
M.SC FORESTRY THESIS SUMMARIES OF 1991-93 COURSE

RAJA M. ASHFAQUE, DIRECTOR, FOREST EDUCATION DIVISION PAKISTAN FOREST INSTITUTE, PESHAWAR

1. Fuelwood Consumption in domestic sector of Peshawar city by Syed Tayyaba Samina

The major objective of this study was to estimate fuelwood consumption in household sector of Peshawar city. Multistage sampling procedure was adopted to collect data through questionnaire. The study area was stratified according to electoral wards. The sample survey revealed that 38.7% households used gas, 33.8% kerosene, 13.4% wood, 7.8% LG, and 6.3% cowdung. The choice of cooking fuel by a household was influenced mainly by the supply of natural gas in the locality. Other factors included household income, education level, and occupation of the household head. The choice of wood was associated with non-availability of gas, low level of household income, illiteracy and manual labour as occupation of the household head.

The per capita energy consumption for domestic cooking and heating was found to be 4.578 million kj (95% confidence limits 4.090-5.066) million kj). It was influenced mainly by household income level. The per capita energy consumption in households with high income was 7.9 million kj, with middle income 4.8 million kj and with low income 4.2 million kj. It was also influenced by household size. Larger households had lower per capita consumption. Households with members between 1-3 had per capita energy consumption of 8.1 million kj. Against this households with 13 or more members had a per capita consumption of 4.1 million kj. Per capita energy consumption was also associated with fuel type. Households using gas, wood, kerosene, LPG and cowdung had per capita energy consumption of 5.9, 5.4, 1.8 and 1.0

million kj respectively.

Household monthly fuel consumption increased by about 40% in winter compared with summer. The increase was 16%, 42% and 49% for households using wood, kerosene oil and gas respectively.

The average annual household expenditure on fuel worked out to 3,526 rupees. It varied with fuel type. It was highest for households using wood (Rs.4,636/-), followed by households using kerosene (Rs.4,065/-) and Rs.3,591/-, and Rs.755/- only for households using gas and cowdung respectively.

The market demand for fuelwood in household sector in Peshawar city was estimated as 40,784 tonnes per annum.

2. Fuelwood consumption in commercial sector for Peshawar city by Shahnaz Kausar

The major objective of this study was to estimate fuelwood consumption in commercial sector of Peshawar city. Data was collected through questionnaire. Due to their small number, all 224 commercial units were taken as sample. Analysis of collected data showed that the private commercial units consumed about 3,725 tonnes of fuelwood and units in Govt. sector used about 3000 tonnes of charcoal annually instead of fuelwood.

Fuelwood was supplied to Peshawar city from different sources. These sources were local wood working units, natural forests growing in adjoining tribal areas of NWFP, and imports from Punjab. Maximum quantity of wood was

supplied to the local market from natural forests in tribal areas of NWFP. Wood consumption was estimated at 22,370 tonnes, 15,000 tonnes and 7,230 tonnes annually from natural forests, local wood working units and imported from Punjab respectively.

The sale price comparison per unit of various fuels in the market showed that the fuelwood was costing Rs. 1.37/kg, kerosene was sold at Rs.3.78/litre, LPG was available at Rs.4.36/Kg, natural gas was marketed at Rs.1.33/m³ and the price of dung was Rs.0.50/kg. If the calorific value is taken into account as unit of measurement for each fuel, then gas was the cheapest commercial fuel than all.

3. Beach Development: Its impacts on the life of Marine Turtles at Karachi Beaches by Agha Tahir Hussain Durrani.

The impact of development was observed on the beaches of Karachi, in July, 1993. In

addition to natural and normally occurring threats viz. predation and erosion the after effects of the human activities like tourism, housing schemes, pollution and projects like Karachi Coastal Zone Management Plan (KCZMP), were going to have detrimental effects on the life and the habitat of the marine turtles. For avoiding the extinction of this national heritage of international repute, effective and result-oriented measures and approaches should be quickly initiated, such as preventing construction of new buildings, strictly controlling tourism on the beaches, effective efforts for pollution control, cancellation of housing schemes near beaches and making projects like KCZMP, environmentally oriented.

4. Financial Analysis of plantations established under Tarbela and Mangala Watershed Management Projects by Arafat Majeed.

Financial Analysis of forest plantations established under Tarbela and Mangla Watershed Management Projects was carried out in this study. Following different alternatives were considered for the analysis.

Alternative No.	<i>Pinus roxburghii</i> (%)	<i>Ailanthus</i> spp. (%)	<i>Robinia pseudoacacia</i> (%)
1	100	-	-
2	80	10	10
3	60	20	20
4	50	25	25
5	40	30	30
6	20	49	40
7	-	50	50
8	-	100	-
9	-	-	100
10	<i>Eucalyptus</i> 100%		
11	Grass Production without Protection		

Planting was done at a spacing of 7 x 7 feet with 20% replacement of failures after one year and 10% after second year. Rotation for chir pine was taken as 80 years with thinning at the age of 20 and 40 years. In case of broad leaved species rotation was fixed at 10 years for fuelwood with two successive coppice rotations after one seedling origin crop. A double increase in the volume of *Eucalyptus* was assumed in case of coppice origin crop and a 20% increase in case of *Ailanthus* and *robinia*.

Benefit Cost Ratio (B/C), Net Present Value (NPV), Land Expectation Value (LEV) and Internal Rate of Return (IRR) were calculated at 8, 10 and 12 percent interest rates for a period of 80 years for an acre of land.

The pure crop of *Eucalyptus* showed highest B/C Ratio, NPV & LEV at all the 3 interest rate (e.g. at 8%, B/C=4.89, NPV = Rs.128921 and LEV = Rs.129195). Pure *Robinia* ranked second (B/C ratio = 2.38, NPV=Rs.41101, LEV=Rs.4118 at 8% interest rate). A mixture (50 : 50) of *Ailanthus* and *Robinia* was third (B/C ratio=2.29, NPV =Rs.38137, LEV = Rs.38218). Chir pine had lowest benefit cost ratio (1.23), NPV (Rs.5434) at 8% interest rate, which were even lower than the grass production. Grass production gave better values of NPV (Rs.20585) and LEV (Rs.20628) than a mix plantation of chir and broad leaved species (chir 60% + *Ailanthus* 20% + *Robinia* 20%). This trend was followed at 10 and 12 percent interest rates also.

The value of IRR was highest for grass production (>600%) and chir pine ranked second (65.93%) due to long gestation period. The lowest value was for pure *Ailanthus* plantation (50.78%).

The broad leaved tree species proved

more profitable due to their fast growth rate and short rotation. When their rotation in mixture with chir pine was increased, the values of B/C ratio, NPV mixture with chir pine was increased, the values of B/C ratio, NPV and LEV also increased. Though *Eucalyptus* was the most profitable species among broad leaved plants but due to its unsuitability in most of chir pine zone, preference should be given to pure *Robinia* or *Robinia* and *Ailanthus* in a mixture (50 : 50). If site conditions were not suitable for pure broad leaved tree species then chir pine should be planted in mixture with broad leaved tree species having not more than 40% ratio.

5. Forest Cover classification in Dir Swat and Malakand Area through Satellite Remote Sensing by Syed Jawad Hussain.

The present study was undertaken for the mapping of forests and their classification using satellite data. Using very simple interpretation techniques, it was possible to discriminate and delineate various features on the basis of tonal contrasts. Dir, Swat and Malakand areas were selected for the conduct of this study. Landsat TM data was used for mapping and estimating the areas of different cover classes. TM data was visually interpreted and results were obtained in the form of a map showing forest cover classification, appreciating the application of TM data to forest mapping. After the completion of the work it was concluded that satellite remote sensing especially Landsat TM data provided a viable, authentic and cost effective means of mapping and area estimation of forest resources.

6. Effect of farm and energy forestry project on socio-economic condition of farmers in Gujrat District by Javaid Iqbal.

The problems raised in this study concerned the ways in which the Farm and Energy Forestry Project had affected the socio-economic conditions of the farmers. The study focussed on three main research objectives: a) The extent of adoption of F.E.F. Project by the farmers, b) The effects of the project on their socio-economic conditions, and, c) The future scope of such Projects in farmers' opinion.

The data for this study was collected from 35 randomly selected participating farmers in 24 villages of Tehsil Gujrat. The data was statistically analysed. Major findings of the study were as follows:

- i) Farm size was an important factor in the adoption of Farm and Energy Forestry Project. The highest participation (63%) was by the farmers having farm size between 2.1 to 6.0 hectares. The small farmers did not want to take risk of planting trees in place of agricultural crops. Big farm owners, although participated in the project but not to that extent as the middle class farmers.
- ii) Education played an important role in the diffusion of the latest information. It was in this context that almost 86% of the participation was from educated farm, owners. The project significantly increased the income of the farmers who had participated in it. There was a correlation between farm size and positive income.

7. Fuelwood consumption survey in urban and rural areas of D.I.Khan District by

Humaira Hashmi.

The main fuelwood species sold in D.I.Khan market were Kikar (*Acacia nilotica*), Shisham (*Dalbergis sissoo*), Farash (*Tamarix dioica*), Kareta (*Capparis aphylla*) and Kandi (*Prosopis cineraria*). These species like kikar and shisham were also imported from nearby districts of the Punjab. Fast growing species such as *Eucalyptus* and Poplar were not marketed because of absence of demand.

The sample survey of the urban area revealed that 25% households used LPG, 3% fuelwood, 14% Kerosene Oil/Fuelwood, 14% LPG/Fuelwood, 13% fuelwood/dung, 8% fuelwood/Dung/LPG, 12% Kerosene Oil/LPG and 11% used other fuels. The choice of cooking fuel by a household was influenced mainly by the availability of LPG in the market. Other factors such as income level, educational status, and occupation of the households also affected the choice of fuel.

The survey indicated that the choice of fuel in rural area was greatly influenced by the ease in access to fuelwood resources, uncertain supply of LPG, and income level of the household. 95% of the households were using only fuelwood or combination with other fuels such as kerosene, dung and LPG. There were only 5% households using efficient commercial fuels (LPG, Kerosene etc.). Increasing economic burden, decreasing fuelwood resources, under employment in agriculture sector, occupation as manual labour and illiteracy lead to choice of other organic fuels available at collection time, cost and/or in reward of work done for others, rural demand for traditional fuels if not increased, is going to remain constant in future, even under a very optimistic scenario.

8. Household fuelwood consumption in Chilas rural, Northern Areas by Iftikhar Ahmad.

Almost entire population of rural areas of Chilas sub-division meet their fuel requirements from natural forests owned by locals. The villages which located far from natural forests fulfill their fuel needs from the trees grown on farmlands. These villagers also use a small quantity of kerosene oil as an alternate source of energy. On the basis of per capita consumption of 456.24 Kg fuelwood in rural area, household requirement was estimated as 6.241 tonnes, in sampled area 624.136 tonnes and in the whole area 21753.52 tonnes of fuelwood per annum. To save the natural forest from over exploitation, it was suggested to practice social forestry on large scale and generation of hydropower in the rural areas where water and land area was sufficient.

9. Livestock exclusion on wildlife habitat at Manglot Wildlife Park (Nizampur) NWFP Pakistan by Safdar Ali Shah.

Livestock exclusion generally improves the wildlife habitat. This natural improvement is slow and takes long time period to predict successional trend. Generally initial data of total vegetation cover, air dried forage production and species frequency are needed to determine the effects of cessation of livestock grazing.

Vegetation cover and air dried forage production data were collected by quadrat (1 m²) sampling procedure. Fifty quadrats were studied inside and 50 outside the Manglot Wildlife Park which were selected randomly in July 1993. Each quadrat was clipped separately for each species after estimating the cover percent.

The statistical analysis (t-test) showed no significant differences in vegetation cover percent and air dried forage production inside the wildlife park and adjacent grazed area. The cover percent and air dried forage production of *Chrysopogon aucheri* increased within the wildlife park after cessation of livestock grazing. The higher cover percent and air dried forage production of *Cymbopogon jawarancusa* in the grazed areas indicated that this species was less preferred by the animals, when it was found mixed with other palatable and nutritious forage species. It, may therefore increase under the continuous grazing system.

The wildlife park had only one year livestock exclusion. The result of the study revealed a positive successional trend within the park. Based on the results of this study, longer time period will be required to detect vegetation differences inside and outside the wildlife park.

The wildlife park could support 1825 Chinkara and 1217 Urial under the current productivity. The bird population was appreciably more within the park than in the area open to grazing.

10. Fuelwood consumption survey in Skardu Urban Area by Jawad Ali

House hold fuelwood consumption pattern was studied by a sample survey by observing 100 households in urban area of Skardu. The analysis of data revealed that fuelwood was the major source of household energy. Out of 100 respondents, 99% used fuelwood in combination with other commercial fuels. The total fuelwood consumption for the population of 3000 persons in the study area was 3,786,000 Kg per annum. The percentage of winter and summer consumption was 72 and 28% respectively.

11. Allelopathic effect of *Eucalyptus* species on legume vegetables by Fauzia Bilqis Malik.

This study was in continuation of the previous work on allelopathic effects of *Eucalyptus camaldulensis* on wheat. In the current work, an effort was made to investigate the allelopathic effect of three *Eucalyptus* species on winter legume vegetables. The effect of leaf extracts of *E. camaldulensis*, *E. citriodora* and *E. tereticornis* on *Pisum sativum* and *Phaseolus vulgaris* was studied. There was no significant inhibitory effect due to allelochemicals on most of the growth parameters of *Phaseolus vulgaris* including yield i.e. weight and number of pods.

However, growth of *Pisum sativum* was significantly reduced due to allelopathic effect of all the three *Eucalyptus* species. The maximum inhibitory effect was observed by the decomposed leaves of *Eucalyptus citriodora* followed by *Eucalyptus camaldulensis* and *Eucalyptus tereticornis*. Similarly the nodulation of roots of sweet peas also significantly reduced due to allelopathic effect of three species with maximum effect by *Eucalyptus citriodora* followed by *Eucalyptus camaldulensis* and *Eucalyptus tereticornis*. Application of leaf extracts of all the three *Eucalyptus* tree species had no effect on beans (*Phaseolus vulgaris*).

12. Household fuelwood consumption in Chilas Town, Northern Areas by Ghulam Haider.

Chilas town is the district headquarter where fuelwood is used for all energy requirements and which is extracted from the natural forest. The study suggests strategies such as practice of large scale social forestry introduction of liquid petroleum gas, (LPG) and

Kerosene oil and generation of hydropower as an alternate source of energy production.

13. Effect of *Acacia modesta* and *Dodonaea viscosa* canopy cover on herbaceous vegetation at Manglot Wildlife Park, Nizampur by Akbar Hasan.

The current study was designed to find out the effect of different canopy covers of *Acacia modesta* and *Dodonaea viscosa* on the cover percent and air-dried forage production of herbaceous vegetation. The statistical analysis of cover percent and air-dried forage production under three canopy cover of 25%, 50% and 75% were performed. The results of the study showed reduction in the production of grass under different canopy covers of *Acacia modesta* and *Dodonaea viscosa*. The *Chrysopogon aucheri* reacted as high light demander as its production was zero under 75% canopy cover. The cover percent and air dried forage production was higher under the partial shade upto 50%. The air dried forage production and cover percent of *Chrysopogon aucheri* and *Cymbopogon jawarncusa* reduced when either of these two species were growing under the different canopy covers of *Acacia modesta* and *Dodonaea viscosa*.

14. Comparison of productivity of seeded and ungrazed and grazed area in Rakh Dagar Kotli Rangelands by Hayat Hassan.

The present study was designed to compare forage production, cover percent and carrying capacity of both seeded and ungrazed and seeded and grazed areas. Air dried forage production and cover percent data were collected from both the pastures in July 1993. Forty quadrats (1m²) were studied in each of seeded ungrazed and seeded grazed area. Carrying capacity for both the areas was

calculated for comparison. Air-dried forage production and cover percent data were statistically analysed using t-test.

Total average air dried forage production in seeded and ungrazed area was 13247.25 Kg/ha and in seeded and grazed area was 846 Kg/ha respectively. Total vegetation cover percent was 50.2 and 48.27 in seeded and ungrazed area and seeded and grazed area respectively. The reduction in cover percent and air dried forage production in seeded and grazed area of these species showed that species decreased under continuous livestock grazing. The high cover percent and air dried forage production of *Cymbopogon jawarancusa* and *Eleusine flagellifera* in seeded and grazed areas indicated that the species increased under continuous livestock grazing. This was attributed to grazing animals having less preference for *Cymbopogon jawarancusa* and *Eleusine flagellifera* when found mixed with *Cenchrus ciliaris* and *Lasiurus hirsutus*. *Eleusine flagellifera* has runner type stem and grows on the ground surface and thus tolerated animals grazing better than others due to their runner stems growing on surface of ground. Productivity of the depleted rangelands of Thal may be increased by artificial reseeding with *Cenchrus ciliaris* and *Lasiurus hirsutus*.

15. Effect of *Acacia modesta* shade on the production of grasses in Lehri Nature Park, Dina, District Jhelum by Imtiaz Ahmad

The purpose of this study was to find out the shading effect of *Acacia modesta* on the cover percent and production of grasses and ultimately the carrying capacity of the area. Ten trees having the same ground vegetation were selected for study. Field data on cover percent and air-dried forage production of grasses were

collected from below the canopy of trees and of area away from the canopy. One hundred and sixty, 1 m² quadrats, were studied for forage production and cover percent. Analysis of variance was performed to find out significant difference in the cover percent and air-dried forage production. The cover percent of grasses beneath the crown (shade) of *Acacia modesta* trees and open area was 23.51 and 34.62 respectively. The average air-dried forage production of grasses beneath the crown (shade) and open area of *Acacia modesta* tree was 2303 gm/m², and 29.01 gm/m² respectively. The carrying capacity below the crown and open area was 15 and 19 A.U.M., respectively. The results of the study showed non-significant difference in the cover percent and air dried forage production of grasses in the North, South, East and West direction of an individual *Acacia modesta* tree. The cover percent and air-dried production of grasses was significantly higher in the unshaded open area as compared with the shaded area under the crown of *Acacia modesta* tree. No considerable difference in carrying capacity (AUMS) was found for shaded and unshaded area.

16. Determination of range utilization using height-weight method of forage species at Khawarmung District Muzaffarabad (A.K.) by Zulfiqar Haider Butt

Range utilization of Khawarmung was calculated using height-weight method. Three grasses namely *Bothriochloa pertusa*, *Chrysopogon aucheri* and *Themeda anethera* were selected to find out range utilization by using height-weight ratio method. Cumulative percent height and weight were calculated for each species. The percent weight (Y) was plotted against percent height (X) removed. The results of this study indicated that weight was not linearly distributed with the height of

these bunch grasses. The weight was higher in the basal 10% portion of each species as compared with other segments of the individual plant.

17. Determination of Range Utilization using Height-Weight Method of forage species at Margala Hills, Islamabad by Imdad Hussain

Range utilization was calculated using height-weight ratio method. Three grasses namely *Chrysopogon aucheri*, *Bothriochloa pertusa* and the *Themeda anethera* were selected to find out range utilization by using height-weight ratio method. Percent height was plotted along "X" against "Y". The result indicated that the weight was not linearly distributed with the height of these bunch grasses. Weight of the basal 10% portion was far greater than the other parts of the plants.

18. Household Fuelwood consumption survey in rural areas of Skardu District by Ijlal Ahmed

In the sampled area, 91% people were using wood as fuel, 4% both wood and kerosene and 5% used kerosene only. A sample survey of households in rural areas of Skardu district in 1993 revealed that 438.20 Kg and 1057.40 Kg of woodfuel were consumed in a summer and winter months respectively. Since wood consumption per month was estimated as 74780 Kg, therefore wood consumption per household came to 747.8 Kg per month. The choice of cooking fuel by a household is influenced mainly by the availability of kerosene in the locality. Other factors include household income levels, education level and occupation of household head. The choice of wood is associated with non-availability of gas, low level of household income, literacy and manual

labour as occupation of household head.

Household monthly fuel consumption increases by about 55% in winter as compared with summer. In summer the average monthly cost for fuel was about Rs.91654.8 which is about Rs.916.54 per household head per month in summer season. In winter the situation is quite different, i.e. expenditure on fuel per month is about Rs. 2113.13. The average monthly cost on fuel is about Rs.1514.84. Fuelwood supplies come mainly from farm lands as Skardu district is generally devoid of natural forests. The most preferred wood fuel species are, Apricot, Juniper and *Elegnus hortansis*.

19. Estimation of root and shoot biomass of *Cenchrus ciliaris* (Dhaman) under barani condition at Jamrud by Muhammad Umar Farooq

Data on shoot and root biomass and number of culms (dry matter) on thirty plants of *Cenchrus ciliaris* (Dhaman) were collected in May and October 1992. t-test was performed to find out significant differences among the shoot, root biomass and number of culms in May and October 1992. Shoot root ratio were also calculated using dry matter production in May and October 1992. The result of statistical analysis revealed that:

Root shoot biomass was significantly different in May 1992.

Root shoot biomass was not different in October 1992.

Number of culms/shoots were significantly higher in May 1992 than in October 1992.

Root shoot ratio increased at the end of growing season in October 1992.

20. Population status and distribution of Urial in Ibrahimzai and Mir Khaili Hills in Kohat by Amir Saeed.

Urial is one of those wild mammals which was heavily hunted in the past and became endangered. This necessitated collection of basic facts on the Urial distribution and population to devise a conservation strategy. This study was done in the area of Mir Khaili and Ibrahimzai Hills of Kohat district during July 1993 to find out the population status and distribution of Urial. The study consisted of direct field observations to ascertain the presence of Urial and administering of a questionnaire to the locals for collecting indirect evidence.

The response to the questionnaire established the presence of urial in winter habitat. The locals reported seeing 35 urials during the winter of 1992-93. Loss of habitat and poaching were indicated as main cause of decline in the Urial population. To arrest further decline in urial population, it was proposed to implement NWFP Wildlife Act, 1975, strengthen wildlife staff, create awareness among public, arrange frequent exhibitions, subsidies to save habitat etc.

21. Fuel Wood consumption survey in Gilgit Urban Area by Mohammad Arif.

A sample survey of 100 households in Gilgit Urban areas was conducted in 1993. The analysis of data revealed that the average household size was 8 and the average earning members were 1.58 with Rs.7863 being the average income. The average income from livestock, fruit trees and forest trees was Rs.661, Rs.50.23 and Rs.3282 respectively. Average consumption of all fuel types increased with the

increase in family size. The expenditure on fuel was different in different categories of people. The expenditure of business men on fuel was higher than other categories of people. The average expenditure of farmers on fuel wood was high and they preferred wood than the other fuel types.

About 25% of the total respondents were illiterate and 75% were educated. The wood consumption rate was high among the illiterate persons as compared to the educated persons. Household monthly fuel consumption become double in winter as compared to summer. Fuel consumption was found positively co-related with household size, illiteracy, household income and occupation of the household heads. Per capita per year wood consumption in the study area was 481.69 kg. *Quercus ilex* (locally called Bani), *Morus alba* and Apricot were first, second and third in order of preference for fuel.

22. Assessment of Woody Raw Material for Pulp Mill in Gujrat District by Hamid Abbas

Gujrat district of Punjab province was selected to assess the woody raw material for the pulp mill being established in this district and evaluate the work done under Forestry Planning and Development Project. 12 villages were selected at random in all the three thesils of this district and 96 respondents were interviewed. The salient findings of this study were that the literacy rate was 43% among all four categories of respondents; average land holding size of all the four classes was 5.4 hectares; average number of family members was 7.48, 67.5% *Eucalyptus* and 32% Poplar trees were grown. Maximum number of trees of *Eucalyptus* are present on the farm lands. Trees of 9-21 cm diameter classes are felled.

The demand of the mill for raw material will hardly be met for two or three years from trees growing in Gujrat. The supply may continue for some years but not on sustained basis. It will have to be met from sources which are outside district Gujrat.

23. The impact of agro-forestry practices on the socio-economic conditions of Katlang Farmers, Mardan, NWFP by Mohammad Ali Shad

A socio-economic survey was conducted to assess the number of trees growing in the study area, farmer's perception of the present and future prospects of agro-forestry and the potential of added income via agro-forestry practices in the study area. Data was collected from 60 persons comprising 30 farmers, 10 owner-cum-tenants, 20 tenants, using a questionnaire. The study revealed significant differences among ownership categories. All the farmers of the study area wanted to plant trees with different perception. Tenants and owner-cum-tenants in the study area expressed strong need for grants, loans and technical assistance with strong feelings for revitalising land reforms.

24. Effect of *Acacia nilotica*, *Prosopis cineraria*, *Zizyphus mauritiana* on crop of wheat and gram in Barani area of Mianwali District by Sajid Qudoos Awan

A survey was conducted to assess the effect of indigenous tree species. *Acacia nilotica*, *Z. mauritiana* and *P. cineraria* on the yield of wheat and grams under barani conditions in Mianwali district. For this purpose, crop yield was assessed by laying out 1 sq. meter quadrats on all the four directions at a distance of 1, 5, 10, 15, 20 meters. The result of the study indicated that all three tree species affected the crop upto 15 m distance in all the

four directions. *A. nilotica* and *Z. mauritiana* had significantly higher negative effect on crop yield under barani condition. While *P. cineraria* had less negative effect on crop yield. It was also observed that there was no significant effect of shade because the crop yield was equally affected on all the four directions. The financial analysis indicated that all three tree species affected the crop yield but over all farm productivity was increased because of reasonable income from trees.

25. Cost of establishment of artificial planting of *Rhizophora mucronata* in Mangrove Forests of Pakistan by Abdul Sattar Khatri

The mangrove are a unique resources of Pakistan which are spread over an area of 617,530 hectares in Sindh and 9,000 hectares along Balochistan coastline. On one hand these forests produce 15-20 m³ wood/hectare, provide habitat for wildlife, feed for grazing animals and on the other hand these support Pakistan's industries of fisheries and shrimps giving thereby Government of Pakistan an earning of about 4 billion rupees annually. About 100,000 fishermen are engaged in fishing and shrimp industry. Additionally, protection of Bin Qasim and Karachi Ports also depend on these forests. The mangroves have lost forest cover on 37.2% of their total area during the last thirty years. Development of infrastructures and industrialization in Pakistan have resulted in polluting marine ecosystem by putting toxic affluent into sea. Similarly fertilizer application on agricultural lands has also contributed in increasing marine pollution. The other threat which is inhibiting the development of mangroves is the decrease of freshwater in-flow by 49.5 MAF. From Kotri Barrage down stream salinity has increased to 41,000 ppt. The volume of silt from Kotri barrage has reduced by 170

MT causing degradation in Indus delta. Other minor threats include lack of knowledge, mismanagement, over exploitation, browsing and less frequent and low tides over deltaic region.

Therefore, a need for rehabilitation of these forests through planting of suitable species in the changed ecological conditions is felt. The Government of Sindh with assistance of the World Bank has launched a programme for afforestation of mangroves with *Rhizophora mucronata* and *Avicennia marina*, and *Ceriops tagal* as secondary species. The cost-benefit ratio of *Rhizophora* species is far better than *Avicennia* which are 1:0.62 and 1:0.35 respectively. *Rhizophora* fetches good timber value. Survival and growth rate of *Rhizophora* are also better than *Avicennia* and *Ceriops* species. If its afforestation is continued then it is expected that the mangroves would be converted into productive forests within next 10 years. There is also a need for initiating a programme of public awareness about importance of mangroves, for establishing fuelwood plantations near villages by involving people in such projects.

26. Study of level of salt tolerance on three multipurpose tree species by Arjumand Nizami

A nursery experiment was conducted to find out the effect of soil salinity on the growth and survival of *Eucalyptus camaldulensis*, *Prosopis juliflora* and *Albizzia lebbek*. To simulate salinity, three salts were applied in four concentrations by preparing their 300, 500, 700 and 900 milli-Molar solutions. Experimental pots were lined with black polythene sheets to maintain the salinity levels induced into the soil. Salinity was found responsible for overall reduction in height growth, biomass production

and nodulation. The effect of different salinity and sodicity on root-shoot ratio and survival was not significant in nursery conditions. In conclusion, the study demonstrated that in the nursery conditions, *Eucalyptus camaldulensis* showed better tolerance to salinity upto 700 ppm concentration level, followed by *Prosopis juliflora* and *Albizzia lebbek* which were tolerant only to lower concentration levels. The results presented and conclusions drawn in this study may not be valid under field conditions where moisture condition fluctuates frequently.

27. Household fuelwood consumption in Hunza Valley, Northern Areas by Khalil Ahmed

A sample survey was conducted to determine the supply and demand of fuelwood in ten villages of the study area. For this purpose, 100 respondents were randomly selected and interviewed by using a questionnaire. Analysis of data revealed that fuelwood was the major source of household energy in the area. Cent percent of the household used fuelwood in various quantities. More than 21% of the households used only fuelwood for domestic energy. About 79% of the sample units consumed fuelwood along with other fuels such as Kerosene oil, LPG and wood wastes. About 10% people were engaged in collection of fuelwood directly from the forest areas whereas 54% people purchased fuelwood from the local shops and 36% obtained fuelwood from their farmlands. The total fuelwood consumption for the population of 47,053 persons in the area was 27,38,484.5 Kg per annum which indicated high pressure on the state forests. In order to overcome shortage of wood, and bring down prices within reach of the poor, it was suggested that the conservation and afforestation programmes should be launched simultaneously through farm forestry with the

involvement of the inhabitants.

28. Fuelwood requirements in Thatta City, Sindh by Zulfiqar Ali Memon

A sample survey of 102 households in Thatta City was conducted in 1993. The analysis of data revealed that the average household size was 10.55 with Rs.6,291 being the average monthly income. 61.8% and 34.3% of the households relied exclusively on fuelwood and LPG respectively whereas mixed use of LPG and fuelwood was practised by 3.9% of the households. Households monthly fuelwood consumption increased by 68% in winter as compared with summer whereas the LPG use remained static. Fuelwood consumption was found positively correlated with household size, illiteracy, low level of household income and manual labour as occupation of the household heads. The average monthly household expenditure on fuel, constituted 6% and 5% of the total household income for LPG and wood respectively. For estimated population of 85000 persons, the per capita fuelwood consumption was 38 Kg. The market demand for fuelwood in household sector in Thatta city was estimated at 2609.138 tonnes per month. Babul, Lai and Kandi were found to be the three fuelwood species in their order of preference. Due to high pressure on the adjacent inland and riverain forest resource, it was suggested that natural gas facility should be provided in Thatta city and social forestry be promoted with afforestation of Babul, Lai and Kandi to meet the fuelwood requirements of Thatta city population.

29. Effect of *Acacia nilotica*, *Prosopis cineraria* and *Zizyphus mauritiana* on wheat and gram in the barani areas of Bannu Division by Mohammad Rashid

Growing of single scattered trees is the predominant agroforestry system in the rainfed (barani) areas of country. It was necessary to find the biological interaction of indigenous tree species on agriculture crops. A study was conducted to investigate the effect of indigenous tree species *Acacia nilotica* and *Zizyphus mauritiana* on the productivity of agronomic crops wheat and gram under Barani condition of Bannu Division. Quadrats of one square meter size were laid to collect samples around the trees of species under study at a distance of 2 meter, half time height of tree, at tree height and twice height of the tree. The results revealed that all the three tree species had deleterious effect on crop yield at 2 meter, but gradually yield increased as one moved away from the tree and maximum yield was observed at a distance equal to two times height of tree. However, *Prosopis cineraria* effect was less than that of *Zizyphus mauritiana* and *Acacia nilotica*.

30. Socio-economic impact of Hurries system on growers in district Hyderabad Sindh by Mohammad Saleem Vistro

Research study was conducted to determine the socio-economic impact of Hurries system on growers in district Hyderabad Sindh. For this purpose, six villages/towns were selected randomly with the help of revenue record and voters list. After analysing the data statistically, result was drawn that farmers of the Hyderabad district prefers to grow Hurries on their private lands which are not suitable for agricultural crops or on the lands which mostly face water shortage problem. Water scarcity was the main cause of shifting agricultural crop land towards Hurrie system. Farmers always used marginal lands for raising Hurries. Hurries not only improve farm water use efficiency but also produced mining timber and increased land productivity. It was concluded from the study

that Hurries are cash crops, generating more income with less expenditure and improved the socio economic condition of the growers.

31. *Beauveria bassiana* as a biological control agent against Forest pests and its efficacy against *Poecilocus pictus* by Mrs. Nighat Mansoor Chughtai

Entomopathogenic fungus *Beauveria bassiana* was tested as a biological control agent against *Poecilocus pectus* in the laboratory to evolve best possible biological control. *B. bassiana* fungus was tried in the doses of 0.8×10^4 spores/ml and 0.4×10^4 sporest/ml in the study. The data recorded revealed that *B. bassiana* has given a non-significant result against *P. pictus* even after 72 hours but results were significant after 96 hours upto 168 hours of treatment. The study revealed that after the treatment of the nymphs, the fungus first established and then caused the mortality within a period of 2-3 days. Among the three doses, 100% mortality of nymphs occurred after 13 days in the dose of 0.8×10^4 spores/ml while the same mortality was recorded by the other two lesser doses in 18 and 29 days, respectively. *Beauveria bassiana* being an entomopathogenic fungus can be used as biological control agent against *P. pictus* for safer and economic control of the pest in the field.

32. Evaluation of sand dune stabilization techniques in Pakistan with special reference to Mastung Valley of Balochistan by Abdul Wadood Khan Bazai

The inland cold sand dunes have swept Mastung valley of Balochistan province. These dunes move with prevailing wind storm and has covered R.C.D. highways, railway lines, Karezes and valuable agricultural and residential areas.

The study was carried out to evaluated the Mastung techniques of sand dune stabilization. Mechanical, chemical and biological sand stabilization techniques were tested. Biological techniques proved most successful in which planting was done with species of *Tamarix gallica*, *Calligonum commosum*, *Calligonum polygonoides* and *Arundo donax* which resulted in effective protection of sand dunes areas, positive effect on ecology and a source of income by controlled grazing, fuelwood extraction and fodder. Microclimate brought in ground vegetation of *Heliotropium dysicarpium*, *Poa bulbosa*, *Panicum antidotale* and *Andropogon annualatus*. The study was conducted by selecting 8 sand dunes randomly i.e. 4 each from treated and non-treated dunes. It was ascertained that the Mastung techniques not only stabilized the sand dunes but also provided better chance for ground vegetation recovery. Although dominant species was *Heliotropium dysicarpium* with cover percent as 42%, but *Andropogon annulatus* showed good performance in both treated and non-treated sand dunes.

33. Market analysis of *Eucalyptus* wood in major irrigated plantations of Punjab by Farid Ahmad

Eucalyptus is a fast growing tree with 10 years rotation age. It has been planted on commercial scale in irrigated plantations of Punjab and in forestry project areas. The data was collected from nine major Forest Divisions of Punjab. The total production of *Eucalyptus* timber and firewood during the year 1991-92 was 2,392 m³ and 5,867 m³ respectively. Similarly the total revenue for the same period obtained from the sale of eucalyptus timber and firewood was 27,07493 and 14,33,910 rupees respectively. The wood contractors (middlemen) of Punjab who purchased the wood from these

plantations had a profit margin between Rs.250-350 per m³. Middlemen were of the view that there was no specific use of eucalyptus wood in the present situation. Eucalyptus wood in Punjab is being utilized as a firewood, constructional material for rural buildings and low class furniture. It is not considered as standard wood for chipboard, plywood, particle board, sports goods and high class furniture due to its splitting property. At present establishment of high capacity pulp and paper mill can solve its marketing crisis in Punjab.

34. Marketing of farm forestry products in Sanghar District by Mohammad Zafar Wassan

A survey was conducted in Sanghar district to study the marketing of farm trees. The study revealed that the wood produced in Sanghar district was being sold in markets located at Sanghar, Shahdadpur, Singhero, Khipro, Tando Adam and Hyderabad. Majority (46%) respondents preferred to sell their wood at Sanghar, 18% at Khipro, 14% at Shahdadpur, 12% at Sinjhero, 7% at Hyderabad and 3% at Tando Adam. Tando Adam and Hyderabad markets were offering higher prices to the farmers. The study also identified three categories of wood buyers in the area i.e. wood contractors, local businessmen, and mine owners. Mine owners usually offered high prices for wood but each market was dominated by the contractors and local businessmen. Majority (68%) farmers sold their wood to the contractors, 20% to the local businessmen, and 10% to the mine owners. All the respondents sold their trees standing. Felling, conversion and transportations operations were generally done by the contractor and local businessmen. The data analysis showed that contractors and local businessmen were earning a major share of their income from wood and that the wood

buyers were offering three times less than the actual price of shisham in the market. In case of kikar and Eucalyptus the offer was less by 1.97 and 2.23 times respectively. Majority of the people in the study area were growing trees in linear form. Common tree species grown in the area were kikar, shisham and eucalyptus.

35. Scope of farm forestry in District Mianwali by Muhammad Mushtaque

Farm forestry commonly promotes commercial tree growing by farmers on their own lands. Practically, there are numerous obstacles to overcome before local people can enter into a programme. The role of a farm forestry programme is to remove these constraints so as to facilitate the participation of large number of farmers in tree growing. Species selection for a programme ought to begin with a clear identification of end uses to which a tree can be put. A survey was conducted in Mianwali district to study attitude of the people towards farm forestry and difficulties faced in this respect. The socio-economics condition were also observed to help in formulating recommendations. The results revealed that family size with 4-6 members was the dominant one. A general observation noted was that the owner cultivator had the maximum family members followed by the owner-cum-tenants. More than 50 percent of the respondents in the area were illiterate. Mostly illiterate respondents belonged to the class of owner cultivators. About 76 percent of the respondents were engaged directly with agriculture. Majority of these respondents belonged to Owner Cultivators. The land holding size of the respondents ranged from 0 to 175 acres; the average land holding being 21.38 acres. This average size included all type of lands i.e. irrigated, barani and wastelands. The problems of the wasteland included salinity,

waterlogging, mass river erosion, deposition of sand and lack of water.

The livestock holding of the respondents ranged from 8 to 97. On an average, a respondent was holding 9 animals. About 62 percent of the respondents were growing on an average up to 25 trees and so the tree number per acre came out to be 1.5. The species grown in the area included *Acacia nilotica*, *Prosopis cineraria*, *Zizyphus mauritiana*, *Tamarix aphylla*, *Morus alba* and *Dalbergia sissoo*. The barani areas had *Prosopis cineraria* and *Zizyphus numularia* as the dominant species. The "KATCHA" area along the river bank supported higher percentage of *Acacia nilotica*. The income from trees varied from none to Rs.25,000 with an average of Rs. 741 per annum. About 70 percent of the people earned nothing from other sources. Majority (82%) of the respondents purchased timber and firewood from village saw mill. Only 2 percent of the respondents were fulfilling their wood requirements from their own trees.

About 56 percent of the respondents were facing the problem of lack of market for the sale of trees, 14 percent of the respondents stated that the expenditure incurred on the transport of wood in the present condition was so high that transportation of wood was not economical. About 27 percent of the respondents were of the view that the wholesalers of the main market were not coming to the villages for the purchase of wood. On an average, 32 percent of the respondents stated that they would prefer those species which are suitable as wind break. Large number of respondents (42%) showed their interest for choosing those species which generate maximum income.

About 20 percent of the sample tree

farmers preferred fast growing species for obtaining quick returns. Only 6 percent of the respondents stated that they did not intend to grow trees on agricultural lands. They were also of the view that tree species such as *Tamarix aphylla*, *Acacia nilotica*, *Albizia lebbek* and *Zizyphus mauritiana* were detrimental to the crops. Generally, 19 percent of the respondents demanded provision of irrigation water in the area. Only 20 percent of the respondents were of the opinion that prices of tree species should be increased to promote farm forestry.

36. Socio-economic evaluation of Integrated Hill Farming Development Project in District Muzaffarabad (A.J.K.) by Ghulam Mujtaba Mughal

The study aimed at assessing the socio-economic impact of the Integrated Hill Farming Development Project (IHFDP) sponsored by the World Bank on the participant households. The study area comprised of three extension circles in Tehsil Muzaffarabad and Hattian. The population belonged to rural areas and depended upon agriculture, livestock and business supplemented by the government and private services. A socio-economic survey was conducted in the study area during June, 1993. The parameters studied were socio-economic factors of the households and control measures of soil erosion through planting and land use practices. Five villages of the study area were selected by simple random sampling method. The respondents were interviewed through a pretested questionnaire.

Thirty five households were interviewed. The data revealed that 95 percent of population of the study area was agrarian by profession. The land holding size was small and people did other jobs to supplement their income. Sixty six percent were literate which had clear perception

of the project than the illiterate. The average earning members per household were 2 while the average dependent members were 8 per household.

Under the forestry component of IHFD project, 238,680 plants of different species had been planted in the study area from 1983-1990. Eighty percent respondents were of the view that soil erosion had reduced since the start of the project. The livestock population decreased in the study area by 12 percent due to various reasons. Only 17 percent of the household heads reported that they had sold surplus fodder while 20 percent reported that they purchased fodder to supplement the livestock feed. The project area was also getting other works like road construction and employment. The project had positive response from the local population. Seventy two percent respondents were strongly in favour of this programme. They were of the opinion that a break through in socio-economic conditions of the area had been achieved.

37. Perception of the range land users about the improvement of their range land in Dir District by Ikram Ullah

This study relates to perception of rangeland users about their rangeland improvement in Timargara and Dir ranges of District Dir Malakand Division. A cross-sectional social survey using the questionnaire technique was conducted to collect information from randomly selected household heads. One hundred and five (105) household heads were interviewed after being selected from four sample villages. The socio-economic, socio-cultural and physical factors which affect the farmers as well as the possible key processes and limitations of interrelationships of human and environmental factors and land use were

discussed. The study suggested that interaction between the prevailing socio-economic forces and physical factors were not conducive to maintaining the rangelands values.

Human and livestock population pressure was very high in the area. Living standard of people was not high. More than half of the population was illiterate, while the literate persons had primary education. The majority of respondents faced the problem of availability of grass/fodder which became scarce in winter months. Major problems of the area were poor condition of roads and non existence of Government ration depot.

38. Water and soil conservation practices among the farmers of Goharabad Watershed in Diamer District by Rahmat Ali

The study was conducted to determine the state of awareness of the local population about water management and soil conservation techniques. A questionnaire relating to management and soil conservation was distributed among fifty (50) respondents of the project area. The study revealed that most of the population were aware about the water management and soil conservation. However, some of them did not know the meaning of the above terms. Due to unawareness of the local population, most of the land scape had badly eroded. Rain water run off had damaged most of the useful soil. It was recommended that a sound survey should be carried out to highlight the deteriorating conditions of the soil, agricultural and forest land in the study area.

39. Evaluation of watershed development Project in Central Northern Area of Pakistan by Sabir Hussain

The study was conducted in the central Northern Areas which had about 5500 families mostly engaged in subsistence farming on small pieces of land and on livestock rearing. Thirty household heads were selected by incidental sampling technique and data were collected by a structured interview schedule. The following are the important findings of the study:

- i) Sixty seven of the respondents were illiterate and remaining had either primary or matric education. Average number of children among the respondents were 4, while the average number of dependents was 9.
- ii) Among the respondents who had sources of cash income (60%) the average monthly cash income was Rs. 814. Main crops raised in the area were wheat, potatoes and maize.
- iii) Majority of the respondents (60%) had agricultural and grazing land while 40 percent had only agriculture land. Average number of livestock per farmer were 24 but forty percent had 1-10 animals. Majority of the respondents (60) faced problem of low availability of grass/fodder which became scarce in the winter months. Grazing was the only benefit mentioned by a significant number of respondents (23%) derived from the forests other than

timber/fuelwood.

- iv) Average consumption of fuelwood per household was 27 maunds for a month. Majority of the respondents (60%) perceived that forests will decrease in future in the valley.
- v) Majority of the respondents (70%) said that their land was being eroded and 53 percent of them thought that excessive tree cutting could accelerate soil erosion but excessive grazing was not a cause of accelerated soil erosion. Majority of them (64%) perceived that they can cope with their soil erosion problem if financial support was made available to them.
- vi) Among the major problems mentioned by them were poor condition of roads and non-existence of Government ration depot. Majority (69%) sought the help of members and chairman of Union and District Council to solve the problems of their area. The overwhelming majority (97%) of the respondents indicated their readiness to participate in watershed development schemes with Government on 50 percent cost sharing basis of their lands.