

Center for
PLANT
Conservation



Dancing with Extinction

The Rising Threat to Florida's Plants and the
People Who Are Trying to Save Them

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Professor's note

If you're a teacher intent on maximizing student engagement, there's nothing like having an alligator swim into your classroom.

Five University of Missouri science journalism students were interviewing plant ecologist Kristie Wendelberger in May 2013 while standing shin-deep in the black water of a Florida Everglades cypress dome. As Wendelberger described the towering trees that ringed the shady pool, one of the students noticed an alligator slowly swim toward us, then submerge.

The interview paused. We assessed the risk, kicked the water to make sure the animal knew we were a big group, and resumed the interview. A few minutes later, the interview over, we slogged as calmly as possible through the water, out of the trees and to our blindingly white van.

The students had come to Florida to get stories about native plant conservation issues, and this particular moment was their only chance to learn about cypress domes (see photos on p. 5). The appearance of an alligator was not going to stop them.

Nor would any other challenge during our nearly two-week Florida exploration, which provided an intense and complex challenge to the students. They responded with equal intensity, producing a set of engaging and informative stories about how

a rich native biodiversity came to be so threatened and how it might be saved. They also learned why that matters.

These students are now more ready to serve as the next generation of truth-tellers our world needs to help us understand the biodiversity crisis, disruptive climate change, water shortages, hunger and a wide range of other intensifying issues that affect billions of people.

Their outstanding learning experience occurred thanks to a wonderful partnership that started with CPC Director Kathryn Kennedy and included the Carnegie Corporation of New York, the Missouri School of Journalism and the MU College of Agriculture, Food and Natural Resources. These and many other people and institutions understand the value of communicating with the public about science.

And the value of bringing students into such interesting classrooms.

Bill Allen
Assistant Professor of
Science Journalism
University of Missouri



A comment on this publication from new director

As the new Executive Director of the Center for Plant Conservation, it is my pleasure to acknowledge Kathryn Kennedy, my predecessor, who saw this publication to near completion. After 14 years of service to the CPC, Kathryn has moved on to take up a more hands-on conservation role with the U.S. Forest Service in Albuquerque, N.M.

This publication was one of her final projects for the CPC and the quality of content in the following pages is a testament to her dedication to recovering America's vanishing flora.

John R. Clark, Ph.D.
Executive Director
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Conservation

Photo by Zach Matson

Pine rockland in a concrete village

By Cade Cleavelin

MIAMI — Bushwhacking her way through a small thicket of slash pine and saw palmetto, West Miami 6th grader Victoria Torez can tell you the names of most of the native plants, where they grow naturally and which ones are best for your garden.

"Used to, when I would see a plant, I would just break it," said Torez. But now her steps through her school's pine rockland garden are slow and gingerly, careful not to disturb the tender natives.

West Miami Middle School lies in the busy inner-city heart of Miami-Dade County, Florida's concrete beehive, tamed by asphalt and transected by motorways.

Wildlife in the area is all but non-existent, limited to small gardens, patches of grass in compliance with municipal ordinances, and royal palms transplanted to stand guard over roads and businesses. Flanked by the tangled Everglades to the south and the flowing Shark River Slough to the west, the whole city is a shining success story of urbanization.

It seems an environment unlikely to foster a primary education in ecology, but West Miami Middle School is distinguished for its ECOTEC (Technology and Environmental Science) Academy, a magnet program that engages students in conservation and restoration programs specific to Florida's natural ecosystem.

Today, Torez is irritated that a bag of Doritos has somehow made its way into the garden, but also excited that the Coontie (*Zamia integrifolia*) — a tough, woody cycad and her favorite plant in the pine rockland — seems to be doing well.

"The Coontie is like my baby!" exclaimed Torez. "I come and look at it every day."

It's this kind of new interest in native plants that the West Miami ECOTEC Academy is looking to foster. Annese Martinez chairs the school's science department and helps coordinate the ECOTEC curriculum.

"It's a lot of work," said Martinez. "This is our first year as an environmental magnet school, so we're really trying to start focusing on that program."

Martinez works closely with her friend and colleague Lisset Perez-Muñoz, and both have made it their mission to instill conserva-

tion in the hearts and minds of their students, many of whom have never even been exposed to natural wilderness.

"Lisset brought the garden idea to us six years ago..." said Martinez, "and then she asked for teachers who were willing to sign up and be part of the garden for a number of years."

In 2007, Perez-Muñoz received a Toyota Tapestry grant to establish a new garden on school grounds. She led the initiative, recruited colleagues to commit students to the garden project, and for the past seven years has overseen the growth of both the garden and students' appreciation for Florida's pine rockland.



Victoria Torez, West Miami Middle School 6th grader, poses beside the Coontie, her favorite native Florida species in a pine rockland garden at the school. Photo by Joyce Maschinski

A garden project seems like an ordinary initiative for a school pushing environmental science, but West Miami Middle School is staunchly inner-city. Even a small patch of soil is a rare educational commodity in Miami-Dade County, and the challenge left to Perez-Muñoz and her colleagues was to capitalize on the opportunity.

"When plans for the garden were underway, some of the kids asked if we could grow pot," said Martinez, laughing. But she and Perez-Muñoz maintained their focus on Florida endemics.

They both commute to school on Palmetto Expressway, a nod to the species found in Florida's pine rocklands, and a tantalizing inspiration for the new project.

"It just clicked," said Perez-Muñoz. "This is the habitat that is so important to Florida's ecosystem that nobody ever thinks

about."

The garden serves as a small addition to the Connect to Protect network, a program established by Miami's Fairchild Tropical Botanic Garden to promote cultivation of pine rockland habitat in suburban settings. More habitat generates more awareness, the theory goes, and more appreciation for the value and aesthetic of Florida's native plant species.

More directly, Connect to Protect gardens help to moderate the hurdles of urban development for animals and plants, offering more stopping points for pollen and pollinators in an impossibly fragmented ecosystem. Two other registered sites grow within a few miles of the middle school.

After seven years of watchful care, the parcel of land that was once a tennis court is now thick with young pine and palmetto, maintained by a command of 6th, 7th and 8th graders who get to trudge through a living slice of the Miami-Dade County of yore.

Torez, 12, and her friends Andrea Osuna, 13, and Amanda Lorenzo, 12, are all part of the magnet program, learning about the plants that have stubbornly existed just out of their view.

"I have learned that the Everglades is not just boring plants and animals," said Torez. "It's an ecosystem of living and non-living organisms all working together."

According to Perez-Muñoz, the idea of conservation through education seems to be working.

"These kids are actually understanding and caring for animals and wildlife, and even just being more observational, just being more observant of the natural environment that these kids even lacked," she said.

Martinez and Perez-Muñoz hope that the garden will not only continue to thrive under the care of their students, but serve as a symbol for the beauty and importance of Florida's natural landscape. Maturing past the idea that the pine rockland is just a collection of weeds has been one of the many successes they've seen so far.

"It's been a generational thing," said Perez-Muñoz. "Kids come back, bring their brothers and sisters, and it just keeps going. It's easy to change the kids. It's very difficult to change the adults, and that, I think, is the tragedy."

Florida's paradox:

Stunning plant diversity but profound threats



Stephen Hodges is a conservation botanist at Fairchild Tropical Botanic Garden in Coral Gables, Fla. Photo by Travis Mowers

By Zachary Matson

Conservation botanist Stephen Hodges and naturalist Eric Fleites were surveying a small parcel of land in March 2013 just yards away from the bustling Overseas Highway that runs down the spine of the Florida Keys when they stumbled across an incredible discovery.

In a flat, dry patch of earth an earshot from the surf and with tall palms standing guard, Hodges and Fleites found an as-yet unknown field of Florida Keys indigo (*Indigofera mucronata* var. *keyensis*), one of the nation's most endangered plants.

They "started pushing through the Brazilian pepper and happened upon a whole other part of the cactus barren," Hodges said as he surveyed the discovery scene a few months later.

Florida cactus barren, a type of habitat, exists in no more than eight locations, all in the Keys. A private landowner recently destroyed one of the most pristine sites, and another site at Windley Key is as small as five feet across. There may be as little as 30 acres remaining of this natural habitat.

"Typically you might get 40 or 60 of the Indigo plants in a given location," said Hodges, of the Fairchild Tropical Botanic Garden, in Coral Gables, and the Key West Tropical Forest & Botanical Garden. "In this clearing, there are two-to-three hundred, and so this site then became a very important refuge for that particular species."

The indigo, morning glories, bloodber-

ries and prickly pear cacti cluster together as the encroaching invasive Brazilian pepper threatens to shade out the natives.

Such scenes of fragile ecosystems threatened and conservationists fighting to defend them play out daily across the state of Florida, as scientists and ordinary folks fight for the survival of the plants that help make Florida the most biologically diverse state in the eastern United States. Many factors have created that diversity.

"Florida is especially important for plant conservation because of its unique geography," said Gary Knight, director of the Tallahassee-based Florida Natural Areas Inventory, which maps natural habitats and rare plants across the state. "We're a peninsula hanging down between the Gulf of Mexico and the Atlantic Ocean. And because of our latitude, we have tropical influences and connections with the north."

'Many Floridas'

From the Keys and ancient islands to citrus groves, cypress domes and gently rolling forested hills of southern Appalachia, Florida is a state of botanical wealth and breathtaking beauty.

Mangrove islands dot the coast, and a river of grass — a nickname for the broad expanse of the Everglades — creeps slowly through a southern Florida landscape laced

with towering pines and stunted palmettos. Plants once on the verge of extinction now find a home beside Miami Beach high-rises, while others are successfully grown in test tubes.

But the threats to Florida's plant life are great. Beachfront developments flatten dunes, and the crisscross of neighborhoods and strip malls fragments natural habitats and suppresses much-needed fire. In even the most protected places, invasive plants dominate the landscape.

"There isn't just one Florida," said Cheryl Peterson, conservation program manager at Bok Tower Gardens, in the central part of the state. "There are many Floridas within Florida, and they are all unique."

Because Florida shifts gradually from the temperate climate of the Carolinas found in the panhandle to the tropical systems of the Caribbean in South Florida, many plants reach either their northern- or southern-most extent somewhere in the state.

The Keys, a limestone archipelago of thousands of islands, stretch 200 miles south and are home to plants that only survive in the tropics. The northern panhandle is home to massive pine forests scattered with carnivorous pitcherplants and stunning orchids.

"The Florida panhandle is one of the rare (biodiversity) hotspots in all of the United States," Knight said.



"The law is simple—there are not that many laws that protect plants."

-Jenny Richards



ABOVE: This photo was captured in the interior of a cypress dome in Everglades National Park. A cypress dome is a type of swamp where the trees at the center of the swamp grow taller than the trees at the edge, which forms a dome-like shape of treetops when viewed from a distance. Cypress domes also make perfect homes for the American alligator. Alligators are only native to China and the southeastern United States. When they construct alligator holes in wetlands, they dig up the muck and peat that make up the Everglades soil, often down to the limestone bed. These depressions provide a refuge for wading birds and fish, nest sites for other reptiles, and colonization sites for plants. Alligators are, therefore, considered an important species for maintaining ecological diversity in wetlands.

Photo by Cade Cleavelin

MIDDLE RIGHT: The closed canopy and seasonal inundation of a cypress dome provide the perfect combination of shade and humidity for the cardinal airplants (*Tillandsia fasciculata*) shown growing on the cypress trees in the photo. Members of the pineapple family, cardinal airplants are listed as endangered in Florida and absorb moisture and nutrients through tiny paper-like structures on their leaves. These plants are threatened by illegal collection, habitat loss and a Mexican bromeliad weevil.

Photo by Travis Mowers



BOTTOM RIGHT: Harper's beauty (*Harperocallis flava*), federally listed as endangered, is found within the Apalachicola National Forest and vicinity where 15 small populations are known. Harper's beauty occurs in wet prairies, seepage slopes and pitcherplant bogs, especially in transitions to shrub zones. It is sometimes seen in nearby moist roadside ditches. Threats to this plant include small population number, land management practices, vandalism, overcollecting, fire suppression, soil and hydrological disturbances and right-of-way herbicide use. Read more about this CPC National Collection species at <http://tinyurl.com/harpers-beauty>.

Photo by Bill Boothe - www.natureinfocus.com



FACING PAGE, BOTTOM: Florida Keys indigo plant (*Indigofera mucronata* var. *keyensis*), state listed as critically imperiled in Florida, exists in as few as five populations in the Florida Keys. Threatened by exotic pest plants, habitat destruction and sea-level rise, the Florida Keys indigo clings to life in a shrinking environment.

Photo by Stephen Hodges



More than 600,000 years ago, most of Florida was under water, but a series of ancient dunes and islands rose to become home to countless plant species that evolved in isolation in what is now central Florida. Nearly 40 percent of Florida's federally endangered plants live on the remaining 15 percent of natural habitat on these ridges.

Archbold Biological Station is a research center on the Lake Wales Ridge that studies the unique habitats and plants of Florida's ancient islands. Archbold's chief scientist, Eric Menges, said the changes one sees driving from South Florida to the state's central ridges is drastic.

"There is more of a difference between the Miami area and here than here and north Florida," Menges said, referring to changes in elevation, ecosystems and species.

Fires and hurricanes are the two most powerful ecological forces shaping the state's plant life and natural habitats. When major storms hit, they clear out the forest canopy, and plants in the understory have a chance to thrive in the sudden burst of sunlight. Sometimes after a storm, endangered or rare species will pop up in places they weren't before.

The Florida Natural Areas Inventory counts 81 distinct natural communities across the state.

But 553 species of the state's native plants are listed as endangered, threatened or otherwise imperiled. How did this happen?

Development and destruction

As Florida grew in popularity through the 20th century, development exploded and natural systems were rapidly altered or completely destroyed. In the south, Floridians built canals and waterways to dry out land for agricultural use.

"The Everglades is half as big and half as wet as it once was, because people were very successful at draining it," said Jenny Richards, a botanist at Florida International University who studies the Everglades.

TOP LEFT: Volunteer Stephanie Thorman works weekly in Fairchild Tropical Botanic Garden's Micropropagation Lab, propagating seeds of rare native orchids. As part of Fairchild's Million Orchid Project, volunteers and staff are working together to propagate native orchids that will be planted in the community, allowing people to learn about and enjoy the rich natural heritage.

Photo by Cade Cleavelin

MIDDLE LEFT: Only the most salt-tolerant plants, such as black mangrove (*Avicennia germinans*), can survive on Florida's coast. Inland from the water's edge, just a few inches above sea level, an entirely different habitat exists, protected from the salty breeze by beach dunes (see graphic on page 16). Scientists worry that, as sea level continues to rise with climate change, some plants will not be able to retreat inland quickly enough to escape the encroaching salinity, and will ultimately perish.

Photo by Cade Cleavelin

BOTTOM LEFT: The Florida Keys tree cactus (*Pilosocereus robinii*), federally listed as endangered, is unlike any other plant in Florida. It is a true tree, with mature individuals possessing differentiated trunks and branches. Plants can reach as high as 30 feet and may have dozens of spreading branches. Most of the larger plants have been destroyed by development and hurricanes. The Keys tree cacti in this photo are in propagation at Fairchild Tropical Botanic Garden. Read more about this CPC National Collection species at <http://tinyurl.com/keys-tree-cactus>.

Photo by Cade Cleavelin



In all, one-third of the state has been converted to agricultural lands, with mighty pine plantations in the north, citrus groves across the peninsula and sugarcane farms in the south.

Developers have converted one-sixth of the state's land into subdivisions and shopping malls, with most of the building concentrated along the coasts.

Conversion of natural lands to farms and neighborhoods divides ecosystems into smaller and smaller parcels, making it increasingly difficult for pollinators to spread the genetic material of plants and reducing the chance of survival for rare species.

"There are really only fragments of fragments of fragments remaining," said Peterson, of Bok Tower Gardens.

Moreover, in fragmented, urbanized areas fire is suppressed. Many of Florida's plants have evolved in tandem with yearly or longer cycles of natural fires, and some species will only emerge after a burn. Invasive species often run rampant in unburned areas. Without fire, many of Florida's rare plants will become even more rare.

If development and invasive species were not enough to threaten the state's plant life, Florida's coastal communities — plant, animal and human — will be among the first in the country to experience the major impacts of climate change. Small deviations in sea level could have catastrophic results for specific species and entire communities.

Along the state's southern tip in Everglades National Park, habitats and plant species are already responding to subtle changes in sea level. The difference between 7 1/2, 9 and 11 1/2 inches (19, 23 and 29 centimeters) above sea level is the difference between entirely distinct plant communities. As sea level and salt water move inland, communities will be forced to shift to higher land, and species could be lost entirely.

Unfortunately, endangered plant species do not enjoy the same protection as animals. If a rare plant occurs on private property, it has little protection beyond the benevolence of the landowner. Examples abound of rare plants and habitats lost to bulldozers.

Conservation efforts and hope

But across the state, scientists and plant lovers refuse to let go of Florida's natural heritage. In botanical gardens, universities, private research centers and citizens groups, they carry out the work of safeguarding rare plants.

Seed banks, experimental research, prop-

agation of rare plants, detailed demographic studies, and reintroduction and restoration projects all provide a lifeline to Florida's imperiled plants.

"If some of these species give up hope, I don't blame them," Peterson said. "But they are all trying to live."

In South Florida, private landowners and West Miami Middle School students grow native plants in their Connect to Protect gardens, a program run by the Fairchild garden.

Meanwhile, Fairchild scientists oversee a variety of projects that are returning rare plants to their native habitats and monitoring other rare communities.

"It's my nature to be optimistic," said Joyce Maschinski, conservation ecologist with the Fairchild garden. "I have come to embrace change and embrace the idea that even doing a little bit will be helpful, even if it's for a little bit of time. Because none of us has a crystal ball where we can predict the future, so let's make it as good as we can right now."

As a state, Florida has invested heavily during the past two decades in buying land for conservation purposes.

"Florida had the largest, most progressive and best-informed environmental land acquisition program in the country," said Knight of the natural areas inventory.

From 1990 to 2010, the state spent \$6 billion and acquired 2.5 million acres of natural habitat. Now, one-third of the state is in protected conservation lands. It will be a continuous challenge to manage these lands, Knight and others said.

Although the Walt Disney Co. has paved

over a large part of central Florida, it also has enlisted the help of the Nature Conservancy to restore and manage a site of more than 11,500 acres of natural habitat.

"It is confirmation that we can put it back together," said Tricia Martin, central Florida conservation director for the conservancy, which runs the Disney Wilderness Preserve, near Kissimmee. "Nature is incredibly resilient."

By filling in old ditches and putting in place a strict burn regime, the preserve has slowly returned to its natural state.

"We're not just about Disney," said Knight, referring to the state's iconic tourist attraction. "People see the benefit of having these lands (around the state) in conservation."

Back in the Keys, over the summer the Florida Department of Transportation and Stephen Hodges removed the invasives at the cactus barren site — one Brazilian pepper tree at a time.

Since they completed the task, the cactus barren has expanded "way beyond what everyone had hoped," Hodges said. "It was exciting to see the changes."

Among the changes was a burst of hundreds of new specimens of imperiled plants, including two species of sedges rarely seen in Florida.

Such steps forward, Hodges and others said, give them hope that the plants of "the many Floridas" may be saved despite the continuing threats.

"It takes being creative at times," Hodges said. "That's just a reality of plant conservation in modern times."

White birds-in-a-nest (*Macbridea alba*), a species endemic to the Florida panhandle, is federally listed as threatened by habitat loss, fire suppression, cattle pastures, the forest industry and chemical herbicides in power line rights-of-way. Read more about this CPC species at <http://tinyurl.com/macbridea>.

Photo by Bill Boothe - www.natureinfocus.com



Panhandle plant makes a comeback



Vivian Negrón-Ortiz, a botanist with the U.S. Fish and Wildlife Service, works to recover imperiled plants in Florida's panhandle. Photo by Ninh Pham

By Christine Coester

APALACHICOLA, Fla. — In a mosaic of flatwoods, scrub and wet prairie habitats, a 10-by-10-foot plot off the side of a dirt road holds the makings of a success story.

This plot, found in the Box-R Wildlife Management Area in the Florida panhandle, some five miles west of Apalachicola, is one of three that federal botanist Vivian Negrón-Ortiz has used to study the telephus spurge (*Euphorbia telephoides*), an imperiled plant.

Negrón-Ortiz, a researcher with this U.S. Fish and Wildlife Service, has studied the telephus spurge since 2007. Federally listed as threatened in 1992, the plant has recovered enough that it could be removed in the near future from the list of threatened and endangered plants.

Only found in Bay, Gulf and Franklin counties, the plant is threatened primarily by tourist development and road building. In her research, Negrón-Ortiz found that the species recovers quickly when land managers burn its habitat with periodic fires set to mimic the long-altered natural fire regime.

“Even though it is in conflict with development, it has potential,” Negrón-Ortiz said, standing in the plot, part of an open scrub no more than two miles from the Gulf of Mexico.

Negrón-Ortiz and her colleagues at University of Georgia found that telephus spurge populations are genetically diverse. Seed germination is low, but established plants have high survivorship. Scientists don't know

what pollinates the plant.

The telephus spurge is a perennial, meaning it will live for many years. Plants undergo two periods of dormancy, always in the winter and sometimes in the summer.

During the first year of the project, Negrón-Ortiz and her staff monitored the plants monthly. Much to their surprise they'd come back and find a plant they thought was female had become male.

The second year, they returned every other week and determined two important traits of the telephus spurge. Previous studies described it as dioecious — meaning the male and female reproductive organs are on separate individuals of the same species — but Negrón-Ortiz found some plants were hermaphroditic — meaning the individual has both the male and female parts.

Finding when and why the plant switches

Telephus spurge (*Euphorbia telephoides*), federally listed as threatened, is found only in Gulf, Franklin and Bay counties in the Florida panhandle. It is threatened by development of coastal areas for roads, housing and tourism. Read more about this CPC species at <http://tinyurl.com/telephus-spurge>. Photo by Ninh Pham



between the sexes requires further research, Negrón-Ortiz said.

To determine whether a plant is a candidate for removal from the list of threatened and endangered species, scientists must look at trends over time, she said.

Telephus spurge emerges in great numbers when lands are properly managed with prescribed burns.

Negrón-Ortiz planned to finish monitoring the adults late in 2013 but will continue to look at germination.

“To recover species that are threatened and endangered takes time,” she said.

All of the data she has collected on telephus spurge will soon be evaluated to decide whether the populations are stable enough for the plant to be removed from the list.

Behind the scenery

By Christine Coester

LAKE WALES, Fla. — Beyond the gift shops and exquisite landscapes of exotic flora, researchers at botanical gardens across the state are using molecular biology in their efforts to protect some of Florida's most endangered plant species.

Cheryl Peterson, manager of the Rare Plant Conservation Program at Bok Tower Gardens, is one of the researchers at the forefront of these conservation efforts.

The program currently has 68 imperiled plants in its collection, of which 53 are listed as federally endangered.

Some plants are living specimens and can be found in one of Bok Tower's 60 growing beds, but most are stored as seeds.

When Peterson and her staff of two aren't getting their hands dirty replanting or collecting seeds, they are in sterile environments using DNA analysis to assess genetic diversity, germination trials to determine seed viability, and micropropagation to clone rare plants. It's meticulous work.

To assess the genetic diversity within rare plant populations, researchers analyze microsattellites, which are small DNA sequences that form a “fingerprint” of the plant. Microsattellites are unique to each plant individual but are also determinants of paternity.

By knowing how much genetic diversity is available, researchers can predict how a plant population might respond to new pathogens or other plant stressors like increased temperatures, longer droughts or new pests.

In germination trials researchers seek to learn about seed viability, meaning a seed's capability to grow and develop normally. They control the humidity, temperature and amount of light seeds are exposed to. These trials allow scientists like Peterson to determine the loss or gain of viability and understand which conditions seeds will germinate in.

Every seed that is put into storage and the trial parameters they undergo are recorded in a database, Peterson said.

For species that fail to produce seedlings naturally and whose seeds don't survive storage or subsequent germination trials, micro-

propagation is an option. Micropropagation is the process by which scientists harvest parent plant tissue and use it to grow plant cells in the laboratory.

It is a last resort for plants on the brink of extinction, like the Florida ziziphus (*Ziziphus celata*).

By giving the plant cells certain growth regulators, scientists can initiate the growth of roots, leaves or stems, creating plantlets in a test tube. Peterson affectionately calls these “test-tube babies.”

Such a technique is possible because plants, like stem cells, are totipotent, meaning every cell is capable of developing into a complete organism.

“Every cell has everything it needs to create an entire plant,” Peterson said.

Micropropagation is an inherently complicated and delicate procedure that requires a proper gel matrix — a sterile nutrient-rich medium to grow the plant on and a cocktail of growth regulators. Both often depend on the species of plant propagated.

If successfully grown in a test tube the plantlet then undergoes climatization, the process of acclimating to a normal environment outside of the test tube.

At this point researchers are extra careful. The plant, having lived in a sterile environment, has no immune system.

It even looks different from a seedling produced in the wild until it reverts to its normal structure, Peterson said.

In 2009, the Florida ziziphus, known to be notoriously difficult to grow in a lab, was successfully micropropagated at the Cincinnati Zoo's Center for Conservation and Research of Endangered Wildlife.

“It never should have lived,” Peterson said, looking at the pot holding the micropropagated Florida ziziphus. “But don't tell it I said that.”

Previously thought to be extinct, micropropagation of the Florida ziziphus marked a huge success in Peterson's conservation efforts.

Since then, the Florida ziziphus has been successfully micropropagated twice more.



Cheryl Peterson of Bok Tower Gardens in Lake Wales, Fla., works to restore some of the rarest plants on Earth. Photo by Ninh Pham



Photo by Travis Mowers

The ‘Ziz’

The Florida ziziphus (*Ziziphus celata*) is one of the state's most imperiled plants.

Named in 1984 from a herbarium specimen originally collected 36 years earlier, Florida ziziphus was thought to be extinct until new populations were found in 1987.

Today the plant is listed as endangered on both the U.S. and state endangered species lists. It is limited to the Lake Wales Ridge in Polk and Highlands counties in central Florida.

Botanists believe that Florida ziziphus once grew in longleaf pine and wiregrass sandhills and depended on periodic burning by natural fires. Its habitat has largely been replaced by agriculture and residential development. Most of the few small places where it holds on are in pastures that may be mowed or trampled by cattle.

Other threats include fire suppression, the spread of invasive species and a lack of genetic diversity.

Research has shown that most remaining Florida ziziphus populations are mainly clones of a single plant. This lack of genetic diversity prevents it from reproducing in the wild and increases its susceptibility to pathogens and other plant stressors.

But the plant is resilient. And botanists are pushing forward with efforts to save it, focusing on plant reintroductions and preserving it with the CPC national collection. These researchers continue to study the reproductive biology, germination requirements and other aspects key to rescuing Florida ziziphus. Read more about this CPC species at <http://tinyurl.com/ziziphus>.

— Christine Coester

Beauty and the beasts: Florida's carnivorous plants thrive in poor soils by trapping their own food

By Zachary Matson

SUMATRA, Fla. — Ann's Bog is a dangerous place to be a bug.

Deep in the Apalachicola National Forest in Florida's western panhandle, a wet prairie surrounded by tall pines and old, mangled cypress trees hosts a canvas of carnivorous pitcherplants and butterworts.

"It's different every time you come out here," said Amy Jenkins, chief botanist with the Florida Natural Areas Inventory, as she surveyed the vibrant yet deadly scene.

Named for Ann Johnson, a botanist who has studied the bog's plants for more than 20 years, the site is a popular destination for scientists and photographers. It and similar sites in this part of the panhandle form what scientists say is a world-class concentration of carnivorous plant species.

Since the soil here lacks many of the nutrients necessary for plants to thrive, those capable of extracting nutrients from alternative sources have a competitive advantage.

Carnivorous plants like the parrot and yellow pitcherplants (*Sarracenia psittacina* and *Sarracenia flava*) and Godfrey's butterwort (*Pinguicula ionantha*) attract insects with brightly colored leaves and the promise of sweet nectar before trapping them inside and slowly devouring them in a cauldron of digestive enzymes.

A pitcherplant rises up a foot or more and uses a long, tubular structure with a top flap to trap its prey, while butterworts lie in wait on the ground and draw in the bugs with

The Florida panhandle is home to carnivorous plants that survive in soil containing poor mineral nutrition. These plants have evolved to supplement their diets by luring and trapping insects or other prey. Nutrients from the decayed pest bodies are absorbed by the plant through special cells. Many carnivorous plants are threatened by over-collection, fire restriction and habitat loss due to draining of bog habitat for cropland, pastures, pine plantations and other commercial uses. Carnivorous plants generally occur in bogs, pine flatwoods, savannas and along wet, sandy roadsides.

- 1: Yellow pitcherplant (*Sarracenia flava*)
- 2: Chapman's butterwort (*Pinguicula planifolia*)
- 3: Gulf purple pitcherplant (*Sarracenia rosea*)
- 4: Godfrey's butterwort (*Pinguicula ionantha*)
- 5: Woolly huckleberry (*Gaylussacia mosieri*)
- 6: Tracy's sundew (*Drosera tracyi*)
- 7: A close-up view of the sticky tentacles of a member of the *Droseraceae* family, commonly known as the sundews
- 8: Amy Jenkins, senior botanist at the Florida Natural Areas Inventory in Tallahassee
- 9: A bee dances with danger on a whitetop pitcherplant (*Sarracenia leucophylla*)

their slick and slippery leaves.

Just three weeks after a prescribed burn, a rainbow of life already blanketed Ann's bog. The ash returns nutrients to the soil, providing the plants with a "nutrient pulse," Jenkins said.

"As time progresses since fire, you get more and more competition for space and light," she said.

Members of the largest family of flowering plants, the orchids, also sprout across Ann's Bog — playing the beauties to the carnivorous beasts.

In all, the Apalachicola forest is home to four federally endangered or threatened plants, all of which are only found in north Florida: Godfrey's butterwort, Harper's beauty (*Harperocallis flava*), Florida skullcap (*Scutellaria floridana*) and white-birds-in-a-nest (*Macbridea alba*).

Checking the long rows of pines, are trees that have been striped with white paint by foresters. These are the homes of red-cockaded woodpeckers, one of Florida's most endangered bird species.

"These plants, they come with a whole cadre of animals and other plants and other life forms that rely on them — bacteria and fungus and everything that goes around them in the ecosystem," said Mike Jenkins, Amy's husband and a plant conservation program ecologist with the Florida Forest Service. "It's a really diverse area — globally outstanding, botanically speaking."

North of Apalachicola Forest sits Torreya State Park, home to two of Florida's most imperiled trees, the Florida torreya (*Torreya taxifolia*) and the yew (*Taxus floridana*). The torreya population has been decimated over the past half-century by a disease known as fuzarian rust.

Local plant photographer Billy Boothe has documented Florida's rare plants for more than 20 years and spends most of his time exploring the panhandle.

Boothe walks through the forest and finds old torreya stumps that are 10 to 15 feet across. Today, the remaining trees grow to be 10 to 15 feet tall.

"Seventy percent of Liberty County is national forest, conservation area or state park, and I think all of the management that's going on is really telling of how important these woodlands are," Boothe said. "If we ever end up losing them, they're gone, and who knows what all will go with it that people haven't even seen yet."





Photo by Travis Mowers

Florida Everglades:

Restoration, conservation and the scars to prove it

By Cade Cleavelin

EVERGLADES NATIONAL PARK, Fla. — Lying steadfast at the end of a 300-mile slope down the great river of grass — in defiance of agriculture, urban development and invasive

species — Florida’s Everglades are the final chapter of an odyssey written by water and played by a cast of distinct native plants in one of the most diverse biological dramas in North America.

From the low-lying sawgrass marshes

and steaming coastal prairies, to the dry sanctuaries of the hardwood hammocks and pine rocklands, every ecosystem in the Everglades is a unique stage, distinct with its own perils and conservation needs.

Before its dedication as a national park in 1947, the clearing of wetlands and construction of drainage canals marked a period of declining health for the Everglades and its many native species. Written in the landscape is a modern history of ecological blunders that conservationists have been trying to reverse for more than 60 years.

“The Everglades now is probably about half as big and half as wet as it used to be,” said Steve Woodmansee, a biologist with Pro Native Consulting and president of the Florida Native Plant Society. “The concept of conservation is to preserve species for this entire region. I think most people out there don’t really know what Florida is, botanically.”

Under a mild May sun, Woodmansee stood at the edge of one of the most aggressive conservation efforts in the Everglades, a patch of land called the Hole-in-the-Donut where Brazilian pepper, an invasive South American plant, had until recently all but completely dominated the landscape.

Brazilian pepper (*Schinus terebinthifolius*) blurs the distinction between small tree and large shrub, and has established itself in the Everglades with vigor. Until managers enacted what Woodmansee calls “the Cadillac

LEFT: Steve Woodmansee, a biologist at Pro Native Consulting, explains the drastic-looking measures taken to remove invasive Brazilian pepper plants in Everglades National Park. Photo by Travis Mowers

of restoration processes,” Brazilian pepper promised to choke many rare plants out of the Everglades and existence altogether.

“The park staff’s policy was to leave it fallow,” Woodmansee said. “But once Brazilian pepper invaded they knew we had to do something serious or it would completely take over.”

Brazilian pepper found such a suitable habitat in the Hole-in-the-Donut because of the agriculture that dominated the area until the 1970s. Before the land was acquired and added to the rest of the park, farmers regularly doused the soil with large amounts of phosphorus-rich fertilizer, which made Brazilian pepper feel much more accommodated. When agriculture ceased, the weeding stopped, and Brazilian pepper flourished.

Park managers met a drastic problem with a drastic solution: remove not just the plants, but the soil itself, straight down to the bedrock almost a foot below. With an army of dinosaurian scraping machines, managers carried away thousands of acres of soil and plant matter, leaving nothing but bare limestone where Woodmansee stood.

“You can think of this spot as a cancer,” he said. “You can dump a bunch of chemicals on it and hope for a cure, or you can remove the cancer.”

A line of trees warped by the rising heat seems impossibly distant across what is now a vacant moonscape. The thorough scraping makes it difficult to understand how Brazilian pepper – or anything else – could ever reestablish itself here. Seeds looking to root may as well try the parking lot in the visitor’s center.

But this ground in particular isn’t the first that’s been scraped in the Hole-in-the-Donut, and Jenny Richards, a botanist with Florida International University, says this strategy has proven successful in saving the landscape.

“The cool thing about the Hole-in-the-Donut is you get to see succession in action, so it’s like an unintended experiment,” said Richards. “We get to see how the landscape responds, how the soil comes back and how

different species move into the area. And we’ve noticed that, like magic, once the water comes in the plants will actually come back quite quickly.”

The marl soil that accommodates early plant life in the Everglades is a blend of algae and bacteria called periphyton. When rain pools on the ground, microbes settle and grow rapidly, producing a spongy mat that can accommodate early-successional grasses. As plants die and their decayed material accumulates, the periphyton can

sustain more robust plants, allowing more native species to re-colonize.

Adjacent to the bare ground is a patch of land scraped in 2011 whose grasses are already waist high. Another swath next to it was scraped in 2003, and

its marl soil is already nearly a half-inch thick.

“Restoration is a very young science,” Richards said. “Sites like this are great because we get to watch it happen. What we’re beginning to find out now is, is it working?”

Conservationists are also gaining more understanding of just how responsive the Everglades are to tiny variations in the environment.

Florida’s low elevation and notoriously flat geography render its plants highly sensitive to water levels, whether inland or near the coast. This is especially true for the Everglades, fed from the north by the waters of Lake Okeechobee, and inundated with salt water on all other sides.

Along the southwestern coast of the Everglades, Florida’s coastal buttonwood forests and halophyte prairies tread a line between fresh and salt water, a line that Kristie Wendelberger, plant ecologist and doctoral candidate at Florida International University, is watching shift. (The prairies get their name halophyte because their plants can grow in salty soil.)

The soils of buttonwood forests, which grow at about 9 inches (23 centimeters) above sea level, seasonally fluctuate between salty and fresh water. These forests



Jenny Richards, a botanist with Florida International University, explains the importance of water movement in south Florida. Photo by Travis Mowers



Photo by Roger L. Hammer

The ‘Bad Boy’ Brazilian

Native to Brazil, Argentina and Paraguay, Brazilian pepper (*Schinus terebinthifolius*) was introduced to the United States in the 1840s as an ornamental plant. Since then it has infested over 700,000 acres in Florida, most notably in the Everglades.

Extreme measures have been taken to thin the Brazilian pepper population, particularly where imperiled native species have become smothered by its overwhelming presence. The tree is also called “Florida holly,” much to the chagrin of conservationists who feel the moniker might promote the false idea that the plant is a Florida native.

Brazilian pepper, while not a true pepper, produces berry-like peppercorns that are edible to humans and are often consumed by birds, which spread them far and wide. The nectar of the tree’s flower can also be used to produce honey. Brazilian pepper is classified in the same family as poison ivy and is a known irritant to people with specific allergies to plants in the same family (Anacardiaceae).

Brazilian pepper is listed as a Category I (exotic, invasive) species on the 2011 Florida Exotic Pest Plant Council List of Invasive Plant Species. It’s also listed as a prohibited aquatic plant and noxious weed for the state.

— Cade Cleavelin



“You can think of this spot as cancer—you can dump a bunch of chemicals on it and hope for a cure, or you can remove the cancer.”

—Steve Woodmansee

harbor such species as the newly listed federally endangered plant Cape Sable thoroughwort (*Chromolaena frustrata*), which requires fresh water to germinate and become established.

In the Everglades, these forests intermix with lower-elevation coastal prairies — sprawling expanses of low-growing plants like saltwort (*Batis maritima*) and perennial glasswort (*Salicornia perennis*) that prefer salty soil and are just 7½ inches (19 centimeters) above sea level. A matter of just a few vertical inches distinguishes the buttonwood forest — where Wendelberger conducts much of her research — from a lower-elevation sea of yellow-green halophyte prairie, lower coastal mangrove forests nestled in the saline coastal soil, and the ocean.

“You get completely different communities within just a few centimeters of elevation,” said Wendelberger. “This prairie is set up like it is because of this balance between saltwater intrusion and freshwater draining.”

Wendelberger is studying how plants adapt to changes in soil salinity. The division between prairie and mangrove forest is already a strong indicator of a soil’s salt content. Along the coast, red and black mangroves thrive in water with salinity up to 60 parts per thousand. The saltwort is at home farther inland where the salinity is lower,

averaging 37 parts per thousand.

The change from prairie to forest is stark and precise, and with the threat of sea-level rise, Wendelberger’s hunch is that these plant communities will respond abruptly to salty ocean water intruding farther inland.

“It’s going to change how these coastal communities grow and interact,” she said. “If there are any big changes in the salinity of the soil, it’s bound to move everything farther inland and to higher ground. It’s hard to know at this point how plants like *Chromolaena* are going to handle it.”

Chromolaena, the Cape Sable thoroughwort, gained its federally endangered status in part because of sea-level rise. It is only known to exist in 11 populations along the southern coast of Florida and on six islands in the Florida Keys. One of six species under close watch in Wendelberger’s study, the thoroughwort likely would not survive the transition if its habitat suddenly shifted inland.

“The coastal lowlands tend to carry less diversity than the highlands because life in general is just harder for salt-tolerant plants,” Wendelberger said. “Fluctuating water and salinity levels is a harsh environment, even without humans contributing to sea-level rise.”



Kristie Wendelberger, a plant ecologist at Florida International University, explains the complex ecosystem within a “cypress dome,” a type of swamp where trees at the center grow taller than those at the edge. Photo by Travis Mowers

Native plants and climate change: An issue of right now

By Christine Coester and Bill Allen

The effects of global climate change loom as potentially the biggest challenge to conserving imperiled native plants in Florida.

The question isn’t will these effects hit Florida, but rather when and how hard, several scientists say.

“Climate change is the threat of this century,” said Vivian Negrón-Ortiz, a botanist with the U.S. Fish and Wildlife Service based in Panama City.

According to the authors of the “Atlas of Florida’s Natural Heritage,” “Of all the challenges faced today in the conservation of biodiversity, none is more difficult to assess, yet potentially more catastrophic, than climate change.” The atlas, published in 2011, is an authoritative reference on the state’s natural resources.

Studies show that Florida likely will experience slight increases in average temperature and rainfall. But the greatest and clearest impact will come from sea-level rise, with plants suffering the biggest losses, scientists said.

A “realistic” 3-foot rise by the end of the century would inundate about 5 percent of the state, according to the atlas. And a 9-foot “worst-case-scenario” rise would cover as much as 15 percent. Especially hard hit would be the Keys and along the coast, where many already rare plants live.

For example, with a 3-foot rise along the panhandle coast, Godfrey’s spiderlily (*Hymenocallis godfreyi*) would lose 60 percent of its habitat, according to the atlas. The plant’s current habitat would disappear with a 9-foot rise.

In the Everglades and Keys, plants that have evolved to withstand the delicate saltwater-freshwater balance now face saltwater intrusion. This can wreak havoc on such niche-specific plant populations as the imperiled Cape Sable thoroughwort (*Chromolaena frustrata*) and the Key tree cactus (*Pilosocereus robinii*).

“As the ocean rises, areas here are going to transition,” said Kristie Wendelberger, a doctoral candidate in biology at Florida International University, in Miami. “The communities are very resilient and a lot will transi-

tion on their own, but some will need help.”

Wendelberger and other scientists already are seeing shifts in plant communities within Everglades National Park.

“This is an issue of today, of right now,” she said. “In 50 years, it might be too late.”

“Knowing that significant changes are coming, but not the exact magnitude or scope, increases the urgency for us to accelerate our seedbanking,” said Kathryn Kennedy, director of the Center for Plant Conservation, in St. Louis. Seed banks provide a backup

mate and nutrient support.”

Such knowledge is crucial for successful restoration, she said. So is working to increase the “natural resilience” of Florida’s landscapes. That includes boosting the raw numbers of native plants and making sure “habitat continuity and connections” are taken into account when designing preserves and other conservation efforts. Such connections will provide pathways for at-risk plants that can disperse naturally to move out of harm’s way.

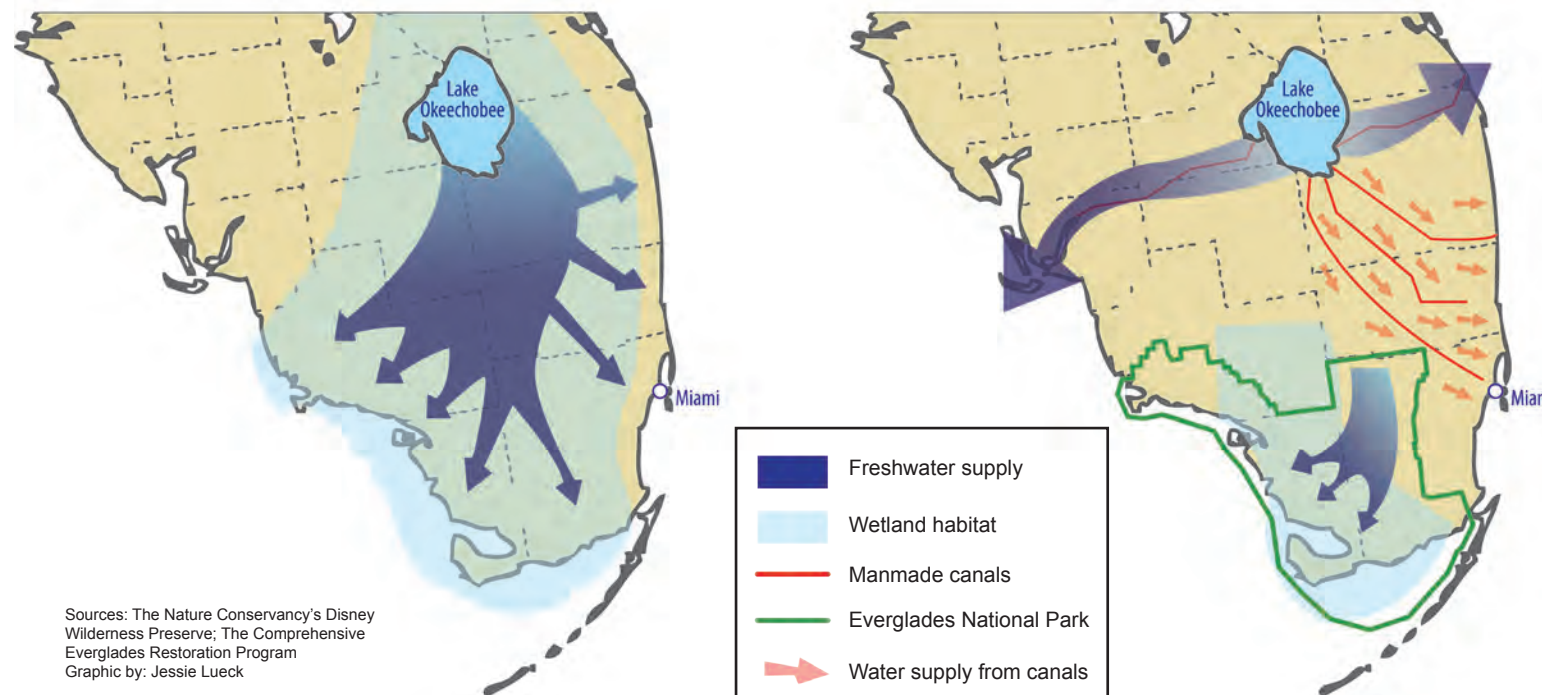


Godfrey’s spider lily (*Hymenocallis godfreyi*), listed as endangered in Florida, is only known from two sites, both within a marsh at the confluence of St. Mark’s and Wakulla rivers. Photo by Bill Boothe - www.natureinfocus.com

WATER FLOW OF THE EVERGLADES

WATER SUPPLY BEFORE CANALS: South Florida’s hydrological system is fueled by the fresh waters of Lake Okeechobee. Before development, rain water spilled over the southern ridge of the lake and flowed through wetlands. The lands were abundant in grasses and tree islands that followed the current of the floods.

WATER SUPPLY AFTER CANALS: In the late 1800s and early 1900s, canals built at the southern end of Lake Okeechobee drained the Everglades for crops. Scientists say the Everglades are now half as large and half as wet. For habitats sensitive to slight changes in the water table, the alteration in water supply can eliminate entire species.



Sources: The Nature Conservancy’s Disney Wilderness Preserve; The Comprehensive Everglades Restoration Program
Graphic by: Jessie Lueck

system to hold seed or other plant parts with wild adapted traits in readiness for studies and restoration activities as needs become clearer.

“To maintain valuable plant diversity that has taken thousands of years to develop, we will be managing species and suites of species much more intentionally and intensively than we have had to do in the past,” Kennedy said. “To do that we will need more ecological information about the habitats these species are successful in. We need to know what the essential dynamics are — from pollinators to soil microbes to other plants in the community that provide important microcli-

“I see a lot of change coming to our world with climate change,” said Joyce Maschinski, conservation ecologist with the Fairchild Tropical Botanic Garden, in Coral Gables. “The impacts of hurricanes in South Florida, for example, are predicted to be more intense and more frequent, and that means some species or populations are not going to make it through to the other side of these catastrophic events.

“I don’t know which species will make it through, and I think it’s important for us to keep as many species as possible alive so we have as diverse a world awaiting our children as possible.”

Holding on to a vine:

Botanists work to save endangered beach plant



Sam Wright, a botanist at Fairchild Tropical Botanic Garden, talks about the large diversity of plants just within a few feet of the Florida coastline. Photo by Ninh Pham

By Christine Coester

KEY BISCAIYNE, Fla. — With his hands in the sand and his nose to the ground, botanist Sam Wright squints at tiny, young plants of beach clustervine that have sprouted on the backside of a sand dune.

“It seems hopeless until you see this,” Wright said, referring to the effort to save Florida’s imperiled plants.

This was his first time back to visit the beach clustervine (*Jacquemontia reclinata*) population at the Bill Baggs Cape Florida State Park since its habitat was inundated with salt water when Hurricane Sandy stirred up the East Coast, in 2012.

Now, seven months later, the clustervine’s population is sparse but surviving.

Listed as federally endangered in 1993, its existence today is due, in part, to the tenacity and passion of Wright and the Fairchild Tropical Botanic Garden.

Wright and Fairchild have spent the past 12 years working on a landscape-scale recovery to save the beach clustervine from extinction. With the help of a \$250,000 grant from the U.S. Fish and Wildlife Service, Wright has done 16 reintroductions

of the species. Two of the reintroductions have become self-sustaining populations.

The beach clustervine lies low to the ground — fanning out with green leaves and small, white, star-shaped flowers. The plant is found only in southeastern Florida, where it thrives in the nutrient-poor sand.

Wright’s reintroduction research has shown that the beach clustervine survives best at roughly 20 to 45 meters from the high-tide line. At that distance, the reintroduced plants had a survival rate of 72 percent after five years.

Invasive species have threatened the clustervine’s habitat to some degree, but its endangerment is primarily the result of urbanization and development, Wright said.

Its remaining habitat is fragmented and interspersed between Dade, Palm Beach and Broward counties.

Coastal areas that are not developed are raked clean to create the perfectly manicured beaches that tourists and natives have come to expect.

These artificial beaches starkly contrast with the natural beaches where the beach clustervine is found. Covered with oscillating mounds of wave-kissed sea debris like seaweed, shells and twigs, natural beaches are a delicate community of living organisms.

“A common person will see these beaches and think that they are ugly,” Wright said.

The brown mounds layered on the beach function as a first defense, softening the onslaught of salty ocean water and providing a food source for invertebrates, which in turn provide for the birds. At the top of the dunes are the Sea Oats (*Uniola paniculata*), whose roots help to keep sand in place.

Farther back is the beach clustervine, known to attract at least 22 different insect pollinators. After that grow dense forests known as maritime

hammocks.

“This particular area has a function,” said Wright. “All we’re trying to do is allow its function.”

The North Shore Open Space Park in Miami Beach is home to another clustervine reintroduction site, and here, the plant is flourishing.

In 2010, Wright introduced 102 plants into this habitat. Currently 99 are alive.

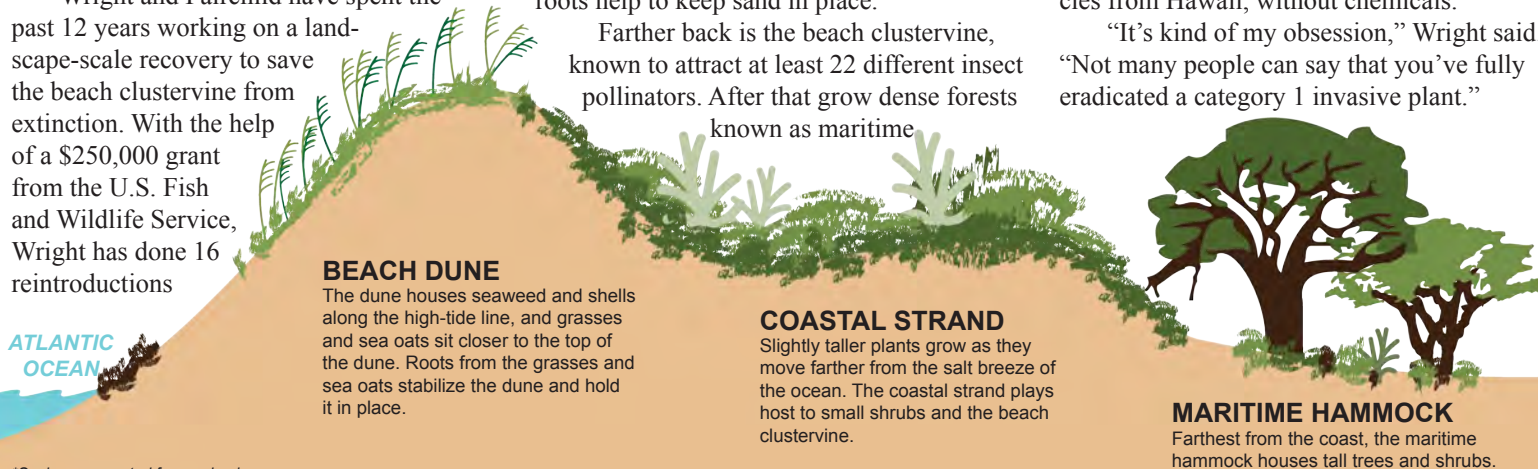
To the west, the Miami skyline lurks over sands blanketed with the beach clustervine and other species, juxtaposing a scene of picturesque diversity that one can only hope doesn’t go unnoticed as beach-goers walk by.



The flower of the beach clustervine, a federally listed endangered plant with fewer than 1,000 individual plants in existence. Read more about this CPC species at <http://tinyurl.com/clustervine>. Photo by Travis Mowers

It took four years of “knocking on doors” before this eight-city-block area was even approved for rehabilitation. It took an additional six years for Wright and roughly 1,500 volunteers to clear the land of the half flower (*Scaevola taccada*), an invasive species from Hawaii, without chemicals.

“It’s kind of my obsession,” Wright said. “Not many people can say that you’ve fully eradicated a category 1 invasive plant.”



PLANT COMMUNITIES OF A PENINSULA SAND DUNE

*Scale exaggerated for emphasis
Source: Florida Natural Areas Inventory
Graphic by: Jessie Lueck

Preserving natural dune habitats

By Zachary Matson

JUNO BEACH, Fla. — Wedged between high-rise condos and sprawling subdivisions in the Palm Beach County town of Juno Beach, hundreds of acres of Florida scrub sit on relic dunes carved by thousands of years of coastal forces.

Scrub is a globally imperiled habitat, home to endangered plants like the four-petal pawpaw (*Asimina tetramera*). The habitat, which occurs sporadically along the coasts and the state’s central ridges, consists primarily of low-growing shrubs that thrive in infertile, sandy soil.

Rare among counties, Palm Beach maintains more than 31,000 acres of preserved natural habitat across 35 sites. The Juno Dunes Natural Area is one of those sites. It runs from the coast to the Intracoastal Waterway and includes more than 10 distinct natural communities and more than 500 plant species, according to site manager Melissa Tolbert.

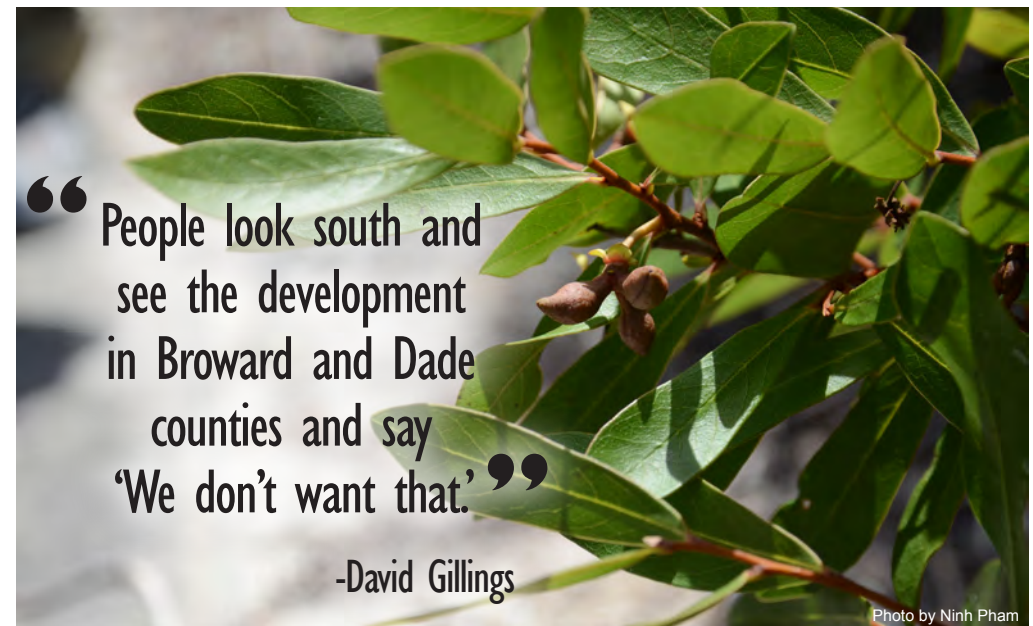
In 1991, more than 67 percent of the county’s voters supported a bond measure to raise \$100 million to buy lands for preservation. Another measure passed in 1999, which included an additional \$50 million for land acquisition.



Close-up detail of the four-petal pawpaw (*Asimina tetramera*). Photo by Bill Boothe - www.natureinfocus.com

“People look south and see the development in Broward and Dade counties and say ‘We don’t want that,’” said David Gillings, Palm Beach County’s environmental manager, as he stood on high ground overlooking rolling dunes and low-lying wetlands. That public attitude persuaded the county commission to establish the program.

Based on aerial photographs from the



-David Gillings

The four-petal pawpaw (*Asimina tetramera*) is federally listed as endangered with just over 1,000 plants in existence. Research is currently underway involving micropropagation, phylogenetics, demographics and population viability. Read more about this CPC National Collection species at <http://tinyurl.com/4pawpaw>.

1930s, Gillings estimates that less than 2 percent of the county’s original scrub habitat remains intact. Most has been converted for development.

Of the county’s preserved lands, more than 18,000 acres have been handed over to third parties like the Nature Conservancy as conservation easements. This reduces the chances that in the future the county would sell the land or build a road on it. Officials would first need the new guardian to sign off.

“If the goal is to preserve the lands in perpetuity, the best way to do that is to put as many layers of protection as possible on them,” Gillings said.

At all but one of the natural areas, the county has successfully reduced the population of invasive plants to less than one percent.

Tolbert, who also manages three other sites, said urban areas present unique management challenges.

“Doing prescribed burns in developed areas can be tricky,” Tolbert said. “But reproduction of (native) plants really drops off after too many years without fire.”

In one case, managers waited three years for the right wind, humidity and smoke-dispersion conditions to do a burn, she said. They are considering experimenting with so-called “microburns,” which would only affect a small area around the most at-risk plants.

The county continues to add small parcels to its overall holdings, but the acquisition money is nearly depleted, Gillings said.

“We are facing a dilemma now,” he said. “We are running out of money from the bonds and we probably have three to five years of money to manage the properties.”

Ultimately, the long-term health of the county’s natural habitats will depend on the support of the community, said Richard Moyroud, who chairs the state’s Endangered Plant Advisory Council.

“There is no guarantee the park will stay, unless the public demands it,” Moyroud said.



David Gillings, Palm Beach County’s environmental manager, estimates that less than 2 percent of the county’s original scrub habitat remains intact. Photo by Ninh Pham



Photo by Travis Mowers

Scorched to life:

Fire's role in the Sunshine State

By Cade Cleavelin

APALACHICOLA NATIONAL FOREST, Fla. — Pacing carefully through an open grove of slash pine, botanist Amy Jenkins checks her map, looks around her, and checks her map again. She's walking a segment of the Apalachicola National Forest in the Florida panhandle, just off of an unmarked road, surveying the aftermath of a controlled burn that took place just a two weeks prior. Fire has left much of the forest floor black and bare, the undergrowth completely burned away. A hall of blackened stalagmites, the dense planting of pines serves as the only bridge between heaven and earth, bracing a canopy of sparse needles against the harsh subtropical sun.

Jenkins, who is with the Florida Natural Areas Inventory, in Tallahassee, is looking for something: an endangered orchid whose seeds respond to either the smoke or heat of a burn (nobody is sure which), and blooms only in the aftermath of a fire in the understorey.

"If you can find it, it's really incredible," she said. "They're a small, pink flower, and sometimes when they come up the ground is just dotted with pink."

The many-flowered grasspink orchid (*Calopogon multiflorus*), dainty by appearance, is heavily dependent on fire. It sprouts in the few weeks following a wildfire or controlled burn, and blooms for maybe 10 days. The orchid is elusive, and the hunt for it can be aggravating. Botanists and savvy plant enthusiasts can take many trips out to suitable burn sites, within just the precise window of time, before they catch the orchid out in the open.

Jenkins has a map marked where a col-

league found a patch growing four days ago.

"They come up about two weeks after a burn," she said. "They flower and drop their seeds in just a week or two, and then they're gone until the next burn."

After a few more minutes of retracing her steps, checking and rechecking her map, it's clear that Jenkins is too late. The orchids have come and gone, and to find the species again she'll have to wait until the next fire. The charred floor is hardly barren, though.

Another plant — not an orchid, but a flowering perennial — has responded vigor-



Eric Menges, senior scientist at Archbold Biological Station, says fire is an "old friend" to some ancient plant communities. Photo by Ninh Pham

ously to the burn. The white, flower-thick tips of Osceola's plume (*Zigadenus densus*), also called crow poison, are more than making up for the want of pink.

"Crow poison is another one of these fire-friendly species," Jenkins said. "They come back every year, but not like this. After a burn, they go wild."

Flowers like Osceola's plume and the multi-flowered grass pink orchid seem delicate, but they have evolved to thrive in an environment that burns regularly. Fire has a knack for reducing competition for sunlight

among plants, especially against invasive species that aren't prepared to be scorched.

Before civilization sprouted in so much of the state, fire was a force unchecked. Lightning strikes would spark blazes in the dry season and forests and prairie alike would be given a regenerative sweep that not only cleared the ground of old vegetation, but also returned nutrients to the soil. It is, or once was, a natural cycle, one that conservationists in Florida wish would happen more often.

"Here in Florida, it's mostly just fire and water," said Kim Gullede, a botanist and researcher with the Florida Natural Areas Inventory. "There aren't really any other ingredients that affect plants so much, besides of course sunlight, which everybody has plenty of."

Gullede conducts plant studies for the state's Florida Forever Program, which publishes guides to natural communities. She knows the forests well. Her master's project was on the distribution of plants in Manatee Springs State Park, an area rife with pine flatwoods.

"We have either mesic flatwoods, wet flatwoods or scrubby flatwoods here, but in general it's all pine," she said. "Historically it should have been longleaf pine."

Whatever their distinctions, fire is a staple in the life cycle of these forests.

"The most important thing the pineland needs is fire," said Dallas Hazelton, Florida natural area's fire program manager, and another fierce proponent of prescribed burning. "These sites don't burn near as often as they need to."

Hazelton is the site manager of the Deering Estate, a state-owned, county-managed, federally listed nature preserve overlooking Biscayne Bay in South Dade County. The 444-acre conservation area is a wild, overgrown, pristine lump of pine rockland, dense with scrub and surrounded by neatly trimmed subdivisions.

In 1991 the preserve was listed as an Environmentally Endangered Land for its

prevalence of pine rockland habitat, and is now managed under funding from a special property tax in the county — a trust fund established for land conservation and restoration.

"We'd like to burn this place every year, but it's tricky," Hazelton said. "You have to have just the right conditions or else it just can't happen."

"If the smoke blows over, people complain. We don't get the conditions we're looking for very often so we have to take any opportunities we can get."

He needs reliable winds out of the northwest, which aren't common on the east coast and make a regular fire regime difficult to sustain.

Other parts of Florida have seen better success with their fire regimes. On Lake Wales Ridge, a relatively high region in Florida's remote central interior, managers at Archbold Biological Station have kept a tight burn schedule for many years.

Eric Menges, Archbold's Senior Research Biologist, has been studying the interaction of fire with the landscape, including studies on smoke-stimulated germination of certain plant seeds. His work focuses at Archbold and at the Lake Wales Ridge National Wildlife Refuge, which in 1993 became the nation's first U.S. Fish and Wildlife Service



The many-flowered grasspink orchid (*Calopogon multiflorus*), endangered in Florida, is a fire-loving species that sprouts within a few weeks following a fire and only blooms for about 10 days. Photo by Bill Boothe - www.natureinfocus.com

refuge created to conserve and recover endangered and threatened plants.

"It's clear that fire is the most important ecological disturbance in Florida," Menges said.

Just a mile from Archbold's main facility, he walks along the edge of a line of flam-

ing scrub that, despite a recent dry spell, is undergoing a scheduled burn today. The welling and swirling of ashes is nearly blinding, keeping a crew of lookouts busy patrolling on four-wheelers for errant embers.

Lake Wales Ridge is unique for its elevation in Florida (about 200 feet) and offers a compelling case study for Menges' research. Since the ground is so high, it's geologically older. Beach scrub communities along the coast might be a few thousand years old, but the scrub on Lake Wales Ridge likely goes back millions of years. And, according to Menges, fire is an old friend.

"Eighty-five percent of this kind of habitat is gone in Florida, and the remaining land is not managed enough by fire," he said.

Researchers at Archbold know the land well and have mapped the area based on how often each division of the property needs to be burned: anywhere from roughly every year to every decade.

"It's very subtle, but you can read changes in the landscape by seeing which plants go where," Menges said. "It's all part of the same ecosystem, but every site needs something different, some sort of attention that it might not be getting, and a lot of it is because of either settlement or agriculture."

"For most of these sites, fire is a huge force that plants might not be getting."

For more stories, pictures and videos, visit the *Dancing with Extinction* Florida page at: <http://tinyurl.com/FloridaCPC>.

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—Bill Allen

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“ There are **many**
Floridas within Florida, and
they are all **unique.** ”
-Cheryl Peterson

Photo by Cade Cleavelin