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

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1) Northeast coastal pine/scrub-oak ecosystems provide essential goods and services and contain many rare and endangered species. These ecosystems may be sensitive to significant changes in intense hurricane frequency. Initial results from Oyster Pond sediments indicate significant hurricane, fire, and vegetation interactions between 1800 and 1100 years ago. However, differentiating between intense hurricanes and less severe tropical cyclones is difficult using only Oyster Pond sediments. Current work focuses on Salt Pond that records only the most extreme hurricane landfalls. Coupling these sedimentary records with modeling of tropical cyclone occurrence, we aim 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? 4) How will this ecosystem respond to a lack of hurricane disturbance?

3) The study is focused in 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 the use of paleoecological records that document past responses to disturbance regimes similar to anticipated future scenarios. Northeast proxy reconstructions of frequent intense hurricane strikes between 1800 and 1100 years ago 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.

5) The results of this research should reveal how catastrophic hurricanes and fire affect the form and function of pine/scrub-oak ecosystems and help predict how this ecosystem will respond to future increases in intense hurricane activity. Modeling hurricane climatologies will provide a means of assessing the record and provide probabilistic information regarding future ecosystem change. The results can be integrated with ecological models that examine ecosystem disturbance and climate change and will improve our ability to predict and manage future changes to these ecosystems. Additionally, our results may provide insights into how other ecosystems respond to increased hurricane disturbance.