

## Major hurricanes can have major impacts on marine environments

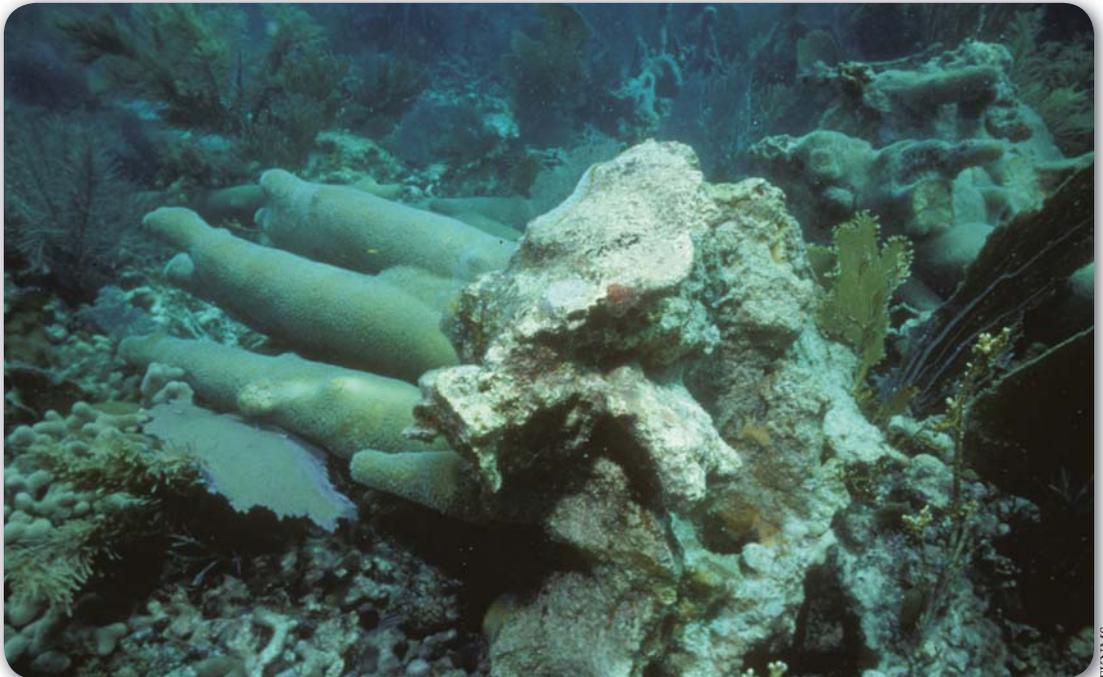
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The loss of human life and property is well documented for major hurricanes. However, the environmental effects of hurricanes are less well-known.

On August 24, 1992, Hurricane Andrew struck near Homestead, Florida just before high tide, resulting in a storm surge of 5.2 meters (17 feet) on the Atlantic coast and 4.6 m (15 ft) on the Gulf coast. It was a relatively dry storm and resulted in approximately 5 centimeters (2 inches) of rain. Its path over land was approximately 100 kilometers (62 miles) long, and it partially or completely defoliated vegetation over a 50 km (31 mi)-wide swath. However, Andrew was a very fast moving storm, which may have reduced its potential damage to the marine environments.

Hurricane Andrew affected nearshore water quality by increasing nutrients from runoff and disturbing bottom sediments.

Increased concentrations of phosphorus and nitrogen resulted in phytoplankton blooms and low levels of dissolved oxygen after the storm. Depleted oxygen levels in waterways resulted in the death of an estimated 7 million fish. In hardbottom communities, sponges, corals, and sea whips were sheared from their substrate and deposited in extensive wracks of debris along shorelines. Juvenile Caribbean spiny lobsters, normally found under sponges and in coral crevices in central Biscayne Bay, disappeared. Minimal losses of seagrasses were documented after Andrew, but seagrass meadows are not immune from storm damage. For example, three of the 30 permanent seagrass monitoring stations in the Florida Keys National Marine Sanctuary were deeply buried by sandy sediment during Hurricane Georges (1998); the seagrasses have yet to recover.



Pillar coral overturned by Hurricane Andrew in the Florida Keys.



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Hurricane Wilma destroyed a large area of mangrove forest near the mouth of Shark River, southwest Florida.

Hurricanes and tropical storms can be beneficial to coral reefs by breaking branching corals (*Acropora cervicornis* and *Acropora palmata*) into pieces, each of which can grow and form a new colony. However, the gains achieved by asexual proliferation of branching corals are likely to be offset by storm scouring and sediment smothering of other corals and turning over coral heads.

Hurricanes have been a central feature in the evolution of subtropical and tropical ecosystems; however, the natural ecosystems are not adapted to withstand additional impacts due to anthropogenic sources. For example, approximately 95,000 liters (25,000 gallons) of gas and oil were spilled into Biscayne Bay during Hurricane Andrew. The most severe damage noted to coral communities was from lobster and crab traps that smashed coral heads and reefs. A ship sank as an artificial reef broke free and destroyed natural coral reefs as it was carried by strong waves generated by the hurricane. During heavy rains, canals rapidly drain freshwater to coastal areas, which results

in rapid drops in salinity and untold impacts to marine biota.

Two weeks after Hurricane Andrew passed, the mangroves within the path resembled a deciduous forest in winter. Many trees that were completely defoliated have not recovered. At Highland Beach, where the hurricane eye left the west coast of Florida, more than 85% of the mangrove trees were blown over and uprooted.

Hurricane Donna (1960) spread the seeds of Australian pine (*Casuarina equisetifolia*), an invasive exotic plant, along the west coast of Everglades National Park, and the resulting vegetative overgrowth posed a threat to turtle nesting areas. Open patches in mangrove forests are threatened by the invasion of Brazilian pepper (*Schinus terebinthifolias*) because it can occupy open areas more quickly than native mangroves. In short, hurricanes may change the balance in favor of nonnative invasive vegetation that can have long-lasting impacts on the ecosystem.