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PERSPECTIVE

Trading forests for yields in the Peruvian Amazon

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Our knowledge of how agriculture expands, and the types of land it replaces, is remarkably limited across the tropics. Most remote-sensing studies focus on the net gains and losses in forests and agricultural land rather than the land-use transition pathways (Gibbs *et al* 2010). Only a handful of studies identify land sources for new croplands or plantations, and then only for farming systems aggregated together (e.g., Koh and Wilcove 2008, Morton *et al* 2006, Gibbs *et al* 2010). Gutiérrez-Vélez *et al* (2011), however, have taken a leap forward by tracking the different expansion pathways for smallholder and industrial oil palm plantations.

Using a combination of Landsat, MODIS and field surveys, they investigate whether higher yields in new agricultural lands spare forests in the Peruvian Amazon and in a smaller focus area in the Ucayali region. Across the Peruvian Amazon, they show that between 2000 and 2010, new high-yield oil palm plantations replaced forests 72% of the time and accounted for 1.3% of total deforestation, with most expansion occurring after 2006.

Gutiérrez-Vélez *et al* went further in the Ucayali region and compared land sources for new high-yield and low-yield plantations. Expansion of higher-yield agricultural lands should logically reduce the total area needed for production, thus potentially sparing forests. In the Ucayali focus area, expansion of high-yield oil palm did convert less total land area but more forest was cleared than with low-yield expansion. Smaller-scale plantations tended to expand into already cleared areas while industrial-scale plantations traded their greater yields for forests, leading to higher land-clearing carbon emissions per production unit (Gibbs *et al* 2008). Gutiérrez-Vélez *et al* show that higher yields may require less land for production but more forest may be lost in the process, and they emphasize the need for stronger incentives for land sparing. The potential land-saving nature of these high-yield plantations could be further analyzed by considering whether they help depress global prices, reducing incentives to expand elsewhere (Angelsen and Kaimowitz 2001).

The significance of the study goes well beyond the bounds of Ucayli, and highlights risks to Amazonian forests from oil palm expansion (Butler and Laurance 2010). Oil palm is an astoundingly profitable and productive crop, with typical oil yields more than ten times that of soy. Some have even argued that oil palm is innately land sparing because it would take substantially more land for all other oil-bearing crops to provide the same output. However, most production gains from oil palm have occurred through increased area rather than increased yield, and in many cases expansion has been through forest clearing (Koh and Wilcove 2008, Gibbs *et al* 2010). The findings of Gutiérrez-Vélez *et al* (2011) are particularly significant considering that the booming palm oil sectors in Indonesia and Malaysia, which currently produce over 80% of the world's product, are facing a host of pressures that constrain future area expansion. Malaysia has little remaining land suited for plantations and Indonesia faces intensifying international scrutiny over the future of their forestlands. Consequently, the Amazon basin is widely considered the new frontier, with more than half of its forest area suitable for palm oil cultivation (Butler and Laurance 2010) and

growing incentives from Brazil's Program for the Sustainable Production of Oil Palm, which aims to utilize degraded lands and spur reforestation efforts.

Their results also illuminate another key issue, namely the constraints faced by large-scale producers when they seek to expand plantation area. Emerging demand-side conservation efforts, such as the Roundtable for Sustainable Palm Oil (RSPO), assume that already cleared and non-forested lands are freely available. Gutiérrez-Vélez *et al* (2011) hint at the obstacles to using such cleared lands, which is that they are inhabited and often have contested land tenure. We must carefully consider our consumption of these commodities in the face of growing land scarcity (Lambin and Meyfroidt 2011). If high-yield plantations displace low-yield plantations they too may follow the path of industrial agriculture and resume destruction of the forests that conservation efforts aim to protect. Without clear incentives to spare land, we could be trading forest for higher yields.

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