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Land Use Changes in the Uplands of Southeast Asia: Proximate and Distant Causes

Introduction

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Humans have been influencing changes in land cover through their changing patterns of land use since the invention of agriculture. The initial small footprints left by agricultural settlements have grown larger overtime and today it is estimated that roughly 50% of the earth's land surface has been affected and transformed by human activities [Vitousek *et al.* 1997; Haberl *et al.* 2007]. This impact is not static, but rather is constantly changing as resource use patterns, farming systems, and settlement patterns change. Since the 1970s, with the application of information from satellite sources to the study of worldwide land use and land cover changes, interest in questions of how and why land use is changing and the impacts of these changes on the natural and built environment has grown. Studies focusing on land use and land cover change have been grouped under the title of "land change science," an inter-disciplinary field that investigates and attempts to understand the dynamics of land use and land cover changes within coupled human-natural systems [Turner *et al.* 2007]. The papers that make up this special issue fit within the scope of this field and attempt to address one of the central questions that land change scientists are addressing today: causes of land use change.

Turner *et al.* [2007] note that most of the proposed causal variables of land use change are proximate factors, such as immigration, subsistence farmers' impacts, deforestation, or local common property resource management strategies [Lambin and Geist 2006] and that more distant factors, such as national policies, tend to be difficult to connect empirically to land use change outcomes. This special issue attempts to address this issue within land change science by focusing on one region of the earth, the montane uplands of Vietnam, Laos, Cambodia, and Hainan Island (China), in Southeast Asia that has

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witnessed an increasing frequency of change over the past few decades. Each paper focuses on how land use, and consequently land cover has changed for the specific study area and the triggers, both proximate and distant, that have influenced the changes.

Background

After World War II, from the late 1940s to the late 1980s, the countries and localities of Southeast Asia represented in these articles experienced upheavals due to a state of almost constant warfare within the region. These upheavals were reflected in the local populations' land use changes across the region, including changes in the use of land in remote upland areas. The changes in land use were not uniform. In some parts of the region's uplands individual land holding was dissolved and cooperative farms and state managed forest enterprises were started. Examples of these types of changes in Vietnam are detailed in Truong *et al.* [2009] and Leisz [2009]; while in other parts, such as in Ratanakiri, Cambodia [Fox and Vogler 2009] and parts of Laos [Thongmanivong *et al.* 2009; Saphangthong and Kono 2009], the uplands were depopulated or people were displaced from their village area. Meanwhile, in other places in the region, such as some remote parts of Hainan Island, it appears that land use was little changed until present [Umezaki and Jiang 2009]. Other aspects of the region were also undergoing change. In most cases population grew and in some cases populations moved, but transportation routes and urban areas did not necessarily improve or grow. In some cases populations left urban areas, either because it was believed that the countryside was safer or because of forced migration, and many railways and roads were damaged by conflict.

Many of these conditions started to change in the late 1980s, as the region became more peaceful, and further change accelerated in the 1990s and into the 21st century. During this period multiple internal policies within each country changed, foreign direct investment to the countries increased, and the region, as a whole became more connected with the wider world. No matter if land use systems in the uplands were impacted by wider regional events during the previous decades or not, from the late 1980s to the first decade of the 21st century, events outside of the region's uplands started to make their impact felt and land use systems in the uplands have been changing. These changes in the land use systems have consequently been reflected in the land cover across the uplands.

The six articles in this special issue bring together 15 land use change case studies from the mountainous areas of Vietnam, Laos, Cambodia, and the province of Hai Nan in China. In each of these countries the mountainous areas are experiencing rapid bio-physical and socio-economic changes. Land use change within these countries, and even within the regions of the countries, is often viewed in

isolation from other regions and from other countries. As noted above by Turner *et al.* [2007], local people, drawing on proximate causes, can usually explain why land use is changing within their village, and explanations are often valid for the locality in question, but these changes are not consciously connected to external influences. The reality is that there are forces external to the village locality that are influencing, or driving the change, and these forces are put into motion by triggers, either of a local, national, or regional nature.

All of the case studies in this special issue investigate the following key questions: (1) what are the overall trends in land use change at the case study site? (2) what are the driving forces behind the case's land use change? and (3) what are the triggers that influenced the driving force(s) at each study site? By addressing these questions this issue seeks to compare and contrast the land use change trends, driving forces and triggers across the sites and draw out the relevant lessons regarding the realities of local land use change across the region and the relationship between these local changes and larger national and regional issues and influences.

Overview of Articles

The articles included here all focus on cases of land use change in the uplands of Southeast Asia. All of the articles make use of remote sensing data combined with ground truthing fieldwork and interviews with local people regarding how their land use has changed over each case study's time-period. The remote sensing methodology used by each of the case studies is similar, making use of air photos and visual interpretation and/or Landsat TM/ETM+ imagery and supervised classification techniques. Two of the articles look at the changing land use and land cover conditions of their case study sites from the late-1960s/early-1970s to the late-1990s/mid-2000, while the other four articles focus on changes in land use and cover from the late 1980s through the middle of the first decade of the 21st century.

The article by Saphangthong and Kono and the one by Dao *et al.* look at the period from the late-1960s/early-1970s. Saphangthong and Kono highlight changes in the land use and cover of three composite swidden farming villages in northern Laos over the period from 1973 to 1999. They divide their analysis into two parts for each of the villages, 1973–82 and 1982–99 and conclude that each of these phases have different mechanisms driving the land use changes. During the first phase drastic deforestation occurs, with reduction in forest cover by 40% to 60% depending upon the village. During the second phase forest cover per village remains constant, but there is an intensification of land use, specifically of agricultural land use. The triggers for each of these changes are different. During the first phase the trigger was the dissolution of community based authority and the transition to a central

government sanctioned local administration based authority. The transition left a period of no recognized authority in the study area, which triggered the deforestation of lands that had supported agriculture. The second phase of land use change, the intensification of the use of agricultural land, was also triggered by an external event, the government intervention into each village's land use system by enforcing a ban on shifting cultivation and introducing a land-forest allocation program.

Dao *et al.* examines land use changes in one village in north-central Vietnam. Similar to the previous cases, this article identifies two distinct phases of land use and cover changes. From the late 1960s to the late-1980s/early-1990s there is a decrease in the forest cover of the village. Two triggers are identified. The first is the proximate cause of population increase in the village, while the second is the increase of logging brought to the area by the state forest enterprise (set up in the 1950s) acting in response to the country's policy emphasizing reconstruction and infrastructure building needs. The second land use and cover change phase from the late 1980s to the mid-2000s saw an increase in forest cover. There are three triggers for this increase. The first is a change in government state forest enterprise policy, away from timber extraction and towards reforestation activities. The second is the government intervention at village level that saw the introduction of a wide range of forest conservation and rural development programs including a forest land allocation program at the village level. The third is the implementation of a foreign funded conservation program in the area that provided resources for reforestation activities and forest protection activities at the village level.

The four articles by Thongmanivong *et al.* focusing on northern Laos, by Leisz focusing on north-central Vietnam, by Fox and Vogler *et al.* focusing on northwestern Cambodia, and by Umezaki and Jiang focusing on upland Hainan Island, all discuss changes in land use and cover from the late 1980s through the mid-2000s. Thongmanivong *et al.* study two districts in northern Laos. They conclude that their study area populations are switching from subsistence rice farming to the cultivation of commercial crops, like rubber, and that an expansion of permanent agricultural land at the expense of swidden agricultural and forest fallow lands is taking place. The trigger initiating this change is market influence, facilitated by personal contacts, specifically the communication of information about the benefits of commercial crop cultivation, in this case rubber tree cultivation, versus subsistence rice farming that were transmitted to the study area's population via their transboundary social networks from China.

The article by Leisz focuses on four hamlet case studies of land use and cover change over three districts in north-central Vietnam. The case studies examine the changes in land use and cover from the 1989/93 period to the 1999/2003 period. Within the overall three districts study area land that is covered by mature trees, tree cover increased and land dedicated to agricultural land use decreased. Within the four hamlet case study areas a similar pattern was seen in each case: forest land use increased

and land reserved for agricultural land use decreased. Investigation into the reasons for the increase in tree cover concludes that there are two overriding factors influencing the expansion. The first trigger identified is the government forest and agricultural land allocation programs that were initiated in three of the four case study hamlets during the decade. The second trigger is the influence of the lowland demand for beef and pork that has reached the upland case study hamlets via the market. In each of the hamlet case studies cattle and pig raising for market has increased. The cattle and pigs are sold in the market, providing cash income to the case study population and decreasing the agricultural land needed per hamlet.

Fox and Vogler *et al.* examine three case study villages in Ratanakiri, Cambodia. The case studies illustrate that from 1989 to 2006 one of the village's protected forest area remained virtually intact and its total forest area decreased at a rate of 0.86% per year, while the total forest area of the second case study village decreased at an annual rate of 1.63%, and the forest area of the third case study village decreased at an annual rate of 4.88%. There are two triggers initiating the land use changes in all three of the case study areas: (1) national government policies to liberalize trade and (2) market access to/from the villages. These two in combination have influenced the village populations to initiate a land use schema that include the planting of rubber and cashew trees, whose products are sold in market, and the intercropping of upland rice within the fields where these trees are grown. The differing rates of forest cover change in the three study villages are a result of differing management strategies by the three villages. The one village with the slowest forest loss has been most successful at managing its resources, while the other two villages increasingly view land as a marketable commodity and have responded to market forces by developing more of their forest lands for income or for sale.

The article by Umezaki and Jiang focuses on two villages in the uplands of Hainan Island, China, and the land use and cover changes that have taken place from 1980 to the early 2000s. This period coincides with the dramatic changes in the Chinese economy as the country went from the planned economy period through the transition to a market economy. During this period of time the land-cover of the two study villages transitioned from predominantly grass/shrub to mature or secondary forest cover. While land-covers transitioned in unison, land use did not. Within one of the villages, the forest area expanded in an area that became a nature conservation park, while in the other village, the forest cover expanded in areas where tree plantations were cultivated. The triggers for these changes are identified by the authors as respectively being government intervention, e.g. the enforcement of conservation laws at the village level, and the market demand for cash crops that influenced the planting and expansion of tree plantations.

Conclusions

The articles in this special issue attempt to identify triggers of land use change in the uplands of Southeast Asia. While the case studies that make up this special issue are drawn from geographically disparate locations across the uplands of Southeast Asia, similar triggers of land use change are identified in each. Triggers of land use changes during the 1990s and the early 21st century rose outside the study area and outside the control of the people in each of the study areas. These distant triggers can be grouped into two major categories: central government policy change and market changes.

Central government policy changes are further subdivided into three main categories: land tenure policies, market policies, and policies related to state owned companies. The land tenure policies are the most widespread. In all but one of the case studies government policies related to the ownership or management of forest land is identified as a trigger leading to the increase in forest or tree cover. Government market policies are seen in one case study, Fox and Vogler *et al.*, where policies related to trade liberalization are identified as a trigger that influenced the land use in the study area. In this case, government policy is credited with decreasing the area under forest cover. Dao *et al.* document how government policies related to a state owned enterprise act as a trigger that leads to an increase of forest cover within the study area.

Market changes are shown to have an influence on land use changes in all of the case studies except for one. In northern Laos, Ratanakiri, Cambodia, and Hainan Island, there is strong market demand for tree plantation derived products, such as rubber and cashews. This demand is a trigger that influenced the local population to convert areas previously used for upland rice to tree plantations. This demand originates from locations far afield and illustrates how the world market can trigger local and remote land use, and ultimately land-cover, changes. In the four case studies related by Leisz, the market also has an influence. Market demand for meat from the lowlands of Vietnam influences upland populations to divert labor from upland cultivation tasks to cattle and pig raising tasks. This diversion of labor means that less upland is cleared for crops and tree cover is expanding as trees mature in previously grass and bush land areas.

The articles of this special issue corroborate other case study information that land use is changing across Southeast Asia [Mertz *et al.* 2009; Schmidt-Vogt *et al.* 2009] and that a forest transition is taking place within some of the countries of the region [Meyfroidt and Lambin 2008]. Further, the case studies present a clear message as to the triggers that are driving land use changes. The disparate case studies all point to two general categories of distant triggers. One category is initiated at the central government level and the other is initiated even farther afoot at the world-market level. The conclusion that

can be drawn from the case studies presented in this issue is that land use changes taking place today in the uplands of Southeast Asia are strongly connected with and being triggered by policies and demands initiating from locations that were in many cases not even in contact with the region as recently as 20 years ago.

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