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## Tree diversity of Pasighat town of Arunachal Pradesh

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### Abstract

This study was carried out to assess the tree species diversity and distribution in Pasighat town of Arunachal Pradesh. Trees are important component of vegetation because of their economic value to mankind. There is high pressure on forest estates due to high demand on forest economic resources as a result of geometric increase of human population in the region. The results of the study showed that a total of 103 tree species representing 85 genera and belonging to 45 families were recorded from the study area. Fabaceae with 19 species was the dominant family of tree species. Co-dominant families were Rutaceae, Meliaceae, Anacardiaceae, Arecaceae, Moraceae, Myrtaceae, Lauraceae, Euphorbiaceae and Sapotaceae. The structural pattern showed a heterogeneous distribution of trees which is the chief character of forests of Eastern Himalaya. The area is rich with diverse plant species and by obtaining proper information about it, prime efforts can be made to conserve it.

**Keywords:** Tree, species, diversity, Himalaya, regeneration

### Introduction

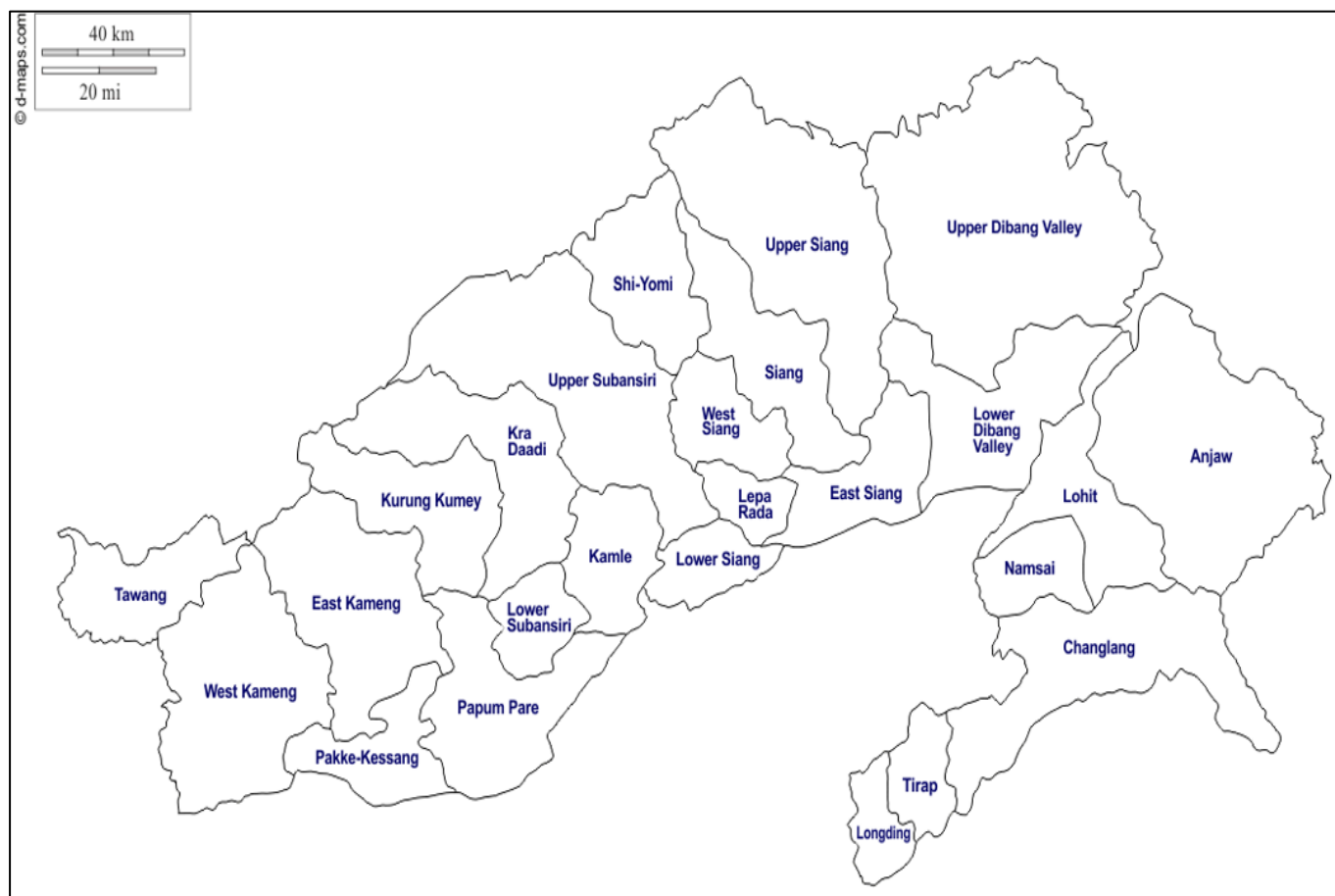
India is a treasure chest of biodiversity which hosts a large variety of plants and has been identified as one of the eight important "Vavilovian centres of origin" and crop diversity (Anil *et al.*, 2014) [1]. India accounts for 8% of the total global biodiversity with an estimated 49,000 species of plants of which 4900 are endemic (Kumar and Asija, 2000) [13]. Himalayas are one of the largest and youngest mountain chains in the world and cover roughly 10 percent of India's total land surface. The Himalayan region harbors nearly 10,000 plant species constituting approximately 2.5% of the global angiosperm diversity of which over 4,000 are endemics (Kumar and Pandit, 2018) [14]. The diverse climate and varied environmental conditions prevailing in the Himalayas support diverse habitat and ecosystems with equally diverse plant forms. Variation in terms of its size, climate and altitudinal ranges have created environment which are unique and characteristics of these regions only. It provides important habitat to the flora and fauna including 9000 species of angiosperms, hence it is considered as biodiversity hotspot.

However, rapid increase in human population created an environmental imbalance in urban as well as in rural areas in most part of the country. It is estimated that 50% people are now living in less than 3% of the earth's urbanized surface. In addition, on the face of climate change, adaptation and mitigation actions for cities in India are critically required where the urban population is likely to grow by around 500 million over the next 50 years (Pandey and Kumar, 2018) [16]. The impacts of uncontrolled population, industrialization and urbanization on biodiversity are clearly visible in form of rapid, large and frequent changes in land and resource use, increased frequency of biotic invasion, reduction in species number, creation of stresses and the potential for changes in climatic systems (Bargali *et al.*, 2013) [2].

The continuous elimination and other anthropological activities have resulted in loss of biodiversity. If these naturally occurring plant resources are not timely conserved, then they may become extinct, and this genetic erosion coupled with soil erosion may retard the prospects of future economic development and welfare of people. Trees are important to mankind not only economically, environmentally and industrially but also spiritually, historically and aesthetically, for they sustain human life through direct and indirect gains by providing a wide range of products for survival and prosperity (Seth, 2003) [21]. Trees play a great part in making the environment beautiful and refining the minds of inhabitants. Beside environmental services urban forests and trees have positive impacts on the physical and

psychological healthiness of the human being, provide healthy environment for stressed residents of city (Schroeder and Anderson, 1984; Hunter, 2001) [20, 8]. Arunachal Pradesh (26°28'-29°30' N and 91°30'-97°30' E) is recognized as global biodiversity hotspot and forms a complex hill system of Siwalik and Himalayan origin. It is criss-crossed by six major rivers and their tributaries (Damand Kumar, 2018) [4]. Pasighat is the oldest town of Arunachal Pradesh. The town was established in 1911 by the Britishers. It is the headquarter of the East Siang district. The town is spread over in an area of 14.6 km<sup>2</sup>. The town got its name from the 'Pasis' an Adi tribe of the area. The British Government had appointed a Political Officer for the area. Due to its 'strategic' situation where the Siang leaves the mountains, Pasighat has been often called the gateway to the state of Arunachal Pradesh. In the process of development, the existing natural ecosystems are disturbed and artificial ecosystems are established and new plants to the area were introduced either for shade, avenue, timber etc. By virtue of its location, the town falls under the Northern Tropical wet evergreen forest type (Champion & Seth, 1968) [3], these forests are the most species rich

terrestrial ecosystems in the tropics of South-East Asia. Unfortunately, anthropogenic interference and infrastructural development in the last few decades have seen a major transformation of once pristine landscape in this region which highlights the need to undertake the present investigation. During the last two decades, Pasighat has experienced a tremendous change in its dimensions, this town is of economic significance to the Central Arunachal as it is the main business area for the people of East Siang, Upper Siang and Dibang valley. This town also has historical significance. Keeping the economic, strategic, historical and ecological significance of the town, the present study was undertaken to know the tree diversity of the town area with a view that such information would be helpful to the planners for the conservation of the rich biodiversity of the town. Knowledge on tree species diversity and distribution would serve as baseline information to know the status of the tree species in the study area; which is basic in understanding regeneration processes, such as tree growth, tree mortality, under-story development, and the spread of disturbances (Isango, 2007; Francisco *et al.*, 2017) [9, 5].



**Fig 1:** Map of Arunachal Pradesh

### Study site

Pasighat is situated in the foot hills of Eastern Himalayan range near the banks of the River Siang at an average elevation of 153m AMSL. The latitude of Pasighat is 28°04' N and longitude is 95°22' E. The climate is hot and humid in

summers and temperate during winters. The average daytime temperature varies from around 32 °C in summer to around 23 °C in winter. The monsoon starts in the month of June and often remains active upto September.



Fig 2: Map of Pasighat town (East Siang)

### Methodology

In the course of investigation, frequent explorations were made for collection during different seasons. Intensive field survey was done with the help of students, field workers and local inhabitants for the identification of plant species. The tree species growing naturally, cultivated and introduced were collected from different localities like, roadside, gardens, parks, cultivated areas, residential areas, schools, hospitals and other Government premises during 2013-2016. Efforts were made to collect species during flowering and fruiting stage for identification of species. The plants were identified with the help of Flora of British India, Flora of Assam, Flora of Namdapha, Working Plan of Pasighat Forest division and local people. Biodiversity values and ecosystems services are tangible and intangible benefits provided by the species are based on the utility to local inhabitants and also from other secondary literature.

### Results and discussion

The stability of ecosystem depends upon its biodiversity, which is the sum total of all flora and fauna. Biodiversity is desirable indicator of environmental health, as the environmental stresses are expressed at different levels of biological organization. Biodiversity can be measured at three levels namely, genetic diversity, species diversity and habitat/ecosystem diversity. A total of 103 tree species representing 85 genera belonging to 45 families were recorded from the study area. Fabaceae with 19 species was the dominant family of tree species. Co-dominant families were Rutaceae, Meliaceae, Anacardiaceae, Arecaceae, Moraceae, Myrtaceae, Lauraceae, Euphorbiaceae and Sapotaceae. The structural pattern showed a heterogeneous distribution of trees which is the chief character of forests of Eastern Himalaya.

Some of the tree species are reported as dominating canopy elements for low land area in the North East region (Kaul & Haridassan, 1987; Proctor *et al.*, 1998) [11, 18]. On the riverine areas leguminous species showed dominance and although they are considered to be seral in nature, their progression to climax does not takes place (Mohan & Puri, 1955) [15]. The

species richness of the studied area is close to the floristic richness recorded in the various parts of Western Ghats, another global hot spot of biodiversity, which varied from 17 species in Kalakad Mundanthurian Tiger Reserve (Ganesh *et al.*, 1996) [6] to 92 species in Kadamakal Reserve (Ghate *et al.*, 1988) [7].

The enumerated species belonged to 45 families in the present study area. It falls well within the range of 16-58 families found in the tropical forests (Swamy *et al.*, 2000; Parthasarathy & Karthikkeyan, 1997) [22, 17]. The comparative species dominance in any given area is a function of tree (Keel & Prance, 1979) [12] and past damage (Jacob, 1987, Swamy *et al.*, 2000) [10, 22]. The dominance of few species could be attributed to the evolution and colonization of the species in various stages of development, varied environmental conditions also results in accumulation of diverse species in the area (Richards, 1996) [19].

### Biodiversity values and ecological services

Biodiversity values and ecosystems services are tangible and intangible benefits provided by the species. Based on the utility to local inhabitants and also from other secondary literature, these were grouped into timber, fruit, ornamental, medicinal, fodder, NTFP yielding trees and exotic categories.

#### Trees of timber value

The species of timber value are *Ailanthus grandis*, *Duabangagrandidiflora*, *Canarium strictum*, *Acrocarpus fraxinifolius*, *Terminalia myriocarpa*, *T. arjuna*, *T. chebula*, *Castanopsis indica*, *Mesua ferrea*, *Chukrasia tabularis*, *Tectona grandis*, *Gmelina arborea* etc.

#### Trees of Fruit value

The tree species where fruit has economic value are *Spondias pinnata*, *Annona squamosa*, *Areca catechu*, *Livistona jenkinsiana*, *Carica papaya*, *Dillenia indica*, *Eleocarpus floribundas*, *Embllica officinalis*, *Artocarpus heterophyllum*, *Psidium guajava*, *Syzygium cumini*, *Zizyphus*, *Prunus*, *Aegle*, *Citrus*, *Litchi* etc.

**Trees of ornamental value**

The trees with beautiful foliage, inflorescence, flowers, and aesthetic value found in the study area are, *Polyalthia*, *Alstonia*, *Casia fistula*, *Delonix*, *Peltophorum*, *Mimosa*,

*Anthocephalus indicus*, *Araucaria* spp., *Bauhinia variegata*, *Caesalpinia pulcherrima*, *Callistemon lanceolatus*, *Jacaranda mimosaeifolia*, *Lagerstroemia speciose*, *Michelia champaca* etc.

**Table 1:** Enumeration of tree species of Pasighattown (Arunachal Pradesh)

S. No.	Name of Species	Common Name	Family
1.	<i>Acacia catechu</i> Willd.	Khoira, Khyar	Fabaceae
2.	<i>Acacia auriculiformis</i> Benth.	Golden shower	Fabaceae
3.	<i>Acacia mangium</i> Willd.	Austrialbabool	Fabaceae
4.	<i>Acrocarpus fraxinifolius</i> Arn.	Silchhal, Mandane	Fabaceae
5.	<i>Aegle marmelos</i> L.	Bael tree	Rutaceae
6.	<i>Ailanthus grandis</i> Prain	Dorpat	Simaroubaceae
7.	<i>Albizia chinensis</i> (Osbeck) Merr.	Koroi, Chakua	Fabaceae
8.	<i>Albizia Lucida</i> Benth.	Mauj	Fabaceae
9.	<i>Albizia procera</i> Roxb.	Siris	Mimosoideae
10.	<i>Alstonia scholaris</i> (L.) R. Br.	Sattni, chatinn	Apocynaceae
11.	<i>Amoora wallichii</i> King	Amari	Meliaceae
12.	<i>Anacardium occidentale</i> L.	Kaju	Anacardiaceae
13.	<i>Annona squamosa</i> L.	Sitaphal	Annonaceae
14.	<i>Neolamarckia cadamba</i> (Roxb.) Bosser	Kadam	Rubiaceae
15.	<i>Araucaria</i> spp.	Araucaria	Araucariaceae
16.	<i>Areca catechu</i> L.	Tamul	Arecaceae
17.	<i>Artocarpus chaplasha</i> Roxb.	Sam	Moraceae
18.	<i>Artocarpus heterophyllus</i> Lamk.	Jackfruit	Moraceae
19.	<i>Averrhoa carambola</i> L.	Kamarakh	Oxalidaceae
20.	<i>Azadirachta indica</i> A.Juss.	Nim, nimgachh	Meliaceae
21.	<i>Bauhinia variegata</i> L.	Bogakatra	Fabaceae
22.	<i>Bixa orellana</i> L.	Sinduri	Bixaceae
23.	<i>Bombax ceiba</i> L.	Himalo, simul	Bombacaceae
24.	<i>Caesalpinia pulcherrima</i> (L.) Sw.	Peacock Flower	Fabaceae
25.	<i>Callistemon lanceolatus</i> Sweet.	Bottle brush	Myrtaceae
26.	<i>Canarium resiniferum</i> Roxb.	Dhuna	Burseraceae
27.	<i>Canarium strictum</i> Roxb.	Dhuna	Burseraceae
28.	<i>Carica papaya</i> L.	Papaya	Caricaceae
29.	<i>Cassia fistula</i> L.	Honalu, amultash	Fabaceae
30.	<i>Cassia javanica</i> L.	Pink shower	Fabaceae
31.	<i>Castanopsis armata</i> Roxb.	Taongasing	Fagaceae
32.	<i>Castanopsis castanicaarpa</i> Spach.	Angkeh	Fagaceae
33.	<i>Castanopsis indica</i> (Roxb. ex Lindl.) A.DC.	Katus, Hinguri	Fagaceae
34.	<i>Celtis australis</i> L.	Honey berry tree	Ulmaceae
35.	<i>Chukrasia tabularis</i> A. Juss.	Bogapoma	Meliaceae
36.	<i>Cinnamomum camphora</i> (L.) Presl	Kapur	Lauraceae
37.	<i>Cinnamomum cassia</i> Daphnae Meisn.	Gonsorai	Lauraceae
38.	<i>Cinnamomum tamala</i> Fr. Nees	Tejpatta	Lauraceae
39.	<i>Cinnamomum verum</i> Presl.	Dalchini, Siripori	Lauraceae
40.	<i>Citrus reticulate</i> Blanco	Mandarin	Rutaceae
41.	<i>Citrus limon</i> Burm.	Lemon	Rutaceae
42.	<i>Cocos nucifera</i> L.	Nariyal	Arecaceae
43.	<i>Cycus revoluta</i> Thunb.	Sago palm	Cycaceae
44.	<i>Dalbergia sissoo</i> Roxb.	Sissu	Fabaceae
45.	<i>Delonix regia</i> Raf.	Radhachura	Fabaceae
46.	<i>Dillenia indica</i> L.	Outenga, sompa	Dilleniaceae
47.	<i>Duabangagrandiflora</i> Roxb.	Khokan	Lythraceae
48.	<i>Dysoxylum binectariferum</i> (Roxb.) Hook.f. ex Bedd.	Banderdima	Meliaceae
49.	<i>Elaeis guineensis</i> Jacq.	Oil palm	Arecaceae
50.	<i>Elaeocarpus floribundus</i> Roxb.	Jalpai	Eleocarpaceae
51.	<i>Emblica officinalis</i> Gaertn.	Amloki	Euphorbiaceae
52.	<i>Eucalyptus</i> spp.	Eucalyptus	Myrtaceae
53.	<i>Ficus benghalensis</i> L.	Banyan	Moraceae
54.	<i>Ficus religiosa</i> L.	Pipal tree	Moraceae
55.	<i>Gmelina arborea</i> L.	Gomari, Gamar	Verbenaceae
56.	<i>Grevillea robusta</i> A.Cunn. ex R.Br.	Silver Oak	Proteaceae
57.	<i>Grewia disperma</i> Roxb	Kakki	Tiliaceae
58.	<i>Heritiera macrophylla</i> Wall. ex Kurz	Sundari	Sterculiaceae
59.	<i>Hevea brasiliensis</i> (Willd. ex A.Juss.) Müll.Arg.	Rubber	Euphorbiaceae
60.	<i>Jacaranda mimosaeifolia</i> D.Don	Blue Gulmohar	Bignoniaceae
61.	<i>Jatropha curcas</i> L.	Ratanjot	Euphorbiaceae

62.	<i>Kydia calycina</i> Roxb.	Pichola	Malvaceae
63.	<i>Lagerstroemia speciosa</i> (L.) Pers.	Azar	Lythraceae
64.	<i>Leucaena leucocephala</i> (Lam.) de Wit	Subabul	Fabaceae
65.	<i>Litchi chinensis</i> Sonn.	Litchi	Sapotaceae
66.	<i>Livistona jenkinsiana</i> Griff.	Tokopatta	Arecaceae
67.	<i>Mangifera indica</i> L.	Mango	Anacardiaceae
68.	<i>Manilkara achras</i> Fosberg.	Chiku	Sapotaceae
69.	<i>Melia azedarach</i> L.	Bakain, Ghoranim	Meliaceae
70.	<i>Mesua ferrea</i> L.	Nahor	Guttiferae
71.	<i>Michelia champaca</i> L.	Titasopa	Magnoliaceae
72.	<i>Mimusops elengi</i> L.	Maulsiri	Sapotaceae
73.	<i>Moringa oleifera</i> Lamk.	Sajina, Sajina	Moringaceae
74.	<i>Morus alba</i> L.	Tut	Moraceae
75.	<i>Morus acedosa</i> Griff.	Nuni	Moraceae
76.	<i>Morus australis</i> Poir.	Kiskuri, Latek	Moraceae
77.	<i>Nephelium lappaceum</i> L.	Tadar, rambutan	Sapindaceae
78.	<i>Nyctanthus arbortristis</i> L.	Jasmine	Oleraceae
79.	<i>Oroxylum indicum</i> L.	Totola	Bignoniaceae
80.	<i>Parkia roxburghii</i> G. Don	Yangchang	Fabaceae
81.	<i>Peltophorum inerme</i> (Roxb.) Naves	Copper pod	Fabaceae
82.	<i>Phoebe cooperiana</i> P.C. Kanjilal & Das	Tapir	Lauraceae
83.	<i>Pinus kesiya</i> Royle ex Gordon	Khasi Pine	Pinaceae
84.	<i>Polyalthia longifolia</i> (Sonn.) Thwaites	Unboi, deb daru	Anonaceae
85.	<i>Pongamia pinnata</i> L.	Karanj	Fabaceae
86.	<i>Populus deltoides</i> Marshall	Poplar	Salicaceae
87.	<i>Prunus persica</i> Batsch.	Peach	Rosaceae
88.	<i>Psidium guajava</i> L.	Guava	Myrtaceae
89.	<i>Roystonea regia</i> (Kunth) O.F. Cook	Royal Palm	Arecaceae
90.	<i>Samanea saman</i> Meeril.	Rain tree	Fabaceae
91.	<i>Sapium sebiferum</i> Roxb.	Chinese tallow tree	Euphorbiaceae
92.	<i>Spondias pinnata</i> Kurtz.	Amara, Golden apple	Anacardiaceae
93.	<i>Saraca indica</i> L.	Ashoka	Fabaceae
94.	<i>Sterculia villosa</i> Roxb.	Udal	Sterculiaceae
95.	<i>Syzygium cumini</i> L. Skeel	Jamuk	Myrtaceae
96.	<i>Tamarindus indica</i> L.	Tetuli	Fabaceae
97.	<i>Tectona grandis</i> L.f.	Teak	Verbenaceae
98.	<i>Terminalia arjuna</i> Bedd.	Arjun	Combretaceae
99.	<i>Terminalia chebula</i> Retz.	Hillika	Combretaceae
100.	<i>Terminalia myriocarpa</i> Van Heurck & Müll. Arg.	Hollock	Combretaceae
101.	<i>Terminalia procera</i> Roxb.	Umbrella Tree	Combretaceae
102.	<i>Thuja orientalis</i> L.	Chinese Thuja	Cupressaceae
103.	<i>Zizyphus mauritiana</i> Lamk.	Ber	Rhamnaceae

**Table 2:** Tree species distribution according to their families

Sr. No.	Family	Number of species
1.	Fabaceae	19
2.	Rutaceae	3
3.	Simaroubaceae	1
4.	Mimosoideae	1
5.	Apocynaceae	1
6.	Meliaceae	5
7.	Anacardiaceae	3
8.	Annonaceae	1
9.	Rubiaceae	1
10.	Araucariaceae	1
11.	Arecaceae	5
12.	Moraceae	7
13.	Oxalidaceae	1
14.	Bixaceae	1
15.	Bombacaceae	1
16.	Myrtaceae	4
17.	Burseraceae	2
18.	Caricaceae	1
19.	Fagaceae	3
20.	Ulmaceae	1
21.	Lauraceae	5
22.	Cycaceae	1
23.	Dilleniaceae	1

24.	Lythraceae	2
25.	Eleocarpaceae	1
26.	Euphorbiaceae	4
27.	Verbenaceae	2
28.	Proteaceae	1
29.	Tiliaceae	1
30.	Sterculiaceae	2
31.	Bignoniaceae	2
32.	Malvaceae	1
33.	Sapotaceae	3
34.	Guttiferae	1
35.	Magnoliaceae	1
36.	Moringaceae	1
37.	Sapindaceae	1
38.	Oleraceae	1
39.	Pinaceae	1
40.	Anonaceae	1
41.	Salicaceae	1
42.	Rosaceae	1
43.	Combretaceae	4
44.	Cupressaceae	1
45.	Rhamnaceae	1

**Table 3:** Range of distributed tree species with their family

Sr. No.	Plant species number range	Number of belonging family
1.	0-4	40
2.	5-8	4
3.	9-12	-
4.	13-16	-
5.	17-20	1

**Conclusion**

Based on the result of this finding in the study area, a total of 103 tree species belonging to 85 genera and 45 families were enumerated in the study area. The results also revealed that Fabaceae had the highest number of tree species (19). There is the need to make proper implementation of conservation and sustainable management strategies. State departments should design programmes to create awareness among the people to understand the need of protecting tree species in the surrounding area.

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