



## ECO-ACADEMY for Youth and Parent Educators

**Tropical hardwood hammocks** are one of many natural communities found in Florida, but one of the few that are characterized by tropical plants. The word “hammock” was first used by early inhabitants to mean a cool and shady place. Later, settlers of Florida used the word “hummock” to indicate areas that were slightly higher in elevation from the rest of the land. Today, the term hammock is used in Florida to describe forest habitats that are typically higher in elevation than surrounding areas and that are characterized by hardwood forests of broad-leaved evergreens. Tropical hardwood hammocks occur in south Florida and along the Florida coastlines where danger from frost is rare and tropical trees and shrubs common to the Caribbean islands (West Indian origin) are able to survive.

### Module: South Florida Ecosystems

## Tropical Hardwood Hammocks

### Sunshine State Standards:

SC.1.L.14.1, SC.1.N.1.1, SC.2.L.17.2, SC.2.N.1.1,  
SC.3.L.14.2, SC.3.N.1.1, SC.4.L.16.2, SC.4.L.17.4,  
SC.5.L.17.1, SC.5.L.15.1, SC.7.L.17.3, SC.7.L.15.3,  
SC.912.L.15.3, SC. 912.L.17.4,  
SC.912.L. 17.4



### Objectives

- Understand the ecology of Tropical Hardwood Hammocks
- Learn about different adaptations of plants and animals to this habitat
- Understand the importance of Tropical Hardwood Hammocks
- Identify the dominant plants found in Tropical Hardwood Hammocks

### Vocabulary

**Canopy** - is the aboveground portion of a plant community or crop, formed by plant crowns.

**Endemic** - in a broad sense, can mean "belonging" or "native to", "characteristic of", or "prevalent in" a particular geography, group, field, area, or environment; native to an area or scope.

**Epiphyte** - is a plant that grows upon another plant (such as a tree) non-parasitically or sometimes upon some other object (such as a building or a telegraph wire), derives its moisture and nutrients from the air and rain and sometimes from debris accumulating around it, and is found in the temperate zone (as many mosses, liverworts, lichens and algae) and in the tropics (as many ferns, cacti, orchids, and bromeliads) — also called *air plants*."

**Mesic habitat** is a type of habitat with a moderate or well-balanced supply of moisture, i.e. a mesic forest, a temperate hardwood forest, or dry-mesic prairie.

---

## Background

### Overview and history



Tropical hammocks are unique areas of hardwood forest that are found only in South Florida and the Keys. These unusual coastal forests were first exposed about 8,000 years ago as sea levels fell and coral reefs were exposed. The beds of coral died and left behind shelves of limestone bedrock which eventually fostered vegetation. Over many thousands of years plants established in these ecosystems as their seeds were carried by winds, tides, and migrating birds. Characterized by a closed canopy of low-growing hardwoods and palms with a fairly open shrub layer and sparse herb layer, the plants growing in these hammocks are a mix between tropical and temperate species. The dense canopy limits the growth of understory plants and favors non-canopy species that climb or live without roots at levels higher in the canopy where there is more available light. Some species that are common in northern Florida forests are at the southernmost limit of their range in tropical hammocks. Many of the trees and plants found in these habitats originated in the Caribbean Islands and are not found farther north.

Tropical hammocks represent one of the rarest plant communities in Florida. Few endemic plant species are found in these ecosystems. The diverse vegetation grows into a dense, wild tangle of shrubs, vines, and epiphytes under a closed canopy of evergreen hardwoods. These beautiful jungle-like habitats were once common along South Florida coastlines and many inland areas. During the late 1800s and early 1900s the forests were a source of valuable logging timber such as mahogany. For many years the trees were harvested and used in the production of tons of charcoal.

Both human and natural impacts have caused such a serious decline in these habitats that they are currently listed as a threatened habitat type in Florida. All that remain today of these unusual ecosystems are scattered islands of tropical forest that are mainly located in parks and preserves in South Florida and the Keys. Careful management and preservation of these precious natural wildlands is critical if they are to survive.

## General characteristics



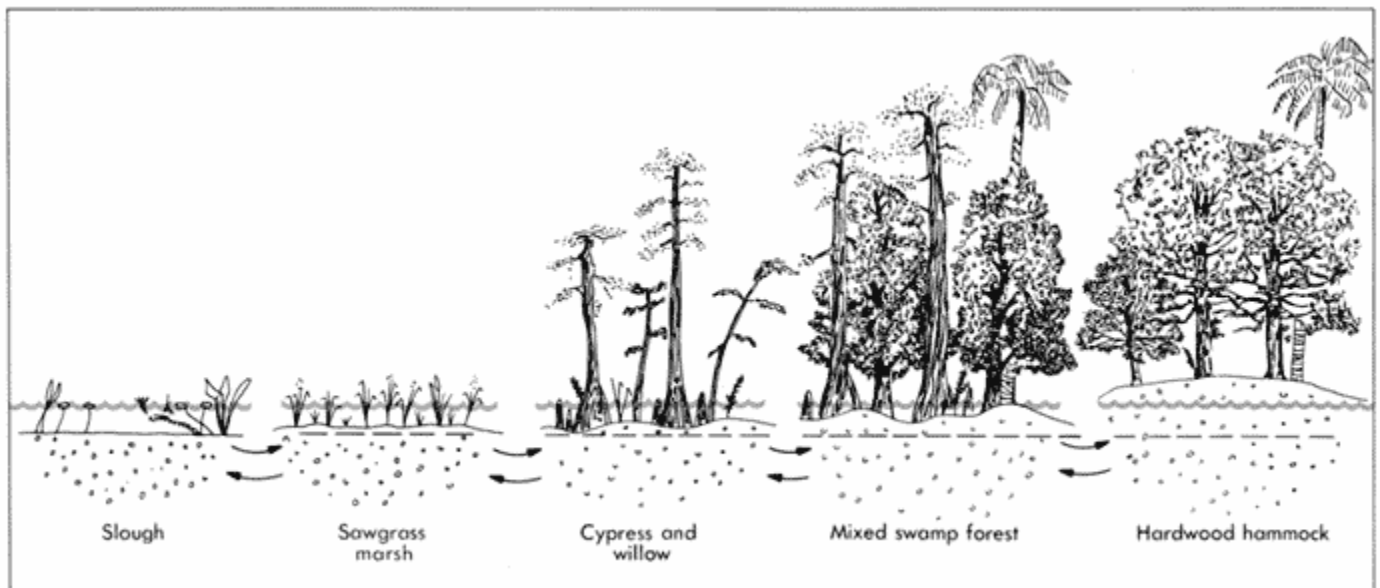
Tropical hammocks may be described as multi-layered, dense forests with both tropical and temperate vegetation. They are easily recognized by their low, spreading overstory of hardwoods and palms with clinging vines, ferns, and colorful orchids. While located in low-lying regions of the South Florida coastal plain, tropical hammocks are slightly elevated from the surrounding terrain and, therefore, they escape flooding most of the time.

The hammocks are elevated far enough above the salt line to allow trees and plants that are not tolerant of salt to establish and grow into lush tropical forests. A thick, spongy layer of leaf litter on the ground helps to maintain moisture while the closed canopy minimizes temperature fluctuations by reducing soil warming during the day and heat loss during the night.

Soils in tropical hardwood hammocks are primarily composed of organic material which has accumulated directly on top of mineral substrate such as limestone bedrock, and are moist, but rarely inundated with water. The tropical hammocks in Florida grow on three main types of geological formations: old sand ridges, marl deposits (a calcium carbonate sediment), and dead coral beds. Some hammocks are also located on ancient Indian shell mounds. The Indians would discard old shells and other refuse in large piles called middens. Eventually vegetation began to take root within the fragmented shell-sand mixture. In the absence of fire these mound communities evolved into hardwood hammocks. Many trees and plants in these ecosystems take root directly in the bedrock. Their shallow root systems extend horizontally and grow into crevices in the rocks surface. This helps to give structural support to the trees while allowing the plants to find water and nutrients in the cracks and crevices of the rough terrain.

The forest floor is often uneven due to the rocky landscape and thick, spongy layers of decaying vegetation. There may be loose rocks and rubble and frequent sinkholes which occur when the soft limestone erodes underneath the ground and causes a collapse of the surface. These solution holes often fill in with soil and decaying organic matter. During wet seasons they may fill with water and provide valuable refuge habitat and breeding areas for reptiles, amphibians, insects, and small fish.

There is an abrupt transition between the salt-tolerant coastal forests of mangrove and buttonwood and the slightly higher-level tropical hammocks which are intolerant of salty conditions. Even a few inches in elevation may alter the plant composition drastically.



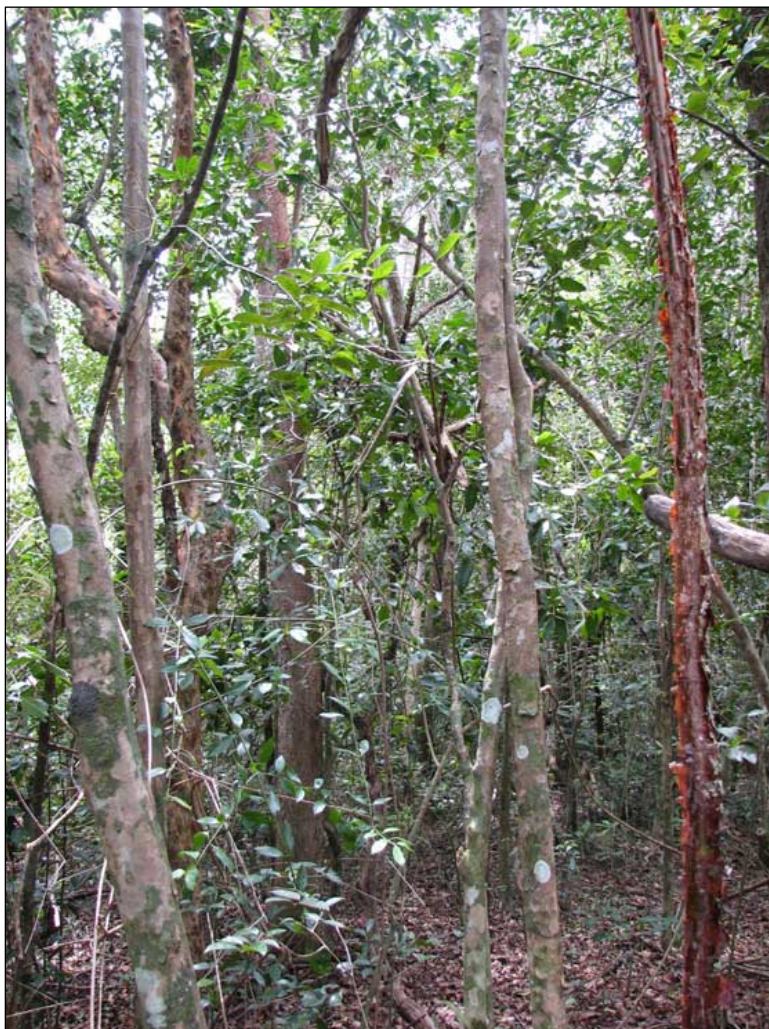
Some tropical hammocks are located in areas where natural wildfires occur frequently. These ecosystems, called pine rocklands, are dominated by an overstory of slash pine and an understory of woody shrubs and herbaceous grasses and wildflowers. The topography is similar to tropical hardwood hammocks with flat, well-drained, rocky terrain and jagged-edged solution holes. However, frequent fires prevent many hardwood trees from ever establishing in these areas. It is the presence of fire that maintains these pinelands and prevents them from evolving into tropical hardwood forests. Over 95% of the original pine rocklands have already been lost due to human development of the land and suppression of fire. In the absence of fire, pine rocklands will eventually succeed to tropical hardwood hammocks.

### **Environmental factors that effect tropical hammocks**

Tropical hammocks develop into self-maintaining plant communities that are usually not affected by floods or fires. These hardwood stands are frequently located on the leeward side of a sand or rock ridge or they may be on high rock out-croppings that are

surrounded by natural “moats” of solution holes or cypress swamp. These natural fire breaks, along with the moist, cool environment of the forest interior, help to limit wildfires. Occasionally fires may start in neighboring ecosystems and if conditions are dry and windy the fire may spread into the hardwood forest. Since most of the plants and trees are not fire-resistant, these fires can be catastrophic. Most woody shrubs and herbaceous plants will be killed. However, many of these species can resprout quickly after a fire. Some of the hardwood trees such as live oak, are fire-resistant and will survive all but the most serious fires.

Aside from the risk of occasional fire, tropical hardwood hammocks are impacted by several other environmental factors. There is a strong correlation between tropical storms and tropical hammocks. Many of these forests were established from wind-born seeds from tropical species. Strong winds have the ability to shape and reshape entire landscapes. These ecosystems are especially prone to damage by high winds from hurricanes and tropical storms. Thousands of years of adapting to the harsh, coastal winds have effected the form, or habit of many trees. Since the trees have shallow root systems they can be easily up-rooted by sudden gusts of strong wind. The branches on many hardwood trees in tropical hammocks have adapted to the winds by spreading out and growing horizontally to minimize damage to the trees and loss of limbs.



Just as high winds helped to establish and shape the landscape of tropical hammocks they can alter or destroy them. Severe tropical storms may cause damage from high winds, storm surges, flood waters, and inland deposits of silt, mud, and salt. Catastrophic hurricanes are responsible for damage and loss to thousands of acres of tropical hardwoods along the South Florida coastlines. Many of the old buttonwood forests of the Everglades were destroyed by a category-five hurricane in 1935. Hurricanes in the mid-1960s toppled most of the remaining buttonwoods and many other trees along the once-wooded coastline. Buttonwood is so dense that it rots very slowly so many of the relic stumps and limbs

from those storms can still be seen along the shoreline. Recent hurricanes such as Andrew (1992) have continued to impact these sensitive coastal forests.



Especially destructive are the storm surges from serious hurricanes. Not only do these bring high winds but they also bring the risk of flooding and incursions of salt water to the salt-intolerant forest. Storms may send significant incursions of sand, mud, and saltwater into the sensitive inland habitats. Frequent or extended periods of saltwater exposure may alter the soil conditions and damage the ecosystem. Incursions of saltwater eventually erode the sand ridges that hardwood hammocks grow on.

Rising sea levels due to global warming pose a serious threat to tropical hammocks. As the water levels rise they encroach upon the usually dry upland hardwood stands and increase the moisture levels and salinity of the soil. This effects which species are able to grow there. Plants and trees that are not able to tolerate frequent flooding or high salinity will be replaced by more tolerant species thus altering the plant community and the wildlife that depend on it.

Tropical hammocks have also been affected by reductions in the mean water table. On the Miami Rock Ridge, the average water table has dropped by several feet since the beginning of the century. This has contributed to the extirpation of at least two fern taxa, one an endemic hybrid.

Many of the trees and plants found in tropical hammocks are cold-sensitive and cannot survive freezing temperatures. Extremely cold temperatures will kill much of the herbaceous vegetation and affect the growth and reproduction of many other plants and trees. In the mid-1980s a series of severe cold snaps caused wide-spread die-offs of tropical vegetation in hardwood hammocks throughout South Florida.

Another serious threat to tropical hammocks is invasion by exotic plant species. At least 162 species of exotic plants are now known to invade tropical hardwood hammocks in South Florida. The excellent growing conditions of these forests provide opportunity for many non-native species to establish and invade the ecosystems. While some exotic species are dispersed in tropical hammocks by migrating birds, others escape from cultivation in residential or commercial landscaping. Since most non-native plants have no natural enemies in their new habitat they are at a competitive advantage over native plants. They grow quickly and often shade out surrounding vegetation. These invasive pests may eventually displace many native species and alter the entire plant community. Several exotic plants are currently causing serious problems in tropical hammocks. These include Schefflera, Brazilian pepper, latherleaf, para grass,

and carrotwood, and old world climbing fern. Hybrids between native and exotic plant species have also begun to appear, ultimately threatening native species with extirpation or extinction.

Exotic animals have also impacted tropical hardwood hammocks. Introduced species that occur in South Florida rocklands include seven mammals, about 30 birds, four amphibians, and 25 reptiles. These species include armadillo, fire ant, and wild hog.

## **Flora and fauna of tropical hammocks**

### *Trees and Plants of tropical hammocks*

Mesic conditions are developed by a combination of the hammocks rounded profile and nearly impenetrable edges, which deflect wind and limit the effects of the harsh coastal conditions. This creates a deeply-shaded interior with a cool, moist environment. Little sunlight is able to filter through to the forest floor so there is sparse herbaceous groundcover. Most of the lower level vegetation is shade-tolerant. The interior of the forest often has a unique spicy odor from all of the exotic flowering plants.

Tropical hammocks are known for their high species diversity. These unique plant communities support over 200 species of plants and trees from the Caribbean tropics alone. Many temperate species that are common to forests in North Florida also grow well in tropical forests, such as live oak, poison ivy, Virginia creeper, and wild grape. The exact structure and composition of each tropical forest differs due to the availability of light and water. Changes in rainfall and local environmental conditions, along with natural disturbances and human activities, affect the character of each plant community.

Some of the most unusual plants in Florida are found in tropical hammocks. One example is the strangler fig. This plant starts out as an epiphyte and attaches to a host tree, usually a cabbage palm. The strangler fig sends out roots that tangle around the host and eventually strangle it.



Many species of epiphytes cling to shrubs and trees for support and utilize the nutrients that are found in rainwater, dust, and leaf litter. Buttonwood trees, found at the coastal edges of tropical hammocks, are one of the favorite host species for epiphytes. Their branches are frequently covered with colorful, vining air plants. Among these are numerous brilliantly-colored bromeliads and orchids. These epiphytes are highly valued by the floral industry and for use in ornamental landscaping. Because of their popularity, these beautiful plants have been over-harvested and are seriously declining in many areas.

## Wildlife that use tropical hammocks

Except for some birds and bats, most vertebrate animal species found in tropical hardwood hammocks are temperate in origin. While plant species can be transported by birds, waves, or wind from the Caribbean, most animal species have to travel to South Florida by land, and a land bridge has never connected South Florida with the Caribbean. Tropical hardwood hammocks provide food, cover, roosting, and nesting sites to a wide variety of wildlife species.



Fifteen species of vertebrates are endemic to South Florida rocklands and many of these utilize tropical hardwood hammocks as habitat. Ten of these are mammals and five are reptiles. There are no endemic birds found in tropical hardwood hammocks. Some mammal species have evolved regional sub-species such as the Florida Key deer, a small relative of the white-tailed deer. These unique animals are only 25" to 30" tall and are found exclusively in South Florida. Other mammals that live in tropical hammocks include white-tailed deer, raccoons, opossum, cotton rat, cotton mouse, and several species of bats. Some of the bats are of Caribbean origin and some are common in other parts of Florida. Federally listed animals that depend upon or utilize tropical hardwood hammocks in South Florida include the Florida

panther, Key deer, and Stock Island tree snail.

Many reptiles and amphibians are common in Florida's tropical forests. Resident snakes include the rough green snake and black racer. Besides these 2 snakes, another common reptile found in the tropical forest is the green anole. Southern toad and green tree frog are common amphibians. The Florida tree snail is a rare animal that feeds on the algae and fungi in tropical forests. Because of the lush vegetation and flowering plants, many insects can be found in these jungle-like habitats. Mosquitos and butterflies are especially abundant. Schaus's swallow-tail butterfly is an endangered species that lives in tropical hammocks. Chemicals used to control mosquito populations have caused high mortality among these rare and beautiful butterflies.



Where there are abundant insects and food resources there will naturally be many birds. Some of the species of birds found in tropical hammocks migrate from the West Indies including the mangrove cuckoo, the black-whiskered vireo, the white-crowned pigeon, and smooth billed anis.

Northern species of birds that frequent tropical forests include the Carolina wren, Northern cardinal, and red-bellied woodpecker. The white-crowned pigeon, a threatened species, often feeds on the fruits and berries of tropical hammocks but lives in neighboring habitats.

Rockland habitats, including tropical hammocks, contain a lower diversity and abundance of wildlife than similar habitats to the north. One study showed hammocks to be surprisingly unimportant to animals. They point out that while hammocks are refuges for a very diverse flora, the factors which influence this biodiversity may reduce the potential diversity of wildlife. Factors which may limit the wildlife diversity include their small size, habitat disturbance by humans, and common proximity to deep water areas which reduce frequency of wildfires. Hammocks are, however, noted to be critical habitat to many species during flood conditions.

### **Human impacts on tropical hammock ecosystems**

Tropical hammock ecosystems are rapidly declining and listed as seriously endangered habitat in Florida. In addition to natural disturbances such as hurricanes and rising sea-levels, human activities have contributed to the loss of these coastal woodlands. During the 19th and early 20th centuries much of the timber in these coastal hammocks was logged. Many beautiful mahogany trees were cut for furniture-making and cabinetry. A booming charcoal industry harvested much of the once-vast buttonwood stands. Poachers and commercial harvesters depleted many of the flowering orchids and bromeliads and hundreds of homes and businesses sprang up as land was developed along the coastlines. Other land was cleared for farming, commercial pine plantations, and livestock rangeland. Late in the 1800s, as railroads were built in South Florida, thousands of acres of pine rocklands were clearcut from coastal hammocks, leaving



less than 2% of the original coastal pinelands intact. All of these activities have contributed to the further decline of delicate tropical hammock ecosystems in Florida. Only a few isolated areas in South Florida still have significant acres of tropical hammocks. If the remaining remnants of these remarkable forests are to be preserved they must be carefully managed and protected from further disturbance.

# Activity: Tree and Leaf Terminology

**Duration:** 30 minutes or more

## Objectives:

- able to understand terminology
- identify leaf characteristics
- create booklets to demonstrate knowledge of this concept

## Materials:

- Tree identification books
- Dichotomy Key
- Construction paper
- Contact Paper
- Hole punch
- Rings
- Yarn
- Binding combs
- Markers, etc.
- Materials may vary depending.

## Procedure:

1. Students will utilize tree identification books to select 4 or 5 trees they believe are present on their home property and record their selections. Students will then collect leaf samples from those trees to identify in the classroom.
2. Working with small groups, use the Dichotomy Key to identify the leaves the students brought in. Students were already introduced to the Key in lesson one.
3. Once all the leaves have been identified, compare the actual answers to their original guesses.
4. Tape one leaf to a sheet of construction paper and label the type of tree it is from. Continue to do this until all the leaves have been mounted and identified. I suggest laminating them or covering each sheet with contact paper to better preserve the leaf.
5. Students will then draw leaves that represent the various parts and types of arrangements.
  - needles
  - blade
  - midrib
  - petiole
  - bud
  - margins

- lobed
  - entire
  - simple leaf
  - compound leaf
    - pinnately
    - palmately
  - alternate
  - opposite
  - whorled
6. Assemble booklets. This could be done in a variety of ways such as with a hole punch and yarn or rings or with a plastic comb binding.

---

## **Activity: Tissue Leaf Rubbings**

**Duration:** 30 minutes

---

### **Objectives:**

Students will develop the shape of texture of a leaf.

### **Materials:**

- 5" squares of tissue paper in autumn colors
- fresh leaves with prominent veins
- pieces of brown crayons
- 6"x18" white construction paper
- liquid starch in a small container
- paint brush and paper towel

### **Procedure:**

- Put a leaf on the table with the vein side up. Place a single piece of tissue paper on the top of the leaf and rub over the top of the leaf with the side of the crayon. This will pick up the vein pattern.
- Repeat step one on different colors of tissue paper. Then tear out the leaf shape rubbing on each piece of paper.
- Using the paintbrush, cover the 6"x18" white construction paper with liquid starch. One at a time lay the tissue leaves on the paper, covering each piece with liquid starch before adding another.

## Resources

<http://edis.ifas.ufl.edu/uw206>

<http://www.fws.gov/verobeach/images/pdflibrary/tropical%20hardwood%20hammock.pdf>

[http://crocdoc.ifas.ufl.edu/msrmap/tropical\\_hardwood\\_hammock.php](http://crocdoc.ifas.ufl.edu/msrmap/tropical_hardwood_hammock.php)

[http://www.sfrc.ufl.edu/4h/other\\_resources/contest/Highlighted\\_Ecosystem\\_II/trophamin dex.htm](http://www.sfrc.ufl.edu/4h/other_resources/contest/Highlighted_Ecosystem_II/trophamin dex.htm)

[http://myfwc.com/docs/WildlifeHabitats/Legacy\\_Tropical\\_Hardwood.pdf](http://myfwc.com/docs/WildlifeHabitats/Legacy_Tropical_Hardwood.pdf)

[http://www.miamidade.gov/derm/hardwood\\_hammock.asp](http://www.miamidade.gov/derm/hardwood_hammock.asp)

[http://en.wikipedia.org/wiki/Tropical\\_hardwood\\_hammock](http://en.wikipedia.org/wiki/Tropical_hardwood_hammock)

<http://www.keysee.org/Hardwood.pdf>

[http://www.servinghistory.com/topics/Tropical\\_hardwood\\_hammock](http://www.servinghistory.com/topics/Tropical_hardwood_hammock)

<http://www.nps.gov/interp/nasa/backup/explorer/hammock.htm>