Chapter 5 - Fire Suppression and Safety

Tropical forest degradation in the Brazilian Amazon – relation to fire and land-use change

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Abstract
While deforestation represents an obvious ecosystem change, forest degradation is often more difficult to discern or quantify, but it impacts a number of ecosystem functions which are vital for biodiversity and climate feedbacks. In the Brazilian Amazon, land-use changes increase fire occurrence, especially in fragmented forests close to managed land. We used remote sensing imagery to estimate the extent and impact of forest fires in degraded tropical rain-forest in the Brazilian Legal Amazon between 2007 and 2010 and examined land-use establishing in degraded areas. The trends in degraded area vs. burned area were different. Even though degradation increased one year after a high fire year, there was no spatial overlap, which points to other causes for degradation. Up to 11% of the degraded area was burned in the same year, playing escaping fires from managed and deforested lands a significant role in degradation by fire. Eighty-four percent of 2007s degraded area remained forest one year later, whereas the rest was identified as deforestation, secondary vegetation or pasture. Three years after degradation, 80% remained forest, the proportion of deforested area decreased and areas in regeneration after being deforested increased. Monitoring of forest degradation across tropical forests is critical for developing land management policies and for carbon stocks/emissions estimation.

Keywords: forest degradation, logging, forest fires, land-use, Brazilian Amazon.

1. Introduction

In Brazilian Amazonia, the extent of canopy and subcanopy disturbance has been underestimated and often exceeds the total area deforested (Peres et al., 2006; Souza Jr. et al., 2013). Deforestation in the region is superimposed upon synergistic processes of anthropogenic forest degradation (events when, unlike in deforestation processes, the forest canopy cover is only partially or temporarily removed), which implies the reduction in the overall capacity of a forest to supply goods and services (Simula, 2009). Several aspects of the forest may be affected by degradation including productive capacity, protective capacity, biodiversity and health and carbon storage (Parrotta et al., 2012). The proximate drivers of forest degradation include unsustainable and illegal logging, human-induced fires, over-harvest of fuelwood and non-timber forest products, overgrazing and poor management of shifting cultivation (Chazdon, 2008; Kissinger et al., 2012). In addition to these adverse impacts of land-use change and human-induced forest degradation, climate change poses an increasing threat to tropical forest ecosystems increasing the frequency of severe droughts (Malhi, 2012).

In the Brazilian Amazon humans have substantially altered forest fire regimes and fires have increased in extent and frequency as a result of forest fragmentation, the expansion of managed lands and logging (Asner et al., 2005; Morton et al., 2008; Armenteras et al., 2012), thus contributing to forest degradation and reducing forest resilience (Barlow and Peres, 2008; Nepstad et al., 2008). Moreover, forest fire can increase susceptibility to further burning in a positive feedback by killing trees, opening the canopy and