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Diversity, Distribution and Utilization Pattern of Economically Important Woody Plants Associated with Agro-Forestry in District Rajouri, J & K (Northwest Himalaya)

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Abstract

The extensive explorations carried out in the study area enabled us to identify 60 woody plant species (47 trees and 13 shrubs) associated with the agroforstry system. These species belonged to 48 genera and were distributed among 30 families. Rosaceae (11 spp.), Rutaceae (5spp.), Euphorbiaceae, Fabaceae, Mimosaceae, Moraceae and Pinaceae (3spp. each) were the species rich. Maximum species were found between the altitudes 1000-1800m. Forty seven species were used as fuel, 30 as medicine, 22 as edibles, 13 as fodder, 7 as timber, where as 4 species were used for making agriculture implements. Only one species was identified as rare, 14 species occasional and remaining were common.

Keywords: Agroforestry, Diversity, Utilization pattern and Conservation management.

Introduction

Himalayas one of the richest repositories of biodiversity, comprises of five bio-geographic zones, Trans, Northwest, West, Central and Eastern Himalaya (Rodgers and Panwar, 1988; Samant and Dhar, 1997), covering an area of 419873 km^2 and considered as the repository of biological and cultural diversity. It supports about 18440 species of plants of which 25.3 % are endemic (Singh and Hajra, 1996; Samant *et al.* 1998). Himalayas are also known to provide the life support system to human beings, particularly due to the fact that on account of remoteness and inaccessible terrain, the local populace has largely depended on plants. The number of people in India who rely on forest products is assumed to be approximately 50 million (Shiva, 1993). The rural populace dwelling Himalayas is economically weak and most of the areas are not connected by roads. They use forests for grazing, firewood collection and numerous other subsistence needs (Kothari *et al.* 1989; Van Shaik *et al.* 1997; Sabarwal and Ranagarajan, 2003). Apart from the forests, the agroforestry systems are also very prominent throughout the Himalayas and are harnessed by the native communities for medicine, fruit, fuel, fodder, timber, fiber, etc. It is recognized as a means of meeting the needs of rural people for income, social and cultural benefits, while at the same time being sustainable. Moreover, it provides opportunity to integrate productivity and profitability with environmental stewardship and result in healthy and

sustainable agricultural systems that can be passed on to future generations.

The agroforstry system include trees in farms, community forestry and a variety of local forest management and ethnoforestry practices (Pandey, 1998).These systems have been presented as a solution to rising fuelwood prices resulting from increase in demand and decrease in supply of fuelwood due to forest degradation (Bowonder *et al.* 1988). Although it is an important component of biodiversity of this region, very few studies have been taken to assess the diversity, distribution and economic importance of trees grown in agroforstry system. The present attempt has been made to study the diversity, distribution pattern, status and economic importance of the trees and shrubs growing in the agroforestry systems of District Rajouri, Jammu and Kashmir (Northwest Himalaya).

Study Area

Spread over an area of 2630 km^2 District Rajouri lies between 30^0 $50^/$ to 33^0 $30^/$ N Latitude and 74^0 to 74^0 $10^/$ E longitude. The area is endowed with high mountain peaks and deep valleys with an altitudinal range from 400 to 4300 msl. District Rajouri is one of the hilly districts of J&K State, bounded by District Poonch in North, District Jammu in South, Reasi in East and Mirpur (Pakistan) in the West. The area has three regions i.e., the alpine, temperate and subtropical regions. The rural populace is economically weak and agriculture is their main occupation.

Material and Methods

The present study is based on the intensive field surveys conducted in the different parts of the District Rajouri during 2007 to 2009. Collection of plant species associated with agroforestry were made from all the seven tehsils viz Rajouri, Sunderbani, Nowshera, Kalakote, Budhal, Thannamandi and Dahral of district Rajouri. Almost all the tribal inhabited areas were explored and attempts were made to gather the information from the local inhabitants. The information was gathered either by taking interviews of the informants or as a witness of the use during the period of studies in the field. Informants were also requested to accompany in the field to detect plants. The information received on the uses of plant species were verified from 2 to 3 other persons apart from primary source. The specimen of plant species were collected, dried and used for making voucher specimen following conventional methods of drying and preservation. The specimens were identified using available floristic literature (Hooker, 1872-1897; Sharma and Kachroo, 1981; Swami and Gupta, 1998; Singh and Kachroo, 1994; Anonymous, 2002). The specimens were also compared with those lying in the Herbarium of Department of Botany, University of Jammu.

Results and Discussion

The study enabled us to record 60 plant species (trees (46 trees and 14 shrubs) belonging to 47 Genera and 32 families. Among the families, Rosaceae was the dominant family represented by 11 species followed by Rutaceae with 5 species. Euphorbiaceae, Fabaceae, Mimosaceae, Moraceae and Pinaceae were represented by 3 species each. Caeselpinaceae, Fagaceae, Meliaceae and Ulmaceae contributed by 2 species each whereas 21 families were monotypic. Among the Genera *Ficus, Prunus,* and *Citrus* were species rich contributing 3 species each. List of plant species along with local name, altitudinal range, lifeform, status and economic importance is given in Table 1.

It has been found that the altitude zone 600-1800m was represented by maximum no. of agroforestry trees (41 species) and shrubs (8 species). The altitudinal zone 1800-3000m was represented by 27 species (20 trees and 7 shrubs). The representative species of zone 800- 1800m were *Mangifera indica, Phoenix sylvestris, Bombax ceiba, Phyllanthus emblica, Ficus palmata, Punica granatum, Ziziphus jajuba, Grewia optiva, Citrus spp., Bauhinia variegata, Acacia catechu, Dalbergia sissoo* etc. and zone 1801-3000m was represented by *Berberis lycium, Elaeagnus umbellata, Indigofera heterantha, Quercus floribunda, Aesculus indica, Cedrus deodara, Pinus wallichiana, Rosa brunonii, R. hoffmeisterianus, Prinsepia utilis, Pyrus pashia, Pyrus communis, Spiraea canescens and Celtis australis* etc. It has been observed that the diversity of the agroforestry species decreased with the increasing altitude. High diversity of the species between altitudes of 800-1800m may be due to mild climatic conditions and diverse habitats supporting a wide range of trees and shrubs growing within the agroforestry systems, whereas low diversity in the higher altitudes may be due to severe climatic conditions not conducive for the germination and growth of the species.

Of the total species, 47 species are exploited for fuel, 30 species for medicine, 22 for fruit, 13 for fodder, 7 species for timber whereas agricultural implements are made from 4 species. Study also revealed that 13 species have multiple utility. The notable multiple utility species were *Aesculus indica, Berberis lycium, Bombax ceiba, Cedrus deodara, Juglans regia, Grewia optiva, Punica granatum, Prunus armeniaca, Quercus leuchotrichophora, Ulmus wallichiana* etc. Amongst the recorded species, only one species was rare, 14 species were occasional, whereas 45 species were common in the study area.

The interviews with knowledgeable persons indicated that the local inhabitants exploit some of the plant species for income generation also. The area is occupied by the horticultural species such as *Punica granatum , Phyllanthus emblica, Juglans regia, Pyrus malus, P. communis, Prunus armeniaca, P. persica, Citrus spp. and Magnifera indica* etc. having very high productivity and is one of the major source of income generation for the inhabitants. They are traded either in the local markets of the state or in the national market. Regular use of plant species of multiple utility may lead to rapid depletion of their population. Therefore, there is an urgent need to develop a proper mechanism for the utilization of such important plant species, so that their population can be maintained for posterity. Baseline information, such as that provided in this paper, on the useful species is essential to understand the population status of species growing in agroforestry systems in order to identify their economic and conservation value and thus develop strategies for conservation and management of economically important species that are under high anthropogenic pressure.

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Table 1. Plant species with economic importance.

Taxa	Local name	Altitude (msl)	Life form	Status	Economic importance
Acanthaceae					
Barleria cristata L.	Barankar	800-2000	Sh	Co	M,Fl

Anacardiaceae					
Mangifera indica L.	Am	600-1300	T	Oc	Ed
Arecaceae					
Phoenix sylvestris (L.) Roxb.	Khajoor	600-1300	T	Oc	Ed,M
Asteraceae					
Inula cuspidata Clarke	Manu	1200-2000	Sh	Co	M
Betulaceae					
Alnus nitida (Spach) Endl.	Champ	1000-2800	T	Co	Fl, Fd
Berberidaceae					
Berberis lycium Royle	Kamble	1800-2800	Sh	Co	M,Fl,Fd
Bombacaceae					
Bombax ceiba L.	Simble	1000-1500	T	Oc	M,Ed,Fl,Fd,Tb
Caeselpiniaceae					
Bauhinia variegata L.	Kachnar	Upto1900	T	Co	M, Fl
Bauhinia purpurea L.	Lal Kachnar	600-1800	T	Oc	Fl
Cupressaceae					
Cupressus sempervirens L.	Saroo	1000-2000	T	Oc	Fl,Ag.tools
Ebenaceae					
Diospyros lotus L.		1000-2000	T	Oc	M,Ed,Fl
Elaeagnaceae					
Elaeagnus umbellata Thunb.	Kiyaan	1500-2800	T	Co	Ed,Fl
Euphorbiaceae					
Phyllanthus emblica L.	Amla	600-1500	T	Co	M,Ed,Fl
Mallotus philippensis (Lam.) Müll. Arg.	Kamela	600-1400	T	Co	M,Ed,Fl
Euphorbia royleana Boiss.	Thor	1000-1500	Sh	Oc	M,Fl
Fabaceae					
Dalbergia sissoo Roxb. ex DC.	Tali	Upto 700	T	Co	M,Fl, Tb
Desmodium elegans DC.	SafedKhathi	1300-1500	Sh	Co	Fl
Indigofera heterantha Wall. ex Brandis	Khathi	1700-2500	Sh	Co	M, Fl
Fagaceae					
Quercus leucotrichophora A. Camus	Banj	1600-2700	T	Oc	M,Fl,Fd
Quercus floribunda Lindl. ex A. Camus	Maru	1600-2800	T	Co	Fl,Fd
Hippocastanaceae					
Aesculus indica (Wall. ex Cambess.) Hook.	Goon	1800-2800	T	Oc	M, Fl
Linaceae					

Reinwardtia indica Dumort.	Piyan	1200-2500	Sh	Co	M
Juglandaceae					
Juglans regia L.	Akhrot	1000-3000	T	Co	M,Fd
Lythraceae					
Woodfordia fruticosa (L.) Kurz	Dhai	800-1600	T	Co	Fl,Ag.tools
Mimosaceae					
Acacia catechu (L. f.) Willd.	Khair	Upto 1000	T	Co	Fl
Acacia modesta Wall.	Farlai	Upto1000	T	Co	Fl
Albizia lebbeck (L.) Benth.	Siris	Upto 1300	T	Co	Fl,Fd
Meliaceae					
Azadirachta indica A. Juss.	Neem	Upto 1400	T	Co	M, Fl
Toona ciliata M. Roem.	Tunnu	1200-1500	T	Co	Fl,Fd
Moraceae					
Ficus palmata Forssk.	Fagwara	1000-3000	T	Co	M, Ed
Ficus carica L.	Anjeer	1000-3000	T	Co	M,Ed,Fl
Ficus auriculata Lour.		1000-2000	T	Oc	Ed
Oleaceae					
Olea cuspidata Wall. ex G. Don	Kahoo	2000-2500	T	Co	M,Fl
Pinaceae					
Cedrus deodara (Roxb. ex D. Don) G. Don	Diyaar	1500-2500	T	Co	Fl,Tb
Pinus roxburghii Sarg.	Chir	1400-2400	T	Co	Fl,Tb
Pinus wallichiana A. B. Jacks.	Kail	1800-3600	T	Co	Fl, Tb
Pistaciaceae					
Pistacia integerrima J. Stewart	Kakersinghi	1200-2500	T	Co	M,Fl
Punicaceae					
Punica granatum L.	Darooni	Upto 2000	T	Co	M,Fl,Ed
Rhamnaceae					
Ziziphus jujuba Mill.	Berry	600-1400	T	Co	Ed
Rosaceae					
Rosa brunonii Lindl.	Kareer	1700-2500	Sh	Co	M,Misc.
Rubus hoffmeisterianus **Kunth & C. D.**Bouché	Khayari	1800-2800	Sh	Co	Ed, Misc.
Prinsepia utilis Royle	Rowari	1600-2800	Sh	Co	M, Ed, Misc.
Pyrus pashia Buch.-Ham. ex D. Don	Kainth	1100-2500	T	Co	Ed,Fl
Prunus persica (L.) Batsch	Aru	1000-2400	T	Co	Ed, Fl
Prunus armeniaca L.	Sarri	1000-2400	T	Co	Ed, Fl

Prunus bokhariensis Royle ex C. K. Schneid.	Alu Bokhara	1400-2200	T	Co	Ed, Fl
Pyrus communis L.	Nashpati	1000-2500	T	Co	Ed, Fl
Malus domestica Borkh.	Seb	1000-2500	T	Co	Ed,Fl
Rubus ellipticus Sm.	Peley Akhere	900-1500	Sh	Co	M,Ed,Fl,Fd
Spiraea canescens D. Don	Kathi	1700-2500	Sh	Co	Fl, Fd, Ag.tools
Rutaceae					
Citrus limon (L.) Burm. f.	Galgal	1000-1600	T	Co	M, Ed, Fl
Citrus aurantium L.	Nimbu	1000-1600	T	Co	M,Ed
Citrus sinensis (L.) Osbeck	Santra	700-1500	T	Oc	Ed, Fl
Bergera koenigii L.	Karipata	Upto 1000	T	Co	M, Fl, Misc.
Zanthoxylum armatum DC.	Timbru	800-2000	Sh	R	M
Salicaceae					
Salix alba L.	Willoo	1000-2000	T	Oc	Fl, Tb, Misc.
Tiliaceae					
Grewia optiva J. R. Drumm. ex Burret	Taman	Upto 1700	T	Co	Fl,Fd, Misc.
Ulmaceae					
Celtis australis L.	Kharik	1100-2500	T	Co	Fl, Misc.,
Ulmus wallichiana Planch.	Mannu	800-2200	T	Oc	Fl,Tb,Misc.,
Verbenaceae					
Vitex negundo L.	Bana	Upto 1700	T	Co	M, Fd

Abbreviations used: Co= Common, Oc= Occasional, R= Rare, T=Tree, Sh= Shrub, M= Medicinal, Fd= Fodder, Fl= Fuel, Ag.tools= Agriculture tools; Ed= Edible; Misc.=Miscellaneous; and Tb= Timber.