

Floristic diversity of Barnadi Wildlife Sanctuary, Assam

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बरनाडी वन्य जीव अभयारण्य, असम की वानस्पतिक विविधता

छाया देवरी एवं एस. आर. तालुकदार

सारांश

प्रस्तुत शोध पत्र असम के बरनाडी वन्य जीव अभयारण्य की वनस्पति विविधता को प्रस्तुत करता है, जो आवृतबीजी एवं पर्णांगों की 454 जातियों, 2 उपजातियों एवं 3 प्रभेदों में व्याप्त है। इसमें द्विबीजपत्री पौधे 332 जातियों, 1 उपजाति एवं 3 प्रभेदों के साथ सर्वाधिक जातियों का प्रतिनिधित्व करते हैं, इसके पश्चात एकबीजपत्री की 99 जातियाँ एवं पर्णांगों की 24 जातियाँ इसमें सम्मिलित हैं। वनस्पतियों के आवास एवं जीवन स्वरूपों के विश्लेषण से ज्ञात होता है, कि वनस्पतिजात में 262 शाक, 89 वृक्ष, 61 क्षुप एवं 47 लघु क्षुप हैं। शोध पत्र में अभयारण्य की वनस्पतियों के आर्थिक महत्व के साथ ही संकट और संरक्षण के उपायों का भी संक्षिप्त विवरण दिया गया है।

ABSTRACT

The paper provides a floristic account of Barnadi Wildlife Sanctuary, Assam which includes 454 species, 2 subspecies and 3 varieties belonging to Angiosperms and Pteridophytes. The maximum numbers of species are represented by dicotyledons with 332 species, 1 subspecies and 3 varieties, followed by monocot with 99 species and pteridophytes with 24 taxa. Habitat and life forms analysis of the flora revealed that there are 262 herbs 89 trees, 61 shrubs and 47 undershrub. A brief account of vegetation of the sanctuary, economic potential of plants, threats and conservation measures has been provided.

Keywords: Floristic diversity, Barnadi Wildlife Sanctuary, Vegetation, Assam, Economic potential, Conservation.

INTRODUCTION

Plant exploration and documentation of plant and plant genetic resources in protected areas is one of the primary objectives of Botanical Survey of India. Floras of number of Biosphere Reserves, national parks, wildlife sanctuaries have already been published by BSI and others are in pipeline. Documents related to the assessment of the diversity and plant genetic resources in the protected areas played an important role in formulating the conservation strategies by the competent authorities.

Lying between 26°48'6.86"N latitude 91°44'31.39"E longitude in the foothills of Himalaya, Barnadi Wildlife Sanctuary (BWS) is situated in the Udalguri district of Assam and a part of Bodoland Territorial Autonomous

District council (BTAD). The sanctuary covers an area of 26.22 sq km and have common boundary with Bhutan in south. (Fig.1). The important rivers flows through the sanctuary are Barnadi, Deosunga and Nalanadi which originate in Bhutan. The name of the sanctuary is derived from river Barnadi. The sanctuary was earlier known as the Barnadi Reserve Forest and has been upgraded to a Wildlife Sanctuary in 1980 by the Govt. of Assam particularly for the protection of the hispid hare (*Caprolagus hispidus* Hoffmann and Smith) and world rarest smallest wild pig or Pigmy hog (*Porcula salvania* Hodgson). Other important animal species found in the sanctuary are Asiatic elephant, Capped Langur, Leopard, Small Indian Civet, Jungle cat, Bison, Porcupine, Pangolin etc. The sanctuary is also known for its abundance of Peacock. No

floristic account on the biodiversity of Barnadi Wildlife Sanctuary is available except some sporadic reports mentioning the plants of Darrang district of Assam (Hooker, 1875-1897, Kanjilal & al., 1934-40 and Chowdhery & al., 2005). The present work is the first of its kind in the sanctuary for the documentation of the plant diversity. In the present paper an attempt has been made to analyze the vegetation and composition of different types of angiosperms and Pteridophytes.

CLIMATE

The climatic of the sanctuary is typical monsoon and remains highly warm and humid throughout the year. This region received rain during summer due to early commencement of south-west monsoon. The maximum temperature during summer is 26°-36° C and minimum during the winter is 7° – 15° C. The soil of Barnadi can be classified into two types, viz (i) Loamy and (ii) Sandy loamy. The former is found in almost all over the area while the latter is found in the areas near to rivers.

MATERIALS AND METHOD

The study of the flora of the Barnadi Wildlife sanctuary under Annual Action Plan project was carried out from June 2010 to March 2013. Three field tours were undertaken covering different seasons in the sanctuary and collected 875 voucher specimens along with GPS reading and colour photographs. All the collected specimens were processed, mounted and identified with the help of relevant literatures and herbarium specimens housed in ASSAM. All the earlier collections from the sanctuary lodged at ASSAM has also been studied. During collection all the field characters viz., locality, habitat, habit, colour of the flower, fruits, distribution were noted.

OBSERVATIONS

Vegetation types: The vegetation of the sanctuary can be classified under tropical type with some elements from tropical semi-evergreen; tropical dry deciduous.

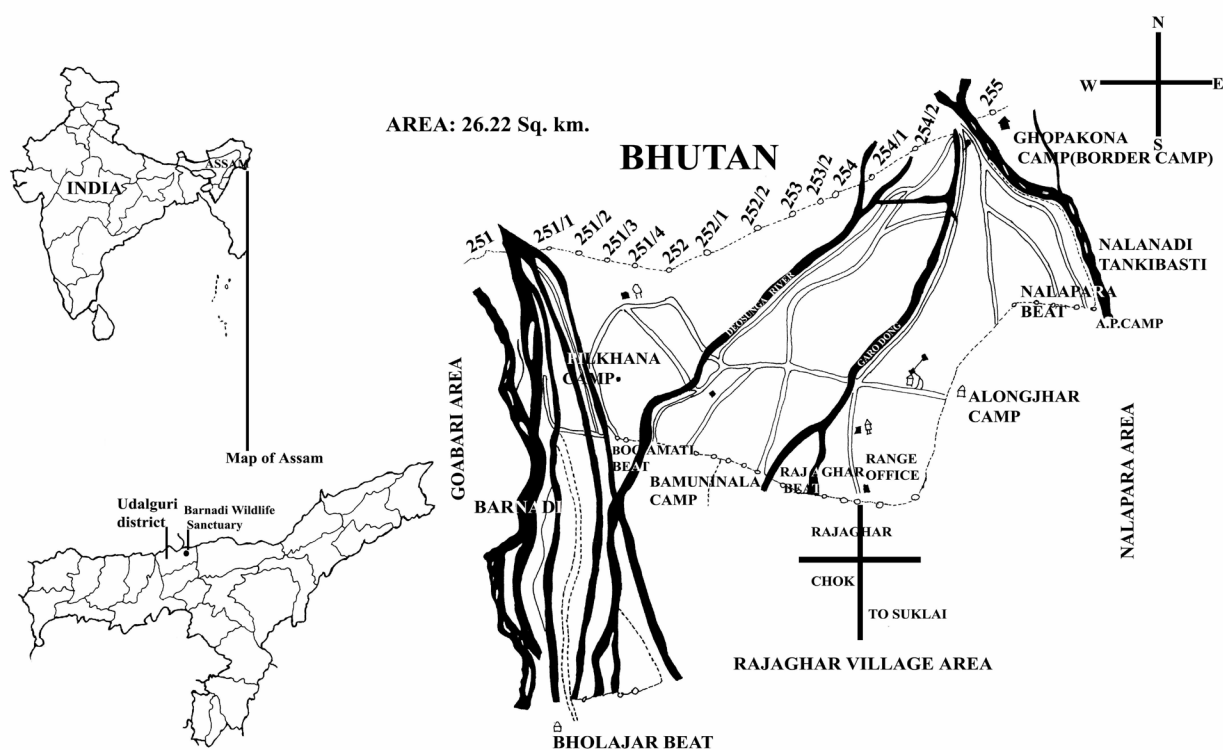


Fig -1: Map of Barnadi Wild life sanctuary.



Plate -1: A-B. View of Barnadi River in BWS, Assam, C. Grassland vegetation, D. Herbaceous vegetation, E. Setting up of tea plantation in BWS, F. Illegal Felling of trees, G. *Equisetum ramosissimum* Desf. sub.sp. *debile* (Roxb. ex Vaucher) Hauke, H. *Lycopodiella cernua* (L.) Pic. Serm.



Plate -2: A. *Aphanamixis polystachya* (Wall.) R. Parker, B. *Glochidion zeylanicum* var. *arborescens* (Blume) Chakrab. & M.G.Gangop., C. *Rauvolfia serpentina* (L.) Benth. ex Kurz., D. *Clerodendrum paniculatum* L., E. *Bidens pilosa* L., F. *Smithia sensitiva* Aiton., G. *Ixora subsessilis* Wall. ex G.Don, H. *Persicaria barbata* H. Hara



Plate -3: A. *Pachystoma pubescens* Blume, B. *Dendrobium aphyllum* (Roxb.) C.E.C.Fischer, C. *Dioscorea hamiltonii* Hook.f. D. *Acampe praemorsa* (Roxb.) Blatt. & McCann., E. *Dioscorea hispida* Dennst., F. *Cheilocostus speciosus* (J.Konig) C. Specht., G. *Dioscorea bulbifera* L., H. *Cyperus rotundus* L., I. *Saccharum rujiplum* Steud.

Sporadic patches of bamboo, degraded & scrub forest and small grassland along river banks are also found in the sanctuary.

Tropical semi-evergreen type of forest prevails in the areas along the Bhutan border of the wildlife sanctuary. Some of the common tree species found here are *Actinodaphne obovata*, *Bischofia javanica*, *Bridelia retusa*, *Dillenia indica*, *Macaranga denticulata*, *Magnolia hodgsonii*, *Meyna spinosa*, *Streblus asper*, *Tamarindus indica*, *Terminalia chebula*, *Trema orientalis* etc. The shrubby species of these forests are *Boehmeria macrophylla*, *Clerodendrum chinense*, *C. japonicum*, *C. paniculatum*, *Glochidion multilolare*, *Croton caudatus*, *Mussaenda roxburghii*, *Rotheca serrata* etc. The climbers and straggling shrubs are abundant in this region and mainly comprises of *Ampelocissus barbata*, *Argyrea nervosa*, *Ampelopteris prolifera*, *Aspidopterys indica*, *Cryptolepis sinensis*, *Dioscorea bulbifera*, *D.hamiltonii*, *D.hispida*, *Merremia umbellata*, *Parabaena sagittata* etc. The undergrowth includes undershrub or herbs mixed with fern allies and ferns. Species such as *Ageratum conyzoides*, *Arundina graminifolia*, *Biophytum sensitivum*, *Calanthe biloba*, *Chloranthus elatior*, *Clerodendrum cordatum*, *C. indicum*, *Colocasia affinis*, *C. esculenta*, *Curculigo orchioideis*, *Dendrolobium triangulare*, *Desmodium gangeticum*, *Impatiens tripetala*, *Lobelia alsinoides*, *Mosla dianthera*, *Phlogacanthus curviflorus*, *Physalis divaricata*, *Persicaria barbata*, *P. orientalis*, *P. pubescens* var. *acuminata*, *Pouzolzia sanguinea*, *Solanum anguivi*, *Stachytarpheta jamaicensis*, *Thysanolaena latifolia* etc., are common in this zone. The fern allies and ferns are mainly *Adiantum lunulatum*, *Blechnum orientale*, *Lycopodiella cernua*, *Lygodium flexuosum*, *Pteris biaurita*, *Selaginella ciliaris* etc. Epiphytic flora consists of *Dendrobium aphyllum*, *Pyrrosia adnascens*, *P. lanceolata*, *P. nummulariaefolia*, *D. jenkinsii*, *Papilionanthe teres*, *Rhynchosyilis retusa* etc.

The dry deciduous forest elements constitute mainly small trees, lianas, climbers with dense ground cover of herbaceous species. It is interesting to note that, ground flora dries completely at the onset of winter season. The common tree species *Aegle marmelos*, *Albizia procera*, *Alstonia scholaris*, *Annona reticulata*, *Aphanamixis polystachya*, *Artocarpus heterophyllus*, *Bombax ceiba*, *Brucea javanica*, *Callicarpa arborea*, *Derris robusta*, *Erythrina stricta*, *Ficus benghalensis*, *Indigofera zollingeriana*, *Litsea glutinosa*, *Melia azedarach*, *Micromelum integerrimum*, *Oroxylum indicum*, *Phyllanthus emblica*, *Semecarpus anacardium*, *Sterculia villosa*, *Tectona grandis*. Among

the shrubs are *Abroma angusta*, *Flueggea virosa*, *Glycosmis pentaphylla*, *Holmskioldia sanguinea*, *Leea asiatica*, *Maesa indica*, *Melastoma malabathricum*, *Phyllanthus reticulatus*, *Tephrosia candida* etc. The woody climbers and scandent herbs are mainly *Acacia pennata*, *Canavalia cathartica*, *Coccinia grandiflora*, *Gongronema nepalense*, *Ipomoea quamoclit*, *Momordica cochinchinensis*, *Passiflora foetida*, *Pericampylus glaucus*, *Stephania japonica*, *Thunbergia grandiflora*, etc. The ground vegetation mostly composed of *Acmella paniculata*, *Amaranthus spinosus*, *Bidens pilosa*, *Carex filicina*, *Cleome viscosa*, *Colocasia esculenta*, *Commelina benghalensis*, *Crassocephalum crepidioides*, *Cuphea carthagenensis*, *Curcuma aromatica*, *C. montana*, *Cynoglossum zeylanicum*, *Cyperus distans*, *Erigeron bonariensis*, *Euphorbia hirta*, *Globba multiflora*, *Grangea maderaspatana*, *Hyptis suaveolens*, *Kyllinga brevifolia*, *Leucas aspera*, *Murdannia nudiflora*, *Ocimum americanum*, *O.tenuiflorum*, *Pennisetum glaucum*, *Peperomia pellucida*, *Persicaria barbata*, *P. orientalis*, *Polygala chinensis*, *Rungia pectinata*, *Scoparia dulcis*, *Smithia sensitiva*, *Torenia diffusa*, *Zingiber zerumbet* etc. Among the ferns mainly *Adiantum lunulatum*, *Diplazium esculentum*, *Pteris ensiformis*, *Thelypteris nudatum* etc. are found.

Degraded and scrub forest are mainly due to encroachment of forest land for setting up of plantations, unscientific felling of trees, exploitation for fire wood, and growth of exotic elements. This forest prevails in outer boundary of the sanctuary. Few deciduous trees like *Bombax ceiba*, *Cassia fistula*, *Ficus hispida*, *Melia azedarach*, *Spondias pinnata* etc; shrubs such as *Abelmoschus moschatus*, *Calotropis gigantea*, *Clerodendrum glandulosum*, *Combretum indicum*, *Croton caudatus*, *Gliricidia sepium*, *Mimosa himalayana*, *Senna alata*, *Talipariti tiliaceum*, etc. are seen. Common climbers are *Momordica cochinchinensis*, *M. dioica* etc. The herbaceous species like *Amaranthus viridis*, *Centella asiatica*, *Chrysopogon aciculatus*, *Corchorus aestuans*, *C. capsularis*, *Cyanthillium cinereum*, *Elephantopus scaber*, *Leonurus sibiricus*, *Ludwigia adscendens*, *Mimosa pudica*, *Murdannia nudiflora*, *Paspalum scrobiculatum*, *P. conjugatum*, *Rauwolfia serpentina*, *Sesamum orientale*, *Spermacoce hispida*, *Senna occidentalis*, *Senna tora*, *Strobilanthes scaber*, *Triumfetta rhomboidea*, *Xanthium strumarium* along with fern like *Diplazium esculentum*, etc. prevails.

Predominant grasses like *Apluda mutica*, *Arundinaria racemosa*, *Arundinella bengalensis*, *A. nepalensis*, *Bracharia distachya*, *Centotheca leppacea*, *Chrysopogon fulvus*, *Echinochloa colona*, *Eleusine indica*, *Eragrostis unioides*, *Isachne albens*, *Kyllinga brevifolia*, *Panicum notanum*,

Table 1: Statistical synopsis of Flora of Barnadi Wildlife Sanctuary, Assam.

Taxonomic Group	Families	Genera	Species	Varieties/ Subspecies
Pteridophytes	13	17	23(5%)	1 subspecies
Dicotyledons	98	252	332(73%)	1 subspecies, 3 varieties
Monocotyledons	18	65	99(22%)	-
Total	129	334	454	5

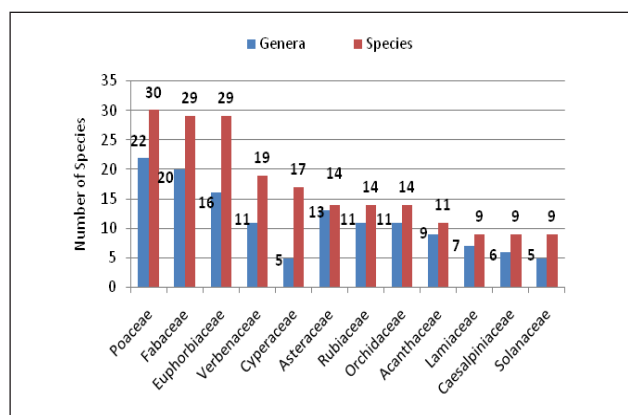
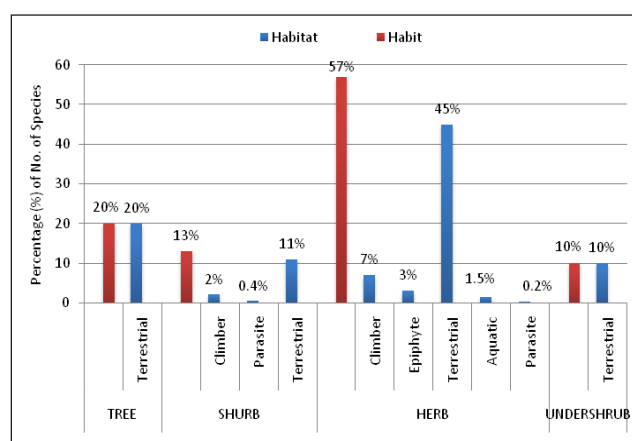
Table 2: Dominant families of Barnadi Wildlife Sanctuary.

Sl. No.	Families	Genera	Species
1	Poaceae	22	30
2	Fabaceae	20	29
3	Euphorbiaceae	16	29(28 sp. 1 var.)
4	Verbenaceae	11	19
5	Cyperaceae	5	17
6	Asteraceae	13	14
7	Rubiaceae	11	14
8	Orchidaceae	11	14
9	Acanthaceae	9	11
10	Lamiaceae	7	9
11	Caesalpiniaceae	6	9
12	Solanaceae	5	9

Table 3: Analysis of different life forms of Angiosperms and Pteridophytes in Barnadi Wildlife Sanctuary, Assam.

Trees 89 (20%)	Shrubs 61(13%)			Herbs 262(57%)			Undershrubs 47(10%)		
Terrestrial	Climbers	Parasite	Terrestrial	Climbers	Epiphytes	Terrestrial	Aquatic	Parasite	Terrestrial
89	9	2	50 (49 sp., 1 var)	33	15	206 (203 sp., 2 sub sp,1 var	7	1	47

Pycreus pumilus, *P. stramineus*, *Saccharum rufipilum* etc., are found along the river sides. Few bamboo patches could be seen at the edge of the forest in the sanctuary comprising

**Fig -2:** Dominant Angiosperm families of Barnadi Wildlife Sanctuary, Assam.**Fig -3:** Analysis of different life forms in Barnadi Wildlife Sanctuary, Assam

of mainly *Bambusa balcooa*, *B. bambos*, *B. pallida*, *B. tulda* and *B. vulgaris*. Scarcely *Pandanus foetidus* is also seen.

During the field trips few aquatic plants of mainly submerged, free-floating, and emergent hydrophytes such as *Utricularia aurea*, *Eichhornia crassipes*, *Monochoria vaginalis*, *Ludwigia adscendens*, *Ottelia alismoides* were seen in small static water bodies of the sanctuary.

DISCUSSION

The flora of Barnadi Wildlife Sanctuary revealed the occurrence of 454 species, 2 subspecies, 3 varieties belonging 319 genera and 111 families of Angiosperms and Pteridophytes. The Angiosperms consist of 431 species, 1 subspecies, 3 varieties distributed in 252 genera and 98 families. Of which the dicots represented by 332 species, 1 subspecies, 3 varieties and monocot by 99 species. The pteridophytes comprise of 23 species, 1

Table 4: Economically important species of Barnadi Wildlife Sanctuary, Assam.

Name of the species	Family	Parts used/	uses
Plants as source of food, Beverage and spices			
<i>Amaranthus spinosus</i> , <i>A. viridis</i>	Amaranthaceae	Whole plant	Food
<i>Centella asiatica</i>	Apiaceae	Whole plant	food
<i>Diplazium esculentum</i>	Athyriaceae	Fronds	food
<i>Tamarindus indica</i>	Caesalpiniaceae	Fruit	Beverage
<i>Commelina benghalensis</i>	Commelinaceae	Seed	spice
<i>Flacourtia jangomas</i>	Flacourtiaceae	Fruit	Beverage
<i>Oxalis corniculata</i>	Oxalidaceae	Leaf	Food
<i>Averrhoa carambola</i>	Oxalidaceae	Fruit	Beverage
<i>Citrus medica</i>	Rutaceae	Fruit	Beverage
<i>Piper nigrum</i>	Piperaceae	Fruit	spice
<i>Capsicum annuum</i>	Solanaceae	Fruit.	spice
<i>Ceratopteris thalictroides</i>	Parkeriaceae	Whole plant	food
<i>Dioscorea bulbifera</i> , <i>D. hamiltonii</i> , <i>D. hispida</i>	Dioscoreaceae	Tuber	food
Broom yielding Plant			
<i>Thysanolaena latifolia</i>	Poaceae	Inflorescence	Broom
<i>Sida rhombifolia</i>	Malvaceae	Whole plant.	Broom
Mat Making			
<i>Schumannianthus dichotomus</i>	Maranthaceae	Petiole	Mat
Plants as fodder for cattles			
<i>Cynodon dactylon</i> , <i>Eleusine indica</i>	Poaceae	Whole plant	Whole plant
Timber yielding plants			
<i>Alstonia scholaris</i>	Apocyanaceae	wood	Timber
<i>Garuga pinnata</i>	Burseraceae	wood	Timber
<i>Aphanamixis polystachya</i> , <i>Toona ciliata</i>	Meliaceae	wood	Timber
<i>Mesua ferrea</i>	Clusiaceae	wood	Timber
<i>Terminalia chebula</i>	Combretaceae	wood	Timber
<i>Bischofia javanica</i> , <i>Bridelia retusa</i> , <i>Mellotus repandus</i>	Euphorbiaceae	wood	Timber
<i>Careya arborea</i>	Lecythidaceae	wood	Timber
<i>Lagerstroemia parviflora</i>	Lythraceae	wood	Timber
<i>Gmelina arborea</i> , <i>Tectona grandis</i>	Verbenaceae	wood	Timber
<i>Litsea glutinosa</i>	Lauraceae	wood	Timber
Dye yielding plants			
<i>Bixa orellana</i>	Bixaceae	Fruit	Dye
<i>Bischofia javanica</i> , <i>Mallotus tetracoccus</i>	Euphorbiaceae	Bark	Dye
<i>Mallotus philippensis</i>	Euphorbiaceae	Fruit	Dye
<i>Butea monosperma</i>	Fabaceae	Flower	Dye
Fibre yielding plants			
<i>Lagerstroemia speciosa</i>	Lythraceae	Bark	Fibre

Name of the species	Family	Parts used/	uses
<i>Bombax ceiba</i>	Bombaceae	Fruit	Fibre
<i>Abelmoschus moschatus</i>	Malvaceae	Stem	Fibre
<i>Sida rhombifolia</i>			
<i>Melochia corchorifolia</i> , <i>Sterculia villosa</i>	Sterculiaceae	Stem	Fibre
<i>Triumfetta rhomboidea</i>	Teliaceae	Stem	Fibre
Oil yielding plants			
<i>Celastrus paniculatus</i>	Celastraceae	seed	Oil
<i>Tamarindus indica</i>	Caesalpinaceae	seed	Oil
<i>Jatropha curcus</i> , <i>Mallotus philippensis</i> , <i>Ricinus communis</i>	Euphorbiaceae	seed	Oil
Plants as source of Medicine			
<i>Andrographis paniculata</i>	Acanthaceae	Leaf	Leaf decoction to cure bronchitis
<i>Thunbergia grandiflora</i>	Acanthaceae	Root	Root in bronchitis
<i>Amaranthus spinosus</i> , <i>A. viridis</i>	Amaranthaceae	Whole plant	Whole plant as health tonic;
<i>Centella asiatica</i>	Apiaceae	Leaf	Leaf as abdominal pain
<i>Alstonia scholaris</i>	Apocynaceae	Milky latex	Milky latex in skin diseases
<i>Rauvolfia serpentina</i>	Apocynaceae	Root	Root extract is taken in stomach ache and hypertension
<i>Holarrhena pubescens</i>	Apocynaceae	Bark	Bark decoction is taken in dysentery
<i>Calotropis gigantea</i>	Asclepidiaceae	Leaf	Leaf used as antiseptic
<i>Ageratum conyzoides</i>	Asteraceae	Leaf	Leaf used as antiseptic
<i>Eclipta prostrata</i>	Asteraceae	Whole plant	Whole plant for Jaundice/ Liver trouble
<i>Oroxylum indicum</i>	Bignoniaceae	Tender leaf and bark	Tender leaf and bark decoction is taken in dysentery
<i>Cassia alata</i>	Caesalpiniaceae	Leaf	Leaf used as antiseptic
<i>Cassia fistula</i>		Pods	Pods are used as purgative
<i>Cannabis sativa</i>	Cannabinaceae	Leaf	Leaf for Gonorrhea
<i>Terminalia chebula</i>	Combretaceae	Fruits	Fruits in indigestion
<i>Terminalia bellirica</i>		Fruits	Fruits in constipation
<i>Commelina benghalensis</i>	Commelinaceae	Leaf	Leaf as abdominal pain
<i>Cuscuta reflexa</i>	Cuscutaceae	Whole plant	Whole plant to cure disc prolapsed of waist
<i>Kyllinga brevifolia</i>	Cyperaceae	Rhizome	Rhizome for rheumatic pain
<i>Euphorbia hirta</i>	Euphorbiaceae	Leaf	Leaf for skin infection
<i>Ocimum americanum</i>	Lamiaceae	Leaf	Leaf for skin infection
<i>Ocimum tenuiflorum</i>	Lamiaceae	Leaf	Leaf for fever
<i>Careya arborea</i>	Lecythidaceae	Bark	Bark extract to cure stomach trouble
<i>Sida cordifolia</i>	Malvaceae	Seed	Seed for Gonorrhea
<i>Sida rhombifolia</i>	Malvaceae	Root	Root used as antiseptic
<i>Boerhavia diffusa</i>	Nyctaginaceae	Leaf	Leaf extract to cure eye disease
<i>Oxalis corniculata</i>	Oxalidaceae	Whole plant	Whole plant as abdominal pain
<i>Portulaca oleracea</i>	Portulacaceae	Whole plant	Plant decoction is taken in hypertension
<i>Solanum americanum</i>	Solanaceae	Fruit	Fruit as abdominal pain

Name of the species	Family	Parts used/	uses
<i>Clerodendrum glandulosum</i>	Verbenaceae	Leaves	Leaves taken to cure high pressure
<i>Clerodendrum cordatum</i>	Verbenaceae	Root	Root decoction to cure dysentery
<i>Rotheca serrata</i>	Verbenaceae	Leaves	Leaves in dysentery
<i>Vitex negundo</i>	Verbenaceae	Leaf	Leaf for skin diseases
<i>Cheilocostus speciosus</i>	Zingiberaceae	Rhizome	Rhizome for rheumatic pain

subspecies belonging to 17 genera and 13 families. Table 1 and Fig.2 shows the breakup of each taxonomic group.

The most dominant family is Poaceae with 30 species which is followed by Fabaceae, Euphorbiaceae (29 species each) and Verbenaceae (19 sp.) etc. Table 2 shows the first 10 dominated families in the sanctuary.

Habitat and Life forms: The study revealed occurrence 262 maximum herbaceous species 89 trees, 61 shrubs and 47 under shrubs. Occurrence of maximum herbaceous species may be due to high anthropogenic disturbances in the sanctuary. Habitat wise, 345 species are of terrestrial, 15 epiphytes, 7 aquatic and 3 parasites. Table 3 and Fig. 3 shows the breakup of the different life forms in Barnadi Wildlife Sanctuary, Assam

Economic Plants: The sanctuary harbours a rich biodiversity and the local inhabitants are directly depended on it for day to day needs (Table 4).

Threats : The floristic composition and fauna of Barnadi Wildlife Sanctuary is facing from major threats due to biotic and abiotic factors. The vegetation and floristic composition is being negatively influenced due to extraction of firewood by villagers and tea garden communities surrounding the sanctuary. Encroachment of forest land by developing tea gardens in the surrounding regions affecting the floristic composition of the vegetation but also the habitat of wild animals reside in the region. For example, this is the major factor for erratic movement of wild elephant inside the sanctuary which not only damages forest lands or natural habitats of wild germplasm but also increased the human conflicts.

Various invasion of exotic species or weeds such as *Ageratum conyzoides*, *Bougainvillea spectabilis*, *Crotalaria micans*, *C. pallida*, *Clerodendrum japonicum*, *Erigeron bonariensis*, *Lantana camara*, *Leea asiatica*, *Mimosa pudica*, *Physalis minima*, *Osbeckia nepalensis*, *Ricinus communis*, *Senna alata*, *Talipariti tiliaceum*, *Tridax*

procumbens, *Zephyranthes minuta* etc. also implies a threat to the sanctuary.

Conservation measures : Introduction of reforestation measures like social forestry and silviculture in the fringe areas may control the habitat loss for flora and lessen the animal-man conflict. Restriction to the free extraction of firewood and cattle rearing inside the sanctuary will curb the unnecessary interference in the natural ecosystem. Moreover, creation of awareness among the people for community participation and conservation is highly required in the region for the efficient management of the area.

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