

An Updated Checklist of Globally Threatened Species in Bhutan as listed in IUCN Red List of Threatened Species

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Abstract Bhutan lies to the East of Himalaya and it hosts around 11,248 species in all taxa. Bhutan's lush and green forest covers 71 percent of land which comes under the five National Parks, four Wildlife Sanctuaries, 1 Strict Nature Reserve, Community Forests and biological corridors connecting different protected areas. More than half (51.44 percent) is protected by law and activities are restricted under certain circumstances. It is home to Takin (*Budorcas taxicolor whitei*), White-bellied Heron (*Ardea insignis*), Black-necked Crane (*Grus nigricollis*), Red Panda (*Ailurus fulgens*), Great Hornbill (*Buceros bicornis*) and Chinese Pangolin (*Manis pentadactyla*) that are globally threatened. Bhutan contributed around 23 new species between 2017 and 2020 which were new to science, and Bhutan's biodiversity holds immense opportunities for researchers and environmental scientists as its biodiversity is in early stage of discovery. To date, Bhutan records 1 species as Extinct (EX), 1 species as Extinct in the Wild (EW) and 134 species as Vulnerable (VU), Endangered (EN) and Critically Endangered (CR) under International Union of Conservation of Nature (IUCN) Red List of Threatened Species. This paper aims to report a checklist of globally threatened species listed in IUCN Red List of Threatened Species from Bhutan. The paper also lists down the new species that were discovered in Bhutan since 2017. More researchers are needed to discover new species from Bhutan's rich and lush forest.

Keywords: *Threatened, Conservation, Biodiversity*

1. Introduction

Bhutan, a landlocked kingdom between China and India, championed the conservation of environment before it joined any of the world bodies and conventions [22]. Bhutan lies in the Eastern Himalaya [3], with elevation ranging from 97 – 7570 meters above sea level (masl) [29]. The Eastern Himalaya range is one of the richest biodiversity hotspots covering 750,000 sq. km. [1] land area covering the Indian state of Sikkim, Arunachal Pradesh, Assam and West Bengal, Bhutan, Nepal, northern Myanmar and southeast Tibet (China) [26]. Bhutan is part of eight ecoregions, twenty-three important bird areas, important plant areas and wetlands with three Ramsar areas – Phobjikha, Khotokha and Bumdeling [17]. The constitution of the Royal Kingdom of Bhutan mandates to keep 60 percent of its land under forest cover for all time to come [28], the current land under forest cover is 71 percent [5]. More than half (51.44 percent) of the land is protected under National Parks (5), Wildlife Sanctuaries (4), Strict Nature Reserve (1), and biological corridors connecting different protected areas [6]. The country currently hosts 11,248 species within all taxa (figure 1) including the Black-necked Crane (*Grus nigricollis*), Great Hornbill (*Buceros bicornis*), Rufous-necked Hornbill (*Aceros nipalensis*), White-bellied Heron (*Ardea insignis*), Snow Leopard (*Panthera uncia*), Takin (*Budorcas taxicolor whitei*), Chinese Pangolin (*Manis pentadactyla*), Bhutan Swallowtail (*Bhutanitis ludlowi*) and Blue Poppy (*Meconopsis bhutanica*) that are globally threatened [20].

International Union for Conservation of Nature and Natural Resources (IUCN) was founded in 1948 to work in the field of natural resources and biodiversity conservation [25]. The IUCN's Red List of Threatened Species was established in 1964 and it is critical indicator of the health of biodiversity [31]. It is predicted that there are around 8.7 million species within all kingdom [19], where 14 percent species on land and 9 percent species in the ocean are described or documented [18]. 86 percent species on land and 91 percent species in the ocean await discovery and documentation [23]. Currently, more than 120,000 species is documented by IUCN Red List of Threatened Species, with more than 32,000 species threatened with extinction including 14 percent of birds, 41 percent of amphibians, 33 percent of reef building corals, 34 percent of conifers and 26 percent mammals [4].

Bhutan's documentation of biological diversity is at early stage. Between 2009 and 2017, Bhutan recorded 16 plants [31], 4 snails [7], 1 dragonfly [15], 3 fishes [10], 2 beetles, 1 stonefly, 4 moths and 2 aphids that were new record for science [20]. Moreover Bhutan also recorded 566 new species including 5 birds, 35 snails and slugs, 59 dragonflies and damselflies, 65 bees and wasps, 1 trueflies, 44 amphibians and reptiles, 101 plants, 108 fishes, 4 beetles, 14 crabs, 4 butterflies, 119 moths, 5 cicadas, and 2 bryophytes in the same years [11]. The new species record for Bhutan has occurred at a rate of 62 species per year (62.88%). Many of the species are not yet discovered and documented in Bhutan, there is a need for much research to document the undiscovered species (to science and Bhutan) and to understand species number and diversity [24].

The study aims to study the threatened species of Bhutan listed in IUCN Red List from numerous published papers and books. There were many published paper on individual threatened species but a comprehensive full list of threatened species is not available. This paper also aims to list the new species discovered from Bhutan as we were not able to find any paper published after 2017 listing the new species to science.

2. Methods and Materials

The paper was prepared by going through the relevant published journal articles globally and nationally on checklist of IUCN Red List of Threatened Species available online. Google Scholar (www.scholar.google.com), Research Gate (www.researchgate.net), JSTOR (www.jstor.org), ProQuest (www.proquest.com), Nature (www.nature.com), Microsoft Academic (www.academic.microsoft.com), Directory of Open Access Journals (www.doaj.org), Science Direct (www.sciencedirect.com), South Asian Archive (www.southasiaarchive.com), Springer Link (www.springer.com), and Wiley Online Library (www.onlinelibrary.wiley.com) were used to search journal papers published since 2000. Distribution and occurrence data of species were extracted from iNaturalist (www.inaturalist.org), Bhutan Biodiversity Portal (www.biodiversity.bt), eBird (www.ebird.org) and IUCN Red List website (www.iucnredlist.org). The paper also lists those species that were discovered between 2017 and 2020 from Bhutan and were new to science in table 3. The data collected were interpreted using Microsoft Excel Spreadsheet and presented in a simple and informative way. The authors and organizations are cited well.

3. Results and Discussions

The IUCN Red List categorizes species under 9 categories based on specie's extinction risk [16]. The categories are Not Evaluated (NE), Data Deficient (DD), Least Concern (LC), Near Threatened (NT), Vulnerable (VU), Endangered (EN), Critically Endangered (CR), Extinct in the Wild (EW), and Extinct (EX) [16].

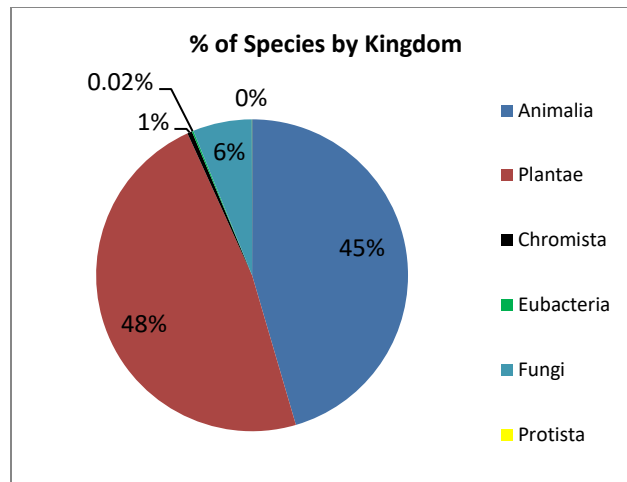


Figure 1: % of Species by Kingdom in Bhutan

Out of 1,438,769 [18] species in world, Bhutan is home to around 11,248 species (Table 1 & Figure 1) [21]. 136 species are listed as globally threatened in the IUCN Red List of Threatened Species (Table 2 & Figure 2) [30]. Out of 136 threatened species found in Bhutan, 1 is Extinct, 1 is Extinct in the Wild and 134 of them are listed as Threatened, Critically Endangered and Vulnerable (Table 4). 1.21 percent of Bhutan's biological diversity is threatened.

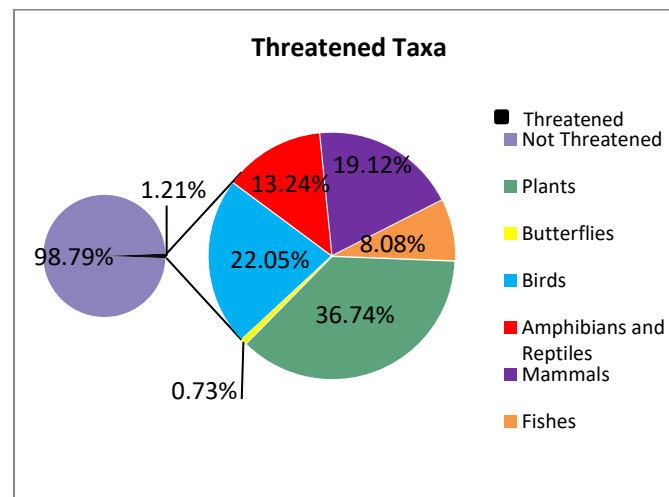


Figure 2: % of Threatened taxa in Bhutan

Bhutan recorded 23 new species to science between 2017 and 2020. Bhutan's biodiversity is rich and not fully documented. If intense research is done in Bhutan's biodiversity, several new species to science would be discovered. There are ample of potential opportunities to future researchers. *Spathogottis jetsuniae* [13], orchid discovered in 2017, was named in honour of Her Majesty Azhi Jetsun Pema Wangchuck, Queen of Bhutan and *Megalestes gyalsey* [15], dragonfly discovered in 2017, was named in honour of His Highness Gyalsey Jigme Namgyel Wangchuck, Crown Prince of Bhutan.

4. Conclusion

While collecting and reviewing the scholarly works, we found out that there were not many papers published regarding checklist of IUCN Red List of Threatened Species and discovery of new species since 2017. The rate of consumption of natural resources, waste generation, economic development, illegal poaching and hunting possess

threat to the survival of critically endangered species. Forest and Nature Conservation Act of Bhutan 1995 and Forest and Nature Conservation Rules and Regulations of Bhutan 2017 protect around 62 species, which are already listed as globally threatened under IUCN Red List of Threatened Species. Insufficient data poses major drawback to the management and conservation efforts. The paper also presents the list of new species that were discovered from Bhutan since 2017. More research need to be conducted to discover new species from Bhutan's rich and lush forest.

Recommendation

Bhutan is rich in biological diversity as news of new species discovered from Bhutan is shown every now and then. Many of the species are not yet discovered and documented in Bhutan, there is a need for much researches to be documented in the undiscovered species list (to science and Bhutan) and to understand species number and diversity. The younger generation interested in environment, biodiversity and research need to be taught the importance of species for our survival and encourage them to do more research based in Bhutan. Our only hope is in younger minds and future generation. The incomplete data possess threats to species and hinders the conservation efforts.

Competing Interests

The authors declared that no conflict of interest exists in this work.

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Table 1: Species Diversity of World and Bhutan

Kingdom	World	Bhutan	Bhutan %
Plantae	224,244	5,369	2.40
Animalia	1,124,516	5,114	0.46
Fungi	44,368	690	1.56
Chromista	17,892	55	0.31
Eubacteria	11,010	18	0.16
Protista	16,236	2	0.01
Archaeobacteria	503	0	0
Total	1,438,769	11,248	0.78 %

Table 2: Threatened percentage of Biodiversity in Bhutan

Order	Bhutan	Threatened	Threatened %
Plants	5,369	50	0.93
Butterflies	759	1	0.13
Birds	752	30	4.98
Amphibians and Reptiles	158	18	11.39
Mammals	129	26	20.15
Fishes	125	11	8.80
Total biodiversity	11,248	136	1.20 %

Table 3: New Species discovered in Bhutan (new to science) (2017-2020)

Sl.No.	Groups	Species	Author (s)	Year
1	Fishes	<i>Parachilognis drukyulensis</i>	D. B. Gurung & R. J. Thoni [10]	2018
2		<i>Parachilognis benjii</i>	D. B. Gurung & R. J. Thoni [10]	2018
3		<i>Parachilognis dangmechhuensis</i>	D. B. Gurung & R. J. Thoni [10]	2018
4		<i>Exostoma mangdechhuensis</i>	D. B. Gurung & R. J. Thoni [10]	2018
5		<i>Creteuchilognis bumdelingensis</i>	D. B. Gurung & R. J. Thoni [10]	2018
6	Plants	<i>Bulbophyllum trongsaense</i>	P. Gyeltshen, D. B. Gurung & P. Kumar [14]	2020
7		<i>Chiloschista himalaica</i>	N. Gyeltshen, C. Gyeltshen, K. Tobgay, S. Dalstrom, D. B. Gurung, N. Gyeltshen & B. B. Ghalley [12]	2020
8		<i>Chiloschista gelephuense</i>	N. Gyeltshen, C. Gyeltshen, K. Tobgay, S. Dalstrom, D. B. Gurung, N. Gyeltshen & B. B. Ghalley [12]	2020
9		<i>Chiloschista densiflora</i>	N. Gyeltshen, C. Gyeltshen, K. Tobgay, S. Dalstrom, D. B. Gurung, N.	2020

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			Gyeltshen & B. B. Ghalley [12]	
10		<i>Roscoea megalantha</i>	T. Yoshida, R. Yangzom & M. F. Newman [32]	2017
11		<i>Meconopsis gakyidiana</i>	T. Yoshida, R. Yangzom & D. Long [31]	2017
12		<i>Meconopsis merakensis</i>	T. Yoshida, R. Yangzom & D. Long [31]	2017
13		<i>Spathogottis jetsuniae</i>	N. Gyeltshen, K. Tobgyel & T. Dalstrom [13]	2017
14	Snails	<i>Erhaia pelkiae</i>	E. Gittenberger, P. Leda, J. Wangchuk, C. Gyeltshen & B. Stelbrink	2020
15		<i>Erhaia jannei</i>	E. Gittenberger, P. Leda, J. Wangchuk, C. Gyeltshen & B. Stelbrink [9]	2020
16		<i>Endothyrella bhutanensis</i>	E. Gittenberger, P. Leda, S. Sherub & B. P. Gergely [8]	2018
17		<i>Endothyrella spirostriata</i>	E. Gittenberger, P. Leda, S. Sherub & B. P. Gergely [8]	2018
18		<i>Endothyrella pemagatshel</i>	E. Gittenberger, P. Leda, S. Sherub & B. P. Gergely [8]	2018
19		<i>Rahula kleini</i>	E. Gittenberger, P. Leda & S. Sherub [7]	2017
20		<i>Rahula trongsaensis</i>	E. Gittenberger, P. Leda & S. Sherub [7]	2017
21	Trueflies	<i>Eumerus druk</i>	J. Smith, T. Zeegers & P. Dorji [27]	2020
22	Dragonflies	<i>Megalestes gyalsey</i>	T. Gyeltshen, V. J. Kalkman & A. G. Orr [15]	2017
23	Beetles	<i>Trilophidius gemmatus</i>	M. Balkenohl [2]	2017

Table 4: List of IUCN Red List of Threatened Species in Bhutan

Sl. No.	Common Name	Biological Name	Status
Mammals			
1	Chinese Pangolin	<i>Manis pentadactyla</i>	Critically Endangered
2	Pygmy Hog	<i>Sus salvanius</i>	Critically Endangered
3	Dhole	<i>Cuon alpinus</i>	Endangered
4	Bengal Tiger	<i>Panthera tigris tigris</i>	Endangered
5	Snow Leopard	<i>Panthera uncia</i>	Vulnerable
6	Clouded Leopard	<i>Neofelis nebulosa</i>	Vulnerable
7	Common Leopard	<i>Panthera pardus</i>	Vulnerable
8	Golden Langur	<i>Trachypithecus geei</i>	Endangered
9	Capped Langur	<i>Trachypithecus pileatus</i>	Vulnerable
10	Asian Small-clawed Otter	<i>Anox cinereus</i>	Vulnerable
11	Smooth-coated Otter	<i>Lutrogale perspicillata</i>	Vulnerable
12	Bearcat / Binturong	<i>Arctictis binturong</i>	Vulnerable
13	Asiatic Black Bear	<i>Ursus thibetanus</i>	Vulnerable
14	Indian Rhinoceros	<i>Rhinoceros unicornis</i>	Vulnerable
15	Asian Elephant	<i>Elephas maximus</i>	Endangered
16	Himalayan Musk Deer	<i>Moschus leucogaster</i>	Endangered
17	Alpine Musk Deer	<i>Moschus chrysogaster</i>	Endangered
18	Bhutan Takin	<i>Budorcas taxicolor whitei</i>	Vulnerable
19	Sambar	<i>Rusa unicornis</i>	Vulnerable
20	Gaur	<i>Bos gaurus</i>	Vulnerable
21	Red Panda	<i>Ailurus fulgens</i>	Endangered
22	Bengal Slow Loris	<i>Nycticebus bengalensis</i>	Vulnerable
23	Hog Deer	<i>Axis porcinus</i>	Endangered
24	Wild Water Buffalo	<i>Bubalus arnee</i>	Endangered
25	Arunachal Macaque	<i>Macaca munzala</i>	Endangered
26	Hispid Hare	<i>Caprolagus hispidus</i>	Endangered
Butterfly			
27	Ludlow's Bhutan Swallowtail	<i>Bhutanitis ludlowi</i>	Vulnerable
Fishes			
28	Walking Catfish	<i>Clarias magur</i>	Endangered
29	---	<i>Devario assamensis</i>	Vulnerable
30	Loach	<i>Aborichthys garoensis</i>	Vulnerable
31	---	<i>Pterocryptis barakensis</i>	Endangered

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32	Golden Mahseer	<i>Tor putitora</i>	Endangered
33	---	<i>Pseudecheneis sirenica</i>	Vulnerable
34	Common Snow Trout	<i>Schizothorax richardsonii</i>	Vulnerable
35	---	<i>Schistura inglisi</i>	Vulnerable
36	Assamese Kingfish	<i>Cyprinus carpio</i>	Vulnerable
37	Mrigal Carp	<i>Cirrhinus cirrhosus</i>	Vulnerable
38	European Carp	<i>Cyprinus carpio</i>	Vulnerable
Amphibians and Reptiles			
39	Indian Peacock Softshell Turtle	<i>Nilssononia hurum</i>	Vulnerable
40	Nankiang Horned Toad	<i>Xenophrys nankiangensis</i>	Vulnerable
41	Gharial	<i>Gavialis gangeticus</i>	Critically Endangered
42	Three-striped Roofed Turtle	<i>Kachunga dhongoko</i>	Endangered
43	Indian Roofed Turtle	<i>Kachuga kachuga</i>	Critically Endangered
44	Southeast Asian Box Turtle	<i>Cuora amboinensis</i>	Vulnerable
45	Elongata Tortoise	<i>Indotestudo elongata</i>	Endangered
46	Crowned River Turtle	<i>Hardella thurjii</i>	Vulnerable
47	Keeled Box Turtle	<i>Cuora mouhotii</i>	Endangered
48	Spotted Pond Turtle	<i>Geoclemys hamiltonii</i>	Vulnerable
49	Assam Roofed Turtle	<i>Pangshura sylhetensis</i>	Endangered
50	Burmese Python	<i>Python bivittatus</i>	Vulnerable
51	Narrow-headed Softshell Turtle	<i>Chitra indica</i>	Endangered
52	King Cobra	<i>Ophiophagus hannah</i>	Vulnerable
53	Asian Rock Python	<i>Python molurus</i>	Vulnerable
54	Indian Eyed Turtle	<i>Morenia petersi</i>	Vulnerable
55	Walnut Kukri Snake	<i>Oligodon juglandifer</i>	Vulnerable
56	Tricarinate Hill Turtle	<i>Melanochelys tricarinata</i>	Vulnerable
Birds			
57	Kashmir Flycatcher	<i>Ficedula subrubra</i>	Vulnerable
58	Black-necked Crane	<i>Grus nigricolis</i>	Vulnerable
59	Blyth's Tragopan	<i>Tragopan blythii</i>	Vulnerable
60	Red-headed Vulture	<i>Sarcogyps calvus</i>	Critically Endangered
61	Steppe Eagle	<i>Aquila nipalensis</i>	Endangered
62	Rustic Bunting	<i>Emberiza rustica</i>	Vulnerable
63	White-rumped Vulture	<i>Gyps bengalensis</i>	Critically Endangered
64	Pallas's Fish Eagle	<i>Haliaeetus leucorhynchus</i>	Endangered
65	White-bellied Heron	<i>Ardea insignis</i>	Critically Endangered
66	White-winged Duck	<i>Asarcornis scutulata</i>	Endangered
67	Baer's Pochard	<i>Aythya baeri</i>	Critically Endangered
68	Egyptian Vulture	<i>Neophron percnopterus</i>	Endangered
69	Common Pochard	<i>Aythya ferina</i>	Vulnerable
70	Beautiful Nuthatch	<i>Sitta formosa</i>	Vulnerable
71	Wood Snipe	<i>Gallinago nemoricola</i>	Vulnerable
72	Indian Spotted Eagle	<i>Clanga hastata</i>	Vulnerable
73	Hodgson's Bushchat	<i>Saxicola insignis</i>	Vulnerable
74	Lesser Adjutant	<i>Leptoptilos javanicus</i>	Vulnerable
75	Great Hornbill	<i>Buceros bicornis</i>	Vulnerable
76	Rufous-necked Hornbill	<i>Aceros nipalensis</i>	Vulnerable
77	Long-tailed Duck	<i>Clangula hyemalis</i>	Vulnerable
78	Wreathed Hornbill	<i>Rhyticeros undulatus</i>	Vulnerable
79	Woolly-necked Stork	<i>Ciconia episcopus</i>	Vulnerable
80	Grey-sided Thrush	<i>Turdus feae</i>	Vulnerable
81	Greater Spotted Eagle	<i>Clanga clanga</i>	Vulnerable
82	Chestnut-breasted Partridge	<i>Arborophila mandellii</i>	Vulnerable
83	Dark-rumped Swift	<i>Apus acuticauda</i>	Vulnerable
84	Eastern Imperial Eagle	<i>Aquila heliaca</i>	Vulnerable
85	Grey-crowned Prinia	<i>Prinia cinereocapilla</i>	Vulnerable
86	Great Slaty Woodpecker	<i>Mulleripicus pulverulentus</i>	Vulnerable
Plants			
87	Bhutanese Blue Poppy	<i>Meconopsis bhutanica</i>	Critically Endangered
88	---	<i>Sorbus lingshiensis</i>	Critically Endangered
89	The Striped Petal	<i>Eulophia stenopetala</i>	Extinct
90	---	<i>Bulleyia yunnanensis</i>	Endangered
91	Sargent Spruce	<i>Picea brachytyla</i>	Vulnerable
92	---	<i>Ilex venulosa</i>	Endangered
93	---	<i>Meconopsis superba</i>	Endangered
94	---	<i>Carex nigra drukyulensis</i>	Endangered

An Updated Checklist of Globally Threatened Species in Bhutan as listed in IUCN Red List of Threatened Species Tej Kumar Nepal & Manita

95	Mangalore Aglaia	<i>Aglaia perviridis</i>	Vulnerable
96	Heart-shaped Slipper Orchid	<i>Cypripedium cordigerum</i>	Vulnerable
97	White Angel Trumpet	<i>Brugmansia suaveolens</i>	Extinct in the Wild
98	---	<i>Ophiorrhiza longii</i>	Critically Endangered
99	---	<i>Bistorta griersonii</i>	Endangered
100	Jatamansi	<i>Nardostachys jatamansi</i>	Critically Endangered
101	---	<i>Androsace hemisphaerica</i>	Endangered
102	Agarwood, Aloeswood, Eaglewood	<i>Aquilaria malaccensis</i>	Critically Endangered
103	---	<i>Onosma griersonii</i>	Critically Endangered
104	---	<i>Astragalus paroensis</i>	Critically Endangered
105	Crown Wand Orchid	<i>Paphiopedilum fairrieianum</i>	Critically Endangered
106	---	<i>Bambusa clavata</i>	Vulnerable
107	---	<i>Saxifraga vacillans</i>	Vulnerable
108	Himalayan Slipper Orchid	<i>Cypripedium himalaicum</i>	Endangered
109	---	<i>Pedicularis sanguilimbata</i>	Endangered
110	Montrey Cypress	<i>Cupressus macrocarpa</i>	Vulnerable
111	---	<i>Strobilanthes accrescens accrescens</i>	Endangered
112	---	<i>Hypericum sherriffii</i>	Endangered
113	---	<i>Cymbopogon bhutanicus</i>	Vulnerable
114	Fern Tree, Blue Jacaranda, Black Poui	<i>Jacaranda mimosifolia</i>	Vulnerable
115	Spicer's Slipper Orchid	<i>Paphiopedilum spicerianum</i>	Endangered
116	Himalayan Yew	<i>Taxus wallichiana</i>	Endangered
117	---	<i>Rhododendron dalhousiae</i> var. <i>rhabdotum</i>	Vulnerable
118	---	<i>Illicium griffithii</i>	Endangered
119	---	<i>Ceropegia bhutanica</i>	Endangered
120	---	<i>Buddleja bhutanica</i>	Vulnerable
121	---	<i>Pedicularis griniformis</i>	Vulnerable
122	---	<i>Sorbus rinzenii</i>	Endangered
123	---	<i>Corallodiscus cooperi</i>	Vulnerable
124	Leopard Spotted Bulbophyllum	<i>Bulbophyllum leopardinum</i> var. <i>tuberculatum</i>	Critically Endangered
125	Adder's Mouth	<i>Malaxis muscifera</i>	Vulnerable
126	---	<i>Cheirostylis sherriffii</i>	Critically Endangered
127	---	<i>Neopicrorhiza minima</i>	Endangered
128	Pandua Gogan	<i>Saurauia punduana</i>	Critically Endangered
129	Assam Cycas	<i>Cycas pectinata</i>	Vulnerable
130	---	<i>Ceropegia dorjei</i>	Critically Endangered
131	Wax Plant	<i>Hoya bhutanica</i>	Endangered
132	---	<i>Oreorchis sanguinea</i>	Critically Endangered
133	---	<i>Isodon atroruber</i>	Endangered
134	---	<i>Drepanostachyum annulatum</i>	Vulnerable
135	---	<i>Cypripedium elegans</i>	Endangered
136	Charming Slipper Orchid	<i>Paphiopedilum venustum</i>	Endangered