A FIELD GUIDE TO JEKYLL ISLAND

written by
H.E. Taylor Schoettle
illustrated by Carol Johnson

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FIGURE 1
Map of Jekyll Island

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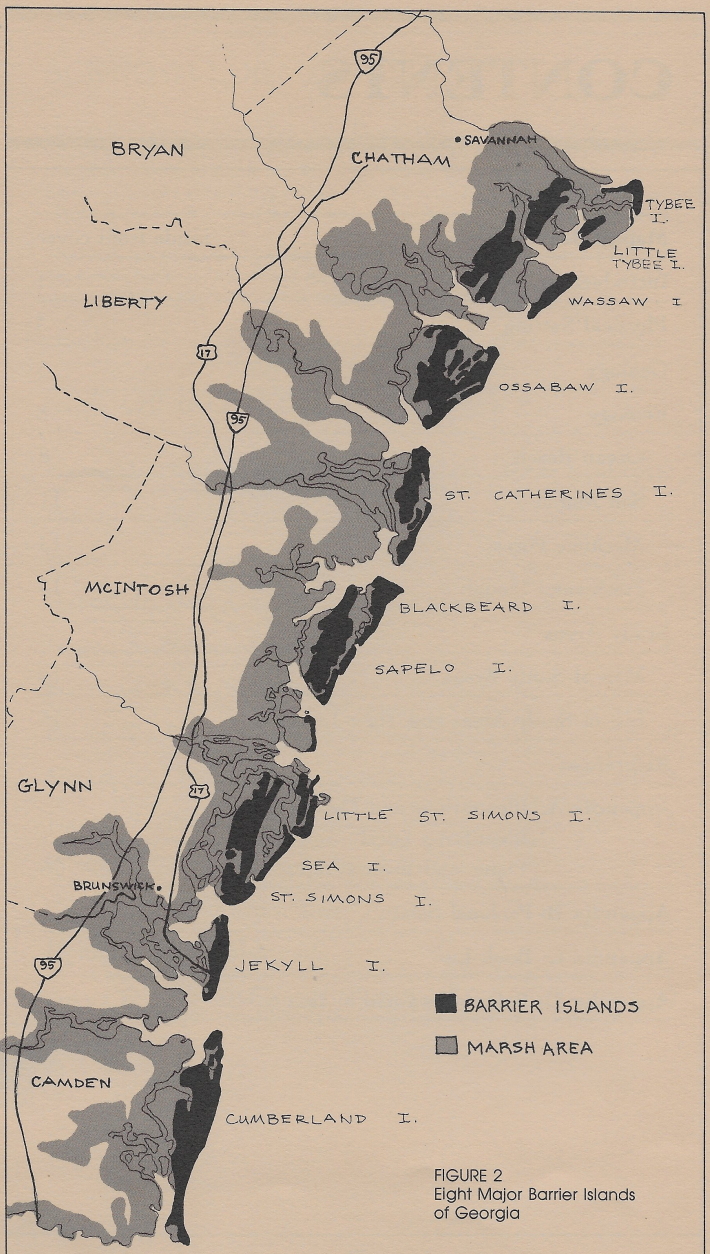

FIGURE 2
Eight Major Barrier Islands
of Georgia

INTRODUCTION

Along the coast of Georgia, a string of eight major barrier islands is separated from the mainland by an extensive system of salt marshes and sounds (Figure 2). The word *barrier* aptly defines the protective role the islands and their marshes play in shielding the mainland from destructive storm waves. Barrier islands form the majority of the beaches of the Atlantic and Gulf Coast states.

Unlike many of the developed barrier islands of the east coast, the islands of Georgia still retain much of their native wilderness. Approximately two-thirds of the islands with the best preserved habitats are designated for use as parks, wildlife refuges, research sites, and heritage preserves, but these are either inaccessible or have limited access. Of the four islands with access by causeways, three of them (Tybee, St. Simons, and Sea Island) have had much of their natural habitats altered through extensive development.

Jekyll Island was privately owned until the State of Georgia purchased it in 1947. Much of the island remains in its natural state, yet roads and a causeway make the natural areas readily accessible. Jekyll Island was selected for this study because, with its natural wilderness and its roadways, it is unique among the barrier islands of Georgia.

This guide provides an overview of the physical forces that create the characteristic shapes and dynamic changes of the Georgia barrier islands. The patterns of plant and animal communities residing on the beaches, salt marshes, forests, and sloughs (fresh and brackish water ponds) are explored. The second half of the guide presents detailed descriptions of the habitats and living communities found in each of 11 natural areas on Jekyll Island (depicted on the map of Jekyll Island, Figure 9). Illustrations identifying over 90 of the more common plants and invertebrates of Jekyll and a list of books and field guides pertinent to this region are presented in the Appendices.

This publication is intended for anyone interested in learning more about the natural history of the Georgia islands.[1] It is hoped that the information here will help educators to feel more at ease with this area and to use the natural resources of Jekyll to enrich their class programs. Teachers are invited to request further assistance in organizing field studies and planning coastal-related curricula.

By being better informed on the nature and dynamics of barrier islands, we and future generations will be able to make better decisions regarding preservation of these serenely beautiful islands.

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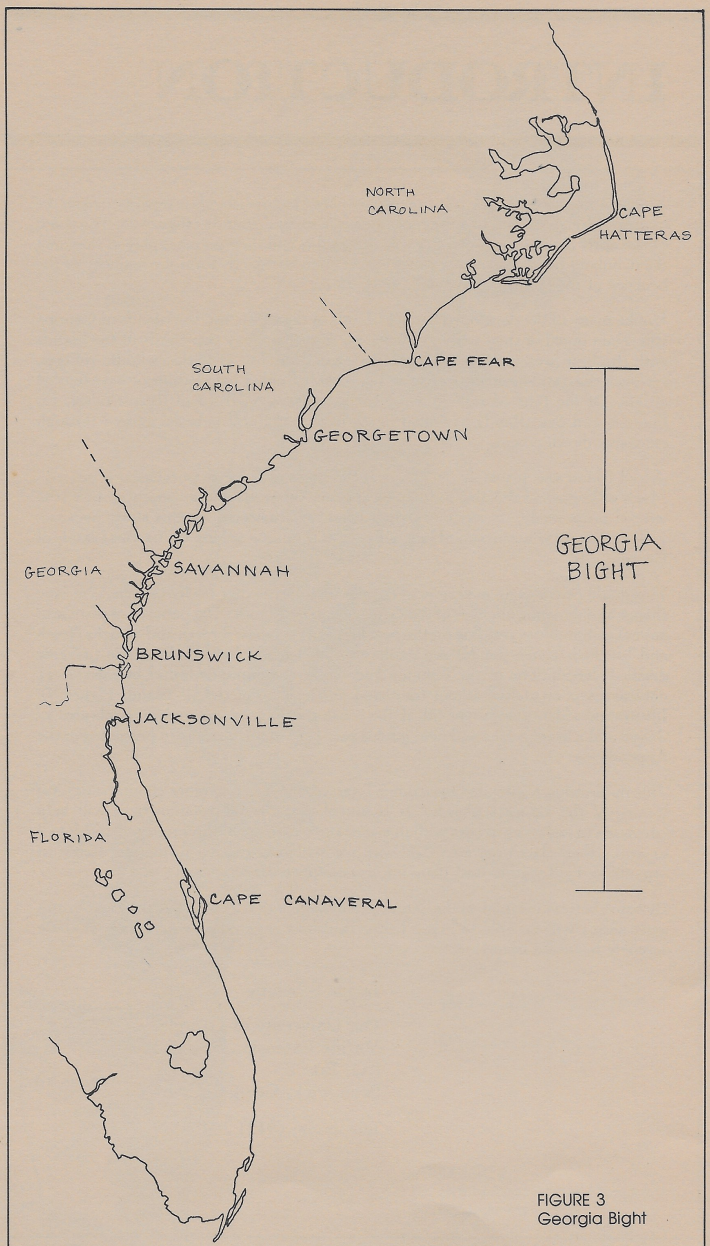


FIGURE 3
Georgia Bight

PHYSICAL SETTING

Jekyll Island is located between St. Simons Island to the north and Cumberland Island to the south and is about 7 miles southeast of Brunswick. The island is 8 miles long and 2.25 miles across at its widest point. It encompasses about 5,000 acres of marshes, beaches, and uplands (high grounds).[2] The climate of this coastal region is moderate, with short winters and long springs and falls. Temperatures during the warmest months (July and August) range from the high 80s to the high 90s. From December to February, temperatures usually range from the high 40s to the low 60s, with occasional freezes. Because of the moderating effects of the ocean and sea breezes, temperatures on the barrier islands tend not to be as extreme as those on the coastal mainland.[3]

Average annual rainfall on the coastal islands is about 53 inches. Much of the rain comes from local afternoon thunderstorms (convectional storms) from May through August. Rains during the fall, winter, and early spring are the result of larger storm systems covering greater areas of the United States. In late summer and fall, tropical storms can bring heavy rainfalls. The drier periods seem to be from November through February.[4]

Predominant winds are from the south and southeast in summer, and from the north and northeast in winter. The strongest winds are usually out of the northeast. Hurricanes pass over or near the Georgia coast about once every 10 years. Many hurricanes coming up the Atlantic coast tend to follow the path of warm air above the Gulf Stream, 80 to 100 miles from the Brunswick area, so to some extent the area is protected by its extreme western location (Figure 3).[5]

Typical of tidal patterns along the southeastern coast, two high tides and two low tides occur in Georgia waters each day. Not typical is the range of Georgia tides. While Cape Hatteras to the north and Miami to the south generally have 2-foot tides, the Georgia coast has 6- to 9-foot tides.

Figure 3 shows that the coast of Georgia is far to the west of both Miami and Cape Hatteras and is in the approximate center of the curved coastline known as the Georgia Bight that extends from Cape Fear, North Carolina, to Cape Canaveral, Florida. As the tide, a very long wave with a duration of 12 hours and 25 minutes, approaches the Atlantic coast, the wave front reaches the northern portion of the Bight first. As the wave comes in contact with these shores, wave energy is deflected southward. The deflected waves impinge onto the tide front, which is still moving landward toward the center of the Bight. In this way the water piles up, increasing the elevation of the mass of water as the tide reaches the Georgia coast.[6]

Except under storm conditions, the wave energy on the coast of Georgia is low since the energy of waves coming from the open ocean is dissipated by bottom friction as the waves move across the broad shallow shelf waters. From the Georgia coast, the continental shelf declines at an average of 1 to 2 feet per mile. Offshore sand bars and inlet shoals cause further loss of wave energy by forcing the waves to break before reaching the beaches.[7]

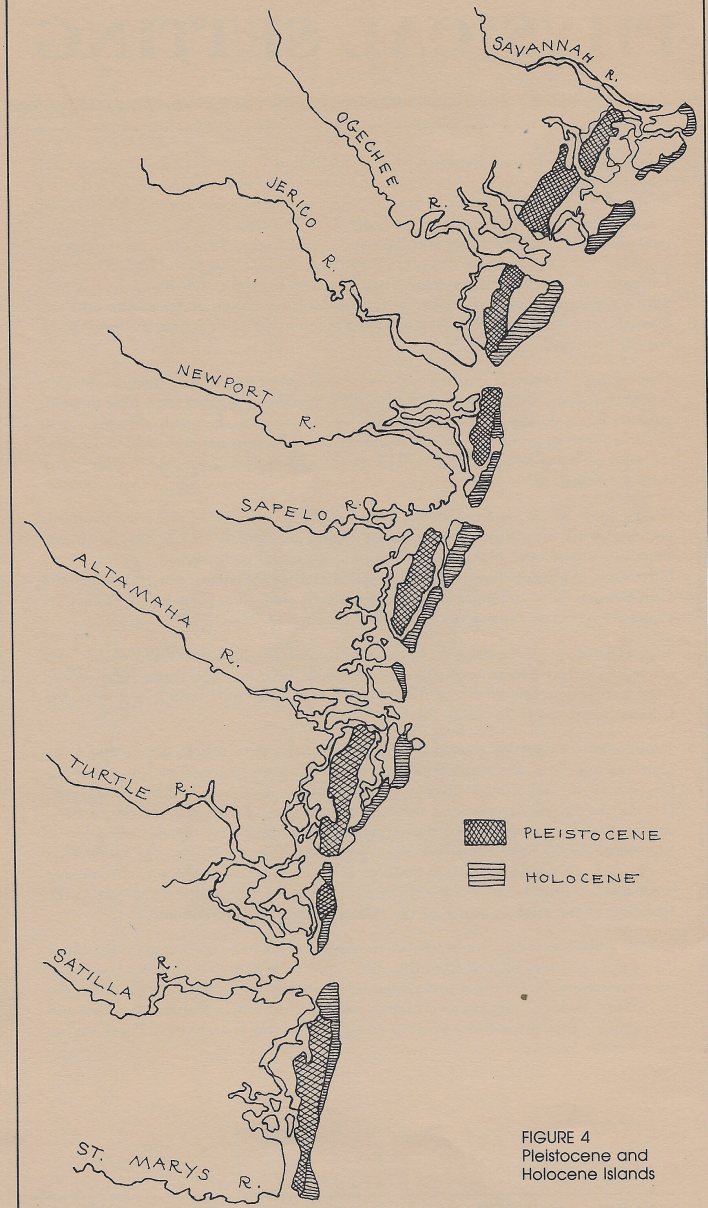


FIGURE 4
Pleistocene and
Holocene Islands

GEOLOGY

The barrier islands of Georgia have the distinct appearance of being split in a north-south plane with their uplands connected by marsh (Figure 2). The reason for this appearance is that there really are *two* sets of barrier islands, each formed during distinctly different geological times.

The islands making up the western side of the chain (Figure 4) were formed about 35,000 to 40,000 years ago, and those to the east date back only 4,000 to 5,000 years. The older islands formed the beaches when the sea level was about 6 feet above the present level — before the formation of the fourth and last great continental ice sheet of the Pleistocene epoch.[8] Enough sea water was frozen into that last big freeze to lower the sea level 300 to 500 feet, placing the shoreline near the present edge of the continental shelf, approximately 80 miles offshore.[9]

About 18,000 years ago, the ice sheets began to melt and the sea level rose relatively rapidly until 4,000 to 5,000 years ago, when the rate of ascent diminished to 4 to 6 inches each century.[10,11] Along with the rise in sea level, newly formed barrier islands (Holocene islands) began migrating westward toward the older islands (Pleistocene islands). The westward migration of these islands occurred and still is occurring as the advancing seas continue to erode the eastern-facing beaches and redeposit the sediments into the marshes and lagoons behind the islands. The way the sediments are redistributed during island migration is well described by Pilkey and Leatherman.[11,12]

The newer Holocene islands over time have become variously juxtaposed to their Pleistocene counterparts (Figure 4). The islands directly south of the Savannah River (Tybee, Wassaw, and the north end of Ossabaw) and those south of the Altamaha River (Little St. Simons and Sea Island) are more separated from their Pleistocene counterparts than the other Holocene islands. The inward advancement of these islands has been impeded by the far more copious output of sediments by the Savannah and the Altamaha Rivers relative to the other smaller rivers. Where the smaller rivers produced less sediment, the Holocene islands have migrated closer and, in some cases, have become attached to the older islands.[13]

Today the sea level continues to rise in this area, but at an increased rate of 12 to 14 inches per century. Pilkey feels that the accumulation of carbon dioxide in the atmosphere over the past 50 years is elevating the atmospheric temperature (the "greenhouse effect") and is further melting the ice caps, contributing to the rate of sea level rise. With the increase in the rise of the sea level, erosion predominates across the Atlantic seashore. The prevailing erosion of the eastern beaches of the barrier islands is evidence of this trend. The many attempts to save developed frontage property and restore the retreating beaches through the use of seawalls, jetties, and groins are well reviewed by Pilkey,[14,15,16] who demonstrates how such methods, instead of stabilizing the beaches, often accelerate their loss.

Through the action of prevailing winds, waves, and tidal currents, dynamic changes in the shape and size of barrier islands occur constantly, especially at the ends of the islands where they come in contact with inlets or narrow bodies of water between the islands (Figure 6). Generally, the southern ends of the islands tend to accrete (build up by deposition), while growth on the northern ends is irregular and often interspersed with erosion.

The map of Jekyll Island (Figure 1) shows the uplands on the southern end below the Ben Fortson Parkway to be shaped like an upside-down shepherd's crook. Close examination reveals that the land is really made up of a series of dune ridges extending toward the southeastern tip. Older ridges, supporting oak and pine, make up the forested uplands and marsh islands (hammocks) on the central and western parts, while younger ridges form the beach meadows and shrub thickets on the southeastern side.

Figure 5 diagrams the process by which the southern part of Jekyll Island, as well as the southern parts of many of the barrier islands, originally formed and grew. Predominant northeast winds drive longshore currents in a southerly direction. The currents carry sand, which is deposited, producing shoals (long bodies of partly submerged sand) and spits (a shoal attached to a land formation). These spits continue to grow, dune ridge by dune ridge, in a southerly direction as the longshore wave transport continues to deposit sand. The free end of the spit tends to curve inward toward the marshes and lagoons under the influence of inward-moving tidal currents and wave refraction. As waves approach a beach at an angle, the part of the wave reaching the shallows first has its movement retarded because of the increased friction of the wave with the bottom. This causes the wave to refract or turn toward the shallow area. As Figure 5, Part (a) shows, the obliquely approaching waves tend to turn toward the beach and around the end of the spit, depositing the sand inward and upward, causing the spit to curve into itself; hence, the term *recurved*. The growth of these spits is subject to the strength of the tidal currents moving through the inlets. The water behind the newly accreted land, now shielded from the breakers, becomes quieter, thereby creating conditions for a marsh, as sediments suspended in the water tend to settle out.[17]

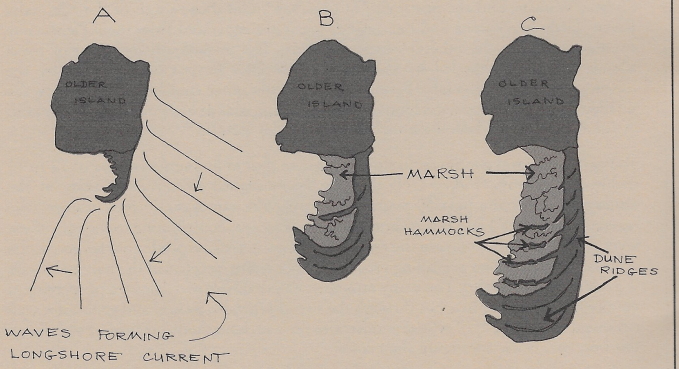


FIGURE 5
Formation and Growth of a Recurved Spit

The north ends of the barrier islands show complicated patterns of growth and erosion which vary from island to island. Large reservoirs of sand in the form of shoals often are seen at the mouths of the inlets, resulting from complex interactions between tidal and longshore currents. Through the action of the southerly-directed longshore currents and wave refraction, the shoals tend to drift downward and inward toward the upper parts of the islands south of the inlets (Figure 6).[18] The frequent incorporation of inlet shoals to the north gives the Georgia barrier islands their characteristic drumstick shape, with the upper ends thicker. Occasionally, a shoal near a barrier island becomes stable enough to support vegetation, and acts as a wave shelter to the beach. Again, suspended sediments tend to fall out in the quieter waters between the shoal and the beach, which can eventually form a marsh connecting the newly-made beach front onto the older shore. Any number of shoals may likewise become attached to an island, creating a corduroy pattern of old dune ridges interspersed with marshes and lowlands. Such areas are often eroded back by storms only to re-form over time.

Three distinct ridges of land (old dune ridges), separated by two wedge-shaped marshes, are seen on the north end of Jekyll Island (Figure 1). This configuration at Jekyll's north end may have been formed by an inlet shoal system in the manner described in the previous paragraph. Today, the inlet shoal system is almost completely absent because there is a shipping channel, which was dredged in 1909, between St. Simons and Jekyll.[19] Details regarding the effects of the shipping channel on the northern beaches of Jekyll are mentioned in the description of Area 9.

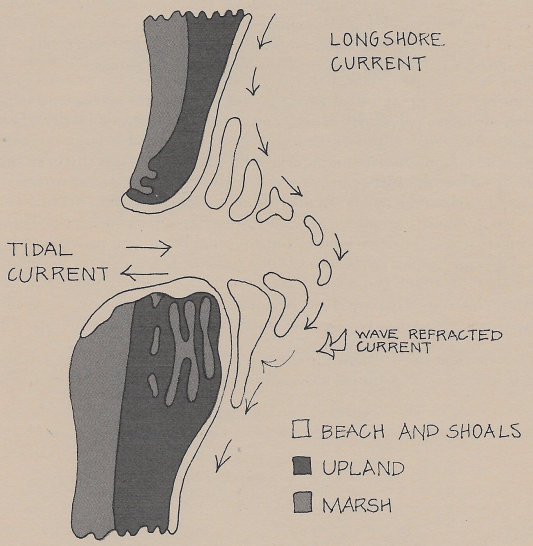


FIGURE 6
Inlet Shoal System Forming from the Interaction of the Longshore and Tidal Currents

ECOLOGY

This section describes the four major barrier ecosystems: ocean beach, salt marsh, forest, and freshwater slough. Besides presenting a background on barrier island ecology, the descriptions in this section act as models for comparison of similar environments in the individual study areas. Through such comparisons, various changes in the individual environments due to location and prevailing physical factors can be seen.

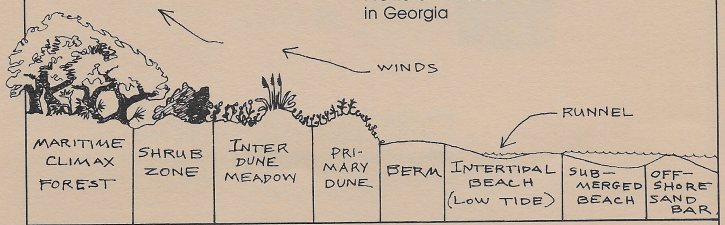
OCEAN BEACH

Figure 7 is a profile of an accreting ocean beach which extends from the offshore sand bar (or bars) to the edge of the maritime forest. Beach sand subject to movement by wind and water currents is highly unstable, and therefore is a hostile environment for plants and seashore life. The sand on the beach dynamically interchanges with the sand of offshore sand bars, submerged beach, and inlet shoals.

When the surf is high, as with a strong northeast wind, the waves tend to scour the sand from the berm (upper dry beach) and dunes and deposit it on the offshore bars and shoals. As a result of predominant northeast winds and large storm systems, the beaches take on a more flattened profile with scarped (buffed) dunes in the winter (Figure 8). When the surf energy is not as high, the action of the waves gradually works sand back to the beach. Runnels (gullies) parallel to the surf line often form where the shoreward migration of sand meets the intertidal beach. Through the action of the wind, the drier sand of the intertidal beach is transported to the back beach zones and rebuilds the berm and dune systems. Eventually the net movement of sand between the beach and offshore area reaches a dynamic equilibrium, only to be temporarily offset by a passing storm or unusually high tide. Due to the predominant mild southeasterly winds, the beaches in the summer tend to build up (Figure 8).

As each zone from the dry beach to the maritime forest becomes less exposed to the wind and salt spray, a continual succession of plant communities occurs (Figure 7).

FIGURE 7
Profile of an Ocean Beach in Georgia



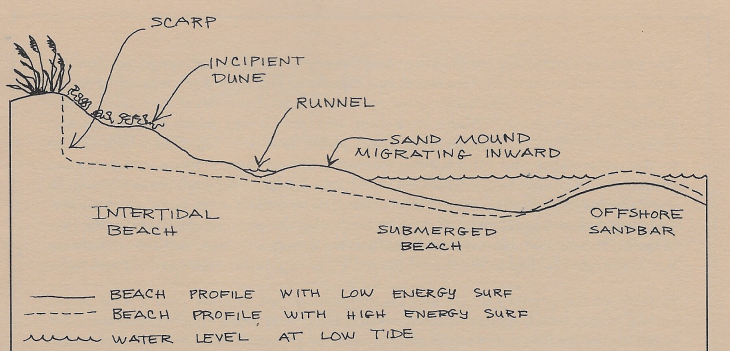


FIGURE 8
Changing Beach Profile with Low and High Energy Surf

The intertidal beach is wet, and its size is subject to the tidal range (relative to the moon cycle) and to the slope of the beach. Because of the gradual slope and high tidal range, the intertidal beaches of Georgia can extend as much as a quarter of a mile out to sea, and beaches near inlets because of the shoals may extend more than a mile during low tide (Figure 6). Due to the effects of wave action and daily inundation by sea water, the diversity of resident life is low in the intertidal zone. The majority of residents are found either in burrows or interspersed among the wet sand grains. The burrows of ghost shrimp and several kinds of polychaete worms become exposed at the lower intertidal beach during low tide. Algae living in the sand often color the wet beaches green during certain seasons and weather conditions. Coquina clams and mole crabs moving just beneath the surface of the sand filterfeed in the backwash of the surf. Myriads of tiny crustaceans (mostly amphipods) and small worms living in the wet sand (which can be exposed by flushing the sand through a screen) provide food for the sandpipers that busily probe the sand with their beaks at the edge of the surf. (See Animal section of Appendix A.)

The intertidal beach is also a visiting place for aquatic and terrestrial animals. Aquatic animals come in with the tide to feed and to escape from enemies. Those that die or are left stranded by the retreating tide provide food for the many shore-birds, ghost crabs, raccoons, rats, and insects.

The berm is the dry sand area between the intertidal beach and the primary dunes. The berm is usually inundated during storms and high tidal ranges and is rebuilt by the process mentioned above during milder weather and lower tide ranges. With such dynamics, plant inhabitation is not permanent. Because of the extreme tidal ranges and gentle slope, the Georgia beaches are characterized by expansive intertidal zones with narrow or nonexistent berms.

Along the high tide line, windrows of marsh wrack (dead cordgrass from the marsh) are often left behind by the wave wash. The marsh wrack provides a moist environment for beach hoppers (amphipods), insects, and microorganisms, and becomes a mesh into which wind-blown sand and seeds are trapped. In this way the marsh wrack plays a vital role in forming new (incipient) dunes supporting plant growth (Figure 8). The 0.5-inch to 2-inch diameter holes seen at the high tide line and among the dunes are ghost crab burrows. Occasionally ghost crabs leave their burrows during the day, but at night hundreds can be seen outside, foraging in the marsh wrack.

The primary dunes offer harsh living conditions because of the salt spray, quick water drainage, shifting sand, and incessant sun exposure. This area is often considered the "desert of the beach" because many resident plants have developed adaptations similar to desert plants.[20] Many have thick succulent leaves which store water and reduce leaf surface area evaporation. Some plants have deep tap roots which extend to the water table and others have extensive fibrous root systems which spread throughout the dunes to catch the rain which quickly filters through the sandy soil. In some species individual plants are interconnected by undergound stems, or rhizomes, which spread over great areas of ground, furthering the chances of survival in the face of the harsh and unstable environment. As in the desert, a number of dune animals are active at night and live in burrows during the day to avoid the intense heat and light.

In front of the primary dunes and on incipient dunes, pioneer plants such as sea rocket, orach, beach croton, Russian thistle, fiddle-leaf morning glory, and the rarer railroad vine are found. On top of and between the primary dunes, grasses such as salt meadow cordgrass, bitter panic grass, dropseed grass, and sandspur grow among the pennywort, beach elder, and prickly-pear cactus. In these areas the sand has little or no humus (decaying organic matter), so essential nutrients for the plants are gleaned from the sea water spray that seeps into the sand with the rain.

Eventually sea oats become established in this area. The long curly leaves and tall oat heads trap wind-blown sand, burying themselves and neighboring plants under the growing dunes they create. By a process of growing new leaves and roots ahead of the accumulating sand, the sea oats continue to survive; other plants of the evolving community suffocate, degrade, and provide humus for the growing oats. This is why almost pure stands of sea oats often thrive on top of well established dunes. Because of their vital role in building and stabilizing dunes, the State of Georgia prohibits the picking of sea oats.

In the interdune meadows behind the primary dunes grows a variety of grasses, weeds, and woody plants. The types of plants vary greatly from beach to beach, depending on the age of the meadows and the content of humus and clay in the soil. Common interdune plants are camphor weed, wild bean, butterfly pea, pennywort, dune primrose, yucca, grass-leaf golden aster, spurge-nettle, and the dramatic red and yellow firewheels.

In the older dunes, woody perennials (plants living for two or more years) appear among the dune grasses and herbs where the humus has built up sufficiently with time. Many of the interdune plants cannot tolerate the shade of the larger woody shrubs, and are replaced eventually by common shrub zone plants such as cat brier (green brier), Hercules'-club, muscadine grape, Virginia creeper, pepper vine, yucca, buckthorn, red bay, yaupon holly, groundsel-tree, saw palmetto, wax myrtle, red cedar, and live oak. Further from the beach, the canopy formed by the live oaks becomes higher, and many of the shrubs such as yaupon holly, wax myrtle, saw palmetto, and all of the vines except the pepper vine become understory species of the forest.

Many birds, reptiles, and mammals inhabit the shrub zone because of the excellent cover and broad range of foraging and breeding environments offered by the abutting forest and nearby beach.

SALT MARSH

Salt marshes of the southeastern coast occur in shallow areas between the barrier islands and the mainland and are flooded by tides twice daily. The large tidal range, coupled with the gentle slope of the land, contribute to the extensiveness of the marsh system. With the marshes ranging from 4 to 8 miles wide, the 100 miles of Georgia's coast contain approximately one-half million acres of marsh land — about one-third of all the salt marshes on the eastern coast of the United States.[21]

The marsh is a harsh environment for resident life. Major factors limiting life are intermittent exposure to air and salt water and the rapid change of temperature and salinity (salt concentration) that comes with the changing tides. The saturated muddy soils are anaerobic (low in oxygen content) and tend to concentrate salt through evaporation of sea water. Typical of the intertidal condition, relatively few species inhabit the marsh full-time, but many land and aquatic species visit the marsh to feed and seek shelter.

The marsh can be divided into several ecological zones, according to the relative time and depth of tidal inundation (Figure 9). The *levee marsh* describes the habitat on the banks of tidal creeks. Here the soil is washed regularly with sea water, which keeps changes in salinity and temperature to a minimum and continually supplies nutrients to the plants on the creek banks. The smooth cordgrass on the levees usually grows to its full height of 6 feet.

Behind the levees is the *low marsh* which makes up most of the southern marshlands. Incoming tidal water overflows the banks of the numerous small creeks and floods the low marsh for several hours a day. The relatively shallow water moves slowly over the black mud, exposing the water to the sun's radiant energy. The increased temperature that results and the great quantity of organic matter (detritus) suspended in the water and mud greatly reduce the amount of oxygen available to living organisms. Increased evaporation accompanies the elevated temperatures, causing a rise in salt concentration. These conditions, coupled with the intermittent exposure to air and water, make the low marsh a less optimal living environment than the levee marsh. Here the cordgrass grows 1 to 3 feet high.

With a slight rise in elevation, the low marsh gradually changes into *high marsh* with sandier soil which, during high tide, is flooded by barely enough water to cover the surface for an hour or less each day. Because the surface of the soil is exposed to air for long periods of time, much of the surface water evaporates, causing subsurface water to be drawn upward by capillary action (the same way water is drawn up a paper towel). Continued evaporation of the soil water makes the salt left behind a severe limiting factor for the plants living in this area. The cordgrass is either dwarfed (3 to 12 inches in height) or nonexistent, and more salt-resistant species like glasswort, saltwort, and salt grass populate the area. Often bare sandy areas, "salt pans," occur where the salt concentration has become great enough to prohibit all plant life.

The levee and low marshes are well populated with mud fiddler crabs, purple marsh crabs (square-backed crabs), oysters, ribbed mussels, polychaete worms, periwinkle snails, and two kinds of black marsh snails (the mud snail and the smaller coffee bean snail). Toward the higher sandier marsh, mud fiddlers and purple marsh crabs give way to sand fiddlers and wharf crabs (smaller, brown, square-backed crabs).

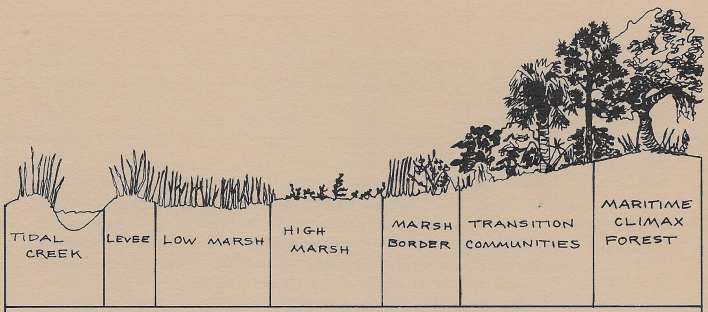


FIGURE 9
Profile of a Salt Marsh in Georgia

A slight elevation above the high marsh prevents tidal inundation except during spring and storm tides. Without the daily wash of sea water, rains and freshwater run-off from nearby uplands markedly lowers salinity. Here a sharp demarcation in plant communities occurs with the presence of needle rush and yellow-flowered sea oxeye, making this zone the true marsh border.[22] As seen in many inner-island salt marshes with a freshwater influence, the entire marsh may be populated with needle rush. In autumn, the light purple blossoms of the marsh lavender and marsh aster add a delicate hue to the marsh border.

At a slightly higher elevation, other marginal plants such as marsh elder, broad-leaf and narrow-leaf groundsel-trees, and salt meadow cordgrass are seen. Salt meadow cordgrass is the predominant plant in the marshes of the New England and Middle Atlantic states, while the smooth cordgrass dominates the southern marshes. Among watery depressions in this less saline area the largest of the fiddler crabs, the brackish-water fiddler, can be found. Occasionally brackish-water fiddlers are seen among foraging groups of sand fiddlers in the high dry marsh.

Cabbage palms, often seen fringing the marshes, are a part of a transition community of woody plants leading toward the maritime forest. Plants such as red cedar, wax myrtle, yaupon holly, red bay, and the introduced saltcedar are also a part of this community. The same border communities are seen surrounding the marsh islands or hammocks. Similar to the shrub zone of the beach, the marsh border and transition communities are common feeding grounds for many mammals, birds, and reptiles.

Where the uplands rise more steeply from the marsh, the climax forest often extends to the edge of the marsh, with no transition community at all. The languid limbs of the great oaks, laden with Spanish moss shading the edge of the marsh, create the serene setting unique to the southern salt marshes.

The shallow tidal waters of the marsh are a nursery where the young of many marine species feed and grow before returning to the sea. Not only are many of these commercial species such as shrimp, crabs, flounder, sea trout, and menhaden, but also they provide food for large offshore marine animals—swordfish, snapper, grouper, porgy, bluefish, tuna, and other commercially valuable fish.

MARITIME FOREST

The maritime live oak forest is the predominant climax community of southern barrier islands. This means that, under prevailing physical circumstances, the climax community continues to propagate itself and tends to remain relatively unchanged over time. Disruptive events like fires, hurricanes, blights, or human influence may temporarily cause new and different communities to form (i.e. fields, pine forests, swamps), but over time these eventually succeed back to the climax community. Live oaks, southern magnolias, and cabbage palms shade understory species such as the red bay, yaupon and American holly, sparkleberry, wax myrtle, saw palmetto, vines (muscadine, cat brier, Virginia creeper), Spanish moss, and many kinds of ferns and woods flowers.

Other hardwoods that form the canopy of island forests are water oak, laurel oak, tulip, sweetgum, red maple, pignut hickory, tupelo, and the introduced sycamore, but these are not as abundant as in the mainland coastal plains forests.

When disruptive forces (mostly fires) destroy the climax forest, loblolly and slash pines often take over because of their rapid growth rate and ability to grow in poor, fire-cooked soil. Unlike hardwoods, pines are unable to succeed themselves without frequent fires or other disasters, because young pines cannot grow under the shade of the parent trees. This is why most pine stands consist of trees approximately the same age. Shade-tolerant hardwood trees grow between the larger pines and take over when the great pines fall from old age or disease. With frequent fires, however, hardwood trees are easily destroyed, while pines often survive due to their peeling, fire-resistant bark. When mature, their 90- to 120-feet high crowns are out of reach of most forest fires. A persistent pine forest is often referred to as a "fire climax."

FRESHWATER SLOUGH

Sloughs come in many forms, from temporary ponds to large permanent ponds and swamps, and they occur where the surface of the ground coincides with the water table. Sloughs occur in dune meadows and shrub zones of beaches, in marsh hammocks, and in forests. In younger Holocene islands, sloughs often lie between ancient dune ridges. Many low areas between dune ridges on the southern part of Jekyll Island contain sloughs (Figure 1).

Ecologically, sloughs are critical as a source of fresh water for wildlife, especially during periods of frequent drought. Sloughs add greatly to the diversity of the island's species by providing a home for many freshwater-dependent organisms such as amphibians, water snakes, insects, and aquatic plants. They provide rookeries for herons, egrets, ibises, and woodstorks as well as excellent feeding and nesting grounds for many other birds. Because of the abundance of life surrounding sloughs, alligators, snakes (cottonmouth moccasins and rattlesnakes), and other predators are also attracted. A slough also accumulates nutrients for the soil and for vegetation with the death of its many plants and animals during seasonal fluctuations of the water level.[23] In contrast to the quiet stillness of the salt marsh on a summer evening, from a freshwater slough emanates the raucous cacophony of innumerable frogs, toads, and peepers.

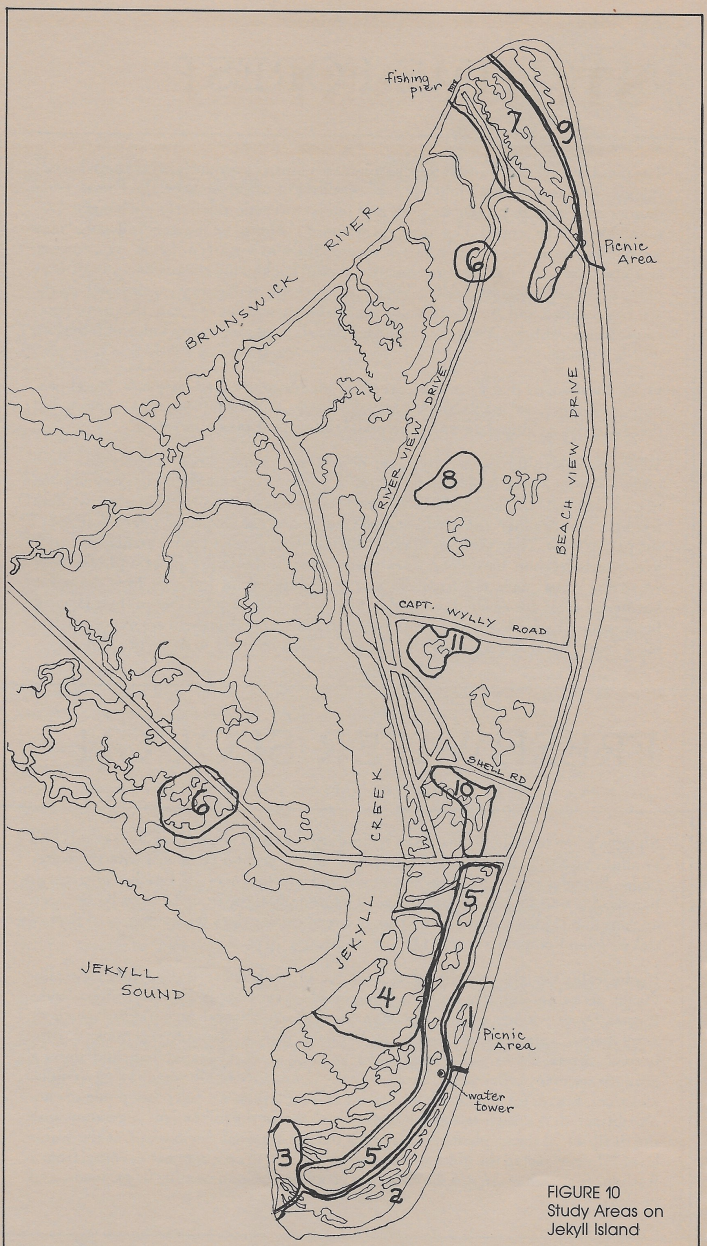


FIGURE 10
Study Areas on
Jekyll Island

STUDY AREAS

AREA 1: Eroded beach with extensive shrub zone and migrating sand dunes encroaching on an oak shrub forest

SITE: South picnic area and Holiday Inn property

The south picnic area is among old dune ridges left behind when the southern part of the island was formed. (See Geology section describing the recurved spit formation.) The two access paths to the beach cut through the tallest ridge, which is covered with a wind-stunted live oak forest. Shortly after passing through the tree-covered ridge a steep, 12-foot dune of wind-blown sand is encountered that must be climbed in order to get to the beach. Along the leading edge of the dune, there is clear evidence of its westward migration as it encroaches onto shrubs and trees in its path. Such large amounts of loose sand have smothered acres of shrubs and trees on Cumberland Island, to the south.

Scattered clumps of grasses, herbs, and woody shrubs growing on isolated sandy hillocks are all that remain of a beach plant community here. The loss of the beach community and the resulting migrating sand dune are due to the constant foot traffic of people coming to the beach.

The Holiday Inn boardwalk, just north of the south picnic area, provides a view of a more representative beach profile and plant community. The beaches on this part of the island have the high tide line extending into the shrub zone, indicating a history of erosion. The shrub zone of the Holiday Inn beach is well developed, showing a graded succession of plant species extending from the high tide line to the edge of the forest. A comparison of these two beaches is a testimony to the conservational benefits of having a boardwalk over fragile beach communities.

The effect of the wind and salt spray on the shapes and sizes of the trees can be seen from both the footpath and the boardwalk passing through the large ancient dune ridge bordering the picnic area and the Holiday Inn. The wind and salt spray dehydrate the exposed buds and leaves; as a result, the limbs on the windward sides of the trees are more stunted than those on the more protected leeward side, thus creating their characteristic lopsided shapes (Figure 11).

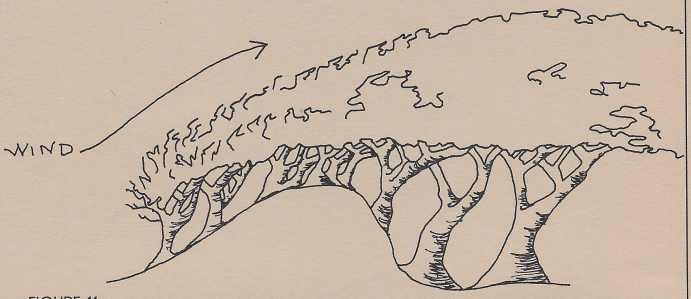


FIGURE 11
Wind-Shorn Trees: Profile of Tree Growth on a Dune under the Influence of Ocean Breezes and Salt Spray

Dehydration of the buds at the ends of the stems also causes the limb growth to become bushier on the exposed surfaces of the tree. In less severe environments, the terminal buds normally inhibit the growth of the many lateral buds in young stems. But in this harsh environment the exposed terminal buds die, releasing the premature growth of the many lateral stems (Figure 12). The same effect is, of course, created when familiar domestic shrubs are regularly trimmed. Other examples of these growth patterns are seen among the isolated trees on Jekyll's golf courses and in the north picnic area.

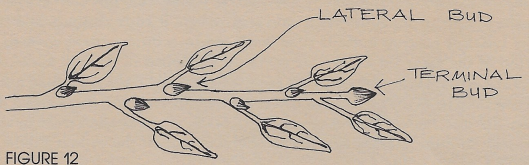
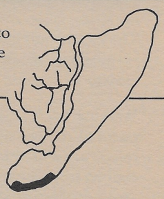


FIGURE 12
Limb with Buds

AREA 2:

Transition from an eroded bluff beach to an accreting beach with an extensive interdune meadow and slough



SITE:

Beach from the south picnic area to the southern tip of Jekyll Island

For the first quarter-mile south of the south picnic area, the beach is narrow, with the high tide wash eroding shrub-covered bluff-like (scarped) dunes; some dunes rise higher than 15 feet. Behind the first row of dunes is an extensive system of closely juxtaposed parallel dune ridges covered with shrubs (Figure 1). The shrubs eventually succeed to a live oak forest on the other side of Beachview Drive. The presence of many tracks and fecal pellets is evidence of active populations of deer and rabbits in this back dune area.

Just past the water tower about one-third of a mile south of the picnic area, the beach broadens, the large scarped dunes gradually diminish, and new incipient foredunes appear. From this position to the southernmost point of the island (approximately three-quarters of a mile), the foredunes gradually give rise to an extensive interdune meadow system covered with sea oats and other dune vegetation. The shrub zone narrows, with older stands of wax myrtle giving way to a dry buckthorn shrub forest.

At the southern end of the island, a large brackish-water slough surrounded by a mixture of freshwater and saltwater marsh plants is seen (Figure 1). The slough and surrounding back beach are main feeding and nesting areas for many shore birds. At this point the intertidal beach extends far out into the water, with several rows of sandbars, some at varying degrees of attachment to the beach. This is an excellent area for brown pelicans, terns, black skimmers, gulls, plovers, turnstones, godwits, curlews, dowitchers, willets, herons, egrets, oyster catchers, and a variety of sandpipers, especially in winter and spring.

AREA 3: Convergence of an inlet bluff beach, salt marsh, and forest-covered dunes

SITE: St. Andrews Sound beach and picnic area

The inlet beach extends approximately one-third of a mile from the southern point of Jekyll to the middle of St. Andrews picnic area, where it ends abruptly at a marsh creek. The beach is narrow, and the tidal wash erodes a dune system covered by a continuation of the same buckthorn shrub forest described in Area 2. Close to the picnic area the erosion is advanced to the point where many trees are falling onto the beach. Proceeding from the picnic area toward the southern point, the scarped dunes become smaller and the vegetation on them gradually changes from trees to shrubs and eventually to dune grasses and plants characteristic of the primary dune area (Appendix A).

Further back in the dry scrub forest are scattered low spots where temporary ponds occur. Because of the savannah-like conditions, field birds such as painted buntings, meadow larks, wild turkey, quail, and many song birds reside here. On the beach, scattered outcroppings of marsh mud, supporting cordgrass and sand fiddler communities, suggest the prior existence of an ancient marsh where the beach is today. The beach ends at the edge of a marsh creek just north of a small seawall in front of the picnic area. Much seining is done from this beach, providing an opportunity to see a variety of aquatic estuarine organisms.

Walking back from the beach into the picnic area, visitors pass through a narrow stand of red cedars into a mixture of loblolly pines and live oaks. Further back, the steep, ancient dunes with their massive live oaks meet narrow fingers of marsh coming from the east. The map of Jekyll (Figure 1) shows that the St. Andrews picnic area is located on the westernmost point of dune ridges that were originally formed by recurved spits. (See Geology section on recurved spits.) From the edge of the forest, the ancient dune ridges can be seen extending deeply into the marsh to the east. Many of the ridges have been broken up into hammocks by the eroding effects of meandering marsh creeks.[24] In spite of people traffic, most of the forested dunes have a well-developed understory. The great oaks harbor on their trunks and branches a variety of epiphytes (air plants) such as resurrection fern, several kinds of lichens (green and red), and two bromeliads — Spanish moss and the rarer *Tillandsia setacea.* Because of the convergence of many habitats, the St. Andrews area provides a diverse spectrum of plant and animal communities, as well as a beautiful place to visit.

AREA 4: A man-made harbor and brackish-water pond in a filled salt marsh

SITE: Marina site

The pond and harbor were dug in 1968 to construct a marina, but the persistent siltation of the 36-acre harbor caused the project to be abandoned. The pond, about 14 acres in size, was intended to hold fresh water but, due to seepage, it now contains

brackish water. The entire mud bottom of the harbor is exposed during low tide, and both bodies of water have oyster-shell banks, allowing easy access to the water's edge. This area offers excellent feeding conditions for shore and wading birds. Easy viewing from the vehicle path surrounding these bodies of water makes this area a favorite among birdwatchers.

The marina site was a salt marsh which has been filled in with dredge spoil from the construction of the harbor and pond. The community of plants it supports is similar to that found in a dry fallow field — dog fennel, broomsedge, pokeberry, etc. A comparison of the soil and communities of plants and animals of the surrounding high marsh with those of the fill area illustrates the dramatic changes that accompany filling in a salt marsh.

The vehicle path around the harbor brings one close to high marsh, salt pan, and scattered saltcedar, red cedar, and wax myrtle hammocks. It then terminates on a point of land separating the harbor and the Jekyll River at the inlet. On the other side of the point, a quarter-mile footpath made from oyster shells allows easy walking along the banks of the Jekyll River. It is interesting to see that sand fiddlers and glasswort restrict themselves to the sand and oyster-shell bank on the river side of the path while mud fiddlers and sea oxeye remain on the muddier substrate on the other side of the path. (See Ecology section on marshes.) Behind the muddy area, the elevated fill area supports a vigorous growth of saltcedars, wax myrtles, and groundsel trees. During summer, Wilson's Plovers distract hikers with attention-getting displays in an apparent effort to protect their nests nearby.

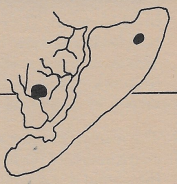
AREA 5: Mid-island live oak/saw palmetto forest with intermittent freshwater sloughs

SITE: South central area of Jekyll Island, between Beachview and Riverview Drives

The live oaks here tend to be taller and the understory species more fully developed than the live oak forests seen in previous areas. Just south of the south picnic area, a sandy vehicle path connects Beachview and Riverview Drives, providing easy access to an excellent cross-sectional view of a mid-island climax forest community. The path is relatively undisturbed, and birds and other animals are plentiful.

Just south of the intersection of the path and Riverview Drive is a narrow freshwater wetland community with a large stand of 8-foot-high rose mallows which have dramatic 6-inch-wide pink flowers in the summer. Many other freshwater wetland species such as marsh fleabane, pickerelweed, and a variety of arrowheads, rushes, and sedges are also seen. The fact that this area is one of several gully-shaped lowlands running parallel and between tree-covered dune ridges again brings to mind the ancient recurved spit from which this part of the island was formed. (See Figure 1 and Geology section on recurved spits.)

AREA 6: Salt marshes



SITE: The salt marshes surrounding the du Bignon Burial Ground picnic area and Latham's Hammock

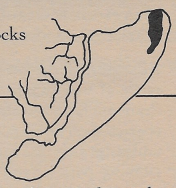
The du Bignon area is a western-facing picnic area and historic shrine about a half-mile south of the Clam Creek picnic area on Riverview Drive. Entering the picnic area from the north, by the burial site, follow the trail south for about 50 yards and turn toward the marsh. A tidal creek appears at the left as the marsh is entered. Sea oxeye grows along the bordér of the picnic area and a high marsh and salt pan are a short distance to the north. Good examples of marsh border plants are found along the edge of the picnic area. Away from the picnic area and deeper into the marsh, the soil becomes muddier, and the high marsh communities give way to those of the lower wet marsh. (See Ecology section on marshes.)

The picnic area proper is a mixed community of cabbage palms, pines, oaks, red cedars, and border species at the edge of the marsh. The historic shrines here and across the street are also welcome points of interest.

Latham's Hammock is the first large island on the left (south) of the causeway leaving Jekyll Island and is one mile from the drawbridge. Entering from the Jekyll Island side of the hammock, high-dry marsh and salt pans are encountered. This sandy substrate provides easy walking almost completely around the hammock and allows access to many environments bordering the island. At any point the walk from the hammock into the marsh demonstrates the transition from dry marsh communities to wet marsh communities. Visitors are discouraged from entering the hammock because of the high probability of encountering snakes in the dense shrubs that cover much of this wild island. (See Appendix B.)

An acre-sized freshwater slough is found close to the center of the hammock, where it abuts the shoulder of the causeway and is hidden behind wax myrtle shrubs. From the causeway, rough paths lead through the shrubs to the slough. Alligators inhabit the slough and herons, ibises, and wood storks roost in the surrounding trees. Visitors to the slough should keep as quiet and still as possible so as not to drive the roosting birds away.

AREA 7: Inland salt marsh with marsh hammocks and a fishing pier



SITE: Clam Creek marsh and fishing pier

The road to the pier and picnic area is an old dune ridge separating Clam Creek marsh from marshes bordering the western side of the island. The entrance to Clam Creek Road passes through a young live oak/saw palmetto forest which rapidly thins to a row of oaks lining both sides of the road. In three locations, Clam Creek meanders to the edge of the road, allowing easy access to the creek. From the road, there are excellent views of both the inland marsh and the marshes bordering the western side of the island.

The entire marsh is circumscribed by the road to the pier, and a bike path that bridges the mouth of Clam Creek goes along the eastern side of the marsh and ends at the north picnic area (Figure 1).

The bike path is built on a dike with culverts for the underlying marsh creeks. On the way to the north picnic area from the bridge (about one and one-fifth miles), the path passes through the young oak/palmetto woods fringing the beach and through several pine and red cedar hammocks, which have enough surrounding high marsh to allow walking around them. All levels of marsh and border communities are encountered. Many herons, rails, painted buntings, hawks, kingfishers, and occasional alligators, minks, otters, and deer may be seen from this path. At the end of the bike path, Clam Creek marsh bends to the southwest, goes under Beachview Drive, and ends as a needle rush/bunch grass marsh abutting a red maple lowland forest from which it receives freshwater drainage. (See Area 8.)

The fishing pier offers an excellent panoramic view of the beaches and marshes of northern and northwestern Jekyll and a view of St. Simons Sound.

AREA 8: Freshwater lowland and forest with temporary ponds

SITE: The woods at the end of Jennings Road

A crude path leading into the woods is seen where Jennings Road terminates at the edge of an oak/pine forest. A left turn from the path about 100 feet into the forest leads to an extensive system of shallow temporary ponds in a stand of red maples and pines. Among the leaf litter, the long delicate recumbent spike-rush *(Eleocharis vivipara)* dominates the shallow pond depressions, and ferns, woods flowers, Carolina willows, wax myrtles, red bays, and button bushes occupy the higher ground surrounding the ponds. Freshwater emergent plants (cattails, arrowheads, and pickerel weeds) border the deeper, more permanent ponds. This area is known for harboring many deer, turkey, and other wild species, as would be expected of an environment of this kind. (See Ecology section on freshwater sloughs.) This appears to be part of the same red maple/lowland forest system to the south of Clam Creek marsh described in Area 7.

AREA 9: Dynamic beach with areas of advanced erosion (tree stump beach) and incipient accretion, joining an inland brackish-water marsh

SITE: North picnic area and beach leading around the north end of the island and ending at Clam Creek

The north picnic area is situated in a large stand of wind-sculpted live oaks which gives this area its special charm. Refer to Area 1 for further information on the shearing process by wind and salt.

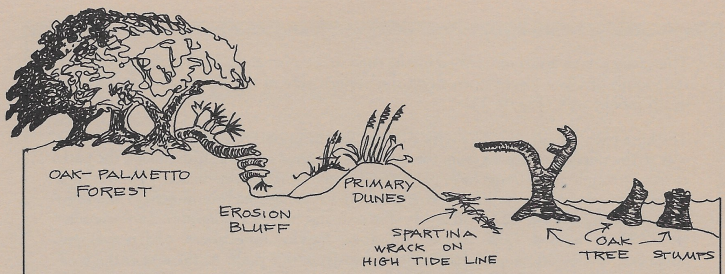


FIGURE 13
Profile of North Jekyll Beach

For the first quarter-mile to the north of the picnic area, the beach is highly eroded, with the high tide line reaching well into the shrub zone and forest. In this section, buried branches occasionally become exposed in the intertidal zone after unusually high tides and surf. Wind shearing and resulting bushy growth of the shrubs and trees bordering this part of the beach is particularly dramatic.

About the first half-mile north of the picnic area, the shrubby oaks in the back beach give way to an isolated area of low sand dunes sparsely covered with grasses and shrubs. This sandy area appears to be the site of an old inlet to the marsh which lies behind the woods bordering the beach.

Past the inlet site, an older pine stand with a young hardwood understory becomes the bordering forest. A little further north, a system of dunes covered with sea oats appears in front of the pine forest. From the height of the dunes closest to the forest and from the density of vegetation, this system appears to have been in existence for at least two or three years. As a result of extraordinary high tides and strong northeast winds in the fall of 1981, much of what was a growing system of incipient dunes and interdune meadows was washed away, leaving the tell-tale scarps (bluffs) on the last row of dunes. Since then the dune system has been rebuilding.

About three-quarters of a mile northward, the beach starts to curve toward the west as it approaches the northernmost point of the island. At this point, the pines give way to oaks with a saw palmetto understory, and the high tide line cuts off the grassy dunes and again extends into the forest. Pine roots appear on the intertidal zone, and the beach becomes narrower and steeper.

Similar to other barrier islands, the eastern beaches of Jekyll have had a long history of erosion. (See Geology section.) The most severe erosion has taken place on the northern and northeastern areas which, according to Nash, have lost 1.2 square miles of beach between 1935 and 1962, with some areas losing nearly 8 feet of beach a year.[25]

The erosion of Jekyll Island greatly increased after the dredging of the shipping channel in 1909. Much of the sand carried by the southerly-directed longshore currents that previously nourished the beach and inlet shoal systems of Jekyll now falls into the channel and continues to be re-dredged and carried out to sea.[26]

Past the northern point, the remnant trees in the intertidal zone become stumps and branches of oak and saw palmetto. Here recent accretion has produced a row of incipient grass-covered dunes growing between the bluffed edge of the eroded forest and the bestumped intertidal beach—a testimony to the dynamics of barrier islands (Figure 13).

About three-tenths of a mile west of the northernmost point of Jekyll Island, the marsh behind the beach (mentioned earlier) appears. The forest bordering the beach grows on the first of three major dune ridges separated by this marsh and Clam Creek marsh (Figure 1). A review of the Geology section offers an explanation for the pattern of land formation seen here.

The marsh shows signs of poor tidal circulation, with pockets of stagnant water and patches of salt marsh plants undergoing varying stages of freshwater succession. A second inlet to the marsh, at its northern end, often is blocked for long periods of time by sand accreting onto the northern beach, and occasionally is reopened by storms and high tides.

Proceeding westward along the beach, the second forested dune ridge bordering the other side of the marsh is encountered. This ridge area is quite wide and appears to be made up of several relict dune ridges close together. A footpath parallel to the dune ridges leads from this beach to the site of the old marsh inlet on the eastern-facing beach mentioned earlier (Figure 1). (See the Geology section on the effect of inlet shoal systems on the northern ends of the islands.) The path goes through a mixed oak and pine forest.

After passing the second series of dune ridges, the beach abruptly terminates at the mouth of Clam Creek. At this point one can either go across the Clam Creek bridge toward the fishing pier, or turn east and take the bike path to the north picnic area (mentioned in Area 7).

AREA 10: A system of salt marshes and sloughs of varying salinities, with uplands and marsh hammocks interspersed

SITE: Area between Shell Road and the Ben Fortson Parkway

The map of Jekyll Island (Figure 1) shows that an extensive system of marshes and sloughs interspersed with uplands and hammocks occurs through most of the lower middle region of the island between Shell Road and the northern borders of Areas 4 and 5 (Figure 10).

This area can be approached by turning north off the Ben Fortson Parkway onto a small road located beside the Phillips 66 service station. This road ends at a pump station where a diked bike path continues across marshes and uplands for about a quarter of a mile to a wooden bridge spanning a small tidal creek. Water from the creek feeds the marsh on both sides of the bike path. Beyond the bridge, the bike path turns westward and skirts along the northern edge of the marsh system at its border with oak/pine uplands. This path closely delineates the southern edge of the older, Pleistocene part of Jekyll from which the original recurved spit grew (Figure 5).

About 150 yards from the bridge, the path takes an oblique turn to the north, leaving the marsh, and ascending through the oak/pine upland for a quarter of a mile until it terminates into the Old Village Boulevard.

Riverview Drive, which traverses the marshes and uplands between the Ben Fortson Parkway and the turn-off onto Old Village Boulevard, provides a view of the western extent of this system of marshes and sloughs. From this road, isolated areas of the marshlands can be seen undergoing a variety of successional changes, some leading toward freshwater and brackish-water lowlands, and others toward drier habitats. Such changes have resulted from the interruptions of tidal flow by the diking required to support Riverview Drive and the old road which is now the bike path mentioned above.

The bike path is a favorite among bird-watchers. With such a diversity of habitats in an area visited so infrequently, a wide variety of plant and animal life abounds.

AREA 11: Freshwater ponds with floating and emerging water plants

SITE: Ponds behind amphitheater off Old Village Boulevard, and beside Captain Wylly Road between the golf clubhouse and the Southern Bell building

The large pond in back of the amphitheater was created when soil was removed for construction of the amphitheater. Both pond systems are virtually choked with water vegetation. The large floating pads and pink blossoms of the sacred lotus, a fairly rare naturalized plant, is predominant in both ponds. Other water plants, more typical of our sloughs, are water-lily, spatterdock, bull tongue, American lotus, pickerelweed, cattail, and duckweed, to mention a few. This is an excellent area for finding amphibians, reptiles, and pond microorganisms, as well as freshwater pond plants.

APPENDICES

APPENDIX A

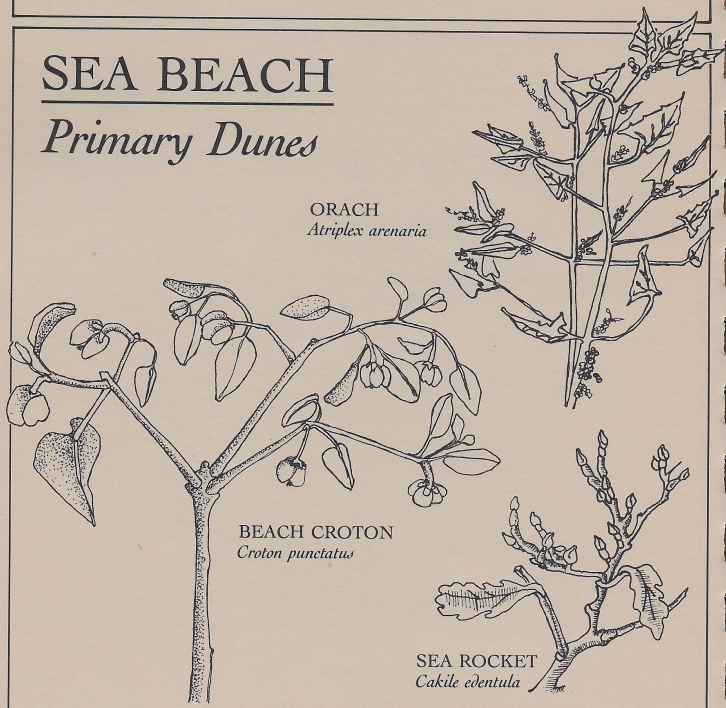
PLANT AND ANIMAL IDENTIFICATION

The plants and animals are grouped here as they appear in their natural communities. Where it is not appropriate to mention the species in the scientific name, the abbreviation *sp.* follows the genus. Brief descriptions of identifying features for the plants and animals are included at the bottom of each page of illustrations. The season (spring, summer, fall) following each plant description indicates when flowering takes place.

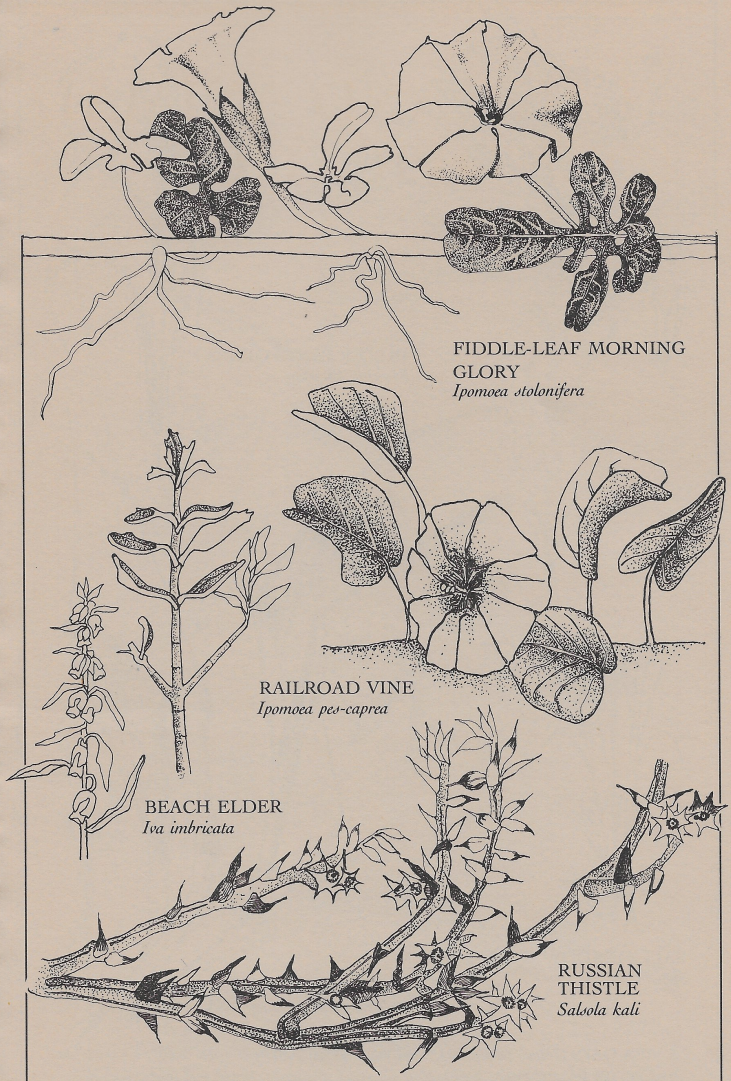
Since there is only one illustration of each plant, plants which are found in more than one community are listed under the subtitle "Other Plants" where they occur in subsequent environments. The environment in which the illustration of the listed plant occurs is in parentheses after the name.

SEA BEACH

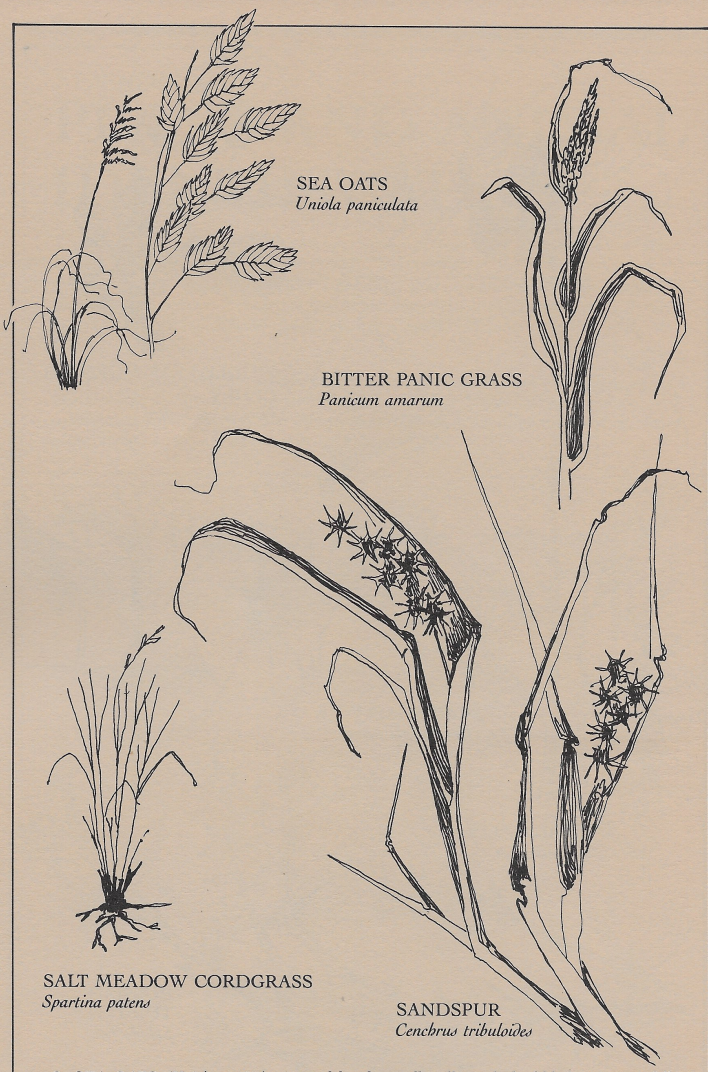
Primary Dunes



1. ORACH *(Atriplex arenaria):* succulent gray-green leaf, red stem, summer.
2. BEACH CROTON *(Croton punctatus):* gray-green plant, round fruit, spring.
3. SEA ROCKET *(Cakile edentula):* succulent plant, dies in summer, spring.



4. FIDDLE-LEAF MORNING GLORY *(Ipomoea stolonifera):* succulent leaf, large white flower, vine, summer-fall.
5. RAILROAD VINE *(Ipomoea pes-caprea):* large purple flower, vine, fall.
6. BEACH ELDER *(Iva imbricata):* succulent leaf, woody stem, summer.
7. RUSSIAN THISTLE *(Salsola kali):* succulent leaf with spine, small prickly flowers, summer.

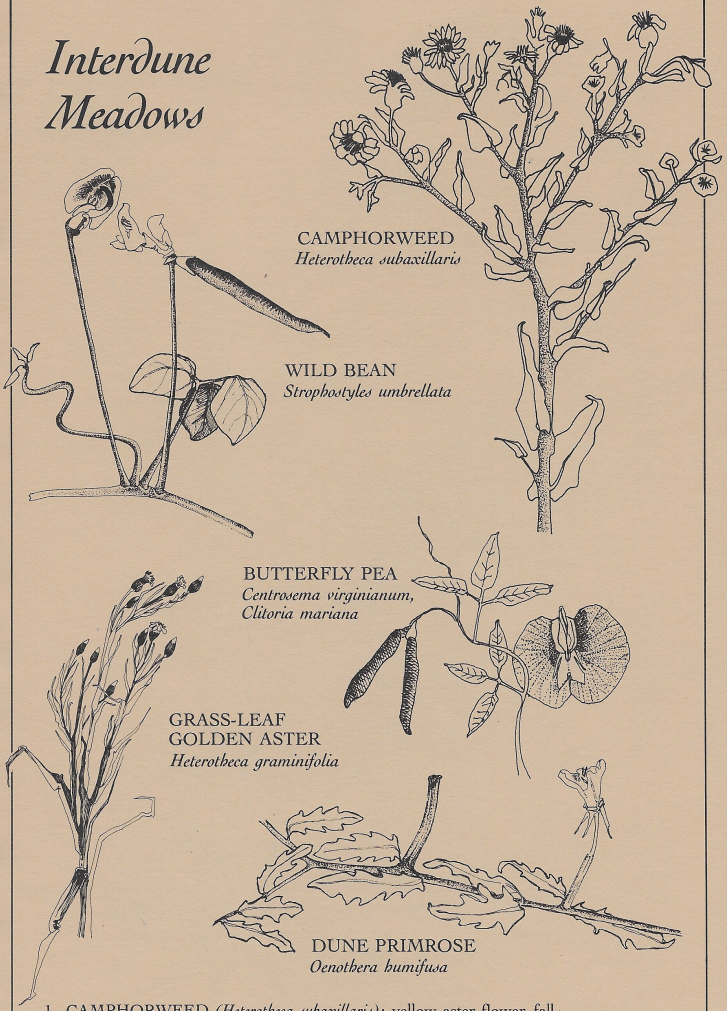


8. SEA OATS *(Uniola paniculata):* seed head on tall stalk, curly leaf blade, summer-fall.
9. BITTER PANIC GRASS *(Panicum amarum):* prostrate, broad leaf blade, summer.
10. SALT MEADOW CORDGRASS *(Spartina patens):* narrow leaf blade, summer.
11. SANDSPUR *(Cenchrus tribuloides):* prostrate, sharp painful burr, fall.

Other Plants:

- PENNYWORT (interdune meadow, beach).
- DROPSEED GRASS: like salt grass (marsh), different seed head.

Interdune Meadows



CAMPHORWEED
Heterotheca subaxillaris

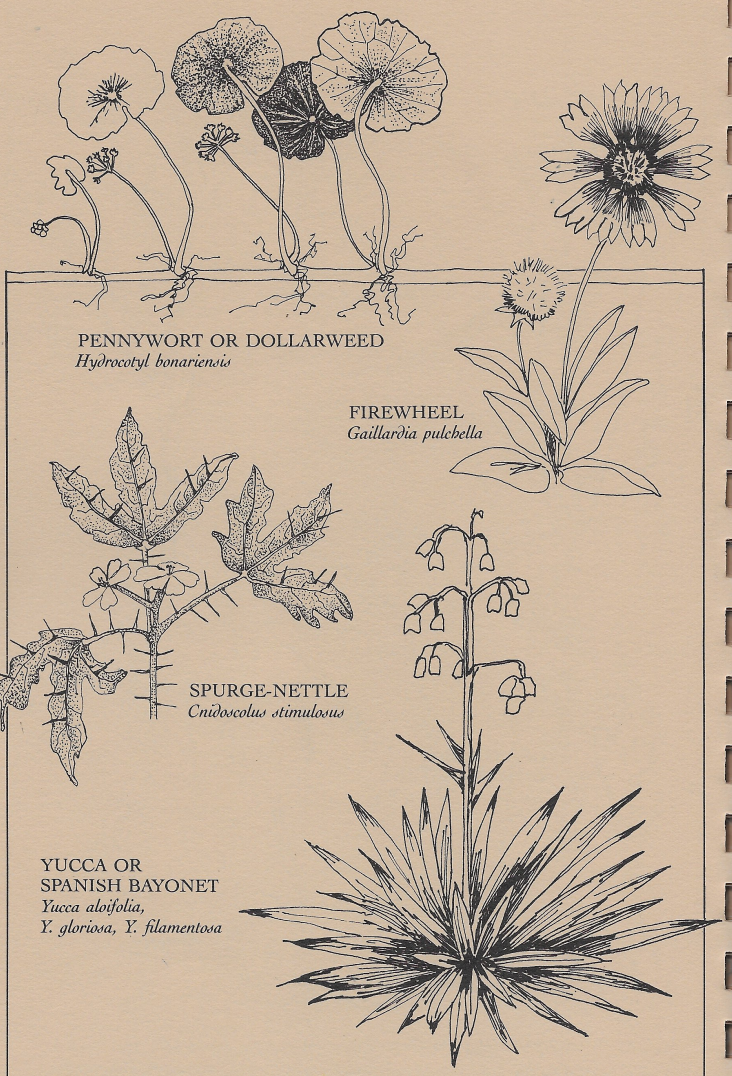
WILD BEAN
Strophostyles umbrellata

BUTTERFLY PEA
Centrosema virginianum,
Clitoria mariana

GRASS-LEAF
GOLDEN ASTER
Heterotheca graminifolia

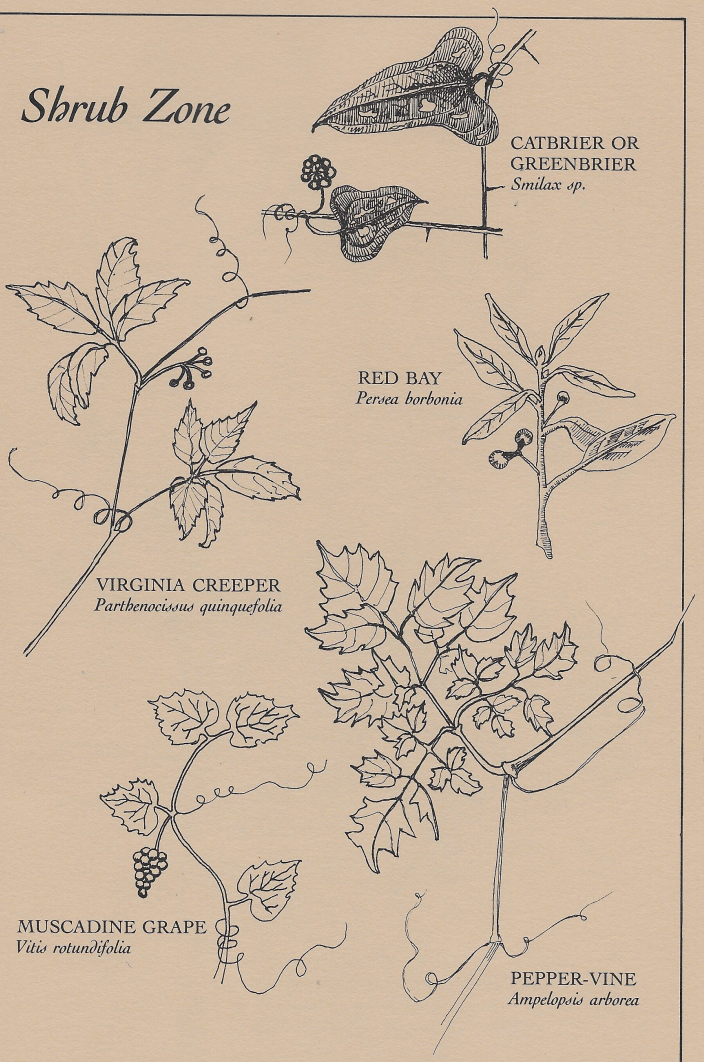
DUNE PRIMROSE
Oenothera humifusa

1. CAMPHORWEED *(Heterotheca subaxillaris):* yellow aster flower, fall.
2. WILD BEAN *(Strophostyles umbrellata):* small red pea flower, slender pod, vine, summer-fall.
3. BUTTERFLY PEA *(Centrosema virginianum, Clitoria mariana):* large purple pea flower, vine, spring-fall.
4. GRASS-LEAF GOLDEN ASTER *(Heterotheca graminifolia):* yellow aster flower, grass-like leaf, summer.
5. DUNE PRIMROSE *(Oenothera humifusa):* prostrate, pink and yellow flower, spring and fall.

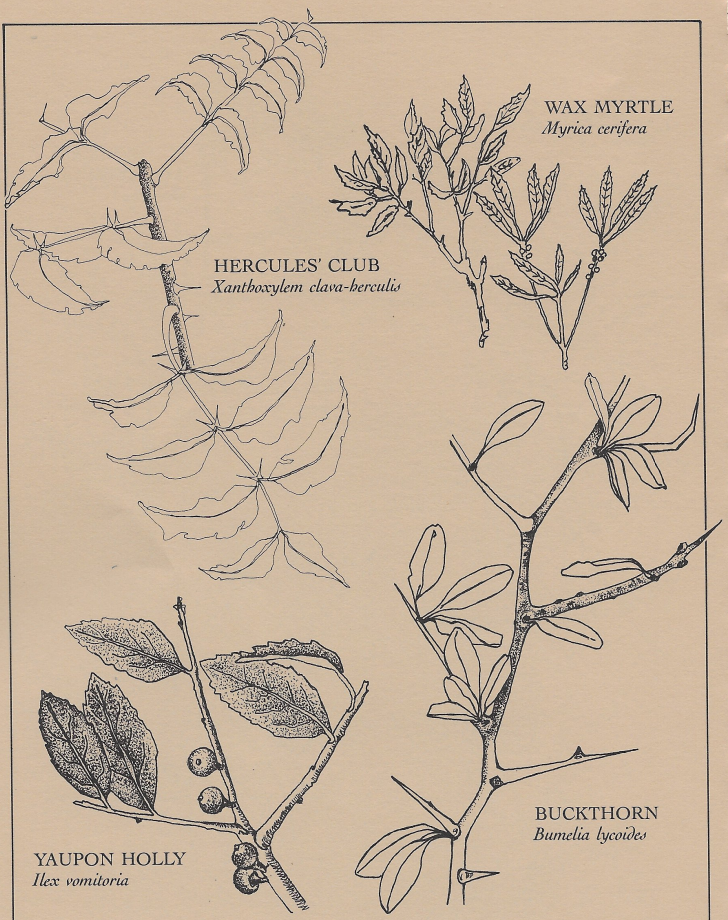


6. PENNYWORT OR DOLLARWEED *(Hydrocotyl bonariensis):* umbrella-shaped leaf, spring-summer.
7. FIREWHEEL *(Gaillardia pulchella):* large red and yellow aster flower, summer-fall.
8. SPURGE-NETTLE *(Cnidoscolus stimulosus):* small white flower, nettles, spring-summer.
9. YUCCA OR SPANISH BAYONET *(Yucca aloifolia, Y. gloriosa, Y. filamentosa):* succulent leaf with sharp point, summer.

Shrub Zone



1. CATBRIER OR GREENBRIER *(Smilax sp):* thorns, black berry, shiny leaf, vine.
2. RED BAY *(Persea borbonia):* aromatic leaf, tree.
3. VIRGINIA CREEPER *(Parthenocissus quinquefolia):* leaf has five leaflets, vine.
4. PEPPER-VINE *(Ampelopsis arborea):* black berry, leaf with many leaflets.
5. MUSCADINE GRAPE *(Vitis rotundifolia):* grapes, vine.



6. HERCULES' CLUB *(Xanthoxylem clava-herculis):* thorns, shrub or small tree.
7. WAX MYRTLE *(Myrica cerifera):* aromatic leaf, small gray-white berry, shrub.
8. BUCKTHORN *(Bumelia lycoides):* thorns, small tree.
9. YAUPON HOLLY *(Ilex vomitoria):* red berry, shrub.

Other Plants:

- YUCCA (interdune meadow, beach).
- GRASS-LEAF GOLDEN ASTER (interdune meadow, beach).
- GROUNDSEL-TREE (marsh).
- RED CEDAR (marsh).
- LIVE OAK SHRUB (forest).
- SAW PALMETTO (forest).

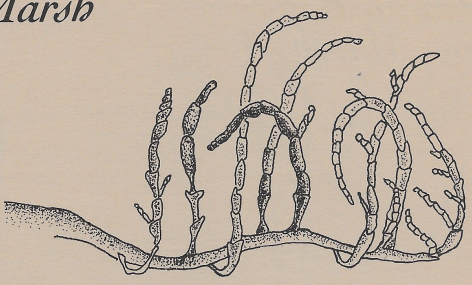
SALT MARSH

Low Marsh

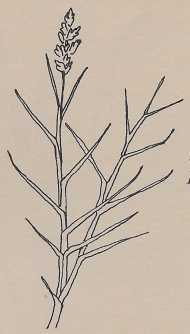
SMOOTH CORDGRASS
Spartina alterniflora

1. SMOOTH CORDGRASS *(Spartina alterniflora):* broad leaf blade, plant size varies.

High Marsh

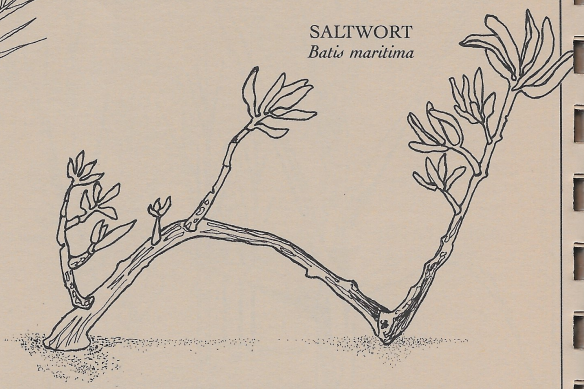


GLASSWORT
Salicornia virginica, S. bigelovii, S. europaea



SALT GRASS
Distichlis spicata

SALTWORT
Batis maritima



1. GLASSWORT *(Salicornia virginica, S. bigelovii, S. europaea):* succulent plant.
2. SALT GRASS *(Distichlis spicata):* leaf blades in one plane.
3. SALTWORT *(Batis maritima):* succulent leaf, prostrate, woody stem.

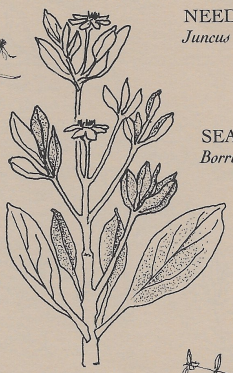
Other plants:

- SALT MEADOW CORDGRASS (beach).
- SMOOTH CORDGRASS (low wet marsh), shorter in size.
- MARSH LAVENDER (marsh border).
- MARSH ASTER (marsh border).

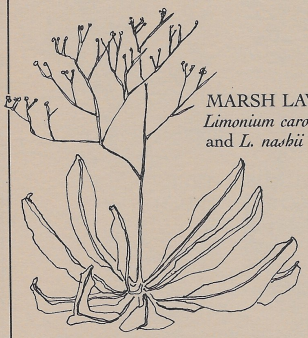
Marsh Border

NEEDLE RUSH
Juncus roemerianus

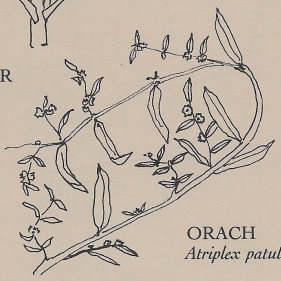
MARSH ASTER
Aster tenuifolius



SEA OXEYE
Borrichia fruitescens



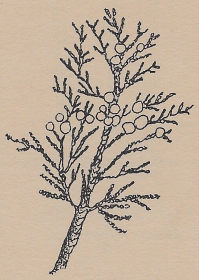
MARSH LAVENDER
Limonium carolinianum
and *L. nashii*



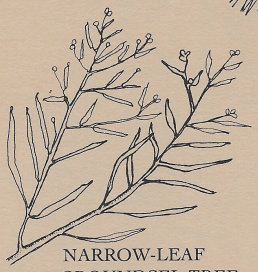
ORACH
Atriplex patula

1. MARSH ASTER *(Aster tenuifolius):* lavender or white aster flower with yellow center.
2. NEEDLE RUSH *(Juncus roemerianus):* long tubular dark-green leaf with sharp pointed tip.
3. SEA OXEYE *(Borrichia fruitescens):* succulent leaf, yellow aster flower, spiky burr, spring.
4. MARSH LAVENDER *(Limonium carolinianum and L. nashii):* Inflorescence of small purple flowers, basal leaves, fall.
5. ORACH *(Atriplex patula):* like *A. arenaria* (beach) but smaller leaves.

Upper Marsh Border and Transition Zone



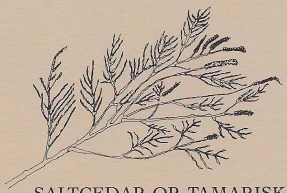
RED CEDAR
Juniperus virginiana



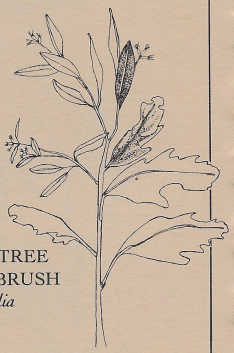
CABBAGE PALM
Sabal palmetto

NARROW-LEAF
GROUNDSEL-TREE
OR FALSE WILLOW
Baccharis angustifolia

MARSH ELDER
Iva frutescens



SALTCEDAR OR TAMARISK
Tamarix gallica



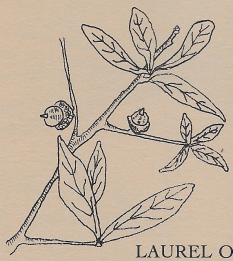
GROUNDSEL-TREE
OR COTTON BRUSH
Baccharis halimifolia

1. CABBAGE PALM *(Sabal palmetto):* no spines on leaf stalks, tree.
2. RED CEDAR *(Juniperus virginiana):* tree.
3. NARROW-LEAF GROUNDSEL-TREE OR FALSE WILLOW *(Baccharis angustifolia):* like groundsel-tree but narrow leaf and rarer.
4. MARSH ELDER *(Iva frutescens):* shrub.
5. SALTCEDAR OR TAMARISK *(Tamarix gallica):* like red cedar but paler color, tiny pink flowers, small tree or shrub, summer.
6. GROUNDSEL-TREE OR COTTON BRUSH *(Baccharis halimifolia):* white seed tufts in fall, shrub.

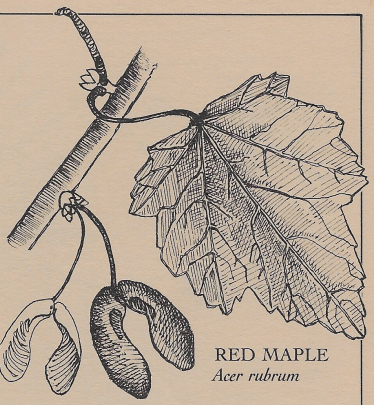
Other Plants:

• WAX MYRTLE (beach) • YAUPON HOLLY (beach) • MARSH FLEABANE (slough)

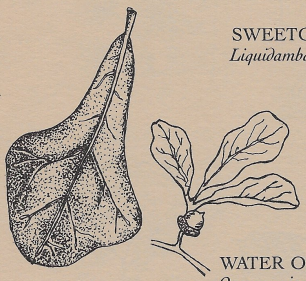
FOREST



LAUREL OAK
Quercus laurifolia



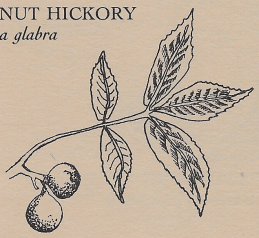
RED MAPLE
Acer rubrum

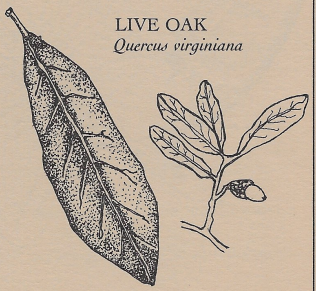


SWEETGUM
Liquidambar styraciflua

WATER OAK
Quercus nigra

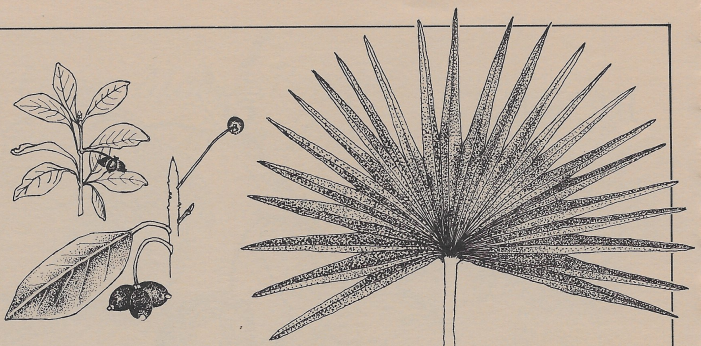
PIGNUT HICKORY
Carya glabra





LIVE OAK
Quercus virginiana

1. RED MAPLE *(Acer rubrum):* red buds in spring, winged fruit, tree.
2. LAUREL OAK *(Quercus laurifolia):* narrow leaf, tree.
3. SWEETGUM *(Liquidambar styraciflua):* gum balls, tree.
4. WATER OAK *(Quercus nigra):* spatula-shaped leaf, tree.
5. LIVE OAK *(Quercus virginiana):* massive tree with low branches.
6. PIGNUT HICKORY *(Carya glabra):* distinct nut, tree.

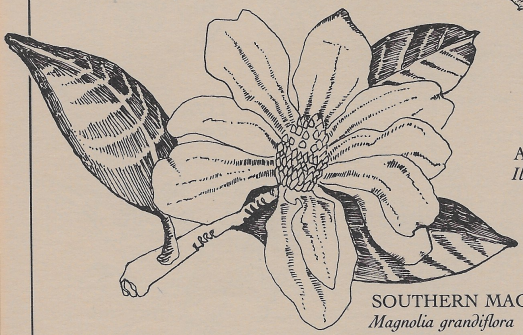


TUPELO OR BLACKGUM
Nyssa sylvatica

SAW PALMETTO
Serenoa repens

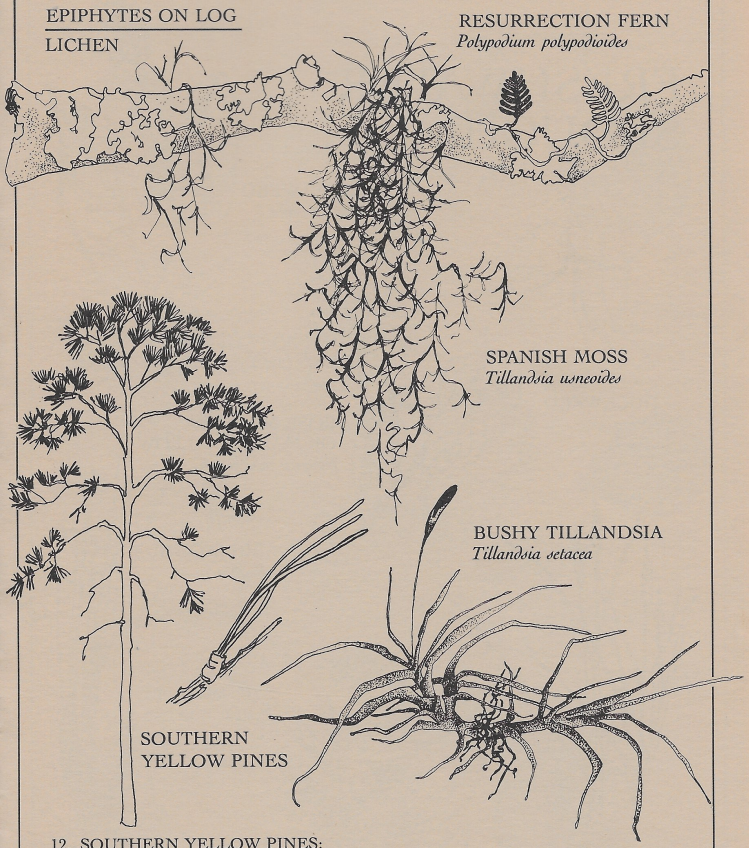
SYCAMORE
Platanus occidentalis

AMERICAN HOLLY
Ilex opaca



SOUTHERN MAGNOLIA
Magnolia grandiflora

7. SAW PALMETTO *(Serenoa repens):* like cabbage palm (marsh), but with spines on leaf stalk, reclining.
8. TUPELO OR BLACKGUM *(Nyssa sylvatica):* blue fruit, small tree.
9. SYCAMORE *(Platanus occidentalis):* blotched bark, distinct fruit, tree.
10. AMERICAN HOLLY *(Ilex opaca):* leaf with spines, red berry, small tree.
11. SOUTHERN MAGNOLIA *(Magnolia grandiflora):* large shiny leaf with rust undersides, fruit with red seeds, large white flowers, tree, spring.



12. SOUTHERN YELLOW PINES:

SLASH PINE *(Pinus elliotti):* mostly two needles per sheath, cones on short stalks, gray bark.

LOBLOLLY PINE *(Pinus taeda):* mostly three needles per sheath, cones with no stalks, bark reddish.

LONG-LEAF PINE *(Pinus palustris):* mostly three needles per sheath, needles usually longer and cones larger than other pines.

POND PINE *(Pinus serotina):* three or four needles per sheath, small top-shaped cones.

13. EPIPHYTES ON LOG:

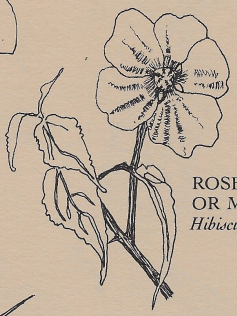
SPANISH MOSS *(Tillandsia usneoides)* BUSHY TILLANDSIA *(Tillandsia setacea)* RESURRECTION FERN *(Polypodium polypodioides)* LICHEN

Other Plants:

• YAUPON HOLLY (beach) • RED CEDAR (marsh) • RED BAY (beach) • WAX MYRTLE (beach) • MUSCADINE GRAPE (beach) • VIRGINIA CREEPER (beach) • CAT BRIER (beach) • CABBAGE PALM (marsh) • BUTTERFLY PEA (beach)

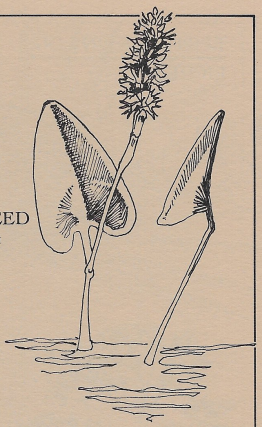
FRESHWATER SLOUGH

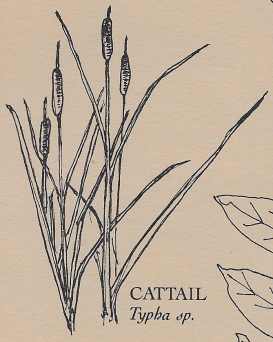
DUCKWEED
Lemna sp.



ROSE MALLOW
OR MARSH MALLOW
Hibiscus moscheutos

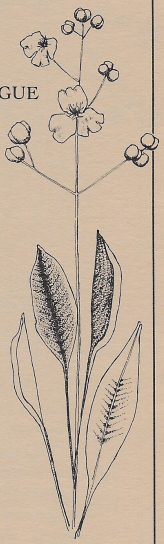
PICKERELWEED
Pontederia cordata





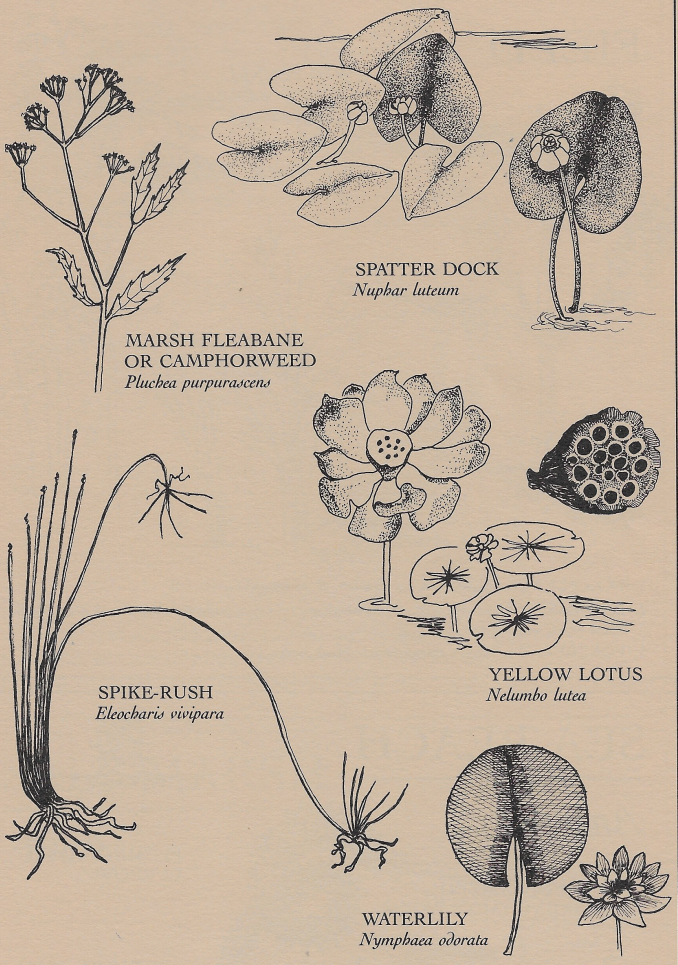
CATTAIL
Typha sp.

BULLTONGUE
Sagittaria sp.



BUTTON BUSH
Cephalanthus occidentalis

1. DUCKWEED *(Lemna sp.):* small floating plant, often covers ponds.
2. ROSE MALLOW OR MARSH MALLOW *(Hibiscus moscheutos):* tall, six-inch-wide red or white flowers, summer-fall.
3. PICKERELWEED *(Pontederia cordata):* blue flowerhead, spring-fall.
4. BULLTONGUE *(Sagittaria sp.):* white flower clusters, summer-fall.
5. CATTAIL *(Typha sp.):* tall green leaves, large brown seed head, summer-fall.
6. BUTTON BUSH *(Cephalanthus occidentalis):* distinct fruit, small tree.



7. MARSH FLEABANE OR CAMPHORWEED *(Pluchea purpurascens):* lavender flowerheads, summer-fall.
8. SPATTER DOCK *(Nuphar luteum):* yellow flower, spring-fall.
9. YELLOW LOTUS *(Nelumbo lutea):* yellow lotus flower, umbrella-shaped leaf, summer.
10. SPIKE-RUSH *(Eleocharis vivipara):* long thin reclining stems, new shoots grow from stem tips.
11. WATERLILY *(Nymphaea odorata):* white flower, spring-summer.

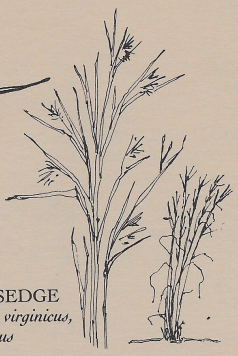
Other Plants:

- SACRED LOTUS *(N. nucifera):* like yellow lotus but larger pink flowers, summer.

FIELD

POKEBERRY
Phytolacca americana

DOG FENNEL
Eupatorium capillifolium,
E. compositifolium



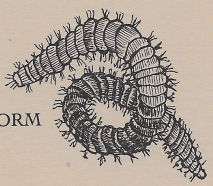
BROOMSEDGE
Andropogon virginicus,
A. glomeratus

1. DOG FENNEL *(Eupatorium capillifolium, E. compositifolium):* fall.
2. BROOMSEDGE *(Andropogon virginicus, A. glomeratus):* yellow-rust colored grass with white seed, tufts in fall.
3. POKEBERRY *(Phytolacca americana):* black berry, fall.

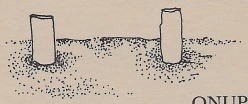
SEA BEACH

Animals

PLUMED WORM
BURROW

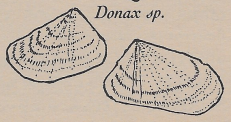


GENERALIZED
POLYCHAETE WORM

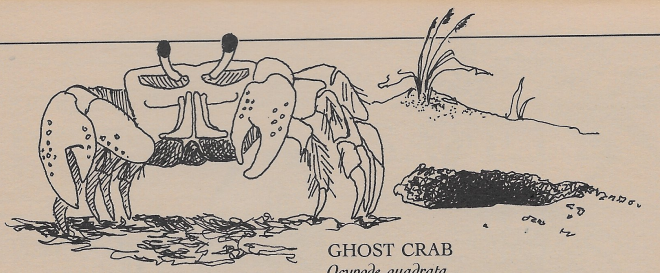


ONUPHIS WORM
BURROW

COQUINA CLAM
Donax sp.

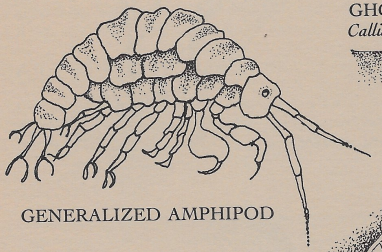


1. GENERALIZED POLYCHAETE WORM: size greatly varies.
   PLUMED WORM *(Diopatra cuprea):* burrow entrance with shells and plant fragments.
   ONUPHIS WORM *(Onuphis sp):* burrow entrance, parchment-like substance.
2. COQUINA CLAM *(Donax sp.):* shell color greatly varies.



GHOST CRAB
Ocypode quadrata

GHOST SHRIMP IN BURROW
Callianassa major



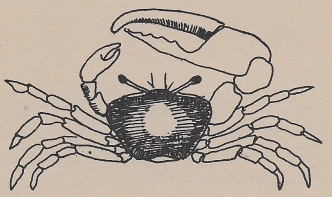
GENERALIZED AMPHIPOD

GHOST SHRIMP
BURROW

3. GHOST CRAB *(Ocypode quadrata):* beside burrow entrance, white with yellow leg bristles.
4. GHOST SHRIMP *(Callianassa major):* burrow entrance, with fecal pellets.
5. GHOST SHRIMP IN BURROW: burrow two to three feet deep.
6. GENERALIZED AMPHIPOD: approximately ⅛ inch in length.

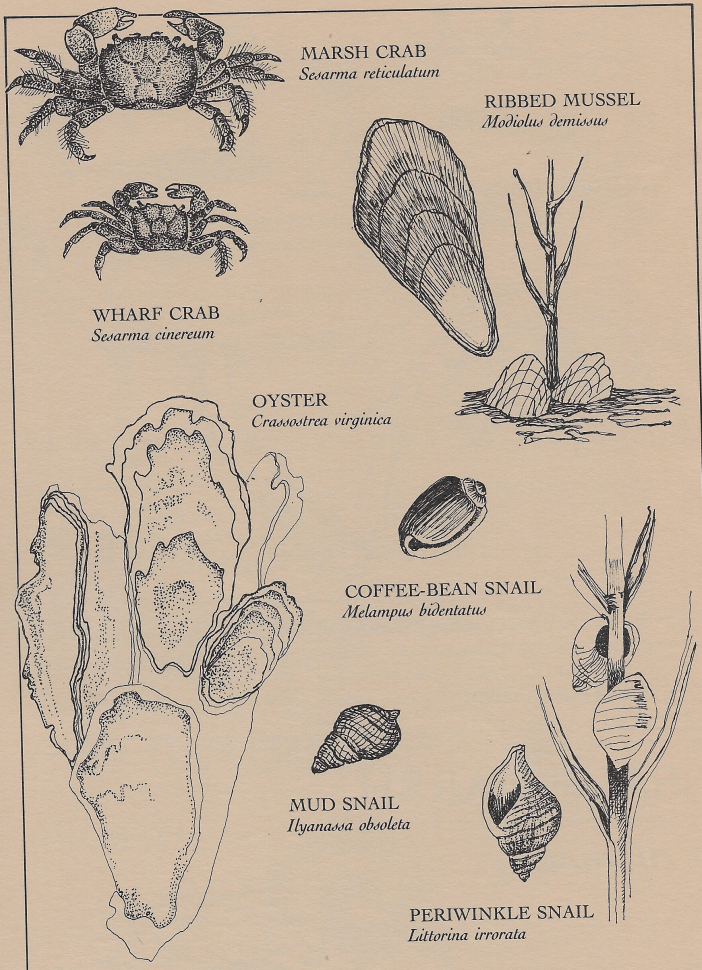
SALT MARSH

Animals



GENERALIZED
FIDDLER CRABS

1. FIDDLER CRABS: generalized
   SAND FIDDLER *(Uca pugilator):* purple on back, white pincer.
   MUD FIDDLER *(Uca pugnax):* brown body, blue line above eyes, yellow pincer.
   BRACKISH-WATER FIDDLER *(Uca minax):* larger than other fiddlers, black back and paler toward face, red dots on joints of pincer, white pincer.



2. SQUARE-BACKED CRABS:
   WHARF CRAB *(Sesarma cinereum):* flat, delicate brown body.
   MARSH CRAB *(Sesarma reticulatum):* stout, black body, larger than wharf crab.
3. RIBBED MUSSEL *(Modiolus demissus):* light color.
4. SNAILS:
   PERIWINKLE SNAIL *(Littorina irrorata):* white snail found on cordgrass stalks.
   MUD SNAIL *(Ilyanassa obsoleta):* black snail found on mud, one-inch size.
   COFFEE-BEAN SNAIL *(Melampus bidentatus):* like mud snail but half-inch size.
5. OYSTER *(Crassostrea virginica):* cluster of oysters seen on creek banks at low tide.

APPENDIX B

PERSONAL SAFETY

EXPOSURE TO SUN

Some kind of protection from sunburn is needed at all times of the year. The reflected light, white sands, and strong breezes all intensify sunburn. A hat is recommended to keep from burning the head and face and to help guard against sand gnats (midges). Keep a long-sleeved shirt handy to avoid overexposure to the sun.

CLOTHING

Old shoes or sneakers should be worn in marshes and woods to protect the feet. Bring extra clothing; temperature changes in autumn, winter, and spring are often sudden, and an accidental fall into mud or water could require a quick change.

INSECTS

Sand gnats, mosquitos, and biting flies can make life miserable. Be sure to bring insect repellent. Most repellents work well for mosquitos and flies, but midges are not so easily discouraged. Avon's Skin-So-Soft so far seems to be the best for repelling midges, but does not work well for other biting insects. Skin-So-Soft can be diluted with water or rubbing alcohol and put into a pump or spray bottle.

DRINKING WATER

The dessicating sun, wind, heat, and salt spray can create an inordinate thirst, particularly on longer field trips. It is a good idea to carry water in a canteen. Many times, the public fountains have sulfur water which, although not harmful, has an unpleasant taste.

GENERAL FIRST AID

Ammonia water or alcohol helps ease jellyfish stings. Antiseptic ointments or tinctures and a can of assorted band-aids and gauze pads should be sufficient for cuts and scratches incurred from thorny vines, thistles, sand spurs, and cactus plants, as well as for cuts on the feet from shells or other sharp objects in the water. Headaches can result from long exposure to the sun and glare from the bright sand, so aspirin is helpful.

SNAKES

Two kinds of rattlesnakes (eastern diamondback and pigmy rattler) and the cottonmouth moccasin are found on Jekyll Island. Rattlesnakes can be found in almost any environment but prefer shrubby places like back dune areas, marsh hammocks, and woods. Cottonmouths stay in and around freshwater sloughs.

Although encountering these snakes is a rare event, caution and common sense are advised. Snakes tend to lie in protected places, so be careful not to place your feet into shrubby thickets, clumps of tall grass, palmettos, or trash piles where you are unable to see where you are stepping. If you must step over a rotting log, be sure to clear the other side by a broad margin.

Occasionally poisonous snakes crawl into the open. Leave them alone, and they will leave you alone.

APPENDIX C

BOOK LIST

The following field guides and books are by no means a complete list, but are recommended to help you become more familiar with this area.

FIELD GUIDES

1. *A Field Guide to the Atlantic Seashore,* Kenneth Gosner, Houghton Mifflin Co.
2. *Beachcomber's Guide to the Golden Isles,* Bertrand Dunegan.
3. *Audubon Society Field Guide to North America Seashells,* Random House.
4. *A Field Guide to the Birds,* Roger Peterson, Houghton Mifflin Co.
5. *Guide to Southern Trees,* E.S. Harrar and J.G. Harrar, Dover.
6. *Wild Flowers of the Southeastern United States,* W.H. Duncan and L.E. Foote, The University of Georgia Press.
7. *Common Marsh, Underwater and Floating Leaved Plants of the United States and Canada,* Neil Hotchkiss, Dover.
8. *Seacoast Plants of the Carolinas,* Karl E. Graetz, U.S. Department of Agriculture, Soil Conservation Service, Raleigh, N.C.
9. *Common Plants of the Mid-Atlantic Coast, A Field Guide,* Gene M. Silberhorn, Johns Hopkins University Press.
10. *Native Flora of the Golden Isles,* Gladys Fendig and Esther Stewart.

BOOKS

11. *Life and Death of the Salt Marsh,* John and Mildred Teal, Ballantine Books.
12. *Portrait of an Island,* John and Mildred Teal, The University of Georgia Press.
13. *The Edge of the Sea,* Rachel Carson, Houghton Mifflin Co.
14. *Seacoast Life: An Ecological Guide to Natural Seashore Communities in North Carolina,* Judith M. Spitsbergin, North Carolina State Museum of Natural History, Raleigh, North Carolina.
15. *An Ecological Survey of the Coastal Region of Georgia,* A.S. Johnson and H.O. Hillestad, Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.
16. *Georgia's Land of the Golden Isles,* B. Vanstory, The University of Georgia Press (History).

APPENDIX D

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14. Pilkey, O.H. and W. Kaufman. 1979. *The Beaches Are Moving. The Drowning of America's Shorelines.* Anchor Press/Doubleday, Garden City, New York, pp. 1-326.

15. Pilkey, O.H. 1981. "America's beaches: An endangered species?" *Sea Grant Today* (Nov.-Dec.), Vol. 11, No. 6, pp. 14-16.

16. Pilkey and Evans, *op. cit.*

17. Leatherman, *op. cit.*

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19. Nash, *op. cit.*

20. Spitzbergin, J.M. 1980. *Sea Coast Life.* An Ecological Guide to Natural Seashore Communities in North Carolina. North Carolina State Museum of Natural History, Raleigh, North Carolina, p. 36.

21. West, R.C. 1977. "Tidal salt marsh and mangrove formations of Middle and South America." *In* Chapman, V.T., editor. *Ecosystems of the World I: Wet Coastal Ecosystems.* Elsevier Publishing Co., Amsterdam, pp. 193-213.

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24. Nash, *op. cit.*

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