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M.Sc. Thesis

Assessment of land cover change in Chieng Khoi Commune, Northern Vietnam, by combining remote sensing tools and historical local knowledge

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Abstract

In mountainous areas of Northern Vietnam, increasing population density has forced agricultural production to expand into upland areas. This trend resulted in decreasing forest resources with associated soil erosion and resource degradation. The reduction of natural forests with a conjoint increase of forestry plantations and a replacement of upland rice-based swiddening farming with continuous maize cropping systems are threatening the sustainability of local land use systems. Although annual land uses provide increased short-term cash income, food security is facing long-term problems due to severe soil degradation. Reconstructing past land use dynamics is crucial to understanding the present situation in the research area and to find ways towards sustainable land use. However, access to classical sources of land use data such as maps and high resolution satellite imagery is difficult in a border region that in the recent past has been affected by military operations.

The aim of this study was to classify land cover changes based on available moderate resolution remote sensing imagery and historical local knowledge as a basis for understanding and future modelling of land use dynamics.

This master thesis was conducted within the framework of the Uplands Program SFB 564, Subproject C4. To analyse the change of land cover in Chieng Khoi commune, Northwest Vietnam, from 1993 to 2007, LANDSAT and LISS III images were used, ENVI 4.3 and ArcGIS 9.3 software were employed to digitize aerial and satellite images and overlay field data collected with a handheld GPS. To ensure a consistent dataset, image-based land cover classification was combined and cross-checked with several data sources: Inventories of land cover, a decision-tree based on land suitability and cropping season for different crops, participatory soil maps and local stakeholder interviews regarding land cover history of plots representing different slope positions.

This study provides an overview of land cover change in Chieng Khoi commune based on historical knowledge and generating land cover maps in 1993, 1999 and 2007. Hybrid classification was used, with overall accuracies achieved in 1993 of 81.1%, 1999 of 98.5% and 2007 of 82.5%. This method was also applied to distinguish upland crops in 2007, overall accuracy obtained was 66.7%. These results may provide input data for the biophysical model LUCIA (Land use Change Impact Assessment tool) to enable reverse modelling and an ex-ante assessment of land cover change consequences at the landscape level, which also can provide the advice for land management and land planning for sustainable farming in long term. Reducing negative factors to hunger, poverty first of all in small scale in Chieng Khoi Commune, Northern Vietnam, for large scale in uplands area, occupy 22.4 million hectare (74%) of total Vietnam's area. Additionally, it provides recommendations for local policy decision making and land planning for sustainable development.

Keywords: Northwest Vietnam, land cover, satellite imagery, historical knowledge.

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