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Mapping of Jhumlands using Remote Sensing Techniques for Restoration of Ecosystem - A Case Study of Garo Hills, Meghalaya State

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ABSTRACT

Mapping of the Jhumlands of garo hill districts of Meghalaya State carried out using IRS-1B-LISS II satellite data revealed two types of such lands i.e. current and abandoned lands. The former occupies majority of jhum land in each and every district. East garo hills dominate in jhumming, followed by West and South Garo Hills.

Introduction

The socio-economic condition and topographic constrain of north eastern hilly region of India lead the people to evolve a specific agricultural system called shifting cultivation or Jhum. The particular system of farming not only causes the ecological imbalance but also induces land degradation problem through soil erosion resulting sedimentation of riverbeds that causes floods in the lower plains. Such problematic area needs immediate attention for effective land management planning and measures (Borthakur *et al.*, 1976; Kushwaha and Ramakrishna, 1987).

In India, there is a lack of reliable and accurate information on jhumlands. The statistics published by various organizations are either mere estimate or generalized information derived on small scale. In fact, no database on Jhumland has so far been generated out of any systematic land resource survey. Most of the information lack spatial presentation of extent and distribution. The existing information, thus, can not meet the requirement for any zonal or regional level planning.

The technology of remote sensing provides the potential solution for inventorying of jhumland by virtue of its wide synoptic coverage in multi spectral band with higher resolution (Dwivedi and Ravishankar, 1991; Kushwaha, 1991). In the present study, Indian Remote Sensing Satellite (IRS-1B) data has been employed for mapping and monitoring of jhumland of Garo Hill districts of Meghalaya during November, 1994 as a part of a scheme on District-wise land degradation mapping initiated by the Ministry of Agriculture. The database could effectively be utilized for site based soil conservation planning and integrated land use management for sustainable development of the area vis-à-vis restoring the ecological balance.

Study Area

Garo Hills, the western zone of Meghalaya State in north-eastern region of India consist of three districts, namely, East, West and South Garo Hills. It covers a geographical area of 8176 sq. km and lies between 25° 08' to 26° 02' N latitude and 89° 50' to 91° 02' E longitude. The majority of the area is dissected and rugged hilly terrain with red and laterite soils that form a part of the Eastern Himalayan Agroclimatic zone. Geologically it is mainly composed to gneissic rock in the north and simsang, chengpara and Baghmara formation in the south alongwith the patches of recent alluvium. The area enjoys a humid tropical to sub-temperate climate with mean annual precipitation 4597 mm. The tropical moist deciduous forest is the main natural vegetation and shifting cultivation is the prime occupation of the people.

Materials and Methods

Satellite and other data : IRS-1B, LISS-II geocoded data (FCC bands 2,3,4; path 16,17 and Row 50; scale 1:50,000) acquired on 2nd March 1994 was used as base for mapping purposes. Besides, ancillary data namely Survey of India (SOI) topographic sheets on 1:50,000 scale and district administrative map were used as reference materials.

Delineation and mapping of the Jhumlands : Base map was prepared on drafting film deriving information on land use limit, cultural features, drainage and coordinates from SOI toposheets on 1:50,000 scale. Hard copies of False Colour Composite (FCC) were monoscopically interpreted using standard visual interpretation technique in conjuction with the data of SOI toposheet and local

reference (NRSA, 1985). The major land use map was prepared first and depending upon the variation in image signature, two categories of jhumland i.e., current and abandoned jhumland (1 to 3 years fallow) were identified and delineated. Sample points covering all interpreted units in accessible area were selected with the help of toposheet for ground verification. In field, ground check was done to establish the correlation between image element and jhumlands and ultimately interpretation key was finalised. After ground verification, the boundaries of jhumlands in the interpreted sheets were corrected and transferred to the base map. The district boundaries from administrative map were then superimposed on the base map and finally districtwise jhumland maps were prepared. The area under shifting cultivation was computed using digital planimeter.

Results and Discussion

The categories of degraded land in jhum cycle and their descriptions are furnished in interpreted key (Table-1). Two types of jhumland i.e. current and abandoned jhum were identified and mapped most accurately. On false colour composite, current jhumland appeared as brownish yellow, greenish blue or blue and also whitish tone at patches whereas light grey and bright red tone indicated abandoned jhumlands in fallow condition upto 3 years. The distinction between succession growth of vegetation in abandoned jhumland beyond 3 years and good forest area was difficult because of identical tonal characteristics.

Table 1. Interpretation key for Jhumland mapping of Garo Hills

S.No.	Category of Jhumland and code	Major land use and symbol	Mapping legend	Image characteristics
1.	Current Jhumland (5a)	Forest (F)	F 5a	Greenish blue/blue and brownish yellow small in size, regular to irregular shape, scattered on hill slope.
2.	Abandoned Jhumland (5b)	Forest (F)	F 5b	Light grey and bright red tone, small to large size, regular to irregular shape, scattered on hill slope.

Table 2. Jhumlands and their extent in Garo Hills

Mapping symbol	Type of Jhumland/ other lands	Total area (ha)	Distribution of area in District (ha)			Percentage of Total	
			West Garo Hills	East Garo Hills	South Garo Hills	Garo Hill Districts	Jhumland area
F 5a	Current	56858	25350 (6.8)	25027 (9.6)	6481 (3.5)	7.0	74.0
F 5b	Abandoned	19952	9256 (2.5)	9174 (3.5)	1522 (0.8)	2.4	26.0
	Total	76810 (9.4)	34606 (9.3)	34201 (13.1)	8003 (4.3)	9.4	100.0
	Other land	739890 (90.6)	336094 (90.7)	226099 (86.9)	177697 (95.7)		
	Grand Total	**816700**	**370700**	**260300**	**185700**		

The study showed that the shifting cultivation is mostly confined to the surrounding of human settlement. The distribution of different types of jhumland in different part of Garo Hills is given in Table-2. The study reveals that jhum cultivation is practiced only in forest land and the land affected by jhuming spreads over 9.4% (76810 ha.) of the whole district. The majority of the jhumland is occupied by current jhuming in each and every district and as a whole it covers an area of 56858 ha. (74% of total jhumland). East Garo Hills dominates in jhuming, followed by West Garo hills and South Garo Hills. Around 13.1% area of East Garo Hills is affected by jhuming whereas 9.3% and 4.3% area in West and South Garo Hills are affected by jhum cultivation respectively.

Conclusion

Remote sensing techniques make the study possible to map the extent of jhum cultivation area with spatial distribution in Garo Hills districts. It would lead to accurate estimation of area affected by jhum cultivation and would enable to adopt a strategic planning to control the practice in a phased manner. The difficulties in mapping of small size jhumland can be overcome by the use of large-scale imagery with better resolution. However, remote sensing is found to be a most suitable tool for inventorying of degraded lands in the inaccessible area like Garo Hills by virtue of wide synoptic coverage and multi spectral sensing capabilities of IRS. The dynamics of shifting cultivation in the North Eastern Region could easily be evaluated and monitored using remote sensing techniques that could form a base for remedial measures of the problem being faced by the people of the area .

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