Matheson Hammock (Miami-Dade County) Photo by Gary Knight

Rockland Hammock

Description: Rockland hammock is a rich tropical hardwood forest on upland sites in areas where limestone is very near the surface and often exposed. Greater than 120 native tree and shrub species make up the diverse closed canopy and shrub layers, most of which reach the northern extent of their ranges in Florida (Snyder et al. 1990; Gann et al. 2009). The forest floor is largely covered by leaf litter with varying amounts of exposed limestone and has few herbaceous species. Rockland hammocks typically have larger more mature trees in the interior, while the margins can be almost impenetrable in places with dense growth of smaller shrubs, trees, and vines (Phillips 1940; Whitney et al. 2004). There are differences in species composition between rockland hammocks found in the Florida Keys and the mainland (see Community Variations below). Typical canopy and subcanopy species include, gumbo limbo (*Bursera simaruba*), false tamarind (*Lysiloma latisiliquum*), pigeon plum (*Coccoloba diversifolia*), false mastic (*Sideroxylon foetidissimum*), strangler fig (*Ficus aurea*), Jamaican dogwood (*Piscidia piscipula*), lancewood (*Ocotea coriacea*), milkbark (*Drypetes diversifolia*), paradisetree (*Simarouba glauca*), willow bustic (*Sideroxylon salicifolium*), black ironwood (*Krugiodendron ferreum*), inkwood (*Exothea paniculata*), live oak (*Quercus virginiana*), poisonwood (*Metopium toxiferum*), and West Indies mahogany (*Swietenia mahagoni*). Mature hammocks can be open beneath a tall well-defined canopy and subcanopy. More commonly, in less mature or disturbed hammocks, dense woody vegetation of varying heights from canopy to short shrubs is often present. Species that generally make up the shrub layers within rockland hammock include several species of stoppers (*Eugenia* spp.), thatch palms (*Thrinax morrisii* and *T. radiata*), sea torchwood (*Amyris elemifera*),

marlberry (*Ardisia escallonioides*), wild coffee (*Psychotria nervosa*), satinleaf (*Chrysophyllum oliviforme*), cabbage palm (*Sabal palmetto*), lignum-vitae (*Guaiacum sanctum*), hog plum (*Ximenia americana*), soldierwood (*Colubrina elliptica*), two species of blackbead (*Pithecellobium unguis-cati* and *Pithecellobium keyense*), seagrape (*Coccoloba uvifera*), and greenheart (*Colubrina arborescens*). Vines can be common and include eastern poison ivy (*Toxicodendron radicans*), earleaf greenbrier (*Smilax auriculata*), Everglades greenbrier (*Smilax havanensis*), Virginia creeper (*Parthenocissus quinquefolia*), medicine vine (*Hippocratea volubilis*), and redgal (*Morinda royoc*). The typically sparse short shrub layer may include coontie (*Zamia pumila*), and dildoe cactus (*Acanthocereus tetragonus*). Herbaceous species are occasionally present and generally sparse in coverage. Characteristic species include smallcane (*Lasiacis divaricata*), woodsgrass (*Oplismenus hirtellus*) and many species of ferns (i.e., *Nephrolepis biserrata*, and *Thelypteris kunthii*) among others. Epiphytes, including orchids, ferns, and bromeliads, are often common on larger trees.

Rockland hammock occurs on a thin layer of highly organic soil covering limestone on high ground that does not regularly flood (Olmsted et al. 1980), but it is often dependent upon a high water table to maintain reservoirs in solution features of the limestone and to keep humidity levels high. Organic acids can dissolve the surface limestone causing collapsed depressions in the surface rock called solution holes (Outcalt 1997). Rockland hammocks are frequently located near wetlands; in the Everglades they can occur on raised peaty platforms above surrounding wetlands; in the Keys they occur inland from tidal flats. They also can occur within a larger matrix of pine rockland, but are now most commonly found as islands surrounded by development or agriculture.

Characteristic Set of Species: gumbo limbo, pigeon plum, stoppers

Rare Species: Rare species are abundant within rockland hammock. Although some widespread rare species occur in rockland hammock as well as many other habitats (e.g. eastern indigo snake [*Drymarchon couperi*]), many rare species of plants and animals, are more specific to this habitat. Most rare plants typical of rockland hammock are tropical plant species more widespread outside the U.S. and have extremely limited distributions within the U.S (Table 1). Characteristic rare animals include Key Largo woodrat (*Neotoma floridana smalli*), Key Largo cotton mouse (*Peromyscus gossypinus* pop. 1), key deer (*Odocoileus virginianus clavium*), white-crowned pigeon (*Patagioenas leucocephala*), mangrove cuckoo (*Coccyzus minor*), black-whiskered vireo (*Vireo altiloquus*), red rat snake, Florida Lower Keys population (*Elaphe guttata* pop. 1), rim rock crowned snake (*Tantilla oolitica*) and Lower Keys ribbon snake (*Thamnophis sauritus* pop. 1). Schaus' swallowtail (*Papilio aristodemus ponceanus*), tree snail (*Liguus fasciatus*), Florida Keys tree snail (*Orthalicus reses nesodryas*), Keys scaly cricket (*Cycloptilum irregularis*) and several species of long-horned beetle such as Strohecker's ivory-spotted long-horned beetle (*Eburia stroheckeri*) are among the many rare invertebrates that inhabit rockland hammock.

Range: Rockland hammocks are globally imperiled and extremely limited in distribution. In Florida, rockland hammock occurs in three general areas: along the southern extreme of the Atlantic Coastal Ridge, also known as the Miami Rockridge, which extends from around downtown Miami southwest to Mahogany Hammock in

Everglades National Park (Miami-Dade County); throughout the Florida Keys (Monroe County); and to a very limited extent in the Big Cypress Region (Monroe and Collier Counties). Similar dry tropical forests occur in the Bahamas and West Indies (Phillips 1940; Beard 1944; Correll and Correll 1982), and the Yucatan peninsula (Loope et al. 1994). The tremendous development and agricultural pressures in the rapidly urbanizing areas where rockland hammock occurs have greatly reduced the extent of this community. Additionally, remnant pine rockland fragments that occur within developed areas under some conditions can succeed to rockland hammock without fire management.

Natural Processes: Rockland hammock is a rare community that is susceptible to fire, frost, canopy disruption, and ground water reduction. The dense canopy minimizes temperature fluctuations by reducing soil warming during the day and heat loss at night, which helps prevent frost damage to the interior of the hammock (Outcalt 1997). Mesic conditions are further maintained by the hammock's rounded profile, which deflects winds, thus limiting desiccation during dry periods and reducing interior storm damage. Rockland hammock can be the advanced successional stage of pine rockland, especially in cases where rockland hammock is adjacent to pine rockland where hardwood seed rain is high. In such cases, when fire is excluded from pine rockland for 15-25 years it can succeed to rockland hammock vegetation (Wade et al. 1980) that can retain a relict overstory of pine (Snyder et al. 1990). Historically rockland hammocks in South Florida evolved with fire in the landscape, fire most often extinguishing near the edges when it encounters the hammock's moist microclimate and litter layer, or a natural moat that can form around hammocks in the Everglades caused by the dissolution of limestone (Whitney et al. 2004). However, rockland hammocks are susceptible to damage from fire during extreme drought or when the water table is lowered. In these cases fire can cause tree mortality and consume the organic soil layer (Olmsted et al. 1980). Although rockland hammock can reestablish within 25 years after fire, maximum development of structure and diversity probably requires more than 100 fire-free years. The ecotone between rockland hammock and pine rockland is abrupt when regular fire is present in the adjacent pine rockland. However when fire is removed, the ecotone becomes more gradual as hardwoods from the hammock push out into the pineland (Wade et al. 1980).

Rockland hammocks are also sensitive to the strong winds and storm surge associated with infrequent hurricanes. Canopy damage often occurs, which causes a change in the microclimate of the hammock. Decreased relative humidity and drier soils can leave rockland hammocks more susceptible to fire (Loope et al. 1994).

Community Variations: The hammocks on the Florida Keys tend to be drier than those on the mainland because of increased ocean breezes and lowered rainfall (Whitney et al. 2004). They also have a higher percentage of tropical species in part because many temperate species, such as live oak, swamp bay (*Persea palustris*), sugarberry (*Celtis laevigata*), and coontie, reach their southern limits on the mainland or in the northern Keys. Many tropical tree species within Florida, such as rough strongbark (*Bourreria radula*) and lignum-vitae only occur in rockland hammocks of the Keys.

In the Keys, there is a structural difference between the rockland hammocks north and south of Big Pine Key. This is at least partially due to differences in geology, ground water salinity and rainfall. The surface rock in the northern Keys from Soldier Key to

Big Pine Key is Key Largo Limestone; the south portion from Big Pine Key to Key West is Miami Oolite. The Key Largo limestone is more permeable than the Miami Oolite and therefore hammocks in the upper Keys tend to have higher ground water salinities (Ross et al. 1992). Rainfall also decreases from the northern to southern Keys (Whitney et al. 2004). Much taller, more developed tree canopies (near 35 feet tall) occur in the northern section, while the hammocks in the southern section are a more scrubby, xeric form of rockland hammock which average less than 20 feet tall (Snyder et al. 1990). These often impenetrable hammocks in the southern keys have previously been referred to as "low hammock" or "Keys hammock thicket" (Snyder et al. 1990).

Within the southern Everglades, rockland hammock rarely may develop in the center of tear-drop shaped islands surrounded by glades marsh (e.g., Grossman and Mahogany Hammocks). In these cases, the hammock develops on organic matter that accumulates on top of the underlying limestone (Outcalt 1997).

One common variant of rockland hammock occurs within Florida.

Variant: THORN SCRUB – occurring along the ecotone of rockland hammock with Keys tidal rock barren or Keys cactus barren or within openings in rockland hammock. Thorn scrub is a low-statured scrubby hammock dominated by spiny species such as saffron plum (*Sideroxylon celastrinum*), blackbead, and hog plum as well as buttonwood (*Conocarpus erectus*), blolly (*Guapira discolor*), brittle thatch palm (Thrinax morissii), poisonwood, devil's smooth-claw (*Pisonia rotundata*) and other rockland hammock species. This transition zone is variously referred to as "Keys hammock thicket" (Duever 1984), "transitional thorn woodland" (Ross et al. 1992), or "cactus scrub" (Avery 1982), in reference to its short stature and the prevalence of spiny species.

Associated Communities: Rockland hammock can grade into glades marsh, tidal swamp, tidal marsh, Keys cactus barren, Keys tidal rock barren, pine rockland, maritime hammock (e.g. Sands & Elliott Keys), or marl prairie. Rockland hammock can be distinguished from pine rockland in having a closed, hardwood canopy rather than an open pine canopy. Rockland hammock can have almost the same structure and species composition as the tropical form of maritime hammock. It differs by being on a rock substrate rather than the sand or shell substrate of barrier islands or high energy coasts. On the mainland in the northern extent of the range of rockland hammock, it can resemble mesic hammock, which is dominated by live oak in the canopy, but may contain some tropical species. Although rockland hammock can include minor temperate canopy components (i.e., live oak, sugarberry), it can be distinguished from mesic hammock by its rocky substrate and dominance of tropical tree species in the canopy.

Management Considerations: Rockland hammock occurs on prime development property and is disappearing rapidly. Many pieces that have been protected through land acquisition programs occur as islands within developed and developing lands. This poses management problems in terms of edge effects (e.g., trash dumping, exotic plant infestation, exotic and feral animal control) and loss of the natural ecotone that forms between the hammock and the adjacent (often fire-maintained) community. Some plants

and animals of rockland hammocks (e.g., tree snails, orchids, bromeliads) are susceptible to collection pressures and must be protected from collectors.

Exotics plant species infestations are an ongoing problem in rockland hammock. Species such as Brazilian pepper (*Schinus terebinthifolius*), lead tree (*Leucaena leucocephala*), seaside mahoe (*Thespesia populnea*), latherleaf (*Colubrina asiatica*), and sapodilla (*Manilkara zapota*) invade and displace native species. Dumping of yard waste can lead to the invasion of species such as bowstring hemp (*Sansevieria hyacinthoides*) and golden pothos (*Epipremnum pinnatum*).

Reference Sites: Dagny Johnson Key Largo Hammock Botanical State Park (Monroe County Keys), John Pennecamp Coral Reef State Park (Monroe County Keys), Lignumvitae Key Botanical State Park (Monroe County Keys), Matheson Hammock (Miami-Dade County), Royal Palm Hammock, Everglades National Park (Miami-Dade County)

Global and State Rank: G2/S2

Crosswalk and Synonyms:

Kuchler	105/Mangrove
	116/Subtropical Pine Forest
Davis	1/Coastal Strand
	3/Southern Slash Pine Forests
	14/Region of open Scrub Cypress
	16b/Everglades Region Marshes, Sloughs, Wet Prairies and Tree Islands
SCS	1/South Florida Coastal Strand
	14/Tropical Hammocks
Myers and Ewel	Subtropical Forests - high or rockland hammocks
SAF	105/Tropical Hardwoods
	89/Live Oak
FLUCCS	426/Tropical Hardwoods
	427/Live Oak

Other synonyms: Low, medium, and high productivity rockland hammock (Ross et al. 1992), evergreen seasonal forest (Beard 1944)

Table 1. Rare plant species (FNAI tracked) in rockland hammock.

Species Occurring on Both the Mainland and Florida Keys	**Species Restricted to the Mainland**
	Adiantum melanoleucum
Byrsonima lucida	*Asplenium* x *biscaynianum*
Calyptranthes zuzygium	*Campyloneurum angustifolium*
Catopsis berteroniana	*Catopsis floribunda*
Coccothrinax argentata	*Ctenitis sloanei*
Colubrina cubensis var. *floridana*	*Eltroplectris calcarata*
Encyclia boothiana var. *erythronioides*	*Eupatorium villosum*
Eugenia confusa	*Ilex krugiana*
Gyminda latifolia	*Galeandra bicarinata*
Hypelate trifolia	*Govenia floridana*
Jacquinia keyensis	*Jacquemontia havanensis*
Microgramma heterophylla	*Lantana canescens*
Prunus myrtifolia	*Licaria triandra*
Psychotria ligustrifolia	*Lomariopsis kunzeana*
Schaefferia frutescens	*Macradenia lutescens*
Swietenia mahagoni	*Oncidium floridanum*
Vanilla barbellata	*Passiflora pallens*
	Picramnia pentandra
Species Restricted to the Florida Keys	*Tectaria coriandrifolia*
Bourreria radula	*Tectaria fimbriata*
Canella winteriana	*Thelypteris reptans*
Cupania glabra	*Thrinax morrisii*
Cyperus fuligineus	*Thrinax radiata*
Drypetes diversifolia	*Trichomanes krausii*
Eugenia rhombea	*Tropidia polystachya*
Guaiacum sanctum	
Guapira floridana	
Hippomane mancinella	
Manilkara jaimiqui	
Passiflora multiflora	
Phoradendron rubrum	
Pilosocereus bahamensis	
Pilosocereus robinii	
Pisonia rotundata	
Zanthoxylum flavum	
Vallesia antillana	

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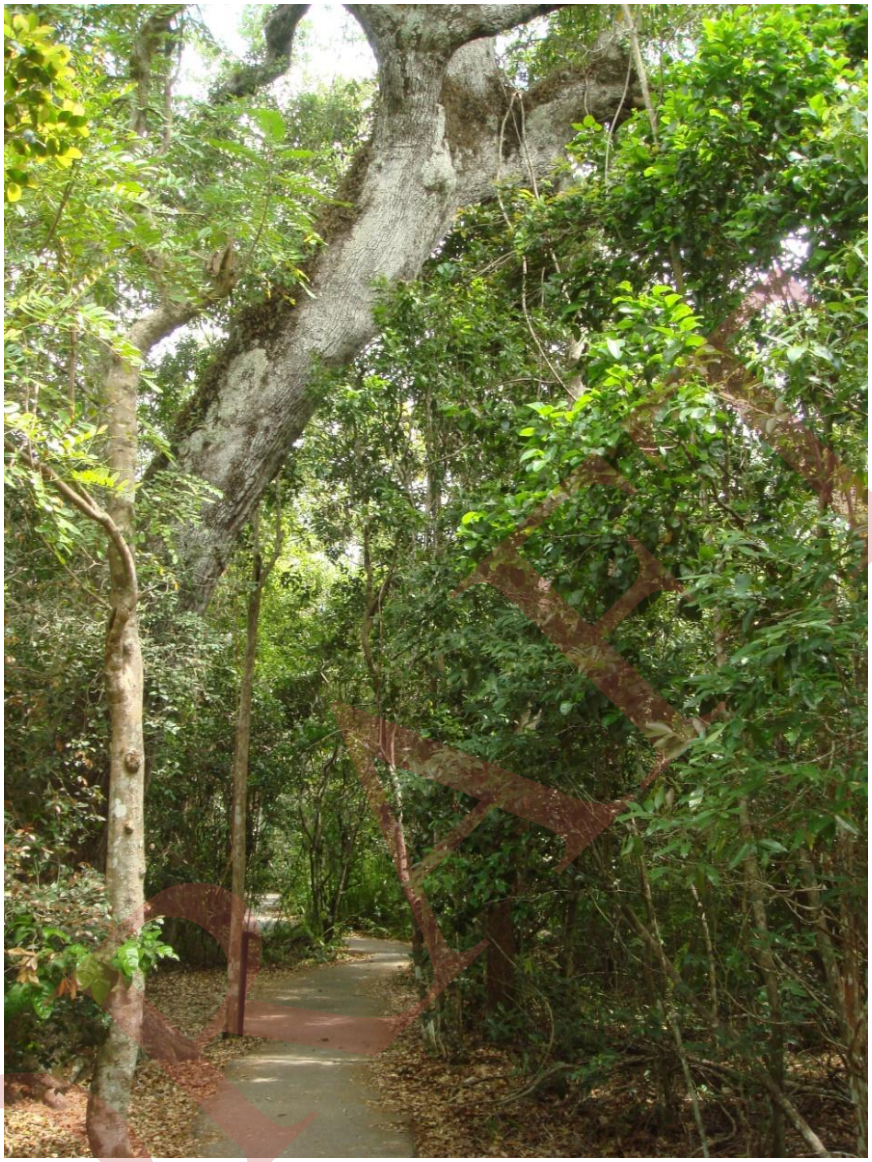

Everglades National Park (Miami-Dade County) Photo by Amy Jenkins