



# Utilisation and valuation of important trees of Monpa tribe in Arunachal Pradesh

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### ABSTRACT

The present study was conducted in eight villages of Dirang circle under West Kameng district in Arunachal Pradesh. A total of 41 tree species were used by Monpa tribe of Arunachal Pradesh in various socio-cultural practices. Rosaceae was the most dominant family. Of these, 20 species were reported to be used as food followed by other uses (15 species), firewood (15 species), fodder (8 species) etc. *Pinus wallichiana* had highest composite salience value (0.75) followed by *Juglans regia* (0.66), *Quercus sp.* (0.62) and *Rhododendron arboreum* (0.52).

## 1. Introduction

Tree is one of the important renewable resources found on earth and it also forms an integral component of both natural and artificial ecosystems such as natural forest, plantation, agroforestry, homegarden etc. Trees have been brought into various uses in human and it not only provides various goods and services to all living being but also has diverse cultural values and symbolic functions to human culture (Koppell, 1993). The indigenous knowledge related to utilisation of trees are very important and its utilisation pattern varies from one tribe to another (Kumar *et al.*, 2015; Srivastava and Nyishi Community, 2010; Tangjang and Arunachalam, 2009). Arunachal Pradesh is one of the 29th states of the India and well-known worldwide as biodiversity hotspot of world *i.e.* eastern Himalaya (Myers *et al.*, 2000). It also has rich growing stock with 511.488 million m<sup>3</sup> in both forest and tree outside forest and also has highest ethnicity with 26 major tribes and 110 sub tribes. (State of Forest Report, 2017). Of these, Monpa tribe is one of the major tribes of Arunachal Pradesh and popular for their natural resource management (Saha and Bisht, 2007; Singh and Sureja, 2006).

Their total population is 60,545 and they are mostly concentrated in two districts of Arunachal Pradesh *i.e.* Tawang and West Kameng (Census of India, 2011). They follow Tibetan Buddhism and their important festivals are Choskar harvest festival, Losar, and Torgya. The present study emphasised on the documentation of utilisation of trees in Monpa tribes and the valuation of trees species for prioritisation of important trees for its effective scientific management and conservation.

## 2. Material and Methods

The study site located in Dirang circle of West Kameng district, Arunachal Pradesh. It lies between 27° 20' 0" North latitude and 92° 16' 0" East longitude with altitude ranging from 1000 m to 1800 m. Monpa tribe was the dominant tribe and Buddhism was the dominant religion. There were 81 villages in Dirang circle, of these, 8 villages were selected randomly for the study namely *Dirang basti*, *Barchipam*, *Sagar*, *Khorung*, *Dowangba*, *Rama camp*, *Lish*, and *Namthung*. The study was done from December 2016 to April 2017. Semi-structured questionnaire was designed and interviews were conducted based on the uses of culturally important tree species of the community wherein 120 informants (64 men and 56 women) were interviewed.

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The informants were above 20 years of age. Composite salience of culturally important trees was evaluated through Free listing (Quinlan 2005) and finds the most culturally salient plants of a particular sort (medicinal, tools, food *etc.*) or ways to use particular plants. Trees were categorized into eight use categories namely as Food (FO), Fodder (FD), Fuel wood (FL), Tools (T), Medicine (MED), Religious purposes (REL), Construction (C), and others use (O).

### 3. Results and Discussion

A total of 41 tree species were found among Monpa tribes. Of these, eight species were exotic namely *Cupressus toluosa*, *Citrus aurantium*, *Citrus medica*, *Malus domestica*, *Prunus persica*, *Punica granatum*, *Prunus cerasifera* and *Salix babylonica*. These tree species belong to 23 families with 33 genera. Rosaceae was the dominant family with 6 species followed by Fagaceae (4 species), Rutaceae (4 species), Fabaceae (3 species),

Pinaceae (3species) *etc.* (Figure 2). In other study, 50 plants species were reported from Monpa tribe and used as herbal medicine, food, religious purpose *etc.* It belongs to 29 families and 39 genera and most of the ethnobotanical plants were herbs (40%), shrubs (28%), trees (26%), and climbers (6%) (Namsa *et al.*, 2011). There were 14 woody species reported to be used in agroforestry system in Bolivia namely *Baccharis dracunculifolia*, *Berberis commutate*, *Buddleja coriacea*, *Clinopodium bolivianum*, *Eucalyptus globules*, *Gynoxys psilophylla*, *Kaunia saltensis*, *Lepechinia graveolens*, *Minthostachys ovate*, *Polylepis subtusalbida*, *Prosopis laevigata*, *Sambucus peruviana*, *Schinus molle* and *Senna aymara*. It belongs to 10 families and 14 genera and both Asteraceae and Lamiaceae were the dominant families and 85.7% of the species were native (Brandt *et al.*, 2013). There were 41 tree species utilised by Monpa tribe in various use categories such as food (FO), fodder (FD), fuel wood (FL), tools (T), medicine (MED), religious purposes (REL), construction (C) and other uses (O) (Table 1; Figure 1).

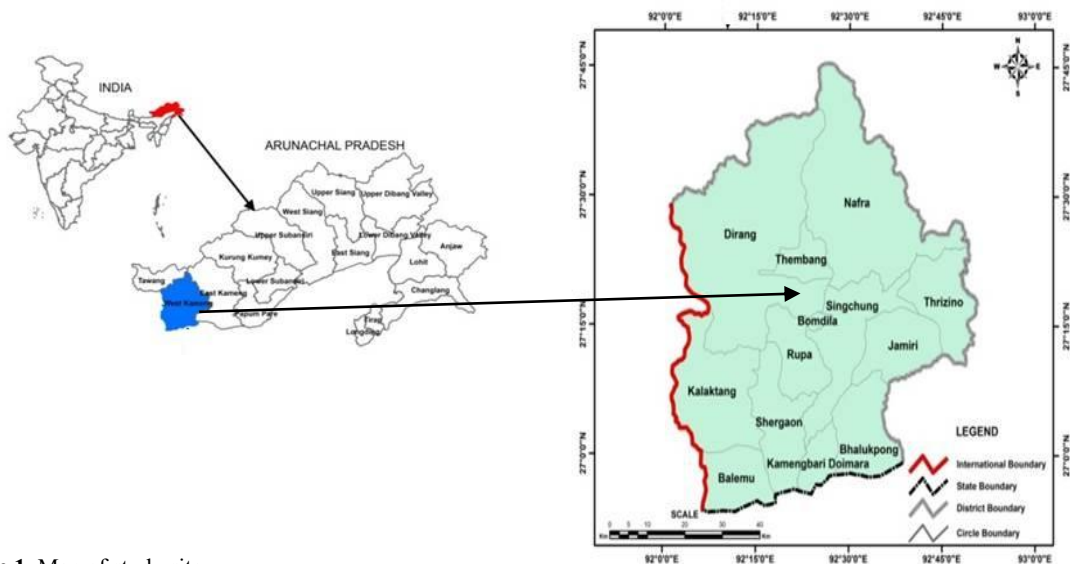


Figure 1. Map of study site.

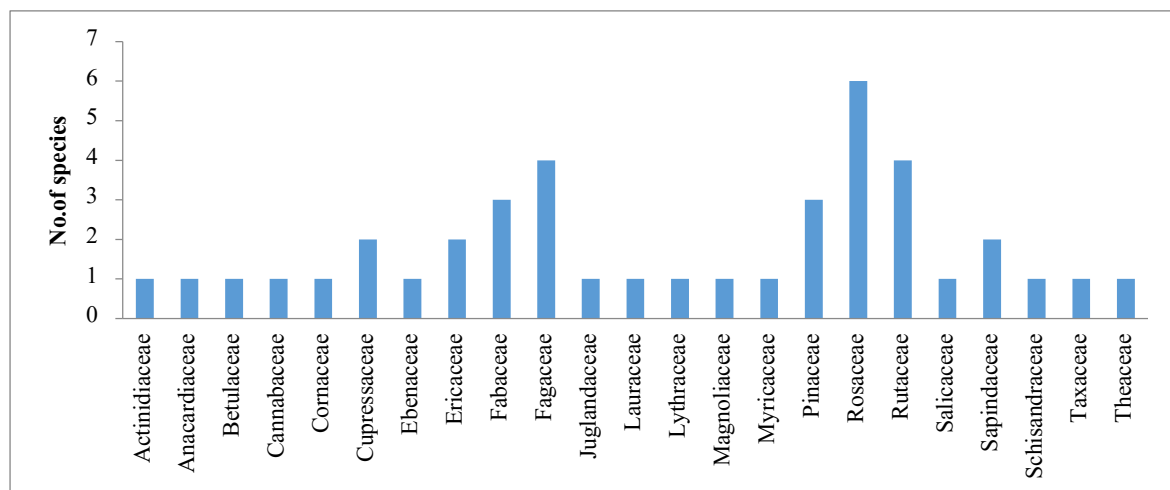


Figure 2. Number of species per family.

**Table 1.** Culturally important trees and their uses.

Sl. no.	Botanical name	Vernacular name	Family	Use category	Plants part	Uses
1	<i>Acer oblongum</i>	Phenphenba shing	Sapindaceae	T	Stems	The wood is considered as best for making knife handle.
				FL	Stem and branches	The wood produces less smoke and use as firewood for Domestic <i>chulhas</i>
2	<i>Acer pectinatum</i>	Khubilam shing	Sapindaceae	FL	Stem and branches	The wood is considered as good firewood.
				T	Stem and branches	The wood is lustrous which have decorative pattern and used to prepare handles of knife and spade.
3	<i>Albizia lebbeck</i>	Knorshing	Fabaceae	FD	Leaves	The leaves and tender shoots are used as fodder.
				O	Stems	The wood is usually used for making small size grinders.
4	<i>Alnus nepalensis</i>	Gongjenang shing	Betulaceae	C	Stems	The timber is good for construction purpose and used as beam and pole for construction. It is treated with smoke for some days in order to make the wood more durable.
				FL	Stems and branches	It is used for cooking and heating purposes. Wood is easily split by axe and it also produces less smoke while burning.
				O	Leaves	The dried leaves are used as manure to replenish loss nutrients.
5	<i>Celtis australis</i>	Chakchi shing	Cannabaceae	FO	Fruits	The fruits are smaller in size and are edible.
				FD	Leaves	The tender leaves are palatable and used as fodder.
6	<i>Cinnamomum sp.</i>	Shangcha shing	Lauraceae	FO	Barks and leaves	The powdered form of bark and dried leaves are used as condiment.
7	<i>Citrus aurantium</i>	Khabru shing	Rutaceae	FO	Fruits	Fruits are edible and also used in religious ceremonies for offering as <i>Chok</i> (Prasad).
8	<i>Citrus medica</i>	Num shing	Rutaceae	FO	Fruits	Fruits are edible and also used in religious ceremonies as <i>Chok</i> (Prasad).
9	<i>Citrus reticulata</i>	Chaluk shing	Rutaceae	FO	Fruits	Fruits are edible and also used in religious ceremonies as <i>Chok</i> (Prasad).
10	<i>Cornus capitata</i>	Shamrongma shing	Cornaceae	FO	Fruits	Dried Fruits are eaten.
11	<i>Cupressus torulosa</i>	Chanang shing	Cupressaceae	REL	Branches and foliages	The branches and foliages are used in religious ceremonies for burning in a special burner made

						up of concrete cement and locally known as <i>Chang shing</i> .
				O	Whole plant	It is also used as an ornamental plant and mostly raised in the periphery of monastery for beautification.
12	<i>Diospyros lotus</i>	Jengong shing	Ebenaceae	FO	Fruits	Fruits are edible and generally consumed in dried form. The colour of fruits varies from yellow to orange.
13	<i>Docynia indica</i>	Thung shing	Rosaceae	FO	Fruits	Fruits are edible and sour in taste. It is consumed both in fresh and dried form. For dried form, fruits are sliced into small pieces and sun dried.
14	<i>Erythrina stricta</i>	Khaedang shing	Fabaceae	FD	Leaves	The leaves and tender leaves are used as fodder.
				O	Whole plant	It is also used as a live fence due to presence of spines.
15	<i>Gymnocladus assamicus</i>	Myangnongba shing	Fabaceae	FO	Seeds	The seeds are edible and consumed in roasted form. It is also used for making beverages like coffee.
				REL	Seed pods	It is used in religious rituals such as <i>Torma</i> making. <i>Torma</i> is a figure/statue/small structure created by using maize flour and <i>ghee</i> during religious ceremony.
				O	Seed pods	The pods are soaked in water and used as disinfectant. It is also used as a substitute of shampoo.
16	<i>Illicium griffithii</i>	Lishi shing	Schisandraceae	FO	Fruits	It is usually not consumed by the local people. However, they collect it in large scale as it has high commercial value and provides good source of income generation. This fruit is used to make spices.
17	<i>Juglans regia</i>	Khae shing	Juglandaceae	FO	Seeds (Nuts)	It is edible seed and also sold in market.
				C	Stems	It is considered as a good quality timber and generally used as beam and pole for construction purposes.
				O	Stems	It is considered as a best wood for furniture making.
					Leaves	The leaves are used to prepare best manure.
					Leaves	The leaves are used to catch fishes by applying the extract from the leaves in the stream that intoxicates the fishes.

18	<i>Juniperus recurva</i>	Posh shing	Cupressaceae	REL	Leaves	The dried leaves are mixed with maize flour and burned together during the religious ceremonies to produce smoke with unique odour which considered as auspicious.
				O	Whole plants	It is usually grown at the boundary of home garden and also in periphery of the monastery as an ornamental plant.
19	<i>Lithocarpus pachyphyllus</i>	Pakko shing	Fagaceae	FO	Seeds	Seeds are edible and consumed after roasting.
				FL	Stems and branches	The wood is considered as good fuelwood.
20	<i>Lyonia ovalifolia</i>	Pang dukshing	Ericaceae	FL	Stem and branches	It is used as fuelwood.
				O	Stems or branches	Local people use the branch with a special cut at one side. As per their tradition, it is considered as a taboo either to touch or steal the property wherever this stem is kept. This stem is traditionally known as <i>Paksar</i> . It is generally practice on the harvested property such as firewood and logs to protect against thief.
21	<i>Malus domestica</i>	Apel shing	Rosaceae	FO	Fruits	The fruits are used in religious ceremonies as an offering locally called as <i>Chok</i> (Prasad). It also has sold at local market.
22	<i>Michelia champaca</i>	Tsamba shing	Magnoliaceae	C	Stems	The timber is considered as best construction material. It also has high demand in local market.
				O	Stems	It is used in all type of furniture making.
23	<i>Myrica esculenta</i>	Chukchigong shing	Myricaceae	O	Fruits	The fruit is edible and especially used as <i>chatni</i> .
				MED	Bark	The bark is used as a medicine to treat blood dysentery.
24	<i>Pinus roxburghii</i>	Roenang shing	Pinaceae	FL	Stem and branches	It is used to prepare charcoal and used in <i>Bukhari</i> (A special burner made of tin & iron) to warm the house during winter.
				C	Stem	The timber is used as house pillar and beam.
				REL	Branches and foliage	The branches and foliage are used in religious ceremonies by burning along with <i>Rhododendron sp.</i> in a special burner locally called as <i>Chang shing</i> . It is generally done to produce smoke which is

						considered sacred and believe to purify the surrounding atmosphere from evil spirit.
25	<i>Pinus wallichiana</i>	Lenchong shing	Pinaceae	FD	Stem and branches	It is used to make charcoal and also used in <i>Bukhari</i> . However, it is rarely used in domestic <i>chulhas</i> because it produces lots of smoke.
				C	Stems	It is one of the important timber used as beam and pole for construction of house, watermill, furniture making <i>etc.</i>
				REL	Branches and leaves	The branches and foliage are used in religious ceremonies by burning along with <i>Rhododendron sp.</i> in <i>Chang shing</i> . It is generally done to produce smoke and considered as sacred and purify the surrounding atmosphere.
				O	Leaves	The dried leaves are also applied in the maize cultivation area for mulching and preventing weed growth.
26	<i>Prunus cerasifera</i>	Plum shing	Rosaceae	FO	Fruits	Fruits are edible and also sold at local market.
27	<i>Prunus persica</i>	Lyang shing	Rosaceae	FO	Fruits	Fruits are edible and also sold at local market.
28	<i>Prunus sp.</i>	Khrangpa shing	Rosaceae	O	Stems	It is used for making <i>Fudang shing</i> , a wooden device/tool used to make local noodles ( <i>Fudang</i> ).
				FD	Leaves	The leaves are used as fodder.
29	<i>Punica granatum</i>	Darim shing	Lythraceae	FO	Fruits	Fruits are edible and also sold at local market.
30	<i>Pyrus pashia</i>	Litho shing	Rosaceae	FO	Fruits	The ripen fruits are edible and are dark in colour.
				FD	Fodder	The leaves are mostly preferred as a fodder.
31	<i>Quercus lanata</i>	Baychinang shing	Fagaceae	FL	Stem and branches	It is considered as best firewood because it retained heat for a longer time.
32	<i>Quercus sp.</i>	Boenang shing	Fagaceae	FL	Stem and branches	It is considered as one of good fuelwood species.
				FD	Leaves	The leaves are considered as a best fodder for goat.
				O	Leaves	The leaves are used to improve soil fertility which are broadcasted in the farmland that act as a good source of nutrients and also prevent weed growth.
33	<i>Quercus semiserrata</i>	Thongpa shing	Fagaceae	T	Stems	The wood is used to prepare best wooden plough.

				FL	Stem and branches	It is considered as one of good fuelwood species.
34	<i>Rhododendron arboreum</i>	Jidang shing	Ericaceae	FL	Stems	It is considered as one of good fuelwood species.
				T	Stem and branches	Wood is very durable and used to prepare handles for agricultural tools such as sickle, knife, spade and axe.
				REL	Branches and leaves	The branches and leaves are used in religious ceremonies for burning along with <i>Pinus sp.</i> in a special burner locally called as <i>Chang shing</i> . It is generally done in order to produce smoke and considered as sacred and also purify the surrounding air.
35	<i>Salix babylonica</i>	Changma shing	Salicaceae	O	Whole plants	It is used as an ornamental plant.
				REL	Branches and leaves	The branch is used in a religious ceremony known as <i>Kurum</i> wherein a Buddhist manuscript written on many small pieces of cloths are tied on a branch of this tree along with 4-5 leaves retained at the apex portion and it is locally known as <i>Paksar</i> .
36	<i>Saurauia napaulensis</i>	Frumla shing	Actinidiaceae	FO	Fruits	Fruits are edible.
				FD	Leaves	It is consider as a best fodder for cow.
				O	Leaves	The leaves are bigger in size and are used for packing material viz. wrapping ghee made from yak milk because it does not altered the taste.
37	<i>Schima wallichii</i>	Khronkhongb a shing	Theaceae	FL	Stem and branches	It is considered as one of good fuelwood species.
				T	Stems	It is used to prepare <i>Yoke</i> , a wooden frame that attached on two oxen on the necks and used for ploughing. The wood of this plant is considered as best. The <i>Yoke</i> is locally called as <i>Nyak shing</i> .
38	<i>Taxus wallichiana</i>	Kidangma shing	Taxaceae	FD	Leaves	The leaves are considered as best fodder for yak.
39	<i>Toxicodendron vernicifluum</i>	Jarshi shing	Anacardiaceae	MED	Fruits and seed	The oleoresin obtained from the fruits and seed (locally known as <i>Jarshi</i> ) are mixed with local alcoholic beverages ( <i>Marchang</i> ) for enhancing its flavour. Oleoresin is also added with local food dish especially made up of maize flour locally called

						as <i>Bokpai</i> . According to the local people, consumption of this dish helps to ease the muscular pain.
40	<i>Tsuga dumosa</i>	Mye shing	Pinaceae	C	Stem	It is used for construction of houses.
41	<i>Zanthoxylum armatum</i>	Khagi shing	Rutaceae	FO	Fruits	The fruits are edible and fruits in dried form are used for preparation of traditional <i>chatni</i> .

FO-Food; FD-Fodder; FL-Fuelwood/Firewood; C-Construction; T-Tools; REL-Religious purposes; MED-Medicine; O-Other uses

Based on utilisation pattern, 27% of the species were used as the food followed by other uses (19%), firewood (15%), fodder (11%), religious purposes *etc.* (Fig. 3). Other study did on Monpa tribe reveals that 60% of ethnobotanical species including herbs, shrubs and trees were used as medicine followed by ritual purpose (14%), fishing (10%), healthcare of animal (7%) and local beverages (7%) (Namsa *et al.*, 2011). Among the 41 important trees species, 20 species

were reported as edible plants that includes fruits, nuts, condiments *etc.* such as *Citrus reticulata*, *Juglans regia*, *Malus domestica*, *Prunus persica*, *Zanthoxylum armatum* *etc.* In fodder category, there were eight (8) tree species used namely *Albizia lebbeck*, *Celtis australis*, *Erythrina stricta*, *Pyrus pashia*, *Prunus sp.*, *Quercus sp.*, *Saurauia napaulensis* and *Taxus wallichiana*. *Quercus sp.* was considered as best fodder tree followed by *Taxus wallichiana*, *Saurauia napaulensis* *etc.* (Figure 4).

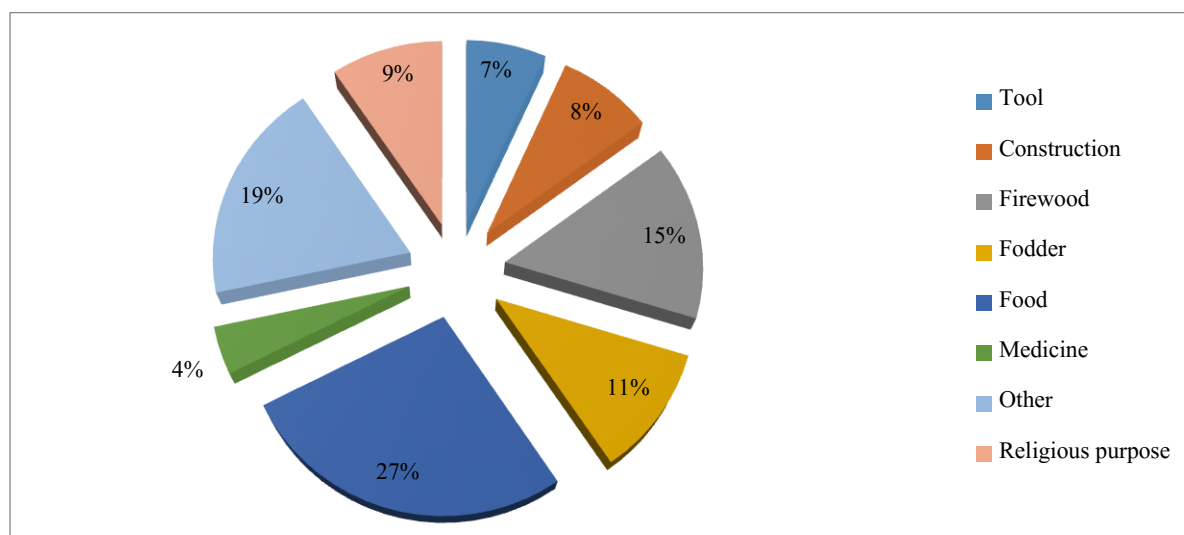


Figure 3. Utilisation pattern of culturally important trees.

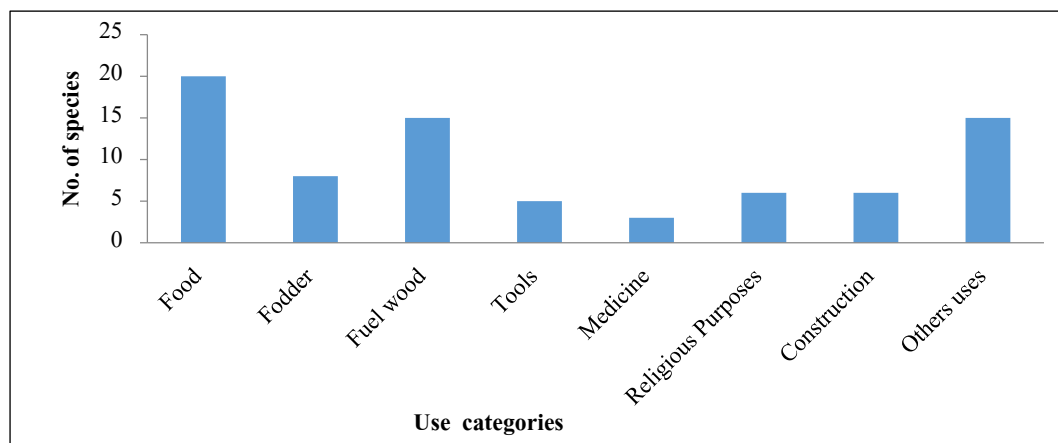


Figure 4. Number of species in different categories.



In fuelwood use category, fifteen (15) tree species were used such as *Alnus nepalensis*, *Castanopsis sp.*, *Lyonia ovalifolia*, *Pinus wallichiana*, *Quercus sp.*, *Rhododendron arboreum* etc. Among these species, *Pinus wallichiana* was found to be most preferred tree species used as fuel wood for *Bukhari* as its burn for longer period of time and produce more heat. Five (5) trees species were used for making tools that includes agricultural implements such as wooden plough, yoke, handle of spade, sickle etc. such as *Acer pectinatum*, *Acer oblongum*, *Quercus semiserrata*, *Rhododendron arboreum* and *Schima wallichiana*. Of these, *Quercus semiserrata* was considered as most preferred species for making plough. Three (3) plant species were used for medicinal purposes

namely *Myrica esculenta*, *Taxus wallichiana* and *Toxicodendron vernicifluum* (Figure 5). Among these, *Taxus wallichiana* was found mostly used tree species with highest number of use report. Six (6) species used by the community for religious purposes such as *Pinus wallichiana*, *Juniperus recurva* and *Rhododendron arboreum*. It is used during religious ceremonies in a burner that made of rocks and cement and locally known as *Changshing* to produce smokes for purifying the surrounding environment. Six (6) species were used in the house construction purposes such as *Alnus nepalensis*, *Juglans regia*, *Michelia sp.*, *Pinus wallichiana*, *P. roxburghii* and *Tsuga dimosa*.



**Figure 5.** Cultural Importance trees (a-l). (a) *Acer pectinatum*, (b) *Malus domestica*, (c) *Myrica esculenta*, (d) *Pinus wallichiana*, (e) *Prunus rufa*, (f) *Punica granatum*, (g) *Prunus persica*, (h) *Pyrus pashia*, (i) *Quercus mongolica*, (j) *Rhododendron arboretum*, (k) *Saurauia napaulensis*, (l) *Taxus wallichiana*.

Among these species, *Pinus wallichiana* was found mostly used as timber or building materials followed by *Juglans regia*, *Michelia sp.*, *Tsuga dimosa* etc. (Figure 6) In other use category, 3 tree species were used for furniture making, craft/domestic goods making (2 species), field use (4 species), manuring (3 species), 1 each species for local

beverages making, packaging, customary and commercial use. Some of the commonly use species were *Albizia sp.*, *Lyonia ovalifolia*, *Michelia sp.*, *Pinus wallichiana*, *Prunus serrulata*, *Quercus sp.*, *Illicium griffithi*, *Juglans regia*, *Juniperus recurva* etc.



**Figure 6.** Uses of trees (a-h). (a&b) Grinders made of *Albizia lebbek*, (c) Handle of sickle made of *Acer oblongum*, (d) Handle of agricultural tools made of *Rhododendron arboretum*, (e) *Fudang shing* (A wooden device made of *Prunus rufa* for making local noodle), (f) Wooden plough and yoke, (g) Sawn timber of *Michelia champaca*, (h) Tradational house made of *Prunus wallichiana*.

### Composite salience of important trees

Based on composite salience values, the most important among 41 tree species was *Pinus wallichiana* with 0.75 composite salience value, followed by *Juglans regia* (0.660), *Quercus sp.* (0.619), *Rhododendron arboreum* (0.517), *Citrus reticulata* (0.495), *Juniperus recurva* (0.447), *Zanthoxylum armatum* (0.396), *Malus domestica* (0.386), *Prunus persica* (0.367), *Alnus nepalensis* (0.360) etc.

*Pinus wallichiana* was considered as most important because meet various socio-cultural aspects of Monpa tribes such as magico-religious aspect (religious ceremonies), domestic requirement (preparation of charcoal for

warming), material cultural requirement (construction of houses, agricultural tools, etc.) and agricultural requirement (mulching in maize cultivation) (Table 3). A study was done in Bolivia and reported *Eucalyptus globules* as most important woody species based on composite salience with 0.71 value followed by *Schinus molle* (0.63), *Baccharis dracunculifolia* (0.53), *Prosopis laevigata* (0.47), *Lepechinia graveolens* (0.21), *Senna aymara* (0.20) etc. (Brandt et al., 2013).

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**Table 3.** Composite salience of 20 culturally important trees.

Sl. no	Trees species	Composite salience (Mean ± SD)
1	<i>Pinus wallichiana</i>	0.755 ± 0.193
2	<i>Juglans regia</i>	0.660 ± 0.206
3	<i>Quercus sp.</i>	0.619 ± 0.288
4	<i>Rhododendron arboreum</i>	0.517 ± 0.233
5	<i>Citrus reticulata</i>	0.495 ± 0.299
6	<i>Juniperus recurva</i>	0.447 ± 0.287
7	<i>Zanthoxylum armatum</i>	0.396 ± 0.305
8	<i>Malus domestica</i>	0.386 ± 0.328
9	<i>Prunus persica</i>	0.367 ± 0.294
10	<i>Alnus nepalensis</i>	0.360 ± 0.271
11	<i>Michelia champaca</i>	0.313 ± 0.340
12	<i>Punica granatum</i>	0.292 ± 0.304
13	<i>Illicium graffithii</i>	0.289 ± 0.267
14	<i>Taxus wallichiana</i>	0.255 ± 0.363
15	<i>Quercus lanata</i>	0.251 ± 0.282
16	<i>Quercus semiserrata</i>	0.237 ± 0.277
17	<i>Toxicodendron vernicifluum</i>	0.211 ± 0.256
18	<i>Gymnocladus assamicus</i>	0.201 ± 0.381
19	<i>Tsuga dumosa</i>	0.197 ± 0.324
20	<i>Lyonia ovalifolia</i>	0.197 ± 0.252

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