PACIFIC ISLANDS

APRIL 2013

Forest Health 2012 highlights

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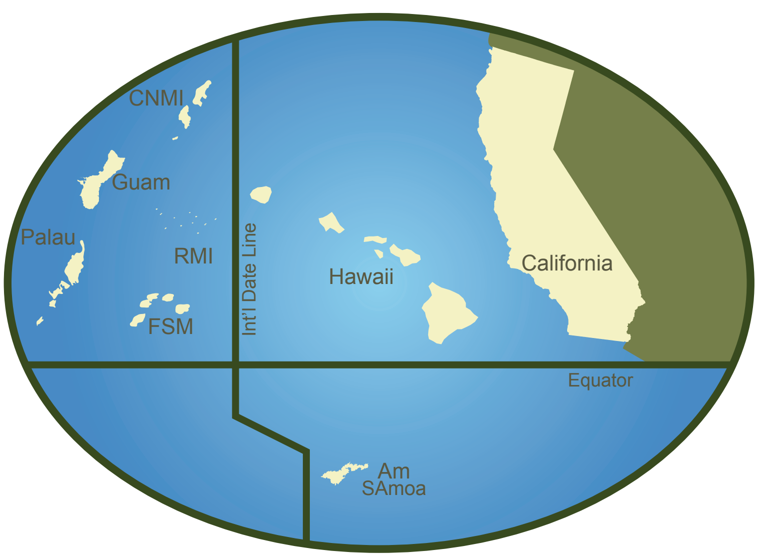
Forest Resource Summary

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.



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, 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.

Cycad Aulacaspis Scale (CAS)

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 surveys, all seedlings within his transects were killed within 9 months after the initial infestation, the absence of seedling and juvenile plants persists to date and mature plants have experienced 73% mortality. Survey results predict imminent population decline and potential extinction by 2020. Other pests adding to the decline include *Chilades pandava* and *Erechthias* sp. infestations. The combination of these three alien arthropod pests, all of which are very recent unintentional introductions on Guam, does not allow *C. micronesica* plants the time to adequately recover carbon from the naturally long-lived leaves following initial leaf construction (Marler and Lawrence 2012).

CAS invaded Rota in 2007 and the plant injury following this invasion appears to greatly exceed that following Guam's 2003 invasion. For example, 85% mortality was recorded after only two years of CAS-caused injury, and 94% mortality was recorded after four years (Figure 1). Prior to the invasion, 68% of the Rota populations were seedlings (Figure 2), while less than 20% of the Guam populations were seedlings. Following

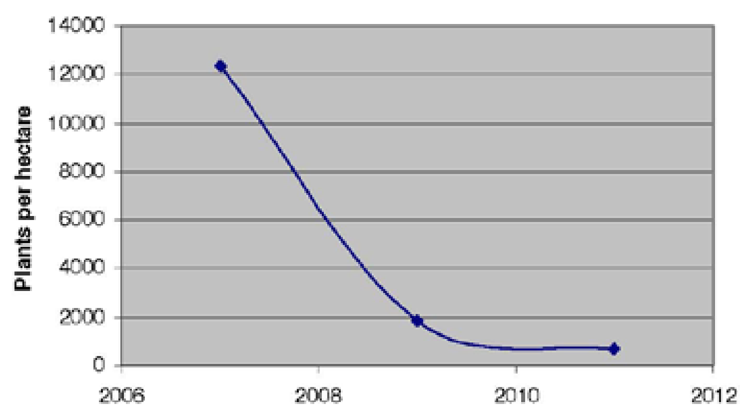


Fig 1. Population density of Cycas micronesica plants on Rota Island from 2007-2011 (Source: Marler 2012 ARRA report).

both invasions, 100% of the seedlings were killed in less than one year. Therefore, based on the total number of plants, a greater percentage of the initial Rota plant population was killed by the scale invasion. Following the initial wave of seedling death, the ongoing rate of plant mortality on Rota appears to be similar to what happened on Guam. The juvenile plants less than 100 cm in height are dying more quickly than the mature plants greater than 100 cm in height. This is shown in Figure 2 where the juvenile plant category accounted for 67% of the total remaining live plants after two years of infestation, but accounted for only 45% of the remaining live plants after four years.

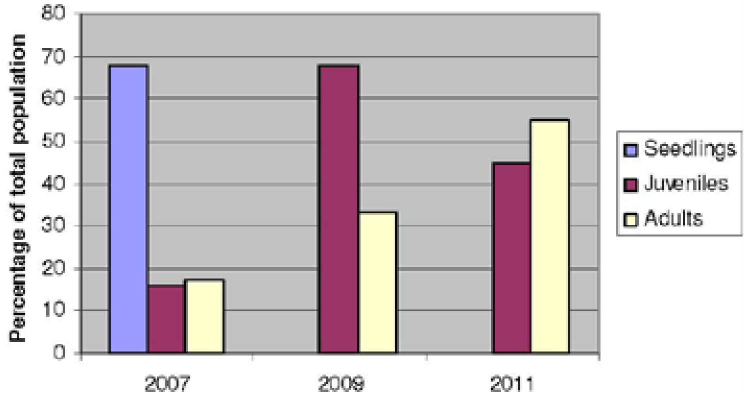


Figure 2. The seedling, juvenile, and adult classifications of surviving *Cycas micronesica* plants on Rota Island. The 2007 data represent the populations before *A. yasumatsui* invasion. (Source: Marler 2012 ARRA report)

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*, betelnut, *Areca catechu*, and *Pandanus* species. During 2012 there were 987 pheromone traps distributed throughout the island. The US Navy provided personnel for trapping on the Naval Base. As of December 2012 over 6,000 beetles were trapped. The infestation has spread to most parts of the island. The project's sanitation crew (Figure 3) found and destroyed 1,492 adult beetles and 11,087 larvae (Figure 4). Sixty dead or dying coconut palms were felled and destroyed to prevent them from becoming breading sites. The projects rearing facility is operating well and is keeping up with demands for experimental beetles. Live beetles are shipped to collaborators in Hawaii once per month following protocols specified by APHIS. Freshly trapped male adult beetles are currently being used for autodissemination of *Metarhizium* spores (biological control agent).

Figure 3. Supervisory staff and crew working to eradicate coconut rhinoceros beetle on Guam.

Figure 4. Coconut rhinoceros beetle larvae (3rd instar larvae are ~3 inches in length).

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 (orange circle, Figure 5). 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 are almost impossible in infested areas. Currently no treatments are occurring to combat LFA and multiple additional infested sites were found in 2012.

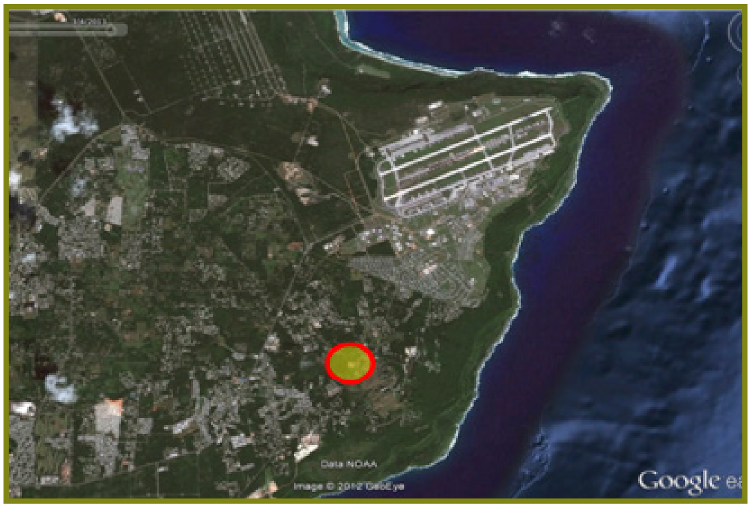


Figure 5. Dump site on Guam where little fire ant was detected in 2011 (orange circle).

Disease Highlights on Guam

In Guam there are two forest projects being advanced in collaboration with Dr. Robert Schlub at the University of Guam. One of these has to do with using molecular genetics to identify root rotting organisms that are contributing to the death of *Casuarina* and other forest trees that have been dying in higher than usual numbers over the past decade. Many of these trees appear to have suffered wind damage during the last big typhoon. The species which are most commonly found belong to the genus *Ganoderma*.

In a separate, but related study, a provenance/progeny test was begun with 35 different seedlots of Casuarina which had been collected from major Casuarina forest areas around the world. The purposes of this test are two-fold: 1) to determine if there are seedlots that are capable of excellent growth in Guam; and 2) to find out if there are sources of Casuarina which are exceptionally resistant to wind damage.

Plant Extinction Program

The Guam Plant Extinction Program is an island-wide program dedicated to preventing the extinction of Guam's rarest plant species that have fewer than 200 individuals remaining in the wild. Multiple partners are involved including the Forest Service. Partners and on-site resource managers are working together to protect wild populations, preserve genes, and reintroduce plants into their natural habitat. There are currently nine high priority plant species; one of which is *Serianthes nelsonii*. Guam's *S. nelsonii* population consists of one remaining tree in the wild, seedlings are being grown in the Guam State Foresty nursery (Figure 6). Most of Guam's main tree species have been greatly impacted by development, invasive species, arson fires, and extreme weather events.

Figure 6. *Serianthes nelsonii* seedlings in the Guam State Forestry nursery.

FSM Vegetation Survey

Following the 2009 National Tidal Surge State of Emergency which catalyzed the National Preliminary Disaster Assessment for the four Federated States of Micronesia (FSM) States, food security was prioritized for the low-lying islands and prompted a need to conduct an integrated rapid assessment to ascertain the vulnerability indicators to climatic changes and adaptation options for the Food Security Sector on the atolls of the FSM. Secretariat of the Pacific Community, Land Resources Division, through the Forests & Trees Team, conducted the vulnerability assessment on 14 atoll islands in the states of Pohnpei, Chuuk and Yap in 2012 (Figure 7). Marisini Semiloli reported on the results of vegetation/ agro-forestry portion of the survey (Figure 8) at the recent Pacific Islands Committee meeting on Guam.

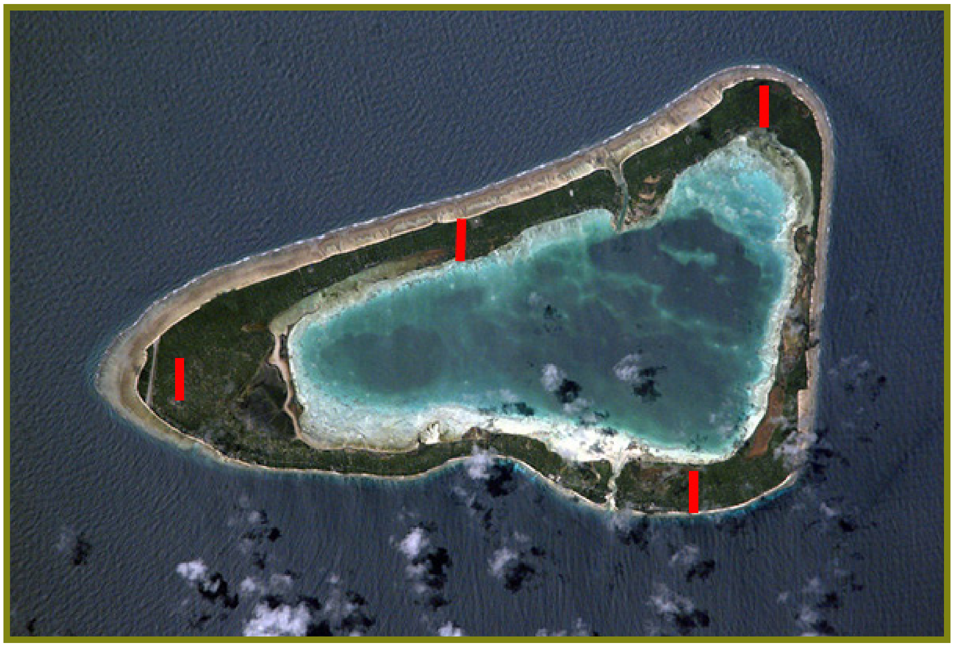


Figure 7. Typical FSM atoll plot layout.

The dominant species in herbaceous strand are herbaceous creeping vines like *Ipomoea pes-carprae* (beach morning-glory), *Vigna marina* (beach pea), *Canavalia rosea* and grasses like *Thuarea involuta* and *Lepturus repens*. *Scaevola taccada* and *Wollastonia biflora* are the two most characteristic species of littoral shrubland. *Pandanus* scrub is a scrubby vegetation dominated by *Pandanus tectorius* typically occurring on rocky shores. Littoral forest is the most common and characteristic type of vegetation occurring on tropical shores. It consists of dense forest and is often dominated by a single tree species. The most characteristic trees are *Barringtonia asiatica*, *Pisonia grandis*, *Hernandia nymphaeifolia*, *Casuarina equisetifolia*, *Guettarda speciosa* and *Terminalia* spp. *Rhizophora stylosa* is the most common species in the mangrove forest of the FSM.

Disturbances such as fires, cyclones, tidal waves, livestock, invasive species, and agriculture clearing were noted. Forest cover is basically limited to agro-forestry, coconut forest & plantation, and breadfruit patches within and near the villages. Breadfruit and coconut were in abundance while banana was only found in patches around the villages. Most of the taro patches visited had problems with salination resulting from king tides hitting the islands. Forests and planted trees can help local communities adapt to climate change through livelihood diversification and provision of ecosystems services. However, forest clearing for agriculture, infrastructure development, and village expansion, in addition to fire, coastal erosion, salt water intrusion, loss of biodiversity, invasive species, increased carbon emissions, and extreme weather patterns will continue to affect forest health, resiliency, and sustainability. Management efforts need to focus on maintaining and building a resilient landscape for food and water security, protection of soil, biodiversity, and to endure through adverse weather conditions.

Figure 8. Forest survey crew taking tree measurements.

Mangrove monitoring in Micronesia

Richard A. MacKenzie, Pacific Southwest Research Station, has initiated a project in the mangroves in Micronesia to study the effects of sea level rise (SLR). 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 Palau Forestry, Dr. MacKenzie has installed rod surface elevation tables (rSETs) and other instruments to measure accretion rates in mangroves in the Republic of Palau (Figure 9). He has also begun to remeasure rSETS, with help from the Kosraean state forester, that PSW installed in the Federated States of Micronesia over 10 years ago The objectives of his work are to 1) identify mangroves that are keeping up with or exceeding SLR and that should be prioritized for conservation, 2) identify mangroves that are not keeping up with SLR and that require a more active management plan, and 3) to collect data for more accurate predictions of SLR impacts on mangrove forests to inform coastal management plans or develop strategic plans for more effective adaptation or management in the face of SLR. If mangrove forest floors rise at rates that are equal to or greater than SLR, then mangroves can be maintained. Below ground root growth, healthy sediment and leaf litter inputs contribute to mangrove forest floor rise. If the rate of SLR is greater than the rate at which the mangrove forest floor rises, then some rearrangement of vegetation will take place and ultimately, the loss of mangroves will occur. The forest floor can fall due to deforestation from cutting, altered hydrology, or forest pests, all of which result in the death of trees and the loss of input of belowground roots. Too much sediment or nutrients can also smother roots and trees, also causing their death and loss of inputs of belowground roots. Decreased inputs of sediment to the forest floor can also slow the rate at which the forest floor rises and thus its height relative to SLR.

Figure 9. Installation of rod surface elevation tables in mangrove forests (Source: Richard MacKenzie).

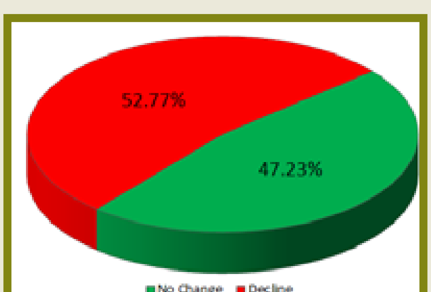
Yap Islands Mangrove Dieback

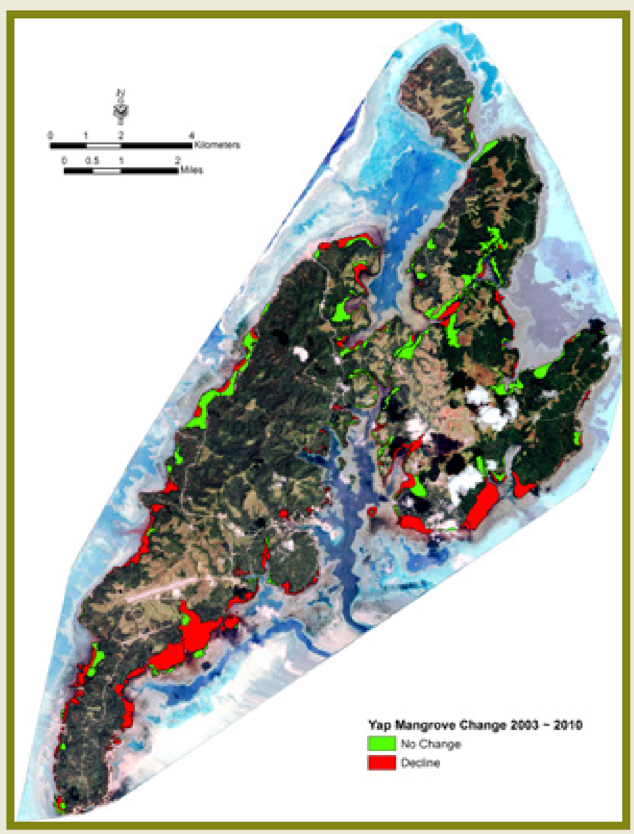
For coastal communities and society as a whole, the mangrove ecosystems provide a wide range of goods and services as sources of food, timber, and protection from extreme events such as tsunamis and cyclones. They also have significant value as global carbon stocks.

When it was brought to our attention that the mangrove forests surrounding the Yap islands in the Federated States of Micronesia might be declining, a quick change detection was conducted by comparing the 0.5-meter resolution WorldView-2 satellite imagery of the Yap islands from 2010 to a set of 1-meter resolution USGS Digital Orthophoto Quadrangle (DOQ) from 2000. All mangrove forests were identified by visual interpretation and labeled into two classes: **Healthy Stands**, and **Stands already Declining or Showing Signs of Stress**.

The result shows that over half of Yap islands' mangrove forests may be under stress and displaying signs of, if not already in, decline (Figures 10a and 10b). Significant patches of mangrove trees have already disappeared. Canopy gaps can be detected in the remaining mangrove forests all around the islands.

Investigations are ongoing to determine the cause of mangrove decline on the Yap islands and to determine how widespread the decline may be on other western Pacific Islands.





Figures 10a & 10b. Yap mangrove changes between 2003 and 2010.

Invasive Plants on the Pacific Islands

Efforts began in 2012 in American Samoa, Palau, FSM, and the Marshall Islands to get a new pesticide registration in place that would be very effective as a tool against albizia (*Falcataria moluccana*). The herbicide is called Milestone, with the active ingredient aminopyralid. The effort began in Hawaii, with the development of a special local needs (SLN) registration for Milestone herbicide that allowed for a much more effective method of using it against albizia; a use that was not on the original product label. This SLN was approved for Hawaii by US EPA in 2012. Subsequent to the approval of the SLN registration in Hawaii, efforts began to get this same use approved for these other islands.

Albizia is an invasive tree that can rapidly dominate an ecosystem. It is a nitrogen fixer that can grow in a variety of soil types and can grow quickly into a dominant overstory tree. A study published in 2012 by Hughes et al.[1] showed a rapid positive response by the native forest vegetation to the removal of albizia in a forest in American Samoa. Within 3 years of the killing of mature albizia trees, the native canopy had recovered sufficiently to shade out the albizia seedlings in the understory.

A pilot project in American Samoa, funded through a grant from the National Association of State Foresters, began in 2012 to utilize satellite imagery and GIS to produce inventory maps of the redbead tree (*Adenanthera pavonina*) on a portion of the main island of Tutuila. This project is intended to determine whether this type of remote sensing can be effective and expanded to other tree-form invasive species and can also be integrated into a more comprehensive inventory strategy for invasive plants that involves a combination of remotely sensed data and ground-based inventory. The map (Figure 13) completed during this pilot showed the promise of this methodology.

[1] Hughes, R.F., A.L. Uowolo, T.P. Togia. 2012. Recovery of native forest after removal of an invasive tree, Falcataria moluccana, in American Samoa. Biological Invasions. (2012) 14:1393-1413.

Figure 11. Branches of Red-Bead Tree (*Adenanthera pavonina*).

Figure 12. Seeds of Red-Bead Tree (*Adenanthera pavonina*)

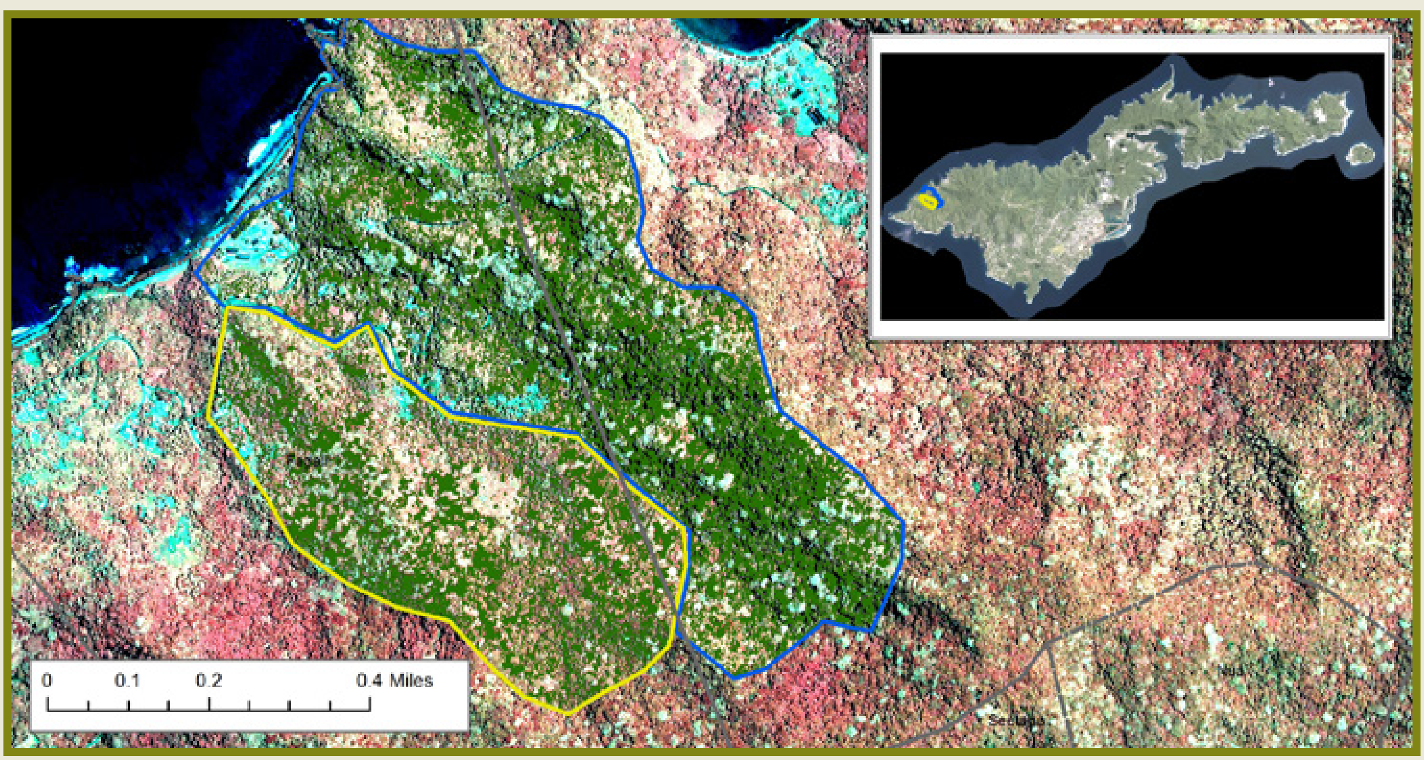


Figure 13. Final map showing all the red- bead trees in the pilot project area.

Commonwealth of the Northern Mariana Islands Forest Health Program

Invasive plant control efforts on Rota are ongoing to combat African tulip, scarlet gourd, lantana, chain-of-love and china berry.

Figure 15. Results of foliar herbicide application to control chain-of love.

Figure 16. Drilling holes in African tulip to inject herbicide.

Figure 14. Saplings of china berry treated with herbicide.

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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