

Distribution of Ethno Medicinal Plants Along Some Important Roads: A Case Study of Northern Mizoram

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Abstract: Mizoram state of India is part of the biodiversity hotspots of the world, the Eastern Himalayan biodiversity hotspot of South Asia which shows roadside rich diversity of flora. These floras are one of the source of carbon sink along the road and also source of medicinal resources for local villagers. India is world leader in the era of medical pluralism because it has strong evidence based biomedical sciences, as well as an immensely rich indigenous medical heritage of its own. Some works related to medicinal plants have been reported by some researchers in some districts and localized area in Mizoram. Till date no work has been reported on the diversity and ecology of medicinal flora growing along the Hill Roads in Mizoram. For listing of the medicinal plants along the roads four (4) major roads of northern part of Mizoram in three different locations were selected for the present study which were surveyed with team of experts for two consecutive years during the months of October to January (2017 & 2018) within 30m of the roads by traversing on foot on both side of the roads. Data on uses of the plants were collected through questionnaire, interviews and discussions with local people local Vadhya and old men and women community along the roads. During survey 318 traditional medicinal plants were recorded, out of which 170 are trees, 48 are shrubs and 100 are herbs. Status assessments of the plants indicate the fact that very few plants has been listed in IUCN list. Study reveals that distribution of these plants are being rare and endangered in their natural habitat due to several factors which need to be conserved and cultivated for their perpetual existence. Proper attention should be made during further capacity augmentation of these roads for conservation of these medicinal plants. The paper enlists the current diversity, habitat and ecology of the ethno medicinal plants and impact of road development on the flora along the road. The study is likely to help in further capacity augmentation/widening of these roads without harming the current diversity of the medicinal flora growing along the road.

Keywords: Hill Roads, Diversity, Ecology, Hotspots, Conservation, Medicinal Plants

1. Introduction

The current global health sector trends suggest that medical pluralism, to which Indian traditional medical systems can contribute critically, will shape the future of health care. This shift from singularity to plurality is taking place because it is becoming increasingly evident that no single source of health science has the capacity to contribute solutions to all of societies health needs. India has a comparative advantage to be a world leader in the era of

medical pluralism because it has strong foundations in evidence based biomedical sciences, as well as an immensely rich and complex indigenous medical heritage of its own [1].

According to the World Health organization (WHO) as many as 80% of world's population depends today on traditional medicine for their primary health care needs. The practice of ethno medicine is an important vehicle for understanding indigenous societies and their relationships with nature [2]. In recent decade significant changes occurring within several aspects of ethno medicine as a result of environmental degradation and tremendous changes in

modern, social, and economic systems [2]. These factors in totality resulted in disappearance of ethno medicinal plants at regional as well as global scale [3].

The Eastern Himalayas is hottest of the 34 biodiversity hotspots of the world. It comprises of a mountain range in South Asia which is youngest of all mountain ranges existing on the face of the earth. It is still in an evolving state. The ecosystem of the region, therefore, naturally exhibit great dynamism. It also holds great significance from ecological and evolutionary point of view. This region is rich in biodiversity and harbours largest number of endemics and Schedule I species as compared to any other part of India [4].

Mizoram, in North–East of India, is a part of Eastern Himalayan biodiversity hotspot, region. Mizoram possesses a geologically distinctive terrain in with low but steep hills ranging in height from 900 - 1,100 meters. The hills of the eastern side are slightly higher than their western counterparts. Its unique location, topography with hills and valleys, and geology provide immense ranges of microclimatic conditions which support diverse gene pools of a variety of flora and fauna, making it a “biodiversity rich” area [5]. The study area is also rich in medicinal important plants. About 500 species under 383 genera have been recorded from the state, which has medicinal and ethno botanical uses [6].

The ethno medicinal plants of Mizoram have been reported by various researchers. Darlianthanga (1989) who reported medicinal plants used for the treatment of 97 diseases [7]; Saptawna (1990) reported 58 species Lallianthanga (1990)

reported 128 plant species [8, 9], Vailinga (1991) documented 165 diseases and their ethno medicines [10] and Chawngkunga (1996) documented 85 ethno medicinal plants [11]. Some other notable contributions were made by Lalramnghinglova and Jha (1997) and Lalnundanga *et al.* (1997) [12, 13]. Lalramnghinglova (2003) documented 126 ethno medicinal plants [12]. Rai & Lalramnghinglova reported 57 less known ethno medicinal plant species belonging to 52 genera and 36 families [14]. Lalfakzuala *et al.* (2007) reported that tribal of western Mizoram use 89 plant species as herbal medicine [15]. Lalzazovi *et al.* (2016) has documented 56 species of medicinal plants belonging to 54 genera and 35 families which are used traditionally within the city of Aizawl [16]. Rama Shankar (2009) reported use of 39 species as medicinal plants by local people in Kolasib, Aizawl, Champhai and Darlawn districts of Mizoram [17]. Laha *et al.* (2016) recoded 53 species of plant distributed over 49 genera and 39 families which are used by local people of Mizoram as medicines for treatment of diabetic [18].

Although we have various workers reporting the ethno medicinal plant found in the state of Mizoram, no study have been reported on medicinal flora along the roads in Mizoram and impact of road development on these plants.

This study aims at documenting the medicinal plants which are found along important roads of Northern part of Mizoram which have been proposed for capacity augmentation and also deals with the impact of capacity augmentation of the roads on medicinal flora along the roads.

2. Materials and Methods

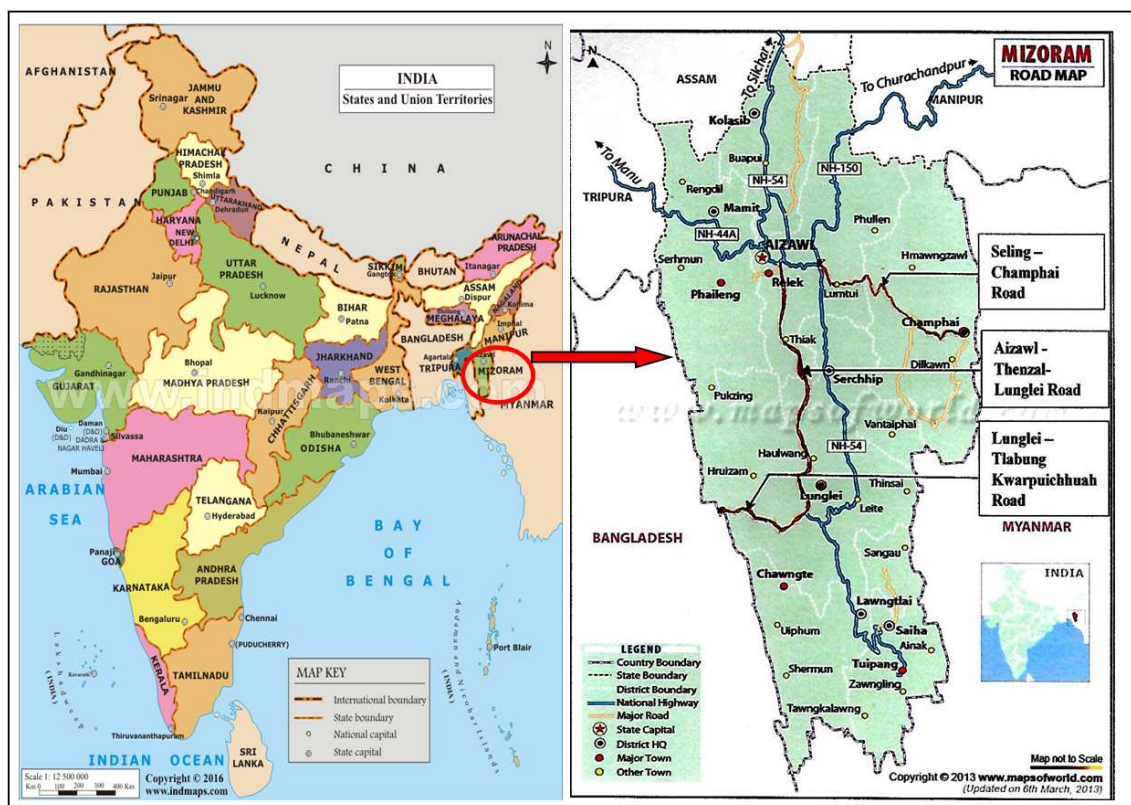


Figure 1. Roads considered for study.

For listing of the medicinal plants along the roads four (4) major roads of northern part of Mizoram in three different locations were selected for the present study. Selected roads were - NH-44A road (Length = 55 Km), Serchip – Thenzal road (Length = 27 Km), NH-54 road (Length = 56 Km) and Champhai – Zokhwatar road (26km) (Figure 1). All the roads were surveyed with team of experts for two consecutive years during the months of October to January (2017 & 2018). Data were collected within 30m (considering corridor of impact, COI) of the roads by traversing on foot on both side of the roads (valley side and hill side 15 m each). Identification of plants and the data on the uses of the plants were collected through questionnaire, interviews and discussions among local people in presence of the Village Council Presidents (VCP), local Vadhya and old men and women of local village community along the roads.

Several visits were made to the field with these resource persons who helped in identifying and naming of some of these plants and their medicinal uses. It consists of basic documentation of traditional botanical knowledge of the local people through interaction with them. Some very common plants like well-known trees were not collected for voucher specimens. Only information provided by the local people for these species was recorded. Specimens were collected and processed into mounted herbarium sheets and were identified using different literatures [19]. Voucher specimens were deposited into the Herbarium of the University Department

of Botany Ranchi University, Ranchi.

3. Results

This study documented 33 species of medicinal important plants distributed over 21 families along COI of NH-44 A which is 55 km in length. Plants of Verbanaceae family were found dominant family. During survey 318 traditional medicinal plants were recorded, out of which 170 are trees, 48 are shrubs and 100 are herbs (Figures 2 & 3). Status assessments of the plants indicate the fact that *Bauhinia variegata* (L.) has been listed as list concern in IUCN red list version 3.1. (Table 1)

Gleditsia assamica Bor. has been listed as vulnerable in IUCN red list version 3.1. *G. assamica* grows in primary and secondary forests of Northeast India at an elevation range of 100-250 m altitude. It is a medium to large sized tree (15-20 m) with a conical crown and thick canopy. Pods have ethno botanical use and Garo tribes of Nokrek Biosphere Reserve use the paste to heal stomachache. (Table 1)

Clear felling along with habitat degradation severely affected the natural population of *G. assamica* and the species is also listed as ‘Vulnerable’ in the IUCN red list of threatened species (IUCN 2009).

Other plants neither listed in IUCN red list version 3.1 nor in Catalogue of Life (COL), 2018. (Refer Table 1)

Table 1. List of Medicinal plants in proposed ROW of NH-44A road (Length 55 km).

Sl. No	Name of Plant species		Family	Part used	Total No. of individuals	Status as per IUCN RED list 2017 and COL
	Scientific Name	Local Name				
Herbs						
1.	<i>Desmodium sequax</i> Wall.	Chabet	Leguminosae	Leaf	45.0	Not listed
2.	<i>Ageratum conyzoides</i> (L.) L.	Vaihlenhlo	Asteraceae	Whole body	20.0	Not listed
3.	<i>Solanum nigrum</i> L.	An-hling	Solanaceae	Fruit	3.0	Not listed
4.	<i>Scoparia dulcis</i> L.	Perhpawngchaw	Scrophulariaceae	Leaf, Stem, Root	32.0	Not listed
Shrubs						
5.	<i>Lantana camara</i> L.	Shillong tlangsam	Verbanaceae	Whole body	17.0	Not listed
5.	<i>Curcuma longa</i> L.	Ai-eng	Zingiberaceae	Whole body	7.0	Not listed
6.	<i>Homalomena aromatic</i> (Spreng.) Schott	Anchiri	Araceae	Root	5.0	Not listed
8.	<i>Clerodendrum infortunatum</i> L.	Phuihnamchhia	Verbenaceae	Root, Leaves	8.0	Not listed
9.	<i>Sarcandra glabra</i> (Thunb.) Nakai	Sen-thet	Verbenaceae	Root, Leaves	6.0	Not listed
	<i>Manihotesculenta</i> Crantz	Pangbal	Euphobiaceae	Root	5.0	Not listed
Trees						
13.	<i>Alstonia scholaris</i> (L.) R. Br.	Thuamriat	Apocynaceae	Bark	6.0	Not listed
14.	<i>Bauhinia variegata</i> L.	Vaube	Caesalpiniaceae	Bark, Leaves	12.0	Least concern ver3.1
15.	<i>Grevillea robusta</i> A. Cunn. ex R. Br.	Silver oak	Proteaceae		3.0	Not listed
16.	<i>Areca catechu</i> L.	Kuhva kung	Arecaceae	Seeds	38.0	Not listed
17.	<i>Litsea monopetala</i> (Roxb.) Pers.	Nauthak	Lauraceae	Root, Bark, Leaf	7.0	Not listed
18.	<i>Derris robusta</i> (DC.) Benth	Thingkha	Fabaceae	Bark	6.0	Not listed
19.	<i>Garcinia lanceifolia</i> Roxb.	Chengkek	Clusiaceae	Fruits, Leaves	7.0	Not listed
20.	<i>Artocarpus heterophyllus</i> Lam.	Lamkhuang	Moraceae	Root	4.0	Not listed
21.	<i>Gmelina arborea</i> Roxb.	Thlanvawng	Verbenaceae	Root, Leaf, Flower, Fruits	8.0	Not listed
22.	<i>Schima wallichii</i> Choisy	Khiang	Theaceae	Fruits, Bark	22.0	Not listed
23.	<i>Duabanga grandiflora</i> (DC.) Walp.	Zuang	Lythraceae	Bark	2.0	Not listed
24.	<i>Callicarpa arborea</i> Roxb.	Hnahkiah	Verbenaceae	Bark, Leaf	4.0	Not listed
25.	<i>Heteropanax fragrans</i> (Roxb.) Seem.	Chang-khen	Araliaceae	Root, Bark	5.0	Not listed
26.	<i>Castanopsis tribuloides</i> (Sm.) A.	Thingsia	Fagaceae	Stem	9.0	Not listed

Sl. No	Name of Plant species Scientific Name	Local Name	Family	Part used	Total No. of individuals	Status as per IUCN RED list 2017 and COL
27.	DC. <i>Gleditsia assamica</i> Bor	Hluk-ral	Leguminsae	Seed, bark, Fruit	3.0	Vulnerable B1+2c ver 2.3
28.	<i>Syzygium cumini</i> (L.) Skeels.	Len-hmui	Myrtaceae	Seed, bark, Fruit	3.0	Not listed
29.	<i>Aporosa octandra</i> (Buchanan-Hamilton ex D. Don) Vickery	Chhawntual	Phyllanthaceae	Bark	8.0	Not listed
30.	<i>Cinnamomum verum</i> J. Presl	Thakthing	Lauraceae	Stem bark and root bark	6.0	Not listed
31.	<i>Mesua ferrea</i> L.	Herhse.	Clusiaceae	Fruits & flower	4.0	Not listed
32.	<i>Tectona grandis</i> L. f.	Teak	Verbenaceae	Root, Bark, flower	10.0	Not listed
33.	<i>Persea odoratissima</i> (Nees) Kosterm	Bulfek	Luraceae	Root, Bark, Flower	3.0	Not listed

Total plants to be cut = 318, trees = 170, shrub = 48, Herb = 100

In Serchip – Thenzal road which is 27 Km long, 29 species of medicinal plants distributed over 22 families were recorded. During survey 152 traditional medicinal plants recorded in COI out of which 79 are trees, 19 are shrubs and 54 are herbs (Figures 2 & 3). Status assessments of the plants

indicate the fact that *Bauhinia variegata* (L.) and *Tamarindus indica* L has been listed as list concern in IUCN red list version 3.1. Other plants neither listed in IUCN red list version 3.1 nor in Catalogue of Life (COL), 2018. (Refer Table 2)

Table 2. List of Medicinal Plants with in Proposed Right of way of the Serchip – Thenzal road (Length = 27 Km).

Sl. No	Name of plant species Scientific Name	Local Name	Family	Part used	Total No. of individuals	Status as per IUCN RED list 2017 and COL
Herb						
1	<i>Alternanthera philoxeroides</i> (Mart.) Griseb.	Nghateril	Amaranthaceae	Extract	3.0	Not listed
2	<i>Ageratum conyzoides</i> (L.) L.	Vailenhlo	Asteraceae	Whole body	11.0	Not listed
3	<i>Chromolaena odorata</i> (L.) King & Robinson	Tlamsam	Asteraceae	Leaf, Stem, Seed	12.0	Not listed
4	<i>Solanum nigrum</i> L.	Anhling	Solanaceae	Fruit, Leaf	4.0	Not listed
5	<i>Desmodium sequax</i> Wall.	Chabet	Leguminosae	Leaf	4.0	Not listed
6	<i>Andrographis paniculata</i> Nees.	Hnahkhpui	Acanthaceae	Leaves, stem, root	20.0	Not listed
Shrubs						
7	<i>Lantana camara</i> L.	Shillong tlangsam	Verbanaceae	Whole body	9.0	Not listed
8	<i>Hibiscus sabdariffa</i> L.	An-thur	Malvaceae	Leaves Fruits, Flower	3.0	Not listed
9	<i>Sida acuta</i> Burm. f.	Khing-khih	Malvaceae	Root, Leaves	2.0	Not listed
10	<i>Portulaca oleracea</i> L.	Hlo-thau	Portulacaceae	Leaves	5.0	Not listed
11	<i>Bauhinia variegata</i> L.	Vaube	Caesalpinaceae	Bark, Leaf	5.0	Least concern ver3.1
12	<i>Adhatoda vasica</i> Nees.	Kawldawi	Acanthaceae	Leaf, root	8.0	Not listed
13	<i>Curcuma longa</i> L.	Ai-eng	Zingiberaceae	Whole body	7.0	Not listed
14	<i>Clerodendrum infortunatum</i> L.	Phuihnamchia	Verbenaceae	Root, Leaves	8.0	Not listed
15	<i>Manihot esculenta</i> Crantz	Pangbal	Eupobiaceae	Root	5.0	Not listed
16	<i>Asparagus recemosus</i> Willd.	Arkebaw	Liliaceae	Rhizome	9.0	Not listed
Trees						
17	<i>Aporosa octandra</i> (Buchanan-Hamilton ex D. Don)	Chhawntual	Phyllanthaceae	Bark.	4.0	Not listed
18	<i>Cinnamomum tamala</i> (Buchanan-Hamilton) T. Nees & Ebermaier	Tespata, Hnahrimtui	Lauraceae	Stem Bark and root bark.	6.0	Not listed
19	<i>Cinnamomum verum</i> J. Presl	Thakthing	Lauraceae	Root bark, stem bark, leaves	4.0	Not listed
20	<i>Phyllanthus emblica</i> Linnaeus	Sunhlu	Phyllanthaceae	Bark, fruit.	7.0	Not listed
21	<i>Eucalyptus globulus</i> Labillardiere	Eucalyptus	Myrtaceae	Leaves	5.0	Not listed
22	<i>Mesua ferrea</i> Linnaeus	Herhse	Clusiaceae	Fruit, flower.	3.0	Not listed
23	<i>Oroxylum indicum</i> (Linnaeus) Kurz	Archangkawm.	Bignoniaceae	Stem bark and root bark.	2.0	Not listed
24	<i>Terminalia chebula</i> Retzius	Reraw	Combretaceae	Fruits	7.0	Not listed
25	<i>Aquilaria malaccensis</i> Lamarck	Thingrai.	Thymelaeaceae	Stem bark	6.0	Not listed
26	<i>Butea frondosa</i> Koen. ex. Roxb.	Tuahpui	Papilionaceae	Leaf, flower, seed	11.0	Not listed
27	<i>Vitex peduncularis</i> Wall.	Thingkhawi-Hlu	Verbenaceae	leaf, root and bark	17.0	Not listed
28	<i>Heteropanax fragrans</i> (Roxb.) Seem.	Chang-khen	Araliaceae	Root, Bark	5.0	Not listed
29	<i>Tamarindus indica</i> L.	Chhimakelek	Caesalpinaceae	seed	2.0	Least Concern ver 3.1

Total plants to be cut = 152. Trees 79, shrubs = 19, Herb = 54

This study also documented 32 species of medicinal important plants distributed over 25 families along COI of NH-54 which is 56 km in length. Plants of Aracaceae and Fabaceae family were found dominant family. During survey 239 traditional medicinal plants were recorded, out of which 126 are trees, 31 are shrubs and 82 are herbs. Status

assessments of the plants indicate the fact that *Caryota urens* L. and *Aeschynomene indica* L. has been listed as list concern in IUCN red list version 3.1. Other plants neither listed in IUCN red list version 3.1 nor in Catalogue of Life (COL), 2018. (Refer Table 3)

Table 3. List of Medicinal Plants with in Proposed Right of way of the NH-54 road (Length = 56 Km).

Name of Plant species			Family	Part used	Total No. of individuals	Status as per IUCN RED list 2017 and COL
Sl. No.	Scientific Name	Local Name				
Herbs						
1	<i>Desmodium sequax</i> Wall.	Chabet	Fabaceae	Leaf	8.0	Not listed
2	<i>Scoparia dulcis</i> L.	Perhpawngchaw	Scrophulariaceae	Whole plant	25.0	Not listed
3	<i>Lantana camara</i> L.	Shillong	Verbanaceae	Leaf	7.0	Not listed
4	<i>Curcuma longa</i> L.	Tlamsam	Zingiberaceae	Root	8.0	Not listed
5	<i>Homalomena aromatic</i> (Spreng.) Schott	Ai-eng	Araceae	Bark	3.0	Not listed
6	<i>Solanum nigrum</i> L.	An-hling	Solanaceae	Leaf and fruits	11.0	Not listed
7	<i>Hibiscus sabdariffa</i> L.	An-thur	Malvaceae	Fruit & flower	4.0	Not listed
8	<i>Ageratum conizoides</i> (L.) L.	Vailenhlo	Asteraceae	Whole plant	16.0	Not listed
Shrubs						
9	<i>Caryota urens</i> L.	Tum (Palm Tree)	Aracaceae	Stem	7.0	Least Concern ver 3.1
10	<i>Aeschynomene indica</i> L.	Hlo-Nuar-Suak	Fabaceae	Root, leaf and flower	5.0	Least Concern ver 3.1
11	<i>Ammomum maximum</i> Roxb.	Aidu	Zingiberaceae	Stem, buds	6.0	Not listed
12	<i>Tabernaemontana divaricate</i> (Linnaeus) R. Brown ex Roemer & Schultes	Pararsi	Apocynaceae	Root, leaf, flower	9.0	Not listed
13	<i>Garcinia lancifolia</i> Roxb.	Pelh	Clusiaceae	Fruits	4.0	Not listed
Trees						
14	<i>Tectona grandis</i> L. f.	Teak	Verbenaceae	Root, Bark, flower	11.0	Not listed
15	<i>Alstonia scholaris</i> (L.) R. Br.	Thuamriat	Apocynaceae	Bark	6.0	Not listed
16	<i>Bauhinia variegata</i> L.	Vaube	Caesalpinaceae	Bark and Leaf	8.0	Not listed
17	<i>Areca catechu</i> L.	Kuhva kung	Arecaceae	Seeds	23.0	Not listed
18	<i>Garcinia lanceifolia</i> Roxb.	Chengkek	Clusiaceae	Frits and Leaves	4.0	Not listed
19	<i>Artocarpus heterophyllus</i> Lam.	Lamkhuang	Moraceae	Root	6.0	Not listed
20	<i>Erythrina stricta</i> Roxb.	Fartuah	Fabaceae	Bark and Leaf	5.0	Not listed
21	<i>Gmelina arborea</i> Roxb.	Thlanvawng	Verbenaceae	Root, flower,	5.0	Not listed
22	<i>Schima wallichii</i> choisy.	Khiang	Theaceae	Fruit, Bark	5.0	Not listed
23	<i>Duabanga grandiflora</i> (DC.) Walp.	Zuang	Sonneratiaceae	Bark	2.0	Not listed
24	<i>Callicarpa arborea</i> Roxb.	Hnahkiah	Verbenaceae	Bark	2.0	Not listed
25	<i>Castanopsis tribuloides</i> (Sm.) A. DC.	Thingsia	Fagaceae	Stem	2.0	Not listed
26	<i>Emblia officinalis</i> Gaertn.	Sunhlu	Phyllanthaceae	Fruit, and root	11.0	Not listed
27	<i>Albizia chinensis</i> (Osbeck) Merr.	Vang	Mimosaceae	Bark	6.0	Not listed
28	<i>Parkia timoriana</i> (DC.) Merr.	Zawngtah	Mimosaceae	Fruit, root, leaf	4.0	Not listed
28	<i>Drimycarpus racemosus</i>	Vawmbal	Anacardiaceae	Bark	5.0	Not listed
30	<i>Terminalia chebula</i> Retzius.	Reraw	Combretaceae	Fruit	6.0	Not listed
31	<i>Oroxylum indicum</i> (Linnaeus) Kurz	Archangkawm	Bignoniaceae	Stem bark and root bark	3.0	Not listed
32	<i>Ziziphus jujube</i> Mill.	Bawrai	Rhamnaceae	Fruit, Bark, root, leaf	12.0	Not listed

Total plants to be cut = 239. Trees = 126, Shrub = 31 and Herb = 82

In C-Z road which is 26 Km long, 25 species of medicinal plants distributed over 20 families were recorded. During survey 160 traditional medicinal plants recorded in COI out of which 42 are trees, 57 are shrubs and 61 are herbs (Figures 2 & 3). Status assessments of the plants indicate the fact that

only *Tamarindus indica* L. has been listed as list concern in IUCN red list version 3.1. Other plants neither listed in IUCN red list version 3.1 nor in Catalogue of Life (COL), 2018. (Refer Table 4)

Table 4. List of Medicinal plants in proposed ROW of C-Z road (Length 26 km).

Sl. No.	Name of Plant species		Family	Part used	Total No. of individuals	Status as per IUCN RED list 2017 and COL
	Scientific Name	Local Name				
Herbs						
1	<i>Mikania micrantha</i> Kunth.	Japanhlo	Asteraceae	Leaf	6.0	Not listed.
2	<i>Ageratum conizoides</i> (L.) L.	Vailenhlo	Asteraceae	Whole plant	25.0	Not listed
3	<i>Chromolaena odorata</i> (L.) R. M. King & H. Rob.	Tlamsam	Asteraceae	Leaf, Stem, Seed	4.0	Not listed

Sl. No.	Name of Plant species		Family	Part used	Total No. of individuals	Status as per IUCN RED list 2017 and COL
	Scientific Name	Local Name				
4	<i>Urena lobate</i> L.	Sehnap	Malvaceae	Leaf, Root, Bark	12.0	Not listed
5	<i>Morus alba</i> L.	Theihmu (Hlingnei)	Moraceae	Fruit, Bark	7.0	Not listed
6	<i>Mallotus roxburghianus</i> Mull. Arg.	Zawngtenawhlung	Euphorbiaceae	Bark, Leaves	7.0	Not listed
Shrubs						
7	<i>Viburnum mullaha</i> Buch.-Ham. ex. D. Don.	Vawngser	Stemonaceae	Root	2.0	Not listed
8	<i>Derris robusta</i> (DC.) Benth.	Thingkha	Fabaceae	Bark	21.0	Not listed
9	<i>Schima wallichii</i> Choisy	Khiang	Theaceae	Bark, Fruit	10.0	Not listed
10	<i>Callicarpa arborea</i> Roxb.	Hnahkiah	Verbenaceae	Bark, Leaf	4.0	Not listed
11	<i>Bauhinia variegata</i> L.	Vaube	Caesalpiniaceae	Bark, Leaf	5.0	Not listed
12	<i>Adhatoda vasica</i> Nees.	Kawldawi	Acanthaceae	Leaf, root	8.0	Not listed
13	<i>Curcuma longa</i> L.	Ai-eng	Zingiberaceae	Whole body	7.0	Not listed
Trees						
14	<i>Albizia lebbek</i> (L.) Benth	Thingri	Mimosaceae	Bark	5.0	Not listed
15	<i>Emblia officinalis</i> Gaertn.	Sunhlu	Phyllanthaceae	Fruit, Bark, Root	7.0	Not listed
16	<i>Azadirachta indica</i> A. Juss.	Neem	Meliaceae	Bark, Leaf, Fruit	6.0	Not listed
17	<i>Albizia chinensis</i> (Osbeck) Merr.	Vang	Mimosaceae	Bark	4.0	Not listed
18	<i>Anogeissus acuminata</i> (Rox. ex DC.)	Zairum	Combretaceae	Bark, Leaf	5.0	Not listed
19	<i>Ficus religiosa</i> L.	Bung	Moraceae	Bark, root, fruits	4.0	Not listed
20	<i>Tamarindus indica</i> L.	Chhimakelek	Caesalpiniaceae	seed	2.0	Least Concern ver 3.1
21	<i>Annona squamosa</i> L.	Theiarbawn	Annonaceae	Leaf, root, fruit, seed	4.0	Not listed
22	<i>Vitex peduncularis</i> Wall.	Thingkhaw-Hlu	Verbenaceae	leaf, root and bark	3.0	Not listed
23	<i>Anthocephalus cadamba</i> Miq.	Banphar	Rubiaceae	Bark, leaf	7.0	Not listed
24	<i>Butea frondosa</i> Koen. ex. Roxb.	Tuahpui	Papilionaceae	Leaf, flower, seed	6.0	Not listed
25	<i>Artocarpus chaplasha</i> Roxb.	tatkawng	Moraceae	Bark	3.0	No listed

Plants to be cut = 160. Trees = 42, Shrub = 57 and Herbs = 61

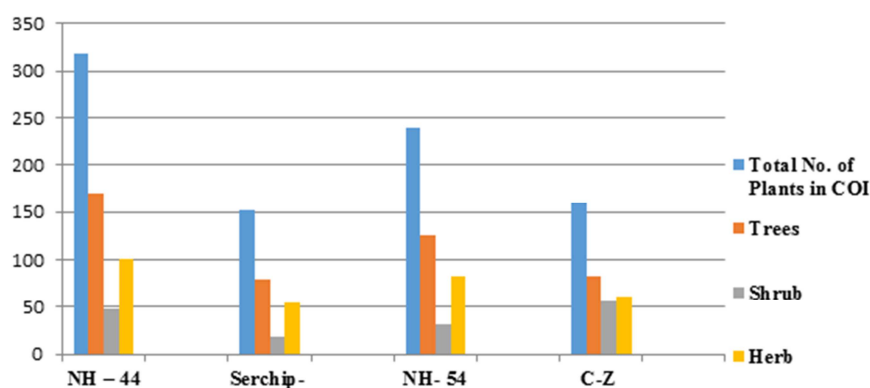


Figure 2. Distribution of medicinal plants along the roads.

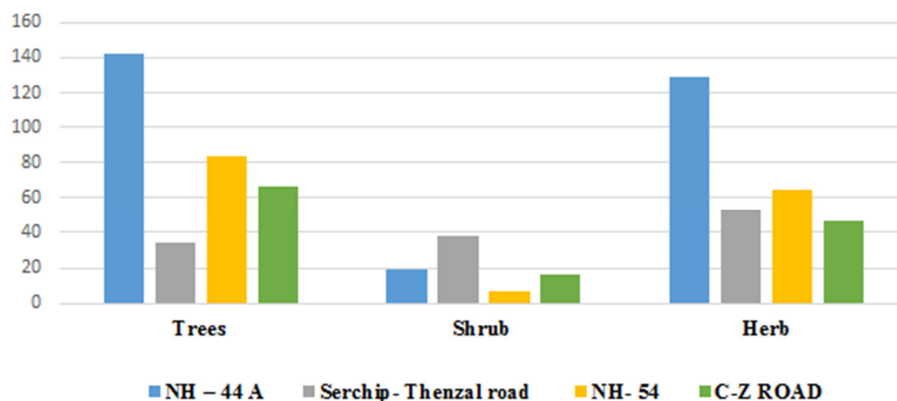


Figure 3. Habitat wise distribution of medicinal plants.

4. Discussion

This study has focused on 164 km of road on northern part

of Mizoram state in India which has been proposed for widening for capacity augmentation of the four (04) roads by the by the state government.

This study has documented 869 species of medicinal plants

distributed in 32 families and 42 genera which are used traditionally by the local people living in the settlements along the project roads under study. Dominant families with traditional medicinal plants recorded in the project roads belongs to Verbanaceae, Aracaceae, Fabaceae, Scrophlurariace, Theaceae, Asteraceae, Acanthaceae and Malvaceae.

Consultation with local people revealed the fact that different parts of the plants were used for preparation of medicine and among them, leaves were most frequently used (52% spp.) followed by roots (33% spp.), bark (8% spp.), whole plant (5% spp.). Other parts used included stem, fruit, flower, rhizome, sap, seed, pith, cladodes, twigs and wood-charcoal (2% spp.).

The mode of preparation varies in different species and the most frequently used modes are decoction and infusion of various plant parts followed by juice of leaves, stem, roots, barks or whole plants. Other modes are paste, powder, raw, steaming. The mode of application may be external or internal. They also confirmed that a single species is used to treat more than one kind of disease and the mode of preparation for the treatment of each disease as well as the plant parts used are different.

It has come out from consultations with local people in the road side villages that these traditional medicinal plants are generally taken for - for fever; crushed leaf juice applied and drunk for inflammatory glands; infusion of leaves taken against tonsillitis some entire plant used in - dysentery and dyspepsia; also used in spleen complaints, colic and strangulation of intestine, constipation, diarrhoea, cholera and bites of rabid jackal. Plant parts are used for stomach-ache, asthma, leaf juice to stop bleeding, bark decoction taken against colic pain and stomach-ache also applied on wounds and chronic ulcer. Leaf infusion is taken against diarrhoea, bronchitis, asthma, and cancer and liver ailments. Leaves smoked as tobacco for chest complaints and asthma; roasted leaf applied on breast for lump or stony hard breast. Grinded bark mixed with water and used for diabetes. Leaf juice is also used in toothache, taken against pneumonia. Plants are also used for sore-throat, toothache and inflammatory glands, rheumatism, sciatica, wounds and applied internally for eye problems. Use of plants to treat epilepsy, snake bite, urinary and kidney problems, stomach-ache and piles was also reported by the villagers during consultation.

5. Conclusion

Different literatures throughout the world indicate a renewed interest in traditional medicine today. There has been an ever increasing demand for more and more drugs from plant sources during the past decade and this revival of interest is mainly due to the widespread belief that green medicine is safe and more dependable than. many of which have adverse side effects.

According to the World Health organization (WHO) as many as 80% of world's population depends today on

traditional medicine for their primary health care needs. The practice of ethno medicine is an important vehicle for understanding indigenous societies and their relationships with nature.

These medicinal plants are also the source of carbon sink along the road. No work has been reported on the diversity, ecology and utilization of the medicinal plants along the hill roads in Mizoram. These plants are very important for local people living along the roads. Study reveals that distribution of these plants are being rare and endangered in their natural habitat due to several factors which need to be conserved and cultivated for their perpetual existence. A single species may be used to treat more than one kind of disease and the mode of preparation for the treatment of each disease as well as the plant part used may be different. These plants are potential for felling and cutting during new road construction and capacity augmentation of the hill roads. This will not only destroy the eco-system of the area as well as deprive the local people living along the roads from traditional rights of using as traditional medicines and also of the eco-system services.

6. Recommendation

Proper attention should be made during further capacity augmentation of these roads for conservation of these medicinal plants. Simultaneously, traditional knowledge should be documented, and preserved for further studies. This type of study would be helpful in monitoring and management of population of the medicinal plants, sustainable road development and eco-efficient and sustainable urban infrastructure approach- initiative for green economic growth in Mizoram.

Author Contributions

All the three authors are working in team in the project for strategy development of sustainable and green road project. All the three authors are going to field and collecting the samples, identifying the species, preparing herbarium and also interacting with different stake holders. Contributions of all the authors are equal in the research project and preparation of the paper.

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