Forest transition in Vietnam: A case study of Northern mountain region

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A B S T R A C T

Since the 1990s Vietnam has experienced forest transition, of which there are mainly two arguments to understand, one is 'smallholder agricultural intensification pathway', and the other one is 'policy initiated pathway'. The former puts more emphasis on local initiatives and the latter emphasizes the role of the government in forest transition. The purpose of this study is to clarify the relationship between the two pathways. Based on a particular case study from Vietnam, we analyze historical forest transition data generated from remote sensing imageries and field research during the period from the 1950s until 2008. As a result, we found that after 1989 the forest area in the study area recovered and smallholder played an important role in forest transition. However, they did not engage in reforestation activities on their own. Rather, government support, technical expertise, a tree processing facility, traders and a research institute all supported reforestation. This broader institutional support from government and the private sector was important next to farmer driven reforestation to explain forest transition.

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1. Introduction

Forest transition theory proposed by Mather provides a theoretical framework to explain forest transition which had been observed to occur along with urbanization and industrialization in several European societies (Mather, 1992). Rudel et al. (2005) advanced the discussion by suggesting two pathways of forest transition. The first of the two is an economic development pathway, and the second a forest scarcity pathway (Rudel et al., 2005; Mather, 2007). Under the economic development forest transition pathway, economic growth results in non-farm jobs, which pull farmers off of the land. As a result marginal agricultural lands are abandoned and left to forest regeneration. Under a forest scarcity pathway, scarcity of forest products increases their market value and as a result agricultural land is replanted with forests.

Forest transition theory was critically reviewed and linked to other land use and land cover dynamics (Perz, 2007). In recent years China, India, and Vietnam have experienced forest transition (Mather, 2007), confirming that forest transition can occur in the global South. There, however, more complex forest transition pathways can be observed (Mather, 2007). For instance, to understand forest transition in Vietnam requires paying attention to chronological and spatial explanatory variables (Mather, 2007; Meyfroidt and Lambin, 2008a).

Meyfroidt and Lambin (2008a,b, 2009) assessed various data sets of forest cover to test the applicability of forest transition theory in Vietnam. They proposed a new pathway that better reflects Vietnam's forest transition, a 'smallholder agricultural intensification pathway'. This pathway holds that a combination of population growth, land degradation, and political restrictions lead to land scarcity, but also to a decline in cultivation on hillsides. Two responses concurred as a result: an increase in labor input in fields with the highest agro-ecological potential, and reforestation of less productive hillsides.

Other case studies of the forest dynamics in rural Vietnam suggest a more important role of policy in forest transition (Gomiero et al., 2000; Sikor, 2001; Tachibana et al., 2001; Castella and Quang, 2002; Castella et al., 2006; Truong et al., 2009). Mather (2007) also pointed out the contribution of policy to forest transition, concluding that it is important, but cannot fully explain forest transition in Asian countries.

Policies that relate to forest transition in Vietnam, however, include supplying tree seedlings for reforestation, providing chemical fertilizers for agricultural intensification, and the improvement of infrastructure to access markets. Furthermore Vietnam's forest policies not only focus on forest use and management, but also on broader social issues of forest residents, such as poverty alleviation and securing food supply. Forest policies that affect forest transition pathways are more or less interrelated, and the interactions vary between regions. For instance, agricultural intensification is a result of introducing high yielding varieties but also of technological improvements like constructing irrigation and drainage systems. Truong et al. (2009) pointed out the importance of multiple channels that link government agencies with the rural population.

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Forest recovery is difficult to link to any specific policy, but rather the result of multiple integrated policies (Truong et al., 2009). Policies in Vietnam have both direct and indirect impacts on forests and thus influence on forest transition pathways. We add a new forest transition pathway, which we call the 'policy initiated pathway' in this study.

The purpose of this study is to clarify the relationship between the 'smallholder agricultural intensification pathway' (Meyfroidt and Lambin, 2008a) and the 'policy initiated pathway'. The first puts more emphasis on local initiatives and the second emphasizes the role of the government in forest transition. We analyze a particular historical case on forest cover change and the related policy in Ngoc Quan village of Doan Hung district, and expand the scope of forest transition theory with this case study. We also aim to contribute to a better understanding of forest transition in Vietnam.

2. Study site and research methods

This study analyzes historical forest transition data generated from remote sensing imageries and field research in Ngoc Quan village of Doan Hung district, Phu Tho province (Fig. 1). It investigates the village's forest transition and identifies factors that have influenced these changes from the 1950s until 2008.

2.1. Study site

Ngoc Quan village is about six km from Doan Hung district town and 160 km North-North-West of Ha Noi, the capital of Vietnam. The region is identified as Vietnam's midland, as it is located in a transitional zone between northern Vietnam's deltaic plain and the high mountains. The midland, which covers approximately one-third of northern Vietnam, is characterized by rolling hills and flat plain between hills (Vien and Fahrney, 1996). The village topography is characterized by low hills, with the highest point being the Dau Mountain in the south-west, with an elevation of 340 m above sea level (Fig. 2). The Digital Elevation Model (DEM) in Fig. 2 shows the elevation increase toward the west and south west border of the village.

In 2005 Ngoc Quan had a population of 6039 persons belonging to 1465 households. The village inhabitants belong to 92% *Kinh* and 8% to *Cao Lan* ethnic groups. With an area of 1420 ha, Ngoc Quan had in 2005 a population density of 425 persons/km^2. The Doan Hung district population density is 356 persons/km^2 (Doan Hung district year book). The population trend in Ngoc Quan is shown in Table 1 which illustrates the rapid increase since 1952.

In 2005 93% of the households engaged in agriculture and forestry. Agriculture includes paddy rice growing in lowlands, dry land-cash crop agriculture in paddy fields after rice growing and on upland fields at the foot of the hills, and animal husbandry. Forestry activities focus on industrial tree planting on the hills. The village has no natural forest left. Industrial tree plantations include eucalyptus (*Bạch đàn*), styrax (*Bồ đề*), acacia (*Keo lá tràm*), manglietia (*Mỡ*) and bamboo (*Diễn*).

2.2. Image analysis and field survey

Our research combined interpretation of remote sensed images, and analysis of statistical data and of information from field surveys. The remote sensed images included aerial photos from 1952, Corona satellite aerial photos from 1967 and 1973, Landsat Thematic Mapper (TM) satellite images from 1989 and 2000 and Enhanced Thematic Mapper (ETM) images from 2005.

Vietnam has over the years used different criteria to define forests, which created difficulties in carrying out the time-series analysis (Truong et al., 2009). Since the changes in forest cover are the central focus of this study, a classification of forest according to forest canopy cover should be a more appropriate one. Therefore, we used the following classes for classification: non-tree cover, including water, paddy fields, upland agriculture, bush and grasslands, and tree-cover. Tree cover only includes an area that has a tree crown coverage >40% (Table 2).
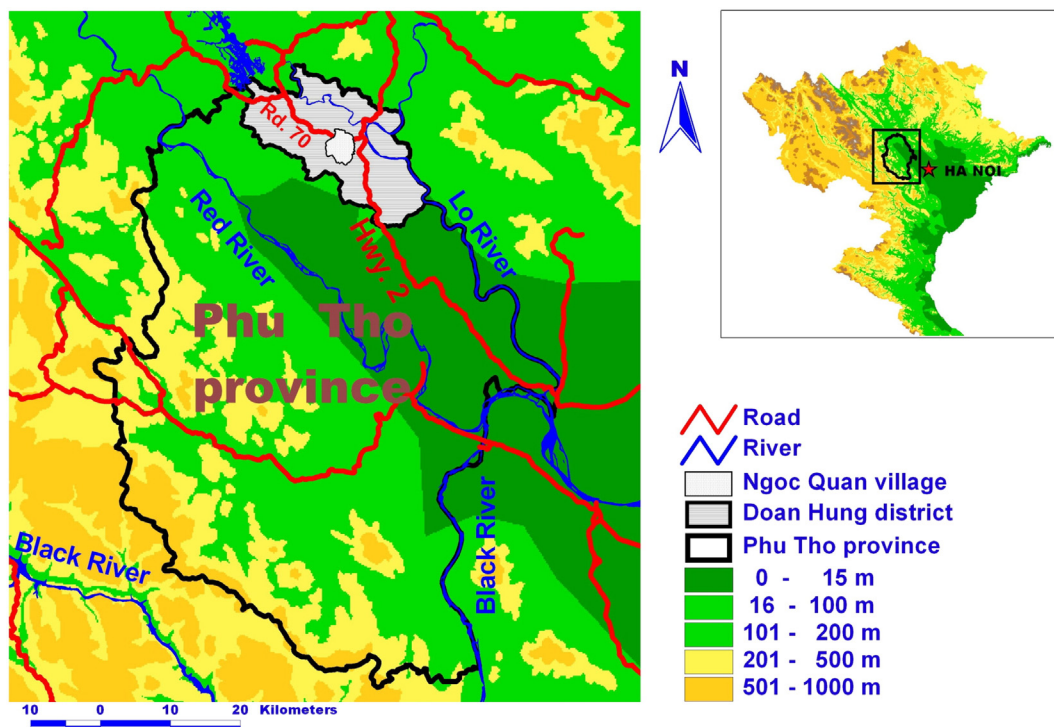

Fig. 1. Location of the study site in Vietnam's Northern mountain region.