



## SPATIAL MODELLING FOR BIOLOGICAL RICHNESS ANALYSIS IN NOKREK BIOSPHERE RESERVE - NORTH-EASTERN INDIA

G. TALUKDAR\*, N. LELE@ AND M.C. PORWAL

Forestry and Ecology Division, Indian Institute of Remote Sensing (NRSA),  
4 Kalidas Road, Dehradun-248 001, India

\*Jharkhand Space Application Centre, Department of Information Technology,  
2<sup>nd</sup> Floor, ATI Main Building, Meur's Road, Ranchi-834 008, India

@Corresponding author : lele@iirs.gov.in

The Meghalaya state lies in the “Indo-Burma” region- one of the eight hottest biodiversity hotspots (Myers *et al.*, 2000). The Nokrek biosphere reserve is one of such regions in Meghalaya, which is threatened by the age-old practice of shifting cultivation and mining. The present study was carried out as a part of national level project ‘Biodiversity Characterisation at Landscape Level-Phase-IB’ at Indian Institute of Remote Sensing for assessing biodiversity of the Nokrek Biosphere Reserve. In view of the previous knowledge that this particular area is endowed with indigenous *Citrus* species (Singh, 1981), initiatives were also taken to explore the genetic diversity of the *Citrus*. The Nokrek biosphere reserve lies in Garo hills of Meghalaya State, India, between 25° 18’ N to 25° 37’ N latitude and 90° 12’ E to 90° 36’ E longitude, respectively (Fig. 1a) covering an area of 820 km<sup>2</sup>. The Nokrek National Park which constitutes the core area of the biosphere reserve occupies area of 47.48

km<sup>2</sup>. There are 128 villages within the biosphere reserve, lying outside the zone of national park. By and large the local people are very poor and a number of people are below the poverty line due to lack of alternative sources of livelihood other than shifting cultivation (Nongsiej *et al.*, 2000).

IRS 1D LISS-III digital data of March 2001 has been processed using ERDAS Imagine 8.4 and the GIS analysis was done in ARC Info 8.1. A customized Unix – Arc Info based package “BIOCAP” was used for Landscape Analysis and Biodiversity Characterisation (IIRS, 2002). Land use land cover map and the biological richness analysis has been carried out using methodology (Fig.1b) adopted by Roy and Tomar (2000). The field information has been used to derive other landscape parameters *viz.* ecosystem uniqueness (EU), species richness (SR) and total importance value (TIV). Based on the tonal variations and their location five

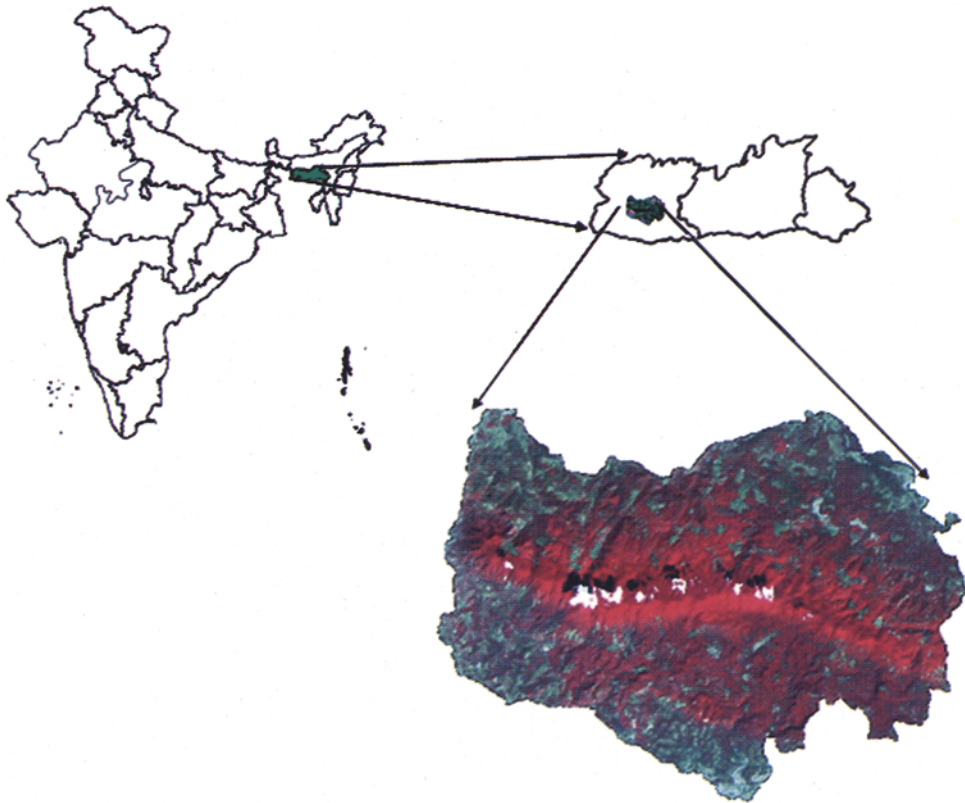


Fig. 1a. Location map of Nokrek biosphere reserve in Meghalaya

vegetation classes- Sub-Tropical Evergreen Forest (30.54 km<sup>2</sup>, 3.37%) confined to the core zone of biosphere reserve, Tropical Evergreen Forest (137.71 km<sup>2</sup>, 16.79%), Tropical Semi-evergreen Forest (109.25 km<sup>2</sup>, 13.52%), Moist Mixed Deciduous (191.69 km<sup>2</sup>, 23.38%), Bamboo patches (15.66 km<sup>2</sup>, 1.91%) growing in areas under abandoned *jhum*.

The land use/land cover map of the Nokrek biosphere reserve and the distribution of the classes is given in Fig. 1c. Out of the total area under biosphere reserve forest occupies 484.85 km<sup>2</sup> (59.13%) and the rest 335.15 km<sup>2</sup> is under various non-forest categories. The area affected by *jhum* cultivation (abandoned *jhum* and current *jhum*) was found to be 314.37 km<sup>2</sup> (38.34%) of the total area.

The status of disturbance among different forest types has also been assessed (Fig. 2a and Table 1). It is observed that out of the total area of Subtropical forest, 94.76% (30.54 km<sup>2</sup>) area is least disturbed. This area is spread across the Nokrek ridge and is away from the human interference. The remaining 5.24% of area, which comes under medium as well as high disturbance categories, is attributed to natural disturbances. It should be noted that in this forest type, there is absence of severe disturbance areas. Tropical semi-evergreen as well as moist mixed deciduous forests are more disturbed as compared to other forest types. Biological richness map is derived by integrating various landscape parameters (Fig. 2b and Table 2) indicates 23.89% of the area is still under high richness. The

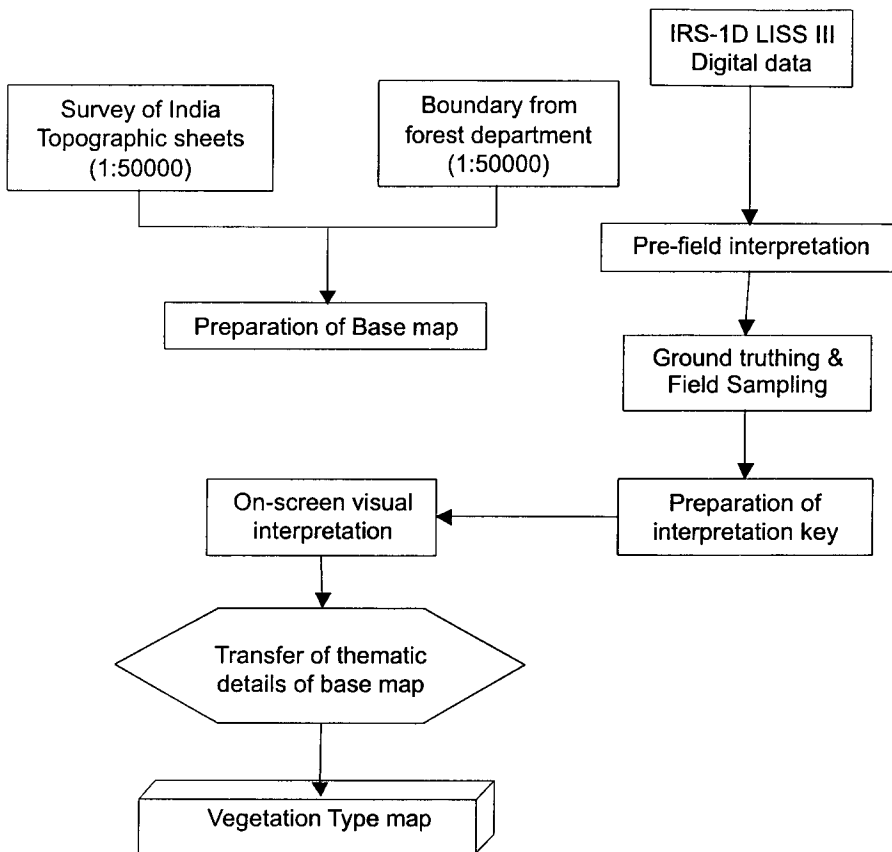


Fig. 1b. Flow chart of the methodology adopted for the present study (adopted from Roy and Tomar (1998))

most unique forest type of subtropical evergreen forest comes entirely within the zone of high richness areas. The moist mixed deciduous forests occupying maximum land cover area shows richness of 57% with the least richness among the Bamboo patches.

The present study shows that major causes of fragmentation and low richness and high disturbance are the results of shifting cultivation, coal mines and limestone quarrying, which are located in the southern side of the National Park. Additionally, local demand of timber and fuel wood are also

among the major threats and the villages adjoining the boundary of reserve creates tremendous pressure on the fringes of national park. The analysis of field data collected indicates that a large variety of *Citrus* exists in semi-wild conditions in and around the villages like Sasatgre and Daribokgre. However, very few individuals of *Citrus* species were encountered in the sample plots that were laid away from villages in the study area. The endangered species present in the reserve should be protected in villages within the biosphere reserve itself.

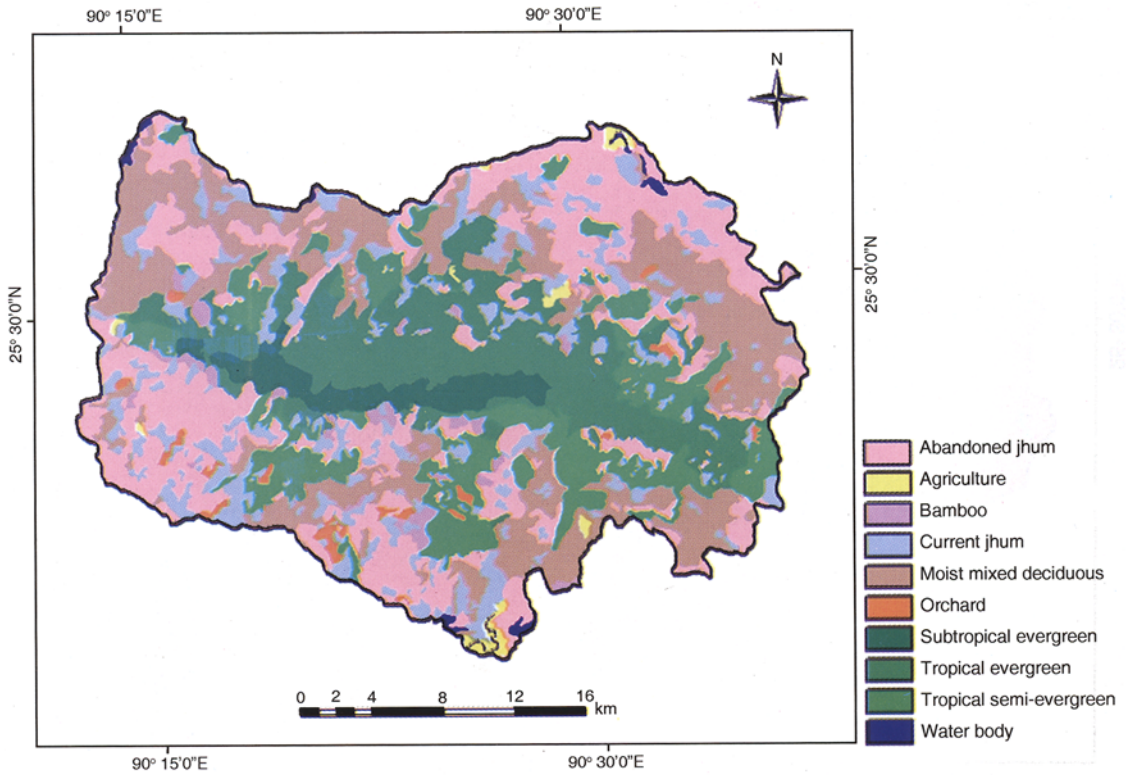


Fig. 1c. Land use land cover map of Nokrek biosphere reserve

Table 1: Forest type-wise status of disturbance regimes in Nokrek biosphere reserve

Disturbance Index	STEG		TEG		TSEG		MMD		Bamboo	
	Area km <sup>2</sup>	%	Area km <sup>2</sup>	%	Area km <sup>2</sup>	%	Area km <sup>2</sup>	%	Area km <sup>2</sup>	%
Low	28.94	94.76	108.8	79.01	47.2	43.20	85.86	44.79	4.39	28.03
Medium	0.75	2.45	10.26	7.45	32.04	29.33	42.93	22.40	3.61	23.05
High	0.85	2.73	12.86	9.34	17.56	16.07	36.55	19.07	5.52	35.25
Severe	—	0	5.79	4.20	12.45	11.40	26.35	13.75	2.14	13.67
<b>Total</b>	<b>30.54</b>	<b>100</b>	<b>137.71</b>	<b>100</b>	<b>109.25</b>	<b>100</b>	<b>191.69</b>	<b>100</b>	<b>15.66</b>	<b>100</b>

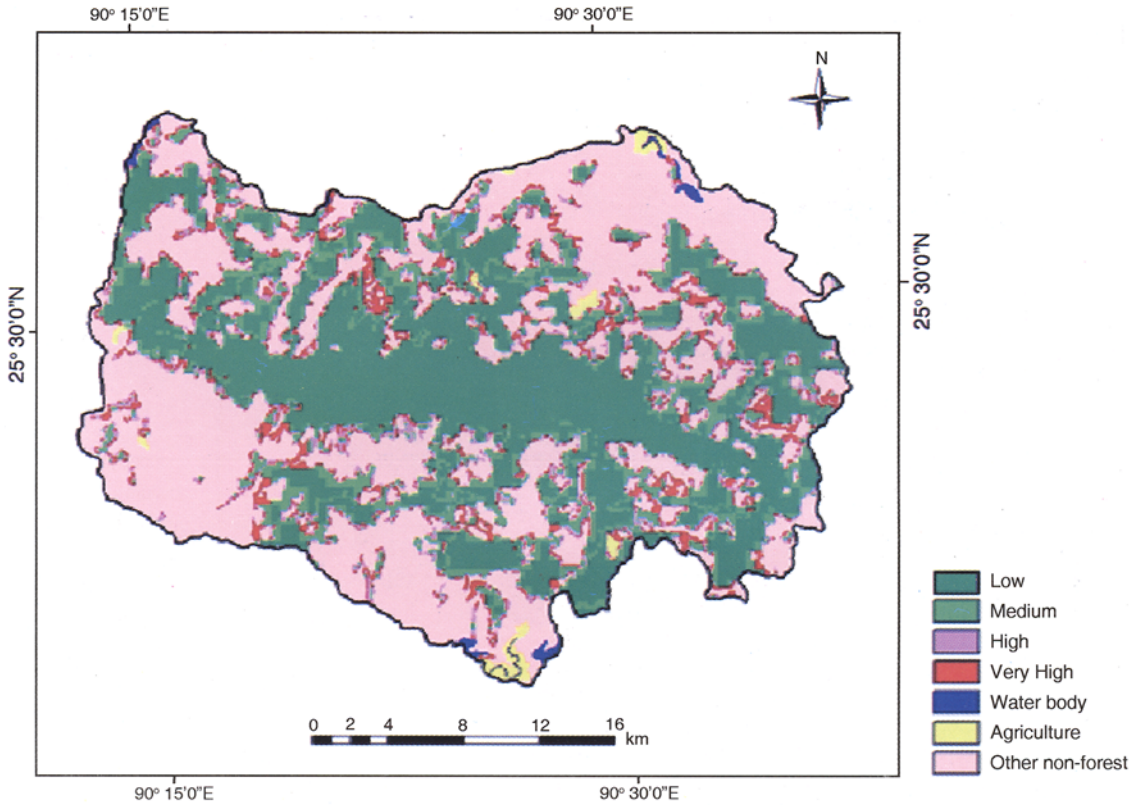


Fig. 2a. Disturbance index map of Nokrek biosphere reserve

Table 2: Forest type-wise status of biological richness of Nokrek biosphere reserve

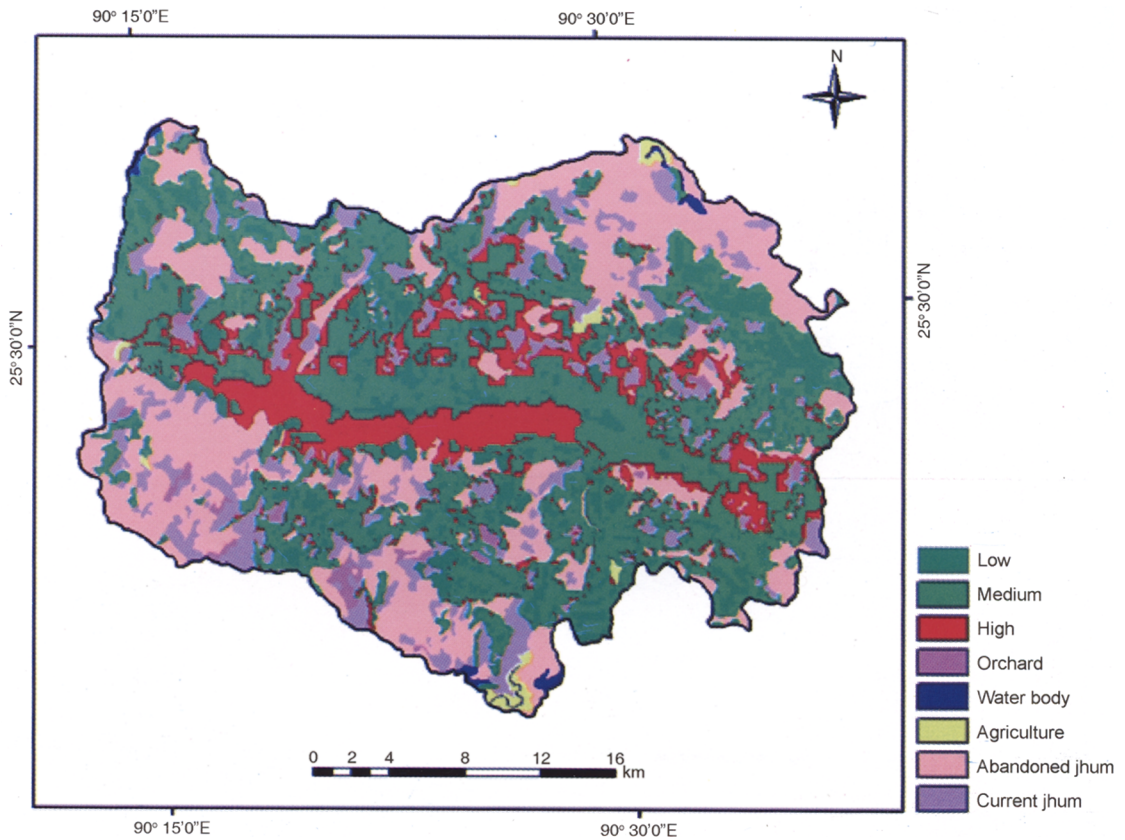
Biological Richness	STEG		TEG		TSEG		MMD		Bamboo	
	Area km <sup>2</sup>	%	Area km <sup>2</sup>	%	Area km <sup>2</sup>	%	Area km <sup>2</sup>	%	Area km <sup>2</sup>	%
Low	—	—	11.39	8.27	20.92	19.1	73.25	38.21	15.52	99.10
Medium	—	—	68.22	49.5	70.41	64.44	109.13	56.93	0.14	0.89
High	30.54	100	58.1	42.1	17.92	16.40	9.31	4.85	—	—
<b>Total</b>	<b>30.54</b>	<b>100</b>	<b>137.71</b>	<b>100</b>	<b>109.25</b>	<b>100</b>	<b>191.69</b>	<b>100</b>	<b>15.66</b>	<b>100</b>

STEG = Subtropical Evergreen forest

TEG = Tropical Evergreen forest

TSEG = Tropical Semi-evergreen forest

MMD = Moist Mixed Deciduous forest



**Fig. 2b.** Biological richness map of Nokrek biosphere reserve

## References

- IIRS (2002). Biodiversity Characterisation at Landscape level in North-East India using Remote Sensing and Geographical Information System. Indian Institute of Remote Sensing, Dehradun.
- Myers, N., Mittermeier R.A., Mittermeier, C.G., da Fonseca, G.A.B. and Kents, J. (2000). Biodiversity hotspots for conservation priorities. *Nature*, **403**: 853-858.
- Nongsieg, S.A., Sangma, S.N. and Marak, T.T.C. (2000). Management plan of Nokrek National Park cum Biosphere Reserve Garo Hills, Meghalaya.
- Roy, P.S. and Tomar, S. (2000). Biodiversity characterisation at landscape level using geo-spatial modelling technique. *Biological Conservation*, **95**(1): 95-109.
- Singh Bhag (1981). Establishment of first gene sanctuary in India for Citrus in Garo hills, Concept Publishing Company, New Delhi.