Observations on Useful Underutilized Wild Food Plants Among the Tharu Tribal of Uttar Pradesh for Sustaining Local People, their Livelihood and Maintaining Biodiversity

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Introduction

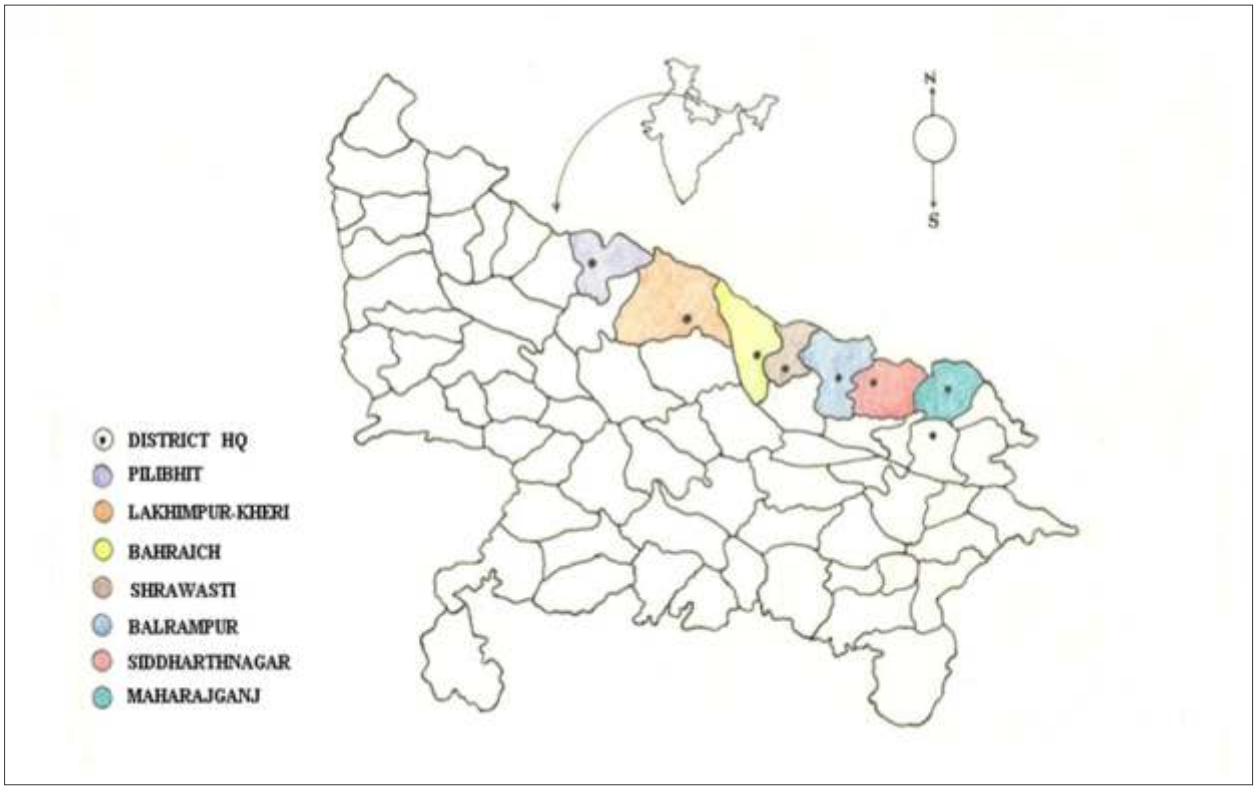
Millions of people, mostly in developing countries, derive a substantial part of their subsistence and income from wild plant products. Underutilized wild edible plants (UWEP) in the forests provide staple food for indigenous people, serve as complementary food for non-indigenous people and offer an alternative source of cash income. The underutilized WEP of Indian origin is directly connected with the socio-economic conditions and tribes living in the remote and close proximity to the forests and fragile ecosystems. They are important nutrient and vitamin supplements for indigenous people, need their full utilization in precedential times may also serve as need of the future. In the times of food shortage, UWEP resources reduce the vulnerability of local communities to food insecurity and provide a buffer. For the development of new food crops through domestication they have substantial potential for hybridization and selection and provide a genetic resource pool.

Many valuable wild food plants are familiar to certain areas or to certain communities but are unknown to others. In view of the rapid decline of traditional knowledge on UWEP and increased reliance on processed food, documentation and evaluation of the traditional knowledge related to the diversity, usage, and status of UWEP, its conservation are crucial and urgent need of the hour. UWEP species are still largely ignored in land use planning and implementation, in the economic development, and in biodiversity conservation endeavours.

The state of Uttar Pradesh is botanically rich on account of its diverse forests, rivers, valleys and hillocks. It has unique physical and ethnic diversity. Large numbers of tribal and aboriginal populations like Tharus, Gond, Kols, Baiga Cheros, Kharwar, Korwa, Ghasiya, Agaria, Panika, Oraon, Mushar and Shaharia etc. inhabit in the state. Tharu tribes are the important tribe chiefly inhabited in the districts like Lakhimpur-Kheri, Pilibhit, Bahraich, Balrampur Shrawasti, Siddharthnagar and Mahrajganj of the terai region in the foothills of Himalaya, Uttar Pradesh. They collect and utilize various plants, leaves, roots, rhizomes, tubers, flowers, fruits and seeds of many wild as well as cultivated plant species grown in ambient vegetation for their dietary requirements, nutrition and food supplements. (Ambasta, 1986; Jain, 1980; Maheshwari *et al.* 1981, 1986; Singh *et al.* 1994; Singh & Prakash 1994). Considering this, the study was undertaken to gather data on diversity, traditional knowledge, economic potential, and conservation value of UWEP in the forests of terai region of the state.

Geology, Soil and Climate

Uttar Pradesh is a state located in the northern part of India. With an area of 243,290 km^2, Uttar Pradesh covers a large part of the highly fertile and densely populated upper Gangetic plain. It shares an international border with Nepal to the north. Other states along Uttar Pradesh's border include Uttarakhand, Haryana and Delhi to the north and northwest; Rajasthan on the west; Madhya Pradesh on the south; Chhattisgarh and Jharkhand on the south east; and Bihar on the east. The climate of Uttar Pradesh is predominantly subtropical; however, weather conditions change significantly



The MAP of Uttar Pradesh showing study area in Terai Forests

with location and season: Temperature: Depending on the elevation, the average temperatures vary from between 12.5–17.5 °C in January to 27.5–32.5 °C in May and June. The highest temperature recorded in the state was 49.9 °C at Gonda on 8 May 1958. Rainfall: Rainfall in the state ranges from between 1,000–2,000 mm in the east to 600–1,000 mm in the west. About 90 percent of the rainfall occurs during the southwest monsoon, lasting from approximately June to September. With most of the rainfall concentrated during this four-month period, floods are a recurring problem and cause heavy damage to crops, life and property. Agriculture is a significant part of Uttar Pradesh's economy. (Map-1)

Tharus Tribal: Lifestyle and Culture

The Tharus are one of the tribes of Utter Pradesh mainly inhabiting the forest areas in the Himalayan foothills of Mahrajganj, Balrampur, Bahraich and Lakhimpur-Kheri districts in close vicinity to the territory of Nepal. They are one of the important tribe in the Dun valley Someshwar ranges of west champaran in Bihar in a compact belt, extending from Nainital in west to Darjeeling in the east. The Tharus and Bhoxas are the only tribes who could survive in the malaria affected area of the Terai region. Infact, they have been struggling hard to survive against the natural force for centuries and have led a secluded life. Even today, the Tharus depend upon the outside world for only such articles as salt, kerosene oil and cloth. They make use of many plant species to meet with their day-to-day needs.

The Tharus are divided into a number of endogamous sects. While the Tharus of Nainital and a majority of them in the Lakhimpur Kheri are Ranas; the Dangurias are the dominant group of the Bhabhar areas of Gonda and Bahraich districts. The Kathuria are found in small number in Lakhimpur-Kheri, Bahraich and the Balrampur district. In Maharajganj districts, most of the Tharus, however, come from Kathuria stock. There are many other sects found in small number in Utter Pradesh but in Nepal in sizeable numbers like Kumhar, Jogi,

Malhauria, saunea, Khunka, Garauhra and Pochila can be located. The Tharus celebrate most of the Hindu festivals; worship Hindu Gods along with the pantheon of their ancient gods. The Hindu Gods, popular among the Tharus, are, Shankar (Lord Shiva), his consort parvati and Hanuman, the Monkey god, while some of the tribal gods, deities and spirits worshiped by the Tharus are Mote Baba, Katiar Baba, Bhuinya, Nagnihai, Jwala, Meri Masan and other. Usually, there is a small place of worship both inside and outside the house. The witch doctor that drives away the evil spirits by his 'Mantras' (enchantment) responsible for animals is called the 'Bharra'. In order to ward off an evil spirit, he hold some ash of cow dung, or grains of mustard seed or wild nuts in his left hand, and after breathing some mystical virtue into them by the utterance of a spell, he force the patient to eat them or have them tied to his arm. The Tharus worship a piece of 'Saku' (*Shorea robusta*) wood in the shape of 'lingam' or phallus, symbolic of Lord Shiva or Mahadeva, near which a long stick is pitched with a bit of red cloth fastened to the object of worship. They worship Shiva (known chiefly among them by the name of 'Bhirava' and 'Thakurs') as the God of reproduction, the stone lingam being the symbol. It is usual practice of a. Tharus to erect a mud mound in fronts of his house, and fix an upright pole in the centre to represent the presence of this phallic divinity. Tharus also believe in Supreme Being, they call Narayana, who gives them sunshine, rain and crops, but they don't have proper idea, how this great far off being is to be approached and worshiped. Nature worship among them represented by two main deities of importance, namely Madhu, the god of intoxicating drink, especially of the rice wine ('Jaund') made by themselves and Dharchandi; the patroness of cattle. The mound dedicated to 'Dharchandi' is studded with the short wooden crosses, on which rice, pulses and other grains are offered on leaf plates. Her shrine is so placed that all the cattle of village together with the swine, sheep and goats pass by it on going out to graze, and repass it on their return. When the cattle are sick or die, more valuable offering are made in large quantity. They also worship plants, such as 'Pipal' (Ficus religiosa.) and 'Aam' (*Mangifera indica*.) and animals, like, cows, serpents and monkeys. The usual age of the marriage for men and women is about fifteen to eighteen. The father of either side arranges the marriage contract, and the couple, for which the negotiation is made, has no say in the matter. The father of groom goes over to the village or where the bride's fathers reside and after making his proposal for the price to be paid for the bride, offer him a drink of wine. If the present is accepted the bargain is the struck. Both the parties faithfully keep the contract once made. In some, regions, the infant marriage is also arranged. Except the Tharus of Nainital, all other Tharus freely intermarry in Nepal. Divorce is easy and widow marriage is permissible. The Tharus community celebrates festivals before harvesting any crop and has a ritual before eating the new grains. In the spring, they observe the annual festivals fire resembling the many respects, the Holi festival (festival of colors). A mound of earth is prepared, and a pole is fixed in its centre in a vertical position. The assembled people offer 'hardi' (*Curuma longa*), hemp (*Cannabis sativa*) 'Dhatura' (*Datura metel*, *D. innoxia*) and other odorous herbs upon the pole placed and mound. The straw, stubble and sticks are then piled around the pole, and the oldest or most respected man in the assembly puts fire to it. Thereafter, they amuse themselves with the dancing, playing the drums and 'mridang' pelting each other with colored powder, signing amorous songs and cracking on lascivious jokes. In the evening they eat fish, meat rice and drink liquor. The festival is also celebrated for seven days. An other festival Mesh Puja is also celebrated during the later part of the rainy season by cutting grasses, which is followed a month later by harvesting of rice crop. In general the festivals are celebrated with a series of ceremonies and sacrifices. During these occasions plants like, 'Bel' (*Aegle marmelos*) 'Neem' (*Azadirachta indica*), 'Tulsi' (*Ocimum sanctum*), 'Paras, Dhak' (*Butea monosperma*), 'Peepal' (*Ficus religiosa*) 'Bargad' (*F. benghalensis*), 'Aam' (*Mangifera indica*), 'Kela' (*Musa paradisiaca*), 'Ber' (*Ziziphus mauritiana*) and 'Jamun' (*Syzygium cumini*) are used to decorate the house and front yard. The Tharus live by hunting and fishing, gathering forest herbs, fruits and vegetable grazing cows and buffaloes making ghee (clarified butter) and rearing pigs, fowls and goat. The animals which they chiefly

Some popular underutilized wild food plants in the area

Nymphaea nouchali

Nelumbo nucifera

Physalis minima

Helminthostachys zeylanica

Agaricus campestris

Ipomea aquatica

Carissa opaca

Dillenia pentagyna

hunt are the wild boar, deer, antelope and hares. Some time on scarcity of food, or pressurized to eat they eat field rats. They eat fowls, fish and tortoises. If there stock of meat is more than that they can consume at a time they preserve it by cutting it into strips and the drying in the sun. The small fish is dried, powded and mixed with rice to form a delicacy. Usually, lentil (*Lens culinaris*.) is used as pulse. The Tharus have their traditional dance performed by both the sexes of all age groups. They dress themselves in colorful clothes and dance to the beats of the drums and 'mridangs' and make great amusements.

Result

100 Underutilized wild edible Plant species used by the tribal population for meeting their nutritional, minerals, fats, carbohydrates and vitamins requirements in the terai area of the state have been arranged in tabular form (Table-1) with their botanical names, family, local names, brief ecology, uses and conservation status etc.

Discussion and Conclusion

The study revealed that there are 86 under-utilized wild edible plant species under 83 genera belongs to 3 fern family, 1 fungal and 54 angiosperm families found in the terai area, such as Pilibhit, Lakhimpur, Bahraich, Balrampur and Shrawasti districts of Uttar Pradesh adjacent to the foothills of Himalaya. The tribal consume these plants either raw or after cooking, roasting or frying. These available plant species are chief source of essential nutrients such as proteins, vitamins, minerals, fats and carbohydrates.

The younger leaves and shoots of *Diplazium esculentum, Marsilia minuta, Ipomea aquatica, Boerrahavia diffusa, Helminthostachys zeylanica, Hemidesmus indicus, Curculigo orchioides, Bauhinia purpurea, Centella asiatica, Ficus virens, Leucas aspera, Phyllanthus fraternus, Rumex dentatus, Solanum nigrum, Trianthema portulacastrum*, are cooked as delicious leafy vegetable in the area. The rootstock of *Nymphaea nouchalii*, is eaten by the children with taste among the tharu tribal in the area. The leaf pup of *Aloe vera*, is roasted with butter, dry nuts or dry fruits and sugar is added to a taste eaten as sweets in the area. The small buds and flowers of *Bombax ceiba, Crotolaria juncea* are fried with mustard oil, chillies, condiments, added salt to a taste and eaten as a vegetable. The fruits of *Xeromphis uliginosa, Capparis zeylanica* are light boiled, rind separated, cut into pieces, fried with mustard oil, chillies, condiments, added salt to a taste and eaten as a vegetable. The seeds of Holoptelea integrifolia are peeled and eaten as tasty nuts. The roots of *Pueraria tuberosa*, *Costus speciosus, Asparagus racemosus,* are light boiled, rind separated, cut into pieces, fried with mustard oil, chillies, condiments, added salt to a taste and eaten as a vegetable.

S. No.	Botanical Name	Family	Local Name	Uses	Ecology	Conservation Status
1	*Agaricus campestris* L.	Agaricaceae	Dharti Ka Phool	Cooked with mustard oil, and eaten as vegetable	Occurs frequently in Sal forests as ground flora	Common
2	Alangium salvifolium (L.f.) Wang.	Alangiaceae	Dhera, Ako	Ripe fruits eaten	Occurs in open areas near the village side	Common
3	*Aloe vera* (L.) Burm .f.	Liliaceae	Gheekwar	The pulp cooked and eaten as sweet Halwas	Found throughout the state	Common
4	*Amaranthus spinosus* L.	Amaranthaceae	Kataili chorai	Tender shoots and leaves eaten as vegetable.	Common in open waste land	Common
5	*Amaranthus viridis* L.	Amaranthaceae	Chaulai	Shoots and leaves used as vegetable	Occurs commonly on wasteland	Common
6	*Amorphophallus paeoniifolius* Dennst.	Araceae	Elephant foot, Zimi Kand	The corms boiled along the leaves of Tamarindus indica and fried with spices and eaten as vegetable.	Occurs commonly on wasteland	Common
7	Ampelocissus *latifolia* (Roxb.) Planch.	Vitaceae	Panibel, Jungli Angoor	The berries eaten either raw or cooked and used as vegetable.	Occurs occasionally along with the edges of Sal forests.	Common
8	*Anthocephalus chinensis* (Lam.) A. Rich.ex Walp.	Rubiaceae	Kadamba	Ripe fruits eaten	Throughout the terai areas.	Common
9	*Antidesma acidum* Retz.	Euphorbiaceae	Banmusari	The ripe fruit eaten by children and local people.	Occasionally along with the edges of Sal forests and in open areas.	Common
10	*Arisaema tortuosum* Schott.	Araceae	Jhagpapri	Stems cooked and eaten as vegetable	Occasionally in the terai area of the state	Common
11	*Artocarpus lacucha* Ham.	Moraceae	Barahar	The sweet ripe fruits eaten	In asociación with Mallotus phillippinensis and Mitragyna parvifolia etc.	Locally threatened
12	*Asparagus racemosus* Willd.	Liliaceae	Shakakul Satavari	Tuberous roots and fried used as food.	Climbing on small trees	Common
13	*Averrhoa carambola* L.	Oxalidaceae	Kamrakh Amrakh	The ripe and unripe fruits eaten	Occurs frequently in moist open areas and sometimes planted	Locally threatened
14	*Basella alba* L.	Basellaceae	Poi, Poy	Leaves used as vegetable.	Found in mixed forests climbing on the shrubs and trees	Common
15	*Bauhinia vahlii* W. & A.	Caesalpiniaceae	Mohlain	Seeds eaten	Climbs on Sal trees	Common
16	*Bauhinia variegata* L.	Caesalpinaceae	Kachnar, Koylar	Shoots and buds boiled, squeezed, fried and eaten	Associated with Ziziphus mauritiana and Trewia nudiflora etc. occurs in the mixed forest	Common
17	*Boerhavia diffusa* L.	Nyctaginaceae	Punarnawa, Patharchatti, Gadahpurna	Tender shoots and leaves fried and eaten as vegetable	Occurs on wasteland and in the out skirts of the forests	Common
18	*Bombox ceiba* L.	Bombacaceae	Semal, Semar	Flower buds fried and eaten as vegetable.	Common in the grassland.	Common

S. No.	Botanical Name	Family	Local Name	Uses	Ecology	Conservation Status
19	*Borassus flabellifer* L.	Arecaceae	Tar	The pulp of ripe fruit eaten. The tree largely tapped for the 'toddy' beverage.	Common in the grassland and open areas in the area.	Common
20	*Bridelia squamosa* Gehrm.	Euphorbiaceae	Khaja	The ripe fruit eaten by locals and children.	In association with Aegle marmelos and Adina cordifolia etc. found in Sal forests	Common
21	*Buchanania lanzan* Spreng.	Anacardiaceae	Chironji, Piyar	The ripe fruits eaten by the local community	Plants associated with Terminalia species.	Locally threatened
22	*Butea monosperma* (Lamk.) Taub.	Fabaceae	Paras, Parasa, Chiula	Flower buds and inflorescence base boiled, fried and eaten as vegetable.	Found in grassland, and mixed forests	Common
23	*Caesulia axillaris* Roxb.	Asteraceae	Panisag	Tender shoots and leaves eaten as vegetable.	Found near marshy places	Common
24	*Capparis zeylanica* L.	Capparaceae	Bhagnaha, Jakham bel	The fruits eaten as vegetable. Also used for pickling.	Found in open area straggling on trees.	Common
25	*Carissa opaca Stapf* ex Haines	Apocynaceae	Karaunda, Karawan	Ripe berries popularly eaten. Unripe fruits made into pickles and chutneys	Occurs in the mixed forest in association with Murraya koenigi, Glycosmis pentaphylla etc.	Common
26	*Centella asiatica* (L.) Urban	Apiaceae	Brahmmi	Tender shoots and leaves eaten as vegetable.	Occurs in shades and marshes	Common
27	*Chenopodium album* L.	Chenopodiaceae	Bathua	Leaves and delicate shoots used as dry vegetable.	Occurs throughout. Cultivated too.	Common
28	*Chlorophytum tuberosum* Bak.	Liliaceae	Safed Musli	Light boiled roots, fried and eaten as vegetable.	Occurs near marshy places and in open	Locally threatened
29	*Coccinia grandis* (L.) Voigt	Cucurbitaceae	Kunduru	Unripe fruits eaten as vegetable	Trailing herb associates with trees like Morus alba and Emblica officinalis etc.	Common
30	*Commelina benghalensis* L.	Commelinaceae	Kantivla	The leaves eaten as vegetable curries and salad.	Occurs in grassland and forest out skirts	Common
31	*Cordia dichotoma* Forst.	Boraginaceae	Lasora	Unripe fruits, sun dried and pickled. Also eaten as vegetables.	Occurs in mixed forests in association with Ziziphus oenoplea and Murraya paniculata	Common
32	*Costus speciosus* (Koenig) Smith	Zingiberaceae	Kewa	Flower buds and young leaves eaten as vegetable.	Occurs in shady and moist places.	Locally threatened
33	*Crotolaria juncea* L.	Fabaceae	Sanai	Light boiled buds eaten as vegetable.	Occurs in grassland and forest out skirts	Common
34	*Curculigo orchioides* Gaertn.	Amaryllidaceae	Kalimushli	Light boiled roots eaten as vegetable.	Occurs in association with Uraria neglecta and Elephantopus scaber in the Sal forests	Common
35	*Curcuma angustifolia* Roxb.	Zingiberaceae	Tikhur	Starch rich corm eaten by the locals	Found in grasslands of terai forests	Common

S. No.	Botanical Name	Family	Local Name	Uses	Ecology	Conservation Status
36	*Dendrocalamus strictus* (Roxb.) Nees	Poaceae	Bans	Delicate shoots made into vegetable and pickles. Seeds edible	Occurs in grassland and out skirts.	Common
37	*Digera muricata* (L.) Mart.	Amaranthaceae	Lehesua	Tender shoots and leaves are fried and eaten	Found near marsh and water bodies	Common
38	*Dillenia pentagyna* Roxb.	Dilleniaceae	Agaii	Lightly boiled unripe fruit fried and eaten as vegetable	Occurs frequently associated with Terminalia bellierica, Bridelia squamosa and Carissa opaca etc. in the Sal forests.	Common
39	*Diospyros exsculpta* Buch.-Ham.	Ebenaceae	Tend, Tendu	The ripe fruits eaten by children and local peoples.	In the Sal forest associated with Holarrhena pubescens and Aegle marmelos etc. of Katarniaghat, sohelwa, sirsia and other terai areas of the state.	Common
40	*Diplazium esculentum* Sw.	Athyriaceae	Lengur, Lunguru	Tender shoots and leaves fried and eaten as vegetable	Occurs in Sal forest and marshy places in the terai region.	Common
41	*Dioscorea bulbifera* L.	Dioscoreaceae	Ratalu	The bulbils boiled, fried eaten as vegetable.	Found along the edges of the forest twining on small trees like Ziziphus maurtiana	Common
42	*Dioscorea glabra* Roxb.	Dioscoreaceae	Ratalu	Tubers cooked and eaten as vegetable	Found along the edges of the forest	Common
43	*Dioscorea hispida* Dennst.	Dioscoreaceae	Bank	Bulbils boiled, fried and eaten as vegetable.	Found in open places	Common
44	*Dioscorea pentaphylla* L.	Dioscoreaceae	Khaniakand	The bulbils used as vegetable.	Found in open places and along the edges of the forest twining on the small trees like Ziziphus maurtiana, and Cassia fistula etc.	Common
45	*Ehretia laevis* Roxb.	Ehretiaceae	Chamror	The ripe fruits eaten by the children	Association with Cassia fistula, Aegle marmelos and Mallotus philippensis in Sal forest.	Common
46	*Emblica officinalis* Gaertn.	Euphorbiaceae	Aonla	Fruits eaten and preserved.	Occurs adjacent to Sal forest in association with Mallotus philippensis and Lagerstroemia parviflora	Common
47	*Erioglossum rubiginosum* Bl.	Sapindaceae	Anga-banga	Ripe fruits eaten by locals and tribals	Occurs frequently in shades. Associated with Shorea robusta and Mallotus philippensis etc.	Common
48	*Ficus benghalensis* L.	Moraceae	Bargad	Receptacles eaten	Found in the open areas of forest.	Common
49	*Ficus hispida* L.f. (Moraceae)	Kathgularia	Kathgularia	Receptacles eaten as vegetable.	Found frequently in waste land adjacent to the mixed forest of the terai areas.	Common

S. No.	Botanical Name	Family	Local Name	Uses	Ecology	Conservation Status
50	*Ficus palmata* Forsk.	Moraceae	Jungli Anjir, Dudhla	Ripe fruits eaten by local people and children	Found commonly associated with Adina cordifolia, Tectona grandis and Mitragyna parvifolia	Common
51	*Ficus racemosa* L.	Moraceae	Gular	Unripe receptacles used as vegetable.	Found frequently in the open areas of mixed forest.	Common
52	*Ficus virens* Ait.	Moraceae	Pakar Pilkhan	Buds eaten as vegetable.	Found frequently in the open areas of mixed forest.	Common
53	*Flacourtia indica* Merr.	Flacourtiaceae	Katai	Ripe fruits eaten by children and local people	Frequently found in association with Emblica officinalis, Trewia nudiflora and Ziziphus mauritiana etc. at the edge and in the open situation.	Common
54	*Flacourtia jangomas* (Lour.)	Salicaceae	Paniyala	Ripe fruits eaten by the locals.	Found at edge of forest.	Common
55	*Grewia hainesiana* Hole	Tiliaceae	Phalasa, Pharsa	Ripe fruits eaten	Common in the mixed forest area in association with Murraya koenigii and Glycosmis mauritiana.	Common
56	*Grewia hirsuta* Vahl	Tiliaceae	Gursakari	Ripe fruits eaten by locals and children	Commonly grown at the edge of the mixed forest and grassland of the area.	Common
57	*Glycosmis mauritiana* Tanaka	Rutaceae	Makranda, Ban Nibu	Fruits eaten by local people and children	Found commonly associated with Murraya paniculata, Clerodendrum infortunatum and Holoptelea integrifolia etc.	Common
58	*Helminthostachys zeylanica* Hook. f.	Ophioglossaceae	Kamraj	Tender shoots and leaves eaten as vegetable	Occurs occasionally in the sal and mixed forest in association with Glycosmis species.	Common
59	*Holarrhena pubescens* Wall. ex G. Don	Apocynaceae	Koraya, Kurchi, Dudhi	Flower buds and inflorescence base boiled, fried and eaten as vegetable	Occurs commonly associated with Terminalia bellirica and Dillenia pentagyna in the Sal forest of the terai area.	Common
60	*Ipomea aquatica* forsk.	Convolvulaceae	Karamua	Shoots and leaves fried and eaten.	Common in marshy, muddy places and ponds.	Common
61	*Leucas aspera* Spreng.	Lamiaceae	Goom	Young leaves and shoots eaten	Occurs as weed in cultivated fields	Common
62	*Limonia acidissima* L.	Rutaceae	Kaintha	Sweet sour pulp of the fruit used in sauce & pickle. Leaves used as aroma enhancer.	Occurs in the mixed forest asocited with Acacia catechu and Adina cordifolia etc. in the terai forest.	Common
63	*Luffa cylindrica* (L.) Roem.	Cucurbitaceae	Ghia taroi	Fruits cooked and used as vegetable	A common trailing herbs on the waste land	Common
64	*Madhuca longifolia* (Koen.) *Macbride* var. *latifolia* Chev.	Sapotaceae	Mahua	Flowers are used for beverage locally called "Tharra". Fruits eaten as vegetable. Seeds good source of oil	Occurs commonly in the mix forest in the terai area in association with Adina cordifolia, Dalbergia sissoo and Mitragyna parvifolia etc.	Common
65	*Manilkara hexandra* (Roxb) Dub	Sapoataceae	Khirini	The fruits edible and best sources of pickles & sauces.	Often planted near tribal habitats and villages in the terai areas.	Common

S. No.	Botanical Name	Family	Local Name	Uses	Ecology	Conservation Status
66	*Marsilia minuta* L.	Marsiliaceae	Tinpatiya Sag	Young leaves and shoots fried and eaten as vegetable	Occurs along with forest roads and at the edges of the forests.	Common
67	*Miliusa velutina* (Dunal) Hook.f.	Annonaceae	Beri	Fruits cooked and used as vegetable	Common with in the Sal forest of terai region.	Common
68	*Momordica dioica* Roxb. ex Willd.	Cucurbitaceae	Kheksa, Golkandra	Unripe fruits eaten as vegetable.	Occurs occasionally on the edge of the forest	Common
69	*Moringa oleifera* Lam.	Moringaceae	Sahjan	Young fruits boiled and eaten as vegetable. Also preserved as pickles	Occurs commonly in the mixed forest and grassland near the villages.	Common
70	*Morus alba* L.	Moraceae	Tut	The ripe fruit eaten	Occurs in the mixed forest in association with Glycosmis maurtiana, Aegle marmelos and Ehretia leavis.	Common
71	*Murraya koenigii* (L.) Spreng.	Rutaceae	Kathnim	The leaves used for frying the pulses and making Raita & Kadhies	In association with Glycosmis mauritania, Flemingia strobilifera and Carrisa opaca in the mixed forest of terai area	Common
72	*Nelsonia canecsens* (Lamk.) Spreng.	Acanthaceae	Jara	The roots mixed in cooked rice and fermented to prepare liquor.	Occurs frequently in marshy and moist places in Sal forests	Common
73	*Nelumbo nucifera* Gaertn.	Nelumbonaceae	Kamal	Rhizome eaten as vegetable. Unripe Seeds popularly eaten in the area.	In association with Nymphaea pubescens and Trapa natans found in ponds	Common
74	*Nymphaea nouchali* Burm. f.	Nymphaeaceae	Chhota Kamal	Butter roasted seeds mixed with sugar eaten. Rhizomes cooked as a vegetable.	In association with Nelumbo nucifera and Trapa natans found in the ponds of the terai region in state	Common
75	*Nymphaea stellata* Willd.	Nymphaeaceae	Kumud	Rhizome collected kept in the shadows and cooked as a vegetable.	Found in the ponds in association with Nelumbo nucifera and Trapa natans in the terai region of state	Common
76	*Ophioglossum reticulatum* L.	Ophioglossaceae	Jivia	Tender shoots and leaves fried and eaten as vegetable	Occurs occasionally in the marshy places	Locally threatened
77	*Oxalis corniculata* L.	Oxalidaceae	Khatti Buti	The younger leaves & shoots fried in edible oil with chilies and salt to a taste used as vegetable.	In moist places and waste land in the forest area	Common
78	*Phoenix sylvestris* Roxb	Arecaceae	Chindi, Khajuri	Sap is trapped and fermentation to prepare alcoholic drink. Ripen fruits edible after removing crown the soft pith	Occurs frequently in open places and grassland in the area	Common

S. No.	Botanical Name	Family	Local Name	Uses	Ecology	Conservation Status
79	*Phyllanthus fraternus* Webster	Euphorbiaceae	Bhui Aonla	Younger leaves and shoots light boiled, squeezed, and fried with edible oil, chilies and salt eaten as vegetable.	In association with Cassia tora, Lecus aspera etc.in shady and marshy places, as weed in cultivated field near the Sal forest	Common
80	*Physalis minima* L.	Solanaceae	Makoicha, Rasbari	Ripe fruit edible, sweet in taste.	Occur occasionally in moist places and waste land near swamps	Common
81	*Pithecellobium dulce* (Roxb.) Benth.	Mimosaceae	Jungle Jalebi	The pulp of ripe fruit largely eaten	In association with Adina cordifolia, Mallotus philippenensis and Aegle marmelos.	Common
82	*Portulaca oleracea* L.	Portulacaceae	Kulfa	Younger leaves and shoots fried and eaten as vegetable.	Weed in association with Centella asiatica, Eclipta prostrata and Oxalis corniculata.	Common
83	*Portulaca quadrifida* L.	Portulacaceae	Chota lonia	Eaten as vegetable.	Common weed in moist soils	Common
84	*Pueraria tuberosa* (Roxb ex Willd.) DC	Fabaceae	Vidari kand	Tubers boiled, fried and eaten as vegetables.	In mixed forest in association with Flemingia chapper, Desmodium hetrocarpon and Glycosmis mauritiana etc.	Locally rare
85	*Rumex dentatus* L.	Polygonaceae	Jungli Palak	Tender leaves, light boiled and eaten as a vegetable.	In marshy places near the swamp forest in the terai area of the state.	Common
86	*Schleichera oleosa* Oken	Sapindaceae	Kosum	The unripe fruit pickled	In the Sal forest in association with Aegle marmelos, Cassia fistula and Holarrhena pubescens etc.	Occasional
87	*Semecarpus anacardium* L.f.	Anacardiaceae	Bhinwala,	Ripe receptacles eaten by tribal.	Found frequently in the Sal forest	Common
88	*Shorea robusta* Gaertn.	Dipterocarpaceae	Sakhu, Sal	Seed eaten. The seed oil is used for cooking purpose.	Frequently in the Sal forest in association with small trees	Common
89	*Solanum nigrum* L.	Solanaceae	Makoi	Leaves and shoots fried and eaten	Occurs frequently in moist shady places	Common
90	*Spondias pinnata* (L.f.) Kurz.	Anacardiaceae	Ambara	Unripe fruits grinded and eaten as chutany and unripe fruits pickled	Occurs in association with Holoptelea integrifolia, Terminalia bellirica and Cassia fistula etc.	Common
91	*Sterculia villosa* Roxb.	Sterculiaceae	Udarkand	Seeds eaten as such and roasted	Along the edge of the Sal forest with Butea monosperma and Ziziphus mauritiana.	Common
92	*Syzygium cerasoides* (Roxb.)	Myrtaceae	Bhadar Jamun	The fruit eaten.	In association with Drypetes roxburghii & Bombax ceiba etc.	Common

S. No.	Botanical Name	Family	Local Name	Uses	Ecology	Conservation Status
93	*Syzygium cumini* (L.) Skeels	Myrtaceae	Jamun	The fruit eaten	Found in the grassland and the mixed forest	Common
94	*Terminalia bellirica* (Gaertn.) Roxb.	Combretaceae	Behera	The kernels eaten by the tribe.	In the forest associated with Aegle marmelos and Adina cordifolia.	Common
95	*Trianthema portulacastrum* L.	Aizoaceae	Patharchatti	Young leaves eaten as vegetable.	Commonly in the wasteland	Common
96	*Vicia sativa* L.	Fabaceae	Eklir, Ankra	Young leaves eaten as vegetable	Commonly in the cultivated field near the forest edge.	Common
97	*Xeromphis uliginosa* (Retz)	Rubiaceae	Pedar, Pindar	Unripe fruits boiled, fried and eaten	In the terai forests throughout the state.	Common
98	*Ziziphus mauritiana* Lamk.	Rhamnaceae	Ber	Fruit largely eaten	In association with Flacourtia indica, Cordia dichotoma etc. in the scrub forest in the terai area	Common
99	*Ziziphus oenoplia* (L.) Mill.	Rhamnaceae	Jharber	The ripe fruit eaten.	In the scrub forests in association with Ventilago denticulata and Embelica officinalis	Common
100	*Ziziphus rugosa* Lamk.	Rhamnaceae	Bair	Fruits eaten raw or ripe	Found in association with Flacourtia indica, Xeromphis uliginosa.	Common

The fruits of *Cordia dichotoma, Schleichera oleosa, Spondias pinnata, Xeromphis uliginosa, Dillenia pentagyna* are utilized for making pickles of excellent tastes need standardization and commercialization in trades. The fruits of *Dillenia pentagyna* have been found as most anti tumour cancerous activity in a study (Rosangkima *et. al.* 2010).

The habitat loss due to some factors like, modernization, overgrazing, animal husbandry has resulted in the loss of diversity. Endangered species have particularly suffered from lack of effective pollinators, viable seed formation and natural regeneration, diseases etc. resulting in the depletion and erosion of the genetic diversity in many plant species. (Prakash and Singh, 2001, Goel, 1992, Jain, and Sastry 1980) The population of some plant species like *Artocarpus Lakucha, Averrhoa carambola, Costus speciosus, Flacourtia jangomas, Manilkara hexandra, Mimusops elengi, Schleichera oleosa, Spondias pinnata, Xeromphis uliginosa Helminthostachys zeylanica, Hemi-desmus indicus, Pueraria tuberosa* having restricted distribution and scarce population are decling in the area considered locally threatened need both, in-situ and ex-situ conservation for their sustainable utilization in trade and commerce.

The plant resources of the area of the state are quite rich in raw materials needed for development of nutritional food and food stuffs with newer tastes and flavor. Extraction of edible and non edible oils from raw material through establishing plant based industries may provide economic development of the area. The organized collection, storage and processing of wild edible plant species for further nutritional validation and investigation will provide employment to the rural and tribal population of the state for economic development and tribal empowerment.

Conservation Strategy

No conservation strategy can be effective unless taken care of the basic needs of the local communities. A good deal of biodiversity is also

protected through folk traditions. Considering the prevailing situation and diverse plant wealth of the area, emphasis must be laid on the conservation measures, both *in-situ* and *ex-situ*. The in-situ approach, however, needs priority for the protection of endangered species, which have already lost the diversity and are not able to adjust. For effective conservation of forest biodiversity *in-situ*, preservation plots in different forest ecosystems can be established. Preservation plots are precise example of local level management norms of biodiversity plots as "demarcated forest areas set aside in perpetuity for the preservation of the forest with no human interference beyond what is necessary for their protection and maintenance". The preservation plots serve as "ecological reference centre or ecological labs" for studying natural ecological processes in isolation from human interference and pressure, thus dealing with wise management of biodiversity. Researches on various ecological habitats of endangered species should also be undertaken. Afforestation of fuel and fodder species under social forestry programmes may be encouraged in the surrounding areas so that the pressure on protected forest is checked. Studies on reproductive behaviour and population dynamics of threatened and rare species should be carried out over a period of time in-situ. The area management should initiate a programme or develop a strategy to examine conservation status of vegetation, communities, habitats and species that are threatened and need protection.

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