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## Season's Over and the Natives Are Returning to Keewaydin Island

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### *Abstract*

In the fall of 1997, Rookery Bay National Estuarine Research Reserve was awarded two grants to aid in the removal of invasive Australian pine trees (*Casuarina* spp.) from Keewaydin (Key) Island. The grants were received from Florida Department of Environmental Protection's (DEP) Bureau of Invasive Plant Management and the U.S. Department of Commerce, in the amounts of \$125 000 and \$250 000, respectively. Originally from Australia, Australian pine was introduced to Florida near the turn of the century as wind breaks for agricultural fields. Known for their salt tolerance, they later became popular in landscaping and shading for beaches, displacing native wildlife habitat and altering ecosystem functions. The taller *Casuarina* trees shade native species causing a decrease in growth and biodiversity of the natural system. The shallow root system does not provide adequate anchoring, causing the trees to topple and increasing shoreline erosion, interfering with sea turtle nesting and limiting beach availability to the public. The restoration project began in March 1998 and is expected to be finished late this summer. Partnerships among the Rookery Bay staff, private landowners, volunteers, and community groups are being developed for long-term maintenance to remove the *Casuarina* seedlings and other invasive plant species, following removal of the mature trees by contractors. Staff and volunteers are also monitoring this restoration project by documenting native plant recovery, reinvasion by exotic species, shoreline migration, bathymetry alterations, gopher tortoise population fluctuations, sea turtle nesting activity, and fish abundance. Upon completion, the removal will open beaches for shorebirds, sea turtles and the public, reestablish native plant communities, and mitigate erosion caused by the fallen trees.

### **Introduction**

Keewaydin Island is an eight mile long, primary barrier island, approximately 1300 ac in size, located in southwest Florida, between the City of Naples and Marco Island. The natural communities on Keewaydin Island consist of coastal scrub, pine

flatwoods, tropical hardwood hammocks, coastal strand, mangrove forests, and open beach. The island is part of Rookery Bay National Estuarine Research Reserve and Aquatic Preserve (Fig. 1). This pristine barrier beach represents a habitat under threat of development, especially in Naples which continues to expand at an alarming rate. The majority of this island (90%) has been purchased by the state using Preservation 2000 funds through the Rookery Bay Conservation and Recreation Lands (CARL) Program. Impacts to the flora and fauna of Keewaydin Island due to invasion by *Casuarina* (Australian pine) trees include impacts to native biodiversity of threatened barrier island habitats, limited wildlife value, enhanced beach erosion, impacts to sea turtle nesting, fisheries alterations, and impacts to public use beach (with over 300 boats and 600 people visiting on any given day on the weekend).

## Methods and Monitoring

### *Exotic plant control*

*Casuarina* trees, using services contracted by the state with Randal's Land Clearing and Development, Perry, Florida, were controlled using two separate methods. In areas of high public use along the Gulf of Mexico side of the island, and where state-owned lots are mixed with privately owned lots, the trees were cut and piled using a fellobuncher with a saw blade cutting head and rubber tires to minimize damage to native vegetation and the sandy substrate of the island. Stumps were treated using Garlon 3A (50%). A front end loader was used to remove fallen *Casuarina* trees from the beach prior to sea turtle nesting season and suppress fire during the burning of these piles. A bobcat was also used for cleaning up smaller debris left from the cutting and piling process. Heavy equipment was transported to and from Keewaydin Island using a landing craft.

On the back-side of the island along the Inland Waterway, *Casuarina* trees on a number of spoil islands (created when the channel for the waterway was dredged) will be treated in place using Garlon 4 (20%).

### *Native plant recovery*

Nine transects were established in dune, coastal strand, and hammock communities prior to removal of *Casuarina* trees to document changes in the vegetational composition following removal of the trees. The transects were placed in areas with varying degrees of infestation by exotic plants and will be monitored at regular intervals to determine the recovery of native plants within each of the community types. Species diversity and cover before and after removal of the *Casuarina* trees will be compared to determine native plant reestablishment. Six photo points were established to visually document pre- and post-removal changes in vegetation. Additionally, native plants will be purchased and planted through the

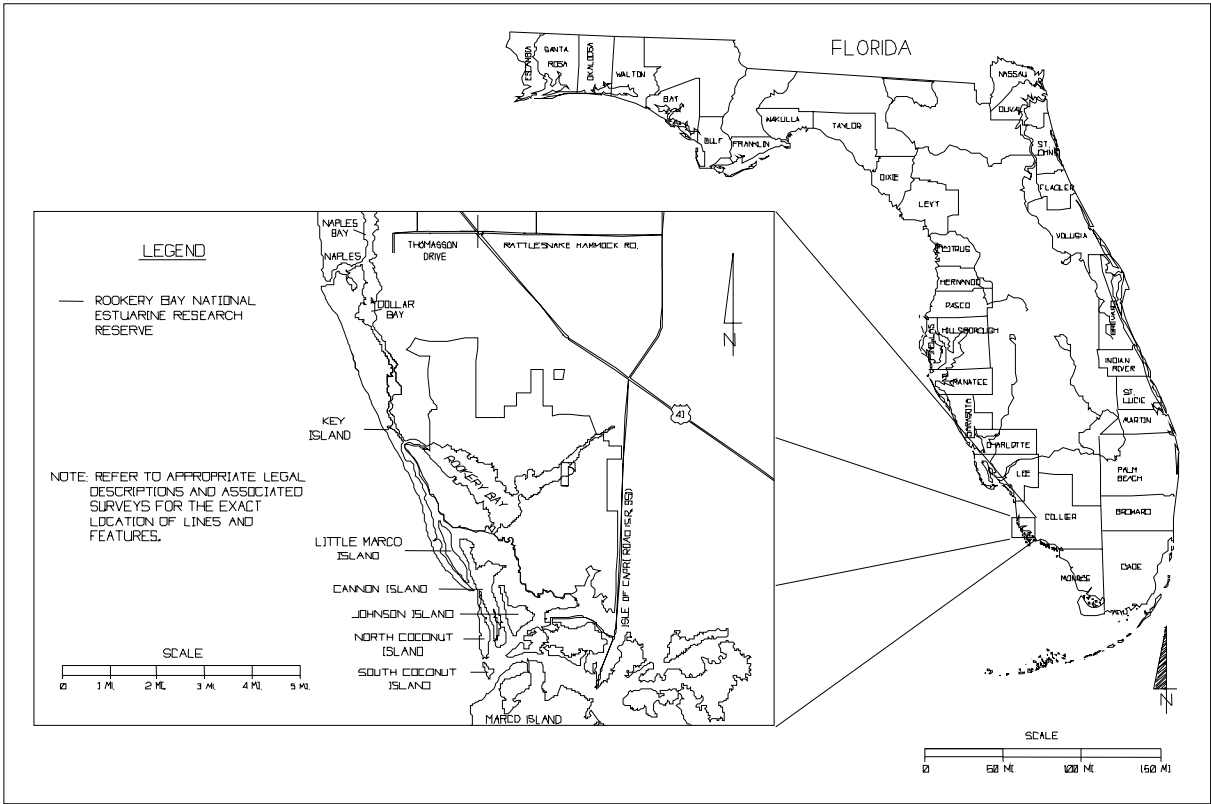


Figure 1. Location map of Rookery Bay National Estuarine Research Reserve and Key Island.

summer months in areas that have high public use or are in need of stabilization.

#### *Gopher tortoise population*

Active gopher tortoise burrows within the removal area were located and mapped using a Trimble global positioning system (GPS) unit prior to removal of *Casuarina* trees. Gopher tortoises will be monitored using the same transects that were established for vegetation recovery. Burrow abundance and size will be used to track changes in the gopher tortoise population due to removal of the trees. A comparison between this data and the native plant recovery data will be completed to determine if the removal of *Casuarina* trees and native plant recovery has increased the available forage area for gopher tortoises on Keewaydin Island.

#### *Shoreline migration*

The dune line of Keewaydin Island was mapped for several months and immediately prior to removal of *Casuarina* trees using a GPS unit. This process will be repeated at regular intervals following removal of the trees to track the island's migration and potential stabilization.

#### *Bathymetry changes*

The water depths were mapped to determine bathymetric changes that may potentially be associated with erosion from *Casuarina* trees and beach stabilization through reestablishment of native plant species. Bathymetric data was collected using a depth finder in conjunction with a GPS unit for the area approximately 1 mi north of the south tip of Keewaydin Island on the Gulf of Mexico, south through Hurricane Pass, and 1 mi north through Little Marco Pass, using transects an estimated 10 m apart. This data was collected prior to removal of *Casuarina* trees and will be tracked at regular intervals as the restoration effort proceeds.

#### *Sea turtle nesting*

The beaches of Keewaydin Island were patrolled by Rookery Bay staff for sea turtle activity each morning from 15 April through 15 May 1998. Interns with the Conservancy of Southwest Florida began patrolling the beaches on 15 May and are tracking the location of turtle crawls and nests on the island. An estimated 1 mi of beach had fallen *Casuarina* trees that impeded the use of the beach by nesting sea turtles. These fallen trees and debris were cleared from the beach as part of the restoration project. The sea turtle crawl and nesting information will be combined with the past locations of fallen *Casuarina* trees on the beach to determine sea turtle use in areas that were previously not accessible.

#### *Fish abundance*

Beach seining in three locations along Keewaydin Island was initiated prior to removal of *Casuarina* trees to determine the current composition of inshore finfish. Due to erosion processes, sand is being transported from the north end of the island to the south end. Increasing or decreasing this sediment load may affect finfish composition in this area. Seining will continue at regular intervals to determine seasonal differences and any changes due to restoration and potential stabilization of the island.

#### *Public use surveys*

In addition to the above referenced monitoring efforts, public use surveys were completed during the removal process to document the location and number of boats (e.g., private, rental, commercial, or jet ski), number of people, types of activities (e.g., swimming, fishing, shelling, and camping), and number of pets. This information will be useful in determining management strategies for high use areas.

## **Results**

At this time, over 50 000 Australian pine trees, encompassing more than 250 ac and 1600 man-hours, have been cut and treated using the cut stump method on Keewaydin Island. An estimated 20 ac of trees will be treated, in place, in June 1998. The heavy equipment used by the contractor produced minimal damage to the substrate and the contractor was able to work around many of the native plants that were intermingled with the *Casuarina* trees. As the piles of tree debris are being burned, the contractor is also burning much of the duff layer produced by the invasive trees in hopes of killing *Casuarina* seeds; the thick layer of duff also acts as a mulch bed, reducing recovery by native species. Due to a lack of rain over the time the contractors have been working and statewide air pollution problems from wildfires in Mexico and Central America, the pile burning has been delayed. Debris burning will resume in June and will be completed by the end of the summer.

## **Summary**

This is the first restoration project of its size on a barrier island that has been attempted by the Reserve's resource management staff. Outlook on the project has been positive. There are approximately 50 private landowners on Keewaydin Island. Eight of these landowners, representing approximately 15 ac, are subcontracting with the state's contractor to have the Australian pine and Brazilian pepper (*Schinus terebinthifolius* Raddi) trees removed from their lots. This work translates into another \$20 000 of private funds being used to aid in restoring the native communities. A federal, state, and private partnership has developed through this

project that will continue through monitoring and maintenance for the long-term health of Keewaydin Island.

The removal of *Casuarina* trees and the associated monitoring is one very important step in restoring Keewaydin Island. Australian pine trees, however, are not the only invasive plant that threatens the native communities on this barrier island; there is a substantial amount of Brazilian pepper. Three opportunities have recently presented themselves in addressing the control of Brazilian pepper on Keewaydin Island. A proposal was submitted to the Southwest Florida Invasive Plant Working Group for funding through the state's Upland Plant Management Program. Also, two private foundations have recently accepted pre-proposals for restoration activities involving public/private partnerships. Since the Keewaydin Island restoration effort involves funding from federal, state, and private sources, as well as on-site involvement by local volunteers, there is a good chance of obtaining funding.

A priority for any site manager involved in a restoration project is to have a clear understanding of the desired results and the methods to monitor the process. A solid monitoring effort will aid in determining the positive and negative points of the project, with the next project benefiting from the data collected and the knowledge gained. The data collected through this restoration project should produce useful information for future restoration efforts at Rookery Bay, as well as for other coastal managers when planning, executing, and monitoring large-scale restoration projects.