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Species Preferences for Fuelwood in Shiwalik Himalayas- Implications for Agroforestry Plantations

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ABSTRACT

Fuelwood is primary source of energy for domestic cooking and space heating in India. There have been many attempts to investigate the quantity of fuelwood used by household in various parts of India. Not withstanding this, the studies on the choice of species of these households for fuelwood has not gained much interest until recently. The present studywas, therefore, undertaken to know the choice of the tree species in Samba district of Jammu & Kashmir where a majority of the households use fuelwood for domestic purpose. The study was carried out in personal interview with the heads of selected households using pre-structured schedule. Three stage sampling with district, block and village as sampling units in each successive stage, was used to select the households. The final sample size comprised of 180 households. To find out the species preference for fuelwood use, species preference index was calculated. State forests was the major source of fuelwood followed by own farm. The species choice varied from village to village owing to variation in personal choice and locality factors. *Acacia nilotica, Dalbergia sissoo*, *Grewia optiva*, *Acacia modesta*, *Leucaena leucocephala* and *Mangifera indica* were the most preferred species for fuelwood in the study area. Emphasis should be given for plantation of these species in agroforestry systems and around the villages to fulfill the need of the rural population for fuelwood and divert the pressure from the existing state forests. A basket approach of providing seedlings of more than one species needs to be adopted to encourage agroforestry plantations for fuelwood.

Keywords: Fuelwood, Species preference index, Jammu & Kashmir

INTRODUCTION

Fuelwood is the primary energy source for cooking and space heating used by rural households (70 per cent) in developing countries (Parikh 1980). Fuelwood is pre-eminently, a renewable source of energy whose decentralised nature is particularly suited to the scattered nature of rural habitation and usually makes it possible to obtain the fuel at a very low cost.

The reliability of a considerable proportion (40 per cent) of people world-wide on fuelwood energy for cooking and space heating has given rise to serious concerns that harvesting of fuelwood could be depleting the forest resources (Anonymous 2010). Continual growth of human population on the earth, increasing demand for food and living space led to the increase of energy demands as well. In communities where fuelwood is used for residential cooking, it is replaced by other technologies reluctantly, driven by cost differentials (Rao 1985). In order to meet the energy demands man utilized different natural resources often to such an extent that some of them are likely to become extinct. The consumption of biomass as fuel has been identified as one of the most important causes of forest decline in many developing countries. The fuelwood accounts for over 54 per cent of all global wood harvest per annum, leading to a significant loss of forest biomass (Wahabet al. 2008). A heavy and growing reliance on forest and other plant species as a source of fuel has become unsustainable. The more dependence of rural households on fuelwood and the anticipated depletion of available stocks present a real threat to economic welfare and growth (Marenya and Barrett 2007). The declining forests result in serious repercussions of all kinds. The rural people have to devote an increasing proportion of limited time and money for obtaining the needed supply of

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fuelwood from state forests (Sood 2003). One of the ways to reduce pressure on existing state forests is to plant trees in agroforestry to fulfill fuelwood needs of the people at the farm level. Many agroforestry programmes were not adopted in the past because of an inappropriate choice of tree species (Akbar et al. 2000; Chand and Singh 1983; Lakshmipathy 1992; Noronha and Spears 1985; Raintree 1991). Therefore, agroforestry programmes should be tuned to meet farmers' priorities for tree species (Eckholmet al. 1984; Raintree 1991). Information about local preferences for tree species can be useful to agroforestry workers to identify the most appropriate tree species for cultivation in an area. The availability of alternate fuels (kerosene, liquefied petroleum gas and agricultural residues) for domestic use is erratic in Samba district of Jammu & Kashmir. Thus, fuelwood is preferred as source of domestic energy by a considerable proportion of the population in this district. Keeping this in view, thecurrent study was carried out in Samba district of Jammu & Kashmir.

MATERIALS AND METHODS

Study area description

Samba district is divided into four blocks for rural development and administrative purposes.It is bounded by districts, viz. Udhampur in the North, Kathua in the East, Jammu in the West, while on the Southern side it has international border with Pakistan. The district is located at 32° 33′ N latitude and 75° 7′ E longitude. There are 382 villages in the district. The district is predominantly rainfed but some area of the district is irrigated through Ravi irrigation canal network. The climate of the district is subtropical which remains hot and dry in summer and cold in winter. The summer season sets in from April and ends up to June. The rainy season starts from July and continues up to September. The winter season begin from October and continues up to March. The average daily temperature in the study area ranges from 6-47^{0}C. The average annual rainfall in the district is 900mm. The total human population of the district is 2.87 lakh, which accounts for 2.75 per cent population of the state (www.samba.gov.in/ district/ sambaestablish.asp). A majority (78.68 per cent) of the population of the district is rural and is dependent on agriculture for their livelihood.

Sampling procedure

A multi-stage, random sampling design was adopted to select the households. In the first stage, two blocks of the district were selected purposively to represent irrigated and rainfed locations respectively. In the second stage, a complete list of villages was prepared in both the locations with the help of tehsil and block officials. The villages were selected using simple random sampling without replacement. A complete list of households in the selected villages was prepared in consultation with panchayat secretaries and village elders. The households within each selected village were selected using proportionate allocation and simple random sampling with replacement method. In this way a sample of 180 households was selected.

Data collection

The data were collected on a well designed interview schedule in personal interview with each of selected head of the household. The schedule contained information on general demographic features of study area and preference of tree species for fuelwood.

Species preference index for fuelwood

To find out the species preference for fuelwood use, species preference index (SPI) was calculated, using the methodology of Singh (1996). The heads of households were asked to indicate preference of species for fuelwood use from 1-3. Preferences from 1-3 were assigned numeral values from 3-1 respectively. The numbers of the preferences for each species were counted. The preference total was obtained for each species and village by multiplying the number of different preferences by corresponding preference numeral and summing them. The species getting the highest total was the most preferred species in the village and vice-versa. In order to calculate the species preference for the whole study area preference weights were determined and the preference index was calculated which represented the order of the preference for the species in the study area.

$$\text{The preference weight } (pw_{ij}) = \frac{\text{Preference total for } i^{th} \text{ species from } j^{th} \text{ village}}{\text{Number of sample households in the village}}$$

Preference index for i^{th} species for the study area =

$$\frac{\Sigma pw_{ij}}{N \times 3}$$

where,

pw_{ij} is preference weight for i^{th} species from j^{th} village

N is number of study villages in the study area.

RESULTS AND DISCUSSION

Primary sources of fuelwood

The median fuelwood consumption was 2080 kg/year for a household size of 6 members in the study district.In total 97.8 per cent of the households used fuelwood for domestic purpose. Forest was the primary source of fuelwood for the households (49.4 per cent)followed by own-farm (35.0 per cent). Only 12.8 per cent of total households werepurchasing thefuelwood (Table 1). The state forest was the major source of the fuelwood implying a great pressure on these for fuelwood collection. This pressure can be diverted to farms by planting fuelwood species in the form of agroforestry systems.

Table 1: Primary sources of fuelwood

Source	Percentage of total households
State forest	49.4
Own-farm	35.0
Purchase	12.8
Do not use	2.8

Preferred species for fuelwood consumption

A total of 14 species viz. *Lantana camera, Leucaena leucocephala, Acacia nilotica, Acacia modesta,Ziziphus mauritiana, Morus alba, Grewia optiva, Dalbergia sissoo, Eucalyptus* spp.*, Pinus roxburghii, Psidium guajava, Calotropis gigantia, Mangifera indica* and S*yzygium cumini* were found important for fuelwood consumption across the 12 villages viz. Parmandal, Madana, Sadral, Paddal, Kothar, Mandal, Kalarian, Parri, Abtal, Gokhal Chakh, Bandral and Keso villages respectively (Table 2).

In each village, more than one species was preferred. The species preference varied from village to village (Table 2). This could probably be due to village-wise variation in the vegetation owing to the variability in locality factors (soil, topographic, climatic and biotic). This implies rather than planting a single species for fuelwood, a basket approach of providing more than one species be adopted to encourage agroforestry adoption.

Table 2: Preference score of species for fuelwood consumption in the study villages

	Location	Village Name											
		Rainfed						Irrigated					
S No.	Species	Madana	Parmandal	Sadral	Paddal	Kothar	Mandal	Kalarian	Parri	Abtal	Gokhalchakh	Bandral	Keso
1	*Lantana camera*	28	43	23	26	23	28	0	0	0	0	0	0
2	*Leucaena leucocephala*	14	0	0	0	0	17	0	0	0	0	0	0
3	*Acacia nilotica*	9	0	15	0	0	11	22	25	36	42	16	33
4	*Acacia modesta*	26	0	20	0	0	35	0	0	0	0	0	0
5	*Ziziphus mauritiana*	7	0	6	0	0	5	0	0	0	0	0	0
6	*Morus alba*	0	0	3	0	0	6	3	0	0	0	0	18
7	*Grewia optiva*	0	24	7	12	31	0	0	7	0	23	0	0
8	*Dalbergia sissoo*	0	23	0	21	18	0	14	22	30	26	14	14
9	*Eucalyptus* spp.	0	2	0	11	8	0	2	7	10	4	1	2
10	*Pinus roxburghii*	0	12	0	6	0	0	0	0	0	0	0	0
11	*Psidium guajava*	0	0	0	0	0	0	8	0	6	0	11	11
12	*Calotropis gigantia*	0	0	0	0	0	0	2	5	8	4	31	1
13	*Mangifera indica*	0	0	0	0	0	0	0	0	0	0	0	16
14	*Syzygium cumini*	0	0	0	0	0	0	3	0	0	0	0	19

Species preference index

Acacia nilotica and *Dalbergia sissoo* were the most preferred species in the study area. The preference for these species could be due to ease of their combustion, better fuel quality and low smoke emission and also their availability due to their better regeneration. *Mangifera indica* and *Pinus roxburghii* were the least preferred species for fuelwood in the study area (Table 3).

Table 3: Species preference index for fuelwood use in the study area

S. No.	Botanical name	Local name	Preference index
1	*Acacia nilotica*	Kikar	0.39
2	*Dalbergia sisoo*	Tali	0.34
3	*Lantana camera*	Santha	0.31
4	*Grewia optiva*	Dhaman	0.19
5	*Acacia modesta*	Fly	0.14
6	*Calotropis gigantia*	Aak	0.09
7	*Eucalyptus* spp.	Eucalyptus	0.08
8	*Psidium guajava*	Amrood	0.06
9	*Leucaena leucocephala*	Luecaena	0.05
10	*Morus alba*	Shahtoot	0.04
11	*Syzygium cumini*	Jamun	0.03
12	*Ziziphus mauritiana*	Ber	0.03
13	*Mangifera indica*	Mango	0.02
14	*Pinus roxburghii*	Chir	0.02

Scientific studies needs to be undertaken to evaluate fuelwood quality, combustion and smoke emission properties of these species and correlate it with the species preference exerted by the people.

CONCLUSIONS

In Jammu and Kashmir, fuelwood is the main source of domestic energy for the rural households. People generally collect fuelwood from forests and own-farms to meet domestic energy needs for cooking and space heating. However, the state forests are the major source of fuelwood in the study area followed by farm land. To divert the pressure for fuelwood on existing forests, fuelwood based agroforestry systems needs to be encouraged. However, the species preference varied from village to village owing variation in locality factors. *Acacia nilotica* and *Dalbergia sissoo* were the most preferred species in the study area possibly owing to their ease of regeneration, better fuelwood quality and low smoke emission. *Acacia nilotica, Dalbergia sissoo*, *Grewia optiva*, *Acacia modesta*, *Leucaena leucocephala* and *Mangifera indica* are preferred fuelwood trees which have scope for plantation in the agroforestry systems.

REFERENCES

Akbar G, Baig MB, Asif M (2000). Social aspects in launching successful agroforestry projects in developing countries. Sci Vis 5: 52-58

Anonymous (2010). Annual Report. Food and Agriculture Organisation, Rome, Italy

Chand KP, Singh R (1983). People's participation and social forestry: A case study of Himachal Pradesh. Indian J Agril Econ 38: 317-322

Eckholm E, Foley G, Barnard G, Timberlake L (1984). Fuelwood: the energy crisis that won't go away. IIED, London and Washington DC, p 107

Lakshmipathy CH (1992). Tree farming. In:PK Khosla (ed) Status of Indian forestry - Problems and perspectives, Indian Society of Tree Scientists, Solan, pp 159-168

Marenya PP, Barett CB (2007). Household-level determinants of adoption of improved natural resources management practices among smallholder farmers in Western Kenya. Food Pol 32: 515–536

Noronha R, Spears JS (1985). Sociological variables in forestry project design. In:MM Cerna (ed) Putting people first, Sociological variables in rural development, Oxford University Press, New York, USA, pp 227-266

Parikh JK(1980). Energy systems and development. Constriants, demand and supply of energy for developing regions. Oxford University Press, Delhi, India

Raintree JB (1991). Socioeconomic attributes of trees and tree planting practices. FAO, Rome, p 115

Rao YS (1985). Building success through people's participation. Unasylva 37: 29-35

Sood KK (2003). Factors affecting tree growing in traditional agroforestry of Western Himalayas, India. Ph.D. Thesis, University of Aberdeen, Aberdeen, UK

Wahab M, Ahmad M, Khan N (2008). Phytosociology and dynamics of some pine forests of Afghanistan. Pakistan J Bot 40(3): 1071-1079

Singh R (1996). Approximately optimum stratification on the auxiliary variable.J Stat Asso 66: 829-833