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Palmetto

Everglades Tree Islands • *Schizaea pennula* • Pricing the Priceless

Everglades Tree-Islands

Vegetation Patches, Geologic Landforms, and Landscape Features

by Peter A. Stone, Columbia SC

Figure 1

Tree-islands are visually distinct patches of forest or tall bushes surrounded by low-stature, usually non-woody vegetation. The surrounding grass, sedge, or herbaceous community typically forms the dominant vegetation of the area, but tree-islands stand out visually, even if small, and add beauty as well as ecological diversity to the open vegetation they adorn. These patches host woody plants and their associated plant and animal species within an otherwise nonforested vegetation. When they occur on mounds in wetlands they provide a locality with mesic habitat and additionally act as high-water refugia for animals. On patches of soil such as limestone outcrops, they often have plants suspected of this edaphic preference. Finally, tree-islands add an aesthetic diversity, perhaps best demonstrated by their frequency in landscape photos and paintings.

Tree-islands occur worldwide in nonforested environments. In Florida, with its abundance of marshes and wet and semi-dry prairies, there are vast numbers and many types of tree-islands. While all these deserve eventual systematic description, Everglades tree-islands (*hammocks*) are perhaps the widest known, and will serve as a good introduction to the larger phenomenon.

Tree-islands in the Everglades

The Everglades proper are more diverse than is commonly considered but do not include all the wetlands in South Florida. The northern and middle Everglades and the Shark Slough portion of the southern Everglades in Everglades National Park are all part of one vast peatland, with an organic soil slowly accreting from marsh plants. Upper flanks of Shark Slough, to the west and east, are marshes underlain instead by marl (freshwater carbonate mud) and rock, and marl also floors the extensions of the Everglades marshes along the extreme southeastern coast.

Several distinct types of tree-islands typify each of these areas, except in the former dense sawgrass marshes of the northern Everglades (now converted to agriculture), which apparently almost entirely lacked tree-islands. In the peatland, most Everglades tree-islands occur in areas that have abundant waterlily marsh combined with sawgrass marsh in a patchy environment, while wet-prairie (sparsely stocked marsh often of relatively thin-leaved species) characterizes the marl prairies and rocky marshes.

Hammocks, heads, and groves

The term tree-island is sometimes extended to patches of distinctly different forest within a prevailing type, notably hammock within pinewoods or mangrove forest. *Hammock* here strictly refers to broadleaf evergreen forest with some tropical affinity, but the term is also widely used for tree-islands in marshes, especially in the Everglades, whether composed of hammock vegetation or

Figure 1: A landscape co-dominated by bayhead tree-islands and waterlily-rich (*Nymphaea*) marshes in the interior of the Arthur R. Marshall Loxahatchee National Wildlife Refuge. These small peat-mound tree-islands probably originated and grew from still smaller floating peat islands. Near the center of the photo, the conspicuously dense patch of waterlilies with the small open-water spot is the site of origin of a floating peat island, this being where it arose from the waterlily marsh bottom. The island itself was still afloat at the time of this photo (ca. 1975) and was covered with bushes and sawgrass, but had moved slightly and lay adjacent to the upper-left. All the established larger tree-islands are fully aground.

not. Thus *hammock* is used somewhat differently in vegetational vs. landscape senses. Because many tree-islands in Florida are on sediment mounds in wetlands, the term tree-island is often extended to the landform as well, being true islands at most water levels. *Head* (when broadleaf trees or cypress) and *grove* (for cabbage palms) are other common terms for tree-islands used in peninsular Florida, and *house* is used for those found in marshes (locally called *prairies*) of the nearby Okefenokee Swamp, Georgia.

Why do tree-islands occur?

Tree-islands intrigue the ecologist in several ways, notably as isolated ecological patches, but an interrelated dual question always exists: why do tree-islands occur at all, and why at their specific sites? These questions in turn raise a more fundamental one: why are the surroundings treeless? Answers may relate to topography, geology, geomorphology, hydrology, soils, fire, archeology, or combinations of these. In addition, the long-term slow areal growth and the distinct elongation of many large tree-islands (elongated parallel to water flow in the surrounding marsh) are fascinating topics fully as important as the controls on tree-island location and origin. Some understanding of these matters is now forthcoming but much remains to be learned.

Flooding and fire are considered principal ecological factors in preventing woody growth in Florida's non-salty marshes and prairies. These limiting factors must somehow be ameliorated at the immediate sites of tree-islands, except in the special case where such forest patches are new – for example a patch of pestiferous Melaleuca in the Everglades surrounding a "mother tree" that arrived at that spot by mere chance. Usually in wetlands such as the Everglades the forested sites are slightly mounded and thus have a less-severe flooding regime than surrounding marshes. The age and origin of this sediment mound is of high interest in understanding tree-island origin and succession (i.e., their history or evolution). Some tree-islands in the southern Everglades, such as cypress domes and willow heads are found instead in shallow depressions in the sediment surface. These are of even more intriguing origin, particularly if they do not occupy solution holes.

Origins and evolution

Fortunately, many wetland tree-islands and their marsh surroundings lie on geologically very young sediments such as peats. These give geologists (like myself), archeologists, and botanists various methods for determining important aspects of how and

Figure 2: Another view of the interior of the A. R. Marshall Loxahatchee NWR showing both the numerous small peat-mound tree-islands (with *Persea palustris* abundant) and one of the large elongated, lower and wetter, "ridge" type tree-islands (*Ilex cassine* dominated). Both of these represent bayhead vegetation.

Figure 3: A small peat-mound tree-island in the NWR, where thousands exist. The sawgrass fringe is typical.

Figure 4: A large, elongated (parallel to natural flow), low peat-ridge tree-island in the NWR, where roughly a hundred exist. Trees here grow mainly on small, closely spaced, root-peat tussocks or mounds, and the general tree-island floor floods at seasonal high water. Waterlily-rich marshes and small peat-mound tree-islands surround it.

Continued on next page

Everglades Tree-Islands

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Figure 5

when these true islands and their supported forest patches came to be, when and how they originated, and how they later evolved or succeeded both as sediment landforms and as forest.

Curiously, many tree-islands originated long after their surroundings had already become open marsh. Everglades peatland marshes are about 5,000 radiocarbon years old (although marl marshes preceded them by up to a few thousand years, and rocky marshes for a while before that). Fully-established tree-islands in the vast assemblage on the deep peats of the northeastern Everglades (A. R. Marshall Loxahatchee National Wildlife Refuge) are as young as ~750 years old, and possibly younger, while others that are smaller and bushier appear still to be initiating (Stone, et al., 2002).

Some Everglades tree-islands farther south that are focused on bedrock mounds may have supported woody growth even before their surroundings first flooded and became marsh. Dating of basal archeological material at a tree-island where thick sediment forms the mound in the mid-latitude Everglades (Broward Co.) shows that ~5000 years of repeated human occupation occurred there (Masson, et al., 1988). Thus, it is possible that little flooding took place during virtually the entire peatland era, and a forested condition occurred at the site throughout.

Human occupation

A long history of human occupation is the rule not the exception for tree-islands, apart from the young peat mounds in the Loxahatchee Refuge area. The most elevated portions of present day tree-islands may be the remains of very old, smaller tree-islands. The obvious association between humans and tree-islands is that these offer the only favorable camping or village sites in the Everglades. The prolonged (though possibly just seasonal or occasional) occupation probably has had important effects on the physical and soil-nutrient characteristics of the island sites and their vegetation. Tree-islands seem to be net-recipients of nutrients brought in from elsewhere, ranging from the abundant guano of roosting wading birds to food debris left behind by human hunter-gatherers.

Composition and development

Many tree-islands in Everglades National Park and the middle-latitude Everglades (especially Conservation Area 3) seem to lie at their upstream ends above slight mounds of hard rock or rock-like mineral sediment, now accentuated by a superimposed mound of younger peaty soil often rich in food-bone debris. At least one reportedly is on a low peat mound that somehow accreted above a shallow depression in the bedrock, in a little understood landform succession. The most astounding topographic situation is a large tree-island focused on 80-foot deep Gator Lake, an extensive limestone sinkhole near the very center of the original Everglades – but here the lake remains open and the tree-island surrounds it.

Most Everglades tree-islands are composed of bayhead vegetation – broadleaf evergreen trees of temperate affiliation (e.g., dahoon holly, *Ilex cassine*). Certain common trees are of tropical affiliation, but of types that extend much father north than southern Florida (e.g., redbay, *Persea palustris*).

Hammock vegetation is common on the higher, rarely-flooded mounds located above the limestone bedrock or mineral sediment rises. The archetypical Everglades tree-island of the middle and southern Everglades has (1) a higher *head*, supporting hammock, which lies above a buried mound of limestone bedrock or other mineral-rich, often hard, carbonate sediment, and (2) a much larger and elongated *tail* on a low broad ridge of peat supporting bayhead, which extends far downstream in the direction of the slow seaward flow of marsh water. Exactly how these peat-ridge tree-islands formed with such elongation is subject to wide and active conjecture and research. Similarly elongated and oriented tree-islands exist in certain large northern peatlands. Some association with flow is obvious.

Equally fascinating in terms of tree-island development is the origin of the many mounds beneath the *heads* of the large, elongated, two-tier tree-islands. (Some researchers have it as a three-part forest: hammock, bayhead, and bayhead swamp, proceeding from *head* through *tail*.) While a low mound in the buried mineral substrate is thought to be the focus, much of the mound height itself is of loose granular organic "peaty" sediment, up to several feet thick, and this is often rich in archeological debris. Almost unbelievably, in many tree-islands in the southeastern Everglades what appears to be the mounded top of the light-colored, ancient marine limestone bedrock is actually a young but hard

Figure 5: The distinctive profile of an upstream *head* on an archetypical tree-island of the middle and southern Everglades. This example is in Shark Slough, Everglades National Park. The view is from the marsh directly upstream. The patch of taller trees in the center is the *head* of hammock vegetation growing on the more-elevated upstream mound. The surrounding lower trees and bushes extend for a long distance downflow (out of sight here) and form a *tail*. This vegetation is wetter bayhead forest on a low peat ridge (just slightly higher than the adjacent sawgrass) and contains root-peat tussocks.

freshwater carbonate or carbonate-cemented layer. This layer somehow relates to human occupation and/or climate change only a few thousand years ago (this fascinating topic is under active investigation: Graf, et al., 2008).

Some small tree-islands without notable mounds exist in the Everglades. Willow heads (some surrounding gator holes), along with wax myrtle, elderberry, buttonbush, and coco plum clumps are common in the marshes. These may be young and are possibly of short duration. Various other isolated minor tree-island types occur, including small patches of pine on tiny rocky plateaus in the southern Everglades.

Unlike the archetypical example with a head of hammock vegetation, thousands of Everglades tree-islands, both large and small, are solely composed of bayhead vegetation. These include the vast assemblage in the less-widely known northeastern Everglades, but some are found elsewhere too, including Shark Slough. Despite being floristically and topographically the least diverse, these tree-islands are among the most interesting ecologically in terms of origin. They occur as low mounds or ridges atop thick marsh peat – the tree-islands formed only long after the local Everglades marshes originated and they developed solely by peatland evolution (local sedimentation) and vegetational succession. They are biogeomorphic features, not focused on relict geological or archeological features. How they formed is not yet known precisely, but the numerous, small, more-rounded type appears to have begun upon incipient low peat mounds produced by floating islands of detached peat. The large elongated type (~100) probably succeeded upon isolated large sawgrass ridges in waterlily-dominated marshes.

Similar modification of local topography by vegetation and peat accretion must explain the few similar tree-islands in the southern Everglades, including those that reportedly are found on low peat mounds above a depression in the mineral substrate, whether bedrock or marl. For instance, a cypress dome in a slight depression might succeed to bayhead by local accretion of peat or muck, as some now seem to be doing in Everglades National Park.

Everglades tree-islands have important ecological functions and unfortunately have been destroyed in large numbers by recent water-management alterations (from drying and the burning away of the peat mound to prolonged flooding and drowning of the forest). They are, belatedly, beginning to receive some of the research attention they deserve (e.g., Sklar and van der Valk, 2002).

Other Florida tree-islands

We need to know more about other tree-island types found elsewhere in Florida, beginning with their areas of notable occurrence. They include:

- Cabbage-palm hammocks on Indian Prairie northwest of Lake Okeechobee, in the rocky salty marshes of the upper Gulf coast, and in the large freshwater marshlands of the upper St. Johns River. These are well recognized if little studied. Many are on low mounds and many have significant archeological accretion.
- In South Florida (outside the Everglades), various marshes and prairies have many types of tree-islands, with cypress domes being the most numerous, but bayheads, palm hammocks, and pine islands occurring as well.
- Farther north in peninsular Florida, Roland Harper, John Small, and earlier botanists and naturalists noted patches and clumps of woody vegetation in a number of otherwise unforested communities, but mainly in passing, without any details.

What do we know of such features now, nearly a century later? In trying to assess this we must be careful not to be fooled. Some prairies, even natural looking ones, may have been pine flatwoods, logged long ago and then repeatedly burned. Tree-islands there may be essentially artificial relicts. There is no doubt though about many tree-islands in the salt marshes. Some are clearly old shoreline dunes protruding through the younger marsh mud, others are of different origin. Tree-islands similar to those of the Everglades have been mentioned for freshwater marshes in Jamaica (Negril) and Cuba (Cienega de Zapata and Isle of Pines) and shown in photos in marshes in the Bahamas (Andros), to mention just some nearby foreign lands. If one has an eye for them, tree-islands are seen in many marshes and prairies. Take a look!

I would appreciate notice of occurrences or unusual tree-island types that I have not mentioned and references to any type. Sources of information generalized here will be gladly provided to anyone interested. E-mail: stonepa@dhec.sc.gov

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About the Author

Peter Stone grew up in Ft. Lauderdale, Florida. He wrote a geomorphology thesis (Florida Atlantic University) on floating peat islands in the Everglades, and early in his career worked several years assisting in Everglades peatland environmental-geology research, emphasizing tree-islands, and a year in vegetational land-cover mapping throughout South Florida. His later work in the Everglades is avocational, mostly done in cooperation with Florida International University researchers. He is a groundwater geologist/hydrologist by career occupation.

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