RESEARCH ARTICLE | *International Journal of Plant Sciences,* Vol. 6 Issue 2 (July, 2011) : 227-232

Impact of Industiral extension on the phytodiversity of Sivasagar district of Northest India with special reference to ONGCL

M. GOGOI, S.J. MAHANTA AND NITU RAJKUMARI

Received : June, 2010; Revised : December, 2011; Accepted : March, 2011

SUMMARY

Sivasagar district falls under North East Biogeographic zone and Brahamputra valley endowed with luxuriant vegetation and rich in biodiversity. The district is comprised of seven reserve forest and 23 grazing forest area. Abhoypur, Sola, Sapekhati, Rangoli, Panidehing, Dilli and Galekey are reserve forest. Abhoypur reserve forest is the transition area in between Assa-Nagaland and Assam-Arunachal Pradesh. Total area covered by the district is 1060 square Kilometer. ONGCL and Tea cultivation are the chief sources of employment opportunity and income generating industry. Drilling operation of ONGCL and extension activities of small tea growers are main causes of loss of phytodiversity. The present investigation prepares an inventory of phytodiversity and recorded 523 numbers of plant species out of which 23 species are pteridophytic plant, Gymnosperms 3 numbers, Angiosperms Dicotyledons 338 and Monocotyledons 159 species. Similarly and dissimilarity index of the phytodiversity index were determined on the basis of disturbed and undisturbed sites of the reserve forest. Moreover 33 endangered and endemic species were recorded from the different forest areas of the district.

Gogoi, M., Mahanta, S.J. and Rajkumari, Nitu (2011). Impact of Industiral extension on the phytodiversity of Sivasagar district of Northest India with special reference to ONGCL. *Internat. J. Plant Sci.*, **6** (2): 227-232.

Key words : Impact of ONGCL, Industrial extension, Sivasagar district

Sivasagar district is situated in the south bank of mighty Brahamputra river, total area covered 2668 square kilometer and lies between $94^0 15^{|}$ and $95^0 45^{|}$ East longitude and $26^0 45^{|}$ and $27^0 15^{|}$ North latitude. Amongst the all biogeographic zones in India the northeast zone is perhaps the richest in communities, species and in endemics. The North Eastern region of India is supposed to be the original home of many flora and fauna, which is one of the hot-spot of biodiversity. There are also many endemic flora and fauna. These endemic species are facing extinction due to several anthropogenic causes as jhoming and agricultural extension, industrial extension, fragmentation of natural forest by means of artificial cultivation etc. The resulting effect of the deplention of natural vegetation due to the biodiversity. However, India's exploding population and its needs in terms in human settlement, agriculture and industrial development has put tremendous pressure on land use.

Correspondence to:
M. GOGOI, Department of Botany, Gargaon College, Simaluguri, SIVASAGAR (ASSAM) INDIA

Authors' affiliations:
S.J. MAHANTA, Department of Geology, Gargaon College, Simaluguri, SIVASAGAR (ASSAM) INDIA

NITU RAJKUAMRI, Department of Botany, Gargaon College, Simaluguri, SIVASAGAR (ASSAM) INDIA

It has been observed that rate of extinction of population and species are related to habitat loss. Due to the continuous oil and gas exploration by ONGCL (Oil and Natural Gas Limited), the original forests are degraded and a number of species are going to disappear and some of them faces danger due to different activities of ONGCL such as transportation, drilling operations, unprotected waste pits inside and out side forest areas and burning of natural gas. Another problem of this area is small tea grower's extension activity in forest areas.

Several botanists have contributes their findings about floristic composition of Sivasagar district and its neighboring area (Hooker, 1872; Islam, 1996; Jain, 1991; Kanjilal *et al.*, 1940 and Gogoi and Islam, 2006).

MATERIALS AND METHODS

Due to differences in interspecific association, the biotic composition of two plant communities are never exactly alike; They may resemble in physiognomy and may have the same dominants but even then like two members of the same family, they will differ and show differences in specific composition. In order to compare two communities that resemble each other in appearance, index of similarly dissimilarity was calculated as per following formulas for present study, to compare protected and disturbed reserve forest areas of Sivasagar district.

The index of similarity is expressed as

$$\text{Similarity index } S = \frac{2C}{A + B}$$

where,

A = Number of species protected site or community A

B = Number of species disturbed site or community B

C = Number of species in simple common to A and B both

S = Similarly index

Dissimilarity index = (1 – S)

Soil plays an important role in the plants life, which acts as fundamental base for the growth and development. The samples of soil were collected from different localities of Sivasagar district *viz.*, Sapekhati, Rangoli, Abhoypur, Sola, Gelekey, Panidehing and Charaideo moidam area, at depth 0-18 cm using a soil auger. A total of 25 samples, 5 from each locality were collected as per usual method (Misra, 1945) and labeled carefully. Samples those collected, were taken in polythene bags and brought to ICAR (NBSS) laboratory, Jamuguri, Jorhat, for analysis.

Soil samples were air-dried and powdered and physico-chemical analysis were made. Determinations of physical properties, as colour of different samples were determined with the help of Munsell colour chart. Soil texture was estimated in quantitative terms as percentage of clay, silt, fine sand and coarse sand followed by (Piper, 1944). Water holding capacities of the samples were determined as per method of (Misra, 1968). Moisture content determined as per dry weight method. Bulk density and porosity determined as per method of Ambasht (1988).

For organic matter in the collected samples were analyzed as per method (Pandey *et al.*, 1968), nitrogen by micro-kjeldahl method (Piper, 1944), phosphorus by Spectrophoto-metric method (Fish and Rao, 1955), potassium by cobalt nitrate method (Piper, 1944) and other quantitative analysis for Ca, Mg, Fe, standard analytical methods of A.O.A.C. (1970).

Due to the habitat destruction by anthropogenic activity, lots of plant species going to be decrease day be day, therefore, an ethnobotanical exploration were undertaken during 2007-2008 in different tribal dominant forest areas of Sivasagar district specially Sola and Gelekey including 23 forest villages and compared past record with interview/interactions. The uses of plants in different aspects of life specially medicinal purpose and causes of endangered were gathered from knowledgeable and elderly persons, because they are the only source to collect of information about local plants name and their uses. And prepare an inventory of endangered and endemic plants of the Sivasagar district with their ethnobotanical importance.

RESULTS AND DISCUSSION

Similarity and dissimilarity index of the species in different study sites of Charaideo sub-division as protected and disturbed sites have been studied and recorded different number of species from both sites. From selected sites, *i.e.* Abhoypur and Charaideo have been considered as protected sites and Sapekhati, Rangoli and Sola as disturbed sites.

For determination of similarity and dissimilarity index of the species in the protected and disturbed site, Sorensen's (1948) standard formula have been used.

$$\text{Similarity index } S = \frac{2C}{A + B}$$

where,

S = Similarly index

C = Number of species common in both sites (126)

A = Number of species in protected site (424)

B = Number of species in disturbed site (321)

Dissimilarity index = (1 – S)

Similarity index = 0.425

Dissimilarity index = (1-S) = (1-0.425) = 0.575

Table 1 shows that the similarly index both in protected and disturbed sites was (0.3382), which indicated that all the species of both sites were diverse and heterogeneous type and same result is shown by the dissimilarity index (0.6617) e.g. Index of dominance of *L. cubeba* in protected sites was found to be 0.0863 and in disturbed sites (0.0598). This formula of Simpson's (1949) has a devised calculating index of dominance. This shows importance of each species in relation to the community as a whole.

Table 1 : Species diversity indices values of protected and disturbed sites

Sites	Dominance indices	Similarity index	Dissimilarity index
Protected	0.0763	0.3382	0.6617
Disturbed	0.1129		

Table 2 : Similarity and dissimilarity index between protected and disturbed sites

Sites	Protected site (A)	Disturbed site (B)	Common in both sites A and B
Number of species	424	321	126

Table 3 : Geographical location of the selected study sites and number of species occurred in the respective sites

Name of sites	Geographical location of the site	Elevation (m) MSL	Total area covered in hecatres	Numbers of species occuring	Major threat to biodiversity of each site
Sapekhati	$27^0 6^l 58^l N$ $95^0 4^l 32^l E$ Latitutde	102	726	156	Human settlement and small tea garden (Disturbed site)
Rangoli	$27^0 6^l 55^l N$ $94^0 59^l 21^l E$ Latitutde	110	4775	112	Cultivated land, human settlement and small tea garden (Disturbed site)
Abhoypur	$27^0 2^l 5^l N$ 95.3E Longitude	115	6738	424	Border reserve forest area of Nagaland and Arunachal Pradesh and protected area (Undisturbed site)
Sola	IV $26^0 58^{ll} 14^l N$ Latitude $94^0 54^l 11^l N$	110	680	321	ONGCL drill sites and human activity, construction of road and establish GGS II inside the reserve forest (Disturbed site)
Dilli	$26^0 55 N$ $94^0 45^l 11^l E$ Latitude	115	1020	283	Human activity, construction of road and establish inside the reserve forest (undisturbed site)
Gelekey	$26^0 48^{ll} 14^l N$ Latitude $94^0 54^{ll} 11^l N$	114	1120	271	ONGCL drill sites and human activity, construction of road and establish GGS IV inside the reserve forest (Distrubed site)
Panidehing	$26^0 48^{ll} 19^l N$ Latitude $94^0 55^{ll} 21^l N$	105	3216	143	Protected site as bird Sanctuary

It was found that there was a significant difference between number of species in protected (424) and disturbed site (321). The numbers of common species was found to be less than 50% in both sites. In indicated that community of the both sites was not similar.

Table 3 indicates the different reserve forest areas of Sivasagar district, their geographical location, total area covered, altitude, total number of species recorded in the respective sites and present status including major threat to those particular area also divide into disturbed and undisturbed sites.

From the field study it is recorded that physically the Sola reserve forest soils are very deep. The horizon is 15 to 25 cm thick. The colour is in hue10 YR, value 4 to 5 and Chroma 4 to 6 with Sandy and loamy.

During the course of study 24, oil wells were recorded which are located at Sola reserve forest and one group gathering station (GGS-II. Each site covers 2.5-5 hectare land area. After successful operation oil well sites were converted into waste land with oil mud's and waste pits along with other polluting substances. Where plant cannot survive or grow and the original structure of forest destroyed. Following Table 1 recorded certain endemic and endangered plant species from the study area.

Table 4 shows that water holding capacity of soil samples in different selected study sites in protected site (52.30%) and in Gelekey and Sola minimum (52.30%). Bulk density of different study sites have also been shown in the Table and found maximum (1.26) in Gelekey and Sola minimum (1.19) in undisturbed sites.

Table 4 : Physical properties of soils from different selected study sites of Sivasagar district (Distrubed and undisturbed sites)

Properties	Disturbed	Undisturbed
Colour	Light brownish grey	Grey
Texture	Clay Loamy	Silty clay Loamy
Water holding capacity	52.30	52.4
Total sand	51.4	40.38
Bulk density	1.26	1.19
Porosity	52.46	55.10
pH	4.50	4.40
Moisture percentage of sample	18.20	30.83

Mean value of 5 replications

Porosity of soil is the most important factor for plant growth. The maximum porosity in soil was found in undisturbed (55.10%) and in disturbed sites (52.46%). The porosity of the soil type also seems to be significance as it is an important physical factor so far as the soil moisture and soil air is concerned. Moisture percentage of the soil in different samples was found 524.04. Mositure percentage maximum (30.83%) in undisturbed site and minimum (18.20%) in disturbed, and pH recorded in all the sites are acidic.

Table 5 shows chemical constituents of soils of different disturb and protected sites. From the Table 5 it is evident that maximum percentage of available Nitrogen (524.04 kg/ha) recorded in the soil sample collected from undisturbed sites which was followed by the sample) minimum nitrogen concentration recorded from site Gelekey and Sola (524.20). Concentration of available Phosphorus in proportionally recorded from site Gelekey (11.34 kg/ha) and undisturbed site (11.87 kg/ha) has significant difference with proportionally equal sites. Available Potassium maximum recorded from soil of (138.30 kg/ha) in Abhoypur, Rangoli, and Dilli, minimum in disturb site Gelekey and Sola (92.07). Exchangeable Ca maximum recorded from (1.24 Mil/kg) undisturbed site followed by (0.6 Mol/kg) have been found from soil of Gelekey. Exchangeable Mg is found maximum (0.4 Mil/kg) from sample from Gelekey and (0.19 Mol/kg) from Charaideo. Percentage of organic carbon were found maximum from soil undisturbed sites, (1.19%) and minimum (0.52%) recorded from disturbed sites.

Table 5 : Chemical constituents of soils of different study sites

Chemical constituents of soil samples	Disturbed	Undisturbed
Available P_2O_5 kg/ha	11.34	11.87
Available K_2O kg/ha	92.07	138.30
Available N_2 kg/ha	524.04	524.20
Exchangeable Ca Mol/kg^{-1}	0.62	1.24
Exchangable Mg Mol/kg^{-1}	0.4	0.19
Organic carbon %	0.52	1.19

Mean value of 4 replications
* indicates significance of value at P=0.01

In the following Table 6 enumerate endangered and endemic medicinal plants available in the protected and disturbed sites were arranged alphabetically with family in parenthesis followed by their local names, habit, uses and their probable cause of extinction.

Total 33 numbers of endemic and endangered plant species were recorded from the district which are available at present disturbed and undisturbed areas of the different reserve forest e.g. *Actinodaphne angustifoliu, Anglopteris evecta, Baccaurea ramifora, Caesalpinia bonduc, Catunareagm uliginosa,*

Table 6 : Enumerate endangered and endemic medicinal plants

Medicinal plant	Local name, habit, uses and probable cuase
Actinodaphne angustifolius Wight	Patihonda (Lauraceae) Standard size tree use as ethno medicine and muga silk worm food plant. Endangered
Andrographis paniculate (Burm.f) Wall. Ex Ness.	Kaimegh (Acantheaceae), Herb, wild, the plant is used for control sugar of diabetic patient, urinary troubles etc. Endangered
Anglopteris evecta Hoffm.	Hati Dhekia. (Angiopteridaceae), Big size fern, wild, used for gonorrthes as medicinal plant, rare, at present found in Sola and Charaideo area, Rare to very rare
Aqulliaria malaccencis Lamk.	Agaru or Sasi, (Thymelaeceae), Small tree, Bark, used to prepare traditional 'Hasipat' stem and agaru oil, Rare in wild state
Baccaurea ramifora, Lour.	Lataku, (Euphorbiaceae), Small tree, wild or cultivate, Epicarp of fruits are used for control skin disease, endangered
Caesalpinia bonduc L.	Letaguti (Caesalpiniaceae) Exotic Lians, Seeds are useful in worm control and fever of children, yung leaves are used in high blood pressure and diabetic patient. Rare
Catunareagm uliginosa Retz.	Bakhor Begena, (Rubiaceae), Tree species, wild, only found in Bokota, Sivasagar district, Endargered
Chrysophyllum lanceolatum (BI)	DC Bonpitha, (Sapotaceae) Tree, wild, Fruits are edible. Latex used in scabies, Gradually disapper and now Endangered
Cinnamomum cocicodaphne Meissn.	Gondhkhoroi, (Lauraceae), Tree species wild, quality timber produced, leaves are used for tertiary muga food plant, Endangered

Contd. Table 6 .....

Table 6 contd…..

Cyathea gigantean Wall. Ex Hook. Holt.	Borchekia (Cyatheaceae), Small tree like Pteridophytic plant, wild, pith edible and used as food, leaves used medicinally for muscular pain, at present found in Sola, Abhoypur and Charaideo area. Endangered
Dendrobium aphyllum Hook. F.	Mota kopw (Orchidaceae) Epiphytic herbs now decrease rapidly used in esthetic beauty. Rare
Dioscorea deltoidea Wall	Kataalu (Dioscoreaceae), Climber, wild important medicinal plant used in leprosy and piles, roots are edible, rapidly decreased in forest areas of Shivsagar district and becoming Endangered
Elaeocarpus granites Roxb.	Rudrakhya (Elaeocarpaceae), Tree, wild, medicinal plant used in epilepsy. Seeds are used making chain in religious aspect. Rare in different reserve forest areas
E. Robustus Roxb.	Rudrakhya small (Elaeocarpaceae), Tree, wild medicinal plant used in epilepsy. Seeds are used making chain in religious aspect. Endangered
Entada scandens Banth.	Bhatghilla (Papilionaceae), A lianas plant, wild, Seeds are used to increase fertility, bark used in fish poisoning, now only found in Abhoypur reserve forest, Rare
Flacourtia cataphractra Roxb.	Poniol (Flacourtiaceae), Small tree, wild, leaves and young shoots are used in diarrhea and stomachache, Fruits are edible. Rare.
Gnatum gnemon L.	Telitia (Gnetaceae), Shrub, wild, inflorescence are used as vegetable. Fruits adible. Important gymnospermic plant found in Sola reserve forest, Rare to very rare
Garcinia cowa Roxb. Ex DC,	Kowrithekera (Clusiaceae), Tree, wild, Fruits are edible important medicinal plant used in dysentery and diarrhea. Rate and endangered
Helminthostachys zeyianica (L.) Hk.	Dhekia (Ophiglossaceae) Herb. Wild, Medicinal Pteridophytic plant, extract of rhizome given in stomach trouble, Rare
Hoya parasitica Wall	Sabon-pata (Asciepladaceae), Epiphytic climber, wild, Latex is used to control pain and boil, Rare to very rare
Litsea assamica Hook	Bontejpat (Lauraceae), Small tree, wild, now endangered
L. angustifolia Wall.	Patihonda (Lauraceae), Small tree, wild, used in high blood pressure and kidney failure. Endangered
L. cubeba Pers	Mejankori (Lauraceae), Small tree, wild, quality fibre producing aromatic plant, fruit, bark and young shoots are used in hypertension, dizziness, intramuscular injury, hysteria, malaria and cancer. Endangered
Magnolia griffuhii Hook. F	Gahonsopa, (Magnoliaceae), Tree, wild, quality timber yielding plant, young leaves are used in malaria, Rare to very rare
M. gustavii Hood. F and Th.	Khorikasopa (Magnoliaceae) Tree, wild, quality timber yielding plant, bark used in piles. Endangered
M. hodsonii (Hook. f & Th*)*	King Borhomthuri (Magnoliaceae), Tree, wild, Young buds are used in skin disease and leap guard, Endangered
M. pterocarpa Roxb.	Thow-thowa (Magnoliaceae), Tree, wild, Timber yielding plant found in Abhoypur reserve forest of Sivasagar district, Rare to very rare
Mamacylon cerasiforme Kurtz	Kakoisera (Melastomaceae), Tree, wild, Stern wood specially used to making comb, found in Sola reserve forest. Rare to very rare
Mucuna puriens DC.	Bandokakua (Papilionaceae) Climber, wild, medicinal plant used in stimulant and diuretic, Rare to very rare
Phlegmarlus phlegmarie (L.) Sen & Sen	Ulomadhekia (Huprziaeae). Herb. Wild. Epiphytic Pteridophyte, used in piles and skin disease, found in Sola reserve forest, Rare
Psllotum nudum (L.) Beauv.	Psilotum (Psllotaceae), A herb. Wild, the plant is used as purgative and in diarrhea of children, Rare to very rare
Rauvolfla serpentine (L.) Benth ex. Kurtz	Sarpagandha, (Apocynaceae), Shurb, wild, important medicinal Plant used in schizophrenia, insanity, isomnia and epllepsy, Endangered
Zanthoxyum rhesuta (Roxb.) DC	Bojormoni (Rutaceae), Tree, wild, Render leaves are used in diarrhea, stimulant, and digestive, tertiary muga food plant, Endangered

Cyathea gigantean considered as endangered, moreover few species are rare e.g. *Entada scandens, Flacourtia cataphracta, Gnatum gnemon, Litsea cubeba, Helminthostachys zeyianica, Magnotia pterocarpa* and *Psllotum nudum* etc. Sivasagar district is famous for endemic flora and fauna where total 33% endemic species recorded. *Aqulliaria malaccencis, Dioscorea deltoidea, Litsea assamica* and *Flacourtia cataphracta* are found in natural condition. These all plants have enthnomedicinal impotence in our day-by-day life. There are lots of causes for decreasing phytodiversity.

– Huge oil sludge and oil spillage poses major environmental problem by contamedicinal the soil and ground water.

– Due to its hazardous nature they need to be treated before disposal, which is usually done by expensive and energy consuming incineration method which causes air pollution.

– Oil splits on paddy fields can be chocking of plant life because the soil may lose its ability to absorb water. Dilute crude oil seeps into the top soil quickly, rapidly percolate and then contaminates ground water. And the other hand, heaver crude oil with high viscosity rate penetrates slowly. Continuous oil spills seriously affect the fertility of soil and forest flora.

ONGCL is one of the employments generating heavy industry of northeast India and assist in different socio-economic aspect of the area but less interest in develop eco-park. If rate of species extinction is same way then with a short period we lost more than 50% plant species from this biogeographic zone. Eco-friendly Oil spill management requires the use of bioremediation is a technique for uses living organisms like bacteria and fungi to dgrade oil contaminated soil or water. Recently ONGCL has associated with TERI (Energy Research Institute) for implementation of this technology and oil zappers technology developed by them has been applied for bio-remediation oil contaminated soil and only sludge laying with in and out side installation. ONGC used this technique in Gelekey reserve forest (Gelekey Oil Field) which needs to be spread to other operational areas of Assam Asset, ONGCL for protection soil heath and phytodiversity.

REFERENCES

Agarwal, V.S. (1988). *Economic plants of India*. Kailash Prakashan, Calcutta

Gogoi, M. and Islam, M. (2006). Life-forms and biological spectrum of the flora of Charaideo sub-division, Assam. *Adv. Plant Sci.,* **19** (1) : 117-119.

Gogoi, M. and Islam, M. (2006). Certain fibre yielding plants of Charaideo and its neighbouring areas. *Bull. Life Sci.*, **12** : 55-62.

Gogoi, M. and Islam, M. (2009). Certain endangered and threatened ethnobotanically important plants of Sivasagar district, Assam, *Adv. Plant Sci.*, **22** (1) : 205-207.

Gogoi, M., Mahanta, S.J. and Jiji, P. (2010). Wild vegetables used by Tai-Shyam people of Sivasagar district and their present status. *Internat. J. Plant Sci.*, **5** (1) : 360-363.

Gogoi, P. (1981). Flora of Golaghat, Ph. D. Thesis, GU.

Gogoi, P. (2003). *Herbal treatment in Healthcare among Tai Tribes of North East India and Thailand*. In : Ethnomedicine of North East India, Eds. G. Singh, H.P. Singh and T.M. Mukherjee, CSIR, New Delhi, pp. 251-255.

Hooker, J.D. (1972). *The flora of British India*. London, Vols. 7.1 Reeve and Co., Kent, U.K.

Islam, M. (1996). *Weeds of Northeast India,* The Assam Paper industry, Tinsukia.

Jain, S.K. (1991). (Ed) *Dictionary of India Folk Medicine and Ethnobotany*. Deep Publication, Pachim Vihar, New Delhi.

Kalita, D. (2001). Ethnobotanical notes on the Sonowal kacharis of Brahmputra valley, Assam, *Vasundhara*, **6** : 21-32.

Kanjilal, U.N., Kanjilal, P.C. and Das, A. (1940). *Flora of Assam.* Vol. 1-IV. Govt. of Assam, Shilong.

Mishra, R. (1945). Variation of leaf form in *Potamogeton perfoliatus*, *J. Ind. Bot. Soc.*, **23** : 44-52.

Nath, D., Gogoi, M. and Zaman, E.(2008). Ethnobotanical study on family planning and birth control of Sivasagar district, Assam, *Internat. J. Plant Sci.*, 3(2) : 366-369.

Piper, C.S. (1944). *Soils and Plant analysis : A Laboratory manual of methods for the inorganic constituents of plants*. A mongor from Waite Agric. Res. Inst. Univ. of Adelaide Press, Adelaide

Sharma, J.N. (1978). *Flora of Sibsagar district Assam*. Ph.D. Thesis Guahati University.

Simpson, E.H. (1949). Measurement of diversity, *Nature*, **163** : 688-699.

****
*****