

Prediction of Pine Forest Changes in the Florida Keys Due to Sea Level Rise

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This pilot study proposes to develop a method to analyze historical losses and predict the loss of coastal low elevation upland forests in the next 50-100 years in response to various scenarios of sea level rise. We will use the pine-dominated landscape of Big Pine Key, Florida as a sample site for testing our concept and method. Low elevation slash pine forests require fresh water in their rooting zone, and are extremely sensitive to elevated salinity in the soil or ground water which is influenced by sea level position.

The scientific questions to be answered are: (1) What is the role of sea level changes in the loss of pine forests? (2) How does landscape structure change in response to sea level rise? (3) What will be the impact of sea level rise on pine forests during the next 50-100 years?

Research activities will be conducted on Big Pine Key in the Florida Keys. We will first study the response of pine forests to past sea level changes, by using remote sensing analysis to map their loss, and associating these losses with sea level rise derived from tidal gauge records. We will superimpose sea level rise on highly accurate digital elevation models obtained using airborne light detection and ranging (LIDAR) technology. We will develop methods to classify the vegetation of the study area using high-resolution satellite imagery and LIDAR measurements. We will next build a quantitative response model by linking the vegetation units with variables such as topographic elevation, distance to the shoreline, and probability of surge flooding which are all likely influenced by sea level rise. Ground surveys supplemented by data from long-term permanent plots will be employed to examine the patterns and causes of recent tree death, quantify relationships between the condition of the pine canopy and understory plant diversity, and verify the remote sensing analysis. Finally, we will predict pine forest changes in the next 50-100 years in response to increased sea level rise under various scenarios of climate change.

This research will increase our understanding of the impact of sea level rise on coastal upland forests. Expected deliverables will be field surveys, remote sensing analysis, and predictive results which will be accessible via the Internet.