PACIFIC ISLANDS
APRIL 2014

Forest Health *2013 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.

Figure 1. U.S. Affiliated Islands in relation to the United States

Forests in the Pacific are host to a variety of insects 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 multiple pathways for introduction due to the increase in travel and trade throughout the Pacific.

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

Cycad Aulacaspis Scale (CAS)

Aulacaspis yasumatsui invaded Guam in 2003. Since initial detection, the scale has been monitored by Dr. Thomas Marler, University of Guam, in part, with funds from the Cooperative Lands Forest Health Management Program (USDA Forest Service, R5) and the 2009 American Recovery and Reinvestment Act (ARRA). Based on results from the most recent census of permanent plots on Guam, no cycad plant mortality occurred in 2013 and the scale population in Guam forests is at an all-time low. Moreover, many cycad leaves were not infested with any scale insects, and most leaves with scales had extremely low numbers of individuals that did not appear to threaten the health of the trees. This marks the first time since 2005 that no mortality has been recorded after a stable four-year trend that depicted the loss of more than 20 trees per hectare per year. Dr. Marler and his collaborators are still interpreting the new information, but the only observable change in the recent past has been a newly discovered parasitoid of male scale insects. This biocontrol agent may be responsible for the lack of plant mortality, caused by scale infestation and relatively clean cycad leaves.

Coconut Rhinoceros Beetle on Guam

Coconut rhinoceros beetle (CRB), *Oryctes rhinoceros*, was first detected on Guam in September, 2007. It is native to Southeast Asia and now occurs throughout much of the Western Pacific. It is a serious pest of coconut palm, *Cocos nucifera*, but many other hosts are also reported. What was started as an eradication program in 2007 has now transitioned into a management program. Sanitation of infested sites and trees continues, as does further development of integrated pest management tools.

Little fire ant, *Wasmannia auropunctata* on Guam

The little fire ant (LFA), *Wasmannia auropunctata,* was detected on Guam in late 2011 by staff of the Guam Coconut Rhinoceros Beetle Eradication Project as they were being bitten by the ants while unloading plant material at the dump. LFA attend mealybugs, scales and other insects which can protect them from natural enemies and move them from leaf to leaf and plant to plant. This can result in stunting of growth, premature fruit excision, and fruit spoilage. LFA is an arboreal ant species that

loves shade and moisture; walking through the forest, enjoying outdoor activities and gardening is almost impossible in infested areas. Currently LFA continues to spread on Guam and no treatments are occurring. Attempts are being made to secure support for LFA work on Guam.

Ant taxonomy training continues to be provided through a Forest Service, State and Private Forestry Competitive grant, by staff from the Hawaii Ant laboratory. A week long training in Palau occurred in May 2013, facilitated by the coordinator of Palau's National Invasive Species Committee. The training has enabled for on-site ant identification in Palau; no new ant introductions were detected in Palau in 2013.

Whiteflies in Micronesia

Whiteflies have been causing problems on the islands of the Federated States of Micronesia for several years (see PestNet summaries at www.pestnet.org). Efforts were made in 2013 to have whiteflies from Kosrae identified by specialists in California. Dr. Gillian Watson, CA Department of Food and Agriculture, recently identified the specimens as *Aleurotrachelus trachoides*. This same species was a big problem on Guam for a few years and then suddenly subsided to the point that it is hard to find; likely being controlled by a biocontrol agent, although this has not been confirmed. Officials on Kosrae are attempting to secure proven biocontrol agents for release.

NEW DETECTIONS

Coconut termites, *Neotermes rainbowi*, were found infesting mature coconut palms at six sites on Kosrae in June 2013. The termite infestations caused weakening and failure of the trees during a wind event. Prior to this discovery in 2013, this termite was only known from atolls and islands in Tuvalu and the Cook Islands. Coconut palm is the predominant host and termite colonies are usually found infesting live trees. Hallows, where wood has been eaten out, are filled with fecal material which is earth-like in appearance, and tunnels are constructed of carton-like material. Although there is little evidence that infestations by this termite affect nut yield of mature trees, structural damage to the trunks makes them susceptible to breakage even at low wind speeds. People on the small islands and atolls in the Pacific are heavily dependent on coconuts for food, fiber and building materials, thus this termite threatens economic and social stability. (Source: Moore et al. 2013)

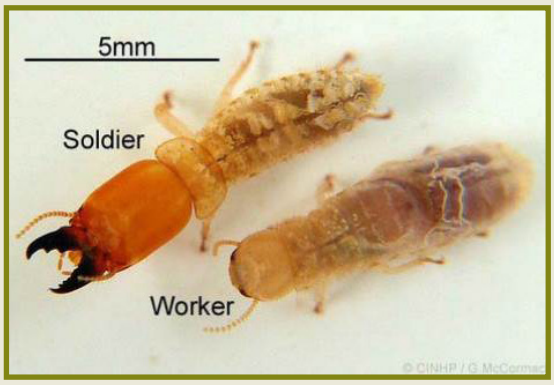

Figure 2. Soldier and worker termites. (Source: G. McCormack)


Figure 3. Net-like grooves and small holes made by *Neotermes rainbowi* on the lower portion of a broken coconut palm trunk. (Source: L. Sigrah)


Figure 4. Trees damaged by termites are susceptible to stem failure, even in light winds. (Source: L. Sigrah)


Figure 5. *N. rainbowi* mature and immature alates (winged). (Source: G. McCormack)

Eggplant mealybug, *Coccidohystrix insolita*, was detected on Guam in December 2013 infesting lower surfaces of eggplant leaves. It is recorded on numerous plants, several of which are important to agriculture and forestry on Guam. Given the broad host range and the lack of known natural enemies on Guam, this species has the potential to become a major pest. A single **spotted cucumber beetle**, *Diabrotica undecimpunctata*, was collected from lettuce growing on Guam in June 2013. It is a major agricultural pest of North America damaging many crops including cucumbers, soybeans, cotton, and many others. Prior to this beetle's discovery on Guam it was confined to North and Central America. It is unknown what agro forestry crops may be affected. A single **brown marmorated stink bug**, *Halyomorpha halys*, was collected on Guam in October 2013. It is a pest of several orchard trees, vine and row crops, and landscape plants in its native range. In cold climates it overwinters in protected areas or inside structures, emerging in the spring. In the warm, low elevations of the Pacific Islands, these insects may remain active year- round. More information on these new pests can be found at http://guaminsects.net/anr/content/guam-new-invasive-species-alerts.

Figure 6. Mangrove uprooted by Typhoon Sudal on Yap. (Source: M. Falanruw)

Forest Pathology in the Pacific

In 2013 there were some major advances in understanding some of the main forest pathology problems that are having an impact in Yap, Palau, Guam, Saipan, Pohnpei and Kosrae.

In Yap, some studies were done to determine why some large patches of mangrove forests had, according to recent satellite images, disappeared. Several possible causes were considered. Typhoon Sudal, whose powerful winds and enormous waves had wracked the southeastern side of this island nine years earlier, emerged as the major cause of this particularly large loss. On the islands of Palau, Pohnpei, and Kosrae there had been no recent typhoons but there were still less-extensive mangrove losses due other factors: 1) to the girdling of trees to allow boat passage; 2) to an undercutting of root systems of trees on the coastlines by ocean waves and rising sea levels; 3) by illicit harvesting of mangrove trees for timber; and 4) in old mangrove forests, by an abundance of butt rots.

In Figure 7, the mangrove forests of Yap are indicated by green in this transformed satellite image taken in 2012. The red areas show the places in these mangroves where trees had largely disappeared since a similar image was taken in 2006. The greatest amount of damage is shown in the SE coast of Yap and in particular on the Island of Yinuf Mn, shown in the NE corner of the inset image. In Figure 6, bowled over relic mangrove trees provide testament to the forces that pounded this area, causing many trees to be thrown over by the wind or the storm surge. Reports indicate that the leaves of many of these trees turned tan soon after Typhoon Sudal passed through. It appeared that the exposed root systems have also become progressively more affected by brown cubical rot.

Butt rotting fungi are common in many older trees in the Pacific. Towards getting a much better understanding of the organisms involved, a small international team of forest pathologists set out to study these fungi in 2013. Two of these pathologists came from Japan, two from the US Forest Service and there were one each from Guam and Korea. A total of 73 different fungal collections were made in the forests of Yap, Palau, Guam, Saipan, Pohnpei and Kosrae. Mostly the samples collected consisted of fungal sporophores or infected wood. Isolations of these samples were then made onto selective media and then sent to laboratories in the US and Japan for identification using molecular genetic techniques.

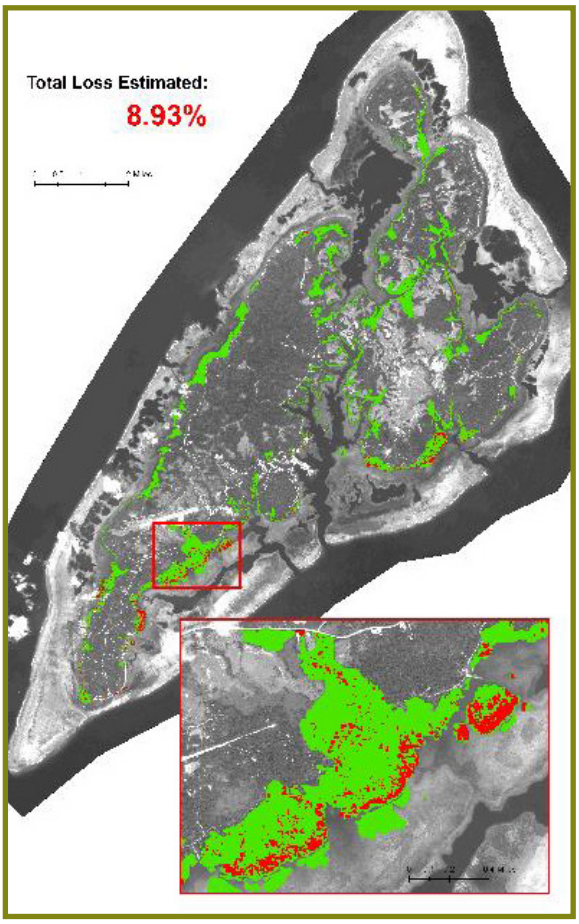

Figure 7. Change in mangrove coverage between 2006 and 2012. (Source: Z. Liu)

Figure 8. The mucilaginous mycelial crust of the aggressive *Phellinus noxius* fungus attacking a breadfruit tree (*Artocarpus altilis*) on Pohnpei. (Source: P. Cannon)

By far the most aggressive butt rotting fungus that was observed on this trip was *Phellinus noxius*. This is a newly-arrived fungus for all of the islands in this part of the Pacific which apparently was introduced after World War II. In areas of Indonesia and Malaysia, where it has a much longer history and may be native, *Phellinus noxius* has shown that it is capable of killing well over 150 of the most common tree species and causing high levels of forest destruction.

On a few of the islands (Palau, Yap and Guam), only a few trees have been killed by this fungus. However, on three other islands (Pohnpei, Saipan and Kosrae) several small patches were found each having 5 to 30 trees that had already been killed by this fungus. Local forestry personnel were trained to identify this fungus and more extensive surveys for this fungus are planned.

Figure 9. This conk of *Phellinus noxius* was found on Saipan, but are rare in Micronesia. (Source: N Klopfenstein)

Invasive Plants

Pulu Mamoe in American Samoa

In American Samoa, the Forest Health staff is continuing control work on *Castilla elastica*, known as pulu mamoe in American Samoa (also known as Panama rubber tree) in the village of Maloata. This species, native to Central America, was first introduced into Samoa and American Samoa in the 1920's, probably as an experimental source for rubber. The mature trees are still occasionally tapped for the sap, which is used to produce rubber cricket balls, among other products. In American Samoa, on the island of Tutuila, it is concentrated in the area of Maloata. In 2013 approximately 13 acres of *Castilla elastica* saplings and trees were treated using glyphosate herbicide. The American Samoa Forest Health staff has written a preliminary management plan for the site, which includes the testing of several herbicide treatments, and a plan for managing multiple invasive plants in Maloata (not just *Castilla elastica*). Results of some of these treatment tests should be available in 2014. The Maloata area will serve as a learning center for the management of *Castilla elastica*, including seed bank longevity and seed dispersal mechanisms.

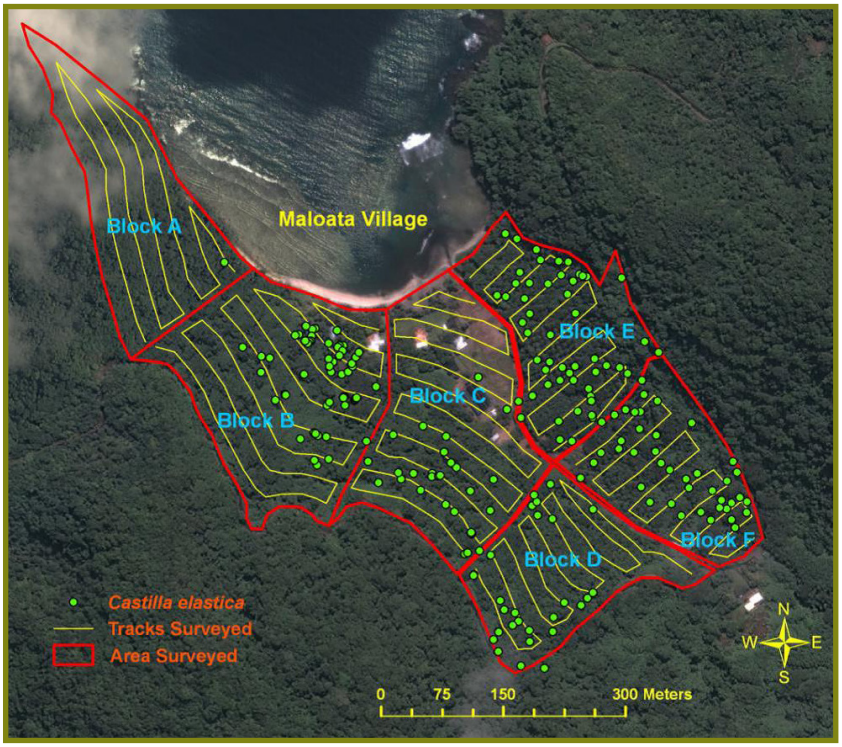

Figure 10. Google earth image with a survey map of the rubber tree in the Maloata area. (Source:)

Figure 11. American Samoa Forest Health staff person applying glyphosate herbicide to a mature tree after creating a girdle with his hatchet completely around the tree. (Source: D. Bakke)

Figure 12. *Mucuna pruriens* fruit. (Source: S. Zona)

Figure 13. Example of denseness of imperata grass if left untreated. Fire can easily burn through this grass. Dave Bakke in photo. (Source: D. Nelson)

Figure 14. Spegazzinii on *Mikania micrantha* vine. (Source: Secretariat of the Pacific Community)

***Mucuna Pruriens* in CNMI**

A new issue came up in the Commonwealth of the Northern Marianas Islands (CNMI) with the invasive plant *Mucuna pruriens* (itchweed, Bengal bean). Residents on Saipan have complained about this plant, which has spread in several villages and represents a health risk. In some cases, kids were taken to the hospital to seek medical attention due to a rash caused by the plant's hair lining around the seedpods and the small spicules on the leaves. The vine has now covered more than 12 acres of private and public land. No direct control has been initiated at this point, except perhaps by individual landowners. Some of the infested areas in one village were burned and the vine seems to be temporarily suppressed. The burned area is currently being overtaken by other weed and vine species such as mile-a-minute (*Mikania micrantha*), elephant grass (*Pennisetum purpureum*), and chain-of-love (*Antigonon leptopis*). *Mucuna pruriens* has only been reported from Saipan, not from Rota or Tinian. A plan is being developed to use volunteers to physically remove this invasive plant.

Imperata (Cogon) Grass on Yap, FSM and in Palau

Yap State in the Federated States of Micronesia continues towards their goal of eradication of *Imperata cylindrica* (imperata grass or cogon grass) which is an invasive species that can greatly affect the ecosystems it is found in by creating a continuous bed of flashy fuels that can easily carry wildfires in ecosystems not adapted to fire. Palau also continues to work towards eradication of this same species.

Biocontrols in the Pacific

There are exciting developments in biocontrols that will have an impact on some especially problematic invasive plants in the Pacific. Work began in late 2013 in New Zealand focusing on identifying new biocontrol organisms for *Spathodea campanulata* (African tulip tree) an invasive tree that is a problem throughout the Pacific, and is very extensive within the state of Hawaii. A rust (*Puccinia spegazzinii*) has been identified for the control of the smothering vine *Mikania micrantha* and this rust has been released in Fiji and Papua New Guinea. Funding was obtained in New Zealand to begin looking at the genetics of *Merremia peltata*, another smothering invasive vine that is a problem throughout the Pacific. This genetic work will determine whether (and where) merremia may be native in the western Pacific; a necessary first step towards developing and distributing biocontrols for that species.

CNMI Forestry staff monitored areas of forest and brushland to determine the presence of the ivy gourd (*Coccinia grandis*) biological control insect *Acythopeus coccinea*, known as the leaf-mining weevil and the impacts it is having on ivy gourd. The leaf-mining weevil appears to be successful and is currently thriving throughout Saipan and Rota. Unfortunately, the scarlet gourd remains resilient and continues to thrive as well. There are areas that have significant decreases in the number of gourds (fruiting bodies) due to a high increase in the number of weevils.

Mangrove Monitoring in Micronesia

Richard A. MacKenzie, Pacific Southwest Research Station, continues to study the effects of sea level rise (SLR) on Micronesian mangroves. Mangroves are important ecosystems of tropical coastal zones, providing a variety of ecosystem services such as sources of food, wood, and protection from extreme weather events. They are also important for carbon storage. Working with crews in Palau, they have installed nearly 100 permanent monitoring plots that will be used to document how forest stand structure and above and belowground carbon pools will change over time. At a subset of these plots, we have also installed rod surface elevation tables (rSETS) that measure how fast mangrove forests floors are rising relative to sea level rise as well as how fast belowground carbon pools are accumulating. Similar rSET plots have been installed in Kosrae and are being measured by Kosrae Island Resource Management Authority (KIRMA). They are planning to measure forest stand structure and above and below ground carbon pools at the Kosrae sites in the near future. They are also planning on reinstating rSETS that have been installed in Pohnpei as well as measuring stand structure and carbon pools. These mangrove monitoring plots will help: 1) identify productive mangroves keeping up with or exceeding SLR and that should be prioritized for conservation, 2) identify less productive mangroves that are not keeping up with SLR and that require a more active management plan, and 3) to more accurately model impacts of SLR to inform coastal management plans or strategic plans to adapt or respond to climate change. This information can also be used as part of the Micronesian Challenge mangrove monitoring protocol.

Figure 15. Omekrael Sadang reads a rod surface elevation table in Palau, 2013. (Source: R. MacKenzie)

Guam's Micronesia Challenge Terrestrial Monitoring Program Overview

"The Micronesia Challenge is a commitment by the Federated States of Micronesia, the Republic of the Marshall Islands, the Republic of Palau, Guam, and the Commonwealth of the Northern Marianas Islands to preserve the natural resources that are crucial to the survival of Pacific traditions, cultures and livelihoods. The overall goal of the challenge is to effectively conserve at least 30% of the near-shore marine resources and 20% of the terrestrial resources across Micronesia by 2020." http://themicronesiachallenge.blogspot.com/p/about.html

The terrestrial monitoring program of the Micronesia Challenge is focusing on collecting baseline forest monitoring assessments across participating Islands. These assessments will monitor selected indicators to detect changes in biodiversity. Indicators include native forest cover, species diversity, abundance, forest structure, human disturbance, bird diversity

Figure 16. Installing plots for the Micronesia Challenge Terrestrial Monitoring Program, Guam 2013. (Source: A. Lehman)

and invasive species. The Micronesia Challenge's Terrestrial Monitoring Program has proposed to install additional FIA permanent plots to gather baseline data on selected indicators in targeted native forest conservation sites across participating islands. Using the FIA sampling design and protocols, strengthens the ability to extrapolate results of intensive research to the broader network of inventory plots. Guam was the initial pilot in this collaborative effort to add supplemental FIA plots.

Figure 17. Micronesia Challenge Terrestrial Monitoring Program participants, Guam 2013. (Source: A Lehman)

In the fall of 2013, three entities of the US Forest Service partnered together to fund Guam's Micronesia Challenge's Terrestrial monitoring program: Institute for Pacific Island Forestry (IPIF), Region 5's Forest Health Protection Program (FHP), and the Pacific Northwest (PNW) Research Station's Forest Inventory and Analysis (FIA) Program. The funding provided for the data collection for 60 new monitoring plots by a hired crew though the University of Guam. The Pacific Northwest Research Station's (PNWRS) Forest Inventory program agreed to overseeing the agreement and working with the personnel at the University of Guam to hire and train the staff for the project. The University of Guam crew installed 32 plots through December 2013.

Data Sources
The data sources used for this report include data gathered by USDA Forest Service, Pacific Southwest Region, Forest Health Protection staff and the Territorial Foresters of the US–affiliated islands (funded in part by Forest Service's Forest Health Programs).

The USDA Forest Service's Forest Health Aerial Survey Program is not currently active in the Islands.

For more information visit:
USDA Forest Service, Pacific Southwest Region - www.fs.usda.gov/main/r5/forest-grasslandhealth

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USDA United States Department of Agriculture