

Can This Swamp Be Saved?

Bold Everglades-protection strategies may revive the river of grass

By LAURA HELMUTH

Everglades National Park, founded in 1947, hosts 22 threatened or endangered species, including the snail kite, Florida panther, American crocodile, and West Indian manatee.

Photos: South Florida Water Management District

In 1905, Florida elected Governor Napoleon Bonaparte Broward, who campaigned on a promise to drain the Everglades. He didn't, but over the next century, others almost did.

Dams, canals, and levees have carved up most of the Everglades, which once covered almost 9 million acres. Everglades National Park protects only about a sixth of the historic Everglades area. Much of the rest has been planted with sugarcane, housing developments, and amusement parks.

Today, the Everglades is at the beginning of the largest ecological restoration effort in history. Many public and private projects are already under way, and in July, the Department of the Interior and the U.S. Army Corps of Engineers will submit to Congress a proposal for a 20-year, \$8 billion massive replumbing of South Florida.

The plan, optimistic and desperate at the same time, includes some of the most ambitious public works projects ever. This venture is designed to repair the damage from another one of the world's largest public works projects, the corps' midcentury effort to reengineer the Everglades.

"We're at a crossroads right now," says Michael L. Davis, deputy assistant secretary of the Army for civil works. "We have the opportunity to reverse 50 to 75

years of degradation of the Everglades ecosystem."

The Everglades once meandered over most of South Florida. The flat state is rimmed with slight rises on the east and west coasts, creating a wide, shallow valley. To the north, and slightly uphill, Lake Okeechobee released water that mingled with rain to form a wide, slow-moving "river of grass," as early conservationist Marjory Stoneman Douglas named the Everglades.

Imagine a grassy sheet of water 60 miles wide and 6 inches deep. A given drop of rain could take a year to glide south from Lake Okeechobee to the Florida Keys.

In the age of ecological awareness, air conditioning, and DEET mosquito repellent, the Everglades inspire awe. Early settlers, however, saw the Everglades as one big, soggy, malaria-infested impediment to prosperity. In the mid-1880s, the state offered Everglades land, cheap, to anyone who would drain it.

Natural disasters, too, impelled Floridians to tame the Everglades, says Lance Gunderson of Emory University in Atlanta. Flooding from a 1928 hurricane drowned thousands around Lake Okeechobee, some 40 miles from the coast. An extraordinary wet season in 1947 dumped 12 to 13 feet of rain on the Ever-

glades watershed, flooding 90 percent of southeastern Florida. The next year, Congress sent the U.S. Army Corps of Engineers to war.

The corps accepted two missions: to control flooding and to supply freshwater, primarily from Lake Okeechobee, to the state's growing population. Twenty years of building canals, dams, levees, and locks fragmented the Everglades' natural flow.

The engineers mounded dams to break the Everglades up into small, easily drained plots. They built a network of canals to sweep water east to the Atlantic Ocean and west to the Gulf of Mexico. The corps diked seeping Lake Okeechobee into a reservoir to supply freshwater to Florida's farms and booming cities during the dry season and to dump excess water into the canals during the wet season.

"The [Army corps] project was very successful," says Davis. "It protected against floods and provided water for the population and for agricultural needs. It also had tremendous unintended consequences—draining the Everglades."

Fifty years after the original South Florida water management plan, the corps and the South Florida Water Management District (SFWMD) have

completed a new study that will form the core of continuing Everglades restoration efforts.

The 3,700-page draft of a report to be officially presented to Congress this summer proposes ways to mimic natural water-flow patterns in what remains of Florida's wetlands. It recommends essentially replumbing the southern end of the state.

"We get 55 inches of rain in an average year," says ecologist Nick Aumen, research director of SFWMD in West Palm Beach. During monsoon season, from May to October, 85 percent of the year's rain falls. The hundreds of water-control structures in and around the Everglades have disrupted the levels, timing, and flow of freshwater, Aumen says.

Everglades wildlife depends on this seasonal cycle, says ornithologist Stuart L. Pimm of the University of Tennessee at Knoxville. During nesting season, wading birds need relatively low water levels that concentrate fish in shallow pools. The birds situate their nests near these reliable food sources. Too much drainage, however, has created frequent bone-dry periods from which fish populations can't bounce back. Both the fish and the birds suffer.

Artificially high water levels can also harm wildlife. The endangered Cape Sable seaside sparrow, for example, builds its nest a few inches above the water. When the water in a parcel of Everglades rises too rapidly, the nestlings drown.

Populations of wading birds in the Everglades are down at least 90 percent in the past 50 years, largely because of changes in water flow. Even in the 15 years that Pimm has been doing aerial surveys of the park, he has seen the number of wading birds decline.

Problems stemming from the artificial water control extend beyond the Everglades. During the wet season, Lake Okeechobee overflows into canals that shunt its water into brackish coastal estuaries. The influx of freshwater kills oyster beds and sea grasses there.

In order to restore the Everglades and still provide enough freshwater for South Florida's growing population, the corps must reclaim the water flowing from Lake Okeechobee into the ocean each year. Under the state's Everglades Forever Act, passed in 1994, Florida has been buying up land ringing the lake. The state is creating new marshes to reserve and filter water for wetlands year-round.

One of the most creative, untested water-storage techniques proposes plumbing on the grandest scale. One thousand feet below Florida's surface lies the briny Floridan aquifer. The corps suggests drilling hundreds of passages into this aquifer and pumping freshwater into it during the wet season.

The less dense freshwater should float in recoverable pockets above the native



Parched parcels of Everglades are prone to frequent, wide-ranging fires.

brine. When the dry season begins, engineers can reverse the pumps and bring the stored water back to the surface to replenish wetlands, farms, and city water supplies.

In effect, South Florida would create a deep, massive, underground parking garage for its freshwater. A complicated system, indeed, but with the high price of South Florida real estate and a population expected to double in the next 50 years, this injection-well solution may be cheaper than ground-level reservoir alternatives, says Aumen.

Other, less futuristic projects are already restoring the state's original waterways. For the sake of wildlife habitat, the corps, which once straightened the

Kissimmee River, is helping it snake back to its natural course. Engineers have begun filling in the trench that their predecessors had dug to speed the water flow. Locks on the two ends of the river, where it meets the Kissimmee Reservoir and Lake Okeechobee, will let the intervening stretch slowly get its kinks back, says Tom Adams, senior policy advisor for the National Audubon Society in Washington, D.C.

The old stereotype about the U.S. Army Corps of Engineers, Adams says, is that they "dig, ditch, drain, and dam, and to hell with everything else." Under their current environmental protection and restoration mission, says Adams, "clearly, that doesn't apply."

The Everglades is a fussy system. It needs very clean water. Excess phosphorus from agricultural runoff, primarily from sugarcane fields, throws the natural plant systems out of balance. The Everglades carpet a limestone bedrock, which historically has bound up most phosphorus and kept it out of the ecosystem. Native plants and animals that evolved in this low-phosphorus condition have been poisoned by runoff or crowded out by phosphorus-friendly species.

Cattails, for example, flourish in phos-

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phorus-rich waters, and the land downstream of agricultural areas has turned into a "monoculture of cattails," says Aumen.

Faced with state and federal lawsuits, the sugarcane industry has drastically reduced the amount of phosphorus flowing into the Everglades during the past few years, says Aumen. Sugarcane growers now use less fertilizer and have altered their crop-rotation schedules and irrigation ditches.

The most dramatic change in phosphorus runoff, however, came when growers changed their procedures for draining cane fields. Rather than beginning to pump water off their fields as soon as it starts to rain, they now wait until 1 inch of rain has fallen, says Aumen.

The reduced pumping hasn't hurt sugarcane productivity, and it allows more of the phosphorus to settle into the soils rather than flow across the state.

The state restoration fund has invested \$800 million over 6 years to buy land and develop marshes that filter agricultural runoff before it reaches the Everglades. One 3,500-acre prototype of a filtering marsh began operating 4 years ago. SFWMD plans to open three more artificial marshes this summer and is designing two more.

"This [complex of marshes] is the largest constructed wetlands in the world," says Aumen. The prototype marsh filters out about 70 to 80 percent of the phosphorus in the water—not enough, says Aumen, but a good start.

The water-management district is evaluating technologies to clean out even more phosphorus before the water flows into the Everglades. Options range from highly engineered plans, such as building chemical treatment plants among the wetlands, to relatively natural strategies, such as submerging mats of algae and vegetation in constructed marshes to trap phosphorus.



Water rushes through flood-control gates of a canal during the rainy season.

The corps' ambitious plan recognizes three basic objectives: to improve the quality of water, to increase the amount of water available for natural systems, and to "reconnect the parts" of the Everglades.

In South Florida's patchwork of pools, levees, dams, and canals, water moves through pipes and gates, rather than flowing freely over the land. One side of Tamiami Trail, the road that cuts through the Everglades from Naples to Miami, can be knee-deep in backed-up swamp water while the other side is dry enough to burn.

The barriers also confine animal populations. "Alligators don't cross Tamiami Trail," says hydrologist Tom Van Lent of the Everglades National Park in Homestead, Fla. The northern gators don't mingle in the southern gators' gene pool,

a situation that eventually could lead to genetically isolated populations. Researchers may already be seeing genetic drift in mosquito fish on different sides of levees, says Van Lent.

Pimm worries that the proposed restoration of the Everglades doesn't go far enough. It will create "a series of very small, managed pools instead of letting this wonderful river of grass flow along natural flow patterns."

The proposed plan calls for ripping up some barriers and filling in some canals, but it's not yet clear whether there will be a net reduction in the number of structures controlling water flow through the Everglades. Tamiami Trail may be raised to allow water to flow underneath, but no one can say yet when it will happen or how much of its expanse will be lifted.

Reconnecting the compartmentalized Everglades is "like putting Humpty Dumpty back together again," says Adams.

Development hasn't shattered the west coast of Florida into as many pieces as the east coast, says David E. Guggenheim, president of the Conservancy of Southwest Florida in Naples. "Right now, we're trying to avoid [this] unwanted destiny—canals, berms, and expensive restoration efforts. Over here, we still have natural flow-ways."

In one of the conservancy's most ambitious efforts, it's tracking down the owners of Golden Gate Estates. These seemingly worthless parcels of land were sold in the 1950s and 1960s, largely sight unseen, to folks who hadn't yet gotten the joke "I've got a piece of swampland in Florida I'd like to sell ya."

The conservancy has begun to buy back and protect these 53,000 acres of prime habitat for black bears and endangered Florida panthers.

Politically, the Everglades has won over many friends during the past century. In Florida's last election cycle, all the candidates for state and federal offices supported Everglades restoration. Several counties, including most recently Palm Beach County, have passed bond initiatives to buy land for water storage and buffering the Everglades from urban areas.

The corps' replumbing plan already has widespread support in Congress, says Rep. Dan Miller (R-Fla.). "This should not be a partisan issue," he says.

The full \$8 billion plan may be a hard sell, however. "There's going to be some sticker shock on this, no doubt," says Adams, "but nobody is saying we shouldn't be doing this."

Even Broward County, named for Florida's swamp-phobic governor and famous for the boundless development in suburban Miami, has begun to limit its sprawl, says Adams.

Bumper stickers protesting overdevelopment say, "Stop the Browardization"—a slogan that also applies to the effort to reverse a century's worth of Everglades decline. □

An invasive species lurks at the gate

Subtropical southern Florida, with its moist, warm, teeming ecosystems, is a natural target for plagues of nonnative species, says Nick Aumen of the South Florida Water Management District in West Palm Beach. The Asian swamp eel, which may have been released from hobbyists' aquariums, is poised to become the Everglades' fiercest invader.

The eel breathes air, grows up to 3 feet long, slithers across land, and voraciously eats fish, frogs, and crayfish. It now swarms in Miami canals, just one flood-control gate away from entering the Everglades. That gate is scheduled to open in June, when the rainy season starts.

No one knows how to stop the eel, but Florida officials may try to block it with a barricade of electricity coursing in front

of the gates. Wildlife managers in the Pacific Northwest have prevented nonnative lamprey eels from migrating into the Columbia River basin by using electric barriers. —L.H.



The hearty, 3-foot-long Asian swamp eel could devour many of the Everglades' native species.