

Background Information: Cay Creek Wetlands Park is a natural area that exhibits many of Georgia's coastal habitats. The habitats that can be found here are: Upland Maritime Forest, Upland Pine Flatwoods, Open Wetland, Freshwater Tidal Swamp, Marsh Hammocks and Shrubby Upland Edge, and Brackish Tidal Marsh. Each one is structurally and compositionally unique. Young children will be able to see these differences in the way that animals and trees are present or the amount of water and sunlight that you can see in a habitat. Older students may explore species composition and the more subtle changes of plants over a salt water and topographic gradient. Underlying the ecosystem structures, the greater biogeochemical life forces are churning.

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1. NATURAL SYSTEMS

What are the different types of clouds?

Clouds are a very important part of our atmosphere because they contribute to controlling the climate of earth's surface. They form around mineral particles that make their way into the atmosphere through the process of condensation (when water vapor converts to liquid drops). Clouds indicate current or impending weather conditions.

Cirrus clouds are thin and wispy, sometimes called "horse-tails" because of their appearance. They occur highest in the atmosphere and are formed by high winds. They are so high that their water particles are frozen ice crystals. They indicate changing weather.

Alto clouds are the next highest. They are formed of ice and water droplets and appear gray or dark blue. These are the clouds you may see before a rainstorm or snowstorm.

Stratus clouds are lower lying and they cover the entire sky you can see in a uniform gray mass. They can produce a light drizzle or flurries.

Cumulus clouds are white, puffy clouds that appear in the sky when there is good weather. They are often shaped with a flat underside and puffy top.

Cumulonimbus clouds are are thunderstorm clouds, and they sometimes appear gray and dark, because they are so saturated that sunlight cannot pass through them. They have a shape like an anvil, with a flat top and bottom that come together in a point.

What is the geology and soil like in this area?

Cay Creek Wetlands Park is on the on the border of the outer Coastal Plain and the Maritime ecoregion. Much of the wetlands are tidally influenced, which causes them to be classified under the Maritime ecoregion habitat type. The coastal plain is comprised of loose particles, or sediments (mostly sand), of the eroded Appalachian Mountains. Few rocks can be found in the soil here other than gravel and stones used for buffers or driveways. These rocks are often made of limestone or sandstone that was quarried in another part of the country and shipped here.

Some of the sediments here date back to as old as the Pleistocene epoch, which began 2.6 million years ago. However, sands and sediments are still being eroded, transported, and deposited on the coast every day. Younger sand and sediments are slightly larger (or coarser) with sharp edges than the older Pleistocene sediments, which are finer and rounder. Of course you can only see these differences under a magnifying lens!

Scientists describe soil based on the size of the particles that are in it. Large particles are called sand, medium sized particles are called silt, and tiny particles are called clay. One grain of sand can be the size of 300 particles of clay all stuck together! Most soils have many different sized particles in them. If we put the soil in a jar of water and shake it then the sizes will separate out and we can

see the proportion of sand, silt, and clay. The heavy sand particles will settle first, then lighter silt and finally (maybe after several hours) the lightest clay. This also demonstrates how sediments in a stream or lake tend to settle on the floor. The sand particles will settle much faster and the clay particles will take a longer time. The clay might stay suspended if the water is moving until it is in a very quiet, calm location.

This water jar experiment helps to demonstrate why the sand on Georgia's beaches is much finer than other coastal states. Wave energy on the Georgia coast is much lower because of the shallow Continental Shelf and the inward curve of the Georgia Bight. Therefore finer grained particles can stay on the beach because they are not stirred up by strong pounding waves.



The sand on Georgia's coasts (and all of eastern North America) is made mostly of quartz crystals and that is why it sometimes appears sparkly. Light reflects off of conchoidal fractures on the sand grain's surface, giving it a shimmery quality.

Most of the soils in the Maritime ecoregion are acidic, but in small pockets it may be neutral to slightly alkaline due to the presence of oyster shells, which break down and shed calcium.

Cay Creek has two main substrates, or soil types. The upland areas have a high sand content while the wetland depressions and marsh are very high in silt, or mud that has settled in the quieter sheltered lagoons behind the barrier islands. Some of these sediments are, like the sand, from the Piedmont region and transported by large rivers such as the Altamaha and Savannah Rivers. This type of dark fine soil also has a high content of detritus (dead organic matter) that has been broken down and digested by the plant and animals that live in this habitat. These sediments are dark in color because they are submerged in an oxygen-deficient wet area.

What are the characteristics of the water cycle in this area?

As previously stated, the Georgia coastline is reported to have the lowest wave energy levels along the southeastern coast. This is not to be confused with tidal energy, however, for Georgia has one of the largest ranges from high to low tide, an average of nine vertical feet. The tidal energy from South Carolina and Florida coasts, which are much further east, funnels into the Georgia Bight, causing a tremendous swell.

The interplay between fresh and brackish water is what shapes the plant composition of the communities of Cay Creek. As you travel from the upland forests toward the tidal creek, you pass through a series of habitats that gradually become lower in elevation, wetter, and saltier. These three factors are something to look for along the way.

The water in the swamps has a distinctly different source than the water in the tidal creek. The freshwater swamp is part of what is called a blackwater system, named for the dark color of the

water that is produced by the tree roots and fallen leaves that are submersed in it. The tree roots and vegetation release tannins, bitter substances that aid in defense against disease and rot, from their plant tissue. This water comes from local groundwater seeps and collects in low areas.

Rain water that falls on the uplands soaks into the sandy soil quickly and travels downward between the sand grains until it hits the water table. You can find out how deep the water table is by using a hand augur and digging a small well into the ground until you hit standing water. In the upland forests at Cay Creek this may be as shallow as 2-4 feet. This will change seasonally and daily, depending on the amount of rainfall the area has recently experienced.

Once the water flowing down through the soil hits the water table it changes direction and flows laterally to a "discharge" zone where the water table is lower. This discharge zone could be a well that is extracting water for plumbing or it could just be a place low in elevation, called a depression. The water table around a well forms a "cone of depression" as groundwater is extracted. Big industries that use a lot of water, such as a paper mill, will have the effect of making the cone of depression so large that the water table drops over a large area. This may result in salty water making its way into the aquifer.

The tides play a huge part in the groundwater level and salinity of these systems, which is why they are said to be "tidally influenced." Salty water is denser than fresh water because of the salt that is dissolved in it. Therefore it remains below the fresh water, but when the tides rise, the pressure in the pore spaces between soil particles increases, pushing the water level in the swamps higher. The swamps still have a fresh water lens on the surface, but may have salt water below.

2. ECOLOGY

What are the natural communities of Cay Creek?

There are 6 distinct habitats that have been identified at Cay Creek. These are: Upland Maritime Forest, Upland Pine Flatwoods, Open Wetland, Tidal Freshwater Swamp, Marsh Hammock and Shrubby Upland Edge, and Brackish Marsh.

The Upland Maritime Forest at Cay Creek is characteristic of other coastal hardwood forests. There is an abundance of live oaks and other species that produce fruit and mast (acorns). These fruits are an important food source for the omnivorous birds and mammals here. Live oak acorns are eaten by deer, raccoons, feral hogs, wild turkeys, and other birds. Other important trees and shrubs for providing food include laurel oak, saw palmetto, smilax, American holly, yaupon, dahoon holly, wax myrtle, vacciniums (blueberry), red bay, sweet bay, southern magnolia, American beautyberry, Virginia creeper, muscadines and other wild grapes. Spanish moss that drapes over the trees provides nesting and feeding habitat for large numbers of songbirds and woodpeckers. **Common plant species here are:** pignut hickory, flowering dogwood, American holly, southern magnolia, red mulberry, devilwood, black cherry, white oak, live oak, sassafras, common sweetleaf, devil's walkingstick, American beautyberry, witchhazel, American mistletoe, sparkleberry, trumpet

honeysuckle, summer grape, muscadine, resurrection fern, smooth elephant's foot, oakleaf fleabane, coral bean, narrowleaf purple everlasting, partridgeberry, spotted beebalm, Carolina phlox, Carolina wild petunia, lyreleaf sage, Canada germander, Spanish moss.

Upland Pine Flatwoods are represented by the line of Pine trees along the right of the driveway. These trees here are loblolly pines that remain from a large tract that was planted for lumber or pulpwood. This area would likely grow up to be a Pine Flatwoods habitat if left to natural succession. A Pine Flatwoods has dry soils during the summer and moister soils in the winter, spring, or times of heavy rainfall. Pine Flatwoods let in much more light relative to the Maritime Forest. The more open canopy encourages herbaceous plants to grow in a mat of needles. Together these dry plant materials provide fuel for frequent fires. The effects of periodic burning are favorable to the maintenance of a predominantly pine stand. This habitat hosts many herbivorous grazers like insects and animals that eat small seeds. **The plant species that may be found here include:** slash pine, loblolly pine, winged sumac, highbush blueberry, cross vine, yellow Jessamine, greenbriar, muscadine, switchcane, Maryland golden aster, comfortroot, hairy lespedeza, powderpuff mimosa, woolly ragwort, American pokeweed, blackeyed Susan, and helmet flower.

The Open Wetland is the beginning of the wetland depression that is described in the hydrology section. Remnants of rice culture are suggested by the elevated ridges and linear channels. This wetland was likely created by both natural and artificial means, for canals were dug to introduce more water for growing rice. **Common plants in this area include:** common buttonbush, Virginia sweetspire, American elderberry, possumhaw viburnum, groundnut, climbing hempvine, American wisteria, bushy bluestem, swamp flatsedge, common rush, sugarcane plume grass, woolgrass, Alligator weed (invasive), Monnier's water-hyssop, justicweed, floating marshpennywort, seashore mallow, anglestem primrose-willow, herbwilliam, pickerelweed, lizard's tail, and bladderwort.

The Freshwater Tidal Swamp is a dark forested wetland that is tidally influenced. This type of ecosystem has been reduced in Georgia by extractive practices of logging cypress trees and clear cutting to make rice dikes. It provides essential habitat and refuge for an abundance of bird and aquatic species. Characteristics of the Freshwater Tidal Swamp include the knees and buttresses of the bald cypress trees, adaptations that allow them to grow in saturated conditions. **Common plants in this area include:** red maple, sweetgum, sweetbay, swamp tupelo, swamp bay, spruce pine, bald cypress, American elm, southern swamp dogwood, dwarf palmetto, climbing aster, trumpet vine, climbing hydrangea, greenbriar, poison ivy, sensitive fern, royal fern, netted chainfern, smallspike false nettle, Virginia iris, bulltongue arrowhead, sphagnum moss.

The Marsh Hammock and Shrubby Upland Edge occurs on the edge of the marsh, creating unique islands of biodiversity. Trees and shrubs are established on hammocks from seeds dispersed by birds. They often have high calcium content from shell middens (mounds) deposited by American Indians. **Common plants in this habitat include:** dahoon holly, southern red cedar, cabbage palm, wax myrtle, hammock snakeroot, and marsh elder.

The Brackish Marsh is riddled with swamp drainage streams that empty into Cay Creek. The water here is slightly more saline (salty) than in the freshwater swamps because of the tidal creek influence. There is no midstory or understory in the Brackish Marsh, and only a few grass and shrub species grow here. Many sea creatures use the marsh as a nursery, traveling into the small creeks to mate and spend their juvenile lives. **Common plants in this habitat include:** groundsel bush, salt-marsh bulrush, black needle rush, smooth cordgrass, big cordgrass, saltmeadow cordgrass, sweetscent, and seaside goldenrod.

What is a habitat?

A habitat is the place where a plant or animal lives. It must provide all of the necessary resources to sustain an organism's life. For plants these include: water, sunlight, space, air. For animals these include: water, food, and shelter.

Plants get their food using their green leaves by capturing the sun's energy. They turn it into sugar using photosynthesis, similar to the way humans digest their dinners. Some plants live out in the open because they require more sunlight than plants that live in the shade, like a swamp. Plants also live in conditions where the amount of water is most suitable for them. A plant like a bald cypress tree, that likes a lot of water, will grow in a swamp. A plant like a pine tree, that likes dry soil, will grow on higher land, like an upland forest. If a pine tree tried to grow in a swamp it might drown, and if a cypress tree tried to grow in a pine forest it might die of thirst. Use these examples to show young children how one habitat is different from another.

Plants and animals depend on healthy habitats to complete their life cycles. They also need the ability to shift to suitable locations if outside pressures, like drought or flooding, force them to move. We tend to think of plants as sedentary species, and indeed, an individual plant cannot move its roots on its own accord beyond the means of a creeping root or rhizome. However, populations of plants do move. Seeds and nuts disperse at a landscape level by wind and water, birds and mammals. If a seed lands in a good habitat it will have a better chance of surviving in this new place and growing to produce seeds of its own.

Animals get their food from plants or other animals. Some are herbivores, like vegetarians, and they only eat plants. Others are carnivores, and they only eat animals. Animals that eat plants and other animals are called omnivores.

Plants and animals that have similar needs, but fill different niches, tend to live together in a community. An ecological community is a group of interacting plant and animal species that live in the same place and influence each other.

What is living and what is non-living?

Simply put, plants, animals, fungi, and microorganisms are living. Everything else is non-living. Living things have cells that grow and perform different functions. Dead matter used to be alive, but it lacked the ability survive and perform functions so it perished. This seems like an obvious distinction, but young children may not be able to grasp certain aspects of what is alive and what is

not alive. A good way to teach these definitions is by showing examples of each category. These could include:

<u>Living</u>	<u>Dead</u>	<u>Non-living</u>
pine tree	wooden table	metal screws in table
potted plant	fresh cut flowers	flower vase
leaves on tree branch	leaves on the ground	wind
fungus growing on a log	log on the ground	sand and rocks

Some tricky ones: Spanish moss is living. Soil is not living, but has millions of living organisms in it. Water is non-living, but it constitutes most mass of living plants and animals.

What is an exotic-invasive species?

Exotic species are not necessarily the same as invasive species, but oftentimes plants and animals that are introduced to a region that is not their native habitat become invasive. Exotic plants are introduced on purpose and by accident. They are shipped from other regions for landscaping or agricultural reasons or to be kept as pets or draft animals. The exchange of plant and animal species across oceans has occurred since humans have learned to travel the seas and continues today at an exponential rate.

Quite commonly exotic species are introduced by accident as “hitchhikers” on planes, ships, or even muddy boots as they cross geographical borders. They can be destructive to the native habitat if they have adaptations that allow them to flourish and outcompete for resources like light, space, water, or food.

In this region, hogs are a harmful invasive species that was introduced by European settlers. They disturb soil and plants like longleaf pine seedlings when they root for food and are predators of sea turtle eggs. Some invasive plant species in Georgia are Japanese honeysuckle, Chinese privet, spring silverberry, chinaberry, Chinese wisteria and Chinese tallow-tree. Japanese honeysuckle and Chinese tallow-tree are present in Cay Creek, though volunteers have worked to eradicate them so the native plants can have a better chance of survival.

Poison ivy is an example of an invasive plant that is native to the area. Not only is it poisonous to many people, but it propagates by its roots and can be very difficult to eradicate for good.

3. PLANTS

What does poison ivy look like?

This is very important for all teachers to know. Though work has been to eradicate the poison ivy at Cay Creek, underground roots may remain and it is likely that the plant will resprout every year.

Poison ivy can grow in a variety of forms, but is usually a vine or shrub. It can be light or dark green, and shiny or flat. Sometimes the leaves have slight lobes and sometimes they are smooth. It turns

red in the fall, and the leaves die back in the winter, though the roots remain underground and can still cause a rash to people who are allergic.



What is Spanish Moss?

Spanish moss (*Tillandsia usneoides*) is a perennial plant that drapes the larger trees. It is not a true moss and does not grow from the tree, but instead obtains nutrients from dust and water particles that soak into it when it rains. It is an epiphyte, meaning that it grows in the canopy of another species. It is classified in the family Bromeliad, of which the pineapple is also a member. Spanish moss affects the forest by reducing the amount of light that penetrates the canopy so that the forest floor retains more moisture and supports plant life. Many birds nest in the Spanish moss (parula and yellow-throated warblers and colorful painted buntings) and others use it to build nests. Lots of insects live in Spanish moss.

What is salt tolerance and how can we see the salt water gradient in the marsh?

Salt tolerance describes the amount of salinity that a plant can grow and thrive in. Some plants have special adaptations that allow them to live in very salty water. Smooth cordgrass, for example, sometimes exudes salt crystals from special glands and secretes it on the leaf surface. Smooth cordgrass also has special root membranes that filter out a lot of the salt. Most other plants do not like salty soil and water. Smooth cordgrass can live in freshwater as well, so it is perfectly adapted to live in low elevation areas that are sometimes inundated with salt water by tides or storms. For these reasons smooth cordgrass is often the only plant that lives in a salt marsh, appearing as a sea of green.

Other rushes and grasses have varying levels of salt tolerance and they can act as indicators of salinity levels. Giant cutgrass is not tolerant of salt and will only grow in fresh water. Big cordgrass and salt marsh bulrush are somewhat tolerant and will fill as ground cover where the cutgrass cannot.

Black needlerush occurs at slightly higher elevations that are infrequently flooded, especially where salinity is lower. It occurs as a narrow zone around the salt marsh or on hammocks.

4. ANIMALS

What is metamorphosis?

Metamorphosis refers to the change in an animal's appearance as it matures. Many arthropod (invertebrate) and amphibian species undergo complete or incomplete metamorphosis as they grow and change. Insects like butterflies, moths, and dragonflies have a completely different appearance as juveniles and then they enter a stage of dormancy (pupa or chrysalis in butterflies) before emerging in their adult form. Juvenile butterflies and moths are caterpillars, juvenile beetles are grubs, and juvenile frogs are tadpoles.

Insects that go through incomplete metamorphosis often look like small versions of the adult when they are young. The "baby" insects that look like adults are called nymphs. They grow by periodically shedding an outer layer (called molting) and expanding in the soft body left behind. Cicadas do this, leaving behind a crusty shell. Crustaceans also molt, and soft-shell crabs are simply the newly molted version of a regular, hard-shelled crab.

What is the difference between resident and migrant?

A migrant species is one that must travel to different ecosystems in order to carry out its life history traits, or the things it must do to live. Many birds are migrant species. For example, the Swallowtail Kites live the majority of the year in the forests of Brazil but migrate to the southeastern United States during the summer months. Resident species mostly stay in the same ecosystem for the entirety of their lives because that ecosystem has everything they need to carry out their life history traits.

At Cay Creek, the live oak and pine forests are used extensively as feeding areas by many resident species. Resident birds that occupy this habitat type include Carolina chickadee, brown-headed nuthatch, Carolina wren, brown thrasher, pine warbler, cardinal, and rufous-sided towhee. Numbers of birds in the live oak-pine forests are greatly augmented each year with migrant species. Some migrants such as the yellow-bellied sapsucker, ruby-crowned kinglet, eastern phoebe, and white-throated sparrow become winter residents. Other migrants that feed in oak-pine forests include solitary vireo, black-and-white warbler, prothonotary warbler, and American redstart

What are some of the protected species in Cay Creek?

All plant and animal species are important and vital to maintaining the health of the natural world in their own particular way, but some species need more protection than others. "Protected species" are the plants and animals that, for whatever reason, are more susceptible to harm from human disturbances, such as road and housing construction and pollution.

Conservation groups have created lists of all the plants and animals in the world and made a scale to rank their level of endangerment. This online database is called the IUCN Redlist (International Union for Conservation of Nature). The rankings range from species of least concern (these species

populations are robust and not in danger) to critically endangered (these species are on the brink of extinction and need human help to revitalize their dwindling populations).

IUCN Redlisted threatened to critically endangered species at Cay Creek:

- Spotted Turtle (endangered)
- Black Racer (critically endangered)
- Gopher Tortoise (vulnerable)
- Painted Bunting (near threatened)
- Bachman's Warbler (critically endangered)

You can check the status of your favorite animals online at <http://www.iucnredlist.org/>

How is the marsh used as a nursery?

The marsh-estuary system performs ecological functions that contribute to maintaining the stability of the biosphere. In particular, the marsh regulates atmospheric composition and moves nutrients to and from marine and terrestrial food chains.

Tidal action is perhaps the most important factor influencing primary production. Twice daily, tides of approximately 7-9 ft carry essential nutrients into the marshes, carry detritus and nutrients back into estuaries, and provide a space for the reproduction of phytoplankton.

The ecological function of marshes and the role of tidal action make them ideal "nurseries" for many aquatic species. Marsh tidal creeks are surrounded by dense and nutrient-rich marsh grasses, like smooth cordgrass. The dense vegetation serves as a protective shield, obscuring animals in the water from bird predators above. These grasses filter pollutants and add nutrients to the water when they decompose. Without the intense wave energy of the ocean, all of this decomposing matter breaks down in the water, making it very nutrient-rich. This rich water serves as an ample food source for plankton. Plankton and other floating creatures are abundant because of the nutrients from the marsh vegetation; these creatures serve as excellent food sources for the early stages of oceanic fish and crustacean species that come to marshes to spawn. In addition, predatory aquatic creatures, like sharks, do not come into the small and twisted tidal creeks, giving the marshes another dimension of protection.

One example of a crustacean that uses marsh tidal creeks as a nursery and breeding ground is the Blue Crab. Blue Crabs go through "metamorphosis" like other arthropods. A series of molts allows crabs to grow into adults. When they molt, their hard outer exoskeleton peels off and the soft skin below becomes saturated with water and nutrients. They grow bigger in the process and a new hard shell forms around them. In between molts, they are very vulnerable to predation, so the marsh is a safe place to be. It takes about 21 molts to reach full maturity.

Georgia White Shrimp are another common animal that utilizes the function of the marshes. Adults lay eggs in the open ocean that drop to the ocean bottom. Fertilized eggs float to the surface and

make their way to the safe tidal creeks. Here they transform into juvenile forms, eating plankton and other small floating creatures. Adults return to the ocean to spawn and the cycle repeats again.

5. HUMANS AND THE ENVIRONMENT

Who was here before us?

The history of Liberty County and the Georgia Coast is a story of how humans and nature interact. The American Indians were living on the coast as far back as 11,500 years ago. They traveled the waterways, finding ample sustenance in native animals and plants for food and medicine. The Guale were here when the Spanish began exploration of Georgia in the 16th century, and the two groups exchanged knowledge of the land and food. The Spanish and colonists from France, Germany, and England introduced exotic species, such as hogs and horses, that continue to affect coastal ecology today.

King George II of Great Britain signed a charter creating the colony of Georgia in 1732. King's Grants were issued for land in St. John's Parish, which became a part of Liberty County in 1777. Rice, cotton and sugar were dominant crops. This area was home to many plantations including one here at Cay Creek, then called Salter's Creek. Owned by Raymond Cay, the plantation grew rice on a small scale as well as other food crops. Salter's Creek Plantation was also home to enslaved workers who enabled rice culture to be possible through their unpaid labor. Although the white planters and black slaves lived in two very different social worlds, they both depended on the ecology of the coast for their sustenance. Tidal fluctuations and river currents created the forces upon which agriculture, fishing, and gathering were, and still are, dependent.

After the American Civil War the main coastal resource used was pine, followed by shrimping, fishing, and oystering. Pine trees were abundant and their sap was gathered for tar, turpentine and other naval stores. Fishing and shrimping became the main industry of the coast after chemicals products began to replace those derived from the pine. The large estuarine systems of coastal Georgia support myriad marine life that provided economic growth for the area.

During the early 20th century pine again became an economic resource when paper companies from the North, such as Union Camp Corporation, saw the potential of the forested resources in the South. Union Camp built mills in the area and bought thousands of acres of pine lands, including Cay Creek. At its peak in 1910 nearly 8 million acres of southeastern pine forests were in production, producing 600,000 metric tons of rosin and turpentine.

Much of the Georgia Coast remains undeveloped due to slow economic growth following the Civil war as well as geography. The shallow continental shelf and inward curve of the coast create the Georgia Bight and land that is suitable for growing few crops other than rice and pine. It does, however, provide many opportunities for recreation, tourism and conservation. The City of Midway purchased the site of Cay Creek Wetlands Park in 1996 to provide a place for locals and visitors to enjoy and learn about the natural communities of the coast. The future of areas like Cay Creek

depends on people understanding the value of these landscapes to the environmental health of the coast as well as the cultural landscape of its people.

How has rice culture shaped the landscape at Cay Creek?

Rich wetland soils from the piedmont sediments made this region productive for growing rice. In fact, marsh mud was often mixed with shell pieces, cordgrass and manure to be used as fertilizer on the fields. Daily tides were essential in bringing water necessary for rice culture as well.

Rice was grown in fields made by clearing cypress swamps. These lands were then ditched (dug) and diked (mounded) to control the flow of water. This type of landscape became abundant with mosquitoes that bred in the still water and carried disease, though many people at the time did not understand that the source of this illness was the mosquitoes. Rice production reached its peak between 1850 and 1860. In Georgia, Chatham County was the leading producer, followed by Camden, McIntosh, Glynn, Liberty, and Bryan counties. In 1859 planters were harvesting an average of 50 bushels per acre, with about 23,000 acres in cultivation. Though almost all rice production ended by 1910 (after a series of devastating hurricanes in the 1890s), traces of the ditches and canals dug for these purposes can still be seen in arial photographs as long, straight depressions along creeks and rivers.

Deforestation along waterways led to erosion of the riverbanks. Early methods of protecting the banks were to dump oyster shells along them to protect the soil from being washed away with the current. William Bartram, a naturalist who traveled these parts in the early 1800s remarked, "I re-assumed my travels, proceeding down the high road towards Fort Barrington, on the Alatomaha, passing through a level country, well watered by large extensive swamps and marshes, their sources: these swamps are daily clearing and improving into large fruitful rice plantations, aggrandizing the well inhabited and rich district of St. John's parish."

Rice culture's effect on the landscape continued into the 1950s, when the government incentivized the draining of these wetlands for other types of agriculture and to decrease mosquito populations.

How has the timber industry shaped the ecology of Cay Creek?

Coastal live oak timber was important to northern shipbuilding. USS Constitution and others like her were the most sophisticated and technologically advanced warships of their type. The Brooklyn Bridge in New York was constructed from live oak as well.

Bald Cypress trees were harvested heavily as a rot-resistant lumber for building homes. Logs were floated down the rivers to coastal sawmills. Many of these sunk to creek bottoms and are salvaged today by divers and heavy machinery.

In the early 1900s timber was used for naval stores, like tar and turpentine, to waterproof boats. Herty Pots were developed to collect sap in a method that did not kill the tree. The scars left on pine trees from this operation are called "catfaces." Charles Holmes Herty, inventor of the Herty pot,

said, "In 1864 when I first went over the railroad from Savannah to Thomasville there was an almost unbroken forest of magnificent pines extending from Bryan Bountly to Thomas County through which the railroad cut its way like a ditch - but now one may go over that same route and scarcely see a merchantable pine. From most of the visible land the timber is entirely gone and the same state of things prevails in much of the piney woods part of the state."

Today the lumber industry grows pine trees for timber and pulpwood. These plantations encourage a monoculture crop that inhibits diversity in the canopy. Frequent disturbance and clear cuts do not allow for an old growth forest to develop and destroy habitats for many wildlife species.

What are some ways that conservation is enacted?

Today, 14% of the 22,045,897 acres in the Maritime ecoregion is in some form of permanent conservation. In the early 1900s many wealthy people bought large tracts of land here for conservation. Many delicate and important ecosystems have been preserved.

It is important that development is limited on the coast because a human presence can severely impact the ability for wildlife to survive. The coast is home for some of the richest and most diverse habitats and should be cared for because of its great ecological value. Aside from development, land and water pollution are also harmful to wildlife. Standards for industries, such as the shrimping or logging industry, can help to decrease the amount of pollution along the coast. One way to make it easier for individuals to be able to have more responsibility for their waste is to have recycling centers more accessible.

Coastal marshes and shoalwaters are destroyed by construction of roads and widening of waterways for shipping. Conservation initiatives fight the construction of roads in and across delicate habitats, and civic action can also change the course of events and save marshlands.