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The Maya Tropical Forest: Cascading Human impacts from Hillslopes to Floodplains

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We review the long-term human impact on fluvial systems in the Maya tropical forest region. Although most of this karstic region is drained by groundwater, the southern and coastal margins have several river systems that drain volcanic and metamorphic as well as sedimentary terrains. Some positive environmental impacts of Maya Civilization were the long-term impacts of both landesque capital, like wetland field systems, and other land uses that have enriched many soils. Some negative impacts included stripped soils and eutrophic rivers, both playing out again today with recent deforestation and intensive agriculture. We review trends in the region's fluvial systems, present new evidence on beneficial and detrimental impacts of Maya civilization, and present a new study using LiDAR mapping of fluvial geomorphology of the Belize River. Our new field research comes from the transboundary Rio Bravo watershed of Belize and Guatemala near the border with Mexico. This watershed today is mainly a well preserved tropical forest but from 3,000 to 1000 years ago was partly deforested by Maya cities, farms, roads, fires, and fields. We present studies of soils and sediment movement along slopes, floodplains, and water quality impacts of high dissolved loads of sulfate and calcium. We use AMS dates and soil stratigraphy to date slope and floodplain flux, and we use multiple proxies like pollen and carbon isotopes to reconstruct ancient land use. Aggradation in the floodplain and colluvial deposits began by at least 3,000 years ago and continued until 1100 years ago in several study sites. Some Classic period sites with peak human population and land use intensity experienced less soil erosion, perhaps due to soil conservation, post urban construction, and source reduction. Additional evidence suggests that ancient terraced sites and colluvial slopes that gained upslope sediment and soil nutrients from ancient Maya erosion had greater biodiversity. Lastly, we map fluvial geomorphology with LiDAR in the Belize River Valley, connect the LiDAR with aggradation and erosion evidence, and develop a model to field test the timing of erosion and aggradation in summer 2016.