

M.SC FORESTRY THESIS RESEARCH AT PAKISTAN FOREST INSTITUTE, PESHAWAR 2001-2003 COURSE

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Leaf area and growth rate relationship in *Populus deltoids* grown in N.W.F.P by Nasreen Fatimah (Advisor: Mr. Tahir Laeeq)

In order to determine the relationship between leaf area and girth of *P. deltoids* trees grown in Charsadda district of N.W.F.P. area, simple, multiple and double log regression analysis was carried out. Girth of the tree was used as dependent variable and leaf area, age and space were used as independent variables. In this regard, data were collected from 2 and 7 years old compact plantations, 3 years intercropping plantation and 8 years linear plantations. It was found that simple regression equations showed better predictability in terms of F-value and R-square estimates. The highest correlation between girth and leaf area was estimated at the age of two years because of higher photosynthetic activity due to large leaf surface area, while the lowest relationship between girth and leaf area was found at the age of 8 years because of maturity of the tree crops. Leaf area/ girth ratio decreased from 2 years to 8 years. Leaf area, age and spacing explained about 84.5 percent of total variation in the girth of the trees.

Socio-economic impact of Hurries on the farmers of Taluka Matiari in District Hyderabad by M. Riaz Shahid Siddiqui (Advisor: Mr. Mohammad Khan SRO)

The study was conducted in Matiari Taluka of District Hyderabad. The main purpose was to know the socio-economic impact of hurry raising on farmers land involved in growing of hurries. Twenty five selected hurry growers were interviewed and some hurries were measured practically. It was found after analyzing the data statistically that raising of *Acacia nilotica* trees in compact form (i.e. hurry plantation) had a promising future if proper attention and intensive management is carried out. Farmers grew hurries on their marginal lands and where there was scarcity of water. Water scarcity is one of the major causes which make farmers to grow hurry plantations on their farmland. It also helped to improve socio-economic conditions of the farmers by providing tangible as well as intangible benefits.

Hurries not only generated more income with less expenditure but also produced mining timber and increased land productivity which ultimately leads to improvement of national income.

Economic Development through Wildlife Conservation in Kohi Barmol Area District Mardan by Muhammad Ali (Advisor: Dr. Mohammad Noor)

Kohi Barmol community Game reserve was established in 1994 when the involvement of communities in conservation activities was initiated in NWFP. Objectives of the study were to assess the current status of wildlife, community's attitude towards wildlife conservation, potential rural development activities that can be done through conservation, analysis of community's income/ possible income from wildlife conservation and to suggest for establishment of conservation fund.

It was found that the status of wildlife population has been improved by adopting proper management practices and involvement of the communities. The community is aware about the need of conservation and the joint management of the Government and more benefits to the community. The community feels that the development activities in the area are only due to conservation and all the segments of the people show interest in conservation. However the means for enhancing the Conservation Fund, determining the sectors in which it is to be used and the transparent procedure for using such funds may be streamlined. For this purpose formulation of bylaws may be of great help.

Water logging and salinity problem in Shorkot irrigated plantation and its remedial measures by Muhammad Azeem Zafar (Advisor: Abdul Khaliq Chaudhry)

It is estimated that approximately 9.4 and 6.2 million hectares (Agricultural Statistics of Pakistan, 1995-96) of land in Pakistan is affected by waterlogging and salinity respectively, of which about half is found in the canal irrigated area. The problem of waterlogging and salinity is not confined to the cultivated areas in Pakistan. A number of irrigated plantations in Punjab are facing the Problem of waterlogging and salinity. The best example in this regard is Shorkot Plantation.

The study was conducted to know the causes and consequences of waterlogging and salinity in Shorkot irrigated plantation. This plantation with an area of 9882.5 acres is divided into 231 compartments for the purpose of

management. Afforestation of this plantation was started in 1947 and completed by 1963-64. Under Indus Basin Treaty, Trimmue Sidhnai and Haveli canals were commissioned in the area in 1965. Since both canals pass through the plantation, so seepage from these canals has raised the water table. Tract was already heavily infested with Kallar. Upward movement of watertable helped salts to move to the soil surface. Due to waterlogging and salinity very good crop of Shisham and other species dried over 7463 acres, where problem is more acute. About 4422.6 acres have been thrown out of production due to this problem. To combat the situation and for reclamation, different engineering and biological works have been carried out in the area. In this regard the Irrigation Research Institute (IRI), Directorate of Land Reclamation (DLR), Salinity Control and Reclamation Project (SCARP), have done special efforts. The study highlights the present situation and severances of the problem and for the first time soil samples were collected from the affected area and analysed for soil pH and Ec organic matter and available Phosphorus contents, which will provide bases for future management. Recommendations for reclamation of the area both biological and non-biological approaches have been suggested.

Menace of Die-back in Shisham Plantations of District Jhang by Shahid Hameed (Advisor: Mohammad Arif Chaudhry)

The study of the menace of die-back in Shisham plantations of district Jhang was carried out in Shorkot irrigated plantation, Sajhowl bela forest, Jhang – Sargodha road side plantation, Rangpur canal side plantation at the rate of 1% sampling intensity for each category and 16 different land holdings of 4 union council selected amongst 41 rural union councils.

The results of Shorkot irrigated plantation aging 30-35 years revealed that 12.36% of total trees on demarcated area were completely dead and 23.12% showed the symptoms of die back (25% crown mortality). Similarly in Sajhowal Bela plantation 20% of the total trees (20600) of 5-35 years age were completely dead and 15% showed die back (25% crown mortality) and Rangpur canal side plantation aging 35-60 years indicated 44% diseased infection rate of the total trees (4282), out of which 25% were completely dead. The road side plantation data indicated the presence of 57% diseased trees of 20-35 years out of which 34% were completely dead and remaining showed more than 25% crown death. None of the soil types of the state owned forests showed any apparent sign of water logging or salinity and presence of any type of industrial waste in their vicinity except Shorkot plantation where water-logging and salinity was observed.

Sixteen different landholdings with an average of 13 trees per acre varying in age from 3-35 years depicted the significant difference of infection percentage and age of trees i.e. infection percentage increased with the increase of tree age and occurrence of Die-back @ 2 trees/ acre on the average. The analysis of mean data of present and past (through the last 10 years) agricultural inputs indicated no significant difference in irrigation sources, number of irrigations/ crop and crop area among wheat, sugarcane and cotton where as the change in area of rice and fodder crops differed significantly.

The comparison of present and past uses of fertilizer (DAP + urea) showed a significant increase in fertilizer application per crop rotation for all the five major crops. A maximum increase of fertilizer application (DAP + urea) amounting to more than 43 kg/ acre in cotton and sugarcane, followed by 31 Kg/ acre in fodder and rice and more than 28 Kg/ acre in wheat was recorded in descending order.

Similarly the increase in the use of chemicals other than fertilizers was highly significant in case of cotton, wheat, and sugarcane followed by significant increase in fodder and non significant in rice crop during the last ten years respectively. The use of insecticide on individual crops was at very high frequency in cotton followed by sugarcane, rice and fodder in descending sequence. No noticeable difference was observed in case of wheat as compared to their past use.

Fuelwood consumption in commercial sector in Mardan City by Ashfaq Ahmad Khan (Advisor: Asif Jah)

The major objective of this study was to estimate fuelwood consumption in commercial sector of Mardan city. Multistage sampling procedure was adopted to collect data through questionnaire. The study area was stratified according to electoral wards. From each strata, commercial units were enumerated and all 196 units were taken as sample. Analysis of collected data showed that the sampled commercial units consumed about 61 tons of fuelwood.

Fuelwood sources to Mardan City constituted local wood working units, natural forests growing in adjoining Buner Valley areas of NWFP, and imports from Punjab. Maximum quantity of wood was supplied to the local market from natural forests in hilly areas of NWFP and was estimated as 10000 tons. From local wood working units it was estimated to be 6700 tons, and the quantity imported from Punjab was estimated as 3230 tons annually.

The sale price comparison per unit of various fuels in the market showed that the fuelwood was costing Rs.3.0 kg, Kerosene was sold at Rs. 24/litre, LPG was available at Rs.35/kg natural gas was marketed at Rs.190.24 MMBTU. If taken into account the calorific value as unit of measurement for each fuel, the gas is the cheapest commercial fuel among all.

Status of Agropastoral production system in Dir Kohistan (Upper Dir District) by Gulzar Rehman (Advisor: Dr. Sardar M. Rafique)

The study was conducted in Dir Kohistan valley of upper Dir District, with the objectives of assessing the present and future fodder needs for domestic livestock, assessing fodder production of the area and suggesting measures to improve fodder production.

Non probability sampling procedure was adopted for the collection of data on social aspect. For the resource assessment, three different sites of representative area were selected randomly. One square meter quadrat was used for estimation of forage production and cover percent data collection of various species found in the range area.

The three types of agro-pastoralists i.e. sedentary, transhumant and nomadic were found in the study area. Main occupation of sedentary and transhumant was farming and that of nomads was livestock rearing, with an average herd size of 53 heads in which 82% were goat and sheep whereas cattle were 18%. Their literacy rate was 8.8% and the average household size was 14 heads.

Forage production from pasturelands was 658.5 kg/ha, which was too low against its potential due to unsystematic continuous grazing. Forage production of agricultural crops was also too low because the farmers were mostly using local varieties of seeds and old traditional methods for growing agricultural crops. The livestock population was facing 30% forage deficiency, which was the main cause of low livestock production besides diseases and poor quality of indigenous breeds.

Majority of the graziers were not satisfied with the existing management system and were willing to participate in any activity to be carried out for the improvement of grazing/pasture land. This willingness of the graziers can play a productive role to implement the recommended scientific management system.

Keeping in view the above situation it was suggested that pasture

managers should draw their attention to the alarming situation and ensure scientific management of these natural resources on sustainable basis through active participation of the local community.

Fuel consumption pattern in rural areas of Peshawar by Salahuddin Ayubi (Advisor: Saliheen Khan)

The major objective of this study was to estimate fuelwood consumption in household sector of rural areas of Peshawar. Multistage sampling procedure was adopted to collect data through questionnaire. Four different villages were selected randomly in the study area. The sample survey revealed that 75% households used gas (because in the area natural gas was supplied). 15% used fuelwood, cowdung and LPG and 10% fuelwood and cowdung.

The choice of household for cooking fuel was mainly influenced by the education level, monthly income, occupation and non-availability of natural gas in the locality. In the areas where natural gas was supplied, the households exclusively used it for cooking.

The per capita consumption of energy for domestic cooking and heating was 5.44 million Kj. The per capita energy consumption in household of high income was 8.113 million Kj, with middle income was 5.024 million KJ and with low income was 4.554 million Kj. The consumption was also influenced by the household size larger the household size, lower the per capita energy consumption. The monthly fuel consumption increased by about 40% in winter as compared to summer.

The average annual household expenditure on fuel was worked out to Rs.4803. It varied with fuel type. It was highest for the households using LPG (Rs.8190) followed by those using wood (Rs.4356). The households using natural gas Rs.3695 and for household using cowdung (Rs.2970) had lowest expenditure.

The sale price comparison per unit fuels in the market showed that fuelwood costing Rs. 3/kg, kerosene Rs.20/ kg, LPG was available at Rs. 35/ kg, cowdung at Rs.3/kg and the price of natural gas Rs.234.8/m³.

All the households were found interested in farmland planting. On average about 15 plants were planted by each household.

The causes of biodiversity depletion and status of existing management system in the chir pine forest of Koh-i-Moor (Bajaur Agency) by Mohammad Shakeel (Advisor: Dr. Kanwar M. Suleman)

The study was conducted in Chir forests of Koh-i-moor mountain Bajaur Agency (FATA). The objectives were, studying biodiversity and management system, determining the causes of biodiversity depletion and exploring the possible options/approaches for the improvement in the present management system in the area. Data were collected on two aspects i.e. technical aspect (for which scientific instruments were used) and social aspect (for which a questionnaire was used).

The total area of the forest was approximated 1201 hectares which consisted mainly of *Pinus roxburghii*, *Olea ferruginea*, *Monothea buxifolia*, *Indigofera paucifolia*, *Mentha* spp. *Themeda anathera* and *Imperata cylendrica* in plants species, while in wildlife species *Rhesus* monkey, Indian wolf, Asiatic jackal, Black bear and Chukor etc. were common. The ownership of the forest totally rested with the community and they were using these forests for the fulfillment of their domestic requirements. Presently there was no proper management system for the conservation of biodiversity in the area. The cutting of chir pine, grazing of livestock and conservation of wildlife were not based on scientific methods.

The over exploitation of the forest resources had caused a threat to the biodiversity of the area. Majority of respondents were of the opinion that 80% of the resources have been lost during the last 20 years including the extinction of many wildlife species like Common Leopard, Urial and Cheer pheasants. The main causes of depletion of biodiversity were over exploitation of the resources, overgrazing, habitat destruction, hunting/ poisoning of wildlife, fire, population growth, poverty, non-availability of alternatives and poor management system.

The Forest Department/NGOs are not playing any role in the conservation of biodiversity, as Pakistan Forest Act has not been extended to these areas. The local communities also did not care about the conservation of biodiversity in the area because of their poverty and lack of awareness. No alternatives/ incentives were given to the local people, however, they desired for alternatives/ incentives like supply of fuelwood/timber, support for proper resource management, plantation of fast growing species, water supply schemes, education and communication facilities.

The community was aware of the draw back of the existing management system but there is a need to create further awareness about the conservation of biodiversity by extension programmes. Participatory planning of forest, proper

wildlife and grazing management, improvement of wildlife habitat, encouragement of farm/ agroforestry practices, community organization, extension of Government/ NGOs programmes to this area, searching of market for the marketable produce, and further detail studies in the area are, therefore, recommended.

The effects of development of forest recreation on forest resources in tehsil Kalam district Swat by Tariq Khadim (Advisor: Mst. Mamoona Wali Muhammad)

The study was aimed at the assessment of effects of development of forest recreation in Kalam on the local forest resources and the ascertainment of the views of local people and visitors about forest recreation potential of Kalam.

For this purpose thirty households in the area were selected and interviewed randomly through a structured questionnaire. Offices of the local forest department were approached to get official records related to the study. Fifty visitors were also interviewed through a structured questionnaire to get the viewpoint of tourists. The data was analyzed statistically. The analysis of data revealed that the fuel use pattern had changed and people had shifted from use of fuel wood to LPG and Kerosene Oil thus reducing pressure on local forests. Number of forest offenses had decreased by 44% due to improved protection measures and creation of awareness among the locals regarding the importance of forests resources.

Among the negative effects of Forest recreation on Forest resources was the increase in livestock population in the area for meeting the increase demand of milk and meat caused by development in tourism. The livestock of the area had caused damages to plants and soil. 63% of the respondents reported increase in the illegal timber trafficking. The environment had also become more polluted due to vehicles and improper waste disposal by the tourists and hoteliers. Number of fresh water springs had dwindled over the years due to changes in land use. It was found that wildlife status of the area had been adversely effected due to development of forest recreation.

The forest recreationists were found satisfied with the recreation facilities provided in the area and favoured further development of recreation opportunities.

Contribution of farm forestry in meeting domestic requirements and farmers' perception in district Charsadda by Hazrat Mir (Advisor: Ghayyas Ahmad)

The study was conducted in Charsadda district. The objective of the

survey was to assess the contribution of farm forestry in meeting the domestic requirements for fuel wood, timber, and fodder and ascertainment of farmers perception about farm trees. Two stage random sampling was adopted for collection of the required information from fifty respondents through a structured questionnaire.

The study revealed that majority of the population owned sufficient area to grow trees. Average daily requirement for fuel wood was 13.2 kg per household. Majority of the population used firewood with other alternatives in various proportion. 84% of the household obtained firewood from the trees growing on their farmlands. Annual timber requirement was 55.3 cft per household. About 50% population met their timber requirements from farm trees. Majority of population planted trees for firewood, timber and income purpose. Multi purpose role of farm tree had not been fully understood by the majority of the population. 76% of the farmers planted trees along water courses in linear way. Farmers expressed their apprehensions of hindrance by tree to agriculture crop production. But they still preferred to grow trees on farmland. Majority of population preferred to grow poplar on their fields.

Majority of the farmers had no problem in tree growing. Very few people used farm tree for fodder purpose. Relationship between education and preference to grow more trees was not significant. Relationship between average number of trees per acre and farmer category was highly significant.

Recommendations include expansion of forest extension services, creating awareness regarding the multi purpose role of farm tree, purchase of seedling from progressive farmers and establishment of functional linkages between farmers and forestry research organization.

The role of women in natural resource management in Dir Kohistan area of upper Dir district by Shazia Ahmad Khan (Advisor: Mst. Mamoonah Wali Muhammad)

The study was carried out in Dir Kohistan to assess the role of women in NRM. Five villages were selected randomly and out of these villages 120 female respondents were interviewed. The result indicated that average household size was 13 persons per household consisting of 52% females and 48% male members. 71% of the households were found with 1-2 earning members. In addition to regular family income 48% females had seasonal income, of Rs.2500 or above from NRM practices particularly agriculture.

82% of the households had less than one acre of agriculture land per household 96% of the people is self-cultivators. As far as forestry is concerned

79% of the task was done by males and 21% by females; in agroforestry 70% by males, and 30% by females. Concluding that less number of women were involved in forestry/agroforestry.

Fuel wood collection was the women's activity, so it was found that 96% of females wanted to grow trees to meet their firewood and fodder requirements. In agriculture 64% males and 36% females did the tasks, whereas livestock and poultry were 100% female's responsibility. The study clearly indicated the gender distribution of labour in NRM activities. The study revealed that females have no or very less (18%) decision making authority and that also is limited to agriculture, live stock and poultry.

Women identified a list of nine major problems which hinder/restrict their participation in NRM practices, 90% of the females confessed male dominance followed by lack of awareness/ restriction on mobility/ other social problems and 100% of them assured NRM productivity enhancement provided the above problems are overcome. The results found that women were burdened with loads of NRM works are 56% of them spent more than 6 hours and 38% spent even 6-10 hours daily.

62% women wished to elevate the living standard. 93% of them realized that the solution was in acquiring new skills, along with NRM interventions in addition to hard work.

Fuelwood consumption survey in rural areas of district D.I.Khan by Shahnaz (Advisor: Raja Muhammad Zarif)

The study was aimed at seeking the information about different types of fuels used in district D.I. Khan. Questionnaire-cum-interview technique was adopted. The study area comprised of 12 villages. 108 respondents were randomly selected and were interviewed for collection of information on socio economic factors as well as fuel used by each household.

The study revealed that the average household size was seven in district D.I. Khan. In study area 39.8% were illiterate. Others were educated at different education levels. The results also indicated that fuel wood was a major source of domestic energy. Other cheaper fuels such as dung and wood waste were also used to economize the energy consumption. About 95% of the households were using fuel woods with other fuels such as kerosene oil, dung and LPG. Only a small portion of population (5%) was found using efficient commercial fuels (LPG, kerosene oil etc.).

The survey also verified that the choice of fuels in rural area is greatly influenced by the ease in access to fuel wood resources, uncertainty in supply of LPG and income level of the household. The household also differentiated fuel wood by species, size, diameter, moisture, content, smoke, and calorific value.

The main species used in D.I. Khan district were Guz (*Tamarix aphylla*) Kareta (*Capparis aphylla*) Shisham (*Dalbergia sissoo*) Kikar (*Acacia nilotica*) Kandi (*Prosopis cineraria*). These species were mostly obtained from wastelands, farmlands and forest area of the D.I. Khan district. Species such as Kikar and Shisham were also imported from nearby districts of Punjab. Fast growing species such as Eucalyptus and Poplar still did not find their places in the market because of no demand.

The fuel pattern was influenced by factors of land holding size, number of earning members, education and preference for trees species. These however have shown very weak correlation. However consumption of wood with respect to education level was found negative with fuel types but was positive when related to household size in the study area. However study considers household size, types of fuels and their costs as important factors to predict the consumption of fuel wood for a household in rural areas of D.I.Khan.

Determination of calorific value of some home grown wood species by Shazia Khushdil (Advisor: Iqbal Mahmood)

Calorific value (heat value) was determined for oven-dried samples of nine wood species including Babul (*Acacia nilotica*), Phulai (*Acacia modesta*), Deodar (*Cedrus deodara*), Shisham (*Dalbergia sissoo*), Eucalyptus (*Eucalyptus camaldulensis*), Kao (*Olea ferruginea*), Kandi (*Prosopis cineraria*), Oak (*Quercus incana*) and Lai (*Tamarix dioca*). The samples were obtained in form of billets from different areas of Punjab, Sindh, and N.W.F.P. Heat values of the species were determined by using the oxygen bomb calorimeter in accordance with the method prescribed in ASTM standards. Heat value of the species was also determined by an empirical formula calculating the percentages of moisture content, ash content, volatile matter and fixed carbon.

Standard procedures were followed for determination of moisture content, ash content, volatile matter, fixed carbon percentages and density in air-dry condition. The results of the study reveal that calorific value of the species is maximum in case of Deodar (*Cedrus deodara*) i.e. 7756 B.T.U/lb (4309 cal/g) followed by Babul (*Acacia nilotica*), which has 7678 B.T.U/lb (4266 cal/g). Lai (*Tamarix dioca*) has the lowest calorific value i.e. about 6972 B.T.U/lb (3873 cal/g). The results were compared with reported values of Babul (*Acacia nilotica*)

Shisham (*Dalbergia sissoo*), Deodar (*Cedrus deodara*) and Oak (*Quercus incana*) and found 11-19% less than the reported values.

This study not only provides technical data for the suitability of different woods for their efficient and economic use and their classification. It will also help for selecting the wood species for making charcoal for commercial purposes. Heat value of the species also provides technical information to reduce the extent of wastage of local woods as fuel and for future research work.

Evaluation of the socio economic benefits of Unhar watershed management project in district Batagram by Muhammad Amjad (Advisor: Syed Zain ul Arifeen)

This study was conducted to have basic knowledge on socio-economic conditions of the inhabitants of the District Batagram where activities under Watershed Management Programme were launched since 1977. Four villages including Batamori, Chappargram, Gajbori and Ajmera were selected randomly for the study.

The study indicated that the vast majority of the households were agrarian in economic, social and cultural outlook. Most of the respondents were small land holders. Most of the population was illiterate i.e. only 20% literate similarly the livestock population had decreased while the fodder production as a result of watershed management activities had increased. Most of the people were using firewood and dung as a fuel.

Study also indicated that the level of interest of the people in the project activities was greatly influenced by their education level. People of the area surveyed were of the view that this project was a success, as a lot of area has been successfully afforested under this project. They also suggested a system of subsidies for further improvement of the project. People regarded watershed management personnel, as diligent and assiduous and they wanted the project to continue.

The study recommends that a practical and purposeful technical education should be imparted to the farmers and their children so as to enable them to make best use of the limited land available to them. A special extension wing within the Watershed Management Project (WSMP) should be established to practically demonstrate and show documentary films on the methods and advantages of Watershed Management Project.