

Rubber is Replacing Natural Forests in Mainland Southeast Asia

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Over the past 50 years, the mountainous region of Mainland Southeast Asia has witnessed a dramatic expansion of commercialized agriculture. The emphasis has been on tree-based cash crops, and in particular, rubber. Much of this expansion has come at the expense of the region's native forests.

A detailed study of time-series data derived from satellite images tracked land-use and land-use change in Southeast Asia from 2003 to 2014. The study focused on the areas where land-use change has been most dramatic—all of Cambodia and Lao People's Democratic Republic (PDR), most of Vietnam, parts of Thailand, Shan State in Myanmar, and Xishuangbanna Prefecture in southern Yunnan, China (Fig 1).

During the 11-year study period, farmers converted approximately 74,960 km² of land to rubber, so that by 2014, rubber accounted for 8 percent of total land cover in the region (Table 1). Seventy percent of this expansion came at the expense of natural forests, while 30 percent occurred in other areas, mainly cropland. Deforestation was greatest in Cambodia and Lao PDR, but there was also significant loss of forests in Vietnam, Xishuangbanna Prefecture, China; and Shan State, Myanmar.

Land-cover	2003	2014
Water	18,628	21,007
Evergreen forests	372,081	289,190
Deciduous forests	173,328	158,128
Low vegetation	304,359	324,097
Rubber	19,322	94,284
Sugarcane	0	1,011
Rotational agriculture	155,287	155,287
Orchards	28,488	28,488
Pineapple	2,531	2,531
Eucalyptus	44,829	44,829
Coffee	19,533	19,533

Table 1: Land cover (error adjusted area estimates of land cover) in km². We mapped the dynamics only among the classes: water, evergreen forests, deciduous forests, low vegetation, rubber, and sugarcane. We did not map changes in the classes marked in gray. We do not know how much they expanded or contracted and from/to which land-cover type. Thus, we can assume that in 2003, forest areas were larger and farmers cleared forests between 2003 and 2014 to plant orchards, eucalyptus, and coffee.

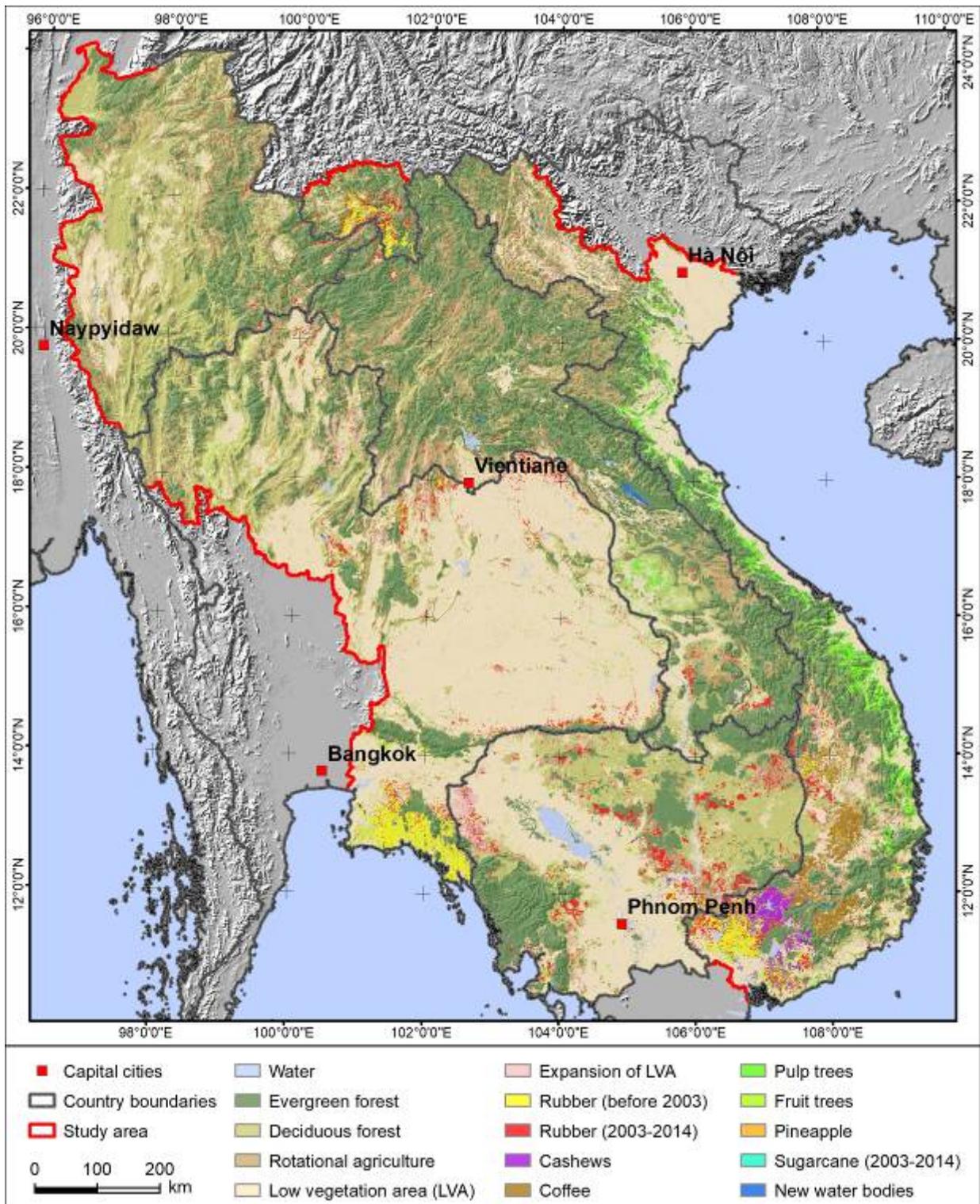


Figure 1: Land-cover change classification of MSEA. We grouped change trajectories to rubber and sugarcane into one class.

Such a massive transition from natural forests to agricultural crops—even tree crops—has worrying consequences for the environment. Preliminary evidence suggests that rubber plantations take up much less carbon dioxide than natural forests. At the local level, the replacement of natural forests by rubber plantations can lead to drier conditions, surface erosion, loss of soil quality, sedimentation and disruption of streams, and risk of landslides.

What appears to be governing the pace of rubber expansion? The primary driver appears to be fluctuations in world rubber prices. Starting in early 2002, rubber prices rose steadily until the economic crisis of 2008. At that point, prices fell steeply, but they recovered quickly and continued rising until the European debt crisis in 2011, when they fell again. Prices deteriorated until about 2014 and have fluctuated since then but essentially remained stagnant.

Although rubber expansion generally followed price fluctuations, the pattern has been somewhat different in each country of the region. In Cambodia, rubber plantations and farmers converted 28,738 km² to rubber between 2003 and 2014. Virtually all (98 percent) of these new rubber plantations replaced natural forests. Companies granted large government land concessions planted most of the rubber trees, but then in 2012, the Cambodian government placed a moratorium on new land concessions. Companies that had already received land continued to plant rubber trees, in spite of unfavorable prices, because the law required that concession utilize all the land granted to them. Recent interviews indicate that companies are diversifying into cashews and black pepper.

In Lao PDR, rubber plantations and farmers converted 7,291 km² to rubber between 2003 and 2014. As in Cambodia, virtually all (97 percent) of these new rubber plantations replaced natural forests. Up to 2007, a land titling program granted large concessions to companies from neighboring countries, most often Vietnam or China. The Chinese companies also received subsidies through the Chinese government's Opium Replacement Program, initiated in 2004 to curb opium production. The Lao government placed a moratorium on new land concessions in 2007 and again in 2012, and rubber expansion essentially stopped after the 2011 financial crisis.

Growers planted about one-half of the rubber plantations in Vietnam before 2003. Of the newer plantations, 71 percent replaced natural forests. In 2009, the government issues a policy aimed at encouraging the production of rubber, but as in other countries, expansion dropped after the financial crisis of 2011.

The pattern has been quite different in Thailand. Between 2003 and 2008, many small farmers in northeast Thailand converted existing cropland to rubber plantations. During the study period, 2003–2014, farmers converted 18,915 km² to rubber. Only 11 percent of these new rubber plantations replaced natural forests, largely because the region had already been heavily deforested. After the 2008 economic crisis, farmers in northeast Thailand stopped planting rubber, and many planted fruit trees.

In Myanmar's Shan State, rubber plantations and farmers converted 2,866 km² to rubber between 2003 and 2014. Eighty-seven percent of these new rubber plantations replaced natural forests. In 2012, the government passed several laws to facilitate the development of large-scale land concessions for tree crops. The government granted most concessions in upland areas along the Thai and Chinese borders, taking land away from customary farmers whose tenure rights were not recognized. The Chinese government's Opium Replacement Program supported much of this activity. Despite favorable laws and Chinese support, rubber planting essentially stopped after the 2008 economic crisis, although there has been a slight uptick since 2012.

Rubber production has a long and complicated history in China's Xishuangbanna Prefecture. The government introduced rubber in the early 1980s, and the State planted more than one-third of the rubber trees in the prefecture before 2003. In 1982, the government dismantled large-scale collective farms. Beginning with a campaign in 2002, the government provided subsidies and extension services to small farmers who wished to plant rubber. Farmers converted eighty-four percent of the new rubber plots planted during this period from natural forests. Growers have planted little rubber in Xishuangbanna since the 2008 economic crisis.

This analysis shows that the expansion of rubber created significant deforestation in all the countries of the region except Thailand, where rubber farmers planted on land that had already been deforested. The expansion of rubber has slowed in recent years with the fall of international prices, but this does not necessarily mean that land cleared for plantations will revert to natural forests.

As farmers replace rubber, there has been a boom in bananas in northern Lao PDR and reports of farmers planting cashews and black peppers in northeast Cambodia. In Thailand, by contrast, some forests are beginning to regrow on former cropland, and in Vietnam, large

government-supported afforestation programs are contributing to expansion of secondary forests (fast-growing agroforestry plantations), although primary forests are still being lost at high rates.

This study has provided more detailed and accurate information on land-use change in Southeast Asia than was available in the past. The pace of change may have slowed, but it is unlikely that governments or farmers will allow significant areas of the region to revert to natural forests. Scientists need to conduct site-specific assessments to understand the impacts of the changes we have documented and to design approaches to minimize environmental damage.

Social and economic implications of change

What has happened to the livelihoods of local farmers where rubber expanded into areas they cultivated for centuries as well as their forest resources? In China, Thailand, and Vietnam, many farmers have been able to grow rubber, and they have become wealthy. In Cambodia, Lao PDR, and Myanmar, by contrast, large companies are squeezing traditional farmers out. Government policies and programs appear to make all the difference in who benefits from expanded rubber production and who does not.

China and Thailand: Flourishing smallholder production

In early 1950s, Chinese researchers developed varieties of rubber suited to the environment of Southeast Asian highlands and introduced rubber in Xishuangbanna Prefecture on large-scale collective farms. In 1982, China dismantled farming communes and returned the land to individual farmers. The government granted farmers in Xishuangbanna long-term use rights to their land and provided seedlings, technical support, and subsidies to plant rubber. Later, rubber farmers received food subsidies to cover the seven-year period before newly planted rubber trees become productive.

As of 2014, rubber plantations covered 6,182 km², or 29 percent of Xishuangbanna Prefecture. Many Chinese rubber farmers have achieved unprecedented wealth. They can now send their children to secondary school and, in some cases, on to university, buy insurance for retirement and healthcare, and take holidays in the city.

In Thailand, the government began promoting rubber in the northeast region in the 1970s. By 2014, rubber plantations in the northeast covered 9 percent of the region.

A state agency, the Offices of the Rubber Replanting Aid Fund (ORRAF), provides technical advice, seedlings, fertilizer, herbicides, and low-cost credit for labor costs (including family labor). ORRAF also supports alternative income-generating activities to help farmers maintain their livelihoods between the time they plant rubber and begin to harvest.

At the community level, ORRAF supports the formation of growers' organizations and cooperatives. As in Xishuangbanna, with secure tenure rights and the support of government programs such as ORRAF, smallholder rubber farmers in Northeast Thailand have greatly increased their household wealth.

Cambodia and Lao PDR: Large-scale commercial enterprises

As of 2014, rubber plantations covered 15 percent of Cambodia. Seven previously state-run plantations, which had been privatized, controlled one-half of this area; companies that had received government land concessions controlled the other half.

The Cambodian government has drafted legislation to protect the land rights of small farmers and ethnic minorities, but these policies lack implementation. Illegal land purchases and the leasing of large economic concessions are increasing rapidly, often facilitated by local government officials in exchange for "commissions."

The shift from subsistence to commercial agriculture in Cambodia has created a new source of income for some local families. In other communities, local farmers have lost their land to illegal speculators, and villagers are struggling to maintain control over their communal lands and forests in the face of growing outside pressures.

Rubber is a new crop in Lao PDR, and the government, lacking experience, has relied on external investment and expertise from state and private entrepreneurs in neighboring countries, particularly China, Vietnam, and Thailand. These external investments have triggered a huge increase in rubber production. In 2014, rubber plantations covered about 4 percent of the entire country.

In a context of poor governmental regulations and enforcement strategies, a large number of institutional arrangements have emerged. Senior government officials negotiated concessions to grow rubber on state lands placing large tracts under direct management by companies that

have limited interaction with local populations. Labor is frequently of foreign origin, which limits the transfer of knowledge to local farmers.

In other cases, the government granted outside companies the right to negotiate contracts with local villagers directly. The farmers provide land, and the companies provide seedlings, fertilizer and other inputs, technical knowledge, and market access. The farmers may also provide labor, or the company may hire workers. The farmers and the company are supposed to share the profits under a variety of arrangements. If farmers become too indebted during the seven years before their trees become productive, they can lose their land.

Some local farmers have been able to maintain control over production in the face of outside pressure, negotiating advantageous arrangements that limit the role of investors or even resisting companies' offers altogether. Other farmers have been victims of unfavorable contracts and varying degrees of coercion. Some have lost their land with little or no compensation. Consequently, in 2007, the Lao government placed a moratorium on land concessions, and announced a second moratorium in 2012. Cambodia placed a moratorium on land concessions in 2012.

Making Sure Local Farmers Benefit from the Transition to Rubber

Throughout the uplands of Mainland Southeast Asia, a steady global demand for natural rubber will continue to drive a transition from traditional farming systems to rubber plantations. The impact of this transition on local farmers varies, depending largely on government policies and programs.

With a seven-year delay between planting and first harvest, rubber is a long-term investment, so first and foremost, farmers must have secure access to their land, either through secure tenure or through long-term use rights. Governments also need to provide technical support, credit, transport, and marketing services such as those provided by ORRAF in Thailand. It may be useful to establish a unified governing body to work closely with all sectors of rubber industry. At the local level, long-term, sustained community building appears to be essential for the support of rubber cultivation, tapping, processing, and marketing.

The establishment of large-scale commercial rubber plantations in Cambodia and Lao PDR has had adverse effects on local farmers, in some instances, even driving them off their

land. By contrast, experience in China's Xishuangbanna Prefecture and northeast Thailand shows that appropriate government policies and support can create a viable smallholder rubber industry that moves rural households and communities out of poverty.

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