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● PACIFIC ISLANDS
● APRIL 2006



Forest Health *highlights*

Forest Resource Summary

The Islands of the western Pacific cover an area larger than the continental United States, although the total land mass encompasses only about 2,500 km² (excluding Hawaii). The area includes the Territories of American Samoa and Guam, the states of Chuuk, Kosrae, Pohnpei, and Yap in the Federated States of Micronesia (FSM), the Republics of Palau and the Marshall Islands, and the Commonwealth of the Northern Marianas Islands (CNMI). Approximately 325,000 acres are forested.

General forest types found on the Pacific Islands include coastal strand, mangrove forest, lowland tropical rain forest, and, on the higher islands, montane rain forest and cloud forest. Pacific Island nations have a variety forest health and management issues. Highly developed territories such as Guam have issues with forest lost to development and past land use. Emerging nations like Palau which have a growing economy and population are just beginning to encroach onto forested lands. Other Island nations like the Marshall Islands have little forested land and are more dependant on rich marine resources.

Forests in the Pacific are locally and globally important. Many island people live a subsistence life style and agro-forests provide a substantial part of their daily food. Pacific island forests also are noted for their high degree of endemism, with many globally threatened species. Island forests have been cleared in past years for unsustainable land uses and international warfare, and more recently, to make room for increasing populations of native islanders and immigrants.

Space is severely limited on tropical Pacific islands. Populations and associated infrastructure are increasing in many areas, resulting in conversion of forest land. Large scale or widespread anthropogenic disturbances can result in undesirable changes in forest structure, composition and function, including alteration of native forest dynamics and the spread of invasive species, and soil erosion and siltation in streams and on coral reefs. For example, the new Compact

Road in Palau has opened up secondary tropical forest land on the largest island, Babeldaob. Disturbance from construction associated with the Compact Road has facilitated the spread and encroachment of *Merremia peltata*, a native large-leaved vine, into adjacent forest. In Pohnpei, *Merremia* dominates numerous forest clearings created for sakau (kava) gardens.

Typhoons are a regular feature in most of the Pacific. Guam and the CNMI are regularly struck by typhoons; the other islands also experience severe storms from time to time. However typhoon frequency and severity are expected to increase with global climate change. From 2001 to 2004, with the aid of Forest Health Protection Prevention and Suppression funding, Yap made significant progress in eradicating a localized infestation of *Imperata cylindrica* (cogon grass). In 2005, the disturbance from Typhoon Sudal and the need to divert all island resources to basic recovery efforts resulted in a major setback in the attempt to eradicate cogon grass.



Native vegetation of Rota. Photo: Zhanfeng Liu

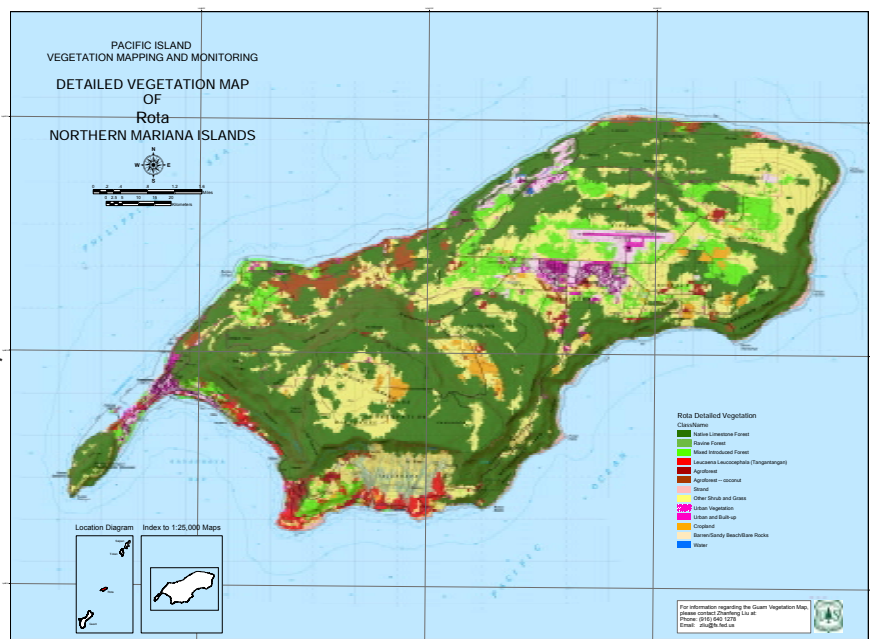
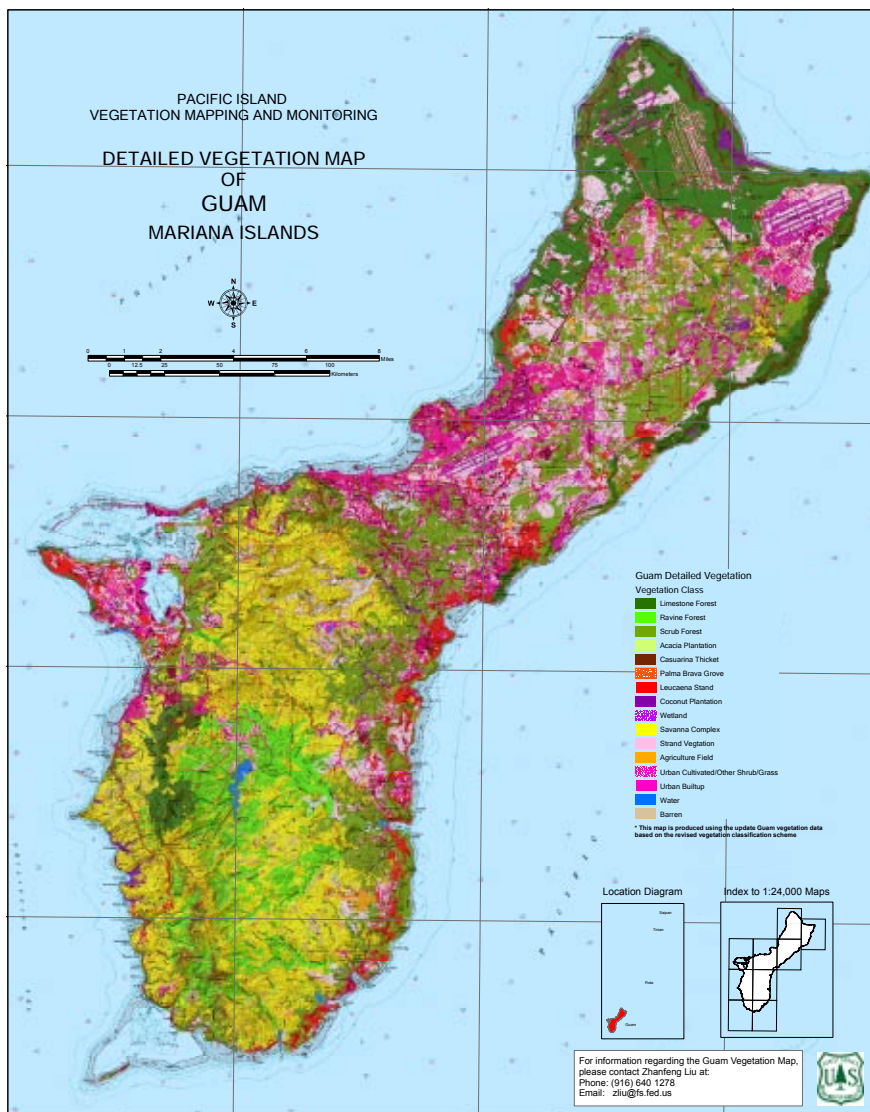
Forest health conditions have been monitored throughout the US-affiliated Pacific Islands on private, community and government-owned lands since 2002. Attention has focused on survey and control of invasive plants, but insect and disease outbreaks are also monitored. Methods vary from island to island but ground and road-based surveys are the primary monitoring methods. Forest Inventory and Analysis (FIA) plots with forest health indicators have been established in American Samoa (2001), Guam (2002), Palau (2003), CNMI (2004), and FSM (2005-2006). Trend data are not yet available from these plots.

Monitoring forest health is challenging on remote islands in the Pacific. Rugged terrain; few, poor quality roads; limited access to aircraft, and many widely dispersed islands present substantial logistic hurdles. For example, there is only 271 square miles of land in the Federated States of Micronesia, but it is distributed among 600 + islands spread across a million square miles of ocean. Access to all except main islands generally occurs by boat, which is time consuming, expensive and hazardous.

Land ownership patterns present additional challenges. On many islands most forest land is privately or communally owned. Access to communally owned parcels requires consensus of a large number of individuals. For example, on American Samoa, where most lands are held communally, an estimated 10,000 landowners own the 23,000 acres of non-industrial private forest lands. In the Commonwealth of the Northern Mariana Islands, an estimated 680 individuals control approximately 4,000 acres of communally owned land.

Changes in Forest Cover over Time

Forest Health Protection maps basic land cover types using remotely sensed data in cooperation with the Pacific Northwest Research Station, Forest Inventory and Analysis. These land cover maps provide a means for stratification and imputation of FIA plot data, as well as a baseline to measure the magnitude of future change in forest cover. Currently, American Samoa, Guam, Palau, CNMI and Yap have been mapped using high resolution remotely sensed data. Imagery for the Marshall Islands is in the queue. Historic vegetation dating back to the early 1970's has been digitized and will be used with the newer maps to show changes over time.



The following is a description of several high profile target species, it is not a comprehensive list of invasive plant species. For more information visit: <http://www.hear.org/>

Invasive plants remain one of the most serious threats to forest health in the Pacific. Surveys of the Pacific islands list more than 300 naturalized plant species that may be causing harm. Invasive weeds follow closely in openings created through natural and human forest disturbance. A much smaller number of plants are able to spread into and through intact forests. Each Pacific entity has determined their priority species and is working to control them through mechanical, chemical and biological means. Local and regional weed committees are now organized on all Pacific Islands. Weeds of widespread importance in the western Pacific under control actions include cogon grass (*Imperata cylindrica*), mile-a-minute vine (*Mikania micrantha*), Siam weed (*Chromolaena odorata*), Koster's curse (*Clidemia hirta*), giant sensitive plant (*Mimosa invisa*), root beer plant (*Piper auritum*) and Molucca albizia (*Falcataria moluccana*).

Early detection and eradication for weeds includes such species as African tulip (*Spathodea campanulata*) in Palau and Panama rubber tree (*Castilla elastica*) in American Samoa. For certain plants, biological control agents have been introduced and are spreading. These include the release of natural enemies to control ivy gourd, giant sensitive plant and Siam weed on Guam and Saipan.

Cogon Grass (*Imperata cylindrica*)

- ▶ Native to Old World
- ▶ Colonizes open, disturbed sites
- ▶ Burns readily and recovers vigorously; increases fire risk
- ▶ Target for eradication in Yap and Palau where extent and distribution are limited



Imperata cylindrica

Koster's Curse (*Clidemia hirta*)

- ▶ Native to Central and South America
- ▶ Aggressive invader; shades out vegetation
- ▶ Readily dispersed by frugivorous birds
- ▶ Target for eradication in Palau where there is one known population



Clidemia hirta

African Tulip Tree (*Spathodea campanulata*)

- ▶ Native to West Africa, cultivated throughout tropics
- ▶ Large tree to 80'
- ▶ Invades agricultural areas and closed forest
- ▶ Target for eradication in Palau which has incipient populations



Spathodea campanulata

Mile-a-minute Weed (*Mikania micrantha*)

- ▶ Native to South and Central America; invasive throughout Western Pacific
- ▶ Smothering vine spreads easily by seed or vegetatively
- ▶ Used as cattle feed and cover crop in some areas
- ▶ Target for control in Palau and Yap



Mikania micrantha

Molucca Albizia (*Falcataria moluccana*)

- ▶ Native to Western Pacific
- ▶ Nitrogen fixer and widely planted for reforestation and landscaping
- ▶ Rapid growth to 15 ft per year, spreading into forests
- ▶ Target for control in American Samoa



Falcataria moluccana

Chain-of love (*Antigonon leptopus*)

- ▶ Native to Mexico, common in tropical areas
- ▶ Weed of disturbed areas, smothers understory vegetation
- ▶ Readily reproduces vegetatively; prolific seed producer
- ▶ Target for control in Guam, Saipan and Tinian



Antigonon leptopus
Poltgonaceae
Photo: G.D. Carr

Some weeds are intractable or have become so widespread in areas of the Pacific that mechanical, cultural and chemical control methods are often not practical or economically feasible. Biological control is the best method for these species. The current program is composed of releasing known enemies of these weeds from elsewhere in the weed's range, rather than engaging in a search for new pests. Following are some of the weeds with active island-based or regional biocontrol programs, and their control agents.

Siam Weed (*Chromolaena odorata*)

- ▶ Native to Tropical America – one of world's worst weeds
- ▶ Grows extremely fast and forms dense stands in open areas
- ▶ Highly flammable, sprouts readily after disturbance, increases fire risk
- ▶ Prolific seeder; small, sticky seeds easily dispersed
- ▶ Target for mechanical and chemical control on Marshall Islands and Yap
- ▶ Biocontrol Programs ongoing in Guam, Saipan, Rota and Tinian
- ▶ Gall fly easy to produce and is effective in reducing seed production
- ▶ Caterpillar feeds on leaves and is partially effective



Damage of Siam weed caused by the gall fly, *Cecidochares connexa*



Damage caused by *Pareuchaets pseudoinsulata*.

Giant Sensitive Plant (*Mimosa diplotricha*)

- ▶ Native to Brazil; found throughout the Pacific
- ▶ Weed of disturbed areas, forms dense thickets
- ▶ Seeds readily dispersed by animals, humans and water
- ▶ Dense dieback is significant fire hazard
- ▶ Biocontrol program on Guam, Saipan, Rota and Tinian, Pohnpei and Palau
- ▶ Sap-feeding insect, *Heteropsylla spinulosa*, stunts plants



Mimosa diplotricha



Heteropsylla spinulosa stunted plant
Jan Breithaupt

Ivy Gourd (*Coccinia grandis*)

- ▶ Native to tropical Asia
- ▶ Smothers native vegetation in the forests and roadsides
- ▶ Widely used as a vegetable in Asia and in some Pacific islands
- ▶ Resistant to herbicides
- ▶ Biocontrol programs in Guam and Saipan
- ▶ 2 weevils recently released: *Acythopus cocciniae*, a leaf miner and *A. burkhartorum*, a leaf feeder (adult) and gall former (larvae).



Coccinia grandis



Galls on ivy gourd caused by the larvae of *Acythopus burkhartorum*.



Adult *A. cocciniae*



Larval mines caused by *A. cocciniae*

Erythrina Gall Wasp

The Erythrina gall wasp, *Quadristichus erythrinae*, which has severely impacted native and ornamental Erythrina trees in Hawaii since its discovery in April of 2005, has now spread to American Samoa and Guam. On December 26 of 2005, the wasp was detected on Tutuila in American Samoa. It is currently infecting *Erythrina variegata* variegata, *E. variegata* orientalis, and *E. subumbrans*. It has not been found on *E. fusca*. Systematic surveys are planned for early 2006. The wasp was also found on Guam in December of 2005. There are no endemic *Erythrina* species in American Samoa or Guam.



Asian Cycad Scale on Guam

The Asian cycad scale (*Aulocapsis yasumatsui*) is a problem in urban areas of Guam on king sago (*Cycas revoluta*) and on native cycads (*Cycas micronesica*, or fadang), a dominant mid-to-upper-canopy forest component in the island's limestone forests and riparian ravine habitats. The scale infestation has spread throughout the island wherever cycads are grown. The majority of cycads on Guam's west coast are infested. The riparian (ravine) forests in the south of Guam are largely free of the scale, but the infestation has spread to ornamental cycads in the area. The current strategy on Guam includes development of genetic stock on uninfested islands, maintenance of genetic stock in-situ in selected areas through periodic chemical control of the scale, and continued release of biological control agents. A coccinellid beetle (*Rhizobius lophanthae*), first introduced in 2004, is established and reproducing throughout the island after being distributed at over 80 sites by biologists. In areas where it is abundant, it appears to be quite effective with predation rates ranging from 80 – 100%. A parasitic wasp, *Coccobius fulvus*, was introduced this year, but establishment is not yet confirmed.



Native cycads are highly susceptible to *A. yasumatsui*. If scale infestations cannot be controlled, it is likely that the structure of Guam's limestone forests will be dramatically altered in the coming years. The scale currently appears to be restricted to Guam in the Western Pacific but is a threat to other Pacific islands where the cycad is native or ornamental cycads are grown, including Saipan, Rota, Yap, and Palau.



Cycad Blue Butterfly on Guam

Cycas micronesica on Guam has also been hard hit by the accidental introduction this year of the cycad blue butterfly (*Chilades pandava*). This butterfly was first discovered in the Ritidian area of Guam in mid-July of 2005. It was first noted in Saipan (CNMI) in 1996 but few native cycads remain in Saipan and there was little concern. Larvae feed on young cycad leaves, resulting in damaged leaves with greatly reduced leaf area and reducing the cycads' ability to recover from defoliation caused by the Asian cycad scale. While the total area of the cycad blue infestation is not known on Guam, the butterfly has been reported in native and ornamental cycads in the northern and southern regions of the island.



Pulvinaria scale attack on *Pisonia grandis* forest on Palmyra Atoll

Biologists from the US Fish and Wildlife Service and The Nature Conservancy working on Palmyra Atoll reported a reduction in cover of *Pisonia grandis* forests from 12% in 2001 to 8% in 2005. *Pisonia* forests are found in the Indo-Pacific region and are important habitat for nesting seabirds. Significant dieback could result in major effects to this ecosystem, which is declining throughout its range. The cause of the dieback in *Pisonia* is attributed to a severe infestation of the invasive scale insect *Pulvinaria urbicola* and an association of mutualistic ant species. Similar dieoffs have occurred recently within the range of *Pisonia*. Treatments with systemic insecticides to control the scale and control of ants are on-going with some success but trees continue to die. Three species of parasitoid wasps (*Coccophagus ceroplastae*, *Euryischomyia flavithorax*, and *Metaphycus luteolus*) and one scale predator (*Cryptolaemus montrouzieri*) are present following their release on NE Herald Cay in July and August of 2001.



The trigger for the outbreak of scale and ants on *Pisonia* is unknown but changes in predator-prey and parasitoid-host interactions, interactions with mycorrhizae, an imbalance in soil microbes due to excess carbohydrates in the soil from honeydew, and nutrient-deficient soils have been suggested. Monitoring is continuing and research into the underlying factors is needed.

Data Sources

The data sources used for this report include data gathered by Hawaii's island-based Invasive Species Committees or ISCs (funded in part by Forest Service FHP Prevention and Suppression Program), Division of Forestry and Wildlife staff, Hawaii Department of Agriculture, University of Hawaii, and partner organizations such as the Hawaii Agriculture Research Center. Survey and monitoring data collected by the ISCs are entered into a statewide database created by the Hawaii Natural Heritage Program, and the data are analyzed at the local and state levels.

Hawaii's Watershed Partnerships, the National Park Service, The Nature Conservancy of Hawaii, and DOFAW's Natural Area Partnership System also conduct monitoring of invasive plants and ungulates to improve the effectiveness of their management activities, but those data are not the focus of this report. The USDA Forest Service's Forest Health Aerial Survey Program and Forest Inventory and Analysis Program are not currently active in Hawaii.

For more information visit:

USDA Forest Service, Institute of Pacific Islands Forestry - <http://www.fs.fed.us/psw/ipif/>

Hawaiian Ecosystems at Risk project (HEAR) - <http://www.hear.org/>

USDA Forest Service, Pacific Southwest Region - <http://www.fs.fed.us/r5/spf/fhp/>

Author

Anne Marie LaRosa, Forest Health Coordinator, USDA Forest Service, Pacific Southwest Research Station, Institute of Pacific Islands Forestry



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