A VEGETATIVE SURVEY OF BACK-BARRIER ISLANDS NEAR SAPELO ISLAND, GEORGIA

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REFERENCE: Proceedings of the 2003 Georgia Water Resources Conference, held April 23-24, 2003, at the University of Georgia. Kathryn J. Hatcher, editor, Institute of Ecology, The University of Georgia, Athens, Georgia.

Abstract. This study was designed to examine the forest composition, structure and species richness of vegetation among undeveloped back-barrier islands near Sapelo Island, Georgia. Known colloquially as "marsh hammocks," back-barrier islands are completely or partially encircled by estuarine salt marsh. There are upwards of 1200 hammocks along the Georgia coast, comprising approximately 6900 ha. In the face of increased development pressure, the cumulative impacts caused by small-scale construction of homes, roads, bridges, and septic fields may alter natural hydrologic and ecological processes. We surveyed vegetation on 11 undeveloped hammocks in four size classes and found that overall species diversity is low, but the diversity of vascular plants may increase with island size. Local and regional planners and conservation organizations may use this information to help develop land-based projects that are consistent with the sustainable use of coastal resources.

INTRODUCTION

A complex of primary and secondary barrier islands stretches along Georgia's 100-mile coast. Barrier islands are dynamic habitats resulting from geologic interactions driven by long-term sea level rise and retreat, wave-driven erosion, accretion, and overwash processes caused by storms and seasonal tidal events (Johnson and Barbour, 1990; Hoyt, 1967). Johnson et al. (1974) described Georgia's Sea Islands as compound barrier islands of relatively recent (4000-5000 years) Holocene landmasses welded onto a core of older Pleistocene ridges. Age differences are based on soil development. The topographic signature and floristic profile of barrier islands are evidence for both physical disturbance and plant succession.

Georgia's secondary, or back-barrier islands, may be completely or partially encircled by salt marsh and are often referred to colloquially as "marsh hammocks." Georgia's back-barrier islands total approximately 6900 hectares of upland area, with those located in McIntosh County comprising 20% of the area (CMHAC, 2002).

Due to increased development pressure in coastal Georgia, back-barrier islands have become a topic of debate. An administrative court suit resulted in the appointment of Georgia's coastal marsh hammock advisory council (CMHAC) in February 2001 to assess hammock development issues and define Georgia's coastal marsh hammocks. The working definition adopted by the CMHAC was:

> Back–barrier islands are all other[1] islands between the landward boundary of the barrier island complexes and the mainland. Natural back-barrier islands are erosional remnants of pre-existing upland, whereas man-made back barrier islands are comprised of dredge spoil matter or ballast stones. These islands may or may not have existing connections to the mainland by bridges, causeways, or other man-made structures. (Note: While we recommend that the term "hammock" not be used in any legal definition in the state of Georgia, we recognize the informal colloquial use of the term "hammock" to describe many back-barrier islands) (CMHAC, 2002).

Although some features of Georgia's primary barrier islands have been well-studied, the ecological significance of the approximately 1,200 back-barrier islands is poorly documented in the scientific literature and can only be derived from studies executed on larger islands within the southeastern region. In 1986, Odum and others identified research needs specifically related to the physical characteristics of interior wetlands of barrier island communities, including microtopographic

[1] The Georgia Barrier Island Complexes and their component units are: Cumberland Island (Cumberland Island and Little Cumberland Island) Jekyll Island, St. Simons Island (St. Simons Island, Sea Island and Little St. Simons Island), Wolf Island, Sapelo Island (Sapelo Island and Blackbeard Island), St. Catherines Island, Ossabaw Island, Wassaw Island and Tybee Island (Tybee Island and Williamson Island) (CMHAC, 2002).

surveys and mapping to locate wetland habitat, measurement of surface-water drainage and groundwater transmissivity, modeling of groundwater dynamics and water quality studies. Beginning in October 2001, the Southern Environmental Law Center and The Georgia Conservancy have organized a semi-annual volunteer survey of hammock areas, noting their particular importance to roosting and migratory birds.

The purpose of this study was to examine the floristic composition, structure, and species richness among a subset of back-barrier islands of different sizes near Sapelo Island. We expected that species diversity of vascular plants would increase with island size in accordance with the theory of island biogeography (MacArthur and Wilson, 1968). Our goal was to inventory and quantify the vegetation that comprises upland areas adjacent to Georgia marshlands, thus providing the framework for monitoring long-term conditions of back-barrier islands. This information may be helpful to the natural resource management community and conservation organizations that make decisions regarding coastal resources.

METHODS

Site Selection

We conducted a series of field observations within and near the Georgia Coastal Ecosystems Long Term Ecological Research (GCE LTER) site at Sapelo Island, Georgia, during the summer and fall of 2002 (Fig 1). The back-barrier islands were selected on the basis of accessibility, minimal impact from residential or agricultural development, natural origin (as opposed to dredge spoil) and size. Back-barrier islands were identified using an ESRI ArcView v.3.2 map database provided by the Georgia Dept. of Natural Resources Coastal Research Division (GADNR CRD). The back-barrier islands that were included in this study ranged in size from 0.01 to 41.8 hectares (ha) and were classified into 4 size classes (Table 1). Three islands were sampled in each size class with the exception of Size Class C (n=2) (we had difficulty identifying a third island in Size Class C that we could sample).

Figure 1. Back-barrier islands sampled in McIntosh County, GA are indicated by shading.

Table 1. Size Classes of Back-barrier Islands (BBI) Sampled Near Sapelo Island, Georgia.

BBI size class	BBI size (ha)	# BBIs surveyed	# Plots/BBI
A	<1.0	3	2
B	1.0-2.0	3	3
C	2.1-4.0	2	4
D	>4.0	3	6

Vegetation Surveys

From July to October 2002, we conducted vegetation surveys at each of the 11 back-barrier islands identified (Fig. 1). Hammocks were accessed via the GCE LTER V-tech boat. Some sites were only accessible during high tide, when the tidal creeks were deep enough for passage. A series of 0.01 ha temporary plots was constructed on each back-barrier island. From 2 to 6 plots were sampled on each island; more plots were sampled on larger islands in order to obtain a more representative survey of the sites (Table 1). Plots were randomly placed at or above the marsh-upland interface as indicated by the first woody tree or shrub. The plots were marked semi-permanently using 1.5" diameter x 12" length metal conduit stakes, so future observation in these areas may be possible. A total of 41 plots were sampled. Latitudinal and longitudinal coordinates were recorded using a hand-held Global Positioning Satellite unit. This information was used to plot onto the GADNR CRD database using ArcView GIS mapping techniques. Each site was also photo-documented with a 35 mm Nikon N65 camera.

We followed the sampling protocol developed for North Carolina Vegetation Surveys (NCVS) (Peet *et al*., 1998). This methodology was chosen due to its flexibility, ease of use, and successful application for rapid assessment in the SE region. A 100 m measuring reel was used to demarcate the perimeter of a 10 x 10 m plot, and a hand held tape measure and 2 meter sticks were used to divide it into quadrats. The vegetation was sequentially assessed by nested quadrats in each of the corners of the module (labeled 1 to 4 in Fig. 2).

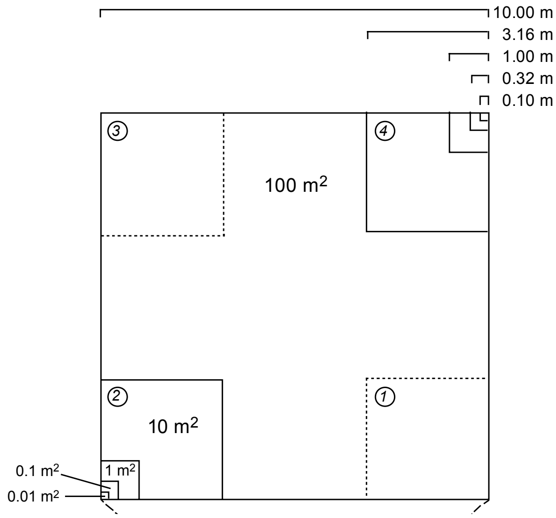

Figure 2. Illustration of 0.01 m^2, 0.1 m^2, 1.0 m^2 and 10.0 m^2 nested quadrats constructed within each corner (1 to 4) of the 100 m^2 plot module, with the length of quadrat sides indicated.

Sampling areas were 0.01 m^2, 0.10 m^2, 1.00 m^2, and 10.00 m^2. Plants in the remaining cross-shaped area were also evaluated. Figure 2 illustrates the sampling strategy for a standard 100 m^2 module.

Vascular species were recorded as present or absent within each subset of nested quadrats. The impact to the site was minimal, although floristic samples were collected for identification as necessary. In these cases, plants were dried and stored in plant presses, frozen for 5 days to prevent contamination, and keyed out and mounted at the University of Georgia Plant Sciences Herbarium, Athens, GA. All vascular plants within plots were identified to species whenever possible: taxonomy followed Radford et al. (1968) and Duncan and Duncan (1987). Due to difficulty in identifying grasses and sedges in a vegetative state, they were excluded from these analyses.

In this paper we present information on species richness determined by tallying the number of species per plot. Although the sampling protocol also allows for more thorough data analyses for cover, abundance and biomass, this information is not presented here.

RESULTS

This study revealed strong trends in the composition of the community on back-barrier islands. Yaupon holly (*Ilex vomitoria*) was the dominant woody species, occurring in 93% of the plots sampled; spanish moss (*Tillandsia usenoides*) is an epiphyte that occurred in 91% of all plots. These plants were found in association with live oak (*Quercus virginiana*), catbriar (*Smilax bona-nox*), cabbage palm (*Sabal palmetto*), red bay (*Persea borbonia*) and saw palmetto (*Serenoa repens*), which are also common plants in maritime forest communities. Of a total of 43 species identified, 25 were found in less than 10% of the 41 individual plots sampled. For these relatively uncommon plants, 41% were found on back-barrier islands in the largest size class. These floras included Hercules' club (*Xanthoxylem clava-herculis*) and passionflower (*Passiflora lutea*). The tiny-leaved buckthorn or shell mound buckthorn (*Sageretia minutiflora*), a plant that is recognized as threatened by the state of Georgia, was only observed on the three largest hammocks in this study.

Mean species richness increased with increasing size category (Fig. 3). Mean species richness values ranged from 6.50 for back-barrier islands less than 1.0 ha and rose to 9.94 for those greater than 4.0 ha. Although overall diversity is low for all back-barrier

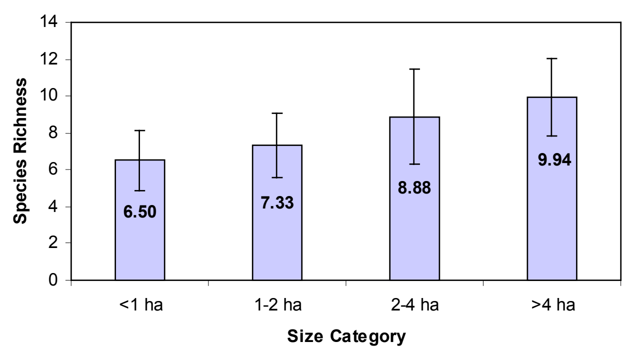

Figure 3. Mean species richness of BBIs sampled in this study. Error bars represent standard deviations.

islands, these data suggest a positive relationship between back-barrier island area and vascular plant diversity, as predicted by the theory of island biogeography. Future analyses will explore the distance of the areas surveyed from potential seed sources, such as the mainland and barrier islands.

DISCUSSION

There are important science and policy reasons for evaluating the maritime vegetative communities found on Georgia's back-barrier islands. Because of their significant ecological value, the state's Marshland Protection Act of 1970 protects Georgia's coastal marshlands from development; however, adjacent back-barrier islands are not currently offered the same safeguards. Although back-barrier island development can be expensive, the potential to attract affluent buyers has stimulated interest in these areas. In addition, private property owners are concerned that their rights may be threatened, so many are seeking permits to secure future access to their land. Although Georgia's Coastal Zone Management Act of 1992 identifies both maritime forests and marsh hammocks as regions of physiographical significance, it may lack the legal framework to maintain their long-term sustainability.

Inventories by Lopazanski and others (1988) and Mathews and others (1980) indicated that approximately 39,000 ha of maritime forest remains intact within North Carolina, Georgia and Florida from an unknown original total prior to human impacts. Of the remaining maritime forest, 65% is located in Georgia. This represents a density of 160 ha per linear kilometer of ocean shoreline. Maritime forests may be important in maintaining fresh groundwater supplies and providing wildlife habitat for resident and migratory birds (Bellis and Keough, 1995).

As back-barrier islands are developed, the cumulative impacts caused by small-scale construction of homesites, roads, bridges, and septic fields may alter the environment to such an extent that natural hydrologic and ecological processes are no longer possible. Although the analyses presented here will be refined to include grasses and sedges, our preliminary results suggest that vascular plant diversity on undeveloped back-barrier islands increases with increasing area and that their species composition is representative of maritime forest vegetation on barrier islands. This type of information can help coastal planners target areas best suited for conservation easements, land acquisition, and make better informed policy recommendations.

ACKNOWLEDGMENTS

We thank our colleagues at the University of Georgia: Ken Helm, Susan White, Monica Moss, and Matt Ogburn for their field assistance; Wendy Zomlefer for herbarium services; and Karen Payne for GIS expertise. Fred Hay, GADNR Coastal Resource Division, graciously provided the map database. Tom Wentworth and Kristen Rosenfeld, North Carolina State University, offered guidance regarding the survey protocol. Support was provided in part by The Georgia Conservancy and the Georgia Coastal Ecosystems LTER Project (NSF Grant No. OCE 99-82133).

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