to status of household

2. Industrial use

a. Within system energy recovery
b. Market fuel

B. Inventory methods for determining wood fuel supplies (See: Bethel et al - Energy from Wood)

C. Comparison between point and non-point energy sources

1. Point sources

a. Mines
b. Oil and gas wells
c. Ports
d. Hydro-electric dams
e. Nuclear power plants

2. Non-point sources

a. Forests
b. Farms
c. Municipal sewage and waste disposal sites

3. Comparison of the logistics of distribution

D. Alternative sources of energy

E. Alternative uses of wood

II. DEVELOPING AN ENERGY BUDGET

A. Units of measure and conversion
[Note: See Tillman (1978) and de Montalembert and Clement (1983)]

B. Tree materials balance
[Note: See Bethel et al (1979), Koch (1972), and Tillman et al (1981)]

C. Forest materials balance

III. WOOD AS A FUEL

A. Forms of wood based fuel

1. Solid wood
2. Charcoal
3. Wood gas
4. Liquified wood

B. Heat of combustion of wood fuels

1. Definition: Heat of combustion is the quantity of heat evolved by the complete combustion of a unit mass of substance in an enclosure of constant volume. As used in this course, it is the total amount of heat obtainable from oven dry material, allowing no deductions for heat losses. The heat of combustion is typically referred to in the literature as the higher heating value.

2. The processes of combustion
[Note: See Koch (1972)]

   a. Heating and drying
   b. Solid particle pyrolysis
   c. Gas phase pyrolysis and oxidation
   d. Char oxidation

3. Factors influencing the difference between HHV and LHV

   a. Enthalpy of the fuel
   b. Moisture content of the fuel
   c. Level of excess air employed
   d. Final stack temperature

4. Wood fuels and components
   [Note: See Koch (1972)]

   a. Resin
   b. Charcoal
   c. Wood gas
   d. Methanol
   e. Decay resistant knots
   f. Needles
   g. Mixed bark
   h. Stemwood
   i. Tops
   j. Old Cones
   k. Kraft black liquor
   l. Hogged fuel

2. Competitive fossil fuels
   [Note: See Tillman (1978) and de Montalembert and Clement (1983)]

   a. Bituminous coal
   b. Anthracite coal
   c. Petroleum
   d. Natural gas

3. Other biomass fuels
   [Note: See Tillman (1978)]

   a. Raw sewage
   b. Sewage sludge
   c. Animal waste
   d. Bagasse
   e. Rice hulls
   f. Rice straw

IV. Wood fuel utilization
    [Note: See Bethel et al (1979)]

A. Favorable factors influencing the use of wood as a fuel

1. Burns without major toxic emissions

2. Widely distributed geographically

3. Can be used as a fuel in solid, liquid, or gaseous form

4. A feasible way of using solar energy as an energy source on a on a large scale

5. Maintains product flexibility from forest systems

6. Provides a convenient way of storing energy for futu use

7. Forest fuels are renewable

B. Unfavorable factors influencing the use of wood as a fuel

1. Wood has a low heat value to weight ratio as compare with fossil fuels

2. Wood has a substantial moisture content as it comes from the forest

3. Geographical dispersion makes collection expensive

4. Wood emits moderate quantities of particulates and water vapor under usual combustion conditions

C. Domestic use of wood as a fuel

1. Efficient stove design

2. Cultural preferences for fuel form, e.g., solid wood vs charcoal

D. Industrial use

1. Heating and drying

2. Steel manufacture

3. Lime kilns

4. Electrical generation

5. Co-generation

E. Sources of wood fuel
[Note: See Bethel et al (1979) and Tillman (1978)]

1. Industrial residues

2. Logging residues

3. Forest residues

4. Exploitation of natural forests

5. Production on managed forests

V. PRODUCTION OF DERIVATIVE WOOD FUELS

A. Charcoal

[Note: See de Montalembert and Clement (1983 and Mayer (1974)]

1. Conversion of wood into charcoal

    a. Drying
    b. Heating
    c. Carbonization or pyrolysis

2. Charcoal properties

    a. Yield
    b. Specific gravity
    c. Volatile matter
    d. Fixed carbon content
    e. Calorific value
    f. Ash content
    g. Minor elements

3. Charcoal production processes

    a. Pit charcoal
    b. Metal kilns
    c. Brick kilns
    d. Carbonization schedules
    e. Carbonization control

B. Wood Gasification

[Note: See Tillman (1978)]

1. Gasification involves producing a low or medium BTU gas by pyrolysis plus water-gas shift reactions

2. Gasification reactors

    a. Fixed
    b. Entrained
    c. Fluidized bed

3. Wood gasification reactions

C. Wood liquification (See: Tillman -

[Note: See Tillman (1978)]

1. Liquification is the conversion of wood to liquid fuel

2. Forms of wood based liquid fuel

    a. Methanol

b. Heavy oil
c. Light oil

D. Comparison of the fuel values of wood, gas, and methane

VI. THE COST OF WOOD FUEL

A. Assignment of residue costs

B. Wood production costs

C. Harvesting costs

D. Transportation costs

E. Processing costs

VII. Marketing wood fuel

A. Non-market industrial use

B. Non-market domestic use

C. Urban fuel markets

D. Rural fuel markets

E. Fuel prices and pricing policy

F. Fuel and forest welfare

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ILLUSTRATIVE TOPICS FOR TERM PAPERS AND SPECIAL PROJECTS

1. Develop an energy budget for a case-study village and contiguous rural area.

2. Compare the cost per delivered calorie of solid wood fuel and charcoal offered for sale at a case-study village market.

3. Compare Shisham, Chir pine and Acacia nilotica as fuels.

4. Describe co-generation and evaluate it based upon solid wood fuel as an integrated energy source for a case-study village.

5. Develop and propose a methodology for estimating the consumption of wood fuel in Pakistan.

S Y L L A B U S

COMPUTATIONAL METHODS AND MODELS IN FORESTRY

This course introduces the student to computers and their applications in the analysis of forestry data. The configuration and functional organization of a computer system is explained. Emphasis is on the use of microcomputer systems since these are generally more useful than main frame systems in organizations as dispersed as forestry organizations. Students are introduced to computer logic and to elementary programming in the BASIC language. Software packages useful in forestry are discussed including spreadsheets, word processing, and data base programs. Included too are presentations of the methods of systems analysis including linear programming with allocation and transportation models, simulation models, and network models. The course is presented using forestry applications and examples.

AN INTRODUCTION TO COMPUTIONAL SYSTEMS

A. Electronic calculators

B. Digital computers - the hardware

1. Input/output devices

2. Central processing units

3. Storage systems

a. Internal memory
b. Disc storage
c. Tape storage

4. Output systems

a. Visual display (CRT, LCS)
b. Printers

C. Digital computers-the software

1. Internal software - (ROM)

2. External software - (RAM)

D. Computer Logic

1. Algorithms
2. Flow charts and their use

II. STANDARD SOFTWARE PACKAGES AND THEIR USE

A. The use of pre-programmed analytical systems

B. The most important general purpose pre-programmed analytical systems

1. Spread sheets

a. The concept of the electronic work sheet
b. Cells and cell entries
c. Commands
d. Cell Ranges
e. Formulas
f. Functions
g. Graphics
h. Output

2. Data bases

a. The special uses of data bases
b. Organizing bodies of data
c. Computations
d. Display

3. Word processors

a. Electronic processing of documents
b. Formatting
c. Input
d. Editing
e. Spelling
f. Addressing
g. Output

4. Statistical packages

a. Input
b. Data manipulations
c. Statistics
d. Graphs and charts
e. Print outs

III. PROGRAMMING IN BASIC

A. Program file management

1. Directories

2. Get/retrieve

3. Save

4. Display (list)

5. Print

6. Erasing a program

B. Programming statements

1. Let

2. Input

3. Delete

4. Remarks

5. List

6. End

C. Variables

1. Strings

2. Numbers

a. Scientific notation
b. Single precision
c. Double precision
d. Integers

D. Expressions and operators

1. Arithmetic operators

2. Relational operators

3. Logical operators

4. Functional operators

E. File operations

1. File names

2. Data files

a. Sequential files
b. Random access files

c. File protection

F. Loops

G. Decision statements, "if" and "on"

H. Sub-routines and their uses; GOSUB,GOTO

IV. OPERATIONS RESEARCH MODELS

A. The types of Operations Research models and their uses

1. Inventory
2. Replacement
3. Queing
4. Competitive strategies
5. Allocation
6. Sequencing
7. Goal programming
8. Dynamic programming
9. Network
10. Simulation

B. Linear programming

1. Linear programming as an optimization model
2. Definition of linear programming including its limitations
3. The kinds of linear programming problems
   a. Assignment
   b. Transportation
   c. Simplex
4. Graphical solution to a simple linear programming problem
5. Algabraic solution to a simple linear programming problem
6. Review of matrices and matrix manipulation
7. Examples of forestry applications of linear programming with special reference to farm forestry examples

8. The use of a packaged linear programming algorithm and pre-programmed package

C. Simulation

1. Simulation as a decision making model

2. Process description

3. Deterministic models

4. Probabilistic models

   a. Known probability distribution
   b. Monte Carlo sampling

5. Examples of forestry applications of simulation models with special reference to farm forestry operations

6. The use of packaged simulation and pre-programmed packages

D. Network models

1. PERT

2. Reference materials systems

TEXTBOOKS AND REFERENCES

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ILLUSTRATIVE TOPICS FOR TERM PAPERS AND SPECIAL PROJECTS

1. Develop a deterministic simulation model representative of Hurries production including fuelwood and mine props as outputs. Produce a flow chart and a BASIC program for the model and a sample run.

2. Develop an inventory model for the supply of planting stock to a farm forestry program from a nursery using Monte Carlo sampling. Program and run the model.

3. Design a database for farm forestry plantations in a forest district.

4. Use linear programming to model a small farm. Limit the model to four constraints and four activities. Demonstrate the solution algebraically and graphically.

5. Using a reference materials system (RMS), make a model of a small farm as a producer of food and fiber commodities.

COURSE ANNOTATION

AN INTRODUCTION TO COMPUTATIONAL SYSTEMS

Explain and demonstrate the use of a basic electronic calculation system beginning with an electronic calculator and moving to a micro-computer. What are the major components of a computer; i.e., the key-board for entering information into the system, the CPU with its internal ROM memory and its manipulative capability, the external storage devices and methodology - including tapes and discs, and the output devices both visual and printer.

The introduction should leave the student with some feel for the idea of a computer as a device for storing information and instructions for manipulating that information to achieve the desired results and, finally, to present the results in a form that is reasonably easy to interpret.

An algorithm is an explicit set of instructions detailing the steps by which a problem is to be solved. The student must understand that, unlike an exercise in manual calculation, there is no place for an implicit instruction in a computer algorithm. An example of a very simple algorithm:

1. Select two numbers
2. Place them in locations called "x" and "y"
3. Multiply the contents of "x" and "y" and place the product in a location called "Z"
4. Display "Z"
5. Print "Z"
6. Stop

Note that algorthms can become more complex involving repetitive and successive operations and intermediate results. They may involve decisions in which one set of instructions is followed under one set of circumstances and another set under a second set of circumstances.

Examples of simple algorithms can be developed from such simple forestry problems as calculating the volume of a log or creating a stand table.

The conventions of flow charts should be explained so that algorithms can be displayed in an easily understandable form.

II. STANDARD SOFTWEAR PACKAGES AND THEIR USE.

Many computer programs are very long, elaborate, and complex. If they are used frequently, they are often designed to be quite efficient in terms of the time required to run them and to obtain the results of their use. If they represent general service data manipulation of a kind that is likely to be engaged in by many people, the original programmer may make them available to other users gratis or through sale. This precludes the need for each user to "re-invent the wheel" and duplicate the programming. Such packaged programs may be quite general, such as statistical packages that calculate means and standard deviations, make least square fits of regression lines or make an analysis of variance, or they may be quite sector specific, such as forest stand simulation models or sawmill yield computation models. Packaged programs are often designed to be user friendly and can be used effectively by people who are not knowledgable about creating their own programs.

Students should be introduced to some standard general purpose pre-programmed analytical systems, including spread sheets, data bases, word processors, and statistical packages, that are adaptable to the computer system available to them, and given "hands on" experience with their use.

III. PROGRAMMING IN BASIC

The object of this portion of the course is not to produce a sophisticated programmer, but to permit the student to understand what programming is all about and to get a feel for what happens when he uses a packaged program. In addition, he is given the capability to produce a simple special program for his own use. This portion of the course should also lay the groundwork for future instruction in more elaborate programming perhaps using other higher programming languages or machine language.

The course should follow one of the many good BASIC texts plus the instruction manual for the BASIC interpreter or compiler appropriate to the computer system available to the course.

IV. OPERATIONS RESEARCH MODELS

Operations research methods have been developed for the most part during the past forty years. They have been found to be very useful in guiding managers to the making of rational decisions. In general they portray the operation being managed in over simplified terms, but if the important factors to be considered are included and their inter-relationships properly defined these models can be very useful in

decision making. They permit the manager to assess the consequences of different decisions without actually conducting the operation; thus, they save the time and money involved in actually doing the operation in a number of different ways. Most real world operations are quite complex and operations research models cannot portray them in all details. If it were possible to do this, it probably would not be worthwhile. It is important to define the model in terms of the decision points that are real and operative and to realize its limitations.

The various kinds of operations research models should be reviewed so that they can be compared and evaluated for forestry applications. The operations research models that have been most widely used in forestry have been the linear programming and simulation models. Dynamic programming, goal programming, and network models have been used as well, but less frequently, and the others rather rarely up to this time.

Linear programming is presented as an optimization model in either a maximization or minimization mode. A very simple allocation model can be set up involving a 4 x 4 square matrix. The problem can be solved graphically with ease yielding a maximum or minimum solution. The same problem can be solved algabraically.

The students should then be led through some of the conventional computational algorithms, such as the "stepping stone" method and the "northwest corner method". The Bethel and Harrell paper provides a step by step description of a manual solution to a transportation model and a simplex model of about the largest size one would want to do manually. The simplex example is an adaptation of the classical "nut mix" problem of Charnes, Cooper and, Henderson to the scheduling of products through a hardwood plywood factory.

Pre-programmed linear programming packages then permit the students to formulate much larger problems than are feasible for manual solution and to run them on the computer. Some of the examples of the use of linear programming in the management of forestry enterprises ought to be studied in some detail and some run through the computer program to duplicate the solution.

A very simple deterministic simulation model can be devised, portrayed manually, and solved using small programmable calculators. One based upon an assumed height/ diameter and form class relationship for trees can be easily devised and run for a variety of growth rates. This model can then be converted to a probabilistic model by adding the notion of a variance to the height/diameter relationship and utilizing a random number generator.

Where the nature of inter- factor relationships cannot be expressed precisely in mathematical terms, the use of Monte Carlo methods of sampling can be introduced.

Pre-programmed simulation models dealing with specific forestry applications can be obtained and run as laboratory examples. Students

should become aware of some of the more important large- scale forestr
simulation programs.

Most network models applied to forestry are relatively simple a
examples of PERT, Critical Path (CPM), and RMS can be presented and ru

BEST AVAILABLE DOCUMENT

S Y L L A B U S

RURAL SOCIOLOGY

This course is constructed on the assumption that the field of rural sociology is of direct relevance to the practice of social forestry, especially to farm and energy forestry and community forestry. It is assumed, that is, that rural sociology represents neither an "add-on" nor "window-dressing" in the forestry curriculum, but that it is every bit as integral to the curriculum as such non-forest fields as, for example, statistics or computer science. In saying this, it should be pointed out that rural sociology is by both its areal focus (rural parts of the developing world) and topical focus (development and modernization) far more relevant to the concerns of forestry than is the field of sociology *per se*, which is more oriented towards urban areas, the developed nations, and theory.

The direct aim of this course is to acquaint the M.Sc. level forestry student with discrete areas of research in rural sociology and anthropology that are likely to be relevant to the work that he engages in after graduating from the PFI. The intention is to give the student a sufficient introduction to each area so that he can employ the research principles involved in his work or, at a minimum, so that he will understand where they could be employed and will be able to summon specialists in these fields as required.

OVERVIEW OF THE COURSE AND OF RURAL SOCIOLOGY

A. The type of technology available to a society affects the ways that it utilizes its natural resources.

B. The type of social structure that a society has also affects the way it uses its natural resources.

C. Societies in the developed western world tend to perceive man as in opposition to nature, while societies in the less developed third world tend to perceive of man as a part of nature.

II. RESEARCH METHODS

A. Rapid Rural Appraisal

1. Most development officials visit the rural areas as 'tourists'.

2. Their visits are biased in terms of where they go, when they go, what they see, and with whom they talk.

3. These biases can be offset by taking more time, leaving the roads and vip treatment behind, listening instead of talking, etc.

B. Surveys

1. Surveys typically face problems of logistics, mobility of respondents, lack of knowledge of ages and dates, and reluctance to give personal information.

2. These problems can be solved by the following means:

   a. Studying a single community intensively, as opposed to a broad region superficially;
   b. Using written records, sibling order, and peer grouping to calculate ages;
   c. Using data from one informant as a cross-check on the data from another;
   d. Using villagers as opposed to outsiders as interviewers; and
   e. Compensating all respondents with small gifts.

3. Agricultural Surveys

   a. Brief informal surveys can yield data that are as reliable, or even more reliable, than those obtained from formal questionnaire surveys.
   b. The first step involves studying secondary data, isolating the problem areas, and formulating questions for the farmer.
   c. The second step involves holding a conversation with the farmer in an informal way in a relaxed, natural setting.

III. RURAL SOCIAL STRUCTURE

A. Gender

1. Women's work does not necessarily decline as household income rises.

2. Increased agricultural yields may result in a decline or rise in the amount of women's work.

3. Rural Pakistani women in general have a low self-image.

4. Increasing specialization and mechanization of agriculture has led to a smaller role for women in agriculture.

5. Despite this smaller role, women still participate in major agricultural decision-making.

B. Demography

1. In systems of agriculture employing draught animals, the cultivable area usually is limited by the need to fallow most land for grazing.

2. Farmers will not plant fodder crops until population/land pressure eliminates sources of natural fodder.

3. Intensification of agricultural practices - e.g., irrigation - usually causes output per unit of area to rise, but output per unit of labor may drop.

4. Farmers usually are aware of techniques for intensifying agriculture but do not use them - because they cause output per unit of labor to drop - until population/land pressure forces them to.

C. Politics

1. The attempt to build a government road into the Waigal valley provides insight into the political structure of its inhabitants.

2. The road was seen by each man of influence in the valley as an opportunity to increase his power and diminish the power of his rivals.

3. Men supported or opposed the plans to build the road, accordingly, based entirely on whether their rivals opposed or supported it, respectively.

IV. RURAL BELIEF SYSTEMS

A. Folk Views

1. A symbolic analysis of the indigenous agronomy of the Punjab reveals it to be systemic, coherent, and empirically based.

2. Punjabi farmers analyze crop growth in terms of a umoral system of hot and cold (referring to the expenditure and conservation of energy, respectively) and wet and dry (referring to the receptivity and resistance of matter, respectively).

3. They view traditional crop varieties as being cooler and wetter, compared with new high-yielding varieties, which they view as hotter and dryer.

4. Therefore, emphasizing cool and wet qualities in development inputs is likely to increase the receptivity of farmers to them.

B. Religious Views

1. Perspectives from the Holy Quran and Bible

   a. Holy Quran
      1) There are references in the Holy Quran to the flowing of irrigation water underground, to the sacredness and blessedness of trees, and to the growing of trees in enclosed gardens.
      2) These references reflect the ecological context in which Islam developed, namely in a desert environment.

   b. Holy Bible
      1) Every image or metaphor in the old testament storyof the Garden of Eden must have some basis in the factual life of the ancient world.
      2) The story of the Garden of Eden is basically a story about plant life.
         a) It probably was a jungle in ancient India.
         b) The story of the Garden reflects the dangers of poisonous fruit and snakes in the jungle.
         c) Man's departure from Eden probably represents a migration from the jungles of ancient India to the deserts and swamps of the Euphrates

Delta, and a change from gathering wild fruits to growing food crops.

2. Functional Analyses

a. The Hindu institution of sacred cattle should be studied not as a dysfunctional superstition, but as a functional adaptation to the environment.
b. The economic benefits of the cattle include: milk, drought power in agriculture, dung for fuel, meat and skins for non-Hindus, and even nonworking and nonlactating animals can provide male calves.
c. The cattle feed on agricultural by-products and scattered grasses that would otherwise not be utilized.
d. Because of their sacred status, cattle belonging to the poor can graze on the lands of the rich with impunity.
e. While slaughtering is banned, farmers in fact still cull their herds through selective starving/neglecting of their animals.

3. Scientific Views

1. Tree Species

a. There is a debate in the subcontinent over whether the large-scale planting of Eucalypts is damaging to the environment or not.
b. The empirical data available do not substantiate any of nine separate criticisms commonly made of Eucalypts.
c. Where proper land and water surveys are carried out, and suitable Eucalypt species are selected and matched to the sites, no ecological damage will result from their planting.

2. Reforestation

a. Reforestation/afforestation of open lands causes the water table to drop.
b. Reforestation causes a decrease in stream flows, especially during the dry season.
c. Reforestation cannot prevent flooding over large river basins, as its impact on storm flows is localized.
d. One proven benefit of reforestation is to reduce erosion and sedimentation, providing that roads and firebreaks (etc.) are carefully engineered so as to minimize their negative impacts.

V. RURAL ECONOMICS

A. Adaptation

1. Floods are beneficial or destructive depending not only upon their height, but also their timing and duration.

2. Farmers adapt to the possibility of destructive floods through intercropping and risk minimizing strategies.

B. Risk Taking

1. Village institutions are resistant to change because they have proven to be successful and because they form the constituent parts of a single system.

2. The question remains as to whether subsistence farmers are responsive to economic opportunities.

3. We must recognize that all peasant farmers have to deal with critical variation in yields, costs, and market prices.

4. Peasants accept innovation only when the expected increase in yield exceeds the expected increase in costs, and when they are assured of at least meeting their subsistence needs.

5. Resistance to innovation is reinforced by a con-concentration on food crops, the nonavailability of other food sources, and high interest rates.

6. Development planners should provide more information on the new technologies and on the average yields to be expected, they should increase the dependability of the new technologies and provide some form of risk insurance.

C. Innovation

1. The general view of traditional agriculture is that it is necessarily very conservative.

2. In fact, peasant farmers do not act uniformly, each one makes his own decisions.

3. Also, while they avoid risk-taking, they do not avoid experimentation.

4. Experimentation with crops, techniques, and even institutions is the rule in traditional agriculture.

5. Traditionalism is not, therefore, an obstacle to change.

D. Intensification and Investment

1. Little under systems of extensive, long fallow cultivation.

2. Under these systems, there are lengthy 'dead seasons' every year in which there is no agricultural work.

3. Intensification of cultivation techniques raises labor requirements and may eliminate the 'dead seasons.'

4. During intensification, the labor inputs required increase at a faster rate than the increase in outputs.

5. Farmers adhere to traditional agricultural techniques for economic reasons, not ignorance.

6. There are often rational grounds for rejecting new intensive agricultural techniques, namely that the increased yield is not in proportion to the increased labor.

7. In fact, there is often no genuine economic incentive to intensify agricultural labor.

VI. RURAL RESOURCE MANAGEMENT

A. ECOLOGY

1. The Relationship Between Man and Vegetation

a. The use of fire in shifting cultivation causes forest to succeed to grassland succession, which can only be cultivated by more intensive agricultural techniques.
b. Fire is also used to manage grazing lands.
c. The use of fire for these purposes has led to forest-grassland succession (and in some cases desertification) all over the world.
d. Some tropical grasslands may be natural, however, as opposed to man-made.

e. Religious beliefs are responsible for preserving many of the few remaining patches of forest in the tropical grassland regions.

2. The Relationship Between Man and Animals

a. The natural vegetation of India has been greatly altered by the use of fire in shifting cultivation.
b. The resultant savanna forest is an ideal habitat for gaur.
c. Hence, man and gaur live in a symbiotic relationship.
d. The gaur population in India has also been protected by the concentration of the human population in villages and by the existence of religious taboos on meat consumption.

3. The Relationship Between Human Groups

a. The relations between different tribes can be analyzed using niche theory from ecology.
b. The institution of men's houses in Pathan society demands that they produce an agricultural surplus.
c. The Pathans are accordingly restricted to the lower elevations of Swat valley, where double-cropping is possible.
d. The Pathans therefore allow Kohistani farmers-herders to exploit the higher elevations of the valley where double-cropping is not possible.
e They also allow Gujar herders to seasonally exploit nonarable land in the lower part of the valley.
f. Thus, different ethnic groups can occupy the same area only if they exploit different niches within it.

B. Organization - Irrigation

1. Pakistan has the largest integrated system of irrigation in the world, but its efficiency of use and productivity are very low.

2. All of the development projects designed to remedy this situation have ignored the social, cultural, and economic contexts of irrigation.

3. A major source of the technical problems with Pakistan's irrigation system is poor management at the local level - and this has a social origin.

4. The Punjabi (e.g.) value of izzat encourages social conflict, not the cooperation that is necessary to efficient community management of irrigation.

C. Politics - Forests

1. Intra-Village Issues

a. Different classes of households use different types and sources of fuel.
b. It is only the most economically and socially disadvantaged households that must purchase fuel from the marketplace.
c. With modernization and development, traditional exploitative relationships of a feudal and patriarchal sort are being replaced by exploitative relationships ofa direct and unqualified sort.
d. As a result of these changes, the availability of crop residues to the poor for fuel is declining.
e. "Apolitical" development analyses, which focus on aggregate energy supply and demand, ignore the fact that the distribution of rural energy supplies is not in fact equitable and are, therefore, inimical to the interests of the rural poor.

2. Village-State Issues

a. The cooperative relations between the forest department and commercial timber merchants contrast with adversarial relations between the forest department and the rural poor.
b. Local elites break the forest laws to make money, and they protect themselves by means of "gratuities" to the officials concerned.
c. The rural poor must often break the forest laws just to fulfill subsistence needs, but they too must protect themselves by means of "gratuities."

D. Tenure - General

1. In long fallow systems of cultivation, all members of the tribe have general rights to its territory, and each family has specific use rights to certain parts of the territory.

2. Under both short and long fallow systems of cultivation, fallowed land is usually free for

grazing; but this becomes a source of conflict as population increases and agriculture intensifies.

3. So-called 'feudal landlords' usually do not own the land, they just own the right to collect taxes and govern the farmers.

4. Colonial governments created problems by misperceiving the administrative rights of tribal chiefs and feudal lords as proprietary rights.

E. Tenure - Communal

1. Problems

a. The so-called tragedy of the commons is based on the general law that the individual will overexploit the commons because the benefits of this to him exceed the costs; but when everyone does it, the costs to society as a whole exceed the benefits.
b. The only way to deal with this law is for society to coerce the individual.
c. This concept applies not just to land use but to all areas of human behavior, including family planning.

2. Benefits

a. The birth-survival ratios and the returns per animal-rupee are higher in traditional tribal areas than in modernizing areas.
b. The institution of closing periods in the traditional areas gives vegetation a chance to recover after each period of grazing.
c. The emphasis on goats (for subsistence) in the traditional areas is easier on the ranges than the emphasis on sheep (for market) in the modernizing areas.
d. The heavier consumption of livestock in the traditional areas for taxes and ceremonial purposes keeps herd densities low.

3. Changes

a. The advantage of livestock in this arid region is that they are mobile and thus less susceptible to the adverse impact of localized droughts.
b. In order to ensure the unrestricted mobility of livestock, common ownership of rangeler developed.
c. Under government land reform, this system of ownership and the traditional system of re-

source management that accompanied it were eliminated.

d. This has led to overexploitation and deterioration in the quality of the ranges, and to a concentration of holdings among the wealthy.

e. Another consequence has been a reduction in the size of herds, hence raising costs and reducing this region's comparative advantage in animal husbandry.

VII. MODERNIZATION AND DEVELOPMENT

A. Problems With Progress

1. General

a. The costs of joining the world economy may exceed the benefits for many tribal and peasant peoples.

b. A rise in the economic standard of living is often accompanied by a decline in the quality of living.

c. Development of the economy can promote such diseases as hypertension, and development of the environment can promote such diseases as malaria and schistosomiasis.

d. The change in diet that accompanies modernization usually results in a lowering of nutritional standards, and an increase in such diet-related diseases as dental caries.

e. The introduction of new technology, higher rates of consumption, lower rates of mortality, and the elimination of traditional controls disrupt the traditional balance between population and natural resources.

2. Subcontinent

a. Reactions to Innovation

1) Villagers will reject any innovation that makes them look prosperous, because that makes their neighbors jealous and attracts the attention of unscrupulous officials.

a) Accordingly, the villagers like shabby walls and old clothes as a means of disguising their wealth.

b) If they are coerced into accepting an innovation, they will reject it as soon as the coercer leaves the village.

2) Their experience is that all outsiders who come to their village desire only to cheat them.

b. Change produces stress
   1) Modernization requires a transition from:
      a) A monsoon cycle to an irrigated agricultural cycle;
      b) The idea of propitiating nature to controlling nature;
      c) The joint family to the nuclear family;
      d) The valuation of large families to family planning; and
      e) From the image of the leader as advocate to the leader as organizer.
   2) The aspects of village life most vulnerable to stress and change are:
      a) The close relations of the family;
      b) The orientation towards community as opposed to self;
      c) The traditional class structure;
      d) The traditional authority of the village elders; and
      e) The traditional position of women.

B. Agricultural Development

1. The Green Revolution has produced more food in Kerala, but it has not met human needs.

2. The rural poor can be fed only by increasing the use of labor in agriculture, whereas current trends are in the opposite direction.

3. The argument is made against land reform, that it would result in uneconomical fragmentation of land, is belied by the fact that small plots are usually more productive than large ones.

C. Ad Hoc Solutions

1. This case study illustrates the dangers of trying to come up with a developmental solution too quickly, of the over fascination with technology, and of the expectation failure.

2. But even technological success can result in socio-political disaster.

3. One-shot infusions of 'help' to the villages are not likely to do much good, and they are very likely to do some harm.

VIII. SOCIOLOGICAL FORESTRY

A. Traditional Farm Forestry

1. The main constraints to farm forestry have been assumed to be lack of seedlings and technical knowledge, ignoring such issues as land tenure, the size of holdings, availability of labor, and so on.

2. The size of home gardens in Kerala is declining, as is the number of different tree species planted in them; but the cropping intensity and density is increasing, as is the proportion of multiple-purpose species planted.

3. However, where agriculture is greatly intensifying, with heavy capital inputs, the value of even multiple purpose trees is being eclipsed by food crops and they are being cut down.

4. A transition is taking place from intensively managed and home gardens of multiple purpose tree species to intensively managed commercial farms - which are neither ecologically stable, nor socially or economically desirable.

5. Social forestry programs should be used to improve the traditional home gardens and protect them from the vagaries of the marketplace; current programs view trees in isolation and so cannot do this.

B. Sociological Issues

1. Farmers living at poverty levels cannot be expected to cooperate with, much less make sacrifices for, development programs.

2. The involvement of village women, who are primarily responsible for gathering and using fuelwood, has been a major factor in the success of some community forestry programs.

3. Many community forestry projects, however, have been primarily commercial, benefitting the large farmers and the paper/pulp/pole industries.

4. The key to successful community forestry projects is a bottom-up design, local participation, and a focus not on the number of trees planted but on the welfare of the people.

5. Even where trees have been a free good in the past, villagers see them as a valuable enough resource that they are usually willing to devote land, labor and capital to their cultivation.

a. However, land, labor, and water are still scarce resources for which any afforestation scheme must compete.
b. Consideration also must be given to how any afforestation scheme will both affect and be affected by local socio-economic stratification.

6. A new type of training for foresters is needed to enable them to deal with these sorts of issues.

C. Sociological Inputs

1. In Project Design

a. Past agroforestry projects failed because they focussed on state land and marginal land, selected fruit trees and slow growing species, used poor nursery techniques, and funneled all funds through the government.
b. What is needed is a focus on economics not ecology, involving the concept of cash cropping wood, within the context of existing systems of land use and tenure.
c. This project focussed on intercropped fast-growing wood trees, planted through formal contract with the farmers, going through Non-Governmental Organizations (NGO) and local motivators not the government - and it was highly successful.

2. In Farm Trials

a. Existing agricultural systems are time-tested, and farmers will not change them unless they can be sure that the replacement is not risky.
b. Scientists and extension workers tend to work with elite male farmers living in prosperous villages near roads.
c. The farmer is the local expert and he should be the teacher, while the visiting scientist should be the student.
d. It is easier to adapt a new technology to a complex farming system, than to try to persuade the farmers to adapt their system to the new technology.

3. In Mid-Project

a. This project planted trees on shamlat lands in Azad Kashmir, in the expectation that they

would largely benefit the community's smaller farmers.

b. In fact, while the shamlat land was de jure community land, it was de facto controlled by the wealthiest families in the community, who thus reaped all of the benefits.

c. The small farmers were the most willing to use some of their own funds to participate in the project, but they worried that they might lose their lands to the forest department.

d. The wealthy farmers did not worry that they would lose their lands to the government, but they were the least willing to use any of their own funds to participate.

e. The first lesson of the project is that formal legal land regulations cannot be assumed to reflect reality.

f. The second lesson is that a written contract is needed between the forest department and each farmer participating in such a project.

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ILLUSTRATIVE TOPICS FOR TERM PAPERS AND SPECIAL PROJECTS

Each student will carry out the following three field exercises, in the context of, and in fulfillment of course requirements for, 'Farm and Energy Forestry Management.'

1. Interview a farmer (or group of farmers) on his attitudes regarding the impact of trees on the growth of food crops; and then write up in coherent fashion, utilizing local terms where appropriate, and including your explanation of why the farmer believes what he believes.

2. Map out the location of every tree growing on a small farm, then interview the farm owner regarding why and when each tree (or grove) was planted, where the planting stock came from, and what the tree has been used for since - then write up in coherent fashion.

3. Follow one working farmer (not non-working landlord) around his farm from dawn until dusk and make a record of each type of work that the farmer does, and how long (in minutes/hours) he devotes to it; then write up in coherent fashion, including your description of any difficulties that you encountered in carrying this out.

COURSE ANNOTATION

I. INTRODUCTION

The aim of this course is not to give the student an 'overview' of all aspects of this field, or of the fruits of its practice in all parts of the world. Such an aim would be practical only if this course were the first in a series of courses available in this subject area, or if its aim was to contribute to the student's 'liberal arts' background.

However, since this is the only course in sociology, rural sociology, or anthropology that the student will receive, and since the course (like the degree program itself) is service-oriented, the aim of the course must be to provide the student with concrete examples of the ways in which this field of study will help him to practice his profession.

II. STRUCTURE AND CONTENT OF THE COURSE

These aims are best attained by presenting the student with case studies of recent research in this field. Each case study presented will illustrate the current state of research in a particular problem area, illustrated by the use of descriptive data from a specific rural area.

It would have been ideal if all or most of the problem areas in these case studies involved forestry. Unfortunately, this is not the case, due to the rarity of such studies (which, in turn, is due to the relative recency of collaboration between forestry and rural sociology). It was, however, possible to include a few case studies on forestry, and quite a few on the related fields of rural economics, ecology, and resource management.

It would also have been ideal if all of these case studies were located in Pakistan, given that rural sociology is a locale-specific science. The socio-cultural factors that affect forestry in rural Pakistan are very different from those affecting forestry in rural Tanzania (e.g.), and so the content of a course on rural sociology in the former must be (at least in large part) specific to its own socio-cultural context. Again, unfortunately, it was not possible to completely realize this ideal (due, again, to the recency of this field of study in Pakistan). However, although it was necessary to take many studies from outside of Pakistan, it was possible to limit most of them to the countries bordering Pakistan, thereby ensuring the relevance and intelligibility of the case studies to the Pakistani student. (In a few cases, the focus on the subcontinent was relaxed in order to include unusually influential studies from elsewhere in the world.)

Among the studies from within Pakistan, an unusually large number concern frontier areas and the tribal peoples. This is not the function of a desire to focus the course on these areas or peoples, but simply reflects the fact that an unusually large number of the rural sociologists and anthropologists who have worked in Pakistan have studied frontier tribal groups.

III. THE LECTURES AND READINGS

The course contains a total of 37 discrete lecture topics, to which a total of 45 classroom hours have been allocated, for a total of 75 marks. The lecture topics are arranged in such a way as to provide a logical introduction to the field of rural sociology. Thus, just as research begins with methodology, so will this be the subject of the first lectures (following a brief introduction to the course and then the field). The succeeding lectures will deal with the general topics of rural social structure and belief systems, proceeding then to topics of greater relevance to foresters, rural economics and resource management, and then finishing with those topics of most immediate relevance, modernization/development and sociological forestry.

Each problem area or case study will be introduced to the student by the teacher with a 5-10 minute lecture on the general theory that applies to this area. The teacher will then devote the remaining and major part of that lecture to a discussion of the one or more required readings for that topic. As many as possible of the readings are taken from recently published, peer reviewed journals or books - and, consequently, they can be taken to represent the state-of-the-art in research in this field. One or more recommended readings - which explore the ethnography or theory in greater detail - are also listed for most of the problem areas.

IV. COURSE DEVELOPMENT

The lecture topics and readings that have been selected for this course are the most relevant and timely that are now available. However, this does not mean that they will still be the most relevant and timely in ten years, five years, or even one year from now. As the topical foci of the field change and, in particular, as case studies and readings that are more directly relevant (whether in topical focus or geographical area) to the concerns of this course appear, they should be incorporated into it - through excising material that has become comparatively less relevant. For example, on the topic of 'Adaptation' (Part IV.1), if a case study is published next year that details the indigenous ways in which peasants adapt to the threat of flooding to tree plantings in the Punjab, then that study should definitely be added to this curriculum - with the current case study on adaptation to the threat of flooding to food crops in Bangladesh being either dropped or made into a recommended reading. The individual case studies or

readings in this curriculum should not be inviolate, therefore. They should be susceptible to replacement in accordance with the development of the field.

V. OUTLINE OF LECTURES

A. Overview of the Course and Rural Sociology (2 hours)

Required Reading: "Cultural Differences in the Interpretation of Natural Resources." In Thomas (1956), pp. 93 - 102.

B. Research Methods

1. Rapid Rural Appraisal (1 hour)

Required Reading: Chambers (1979).

2. Surveys (1 hour)

Required Reading: "Truths and Untruths in Village Haiti: An Experiment in Third World Survey Research." In Marshall and Polgar (1976), pp. 241 - 262.

Recommended Reading: Pastner (1982)

3. Agricultural Surveys (1 hour)

Required Reading: Rhoades (1982a).

C. Rural Social Struggle

1. Gender (1 hour)

Required Reading: Khan and Bilquees (1976) and Sharma (1982).

Recommended Reading: Boserup (1970), Chapter 1.

2. Demography (1 hour)

Required Reading: Boserup (1965), Chapter 4.

3. Politics (1 hour)

Required Reading: Jones (1974), Chapter 12.

Recommended Reading: Lindholm (1982), Chapter 6.

C. Rural Belief Systems

1. Folk Views (2 hours)

   Required Reading: Kurin (1983).

2. Religious Views

   a. Perspectives from the Holy Quran and Bible (1 hour)

      Required Reading: Ahmad (1984) and "The Botany of The Garden of Eden." In Mabberley (1981) pp. 237-245.

   b. Functional Analyses (2 hours)

      Required Reading: Harris (1966).

      Recommended Reading: Diener et al (1978). and Harris (1972-1973).

3. SCIENTIFIC VIEWS

   a. Tree Species (1 hour)

      Required Reading: Davidson (1985).

   b. Reforestation (2 hours)

      Required Reading: Hamilton (1983). Chapter 12: "Reforestation or Afforestation," pp. 113 - 121.

E. Rural Economics

1. Adaptation (1 hour)

   Required Reading: Paul (1984).

   Recommended Reading: Shahrani (1979). Chapter. 8: "Adaptation to Socioeconomic and Cultural Restrictions", pp. 186 - 212 and "Indian Civilization and the Tropical Savanna Environment." In Harris (1980), pp. 185 - 207.

2. Risk Taking (2 hours)

   Required Reading: "Risk, Uncertainty, and the Subsistence Farmer." In Dalton (1971), pp. 566 574.

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G. Modernization and Development

1. Problems with Progress

a. General (1 hour)

Required Reading: Bodley (1982). Chapter 8: "The Price of Progress," pp. 149 - 163.

b. Subcontinent (1 hour)

Required Reading: Wiser and Wiser (1965). Chapter IX: "Let All Things Old Abide," pp. 117 - 134 and Zaidi (1970). Chapter IX: "The Village Culture Under Stress," pp. 133 - 134.

2. Agricultural Development

Required Reading: "The Rural Elite and Agricultural Development in Pakistan." In Stevens et al (1976), pp. 317 - 353 and Mencher (1981)

Recommended Reading: "The Green Revolution and Future Developments of Pakistan's Agriculture. In Stevens et al (1976), pp. 354 - 382.

3. Ad Hoc Solutions (1 hour)

Required Reading: "A Pump for Gopalpur." In Vatuk (1978), pp. 496 -517.

Recommended Reading: Glantz, Michael. (n.d.)

H. Sociological Forestry

1. Traditional Farm Forestry(1 hour)

Required Reading: "Socio-Economic Factors Influencing Farm Forestry: A Case Study of Tree Cropping in Homesteads in Kerala, India." In F.A.O. (n.d.), pp. 115 - 130.

2. Sociological Issues (2 hours)

Required Reading: "Social Forestry: Who Benefits?" In F.A.O. (n.d.), pp. and Burley (1982). Chapter 2: "India," pp. 16 - 17.

Recommended Reading: Noronha (1982) and Bilmes (1980).

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3. Sociological inputs

a. In Project Design (2 hours)

Required Reading: Murray (1985).

b. In Farm Trials (1 hour)

Required Reading: Rhoades (1982b).

Recommended Reading: Epstein (1983).

c. In Mid-Project (2 hours)

Required Reading: "Alternative Units of Social Organisation Sustaining Afforestation Strategies." In Cernea (1985), pp. 267 293.

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S Y L L A B U S

PUBLIC ADMINISTRATION

I. COURSE INTRODUCTION

A. Define public administration

B. Explain purpose, scope and content of course

C. List instructional objectives: At the conclusion of instruction the student should:

1. Have a basic knowledge of and appreciation for administration in public agencies;

2. Be familiar with the structure and function of a line-staff organizations;

3. Understand management as a process and appreciate the role of the executive;

4. Appreciate the rudiments of personnel administracion;

5. Understand the basics of Federal/Provincial administrative procedures and office practices; and

6. Understand the organizational structure of the Pakistan Forest Service and the duties, authority and responsibilities of a forest officer

II. INTRODUCTION TO PUBLIC ADMINISTRATION

A. Contrast public vs private sector administration:

1. Mandate and authority

2. Fiscal resources

3. Personnel management systems

4. Motivation

5. Accountability

6. Planning and policies

C. Describe the roles of the various levels of government (Federal, Provincial, District, and local governments) in general, and in the management of natural resources, specifically

D. Indicate how Pakistan's philosophy and style of public administration are influenced by Islam, politics, and law

III. MANAGEMENT PROCESS

A. Define management and describe it as a process (Planning, monitoring, control and evaluation)

B. Explain the importance of planning, establishing goals, and coordinating

C. Give examples of monitoring gross productivity, cost effectiveness, product quality, and utilization of supervisory personnel in a forest nursery operation

D. Explain the difference between operational control and strategic planning in the context of a working circle

D. Relate evaluation as a process to goals and objectives

E. Identify the roles of line and staff officers in the management process

F. Describe decision making as a process and indicate the role of uncertainty and risk

IV. LINE-STAFF ORGANIZATION

A. Explain the structure of a line-staff organization including lines of authority, coordination, and communication

B. Contrast the roles and responsibilities of a line officer and a staff officer.

C. Explain the difference between delegation of authority and delegation of responsibility

D. Explain the need for communications vertically and horizontally within the organizational structure

E. Contrast norms of behavior and performance in a military vs civil line and staff organization

V. THE ROLE OF THE EXECUTIVE

A. Define leadership and contrast leadership styles, e.g., leadership by example, delegation, and facilitation

B. Explain the executives dependence on information and communication in contrast to authority

C. Compare the leadership role in a line and staff organization to that in a voluntary community cooperative.

D. Explain the role of the executive as a planner

VI. PERSONNEL MANAGEMENT

A. Describe the role and importance of personnel management

B. Explain motivation and morale as determinants of productivity in individuals and organizations

C. Identify common types of personnel problems, via case studies, e.g., lack of motivation, lack of training or appropriate skills

D. Illustrate problem solving principles through presentation of a case study

VII. DESCRIBE THE ORGANIZATIONAL STRUCTURE OF THE PAKISTAN FOREST SERVICE AND THE ROLE OF A FOREST OFFICER

A. Describe the forest service's organizational structure and the general responsibilities of the line and staff positions

B. Discuss the appointment, duration of service and special obligations of forest officers under forest and general laws

C. Outline the legal authority vested in, and the protection extended to, forest officers under law

D. Explain the protection provided under law to forest officer

E. Discuss the nature of offenses against the authority of public servants

VIII. INTRODUCTION TO ADMINISTRATIVE PROCEDURES AND OFFICE PRACTICES

A. Decribe administrative procedures for:

1. Referral of cases

2. Handling of Assembly questions

3. Budgets and Disbursements under general system of financial rules

4. Appointment, promotion, and transfer

5. Personnel grievances

B. Explain office practices for:

1. Forms of communication between offices, departments, and agencies

2. Establishing files: recording, indexing, and classifying

3. Disposal of files: weeding and preservation of records

4. Receipt and distribution of papers

IX. FUNDAMENTAL FOREST LAW

A. Constituting Forest Estates

1. Reserved forests

a. Preliminary steps
   1) Claim to land
   2) Claim to forest rights
b. Definition of rights admitted according to their intrinsic features
c. Commutation of forest rights
d. Extension of unclaimed rights
e. Appeal against settlement officers
f. Final notification of the forest demarcation

2. Protected forests

3. Village forests

4. Section 38 shared forests

5. Guzara forests

B. Government Property and Its Acquisition

1. Need - estates or other properties which are acquired or held by succession to rights of former governments

2. Land occupied by roads, railways, riverbeds, and canal waste lands

3. Land acquired for public purposes

C. Protection of Forests and Forest Products in Transit

1. Source of damage and its prevention

2. Application of the Forest Act

3. Application of the Pakistan Penal Code to forest offences

4. General principles of criminal law relating to offences

5. The legal principles of punishment

D. Contracts

1. Essentials of a valid contract

2. Proposal acceptance acting by agent

3. Power of attorney and its attributes

4. Impossibility of things agreed on

5. When things are immoral or illegal

6. Consideration

7. Tender effects of new agreement on alteration

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ILLUSTRATIVE TOPICS FOR TERM PAPERS AND SPECIAL PROJECTS

1. Discuss the ethical and legal responsibilities of a Forest Officer who has been offered a bribe. Define ethics and ethical behavior and contrast with legal responsibility.

2. Interview a local Divisional Forest Officer regarding the types of administrative problems he has been concerned with during the past month. Classify these problems, e.g., technical forestry, personnel, fiscal, public relations, etc Identify the legal, administrative or procedural basis for dealing with these types of problems.

3. Describe the impact of Islam on the organization and efficiency of public agencies.

4. Develop a job description for the Inspector General of Forest detailing his responsibilities at the Federal level and to th Provincial Forest Departments.

5. Risk and uncertainty are common in public administration. Describe how these problems are handled in terms of personnel appointments, field operating programs and fiscal planning.

6. Review and analyze the criteria and process for promoting officers. Contrast the factors that you perceive are different for junior as opposed to senior officers.

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S Y L L A B U S

FORESTRY OUTREACH

I. INTRODUCTION

A. Describe the Course

1. Purpose and Goals

2. Organization and Emphasis

3. Instructional Objectives

At the conclusion of this course the student will be able to:

a. Appreciate the role of Outreach programs in forestry and the potential contribution that can be made to national development by Forestry Outreach;
b. Understand Extension and Outreach as evolving programs in Pakistan and be familiar with new concepts/programs being introduced;
c. Explain and appreciate the importance of participation, motivation, communication, education and related concepts and methodologies useful in establishing and managing Outreach programs;
d. Understand Outreach planning and instructional methods and the use of evaluation as a program improvement tool; and
e. Be able to contribute to farm and energy Forestry Outreach.

B. Explain Outreach and Extension

1. Define and contrast the philosophy, objectives, audiences, and targets of Extension, Outreach, social forestry, continuing education programs, and Conservation Education

2. Explain the need for Outreach in forestry and discuss the added role of the Forest Departments as service agencies in addition to the traditional role as protection and management agencies

3. Outline agricultural extension prgrams and show the relationships to farm forestry.

C. Survey of Extension/Outreach in Pakistan

1. Summarize the evolution of Extension programming in Pakistan since Partition and its current status

2. Describe "Integrated Rural Development" and the PARC Extension Model

D. Introduce Basic Analytic Concepts

1. Describe the Training and Visit Extension system, explain its philosophy and development, and summarize experiences with the system in South Asia

2. Describe the utility of Farming Systems Research as a basis for planning Outreach programs and describe some practical examples from Pakistan and South Asia

3. Describe the Diagnosis and Design methodology

E. Survey Forestry Extension Programs Abroad: Case Studies

1. Nepal

2. Philippines

F. Overview of Forestry Extension in Pakistan

1. Current efforts of the Forest Departments and the role of Forest Officers

2. Importance of Extension to the Provincial Forest Departments and to rural and national development

3. Lessons from earlier programs in forestry, agricultural extension, and development

G. Overview of Conservation Education in Pakistan

1. Relationship of Forest Departments to the educational establishment

2. Role of school teachers in rural communities

3. Reaching parents through school children

4. Choosing appropriate grade levels for conservation materials

II. SOME BASIC CONCEPTS IN MOTIVATION, LEARNING, AND COMMUNICATION

A. Motivation and Learning

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1. Motivation defined
2. Learning theories
3. Behavior formation
4. Education to acheive goals
5. Group vs. individual motivation and achievement
6. Role of motivators
7. Use of incentives, e.g., fiscal or material or psychological

B. Diffusion and Adoption of Innovations

1. Diffusion as a process of social change
2. Levels and types of innovation
3. Channels of communication
4. Adoption by individuals and organizations
5. Time requirements and degree of diffusion/adoption

C. Analyzing Social Power and Community Leadership

1. Sources of power and influence excercised by leader
2. Identifying the social power structure
3. Social action process
4. Mobilizing community support for Extension

D. Communication: Sending and Receiving
[Refer to Duldalao]

1. Define the communication process: sender and receiver; message and medium
2. Factors influencing sending messages
3. Factors influencing the receipt of messages
4. Extension as a sending and receiving system
5. Communication media and Outreach
6. Audience analysis

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E. Design of Materials

F. Presentations to Groups

III. COMPREHENSIVE IN-SERVICE TRAINING PROGRAMS

A. Overall philosophy for departmental training

1. Transmitting of new technical information - the results of research; debunk the notion of "refresher" training

2. Conveying policy directives and plans from the center

3. Conveying field conditions and responses to the center

B. Planning a Training Program

1. Setting objectives

2. Choosing the appropriate levels

3. Training the trainers

C. Preparing a Training Course

1. Assessing the characteristics of the target group

2. Organizing the material

3. Choosing the venue

4. Pre-planning and testing the material

5. Testing

a. The material
b. The students
c. The instructors

IV. PROGRAM PLANNING, EXECUTION, AND EVALUATION

A. Planning Extension Programs

1. Importance of program planning

2. Strategic vs. program planning

3. Identifying needs and achievable objectives

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4. Types of programs and activities

5. Importance of integrated activities

6. Program evaluation

B. Obtaining Useful Public Information

1. Benefits and risks of public participation

2. Barriers to participation

3. Process of public involvement

4. Consensus methods

5. Conflict resolution

6. Leadership styles

C. Instruction

1. Styles of instruction and learning

2. Instructional objectives

3. Character of audience, facilities, and instructional materials

4. Instructional techniques

5. Instructor: Fountain of knowledge or facilitator?

6. Reference materials

D. Program Evaluation

1. Defining standards for success

2. Objective-based evaluation

3. Experimental model

4. Advisory evaluation

5. Bias

6. Evaluating the evaluation

7. Using the evaluation for program decisions

E. Introduce A Case Study Relevant to Farm and Energy Forestry Extension

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S Y L L A B U S

RESOURCE ECONOMICS

I. INTRODUCTION

A. Developing the course title

1. Economics

a. Definition
b. Branches
1) Micro-economics
2) Macro-economics
3) Welfare economics

2. Resources

a. Definition
b. Attributes of resources
1) Quantity
2) Quality
3) Space
4) Time
c. Types of resources
1) Stock
2) Flow
3) Renewable
4) Non-renewable
d. Forest resources

B. Course overview

II. THE ROLE OF ECONOMICS IN RESOURCE MANAGEMENT

A. Institutional objectives and perspectives

1. Profit maximization

2. Welfare maximization

3. Other

a. Cost minimization
b. Cost effectiveness

B. Management environments and constraints

1. Overview sof constraints

2. Maximization or minimization subject to constraint

C. Economics as a tool for decision making

D. Economics as an input to the decision-making process

E. Efficiency, equity, and the distribution of benefits an costs

III. REVIEW OF MARKET FACTORS

A. Consumers and market demand

B. Producers and market supply

C. Demand/supply interaction and market equilibrium

IV. CAPITAL THEORY: INTERTEMPORAL PRODUCTION AND CONSUMPTION

A. Investment decisions

1. Private decisions

2. Public decisions

B. The interest (discount) rate

1. Compnents of the interest rate

2. Interest rates for the private sector

3. Interest rates for the public sector

4. Effect of interest rates on conservation

C. Interest concepts

1. Simple versus compound interest

2. Time lines

3. End of year convention

D. Basic interest formulae

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1. Single payments

   a. Compound interest formula
   b. Discount formula
   c. Rate of interest and time period
   d. Rule of 72

2. Series of payments

   a. Terminating series
      1) Future value of a terminating annual series
      2) Present value of a terminating annual series
      3) Future value of a terminating periodic series
      4) Present value of a terminating periodic series
   b. Perpetual series
      1) Present value of a perpetual annual series
      2) Present value of a perpetual periodic series
   c. Sinking fund formula
   d. Installment payment (capital recovery) formula
   e. Amortization schedules

3. Nominal versus effective interest rates

4. Add-on and discount rates

5. Decision tree for compound interest formulae

E. Decision criteria

1. Conventional decision rules

   a. Payback period
   b. The peak profit method
   c. The average profit method
   d. The simple rate of return

2. Compound interest techniques

   a. Net present value
   b. Internal rate of return
   c. Composite rate of return
   d. Benefit-cost ratio
   e. Equal annual equivalent

3. Comparison of decision criteria results

   a. Analyzing a single project
   b. Analyzing multiple projects

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F. Financial versus economic analysis

1. Financial analysis defined

2. Economic analysis defined

G. Incorporating risk and uncertainty

1. Decision making with risk

2. Decision making with uncertainty

3. Sensitivity analysis

V. VALUATION OF FOREST LAND AND TIMBER

A. Stumpage valuation

1. Market comparison technique

2. Income value technique

3. Calculating the margin and stumpage value

4. Adjusting for inflation and price appreciation

a. Inflation
b. Real versus current cash flows
c. Differential price changes

B. Determination of financial rotation age

1. Money yield tables

2. Financial rotation age

a. Single rotation
b. Multiple rotations
c. Coppicing species

3. Comparison with other rotation ages

a. Maximization of mean annual increment
b. Maximization of physiological maturity

4. Incremental or marginal analysis of existing stands

C. Forest land valuation

1. Land expectation value

2. Land and timber value

3. Land valuation with uneven-aged management

D. Taxation

1. Types of taxation

a. Income
b. Excise
c. Progressive
d. Proportional
e. Regressive

2. Calculating tax liabilities

3. Effects of taxes on forestry investments

VI. MULTIPLE USE MANAGEMENT

A. An economic model of multiple use

B. Current approaches to quantitative modelling of multiple use

VII. Planning in developing countries

A. Determining of plan objectives

B. Formulation of plans and projects

C. Simple budgeting approach to benefit-cost and basis for farm decision making

D. History of economic planning in Pakistan

E. Evaluation of the forestry sector of past national plans

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S Y L L A B U S

RESOURCE POLICY AND LAW

PART I: RESOURCE POLICY

I. INTRODUCTION

A. Definition of policy: A course of action, consistent over time, followed by an actor or set of actors in dealing with a problem or matter of concern

B. Levels of forest policy

1. Legislation

2. Rules and regulations

3. National plans

a. Five year plans
b. Plans of other durations

4. Departmental directives

5. Informal structures

C. Relevance of policy to the professional forester

1. Mandates and guidelines for management

2. Constraints for management

3. Relevance of non-forest policies

a. Policies regarding other natural resources, for example:
1) Agricultural policies
2) Mineral policies

b. Policies regarding social and/or economic objectives, for example:
1) Energy policies
2) Economic growth and development policies
3) Import/export policies
4) Transportation policies
5) Monetary and fiscal policies

D. Philosophical approaches to policy formulation

1. Institutionalism

2. Elitism

3. Incrementalism

4. Group theory

5. Rationalism

E. Approaches to teaching policy

1. Historical approach - involves an instructional sequence in which the evolution of forestry and forest policy is delineated. This approach is defined by chronology and the highlights of major developmental events

2. Comparative approach - contrasts the policy structure of Pakistan to that of other countries or contrasts the policy structure of one province with another

3. Analytical approach utilizes information on the economic, political, and conservation rationale for forest management actions and decisions. This approach teaches the student to analyze processes and to relate these processes to forestry

4. Case study approach - events and forces which shape issues are studied. This approach is commonly used in combination with one of the other approaches to illustrate cause and effect relationships

5. Course approach all approaches will be used, but the analytical approach is emphasized.

II. THE STAGES OF THE POLICY PROCESS AND POLICY INSTITUTIONS

A. Problem identification-the list of problems requiring action

1. Professional policy agenda

a. National
b. Provincial

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2. Formulation of the agenda in Pakistan

   a. Role of elected officials/bodies
   b. Role of government agencies
   c. Role of citizens

B. Policy formulation

1. Identifying alternative courses of action in resolving those problems that have been placed on the policy agenda

2. Examining the merits and demerits of each alternative

3. Knowing clientele

   a. Fiscal consequences
   b. Economic analysis
   c. Administration-selection of appropriate agencies

C. Adopting policy: Some specifics on how formulated policies are adopted

1. Enactment of legislation

   a. The legislative process in Pakistan
      1) National
      2) Provincial
   b. Groups that influence legislation (Note: Use the "Iron Triangle")

2. Enacting rules and regulations

3. Adopting national plans

4. Promulgating departmental directives

D. Policy implementation

1. Enforcement of the adopted policy

   a. Legislative responsibilities
   b. Responsibilities of provincial governments
   c. Responsibilities of forestry departments
   d. Responsibilities of the judicial system

2. Agency interactions

   a. Conflicts
   b. Jurisdictions

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c. Coordination

3. Funding

a. The Five Year Plan
   1) Distribution of targets by year and Province
   2) Disaggregating the targets to the Division level
b. Setting annual Provincial targets
c. The Federal and Provincial budget process
   1) Regular budgets
   2) Development budgets
d. Summarizing the linkages between policy and the planning and budgeting process

E. Policy monitoring and evaluation

1. Determine if the selected policy option is being implemented

a. Planning and development agencies
   1) Fiscal targets
   2) Physical targets
b. Resource mobilization
   1) Department
      a) Manpower - authorized posts to be filled
      b) Budgets released
      c) Equipment and facilities in place
   2) Coordination

2. Determine if the selected policy option is actually resolving the identified problem

a. Bio-physical indicators
b. Socio-economic indicators

3. Evaluating should indicate

a. Progress
b. Bottlenecks
c. Need for mid-course correction
d. Need to modify the selected option

III. FOREST POLICY STATEMENTS AND THEIR IMPLEMENTATION

A. Forest policy resolutions and directives and the five year plans

1. Forest policy resolution of 1894

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2. Forest policy resolution of 12 November 1955

3. Implementation of forestry development programs during the first five year plan (1955-1960)

4. Directive on forest policy of 1962 - Minister of Agriculture division letter no. F. 4-30/62

5. Implementation of forestry development program during the second five year plan (1960-1965)

6. Policy directive on watershed management of 1962

7. Policy directive on range management of 1962

8. Implementation of forestry development program during the third five year plan (1965-1970)

9. Implementation of forestry development program during the fourth five year plan

10. National forest committee report of 1972

11. Decisions of the council of common interests, July 1975

12. Implementation of forestry development program under the fifth five year plan

13. Provisions of the national agricultural policy of 1980 with respect to wildlands

14. Forestry development during the sixth five year plan (1983-1988)

B. Linkages between the policies and the plans

C. Trends and implications

IV. THE IMPACT OF FOREST LEGISLATION ON FOREST POLICY

A. Legislation for the protection of state owned lands

1. Pakistan Forest Act of 1927

2. NWFP Hazara Forest Act of 1936

B. Powers to make rules to correct or prevent site deterioration in privately owned forests or wastelands

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1. Punjab Land Preservation (Chaos) Act of 1900
2. Pakistan Forest Act of 1927
3. Hazara Management of Wastelands (Guzara) Rules of 1950
4. Hazara Forest Act of 1936

C. Protection of forests at the request of owners

D. Other legislation

1. The Baluchistan Forest Regulation of 1880
2. Guzara Rules of Hazara
3. Guzara Rules of Rawalpindi
4. Cattle Trespass Act
5. Kohat Mazri Control Act of 1954
6. Import Duty Rules
7. Sind Grazing Rules
8. West Pakistan Wildlife Protection Rules
9. Punjab Fisheries Act of 1914

E. Interaction & relevance of Province-specific legislation

V. CURRENT ISSUES IN FOREST POLICY, FOR EXAMPLE:

A. Farm & energy forestry

B. Forest protection

C. Increasing the area under the control of the forest departments

D. Importance of forest working plans

E. The concept of sustained yield

F. Multiple use

G. Intensification of forest management

H. Prompt regeneration

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I. Watershed management

J. Range management

K. Education and research

L. Creating a national park system

PART II: RESOURCE LAW

I. Introduction

A. Definition of law

B. The need for law

C. The basis of law

D. Application of law to natural resources

II. GENERAL LEGAL NOMENCLATURE AND PROCESSES

A. Definition of common legal terms, for example:

1. Abatement, adverse possession, bail, cattlepound, cognizable and non-cognizable offences, collusion, compounding an offence, confiscation, confession, criminal breach of trust, criminal misappropriation, criminal trespass, easement, escheat, evidence, forfeiture, intermission, interruption, leading question, mischief, mistake of fact, preemption, recognizance, reanullius, right. royal tree, salvage, search warrant, seizure, servitude, summary trials, summons, summons case, treasure, warrant case, waif wood, wasteland.

B. Law of criminal procedure

1. The criminal courts and their powers

2. The classification of offences according to procedure of law

3. Trial method of obtaining the attendance of witness and recording evidence and examination

4. Execution of sentence and recovery of fines, appeal, appeal revision, contempt

C. Law of evidence

1. Relevancy for witness

2. Forest inquiries

D. Law of contracts

1. Essentials of a valid contract

2. Proposal acceptance, acting by agent, power of attorney and its attributes, non-binding character of agreements and contracts when the subject of the agreement is immoral or illegal, consideration

3. Tender effects of new agreement on alteration

E. Property

1. Definition

2. Classification

3. Acquisition of property

4. Possession of discontinuous rights

5. Joint ownership

6. Possession in the case of co-proprietors

7. Being put out of possession

8. Consequence of possession

9. Adverse possession

10. Transfer of property

F. Rights and ownership

1. Nature of rights-ownership

2. Servitude-easement

3. Rights of common acquisition of rights

4. Extinction of rights

5. Distinction between right and ownership-limitation

6. The principle, the extent, and the regulation of various classes of rights

III. GOVERNMENT PROPERTY AND ITS ACQUISITION

A. Need - estates or other property which are acquired or held by succession to rights of former government

B. Land occupied by roads, railways, river beds and canal wastelands

C. Land acquired for public purposes

D. Alluvial lands

E. Constituting permanent Forest Estates (Reserved Forests)

1. Preliminary steps

a. Claim to land
b. Claim to their forest rights

2. Definition of rights admitted according to their intrinsic features

3. Commulation of forest rights

4. Extension of unclaimed rights

5. Appeal against settlement officers

6. Final notification of the forest demarcation

F. Constituting other types of forest estates

1. Protected forests

2. Village forests

3. Section 38 areas shared forest

4. Guzara forests

IV. LEGAL ASPECTS OF IMPLEMENTING SPECIFIC ACTS, REGULATIONS, AND RULES

A. General

1. Application of Pakistan penal code to forest offences

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2. General principles of criminal law relati to offences

3. The legal principles of punishment

B. Natural resources

1. The Pakistan Forest Act of 1927

2. The Hazara Forest Act (1939)

3. The Baluchistan Forest Regulation (1880)

4. Guzara Rules of Hazara

5. Guzara Rules of Rawalpindi

6. Cattle Trespass Act

7. Kohat Mazri Central Act (1954)

8. Import Duty Rules

9. Sind Grazing Rules

10. West Pakistan Wildlife Protection Rules

11. Punjab Fisheries Act (1914)

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S Y L L A B U S

PEST MANAGEMENT, FIRE, ANIMAL DAMAGE, AND WEED CONTROL
(Protection "C")

I. INSECTS

A. The principal insects destroying forest trees in Pakistan

1. Natural forests

2. Man made forest plantings

a. Insect pests unique to plantations
b. Epidemiology - Plantations as environments for insect epidemics

B. The major wood destroying insects in Pakistan

C. Diagnostic methodology

1. Identification of important insect pests

2. Evidence of insect predation

a. Direct
b. Indirect

D. The use of insecticides in insect control

1. Types of insecticide

a. The chemical composition of insecticides
b. The nature of insecticide impact on predatory insect pests

2. Environmental impacts of insecticides

a. Impacts on man
b. Impacts on wildlife and domestic animals
c. Impacts on non-target insects

E. Methods of application

1. Spraying

a. Hand spraying
b. Motorized spraying
c. Aerial spraying

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2. Dusting

3. Poison bait

F. The use of biological controls

1. Introduced predators

2. Sex attractants

3. Sterile males

4. Silvicultural controls

5. Genetic controls

6. Mechanical controls

a. Collection
b. Traps

G. The use of fire in predatory insect control

1. Destroying infested material

2. Modifying the insect environment

II. PLANT PATHOGENS

A. The principal fungi destroying forest trees in Pakist

1. Natural forests

2. Man made forest plantings

a. Diseases unique to plantations
b. Epidemiology - Plantations as environments for disease epidemics

B. The major wood destroying fungi in Pakistan

C. Damaging bacteria and viruses

D. Molds

E. Diagnostic methodology

1. Identification of important plant pathogens

2. Epidemiology - Plantations as environments for

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insect infestations

3. The alternate host problem

F. The use of pesticides in disease control

1. Types of pesticides

a. The chemical composition of pesticides
b. The nature of pesticide impact on predatory plant pathogens

2. Methods of application

a. Soil sterilization
b. Stump sterilization
c. Direct tree application

G. The use of preservatives in stain and decay control

III. INTEGRATED PEST MANAGEMENT

A. Interactions between insect and disease agents

B. Key factors capable of damaging forests and reducing yield

C. Legislative control and plant quarantine methods

D. Relationship of pest control to forest management

V. ANIMAL DAMAGE

A. The principal animals causing damage to farm forests in Pakistan

1. Wildlife

2. Domestic animals

B. The nature of animal damage

1. Destruction of bark

2. Destruction of roots

3. Soil compaction

4. Excessive browsing

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C. Methods of damage control

1. Exclusion

a. Fences
b. Ditches

2. Repellents

3. Physical protection

4. Toxic chemicals

V. FIRE DAMAGE

A. Causes of forest fire

1. Natural

2. Man caused

a. Accidental
b. Using fire as a farm tool
c. Fire trespass

B. Fire ecology

1. Synecology and autecology of dominant species in forest and rangeland habitats

2. Impact of fire on vegetation succession

3. Effects of fire on soil, nutrient cycling and forest development

C. The role of fire in the forest

1. Natural role
2. Prescribed burning as a silvicultural and hazard reduction tool

D. Forest fire management

1. The nature of ignition and combustion
2. Evaluation of forest fuels and fuel inventory

a. Quantity
b. Quality

3. Environmental influences upon fire vulnerability

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4. Fire prediction technology

5. Fire suppression techniques

6. The economic consequences of failure to manage fire

VI. WEEDS

A. The nature of forest weed damage

1. Competition with seedlings

2. Competition with planting stock

3. Competition with standing trees

B. Damaging weeds in Pakistan forest plantings

1. Weed ecology

. Weed geography

C. Forest Weed control

1. Mechanical

2. Chemical

a. The chemical nature of herbicides
b. Methods of applying herbicides
c. Environmental impacts of herbicides

VIII. FOREST PROTECTION ECONOMICS

A. The managerial objectives of protection

1. Prevention of physical loss of trees and stands

2. Prevention of reduction in growth

3. Prevention of loss of product or reduction in product quality

4. Enhancement of stand establishment

B. Assessing the financial value of loss

1. Investment in forest or product

2. Market value of forest or product

C. Cost of protection against and control of damaging agents

D. Cost-benefit analysis

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S Y L L A B U S

STATISTICAL METHODS IN FORESTRY

I. INTRODUCTION

This course is designed to provide an introduction to mathematically based quantitative methods used to analyze forestry data and experiments, to present forest information, and to create forestry analytical models. It includes a presentation of the methods of statistical analysis including descriptive statistics probability theory and the concept of probability distributions measures of central tendency and dispersion, correlation and regression, sampling techniques, the design of experiments and tests of significance.

II. PROBABILITY THEORY

A. Basic concepts

1. The idea of randomness
2. The universe and the sample
3. The probability of an event

B. Probability theorems

1. Addition theorem
2. Multiplication theorem
3. Conditional theorem

C. Descriptive statistics

1. Discrete and continuous data
2. Frequency distributions
3. Cumulative frequency distributions
4. Measures of central tendency; mean, mode, median

5. Measures of dispersion; range, standard deviation

6. The variance as a measure of dispersion

D. Discrete probability distributions

1. The hypergeometric distribution

   a. Factorials
   b. Combinations
   c. Permutations
   d. The form of the hypergeometric distribution
   e. The equation of the hypergeometric
   f. Examples from forestry

2. The binomial distribution

   a. The binomial: definition, scope, applications
   b. The binomial as an approximation to the hypergeometric
   c. The form of the binomial
   d. The equation of the binomial distribution
   e. Examples of the binomial distribution from forestry

3. The Poisson distribution

   a. The Poisson; definition, scope, application
   b. The Poisson as an approximation to the binomial
   c. Cumulative Poisson probabilities; tables and graphs
   d. The form of the Poisson distribution
   e. The equation of the Poisson distribution
   f. Examples of the Poisson distribution from forestry

E. Continuous probability distributions

1. The rectangular distribution

2. The exponential distribution

   a. The equation of the exponential distribution
   b. The form of this exponential distribution
   c. Examples of the exponential distribution from forestry

3. The normal distribution

   a. Definition, scope and application
   b. The equation and form of the normal distribution
   c. Tables of this normal curve
   d. The normal distribution as an approximation of the binomial

III. INFERENTIAL STATISTICS

A. Parameter estimation

B. Distribution of sample means

C. Statistical errors and hypothesis testing

1. Type I errors-reject when true

IV. CORRELATION AND REGRESSION

A. Scatter diagrams

B. The method of least squares

C. Linear regression

D. Non-linear regression models

E. Multiple regression

F. Correlation

G. Tests of significance and goodness of fit

V. STATISTICAL CONTROL

A. Patterns of statistical variation

B. Steady state patterns of variation

C. Non-steady state patterns of variation

D. Control charts as graphical tests of significance

1. Control charts for variables

2. Control charts for attributes

3. Operating characteristics of control charts

4. The use of control charts in forestry

VI. ACCEPTANCE SAMPLING

A. Types of samples

1. Systematic

2. Random

3. Stratified

B. Acceptance sampling plans

1. Operating characteristic curves of sampling plans

2. Acceptance sampling by attributes

a. Single sampling
b. Double sampling
c. Sequential sampling

C. Acceptance sampling by variables

VII. EXPERIMENTAL DESIGN

A. Randomized block experiments

B. Latin square experiments

C. Factorial experiments

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TEXTBOOKS AND REFERENCES

TEXTBOOKS

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S Y L L A B U S

BIOMETRY

The following module should be added to the existing course:

I. EVALUATION OF WHOLE TREE BIOMASS

A. Within organism mensuration relationships

1. Root/shoot ratios
2. Dbh/diameter of crown ratios
3. Dbh/total height ratios

B. The use of allometric equations

1. Form of typical allometric equations
2. Parabolic equations
3. Logarithimic equations
4. Exponential equations
5. Power equations

C. Conversion of volume to mass

1. Specific gravity of wood
2. The general weight/density relationship

$$W = (1 + M / 100)\ (G)\ (62.43)$$

Where:

W = Weight of a cubic foot of wood in ounces
M = Moisture content in percentage
G = Specific gravity based upon oven dry mass and green volume

D. Calorific relationships for wood

E. Common allometric relationships used to estimate biomass for fuel estimation purposes

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1. Bark in stem

2. Bark in branches

3. Wood in stem

4. Wood in branches

   a. Live branches
   b. Dead branches

5. Foliage

TEXTS AND REFERENCES

REQUIRED

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Sancier, J.R., A. Clark and R.G. McAlpine. 1972. "Above Ground Biomass Yields of Short-rotation Sycamore." Wood Science, 5 (1): 1-6.

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APPENDIX I

WORKSHOPS AND WORKING GROUPS

Planning and review workshops, chaired by the Director General of Pakistan Forest Institute (PFI) were held on April 13th and May 7th. Both workshops were attended by PFI staff, representatives of the Forestry Planning and Development Project Technical Assistance Team and the Curriculum Development Team. The second meeting was attended by the Deputy Inspector General of Forests as well as representatives of the Provincial Forest Services and U.S.AID.

The members of 13 Working Groups were named by the Director General of PFI. The Working Groups were formed to provide forums for the interchange of ideas on the development of course syllabi. Membership included PFI faculty, Winrock Technical Assistance Team members, the U.S.AID Project Manager and members of the Curriculum Development Team. The working groups met at the call of Director of Forest Education. In successive meetings the Working Group members developed the course syllabi previously presented. The Working Group members concentrated primarily on course content and organization.

The April 13th workshop permitted alternative strategies for design of the Farm and Energy Forestry Curriculum identified by the Curriculum Development Team to be reviewed by the PFI faculty. It also permitted other issues relating to the curriculum to be discussed. The Director General set the standard for the Working Groups by stating his desire to achieve an international standard in the curricula of the PFI. At the conclusion of the meeting the Director General indicated his approval, in principle, of the strategy recommended by the members of the Curriculum Development Team. The strategy involved, modification of several existing courses, the design of six new courses, and differentiation in curricula based on the previous training of entering students.

The second workshop focused on a review of the course syllabi compiled by the Working Groups. These syllabi were presented by the members of the Curriculum Development Team and discussed by the participants which included a number of the Working Group members. A number of useful suggestions were made for incorporation into the draft syllabi. This meeting also afforded a number of PFI faculty, Provincial Forest Service representatives, and U.S.AID personnel not previously involved in the discussions an opportunity to learn about the curriculum and to comment.

As a result of the Working Group deliberations and the general workshops, the Curriculum Development Team was provided substantial guidance and assistance both in overall direction and in detail. The first workshop established goals and direction; the second workshop provided an opportunity for the PFI constituency, i.e., the Provinces who employ its graduates, to become familiar with the proposals and to offer insights into the specific needs of the Provincial services.

The curriculum recommendations resulting from this effort were formally presented to the Director General on April 21st, 1986.

A P P E N D I X II

RECOMMENDATIONS FOR FARM AND ENERGY FORESTRY SITES TO BE INCLUDED IN M.SC.FORESTRY TOURS

EXISTING SITUATION

Farm and Energy Forestry sites should be included in the tours and camps currently required in the existing M.Sc.Forestry curricula. The existing tours include:

TOUR	DURATION	SEMESTER	MARKS
Orientation	2 weeks	I	25
Forest Types	3 weeks	II	75
Chir Pine/Surv	2 weeks	II	75
Moist Temperate	2 weeks	II	75
Forest Mgt.	3 weeks	III	100
Dry Temperate	1 week	IV	0

The existing tour and camp schedule includes a 6 week Working Plan camp during the Fourth Semester.

SITES TO BE VISITED

The following list indicates sites recommended for inclusion in the tour. For each site a brief description of the Farm and Energy Forestry system, site conditions, and management scheme is provided.

Hyderabad Area

Hurri plantations; irrigated block plantations on a rotation with agricultural crops: some intercropping in early years of plantations. Species include *Acacia nilotica*. Plantations vary in size and age class.

The management scheme involves private farms of subsistence and above. Products include firewood, fodder, and mine timbers along with agricultural crops. Some products are sold in established markets.

Changa Manga Area

Irrigated block plantations with Shisham overstory and mulberry understory.

These plantations are managed for commercial production of shisham by the government. The mulberry understory provides the basis for silk production and also provides fodder.

Margalla Hills

Traditional grazing among pine

Sind

Field crops are combined with tree species in windbreaks. Mangos are planted in combination with field crops.

Peshawar

Orchards are planted in grasses to provide fodder.