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P34.13

LUCC in the Philippines over the 20th century: links to population growth, food demand and trade

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Understanding dynamics of land use and cover change (LUCC) is of crucial importance when discussing global change. Historically, LUCC has contributed a large share to total emissions of greenhouse gases (Houghton, 2003). Close links between LUCC, population growth and increased demand for agricultural produce have been suggested (Geist and Lambin, 2002). We investigate these links for the Philippines over the 20th century. This forms a compelling case, as over this period the nation's population grew exponentially, from 8 to 80 millions and massive LUCC took place. A consistent data set of LUCC over the 20th century was established through extensive literature research, utilizing the best available sources and applying simple modeling approaches to fill gaps (details see Kastner, 2007). To link LUCC to food demand, actual land demand of the prevailing food consumption patterns was calculated. The approach used is similar to methods suggested by Gerbens-Leenes et al., 2002 and Erb, 2004. We use FAO food balance sheets and data on production, yields and trade from various historical sources to establish the time series. [insert Figure 1 here] Looking at LUCC over the 20th century (Figure 1), we find that – while population grew exponentially – changes in LUCC were less continuous. Deforestation was strong throughout the century until the late 1980s. Large differences exist, however, of what happened to the cleared lands. Over the first half of the century, deforestation was linked to the expansion of permanently cultivated area. Large shares of the cleared lands were planted to rice and cash crops (mainly coconuts). In the second half of the century this picture changed. Deforestation continued – linked to large scale exports of wood – mainly on sloped lands not suitable for permanent cultivation. Large areas of grass- and brushland and minor quality re-growth forests emerged, being of low economical and ecological value. At the same time agricultural intensification (through irrigation and increased inputs of labor, fertilizers and fossil fuels) brought about rapid yield increases on land already under cultivation. These changes in land use intensity, lead to the decrease in average land requirements per capita and necessary increases in food production could be achieved without further aerial expansion of agriculture. Over the last decades yield increases have slowed down, while population still increased strongly. This was linked to changes in the nation's trade patterns. As a colony the country was integrated into the global economy early-on, mainly as exporter of tropical cash crops. Large areas of cultivated lands were devoted for export crops. Over the past decades, the share of these areas declined, while imports increased. Linked to increased domestic demand, the trade balance of the country changed and the Philippines are now a net importer of biomass. In this way, actual land demands for food consumption could increase further, while area domestically under production stabilized (Figure 2). [insert Figure 2 here] This research gives valuable insights in historical dynamic of land use change. It shows, that developments in LUCC are often non-linear and dependent on factors such as land availability and quality, land management practices and links to the global economy. Considering the Philippine future, this study raises some serious concerns: population is projected to double by 2050, and current domestic increases in food production lag behind population growth rates. A high import-dependency seems not advisable for a rather poor country, having increased global food prices, and food – bio-fuel competition in mind. A solution could be to find ways rehabilitate the vast areas of degraded lands and use them more profitable.

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