

**ANCIENT MAYA LAND USE REDUCED THE RESIDENCE
TIME OF CARBON IN TROPICAL FOREST SOILS**

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Tropical forest soils constitute a large carbon reservoir (~700 Pg), but we know little about how they are affected by anthropogenic or climatic disturbances over time scales longer than decades. The Maya lowlands of southeastern Mexico and northern Central America provide a unique setting to assess the response of tropical forest carbon-cycling to long-term land-use change, given the widespread deforestation and agriculture practiced by ancient Maya populations between about 3500 and 1000 years BP. We calculated past changes in the mean soil residence time of plant wax lipids during the late Holocene using radiocarbon ages of plant waxes and terrigenous macrofossils in three lake sediment cores from northern Guatemala and the central Yucatan Peninsula of Mexico. Plant waxes in the lake sediments represent relatively slow-cycling soil organic carbon, and plant-wax ages in local soils are consistent with bulk soil organic carbon ages. The difference between ages of plant waxes and terrestrial macrofossils from the same stratum yield the mean plant-wax soil residence time (MRT_{wax}), and stratigraphic shifts in MRT_{wax} reflect changes in the turnover of recalcitrant soil organic carbon within the lake catchments. In all three lake cores we observed a decrease in MRT_{wax} of ~1000 years between 3500 and 1000 years BP, coinciding with intense deforestation and agricultural land use. This reduction in MRT_{wax} was partially reversed from 1000 to 200 years BP, a period of regional depopulation and afforestation. Comparison of shifts in MRT_{wax} and regional paleoclimate records suggests that the effects of hydrological variability on soil carbon dynamics were secondary to land-use effects. We conclude that ancient land use in the tropical forests of the northern Neotropics caused substantial, widespread changes in the turnover of recalcitrant soil organic carbon on millennial timescales. These data indicate that preindustrial anthropogenic activity significantly altered late Holocene soil carbon reservoirs, and suggest that recent deforestation could have millennial-scale effects on carbon storage in tropical forest soils.