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THE EFFECT OF DIFFERENT SALINITY LEVELS OF IRRIGATION WATER ON SALT TOLERANT TREE SPECIES (AMIR ABBAS)

Pot culture study was conducted to determine the effect of different salinity levels of irrigation water on growth parameters such as height, biomass and root-shoot ratio of three salt tolerant tree species, *Eucalyptus camaldulensis*, *Casuarina cunninghamiana* and *Acacia nilotica*. Saline water irrigation treatments were tap water with 0.1%, 0.2% and 0.3% NaCl solutions.

For recording data on height, 100%, and for data on biomass yield and root-shoot ratio 50% sampling were carried out. Saline water irrigation treatments were found responsible for overall reduction in height growth, biomass production and root-shoot ratio. The results were significant at 0.05 probability level for all the three growth parameters. There was no mortality of seedlings irrigated even with 0.3% salt solution.

The study showed that in nursery conditions *C. cunninghamiana* was better tolerant to saline irrigation followed by *E. camaldulensis* and *A. nilotica*.

NAIL WITHDRAWAL RESISTANCE OF EUCALYPTUS SPECIES (ARSHAD MAHMOOD SHAH)

Eucalyptus camaldulensis and *Eucalyptus microtheca* were studied for their nail withdrawal resistance. The material was obtained from the silvicultural research garden, Pakistan Forest

Institute, Peshawar. Standard method for testing was adopted for both wood species. Nail holding power of the above mentioned species was found on radial, tangential and end surfaces. Results of the study showed that *Eucalyptus camaldulensis* was superior than *Eucalyptus microtheca* regarding their withdrawal loads on each surface. Moreover, *E. camaldulensis* and *E. microtheca* were found better than Shisham and Deodar for withdrawal loads endwise. On the basis of the maximum withdrawal loads for each side of these species, it was suggested that these wood species were suitable for any kind of carpentry work, particularly for better strength of joints.

HOUSE HOLD FUELWOOD CONSUMPTION SURVEY IN VILLAGE DEHRAI TEHSIL KABAL (DISTRICT SWAT) (ABDUL WAHID KHAN)

The aim of the study was to determine fuel consumption in village Dehrai, district Swat. A sample survey of 150 households was conducted in June-July. Analysis of the data revealed that the average household size was 9.78 and the average earning members were 2.01.

Average consumption of all the fuel types increased with increase in family size. The expenditure on fuel was different in different categories of people. Consumption was more in winter as compared to summer. Fuel consumption was found positively co-related with household size, literacy, income level and occupation of the household head. A shift from fuelwood to LPG consumption was obvious with rise in income

level. Per capita monthly consumption of fuelwood in summer and winter was 35.06 kg and 46.72 kg respectively.

WOOD RECOVERIES FROM EUCALYPTUS TREES (MUHAMMAD IMRAN RIAZ)

The study aimed to develop a database on the wood recoveries from *E. camaldulensis* trees for the wood producers and users. Logs produced from nine trees of 26 years age were studied for wood production potential particularly in the form of quantitative production of industrial round, pulp wood, wood density variation, quantity of bark and production of sawn material as affected by the sawing techniques.

The diameter classification of logs indicated that more than 90% of the logs produced from nine trees were below 40 cm mean diameter. Only two logs of mean diameter 40 and 46 cm were produced indicating that an acre plantation cannot supply more than 43 logs of such size and a hectare would produce 105 trees after 26 years. This showed that a commercial sawmill for converting eucalypt logs economically cannot be established on trees of 26 years age. However, if logs of about 50 cm diameter are produced under longer rotation, then economical productions of sawnwood from this species can be expected.

Quarter sawing produced better quality planks but of smaller width as compared to plain sawing. The lower diameter of logs hindered quarter sawing considerably. The flat sawn board contained brittle heart, removal of which lowered the width of boards in some planks.

The quantity of industrial roundwood produced per tree was found to vary between 247-1.398 m³ averaging at 0.381 m³. The quantitative production of pulpwood per tree varied from 0.037-0.095 m³ averaging at 0.061 m³. In general

average production of total wood in a tree varied from 0.317 to 1.452 m³ out of which 3.7 - 23.1% in different trees was pulpwood and 77.9 to 96.3% industrial roundwood.

Theoretical recovery of 25 mm thick planks varied from 30.1 to 70.5% whereas actual recovery from 29.1 to 58.1% in different logs produced from different trees. Theoretical sawnwood recovery varied from 47.5 to 57.08% whereas actual recovery varies from 33.67 to 49.05% in different trees. The actual recovery factor mean for nine trees was calculated as 0.79.

Girdling of trees prior to felling and bark collar girdling of tree trunks after tree felling together with painting of log ends and storage under shade improved the quality of sawn wood by controlling the end splitting. Girdling together with painting was better than bark collar girdling together with painting log ends. Storage under shade of logs produced from girdled trees as well as bark collar girdled trees was found useful.

PERCEPTION OF TREE FARMERS ABOUT TREE PLANTING IN ATTOCK DISTRICT (SHAHZAD ASHRAF)

The study was conducted in Attock district to find out the perception of tree farmers about tree planting. Fifty four household heads were selected through random sampling and data were collected by a structured interview schedule. The study revealed that the farmers' attitude towards tree planting was positive. 77% of farmers were willing to plant more trees on their land. Farmers were neither willing to purchase nor wanted to continue tree growing business if the government incentives were withdrawn. Main problem perceived by the tree farmers was marketing of their produce. Education had no significant effect on the farmers' views regarding effect of trees on their agricultural crop.

INFLUENCE OF VARIOUS CANOPY COVERS OF *PINUS ROXBURGHII* ON SPECIES DIVERSITY AT TRET (MUHAMMAD AFTAB MAJEED)

This study was conducted in June, 1994 at Tret, Sub-forest division of Rawalpindi District. The data on density, frequency and cover percent of ground vegetation was collected under three canopy covers of *Pinus roxburghii* viz; open (25% and less), medium (26% to 50%) and close (51% to 75%).

The number of species found in *Pinus roxburghii* were 14, 6 and 4 under, open medium and close canopy covers respectively. The importance value of shrubs and grasses under open medium and close canopy covers was 270.27 and 29.07, 89.35 and 301, and 86.01 and 214 respectively. The ground vegetation diversity based on the number of species and Importance Value was higher under open as compared to medium and close canopy covers of *Pinus roxburghii*.

EFFECT OF TREES ON THE YIELD OF WHEAT CROP (YASIR AZIZ KHAN)

Agroforestry practice is one of the alternatives that can ensure more wood production for local consumption in the country. But the farmers have certain doubts about growing trees on farmland. They think that trees on farmland suppress yield of agricultural crops due to their competition for light, moisture and nutrients. Keeping this into consideration, an agro-forestry trial was conducted in the research garden of Pakistan Forest Institute, to determine the effect of trees on the yield of wheat crop.

The tree species under study were Iple Iple, poplar, Eucalyptus and Kikar. Data were recorded on eight parameters: yield of wheat crop, production of straw, number of tillers, number of

plants, number of grains per ear, weight of 1000 grains, length of ear, and height of wheat plant.

The study revealed that wheat yield was one and half time higher in the open than under the trees. The tree species among themselves were non significantly different in the wheat yield. However, poplar had maximum adverse effect on the yield of wheat crop as compared to Iple Iple and Kikar. The crop yield was better under Eucalyptus trees than under poplar, Iple Iple and Kikar.

EFFECT OF ESTABLISHMENT OF KHUNJERAB NATIONAL PARK ON SOCIOECONOMIC CONDITIONS OF LOCAL COMMUNITY OF GOJAL, UPPER HUNZA VALLEY, DISTRICT GILGIT (MOHAMMAD JAFFAR)

Khunjerab National Park (KNP) was established in 1975 to protect marcopolo sheep, blue sheep and snow leopard. Before the establishment of the park, the areas were under the control of the local population who used to meet their domestic needs from these pasture lands for fuelwood collection and grazing of their livestock. Their household economy mostly depended on livestock rearing.

The local community of Gojal which consisted of about 500 households was prohibited to enjoy grazing and fuelwood collection when the area was declared as National Park. This community was facing many social and economic difficulties due to the establishment of National Park.

This study was designed to collect the socioeconomic information from the respondents through a detailed social survey. In this study, 100 respondents were selected randomly from seven villages of Gojal in district Gilgit.

All the respondents used the Khunjerab pasture for grazing purpose in the past. 78 percent of the respondents collected fuelwood from Khunjerab pasture without any restriction before establishment of National Park. After establishment of KNP the local population was prohibited from grazing and fuel wood collection. The study also revealed that 52 percent of the respondents divulged that their problem could be solved if the royalty of pasture was given or alternate grazing grounds were provided elsewhere. Compensation for fuelwood energy supplies e.g. kerosene stoves, fuel wood plantation or fuel wood supply at subsidized price, would also help to solve these problems.

IMPROVING THE PROPERTIES OF PARTICLEBOARD MANUFACTURED FROM EUCALYPTUS CAMALDULENSIS AND BROUSSONETIA PAPYRIFERA (MOHAMMAD NADEEM AKBAR)

Urea-formaldehyde particle boards of density 600 kg/m³, 640 kg/m³, 680 kg/m³, 720 kg/m³, 760 kg/m³ and 800 kg/m³ were manufactured from various mixtures of *Eucalyptus camaldulensis* (700 kg/m³) and *Broussonetia papyrifera* (480 kg/m³) at compression ratios 1.20, 1.23, 1.25, 1.27 and 1.30. Effect of board density and compression ratio on Modulus of Elasticity (MOE), Modulus of Rupture (MOR), Face Screw withdrawal resistance (FSWR), Edge Screw withdrawal resistance (ESWR) and dimensional stability (Linear expansion, after exposure to 50 to 90 percent RH, Thickness swelling and water absorption by 2 and 24-hours water soak test) was determined. MOR, MOE, FSWR and ESWR increased linearly with increase in particleboard density and compression ratio. An increase in board density and compression ratio generally resulted in a decrease in linear expansion, thickness swelling and water absorption.

COMPARISON OF ROOT AND SHOOT BIOMASS OF DOMINANT GRASS SPECIES IN GRAZED AND UNGRAZED AREAS IN KHARIAN (KHALID JAVED)

The study was carried out for the comparison of root and shoot biomass in grazed and ungrazed areas at Pabbi Rasul Hills in Kharian. Two dominant species namely *Cenchrus ciliaris* and *Heteropogon contortus* were identified in ungrazed areas and *Cenchrus setegeris* with *Bothriochloa pertusa* in grazed area.

Results showed that there was no significant difference at 0.05 probability level between the root biomass in ungrazed and grazed areas. On the other hand, statistical analysis of the shoot biomass in grazed and ungrazed areas revealed significant difference. This was due to heavy grazing pressure and continuous removal of the shoots in grazed area.

COMPARISON OF FORAGE PRODUCTION IN SEEDED AND UNSEEDED RANGELANDS IN KHARIAN (SYED BAQIR RAZA)

The thesis research was carried out in the Range Research Station, Kharian. The objective of the study was to compare the forage production, grazing capacity and cover percent in seeded fenced area and unseeded unfenced area in the Range Research Station. The average cover percent of seeded area was 60% against the cover percent of 29.2% in the unseeded area. Total cover percent, forage production and carrying capacity was higher in the seeded areas than in the unseeded areas. The differences were statistically significant at $P \leq 0.01$ and 0.05 level. This indicates that potential of deteriorated rangeland of Kharian could be restored by reseeding and proper grazing management.

SOIL INFILTRATION AND BULK DENSITY DIFFERENCES BEFORE SNOWFALL AND AFTER SNOWMELT AT PAYA (KAGHAN) (NAJAM-UL-HUDA KHAN)

The study was carried out to find the differences between the infiltration and soil bulk density before snowfall and after snowmelt. The infiltration was measured randomly at 10 different points in the experimental area. Each infiltration was run for 3.25 hours. Ten samples of soil bulk density were taken with the help of steel core sampler, 15 cm long with 4 cm diameter. The data were collected in September 1993 and June, 1994 at Paya. The initial infiltration rate and infiltration capacity before snowfall were 136.48 mm or 48 mm/hr and 22.67 mm/hr respectively. The initial infiltration rate and infiltration capacity after snowmelt were 73.712 mm/hr and 10.24 mm/hour respectively. The average infiltration rate was 41.58 mm/hr. and 23.63 mm/hr. for before snowfall and after snowmelt, respectively. The soil bulk density before snowfall and after melt was 1.39 gm/cm³ and 1.31 gm/cm³, respectively. The initial infiltration and infiltration capacity were significantly higher before snowfall compared with after snowmelt. The difference between average soil bulk density was non-significant before snowfall and after snowmelt at Paya.

EFFECT OF GRAZING ON REGENERATION OF CONIFEROUS FORESTS IN ASTORE VALLEY (JAVED AKHTAR)

The study was carried out in two forests namely Gudai forest (grazed) and Rama forest (ungrazed). Within these forests, two compartments from each forest were selected randomly. Five sample plots each of 10 m² size were laid in each compartment to study the density, composition, establishment of regeneration and extent of forest injuries to tree species. A small plot of 1 sq. m. size was laid out in the

center of each plot to study species composition, cover percentage, forage production, surface material distribution and evidence of soil erosion/compaction. Results indicated that the forage production per hectare in ungrazed forest was 45 percent higher than in grazed forests. On an average, there was 50 percent less regeneration in grazed forest. Similarly, marked differences in species composition and soil erosion as compared to ungrazed forest were found. Grazing injuries to both coniferous and deciduous tree species was also observed.

In view of these results, it was concluded that heavy and season-long grazing in coniferous forests of Astore valley not only degenerated the forests but also caused retrogression in plant community.

MONOGRAPH ON NEEM (*AZADIRACHTA INDICA*) (SAEED AHMED PIRANI)

The study was conducted to compile all the scattered information on neem in a book form to provide comprehensive material as reference to research workers and students. The species is native to dry forest areas of Pakistan, India, Bangladesh, China, Burma, Srilanka and Malaysia. It has been planted successfully in Sudan and Sahelian zones of Africa as well as the non-Sahelian areas of Guinea, Nigeria and Ghana.

In Pakistan, it is cultivated throughout Sindh, southern Punjab (as far west as Sarai Alamgir), lower Baluchistan and southern N.W.F.P. Compact plantations are not found in the country. However, scattered cultivated trees are found near habitations, railway stations, in schools and along canals and roads.

The tree is fairly fast growing, large sized, deep rooted, broad leaved almost evergreen with wide spreading branches forming rounded or oval

shaped dense crown. It has wide climatic adaptability and can thrive under sub-humid to semi-arid conditions. Its altitudinal range varies from 50-1500 m but prefers low altitudes. It grows on a variety of soils such as clayey, saline and alkaline, but does well on black cotton soils. It has also been successfully used to reclaim arid wastelands and found growing in soils that are free from salts.

Neem has great economic value. Nearly every part of the tree can be put to some special use. It produces timber, fuelwood, fodder, medicines, pesticides, oil and lubricants. The wood is hard and resistant to termites, borers and fungi and difficult to impregnate with preservatives. It is classified as hardwood with specific gravity of 0.74 in dry condition. The calorific value of wood is 6943 kilo cal/kg. It seasons well and is durable in use.

The fruits, seeds and foliage contains several compounds that repel or kill insects, inhibit the growth and development of fungi, and limit infectivity of plant virus. Neem is reported to control more than 100 species of insects, mites and nematodes, including some major pests such as desert and migratory locusts, rice and maize borers, pulse beetle, rice weevil and citrus redmint as well as aphids and white flies.

Environmental degradation due to excessive use of pesticides has laid a renewed interest in natural pesticides for ecological sustainability.

Traditionally, neem is used by rural folk because of its medicinal properties. The bark, leaves and fruits are used in the treatment of infections and skin diseases.

Research work has not been conducted in depth so far on this indigenous trees species. It

may be initiated for further improvement and utility in the following directions:

- Evaluating growth and fruit harvest under the prevailing climatic conditions and management.
- Assessing NPK and other nutrient needs for better growth, fruit yield and quality.
- Provenance trials should be established to identify fast growing and high yielding provenance from Indigenous and exotic sources.
- Establishment of seed orchards for better quality seed production.
- Optimum spacing trial for optimum timber production.

IMPROVING THE QUALITY OF BLEACHED KRAFT PULP FROM EUCALYPTUS CAMALDULENSIS WOOD (KASHIF IJAZ)

Bleached kraft pulp was manufactured from locally grown *Eucalyptus camaldulensis*. For the production of bleachable grade of *E. camaldulensis* pulp, optimum cooking conditions under kraft pulping process were set out as 20% active alkali and 25% sulphidity at 170 °C temperature with 2 hours cooking time. Kraft pulp was further bleached under different bleaching series. It was inferred that among the different bleaching sequences such as CEH, CEHD, CEDED, CEHDP and CEHH, used for Eucalyptus pulp brightening, CEDED arrangement was the most haximounous, produced pulp with high brightness as 85% Eliehp, with the minimum reduction of viscosity and strength properties. It was further concluded that *Eucalyptus camaldulensis* kraft pulp required 4-5 bleaching stages under controlled operation to attain the imported bleached pulp quality.

FUNCTIONAL TERRAIN CLASSIFICATION OF MASSAR AND PANJUL RESERVED FORESTS OF PFI FIELD STATION, SHINKIARI (MOHAMMAD IMTIAZ ARIF HASHMI)

In the northern hilly forest area of Pakistan almost all timber harvesting operation are performed manually. The felling and conversion is carried out by conventional tools i.e. axe and cross-cut saw and for the extraction of timber manual methods like dragging, skidding and sliding are used irrespective of the terrain condition.

This study dealt with the Functional Terrain Classification of some of the compartments of Massar and Panjul reserved forests in Shinkari, Hazara. Collection of data of the study was based on topographic sheets of RF. 1: 5000, suited for the terrain classification. Various slope classes were marked on the map by using the techniques of divider step method and grid distribution system. Areas with gentle to very steep slope were marked in each compartment of the Massar and Panjul R.F., related to Field Station Shinkari. The study revealed that distribution of slope varied below 25% to 60% and above. Gentle slopes were meant for use of tractors and other 2 x 4 machine for the extraction of timber, while 40% to 60% and above 60% slope conditions were gentle for the use of 4 x 4 machine i.e. Skidder, road construction and cable crane. 80% of the terrain of the field station at Shinkari was steep for which cable crane method was recommended for extraction of the forest produce.

STUDY OF MYCOFLORA ASSOCIATED WITH KIKAR SEED (SHAHBAZ AHMAD KHAN)

500 Kikar (*Acacia nilotica*) seeds obtained from two seedlots of Dera Ismail Khan were

studied by the agar test method to determine seed infestation by fungi. The average infestation was found to be 30.0% in non-treated and 9.5% in the treated seeds.

A total of nine fungal and one bacterial isolates were determined comprising Zygomycetes and Deuteromycetes classes of fungi. The Zygomycetes included: *Rhizopus nigricans* and *Rhizopus* sp; while Deuteromycetes were represented by *Aspergillus janus*, *Aspergillus terricola* var. *americana*, *Botrytis cinerea*, *Fusarium moniliforme*, *Gliocladium deliquescens*, *Nematogonium parasiticum* and *Spicaria* sp. *Xanthomonas campestris* was the only bacterium found associated with Kikar seed.

These isolates, identified and described are reported first time in Pakistan.

EFFECT OF ZIZYPHUS MAURITIANA ON WHEAT CROP IN LAKKI MARWAT DISTRICT OF N.W.F.P. (MOHAMMAD AYAZ KHAN MARWAT)

Growing of single scattered trees is the predominant agroforestry system in the rainfed areas of country. It was necessary to find the biological interaction of indigenous tree species on agricultural crops.

A study was conducted to investigate the effect of *Zizyphus mauritiana* on the wheat crop, for the particular environmental conditions of Lakki Marwat. Around the tree in all the four directions at distance 2 m, 5 m, 10 m and 20 m, one meter quadrats were laid and samples collected.

From the results it was concluded that the yield of wheat increased with increase in distance from *Zizyphus* tree. Maximum yield was observed at a distance of 20 meters.

ALLELOPATHIC EFFECT OF KIKAR (ACACIA NILOTICA) ON THE PRODUCTION OF WHEAT (TRITICUM AESTIVUM) (MOHAMMAD ZUBAIR SULEMANI)

This study was undertaken to evaluate the allelopathic effect of *Acacia nilotica* on the production of wheat crop. All the parameters responsible for crop vigor and uplift of wheat yield such as plant biomass and length, shoot weight and length, root weight and length, 1000 grains by weight, germination percentage of seven important crop species including four cereals (Wheat, Maize, Jawar, Bajra) and three important oil seed crops (Sarsoon, Taramira, Sunflower), were studied.

The results indicated that there was no significant inhibitory effect due to allelochemicals on most of growth parameters of wheat which had a correlation with yield except that it had greatly inhibited the germination of all the seven crop species.

INFILTRATION AND SOIL BULK DENSITY DIFFERENCES BETWEEN GRAZED AREA AND OFF-ROAD TRACK, AT PAYA (ASAD LODHI)

The purpose of this research was to evaluate and compare infiltration rates, soil bulk density and soil porosity between grazed area and off-road track at Paya. Infiltration rates were significantly greater on grazed areas than the off-road tracks. The soil bulk density values were significantly lower on grazed area than that of off-road track. The initial infiltration rate on grazed area was 183.92 mm/hr, while infiltration capacity was 43.93 mm/hr on grazed area. However on off-road track, the initial infiltration rate was 54.62 mm/hr, and infiltration capacity was only 2.24 mm/hr. The average infiltration rates on grazed area and off-road track were calculated to be 76.62

mm/hr and 10.28 mm/hr respectively. The soil bulk density for grazed area was 1.25 gm/cm³ while that for off-road track was 1.58 gm/cm³.

STUDIES ON ERGONOMIC CONDITION OF NURSERY WORKERS AT PAKISTAN FOREST INSTITUTE, PESHAWAR (RAO ZAHID MAHMOOD)

The study was carried out by selecting a random sample of 15 workers engaged in nursery and afforestation works. Personal data like age, weight and height etc. were recorded on these workers. The workers were tested for their physical work capacity as indicated by PPI, Watts of energy/min and Maximum O₂ uptake as liters of O₂/min at a maximum predicted heart rate of 170. In this experiment an ergonomic bicycle was used to load the workers for different levels of stress (10, 20, 30, 40, 50, 60, 70, 80, 90 and 100 Watts) for about 1 minute at each load and at a constant pedalling speed of about 50 rpm. In the middle of each minute heart rate of the workers was recorded with the "Polar" sport tester. Using regression between Watts (in tens) and heart rate, the PPI of the workers was calculated. By applying standard formulae Work capacity of the workers as output in Watts/min and liters of O₂/min, at a predicted maximum heart rate of 170, were also calculated.

Results showed that the workers engaged in afforestation were having an average age of 34 years, 54 kg of body weight and 164 cm as body height. The standard weight for a body height of 164 cm is 63 kg. This showed that the workers were under weight by 9 kg. The average resting pulse of the workers was 72 (59-92) with high personal variations. The average working pulse for a maximum predicted heart rate of 170 was 98 beats per minute. Like resting pulse, the average working pulse also showed high variation from person to person. The average PPI was 5.12 (2.64-

8.30), while the PPI range for trained, healthy and experienced workers was between 2.0 to 3.5. This showed that the workers were as a whole weak. Similarly the maximum Watts/min and maximum O₂ uptake/min was 203 (125-318) Watts and 2.46 (1.15-4.41) liters, respectively.

As indicated by all the physical parameters of maximum work capacity, the workers in the majority of cases were weak. This was probably due to their poor nutrition as depicted by their low body weight in relation to body height. The physical work capacity tests on the workers were carried out in the month of Ramazan. All the workers were fasting. This could also be a reason for the low work capacity of the tested workers.

TIME STUDIES ON NURSERY OPERATIONS (SALMAN ASIF SIDDIQUI)

The objective of this study was to assess the time demand, productivity of labour and cost of different work elements in nursery operation.

These studies were carried out in the nursery of the Silvicultural Research Garden, Pakistan Forest Institute (PFI), Peshawar. The time study observations were made on a single nursery worker.

The worker on which time study observations were made had an age of 28 years, height and weight of 160 cm and 58 kg respectively. The worker had already put in 11 years in his nursery work and from his age, experience and motivation was rated as standard worker working at 100% efficiency.

Fly-back Timing or Single Time Method was used for recording the time for different work elements in the nursery operation. Each work element was timed separately and data recorded in specially designed proforma. The actual time

values recorded initially were changed to normal time and standard time values by using correction factors for efficiency rating (100%) and allowances (30%) for personal time, fatigue and delay.

The results of the study showed that time demand for mixing of 1 cft of soil is about 2 minute and 31 seconds. Similarly time per unit of work for different work elements is 8.02 sec. for punching/tube, 29.4 sec. for filling tube, 20.53 sec. for laying tube, 15.80 sec. for pricking seedlings, 8.05 sec. for sowing seed and 3 minutes and 5 seconds for irrigating nursery beds.

Per man-day productivity in different work elements is 191.24 cft of soil mixed, 3,594 tubes punched, 980 tubes filled, 1,403 tubes laid, 1,823 seedling-pricked out, 3,574 seeds sown and 156 beds (11,454 sft) watered.

Cost of work per 100 units of different work elements is Rs.21 for soil mixing, Rs. 1.11 for punching, Rs.4.08 for tube filling, Rs.2.85 for tube laying, Rs.2.19 for pricking out, Rs. 1.12 for sowing and Rs. 25.64 for watering.

The study suggested that the efficiency of nursery works could be increased by using shovel for working soil, filling tubes with scoop and by improving design and quality and punching machine.

EFFECT OF WATERSHED MANAGEMENT ACTIVITIES ON RANGE CONDITIONS AND TRENDS AT KARKHASA VALLEY, QUETTA (MOHAMMAD IBRAHIM)

The study was conducted to evaluate the effect of watershed management activities on range condition and range trend. Three "sample units" comprising of 60 sample plots located randomly were studied.

The study revealed that although range condition was poor but showed an upward trend on the basis of presence of litter cover (18 percent), cryptogams cover (13 percent), and total aerial cover (38%). It was concluded that the watershed management activities and protection from grazing, had positive effect on range condition and trend.

IMPROVING THE PROPERTIES OF PARTICLEBOARD MADE FROM LOCAL RAW MATERIAL, THROUGH THREE COMPONENT MIXTURE (NAEEM-UD-DIN TARIQ)

The study was conducted to develop a data base for predicting the suitability of wood species of densities 1000 kg/m³, 600 kg/m³ and 280 kg/m³ for producing particle boards of varying densities from 800 kg/m³ to 400 kg/m³.

Performance of different mixtures made by mixing of different density wood species were tested theoretically by calculating the compression ratios, theoretical board thickness and volume of voids. It was concluded that mixing of wood species of densities 1000 kg/m³ and 280 kg/m³ in different ratios produced particleboards of varying densities and compression ratios, thereby improving the usefulness of high densities wood species for producing desired density particleboards.

RANGE VEGETATION TYPE OF HACHINDAR PASTURE, NASIRABAD, HUNZA VALLEY, DISTRICT GILGIT (IBRAHIM HUNZAI)

The purpose of study was to evaluate range vegetation and to assess cover percent, species composition, forage production and carrying capacity of the pasture. Fifty quadrats of size one square meter were laid out randomly in the selected unit of the study area. The study revealed

that the total cover percent was 42.84 and the airdry forage production was 637 kg/ha. The cover percent of *Festuca rubra* and *Brumus inermis* was 14.94 and 14.47% in the pasture respectively. Species composition, airdry forage production and carrying capacity showed that livestock exclusion may be one of the best range improvement practices to increase the productivity of the pasture.

COMPARISON OF FORAGE PRODUCTION BETWEEN SEEDED AND UNSEEDED AREAS AT RAKH CHOTI DALANA (D.G. KHAN) (AHSAN-UL-HAQ PARACHA)

The present study was designed to compare forage production, cover percent and carrying capacity of seeded and unseeded areas in Thal area. The study showed that the total forage production of 177 kg/ha. (AD) in seeded area was 65 percent higher than in the unseeded area (37 kg/ha). Similarly total vegetation cover percent (9.2%) was 8 per cent higher than unseeded area (1.3%). Further, forage production and cover per cent of *Lasiurus hirsutus* was higher in seeded area as compared to unseeded area. However, the difference was statistically significant. Artificial reseeding with *Lasiurus hirsutus* and *Cenchrus ciliaris* was recommended to increase productivity in the Thal Range land area.

EFFECT OF GRAZING ON SOIL CHARACTERISTICS, INFILTRATION CAPACITY, PERMEABILITY, BULK DENSITY AND PORE SPACE, IN THE RAWALPINDI DISTRICT (TAXILA AND MANDRA) (AKMAL HUSSAIN)

The objective of present study was to determine the effect of grazing on some of the physical characteristics of soil such as infiltration capacity, permeability, bulk density and pore space in the scrub zone of Taxila and Mandra soils. For

this purpose two sample sites were taken in Margalla hills near Taxila and one in Mandra. The infiltration capacity was determined at the site and undisturbed samples were taken for other characteristics. The samples were analysed in PFI laboratory. The average infiltration capacity after 60 minute was observed to be 15.4 cm/hour in grazed area and 26.7 cm/hour in ungrazed area. On the average, bulk density was 1.35 gm/cm³ and 1.57 gm/cm³ for Taxila and Mandra respectively for grazed area and these values were 1.18 gm/cm³ and 1.26 gm/cm³ for ungrazed area. The average permeability was 7.31 cm/hour and 2.18 cm/hour for Taxila and Mandra respectively for ungrazed area and these values were 2.36 cm/hour and 0.78 cm/hour for grazed area. On the average, porosity was 49.2% and 40.8% for Taxila and Mandra respectively for grazed area and 55.4% and 52.6% for ungrazed area. All the physical characteristics of grazed area were compared statistically to those of ungrazed area. Statistical analyses indicated that characteristics of grazed area were significantly different from those of ungrazed area.

STUDY OF MYCOFLORA ASSOCIATED WITH BLUE PINE SEED (ASHEER FAROOQ)

A study of 500 blue pine seeds, collected each from Bhurban and Kuzagali, revealed the occurrence of 7 fungi and one bacterium on the sample seeds.

The Bhurban sample was found to have 80% and 20% infestation in the non-treated and treated seeds respectively; while the Kuzagali sample had 100% infestation in the non treated and 3.3% in the treated seeds.

The fungal isolates belonged to Zygomycetes and Deuteromycetes classes. The former included; *Rhizopus nigricans* and *Rhizopus oryzae* the latter comprised *Aspergillus flavus*,

Aspergillus janus, *Diplodia pinea*, *Fusarium moniliforme* and *Penicillium canadense*. *Rhizopus nigricans* was the only fungus found associated with non-treated as well as treated seeds.

Xanthomonas campestris, was the only bacterium isolated from blue pine seeds. These isolates, identified and described, are reported first time in Pakistan.

SELECTION OF SUITABLE TREE SPECIES FOR AFFORESTATION IN SALINE AND WATERLOGGED AREAS IN PAKISTAN (MUHAMMAD NAEEM ASHIQ)

The study was aimed at to compile literature on tree species suited for afforestation in waterlogged and saline areas. Pakistan is faced with twin menace of salinity and waterlogging, resulting in deterioration of agricultural lands with an increasing ratio. According to rough estimates more than 5 million hectares have already been affected and about 40,000 hectares are being added to it every year. Poor drainage of irrigation water and seepage through unlined canals are major causes of waterlogging in Pakistan, where as weathering of rocks and continuous rise in water table reduces the drainage capacity of soil and the evaporation of water increases the accumulation of salts near and above the top soil.

In the past, stress was laid on mechanical methods for reclamation of saline and waterlogged lands but they were found to be expensive and temporary. At present biological control through trees is being preferred.

In a number of experiments on saline and waterlogged lands, tolerance of tree species to salinity and alkalinity, ameliorative effect of growth of vegetation on the soil, role of trees as a biological drainage and biological desalination were studied.

Tree growth in salt affected soil exert ameliorative effect by improving physical, chemical and biological properties of soils. The ground water table is kept below the capillary level by the greater loss of moisture through transpiration. Furthermore, the shade provided by the vegetal cover reduces evaporation of soil moisture thus decreasing upward movement of ground water. The trees through their massive root system open up the soil and improve permeability of soil thereby facilitating leaching down the salts. The incorporation of organic matter brings about the favourable changes in the physico-chemical properties of the soil.'

It was observed that most of the suitable tree species belong to leguminous family having nodules in their roots. They also play an important role of nitrogen fixation in the soil. Selected species were proved to be helpful to reduce electrical conductivity (ECe) and pH of the soil and to increase the infiltration capacity.

Some of the major species for the afforestation of saline and waterlogged areas of Pakistan are as under:

<i>Eucalyptus camaldulensis</i>	<i>E. tereticornis</i>
<i>Eucalyptus microtheca</i>	<i>Prosopis juliflora</i>
<i>Casuarina equisetifolia</i>	<i>Acacia nilotica</i>
<i>Eucalyptus rubusta</i>	<i>Terminalia arjuna</i>
<i>Albizzia lebbek</i>	

Appropriate methods for planting are ripping, auger holes, level pits and furrows for saline and mounding in case of waterlogged areas.

FIBER MORPHOLOGY OF LOCAL TIMBERS FOR PREDICTING THEIR USE IN PULP AND PAPER MANUFACTURING (AHMAR MAJEED)

The study was conducted to find a suitable raw material for pulp and paper production. Wood samples of *Eucalyptus cerebra*, *E. camaldulensis*, *E. tereticornis*, *E. torelliana*, *E. microtheca*, *E. melanophloia*, *E. ochrofolia* and *Broussonetia papyrifera* were collected from PFI research garden and studied for their fibre morphological features such as fiber length, diameter, and wall thickness. From the average values of fiber dimensions calculated, wood properties such as runkel ratio, felting power ratio, flexibility co-efficient ratio, and rigidity co-efficient ratio were also computed. Results showed that on the basis of runkel ratio *B. papyrifera*, *E. camaldulensis*, *E. tereticornis*, *E. torelliana* and *E. cerebra* could be used as a raw material for pulp and paper production because of possessing acceptable value of runkel ratio. Whereas, *E. microtheca*, *E. ochrofolia* and *E. melanophloia* might not be suitable for pulp and paper manufacturing because of the runkel ratio above the standard value. Furthermore, it was found that *B. papyrifera* is the most suitable species for manufacturing of high tearing resistant, bonding strength, folding endurance, flexibility, and bursting strength paper; *E. cerebra* for a well bonded, tightly knit, and strong paper and *E. ochrofolia* for making of high tensile strength paper than all the other studied species.

DEMAND AND SUPPLY OF WOOD FOR SPORTS GOODS INDUSTRIES IN SIALKOT (JAVED IQBAL)

The study was conducted to find out demand and supply of wood for sports goods industries in Sialkot. A sample of 20 manufacturing units was taken randomly and observations were recorded by visiting the firms and filling the questionnaires. Out of 20 units, 9 were of large size, 8 were of small size and 3 were of medium size. These units represented 25 percent of the total sports industries in Sialkot.

The total wood consumption species-wise was observed as poplar 16638.37 m³, willow 8941.71 m³, mulberry 8375.29 m³ and others 5263.16 m³. Total future consumption of various species was projected as 43187.47 m³ in year 2000. Main sources of mulberry wood were Changa Manga and Daphar irrigated plantations. Willows and poplars wood were transported from Mardan and Abbottabad.

HOUSEHOLD FUELWOOD CONSUMPTION SURVEY IN VILLAGE GAHKUCH BALA TEHSIL PUNIAL DISTRICT GHIZAR NORTHERN AREA'S (MOHAMMAD WALI KHAN)

The aim of this study was to determine the household consumption of fuel wood". Sample survey was conducted in rural village of study area. For this purpose 120 respondents were interviewed under a set of questions by using a questionnaire.

Analysis of data revealed that fuel wood was the major source of house hold energy in the area. All the household used fuel wood in various quantities. More than 24 of the households used only fuelwood for domestic energy. About 76% of the sample units consumed fuelwood along with other fuels such as kerosene oil, LPG, wood waste, cow dung and crop residuals. About 51% people were engaged in collection of fuelwood directly from the forest area whereas 6.67% people purchased fuelwood from the local shops and 12.5% obtained fuelwood from their farm lands. The total fuelwood consumption for the population of 1272 persons in the area was 75364 kgs per annum. Thus high pressure on state forest was obvious.

About 61.66% of the total respondents were illiterate and 38.34% were educated. The wood consumption rate high among the illiterate

persons as compare to the educated persons. House hold fuel consumption became double in winter as compared to summer.

It was therefore suggested that the conservation and afforestation programmes should be launched simultaneously through farm forestry approach with the intimate involvement of the inhabitants.

HOUSEHOLD FUELWOOD CONSUMPTION IN A VILLAGE OF TEHSIL KASHMORE, DISTRICT JACOBABAD, SINDH (MOHAMMAD ARIF, DOMKI)

In order to investigate the fuelwood consumption pattern of a village in district Jacobabad, selected after applying multistage sampling procedure, a survey through a set questionnaire, was carried out. The results of the study revealed that there were 114 household with total population of 950 persons (average household size of 8.33 persons) in the village. About 97% households were illiterate; belonged to low income group with tenant as their occupation, cultivating land owned by two absentee owners of the village. It was found that the tenants have a per capita per month consumption of 28 kg fuelwood and 17.62 kg dung whereas landlords were exclusive wood users with 101.86 kg per capita monthly fuelwood consumption. It was further observed that almost every household was rearing livestock which affected the fuelwood consumption pattern. An increase in livestock number decreased per capita fuelwood consumption as dung is cost effective and most easily available fuel for domestic cooking. The main source of fuelwood for tenants was privately owned marginal lands growing lai (*Tamarix dioica*) on commercial basis whereas landlords purchased wood from market.

Furthermore, an increase in household size decreased per capita fuelwood and dung

consumption. A similar correlation was also found between occupation and fuelwood consumption. The annual per capita consumption for an estimated population of 950 persons was found to be 347.41 kg and 195.07 kg fuelwood and dung respectively with a total annual consumption of 330048 kg fuelwood and 185320 kg dung.

It was finally suggested that the existing pattern could be improved by providing more convenient and cheaper sources of energy such as natural gas, kerosene oil and LPG in the nearby markets which were easily accessible to the rural households.

HOUSEHOLD FUELWOOD CONSUMPTION SURVEY IN A VILLAGE OF TEHSIL CHICHAWATNI DISTRICT SAHIWAL (LIQAT GULZAR SHEIKH)

A sample survey of 134 households in a village of Tehsil Chichawatni, District Sahiwal was conducted in 1994 under the study entitled "Household Fuelwood Consumption Survey in a Village of Tehsil Chichawatni, District Sahiwal". The analysis of the data revealed that average household size was 7.19, average earning members were 1.9 and the literacy rate of the study area was 64.97%. 61.19% respondents were living in single family system. 24.63% respondents were farmers (zamindars), moreover, the average land holding size per household was 1.5 hectare.

8.2% of the total respondents were exclusively fuel wood users. 8.95% used crop residues and 9.7% respondents were LPG users. The use of fuelwood along with crop residues was 14.8%, 2.98% respondents consumed fuelwood and LPG and they mostly belonged to middle class income group.

The wood consumption percentage was high among illiterate persons as compared to the

educated ones. Household fuelwood consumption was 20% more in winter as compared to the summer. Fuel consumption was found positively correlated with household size, illiteracy and household income.

In the study area per capita per year fuelwood, crop residues, dung and LPG consumption was 200, 387, 46, and 9.00 kg respectively. The demand for fuelwood and LPG in household sector in the rural areas of tehsil Chichawatni was estimated at 13,403 and 591 tonnes per month respectively for estimated population of 788,412 persons of tehsil Chichawatni during (1993-94). Shisham, kikar and kandi were found to be the three fuelwood species preferred by the respondents. Annual average household fuel expenditure worked out to be 2404 rupees. Crop residues and dung both were available free of cost and in abundance, therefore biogas plants can be established to meet the fuel requirements in the study area. This would be the most economical solution to overcome fuel scarcity and pollution problems in the area of survey because the sustained supply of raw materials (crop residues and dung) for biogas production is not a problem.

COMPARISON BETWEEN CONSTRAINTS AND MOTIVES OF GROWING TREES IN DISTRICT DIAMER AND CHARSADDA (ISMAIL)

The study was conducted to determine constraints and motives of growing trees in the farms and their comparison in district Diamer and Charsadda. Three villages from each district with fifty respondents in each village were randomly selected. The two districts were compared on the bases of socio-economic characteristics. The major constraints were smaller farm sizes in Diamer and the perception of adverse effect of tree on agricultural crops in Charsadda. Another major

problem common in both the areas was nonavailability of nursery stock. Whereas motive of farmers was fruit production in Diamer and income from sale of trees in Charsadda, timber and fuelwood had comparatively secondary importance.

HOUSEHOLD FUELWOOD CONSUMPTION SURVEY IN JUNIPER FOREST AREAS OF DISTRICT ZIARAT (SYED FARAZ ABBAS)

The aim of this study was to determine "the supply and demand of fuelwood" in the domestic sector in district Ziarat. Sample survey was conducted in six villages of study area. For this purpose 194 respondents were randomly selected and interviewed under a set of questions by using a questionnaire.

Analysis of data revealed that fuelwood was the major source of house hold energy in the area. All of the house hold used fuelwood in various quantities. 6.7% of the households used only fuelwood for domestic energy. 92.3% of the sample units consumed fuelwood along with other fuels such as kerosene oil or LPG and most of them consumed wood and kerosene whose share was 86.59 percent. 100 percent people were engaged in collection of fuelwood directly from the forest areas. The total fuelwood consumption for the population of 2249 persons in the area was 1408773.62 kg per annum. Thus high pressure on state forests was obvious.

It was suggested that conservation and afforestation programmes should be launched simultaneously through farm forestry approach with the intimate involvement of the inhabitants to reduce the pressure on state forests.

EFFECT OF SLOPE OF GRAIN ON BENDING PROPERTIES OF MORUS ALBA (KHALID MEHMOOD BUTT)

The study was carried out to find the effect of sloping grain on bending properties of *Morus alba*. For this purpose, Modules of rupture (MOR) and Modules of elasticity (MOE) for varying slope of grain were calculated. The range of MOR was determined to be between 663 to 1163 kg/cm³ for slope of grain varying from 1:2 to 1:17. The values of MOE ranged from 63300 to 94846 kg/cm³ for slope of grain varying from 1:2 to 1:16. From the results it was evident that increase in sloping grain was accompanied by a corresponding decrease in bending strength of *Morus alba*.

ECONOMIC ASPECTS OF UTILIZING EUCALYPTUS FOR PULP AND PAPER IN PUNJAB (SAEED AKHTAR KHAN)

The study was designed to assess the economic benefits of eucalyptus wood utilization in pulp and paper industry in Punjab. Data pertaining to the study was collected from offices of the Punjab Forest department and by personal contacts with the farmers who cultivated eucalyptus on their farm land. The annual monetary benefit from eucalyptus pulp, produced in the country, was calculated as Rs. 150 million and Rs. 520 million for NSSC and Kraft pulping process respectively.

For the success of social forestry, it was suggested that the demand of eucalyptus wood should be created by establishing a pulp mill in the eucalyptus supporting areas.

MEASUREMENT OF PHYSICAL WORK CAPACITY OF FOREST WORKERS IN HILLY AREAS (NADEEM QAISER)

The study was conducted to test the physical work capacity of the workers engaged in different forestry operations, a random sample of ten workers was chosen. These workers were tested for their physical work capacity by Walk test, Step test and Ergometer test. Heart rates of workers were recorded at different load in different tests. From heart rate and load data physical work capacity as energy expenditure and maximum aerobic power was determined.

The results of these tests showed that the Pakistani workers, at the average, are nearly comparable to the workers from other countries so far as their physical work capacity is concerned. However there was a strong need for the improvement in the physical work capacity of the worker for higher work output, increased income and socio economic conditions of forest workers which could be achieved by proper selection, nutrition and vocational training of the workers in Pakistan.

HOUSEHOLD SURVEY FOR FUELWOOD CONSUMPTION PATTERN IN VILLAGE IN JAN MOHAMMAD BHARO SARHAD DISTRICT SUKKUR SINDH (GUL HASSAN DAUDPOTA)

The purpose of this study was to estimate fuelwood consumption in households village of Ghotki Tehsil District Sukkur. Multistage sampling was adopted to collect data through questionnaire. The sample survey revealed that out of 68 respondents 38 were illiterate and the rest educated in the village. Maximum persons were farmer i.e. 26 and the remaining were Artisan, Labour, Government servant, Idle and shopkeeper. Maximum number of persons (55) were of low

income level followed by Medium (10) and high income level (3). Tenure status of the village was landless 42, Tenant 13, owner-cum-tenant 7 and 6 were owners. 61 persons had live stock and 7 without any live stock. The people collected fuelwood from their own lands, others lands or forest. Only 16% peoples purchased woodwaste from the sawmill. Whereas maximum persons (26) consumed crop residues 19 persons used wood wastes and only 15 persons consumed fuelwood. 5 consumed wood + cropresidues and 3 wood waste + cropre sidues.

It was also observed that illiterates consumed more fuelwood as compared to educated persons. High income level households consumption was more than lower level. It was also observed that larger households had lower per capita consumption of fuelwood on monthly basis. The per capita consumption with family size of (13-15) was 2.56 in summer, in winter 3.41 where as in lower family size (1-3) it was 8.67 in summer and 10.0 in winter. Preferred species were Shisham, Shisham + Babul and Babul in order + Preference. Seasonal variation also affected the fuelwood consumption. Since the summer was 4 month as compared to a months long of winter fuelwood consumption increased by 61.50% in summer than in winter (38.50%) on annual basis.

THE ROLE OF AGRISILVOHORTICULTURAL PRACTICE ON THE SOCIO-ECONOMIC CONDITIONS OF THE FARMERS OF MALAKAND TEHSIL (ABDUL HAMEED KHAN)

A socio-economic survey was conducted in Malakand Tehsil of North West Frontier Province for assessment of farmers' perception of agrisilvo-horticultural practice, added income return from trees, awareness of agrisilvo-horticulture and identification of adopters. Thirty respondents were selected randomly from six villages.

The data was analyzed to determine characteristics of adopters of agrisilvo-horticulture with income before and after adoption of practice. It was concluded from the study that Agrisilvo-horticultural practice increased income by about 100% for the people belonging to high income class and by about 50% for the medium and low income class. The said practice, therefore, gave monetary benefit to the adopters resulting in improvement in their socio-economic condition.

IMPROVING THE QUALITY OF WOOD FROM *EUCALYPTUS CAMALDULENSIS* TREES (MUHAMMAD SALEEM)

The study was aimed at improving the quality of wood in logs produced from *E. camaldulensis* tree. A set of three logs from each tree was taken to apply major treatments viz. girdling of trees, bark collar girdling of tree trunks after felling and control. Each set of logs was exposed to subtreatments like shade storage, sun storage and painting the log ends.

The effects of these treatments and their combinations on the intensity of defects such as star shakes and radial shakes developed on log ends were measured. The statistical analysis of the data indicated that the combined treatment of girdling + painting + undershade storage, bark collar girdling + painting + undershade storage gave the best results followed successively by girdling + undershade storage, control + painting + undershade storage, girdling + painting + sun storage, bark collar girdling + painting + sun storage, bark collar girdling + undershade storage, control + painting + sun storage, control + undershade storage, girdling + sun storage, bark collar girdling + sun storage and at the last, control + sun storage. *E. camaldulensis* has been widely planted throughout the country but the quality of its wood is not considered commercially

important. It was suggested that the wood should be treated prior to use, to enhance its value.

POPULATION STATUS, DISTRIBUTION PATTERN AND HABITAT OF GREY PARTRIDGE (*Francolinus pondicerianus*) IN DISTRICT FAISALABAD (M. IKRAM HAIDAR TOOR)

A survey of seven selected habitats was conducted in the study area. Four sample blocks, each of 10 hectares were taken in each habitat and vegetation composition, vegetation cover percent, intensity of pesticides (if used) and the number of partridges present in the sample blocks were recorded.

The population status of grey partridge was found "Common" in sandy scrub, alkaline wastes, ecotonal zone of alkaline wastes and croplands irrigated plantations and ecotonal zone of alkaline wastes and croplands. In croplands adjoining wetlands and normal croplands, where heavy pesticides were used, the status was "Rare". Ecotonal zone of sandy scrub and croplands was found the most favourable habitat while croplands adjoining wet lands were found unfavourable habitat for grey partridge. The distribution pattern of the bird varied within each and between various habitats.

COST BENEFIT ANALYSIS OF THE SAWMILL OF AZAD KASHMIR LOGGING AND SAWMILLS CORPORATION MIRPUR (AZAD KASHMIR) (RAJA MOHAMMAD SALEEM)

The study was conducted to evaluate the performance of the sawmill since its commissioning in 1973 and suggest improvement. The inspection of the mill and its records indicated that since its inception the mill was running at loss. It was concluded that in order to make the mill profitable, some hard decisions like

retrenchment of staff, reduction of huge managerial expenses, closing of some sections and establishment of integrated wood based industrial complex need to be made immediately.

RECREATIONAL VALUES OF JALLO PARK (SARWAT JABEEN)

The study was conducted to measure the benefits from recreation in the form of output produced by the Jallo Park in terms of demand function. The net social benefits of recreation produced by the Jallo Park were measured in terms of the area under the demand curve that exceeded the consumer's actual expenditures for each visit. The recreational value of Jallo Park was estimated by using travel cost approach. The recreational value of the study area was estimated to be about Rs.1 million per annum under the existing system of management.

SOCIO-ECONOMIC FACTORS INHIBITING SERICULTURE AROUND PESHAWAR (SEEMA QAZI)

The study was conducted to find out socio-economic factors which inhibit practice of sericulture in western areas of Peshawar tehsil. Some of the factors inhibiting sericulture practices were noted as lack of sufficient monetary resources, inadequate mulberry plantations exclusively for sericulture practices, unawareness of the people about sericulture practices, small land holdings, hesitation of the working class for sericulture practices, family size, non-availability of technical guidance and silk seeds. The study also suggested that the concerned sericulture department did not make any serious efforts for the promotion of sericulture in the area. These inhibition could be overcome provided the provincial government provides silk seeds and proper guidance to the interested people.

HOUSEHOLD FUELWOOD CONSUMPTION IN MANSUH VILLAGE OF DISTRICT KOTLI (AZAD JAMMU & KASHMIR) (MOHAMMAD NASEER CHOUDHRY)

A survey of 83 households in village Mansuh, District Kotli (AJ&K) was conducted in 1994 under the study entitled "House hold fuelwood consumption in village Mansuh, District Kotli (AJ&K) by applying multistage sampling technique. The analysis of data revealed that 100% fuelwood is being used for all the energy requirements and also the whole fuelwood is extracted from natural forests.

House hold monthly fuelwood consumption increased in winter as compared to summer fuelwood consumption and was found positively correlated with household size, illiteracy and manual labour as occupation of the household heads.

100% of the respondents used fuelwood from the Government owned natural forests free of cost. For estimated population of 800-900 persons, the per capita fuelwood consumption was 29.51 kgs. *Pinus roxburghii* and *Dodonaea viscosa* were found to be two fuelwood species in their order of preference.

Due to high pressure on the natural forests it was suggested that to reduce the burden from natural forests and to save them from adverse effect, alternate arrangement for energy requirements were of tremendous importance. The alternate arrangements may be social forestry on large scale, motivation of people to use LPD and kerosene oil and generation of hydropower for which the potentials exist in the area.

EFFECT OF EUCALYPTUS PLANTATION ON WATER-LOGGING AND SALINITY IN CHAK NO. 96.S.B (DISTRICT SARGODHA) (NADEEM ASHRAF WARAICH)

The study was carried out to determine the suitability of *Eucalyptus camaldulensis* for afforestation and reclamation of saline and waterlogged area in Chak No. 96(SB) District Sargodha.

Soil samples collected from the site planted with one, two, three and four years old *Eucalyptus camaldulensis* as well as control area without plants were analysed for pH, ECe soluble salts and texture classification. Water-table of the area was also measured. The results showed that the soil of the area was saline sodic, sandy loam and waterlogged. pH and ECe decreased gradually with an increase in the age of plantation as compared to control. Water-table showed gradual decrease in the planted as compared to unplanted area. Due to its tolerance and survival in problem areas, this species was found suitable for afforestation and reclamation of saline and waterlogged areas.

ENTOMOPATHOGENIC FUNGAL EFFICACY TRIALS OF *Beauveria bassiana* (BALSAMO) AGAINST FOREST PEST CRICKET (*Brachytrypes portentosus*) (Miss Rukhsana Kausar)

Beauveria bassiana (Entomopathogenic fungus) was tested as a biological control agent against nursery pest cricket (*Brachytrypes portentosus*) in the laboratory at the Pakistan Forest Institute Peshawar under the controlled temperature of 25-35°C and 55-65% relative humidity.

The entomopathogenic fungus was tried in the doses of 0.8×10^4 spores/ml, 0.6×10^4 spores/ml and 0.4×10^4 spores/ml by applying them on the crickets and host plant. Mortality of

crickets occurred in all the above doses. The doses 0.8×10^4 spores/ml and 0.6×10^4 spores/ml killed the crickets in 96-144 hours after treatment while the dose 0.4×10^4 spores/ml caused the mortality of crickets in 168 hours.

The fungal hyphae developed in the crickets treated with 3 doses and first covered the soft parts like the thorax and abdomen. In a period of two weeks the fungus covered the whole body of the cricket.

The study showed the susceptibility of cricket to the fungus *Beauveria bassiana* which could be used as Bio-control agent in the field.