Title: **Catastrophic Forest Disturbance and Subsequent Regrowth in Puerto Rico Following Hurricane Maria**

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Project Abstract: Tropical cyclonic storms are an important cause of forest disturbance in coastal zones. We analyzed data from high density airborne lidar from Puerto Rico collected prior to Hurricane Maria (2017) and about eight months (2018) and 30 months (2020) following the storm. Our analyses covered both an elevational gradient (439 ha) from 100 to 800 m ASL in the El Yunque National Forest and transects (25,188 ha) distributed across the island. On the elevational transect, we found that forest canopy damage was widespread, with 73% of the study area losing ≥1 m in canopy height (mean = -7.1 m). Taller forests at lower elevations suffered more damage than shorter forests above 600 m. Yet only 13.5% of the study area had canopy heights ≤2 m after the storm in 2018 highlighting the importance of damaged trees and advanced regeneration on post-storm forest structure. Heterogeneous patterns of regrowth and recruitment yielded shorter and more open forests by 2020. Nearly 45% of forests experienced initial height loss >1 m (2017-2018) followed by rapid height gain >1 m (2018-2020), whereas 21.6% of forests with initial height losses showed little or no height gain, and 17.8% of forests exhibited no height changes larger than ±1 m in either period. Canopy layers <10 m tall accounted for most increases in canopy height and fractional cover between 2018-2020, with gains split evenly between height growth and lateral crown expansion by surviving individuals. Across the island of Puerto Rico, we measured canopy damage using flights from 2017 and 2018. Island-wide, canopy height decreased by an average of 4.8 m, or 34%, from a mean height of 13.2 ± 6.1 m before the storm to 8.4 ± 4.1 m after the storm. We selected 140,000 grid cells randomly from our full lidar collection (370,885 grid cells) stratified on estimated peak wind speed (Tropical storm, Category 1, or Category 2) and forest type (wet, moist, and dry). Using a Random Forests analysis, we found that the absolute change in canopy height was best predicted by pre-storm canopy height, maximum sustained wind speeds, and the distance from the path of the storm. We seek to understand how these data can be used to calibrate and benchmark FATES and other models. Our data inform rates of gap formation, crown expansion, and canopy closure following hurricane damage and highlight the diversity of ecosystem impacts from heterogeneous spatial patterns and vertical stratification of forest regrowth following a major disturbance event.