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● PACIFIC ISLANDS  
● APRIL 2007

# 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 km<sup>2</sup> (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 of 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 species endemism, with many globally threatened species. Island forests have been cleared in past years for unsustainable land uses and international warfare. More recently, island population increases are resulting in the conversion of intact native primary and secondary forest to agroforest and agroforest to urban areas on many islands.

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 cyllindrica* (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.

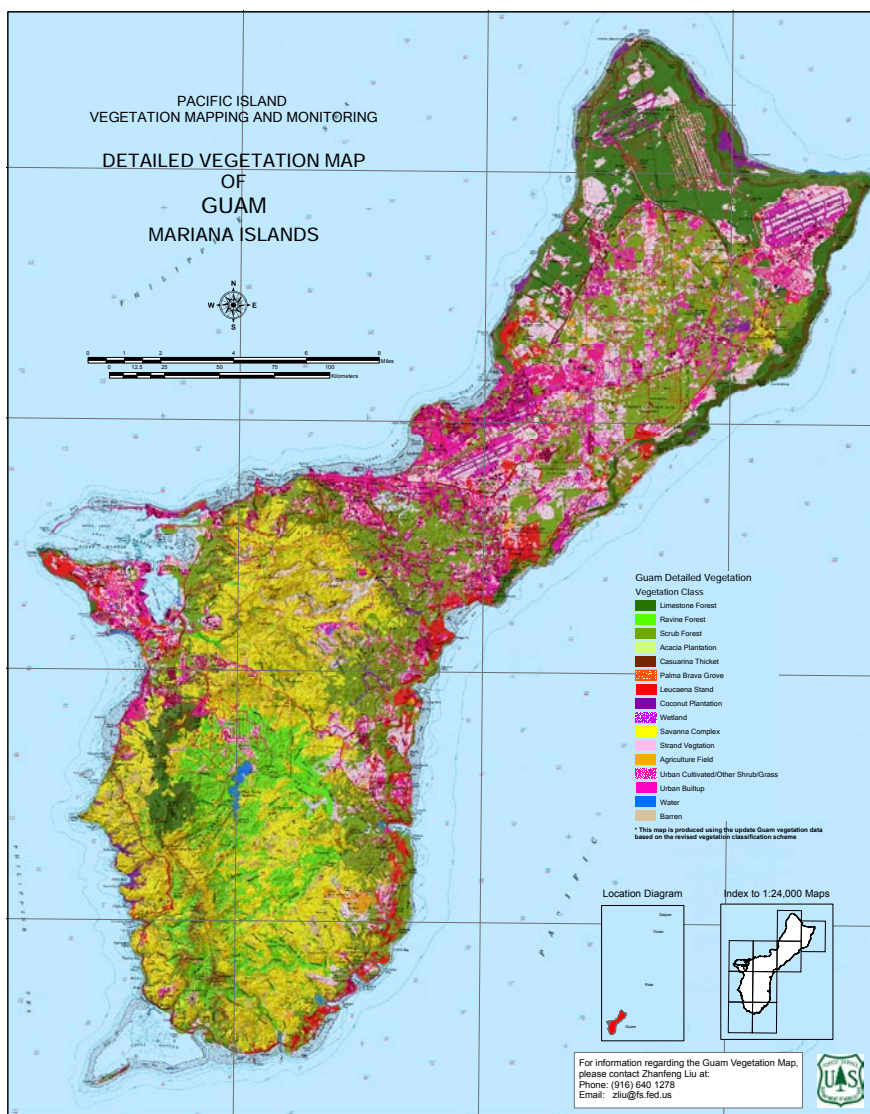


African tulip tree. Photo: Warren L. Wagner

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.

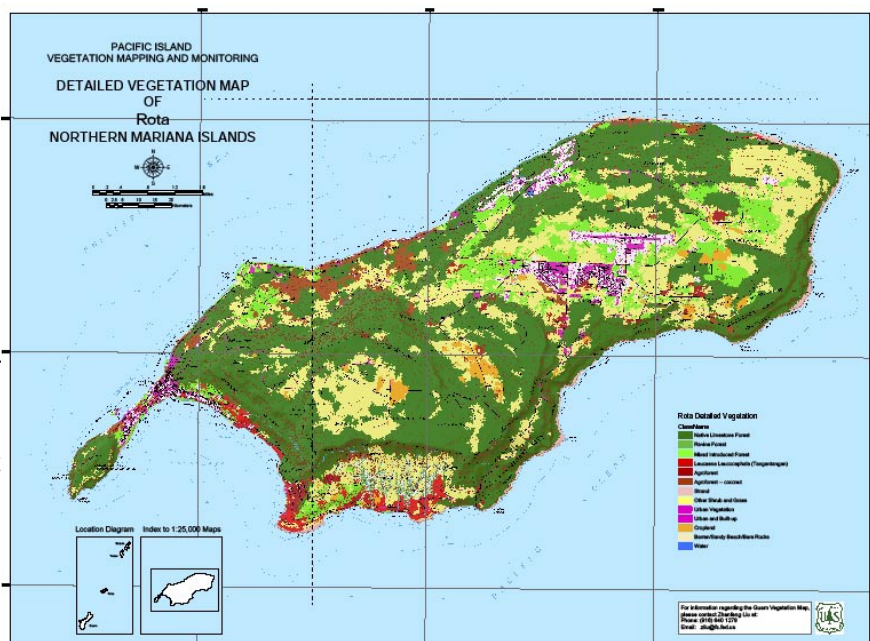


## Changes in Forest Cover over Time

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.

Vegetation data and maps are available from the Forest Health Protection Website at:

<http://www.fs.fed.us/r5/spf/fhp/fhm/>



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 throughout 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. Pacific islands have recognized the serious threat and the need for action by organizing into island, national and regional invasive species groups, several of which have strategic plans in place. Priority species are controlled through mechanical, chemical and biological means. 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; eradication efforts in Yap have been set back by recent typhoon (2005) and population is currently increasing despite control efforts



*Imperata cylindrica*

### Kebeas (*Merremia peltata*)

- ▶ Native to Indo-Pacific region. On Pacific islands thought to be either native, aboriginal or recent introduction on many, absent from some.
- ▶ Establishes in disturbed areas, especially roadsides
- ▶ Spreads across intact canopy and where abundant can smother and kill trees
- ▶ Reproduces by seed and vegetatively
- ▶ Serious problem in Palau and American Samoa; target for localized control in Palau
- ▶ Under consideration for biological control in other areas of the Pacific



*Merremia peltata*  
Photo: Konrad Englberger, SPC

### False Kava (*Piper auritum*)

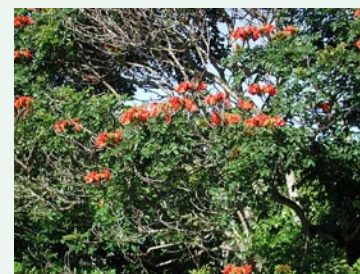
- ▶ Native from southern Mexico to northern South America
- ▶ Introduced to Pohnpei in 1998 as an alternative crop to sakau (kava)
- ▶ Also planted in native forest clearings under shifting cultivation where it has persisted and may cause environmental and economic damage
- ▶ Seeds are probably spread by birds and bats and suckers rufously
- ▶ Eradicated at two-thirds of the almost 100 sites where this plant has been found on Pohnpei



*Piper auritum*  
Photo: Konrad Englberger, SPC

### 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 and American Samoa which have limited or incipient populations, and for control in Yap and Chuuk



*Spathodea campanulata*  
Photo: Warren L. Wagner

### Molucca Albizia (*Falcataria moluccana*)

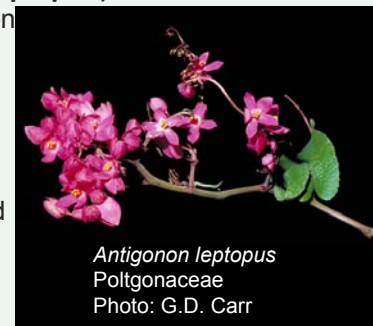
- ▶ Native to Western Pacific
- ▶ Nitrogen fixer and widely planted for reforestation and landscaping
- ▶ Rapid growth to 15 ft per year, spreading into forests
- ▶ Target for eradication in American Samoa; more than 1800 mature trees have been controlled to date by the National Park



*Falcataria moluccana*  
Photo: Forrest and Kim Starr, USGS

### 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, Tinian, Yap, Pohnpei and Palau



*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 eradication on Marshall Islands and Yap
- ▶ Biocontrol Programs ongoing in Pohnpei, 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



*Chromolaena odorata*  
Photo: Nancy VanderVelde



Damage of Siam weed caused by the gall fly, *Cecidochares connexa*  
Photo: Konrad Englberger, SPC



Damage caused by *Pareuchaeta pseudoinsulata*.  
Photo: Australian Government

## Koster's Curse (*Clidemia hirta*)

- ▶ Native to Central and South America
- ▶ Aggressive invader; shades out vegetation
- ▶ Readily dispersed by frugivorous birds
- ▶ Spread is limited on Palau and American Samoa by the earlier introduction of a thrips, *Leothrips urichi* which kills shoot terminals. Additional agents would be useful in furthering control in shaded areas where *L. urichi* is less effective.



*Clidemia hirta*  
Photo: Forrest and Kim Starr, USGS

## 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
- ▶ Target for eradication on Pohnpei
- ▶ Biocontrol programs in Guam and Saipan
- ▶ Continued release of 2 weevils: *Acythopeus cocciniae*, a leaf miner and *A. burkhartorum*, a leaf feeder (adult) and gall former (larvae).



*Coccinia grandis*  
Photo: Forrest and Kim Starr, USGS



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



Adult *A. cocciniae*  
Photo: Forrest and Kim Starr, USGS



Larval mines caused by *A. cocciniae*  
Photo: Forrest and Kim Starr, USGS

## Erythrina Gall Wasp

*Quadristichus erythrinae*, continues to spread in the Pacific where it has severely impacted native endemic and ornamental Erythrina trees in Hawaii since its discovery in April of 2005. In 2006, it spread from Guam to Saipan and from the island of Tutuila to the remainder of American Samoa. Systematic surveys are planned for Tinian and Rota and continue in American Samoa in 2007. It currently infests *Erythrina variegata* and *E. subumbrans*. It has not yet been found on *E. fusca*. There are no endemic *Erythrina* species in American Samoa, Guam, or Saipan. *E. fusca* and *E. variegata* are native to American Samoa and there is interest there in the ongoing biological control work in Hawaii



*Quadristichus erythrinae*  
Photo: Ron Heu – Hawaii Department of Agriculture

## 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 continued to spread throughout the island and it now occurs in all of Guam's limestone and riparian forests as well as on ornamental cycads. 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 where distributed but natural dispersal is limited. Predation rates are high, ranging from 80 – 100%, where the beetle is abundant, providing localized control of the scale. A parasitic wasp, *Coccobius fulvus*, was introduced last year, but has yet to establish.



*Aulocapsis yasumatsui*  
Photo: Holly Glenn, University of Florida



Parasitic wasp, *Coccobius fulvus*

Native cycads are highly susceptible to *A. yasumatsui*. Early cycad mortality was largely of seedling and juvenile cycads. Recent deaths have included more mature plants. 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 last 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. The spread of this butterfly throughout Guam has been rapid and currently no area is safe from this cycad-specific pest.



*Chilades pandava*

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

Although scale populations have fallen in 2006, and *Pulvinaria* is at low densities in most areas, tree mortality continues to be significant. *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 but the mechanism of decline and death is likely complex. Similar dieoffs have occurred recently within the range of *Pisonia*. An integrated plan for scale control continues with systemic insecticide treatments in remaining patches of high scale density, a quarantine to prevent inter-island spread, and a plan for introduction of the lady bird beetle (*Cryptolaemus montrouzieri*) when overall scale densities increase. Two species of parasitoid wasps (*Coccophagus ceroplastae*, and *Metaphycus luteolus*) are present but are not affecting scale mortality.



*Pulvinaria urbicola*  
Photo: US Fish and Wildlife Service

The trigger for the outbreak of scale and ants on *Pisonia* is unknown. Information is critically needed on interactions between obligate ectomycorrhizae and nutrient cycling and changes in water quality and availability as possible triggers for plant stress and subsequent scale outbreaks.

## Data Sources

The data sources used for this report include data gathered by island Invasive Species Committees,, the Territorial Foresters of the US–affiliated islands (funded in part by Forest Service’s Forest Health Programs), the US Forest Service’s ,Forest Inventory and Analysis Program, the US Fish and Wildlife Service, the National Park Service, Secretariat of the Pacific Community, American Samoa Community College, and the University of Guam. The USDA Forest Service’s Forest Health Aerial Survey Program is not currently active in the Islands.

## 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/>

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