CHAPTER 6

DISCUSSION

6.1. Analysis

Out of 728 taxa, Angiosperms account for 676 species, 2 subspecies and 12 varieties under 463 genera of 123 families. Dicotyledons are comprised of 518 species, 2 subspecies, and 8 varieties under 358 genera of 104 families. The study shows dicotyledons with the highest number of the species, representing 72.52% of the study area. It is included with 509 terrestrial, 8 parasitic, 6 epiphytes and 5 aquatic taxa (Table 5). Among these, 171 taxa are trees, 163 shrubs, 127 herbs, and 67 climbers (Table 6). Monocotyledons comprised of 158 species and 4 varieties under 105 genera of 19 families. It consists of 100 terrestrial and 62 epiphytic taxa (Table 7). Among these, 143 taxa are herbs, 10 are climbers and 9 are shrubs (Table 8). The present study shows that dicots are dominant over monocots with reference to their number. Out of the total 138 families, 10 dominant families of the study area are Orchidaceae Juss. (77 species), Fabaceae Lindl. (36 species), Phyllanthaceae Martinov (31 species), Moraceae Gaudich. (30 species), Poaceae Barnhart (25 species), Euphorbiaceae Juss. (24 species), Apocynaceae Juss. (24 species), Rubiaceae Juss. (23 species), Asteraceae Bercht. and Presl (20 species), and Acanthaceae Juss. (20 species) (Table 9). Comparison of 10 largest families with BTR and Assam's flora are displayed in Table 10. At the generic level, top 10 dominant genera are *Ficus* L. (24 species), *Dendrobium* Sw. with 14, *Phyllanthus* L. and *Clerodendrum* L. with 8 each, *Glochidion* Forst. and Forst., *Bulbophyllum* Thouars and *Syzygium* Gaertn. with 7 each, *Piper* L. and *Elaeocarpus* L. with 6 each, and *Litsea* Lam. with 5 (Table 11). The generic diversity under families, and species diversity under genera and families are provided in Table 12.

The Gymnosperms represent 3 species under 3 genera of 3 families. These are all terrestrial and included with 2 trees and 1 climber species (Table 13).

The present study enumerates a total of 35 species of Pteridophytes under 26 genera of 12 families. It consists of 24 terrestrial, 8 epiphytes, and 3 aquatic species (Table 14). The top five dominant families are Polypodiaceae Presl and Presl with 9 species, Aspleniaceae Newman with 8 species, Pteridaceae Kirchn. with 5 species, Lycopodiaceae Beauv. ex Mirb. with 3 species, and Schizaeaceae Kaulf., with 2 species (Table 15). The dominant genus is *Pteris* L., with 4 taxa. The generic diversity under families and species diversity under genera and families are provided in Table 16.

Table 5. Habitat of the dicotyledons

Habitat	Numbers of taxa	Percentage
Terrestrial	509	96.58
Parasites	8	1.51
Epiphytes	6	1.13
Aquatic	5	0.95
Total	**527**	

Table 6. Habit of the dicotyledons

Habit	Numbers of taxa	Percentage
Trees	171	32.45
Shrubs	163	30.93
Herbs	127	24.09
Climbers	67	12.71
Total	**527**	

Table 7. Habitat of the monocotyledons

Habitat	Numbers of taxa	Percentage
Terrestrial	100	61.73
Epiphytes	62	38.27
Total	**162**	

Table 8. Habit of the monocotyledons

Habit	Numbers of taxa	Percentage
Herbs	143	88.27
Climbers	10	6.17
Shrubs	9	5.55
Total	**162**	

Table 9. Top 10 dominant Angiosperms families

Names of families	Numbers of genera	Numbers of taxa
Orchidaceae	41	77
Fabaceae	27	36
Phyllanthaceae	9	31
Moraceae	5	30
Poaceae	22	25
Euphorbiaceae	14	24
Apocynaceae	19	24
Rubiaceae	19	23
Asteraceae	19	20
Acanthaceae	17	20

Table 10. Comparison of 10 largest families with BTR and Assam's flora

Chirang Reserve Forest		BTAD (Now BTR) (Borthakur *et al*. 2018)		Assam (Barooah and Ahmed 2014)	
Families	**Genera/ species**	**Families**	**Genera/ species**	**Families**	**Genera/ species**
Orchidaceae	41/77	Fabaceae	50/132	Orchidaceae	96/328
Fabaceae	27/36	Poaceae	53/116	Poaceae	108/295
Phyllanthaceae	9/31	Cyperaceae	14/76	Fabaceae	72/274
Moraceae	5/30	Asteraceae	43/64	Rubiaceae	57/141
Poaceae	22/25	Orchidaceae	27/45	Cyperaceae	24/132
Euphorbiaceae	14/24	Rubiaceae	25/41	Asteraceae	74/129
Apocynaceae	19/24	Euphorbiaceae	17/33	Euphorbiaceae	35/90
Rubiaceae	19/23	Acanthaceae	17/32	Lamiaceae	33/87
Asteraceae	19/20	Phyllanthaceae	11/31	Lauraceae	14/81
Acanthaceae	17/20	Verbenaceae	12/28	Scophulariaceae	25/66

Table 11. Top 10 dominant genera of Angiosperms

Names of genera	Numbers of taxa	Percentage
Ficus	24	3.47
Dendrobium	14	2.03
Phyllanthus	8	1.16
Clerodendrum	8	1.16
Glochidion	7	1.01
Bulbophyllum	7	1.01
Syzygium	7	1.01
Piper	6	0.87
Elaeocarpus	6	0.87
Litsea	5	0.72

Table 12. Species and generic diversity under the families of Angiosperms

Numbers of taxa in genera	Numbers of genera	Numbers of families
1	354	46
2	67	20
3	20	10
4	10	8
5–10	10	27
10–20	1	4
20–30	1	5
30–40	-	2
50>	-	1

Table 13. Habit of the Gymnosperms

Habit	Numbers of species	Percentage
Trees	2	66.67
Climbers	1	33.33
Total	**3**	

Table 14. Habitat of the Pteridophytes

Habitat	Numbers of taxa	Percentage
Terrestrial	24	68.57
Epiphytes	8	22.86
Aquatic	3	8.57
Total	**35**	

Table 15. Top five dominant families of Pteridophytes

Names of families	Numbers of taxa	Percentage
Polypodiaceae	9	25.71
Aspleniaceae	8	22.86
Pteridaceae	5	14.28
Lycopodiaceae	3	8.57
Schizaeaceae	2	5.71

Table 16. Species and generic diversity under the families of Pteridophytes

Numbers of taxa in genera	Numbers of genera	Numbers of families
1	22	7
2	3	2
3	1	1
4–10	1	2

6.2. Interesting floral elements of the study area

6.2.1. Rediscovery

Sarcopyramis subramanii Nayar of Melastomataceae has been rediscovered after the collection of the type material. It has only been collected once in India, from the Lushai Hills in Mizoram State in 1926 (Basumatary and Baruah 2021).

6.2.2. New distribution records taxa to Assam

A total of eight species have been reported as the new distributional records for the state. The names of the species, along with families, are listed in Table 17.

Table 17. New distribution records to Assam

Sl. Nos.	Species	Families	References
1	*Agapetes bhutanica* Balakr. and Chowdhury	Ericaceae	Basumatary and Baruah (2022)
2	*Bulbophyllum parviflorum* Parish and Rchb.f.	Orchidaceae	Basumatary *et al*. (2021)
3	*Bulbophyllum tenuifolium* (Blume) Lindl.	Orchidaceae	Basumatary *et al*. (2021)
4	*Hoya oreogena* Kerr	Apocynaceae	Reported in present study
5	*Peliosanthes bipiniana* Roy, Odyuo and Tanaka	Asparagaceae	Reported in present study
6	*Sarcopyramis subramanii* Nayar	Melastomataceae	Basumatary and Baruah (2021)
7	*Strobilanthes anisophylla* (Wall. ex Hook.) Anderson	Acanthaceae	Basumatary *et al*. (2022)
8	*Strobilanthes sabineana* (Wall. ex Lindl.) Nees	Acanthaceae	Basumatary *et al*. (2022)

6.2.3. New additions to the flora of BTAD (now BTR)

Analysis shows that out of 728 taxa in the study area, a total of 210 taxa have been added to the flora of BTR that were not recorded by Borthakur *et al.* (2018). The names of the taxa along, with the families' names, are listed below in Table 18.

Table 18. Species new addition to the flora of BTR

Sl. Nos.	Taxa	Families	Habitat	Habit
1	*Acampe praemorsa* var. *praemorsa* (Roxb.) Blatt. and McCann	Orchidaceae	Epiphyte	Herb
2	*Acampe praemorsa* var. *longepedunculata* (Trimen) Govaerts	Orchidaceae	Epiphyte	Herb
3	*Acanthus leucostachyus* Wall. ex	Acanthaceae	Terrestrial	Herb

	Nees			
4	*Achyranthes bidentata* Blume	Amaranthaceae	Terrestrial	Herb
5	*Achyrospermum densiflorum* Blume	Lamiaceae	Terrestrial	Herb
6	*Acronychia pedunculata* (L.) Miq.	Rutaceae	Terrestrial	Tree
7	*Adinandra griffithii* Dyer	Pentaphylacaceae	Terrestrial	Tree
8	*Aeschynanthus gracilis* Parish ex Clarke	Gesneriaceae	Epiphyte	Herb
9	*Aeschynanthus micranthus* Clarke in DC. and DC.	Gesneriaceae	Epiphyte	Herb
10	*Agapetes bhutanica* Balakr. and Chowdhury	Ericaceae	Epiphyte	Shrub
11	*Agapetes macrantha* var. *grandiflora* Banik and Sanjappa	Ericaceae	Epiphyte	Shrub
12	*Alchornea tiliifolia* (Benth.) Müll. Arg.	Euphorbiaceae	Terrestrial	Shrub
13	*Alpinia roxburghii* Sweet	Zingiberaceae	Terrestrial	Herb
14	*Ania penangiana* (Hook.f.) Summerh.	Orchidaceae	Terrestrial	Herb
15	*Antidesma montanum* Blume	Phyllanthaceae	Terrestrial	Tree
16	*Antidesma roxburghii* Wall.	Phyllanthaceae	Terrestrial	Shrub
17	*Apostasia wallichii* Br.	Orchidaceae	Terrestrial	Herb
18	*Ardisia neriifolia* Wall. and DC.	Primulaceae	Terrestrial	Shrub
19	*Ardisia thyrsiflora* Don	Primulaceae	Terrestrial	Shrub
20	*Aristolochia assamica* Borah and Do	Aristolochiaceae	Terrestrial	Climber
21	*Barleria strigosa* Willd.	Acanthaceae	Terrestrial	Herb
22	*Begonia nepalensis* (DC.) Warb. in Engler and Prantl.	Begoniaceae	Terrestrial	Herb
23	*Boesenbergia hamiltonii* Mood, Dey and Prince	Zingiberaceae	Terrestrial	Herb

24	*Bolbitis heteroclita* (Presl) Ching	Polypodiaceae	Terrestrial	Herb
25	*Bonnaya oppositifolia* (Retz.) Spreng.	Linderniaceae	Terrestrial	Herb
26	*Breynia macrantha* (L.) Chakrab. and Balakr.	Phyllanthaceae	Terrestrial	Shrub
27	*Breynia trinervia* (Hook.f. and Thomson ex Müll.Arg) Chakrab. and Balakr.	Phyllanthaceae	Terrestrial	Shrub
28	*Bulbophyllum crassipes* Hook.f.	Orchidaceae	Epiphyte	Herb
29	*Bulbophyllum gracilipes* King and Pantl.	Orchidaceae	Epiphyte	Herb
30	*Bulbophyllum odoratissimum* (Sm.) Lindl. ex Wall.	Orchidaceae	Epiphyte	Herb
31	*Bulbophyllum parviflorum* Parish and Rchb.f.	Orchidaceae	Epiphyte	Herb
32	*Bulbophyllum protractum* Hook.f.	Orchidaceae	Epiphyte	Herb
33	*Bulbophyllum roxburghii* (Lindl.) Rchb.f. in Walpers	Orchidaceae	Epiphyte	Herb
34	*Bulbophyllum tenuifolium* (Blume) Lindl.	Orchidaceae	Epiphyte	Herb
35	*Calamus melanochaetes* Miq.	Arecaceae	Terrestrial	Shrub
36	*Calanthe densiflora* Lindl.	Orchidaceae	Terrestrial	Herb
37	*Calanthe longipes* Hook.f.	Orchidaceae	Terrestrial	Herb
38	*Calanthe sylvatica* (Thouars) Lindl.	Orchidaceae	Terrestrial	Herb
39	*Calanthe tankervilleae* (Banks) Chase, Christenh. and Schuit.	Orchidaceae	Terrestrial	Herb
40	*Callicarpa longifolia* Lam.	Lamiaceae	Terrestrial	Shrub
41	*Callostylis rigida* Blume	Orchidaceae	Epiphyte	Herb
42	*Calophyllum polyanthum* Wall. ex Choisy	Calophyllaceae	Terrestrial	Tree
43	*Capparis assamica* Hook.f. and Thomson	Capparaceae	Terrestrial	Shrub
44	*Capparis olacifolia* Hook.f. and	Capparaceae	Terrestrial	Shrub

	Thoms.			
45	*Chiloschista parishii* Seidenf.	Orchidaceae	Epiphyte	Herb
46	*Chrysoglossum ornatum* Blume	Orchidaceae	Terrestrial	Herb
47	*Cleisocentron pallens* (Cathcart ex Lindl.) Pearce and Cribb	Orchidaceae	Epiphyte	Herb
48	*Cleisostoma subulatum* Blume	Orchidaceae	Epiphyte	Herb
49	*Cleome houtteana* Schltdl.	Cleomaceae	Terrestrial	Herb
50	*Clerodendrum hastatum* Lindl.	Lamiaceae	Terrestrial	Shrub
51	*Coelogyne articulata* (Lindl.) Rchb.f.	Orchidaceae	Epiphyte	Herb
52	*Coelogyne flaccida* Lindl.	Orchidaceae	Epiphyte	Herb
53	*Coelogyne imbricata* (Hook.) Rchb.f.	Orchidaceae	Epiphyte	Herb
54	*Connarus paniculatus* Roxb.	Connaraceae	Terrestrial	Shrub
55	*Corymborkis veratrifolia* (Reinw.) Blume	Orchidaceae	Terrestrial	Shrub
56	*Cryptochilus acuminatus* (griff.) Schuit., Ng and Pedersen	Orchidaceae	Epiphyte	Herb
57	*Cryptochilus strictus* (Lindl.) Schuit., Ng and Pedersen	Orchidaceae	Epiphyte	Herb
58	*Cryptocoryne retrospiralis* (Roxb.) Kunth	Araceae	Aquatic	Herb
59	*Curculigo capitulata* (Lour.) Kuntze	Hypoxidaceae	Terrestrial	Herb
60	*Dendrobium fimbriatum* Hook.	Orchidaceae	Epiphyte	Herb
61	*Dendrobium aduncum* Lindl.	Orchidaceae	Epiphyte	Herb
62	*Dendrobium anceps* Sw.	Orchidaceae	Epiphyte	Herb
63	*Dendrobium farmeri* Paxton	Orchidaceae	Epiphyte	Herb
64	*Dendrobium formosum* Roxb. ex Lindl.	Orchidaceae	Epiphyte	Herb

65	*Dendrobium fugax* Rchb.f.	Orchidaceae	Epiphyte	Herb
66	*Dendrobium jenkinsii* Wall. ex Lindl.	Orchidaceae	Epiphyte	Herb
67	*Dendrobium nobile* Lindl.	Orchidaceae	Epiphyte	Herb
68	*Dendrobium ruckeri* Lindl.	Orchidaceae	Epiphyte	Herb
69	*Dendrobium salaccense* (Blume) Lindl.	Orchidaceae	Epiphyte	Herb
70	*Dendrobium terminale* Parish and Rchb.f.	Orchidaceae	Epiphyte	Herb
71	*Dendrobium transparens* Wall. ex Lindl.	Orchidaceae	Epiphyte	Herb
72	*Dendrocnide meyeniana* (Walp.) Chew	Urticaceae	Terrestrial	Tree
73	*Didymocheton mollissimus* (Spreng.) Mabb.	Meliaceae	Terrestrial	Tree
74	*Dioscorea oppositifolia* L.	Dioscoreaceae	Terrestrial	Climber
75	*Diploclisia glaucescens* (Blume) Diels	Menispermaceae	Terrestrial	Climber
76	*Ehretia aspera* Willd.	Boraginaceae	Terrestrial	Shrub
77	*Elaeocarpus angustifolium* Blume	Elaeocarpaceae	Terrestrial	Tree
78	*Elaeocarpus lucidus* Roxb.	Elaeocarpaceae	Terrestrial	Tree
79	*Elaeocarpus rugosus* Roxb. ex Don	Elaeocarpaceae	Terrestrial	Tree
80	*Elaeocarpus stapfianus* Gagnep.	Elaeocarpaceae	Terrestrial	Tree
81	*Elaeocarpus varunua* Buch.-Ham. ex Masters	Elaeocarpaceae	Terrestrial	Tree
82	*Elatostema acuminatum* (Poir.) Brogn.	Urticaceae	Terrestrial	Herb
83	*Eranthemum griffithii* (Anderson) Bremek. and Nann.-Bremek.	Acanthaceae	Terrestrial	Shrub
84	*Eriocaulon quinquangulare* L.	Eriocaulaceae	Terrestrial	Herb
85	*Euonymus attenuates* Wall. ex Lawson	Celastraceae	Terrestrial	Tree

86	*Euonymus vagans* Wall. in Roxb.	Celastraceae	Terrestrial	Climber
87	*Excoecaria oppositifolia* Griff.	Euphorbiaceae	Terrestrial	Tree
88	*Fagraea ceilanica* Thunb.	Gentianaceae	Terrestrial	Tree
89	*Ficus assamica* Miq.	Moraceae	Terrestrial	Shrub
90	*Ficus drupacea* Thunb.	Moraceae	Terrestrial	Shrub
91	*Ficus hederacea* Roxb.	Moraceae	Terrestrial	Shrub
92	*Ficus heteropluera* Blume	Moraceae	Terrestrial	Shrub
93	*Ficus lamponga* Miq.	Moraceae	Terrestrial	Tree
94	*Ficus sagittata* Vahl	Moraceae	Terrestrial	Shrub
95	*Ficus subulata* Blume	Moraceae	Terrestrial	Shrub
96	*Ficus variegata* Blume	Moraceae	Terrestrial	Tree
97	*Garcinia assamica* Sarma, Shameer and Mohanan	Clusiaceae	Terrestrial	Tree
98	*Gastrochilus inconspicuous* (Hook.f.) Kuntze	Orchidaceae	Epiphyte	Herb
99	*Geophila repens* (L.) Johnst.	Rubiaceae	Terrestrial	Herb
100	*Globba orixensis* Roxb.	Zingiberaceae	Terrestrial	Herb
101	*Glochidion zeylanicum* var. *tomentosum* (Dalzell) Trimen	Phyllanthaceae	Terrestrial	Tree
102	*Gynostemma pentaphyllum* (Thunb.) Makino	Cucurbitaceae	Terrestrial	Climber
103	*Hedychium coccineum* Buch.-Ham. ex Sm.	Zingiberaceae	Terrestrial	Herb
104	*Hedychium thyrsiforme* Buch.-Ham. ex Sm. in Rees,	Zingiberaceae	Terrestrial	Herb
105	*Hetaeria affinis* (Griff.) Seidenf. and Ormerod	Orchidaceae	Terrestrial	Herb
106	*Heterostemma alatum* Wight	Apocynaceae	Terrestrial	Climber
107	*Hoya globulosa* Hook.f.	Apocynaceae	Epiphyte	Climber
108	*Hoya oreogena* Kerr	Apocynaceae	Epiphyte	Climber
109	*Hylodesmum laxum* (DC.) Oshahi and Mill	Fabaceae	Terrestrial	Herb
110	*Hypolytrum nemorum* (Vahl)	Cyperaceae	Aquatic	Herb

	Spreng.			
111	*Hyptianthera stricta* Wight and Arn.	Rubiaceae	Terrestrial	Shrub
112	*Ilex odorata* Buch.-Hum. ex Don	Aquifoliaceae	Terrestrial	Tree
113	*Impatiens trilobata* Colebr.	Balsaminaceae	Terrestrial	Herb
114	*Indofevillea khasiana* Chatterjee	Cucurbitaceae	Terrestrial	Climber
115	*Ipomoea alba* L.	Convolvulaceae	Terrestrial	Climber
116	*Isodon ternifolius* (Don) Kudô	Lamiaceae	Terrestrial	Shrub
117	*Ixora goalparensis* Bremek.	Rubiaceae	Terrestrial	Shrub
118	*Jasminum flexile* Vahl	Oleaceae	Terrestrial	Climber
119	*Jasminum subglandulosum* Kurz	Oleaceae	Terrestrial	Climber
120	*Kadsura heteroclita* Craib	Schisandraceae	Terrestrial	Climber
121	*Knema tenuinervia* Wilde	Myristicaceae	Terrestrial	Tree
122	*Lasianthus sikkimensis* Hook.f.	Rubiaceae	Terrestrial	Shrub
123	*Limnophila rugosa* (Roth) Merr.	Plantaginaceae	Aquatic	Herb
124	*Lindernia rotundifolia* (L.) Alston	Linderniaceae	Terrestrial	Herb
125	*Liparis mannii* Rchb.f.	Orchidaceae	Epiphyte	Herb
126	*Litsea cubeba* (Lour.) Pers.	Lauraceae	Terrestrial	Tree
127	*Litsea meghalayensis* Singh	Lauraceae	Terrestrial	Tree
128	*Lobelia zeylanica* L.	Campanulaceae	Terrestrial	Herb
129	*Luisia brachystachys* (Lindl.) Blume	Orchidaceae	Epiphyte	Herb
130	*Luisia filiformis* Hook.f.	Orchidaceae	Epiphyte	Herb
131	*Luisia trichorhiza* (Hook.) Blume	Orchidaceae	Epiphyte	Herb
132	*Lycianthes neesiana* (Wall. ex Nees) D'Arcy and Zhang	Solanaceae	Terrestrial	Herb
133	*Macaranga indica* Wight	Euphorbiaceae	Terrestrial	Tree
134	*Maesa paniculata* DC.	Primulaceae	Terrestrial	Shrub
135	*Medinilla rubicunda* (Jack) Blume	Melastomataceae	Epiphyte	Shrub
136	*Melodimus cochinchinensis* (Lour.) Merr.	Apocynaceae	Terrestrial	Climber
137	*Memecylon cerasiforme* Kurz	Melastomataceae	Terrestrial	Tree
138	*Micropera rostrata* (Roxb.) Balakr.	Orchidaceae	Epiphyte	Herb

139	*Microtropis discolour* (Wall.) Wall. ex Meisn.	Celastraceae	Terrestrial	Tree
140	*Miliusa dioeca* (Roxb.) Chaowasku and Kessler	Annonaceae	Terrestrial	Tree
141	*Monoon simiarum* (Buch.-Ham. ex Hook.f. and Thomson) Xue and Saunders	Annonaceae	Terrestrial	Tree
142	*Mussaenda glabra* Vahl	Rubiaceae	Terrestrial	Climber
143	*Mycaranthes floribunda* (Don) Chen and Wood	Orchidaceae	Epiphyte	Herb
144	*Myrsine capitellata* Wall.	Primulaceae	Terrestrial	Tree
145	*Myxopyrum smilacifolium* (Wall.) Blume	Oleaceae	Terrestrial	Climber
146	*Oberonia mucronata* (Don) Ormerod and Seidenf.	Orchidaceae	Epiphyte	Herb
147	*Oxystelma esculentum* (L.f.) Sm. in Rees	Apocynaceae	Aquatic	Climber
148	*Pegia nitida* Colebr.	Anacardiaceae	Terrestrial	Climber
149	*Peliosanthes bipiniana* Roy, Odyuo and Tanaka	Asparagaceae	Terrestrial	Herb
150	*Peliosanthes macrophylla* Wall. ex Baker	Asparagaceae	Terrestrial	Herb
151	*Phalaenopsis lobbii* (Rchb.f.) Sweet	Orchidaceae	Epiphyte	Herb
152	*Phalaenopsis mannii* Rchb.	Orchidaceae	Epiphyte	Herb
153	*Phalaenopsis deliciosa* Rchb.f.	Orchidaceae	Epiphyte	Herb
154	*Huperzia vernicosa* (Hook. and Grev.) Trevis.	Lycopodiaceae	Epiphyte	Herb
155	*Phyllanthus leschenaultia* Müll.Arg.	Phyllanthaceae	Terrestrial	Herb
156	*Phyllanthus rheedei* Wight	Phyllanthaceae	Terrestrial	Herb
157	*Phyllanthus sikkimensis* Müll.Arg.	Phyllanthaceae	Terrestrial	Shrub
158	*Picrasma javanica* Blume	Simaroubaceae	Terrestrial	Tree

159	*Pinalia bractescens* (Lindl.) Kuntze	Orchidaceae	Epiphyte	Herb
160	*Pinalia connata* (Joseph, Hedge andAbbar.) Ormerod and Wood	Orchidaceae	Epiphyte	Herb
161	*Poikilospermum suaveolens* (Blume) Merr.	Urticaceae	Terrestrial	
162	*Pomatocalpa armigerum* (King and Pantl.) Tang and Wang	Orchidaceae	Epiphyte	Herb
163	*Pseuderanthemum latifolium* (Vahl) Hansen	Acanthaceae	Terrestrial	Herb
164	*Psychotria calocarpa* Kurz	Rubiaceae	Terrestrial	Shrub
165	*Psychotria monticola* Kurz	Rubiaceae	Terrestrial	Shrub
166	*Pteris quadriaurita* Retz.	Pteridaceae	Terrestrial	Herb
167	*Pterospermum lanceifolium* Roxb. ex DC.	Malvaceae	Terrestrial	Tree
168	*Pycnarrhena pleniflora* Miers ex Hook.f. and Thomson	Menispermaceae	Terrestrial	Shrub
169	*Pyrrosia piloselloides* (L.) Price	Polypodiaceae	Epiphyte	Herb
170	*Rauvolfia verticillata* (Lour.) Baill.	Apocynaceae	Terrestrial	Shrub
171	*Robiquetia spahtulata* (Blume) Sm.	Orchidaceae	Epiphyte	Herb
172	*Rubus rugosus* Sm.	Rosaceae	Terrestrial	Shrub
173	*Rubus sumatranus* Miq.	Rosaceae	Terrestrial	Shrub
174	*Sabia lanceolata* Colebr.	Sabiaceae	Terrestrial	Shrub
175	*Sabia limoniacea* Wall. ex Hook.f. and Thmson	Sabiaceae	Terrestrial	Shrub
176	*Salacia salacioides* (Roxb.) Rao and Hemadri	Celastraceae	Terrestrial	Shrub
177	*Sarcopyramis subramanii* Nayar	Melastomataceae	Terrestrial	Herb

178	*Scurrula pulverulenta* (Wall.) Don	Loranthaceae	Epiphyte	Shrub
179	*Smilax bockii* Warb. ex Diels	Smilacaceae	Terrestrial	Climber
180	*Smilax orthoptera* DC.	Smilacaceae	Terrestrial	Climber
181	*Spermacoce exilis* (Williams) Adams ex Burger and Taylor	Rubiaceae	Terrestrial	Herb
182	*Stereochilus hirtus* Lindl.	Orchidaceae	Epiphyte	Herb
183	*Stixis suaveolens* (Roxb.) Pierre	Resedaceae	Terrestrial	Shrub
184	*Strobilanthes anisophylla* (Wall. ex Hook.) Anderson	Acanthaceae	Terrestrial	Shrub
185	*Strobilanthes sabineana* (Wall. ex Lindl.) Nees	Acanthaceae	Terrestrial	Shrub
186	*Strobilanthes simonsii* Anderson	Acanthaceae	Terrestrial	Shrub
187	*Strongyleria pannea* (Lindl.) Schuit., Ng and Pedersen	Orchidaceae	Epiphyte	Herb
188	*Symplocos acuminata* Miq.	Symplocaceae	Terrestrial	Tree
189	*Syzygium kurzii* (Duthie) Balakr.	Myrtaceae	Terrestrial	Tree
190	*Syzygium praecox* (Roxb.) Rathakr. and Nair	Myrtaceae	Terrestrial	Tree
191	*Tainia latifolia* (Lindl.) Rchb.f.	Orchidaceae	Terrestrial	Herb
192	*Terminalia myriocarpa* Van Heurek and Müll.Arg.	Combretaceae	Terrestrial	Tree
193	*Ternstroemia gymnanthera* (Wight and Arn.) Bedd.	Pentaphylacaceae	Terrestrial	Tree
194	*Pterygota alata* (Roxb.) Br.	Malvaceae	Terrestrial	Tree
195	*Tetrastigma leucostaphylum* (Dennst.) Alston ex Medd.	Vitaceae	Terrestrial	Climber
196	*Thelasis longifolia* Hook.f.	Orchidaceae	Epiphyte	Herb

197	*Thrixspermum centipeda* Lour.	Orchidaceae	Epiphyte	Herb
198	*Tolypanthus involucratus* (Roxb.) Tiegh.	Loranthaceae	Epiphyte	Shrub
199	*Trachelospermum lucidum* (Don) Schum.	Apocynaceae	Terrestrial	Climber
200	*Trichotosia pulvinata* (Lindl.) Kraenzl.	Orchidaceae	Epiphyte	Herb
201	*Trigonostemon semperflorens* (Roxb.) Müll.Arg.	Euphorbiaceae	Terrestrial	Tree
202	*Uncaria sessilifructus* Roxb.	Rubiaceae	Terrestrial	Shrub
203	*Urceola micrantha* (Wall. ex Don) Middleton	Apocynaceae	Terrestrial	Shrub
204	*Utricularia caerulea* L.	Lentibulariaceae	Aqautic	Herb
205	*Vitex quinata* (Laur.) Williams	Lamiaceae	Terrestrial	Tree
206	*Vrydagzynea viridiflora* Hook.f.	Orchidaceae	Terrestrial	Herb
207	*Yamazakia pusilla* (Willd.) Barker, Liang and Wannan	Linderniaceae	Terrestrial	Herb
208	*Zehneria japonica* (Thunb.) Liu	Cucurbitaceae	Terrestrial	Climber
209	*Zeuxine affinis* (Lindl.) Benth. ex Hook.f.	Orchidaceae	Terrestrial	Herb
210	*Ziziphus apetala* Hook.f.	Rhamnaceae	Terrestrial	Shrub

6.2.4. Threatened plants

A total of 51 species under 40 genera belonging to 18 families were recorded under threatened categories (Table 19). Out of 51 species, 39 species are Rare (R), 4 are Endangered (E), 3 are Critically Endangered (CR), 2 are Vulnerable (VU), 2 are Least Concern (LC), and 1 is Data Deficient (DD). Among the genera, *Dendrobium* is the dominant with 6 species, followed by *Pinalia* with 3 species. Among the families, Orchidaceae shows the highest threatened species with 32.

Table 19. Details of threatened taxa

Sl. Nos.	Species	Families	Status	References
1	*Adinandra griffithii* Dyer	Pentaphylacaceae	CR	Mir *et al*. (2020)
2	*Ania penangiana* (Hook.f.) Summerh.	Orchidaceae	R	Gogoi (2017)
3	*Apostasia wallichii* Br.	Orchidaceae	E	Gogoi (2017)
4	*Artocarpus lacucha* Buch.-Ham.	Moraceae	R	Rao and Haridasan (1983)
5	*Arundina graminifolia* (Don) Hochr.	Orchidaceae	R	Kataki (1983), Gogoi (2017)
6	*Bulbophyllum gracilipes* King and Pantl.	Orchidaceae	R	Gogoi (2017)
7	*Bulbophyllum protractum* Hook.f.	Orchidaceae	R	Gogoi (2017)
8	*Calanthe densiflora* Lindl.	Orchidaceae	R	Gogoi (2017)
9	*Calanthe longipes* Hook.f.	Orchidaceae	E	Gogoi (2017)
10	*Calanthe tankervilleae* (Banks) Chase	Orchidaceae	R	Kataki (1983)
11	*Capparis olacifolia* Hook.f. and Thoms.	Capparaceae	R	Saxena and Brahmam (1983)
12	*Chiloschista parishii* Seidenf.	Orchidaceae	R	Gogoi (2017)
13	*Chrysoglossum ornatum* Blume	Orchidaceae	R	Gogoi (2017)
14	*Clerodendrum hastatum* Lindl.	Lamiaceae	R	Rao and Haridasan (1983)
15	*Coelogyne flaccida* Lindl.	Orchidaceae	R	Gogoi (2017)
16	*Corymborkis veratrifolia* (Reinw.) Blume	Orchidaceae	R	Nayar and Sastry (1987), Gogoi (2017)
17	*Cryptochilus acuminatus*	Orchidaceae	R	Gogoi (2017)

	(griff.) Schuit.,			
18	*Cryptochilus strictus* (Lindl.) Schuit.	Orchidaceae	R	Gogoi (2017)
19	*Dendrobium anceps* Sw.	Orchidaceae	R	Giri and Nayar (1983), Gogoi (2017)
20	*Dendrobium farmeri* Paxton	Orchidaceae	R	Gogoi (2017)
21	*Dendrobium formosum* Roxb. ex Lindl.	Orchidaceae	R	Gogoi (2017)
22	*Dendrobium nobile* Lindl.	Orchidaceae	R	Kataki (1983), Gogoi (2017)
23	*Dendrobium ruckeri* Lindl.	Orchidaceae	R	Gogoi (2017)
24	*Dendrobium salaccense* (Blume) Lindl.	Orchidaceae	R	Gogoi (2017)
25	*Drosera burmanni* Vahl.	Droseraceae	VU	Giri and Nayar (1983)
26	*Gnetum montanum* Markgr.	Gnetaceae	E	Chowdhery and Murti (2019) (CITES)
27	*Indofevillea khasiana* Chatterjee	Cucurbitaceae	R	Naithani and Bahadur (1983), Baishya (1999)
28	*Liparis mannii* Rchb.f.	Orchidaceae	R	Gogoi (2017)
29	*Luisia brachystachys* (Lindl.) Blume	Orchidaceae	R	Giri and Nayar (1983), Gogoi (2017)
30	*Luisia filiformis* Hook.f.	Orchidaceae	R	Gogoi (2017)
31	*Medinilla rubicunda* (Jack) Blume	Melastomataceae	R	Rao and Haridasan (1983)
32	*Memecylon cerasiforme* Kurz	Melastomataceae	CR	Karthigeyan *et al*. (2016)
33	*Monoon simiarum* (Buch.-	Annonaceae	R	Kumar and Rao

	Ham. ex Hook.f. and Thomson) Xue and Saunders			(1983)
34	*Mycaranthes floribunda* (Don) Chen and Wood	Orchidaceae	R	Gogoi (2017)
35	*Natsiatum herpeticum* Buch-Ham. ex Arn.	Icacinaceae	R	Saxena and Brahmam (1983)
36	*Parabaena sagittata* Miers ex Hook.f. and Thomson	Menispermaceae	R	Saxena and Brahmam (1983)
37	*Paspalum conjugatum* Berg.	Poaceae	LC	Rehel (2013)
38	*Persicaria hydropiper* (L.) Delarbre	Polygonaceae	LC	Lansdown (2014)
39	*Picrasma javanica* Blume	Orchidaceae	R	Rao and Haridasan (1983)
40	*Pinalia acervata* (Lindl.) Kuntze	Orchidaceae	R	Gogoi (2017)
41	*Pinalia bractescens* (Lindl.) Kuntze	Orchidaceae	R	Gogoi (2017)
42	*Pinalia connata* (Joseph, Hedge andAbbar.) Ormerod and Wood	Orchidaceae	R	Gogoi (2017)
43	*Podocarpus neriifolius* Don	Podocarpaceae	E	Chowdhery and Murti (2019) (CITES)
44	*Rauvolfia serpentina* (L.) Benth. ex Kurz	Apocynaceae	VU	Saxena and Brahmam (1983)
45	*Stereochilus hirtus* Lindl.	Orchidaceae	R	Gogoi (2017)
46	*Strobilanthes simonsii* Anderson	Acanthaceae	DD	Wood and Scotland (2009)
47	*Trichotosia pulvinata* (Lindl.) Kraenzl.	Orchidaceae	R	Gogoi (2017)
48	*Vatica lanceifolia* (Roxb.)	Dipterocarpaceae	CR	Ashton (1998)

	Blume			
49	*Vrydagzynea viridiflora* Hook.f.	Orchidaceae	E	Gogoi (2017)
50	*Wrightia coccinea* (Roxb. ex Hornem.) Sims	Apocynaceae	R	Rao and Haridasan (1983)
51	*Zeuxine affinis* (Lindl.) Benth. ex Hook.f.	Orchidaceae	R	Gogoi (2017)

6.2.5. Endemic plants

A total of 13 species found restricted distribution. The list of the species is displayed below in Table 20.

Table 20. Details of endemic species

Sl. Nos.	Species	Families	Distribution	References
1	*Adinandra griffithii* Dyer	Pentaphylacaceae	Assam and Meghalaya	Adhikari *et al*. (2018)
2	*Aristolochia assamica* Borah and Do	Aristolochiaceae	Arunachal Pradesh and Assam	Borah *et al*. (2019)
3	*Bulbophyllum gracilipes* King and Pantl.	Orchidaceae	Assam and Sikkim	Gogoi (2017)
4	*Garcinia assamica* Sarma, Shameer and Mohanan	Clusiaceae	Assam (Bodoland Territorial Region)	Sarma *et al*. (2016)
5	*Huperzia vernicosa* (Hook. and Grev.) Trevis.	Lycopodiaceae	India	Fraser-Jenkins *et al*. (2017)
6	*Ixora goalparensis* Bremek.	Rubiaceae	Assam	Baishya (1999)
7	*Litsea meghalayensis* Singh	Lauraceae	Assam, Meghayaya,	Singh (2017)

			Sikkim and West Bengal	
8	*Peliosanthes bipiniana* Roy, Odyuo and Tanaka	Asparagaceae	Assam and Meghalaya	Roy *et al*. (2020)
9	*Pinalia connata* (Joseph, Hedge and Abbar.) Ormerod and Wood	Orchidaceae	Arunachal Pradesh, Assam and Sikkim	Gogoi (2017)
10	*Polyura geminata* Hook.f.	Rubiaceae	Assam, Aruanachal Pradesh and Meghalaya	Rana and Ranade (2009)
11	*Pomatocalpa armigerum* (King and Pantl.) Tang and Wang	Orchidaceae	Assam and Sikkim	Bora *et al*. (2010)
12	*Sarcopyramis subramanii* Nayar	Melastomataceae	Assam and Mizoram	Basumatary and Baruah (2021)
13	*Vrydagzynea viridiflora* Hook.f.	Orchidaceae	Assam	Bhattacharjee and Ormerod (2017)

6.2.6. Primitive taxa

Referring Baishya (1999), Chowdhery and Murti (2019), a total of 21 species under 16 genera belonging to 10 families are identified as primitive plants (Table 21). Lauraceae is the dominant families with 10 species under 6 genera. The dominant genus is *Litsea* with 5 species.

Table 21. Details of primitive taxa

Sl. Nos.	Families	Genera	Species	Habit
1	Annonaceae	*Miliusa* Lesch. ex	*Miliusa dioeca* (Roxb.)	Tree

		DC.	Chaowasku and Kessler	
2		*Monoon* Miq.	*Monoon simiarum* (Buch.-Ham. ex Hook.f. and Thomson) Xue and Saunders	Tree
3	Chloranthaceae	*Chloranthus* Sw.	*Chloranthus elatior* Link	Shrub
4	Gnetaceae	*Gnetum* L.	*Gnetum montanum* Markgr.	Climber
5	Lauraceae	*Actinodaphne* Nees	*Actinodaphne obovata* (Nees) Blume	Tree
6		*Cinnamomum* Schaeff.	*Cinnamomum bejolghota* (Buch.-Ham.) Sweet.	Tree
7		*Cryptocarya* Br.	*Cryptocarya amygdalina* Nees	Tree
8		*Litsea* Lam.	*Litsea cubeba* (Lour.) Pers,	Tree
9			*Litsea glutinosa* (lour.) Rob.	Tree
10			*Litsea meghalayensis* Singh	Tree
11			*Litsea monopetala* (Roxb.) Pers.	Tree
12			*Litsea salicifolia* (Roxb. ex Nees) Hook.f.,	Shrub
13		*Machilus* Nees	Machilus gamblei King ex Hook.f.,	Tree
14		*Phoebe* Nees	*Phoebe bottanica* (Meisn.) Gangop.	Tree
15	Magnoliaceae	*Magnolia* L.	*Magnolia champaca* (L.) Baill. ex Pierre	Tree
16			*Magnolia hodgsonii* (Hook.f. and Thomson)	Tree

			Keng	
17	Menispermaceae	*Pycnarrhena* Miers ex Hook.f. and Thomson	*Pycnarrhena pleniflora* Miers ex Hook.f. and Thomson	Climber
18	Myristicaceae	*Knema* Lour.	*Knema tenuinervia* subsp. *tenuinervia* Wilde	Tree
19	Podocarpaceae	*Podocarpus* Pers.	*Podocarpus neriifolius* Don	Tree
20	Saururaceae	*Houttuynia* Thunb.	*Houttuynia cordata* Thunb.	Herb
21	Schisandraceae	*Kadsura* Kaempf. ex Juss.	*Kadsura heteroclita* Craib	Climber

6.2.7. Monotypic genera

Referring Khanna and Kumar (2016), IPNI (2022), a total of 13 genera with single species belonging to 12 families are identified from the study area (Table 22).

Table 22. Details of monotypic genera

Sl. Nos.	Genera	Species	Families	Habit
1	*Abroma* Jacq.	*Abroma augustum* (L.) L.f.	Malvaceae	Shrub
2	*Arundina* Blume	*Arundina graminifolia* (Don) Hochr.	Orchidaceae	Herb
3	*Cannabis* L.	*Cannabis sativa* L.	Cannabaceae	Herb
4	*Gynocardia* Br.	*Gynocardia odorata* Br.	Achariaceae	Tree
5	*Houttuynia* Thunb.	*Houttuynia cordata* Thunb.	Saururaceae	Herb
6	*Hyptianthera* Wight and Arn.	*Hyptianthera stricta* Wight and Arn.	Rubiaceae	Shrub
7	*Natsiatum* Buch.-Ham. ex Arn.	*Natsiatum herpeticum* Buch-Ham. ex Arn.	Icacinaceae	Climber

8	*Oroxylum* Vent.	*Oroxylum indicum* (L.) Kurz	Bignoniaceae	Tree
9	*Polyura* Hook.f.	*Polyura geminata* Hook.f.	Rubiaceae	Herb
10	*Pongamia* Adans.	*Pongamia pinnata* (L.) Pierre,	Fabaceae	Tree
11	*Ricinus* L.	*Ricinus communis* L.	Euphorbiaceae	Shrub
12	*Tetrameles* Br.	*Tetrameles nudiflora* Br.	Tetramelaceae	Tree
13	*Thysanolaena* Nees	*Thysanolaena latifolia* (Roxb. ex Hornem.) Honda	Poaceae	Shrub

6.3. Plants with traditional knowledge

A total of 174 species under 145 genera belonging to 79 families related to ethno-botany have been recorded from the study area. The family Phyllanthaceae (10 spp.) is the dominant followed by Asteraceae (08 spp.) (Figure 4 and 5). The plant parts used for different purpose are—whole plant, roots, rhizome, tubers, barks, stems/shoots, leaves, flowers, fruits, and seeds. Among these, fruits are the most used plant parts followed by leaves (Figure 6 and 7). A total of 99 species have medicinal values, 57 species as vegetables or other foods, 44 species as edible fruits and 7 species are used in fish poisoning (Figure 8 and 9). All the recorded medicinal plants fall under 87 genera belonging to 50 families. Apocynaceae, Fabaceae, and Asteraceae are the dominant families followed by Lamiaceae (Figure 10). Leaves and roots are the most used part followed by fruits (Figure 11). Plant used as vegetables or other foods fall under 56 genera belongs to 39 families. The shoots are the dominant used part followed by leaves (Figure 12).

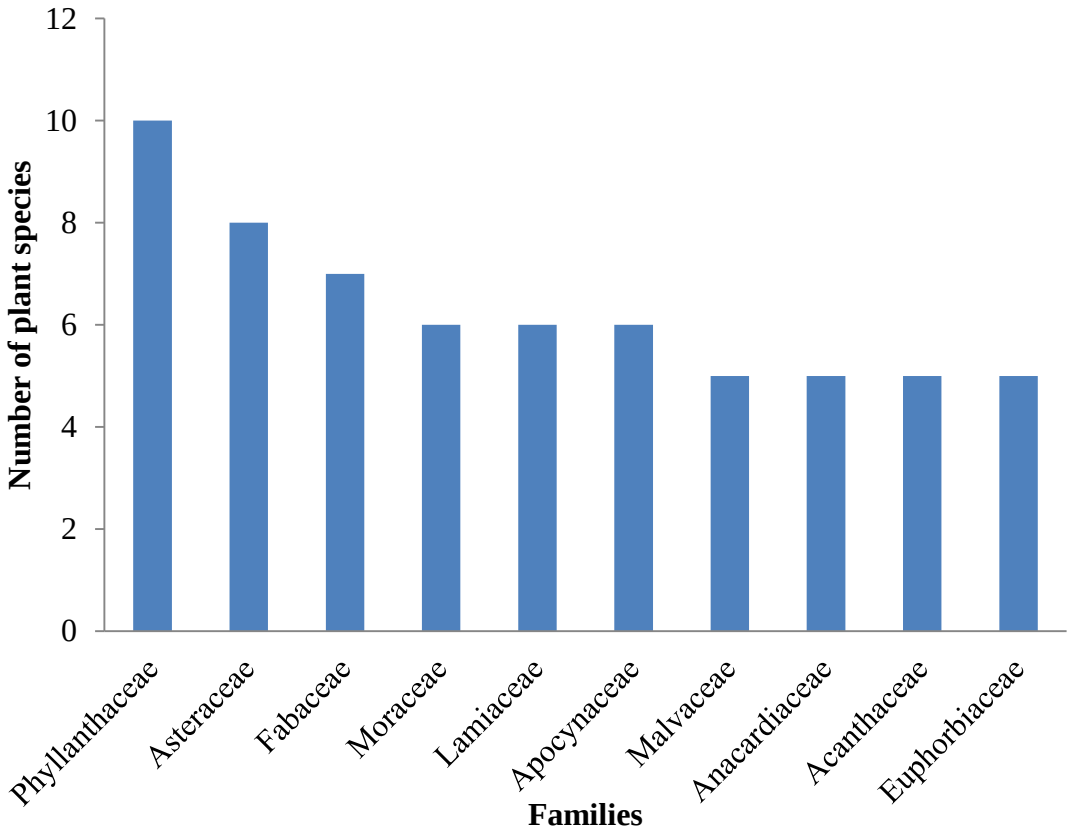

Figure 4. Top 10 dominant families of useful plants.

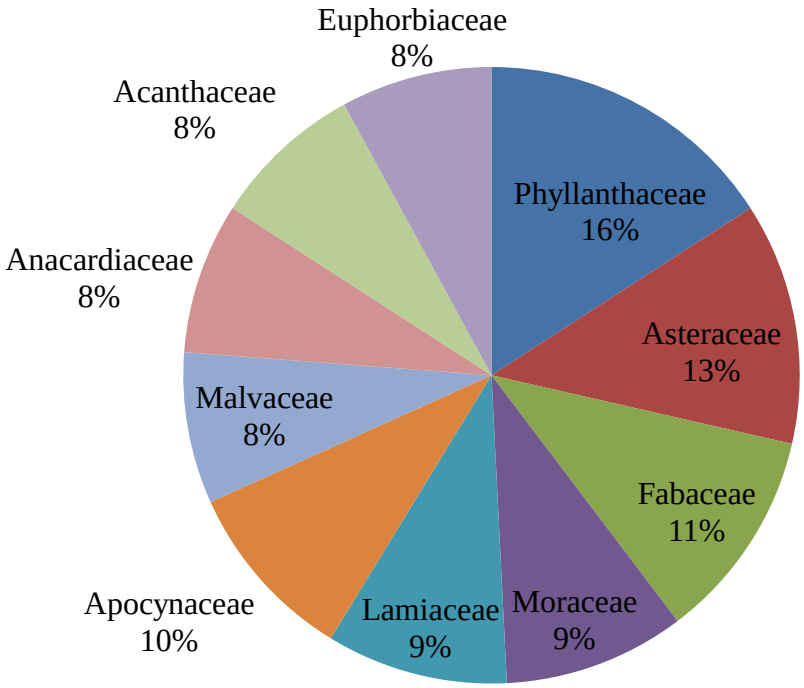

Figure 5. Percentage of top 10 dominant families of useful plants.

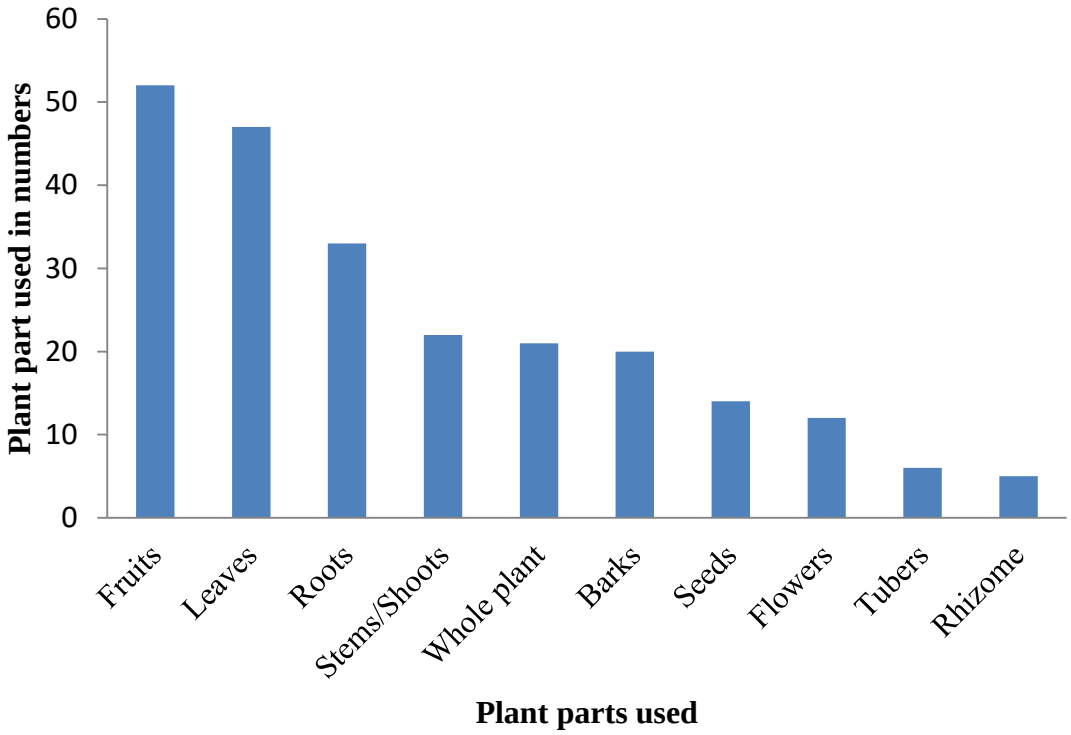

Figure 6. Plant parts used for various purposes of useful plants.

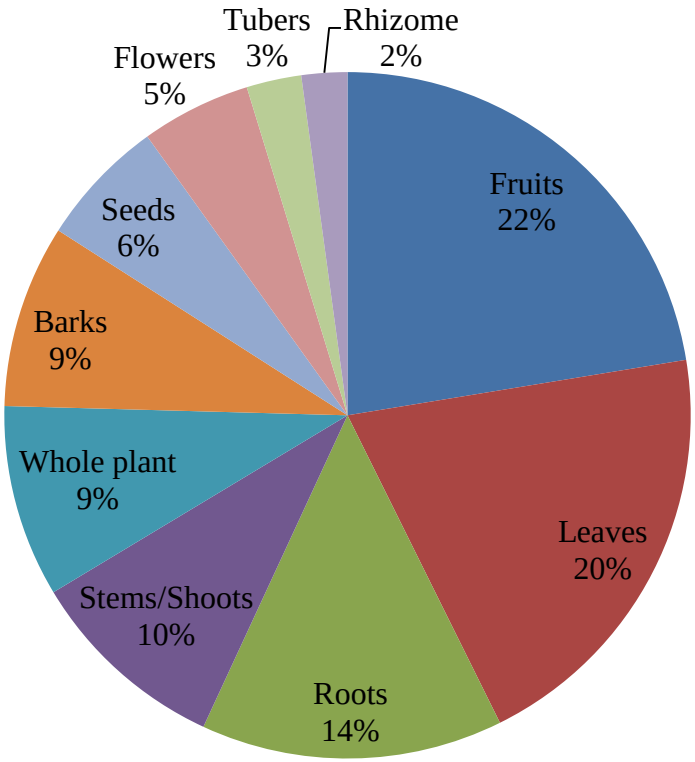

Figure 7. Percentage of plant parts used for various purposes of useful plants.

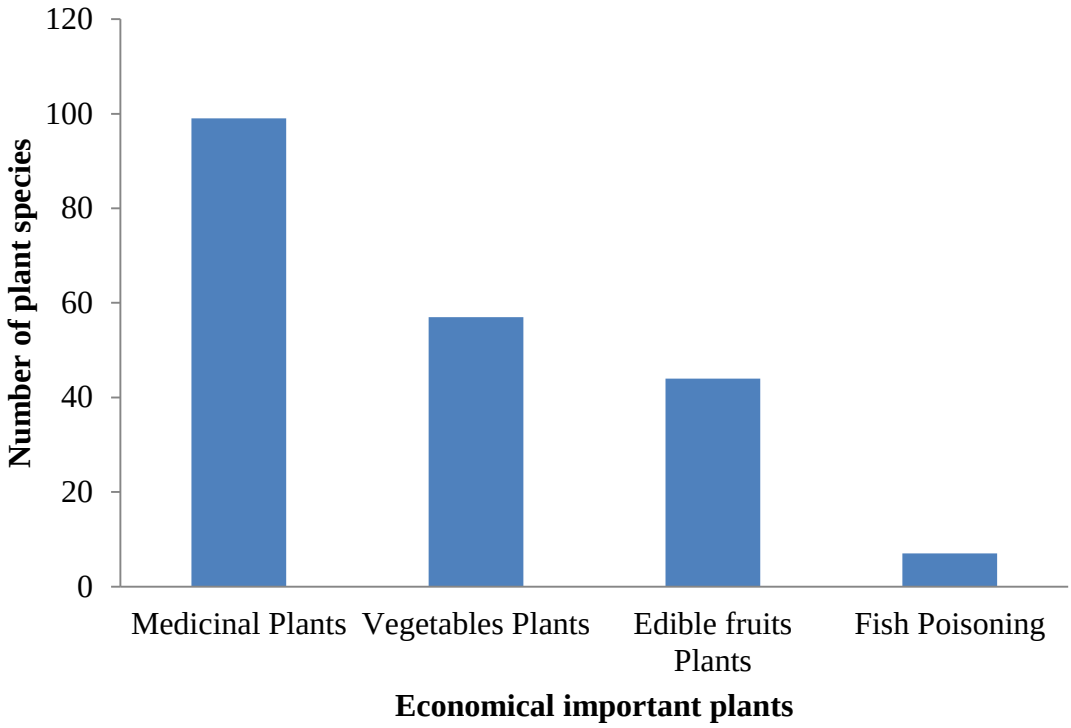

Figure 8. Numbers of plant used for various purposes.

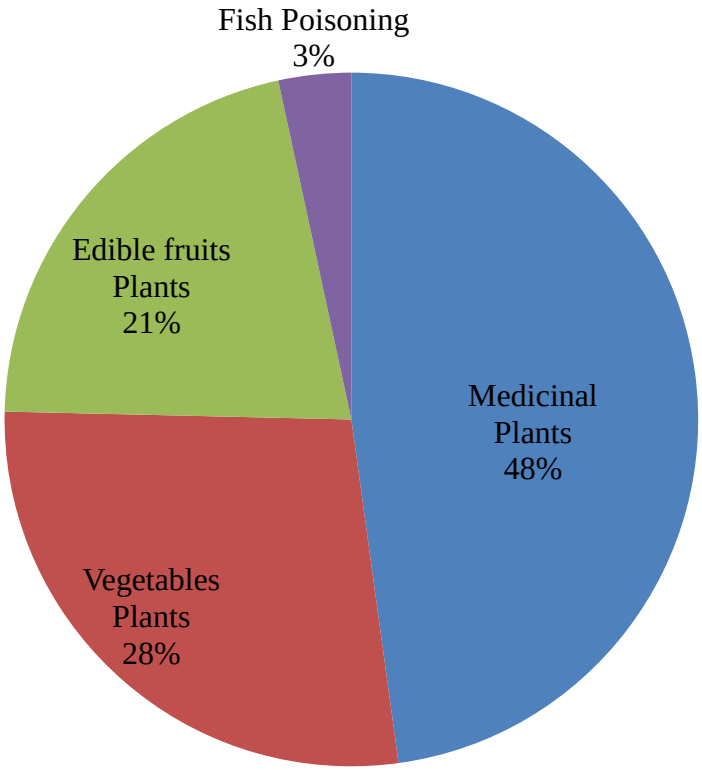

Figure 9. Percentage of the numbers of plant used for various purposes.

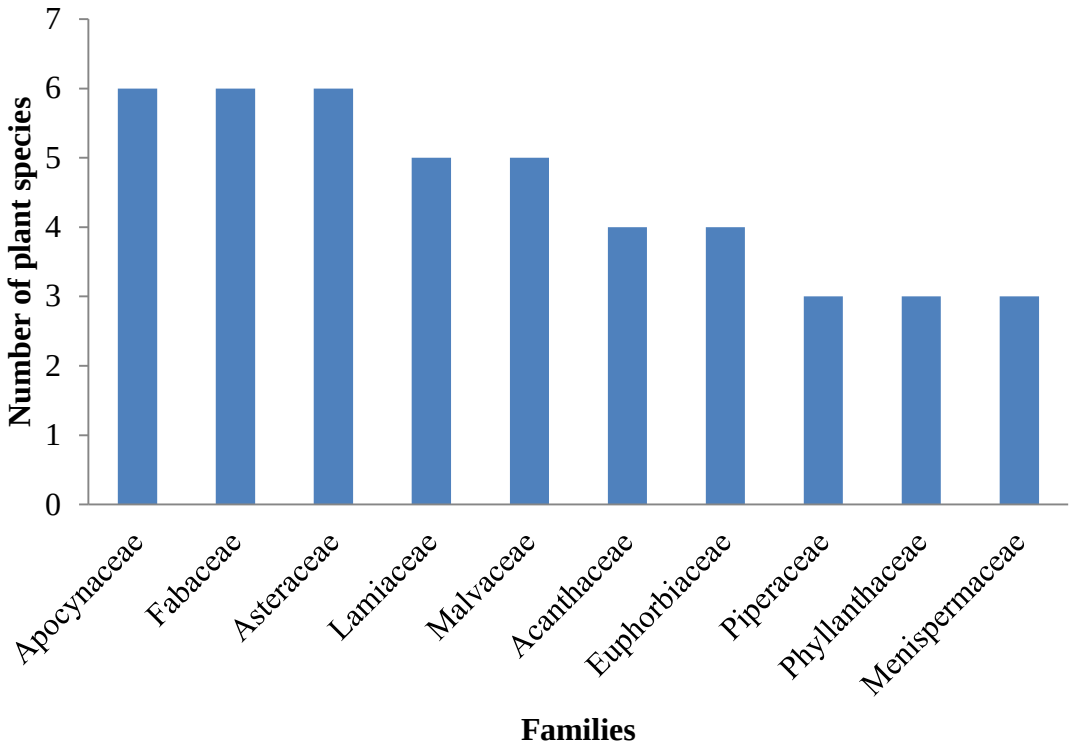

Figure 10. Dominant families of medicinal plants.

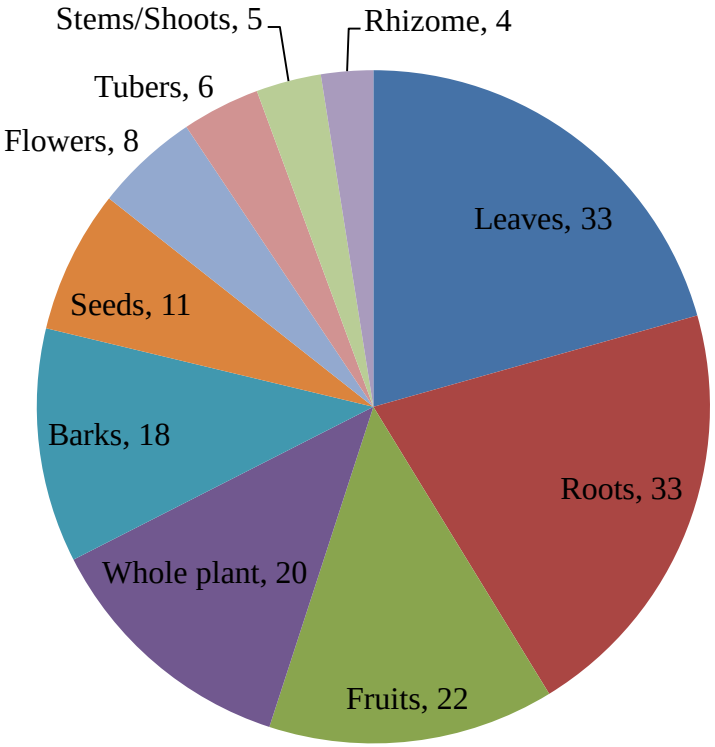

Figure 11. Numbers of medicinal plant parts used.

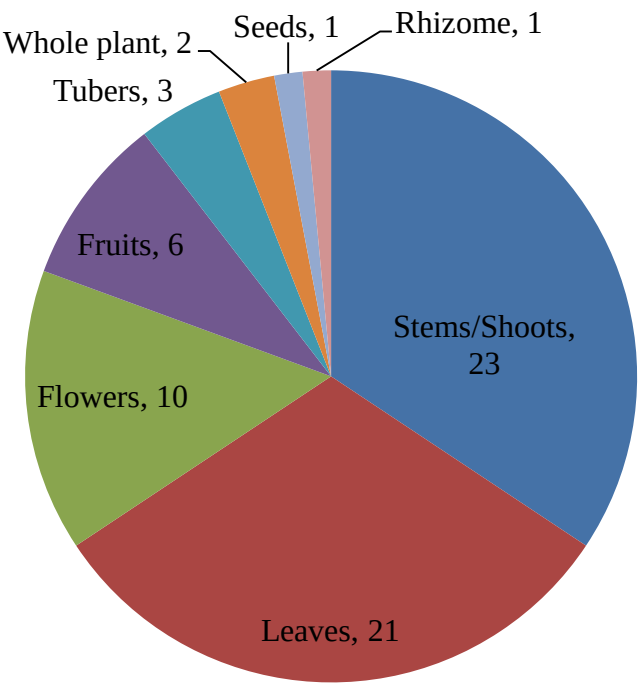

Figure 12. Numbers of vegetables/foods plant parts used.

6.4. Exotic plants

A total of 53 species under 46 genera belonging to 23 families have been encountered as exotic species (Table 23).

Table 23. Details of exotic species.

Sl. Nos.	Species	Families	Habit	Habitat
1	*Acacia auriculiformis* Cun. ex Benth.	Fabaceae	Tree	Terrestrial
2	*Ageratum conyzoides* L.	Asteraceae	Herb	Terrestrial
3	*Alocasia macrorrhizos* (L.) Don	Araceae	Herb	Terrestrial
4	*Amaranthus spinosus* L.	Amaranthaceae	Herb	Terrestrial
5	*Asplenium nidus* L.	Aspleniaceae	Herb	Epiphyte
6	*Axonopus compressus* (Sw.) Beauv.	Poaceae	Herb	Terrestrial
7	*Bidens pilosa* L.	Asteraceae	Herb	Terrestrial

8	*Camonea umbellata* (L.) Simões and Staples	Convolvulaceae	Climber	Terrestrial
9	*Canna indica* L.	Cannaceae	Herb	Terrestrial
10	*Cannabis sativa* L.	Cannabaceae	Herb	Terrestrial
11	*Chromolaena odorata* (L.) King and Rob.	Asteraceae	Shrub	Terrestrial
12	*Cleome houtteana* Schltdl.	Cleomaceae	Herb	Terrestrial
13	*Codiaeum variegatum* (L.) Rumph. ex Juss.	Euphorbiaceae	Shrub	Terrestrial
14	*Crassocephalum crepidioides* (Benth.) Moore	Asteraceae	Herb	Terrestrial
15	*Croton bonplandianus* Baill.	Euphorbiaceae	Shrub	Terrestrial
16	*Delonix regia* (Bojer ex Hook.) Raf.	Fabaceae	Tree	Terrestrial
17	*Eclipta prostrata* (L.) L.	Asteraceae	Herb	Terrestrial
18	*Euphorbia pulcherrima* Willd. ex Klotzsch	Euphorbiaceae	Shrub	Terrestrial
19	*Evolvulus nummularius* (L.) L.	Convolvulaceae	Herb	Terrestrial
20	*Heliotropium indicum* L.	Boraginaceae	Herb	Terrestrial
21	*Imperata cylindrica* (L.) Beauv.	Poaceae	Herb	Terrestrial
22	*Ipomoea alba* L.	Convolvulaceae	Climber	Terrestrial
23	*Ipomoea carnea* subsp. *fistulosa* (Mart. ex Choisy) Austin	Convolvulaceae	Shrub	Aquatic
24	*Jatropha curcas* L.	Euphorbiaceae	Shrub	Terrestrial
25	*Jatropha gossypiifolia* L.	Euphorbiaceae	Shrub	Terrestrial
26	*Lantana camara* L.	Verbenaceae	Shrub	Terrestrial
27	*Lippia alba* (Mill.) Br. ex Britton and Wilson	Verbenaceae	Shrub	Terrestrial
28	*Manihot esculenta* Crantz	Euphorbiaceae	Shrub	Terrestrial

29	*Mesosphaerum suaveolens* (L.) Kuntze	Lamiaceae	Herb	Terrestrial
30	*Mikania micrantha* Kunth	Asteraceae	Climber	Terrestrial
31	*Mimosa pudica* L.	Fabaceae	Herb	Terrestrial
32	*Oxalis corniculata* L.	Oxalidaceae	Herb	Terrestrial
33	*Oxalis debilis* Kunth	Oxalidaceae	Herb	Terrestrial
34	*Parthenium hysterophorus* L.	Asteraceae	Herb	Terrestrial
35	*Paspalum conjugatum* Berg.	Poaceae	Herb	Terrestrial
36	*Passiflora foetida* L.	Passifloraceae	Climber	Terrestrial
37	*Peperomia pellucida* (L.) Kunth	Piperaceae	Herb	Terrestrial
38	*Phyllanthus acidus* (L.) Skeels	Phyllanthaceae	Tree	Terrestrial
39	*Physalis angulata* L.	Solanaceae	Herb	Terrestrial
40	*Piper betle* L.	Piperaceae	Climber	Terrestrial
41	*Pontederia crassipes* Mart.	Pontederiaceae	Herb	Aquatic
42	*Portulaca oleracea* L.	Portulacaceae	Herb	Terrestrial
43	*Ricinus communis* L.	Euphorbiaceae	Shrub	Terrestrial
44	*Samanea saman* (Jacq.) Merr.	Fabaceae	Tree	Terrestrial
45	*Scoparia dulcis* L.	Plantaginaceae	Herb	Terrestrial
46	*Senna alata* (L.) Roxb.	Fabaceae	Shrub	Terrestrial
47	*Senna hirsuta* (L.) Irwin and Barneby	Fabaceae	Shrub	Terrestrial
48	*Senna occidentalis* (L.) Link	Fabaceae	Herb	Terrestrial
49	*Senna siamea* (Lam.) Irwin and Barneby	Fabaceae	Tree	Terrestrial
50	*Senna tora* (L.) Roxb.	Fabaceae	Herb	Terrestrial
51	*Spermacoce exilis* (Williams) Adams ex Burger and Taylor	Rubiaceae	Herb	Terrestrial
52	*Tridax procumbens* L.	Asteraceae	Herb	Terrestrial
53	*Xanthium strumarium* L.	Asteraceae	Herb	Terrestrial

6.5. Current and future threats status of the study area

The study area and the floral compositions are under serious threat due to various reasons. Manmade activities played significant roles in causing drastic changes in the forest diversity of the area. The factors causing threats to the biodiversity rich area are discussed below.

Encroachment: It is the main problem in the study area. Migration and an increasing population lead to severe encroachment and deforestation in the area (Plates 5A, 5B and 5C). Ultapani Forest range has the richest floral and faunal diversity, possessing diverse land forms and habitats such as hilly tracts, streams inside forests, patches of mangrove-like forests etc. (Plate 76–79), which are now badly affected parts of CRF. The upper part of the forest ranges was fully deforested and encroached upon, which was a climax and evergreen forest. The invasion of the forest is still on-going, which could remove many important, threatened, and endemic species from the area. Invading the forest from the eastern boundary is also in severe form, leading to the loss of floral and faunal diversity along with many valuable mature timber yielding plants. The data of encroached area and the encroached villages of entire CRF are presented in Table 24. The forest cover of CRF is drastically changed during last few decades. The change of forest covers are presented through Google Earth Pro images in Plates 6I, 6II, 6III and Table 25. Out of 592.54 sq. kms., c. 360 sq. kms. areas are only remaining forest covers now in CRF.

Table 24. Encroached area and the numbers of encroached villages of CRF (Source: Haltugaon Forest Division, Kokrajhar)

Forest Divisions	Reserve Forest	Forest Ranges	Total area (in sq. kms.)	Encroached area (in sq. kms.)	Encroached villages
Haltugaon Forest Division	Chirang Reserve Forest	Gaurang Range	462.87	150	228
		Jharbari Range		3.68	10
		Ultapani Range		10.77	55
Chirang Forest Division		-	129.67	16.16	63
Total			**592.54**	**180.61**	**356**

Illegal tree felling: It is well detected in the study area, as the people of the areas are unaware of the importance of plants (Plates 7B and 7C). Many people in the area took it as livelihood. The main inhabitants of the areas are now a little bit more aware of the importance of the forests as many NGOs and Forest Department conducted awareness programmes. But the main problems are with the migrating people in the last 10 years, especially in the Ultapani Forest Range. Almost all the valuable tree species are removed from the forests. Now, finding a single Sal (*Shorea robusta* Gaertn.) tree at entire reserve forest is difficult. *Magnolia champaca* (L.) Baill. ex Pierre, *Lagerstroemia parviflora* Roxb., *Phoebe bottanica* (Meisn.) Gangop. and *Aglaia spectabilis* (Miq.) Jain and Bennet are the main target species, which are now in very low population.

Poaching: Poaching is common in the study area. Earlier, group poaching was seen during the month of April (during Bwisagu/Bihu festival) as fun but now it is rarely seen. The Forest Department and local NGOs took strict action against the poaching and dealt as per the provisions of law, whenever the incident occurred.

Fire: Due to a lack of awareness, some of the local people, especially poachers, burn the litters of the forests during March and April, which damage and hamper the growth of many herbaceous flora and saplings of many shrub and tree species. During the survey, we detected this activity in encroached area and in deciduous forests where we see less diversity of herbaceous flora (Plate 7A). A lower density of shrubs and trees was also observed.

Use of chemicals and poison: Many parts of the reserve forest used several hazardous chemical herbicides, and fertilizers for their crop cultivation. Especially the encroachers are the ones who are using highly toxic chemical herbicides in newly encroached forest areas, resulting in damage to all herbaceous flora of the forest. Even herbivores are also affected in many ways. Chemical fish poisoning and electric shock in the streams of forest is also encountered during the survey, which is a major threat for all aquatic species as their eggs become unfertile.

Table 25. Reduction in forest cover since 1984 through 2022 in CRF (Google Earth Pro)

Year	Forest covers (in Sq. kms.)	Forest cover reduced (in Sq. kms.)
1984	455	0
1990	441	14
1996	355	86
2002	346	9
2008	327	19
2014	309	18
2020	281	28
2022	260	21
	Total	**195**

Grazing: Domestic livestock grazing is very common in buffer areas of the reserve forest. But now this factor can be seen in entire forests due to increasing population, leading to the loss of diversity and vegetation (Plates 8A, 8B, 8C and 8D). The forest is now under high grazing pressure, which possesses a threat to the existence of floral composition in the study area.

Exotic weeds: Many exotic species are encountered in the study area, which disrupt the growth of many important native flora. *Ageratum conyzoides* L., *Cannabis sativa* L., *Chromolaena odorata* (L.) King and Rob., *Cleome houtteana* Schltdl., *Ipomoea carnea* subsp. *fistulosa* (Mart, ex Choisy) Austin, *Lantana camara* L., *Mesosphaerum suaveolens* (L.) Kuntze, *Mikania micrantha* Kunth, *Pontederia crassipes* Mart. and *Xanthium strumarium* L. are the dominant exotic species in the study area.

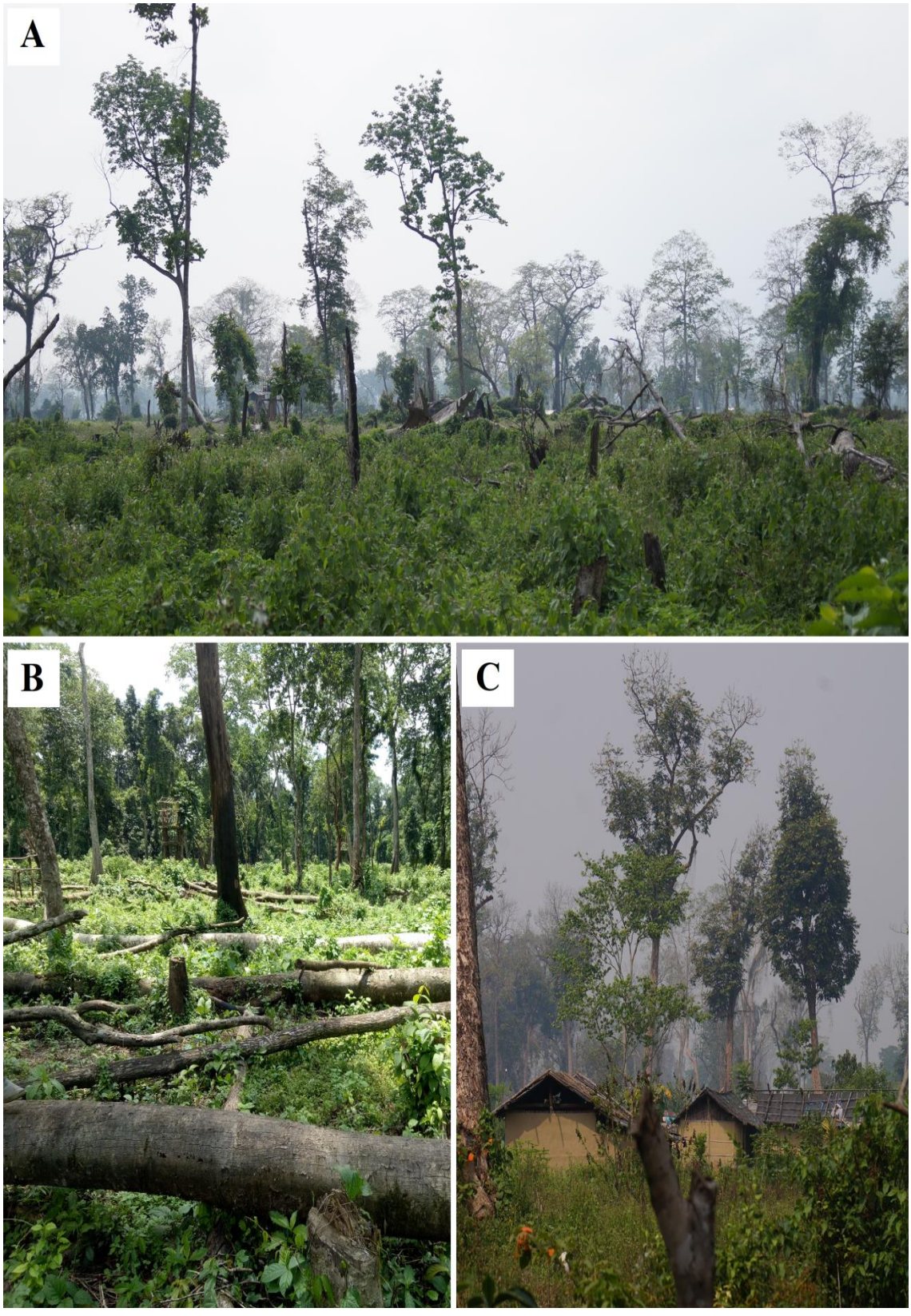

Plate 5

A, B and **C:** Deforestation and encroachment.

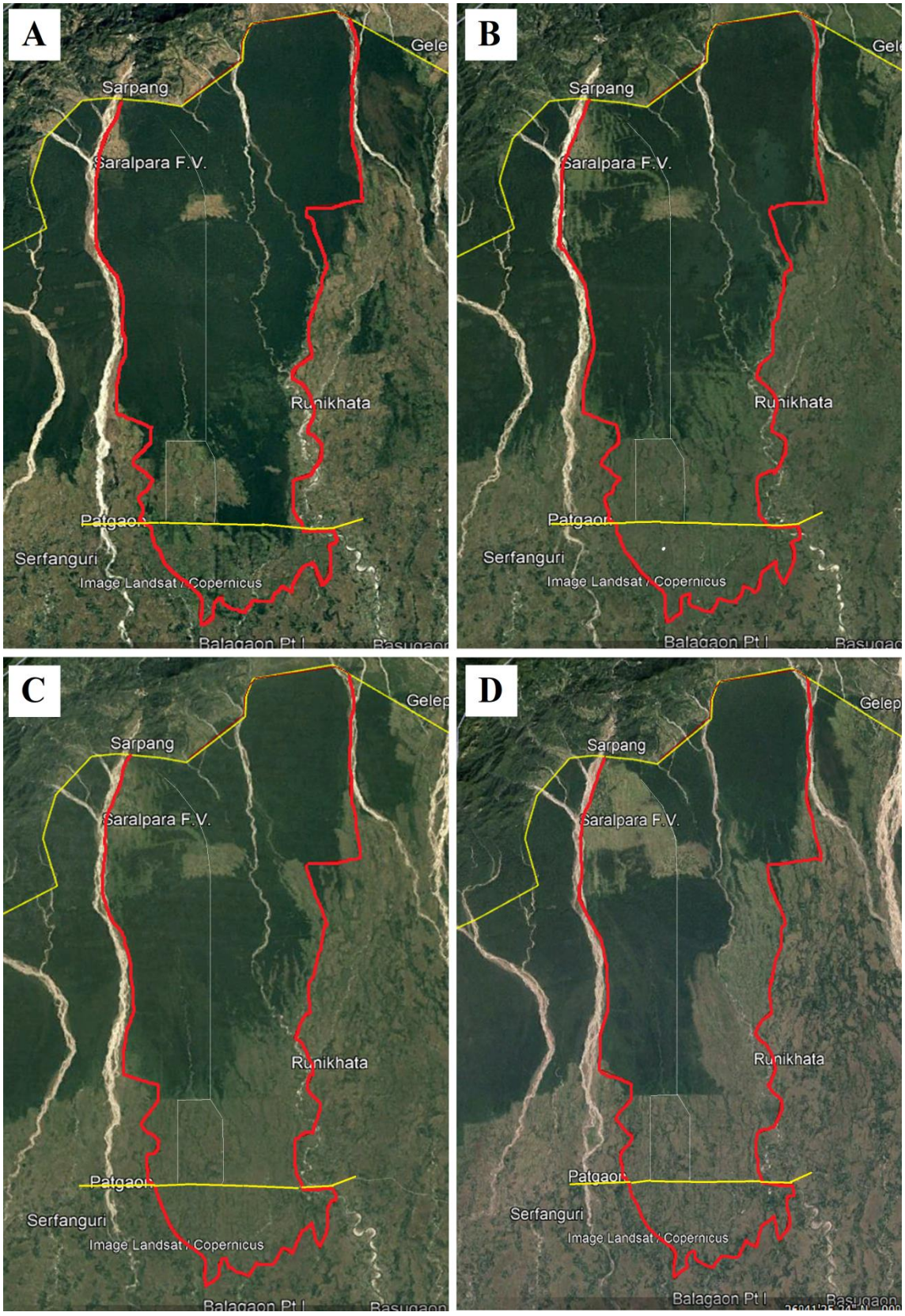

Plate 6I

The change of forest cover in CRF: A. 1984, **B.** 1996, **C.** 2008, **D.** 2020.

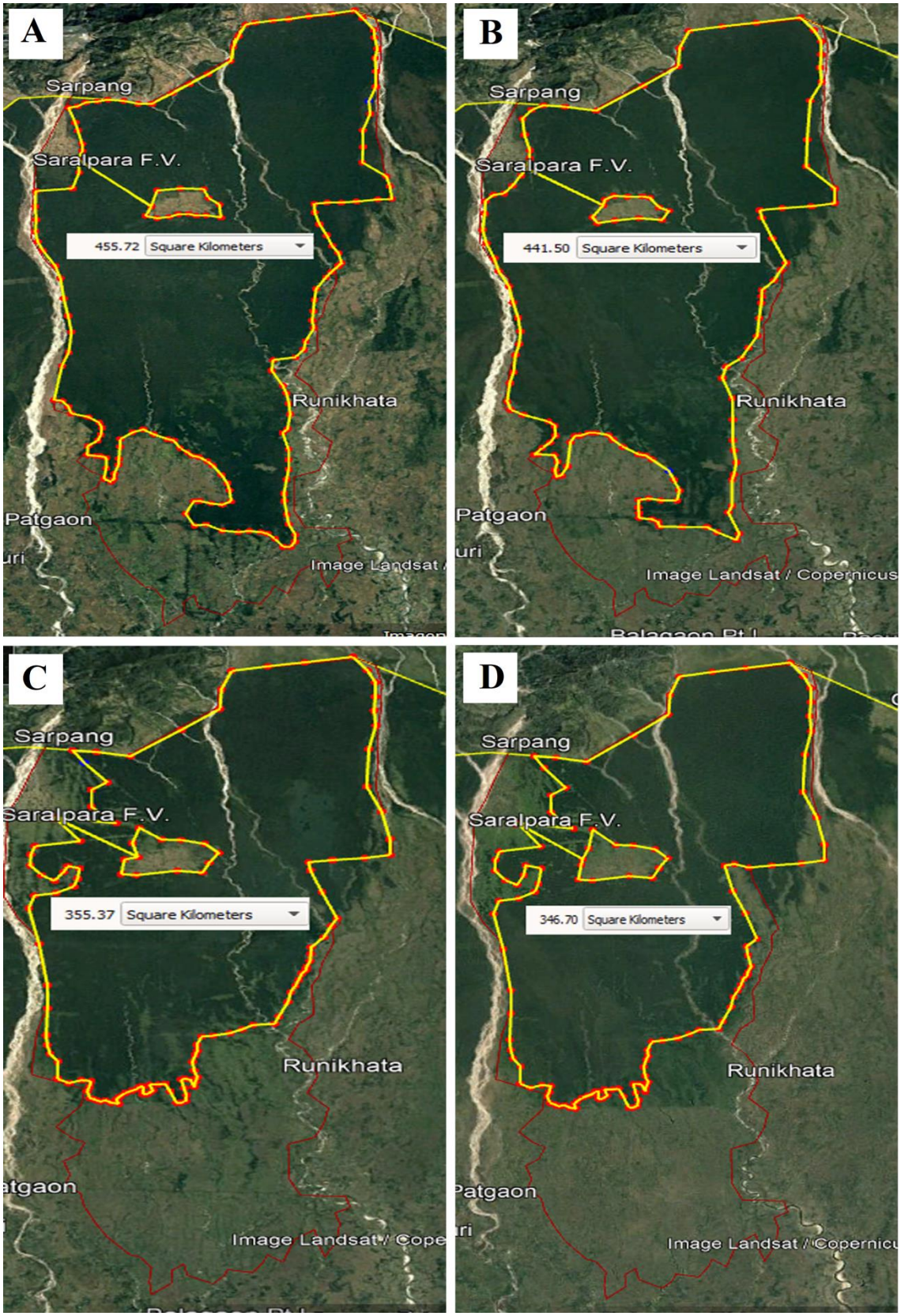

Plate 6II

Reduction in forest cover in CRF: A. 1984, **B.** 1990, **C.** 1996, **D.** 2002.

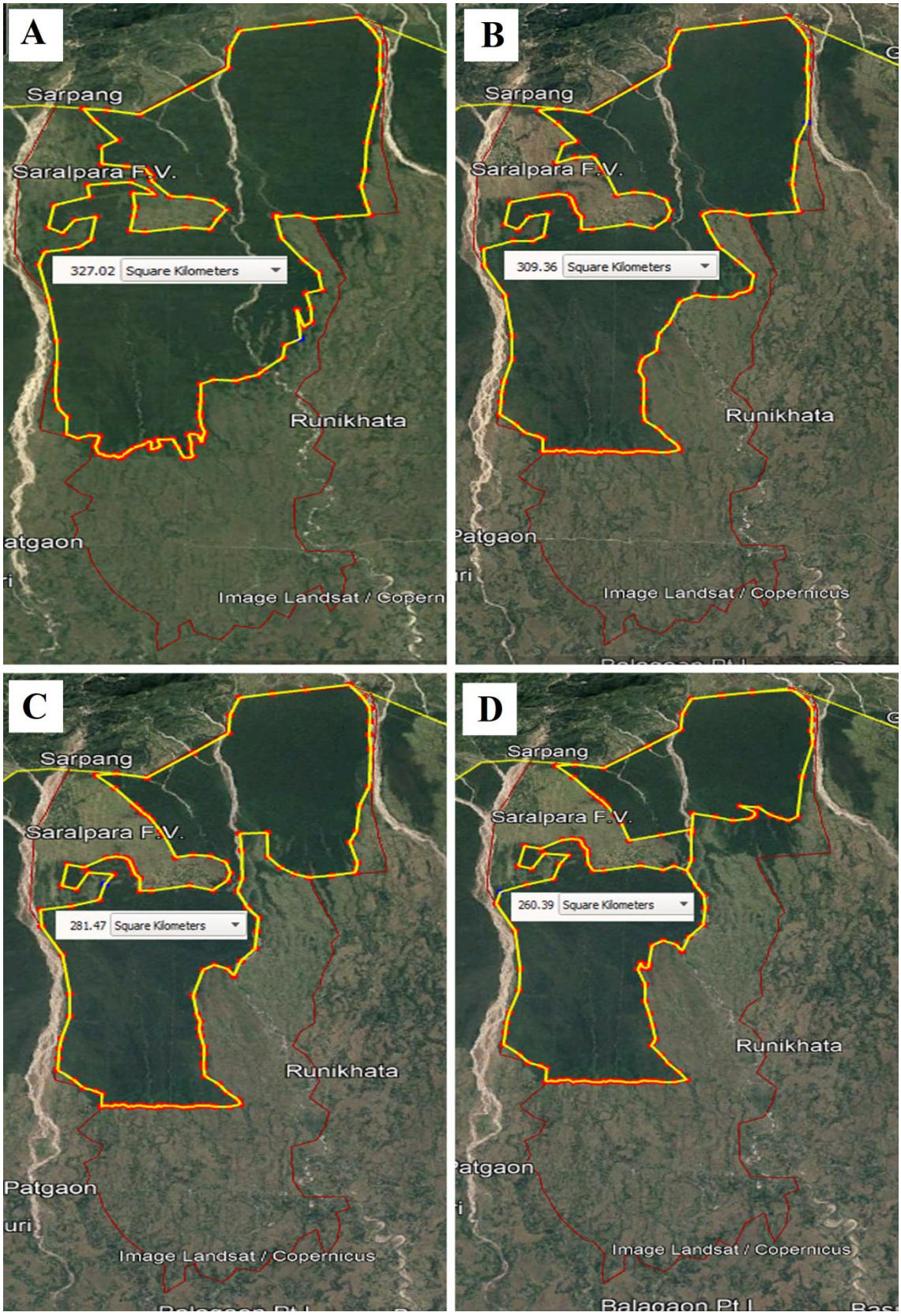

Plate 6III

Reduction in forest cover in CRF: A. 2008, **B.** 2014, **C.** 2020, **D.** 2022.

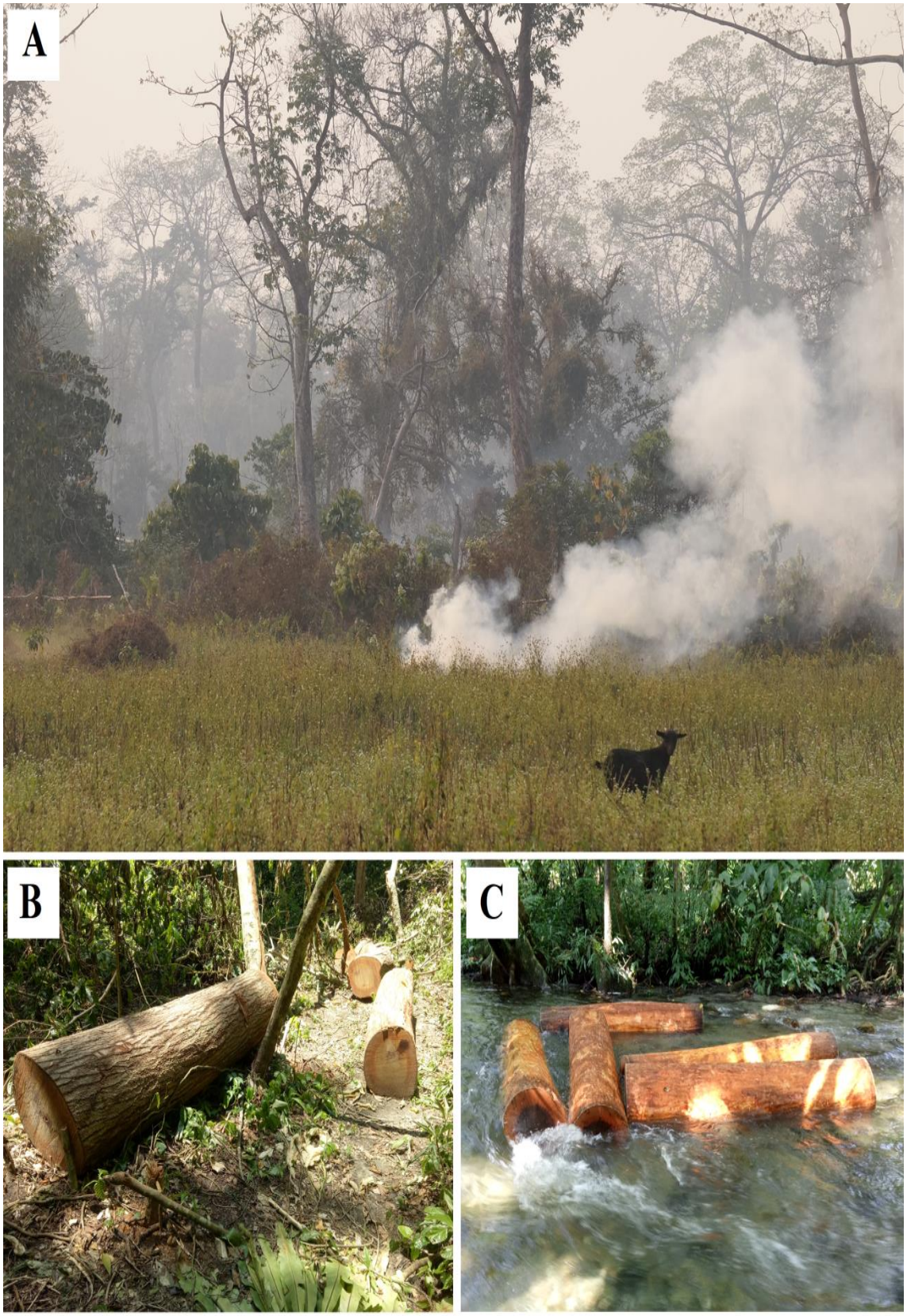

Plate 7

A. Forest fire in encroached area; **B** and **C:** Illegal tree felling.

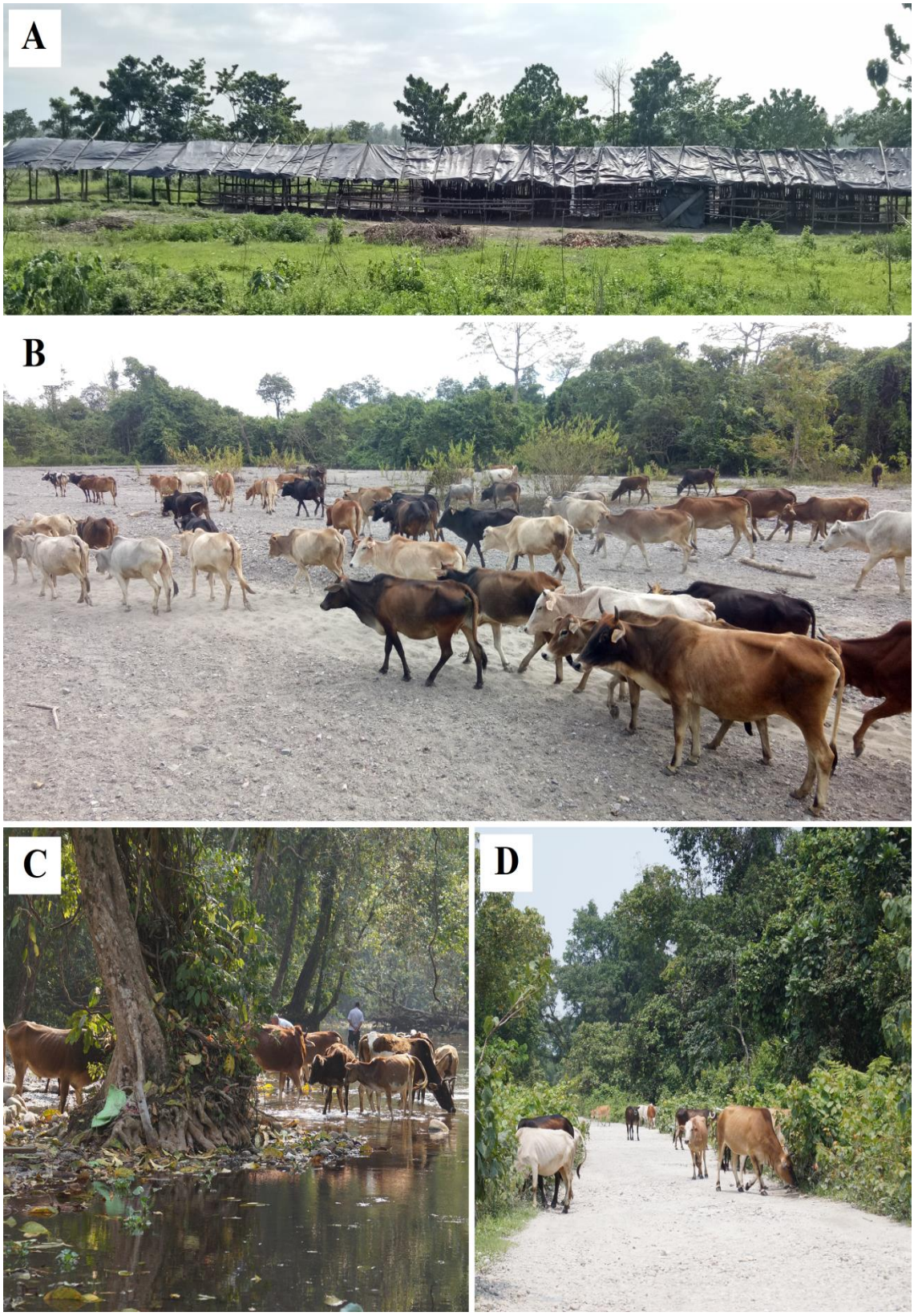

Plate 8

A. Cowshed at forest margin; **B, C** and **D:** Cow inside forests.

6.6. Conservation strategies

The importance of conservation of threatened plants in biodiversity is for their perpetual existence and for the survival of humanity. It is essential for maintaining ecological balance and biodiversity, preserving cultural heritage, supporting local economics and livelihoods, and enabling future research and development. Conservation of biodiversity requires a multifaceted approach that involves a combination of strategies, and collaborations between government agencies, conservation organisations and local communities.

CRF possesses rich floral and faunal diversity. The area represents many significant threatened, endemic plant species. The area shows healthy orchid diversity, and one of the patches of the Ultapani forest is known as 'Orchid Valley' ('*Daotu Bibarni Halam*' in Bodo) termed by the local inhabitants. This biodiversity rich area should be conserved for the future generation so that sustainable growth and relationships can be established. The following remedial measures should be adopted as consideration for the effective conservation of the area.

1. It is unacceptable to clear thriving forests for human habitation. The government needs to come up with an alternate plan for the encroachers. Otherwise, both the area of forest and its wealth will decline.
2. Educating local people on the importance of forest conservation and protection so that they will actively participate in the conservation of forest wealth.
3. In collaboration with the local villagers who live in the forest area, NGOs and government organizations should organise more awareness campaigns.
4. Use of chemical herbicides, pesticides, and other poisons for fishing should be banned immediately.
5. *Ex-situ* conservation for threatened, endemic, and economically important plant species can be made in a governmental or institutional botanical garden for their existence.
6. Providing sufficient forest staff and strict implementation of the Forest protection Acts may play a significant role in the conservation of this biodiversity rich area.

7. Reduction of anthropogenic activity inside forests ultimately leads to the flourishing of forest wealth.
8. A holistic approach is required for proper utilization and management of forest resources of CRF.
9. The government should take initiative to declare the Chirang Reserve Forest a wildlife sanctuary.