U.S. Geological Survey Fact Sheet

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Biogeochemical study of the Pinelands in Everglades National Park, Florida

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The subtropical Everglades, noted as the largest sawgrass marsh in the world, is actually a complex, intertwined mixture of ecosystems that are well represented, but not wholly contained or protected within the boundaries of Everglades National Park. The principal upland ecosystem within Everglades National Park is the pinelands on Long Pine Key. The pinelands occupy slightly elevated ground along the Atlantic coastal ridge. The ridge, which extends from north of Miami southward into Everglades National Park, is transected by remnant tidal channels, known as transverse glades, that effectively create islands or keys of pine forests. The slash pine forest with interspersed hardwood hammocks and a dense understory of shrubs is rooted in the extremely rough, solution-carved limestone on which only a thin, discontinuous veneer of poorly developed soil.

Although pinelands once occupied more than 5,000 km^2 in southern Florida, their distribution has been severely reduced as a result of development. Prior to Hurricane Andrew in 1992, the total extent of pines in Everglades National Park was about 80 km^2. With more than 200 plant species in the pinelands and associated prairies and hammocks, this ecosystem contains the most diverse of flora of any ecosystem in the Everglades. Long Pine Key is "...the principal remnant of a vegetation complex unique in the United States and the only area in which a number of tropical and endemic taxa are likely to survive" (National Park Service). Thus, the pinelands are a critical component of Everglades National Park if the park is to maintain its biological diversity and natural state.

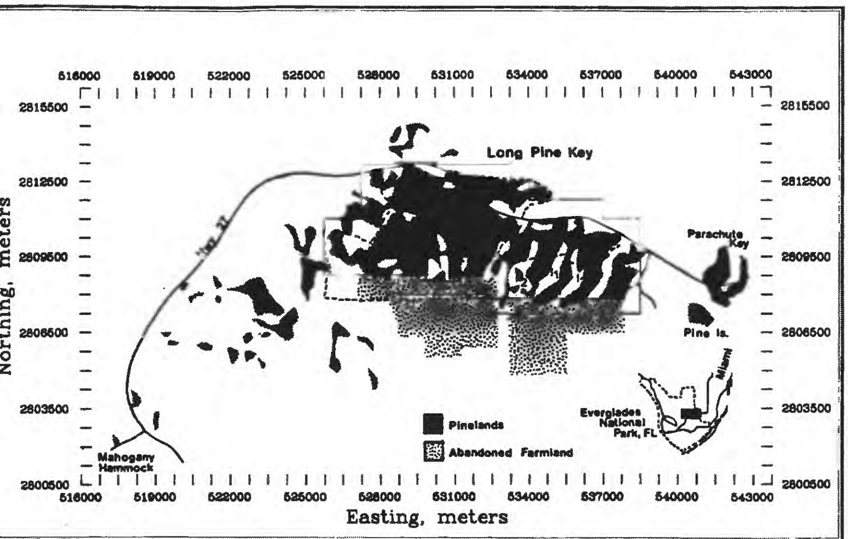
The U.S. Geological Survey and the National Park Service cooperated in a joint study of the Everglades pinelands to determine element concentration baselines in South Florida slash pine (*Pinus elliottii* Engelm. var. *densa*) and the associated soils and to examine element concentrations and spatial trends for human influences on the biogeochemistry of this ecosystem. Samples of pine needles and soils from 76 locations throughout the Everglades pinelands were chemically analyzed

"Everglades deterioration at 'now-or-never stage'"

"Everglades in 11th hour, beyond saving?"

Babbitt: "Saving Glades Crucial"

These are but a few of the recent headlines that focus on the deterioration of the Everglades. Because natural water flow patterns have been drastically changed, agricultural runoff is leading to eutrophication of the wetlands, wildlife populations have been decimated, exotic plant species are taking over at a prodigious rate, and many South Florida fish are not fit for human consumption because of high levels of mercury, concern for the fate of the Everglades is at an all-time high. Numerous Federal, State, and private agencies are now working together to stop the destruction of the unique Everglades ecosystem and restore it to its natural state.



Location map for the major stands of pines within Everglades National Park

for a variety of elements. A representative subset of the samples was analyzed specifically for arsenic, mercury, and stable sulfur isotope ratios—all possible indicators of human-caused pollution of the pinelands.

Although contour maps of element concentrations generally indicate that element concentrations in the pines and soils are fairly uniform throughout Long Pine Key, there are some subtle manifestations of edge or ecotonal effects. For example, the somewhat higher phosphorus content in pine needles and soils along the northern edge of the key may be a result of agricultural and urban runoff. Most elements in the pines and rockland soils do not appear to be greatly enriched, but data for comparison are very limited. In the pines, copper, lead, and zinc concentrations were lower than in a very limited sampling made in a previous study of nearby, more urban Dade County locations. In the soils, chromium, nickel, and lead may be enriched and sulfur and zinc depleted compared to soils of the Eastern United States in general. Some elements, such as arsenic in soils and mercury in pines and soils, exhibited high concentration levels that indicate potential enrichment from human activity.

These evaluations were based, however, on comparisons with data from other areas and are hampered by the lack of prior background or baseline chemical data from Everglades National Park. Because information to estimate a true background element concentration range (before any human impact) is lacking, an alternative is to determine a contemporary baseline range. In our studies, the baseline range usually is defined as the 95 percent expected concentration range (using a geometric or arithmetic mean concentration and its standard deviation) for an element in a specific plant species, plant part, or soil horizon at a specific time. These baseline ranges can be used for comparisons with other sites or with future changes. Differences between regions and even between microhabitats may, however, significantly affect the elemental content of plants or soils. Also, seasonal cycling or other episodic changes in element content may produce a significantly different baseline range. Thus, when using ranges measured for one specific time it is important to understand the processes controlling element mobility in an environment .

In addition to establishing element baseline ranges, these studies have helped us to understand the impact from point and non-point pollution sources and to define future research needs for effective biomonitoring programs in order to provide information critical to understanding pollution and the processes controlling element translocation within the Everglades ecosystems.

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