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FLORISTIC AND VEGETATIONAL ANALYSIS OF NABARANGAPUR DISTRICT OF ORISSA, INDIA

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ABSTRACT

Nabarangapur district of Orissa is floristically worked out. The vegetation of the district is found to fall broadly under 1). Tropical semi-evergreen Forests and 2). Tropical Dry Deciduous Forests as per the classification of Champion and Seth. In addition to the above, several sub types and seral types like Bamboo brakes, Riparian Fringing Forest, Scrubs, Grasslands etc. are noticed. The natural vegetation which was predominantly arboreal before 1970 became greatly modified due to the settlements of East Bengal (Bangladesh) refugees under Dandakaranya rehabilitation programme.

INTRODUCTION

Nawrangapur (Nabarangpur) lying between 19°10'42" and 20°6'12" N latitudes and between 81°51'30" and 82°52'36" E longitudes is carved as a separate district from the erstwhile Koraput of Orissa by an administrative approval and it has started functioning as a distinct unit from 1st April 1993 onwards. With an area of 5290.1 sq. km, Nawrangapur is a land locked district surrounded on the west and north by Bastar and Raipur districts of Madhya Pradesh, and on the east and south by the Kalahandi and Koraput districts of Orissa. The whole district is more or less an elevated plateau of Eastern Ghats with numerous peaks ranging from 1000 to 1400 m. and occasional valleys here and there. Indravati, the chief river of the district with its numerous tributaries drain more or less westwards except in the north where it slopes down towards east dropping into the valley of the river Tel, a tributary of Mahanadi. The climatic and edaphic factors coupled with riverine system have given rise to rich and varied flora. The natural vegetation, which was predominantly arboreal before 1970, became greatly modified due to the settlements of Bangladesh (East Bengal) refugees under the rehabilitation programme of Dandakaranya project.

GEOLOGY AND SOIL

Major portion of geological formation is Archaean which includes unclassified crystalline-granites, gneisses and other magnetitic rocks, the stratification of which is uncertain. Towards the western margin bordering Madhya Pradesh upper Precambrian consisting of limestones,

shales and quartzites are noticed in detached patches. Among mineral wealth, iron, china clay and fire clay dominate the occurrence. Three types of soils in distinct patches are found in the district.

(a). **Black Cotton Soil**: This is seen towards extreme northwestern part of the district with Raigarh as the epicentre. The vegetation is luxuriant dominated by Teak (***Tectona grandis***). The soils crack when exposed to hot sun. This is not suitable for erection of buildings because the foundation sinks. Soils are fertile and yield per hectare is high. Cotton grows well.

(b). **Red Soil**: These soils are found towards Chandahandi bordering Kalahandi district. This is poor for plant growth but Sal (***Shorea robusta***) in different magnitudes dominates the vegetation. Iron, Manganese and limestone, etc. are the principal minerals found in this type.

(c). **Lateritic Soils**: Major portion of the district through which Eastern Ghats pass through, contain lateritic soils. The soils suffer from nutrient deficiency and hence very poor in plant nurturing. It is good for building construction.

CLIMATE

The area has a dry monsoon climate characterised by the seasonal rhythm as prevailing in rest of southwest Orissa. The whole year can conveniently be divided into three distinct seasons. The winter extends from November to February and this is followed by summer from March to June. The period from July to September is the monsoon while October and November constitute the post monsoon transition period. The maximum temperature recorded towards the end of May is 44°C and the minimum temperature is as low as 14°C during middle of December. Average annual rainfall is 1120 mm and the average number of rainy days per year is 72. The July and August months record highest rainfall accounting nearly 70% of the total annual rainfall. Relative humidity varies between 70 and 80%. Winds are moderate and thunderstorms occur in pre monsoon months but they sometimes become violent.

PREVIOUS BOTANICAL EXPLORATIONS

The flora and vegetation of this area remained unknown, as it was not botanised either by the British or by the present day workers. Though a few pockets of undivided Koraput were explored both by the British and Indian botanists, Nabarangapur and its neighbourhood somehow remained uncovered. This might perhaps be due to the restrictions imposed by the native rulers for the British and lack of proper tracks in the hilly terrain for Indian workers. The Flora of the Presidency of Madras by J.S.Gamble and C.E.C.Fischer (1915-36) does not contain any references to the floristic elements of Nabarangapur though it was part of erstwhile Koraput District. The Botany of Bihar and Orissa by H.H. Haines (1921-25) also does not contain any reference to the floristic elements of this area because it remained in Madras Presidency by the time the flora was compiled. H.F.Mooney's Supplement to the Botany of Bihar and Orissa (1950) remained silent about the floristic

composition of the district because the supplement had the same geographical jurisdiction as that of Haines. The Flora of Orissa by H.O.Saxena and M.Brahmam (1994-96) also has not mentioned any part of the district as having been botanised nor the herbarium contains specimens from this area. The increased trend of human settlements and consequent conversion of prime forestlands into arable fields, the indigenous flora is drastically reduced. Uncontrolled grazing by the cattle of new settlers on woodlands coupled with the age-old shifting cultivation by the indigenous people had further reduced the forest wealth. The invasion by the exotic weed flora of unknown origin is also partly responsible for the forest shrinkage.

PRESENT EXPLORATIONS

Realising that the district was not adequately botanised earlier, systematic surveys were undertaken in the newly formed district. The study involved intensive explorations and critical study of specimens for the last three years. The field trips were organised in such a way so as to cover all the areas of the district at regular intervals in different seasons. As a result it became possible to record the seasonal variations in the vegetation including distributional patterns and collect most of the plants in different developmental stages of their life cycle. Field observations on phenology, habit, habitat, local names, local uses, frequency of occurrence, etc. were noted. Customary procedures were followed for processing the specimens. After critical study the specimens were identified and compared with the authentic specimens of the herbarium. Voucher specimens are preserved in the Herbarium of Regional Research Laboratory, Bhubaneswar. The well forested ghat region of the district harbours as many as 36 different tribes but nine are numerically rich and these are Porja, Gond, Batra, Ho, Khanda, Saora, Kol, Lodha and Bathudi. Some of them are very primitive by all standards and they have been following the age-old methods of herbal healing for all their ailments (Saxena & Brahmam, 1989). During floristic surveys, ethnobotanical studies were also simultaneously carried out and published elsewhere.

FLORISTICS AND VEGETATION

Nabarangapur falls under Deccan region of Hooker's (1904) sketch of the Flora of British India but Gamble (1915-36) placed it in the sal region of Madras presidency. The existing vegetation as surveyed by the authors is found to fall broadly under the following three types as per the classifications of Revised Forest Types of India (Champion & Seth, 1968). These are (1) Tropical semi-evergreen Forests (2) Tropical Dry Deciduous Forests and (3) Tropical Moist Deciduous Forests. Besides, several sub types and seral types like Bamboo brakes, Riparian Fringing Forest, Scrubs, Grasslands etc. are noticed mostly either developed or resulted due to biotic influence.

SAL FOREST : Major portion of the district is occupied by sal (*Shorea robusta*) and it occurs in different plant communities in different frequencies. It ascends even to the top of the hills if sufficient soil is available. When sal occurs in continuation with the semi-evergreen

type close to the moist valleys, then it is classified as Tropical moist Deciduous Forests (Champion & Seth, 1968). The top storey in this consists of predominantly deciduous elements but the second storey has some evergreens. Predominant associates are *Terminalia bellirica, T.chebula, Lannea coromandelica, Lagerstroemia parviflora, Madhuca indica, Pterocarpus marsupium, Bambusa arundinacea, Bombax malabaricum, Haldina cordifolia,* etc. The shrubby layer consists of *Daedalacanthus nervosus, Ardisia solanacea, Barleria strigosa,* etc. The ground flora represents *Justicia* spp., *Andrographis* spp., *Dicliptera* spp., etc. It is also rich with several members of Zingiberaceae, Asteraceae, Orchidaceae, Poaceae.

Wherever the conditions are hot and dry, the sal quality is also reduced and this type may be classified as Tropical Dry Deciduous (Champion & Seth, 1968). Both upper and lower canopies are composed of deciduous elements. The important associates of sal are *Terminalia alata, Anogeissus latifolia, Diospyros melanoxylon, Mangifera indica, Haldina cordifolia, Dendrocalamus strictus, Butea monosperma, Cassia fistula, Buchanania lanzan, Sterculia urens, Cochlospermum religiosum,* etc. The shrubby layer is dominated by *Cleistanthus collinus, Randia dumetorum, Zizyphus rugosus, Gardenia latifolia, Pavetta indica, Ixora parviflora, Helicteres isora,* etc. The climbers are not many, but *Combretum roxburghianum, Bauhinia vahlii, Leea macrophylla, Ventilago maderaspatana, Ampelocissus tomentosa,* etc. are frequently observed.

MIXED FORESTS : Wherever drier conditions prevailed in the district, mixed forests made their presence. Moist valleys, steeper hill slopes, low and open places in plains, etc. are the commonest sites for this type of vegetation. Besides a few evergreens, deciduous species, climbers, epiphytes, etc. make their presence felt. The important constituent elements frequently encountered are *Diospyros peregrina, Mangifera indica, Dillenia pentagyna, Litsea monopetala, Schleichera oleosa, Leea indica, L. macrophylla, Flemingia macrophylla, Pongamia pinnata, Bridelia stipularis, Polyalthia cerasoides, Albizia odoratissima, Cissus repanda, Cayratia auriculata, Gnetum ula, Ampelocissus latifolia, Entada pursaetha, Clematis gouriana, Smilax macrophylla, S. prolifera,* etc. The epiphytic flora include *Aerides odorata, Bulbophyllum trista, Cymbidium aloifolium, Dendrobium bicameratum, Luisia trichorrhiza, Viscum articulatum,* etc. Several ferns and mosses also occur along moist valleys.

On steep slopes and below the ridges, Dry mixed forests are generally found. Here sal is usually absent but other associates become dominant. Common constituents are *Terminalia alata, Sterculia urens, Anogeissus latifoila, Cochlospermum religiosum, Oroxylum indicum, Bursera serrata, Callicarpa arborea, Dalbergia latifolia, Grewia hirsuta, Bridelia retusa, Petalidium barlerioides,* etc. Mixed forests at lower elevations are composed of *Diospyros sylvatica, Gelonium multiflorum, Capparis zeylanica, Alstonia venenata, Chloroxylon sweitenia, Strychnos nux-vomica, Randia malabarica, Croton caudatus, Hugonia mystax, Glycosmis arborea,* etc.

SCRUB FORESTS : These are found scattered throughout the length and breadth of the district. These are the by-products of heavy biotic interference and may be termed

as 'Induced scrubs'. Important species in this type are *Ziziphus oenoplia, Ochna squarrosa, Hugonia mystax, Flacourtia sepiaria, Toddalia asiatica, Pavetta crassicaulis, Webera corymbosa, Randia malabarica, Capparis zeylanica, Allophylus serratus, Euphorbia neriifolia, Gymnosporia emarginata, Carissa spinarum, Cassytha filiformis, Cipadessa bacciformis, Mimosa rubicaulis, M. pudica, Diospyros ferrea,* etc.

GRASSLANDS : The upper slopes and flat summits of hills are mostly grasslands. These are considered to be biotic sub climax or plagioclimax. It is also possible that above 1000 m, their ecological status is of climax vegetation as there is no indication that in course of time forest would again supervene naturally though there is no appreciable biotic interference. The important grass species met with in this type are *Themeda triandra, T. quadrivalvis, Cymbopogon flexuosus, Heteropogon contortus, Apluda mutica, Chrysopogon verticillatus, Arundinella setosa, A. ciliata, Imperata cylindrica, Bothriochloa glabra, Eragrostis coaractata, Sporobolus fertilis, Cynodon dactylon,* etc. Other herbaceous species found scattered among the grasses are *Crotalaria* spp., *Cassia leschenaultiana, Viola betonicifolia, Glossogyne pinnatifida, Sonchus arvensis, Swertia angustifolia, Rubia cordifolia, Scleria* spp., etc.

HYDROPHYTES : Nabarangapur falls under monsoonic zone and receives on an average 1160 mm rainfall annually. This has helped in the formation of a number of tanks, pools, lakes, ditches reservoirs, etc. in low elevations that supply water for drinking and irrigation purposes. Additionally, they harbour hydrophytic vegetation and common species in this type are *Nelumbo nucifera, Nymphaea nouchali, N.stellata, Trapa bispinosa, Ipomoea aquatica, Ludwigia adscendens, Limnophila indica, Hydrilla verticillata, Vallisneria spiralis, Ottelia alismoides, Eichhornia crassipes, Monochoria hastata, Pistia stratiotes, Eriocaulon quinquangulare, Wolfia arrhiza,* etc. In the stream edges, *Ipomoea pes-caprae, Geniosporum prostratum, Eleocharis dulcis,* etc. are seen among sand heaps.

RHEOPHYTES : Rheophytes are those plants which are riverine and found among rocky, gravely, sandy river beds below the flood zone. These species are resistant to sudden overflow of swift running water. Some of those occurring in Nabarangapur are *Homonoia riparia, Barringtonia acutangula, Polygonum hydropiper, Salix tetrasperma, Ludwigia adscendens,* etc.

Table 1 : Statistical Synopsis

Class	Families	Genera	Indigenous species	Cultivated species	Total species
Angiosperms					
Dicotyledones	110	447	549	72	621
Monocotyledones	32	147	274	7	281
Gymnosperms	4	4	3	1	4
Pteridophytes	12	12	12		12
Total	158	610	838	80	918

STATISTICAL ANALYSIS OF INDIGENOUS FLORA

Based on the results obtained from the field surveys and critical studies of the specimens it is found that the total number of species of vascular plants in the flora is 918 including 80 species of cultivated origin. A statistical analysis (Table-1) of the indigenous flora shows the percentage of Dicot and Monocot plants as 66.7:33.3 as against 81.3:18.7 in the World flora. This shows higher percentage of monocots in the flora of Nabarangapur. This is mainly due to the presence of larger number of grasses and sedges in the flora. Out of 274 species of monocots, 172 species belong to two families Poaceae and Cyperaceae and the remaining 30 families are represented by only 102 species. The families Zingiberaceae and Commelinaceae, though poor in number of species, are otherwise fairly abundant and form the dominant feature of the herbaceous vegetation (Brahmam & Saxena, 1980). Pteridophytes include 12 species of Ferns and Fern Allies and the Gymnosperms are represented by only 4 species.

RESULTS AND DISCUSSION

The ten most dominant families of Nabarangapur, Orissa (Saxena & Brahmam 1994-96), British India (J. D.Hooker 1872-97) are plotted in the order of their dominance with respect to number of species represented in Table-2. While more than 70 % of families in the flora of the 3 regions are almost the same, the family Orchidaceae which occupies 1st position in British India and 4th position in Flora of Orissa does not figure in the flora of Nabarangapur and this is due to the fact that Nabarangapur is more a dry area and the forest has become thoroughly disturbed due to the settlement activity of Bangladesh refugees. Any disturbance in the site is detrimental for the development of Orchid flora. Orchids as a rule do not tolerate the direct beam of sunlight (Brahmam & Saxena, 1990) and hence they did not flourish much in the site. The dominant families in both the floras (Orissa and Nabarangapur) are more or less same but their sequence is different. Due to the settlement activities of refugees, the indigenous flora is replaced by the more aggressive exotic species especially from new world countries (Nayar, 1977).

Table 2 : Dominant Plant Families of Nabarangapur, Orissa State & British India

Nabarangapur (Brahmam & Dhal 2001)	Orissa State (Saxena & Brahmam 1996)	British India (Hook.f. 1872-97)
Fabaceae	Poaceae	Orchidaceae
Poaceae	Fabaceae	Leguminosae
Cyperaceae	Cyperaceae	Graminae
Asteraceae	Orchidaceae	Rubiaceae
Euphorbiaceae	Asteraceae	Euphorbiaceae
Rubiaceae	Euphorbiaceae	Acanthaceae
Acanthaceae	Rubiaceae	Compositae
Lamiaceae	Acanthaceae	Cyperaceae
Convolvulaceae	Scrophulariaceae	Labiatae
Malvaceae	Lamiaceae	Urticaceae

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REFERENCES

B RAHMAM, M. AND H.O. SAXENA. Flora of Ganjam, Orissa, India. *J. Econ. Tax. Bot.* 1:119-125. 1980.

BRAHMAM, M. AND H.O. SAXENA. The Flora of Mahendragiri Hills. In the Book Mahendragiri: The Pride of Eastern Ghats. 35-57, Orissa Environmental Society, Bhubaneswar, Orissa. 1990

CHAMPION, H.G. AND S.K. SETH. A Revised Survey of the Forest types of India, Delhi. 1968.

GAMBLE, J.S. AND C.E.C. FISCHER. Flora of the Presidency of Madras, London. Repr. ed.1967, Calcutta. 1915-36.

HAINES, H.H. The Botany of Bihar and Orissa, London. Repr. ed.1961, Calcutta. 1921-26.

HOOKER, J.D. The Flora of British India, London. 1872-1897.

HOOKER, J.D. A Sketch of the Flora of British India, London. 1904.

MOONEY, H.F. Supplement to the Botany of Bihar and Orissa, Ranchi. 1950.

NAYAR, M.P. Changing patterns of the Indian Flora. *Bull. Bot. Surv. India* 19:145-146. 1977.

SAXENA, H.O. AND M. BRAHMAM. The Flora of Similipahar (Orissa) with particular Reference to the potential Economic Plants. Regional Research Laboratory (C. S. I. R.) Bhubaneswar 751 013. 1989.

SAXENA, H.O. The Flora of Orissa. Orissa Forest Development Corporation, Bhubaneswar-751 001, Orissa. 1994-96.