Climate Change and U.S. Coastal Ecosystems

Jeffrey Q Chambers
Ecology and Evolutionary Biology

Tulane University
Hurricane Impacts on U.S. Coastal Forests

National Institute for Climatic Change Research (NICCR) Coastal Center project
Generic Image Endmembers

![Graphs showing reflectance vs wavelength for different categories: GV, Shade, NPV, and Soil. Each category has a graph depicting the mean and endmember bundle of reflectance over wavelength.]
Hurricane Katrina Impact in the Pearl River Basin

Stratified random sampling of hurricane tree mortality impact using $\Delta$NPV
Mapping hurricane Katrina impact at a regional scale: linking field ecology and remote sensing

Stratified random sampling of hurricane tree mortality impact using $\Delta$NPV
• 320 million trees dead or severely damaged – 100 Tg C of dead wood
• Annual net U.S. forest tree carbon sink = 100 Tg C
• Novel biological climate feedback hypothesis: Increasing CO₂, stronger storms, more dead trees, elevated ecosystem respiration, increasing CO₂.
Bad warmth. The AMO’s warm years favor more U.S. hurricanes (right).

Wobbly ocean. North Atlantic temperatures have wavered up and down at a roughly 60- to 80-year pace.
Warming the World’s Oceans

Gabriele C. Hegerl and Nathaniel L. Bindoff

Rising greenhouse gas concentrations in the atmosphere are trapping more infrared radiation near Earth’s surface. This extra radiation is expected to warm Earth’s surface and lower atmosphere, but observations indicate that most of the heat is transported into the oceans (see the figure). On page 284 of this issue, Barnett et al. (1) substantially strengthen the evidence that human activities are indeed warming the world’s oceans.

Observations have shown that 84% of the total heating of the Earth system since the 1950s is in the oceans (2). This increased ocean heat content has led to thermal expansion of the ocean, contributing at least 25% of the global sea-level rise observed over the same period (3). Ocean warming may also...
Impacts of tropical cyclones on U.S. forest tree mortality and carbon flux from 1851 to 2000

Hongcheng Zeng, Jeffrey Q. Chambers, Robinson I. Negrón-Juárez, George C. Hurtt, David B. Baker, and Mark D. Powell

www.pnas.org/cgi/doi/10.1073/pnas.0609141106
Impacts of tropical cyclones on U.S. forest tree mortality and carbon flux from 1851 to 2000

Hongcheng Zeng, Jeffrey Q. Chambers, Robinson I. Negrón-Juárez, George C. Hurtt, David B. Baker, and Mark D. Powell

www.pnas.org/cgi/doi/10.1073/pnas.0603914106

PNAS Early Edition | 1 of 5
22 gauge stainless steel linear polyethylene capped 6" pvc pipe
Summary

• Hurricane Katrina caused death and severe structural damage to ~320 million trees over an area the size of Maine.

• Katrina produced a “dead wood” flux equivalent to the net carbon gain by all U.S. forests in one year.

• LEAG-funded effort (yet to be published) to separate the effects of wind and storm surge in explaining variability in coastal forest disturbance variability.

• NICCR experiment to explore effects of storm surge and sea level rise on coastal ecosystems (forested wetlands and marshes)

• LEAG-funded project to explore how flooding height and salinity effects species composition within the enclosures

DOE National Institute for Climatic Change Research
NAnna
University of Notre Dame
University of New Hampshire Institute for the Study of Earth, Oceans, and Space
Long-Term Estuary Assessment Group