

## **Contribution of forest flora in rural livelihood: a study of Jayanti, Buxa Tiger Reserve, West Bengal, India**

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### **Abstract**

Contribution of some of the Non-Timber Forest products (NTFP), through sales, comes to nearly 50 per cent of the total revenue from the forestry sector in India. The present ethnobotanical study of Jayanti village, inside the core area of Buxa Tiger Reserve aims to accumulate information about the number of floral species in use on harvesting from the forests, availability status, quantity harvested, the economics thereof and the role of local level institutions (if any) in ensuring their sustainable use. The study has recorded use of around 87 plant species, 60 of those are used for commercial purpose and another 27 for subsistence purpose. Very often 35 NTFP species are harvested for commercial purpose to sustain the livelihood of the locals and the rest harvested rarely. However, an alternative source of income has decreased commercial harvesting recently.

**Key words:** Forest flora, rural livelihood, environment, conservation, sustainable, subsistence

## **INTRODUCTION**

### **The background**

“Contribution of some of the Non-Wood Forest Products (NWFP), through sales, comes to nearly 50 per cent of the total revenue from the forestry sector in India. The under-valuation of material goods alone from the forests if India is reflected in their estimated (real) value of about US\$ 43.8 billion compared to forestry’s share of GNP of US\$ 2.9 billion. The difference will increase further if an imputed value is assigned to the environmental contribution of forests” (<http://envfor.nic.in/nfap/jfmp.html>). In this context it is worth mentioning that the honorable Supreme Court of India has already initiated an effort to quantify the value of different contributions from forests. In addition, vast ethnobotanical knowledge developed and exists in India since ancient time, when man first stepped into this part of the world. India has about 45,000 plant species and the medicinal properties have been assigned to several thousands of these. Throughout India “collecting and processing of NWFPs are economically significant activities for forest dependent tribals” (<http://www.fao.org/DOCREP/x0212e/x0212e05.html>). The poorer households tend to attach importance to food and income derived from collection and sale of NTFPs.

The tropical forests of Duars in sub-Himalayan Paschimbanga (formerly *West Bengal*), India is a repository of rich Biodiversity. Buxa Tiger Reserve (BTR) situated in Alipurduar subdivision of Jalpaiguri district is a part of this tract of forests with an area of 760.87 sq km. The forest is dominated by natural vegetation including plantation in two blocks. According to Champion & Seth (1968), two major forest types are identified there:

1. Riverine forest (Northern Dry Deciduous Seral Sal, Khair, Sisoo, Simul association [5b/1S<sub>2</sub>]; and

## 2. Sal forest (Eastern Bhabar and Terai Sal [3C/C<sub>1b</sub> and 3C/C<sub>1c</sub>].

These two forest types are harbouring wide range of floral species and a large number of those are used as Non-Timber Forest Produces (NTFP).

Almost 100 species of NTFPs are known to occur in Jayanti forest, BTR and used by the locals for their self-consumption and commercial purposes as well. Different scientists and agencies have conducted so many studies (Griffith 1839; Hooker 1848; Prasad 1996; FSI 1993 & 1999; Sylviculture Division 1999; Bandyopadhaya & De 2002; Choudhary *et al* 2011) to know the forest system of BTR. This kind of study was also done in other parts of our country (Griffith 1836; Hooker 1848; Biswas 1967; Das 1986; Bhujel 1996; Goel & Mangain 2001; Krishnankutty 2001; Suresh *et al* 2001; Tewari 2001). A study on NTFP species of Northern part of Paschimbanga was done by M.F.P. Division, Directorate of Forest, Government of West Bengal which recorded about 400 NTFP items those are in regular use by the communities living in and around forests. Available records from Territorial Forest Division (DoF 1997) show that only 20 NTFP species are extracted commercially. Pandit *et al* (2004) recorded 132 species of plants or their parts being used as NTFP in Jaldapara wildlife Sanctuary.

Jayanti forest recorded 53 tree species and dominating species is *Shorea robusta* Gaertner *f.* (Chakrabarti *et al* 2002). The other dominant tree species are *Michelia champaca* Linnaeus, *Schima wallichii* (DC.) Korthals, *Chukrasia tabularis* A. Jussieu, *Terminalia bellirica* (Gaertner) Roxburgh, *Lagerstroemia purviflora* Roxburgh, *Toona ciliata* Roemer, *Aglaia spectabilis* (Miquel) Jain & Bennet, *Aphanamixis polystachya* (Wallich) Parker, *Duabanga grandiflora* (DC.) Walpers, *Bombax ceiba* Linnaeus, *Acacia catechu* (Linnaeus *f.*) Willdenow, *Castanopsis indica* (Roxburgh) A. DC., *Talauma hodgsonii* Hooker *f.* & Thomson, *Terminalia myriocarpa* Heurck & Mueller, *Ailanthus integrifolia* Lamarck, etc.

The area is located about 90 m above the sea level and the dominant soil type is Clay Loam (Chakrabarti *et al* 2002). Annual temperature varies from 12<sup>o</sup> C to 32<sup>o</sup> C and the annual mean rainfall is 4100 mm (DoF 2000).

There are 114 settlements [37 Forest villages within the reserve forest (buffer area), 8 forest villages within the core area, 44 revenue villages and 25 tea gardens) comprising of a large population of diverse ethnic compositions (*Rava, Bhutia, Boro, Garo, Mech, Nepali, Santhal* etc.) in and around BTR. Jayanti is a fixed demand holding village (FDHV<sup>1</sup>) inside the core area. However, Department of Forest kept the human habitation of Jayanti outside the ambit of National Park. The people of Jayanti however, still collect NTFP from the core area.

As in all protected areas in India there is a strong relation between the people and the forests because the people living in and around the forests are considerably dependent on the forest resources for subsistence, commercial and cultural purposes. Few studies have addressed this complex “man-forest” relation. Such complexities in the man-forest relation assume added significance for BTR in view of the recent concerns about dwindling tiger population in the country coupled with the proposed bill passed to develop land rights to forest dependent population.

Present study has been confined to the core area of BTR spread over an area of 117.10 sq km (15.39 % of the total area under BTR), designated as National Park, under the Jayanti Forest range, Buxa East Division and consists of two beats, Jayanti and Phanskhawa (DoF 2000).

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<sup>1</sup> FD went for leased out forestland for mining or other non-forestry operation and thus were in need of continuous supply of labour in view of the lack of availability of labour from local regions. The forest Department issued pass to different individuals working in such companies in yearly renewal basis. Pass holders used to pay yearly holding tax to the forest department. This type of villages is known as Fixed Demand Holding Village.

## OBJECTIVES OF THE STUDY

This paper has tried to interrelate between livelihood and the forest resources of the people living inside the forests.

## METHODOLOGY

All the information or data have been collected through Participatory Rural Appraisal or PRA (Richards *et al* 1999; Wolfe & Frongillo 2001) and Rapid Rural Appraisal or RRA (Wolfe & Frongillo 2001) techniques and also enlisted the whole village to find out their family income, daily expenditure and family size. During the survey the enquiry was made with the people regarding the past history of Jayanti, their occupational status, which NTFP species they collect, total income from NTFPs, any problem related to this occupation and probable solutions. Local uses of different plants/ NTFPs have also been documented during survey. Methodology of Jain (1981, 1987, 1991); Rai *et al* (1998); Rai & Bhujel (1999); Rai (2006); Sarkar (2011) are followed for this purpose. Vegetation study has been done using the methodology of Ostrom (1998).

Voucher specimens for all commercially harvested NTFP species are properly preserved, herbarium accession number is allotted for all species and stored in the herbarium of North Bengal University (NBU). Identification of all the materials is done in the Taxonomy & Environmental Biology Laboratory of the Department of Botany, North Bengal University by both the authors. Analysis of Species richness, Simpson Index and Shannon Index is made following the methodology used by Misra (1966), Shimwell (1971), Das & Lahiri (1997), Kadir (2001), Rai (2006) and Ghosh (2006).

## RESULTS AND DISCUSSION

The mean collar diameter (CD) of the shrub species is 7.94 cm while the total stem count is found to be 36. The mean height is 3.65 m. there are about 0.97 stems per plot and the projected stem count/ha is 345. There are a total of 7 species in the forest plots with a *Simpson Index* of 3.73 and a *Shannon Index* of 1.4769. *Morinda angustifolia* and *Tabernaemontana divorticata* are the most dominant species.

The mean CD of the saplings is 7.29 cm and the mean height is 4.44 m. The total stem count of the plots in 63 thus stems per plot is 1.70 and the projected stem count/ha is 607. A total of 20 species of sapling are recorded with *Simpson Index* of 16.01 and *Shannon Index* of 2.7316. *Michelia champaca*, *Holarrhena pubescens*, *Albizia* sp and *Aglaia spectabilis* are the most commonly occurring species.

The number of commercially harvested species and their economics is summarized in the Tables 1 & 2. The details about the commercially harvested NTFPs and the socio-economic linkage of the harvesters in Jayanti village are discussed below. The taxonomic distribution of different harvested NTFPs has been summarized in Table 3. Commercially sold NTFPs are collected from this forest for the following purposes: Decorative 14 species; Medicinal 19 species; Insence 1 species; Broom 1 species; Handicraft 1 species.

*Bombax ceiba*, *Oroxylum indicum*, *Thysanolaena latifolia*, *Luffa aegyptica*, *Rubia manjith*, *Parthenocissus semicordata* has multiple uses. Stem, leaf, inflorescence, fruit, floss, gum of noted NTFP species are regularly harvested from this forest and sustain their lives. Harvesters sell their harvested products to the local trader, who, in turn, supplies it to a trader in the nearby town Coochbehar.

Jayanti settlement is inhabited by 215 households, 68 having one member each who works outside the settlement on full time jobs. There are 1041 individuals of which 36.41 % population is adult male while 33.24 % population is adult female. The Jayanti village is also comprises of about

**Table 1:** Commercially important NTFFPs of BTR along with their harvest season and usage

Local name	Scientific name [Family]; Exsiccate	Harvest period	Usage
<i>Amlaki</i>	<i>Phyllanthus emblica</i> Linnaeus [Euphorbiaceae]; <i>Animesh &amp; AP Das 9511</i>	January	Medicinal
<i>Bahera</i>	<i>Terminalia bellirica</i> (Gaertner) Roxburgh [Combretaceae]; <i>Animesh &amp; AP Das 9495</i>	February – March	Medicinal
<i>Basak patta &amp; fruit</i>	<i>Justicia adhatoda</i> Linnaeus [Acanthaceae]; <i>Animesh &amp; AP Das 9504</i>	December – April	Medicinal
<i>Bet fruit</i>	<i>Calamus viminalis</i> Willdenow [Arecaceae]; <i>Animesh &amp; AP Das 9518</i>	February – March	Decorative/edible
<i>Bet leaf</i>	<i>Calamus acanthospathus</i> Griffith [Arecaceae]; <i>Animesh &amp; AP Das 9498</i>	January – December	Decorative
<i>Broom stick</i>	<i>Thysanolaena latifolia</i> (Roxburgh ex Horneman) Honda [Poaceae]; <i>Animesh &amp; AP Das 9503</i>	January – March	Broom, dry flower
<i>Charchara, Chai</i>	<i>Parthenocissus semicordata</i> (Roxburgh) Planchon [Vitaceae]; <i>Animesh &amp; AP Das 9521</i>	March – April	Vegetable/Medicinal
<i>Chikrasi fruit</i>	<i>Chukrasia tabularis</i> A. Jussieu [Meliaceae]; <i>Animesh &amp; AP Das 9529</i>	October – December	Decorative
<i>Chilauni fruit</i>	<i>Schima wallichii</i> (DC.) Korthals [Theaceae]; <i>Animesh &amp; AP Das 9520</i>	February – March	Decorative
<i>Chutro</i>	<i>Mahonia napaulensis</i> DC. [Berberidaceae]; <i>Animesh &amp; AP Das 5499</i>	December – April	Medicinal
<i>Dhundul chobra</i>	<i>Luffa aegyptica</i> Miller [Cucurbitaceae]; <i>Animesh &amp; AP Das 9516</i>	March – April	Decorative & toilet use
<i>Golden Mushroom</i>	Unidentified Polypore	October – December	Decorative
<i>Harra</i>	<i>Terminalia chebula</i> Retzius [Combretaceae]; <i>Animesh &amp; AP Das 9510</i>	February – March	Medicinal
<i>Jibanti/Sunakheri</i>	<i>Bulbophyllum cornu-cervi</i> King & Pantling [Orchidaceae]; <i>Animesh &amp; AP Das 9517</i>	January – December	Medicinal
<i>Kanchan spring</i>	<i>Bauhinia malabarica</i> Roxburgh [Caesalpiniaceae]; <i>Animesh &amp; AP Das 9493</i>	March – May	Decorative
<i>Lali fruit</i>	<i>Aglaia spectabilis</i> (Miquel) Jain & Bennet [Meliaceae]; <i>Animesh &amp; AP Das 9522</i>	February – March	Decorative
<i>Lampate fruit</i>	<i>Duabanga grandiflora</i> (DC.) Walpers [Lecythidaceae]; <i>Animesh &amp; AP Das 9512</i>	October – December	Decorative
<i>Majeto</i>	<i>Rubia manjith</i> Roxburgh [Rubiaceae]; <i>Animesh &amp; AP Das 9500</i>	January – December	Medicinal
<i>Malagiri fruit</i>	<i>Cinnamomum glaucescens</i> (Nees) Drury [Lauraceae]; <i>Animesh &amp; AP Das 9519</i>	July – September	Medicinal
<i>Mocha stick</i>	<i>Musa paradisiaca</i> Linnaeus [Musaceae]; <i>Animesh &amp; AP Das 9505</i>	January – December	Decorative
<i>Musraj (Shimul atha)</i>	<i>Bombax ceiba</i> Linnaeus [Bombacaceae]; <i>Animesh &amp; AP Das 9494</i>	December – April	Medicinal
<i>Nagbeli/Sarpagandha</i>	<i>Rauwolfia serpentina</i> (Linnaeus) Kurz [Apocynaceae]; <i>Animesh &amp; AP Das 9515</i>	January – December	Medicinal
<i>Nagfeni</i>	<i>Bauhinia scandens</i> Linnaeus [Caesalpiniaceae]; <i>Animesh &amp; AP Das 9523</i>	January – April	Decorative
<i>Narikeli fruit</i>	<i>Pterygota alata</i> (Roxburgh) R. Brown [Sterculiaceae]; <i>Animesh &amp; AP Das 9497</i>	January – March	Decorative
<i>Phirphire fruit</i>	<i>Firmiana colorata</i> (Roxburgh) R. Brown [Sterculiaceae]; <i>Animesh &amp; AP Das 9507</i>	March – April	Decorative
<i>Pipla fruit</i>	<i>Piper longum</i> Linnaeus & <i>P. pedicellatum</i> C. DC. [Piperaceae]; <i>Animesh &amp; AP Das 9524</i>	July – October	Medicinal
<i>Plinji</i>	<i>Firmiana colorata</i> (Roxburgh) R. Brown [Sterculiaceae]; <i>Animesh &amp; AP Das 9507</i>	March – April	Decorative

Local name	Scientific name [Family]; Exsiccate	Harvest period	Usage
<i>Nagfeni</i>	<i>Bauhinia scandens</i> Linnaeus [Vaesalpinaceae]; <i>Animesh &amp; AP Das</i> 9523	January – April	Decorative
<i>Narikeli fruit</i>	<i>Pterygota alata</i> (Roxburgh) R. Brown [Sterculiaceae]; <i>Animesh &amp; AP Das</i> 9497	January – March	Decorative
<i>Phirphire fruit</i>	<i>Firmiana colorata</i> (Roxburgh) R. Brown [Sterculiaceae]; <i>Animesh &amp; AP Das</i> 9507	March – April	Decorative
<i>Pipla fruit</i>	<i>Piper longum</i> Linnaeus & <i>P. pedicellatum</i> C. DC. [Piperaceae]; <i>Animesh &amp; AP Das</i> 9524	July – October	Medicinal
<i>Phirpire</i>	<i>Firmiana colorata</i> (Roxburgh) R. Brown [Sterculiaceae]; <i>Animesh &amp; AP Das</i> 9514	February – March	Medicinal
<i>Ritha</i>	<i>Sapindus mukorossi</i> Gaertner [Sapindaceae]; <i>Animesh &amp; AP Das</i> 9525	January – March	Medicinal
<i>Sal dhup</i>	<i>Shorea robusta</i> Gaertner f. [Dipterocarpaceae]; <i>Animesh &amp; AP Das</i> 9501	January – December	Incense
<i>Satamuli/ Kurilo/ Nagbel</i>	<i>Asparagus racemosus</i> Willdenow [Asparagaceae]; <i>Animesh &amp; AP Das</i> 9509	January – December	Medicinal
<i>Shimul tula</i>	<i>Bombax ceiba</i> Linnaeus [Bombacaceae]; <i>Animesh &amp; AP Das</i> 9513	April	Handicraft
<i>Sikakai</i>	<i>Acacia concinna</i> (Willdenow) DC. [Fabaceae]; <i>Animesh &amp; AP Das</i> 9502	July – October	Medicinal
<i>Sponge Mushroom</i>	Not identified	October – December	Decorative
<i>Timboor fruit</i>	<i>Zanthoxylum rhetsa</i> (Roxburgh) DC. [Rutaceae]; <i>Animesh &amp; AP Das</i> 9496	July – September	Medicinal
<i>Totala fruit/ seed</i>	<i>Oroxylum indicum</i> (Linnaeus) Ventenat [Bignoniaceae]; <i>Animesh &amp; AP Das</i> 9506	January – March	Medicinal

**Table 2:** yearly economics of harvested and commercially important NTFP species

Local name	Scientific name [Family]; Exsiccate	Harvest period	Usage
<i>Nagfeni</i>	<i>Bauhinia scandens</i> Linnaeus [Vaesalpinaceae]; <i>Animesh &amp; AP Das</i> 9523	January – April	Decorative
<i>Narikeli fruit</i>	<i>Pterygota alata</i> (Roxburgh) R. Brown [Sterculiaceae]; <i>Animesh &amp; AP Das</i> 9497	January – March	Decorative
<i>Phirphire fruit</i>	<i>Firmiana colorata</i> (Roxburgh) R. Brown [Sterculiaceae]; <i>Animesh &amp; AP Das</i> 9507	March – April	Decorative
<i>Pipla fruit</i>	<i>Piper longum</i> Linnaeus & <i>P. pedicellatum</i> C. DC. [Piperaceae]; <i>Animesh &amp; AP Das</i> 9524	July – October	Medicinal
<i>Phirpire</i>	<i>Firmiana colorata</i> (Roxburgh) R. Brown [Sterculiaceae]; <i>Animesh &amp; AP Das</i> 9514	February – March	Medicinal
<i>Ritha</i>	<i>Sapindus mukorossi</i> Gaertner [Sapindaceae]; <i>Animesh &amp; AP Das</i> 9525	January – March	Medicinal
<i>Sal dhup</i>	<i>Shorea robusta</i> Gaertner f. [Dipterocarpaceae]; <i>Animesh &amp; AP Das</i> 9501	January – December	Incense
<i>Satamuli/ Kurilo/ Nagbel</i>	<i>Asparagus racemosus</i> Willdenow [Asparagaceae]; <i>Animesh &amp; AP Das</i> 9509	January – December	Medicinal
<i>Shimul tula</i>	<i>Bombax ceiba</i> Linnaeus [Bombacaceae]; <i>Animesh &amp; AP Das</i> 9513	April	Handicraft
<i>Sikakai</i>	<i>Acacia concinna</i> (Willdenow) DC. [Fabaceae]; <i>Animesh &amp; AP Das</i> 9502	July – October	Medicinal
<i>Sponge Mushroom</i>	Not identified	October – December	Decorative
<i>Timboor fruit</i>	<i>Zanthoxylum rhetsa</i> (Roxburgh) DC. [Rutaceae]; <i>Animesh &amp; AP Das</i> 9496	July – September	Medicinal

Local name	Scientific name [Family]; Exsiccate	Harvest period	Usage
Satamuli/ Kurilo/ Nagbel	<i>Asparagus racemosus</i> Willdenow [Asparagaceae]; <i>Animesh &amp; AP Das 9509</i>	January – December	Medicinal
Shimul tula	<i>Bombax ceiba</i> Linnaeus [Bombacaceae]; <i>Animesh &amp; AP Das 9513</i>	April	Handicraft
Sikakai	<i>Acacia concinna</i> (Willdenow) DC. [Fabaceae]; <i>Animesh &amp; AP Das 9502</i>	July – October	Medicinal
Sponge Mushroom	Not identified	October – December	Decorative
Timboor fruit	<i>Zanthoxylum rhetsa</i> (Roxburgh) DC. [Rutaceae]; <i>Animesh &amp; AP Das 9496</i>	July – September	Medicinal
Totala fruit/ seed	<i>Oroxylum indicum</i> (Linnaeus) Ventenat [Bignoniaceae]; <i>Animesh &amp; AP Das 9506</i>	January – March	Medicinal

**Table 3:** taxonomic distribution of different plant species

Taxa	Families	Genera	Species
Dicotyledons	27	26	29
Monocotyledons	4	3	4
Fungus	2	2	2
	33	31	35

**Table 4:** gender & age wise distribution of village population

Category	No. of persons
Household	215
Population	1041
Adult Male	379 (36.41%)
Adult Female	346 (33.24%)
Child Male	172 (16.52%)
Child Female	146 (14.02%)

16.52 % population of male children and 14.02 % population of female children (Table 4). Of the 1041 individuals 859 (82.52 %) depend on the forest for commercial activities of harvesting and selling of NTFPs. Wood is used as energy source for cooking.

People of Jayanti are extracting 35 species of plants of commercial importance to maintain their livelihood. Quantitatively Broom stick, Bet leaf, Golden Mushroom, Tanki fruit, Dhundul chhobra (fibrous mesocarp) and Narikeli fruit are harvested in more than one lakh (1,00,000) pieces and more than one lakh kgs harvested products are Ritha, Bet fruit, Phirphire fruit, Sikakai fruit and Lali fruit. However, in terms of cost, Chilauni fruit and leaf of Basak are recorded the highest price of Rs. 200 per kg (Table 2).

Gross annual income of NTFP harvesters is around Rs.5768870/- (Rupees Fifty seven lakh sixty eight thousand eight hundred seventy only). 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).

Recently, since 2006, Forest Department slowly allowed the collection of boulder from the Jayanti River and in February 2008 the scarcity of labour was evident. 11 self-help groups are also formed in the area.

## CONCLUSION

NTFPs from the Jayanti forest area are harvested basically for commercial purpose to sustain the livelihood of the local people. Alternative livelihood option is necessary to sustain the NTFPs in one side and the human population on the other. An alternative source of income to

work as the wage-labour in the river to load boulder has been very effective to reduce the pressure on the forest. Different NTFPs are now commonly available around the forest, which were quite rare earlier. Proper study is necessary to enumerate different NTFPs and to estimate the average production. It is also very crucial to understand the phytosociological relationship of different floral species in the vegetation for the conservation of different important floristic elements.

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### LITERATURE CITED

- Bandopadhyaya, N.G. & De, G.C. 2002. *Draft final report on consulting services for studies on aquatic flora, fauna and hydro-biology of wetland in Buxa Tiger Reserve under Eco-Development Project*. Alipurduar College, Jalpaiguri.
- Bhujel, R. 1996. *Studies on the Dicotyledonous Flora of Darjeeling District*. Ph.D. Thesis, North Bengal University.
- Biswas, K. 1967. *Plants of the Darjeeling and Sikkim Himalayas*. Government Press, West Bengal,
- Chakrabarti, M.; Sarkar, A.; Ghosh, S.R. & Sarkar, A. 2002. *Forest structure, resource use and institutions: site report from Jayanti-Bhutia Basti, Buxa Tiger Reserve, Jalpaiguri, India.*, Centre for Rural Economy Appropriate Technology and Environment, St. Joseph's College, Darjeeling.
- Champion, H.G. & Seth, S.K. 1968. *A revised Survey of the Forest Types in India*. Govt. of India Publications, Delhi.
- Choudhary, R.K.; Oh, S. & Lee, J. 2011. An ethnomedicinal inventory of knotweeds of Indian Himalaya. *J. Med. Pl. Res.* 5(10): 2095 – 2103.
- Das, A.P. 1986. *On the Floristic and Palynological Surveys of Darjeeling and the adjoining places*. Ph.D. Thesis. Calcutta University.
- Das, A.P. & Lahiri, A.K. 1997. Phytosociological studies of the ground covering flora in different types of vegetation in Tiger Hill, Darjeeling District, West Bengal (India). *Indian For.* 123 (12): 1176 – 1187.
- Department of Forest 1997. *Annual Reports of Northern and Hill Circles / Jalpaiguri Forest Division*. Directorate of Forest, Government of West Bengal.
- DOF 2000. *First Combined Management-Cum-Working Plan of Buxa Tiger Reserve for the period of 2000-01 to 2009-10*. Department of Forest, Government of West Bengal, Vol. I.
- FSI 1993. *The State of Forest Report, Govt. of India*. Forest Survey of India Kalugarh Road, Dehradun.

- FSI 1999. *Report on Forest Resources of Jalpaiguri district of West Bengal*. Forest Survey of India, Eastern Zone, Calcutta.
- Ghosh, C. 2006. *Biology of Tea Garden Weeds in Darjeeling District of West Bengal (India)*. Ph.D. Thesis, University of North Bengal.
- Goel, A.K. & Mamgain, S.K. 2001. Ex-situ conservation of some endemic and threatened plant species of India. *Indian For.* 127 (5): 552 – 562.
- Griffith, W. 1836. Description of some grasses which form part of the vegetation in the jheels of the district of Syleth (2pl). *J. Asiat. Soc. Bengal* 5: 570 – 575.
- Griffith, W. 1839. Journal of the Mission which visited Bootan, in 1837-38, under captain R. Boileu Pemberton. *J. Asiat. Soc. Bengal* 8(1): 208 – 24: 251 – 291.
- Hooker, J.D. 1848. *Observation made when following the Grand Trunk road across the hills of upper Bengal, Parus Nath, etc. in the Soane Valley; and on the Kymaon branch of the Vidhya Hills*. Kessinger Publishing, USA.
- <http://envfor.nic.in/nfap/jfmp.html>
- <http://www.fao.org/DOCREP/x0212e/x0212e05.htm>: *Tribal household economy, forests, and the role of women*:
- Jain, S.K. 1981. *Glimpses of Indian Ethnobotany*. Oxford & IBH Publishing Co., New Delhi.
- Jain, S.K. (Ed.) 1987. *A Manual of Ethno-Botany*. Scientific Publishers, Jodhpur.
- Jain, S.K. 1991. *Dictionary of Indian Folk Medicine and Ethnobotany*. Deep Publications, New Delhi.
- Kadir, A.F.M.Manzur 2001. *Ecology of subhimalayan herblands in Darjeeling with special emphasis on Streptocaulon sylvestre Wight — an endangered and endemic plant*. Ph.D. Thesis, North Bengal University.
- Krishnankutty, C.N. 2001. Rural Bamboo trade in Kerala and retail markets. *Indian For.* 127 (6): 671 – 677.
- Misra, R. 1966. *Ecology Work Book*. Oxford & IBH, Calcutta.
- Ostrom, E. 1998. *Field Manual. International Forest and Resources Institutions Research Programme*. Center for the Study of Institutions, Population, and Environmental Change, Indiana University, USA.
- Pandit, P.K.; Ghosh, C. & Das, A.P. 2004. Non-Timber Forest Products of Jaldapara Wildlife Sanctuary: An Assesment. *Indian For.* 130 (10): 1169 – 1185.
- Prasad, R.S. 1996. *Seed stands, plus trees and seed trees of North Bengal plains (Jalpaiguri, Coochbehar and part of Darjeeling district)*. Sylviculture Division (North), Directorate of forests, Govt. Of West Bengal, Bull. 2.
- Rai, P.C.; Sarkar, A.; Bhujel, R.B. & Das, A.P. 1998. Ethnobotanical Studies in some fringe areas of Sikkim and Darjeeling Himalayas. *J. Hill Res.* 11(1): 12 – 21.
- Rai, S.K. & Bhujel, R.B. 1999. Notes on some less known ethnomedicinal plants from the Darjeeling Himalayas. *J. Hill Res.* 12(2):160 – 163.
- Rai, U. 2006. *Characterisation of Plant Biodiversity in Darjiling Hills using Remote Sensing Techniques*. Ph.D. Thesis, University of North Bengal.
- Richards, M.; Davies, J. & Cavendish, W. 1999. *Can PRA methods be used to collect economic data? A non-timber forest product case study from Zimbabwe*. PLA Notes 36, pp.34–40.



- Sarkar, A. 2011. *Ethnobotanical Studies of Sub-Himalayan Duars in West Bengal and Assam with particular reference to the Tribe Mech*. Ph.D. thesis, University of North Bengal
- Shimwell, D.W. 1971. *Description and classification of vegetation*. Sidgwick & Jackson, London.
- Suresh, K.K.; Jambulingam, R. & Sekar, I. 2001. Effect of tree age on seed and seedling quality in *Acacia nilotica*. *Indian For.* 127(6): 685 – 689.
- Sylviculture Division (North) 1999. *Plus Tree and CPT of North Bengal plains*. Directorate of Forests, Govt. of West Bengal.
- Tewari, D.D. 2001. Domastication of Non Timber Forest Products (NTFPs): A case study of Bamboo farming in Kheda district, Gujrat, India. *Indian For.* 127(7): 788 – 798.
- Wolfe, W.S. & Frongillo, E.A. 2001. Building household food-security measurement tools from the ground up. *Food & Nutri. Bull.* 22(1): 8.