

SUMMARY

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Forests ecosystem plays prominent role in controlling environmental well being and similarly growth of forest depends on the combination of environmental factors such as climate, soils, slope and aspect, and elevation. These factors determine vegetation type, how fast they'll grow and their form at maturity, as well as determine the micro-climate of a site. Linking environmental variation to population dynamics is necessary to understand and predict how the environment influences species selection, abundances, distributions and other ecological factors in a forest system.

Socio-ecological relationship in a forest system provides positive as well as negative effects. NTFP provides subsistence and commercial income to the people in and around the forests. Millions of household depends heavily on NTFP products for income worldwide. In India only the real value of NTFP is many fold greater (US\$ 43.8 billion) compared to forestry's share (US\$ 2.9 billion). It plays an important role for ecological conservation, building socio-ecological relationship and economical development of a region. However, over harvesting of produces negatively affects and made the socio-ecological relationship unsustainable. Forests also clean the atmosphere by Carbon sequestration, facilitates soil formation and check soil erosion.

Geographically BTR is lying between the latitudes of 26° 30' and 26° 55' N and the longitudes of 89° 20' and 89° 55' E and is primarily situated in Bhabar and Terai areas consisting of slightly undulating land. The overall topography of the area is an amalgamation of plains and hills. The elevation ranges from 60 to 1750 m. Hilly areas are steep and precipitous. The mountainous tract is an extension of the outer spurs of the Eastern Himalaya. Also, this is the only tiger reserve located in the northern part of West Bengal. This Protected Area is sharing its boundary with the international border with Bhutan on the North and the eastern boundary touches the Indian state of Assam. Western and Southern boundaries are demarcated by several Tea Estates (T.E.) within the Indian territory.

Four distinct climatic seasons (summer, monsoon, autumn and winter) are observed in BTR. South-West monsoon is the primary source of rainfall. June to September is the main period of precipitation. December is the driest season with minimum or no rainfall. The average annual rainfall in the reserve is 4100 mm and average minimum and maximum temperature varies between 32° C to 12° C. Maximum and minimum relative humidity varies between 80 % and 95 % and never observed below 75 %. The reserve generally does not face any devastating cyclonic storm.

BTR spreads over 760.87 sq km area with a core zone of 314.5 sq km of which 117.17 sq km is designated as National Park. The study area is Jainti – the core area of Buxa Tiger Reserve consists mainly of natural vegetation with patches of old plantations.

BTR was constituted in 1983. It includes forest area under Buxa Tiger Division and some area from Coochbehar Forest Division. 314.52 sq km area of BTR had been declared as Buxa Wildlife Sanctuary

(BWLS). The core area of BWLS (117.10 sq km) was declared as National Park in 1992. Final notification regarding the constitution of National Park came out in 1997.

It is located in the confluence of three major Bio-geographic zones (Das, 2000):

- Lower Gangetic plains;
- Central Himalayas; and
- Brahmaputra Valley.

Study area of BTR consists of mainly two types of forest:

1. Northern dry deciduous seral Sal, Khair, Sissoo, Simul association (5B/1S₂); and
2. Eastern Bhabar & Terai Sal (3C/C_{1b} & 3C/C_{1c}).

Keeping in mind the existing inter-linkage between social and ecological systems the study has been divided into two components:

1. Vegetation study; and
2. Socio-economic study including ethno-medicinal practices.

The present survey revealed that Jainti is the repository of at least 413 species of vascular plants of which 396 are angiospermic, 16 pteridophytic and only one species of gymnosperm. These plants are distributed in 95 families. In terms faunal diversity, the reserve provides habitat to 67 species of mammals, 230 species of birds, 28 species of fishes, 35 species of reptiles and 4 species of amphibians. It is observed that Fabaceae (s.l.) is represented by highest number of 40 species.

As much as 150 species of trees and 18 species of woody climbers or liana (total 168 species) are recorded in this forest stand from the sample plots. The mean DBH of trees in the forest is 26.02 cm with a mean height of 5.2 m. The total stem count is 893, giving a figure of 17.9 stems per plot with a projected number of 595 stems/ha. The mean collar diameter (CD) of the woody species in the under-storey is 4.78 cm while the total stem count is found to be 153. The mean height is 2.89 m. There are about 3.06 stems per plot and the projected stem count/ ha is 1082.80. There are a total of 62 shrub species. Number of individuals in the studied plots is 3131, thus the individuals per plot is 62.62 and the projected number of individual count/ha is 199426.8. A total of 183 species of herbs are recorded.

Among the enlisted tree species, *Shorea robusta* is stood at top of all other tree species with IVI 27.08. Highest IVI in shrubby plants registered by *Atlantia missionis* (64.67) and in herbs by *Panicum notatum* (44.98). Simpson's Dominance Index of herb, shrub and tree species are respectively 0.94548870, 11.78355 and 167.972597. Shannon-Weavers Diversity Index of herb, shrub and tree species are respectively 0.7234, 0.4389 and 0.7992. Species Richness of trees is highest (5.254) followed by herbs (2.457) and shrubs (1.018).

Shorea robusta is the most dominant species in this forest and has highest percentage (88.89 %) of presence compared to other dominant species. *Croton tiglium* and *Schima wallichii* have phytosociological relationship (77.78 %) with dominant species followed by *Duabanga grandiflora* and *Aglaia spectabilis* (66.67 %), *Wendlandia coriacea* and *Magnolia pterocarpa* (55.56 %), *Tectona grandis* (33.33 %) and lowest affinity with the dominant species found in *Tetrameles nudiflora* (11.11 %). *Atlantia missionis* has the highest (85.71 %) phytosociological affinity with the dominant shrub species followed by *Tabernamontaena divaricata* (42.86 %) and *Mussaenda roxburghii*, *Bambusa tulda*, *Meyna spinosa* and *Clerodendrum infortunatum* (28.57 %). *Citrus limon*, *Eranthemum griffithii*, *Buddleja asiatica* and *Artabotrys caudatus* have grown rarely with any other dominant shrub species. *Panicum notatum* is the widely associated (88.89 %) species followed by *Globba racemosa* (77.78 %),

Eragrostis tenella, *Alternanthera philoxeroides*, *Lindernia parviflora*, *Bulbophyllum careyanum* (66.67 %), *Barleria prionitis* (55.56 %) and *Piper mulesua* (44.44 %). Least affinity towards other dominant species is found in *Cynadon dactylon* (11.11 %).

100 % of survival is recorded in 12.10 % followed by 86 % (0.64 %), 75 % (1.91 %), 67 % (4.4.46 %), 63 % (0.64 %), 50 % (5.10 %) and <50 % (21.66 %). Study shows that, 7 % of species arrived or introduced newly in Jainti forest. 14.6 % species are threatened and 12.1 % are vulnerable.

Jainti forest is inhabited by two human settlements – Jainti village and Bhutia Busty Bengal Line village. People of these villages are completely depending on the resources from Jainti forest. Excluding these two settlements, people from Nurpur village also depends on this forest for commercial as well as subsistence purposes. National Highway No. 31C roughly runs along its southern boundary. Nearest railway station is Rajabhatkhwa. It is 15 Km. away.

There are 112 plant species in use by the locals of which 59 plants are for purely subsistence purpose and 53 for commercial purpose. Among the commercial species 35 are widely sold in the market and the rest are rarely sold. Phytosociological relationship between NTFP species and 10 dominant tree species is observed that 19 species has no affinity to grow with dominant 10 tree species and only one species has 100 % phytosociological association with these species. *Angiopteris evecta* (G. Forster) Hoffmann, is an endangered species. *Rauwolfia serpentina* (Linnaeus) Bentham ex Kurz and *Dioscorea deltoidea* Wallich ex Grisebach are designated as threatened species. All three are medicinally important to the locals. Occurrence of NTFP depends on altitude, slope and face. Soil is acidic and Nitrogen deficient.

Commercially sold NTFPs are collected from this forest for the following purposes. Decoratives 14 species; Medicinal 19 species; Insence 1 species; Broom 1 species; Handicraft 1 species. *Bombax ceiba*, *Oroxylum indicum*, *Thysanolaena maxima*, *Luffa aegyptica*, *Rubia manjith*, *Parthenocissus himalayana* has multiple uses. Stem, leaf, inflorescence, fruit, floss, gum of noted NTFP species are regularly harvested from this forest and sustain the lives of village people. Harvesters sell their harvested products to the local trader, who, in turn, supplies it to a trader in the nearby town Coochbehar.

Monthly average income is recorded as Rs.2716/- per family. Per capita daily income among the NTFP harvesters from this resource is Rs.18.40/-. As per state average most of the NTFP harvesting families are enjoying better life taking into consideration Rs.350.17/- as the demarcation of Below Poverty Line (BPL).

There is no functional community organization to manage issues related to socio-ecological system. Only forest department and some times political parties convene meeting with the local residents.

CONCLUSION

1. Locational disadvantage taught these people to use local resources.
2. Boulder lifting allowed since 2006 has reduced dependence on NTFPs. However, Nurpur people take it as an advantage to harvest more NTFPs from the forest.
3. Formation of a special FD team and appointing an HRM is a necessity to form a pro-conservation group and to move forward.
4. To motivate locals, a new resource sharing mechanism has to be framed.
5. Harvested species with enough commercial demand are going directly to the nearest markets. Value addition to some selected products will reduce the harvested quantity as well as will help to raise their income.

6. Overall observation of soil in studied area indicates low amount of Nitrogen and Potassium. Presence of Phosphorus and Sulphur is very high. So, a proper management system may be adopted to reclaim the amount of Nitrogen and Potassium in the forest area.
7. Lack of trust between villagers and FD is also affecting the issue of conservation.
8. Mining in adjoining Bhutan territory has raised question regarding the stability of this reserve. Creating a trans-boundary National Park with adjoining Phipsu Wildlife Sanctuary in Bhutan will benefit both sides to manage the precious diversity in BTR.
9. Over the mlliennia, many rural communities sustained on indigenous plants traditionally recognized as main sources of food (Hoeven *et al*, 2013) and medicine. So, proper research programs need to be under taken to record and to test the efficacy of these plants with medicinal value as well as other values in Jainti.