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Perspective

Southwest Florida Weather Forecast

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Abstract

The low-lying barrier island (latitude 26.436394, longitude -82.155589) has a surface area of around 4,900 hectares and was formed by sediment accretion, resulting in linear dune systems that vary in height (between 0 and 3 m above sea level). Natural sand dune ridges encircle the lower elevation of the island's core, forming a freshwater wetland. Osmotic pressure caused by seasonal rains and a thin clay layer protects Sanibel Island's freshwater wetlands from subterranean saltwater intrusion from salty aquifers beneath the island and the Gulf of Mexico. These wetlands flood during the summer and fall wet seasons, when Sanibel receives 85% of its yearly precipitation, and the water levels decrease throughout the winter and early spring dry seasons.

Keywords: Freshwater • Wetland • Sanibel Island • Season Changes • Model resolution in high • Glaciers • Summer

Introduction

Woody plants, particularly buttonwood (*Conocarpus erectus*), have taken over sand cordgrass (*Spartina bakeri*)-dominated freshwater marshes in South Florida. Homes, industries, and infrastructural development have taken up upland areas. Being a low-lying barrier island, Sanibel Island and its flora are vulnerable to the effects of climate change. The predicted increases in frequency and intensity of heavy rainfall events will cause more flooding in this area. Coastal habitats are particularly vulnerable to floods due to the higher underlying water table brought on by sea level rise, which restricts or prohibits precipitation entry into the soil and increases flood potential. Low-lying areas become flooded as the water table rises above their level, contributing to sea level rise without changing rainfall [1]. The composition and structure of grassy systems, like the freshwater interior marshes of Sanibel Island, have changed due to the encroachment of shrubs, which is made easier by shortened hydroperiods, dewatering projects and the plugging of the wetland's natural outfall, salinity changes, the suppression of wildfires, and elevated atmospheric CO2 concentrations. However, it seems unlikely that this distinctive vegetative community would persist for very long in the freshwater interior marshes of Sanibel Island. The interior freshwater marshes of Sanibel Island are predicted to be submerged by sea level rise during the next century, enabling the transformation into mangrove forests, as has already been observed elsewhere in south Florida. scientific species Cotton, rice, and black rats all live on Sanibel Island. Because rice rats and cotton rats have distinct ecological features, there is less overlap in their niches. Rice rats are omnivorous whereas cotton rats are herbivorous, which may lessen competition for food sources. However, seasonal dietary overlap and resource-related competition may exist because both species' seasonal diet flexibility and resource availability. Although it has been suggested that cotton rats and rice rats stay away from one another in some locations, species-specific preferences for particular habitats are most likely to account for this pattern. Although cotton rats and rice rats typically live in drier and wetter climates, respectively, there is substantial spatial overlap between the two. If we took measurements of three environmental characteristics (shrub cover, mangrove density, and seasonal flooding) that are predicted to get worse with climate change [2]. Sea-level rise facilitates mangrove invasion, which has already been observed throughout south Florida's coastal wetlands.

During the first field season, we counted the number of mangrove stems within a 4-m2 quadrat at a spatially standardised subset of nine of the twenty-five trap points per site; these nine places are referred to as "environmental sampling points" from now on. On buttonwood and sand cordgrass sites (n = 36), we repeated mangrove stem counts every year because these sites were potentially vulnerable to mangrove invasion and because managed fire and mechanical shrub removal altered the vegetation composition. We didn't use stem twice. On mangrove sites (n = 18), we did not repeat stem counts annually because these areas did not experience fire or mechanical shrub removal and remained throughout the research. We did not distinguish between red (*Rhizophora mangle*), white (*Laguncularia racemosa*), or black (*Avicennia germinans*) mangroves. Increased atmospheric CO_2 concentrations, shortened hydroperiods brought on by previous dewatering initiatives, and perhaps the abolition of wildfire is all contributing factors to the ongoing shrub encroachment on Sanibel Island's interior marshes. We used a remote sensing method to measure the amount of shrubs using real colour (red, blue, and green) images that were made accessible to the public by the Lee County government [3]. We used a remote sensing technique to measure the amount of shrub cover using publicly accessible true colour (red, blue, and green bands) georeferenced aerial footage from January 2015 that was made available by the Lee County government. We classified photos in ArcGIS using a supervised method based on true colour spectral reflectance data, allowing us to choose types of land cover in advance. Shrubs, sand cordgrass, leather fern, and open water were among the several types of land cover [4]. The additional classifications were added even though shrub cover was the only remotely sensed land-cover class of interest. This is because (a) they are common in Sanibel Island's freshwater interior and (b) supervised classification necessitates the identification of other land-cover classes that are present. Then, for places that weren't naturally dominated, we retrieved shrub cover estimates in 0.44-ha circular polygons with a 75-m diameter. By excluding areas with mangroves or upland tropical hammocks from our sample (i.e., n = 27), we were able to only include regions where measurable changes in shrub cover may occur. All other websites were set to zero. Using information gathered at the 9 environmental sampling locations set up on each of the 27 remotely sensed sites, we evaluated the precision of shrub cover estimations. In the remotely sensed data layer, we recorded a binary measure of whether shrub cover was dominant at each position in 2015 and within a 1 ml buffer of each point. To evaluate categorization accuracy, we then computed omission and commission error rates. Seasonal flooding on Sanibel Island is predicted to increase due to climate change due to more intense individual rain events. We created a flooded point count by counting the number of environmental sampling points (0 points–9 points) with standing water at each site during each trap period in order to estimate seasonal flooding. Any environmental sampling point, including tidally flooded points that was submerged for a portion of the survey period was counted. We took into account two factors (visual blockage and season) that we hypothesised would affect rodent detection [5]. Visual blockage may change foraging-related fear feelings that affect detection likelihood. Using a Robel pole, we annually quantified visual obstruction, a metric of vegetation density, at each environmental sampling point per site. We measured the lowest visible point on the Robel pole to the closest decimeter from each cardinal direction while standing at 0.7 m height, roughly the height of mammalian predators. To calculate an annual average measure of visual obstruction for each site, we averaged observations over the nine environmental sampling points at each site. Seasonal variations in temperature and food availability affect activity levels and bait attractiveness [6]. We hypothesised that two factors (visual blockage and season) would affect rodent identification. The likelihood of detection may differ due to visual blockage. Consequently, we added a binary season metric. The chance that invasive species and erratic environmental circumstances would change how island endemic wildlife is distributed. We discovered that the distribution of native and invasive wildlife was likely to vary as a result of environmental factors related to climate change [7]. As a result of the environmental changes anticipated by future climate change scenarios, we also discovered that interspecific interactions between invasive and native species were likely to grow. In particular, we discovered that the distribution of mangroves on Sanibel Island was predicted to increase through at least 2100, which would increase interspecific interactions between invasive black rats and endemic cotton rats. Coexistence without competitive exclusion may have been aided by differences in space utilisation and dietary flexibility. Black rats are able to obtain resources for nesting and feeding in trees that may be less available to cotton rats. Additionally, black rats are omnivorous, with a significant portion of their diet made up of invertebrates and other non-vegetative food sources as opposed to cotton rats, which are mostly herbivorous. By utilising novel food sources like mollusks in mangrove forests, black rats are able to further limit the likelihood of dietary overlap with cotton rats [8]. Alternatively, the observed co-occurrence patterns might be explained by a mutualistic relationship. Given that the black rat has a history of outcompeting many native species and since there doesn't appear to be a mechanism for either It is possible for one species to encourage the occurrence of a different one. The attenuation of predatory pressure and facilitation of habitat alteration are conceivable mechanisms, but more study is required to determine their viability [9]. As anticipated, the continuation of cotton rats on Sanibel Island may be threatened by increased floods and mangrove density. Cotton rat occurrence may decline in those locations when sea level rise enables a gradually expanding mangrove distribution around Sanibel Island's northern edges. But within the next century, when sea levels rise and wetlands in the interior become submerged, the distribution of cotton rats on Sanibel Island might shift most dramatically. This would then allow mangrove forests to grow. Flooding and mangrove expansion, two phenomena that are detrimental to cotton rat occurrence, combined as a result to may drive cotton rats out of the interior freshwater wetlands where they have historically been most prevalent [10].

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