Title: **Tracking the Structural Reassembly of Puerto Rican Tropical Forests Following Hurricane Maria**

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Project Abstract:

Hurricane Maria hit the island of Puerto Rico as a powerful Category 4 storm in September, 2017. Strong, sustained winds broke stems, uprooted trees, snapped branches from tree crowns, and stripped leaves from forests. Initial estimates of canopy tree damage indicated that Hurricane Maria resulted in greater damages than other recent hurricanes that hit the island, likely due to higher wind speeds and rainfall from Maria. Here, we combine pre- and post-hurricane data from forest inventory plots (2017-2020) and terrestrial laser scanning (TLS) data (2019-2020) to assess delayed mortality from hurricane damage, growth of damaged individuals, and rates of canopy closure from regrowth of canopy branches, resprouting of damaged canopy trees, and rapid growth of new individuals and understory vegetation. Field and TLS data were collected in wet forests on volcanic soils in El Yunque National Forest and moist forest on karst in Cambalache State Forest. In addition, we collected data in 2017, 2018, and 2020 using NASA Goddard's Lidar, Hyperspectral, and Thermal (G-LiHT) Airborne Imager with support from NGEE-Tropics (2017), the Department of Interior (2018), and the USDA-Forest Service (2020). High-resolution airborne data from G-LiHT provide important context for the landscape-scale heterogeneity of forest damage and recovery processes. Across the island, hurricane damages decreased fractional canopy cover by >20% , on average, and lowered average canopy height by approximately 4 m. These open conditions provided full sunlight to the forest floor, leading to rapid growth of pioneer species (e.g., *Cercropia*, *Inga*), palms (*Prestoea acuminata*), and understory vegetation, including lianas and herbaceous species. By 2020, the height of new pioneer trees reached 3-5 m, establishing a dense mid-story canopy layer comprised of both new individuals and sprouts. However, the forest canopy remained open based on the survival of damaged trees but limited regrowth of canopy branches lost during the hurricane. Together, the inventory, TLS, and G-LiHT data provide limited evidence for rapid canopy closure from canopy tree plasticity following disturbance. These findings challenge ecosystem models such as FATES to incorporate the survival and regrowth of damaged individuals and the time scales of forest recovery following catastrophic disturbance events such as hurricanes.