

Understanding the impact of frequent intense hurricane disturbance on the coastal pine/scrub-oak forests of the northeastern United States

Jeffrey P. Donnelly
Woods Hole Oceanographic Institution

1) Climate warming in the next century may cause increases in intense hurricane landfalls in the Northeast. Coastal pine/scrub-oak ecosystems in the Northeast provide essential goods and services and contain many rare and endangered species. Using a paleoecological approach this project aims to understand how increases in intense hurricane landfalls will impact pine/scrub-oak ecosystems.

2) The proposed work addresses several fundamental questions: 1) How will individual intense hurricane strikes impact pine/scrub-oak ecosystems? 2) How will this ecosystem respond to frequent hurricane disturbance? 3) How will frequent intense hurricane strikes impact the fire regime of this ecosystem? and 4) How will this ecosystem respond to a lack of hurricane disturbance?

3) The focus of the study is southwestern Cape Cod where sandy soils support a pine/scrub-oak ecosystem similar to many other areas in the Northeast.

4) An ideal way to examine how ecosystems will respond to future disturbance is to look to paleoecological records that document past responses to disturbance regimes similar to what is anticipated in the future. Proxy reconstructions reveal intervals of frequent intense hurricane strikes between 3500 and 1000 years ago in the Northeast. These intervals provide analogs for what we may experience over the next 100 years. In this study we will examine the record of vegetation change and fire occurrence over the last 2500 years recorded by the fossil pollen and macro-charcoal preserved in annually laminated high-deposition rate coastal pond sediments. The pond sediments also contain evidence of intense hurricane landfalls, providing a unique and ideal setting to study the response of the surrounding ecosystem to hurricane disturbance from the event to centennial scale.

5) The proposed work will couple a detailed regional record of prehistoric catastrophic hurricane strikes with an ultra-high resolution reconstruction of changes in vegetation and fire. The results should reveal how catastrophic hurricanes and fire affect the form and function of pine/scrub-oak ecosystems and will provide an important benchmark for predicting how this ecosystem will respond to future increases in intense hurricane activity. The results can be integrated into a variety of ecological models that examine ecosystem disturbance and climate change and will improve our ability to predict and manage future changes to these ecosystems. In addition our results may provide insights into how other ecosystems may respond to increased hurricane disturbance. And finally, the time scales of our results will provide managers with critical information needed in planning.