

PLANT DIVERSITY OF ASSAM

A checklist of Angiosperms & Gymnosperms



**ASSAM SCIENCE TECHNOLOGY
AND ENVIRONMENT COUNCIL**

About the book

The book, "PLANT DIVERSITY OF ASSAM: A Checklist of Angiosperms & Gymnosperms" contains brief notes on Topography, Soil, Climate, Vegetation, History of Botanical Exploration and Enumeration of Angiosperms & Gymnosperms of Assam. The taxa are arranged in alphabetical order under each family with their botanical names followed by English name(s), local name(s), distribution in Assam and elsewhere, habitat, habit and conservation status. The data tabulated in the Enumeration are retrieved from both primary and secondary sources. In regard to distribution of taxa, the term "elsewhere" refers to distribution of taxa in India as well as in other parts of the world. The taxon for which place of occurrence is not known or occurring in all over Assam have been provided with an asterisk (*) mark. Besides, taxa categorized under different conservation status are also mentioned.

This book includes 3854 taxa (including infraspecific taxa) under 1394 genera and 236 families found in Assam. Out of them, 2752 taxa are Dicotyledons, 1080 taxa are Monocotyledons and 22 taxa are Gymnosperms. A total of 871 taxa are categorized under different conservation status including 167 taxa of endemic plants of Assam.

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FOREWORD

Assam, a state of north-eastern part of India, is bounded by Bhutan and Arunachal Pradesh in north; Arunachal Pradesh, Nagaland and Manipur in the east; Mizoram and Meghalaya in south and Bangladesh, West Bengal in the west. The State is extremely rich in flora and fauna with a number of endemic as well as threatened species as it provides a profusion of habitats. The first consolidated account, "*Flora of Assam*" was written by Upendra Nath Kanjilal and his associates (1934 – 1940) but the work did not include the members of the monocotyledonous families except Gramineae and most of the herbaceous species of the area. Later, in 2005, another checklist entitled "*Assam's Flora (Present Status of Vascular Plants)*" was published by Assam Science Technology and Environment Council (ASTE) which too lacked information on distribution, habit and habitat of the taxa. Although several field based work on plants have been completed and a number of publications have also been appeared from time to time, but still perhaps there is a dearth of a complete list of all plants found in Assam.

This book "*PLANT DIVERSITY OF ASSAM: A checklist of Angiosperms & Gymnosperms*" enumerates 3854 taxa under 1394 genera and 236 families including possible extent of the infraspecific taxa, like sub-species, varieties and form. The checklist provided in the book is based on primary and mostly on secondary data and all the plant taxa are arranged in alphabetical order under each family. During preparation of the checklist, an emphasis was given to provide all possible currently accepted names of the Angiosperms and Gymnosperms and the scientific names are followed by English name(s) and local name(s) wherever available, distribution in Assam and elsewhere, habit, habitat along with their conservation status. Besides, this book also contains brief notes on topography, soil, climate and vegetation of Assam and the history of botanical explorations and floristic studies in the State. This publication is an outcome of the project "State Biodiversity Data Bank" of Assam Science Technology and Environment Council supported by the Department of Environment and Forests, Government of Assam that was conceived in the year 2009.

The Assam Science Technology and Environment Council (ASTE) would not like to claim this publication as a perfect one in all respect. However, the Council hopes that this publication would reflect the best possible effort to up-date the data base; and looks towards further work in it. The Council would also welcome any further research-based input for improvement of the data base.

I hope, this work will be able to provide a strong base for research on plant science in future and would be of great help for seeking information on biodiversity by academicians, students, teachers and researchers, organizations, etc.

I wish to congratulate the authors of this book for bringing out this publication.

Place: Guwahati
Date: 15/05/2014



Haresh Chandra Dutta
Director, ASTE Council

PREFACE

Biodiversity of Assam is rich in flora and fauna, some are categorized under different conservation status while some are endemic. Earlier, the plants of Assam was known through the publication, “*Flora of Assam*” by U.N. Kanjilal and his associates (1934 – 1940) for the whole of the present north-east region of India which also included a part of the then Sylhet district of present Bangladesh. Later, *Assam’s Flora (Present Status of Vascular Plants)* was published by Assam Science Technology and Environment Council (ASTE) in 2005 and it was compiled, written and edited by Prof. S. Chowdhury, based on his collections, thorough survey of literature and consultation of herbaria. Since then, numerous publications, in the form of new species, new records for the State, new distributional notes, revision of genera and families, enumeration from under-explored or unexplored localities and areas, appeared in various national and international journals and books in a scattered way. Further, many nomenclatural changes have also been effected during last few decades. As such, an account with all possible information on Angiosperms & Gymnosperms of Assam was felt necessary as a ready reference for researchers and plant lovers.

This book has been prepared based on the available literature gathered under the project “State Biodiversity Data Bank”. However, many places were visited and most of the Reserved Forests of Assam were explored by the first author and a number of plant specimens were collected with field based information which has also helped in preparing the checklist.

The checklist of this publication provides scientific names of Angiosperms and Gymnosperms followed by English names, local names, distribution, habitat, habit and status of taxa. In determining the names and data of the taxa, an effort has been made to present the nomenclature accepted as valid in current literature while a few are yet to be updated. The check list enumerates 3854 taxa under 1394 genera and 236 families, out of them 2752 taxa are Dicotyledons, 1080 taxa are Monocotyledons and 22 taxa are Gymnosperms. Besides, a total of 871 taxa are categorized under different conservational status for Assam including 167 taxa of endemic plants. The families of Angiosperms and Gymnosperms are arranged according to G. Bentham & J.D. Hooker’s (1862-1883) system of Classification with split families while taxa are arranged in alphabetical order under each family.

Indeed, it was an uphill task to accomplish a complete checklist of Angiosperms & Gymnosperms of Assam, the authors wish to record acknowledgement to a number of persons for their valuable suggestions and help rendered during the course of work. We are grateful to former Directors of ASTE Council, Sri Niraj Verma, IAS and Dr. Satyendra Kr. Choudhury and Director of ASTE Council Sri Haresh Chandra Dutta for providing necessary facilities. We are thankful to Prof. S. K. Borthakur, Gauhati University for constant guidance and reviewing this work with his valuable suggestions. Sincere thanks are also due to Sri Jaideep Baruah, Scientific Officer & Head i/c, Environment Division of ASTE Council for his timely support and encouragement. We wish to record our thankfulness to Sri Santanu Dey, Dr. Paresh Ch. Kalita and Dr. Tilak Ch. Dutta for providing some photographs. Special thanks are due to Sri Rupam Sankar Baruah for helping us during preparation of the checklist and providing few photographs. We also record our sincere gratitude to the employees of ASTE Council who have rendered help and support during compilation of the data base.

It is hoped that this effort would be a base work for future research on Angiosperms & Gymnosperms. Criticisms and suggestions are welcomed for improvement of this work in subsequent edition.

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INTRODUCTION

The term "Biodiversity" refers to the diversity that is found among life forms within a given ecosystem, biome, or on the globe. There are three levels of biodiversity: *Genetic Diversity* - genetic variation among the living organisms; *Species Diversity* - variation encountered within a genus and *Ecosystem Diversity* - diversity of ecological complexity showing variations in ecological niches, trophic structure, food web, etc.

Biodiversity is not evenly distributed on the earth: rich in the tropics and in specific localized regions while poor in Polar Regions, where fewer species are found. Some regions of the earth are regarded as "Biodiversity Hot Spots" based on certain criteria or the term can be explained as a biogeographic region containing a significant reservoir of biodiversity and also rich in endemic taxa. The concept of biodiversity hotspots was conceived by Norman Myers in two of his publications in "The Environmentalist" (1988 & 1990), revised after thorough analysis by Myers and others in "Hotspots: Earth's Biologically Richest and Most Endangered Terrestrial Ecoregions". To qualify as a biodiversity hotspot on Myers 2000 edition of the hotspot-map, a region must meet two criteria: (a) it must contain at least 0.5% or 1,500 species of vascular plants as endemics; (b) it has to have lost at least 70% of its primary vegetation. Around the world, there are 34 biodiversity hotspots (Conservation International Founder: Spencer Beebe founded in 1987). These sites support nearly 60% of the world's plant, bird, mammal, reptile and amphibian species, with a very high share of endemic species. India has three Biodiversity Hotspots - Himalaya, Western Ghats and Indo -Burma.

The North Eastern Region of India represents nearly 50% of the total biodiversity of the country. The first consolidated account on the flora of Assam was "Flora of Assam" by Upendra Nath Kanjilal and his associates but the work was an incomplete one because of non-inclusion of monocotyledons except Gramineae and most of the herbaceous species of the area. Later on, a checklist entitled "Assam's Flora (Present status of Vascular Plants)", was published by Assam Science Technology and Environment Council (ASTEC) during 2005 with the data available to them, but without any information in regard to distribution, habit and habitat of the taxa. Since then, several works have been completed and a number of publications appeared relating to the plants of the state. This resulted in accumulation of enormous data scattered in various publications. With the intension to bridge this gap and to disseminate information on biodiversity related issues to the academic institutions, students, teachers and researchers, organizations and all other beneficiaries, the idea of "Establishment of Biodiversity Data Bank" was conceived in the year 2009 by the Environment Division of ASTEC, which was supported by the Department of Environment and Forests, Government of Assam. Thus, under this project a checklist of phanerograms has been prepared using secondary data.

The checklist

The checklist of Angiosperms & Gymnosperms is based on primary and mostly secondary sources. The taxa are arranged in alphabetical order under each family. In determining the names of

the taxa, an effort has been made to present as per the nomenclature accepted as valid in current literature. The checklist provides scientific name of each taxon followed by English name, local name, distribution, habitat, habit and conservation status. Since, the data have been retrieved from mostly secondary sources they are retained as such particularly in case of the distribution of the taxa including the spelling, old names and political divisions of states and districts. In regard to distribution of taxa, the term "elsewhere" refers to distribution of taxa in India as well as in other parts of the world. The taxon for which place of occurrence is not known or occurring in all over Assam, has been provided with an asterisk (*) mark. The present political Assam has been divided into three parts to state the occurrence of plant taxa; (a) Western Assam comprising of Kokrajhar, Bongaigaon, Baksa, Chirang, Nalbari, Barpeta, Goalpara, Dhubri, Kamrup, Kamrup(M), Morigaon, Nagaon, Udalguri and Darrang districts; (b) Eastern Assam comprising of Golaghat, Sonitpur, Lakhimpur, Dhemaji, Dibrugarh, Jorhat, Dima Hasao, Karbi Anglong, Sivasagar and Tinsukia districts and (c) Barak Valley comprising of Cachar, Karimganj and Hailakandi districts. The conservation status of the taxa for the state of Assam, the work of Chowdhury(2005) has been mostly followed along with IUCN status of taxa. Besides, taxa included under CITES list, CAMP list and those endemic to Assam are also mentioned in the checklist.

Floristic composition of Angiosperms & Gymnosperms in Assam

The present work includes 3854 taxa (including infraspecific taxa) under 1394 genera and 236 families. Out of them, 2752 taxa are Dicotyledons, 1080 taxa are Monocotyledons and 22 taxa are Gymnosperms (Table – 2). This represents about 22.68 % of the Indian flora. A total of 40 subspecies (ssp.), 218 varieties (var.) and 3 forma (f.) are recorded so far. A total of 167 endemic taxa are found in Assam and 871 taxa have been categorized under different conservational status (Based on IUCN & Conservation status of plants of Assam). A conspectus of families showing the number of genera, number of taxa and number of endemic taxa are shown in Table – 1, while Table – 2 contains a general statistical analysis of Angiosperms & Gymnosperms of Assam.

Table-1: *A conspectus of families, genera, taxa, Threatened, Rare and Endemic taxa of flowering plants of Assam.*

Sl. No.	Family	No. of Genera	No. of Taxa	Threatened (CR, EN, VU)	Rare (R)	Endemic
Dicotyledones						
1	Ranunculaceae	7	18	1	5	-
2	Dilleniaceae	2	5	-	-	-
3	Magnoliaceae	3	19	-	1	5
4	Schizandraceae	1	1	-	-	-
5	Annonaceae	15	45	-	8	5
6	Menispermaceae	14	19	-	5	1
7	Berberidaceae	1	2	-	2	-
8	Lardizabalaceae	2	4	-	-	-

9	Nandinaceae	1	1	-	-	-
10	Nymphaeaceae	2	4	-	-	-
11	Nelumbonaceae	1	1	-	-	-
12	Papaveraceae	2	4	-	-	-
13	FumERICACEAE	1	1	-	-	-
14	Brassicaceae	10	27	-	4	-
15	Capparaceae	3	12	-	4	-
16	Cleomaceae	1	5	-	1	-
17	Violaceae	3	11	-	3	-
18	Bixaceae	1	1	-	-	-
19	Flacourtiaceae	5	10	-	2	-
20	Pittosporaceae	1	2	-	1	-
21	Polygalaceae	4	15	-	1	-
22	Xanthophyllaceae	1	1	-	1	-
23	Caryophyllaceae	8	11	-	1	-
24	Portulacaceae	3	7	-	-	-
25	Tamaricaceae	1	1	1	-	-
26	Elatinaceae	1	1	-	2	2
27	Hypericaceae	1	9	-	4	3
28	Clusiaceae	4	21	-	10	2
29	Theaceae	7	23	-	-	-
30	Actinidaceae	1	2	-	2	-
31	Saurauiceae	1	7	-	2	-
32	Dipterocarpaceae	3	7	-	-	2
33	Ancistrocladaceae	1	1	-	-	-
34	Malvaceae	16	53	-	4	-
35	Bombacaceae	2	3	-	-	-
36	Sterculiaceae	13	26	-	2	2
37	Byttneriaceae	1	3	-	-	-
38	Tiliaceae	4	28	-	-	-
39	Elaeocarpaceae	2	21	1	4	-
40	Linaceae	2	3	-	-	-
41	Ixonanthaceae	1	1	-	1	1

42	Erythroxylaceae	1	1	-	-	-
43	Malpighiaceae	2	7	-	-	2
44	Zygophyllaceae	1	1	-	-	-
45	Geraniaceae	2	5	-	-	-
46	Oxalidaceae	1	4	-	1	-
47	Averrhoaceae	1	2	-	-	-
48	Balsaminaceae	2	13	-	3	2
49	Tropaeolaceae	1	1	-	-	-
50	Rutaceae	14	37	-	8	2
51	Simaroubaceae	3	6	2	-	1
52	Ochnaceae	1	2	-	1	-
53	Burseraceae	5	7	-	1	-
54	Meliaceae	11	29	1	6	2
55	Dichapetalaceae	1	1	-	-	-
56	Olacaceae	3	5	-	2	1
57	Icacinaceae	5	6	-	1	-
58	Cardiopharyngaceae	1	1	-	1	-
59	Erythrolalaceae	1	2	-	-	-
60	Opileaceae	1	1	-	-	-
61	Aquifoliaceae	1	4	-	1	1
62	Celastraceae	8	16	-	4	-
63	Hippocrateaceae	3	9	-	-	1
64	Rhamnaceae	7	21	-	1	1
65	Vitaceae	6	28	-	5	1
66	Leeaceae	1	8	-	1	-
67	Sapindaceae	11	17	-	2	-
68	Staphyleaceae	1	1	-	-	-
69	Aceraceae	1	2	-	1	-
70	Hippocastanaceae	1	1	-	-	-
71	Sabiaceae	2	14	-	1	-
72	Anacardiaceae	11	19	1	4	2
73	Moringaceae	1	1	-	-	-
74	Connaraceae	2	2	-	-	-

75	Mimosaceae	11	35	-	-	1
76	Caesalpiniaceae	10	41	-	-	-
77	Papilionaceae	51	198	5	25	1
78	Rosaceae	7	30	-	3	1
79	Saxifragaceae	3	3	-	1	-
80	Iteaceae	1	1	-	-	-
81	Hydrangiaceae	1	2	-	1	-
82	Crassulaceae	4	5	-	-	-
83	Droseraceae	1	1	-	-	-
84	Altingiaceae	1	1	-	-	-
85	Haloragidaceae	2	3	-	2	-
86	Rhizophoraceae	1	1	-	-	-
87	Combretaceae	4	22	-	4	1
88	Myrtaceae	5	34	-	-	-
89	Lecythidaceae	2	2	-	-	-
90	Barringtoniaceae	1	1	-	-	-
91	Melastomaceae	7	19	-	4	-
92	Memecylaceae	1	9	-	2	-
93	Lythraceae	6	18	-	2	1
94	Crypteroniaceae	2	2	-	-	-
95	Punicaceae	1	1	-	-	-
96	Onagraceae	3	6	-	-	-
97	Trapaceae	1	3	-	-	-
98	Samydaceae	2	6	1	-	-
99	Passifloraceae	2	7	-	2	-
100	Caricaceae	1	1	-	-	-
101	Cucurbitaceae	20	37	-	5	2
102	Begoniaceae	1	17	-	1	5
103	Datisceae	1	1	-	-	-
104	Cactaceae	6	8	-	-	-
105	Aizoaceae	1	3	-	-	-
106	Molluginaceae	1	1	-	-	-
107	Apiaceae	11	14	-	-	-

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108	Araliaceae	7	11	-	1	-
109	Cornaceae	2	2	-	1	-
110	Nyssaceae	1	1	-	-	-
111	Alangiaceae	1	3	-	-	-
112	Caprifoliaceae	4	9	-	-	-
113	Rubiaceae	57	141	-	20	5
114	Asteraceae	74	129	-	2	3
115	Stylidaceae	1	1	-	1	-
116	Campanulaceae	2	4	-	-	-
117	Lobeliaceae	1	3	-	-	-
118	Sphenocleaceae	1	1	-	-	-
119	Vacciniaceae	1	3	-	2	1
120	Ericaceae	2	3	-	-	-
121	Plumbaginaceae	1	3	-	1	-
122	Primulaceae	2	2	-	1	-
123	Myrsinaceae	8	39	-	7	-
124	Sapotaceae	8	10	-	2	-
125	Ebenaceae	1	10	-	-	1
126	Styracaceae	2	2	-	-	-
127	Symplocaceae	1	11	-	1	-
128	Oleaceae	5	26	-	2	-
129	Apocynaceae	25	35	-	5	-
130	Asclepiadaceae	18	41	1	7	-
131	Periplocaceae	6	7	-	2	-
132	Loganiaceae	2	5	-	-	-
133	Buddleiaceae	1	2	-	1	-
134	Gentianaceae	6	13	-	-	-
135	Menyanthaceae	1	2	-	-	-
136	Polemoniaceae	2	2	-	-	-
137	Hydrophyllaceae	1	1	-	-	-
138	Boraginaceae	5	7	-	-	-
139	Ehretiaceae	4	8	-	1	-
140	Heliotropaceae	2	5	-	1	-

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141	Convolvulaceae	11	46	-	2	-
142	Cuscutaceae	1	1	-	-	-
143	Solanaceae	14	38	-	2	-
144	Scrophulariaceae	25	66	-	3	-
145	Orobanchaceae	2	3	-	1	-
146	Lentibulariaceae	1	6	-	-	-
147	Gesneriaceae	10	23	-	4	1
148	Bignoniaceae	15	18	-	1	-
149	Pedaliaceae	1	2	-	-	-
150	Acanthaceae	27	92	-	5	1
151	Thunbergiaceae	2	6	-	-	-
152	Verbenaceae	18	64	-	1	-
153	Lamiaceae	33	87	-	2	-
154	Plantaginaceae	1	1	-	-	-
155	Nyctaginaceae	3	4	-	-	-
156	Amaranthaceae	14	31	-	-	-
157	Chenopodiaceae	5	6	-	-	-
158	Basellaceae	1	2	-	-	-
159	Phytollacaceae	2	2	-	-	-
160	Polygonaceae	6	37	-	-	-
161	Podostemaceae	1	1	-	-	1
162	Nepanthaceae	1	1	-	1	1
163	Rafflesiaceae	1	1	-	1	1
164	Aristolochiaceae	1	5	-	-	-
165	Piperaceae	2	20	-	-	1
166	Saururaceae	1	1	-	-	-
167	Chloranthaceae	1	1	-	-	-
168	Myristicaceae	3	6	-	-	-
169	Lauraceae	14	81	-	2	22
170	Hernandiaceae	1	3	-	-	-
171	Proteaceae	2	2	-	-	-
172	Thymeliaceae	3	3	-	1	-
173	Elaeagnaceae	1	2	-	-	-

174	Loranthaceae	7	13	-	1	-
175	Viscaceae	1	2	-	-	-
176	Santalaceae	2	2	-	1	-
177	Balanophoraceae	1	1	-	1	-
178	Euphorbiaceae	48	139	-	1	5
179	Urticaceae	15	47	-	5	1
180	Ulmaceae	5	9	-	-	-
181	Moraceae	6	60	-	3	-
182	Cannabidaceae	1	1	-	-	-
183	Juglandaceae	1	3	-	-	-
184	Myricaceae	1	1	-	-	-
185	Casuarinaceae	1	1	-	-	-
186	Betulaceae	1	1	-	-	-
187	Fagaceae	3	21	-	4	-
188	Salicaceae	1	3	-	-	-
189	Ceratophyllaceae	1	1	-	-	-
	Total	1011	2752	14	266	95
Gymnospermeae						
1	Gnetaceae	1	4	2	1	-
2	Pinaceae	1	2	-	-	1
3	Cupressaceae	3	5	-	-	-
4	Taxaceae	3	3	1	-	-
5	Podocarpaceae	2	2	-	-	-
6	Cycadaceae	2	4	-	2	-
7	Araucariaceae	2	2	-	1	-
	Total	14	22	3	4	1
Monocotyledones						
1	Hydrocharitaceae	6	9	-	-	-
2	Burmanniaceae	1	1	-	1	-
3	Orchidaceae	96	328	301	86	35
4	Zingiberaceae	14	45	-	4	4
5	Strelitziaceae	2	2	-	-	-
6	Musaceae	2	11	-	2	-

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7	Heliconiaceae	1	1	-	-	-
8	Costaceae	1	1	-	-	-
9	Cannaceae	1	2	-	-	-
10	Marantaceae	4	6	-	-	-
11	Bromeliaceae	1	1	-	-	-
12	Haemodoraceae	2	2	-	-	-
13	Iridaceae	1	3	-	-	-
14	Amaryllidaceae	6	10	-	-	-
15	Agavaceae	7	16	-	-	-
16	Hypoxidaceae	2	2	-	-	-
17	Taccaceae	1	1	-	-	-
18	Dioscoreaceae	1	20	-	-	-
19	Stemonaceae	2	2	-	-	-
20	Liliaceae	11	13	-	2	-
21	Alliaceae	1	3	-	-	-
22	Smilacaceae	2	10	-	1	-
23	Pontederiaceae	2	3	-	-	-
24	Xyridaceae	1	1	-	1	-
25	Commelinaceae	10	34	-	2	-
26	Flegillariaceae	1	1	-	1	-
27	Juncaceae	1	7	-	-	-
28	Arecaceae	18	36	-	1	1
29	Pandanaceae	1	6	-	-	-
30	Typhaceae	1	2	-	-	-
31	Araceae	24	45	-	-	-
32	Lemnaceae	4	4	-	1	-
33	Alismaceae	2	3	-	-	-
34	Butomaceae	1	1	-	-	-
35	Najadaceae	1	3	-	-	-
36	Aponogetonaceae	1	2	-	-	-
37	Potamogetonaceae	2	4	-	-	-
38	Eriocaulaceae	1	12	-	-	-
39	Cyperaceae	24	132	-	11	7
40	Poaceae	108	295	-	3	24
	Total	368	1080	301	116	71

Table 2. *General statistical analysis of Angiosperms & Gymnosperms of Assam*

Sl. No.	Plant group	No. of families	No. of Genera	No. of taxa
1.	Gymnosperms	7	14	22
2.	Dicotyledons	189	1012	2752
3.	Monocotyledons	40	368	1080
	TOTAL	236	1394	3854

Angiosperms and Gymnosperms of Assam represent about 47% herbs, 22% shrubs, 20% trees/small trees, 8% climbers/lianas and 3% undershrubs. Out of 236 families of flowering plants recorded from Assam, in regard to taxa of dominance, Orchidaceae is the most dominant family with 328 taxa, followed by Poaceae of 295 taxa, Papilionaceae of 198 taxa, Rubiaceae of 141 taxa and Euphorbiaceae of 139 taxa, while in regard to genus dominance the five dominant families are Poaceae of 108 genera, followed by Orchidaceae of 96 genera, Asteraceae of 74 genera, Rubiaceae of 57 genera and Papilionaceae of 51 genera respectively.

Phytogeographical analysis for Angiosperms & Gymnosperms

An analysis of the distribution patterns of the Gymnosperms and Angiosperms of Assam reveals that Assam being a state with land connections, plants had migrated in past from Africa, America, Australia, West Asia, South-East Asia through Afghanistan, Bangladesh, Myanmar, Pakistan, Nepal, etc. The presence of land connections, along with isoclimatic conditions probably promoted this migration and distribution of plants from one place to another and vice versa, by natural as well as by artificial process of dispersal. Besides, it has also been found that floristic composition is much rich in Brahmaputra Valley than in Barak valley of Assam.

Plants of different threat categories

Based on the study of available literature and herbarium materials, a total of 3854 taxa of Angiosperms and Gymnosperms have been mentioned in the taxonomic enumeration. A total of 871 taxa are categorized under different conservational status. Out of them 167 taxa are endemic, 318 are CR/EN/VU and 386 taxa are R for Assam. The different conservation status include in the list are "CR" - Critically endangered, "EN" - Endangered, "VU" - Vulnerable, "NT" - Near Threatened, "LC" - Least Concerned, "DD" - Data Deficient, "NE" - Not Evaluated as given by IUCN while "R" - Rare, "S" - Scattered, "O" - Occasional, "DI" - Data Insufficient in lieu of sate status based on the works of S. Chowdhury (2005).

ASSAM: AN OVERVIEW

TOPOGRAPHY

Assam is bounded by Bhutan and Arunachal Pradesh on the north; Arunachal Pradesh, Nagaland and Manipur on the east; Mizoram and Meghalaya on the south and Bangladesh and West Bengal on the west. It is located at the central part of the north-east India, with an area of 78,438 sq. km of which, 77667.99 sq. km is rural and 770.01 sq. km is urban area. The state of Assam is situated in between 24°08' 10" N and 27°58' 15" N latitudes and 89°42' 05" E and 96°01' 14" longitudes. Topographically, Assam can be divided into two major divisions: Plains and Hills. Plains can further be divided into two physiographic divisions: Brahmaputra Valley & Barak Valley. The hills are also divided into two physiographic divisions: Karbi Plateau & Barail Hills.

Plains

Brahmaputra Valley: The Brahmaputra Valley is the largest unit in the state. It is largely an alluvial plain with a total area of 56,339 sq. km. It extends from east to west for about 720 km and average width of 80 km. It covers about 72% of the State's total area. It is bounded on the north by the Bhutan and Arunachal Himalaya, on the east by Patkai hills and its branches lying in Arunachal and on the south by the hills of Nagaland and the plateaus of Karbi Anglong and Meghalaya. The Brahmaputra plain in its east-west direction has four distinct physiographic divisions viz. (a) The Northern foothills, (b) The North and South plains, (c) The floodplains and (d) The Southern foothills. The Brahmaputra, the biggest river in Assam and one of the biggest rivers in the world, rolls down the plain of Assam from east to west for a distance of 640 km up to the Bangladesh border. This river is known as the Tsangpo in Tibet, the Siang or Dehang in Arunachal Pradesh and the Brahmaputra in Assam and Jamuna in Bangladesh. It traverses a total distance of 2906 km through the Tibetan Plateau, Himalayan Mountain and the hills and plains until reaching the Bay of Bengal in Bangladesh. The Brahmaputra river system drains a unique physical setting of diverse biotic environment with its major tributaries like Manas, Pagladia, Puthimari, Jia Bhoroli, Ranganadi, Subansiri, etc. on the north and Krishnai, Kolong, Kopili, Dhansiri, Dikhow, Burhidihing, Lohit, etc. on the south

Barak Valley: The Barak Valley is situated in the southern part of Assam. It is also of alluvial origin and surrounded by North Cachar hills in the north, in the east by Manipur hills, in the south by Mizoram hills and in west by Sylhet plain of Bangladesh. The valley is about 85 km long from the east to the west and about 70 km wide on average from the north to the south. It covers an area of about 6962 sq. km accounting for about 9% of the total geographical area of the State. It is characterised mainly by presence of numerous scattered low hillocks which is locally known as 'Tilas' with maximum height of about 100m. The Barak plain contains numerous swamps, 'Beels', 'Jheels', and rivers. The Barak is the second largest river in north-east India as well in Assam. It rises on the southern slope of the Barail Range near the border of Manipur and Nagaland. The river with a total length of 900 km from its origin to mouth covers an area of 52,000 sq. km while it traverses a distance of 532 km up to the Indo-Bangla border in India. In Assam, the Barak has a total length of 225 km and it drains the southern part of Assam which includes Cachar, Karimganj, Hailakandi and the southern part of Dima Hasao district. The important north bank tributaries of Barak river are Jiri, Siri, Madhura, Jatinga and Larang, while important south bank tributaries include Sonai, Rukni, Ghagra, Dhaleswari and Katakahal.

Many ox-bow lakes are also present on both the banks of Barak River.

Hills

Karbi Plateau: It is the north-eastern extension of the Meghalaya Plateau. The whole region consists of two unequal hilly parts, which are separated by Kapili River and its tributaries like Diyung, Lumding, etc. The two hilly parts are: The *Central Karbi Plateau*, which is the eastern part of the plateau. It is about 7400 sq. km. The region is dome shaped, while the *Hamren plateau*, is the southwestern part of the plateau and all streams and rivers present here are tributaries of Kapili River. It covers about 3000 sq. km.

Barail Hills: The Barail Hills of Assam, which covers the entire Dima Hasao district, are actually the continuation of Barail Range towards west stretching from Tuensang across Nagaland. In the middle part of the Dima Hasao district, the Barail ranges attain their highest peak. It divides the N.C. Hills into two main parts namely Brahmaputra basin and Barak basin. The northern part falls under Brahmaputra basin and southern part falls under Barak basin. The main Barail range is like common water shed of both Brahmaputra basin and Barak basin. In southern region of the Karbi Plateau, the Barail range rises from 300m and attains a maximum height of about 1866m. Processes like weathering, erosion are very much active in this region due to which deep valleys and steep slopes are seen.

SOIL

Soil is the most important resource and it serves as one of the prime requisites of life. Soils turn the land through their relative fertility, support all agricultural activities and the plant growth and thereby act as the most important element of the natural ecosystem. As regards the soils of Assam, geology (parent material), topography and climate seem to play a vital role in their formation. Therefore, under varying geological conditions, topographical characteristics and agro-climatic situation five major types of soils are found in the hills, piedmonts, plateaus and plains of Assam, viz. (i) Entisols, (ii) Mollisols, (iii) Alfisols, (iv) Ultisols and (v) Histosols.

Entisols

Two types of Entisols are found in Assam- Udifluvents, *i.e.* Younger Alluvial Soils and Ustorthent, *i.e.* Bhabar soils. The Younger Alluvial soils are found mostly in the flood prone areas and these soils are deposited by floods of the rivers carrying silt. The texture of the soil is sandy, silty or clayey-loam. These soils are often neutral to alkaline with a pH value of 5.5. They are rich in phosphate, potash, calcium and nitrogen and suitable for cultivation of rice, jute, pulses, mustard, potato, vegetables, etc.

Mollisols: Haplaquolls or Tarai Soil

Haplaquolls or Tarai Soils form in semi-arid to semi-humid areas. These soils are coarse alluvium formed by debris of pebbles, cobbles and coarse sand and have deep, high organic matter, nutrient-enriched surface soil and are acidic in nature. They are formed along the south of the Bhabar region with dense vegetation of eastern Himalayas and is known as Tarai zone. In Assam, these soils are found particularly in the northern parts of Kokrajhar, Bongaigaon, Barpeta, Nalbari, Darrang, Sonitpur and Lakhimpur districts.

Alfisols

Alfisols are acidic in nature with pH value ranging from 4.5 to 5.0. In Assam, three types of Alfisols are

found. *Paleustalfts, Haplaquants (Older Alluvium)*: This type of soil is found mostly in the zone above the annual flood level and occupies the areas between the upper limit of Brahmaputra flood plain and fringe areas between Karbi Anglong and Kopili and Dhansiri valley. The old alluvium extends in certain parts of the flood plains of Kamrup, Nalbari, Bongaigaon, Kokrajhar districts and the tracts bordering hill ranges extending from north to south in Karimganj and Hailakandi. The texture of the soil varies from coarse sand to clayey loam.

Haplustalfts, Paleustalfts, Rhodustalfts (Red Sandy Soil): This soil is formed sediments derived from crystalline metamorphic rocks which consist largely of granite and gneisses and occupies the area covering the Precambrian Plateau tracts of Karbi Anglong and the regions bordering Meghalaya with Kamrup and Goalpara districts. Red Sandy Soils are found in some isolated areas within the Brahmaputra alluvial plain in Kamrup, Kokrajhar, Dhubri, Bongaigaon districts, the southern part of the Borail Range in Dima Hasao district and the elongated tracts in southern Cachar district. The texture of the soil varies from coarse to fine sand and clay.

Haplustalfts, Paleustalfts, Rhodustalfts (Red Loamy Soil): The Red Loamy Soil is comprised of sand, silt and clay mixed pebbles brought down by rain from higher slopes. It is found as elongated tracts lying in the north-south direction in Cachar, Hailakandi and Karimganj districts. It is also found towards the Assam-Meghalaya border areas in Karbi Anglong and Dima Hasao districts.

Ultisols

Ultisols are highly acidic with pH value varying between 4 to 4.5 and poor in plant nutrients. This type of soil is classified into two groups:

Palehumults (Brown, Red and yellow soils): These soils are found in long strips of land between border areas of Bhutan hills and districts of Darrang, Kamrup, Nalbari, Barpeta and Kokrajhar. Another patch is seen bordering Arunachal Pradesh in either sides of Subansiri river. This type of soil is derived from oxidation and hydrolysis of Iron minerals and comprises sandy clay originated from sedimentary formation.

Plinthaqualts, Plinthustulcs, Plinthudults (Lateritic soil): The Lateritic soil is highly leached soil, developed under the conditions of high rainfall with alternating dry and wet period. It occupies the area situated between old alluvium and red loamy soil in south and south-western part of Golaghat, south-eastern part of Nagaon district and almost northern part of Dima Hasao district. The Lateritic soil is also found between the Barak alluvial plain and foot hills of Barail Range bordering Cachar with Dima Hasao district.

Histosols

Troposaprists (Peaty and saline Peaty Soils): This type of soil comprises silt and clay materials. It occupies the low-lying areas of the Brahmaputra flood plains and the riverine tracts of Lakhimpur, Barpeta and Jorhat district of Assam. It is also found in Barak flood plains especially in the western part of Barak alluvial plain in Karimganj district.

CLIMATE

Climate of Assam is governed by a number of factors which include orography, alternating pressure cells of north-west India and Bay of Bengal, periodic Western disturbances, local mountain valley winds, geological configuration, extensive water bodies, local depression and forests. The climate of

the state is characterised by high humid tropical climate with heavy rainfall and moderate temperature. The greater part of two hilly districts, viz. Karbi Anglong and Dima Hasao, enjoys sub-tropical monsoon climate. The climatic year in Assam is divided into four seasons: Winter, Pre-monsoon or Summer, Monsoon or Rainy and Post Monsoon or Autumn.

Winter

It extends from December to February. This season is characterised by the northerly and north easterly cold winds and damp fogs. Besides, foggy morning, dry days along with misty and cold long nights are other general characteristics of this season. Average minimum temperature during this period is around 7°C and the average maximum temperature is around 24°C in the Brahmaputra valley, while slight variation is being noticed in the Barak Valley and the hilly districts of Assam. The minimum temperature generally remains around 11°C at an average while average maximum temperature remains around 26°C in the Barak Valley, whereas in Karbi Anglong and Dima Hasao, it goes down to 5.5°C and rises to 23°C. Rainfall is scarce and it does not exceed 3 cm at an average. The Relative Humidity varies from 60% to 90% in average. During the early part of this season the deciduous trees shed their leaves and start leafing in the latter part of February.

Pre-monsoon or Summer

It extends from March to May. During this season the temperature rises, fogs gradually disappear and at the later part of the season there is occasional thunderstorm and often the weather remains windy and dusty. The wind usually blows south-west to north-west and is often accompanied by cyclonic storm and torrential rains. Average rainfall during the months of March, April and May is found to be 60, 190, 240 cm (mean) respectively. The maximum temperature varies from 29°C to 32°C and minimum temperature varies from 24°C to 26°C.

Monsoon or Rainy

It extends from June to September. The season is characterised by cloudy weather, more or less incessant rain with heavy precipitation and high atmospheric humidity. Though there are more rainy days in the season, the temperature rises to maximum of 38°C. The State of Assam receives an average annual rainfall of 200 cm. It is found to be as high as of 335 cm and 323 cm respectively in North Lakhimpur and Silchar and as low as of 129 cm in Luming.

Post Monsoon or Autumn

It extends from October and continues till the onset of winter. Clouds start disappearing with progressively clear weather and gradual fall of temperature. The weather is quite stable and is often accompanied by mist and fogs with the advancement of the season. The temperature does not rise beyond 28°C, rainfall is negligible and humidity ranges from 78% to 90%.

VEGETATION

Vegetation of Assam is primarily of tropical and sub-tropical types. On the basis of floristic composition, the forest area can be divided as follows:

Tropical Forests

(a) Tropical wet evergreen forests: This type of forest lies along the foothills of Arunachal Pradesh, Lakhimpur, Tinsukia, Dibrugarh and southern parts of Sivasagar district adjoining Nagaland and the

Barak Valley, foothills of Barail ranges and south-eastern parts of Cachar district comprising Loharbund Reserved Forest. Often, single species dominance in the top canopy are observed such as *Dipterocarpus retusus*, *Mesua assamica*, *Mesua ferrea*, *Shorea assamica*, etc. in upper Assam while *Dipterocarpus turbinatus*, *Mesua floribunda*, etc. in Barak Valley. Characteristic floristic elements include: *Altingia excelsa*, *Dipterocarpus retusus*, *Dipterocarpus turbinatus*, *Magnolia* sp., *Mesua assamica*, *Mesua ferrea*, *Schima wallichii*, *Shorea assamica*, *Stereospermum tetragonum*, *Terminalia chebula*, etc. These tree species form the main canopy. Smaller trees and shrub species found in this type of forest include: *Bauhinia* sp., *Cinnamomum* sp., *Clerodendrum* sp., *Holarrhena pubescens*, *Ixora* sp., *Pavetta indica*, etc. Lianes and climbers which include: *Acacia* sp., *Entada rheedii*, *Gnetum montanum*, *Pothos* sp., *Thunbergia laurifolia*, etc. while *Musa* sp., *Phrynium* sp., *Arenga* sp., *Calamus* sp. and *Pinanga* sp. are common in damp slopes.

(b) Tropical semi-evergreen forests: These forests are found in the Brahmaputra Valley and along the foot hills of Barail ranges and Manipur hills in the Barak Valley. In these regions, the forests are characterised by emergent deciduous species. Common tree species include *Phoebe goalparensis* in the western Assam districts and *Phoebe cooperiana* and *Phoebe attenuata* in Sivasagar and other similar localities. Other tree species include *Castanopsis indica*, *Dillenia indica*, *Dillenia scabrella*, *Dysoxylum* sp., *Michelia champaca*, *Schima wallichii*, *Cedrela toona*, etc. along with deciduous species like *Albizia lebeck*, *Albizia procera*, *Bauhinia purpurea*, *Dillenia pentagyna*, *Shorea robusta*, etc. *Clerodendrum glandulosum*, *Gnetum gnemone*, *Litsea* sp., *Morinda angustifolia*, etc. are some of the shrubby species. *Apostasia odorata* and *Apostasia nuda* are the two interesting ground orchids which remain restricted to the vegetation of Garampani and Joypur Reserved Forests. Epiphytic flora is also rich in these forests. Numerous species of Orchidaceae, Asclepiadaceae, Piperaceae are some common families found here.

(c) Tropical moist deciduous forests: These forests comprise the Sal forests and major parts of scrub forest in the state, which are seen in the districts of Kokrajhar, Goalpara, Kamrup, Nogaon, Dima Hasao and plains of Barak Valley. The dominant species in the Sal forest areas is *Shorea robusta*. Other species include *Derris robusta*, *Dillenia pentagyna*, *Gmelina arborea*, *Lagerstroemia parviflora*, *Schima wallichii*, *Cedrela toona*, etc. Woody climbers and lianes are scarce. The common ones include *Combretum* sp., *Bauhinia vahlii*, etc.

(d) Grasslands: These are grass dominated biomes. Extensive areas of Assam are covered by grasslands in alluvial flood plains of Brahmaputra Valley. The grasslands are most conspicuous in all the National Parks of Assam and most of the Wildlife Sanctuaries of Assam viz., Sonai Rupai, Laokhowa, Pabitora, Bornadi, Burachapori, etc. Besides these grasslands also occur in the riparian vegetation, marshes and swamps, marshy depressions, beels and hoars. Vegetation studies reveal that there are two different types of grasslands in Assam: (1) Grasslands occurring in recent alluvial deposits in low lying and Char areas annually inundated and flood water retained for a considerable period of time. These are wet alluvial pure Grasslands. Some of the dominant grasses are *Apluda mutica*, *Arundo donax*, *Brachiaria villosa*, etc. (2) Grasslands in old alluvium deposits of high land. The dominant grasses include : *Apluda mutica*, *Digitaria abludens*, *Imperata cylindrica*, *Neyraudia reynaudiana*, *Panicum auritum*, *Saccharum arundinaceum*, etc.

(e) Riparian Forests: These forests occur all over the evergreen and semi-evergreen zones in Assam along river banks and extended in several areas. In low lying areas, species like *Albizia lebeck*, *Dillenia indica*, *Dalbergia stipulacea*, *Semecarpus anacardium* are some of the common species

while on slightly higher level, species like *Mesua ferrea*, *Michelia doltsopa*, etc. are found. A variety of orchids and ferns are the major component of the epiphytic flora in these areas.

(f) Swamps: The total wetlands have been estimated to be 2.1% and occupy an area of 1,036.76 sq. km. i.e. about 1.32% of the total geographical area (78,523 sq. km.) of the State. The plants growing in wetlands are usually termed as Hydrophytes. Aquatic families such as Araceae, Cyperaceae, Eriocaulaceae, Lemnaceae, Nymphaeaceae are common in these beels. Common species of the genera in this type of vegetation include *Cyperus* sp., *Nelumbo* sp., *Nymphaea* sp., *Ottelia* sp., *Scirpus* sp., etc.

Sub-tropical Forests

(a) Subtropical Broad-leaved Forests: These forests are confined only to places where elevation rises above 900 m and mainly found in Hamren Sub-Division of Karbi Anglong district and Dima Hasao district. Ascending upwards from 900 m – 1700 m the vegetation is predominated by broad-leaved plants. Common species include *Alseodaphne petiolaris*, *Antidesma bunius*, *Chaetocarpus castanocarpus*, *Cinnamomum tamala*, *Ficus albelii*, *Ficus squamosa*, *Glochidion zeylanicum*, *Glochidion sphaerogynum*, *Helicia robusta*, *Litsea nitida*, *Phoebe lanceolata* and *Schima wallichii*. Associated species of shrubs and undershrubs are less in number, some of which are *Alchornea tiliifolia*, *Boehmeria clidemioides*, *Eriosolena involucrata*, *Oreocnide frutescens*, *Pouzolzia sanguinea*, etc. The herbaceous angiosperms chiefly belong to members of Asteraceae, Lamiaceae, Araceae, Zingiberaceae and Poaceae. Higher up beyond 1700 m the broad-leaved vegetation is replaced by pure stand of pine forests but not dense. The species here is *Pinus kesiya*. Associated species of other angiosperms are less in number and mostly with species like *Schima wallichii*, *Betula alnoides*, *Quercus semiserrata*. Annual burning of pine needles affects the undergrowth vegetation much. Only a few hardy herbaceous plants of the families viz, Asteraceae, Rosaceae and Theaceae are found scattered.

(b) Subtropical Pine Forests: These forests occur at an elevation from 900 -1800 m, having moderate rainfall and found in areas of Dima Hasao bordering Jaintia hills district of Meghalaya and Karbi Anglong district. The pine forests i.e. mainly *Pinus kesiya* are intercepted by tree species like *Cinnamomum* sp., *Engelhardtia spicata*, *Myrica esculenta*, *Quercus griffithii*, *Schima wallichii*, *Symplocos* sp., etc. The floor is generally devoid of plant growth due to deposition of pine needles and very few plant species occur.

(c) Bamboo forests and cane brakes: There is as such no bamboo forest in both the valleys of Assam. Bamboo brakes are mostly found along the edges of Reserved Forests and residential compounds, often cultivated by the villagers, with scattered distribution of a few species. Pure bamboo forests are found in the two hill districts of Assam and mostly along the foothills of Barail range near Jatinga of Dima Hasao and in hilly slopes of Karbi Anglong district predominated with *Chimonobambusa callosa* and *Melocanna baccifera*. Langting Mupa Reserved Forest of Dima Hasao and in parts of Karbi Anglong are mostly with *Melocanna baccifera* in association with *Bambusa tulda*, *Dendrocalamus hamiltonii*, *Dendrocalamus hookeri*, *Dendrocalamus strictus*, *Gigantochloa parvifolia*, *Phyllostachys mannii* interrupted by moist semi – evergreen and deciduous species. Similarly in slightly more wet places different species of *Calamus* such as *Calamus erectus*, *Calamus floribundus*, *Calamus tenuis* form thick patches in Karbi and Dima Hasao hills.

BOTANICAL EXPLORATION AND FLORISTIC STUDIES IN ASSAM

Assam has been a centre of classical botanical collections. It has attracted the attention of a number of Botanists, both professionals and amateurs. Francis Buchanan (later in 1820 Hamilton) pioneered the botanical collection around Guwahati in 1808 -1809. Wild growing tea plant in Assam was reported by Robert Bruce in 1823 from an area known as 'Bisa' in former Lakhimpur Frontier Tract near Burhi Dihing River. David Scott, the Governor General's Agent of North East Frontier in 1826 got a leafy twig from Manipur and it was identified by N. Wallich as *Camellia scottiana* with a question mark. Col. Lister made a good collection of plants during 1828 -1832 between Cherrapunji and Guwahati. Latter Francies Jenkins during his stay at Guwahati from 1831 to 1854 as the Governor General Agent, along with his collector Simons, gathered a number of plants from various places chiefly around Brahmaputra Valley and the Mikir Hills (now Karbi Anglong and Dima Hasao). He got a twig of wild tea through Charles Alexander Bruce, the younger brother of Robert Bruce and Captain Andrew Charlton. Griffith identified the plant as *Camellia theifera* Griff. in 1834 but the publication was made in 1854. The up to date nomenclature of the true tea plant is *Camellia sinensis* (L.) O. Kuntze. This led to the formation of a tea delegation of East India Company headed by N. Wallich (surgeon) with his associates W. Griffith (surgeon) and John McClelland (soil chemist) to study the areas of tea growing in the wild and the possibility of its cultivation in Assam. They started the journey from Calcutta on 31st August 1835 by boat and reached Sadiya on 16th January 1836 collecting plants on the way. They also made short trips to Dibrugarh and Jorhat. Griffith's contribution was more than his associates who stayed at Sadiya till February, 1837, chiefly collecting in the vicinity of Sadiya. Griffith published an excellent treatise in 1838 entitled "*The tract producing indigenous Tea plant*" in Transactions of Agricultural and Horticultural Society of India Vol. V. Griffith revisited the region in 1838 including the present Kamrup district. He with his associates and personal collectors collected as many as 2500 species. Of these, major collection was from Assam and some from present day Meghalaya and Nagaland and the Mishimi hills of erstwhile NEFA (now in Arunachal Pradesh). This is in brief the history of the earliest botanical works in Assam.

Many other explorers enriched the collection of plant species in the years that followed. Notable among them are John White (a Sub-Assistant under Jenkins) and Masters during 1843 -1873 in Golaghat, Nagaon and Sadiya. Masters in 1844, 1845, 1846, Hanny in 1845, Gammie in 1895 and J.D. Hooker & T. Thomson made a large number of collections from the Khasi Hills in 1850 staying nearly 6 months in the region. Falconer and his collectors (1852 -1854) from Mikir Hills; R.L. Keenan (1872 -1873) and also Klein and Prazer from Cachar, Peal from Sibsagar contributed to the sporadic collection. Charles Baron Clark, a Mathematician who came to India in 1866, joined as a Lecturer in Presidency College, Calcutta also made collection tours to Khasi & Jayantia Hills in 1866, 1872 and 1877. Later as Inspector of Schools in Assam during 1883 -1887, he extensively toured Shillong and its neighbouring areas. In October - November, 1885 he made valuable collections in several areas of Golaghat, Kohima and Manipur. I.H. Burkill (1965) has provided an authentic list of the pioneer plant explorers of Assam.

Gustav Mann, the first Conservator of Forests of Assam during 1863 -1881 (1891?), made splendid collections from different parts for a detailed knowledge of the Flora of Assam. He was the first to conceive the idea of the establishment of Forest Herbarium of Assam for the preservation of voucher

specimens mounted on writing paper only and deposited a fairly large number of collections. G. Watt in 1882 and 1883 collected plants from Golaghat and Cachar.

All the above mentioned collectors and others had made valuable contribution to the study of the Flora of Assam. However, most of the specimens were sent to the Kew Herbarium, London, but a few duplicates left for Sibpore Herbarium. Based on these collections and explorations, different workers have published their floristic accounts on the plants of Assam. Notable amongst them were F. Buchanan Hamilton (1820), W. Roxburgh (1820, 1824, 1832), W. Robinson (1844), W. Griffith (1834, 1838, 1847), J.D. Hooker (1844) and J.D. Hooker & T. Thomson (1855). Sir J. D. Hooker (1872-1897) had included all these materials including the area of collection, in his monumental publication in 7 volumes of the Flora of British India. The localities referred in this work are not precise and mentioned as Upper Assam, Lower Assam, Assam plains, Brahmaputra Valley or Surma Valley (the major portion of Sylhet district is now in Bangladesh) for the plain areas and on the other hand the hilly regions are termed as Mikir Hills and so on. The establishment of Botanical Survey of India on 13th February 1890 under the leadership of George King, the First Director, activated the exploration work in different parts of India including that of Assam. G.A. Gammie made collections in the months of March and April in 1894 in areas of erstwhile Lakhimpur district centred around the present Dibrugarh and Tinsukia districts and published his works in 1895. In early part of the 20th century Meebold (1906 and 1907) collected plants from areas of Golaghat, Kohima and Manipur. H.G. Carter and D.N. Carter made 2 tours in spring and autumn in 1915 and collected specimens from different places of erstwhile Lakhimpur district and published their account in the records of Botanical Survey of India entitled *Useful Plants of the district of Lakhimpur in Assam* in 1895.

At the initiative of Sir Archdale Earle, the then Chief Commissioner of Assam, U.N. Kanjilal joined the Forest Service of Assam. During his tenure (1906-1928), he made extensive and intensive collections from most parts of erstwhile Assam and also engaged most of the forest staff members spread over the length and breadth of the region with a view to publishing the Flora of Assam. He has to his credit in establishing the Assam Forest Herbarium in 1927 as Extra-Deputy Conservator of Forest of Assam. Even after retirement, he worked on the manuscripts of the First Volume of the Flora of Assam but expired on 25th October 1928, before its publication. His monumental collections, mostly identified or confirmed at Sibpore Herbarium, and invaluable elaborate field notes and drafts have remained assets to his successors. The progress of the Flora Project of Assam slowed down till P.C. Kanjilal – Deputy Conservator of Forest, U.P. was invited to complete the work. He had also made exhaustive collections from various parts of Assam and enriched the Herbarium to 40000 specimens with the assistance of workers like G.K. Deka, S.R. Sharma, D. N. Pal, R. Sunar, H. K. Deka, S.R. Talukdar, M. R. Dhar, R.N. Dey, D.N. Kalita, B.B. Shyam and others. P.C. Kanjilal before leaving Assam completed the final draft and described a few Families of Monochlamydae. Later, A. Das – the Silviculturist and Botanical Forests Officer took over the responsibility in 1931 and publication was completed between 1934 and 1940. The Flora of Assam stands out as the last Regional Flora of India authored by Indians before Independence.

During the publication of the Flora of Assam, N.L. Bor came as Political Officer in the Naga Hills and Aka Hills (Kameng). He took keen interest in Grasses and started collecting since 1936 when he became the Botanical Forest Officer. He extensively traveled most parts of erstwhile Assam collecting grasses, took all his collections and compared with earlier collections at Kew and published the 5th volume of the Flora of Assam, only on Gramineae of Monocotyledons in 1940. From 1937 to 1948 R.N. De, M.M. Srinivasan, M. L. Saikia (all Silviculturists), S.R. Sharma and G.K. Deka made substantial collections for the Forest Herbarium. Thereafter, there was negligible

collection till the establishment of Botanical Survey of India on 9th August 1956 with its Regional Head Quarters in Shillong. Mr. M.C. Jacob, the then Chief Conservator of Forests, played a key role in transferring the Assam Forest Herbarium with its staff members to the newly established Botanical Survey of India. With its 5 volumes of Flora of Assam covering 3431 species including a few varieties of plants, the Forest Department of Assam has made splendid contribution towards the floristic study of Assam. But the work of the Forest Botanist cannot be described as exhaustive or complete as the work includes mainly the flowering plants and that too only the woody ones, which have much value in Forestry. Only sporadic references have been made to the herbaceous plants. But it connotes a landmark in the history of Botanical studies in Assam by Indian Botanists. Except for the publication of Gramineae (Poaceae) in Flora of Assam (Vol.-V) by Bor (1940), other Monocotyledonous families remained unrecorded.

The Botanical Survey of India, Eastern Circle, was set up in Shillong in 1956. It took over the charge of Assam Forest Herbarium on 8th August 1956. Thereafter, several members of the organization have undertaken exploration work and collected all types of plants from different parts of North Eastern Region of India with the aim of completing the Flora of Assam. Scrutiny of literature and herbarium specimens reveal that plant collectors from BSI have visited only certain selected parts of Assam and that too not covering all the seasons of the year. According to M.S. Swaminathan and J. Joseph (1985) personals from BSI could study only 25 % of Flora of Assam. However, notable among the collectors from BSI who have enriched the Assam Forest Herbarium, now called "Kanjilal Herbarium" (ASSAM), are R.S. Rao, G. Panigrahi, D.B. Deb, A.S. Rao, S. Chowdhury, S.K. Jain, S.K. Kakati, L. C. Rabha, D.N. Verma, S. Das, R.B. Majumdar and P.K. Hajra. They have published their results of collection trips outlining the vegetation and enumerated the species mainly covering Hill States of North East India but sporadically of plain areas of Assam. The contributions made by Panigrahi (1960, 65); R.S. Rao & Panigrahi (1961); Chowdhury (1961); Naik & Panigrahi (1962); Kar & Panigrahi (1963); Kataki & Panigrahi (1964); Naik (1965); A.S. Rao & Rabha (1966); Panigrahi & Kar (1967); A.S. Rao (1969, 70, 74, 770); A.S. Rao & Rabha (1966); Panigrahi & Kar (1967); A.S. Rao (1969, 70, 74, 77); A.S. Rao & Dcori (1967); A.S. Rao & Hajra (1977); Jain & Hajra (1975a, b, 1978); Borthakur & Hajra (1976); Hajra (1978, 1980); Majumdar (1980, 1983) and Kataki & Barua (1989) are worth mentioning. On the other hand, Panigrahi (1960); Panigrahi & Chowdhury (1961, 1962); Panigrahi & Patnaik (1961, 1968) have made valuable contribution to the study of Fern allies and Ferns of North East India.

A.S. Rao & D. M. Verma (1972-1979, 1982) have bought out a series of publications to complete the Monocot Flora of Assam (undivided Assam) but could not do so as there are a number of families of Monocotyledons still left out, including the Orchidaceae. U. Shukla had published The Grasses of North Eastern India in 1996. As such the Monocot Flora of Assam still remains incomplete.

The work on Taxonomic and Floristic research of present Assam has been initiated and activated by Dr. S. Chowdhury from the date of his joining the Department of Botany, Gauhati University in 1967. He has developed and enriched the Herbarium of the Department and at the time of his retirement as Prof. & Head, the Herbarium holds nearly 10,000 specimens from almost all the parts of Assam. Apart from these, the herbarium also contains collection of his students and Research Scholars engaged in floristic studies. The Taxonomy Laboratory of the Department of Botany is now internationally recognized as a Centre for Taxonomic Research.

Prof. Chowdhury has made notable contribution highlighting the plant resources of Assam and its novelties in National and International Journals. He discovered several species of plants new to science and also recorded a number of plants previously unknown from areas within Assam [cf. Chowdhury

1961, 1974a, b, 1982, 1987, 1988, 1990, 1993 a,b, 1996 and Chowdhury, Baruah & Majumdar (1970), Chowdhury, Baruah & Baruah (1971), Chowdhury & Phukan (1974), Chowdhury & Baruah (1976), Chowdhury & Singh (1991, 1992), Chowdhury, Kakati & Baruah (1974, 1978); Handique, Medhi, Goswami, Goswami & Choudhury (1987); Sarkar, Handique, Goswami, Goswami & Chowdhury (1989); Baruah, Choudhury & Neog (1988); Chakraborty, Prasad & Chowdhury (1990); Goswami & Chowdhury (1990); Prasad, Majumdar, Chowdhury & Chakrabarty (1992); Nath & Choudhury (1994); Malakar & Chowdhury (1997); Singh & Chowdhury (1997); Dutta Chowdhury & Chowdhury (1997)]. Novelties include 3 new species of orchids discovered in the mainland of Assam viz., *Dendrobium assamicum* Chowdhury (1988), *Eulopia kamarupa* Chowdhury (1993) and *Zeuxine debrajiana* Chowdhury (1996). Other new species described by him with associates from North East Region are *Oberonia sulcata* Joseph & Chowdhury (1966), *Katherinea navicularis* Balakr. & Chowdhury (1996), *Agapetes bhutanica* Balakr. & Chowdhury (1966), *Bulbophyllum leopardianum* var. *tuberculatum* Balakr. & Chowdhury (1967) and *Arthromeris jarettii* Sastry & Chowdhury (1972).

Over the years, floristic studies in Assam have made steady progress. Prof. S. Chowdhury and his students carried out good number floristic and ethnobotanical studies. Most of his students have developed herbaria in different Colleges of Assam. Besides him there are many pioneer workers who have contributed a lot in regard to the study of flora of Assam in the recent years. Prof. S.K. Borthakur is another such name who had identified and rediscovered many new species in his botanical works. *Begonia xanthium* Hook was rediscovered by him along with Amad Uddin, S. Phukan. Four new species of *Bambusa* from Assam were discovered by C. Barooah and S.K. Bothakur. Ranjit Daimary, S. Phukan, S.K. Borthakurs' recollection of *Ariopsis peltata* Nimmo from Assam, two new species of *Glochidion* J.R. & G. Forst. (Euphorbiaceae) identified from Assam by P.C. Kalita & S.K. Borthakur. Besides, he had also guided many research scholars in floristic works of different places of Assam. Works of M. Islam on – *A contribution to the flora of the greatest river Island Majuli, the Flora of Majuli, the aquatic and marshland flora of Assam* are of immense importance in regard to the floristic study of Assam. Other notable contributions to the floristic study of Assam are *Studies on the systematic of Orchids in the Brahmaputra valley, Assam* by Bhabananda Baruah, *Bamboos of Assam-Taxonomy and Distribution* by C. Barooah, *Floristic Composition of Tinsukia District of Assam - A systematic study* by Apurba Bhaskar Baruah, *Flora of the Bongaigaon District of Assam* by Ananta Bora, *Herbaceous Angiosperms of Tezpur subdivision of Sonitpur District, Assam* by Maya Devi, *Systematics studies on the Acquatic Angiosperms of Cachar District of Assam* by Nripendra Chandra Malakar, *Systematic Studies of the Angiosperms of Kamrup District, Assam* by I.C. Baruah, *Eco-taxonomy of the Genus Dendrobium Sw. (Orchidaceae) of North-East India* by Chaya Deori, *A detailed study of Golaghat subdivision and its neighbouring areas* by P. Gogoi, *Floristic composition of Orang wildlife sanctuary of Assam* by Surendra Mohan Nath and *Study of plant diversity status in Manas Biosphere Reserve with special reference to Community Structure* by Pranjal Bezbarua. Besides, discovery of a new species *Larsenianthus assamensis* S. Dey, Mood, & S. Choudhury is another new record to the flora of Assam. *Centrosema pubescens* Benth., a species found in Assam was reported to be new to Assam by Rajib Gogoi.