PACIFIC ISLANDS
APRIL 2011

Forest Health *2010 highlights*

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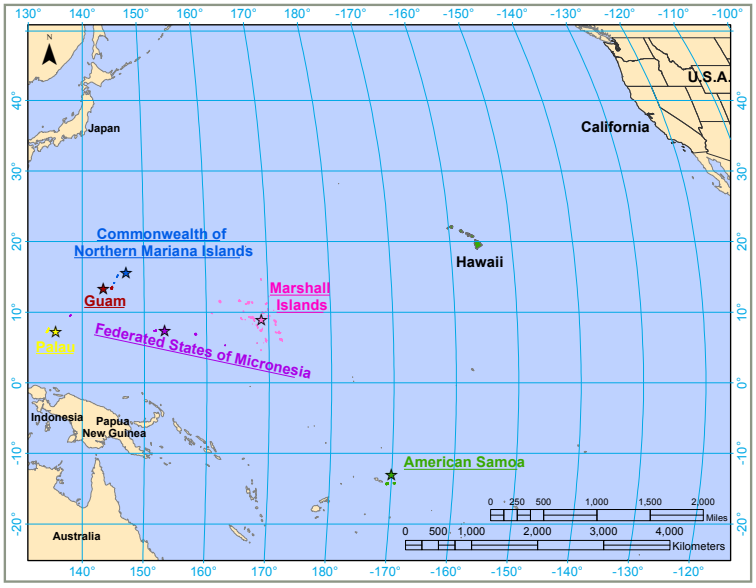
Forest Resource Summary

The US-affiliated Islands of the western Pacific cover an area larger than the continental United States, with a total land mass of 965 square miles. 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 Mariana Islands (CNMI). Approximately 325,000 acres are forested.



Location of the U.S. Affiliated Pacific Islands

Forests in the Pacific are host to a variety of pests and pathogens and are subject to natural and human-caused disturbances which adversely affect forest health. Forest health issues vary widely among islands and most pest issues result from the multiple pathways for introduction due to the prevalence of travel and trade throughout the Pacific.

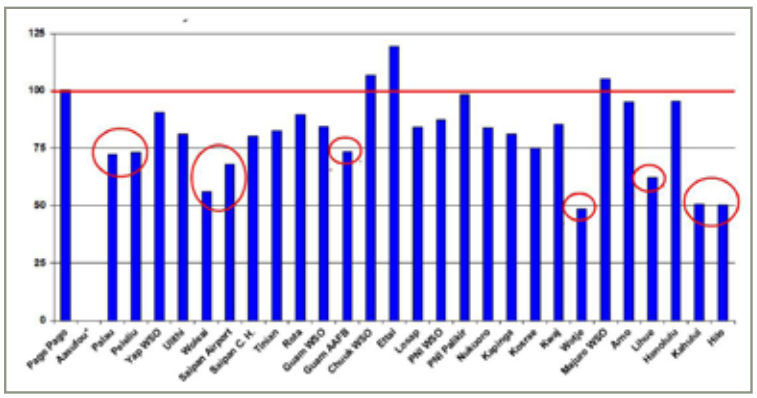
Invasive plants remain one of the greatest forest health issues on the islands, all of which have active invasive plant survey and control programs. Invasive insect introductions are becoming more frequent increasing the need for early detection and control tools.

Abiotic Conditions

El Niño/Southern Oscillation (ENSO)

Climate and sea level in Micronesia are strongly influenced by the El Niño/Southern Oscillation (ENSO). El Niño conditions matured during the first few months of 2010, and by the end of June 2010, the Pacific Basin entered a La Niña. The climate state of the Pacific Basin progressed to moderate to strong La Niña conditions from August through the end of the year. Examples of moderate to strong La Nina conditions include very strong and persistent easterly surface winds and a westward displacement of tropical cyclone activity. There was a deep collapse in the number of tropical cyclones in the Pacific Basin during 2010, however American Samoa experienced tropical cyclone Wilma. Wilma's intensity was not extreme and registered somewhere at or just below minimal hurricane intensity.

Rainfall for 2010 ended at near average for American Samoa, Yap and Chuuk. All other islands including Kosrae, Pohnpei, CNMI, Guam, the Republic of Palau and the Republic of the Marshall Islands had rainfall in most months of 2010 below normal. Despite the shortfall there was generally enough rainfall to ensure adequate water supplies throughout most of the islands. Current ENSO model forecasts La Niña to persist through spring 2011 at a lesser intensity.



2010 Rainfall totals in inches and anomalies (expressed as % of normal). The red solid line indicates normal rainfall (100%) and circles indicate rainfall less than 75% of normal. Source: Pacific ENSO Update, 1st quarter 2011, Vol. 17 No. 1
http://www.prh.noaa.gov/peac/peu/2011_1st/PEU_v17_n1.pdf

The Pacific islands list more than 300 naturalized plant species that may be causing harm. Invasive weeds quickly invade openings created by natural and human–caused forest disturbances, and some plants are able to spread into and through intact forests. Pacific islanders have recognized the serious threat and the need for action by organizing into island, national and regional invasive species groups, most of which have strategic plans in place. Priority species are controlled through mechanical, chemical, and biological methods.

The completion of the 2008 Farm Bill mandated Statewide Assessment and Resource Strategy (SWARS) documents by all island states is an important document for identifying priority landscapes and issues. The documents throughout the islands highlighted the need to develop GIS-based inventories of invasive plant species, Most of the work was underway on most islands in 2010.

Falcataria moluccana (a.k.a. 'albizia' in Hawaii and 'tamaligi' in American Samoa) is an exotic nitrogen-fixing tree that has invaded native forests throughout the Pacific and is among the fastest growing trees in the world. Throughout the early 20th century this tree was introduced to Hawaii, American Samoa, Palau, and numerous other Pacific Island nations. During recent years, research conducted by scientists from the Pacific Southwest Research Station's Institute for Pacific Islands Forestry (IPIF) have demonstrated the deleterious impants of *F. moluccana* on native-dominated forests of Hawaii and American Samoa; it has been shown to displace native Hawaiian and Samoan tree species, alter the intrinsic biogeochemical cycling of these forests, and facilitate the invasion of other exotic species such as strawberry guava (*Psidium cattleianum*). Research has also shown that current management approaches to control *F. moluccana* in American Samoa have resulted in the successful recovery and persistence of the native forest. As an extension of these ongoing research and management programs, and a realization that incipient but expanding populations of *F. moluccana* were present in forests of the Republic of Palau, an effort was conducted during the summer of 2010 in Palau that included outreach and presentations to increase awareness regarding the potential threat posed by the current presence of *F.*

F. moluccana trees invading native forest of Babeldaop Island, Palau.

Palau Forestry staff collecting seedling density data in one of the permanent forest monitoring plots

moluccana in Palau's native forests and to provide the means to control this invasive species. Activities related to outreach included:

- Communicating research findings from Hawaii and American Samoa to land managers and conservation organizations in Palau to increase awareness regarding current knowledge and techniques used in invasive species management;
- Increasing understanding of the impacts of *F. moluccana* invasion and its subsequent removal on the function of native forest ecosystems in Palau;
- Demonstrating various methods that have been successful in Hawaii and American Samoa for controlling *F. moluccana*;
- Educating local land managers regarding proper data collection methods for forest monitoring.

Outreach efforts began in June 2010 and included a series of presentations, hands-on demonstrations, and training seminars to various organizations and agencies. Impacts of *F. moluccana* in native forests, current distribution of albizia in Palau, and the threat it poses if left alone were discussed. Seminars covered successful methods for controlling albizia with hand tools. Long-term demonstration and forest monitoring plots were established in native dominated forests, albizia invaded forests, and stands where albizia would be controlled. Local forestry staff and botanists were also trained on data collection methods, use of geographic positioning systems (GPS) and ArcGIS software, as well as concepts for conducting forest monitoring.

Biological Control of Invasive Plants

Biological agents have long been released for the control of widespread invasive plants in Micronesia. Target plants include:

- *Chromolaena odorata* in Palau, CNMI, Guam and the FSM;
- *Coccinia grandis* and *Lantana camara* in CNMI and Guam; and
- *Mimosa diplotricha* in CNMI, Guam, and FSM.

In 2010, active biocontrol monitoring and releases were

Galls on Chromolaena odorata caused by gall fly insect biocontrol.
Photo: David Bakke

occurring in CNMI on *Lantana camara*, *Coccinia grandis*, *Bidens pilosa*, *Mimosa diplotricha*, and *Chromolaena odorata*; on Guam on *Chromolaena odorata*. Coccinia grandis (scarlet gourd) has been largely controlled in the CNMI.

The Northern Marianas is looking to import a biocontrol to control fruit piercing moth (*Eudocima phalonia*). This moth flies at night and sucks juices out of fruit resulting in ruining the fruit for commercial sale. The larvae feed on leaves on a variety of plants including erythrina and can cause severe defoliation. Importing a biological control agent is an important step to consider in order to save farmers from serious crop loss.

In American Samoa, the Seychelles scale insect (*Icerya seychellarum*) is causing serious damage to breadfruit trees and many other plants on Ofu, Olosega, and Ta'u Islands. A predatory lady beetle, *Rodolia limbata*, was released in 1999 on Ofu. The beetle spread to Olosega and brought the scale under control, however outbreaks continued on Ta'u.

In 2010 an extensive survey of breadfruit trees on the three Manu'a Islands found Seychelles scales had been suppressed to very low levels on Ta'u Island and were present at very low densities on Ofu and Olosega. Breadfruit trees, whose leaves

Breadfruit infested with Seychelles scale insect.
Photo: Mark Schmaedick, ASCC CNR.

Asian citrus psyllid on lime.
Photo: Mark Schmaedick, ASCC CNR

had previously been stunted and coated with black sooty mold growing on the scales' exudate, were once again bright green and producing abundant fruits. Control of the scale by the predatory beetles has allowed plants to recover their aesthetic beauty and ensure they will continue to play an important role in island food security.

Invasive Insects
Asian citrus psyllid:
In 2010, the Asian citrus psyllid (*Diaphorina citri*) was detected in American Samoa. Delimitation surveys revealed that the psyllid was already widespread on Tutuila Island around the territory's main population centers. The Asian citrus psyllid damages citrus trees and some ornamental plants in the citrus family by sucking the plant sap, but its most serious threat is as a carrier of citrus greening, or huanglongbing, disease. Trees infected with citrus greening become unproductive and eventually decline and die. With the establishment of Asian citrus psyllid in American Samoa, it is now important to monitor for citrus greening disease; surveys began in 2010 and will continue into the future. To date, citrus greening disease has not been detected.

Cycad Aulacaspis Scale (CAS) in Micronesia:

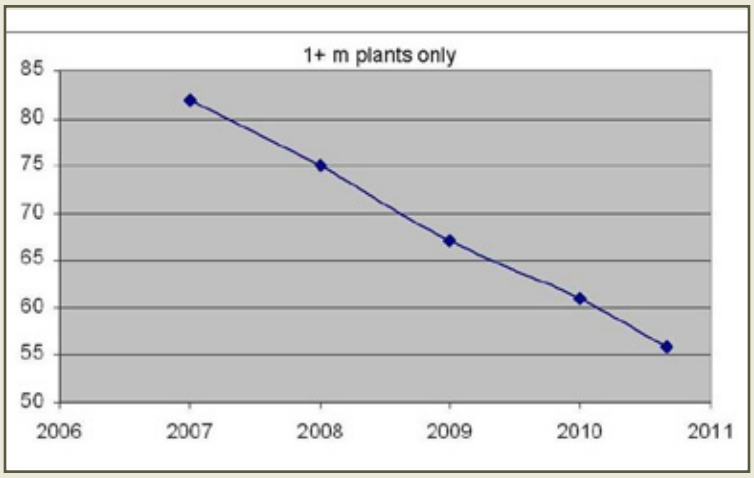
Guam's native cycad, fadang (*Cycas micronesica*), continues to decline from the infestation of the cycad aulacaspis scale (*Aulacaspis yasumatsui*) and other native and introduced pests. The cycad scale is now also found on Rota (Northern Marianas Islands) and Palau, where cycad populations are smaller, scale infestations fewer and effects are less dramatic.

Survival and health of *Cycas micronesica* in Guam and Rota continue to decline as a result of the invasions of *Aulacaspis yasumatsui* and a blue butterfly, *Chilades pandava*. Mortality of seedlings and juveniles was acute initially, and reached 100% during 2009 for Guam. The remaining large trees have been dying steadily for four years, and the negative slope of the survival curve predicts extirpation of this tree by summer 2019. A comparison of survival and health between Guam and Rota forests in the forthcoming years will be of interest. Guam trees are also threatened by a leaf miner, stem borer, and several termites. It is believed that the combination of so many threats

have contributed to the sustained plant mortality. Long-term mortality rates on Rota are predicted to be less severe than on Guam because the list of serious threats is restricted to *Aulacaspis yasumatsui* and *Chilades pandava*.

An initial release of *Rhyzobius lophanthae* to control *Aulacaspis yasumatsui* on Guam in 2005 and Rota in 2007 yielded reasonable control on mature plants and ineffective control on seedlings. Four major factors have been determined to constrain predation efficiency:

1. The predator does not exhibit a preference for male versus female *A. yasumatsui.*
2. The predator preferentially attacks scale on large plants and fails to protect small juveniles and seedlings from scale herbivory.
3. Predation efficiency does not increase above 60% to 70% for some unknown reason.
4. The tiny size of *A. yasumatsui* allows it to establish in various small sites on the surface of *Cycas* organs that are inaccessible to the biological control agent.



Survival of *Cycas micronesica* along one permanent transect located in Ritidian, Guam. T. Marler, ARRA report.

Cycad Stem Borer

A project was initiated in 2010 on Guam to survey for the stem borer, *Dihammus marianarum*, a native borer that is now contributing to cycad decline and death due to the additive stresses caused by Asian cycad scale and blue butterfly larval feeding. The goal of the project was to obtain some adult borers to determine if pheromone compounds could be identified and potentially used as part of an IPM program.

A commercially available ramp trap and three other locally fabricated traps (ground, bucket, and pitfall) were evaluated for monitoring the cycad stem borer. The pheromone lure and ethyl acetate were attached to the ceiling of the trap with a piece of vinyl clad steel wire, and two cut pieces of sugarcane were placed inside the traps. Cycad cut stems (food source for trapped beetles) were placed in the floor of the trap.

Several synthetic pheromone lures were tested for their potential attraction by cycad stem borer. Lures included those commercially available for the banana root borer, *Cosmopolites sordidus*, *Rhabdoscelus obscures* (sugarcane weevil), *Oryctes rhinoceros* (rhinoceros beetle), and *Cylas formicarius*, (sweetpotato weevil). Ramp traps baited with the lures were set up at four locations during July 2010. None of the traps caught any adult cycad stem borers, however, traps with *R. obscurus* lures caught 2 adults of *R. obscurus* at one field site. Other trap types (funnel and panel) and different lures will be tested in the future.

Coconut rhinoceros beetle (CRB)

Monitoring and treatment of CRB has been ongoing since it was first detected on Guam in 2007. Project work includes survey and detection of infested host material via project crews and detector dogs, sanitation of host material, distribution of CRB virus via artificially infected beetles and detection trapping. Infested material is transported to a treatment site within the quarantine boundary for chipping and/or fumigation.

During 2010, CRB escaped from the quarantine zone along the northeast coast of Guam and spread to inland areas where adults have established breeding sites in large compost piles, some of which exceed 200 cubic yards. These piles were infested with large numbers of CRB grubs and will generate large numbers of adults if emergency treatments are not applied in the near future. In addition, a large infestation of CRB was discovered at the northern tip of Guam, at the Guam

Ramp trap baited with pheromone lures of four species.
Photo: Gadi Reddy, University of Guam

Chipping of CRB-infested host material.
Photo: Sheri Smith

National Wildlife Refuge at Ritidian Point. Multiple breeding sites were discovered in a large, abandoned copra plantation. The Refuge is adjacent to Andersen Air Force Base.

An unexpected observation has lead to a better understanding of the biology of CRB on Guam. University of Guam scientists discovered that a significant number of CRB are going through their entire development cycle in the crowns of coconut palms. Immatures are not feeding on live tissue, but on decaying detritus caught between petioles. Arboreal development of CRB has not been reported previously (A. Moore pers. com.).

The Guam experience has shown that it is not easy to eradicate coconut rhinoceros beetle; many of the ports throughout the Pacific Islands are continuing to monitor for this beetle.

Casuarina Dieback on Guam

Casuarina equisetifolia (gago or ironwood) is a hardy, pioneer, salt-resistant tree that occurs on both limestone and volcanic soils. It's ability to fix free nitrogen allows it to thrive on coastal sands where few other plants can survive. Native to the Marianas, including Guam, ironwood is widely used and propagated for windbreaks, reforestation, and erosion protection programs on southern Guam's volcanic soils. Although normally a hardy species, widespread dieback of ironwood is occurring on Guam. By 2005, Ironwood Tree Decline (IWTD) was widespread and based on tree surveys conducted in 2008 and 2009, an estimated 51% of Guam's trees greater than 12.7cm DBH are showing symptoms of decline.

Large ironwood (casuarina) trees showing symptoms of decline on Guam. Photo: Robert Schlub

Complex biotic and abiotic factors are thought to be responsible for the decline. At least five conk-forming fungal species have been identified on Guam's ironwood trees, *Ganoderma* and *Phellinus*, and are most likely playing a role in IWTD. Various modeling techniques applied to Guam's ironwood survey data based on 1427 trees, 44 sites, and 15 variables concluded that the presence of conks, termites, and imporper tree care were significant explanatory variables for the decline.

The decline appears to be distributed randomly across the island and is also reported to exist in pockets on Rota but not Saipan or the Federated States of Micronesia, where casuarina is native.

CNMI: Potentially Destructive Caterpillar Discovered and Eradicated

In Fall 2010, an Environmental Science class from the College of the Marshall Islands discovered a large group of unknown caterpillars feeding on a false elderberry tree while on a field trip near the container yard of a major dock. The students notified Quarantine officers at the Ministry of Resources and Development, who photographed the infestation and circulated the photos to entomologists in the Pacific region. The caterpillars were identifed as in the family of Lasiocampidae (a type of tent moth), a highly destructive type of moth. Quarantine Division and USDA personnel sprayed insecticides multiple times in an effort to eradicate the caterpillars. To date, no adults have been found, and the hope is that establishment, as well as spread to other neighboring islands has been averted.

Caterpillars of the family Lasiocampidae on a false elderberry tree (kaar), near the container yard of a major dock. Photo: H. Capelle

The original egg case or female moth with eggs likely arrived via a container ship. Photo: H. Capelle

Data Sources
The data sources used for this report include data gathered by USDA Forest Service, Pacific Southwest Region, Forest Health Protection staff, 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 (FIA) Program, the US Forest Service's Pacific Southwest Research Station's Institute of Pacific Island Forestry; USDA-APHIS, USDA-NRCS; US-AID; Guam Department of Agriculture, the National Park of American Samoa, New Zealand National Institute of Water and Atmospheric Research, American Samoa Community College.

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For more information visit:
USDA Forest Service, Pacific Southwest Region - http://www.fs.fed.us/r5/spf/fhp/

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