The end of slash-and-burn by Amazonian smallholders?

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Abstract

Wildfires pose a major threat to the integrity of the planet’s remaining tropical forests, whose flammability is increased by continued fragmentation and over-exploitation of timber, combined with more frequent and severe droughts from a changing climate. Forest fires also jeopardize the effectiveness of investments in forest conservation from carbon finance, in addition to having the potential to cause serious health problems in rural populations. Consequently, the use of fire in tropical agricultural – traditionally used as a labour-saving method of clearing fallow - appears increasingly incompatible with both forest conservation and sustainable development for the very communities who depend upon its use. Yet governments in forested tropical regions lack capacity to deliver fire-free alternatives to slash-and-burn for hundreds of thousands or millions of smallholders. In this paper we examine the potential for a transition away from slash-and-burn by smallholders as an unexpected consequence of the tractor provision through the private sector and capitalized farmers. We evaluate plausible smallholder transitions (from slash-and-burn to mechanization) by comparing three competing hypotheses, (i) a public sector-led transition through government investment, ii) a private-sector led transition amongst smallholders driven by tractor provision from intensive cattle-ranching and soy expansion (ii) an agricultural transition driven by rural demographic change and labour shortages. We examine possible evidence for such transitions at two spatial scales in the Brazilian Amazon using: (1) field surveys that capture land-management decisions between 2000-2009 by 480 farmers spread across 36 * 5000 ha landscapes in the eastern Amazon, and (2) 2006 agricultural census data at the municipal scale (n=771) capturing land-management decisions by 732,672 rural producers across 1.15 million km2 of farmland in the Legal Amazon. Our field data gives evidence for a partial transition by smallholders from slash-and-burn to mechanization led by the private sector and an increasing prevalence of fire-free landscapes in areas with higher private tractor provision. At the basin-wide scale a smallholder transition from slash-and-burn to mechanized

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fallow clearance was also observed and was associated with intensive cattle-ranching (but not soy farming) and the local supply of privately-owned tractors. Conversely, the transition was inhibited by high rural labour supply (males aged 15 to 59) and rural poverty, presumably indicative of low farm worker wages. Local government spending had no observable impact on tractor-use but this spending was associated with a more ‘complete’ transition in which smallholder tractor use was combined with application of fertilizer. We combine these sources of farm-management data with satellite-derived estimates of fire-occurrence to explore whether smallholder transitions at the scale of the entire Amazon basin result in fewer forest wildfires. Finally, at the basin scale we consider the spatial distribution of road networks, privately owned tractors and vulnerable forest to explore the viability of using public funds to provide smallholders with temporary access to tractors during El Niño events in order to maintain rural livelihoods and safeguard forests.

**Keywords:** slash, burn, Amazon, fire, smallholders, forest degradation, mechanization