

## **Account of common and traditional non-timber forest products used by Apatani tribe of Arunachal Pradesh, India**

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### **Abstract**

The various ethnic communities inhabiting in the biodiversity rich state of Arunachal Pradesh are completely dependent of forest resources for their livelihood and economic development. The tribe Apatani residing in Lower Subansiri District of Arunachal Pradesh particularly in the Ziro valley have their unique systems of resource management. The present paper documented the NTFP plants used by the Apatani people. Present study recorded 111 species of NTFP yielding plants under 58 families and 95 genera. It includes 104 species of Angiosperm followed by 4 species of Pteridophytes, 2 species of Fungi and 1 species of Gymnosperm. Habit wise the herbs represent maximum number (47 species) followed by trees (27 species). All these species used by the communities for various food items, fruits, medicines, house building materials and miscellaneous purposes. Utilization of the forest species for different religious and cultural aspects is also one important aspect. Based on the availability and commercial potential 18 species has been recognized for cultivation and management in various agricultural systems

**Key words:** NTFPs, Apatani tribe, Traditional knowledge, cultivation, management

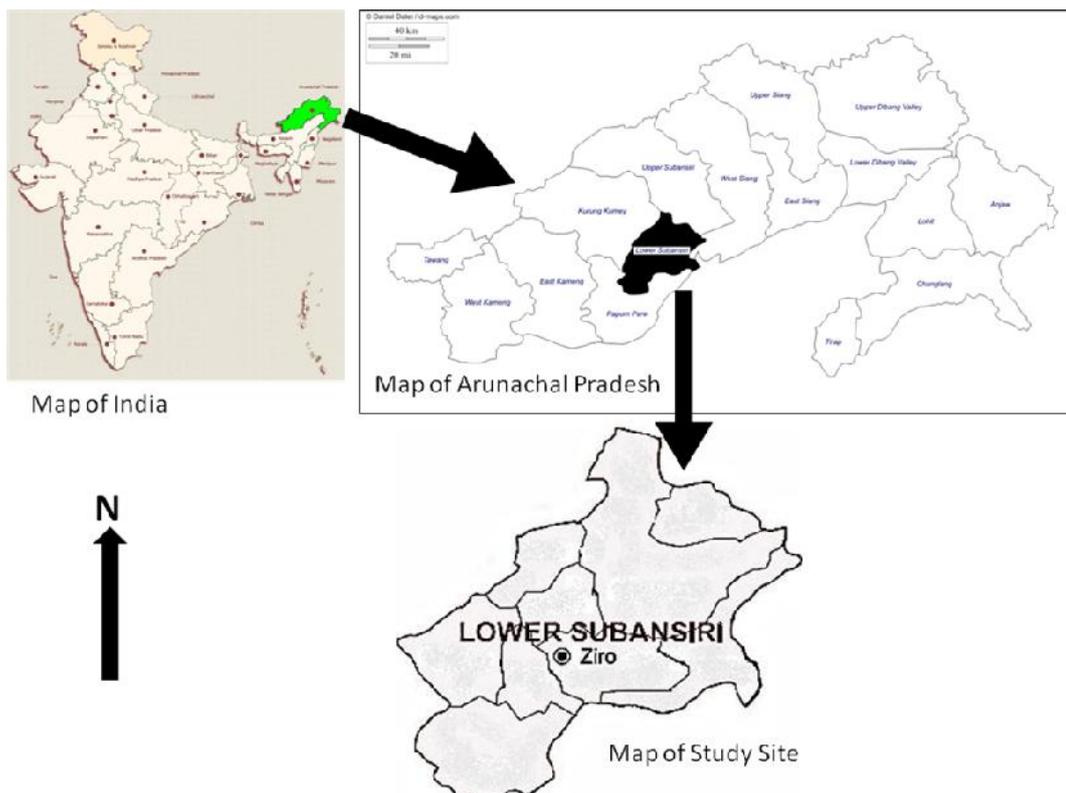
### **INTRODUCTION**

Arunachal Pradesh is located on the Eastern Himalaya and falls under the Himalaya Biodiversity Hotspots (Mittermeier *et al* 2004). It is well known for its rich forest resources and indigenous traditional knowledge systems. The state comprised of about 26 major tribes like *Nyishi*, *Apatani*, *Adi*, *Tagin*, *Monpa*, *Nocte*, *Mishimi*, *Idu-mishmi* etc and over 110 sub-tribes inhabiting in different parts of the state (Pandey *et al* 1999). The majority of the tribal communities in Arunachal Pradesh depend on forest resources for their livelihood. Non Timber Forest Produces (NTFP) are the main resources for the livelihood and economy of most of the tribal communities. Sustainable development of tribal villages is possibly only if the forests are preserved and its resources are properly managed. They commonly collect various NTFPs from the adjacent forests to meet their daily requirement as well as source of revenue through marketing of the collected potential resources. The uses of NTFPs as vegetable, fruit, medicine etc. by different ethnic communities of the state have been

documented mostly through ethnobotanical approach by a number of workers (Kohli 2001; Murtem & Das 2005; Kala 2005; Tiwari *et al* 2009; Doley *et al* 2009, 2010; Gajurel *et al* 2010; Srivastava *et al* 2010; Khongsai *et al* 2011; Sarmah & Arunachalam 2011; Jeri *et al* 2011). The uses of more than 1000 NTFPs yielding species in the state by various tribal groups in different aspects of livelihood are now known (Gajurel *et al* 2013). However the details of all the NTFPs used by a specific community with traditional knowledge associated with the uses and economic prospects of such NTFP used is still to be made. So far, no any holistic study has been carried out in the north-eastern India to understand the linkages between resource utilization patterns of NTFPs in conjugation with the traditional knowledge systems of indigenous communities living nearby the forested areas. In this context an attempt has been made here to document and categorize the NTFPs used commonly by the Apatani tribe of Arunachal Pradesh with a discussion on commercial potential and management of selected species.

### STUDY AREA

The present study area, the Ziro valley is located in Lower Subansiri District which is lies between  $26^{\circ} 55'$  and  $28^{\circ} 21'$  North latitude and  $92^{\circ} 40'$  and  $94^{\circ} 21'$  East longitude, in the Central-Western part of Arunachal Pradesh (Fig. 1). The Ziro Plateau (often called the Apatani Plateau) is situated between the Panior and Kamla (Kuru) rivers at an altitude of 1,524 to 2,738 m above mean sea level with a total geographical area of 3460 sq km of which 277.94 sq km area is forest covered. It exhibits mostly the subtropical and temperate



**Fig. 1.** Map of Arunachal Pradesh showing the study site.

vegetation. Ziro is famous for paddy-cum-fish cultivation. *Apatani* is one of the major ethnic tribal groups of the state, sharing 2.26 % population of the state. There are seven major villages namely Hong, Bulla, Hari, Hiija, Bamin–Michi, Mudang- Tage and Dutta (Dollo *et al* 2009).

The Apatanis belong to the Tibeto-Mongolid stock (Haimendorf 1962). Literally the word Apatani is from ‘*Apa*’ means addressing someone out of affection and ‘*Tani*’ means the descendents of *Abotani*, who is considered as the forefather of the Apatanis. During olden days Apatani women were mainly recognized or distinguished from the other tribes from the *Tiippe* marks (tattoo) that they had on their face and the nose plugs (*Yaping hullo*) made of bamboo. Apatani people perform different ritual ceremonies like *Myoko*, *Murung*, *Dree* of which *Myoko* is the most important festival. Though Apatani’s have over the years incorporated many ways of the modern world, but they still give significance to their traditions and customs.

## METHODS

A number of different, complimentary approaches and techniques were used to obtain information and data relevant to this study. Four villages, namely Bamin-Michi, Bulla, Hija and Hong in Ziro were selected for the survey. A total of 80 households, 20 from each village were targeted for data collection. Field survey had been carried out in four seasons in selected villages and the adjacent forests during the years 2009 to 2011. Collections of data were made as per standard ethnobotanical methodology (Jain 1989; Martin 1995) and thorough discussion and interview with the selected villagers. Relevant information were also recorded from forest department, department of industry etc as well as from civil administration. Pre-structured questionnaires were used for collecting information about the plant specimens used, the traditional knowledge associated with the uses of the plant specimens and as well as the traditional techniques applied in conservation and sustainable use of the forest resources mainly the NTFPs. Voucher specimens were preserved for authentication of the collected data. Identification of species is made following taxonomic literature and herbarium specimens at Botanical Survey of India, Itanagar, State Forest Research Institute, Itanagar and NERIST, Nirjuli and has been deposited in the Forestry Herbarium of NERIST.

## RESULT AND DISCUSSION

The studies on NTFPs used by the Apatani people revealed that the community is still highly dependent on forest resources for their livelihood. Apatani’s are still entirely dependent on forest resources and forest products for their daily requirement for food (like fruits and vegetables), medicines, dyes, firewood and also for other household needs and religious purposes. The present study revealed that 111 species of plants are commonly used by the Apatani to fulfill their various requirements. The details of all the species with their botanical identity, common name, parts used and utilization pattern have been tabulated (Table 1). These includes 104 species belonging to Angiosperms (93.69 %) followed by 4 species of Pteridophytes (3.60 %), 2 species of Fungi (1.8 %) and 1 species of Gymnosperm (0.90 %). The Angiosperms are represented by 58 families and 95 genera. The habit-wise grouping revealed that the maximum species used by them are herbs (46 spp), followed by trees (27 spp), shrubs (21 spp), climbers (15 spp) and fungi (2 spp) (Fig 2). The dominance of herbaceous NTFP species is probably because of the high preference for wild vegetable and medicine which are mostly seasonal plants and the bamboos by the communities. The tree species are mostly preferred for fruits, firewood and ritual performances. All these species

**Table 1.** List of plant species used as NTFPs by Apatani tribe of Arunachal Pradesh

Name of plant [Family]; Voucher specimen	Local name	Habit	Parts used	Uses
<i>Acemella paniculata</i> (Wallich <i>ex</i> DC.) R.K. Jansen [Asteraceae]; <i>Bamin-20</i>	<i>Yakhohamang</i>	Herb	Leaves	i. Vegetable. ii. Consumed raw against constipation.
<i>Acorus calamus</i> Linnaeus [Acoraceae]; <i>Bamin-05</i>	<i>Kile tolyo</i>	Herb	Rhizome	Paste of rhizome applied on cuts, wounds and bone fracture which tied with a cloth to set it right and for healing.
<i>Actinidia callosa</i> Lindley [Actinidiaceae]; <i>Bamin-09</i>	<i>Hari Harkhu</i>	Climber	Fruits	Eaten raw.
<i>Actinidia sinensis</i> Lindley [Actinidiaceae]; <i>Bamin-04</i>	<i>Antii Tarey</i>	Climber	Fruits	Eaten raw.
<i>Ageratum conyzoides</i> Linnaeus [Asteraceae]; <i>Bamin-10</i>	<i>Borbia tami</i>	Herb	Leaves	Leaf-paste stops bleeding in cuts & wounds.
<i>Allium hookeri</i> Thwaites [Amaryllidaceae]; <i>Bamin-06</i>	<i>Lepi</i>	Herb	Tubers, leaves	i. Spice, vegetable ii. Cold, cough, nausea, abscesses, allergy, cuts & wounds, bone fracture, eruption of skin, stimulant, vermicide, anti-inflammatory and for veterinary.
<i>Allium tuberosum</i> Rottler <i>ex</i> Sprengel [Amaryllidaceae]; <i>Bamin-01</i>	<i>Tale</i>	Herb	Leaves	Eaten as salad and local chutney (“ <i>Pike</i> ”).
<i>Alnus nepalensis</i> D. Don [Betulaceae]; <i>Bamin-76</i>	<i>Riime</i>	Tree	Trunk	Firewood.
<i>Amaranthus spinosus</i> Linnaeus. [Amaranthaceae]; <i>Bamin-57</i>	<i>Pulu Tayi hamang</i>	Herb	Leaves, whole plant	Vegetable.
<i>Amaranthus tricolor</i> Linnaeus. [Amaranthaceae]; <i>Bamin-122</i>	<i>Lancha tayi hamang</i>	Herb	Leaves, whole plant	Vegetable.
<i>Angiopteris evecta</i> (G. Forster) Hoffmann [Marattiaceae]; <i>Bamin-27</i>	<i>Tari</i>	Small tree	Stem, tubers	For making “ <i>Piyu</i> ” (ash) and “ <i>Pila</i> ” (filtered liquid ash).
<i>Anisomeles indica</i> (Linnaeus) Kuntze [Lamiaceae]; <i>Bamin-11</i>	<i>Narutami</i>	Herb	Whole plant	Paste applied on cuts, wounds and in muscle pain.
<i>Artemisia indica</i> Willdenow [Asteraceae]; <i>Bamin-120</i>	<i>Kukulyu/ kuku lyolye hamang</i>	Shrub	Leaves	i. Vegetable. ii. Leaves kept in poultry baskets repel pests. iii. Inhaling strong smell of leaf relieves nose blockade and headache.
<i>Aspidopterys indica</i> (Willdenow) William Theobald [Malpighiaceae]; <i>Bamin-12</i>	<i>Tarru Palyu</i>	Climber	Whole plant	Plant extract is boiled with water till it becomes thick and sticky as gum to use for catching birds.
<i>Begonia obversa</i> C.B. Clarke [Begoniaceae]; <i>Bamin-95</i>	<i>Lukhu</i>	Herb	Leaves	Vegetable and fodder.
<i>Begonia roxburghii</i> (Miquel) De Candolle [Begoniaceae]; <i>Bamin-15</i>	<i>Byukhu</i>	Herb	Tubers	Tuber boiled with <i>Rubia manjith</i> produce a dye to colour clothes.

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Name of plant [Family]; Voucher specimen	Local name	Habit	Parts used	Uses
<i>Berberis wallichiana</i> DC. [Berberidaceae]; <i>Bamin-43</i>	<i>Tiipe tiire/ lobyotiire</i>	Shrub	Thorns, bark	i. Spines or thorns used for tattooing “ <i>Tiipe</i> ” (The Apatani’s identification tattoo). ii. Bark paste applied on wounds and swelling for instant pain relief.
<i>Calamus acanthospathus</i> Griffith [Arecaceae]; <i>Bamin-22</i>	<i>Taser</i>	Climber	Whole plant	i. House building structure and binding purposes. ii. For making accessories in festivals. iii. Household items like rucksack a traditional baskets etc.
<i>Cantharellus</i> sp [Cantharellaceae]; <i>Bamin-23</i>	<i>Tayiing</i>	Fungi	Fruiting body	Food and preferred boiled.
<i>Cardamine hirsuta</i> Linnaeus [Brassicaceae]; <i>Bamin-19</i>	<i>Paddii hamang</i>	Herb	Leaves	Leaves as salad mostly with “ <i>Tero pilla</i> ” and “ <i>Tapyo</i> ” (locally preferred delicacies).
<i>Castanopsis hystrix</i> Hooker f. & Thomson ex A. DC. [Fagaceae]; <i>Bamin-64</i>	<i>Kiira</i>	Tree	Fruits, leaves and whole plant	i. Nuts are cooked and eaten. ii. Leaves used for decorating the sacred alter and other materials used during rituals and religious ceremonies. iii. Firewood.
<i>Castanopsis indica</i> (Roxburgh) Miquel [Fagaceae]; <i>Bamin-21</i>	<i>Rahu kira</i>	Tree	Leaves, whole plant	i. Firewood. ii. Leaves for decorating the sacred alter during rituals and religious ceremonies.
<i>Castanopsis tribuloides</i> (Smith) A. de Candolle [Fagaceae]; <i>Bamin-24</i>	<i>Korbing kira</i>	Tree	Leaves, whole plant, fruits	i. Leaves used during chanting of rituals and religious ceremonies. ii. Firewood. iii. Fruits edible. iv. House building material such as post and partition.
<i>Centella asiatica</i> (Linnaeus) Urban [Apiaceae]; <i>Bamin-109</i>	<i>Ngilyang Khiko</i>	Herb	Whole plant	i. Eaten with salad and as boiled vegetable. ii. Remedy for gastritis, blood purification and also increases appetite.
<i>Cerasus cerasoides</i> (Buchanan-Hamilton ex D. Don) S. Y. Sokolov [Rosaceae]; <i>Bamin-90</i>	<i>Semo</i>	Tree	Fruits	Fruits edible as ingredient for making chutney.
<i>Chimonocalamus callosus</i> (Munro) Hsueh & Yi [Poaceae]; <i>Bamin-17</i>	<i>Rijiang</i>	Shrub	Culms, shoots	i. Young shoots edible as vegetable. ii. Culms as firewood & fences.
<i>Chimonocalamus griffithianus</i> (Munro) Hsueh & T.P. Yi [Poaceae]; <i>Bamin- 131</i>	<i>Tabiyo</i>	Herb	Whole culm, young shoot	i. Young shoot as vegetable. ii. Whole culm as house building materials. iii. As firewood.
<i>Choerospondias axillaris</i> (Roxburgh) B.L. Burt & A.W. Hill [Anacardiaceae]; <i>Bamin-26</i>	<i>Biling</i>	Tree	Fruits	Eaten raw.
<i>Clerodendrum colebrookianum</i> Walpers [Lamiaceae]; <i>Bamin-92</i>	<i>Pato hamang</i>	Shrub	Leaves	i. Vegetables and as an ingredient for “ <i>Pike</i> ”



**PLATE - I:** Some plants used as NTFPs by Apatani people of Arunachal Pradesh. **A.** *Primula denticulata*; **B.** *Clerodendrum colebrookianum*; **C.** *Phyllostachys manii*; **D.** Fruits of *Myrica esculenta*; **E.** Fruits of *Rubus ellipticus*; **F.** Fruit of *Coccinea grandis*; **G.** Unripe fruits of *Mahonia napaulensis*; **H.** *Rubia manjith*; **I.** Fruits of *Viburnum foetidum*; **J.** Fruits of *Litsea cubeba*; **K.** Fruits of *Ficus auriculata*; **L.** Leafy shoots of *Piper pedicellatum*; **M.** Fruits of *Magnolia champaca*; **N.** Freshly collected bamboo shoots in market; **O.** Fermented bamboo shoots in market

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Name of plant [Family]; Voucher specimen	Local name	Habit	Parts used	Uses
<i>Clerodendrum glandulosum</i> Lindley [Lamiaceae]; <i>Bamin-35</i>	<i>Pato hamang</i>	Shrub	Leaves	i. Vegetables and as an ingredient for "Pike". ii. Remedy for blood pressure.
<i>Coccinia grandis</i> (Linnaeus) Voigt [Cucurbitaceae]; <i>Bamin-51</i>	<i>Jojuru</i>	Climber	Fruits	Eaten raw.
<i>Colocasia affinis</i> Schott [Araceae]; <i>Bamin-32</i>	<i>Yarri</i>	Herb	Leaves	Fodder.
<i>Crassocephalum crepidioides</i> (Benth) S. Moore [Asteraceae]; <b>Bamin-28</b>	<i>Halyang Hamang</i>	Herb	Whole plant	Vegetables.
<i>Croton roxburghii</i> Wallich [Euphorbiaceae]; <i>Bamin-37</i>	<i>Pai lamu</i>	Shrub	Leaves	Relief from stomach disorder.
<i>Cyanthillium cinereum</i> (Linnaeus) H. Robinson [Asteraceae]; <i>Bamin-45</i>	<i>Tapyo</i>	Herb	Whole plant	As food and in preparation of local ash or salt.
<i>Cyathea gigantea</i> (Wallich ex Hooker) Holttum [Cyatheaceae]; <i>Bamin-29</i>	<i>Tashe</i>	Tree fern	Pith, leaves	i. The pith as food. ii. Leaves and pith as fodder. iii. Leaves as a remedy against body ache.
<i>Dendrocalamus hamiltonii</i> Nees & Arnott ex Munro [Poaceae]; <i>Bamin-31</i>	<i>Yayi byapu</i>	Shrub	Shoots, stem	i. Young shoots as vegetable. ii. The stem is used for household items like local mugs, spoon etc. and also as house building & firewood.
<i>Dendrocnide sinuata</i> (Blume) Chew [Urticaceae]; <i>Bamin-33</i>	<i>Hathi pata</i>	Shrub	Roots, leaves	Extracts of leaves and root is used for curing fever and dysentery. It is also applied to get relief from swelling.
<i>Dicranopteris linearis</i> (Burman f.) Underwood [Gleicheniaceae]; <i>Bamin-36</i>	<i>Takho</i>	Herb	Whole plant	i. Spring action traps for rodents. ii. Fences for altars or shrines during certain rituals and religious purposes. iii. In preparation of food items.
<i>Dioscorea bulbifera</i> Linnaeus [Dioscoreaceae]; <i>Bamin-25</i>	<i>Engin/Hula</i>	Climber	Tuber, Leaves	i. Tubers as food and vegetable. ii. Leaves as fodder.
<i>Diplazium esculentum</i> (Retzius) Swartz [Athyriaceae]; <i>Bamin-08</i>	<i>Hiika</i>	Herb	Tender leaves	The young fronds edible.
<i>Elatostema platyphyllum</i> Weddell [Urticaceae]; <i>Bamin-48</i>	<i>Hiipe</i>	Herb	Leaves	Vegetable.
<i>Eremocaulon capitatum</i> (Trinius) Londoño [Poaceae]; <i>Bamin-38</i>	<i>Yabiing</i>	Herb	Culm, shoots	i. Young shoots as vegetable. ii. Mature bamboos used for filtering water and are a good water purifier. iii. Piece of culm was sharpened and used for cutting umbilical cord of a new born baby when delivery was done at home. iv. Rituals and religious purposes.
<i>Eurya acuminata</i> DC. [Theaceae]; <i>Bamin-104</i>	<i>Sankhii/nausankhii</i>	Tree	Leaves	As dye. The leaves are boiled along with <i>Rubia manjith</i> in water or starch till the yellow-brownish colour appears and the clothes are then dipped in it for dying.

Name of plant [Family]; Voucher specimen	Local name	Habit	Parts used	Uses
<i>Ficus auriculata</i> Loureiro [Moraceae]; Bamin- 34	Taro	Tree	Fruits	Eaten raw.
<i>Ficus hookeriana</i> Corner [Moraceae]; Bamin-138	Saro ayii	Tree	Fruits, whole plant	i. Eaten raw. ii. Religious and traditional use, it is believed that the leaves of this plant gave protection from forest fire in olden days. iii. Firewood.
<i>Duchesnea indica</i> (Andrews) Focke [Rosaceae]; Bamin-46	Subu Tute jilyung	Herb	Fruits	Eaten raw.
<i>Gnaphalium affine</i> D. Don [Asteraceae]; Bamin-42	Miiyang	Herb	Leaves	Dried leaves used for making fire.
<i>Gonostegia hirta</i> (Blume ex Hasskarl) Miquel [Urticaceae]; Bamin- 118	Hiipe Hamang	Herb	Young leaves	i. Vegetable. ii. Leaves used as fodder.
<i>Gynostemma pedata</i> Blume [Cucurbitaceae]; Bamin-18	Rikko	Climber	Stem	Stem is dried and made into powder and it is added with hot water or starch during cold, cough and other throat infection.
<i>Houttuynia cordata</i> Thunberg [Saururaceae]; Bamin-60	Siiya hamang	Herb	Shoot, leaves	i. Vegetable or eaten raw with "pila" (chutney). ii. Gives relief from sleep disorder, appetizer and indigestion.
<i>Hydrocotyle javanica</i> Thunberg [Araliaceae]; Bamin-07	Hiibyoy	Herb	Leaves, roots	Vegetable, gives relief from indigestion.
<i>Hyptis suaveolens</i> (Linnaeus) Poiteau [Lamiaceae]; Bamin-41	Narutami	Herb	Leaves	Leaves crushed and applied on cuts and wounds to stop bleeding.
<i>Impatiens racemosa</i> DC. [Balsaminaceae]; Bamin-50	Aki Tai	Herb	Leaves	Vegetable.
<i>Kavalama urens</i> (Roxburgh) Rafinesque [Malvaceae]; Bamin-13	Niji yanii	Shrub	Leaves	For wrapping different items like meat rice powder etc. offered to God. It is used for covering local wine for fermentation.
<i>Lasianthus japonicas</i> ssp. <i>longicaudus</i> (Hooker f.) C.Y. Wu & H. Zhu [Rubiaceae]; Bamin-47	Santu Palyu	Tree	Fruits, stems	Gum.
<i>Ligustrum ovalifolium</i> Hasskarl [Oleaceae]; Bamin-115	Sankhan melyan	Shrub	Whole plant, stem	For rituals and mostly for fences around the houses and bamboo groves.
<i>Litsea cubeba</i> (Loureiro.) Persoon [Lauraceae]; Bamin-65	Santero	Tree	Fruits	i. Ripe or unripe fruits are eaten fresh for relief from cold and cough. ii. As spices.
<i>Magnolia champaca</i> (Linnaeus) Bailon ex Pierre [Magnoliaceae]; Bamin-53	Salyo	Tree	Fruits, trunk	i. Eaten raw and also cooked for local delicacies called "pike". ii. Improves appetite and liver disorder. iii. Trunk used for house building materials. iv. Firewood.
<i>Magnolia oblonga</i> (Wallich ex Hooker f. & Thomson) Figlar [Magnoliaceae]; Bamin-66	Salyo	Tree	Fruits, trunk	i. Fruits edible and preferred for making local chutney. ii. Trunk used as firewood.

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Name of plant [Family]; Voucher specimen	Local name	Habit	Parts used	Uses
<i>Mahonia napaulensis</i> DC. [Berberidaceae]; <i>Bamin-39</i>	<i>Taaming</i>	Shrub	Fruits, bark	i. Fruits eaten raw. ii. Bark and leaves are kept around the corner of the house to keep evil spirits away. iii. Bark is used for obtaining a deep yellow dye.
<i>Manihot esculenta</i> Crantz [Euphorbiaceae]; <i>Bamin-52</i>	<i>Sann engin</i>	Shrub	Tubers	Tubers edible as food and vegetable.
<i>Mikania micrantha</i> Kunth [Asteraceae]; <i>Bamin-55</i>	<i>Riring hamang/ Maantami</i>	Climber	Leaves, stem	Paste of leaves and stem made into and juice or liquid of leaves and stem are applied on rashes, wounds or clotting of blood.
<i>Miscanthus sinensis</i> Andersson [Poaceae]; <i>Bamin-62</i>	<i>Mima</i>	Herb	Whole plant	Miscellaneous uses like tying vegetables, meat etc.
<i>Molineria recurvata</i> (Dryand) Hebbert. [Hypoxidaceae]; <i>Bamin-63</i>	<i>Loli</i>	Herb	Leaves	Religious purposes such as for tying animals. Also used in rituals performed for safety of mother and child and for easier and safe delivery of baby.
<i>Morus nigra</i> Linnaeus [Moraceae]; <i>Bamin-75</i>	<i>Gende</i>	Tree	Fruits	Eaten raw.
<i>Musa x paradisiaca</i> Linnaeus [Musaceae]; <i>Bamin-59</i>	<i>Kol</i>	Herb	Pseudo stem, inflorescence	i. The stumps are dried and burned to an ash which is used in food items. ii. Inflorescence as vegetable.
<i>Myrica esculenta</i> Buchanan- Hamilton ex D. Don [Myricaceae]; <i>Bamin-130</i>	<i>Baching</i>	Tree	Fruits	Eaten raw.
<i>Neomicrocalamus manii</i> (Gamble) R.B. Majumdar [Poaceae]; <i>Bamin-61</i>	<i>Tajer</i>	Herb	Whole plant	i. Piece of the plant is worn in hair by the priest during rituals. ii. Roof-making.
<i>Oenanthe javanica</i> (Blume) DC. [Apiaceae]; <i>Bamin-67</i>	<i>Hiigu hamang</i>	Herb	Leaves	i. Eaten raw for relief from indigestion. ii. Vegetable.
<i>Oxalis corniculata</i> Linnaeus [Oxalidaceae]; <i>Bamin-118</i>	<i>Okhui hamang</i>	Herb	Leaves, stem	Gives relief from stomachache.
<i>Paederia foetida</i> Linnaeus [Rubiaceae]; <i>Bamin-70</i>	<i>Paritaro</i>	Climber	Leaves, stem	i. Vegetable. ii. Leafy stem is eaten in indigestion.
<i>Pericampylus glaucus</i> (Lamarck) Merrill [Menispermaceae]; <i>Bamin-49</i>	<i>Rukki taru</i>	Climber	Stem	House building material and highly preferred because of durability.
<i>Perilla frutescens</i> (Linnaeus) Britton [Lamiaceae]; <i>Bamin-79</i>	<i>Tining</i>	Herb	Seeds	i. Seeds are grounded and used as condiment. ii. Food, in preparation of rice cakes.
<i>Persicaria bartata</i> (Linnaeus) H. Hara [Polygonaceae]; <i>Bamin- 88</i>	<i>Luli</i>	Herb	Whole plant	Fodder.
<i>Persicaria hydropiper</i> (Linnaeus) Delarbre [Polygonaceae]; <i>Bamin- 103</i>	<i>Roring</i>	Herb	Leaves	As poison in fishing.
<i>Phoebe goalparensis</i> Hutchinson [Lauraceae]; <i>Bamin-128</i>	<i>Samper</i>	Tree	Fruit	Fruits as vegetable and for making chutney.

Name of plant [Family]; Voucher specimen	Local name	Habit	Parts used	Uses
<i>Phragmites karka</i> (Retzius) Trinius <i>ex</i> Steudel [Poaceae]; <i>Bamin-111</i>	<i>Pepu</i>	Shrub	Whole plant	Miscellaneous uses like preparation of local salt and mats.
<i>Phyllostachys manii</i> Gamble [Poaceae]; <i>Bamin-30</i>	<i>Bije</i>	Herb	Young shoots, whole plant,	i. Young shoots edible. ii. Plant parts used in house building, fencing and curving of various household and handicraft items.
<i>Pinus wallichiana</i> A. B. Jackson [Pinaceae]; <i>Bamin-108</i>	<i>Saati</i>	Tree	Resins	Resins of the tree are used for relief from cuts, wounds and crack heels.
<i>Piper hamiltonii</i> C. DC. [Piperaceae]; <i>Bamin-129</i>	<i>Riidii</i>	Climber	Fruits, leaves	i. Vegetable. ii. Fruits chewed to get relief from cough and cold.
<i>Piper pedicellatum</i> C. DC [Piperaceae]; <i>Bamin-110</i>	<i>Raru/rari</i>	Shrub	Leaves	Vegetable.
<i>Plantago erosa</i> Walliach [Plantaginaceae]; <i>Bamin-125</i>	<i>Mepi</i>	Herb	Whole plant	i. Vegetable. ii. Fodder.
<i>Plectocomia himalayana</i> Griffith [Arecaceae]; <i>Bamin-89</i>	<i>Tarpi</i>	Climber	Whole plant	Household items and building material.
<i>Pleurotus</i> <i>sps.</i> [Pleurotaceae]; <i>Bamin-54</i>	<i>Tayiing</i>	Fungi	Fruit-body	Vegetable.
<i>Portucala oleraceae</i> Linnaeus [Portulacaceae]; <i>Bamin-16</i>	<i>Lai hamang</i>	Herb	Leaves, whole plant	Vegetable.
<i>Primula denticulata</i> Smith [Primulaceae]; <i>Bamin-102</i>	<i>Bagang rinyo</i>	Herb	Whole plant	Ornamental flower.
<i>Prunus persica</i> (Linnaeus) Stokes [Rosaceae]; <i>Bamin-98</i>	<i>Takung ahii</i>	Tree	Fruits, whole tree	i. Eaten raw. ii. Tree is used as the main alter ( <i>Yugyang</i> ) for important rituals.
<i>Pyrus calleryana</i> J. Decaisne [Rosaceae]; <i>Bamin-81</i>	<i>Piita ahii</i>	Tree	Fruits	Eaten raw.
<i>Pyrus pashia</i> Buchanan-Hamilton <i>ex</i> D. Don [Rosaceae]; <i>Bamin-94</i>	<i>Pecha</i>	Tree	Fruits	Eaten raw.
<i>Quercus griffithii</i> J. D. Hooker & Thomson <i>ex</i> Miquel [Fagaceae]; <i>Bamin-78</i>	<i>Sankhe</i>	Tree	Fruits	Nuts are cooked and eaten.
<i>Quercus semecarpifolia</i> Smith [Fagaceae]; <i>Bamin-81</i>	<i>Saii</i>	Tree	Fruits	Nuts are cooked and eaten.
<i>Rhododendron arboreum</i> Smith [Ericaceae]; <i>Bamin-84</i>	<i>Senyi apu/ Senyi-muru</i>	small tree/ shrub	Flowers, whole plant	Ornamental plant.
<i>Rhus chinensis</i> Miller [Anacardiaceae]; <i>Bamin-80</i>	<i>Tamo</i>	Tree	Fruits	i. Eaten raw. ii. For stomach disorder.
<i>Rubia manjith</i> Roxburgh <i>ex</i> Fleming [Rubiaceae]; <i>Bamin-137</i>	<i>Tiiming</i>	Climber	Roots, stem	i. Roots are powdered and mixed with water to get relief from cold, cough and dysentery. ii. Stem is used for dying traditional cloths.
<i>Rubus ellipticus</i> Smith [Rosaceae]; <i>Bamin-71</i>	<i>Jilyung</i>	Shrub	Fruits	Eaten raw.
<i>Rubus niveus</i> Thunberg [Rosaceae]; <i>Bamin-74</i>	<i>Henchi</i>	Shrub	Fruits	Eaten raw.

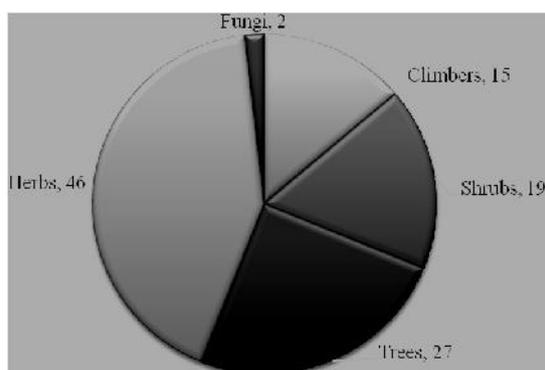
## 524 Traditional NTFPs used by Apatani tribe

Name of plant [Family]; Voucher specimen	Local name	Habit	Parts used	Uses
<i>Rubus rosaefolius</i> Smith ex Baker [Rosaceae]; <i>Bamin-72</i>	<i>Hitungbulung</i>	Shrub	Fruits	Eaten raw
<i>Saccharum arundinaceum</i> Retzius [Poaceae]; <i>Bamin-127</i>	<i>Peji Paelo</i>	Shrub	Leaves	Leaves for tying animals sacrificed during rituals and during chanting in religious ceremonies.
<i>Saccharum spontaneum</i> Linnaeus [Poaceae]; <i>Bamin-105</i>	<i>Paelo</i>	Shrub	Stems	House building, mat, partition wall, etc.
<i>Sageretia filiformis</i> (Roth) G. Don [Rhamnaceae]; <i>Bamin-126</i>	<i>Miiji</i>	Tree	Bark, Stem	Bark or stem is burnt and its smoke is used for giving heat on the corn for relief and cure.
<i>Solanum kurzii</i> Brace ex Prain [Solanaceae]; <i>Bamin-113</i>	<i>Byako</i>	Herb	Fruits	i. Fruit as vegetable. ii. Eaten with a little salt in case of stomach and is good for expelling worms.
<i>Solanum myriacanthum</i> Dunal [Solanaceae]; <i>Bamin-44</i>	<i>Siit Byako</i>	Herb	Seeds	Seeds are chewed to get relief from toothache.
<i>Solanum nigrum</i> Linnaeus [Solanaceae]; <i>Bamin-40</i>	<i>Hiiro hamang</i>	Herb	Fruits, leaves, stem	i. Fruits eaten raw. ii. Leafy stem as vegetable.
<i>Sonchus brachyotus</i> DC. [Asteraceae]; <i>Bamin-85</i>	<i>Kochi/pakuharbu hamang</i>	Herb	Leaves, whole plant,	i. Leaves as vegetable. ii. The extract of whole plant is used as medicine for stomach disorder.
<i>Strobilanthes helictus</i> T. Anderson [Acanthaceae]; <i>Bamin-83</i>	<i>Tagging</i>	Herb	Young leaves	Vegetable.
<i>Symplocos paniculata</i> Miq[ue]l [Symplocaceae]; <i>Bamin-117</i>	<i>Sankhi</i>	Shrub	Whole plant	Fencing material.
<i>Trichosanthes tricuspidata</i> Loureiro [Cucurbitaceae]; <i>Bamin-133</i>	<i>Bullungkoa</i>	Climber	Fruits	Fruits occasionally used for boils and sore and considered as poisonous.
<i>Vibrunum foetidum</i> Wallich [Caprifoliaceae]; <i>Bamin-68</i>	<i>Yoyu</i>	Shrub	Fruits	Eaten raw.
<i>Wallichia oblongifolia</i> Griffith [Arecaceae]; <i>Bamin-100</i>	<i>Tisse</i>	Tree	Rhizome, stem	As food. It is an alternate for food during drought periods.
<i>Zanthoxylum armatum</i> DC. [Rutaceae]; <i>Bamin-123</i>	<i>Yorkhung</i>	Tree	Fruits	i. Fruits edible. ii. Dried fruits taken during cold and cough and also eaten raw as a good appetizer. iii. Used as spices in boil foods and chutney.

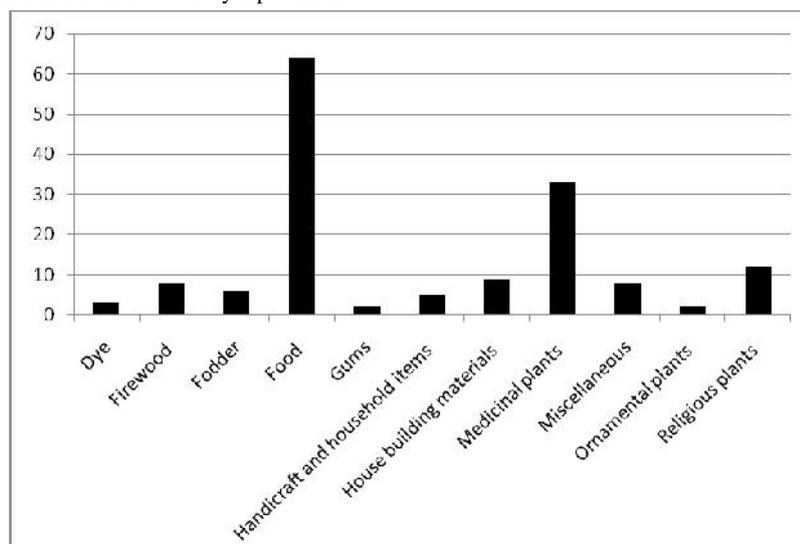
can be grouped in 11 distinct categories according to their utility pattern *viz* food (vegetables, fruits, mushrooms), medicinal, fodder, firewood, house building materials, household items, dyes, gums, ornamental, ritual and miscellaneous (Fig 3). The group food is the dominant one with a total of 64 species followed by medicinal plants (33 spp), religious plants (12 spp), house building materials (9 spp), firewood (8 spp), miscellaneous (8 spp), fodder (6 spp), handicrafts and household items (5 spp), dyes (3 spp) and gums and ornamental plants (2 spp each). In the food plants vegetable is represented by 40 species, fruits by 22 species and mushrooms by 2 species which are either eaten raw or cooked form. Eight species are grouped in the miscellaneous category which include plant used for poison, trap, packaging etc. Among the vegetables the species like *Acmella paniculata*, *Allium tuberosum*, *Clerodendrum glandulosum*, *Houttuynia cordata*, *Cardamine hirsuta*, *Portulaca oleracea*, *Piper pedecellatum* etc. are some of the commonly available and mostly preferred

**Table 2.** High priority species for management and socioeconomic upliftment

Species	Type of NTFP	Marketing potentiality	Status of occurrence	Management prospects*
<i>Acorus calamus</i>	Medicinal	Outside	Common	HG, AS, CF
<i>Allium hookeri</i>	Spice, condiments	Locally and outside	Common	HG, CF
<i>Allium tuberosum</i>	Spice, vegetable	Locally and outside	Common	HG, AS
<i>Cerasus cerasoides</i>	Fruit	Locally	Frequent	HG, CF
<i>Choerospondias axillaris</i>	Fruit	Locally	Rare	HG, CF
<i>Clerodendrum colebrookianum</i>	Medicinal, vegetable	Locally	Common	HG, AS
<i>Clerodendrum glandulosum</i>	Leaves	Locally	Common	HG, CF
<i>Litsea cubeba</i>	Spices	Locally and outside	Frequent	HG, CF
<i>Magnolia champaca</i>	Edible fruit	Locally	Frequent	HG, CF, AS
<i>Myrica esculenta</i>	Fruit	Locally	Frequent	HG, CF
<i>Phyllostachys manii</i>	House building	Locally and outside	Common	HG, CF, AS
<i>Piper pedicellatum</i>	Vegetable	Locally	Frequent	HG, LP
<i>Pyrus pashia</i>	Fruit	Locally	Frequent	HG, CF
<i>Rubia manjth</i>	Dye, medicine	Outside the region	Common	HG, CF, AS
<i>Chimonocalamus griffithianus</i>	Vegetable, firewood, house building	Locally and outside	Common	HG, CF
<i>Solanum kurzii</i>	Fruit	Locally	Common	HG, CF, AS
<i>Solanum myriacanthum</i>	Fruit	Locally	Common	HG, CF, AS
<i>Zanthoxylum armatum</i>	Spice and medicine	Locally and outside	Common	HG, CF, AS

**Fig. 2:** Habit wise grouping of the plant species used by Apatani people

by the tribals. It has been found that commonly the leafy vegetables are consumed in simple boiled form with addition of just a pinch of salt and water. To increase the taste and flavor sometime chilies, zinger, bamboo shoots and garlic are also added. Some of the species used

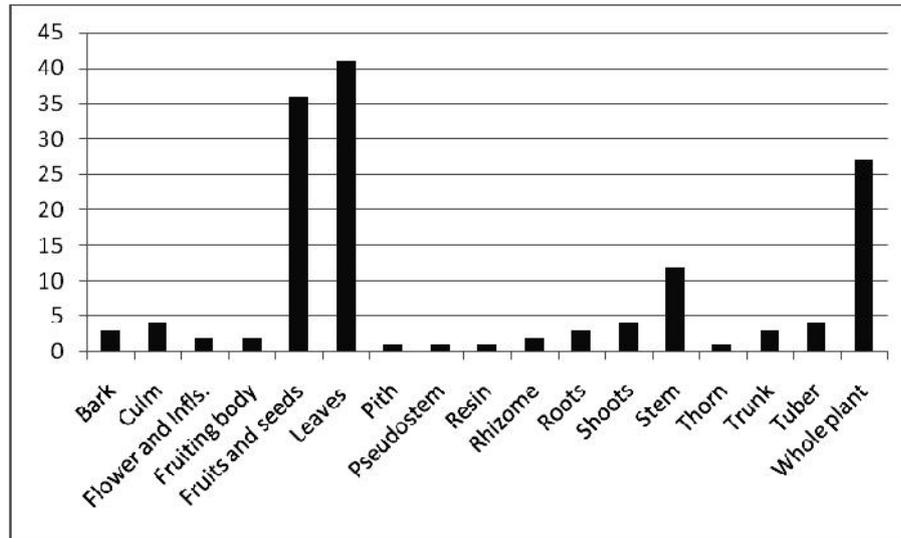


**Fig. 3:** Categorization of recorded species based on utility pattern

for vegetable like *Clerodendrum glandulosum*, *Solanum kurzi*, *Rhus chinensis*, *Houttuynia cordata*, *Gynostemma pedata*, *Centella asiatica*, *Mahonia napaulensis*, etc. have also medicinal properties and used as medicine for various stomach disorders. The other important species used medicinally are *Acorus calamus*, *Anisomeles ovata*, *Gynostemma pedata*, *Mikania micrantha*, *Oxalis corniculata*, *Rubia manjith*, etc. Among the fruit species *Pyrus pashia*, *Prunus spp*, *Magnolia champaca* and *Myrica esculenta* are highly preferred by the Apatani's because of their taste, nutrient value and easy availability. As the other tribes of northeast India, the use of bamboos is another aspect of Apatani livelihood. The bamboo species used extensively are *Neomicrocalamus manii*, *Chimonocalamus callosus*, *Chimonocalamus griffithianus*, *Dendrocalamus hamiltonii*, *Phyllostachys manii*, *Eremocaulon capitatum* etc. However, the *Dendrocalamus hamiltonii* occur naturally only in areas of lower elevation and attempted for cultivated by few people. Among the plant parts used, it has been found that the leaf is dominated and used in maximum cases (41 spp) followed by fruits (36 spp), whole plant (27 spp), and stem (12 spp) where more than 10 species are used in each cases. The other parts like shoot, tuber, bark, culm, root, seed, flower, rhizome, pith, resin and thorn are also used but the number of species used in each cases is ranges from 1 to 4 species only (Fig 4). The present investigation revealed that about 20 NTFP species are found strongly attached socio-culturally to the Apatanis as these species are preferred and used in various cultural performances and rituals. Plants like *Allium tuberosum*, *Angiopteris evecta*, *Artemisia indica*, *Berberis wallichiana*, *Calamus acantospathus*, *Castanopsis hystrix*, *Cyathea gigantea*, *Dicranopteris linearis*, *Eremocaulon capitatum*, *Kavalama urens*, *Prunus persica*, *Phyllostachys manii*, *Molinieria recurvata*, *Saccharum arundinaceum* etc. are some such traditionally preferred plants. Except few almost all the species are collected by the communities from the wild vegetation of Ziro and adjacent region.

About 158 species of ethno medicinal plants used by the Apatanis have been reported by Kala (2005), which includes both naturally growing as well as cultivated species like *Hibiscus rosa-sinensis*, *Murraya koenigii*, *Zingiber officinale*, etc. Such cultivated species are not included in the present study as the study is aimed for the NTFPs naturally found in

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**Fig. 4:** Various plants part used with number of species.

the vicinity of the study area and can be managed. When compared with the other tribes, it has been found that about 50 plant species including *Artemisia indica*, *Ageratum conyzoides*, *Acorus calamus*, *Castanopsis hystrix*, *Allium tuberosum*, *Cardamine hirsuta*, *Litsea cubeba*, *Magnolia champaca*, *Zanthoxylum armatum*, *Impatiens racemosa*, *Centella asiatica*, *Angiopteris evecta*, *Clerodendrum colebrookianum*, *Plantago erosa*, *Houttuynia cordata*, *Berberis wallichiana*, and *Castanopsis indica* recorded in the present study are also found to be used in similar way by other communities of the state as reported by various authors (Murtem 2000; Kar 2004; Yonggam 2005; Kar *et al* 2005; Angami *et al* 2006; Tag *et al* 2006; Bhuyan, 2007, Tarak *et al* 2009; Srivastava & Adi community 2009; Sarmah 2006, 2010).

Srivastava *et al* (2010) in their studies on indigenous biodiversity of Apatani plateau reported about 100 species used by the Apatani and adjacent Nyshi communities. It has been found that about 45 species recorded in the present study are not reported by them. Among these the important and highly preferred species like *Angiopteris evecta* (food), *Alnus nepalensis*, *Ficus auriculata* (fruit and firewood), *Ficus hookeriana*, *Kavalama urens*, *Castanopsis hystrix*, *Eremocaulon capitatum* (in religious and rituals); *Cardamine hirsuta*, *Choerospondias axillaris* (fruits), *Piper pedicellatum*, *Gonostegia hirta*, (vegetable) *Colocasia affinis* (vegetable and fodder).

A number of species reported in the present study has high commercial potential which can be used for socio-economic development of the Apatani community. Some such potential species include *Litsea cubeba*, *Magnolia champaca*, *Rubia manjith*, *Zanthoxylum armatum*, *Piper pedicellatum*, *Myrica esculenta*, *Clerodendrum glandulosum*, *Phyllostachys manii*, *Solanum myriacanthum*, *Choerospondias axillaris* etc. Based on the local preferences and high commercial feasibility, 18 species have been identified those can be cultivated and managed in various agricultural systems. The details of these species are provided in Table 2. The efficient management of the selected species those grow luxuriantly in the locally prevalent climatic conditions may become the source of regular revenue generation particularly for the poor section of the community.

### CONCLUSION

The Apatani community has rich traditions and cultural practices and the forest resources play a crucial role in fulfilling the daily requirements. The NTFPs still play a significant role in the livelihood of the community. However, except few, little attention has been paid for the cultivation and management of majority of the NTFPs producing species. As the Ziro is well connected to the state capital Itanagar and also the marketing centers of Lakhimpur district in Assam, the sustainable management and harvesting of commercially viable species can easily be linked to the markets and thus may boost the economy of the farmers.

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