Biodiversity Hotspot: The Florida Panhandle

Conservation in the Florida Panhandle, one of the richest biodiversity hotspots in North America, improves through major restoration efforts and new partnerships.

RICHARD J. BLAUSTEIN

The Choctawhatchee River is one place where ivory-billed woodpeckers have reputedly been sighted. Though the river is in comparatively good condition, a recent report by the Nature Conservancy describes the main threats to panhandle river biodiversity, from greatest to least: dams and water management and use, agricultural and forestry effluents, roads and railroads, housing and urban areas, and invasive species. Photograph: Marguerite Foxon.

The reported recent sightings of the ivory-billed woodpecker in the Florida Panhandle spotlighted not only the reputedly extinct bird but also the rich biodiversity of the Choctawhatchee River. The focus on the Florida Panhandle, one of two locales (the Big Woods area of Arkansas is the other) being searched for the ivory-billed woodpecker, has underscored the environmental context for species survival. As a free-flowing river through protected, successional

forests, the Choctawhatchee River figures large in the possible survival of this iconic North American bird.

The Florida Panhandle, considered one of the five richest biodiversity hotspots in North America, has been the center of regional and national attention for reasons other than the ivory-bill. Prominent developments in the panhandle include the ongoing disagreement between Georgia, Alabama, and Florida over diversion of waters in the Apalachicola–Chattahoochee–Flint River system, which affects the biodiversity and commercial fisheries of Apalachicola Bay; the establishment of the Northwest Florida Greenway, a protected corridor through the panhandle; the recent identification of a second species of the rare flatwoods salamander; and the groundbreaking for the E. O. Wilson Biophilia Center, expected to open in the fall of 2009. These join the ongoing recovery efforts in the panhandle for species such as the red-cockaded woodpecker and the Okaloosa darter at Eglin Air Force Base, in the western panhandle, and substantial longleaf pine–wiregrass restoration, which makes use of refined fire applications.

Deborah Keller, senior policy representative at the Nature Conservancy (TNC), clarifies why the panhandle is a biodiversity hotspot: "Its rivers run clean; its coastal estuaries and forests are productive. It has changed more slowly than peninsular Florida, so species and natural ecosystems have survived." Although political choices and economic development pose pressing challenges for the area, the Florida Panhandle is a biological wonder that presents scientific, public policy, and educational questions.

Natural history

Ecologist Bruce Means, founder and executive director of the Coastal Plains Institute and Land Conservancy in Tallahassee and adjunct professor at Florida State University, has been involved in conservation in the panhandle for more than 40 years. He points out that no area of its size in the United States or Canada has more species of frogs (27) or snakes (42), and it ranks about third in the world for turtle species (18). The diversity of

E. O. Wilson Biophilia Center

In May 2008 the E. O. Wilson Biophilia Center formally broke ground at its Nokuse Plantation site in the western panhandle. Named after Harvard biologist E. O. Wilson, who spent much of his youth in the Florida Panhandle and in nearby eastern Alabama, the center is scheduled to open in fall 2009. Local businessman and conservationist M. C. Davis is the driving force behind both the Nokuse Plantation and the E. O. Wilson Biophilia Center. He says the center will make use of the natural setting of the 48,000-acre Nokuse Plantation to "give children an opportunity to learn and then to love nature." After completing the program, he expects, each one will be "at least a little bit of a naturalist."

The center's director, Christy Scally, is already consulting with local school districts. She explains that the Biophilia Center will have multifaceted programs demonstrating the importance of a balanced ecosystem. The programs will include discovery trails, interactive exhibits, curricular materials in line with Florida's state science standards, and a theater for showing science films and presentations from noted scientists and environmentalists.

The Nokuse Plantation, with its major longleaf-pine restoration program, is representative of the larger conservation effort in the Florida Panhandle and has linkages to the million-acre Gulf Coastal Plain Ecosystem Partnership and the prospective Northwest Florida Greenway. Ecologist Matt Aresco, director of Nokuse Plantation, points out that Nokuse comprises a diversity of habitat types that were originally found in the region. "Much of the area has been impacted by silviculture and agriculture," he says, "but all the pieces are there for restoration." The goal at Nokuse is to restore natural communities to their pre-European settlement conditions, which means a reemergent longleaf-pine dominance. Other habitats include herbaceous seepage bogs and blackwater streams.

Some of the state and federally listed rare species found there are the gopher tortoise, pine snake, and Cooley's meadow rue. Aresco has been directing Nokuse's gopher tortoise rescue effort, which is the largest in the state, involving about 1500 gopher tortoises. The aim, Aresco says, is "to save gopher tortoises from development and reestablish gopher tortoise populations on land where they were historically overharvested by humans."

Education and conservation objectives are intertwined at Nokuse Plantation and the E. O. Wilson Biophilia Center. The education component is as important as land acquisition, Aresco says. The public needs to know why land is being acquired and what might be lost, in terms of natural communities, if property isn't protected.

Davis says Nokuse Plantation is his effort "to save biodiversity on the largest scale personally possible." Much of the species loss is caused by our ignorance, he says, and the only cure is knowledge, which is gained most efficiently through formal education. E. O. Wilson has not only shared his name with the center but, through his research and writing, has inspired people all over the world. Wilson's writings, says Davis, "were the catalyst that caused my own dedication to conservation."

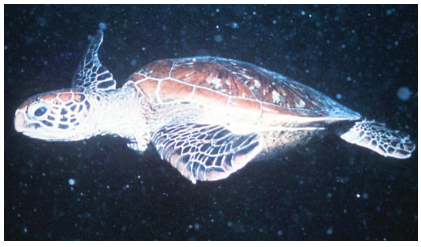
Harvard biologist E. O. Wilson (right) spent much of his youth in the panhandle and in nearby Mobile, Alabama. Also pictured are M. C. Davis (center), Nokuse Plantation's developer, and Matt Aresco (left), Nokuse's director. Photograph: Margaret Gunzburger.

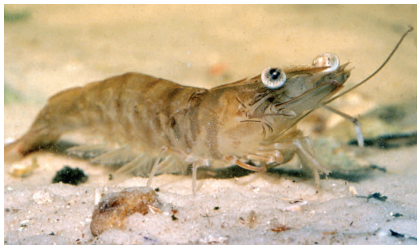
The flatwoods salamander is a noted example of the species diversity and endemism of the panhandle. Hundreds of thousands of salamanders and frogs emerge every year from small, temporary ponds and migrate into the longleaf forests, Bruce Means says. They transport nutrients upslope from their natal pond, they feed on a host of invertebrates, and their bodies are abundant food for predators. Photograph: D. Bruce Means.

salamanders (28 species), birds (approximately 300 species), and plants (more than 2500 species) is also very high. "All this is a reflection of the high habitat diversity of the Florida Panhandle," Means says.

Steve Herrington, a senior aquatic ecologist for TNC, explains that the natural history of Florida Panhandle rivers is linked to changes in sea level. "Unlike peninsular Florida," he says, "panhandle rivers remained connected to mainland North America throughout the Pleistocene Epoch" (1.8 million to 12,000 years ago), providing a refuge whenever the sea level rose. The Apalachicola River has the most remarkable biodiversity of the large rivers of the panhandle, "supporting more primary freshwater fish [more than 90 species], mussels [more than 30 species], and reptile and amphibian species than the other rivers." Although less diverse, other panhandle river systems contain numerous endemic species, as well. Yet the hotspot for biodiversity is the Apalachicola, where notable species include Apalachicola rosemary, Florida torreya trees, fat threeridge mussels, Say's spiketail dragonflies, fireback crayfish, shoal bass, and Apalachicola dusky salamanders. "The reason for this high diversity and endemism," Herrington says, "is strongly related to historical biogeographical patterns of colonization and recolonization during the Pleistocene Epoch until present day."

The Gulf Coast of the panhandle is also uniquely varied, with the most biodiversity in the eastern Big Bend, where seagrass meadows thrive. Marine biologist Anne Rudloe, managing director of the Gulf Specimen Marine Laboratory in Panacea, Florida, says the Florida Panhandle has one of the most biologically diverse coasts in the continental United States. "To the west, the wave energy created by deep water close to shore and large rivers builds extensive barrier beaches with endemic subspecies of beach mice among the fauna. To the east," she continues, "shallow water for miles offshore dampens waves and allows huge salt marshes and seagrass meadows to stretch for miles." Its denizens include attention-getting manatees, bald eagles, and sea turtles, but also tarpon, grouper, pink shrimp, and "all the thousands of smaller marine species that support the larger headliners."





*Green sea turtles (*Chelonia mydas, *top), along with manatees, are the dominant large herbivores in the panhandle's seagrass habitat. Their populations were decimated by centuries of overharvesting, says Anne Rudloe, of the Gulf Specimen Marine Laboratory, so the ecosysytem today is probably significantly different from what it was when they were more common. The pink shrimp (*Farfantepenaeus duorarum, *bottom), which supports the most valuable fishery in the Gulf of Mexico, uses seagrass as its juvenile habitat. Without seagrasses, Rudloe says, there would be no pink shrimp. Photograph courtesy of Gulf Specimen Marine Laboratory, Panacea, Florida.*

Florida's Big Bend, which extends beyond the panhandle all the way south to the Withlacoochee River, has one of the largest seagrass beds areas in the world and is encompassed almost entirely by publicly owned lands. Marine ecosystems are more diverse at the phylum and class levels than terrestrial ecosystems, explains Rudloe, "for the simple reason that most biological lineages are marine and never became established on land." Like coral reefs, seagrass beds are especially rich because they combine abundant food and shelter with a relatively stable physical environment. "The result is an underwater meadow teeming with life."

Longleaf-pine savannas

The panhandle has many rich and dramatic habitats. For example, seepage bogs contain colorful arrays of carnivorous plants in communities that rival rain forests in diversity, with more than 50 species of plants per square meter, by some estimates. The panhandle's steephead ravines, small canyons formed by spring water, are also known for their endemism. However, it is the the longleaf-pine habitat that is the most extensive and broadly supportive habitat for which the panhandle is best known.

"Longleaf-pine ecosystems may be North America's least appreciated re-

The Florida Panhandle contains vital remnants of old growth and regrown longleaf-pine habitat, which once covered over 60 percent of southeastern land from Virginia to Texas. "The vast majority of the diversity in southern pine forests occurs from the knees down," says David Printiss. "At least 40 plant species have been documented per square meter." Photograph: D. Bruce Means.

positories of biodiversity," Means explains. Longleaf-pine habitats once accounted for 60 percent of the landscape, spanning a 2000-mile swath of land from Virginia to Texas, but now they are reduced to less than 2 percent of their original expanse. What remains is protected on publicly owned lands of the Florida Panhandle: Eglin Air Force Base, Apalachicola National Forest, Blackwater River State Forest, St. Marks National Wildlife Refuge, and state parks. Most old-growth longleaf-pine timber was removed between 1880 and 1930; what longleaf acreage is left is second growth. "An ancient plant community with origins in the Miocene," Means says, "longleaf-pine savannas support up to 150 species of plants per hectare. Such plant species richness is mirrored in animal life. Of 212 resident species of vertebrate animals, 38 are specialists occurring exclusively or primarily in longleaf-pine savannahs." Adds James Furman, wildland fire program manager at Eglin Air Force Base: "With predominantly open, park-like stands that were maintained by frequent fire, many animal and plant species evolved in this fire-dependent ecosystem and are found nowhere else."

In fact, fire is central to longleaf-pine habitat, facilitating faunal and floral succession and clearing out less biodiversity-supportive hardwoods. Restoration ecologist David Printiss, director of TNC's Northwest Florida program, which includes Apalachicola Bluffs and Ravines Preserve, says that for southern pine forests, and not just long-leaf pine, "the most important ecological process by far is fire." It is carried across the landscape by a blanket of grassy ground cover, and although pine trees do play an integral part, the ground cover, dominated by *Aristida stricta,* defines it. The red-cockaded woodpecker and other rare fire-dependent species, Furman adds, such as the gopher tortoise and indigo snake, thrive in the open savannalike forests that frequent fires produce.

Among the panhandle's other biodiverse habitats are the Apalachicola Lowlands biotic region, the many natural springs, and Apalachicola Bay, which is, Herrington observes, "arguably the most biologically productive bay in the Northern Hemisphere." Drought and upstream water diversions have had a major impact on the bay, and as with all panhandle habitats, its future depends on public policy, development agendas, and conservation and restoration efforts.

21st century conservation: Restoration, partnerships, and policy

Restoration of longleaf-pine habitat is making great strides, in terms of both scientific advances and major commitments (see the box on p. 785). Printiss's restoration work at Apalachicola Bluffs and Ravines Preserve emphasizes the application of prescribed fire. To address habitat damage from mid-20th-century timber harvesting, which noticeably uprooted the forest floor as part of site preparation, his program focused early on the need to restore wiregrass, the critical ground cover. It was not known how wiregrass reproduced before the

Fire has always been integral to the longleaf-pine habitat; the unique species assemblage of longleaf-pine areas evolved in the context of recurrent fires. Lightning strikes were once the most common cause, but Native Americans also instigated fires for hunting, land clearing, and pest control. Today, prescribed fire is necessary for maintaining the remaining and restored longleaf-pine habitat. Photograph: D. Bruce Means.

late 1980s, but his research has since shown (a) how to stimulate flowering by growing-season fire, (b) when to collect the seed, and (c) how to successfully propagate the seed for both sowing in the nursery and direct seeding in restoration sites. "Through the continued refinement of techniques and equipment," he says, "we have reduced ground cover restoration costs from over $10,000 per acre to hundreds of dollars per acre."

Eglin Air Force Base, whose 464,000 acres are a prime focus of panhandle conservation, is comparable in size to Rhode Island; 11 federally listed threatened and endangered species persist there. "Eglin Air Force Base," Furman says, "includes the largest remaining longleaf-pine forest under single ownership, as well as the largest tract of old-growth longleaf-pine forest, making it extremely important from a conservation standpoint." The base made taxonomic news in 2007 when a new species of flatwoods salamander at Eglin (*Ambystoma bishopi*) was identified, distinguishing it from its sister species (*Ambystoma cingulatum*) east of the Apalachicola River.

Partnerships play a large role in conservation at Eglin. Steve Seiber, chief of natural resources at the base, says that without them, the principles of ecosystem management and biodiversity conservation at Eglin could not have been developed. From workshops with military test and training range planners to TNC's site conservation planning process, partners have played a vital role in improving the natural resources management of the base. Keller, who leads TNC's work at Eglin, says the Northwest Florida–Conservancy–military partnership works well because all members embrace the long-term benefits of protecting a healthy ecosystem. "It is truly a win-win arrangement," she says. The protection plan for high-priority conservation areas that is in place in the panhandle preserves the ecosystem services for wildlife and human populations, as well as provides a buffer between residential areas and military operations and training missions.

The entire population of Okaloosa darter (*Etheostoma okaloosae*) is endemic to the Florida Panhandle, and Eglin has management responsibility for 95 percent of the endangered species' habitat, Seiber explains. The fish live in only six small streams, and the main threat has been sedimentation from borrow pits (excavated holes) and from nonpoint sources, such as roadways and rights-of-way. From 1994 to 2007, he says, a total of 324 sites totaling 495 acres have been rehabilitated and maintained. As a result of Eglin's restoration efforts, the US Fish and Wildlife Service is proposing downlisting the Okaloosa darter from endangered to threatened.

The red-cockaded woodpecker (*Picoides borealis*) is perhaps the most famous species drawing attention to Eglin. The woodpecker constructs its highly crafted nest in the older longleaf-pine trees found at Eglin, as these trees are prone to the heart rot fungus that makes the tree amenable to deep nest excavation. "We have been implementing a comprehensive management program for the red-cockaded woodpecker on Eglin for 18 years and have made great strides towards the recovery of the species," explains Bruce Hagerdon, wildlife program manager at Eglin. Starting from an

estimated 184 potential breeding groups in 1994 to the latest, but still unofficial, 2008 count of 335 groups, "we have documented what I think is an impressive 55 percent increase in our population," he says. The recovery goal, as established in the species recovery plan, is 350 potential breeding groups. Hagerdon credits their recovery to artificial cavity/nest drilling and translocation of juvenile birds, as well as to good ecosystem management.

Conservation efforts in the panhandle owe a great deal to existing government support and overarching initiatives. For example, notwithstanding significant environmental problems, such as invasive species and agricultural waste in some locations, "The overall status of panhandle rivers is generally good," Herrington says, owing much to the relatively low human population density of the panhandle. The State of Florida, particularly in the past 15 years, has been purchasing lands to protect and restore natural areas for conservation purposes. The federal government has also been protecting large areas. The result, he says, is "a comparatively extensive amount of land protection [that] helps protect riverine resources from problems resulting from development and human land practices."

The purchasing of land for conservation is often a part of the popular Florida Forever program, which received funding in May 2008 for the fiscal year, notwithstanding a budgetary crisis, and which was extended until 2020 by the state legislature. Yet the most ambitious initiative is the Northwest Florida Greenway, which is a plan for an extended biodiversity corridor linking Eglin Air Force Base and the Apalachicola National Forest 100 miles to the east, and which sprang from a cooperative understanding among various state and federal offices, TNC, and others. The proposed greenway from Apalachicola to Eglin Air Force Base, Keller says, will create a corridor of wilderness and conservation lands that stretches from Florida's Big Bend to Alabama. These lands harbor species, protect future water resources, provide storm buffers, and allow ecological adaptations to shifts in sea level and rainfall, she explains, "and they are the places of our cultural and natural heritage."

Located alongside fire-replenished areas of longleaf pine, seepage bogs are exceptionally diverse. These water-permeated habitats contain colorful carnivorous plants, including 6 species of butterworts, 12 species of bladderworts, and 6 species of pitcher plants. These plants, which have been around for millions of years, devour insects that become trapped in their intricate and alluring flowers. Photograph: D. Bruce Means.

The biodiversity and endemism of steephead ravines are accentuated by the unique progression of plant life down the steep slopes. Steepheads are small canyons, Bruce Means explains, formed by the sapping action of springwater emerging from the toe of sandy slopes. Over time, the slopes migrated headward as sand was removed, creating the "steep heads." Steephead springwater is buffered thermally and chemically, making a very stable wetland habitat. Photograph: D. Bruce Means.

For more information, visit these sites:
www.nature.org/florida
www.eowilsoncenter.org
www.cooperativeconservationamerica.org/viewproject.asp?pid=544
www.coastalplains.org
www.gulfspecimen.org
www.auburn.edu/academic/science_math/cosam/departments/biology/faculty/webpages/hill/ivorybill/index.html

The future

As the greenway plan moves forward, other efforts for major highway extensions across the panhandle are being advanced by a different group of stakeholders. This extension plan raises concerns about undercutting the scope of the greenway and undermining sensitive species recoveries. Even though the Northwest Florida Greenway is viewed as a serious Florida initiative, with bearing for the future, how these contravening agendas will interface remains to be seen in the time ahead.

Significant business, development, and environmental pressures weigh on the future of the Florida Panhandle and its natural springs, seagrass meadows, estuaries, and forest savannas. The diminished productivity of Apalachicola Bay, the invasive species and nutrient problems at Wakulla Springs, and development threats to seagrass beds, to name a few difficulties, are causing some concern as to whether development forces can be kept in balance. At the same time, conservation and education efforts are a substantial influence in the panhandle.

The elusive ivory-billed woodpecker is perhaps emblematic of biodiversity in the panhandle, Keller reflects, in that "it evokes the hope and the promise that nature, given the opportunity to survive, can and often will." In a place where rivers run fresh and forests cycle naturally, long-lost treasures like the ivory-billed woodpecker or longleaf-pine habitats may yet be recovered.

Richard J. Blaustein (e-mail: richblaustein@hotmail.com) is an environmental lawyer and freelance writer based in Washington, DC.

doi:10.1641/B580904
Include this information when citing this material.