1. INTRODUCTION

India is one of the 18 mega diverse countries of the world, with only 2.4% of the world’s land area and contributing to about 8% of the known global biodiversity. There has been an enormous demand on our natural resources by the burgeoning population and rapid development in the country. The National Board for Wildlife (NBWL) provides policy framework for wildlife conservation. The National Wildlife Action Plan (2002-2016) was adopted in 2002. India’s conservation planning is based on the philosophy of identifying and protecting representative wild habitats across all the ecosystems. The Indian Constitution entails the subject of forests and wildlife in the concurrent list. The Federal Ministry deals with the policies and planning on wildlife conservation, while the provincial Forest Departments are vested with the responsibility of implementation of national policies and plans. In all these policies, people’s participation and their support for wildlife conservation were emphasized. There are now about 1,30,000 protected areas, covering nearly 13% of the world’s terrestrial surface and over 6% of territorial marine areas (http://www.cbd.int/protected/overview/).

The Commission on National Parks and Protected Areas (CNPPA) of the International Union for Conservation of Nature and Natural Resources (IUCN) has broadly categorized the protected areas into six major management categories. There are 4 categories of the Protected Areas viz., National Parks, Sanctuaries, Conservation Parks and Community Parks in India. At present, there are 700 Protected Areas (PAs), including 103 National Parks (NPs), 528 Wildlife Sanctuaries (WLSs), 65 Conservation Parks (CRs) and 4 Community Parks in India, covering a total geographical area of 1,60,096 sq km. This is approximately 4.86% of the total area. Besides, there are 17 Biosphere Reserves, 25 Elephant Parks and 39 Tiger Reserves (http://oldwww.wii.gov.in/nwdc/).

West Bengal, stretching from Himalayas in the north to the Bay of Bengal in the south (21°45’–27°16’ N and 85°55’–89°56’ E) spreads in an area of about 87,675 sq km. Its varied physical features have given rise to 5 well defined phyto-ecological zones.

1. The Himalayan zone between 500-3800 m (Darjeeling); 2. Sub-montane Terai region and the adjacent plain (Lower plains of Darjeeling and Jalpaiguri districts); 3. Alluvial plain on both sides of the Bhagirathi (Ganges) and its northern and western tributaries (Berhampur, Krishnanagar); 4. The Western dry flanks of Chhota Nagpur Plateau (Purulia, Bankura and West Midnapur districts) and 5. Mangrove forests of Sundarbans (Bhattacharyya, 1997).
The forest cover is about 14% of the geographical area of the state with 5 National Parks, 15 Wildlife Sanctuaries and 1 Biosphere Reserve (Singh & Singh, 2002; http://www.wiienvis.nic.in/Database/WestBengal_7842.aspx). The impact on bio-ecological factors has been so intense in the last 50 to 60 years that had shaped the vegetation to a great extent (Basak & Guha Bakshi, 1977).

Protected areas are one of the well-recognized in-situ conservation methods to protect the biodiversity across the world. Scientific Research/documentation in the Wildlife Protected Areas is vital for a better understanding of ecosystems, their functions, ecology and status of various species and their habitats. These areas also serve as control sites and information generated by scientific research in these areas would be useful in understanding ecological processes and taking appropriate conservation and management actions. The Botanical Survey India has given adequate importance to protected areas documentation both in 11th plan and 12th plan documents. The Survey has been engaged in studies on the vegetation/flora of many National Parks and Wildlife Sanctuaries in India. The present study is one such effort to document all floral elements and assess the diversity of vascular plants in the Buxa National Park.

**Study Area and its Significance**

The forests (Buxa Tiger Reserve, hereafter, BTR) came under British rule in 1865 and most of the forest areas enjoyed the status of reserved forests prior to and after independence under Indian Forest Act (1927). The Buxa Tiger Reserve, 15th declared such Tiger Reserve in 1983 of the country under Project Tiger, spreads in an area of 758 sq km. The core area of the BTR is of 390 sq km. Prior to declaration of Tiger Reserve, Buxa Wildlife Sanctuary was declared that covers an area 314 sq km under Indian Wildlife Protection Act (1972) and in the year 1990, an additional area of 54.5 sq km was added to the Sanctuary making its total area of 386 sq km. In 1992, an area of 117 sq km of the Sanctuary was preliminarily notified as National Park and finally constituted as Buxa National Park in the year 1997. Both the National Park and the Sanctuary are partly part of the Buxa Tiger Reserve (Plate 1a-c).

The total core area of Buxa Tiger Reserve is of 390.6 sq km. The break up of Buxa National Park and Buxa Wildlife Sanctuary in the core is given below (Table 1).
Table 1: Break up of Buxa Tiger Reserve

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Status</th>
<th>Area in sq km</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Buxa National Park</td>
<td>117</td>
</tr>
<tr>
<td>2.</td>
<td>Buxa Wildlife Sanctuary</td>
<td>273</td>
</tr>
<tr>
<td>3.</td>
<td>Reserve Forests</td>
<td>370</td>
</tr>
</tbody>
</table>

The Buxa National Park (26° 38’-26°44’ N and 89° 34’-89°38’ E) has been so named due to box-shaped appearance of the valley bounded by Assam in the East, Coochbehar Forests Division (West Bengal) in the West and West Dinajpur district (West Bengal) partially in the South and Bhutan in the North (Maps 1, 2, 3, 4, 5). The area of the park is mostly a plain land with the exception of Tashigaon hills (Jainti range). The continuous stretch of vegetation of the Park comprises four forest ranges namely East Damanpur (11.41 sq km), Gadadhar (20.66 sq km), Jainti (72.51 sq km) and West Rajabhatkhawa (12.52 sq km). The park is surrounded by two rivers Jainti and Bala in North-Eastern portion and West respectively. The Bala river covers most of the Western portion of the park. In the Rajabhatkhawa range the Bala river bisects the two compartment of SRVK whereas the Jainti river moves toward north-west side of the park and finally turns towards south. The Jainti river makes the park a scenic beauty and most of tourist usually visiting the park throughout the year, especially in the month of February (Plate 1d-f). An aerial view of the park makes it distinctly like an island in its appearance. Besides, there is one sacred wetland named ‘Bhutia Pukur’ at an altitude of 329 m, where most of devotees come for offering the flowers to Lord Shiva throughout year (Plate 2g, 2h).

Climate

Temperature

The area lies in the moist tropical zone. The average day temperature varies from 12°C to 21°C from November to February, between 27°C to 32°C in September between 24° to 27° for the rest of the months. The highest recorded temperature was 39°C in 1899 and lowest was 2°C in 1887. There is appreciable variation in day & night temperatures throughout the year. Sometimes, winter nights are too severe. From July to September, the days and early evening are moist and hot and indeed oppressive. However, nights are always cool.

Rainfall

South-West monsoon is the main source of rainfall. The Park receives maximum rainfall from mid-June to September. The rainfall is very high during the month of June, July & August. It subsides from the early September and disappears during the first week of
Map 4: Buxa National Park inside Buxa Tiger Reserve

- Buxa National Park
- Buxa Wildlife Sanctuary
- Reserve Forests
- Forest village

*Nos. refer to compartment number
Plate 1: a. Main entrance of the Park; b. Entrance at Checka; c. Watch tower at Tashigaon; d. Sal avenue at Jainti range; e. Bala river (in November); f. Jainti river (in April); g. Gadadhari and h. Jainti (villages)
October. December is the driest month with minimum rainfall. March receives maximum of winter rain. Pre-monsoon showers accompanied by hail & thunder storm occur in the month of April to May. The average annual rainfall in the Park is about 4100 mm, increasing a little towards North. Along the foot hills the rainfall varies according to the configuration of the hills. The average annual rainfall at Rajabhatkhawa is 3750 mm. The highest rainfall in a day in last 10 years was recorded as 992 mm on 19th July 1993. The hill streams are always unpredictable. Devastating floods were reported during 1950, 1952, 1954, 1968 and 1993 causing massive damage to the forests. Heavy rains occurred on 19th July 1993, as a result of which the Park suffered heavily. Entire Alipurduar Subdivision suffered heavily as road connections were cut off and wooden as well as concrete bridges were washed out. This flood caused havoc to vegetation and forest land.

**Humidity**

As the National park is located in the foothills of the outer Himalayas, it remains adequately humid throughout the year. Maximum relative humidity varies about 80% [± 5%], seldom below 75% with a maximum in June to September and minimum in December to February. The nights are very cold with much frost and dew during November to February and in low lying areas a dense fog lingers often even beyond 9.00 am. From March to July, fog & frost are absent but dew is seen deposited till April.

**Water sources**

The principal rivers that flow through this National Park are Jainti and Bala rivers. The rivers become full and fierce with torrents during May-August but are shallow and tame in the dry season. The Jainti river originates from Bhutan hills and flows southwards through Phaskhawa and Jainti blocks. It carries water up to January and remains dry till monsoon breaks. It often changes course during the monsoon. It threatens embankments and affects important habitats in Jainti range (Jainti 3, 6 and 7 compartments) of the park during such shifts. The Bala river originates in Buxa hills and receives water from Thelchnag and Kalkut rivers in its Southern part and finally falls into Kaljani river. Since, the flood of 1950, Bala river had caused considerable damage to the standing forests in SRVK and Checko blocks. Apart, there are other smaller perennial and seasonal streams flowing through BNP, some of them are given below.

**Cheko River**: It originates from Panbari-1, 2 compartments & passes through Panbari-7, 8 and Gadadhar 1, 2 compartments and ultimately merges with Kalkutriver outside forests.
Gadadhar River: It originates from Panbari compartment and passes through KG-1, & SNK-1 compartments and merges with Sankosh river.

Dumrijhora: It originates from Jainti river & passes through Jainti 3B, 6B, 7B, compartments. It carries water only during rainy season and become torrential at that time.

**The forest villages and people of Buxa National Park**

There is one fix demand holding (Jainti FD) and 10 fringe villages (Jainti, Santrabari, Rajabhatkhawa, Garo, Naya basti, Depo Line, Panbari, Bhutia basti, Poro) in the park. A substantial proportion of the population are tribes such as Bhutia, Garo, Mechia, Modesia, Nepali, Rajbanshi, Rava, Santhal etc. The people are mostly farmers or labourers in farms and tea gardens. Most of them depend on forests for their livelihoods and some depend on tourism in Jainti and Rajabhatkhawa ranges. Jayanti is a fixed demand holding village (FDHV) inside the core area. However, forest department kept the human habitation of Jayanti outside the ambit of National Park. The people of Jayanti however, still collect NTFPs from the core area (Map 5).

**Objectives of the present work**

1. Evaluation of the status of plant wealth, rare, endemic and threatened taxa, exotic species, ethnobotanically importance taxa, species used as minor forest produce.
2. Threat to the flora will be identified and future strategies for protection, preservation and maintenance will be suggested.

**2. BOTANICAL HISTORY OF THE STATE**

The vegetation and floristic diversity of the state is quite fascinating and attracted many explorers in the past. A perusal of the literature pertaining to the present study reveals that Botanical activity in West Bengal initiation in Calcutta as early as in 1784, when W. Jones founded the Asiatic Society of Bengal. The botanical findings during his travels have been systematically recorded by him Hooker (1848, 1849, 1850, 1852, 1907) and Long (1857, 1858, 1859). Gamble (1875) was the first botanist who made sporadic collections after joining his services in North Bengal in 1872 and was exceedingly fascinated with the luxuriant and most varied forests in Terai and the Himalayan district of Darjeeling and described its forest types. He made rich collections from Darjeeling and foothill areas of Jalpaiguri district. A first hand list of Himalayan woody plants including climbers under
Map 5: Buxa National Park with ranges and compartments

East Damanpur range
(11.41 sq km)

Jainti range
(72.51 sq km)

Gadadhra range
(20.66 sq km)

Rajabhatkhawa range
(12.32 sq km)

Nos. refer to compartment number

River

Forest village
various forest zones of Darjeeling district with lucid notes and phenological data were enumerated by him (Gamble 1878). Clarke (1876, 1885) also made thorough collections from the district and made a critical study of the vegetation of the botanically rich valleys and prepared valuable notes. Clarke's entire set of collections was utilized in preparing the useful catalogue by Gamble (1875). Various parts of North Bengal and Duars were subsequently explored by Haines (1896) and Prain (1903a). Prain published the Flora of the Plains of Bengal as "Bengal Plants" (1903a). This work stands out as the only comprehensive Flora of the erstwhile Bengal with workable keys for identification of different taxa and also with vernacular names. He also published Flora of Sundribuns (Prain, 1903b) and the Flora of Howrah, Hooghly and 24-Parganas (Prain, 1905). Botanical researches on Bengal plants till 1920 were confined to Botanical Survey of India or the Agriculture and Forest departments of the state. Subsequently various botanical institutes, different universities and colleges had taken up similar work (Bose, 1920; Burkill, 1965; Ghosh, 1960 and Guha, 1968, 1971).

Botanical History of the BNP