

Hurricane Wilma benefits mangrove forests at Everglades National Park

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WE TYPICALLY VIEW HURRICANES AS DISASTERS

that cause extensive damage, particularly to infrastructure but also to natural areas such as estuaries, beaches, and barrier islands. However, hurricanes also have ecological benefits, such as dispersing species to new areas; thinning forests, which may favor regeneration by specific species; and flushing bays. Additionally, in 2006, researchers at Everglades National Park (Florida) found that hurricanes added needed sediments to wetlands, in particular the park's mangrove forests. Along the southwestern coast of Florida, the average annual rate of sea-level rise is 0.07 inch (1.9 mm) per year; mangrove forests can keep pace with increasing sea-level rise only if an adequate sediment supply sustains the soil elevation relative to sea level. Hurricanes can provide a sudden pulse of sediment

to mangrove communities, which are critical habitat for the park's world-renowned wading bird populations—the primary reason for the establishment of the park. Mangroves also harbor threatened and endangered species (e.g., American crocodile [*Crocodylus acutus*] and West Indian manatee [*Trichechus manatus*]) and are an important nursery for many sport fish.

On 24 October 2005, Hurricane Wilma came ashore between Cape Romano and Everglades City as a category 3 storm, with sustained winds varying from 61 to 103 miles per hour (98 to 166 kph). Prior to landfall, Hurricane Wilma was the third category 5 hurricane of the 2005 Atlantic season but became the most intense hurricane on record in the Atlantic basin. The National



Mangrove forests, including the one at the mouth of the Shark River, cover more than 148,000 acres (60,000 ha) in Everglades National Park, Florida.

Oceanic and Atmospheric Administration National Weather Service Forecast Office estimated Hurricane Wilma's storm surge to be 16 to 18 feet (4.9 to 5.5 m) of water for the mangroves of southwestern Everglades National Park. As reported in *Natural Resource Year in Review—2005*, defoliation by Hurricane Wilma was so severe that researcher Thomas J. Smith expected that the mangroves would continue to die for months after the storm.

On 11 November 2005, investigators from the NPS South Florida/Caribbean Inventory and Monitoring Network and the U.S. Geological Survey sampled the storm deposit from Hurricane Wilma at a long-term soil surface monitoring site. Varying from 1.2 to 2.4 inches (30 to 60 mm) thick, the storm-deposited layer was composed of very fine marine material (1.2 to 1.6 inches [30 to 40 mm]) on top of mangrove leaf matter (0.4 to 0.8 inch [10 to 20 mm]), which hurricane winds had stripped from the trees. Deposition increased the elevation of the soil surface by about 1.2 inches (30 mm). The increase in soil surface elevation from this one hurricane was greater than the measured accumulation at the site for the previous seven years. This event deposited material that will “combat” 16 years of estimated sea-level rise. One year after Hurricane Wilma, investigators resampled the layer and found that minimal erosion (0.33 inch [8.5 mm]) had



In November 2005, investigators sampled the sediment layer deposited during Hurricane Wilma (red arrow) and the layer of green mangrove leaves stripped by hurricane winds (green arrow). Deposition during Hurricane Wilma is helping the mangrove forests keep pace with rising sea levels. The feldspar marker horizon (white arrow) is an artificial layer that investigators applied to the soil surface. It is slowly being buried in the soil column as sediment is deposited.

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occurred; approximately 68% of the storm-deposited, soil surface elevation remained. This gain keeps pace with 10 years of estimated sea-level rise. Additionally, numerous fine roots from the mangrove trees now penetrate the storm deposit.

The material deposited during Hurricane Wilma should have a beneficial impact on the overall soil elevation of the mangroves of southwestern Everglades National Park and will be an important factor for soil dynamics in the near future. Additionally, this deposit will have a lasting effect on soil nutrients and soil hydrological conductivity (how water moves through sediment). It may also change mangrove seedling recruitment and the burrowing fiddler crab (*Uca thayeri*) community. The ecological outcome of Hurricane Wilma in the mangroves of Everglades National Park will be the result of the interaction between the beneficial effect of the storm deposit on soil elevation and the deleterious impacts from large-scale tree damage and mortality. ■

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