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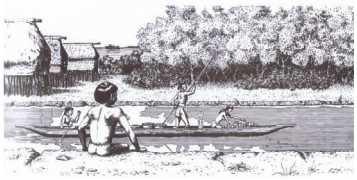
Effects of Canals and Levees on Everglades Ecosystems

Introduction

Canals and levees are the foundation of south Florida's water-management system. However, degradation of Everglades ecosystems has resulted directly from these structures and their effects of drainage and impoundment. The purpose of this fact sheet is to summarize the science on ecological and hydrological impacts of Everglades canals and levees.



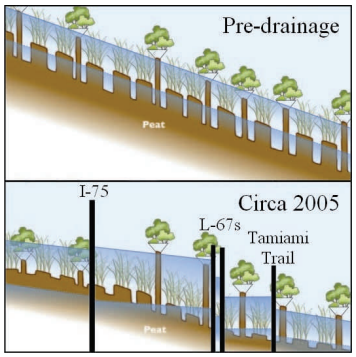
Calusa canal, ca. 1500 (M. Clark)

Present-day canals (SFWMD)

Although native peoples in south Florida built small, shallow canals to connect villages to coastal trade routes, the modern canal system covers hundreds of linear miles with wider and deeper cuts. Canals and levees were created to drain and reclaim the wetlands for urban and agricultural use, to store and provide water to developed areas, and to provide flood control. They have met those objectives but, in the process, have transformed the landscape and ecology of south Florida.

How do canals and levees affect Everglades hydrology?

Canals draw water from the surrounding wetlands. In combination with reduced water deliveries, this results in completely dry land during the dry season, diminished aquatic habitat during the wet season, soil loss and flattening of the peat surface. Canals also alter surface water chemistry by directly exposing surface water to the bedrock.

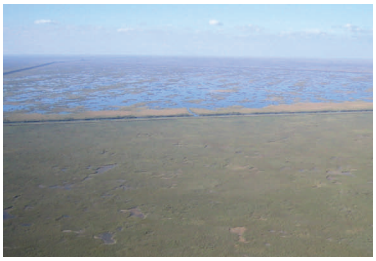


Hydrological impacts of canals and levees (C. McVoy, SFWMD)

Levee construction replaced relatively even water depths and flows with a "stair-step" of impoundments, simultaneously making upstream portions too dry and downstream ones too wet, leading to widespread vegetation and soil changes.

How do canals and levees affect Everglades landscape and habitats?

Wetland Fragmentation

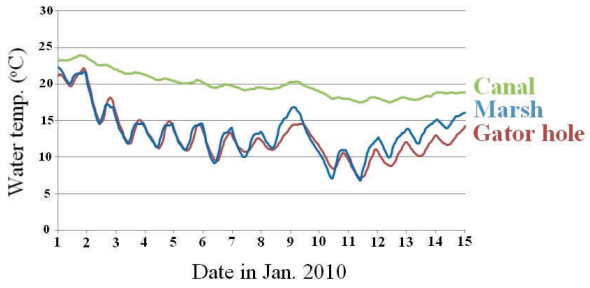


Degraded ridge and slough landscape in "the Pocket" between L-67A and L-67C (front), compared to intact ridge and slough in WCA 3A (back) (C. McVoy, SFWMD)

Hydrological barriers have led to loss of sheet flow and degradation of the distinct directional pattern of ridge and slough vegetation. The mosaic landscape has been replaced in many areas by large uniform stands of sawgrass, which offer fewer foraging areas and refuges for wildlife. Canals, levees, and roads also function as barriers to gene flow of aquatic fauna and to movement of fire across the landscape.

Nonnative Species

Canals facilitate establishment of nonnative fishes by offering permanent thermal and drought refuges. During the record cold event of January 2010, canal water temperatures remained above the lethal limits of nonnative fishes, which range from 6 to 15 °C (43–59 °F) (below). Canals also serve as pathways for nonnative species to invade interior wetlands, increasing the potential for impacts that may alter ecosystem structure and function.



Water temperatures at three hydrostations in Everglades National Park during record cold spell (J. Kline, NPS)

Canals provide deep-water, nutrient-enriched habitats for expansion of nonnative pest plants such as water lettuce, hydrilla, and water hyacinth. These plants can modify water chemistry, deplete oxygen levels, shade out native species, decrease water flow, and interfere with navigation and flood control. Levees also provide disturbed upland habitat for noxious terrestrial pest plants, and corridors into the wetlands for insects such as fire ants.

Common nonnative fish in south Florida canals (D. Gandy, FIU)

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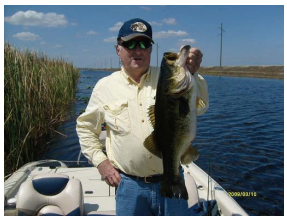
Refuges and Sinks

Canals provide habitat for dense populations of alligators, but these populations are dominated by adults. Nesting success in canals is negligible. Alligators that rely on canals may no longer construct and maintain alligator holes, which provide critical dry-season habitat for wetland fishes, amphibians, and wading birds.

Alligators in canals and in alligator hole (B. Jeffery and W. Guzman, UF)



Bass fishing in Everglades canals (South Florida Fishing Adventures)

The sport fishery in Everglades canals is "subsidized" by prey from the wetlands that are forced into canals in the dry season. Canals may act as sinks for forage species, which suffer heavy losses from native and nonnative predatory fishes. Without canals, prey fishes would remain on the marsh, available to wading birds. The effect of the loss of this forage base to wading birds requires study.

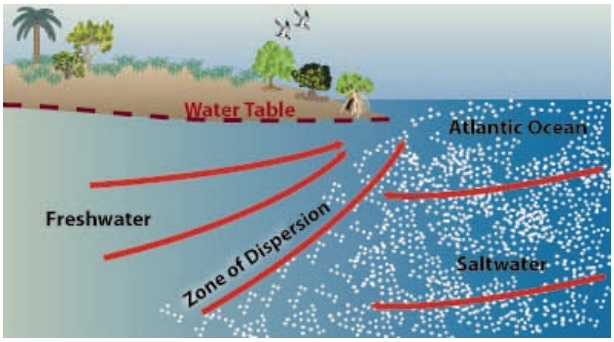
How do canals and levees affect Everglades water quality?

Phosphorus delivery into wetlands via canals has led to replacement of periphyton/*Utricularia* mats with filamentous algal species that thrive in enriched waters, and the shift from a sawgrass-dominated vegetation community to one dominated by cattails. The most pronounced expansion of cattails is in WCA-2A, which receives water directly from the Everglades Agricultural Area. Cattails limit light penetration, decrease oxygen availability, and alter invertebrate and fish communities. Canals also transport chemical pesticides (e.g., endosulfan, atrazine) and sulfur (a mediator in methylation of mercury) into the Everglades.

Cattails in Arthur R. Marshall Loxahatchee National Wildlife Refuge (H. Henkel, USGS)

Water management structure releasing water (SFWMD)

Diversion of fresh water from wetlands into canals has led to saltwater intrusion in coastal well fields and hypersalinity in biologically vital estuaries. Fresh water is no longer delivered by gradual sheet flow but via canals in sudden, unnaturally timed pulses which flood wildlife habitat, disperse fish concentrations, and dramatically alter salinities, resulting in mortality of estuarine species.



Saltwater intrusion into coastal aquifers (P. Fletcher, adapted from USGS)

Conclusion

Decompartmentalization, a planned project at the heart of Everglades restoration, involves removing or modifying canals, levees, and other barriers to sheet flow. It will reconnect fragmented wetlands, decrease rapid canal routing of water, and reduce artificial habitats that support introduced species. We urge managers and engineers to work closely with ecologists and hydrologists, to consider potential impacts across multiple ecological scales, to consider alternatives to meeting recreational needs without compromising restoration goals, and to devise new ways to deliver water in an environmentally sustainable manner.

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Footnote

1. This document is WEC309, one of a series of the Department of Wildlife Ecology and Conservation, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. First published: February 2011. Please visit the EDIS Web site at http://edis.ifas.ufl.edu.

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