Land cover dynamics following a deforestation ban in northern Costa Rica


Introduction
Forest protection policies potentially reduce deforestation and redirect agricultural expansion to already-cleared areas. In 1996, the Costa Rican government banned deforestation country-wide and concentrated payments for environmental services (PES) within Biological Corridor zones to promote tree plantations and protect forests on private land. Using satellite imagery, we assessed whether deforestation for pasture and cropland decreased in the lowlands of northern Costa Rica following the ban on forest clearing, despite a tripling of area under pineapple cultivation in the last decade.

Results and Conclusions
Following the ban:
- Mature forest loss decreased from 2.2% to 1.2% per year (Fig. 2).
- The proportion of pineapple and other export-oriented cropland derived from mature forest declined from 16.4% to 1.5% (Fig. 3).
- All agricultural land covers decreased their proportional expansion into mature forest (Fig. 4).
Overall, there was a small net gain in forest cover due to a shifting mosaic of regrowth and clearing in pastures (Figs. 5 and 6).

We conclude that forest protection efforts in northern Costa Rica likely have slowed mature forest loss and succeeded in re-directing expansion of cropland to areas outside mature forest.

Our results suggest that deforestation bans may protect mature forests better than older forest regrowth and may restrict clearing for large-scale crops more effectively than clearing for pasture.

Methods

Figure 2: A) mature forest loss rates over time from single-date classifications; B) total forest (mature forest, native reforestation (natural regeneration and native tree plantations), and exotic tree plantations) loss rates over time. All errors are 95% confidence intervals derived from Tables 1 or 2, respectively.

Figure 3: Conversions of other land-uses to cropland. The percentage of total land converted to cropland from mature forest is labeled in dark green.

Figure 4: The expansion of banana, pineapple, and pasture into other land covers over time; note the different axis scales. From 1986-1996, pasture expanded into mature forest proportionally more often than it was represented in the landscape (see Figure 5).

Figure 5: Percent change in each land cover category over time within the study area. Error bars are 95% confidence intervals.

Figure 6: Map of land cover changes over time in the region, in two time intervals: 1986-1996 and 1996-2011. Native reforestation and exotic tree plantations regrew from 1986 to 1996, and may have persisted to 2011 or have been cleared between 1996 and 2011.