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The Ecology of the Sapelo Island National Estuarine Research Reserve

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National
Estuarine Research Reserve***

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Preface

Our nation's estuaries are extremely valuable. Human activities such as dredging and filling have damaged many estuaries in modern times. Based on its concern for these areas, the United States Congress, in 1972, enacted the Coastal Zone Management Act to provide federal aid to the individual states to establish and manage natural field laboratories for research and education.

Sapelo Island's Duplin River estuary lies about midway on the Georgia coast between the Savannah and St. Marys rivers. Throughout its history it has received protection by public and private landowners and, since the early 1950s, Sapelo Island has been the focus of ecological and archaeological research. In 1975, the state of Georgia proposed the Duplin estuary as a National Estuarine Sanctuary. The U.S. Department of Commerce studied and approved the Georgia proposal, the state completed its land acquisition and, on December 22, 1976, the site received formal designation as the Sapelo Island National Estuarine Sanctuary, later Estuarine Research Reserve.

Since then, the Department of Commerce has designated 20 other estuarine areas nationwide as part of the National Estuarine Research Reserve program. The National Oceanic and Atmospheric Administration (NOAA) administers this system for Commerce. As part of the national program, Sapelo Island represents Georgia in the Carolinian biogeographic region and it is the focus for NERR support of estuarine scientific research and education in Georgia.

The Duplin River estuary includes unspoiled coastal salt marsh and tidal creeks, areas that are among the earth's most biologically productive systems. They began forming at the present location several thousand years ago; the ability of the tidal marshes to produce food has captured the interest of man since pre-historic times. More recently, people have come to the system for scientific research, education and recreation.

The Sapelo Island National Estuarine Research Reserve has several primary functions, among them to provide opportunities for scientists to investigate the workings of estuarine systems, public education and compatible recreation and to protect and monitor the Reserve's natural and cultural resources. About 6,000 visitors a year participate in the SINEERR's public tour program and organized educational activities. The Georgia Department of Natural Resources, the University of Georgia Marine Institute and NOAA have a large public audience for programs about estuaries and the SINEERR is excellent location to present these types of programs.

The 16,500 acres that make up Sapelo Island include the SINEERR. Sapelo represents a direct investment of some \$5 million in state and federal funds. The Reserve occupies just over one third of the island, comprising the Duplin River estuary and several

upland tracts. In all, the Reserve has 2,100 acres of uplands and 4,000 acres of tidal salt marsh. NOAA provided a grant of \$1.5 million to help the state of Georgia acquire 2,094 acres of the SINERR.

- Primary management goals for the SINERR include:
- a. maintaining the integrity of the Reserve for research and educational programs;
 - b. protecting its lands and waters from stress and alteration;
 - c. promoting quality public access to Sapelo Island for nature interpretation and low-intensity recreation;
 - d. promoting and encouraging improved scientific understanding of estuarine ecosystems.

Georgia DNR has administrative offices within the SINERR. In addition the University of Georgia has a major research facility within the Reserve, the UGA Marine Institute. Visitor activities include guided interpretive tours, hunting, fishing, nature study and camping. DNR manages the Reserve for NOAA, coordinates the public tours through a mainland Interpretive Center, presents on-site and off-site educational programming, manages Sapelo Island's wildlife and forest resources, enforces conservation laws on the island and operates a public ferry to provide the primary means of access to the Reserve and the island in general. The Reserve contracts with the UGA Marine Institute to conduct continuous scientific monitoring at four sites on the Reserve with regularly collected data being compiled and reported to NOAA on a quarterly and annual basis.

This comprehensive site ecological profile has been made possible by grant funding provided by NOAA to the Sapelo Island NERR. The UGA Marine Institute was awarded a contract in late 1994 to begin work on the site profile. The Sapelo Reserve is the fourth Reserve in the national system to complete its site profile. NOAA is encouraging the other Reserves in the System to compile similar profiles as well. The SINEERR management and staff would like to thank the UGMI and its lead investigator on this project, Dr. Alice Chalmers, for their efforts in compiling this document, which should provide a valuable tool for coastal managers and planners in the future management and protection of Georgia's vital coastal resources.

**Buddy Sullivan, Manager
Sapelo Island National Estuarine Research Reserve
March 1997**

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Introduction by Buddy Sullivan

In 1972, Congress passed the Coastal Zone Management Act (CZMA). In the CZMA, and its subsequent reauthorizations, Congress officially recognizes that resources of the coastal zone are of national significance and are rapidly disappearing. The CZMA also recognizes the interrelationships between uplands and tidelands. The "coastal zone" was defined in the Act as including all uplands "to the extent necessary to control shorelands." The CZMA established as a national goal "to preserve, protect, develop and, where possible, to restore and enhance the resources of the nation's coastal zone for this and succeeding generations."

Section 315 of the CZMA of 1972, as amended, establishes the National Estuarine Research Reserve System. Under the system, healthy estuarine ecosystems which typically different regions of the U.S. are designated and managed as sites for long-term research, and used as a base for estuarine education and interpretive programs. The system also provides a framework through which research results and techniques for estuarine education and interpretation can be shared throughout the region and across the nation.

As stated in the Coastal Zone Management Act, the National Estuarine Research Reserve System provides for "the establishment and management, through Federal-state cooperation, of a national system of Estuarine Research Reserves representative of the various regions and ecological types in the United States. Estuarine Research Reserves are established to provide opportunities for long-term research, education and interpretation."

Prior to the establishment of the NERR system, scientific understanding of estuarine processes was increasing slowly and without national coordination. There was no ready mechanism for the detection and measurement of local, regional or national trends in estuarine conditions. Resource managers, governments and the public did not always have access to information about the significance and ecology of their estuaries, could not assess the full impact of past activities, and could not readily anticipate the damaging effects of proposed management and development policies. NERR System research and education can help fill those gaps in knowledge and guide estuarine management for sustained support of commercial and recreational fisheries, tourism and other activities.

NERRS sites serve as laboratories and classrooms where the effects of both natural and human activity can be monitored and studied. There are currently 22 Estuarine Research Reserves comprising 445,000 acres in 17 states and Puerto Rico. Through careful management of these resources, generations of scientists, fishermen, naturalists and others will come to experience the beauty to be found where rivers return to the sea.

The Sapelo Island National Estuarine Research Reserve lies in the midst of an estuary where the currents of Doby Sound and the Duplin River meet. The Reserve comprises 6,110 acres and encompasses ecologies typical of the Carolinian biogeographic

1. The story of human activity on Sapelo Island, current use and ownership of the island and the regional setting of the SINEER, including the commercial and recreational utilization of Georgia estuarine areas;
2. The geological and hydrological characterization of the SINEER, to include the development of lagoon marshes, tidal conditions, hydrology of the Duplin River, geomorphology of the Duplin River, influence of the Altamaha River and upland runoff, and beach morphology and the sand-sharing system;
3. Ecological habitats of the Reserve, including (a) aquatic, Duplin River and Doby Sound; and (b) intertidal, mudflats and mudbanks, intertidal creeks, vegetated salt marsh and high marsh, beaches and sand dunes, forested uplands, vegetation patterns and shoreline changes through time utilizing Geographic Information System (GIS) and historical maps and photos to document changes;
4. Chemical characterization of aquatic and marsh habitats, including water column (carbon, nitrogen, phosphorous and silica nutrients), marsh sediments and biota;
5. Primary productivity (water column and salt marsh);
6. Secondary productivity, including the Duplin River (zooplankton, crabs and fish) and salt marsh (fiddler crabs, snails and tidal migratory organisms);
7. Organic matter;

The Reserve annually receives funds from the National Oceanic and Atmospheric Administration (NOAA), supplemented by matching state funds to conduct various educational and scientific monitoring programs. Part of the monitoring program has entailed the preparation of this ecological site characterization profile. This project began in late 1994 with a contract between the Georgia Department of Natural Resources, which manages the Reserve, and the University of Georgia Marine Institute. The UGMI, with funding provided by the Reserve's annual operations grant award from NOAA, has prepared this document based, in part, on the forty-five years of scientific research its resident faculty members have conducted on Sapelo Island, primarily within the boundaries of the Estuarine Research Reserve. This ecological profile contains a diverse range of material, including:

region and incorporates a coastline characterized by expanses of tidal salt marshes protected by a chain of barrier islands. The SINEER contains about 2,200 acres of upland forest dominated by stands of southern live oak hardwoods, pine (longleaf and loblolly), white-tailed deer, wild turkey and numerous other forms of wildlife. Two-thirds of the Reserve is comprised of expansive belts of salt marsh, which host a wealth of inhabitants. Members of this diverse salt marsh community feed and reproduce in the marshes and along the exposed river and creek banks at low tide. The Reserve also includes large areas of beach and dune communities fronting the Atlantic Ocean, as well as a network of oak, cedar and palm upland hammocks scattered through the marsh and beach areas.

8. Detritus foodweb and outwelling (hypotheses and paradigms about SINEER marshes), including early mass balance studies and models, the salt marsh as a nursery, coupling of marsh to nearshore and riverine influences on marsh and nearshore.
 9. The future of the SINEER: management and recommendations.
- The Ecological Profile of Sapelo Island is a document to be read and understood by the concerned citizen, by monitoring groups and management agency personnel, and by scientists studying this and similar estuarine systems. Much of the material referenced is necessarily very technical, but the Profile itself should give a useful overview of the ecology of the Sapelo Island National Estuarine Research Reserve to anyone with the interest to read it.

The Sapelo Island National Estuarine Research Reserve and Sapelo Island

The Sapelo Island National Estuarine Research Reserve was established in December 1976 in the Duplin River watershed of McIntosh County, Georgia, on the western side of Sapelo Island (Fig. 1). Sapelo Island and its surrounding marshes have been the focus of ecological and geological research since the early 1950s; archaeological research has

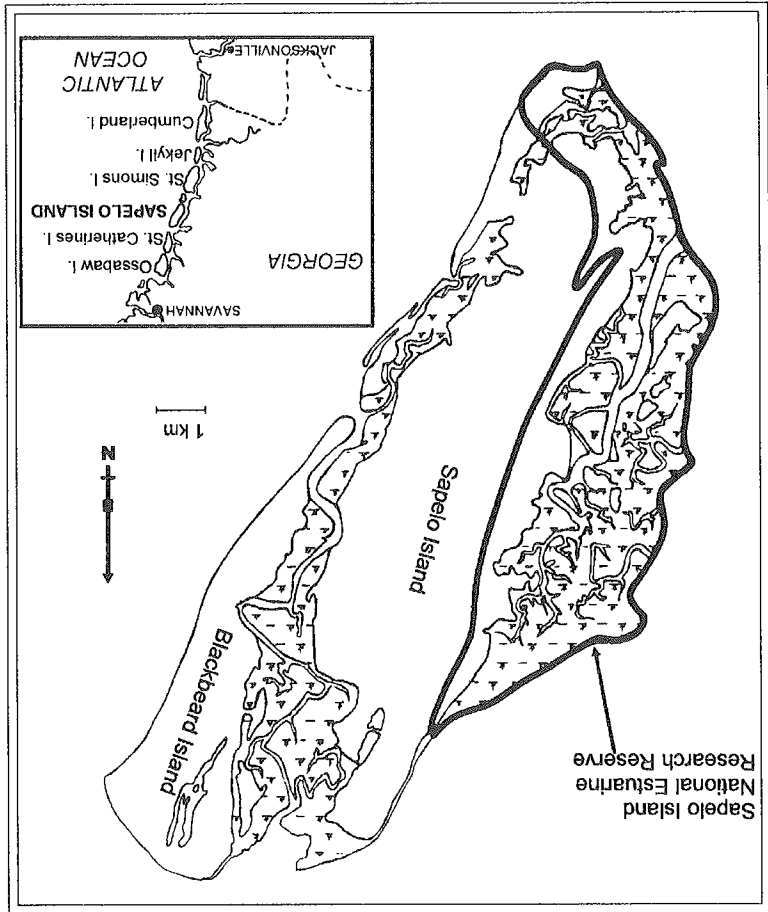
been conducted on the uplands of Sapelo Island since the late 1800s. In 1981 *The Ecology of a Salt Marsh* (Pomeroy and Wiegert, 1981) was published, synthesizing much of the research that had been done in the SINERR and describing quite thoroughly our understanding of the ecology of the marsh as it stood at that time. This profile presents an update of *The Ecology of a Salt Marsh*, reviewing research that has been completed since that book was written, and adding some supplemental information that was not included. Some of the material contained in *The Ecology of a Salt Marsh* is included here for the sake of clarity. For further information on research that has been done in the SINERR and elsewhere on Sapelo Island, the reader may consult the original publications on which this review is based. Scientific publications reporting results of research conducted on Sapelo Island are collected by the University of Georgia Marine Institute and published periodically in their Collected Reprints series. A list of selected papers from the Collected Reprints series can be found in Appendix 8.

REGIONAL SETTING OF SINERR

Climate

Sapelo Island has a subtropical climate with short, mild winters and long, humid summers (Fig. 2a and 2b). The ocean has a moderating effect on temperatures, with

Figure 1. Location of Sapelo Island and SINERR.



Sapelo Island generally reporting lower maxima and higher minima than are reported from inland areas. Rainfall is heaviest during the summer months (Fig. 3a), when short, intense afternoon thunderstorms are common, and heavy rains associated with hurricanes and tropical storms often impact the area. Total annual rainfall over the 30 year record averaged 51.3 inches, with a minimum of 32.3 and a maximum of 66.9 inches (Fig. 3b). Although there are cycles of wet and dry years (Fig. 3b), it is unusual to have a month

Figure 2. Temperatures at Sapelo Island, 1964 - 1994. Measured at the National Weather Service station at the University of Georgia Marine Institute.

