2nd German-Indian Conference on Research for Sustainability
United Nations University, Bonn, 27-28 April, 2009

Landuse Change in Meghalaya

B.S. Mipun, North-Eastern Hill University, Shillong, India

Human interventions in natural systems have resulted in large changes in vegetation composition and distribution patterns. Changes in land use and hence in vegetation cover, due to climatic change and human activity, affect surface water and energy budgets directly through plant transpiration, surface albedo, emissivity and roughness. Thus, there is a need for spatial and temporal characterization of vegetation cover at different scales. Satellite remote sensing provides detailed information regarding the spatial distribution and extent of land use changes in the landscape. Meghalaya, in North-East India, is one of the most important, biologically rich landscapes. Degradation due to shifting cultivation, clear felling of forests for timber, and mining, have altered the natural landscape to a great extent. Because of these increased anthropogenic activities the natural landscape has been modified which has resulted in a fragmented landscape with poor species composition. These changes in the landscape were analyzed using IRS 1A, 1B and Landsat Multi-Spectral Scanner (MSS) data during the period 1980-1995 by Roy and Tomar (2001) in their study “Landscape cover Dynamics Pattern in Meghalaya”.

Land use/land cover (LU/LC) change affects ecological energy flows and biogeochemical cycles at local to global scales. Anthropogenic disturbances in both natural and managed ecosystems can cause changes in ecosystem structure and function and potentially alter biogeochemical cycling and overall sustainability of ecosystems (Wali et al. 1999; West and Marland 2002). For example, human-induced changes in forest cover through deforestation have been shown to result in multiple ecological impacts, such as decreased biodiversity (Shukla et al. 1990), degradation of soil conditions (Buschbacher et al. 1988) and changes in the balance of greenhouse gases (Post et al. 1990; Dale et al. 1993). Similarly, land use change in agricultural ecosystems can result in changes in carbon fluxes, including soil organic carbon and carbon dioxide emissions (Paustian et al. 2000; West and Marland 2002). Traditional methods for examining land use change and impacts on various ecosystems have typically treated the socioeconomic and ecological effects independently (Dale et al. 2000). However, there is a need to define appropriate and measurable variables to understand and quantify social, cultural and biophysical phenomena in an integrated approach for understanding LU/LC change and their ecological impacts.

The total population of Meghalaya is 23,06,070 in 2001 census. Agriculture is the mainstay of the people of Meghalaya. About 85 percent of the population of the State lives in rural areas and depends on agriculture for its livelihood. Of the total geographical area, about 13 percent is under cultivation. Agriculture is in the primitive stage of shifting cultivation in major parts of the State. Shifting Cultivation, known locally as ‘Jhum’, is practiced extensively on the hill-slopes in the Garo Hills and part of the Khasi and Jaintia Hills Districts (Mipun 2003). The soil and climatic condition of the State is suitable for growing different types of agricultural crops from cereals to fruits in both tropical and temperate climatic environment occurring on different altitudes. The State is rich in species of flora and varies from open scrub to dense forests. The rest is covered by mostly deciduous to evergreen forests and transitional tropical moist deciduous pine forests. The Jhum cycle in Meghalaya has been reduced to 3-5 years and in parts 1-3 years. The rationale behind the persistency of the system greatly lies in its compatibility with the physical environment. This has made the land highly unproductive and is alarmingly leading to extensive land degradation and imbalance in the socio–economic setup of the village community.

The rationale behind the continuation of Jhum cultivation also lies in these advantages of this system over settled cultivation. The village and community ownership of land and forest helps in reinforcing the system even if it is no longer viable and sustainable. With the growth of population and reduction on area available for jhumming, the rotation cycle has gone down to around 5 years. As a result, the fertility of soil and production from Jhum is constantly declining so much that the system of today has become hazardous that leads to progressive degradation of the production base. Due to intensive Jhum cultivation, soil erosion has increased.

Shifting cultivation is practiced in remote and scattered areas, and is becoming unsustainable due to increasing pressure on land resources. It is difficult to provide any meaningful development infrastructure to these areas due to the remoteness and scattered nature of the settlements. Shifting cultivation is estimated to support currently between 300-500 million people worldwide.

An essential feature of Jhum is mixed cropping as though to imitate nature in terms of species diversity (i.e. as though to replicate the very forest- with all its species- that is been slashed and burned). The crops generally grown include rice, maize, tapioca, colocasia, cucurbits, chilies, ginger, sweet potato, turmeric, millet, cotton, tobacco, taro, etc. (Toky, 1981) The large crops species over both space and time are effectively managed by sequential harvesting throughout the year.

A complete change or switch over from shifting cultivation is neither possible nor advisable in view of the terrain, fear of changes in tribal dietary habits and other viable alteration with immediate effect. Instead of changing shifting cultivation to another type the effort should be to improve and control the process. Though the Government spent considerable effort to settle shifting cultivators and stabilize their farming techniques, large shares of forest land in the highlands are still cultivated.

Shifting cultivation is a dynamic process which needs to be monitored every year. Using satellite data is the only source of getting authentic and current seasonal data to carry out such study. Therefore, to monitor the land use changes in the shifting cultivation areas, study-based remote sensing data and analysis through GIS-based input like mapping and analysis is a must. The research on land use change in Meghalaya is of great significance to prioritize land use planning programmed for sustainable development.

References:

Buschbacher, R., Uhl, C. and Serrao, A.S. (1988): Abandoned pastures in eastern Amazonia. II. Nutrient stocks in the soil and vegetation. Journal of Ecology 76:682–699.
emissions, and net carbon flux in agriculture: comparing tillage practices in the United

Dale, V.H., Brown, S., Haeuber, R.A., Hobbs, N.T., Huntly, N., Naiman, R.J., Riebsame, W.E., Turner, M.G., Valone, T.J. (2000): Ecological Principles and Guidelines for Managing the Use of Land. *Ecological Applications* 10:3, 639-670.

Mipun, B.S. (2003): Landuse/Landcover Detection Mapping and Identification of Shifting Cultivation Areas of Tirap District. In: *Environment, Locational Decisions and Regional Planning,* edited by S. Singh et al., Published by The Geographical Society of the North-Eastern Hill Region (India), Shillong

Paustian, K, Six, J, Elliott, E.T., Hunt, H. W. (2000): Management options for reducing CO2 emissions from agricultural soils, Journal of Biochemistry, Springer, Netherlands, Pages 147-163.

Post, W. M., and Kwon, K.C. (2000): Soil Carbon Sequestration and Land-Use Change: Processes and Potential *Global Change Biology* 6, 317–328.

Roy, P.S. and Tomar, S. (2001): Landscape Cover Dynamics Pattern in Meghalaya; *International Journal of Remote Sensing*, Volume 22 (18), Indian Institute of Remote Sensing, Dehradun, India, pp 3813–3825.

Shukla, J, DeFries, R., and Bounoua L. (2000): Consequences of land use change for ecosystem services: A future unlike the past Geo Journal, Springer, Netherlands pages 345-351.

Toky, O.P. and Ramakrishanan, P.S. (1981): Soil Nutrient Status of Hill Agro-Ecosystems and Recovery Pattern after Slash and Burn Agriculture (Jhum) in North-Eastern India. *Plant and Soil* 60, pp 41-64.

Wali, M. K., Evrendilek, F.,West, T.,Watts, S., Pant, D., Gibbs, H., McClead, B. (1999): Assessing terrestrial ecosystem sustainability: Usefulness of regional carbon and nitrogen models, *Nature Resources* 35, 20–33.

West, T. O. and Marland, G. (2002): A synthesis of carbon sequestration, carbon emissions, and net carbon flux in agriculture: Comparing tillage practices in the United States. Agriculture, *Ecosystems and Environment* 91:217–232.