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Climate impacts of expanded soy agriculture in the arc of deforestation in Brazil

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The recent expansion of pastures and agricultural monocultures has resulted in 730,000 km2 of the Amazon Basin being deforested. Despite recent declines in the rates of forest clearing, the deforested area of the Amazon Basin is projected to advance from ∼18% today to as much as 40% by 2050 as the global demand for agricultural commodities continues to rise. This increase in deforested area for the expansion of crop and pasturelands is expected to exert important influences on the surface temperature and precipitation patterns across the Amazon. Until recently, our ability to quantify these effects of land use change on ecosystem processes was constrained by the lack of spatial-temporal information that captured the complex land use transitions in Amazonia. However, with the high temporal resolution and decade-long span of the MODIS dataset, we have new opportunities to not only map these complex dynamics, in spatial as well as temporal detail, but also to quantify their consequences for the regional climate. Here we present results from a spatial-temporal analysis of land-use transitions in Amazonia. In particular, we show that land use transitions during the 2000s reduced contemporaneous evapotranspiration (ET) in southeast Amazonia by 35 km3 and warmed the land surface temperature (LST) by 0.3 °C. Forest-to-pasture and forest-to-crop transitions accounted for most of the observed reductions in evapotranspiration and increases in LST. These results show that non-GHG forcing has already altered regional climate in southeastern Amazonia.