



Project Abstract

Understanding dynamic resource Management Systems and Land Cover Transitions in Montane Mainland Southeast Asia

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Overall Mission/Objective

Contemporary concerns with climate change, global environmental change, and sustainability have rejuvenated interest in the development of an integrative theory of human-environment relationships. Montane mainland Southeast Asia is a region of great biological and cultural diversity that has come under close scrutiny in the last several decades as a result of both real and perceived deforestation, land degradation, and most recently, the conversion of traditional agricultural practices to more permanent cash crop agriculture driven by regional and global markets. This project seeks to understand how resource management systems in montane mainland Southeast Asia are changing in the wake of commodification of resources in order to appreciate how these changes may affect sustainable resource use, landscape transformation, and land cover.

The project is constructed around three broad research objectives:

1. To use an environmental entitlements approach to inform economic, demographic, institutional, and cultural data collection at household, district, provincial, national, and international scales on factors affecting land-cover and land-use change in the region. This analysis will be used to develop narratives of economic, demographic, institutional and cultural change in the region including changing political economics, environmental feedbacks on land use, and external shocks.
2. To link economic, demographic, institutional and cultural data to a comprehensive, high-resolution spatial database of land cover in montane mainland Southeast Asia developed in a project funded by NASA (see below).
3. To develop cellular automata and agent-based models that utilize the narratives of economic, demographic, institutional, and cultural change within the spatial framework to address “what if” questions concerning hypothesized changes in social and biophysical variables and to increase our understanding beyond the available empirical data.

A multidisciplinary team (including economists, foresters, geographers, and social scientists) is collecting economic, demographic, institutional and cultural data and tying these data together in a multi-temporal high-resolution spatial database (the spatial database is being put together as part of a [NASA funded project](#)). Data are being used to develop a narrative of land-cover and land-use change in montane mainland Southeast Asia. We are also building cellular automata and agent-based models to address "what if" questions concerning hypothesized changes in social and biophysical variables and to increase our understanding beyond the available empirical data.

Progress and (Preliminary) Outcomes

To date the project has made significant progress towards completing the first objective of the project, i.e., collecting economic, demographic, institutional, and cultural data at different scales including (1) major river systems (e.g. Mekong, Chao Phraya), (2) river basins (e.g. Upper Ping – 25,000 km²) and sub-basins (e.g. Mae Chaem – 4,000 km²), and (3) local sub-watersheds (about 10 to 100 km² orders of magnitude) and individual community and household levels. These levels are useful in terms of analyzing issues of scale, but are also important because of government programs to encourage development of actors and institutions at these various nested levels. We are using both qualitative and quantitative methods to understand the nature of human and environment interactions in the region.

At the major river systems scale we are working in the Mekong and Chao Phraya basins. We have documented changes in national policies influencing land use (e.g., tenure, taxation, credit, import and export regulations) as well as changes in infrastructure (roads and markets). At the river basin and sub-basin scale we are working in the Luang Namtha basin in northern Laos and the Nan-e watershed in Yunnan. We have conducted focus group and household interviews, participatory exercises (fuzzy cognitive mapping) to learn more about key stakeholders in resource management and historical trend of resource use, as well as socioeconomic factors contributing to land-use and land-cover decisions. This methodological innovation offers promise of being able to make land-use and land-cover change research more participatory, as

well as based more on narratives of change from the perspective of local people rather than on the quantitative analyses of panel datasets.

This year we focused on understanding the conversion of upland fallows to rubber in light of the rising price of rubber on the Chinese market. Interviews with local officials and statistical data in China and Laos are helping to build a picture of the impacts of changing policies and markets on land use, and on administrative responses to change. An important finding has been that the same policy may be understood in very different ways by officials in different branches of administration, by local leaders, and by land users themselves. This will have implications in modeling the impacts of land use change of stated national and regional policies.

At the local sub-watershed scale we are working within the two watersheds being monitored in the hydrological portion of the NASA project. One of these sub-watersheds, the Nan-e, is in Yunnan and the other, the Nam Mae Rim, is in northern Thailand. We are utilizing both participatory and more conventional survey research methodologies to develop household resource use histories and to understand the impacts on the landscape of changing markets, changing access to resources, and changing land uses.

The second objective of the project is to link economic, demographic, institutional and cultural data to a comprehensive, geographic information system (GIS) spatial database of recent and current land cover in the region. We have completed significant components of this database including information on the location and size of villages, roads, streams, and agricultural fields, and a digital elevation model with information on elevation, slope, and aspect. We are beginning to key information on individual fields to information collected through interviews with farmers and key informants.

The third objective of the project is to develop cellular automata and agent-based models that utilize the narratives of economic, demographic, institutional, and cultural change to address “what if” questions concerning hypothesized changes in social and biophysical variables and to increase our understanding beyond the available empirical data.

We have developed a first draft of a cellular automata model based on rules that predicts the conversion of fallow land in Southern Yunnan and Northern Laos to rubber. The rules are based on our understanding of the factors that affect farmers’ decisions to convert to rubber (we are currently revising these rules based on what we learned from the fuzzy cognitive mapping exercise conducted this summer). We then prioritized these rules by using Analytical Hierarchical Process (AHP) modeling. AHP quantifies the dominance of a set of decision elements among one another in assessing achievement of a higher-level goal or criterion. Dominance is an abstract mathematical notion of “more-ness”; in practice, dominance being assessed can represent preference on behalf of a decision maker, importance, likelihood, etc. AHP’s capacity to quantify dominance is especially valuable in cases where the decision maker has a good deal of knowledge about a given problem system (especially the structure of the problem—the way that components related to the problem or participating in it are interrelated), but the knowledge is not already cast mathematically as data. An AHP model relies on expert knowledge of the decision maker.

Broader Impacts

The project is structured to allow participants to learn from each other's experiences and to develop a more realistic understanding of the challenges and opportunities involved in developing an integrative theory of human-environment relationships. The project is designed to acknowledge and to meet the urgent need to look at the social implications of land-cover and land-use change on the numerous different ethnic groups found in montane mainland Southeast Asia. One goal of the project is to raise the visibility to policy makers of these groups who are underrepresented in discussions on the human dimensions of global environmental change. The project will produce both integrative publications and articles of more disciplinary focus of research results by the collaborating scientists, both jointly and individually. Dissemination of research results will be facilitated by the experience and established infrastructure of the East-West Center with long-established links in Asia. Research findings will be presented both at local seminars in montane mainland Southeast Asia involving the scientific and development community as well as at international fora.

Project Website

<http://www2.eastwestcenter.org/environment/MMSEA/>