



Ethno-botanical diversity of important Woody Flora of Tehsil Thannamandi, district Rajouri (J&K), India

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Abstract

The present study described the occurrence of woody species and its usage in Tehsil Thannamandi of district Rajouri (J&K). An extensive and intensive survey of the area was conducted during the month of January 2022 to Dec., 2022 based on altitudinal gradients the area was divided into three site i.e., hill base (S1), hill top (S3) and mid-elevation (S2). A total of 46 plant species were found belonging to 26 families were identified and some of them were collected and preserved after exsiccating. The ethno-botanical information was gathered from the local and tribal inhabitants of the region. It was observed that Fabaceae, Rosaceae, Moraceae and Pinaceae (in higher altitude) were the dominant families with regards to ethno botanical aspects of Tehsil Thannamandi. Thus, contributing to the regional biodiversity; the present study provides an updated checklist of the Ethno-botanical woody flora of the area. The importance of recording the usage of plants in this region is imperative because of rapid loss of forest wealth and traditional wisdom. In view of the various resources use, habitat uniqueness and anthropological pressure on the forest resources, the need for conservation is to be stressed.

Keywords: Ethno-botany, Woody Flora, diversity, anthropogenic pressure.

Introduction

Biodiversity provides supporting (e.g. nutrient cycling and primary production), provisioning (e.g. food, timber, fuel, fresh water), regulating (e.g. climate and water regulation) and cultural (e.g. spiritual experience, recreation, education) ecosystem services that are essential for human well being (MA 2003; Díaz *et al.* 2018) [13]. In this context, woody plants provide many important services that are directly or indirectly associated with particular species (Díaz *et al.* 2006) [12]. Especially in less wealthy countries, many people directly depend on woody plants for their daily lives (Rasmussen *et al.* 2017 [35]; Reed *et al.* 2017) [37]. However, the sustainable management of woody plants and their services for long-term human well being remains a challenge.

The sustainable management and maintenance of woody plant species and their associated ecosystem services are influenced by numerous direct drivers (i.e. activities directly causing changes in woody species) as well as indirect drivers (i.e. underlying circumstances that prevent the maintenance of woody plants) (Geist and Lambin 2002 [21]; Hosonuma *et al.* 2012) [24]. Direct causes of woody plant species declines include land conversion for agriculture and agricultural intensification, logging, fuelwood collection and cattle grazing (Foley *et al.* 2005 [16]; Asner *et al.* 2009 [3]; Lewis *et al.* 2015) [32], as well as commercial forest management (e.g. for oil palm in Southeast Asia; Edwards *et al.* 2014 [14] and coffee in Ethiopia; Hundera *et al.* 2013 [25]; Geeraert *et al.* 2019) [20]. These direct causes, in turn, are linked to indirect drivers such as demographic pressure and certain property rights, policies and markets, all of which influence local people's ability to maintain woody plants and associated benefits (Lambin *et al.* 2001 [30]; Geist and Lambin 2002 [21]; Díaz *et al.* 2015) [11]. Understanding such complex links between nature and people can be

facilitated through taking a social-ecological systems perspective (Bennett *et al.* 2015) [8]. Social-ecological systems are systems with strong and close links between people (the social system) and environmental processes (the ecological system) (Berkes *et al.* 2003 [9]; Folke 2006 [17]; Fischer *et al.* 2012) [15]. In such systems, among others, questions that require investigation relate to the ways in which people use different species of woody plants; how property rights impede or facilitate the use and conservation of woody plants; and whether species are managed sustainably or not. To the best of our knowledge, such interrelated issues have not been investigated to date via focusing on local people at the same time as considering the forest-agriculture mosaic from a landscape ecological perspective (e.g. Balvanera *et al.* 2014 [4]; Isbell *et al.* 2017 [26]; Díaz *et al.* 2018) [13].

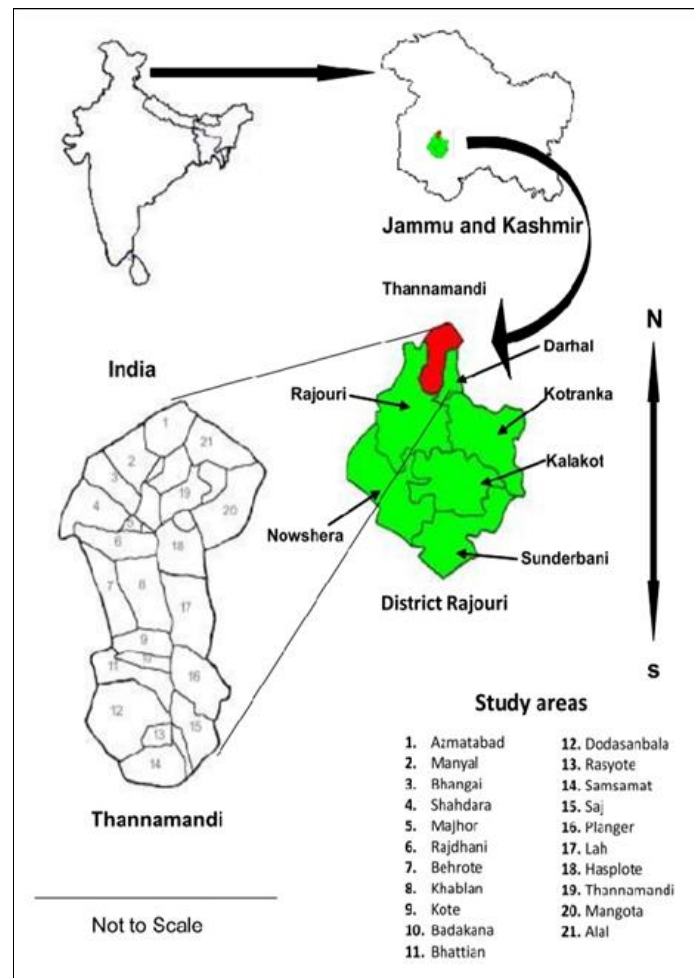
Globally, several billion people rely on woody plants for their livelihoods (Kaimowitz and Sheil 2007 [27]; Reed *et al.* 2017) [37] with, for example, between 1.3 and 2.4 billion people using wood for house construction and cooking, respectively. The benefits people obtain from woody plants are numerous and may involve both direct and indirect services associated with particular plant species (Díaz *et al.* 2006) [12]. These benefits are important to meet basic needs and mitigate income insufficiency of rural households (Reed *et al.* 2017) [37]. Among others, trees and shrubs provide food, timber, fuelwood, shelter, farming tools (such as yolks and beams), fodder, and medicine (Iiyama *et al.* 2014). Woody plants also contribute to indirect benefits such as hosting agricultural crop pollinators or enhancing soil fertility, water infiltration and flood protection (Rasmussen *et al.* 2017) [35].

Despite such important benefits, human land use has been a major driver of biodiversity loss, influencing all taxa

including woody plants (Keenan *et al.* 2015 ^[29]; Barlow *et al.* 2016) ^[7]. Unsustainable utilisation of woody plant species, such as overharvesting or the inability to protect these species, can lead to extinction. In this concern, the

present investigation have documented ethno-botanical study of woody flora of Tehsil Thannamandi, District Rajouri (J&K), India for the sustainable management of woody plants.

Material and Methods



Study Area

The study area is situated in the north of district Rajouri of J&K India, between Longitude: 74.38°E and Latitude: 33.55°N with an altitude ranging from 1100 to 2200 m asl. The region is located on the famous Mughal Road and is bounded to east by the famous Pir Panjal mountains and toward north and west by the border district Poonch. Annually, it rains 1150 mm and the average temperature is 18-22°C. Topography is distinctly marked with several mountains, springs, rivulets, and rivers. This area is geographically located in the middle Himalaya's Pir Panjal region.

Methodology

The present paper is the result of detailed field studies made during the floristic surveys conducted in the tehsil Thannamandi of district Rajouri (J&K) from January 2022 to Dec., 2022. During these surveys, plants were collected from diverse habitats in different sites of the region. During collections, detailed field observations and ethno-botanical data were recorded from local and tribal inhabitants. The collected plant specimens were identified using relevant Floras and other available taxonomic literature including Hooker (1872–1897) ^[23], Stewart (1972) ^[41], and Sharma

and Kachroo (1981, 1982) ^[31] and online resources, such as various e-floras, International Plant Name Index (IPNI), Catalogue of Life, The Plant List and GRIN. For convenience, the sequence of plant species in the inventory is alphabetical.

Based on extensive and intensive survey the study area has been divided into 3 regions.

- **The Hill Base (S1):** -at an elevation of 1100 to 1400 m
- **The Mid Elevation (S2):** -at an elevation of 1400 to 1800 m
- **The Hill Top (S3):** -at an elevation of 1800 to 2100 m (Before Identification) to 7 field trips were conducted in each site for the collection of data.

Depending upon the dominancy of species in any site they were designated as abundant (+++), common (++) , rare (+) and absent (-).

Results & Discussion

In this study a total 46 important medicinal plant species were found belonging to 26 families (Table 1). The 26

families included in this study are: Amaranthaceae (1), Annabaceae (1), Berberidaceae (1), Cannabaceae (1), Ehretiaceae (1), Elaeagnaceae (1), Ericaceae (2), Fabaceae (5), Fagaceae (3), Juglandaceae (1), Lamiaceae (1), Malvaceae (1), Meliaceae (2), Moraceae (4), Myrtaceae (1), Pinaceae (2), Plantanaceae (1), Poaceae (2), Rhamnaceae (1), Rosaceae (8), Rutaceae (1), Salicaceae (1), Sapindaceae (1), Taxaceae (1), Thymelaceae (1), Urticaceae(1).

The collected information has been compared with ethno-botanical literature. The highest ethno-botanical diversity of woody plants species were reported from the Mid Elevation (S2) region followed by The Hill Base (S1) and The Hill Top (S3). The majority of the reported plant species were found between the elevation ranges of 1400 – 1800m.

The current study documented and collected traditional knowledge of ethno-botanical plants in the J&K state of Tehsil Thanamandi. Documentation of traditional knowledge is critical since it aids in the preservation of this novel information. Keeping records of this valuable knowledge is just as vital as conserving medicinal plants (Raut *et al.*, 2012) [36]. The population of J&K state embody a wealth of knowledge that has been learnt and passed down via their culture across space and time. The current study clearly demonstrates the tight association between plant ecosystem services and human well-being in this Himalayan state. According to the regional distribution of J&K state's medicinal flora, the majority of these species are utilised in the temperate region, followed by the cold desert zone and subtropical (Tali *et al.* 2019) [42]. These differences directly

reflect the state's vegetation and floristic variety (Gairola *et al.* 2014) [18]. The present investigation shows that the Rosaceae (8 species) have the most ethno-botanical plant species, followed by Fabaceae (5) and Moraceae (4), with the remaining families having a varying number of species. The findings indicating the high use of Rosaceae and Fabaceae plants in J&K are consistent with recent studies on ethno-medicinal floras in other parts of the world, such as Tali *et al.* 2019 [42]; Bano *et al.*, 2012 [6]; Bano *et al.*, 2014 [5]. Furthermore, the greater number of species in these families may be related to the presence of important bioactive chemicals in these families that are used to treat various disorders (Gazzaneo *et al.*, 2005) [19]. The higher share of native species emphasises the historical interaction between local cultures and plants, allowing for more or less experimentation and experience with them (Molares and Ladio 2009) [34]. Simbo (2010) [40] claims that the presence of pharmacologic components in higher concentrations in herbs makes them effective for the treatment of many ailments. In J&K, people usually employ the entire plant to treat various diseases, followed by the leaf, underground area, flower, and seed. This trend contradicts previous studies conducted in various parts of the world (Bano *et al.* 2014 [5]; Ahmad *et al.* 2014) [2], in which the leaves were reported to be the most commonly used parts of the medicinal plants, and in some cases, underground parts were shown to be the most utilised parts (Kala *et al.* 2004) [28]. It was also discovered that some medicinal plants are used to

Table 1: Shows ethno-botanical diversity of plant species belonging to different families in different elevations.

S. No	Family	Scientific Name	Vernacular Name	S1	S2	S3	Altitude (asl.)	Uses
1	Amaranthaceae	<i>Chenopodium album</i>	Bathua	+	+	+	1900 m	It has been used as a digestive, cardiogenic medicines.
2	Cannabaceae	<i>Celtis sinensis</i>	Khirkak	+	+	-	1100 m	Leaves and barks were used to treat menstruation and lung abscess.
3	Berberidaceae	<i>Berberis lycium</i>	Simlu	++	+++	++	1820 m	Used to treat liver disease, fever, depression etc.
4	Cannabaceae	<i>Cannabis sativa</i>	Bhang	+++	++	-	1100 m	Treatment of pain, asthma, insomnia, depression etc.
5	Ehretiaceae	<i>Ehretia acuminata</i>		+	-	-	1250 m	Can be used for planting roadside as well as furniture timber.
6	Elaeagnaceae	<i>Elaeagnus umbellata</i>	Kankoli	++	++	-	1250 m	Seeds are used as stimulant in the treatment of coughs.
7	Ericaceae	<i>Rhododendron arboreum</i>	Hardulli	+	+	-	2100 m	The flower is edible and flower juice can be used to cure fever.
8	Ericaceae	<i>Rhododendron campanulatum</i>	Hardulli	-	-	+	2100 m	The leaves can be used with tobacco as a snuff for treating cold and headache.
9	Fabaceae	<i>Dilbergia sissoo</i>	Sheesham	+	-	-	1250 m	Used as plywood, carrying goods, and cooking purposes.
10	Fabaceae	<i>Flemingia macrophylla</i>	Guch	-	-	++	1800 m	The plant has moderate drought tolerance and used for weed control and rod protection.
11	Fabaceae	<i>Indigofera tinctoria</i>	Neela	-	++	+	1650 m	Used as emetic, detoxify the blood, reduce inflammation etc.
12	Fabaceae	<i>Robinia pseudoacacia</i>	Kikar	+	++	-	1600 m	Used as pulp wood, fuel wood, and also the seed is poisonous to consume.
13	Fabaceae	<i>Vachellia nilotica</i>	Babool	+	+		1300 m	Excellent healer, it also helps to treat skin disease.
14	Fagaceae	<i>Quercus semicarpfolia</i>	Pila Ree	-	-	+	1800 m	Wood can be used for fuel, leaves for fodder and the acorns can be used as food for animals and birds.
15	Fagaceae	<i>Quercus leucotrichophora</i>	Reen	++	++	-	1300 m	Used to make home furniture ships barrels etc.
16	Fagaceae	<i>Quercus galuca</i>	Reen	-	+	+	1800 m	The acorns are edible wood is value able for fuel wood.

17	Juglandaceae	<i>Juglans regia</i>	Akhrot	+	++	+	1600 m	The fruit is edible and wood can be used for furniture.
18	Lamiaceae	<i>Vitex negundo</i>	Bana	++	-	-	1100 m	The plant has significant role in folk medicine.
19	Malvaceae	<i>Grewia optiva</i>	Taman	+	-	-	1100 m	Provide fodder, fibre. Also, can be used as a fuel wood.
20	Mellicaceae	<i>Toona serrata</i>	Toon	-	++	++	1850 m	Used for furniture, ornamental panelling, musical instrument etc.
21	Miliaceae	<i>Toona ciliata</i>	Toon	+	-	-	1195 m	Used to make bags, strings etc.
22	Moraceae	<i>Broussonnetia papyrifera</i>	Tooni	+	-	-	1400 m	Used in treatment of dysentery.
23	Moraceae	<i>Ficus carica</i>	Anjir	++	+	-	1430 m	Fruits can be eaten and used as jams also has a medicinal value.
24	Moraceae	<i>Ficus palmata</i>	Anjeer	++	++	-	1420 m	It is used to treat constipation gastrointestinal disorder.
25	Moraceae	<i>Morus alba</i>	Toot	++	+	-	1769 m	Protective effect against atherosclerosis, liver and kidney disorder.
26	Myrtaceae	<i>Callistemon</i>	Bottle Brush	+	+	-	1300 m	Can be used as insecticide and for ornamental purposes.
27	Pinaceae	<i>Cedrus deodara</i>	Deodar	-	-	+	2100 m	Anti-inflammatory, antioxidants, inner wood is aromatic and used to make incense.
28	Pinaceae	<i>Pinus wallichiana</i>	Byarh	-	+	++	2000 m	The cones are used for fuel purposes and the wood can serve construction purposes.
29	Plantanaceae	<i>Plantanus orientalis</i>	Chinar	+	+	-	1500 m	Wood can be used for furniture and as fuel.
30	Poaceae	<i>Phyllostachys aureariveria</i>	Nigal	++	+	-	1200 m	The shoots can be used to manufacture canned bamboo sprouts.
31	Poaceae	<i>Saccharum officinarum</i>	Ganna	+	+	-	1400 m	The plant has been used to dress wound, can be used for production of ethanol, sugar etc.
32	Rhamnaceae	<i>Zizipus mauritiana</i>	Beer	+	-	-	1200 m	Improve muscular strength, also has high nutritional value.
33	Rosaceae	<i>Malus domestica</i>	Saib	-	-	+	1900 m	The fruit can be processed as jam. Prevent cordial vascular disease.
34	Rosaceae	<i>Prinsepia utilis</i>	Brohi	+	++	++	1750 m	Used traditionally to cure joint pain, scabies, rheumatism and also for body massage.
35	Rosaceae	<i>Prunus cerasifera</i>	Plum	++	++	+	1400 m	Used to make wines and jams.
36	Rosaceae	<i>Prunus persia</i>	Aaro	+	+	+	1500 m	Used to treat cough, asthma and constipation.
37	Rosaceae	<i>Prunus armaniaca</i>	Khubani	+	++	+	1190 m	The fruit is eatable. Oil extracted from seed can be used for many purposes.
38	Rosaceae	<i>Pyrus pashia</i>	Batangi	+	++	+	1400 m	The fruit is edible and wood can be used for various purposes.
39	Rosaceae	<i>Rubus sellipticus</i>	Akhray	+	++	+	1700 m	Its juice can be used to treat coughs, fever etc. The plant can also be used to make dye.
40	Rosaceae	<i>Sorbus aria</i>	Khuch		+	++	1930 m	Beneficial for treatment of cancer.
41	Rutaceae	<i>Zanthoxylum armatum</i>	Timber	+	+	-	1200 m	Used for treatment of asthma, indigestion and diarrhoea.
42	Salicaceae	<i>Salix alba</i>	Beesa	++	++	-	1200 m	It has been used for rural craft and for relaxing toothache.
43	Sapindaceae	<i>Asculus indica</i>	Bankhori	-	++	+	1400 m	It treats bronchitis and venous problem.
44	Taxaceae	<i>Taxcus bacata</i>	Barmi	-	-	+	1900 m	Used to treat asthma, indigestion, epilepsy etc.
45	Thymelaceae	<i>Daphne mazereum</i>	-	-	+	-	1600 m	It is used to treat headache, toothache and joint pain.
46	Urticaceae	<i>Debregeasia longifolia</i>	Sindoori	++	++	-	1200 m	The wood is used for fuel purpose and the fruit is edible.

treat more than one ailment, and that more than one medicinal plant is used to cure a specific disease. The use of a single plant species to cure many ailments is likely related to the existence of many metabolites in a single plant, as well as the fact that the same molecule can be active against different infections (Tugume *et al.* 2016) [43]. The diversity of ethno-botanical plants and associated traditional knowledge is rapidly declining worldwide, and one of the other recommendations made for their conservation and sustainable use is the creation of species and traditional knowledge inventories, which would greatly aid in minimising the loss of this valuable knowledge (Chen *et al.*,

2016) [10]. The importance of medicinal plant inventories is enormous since they are critical for conservation and sustainable use, which in turn can build strong scientific foundations for the conservation of natural ecosystems and ecological services (Hamilton, 2004) [22].

Conclusions

Taxonomic documentation is the first step in achieving conservation and sustainable use of biodiversity at the local, regional and global scales. Also, the woody species such as trees determine the type, richness and abundance of other biota through the regulation of limiting resources (Abbate *et al.* 2012) [1]. In keeping with this, the present paper provides

the first annotated taxonomic inventory of the woody flora of Tehsil Thannamandi district Rajouri J&K. This checklist will act as baseline data for use by the researchers, policy makers, land managers, and common people interested in documentation, conservation, and sustainable use of plant diversity of this region. Many arboreal species growing here are used as sources of food, fodder, fuel wood, timber, dye, essential oils, and medicines.

Nonetheless, forests of Tehsil Thanamandi are badly affected due to exploitative anthropogenic activities, including non-eco-friendly tourism. As an immediate step, comprehensive study of the flora of this region is warranted. This is because, with the construction of the historical Mughal Road, there has been considerable increase in landslides and avalanches all through this area. This has resulted in a large number of trees and shrubs having been uprooted; the germinating seeds and young seedlings are also eroded. Land sliding has been augmented due to fragmentation/loss of original patches of grasses and plants, making the slopy terrain all along the road prone to erosion.

Declaration of competing interest

We hereby declare that we have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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