PACIFIC ISLANDS
APRIL 2016

Forest Health *2015 highlights*

VISIT US ON THE WEB: WWW.FS.USDA.GOV/MAIN/R5/FOREST-GRASSLANDHEALTH

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.

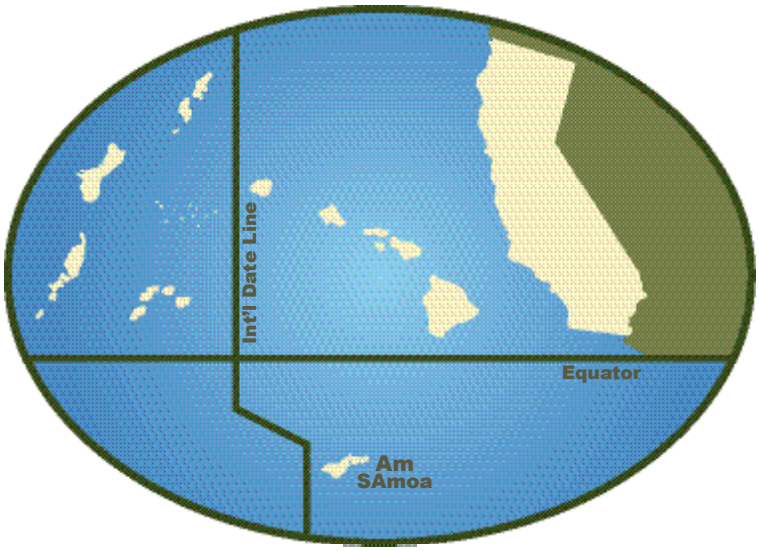

Figure 1. U.S. Affiliated Islands in relation to the United States

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)

Cycad aulacaspis scale (CAS), *Aulacaspis yasumatsui,* invaded Guam in 2003. Since initial detection, the scale, and plant health of the native cycad *Cycas micronesica*, has been monitored by Dr. Thomas Marler, University of Guam (UOG), in part, with funds from the Cooperative Lands Forest Health Management Program (USDA Forest Service, R5). In November 2015 *Cycas micronesica* was added to the Threatened list under the Endangered Species Act.

Dr. Marler's monitoring of cycad populations now includes Guam, Rota, Yap, Tinian and Palau due to continued funding from the Forest Service that supports this critical work. Dr. Marler's monitoring data from 2015 indicates that nine years of consistent mortality have occurred on Guam with loss of about 16 trees per hectare per year. Extrapolating this slope generates a prediction of 100% mortality by 2030 if current rates of tree loss are sustained on Guam; the trend is similar for Rota. Yap cycads remain pest-free, with no signs of any exotic insect pests. Every plot re-measured on Yap in 2015 exhibited extremely high plant density and health. An ex situ collection of Guam genotypes established on Tinian also remains pest-free.

The largest population of *Cycas micronesica* in Palau is on Ngellil Island. The western edge of this population is directly east of where CAS infestations have been sustained for years on planted *Cycas revoluta* plants in commercial landscapes. One meteorological event that shifts wind direction could easily vector CAS crawlers into this wild population. None of the Koror State *Cycas micronesica* populations are exposed to this threat that is caused by geographic proximity. Moreover, one of the popular tourist attractions in Airai State is an abandoned Yap stone money quarry, and the trail that leads to this quarry cuts through this cycad habitat. Any tourist could pick up a CAS crawler as they depart their hotel where the infested *Cycas revoluta* plants are located, then vector that crawler into the native cycad habitat– this would be devasting. Joel Miles, Bureau of Agriculture, Ann Kitalong, Belau National Museum, Princess Blailes, Governor Adachi's office, and the Koror State Rangers were critical to the success of Dr. Marler's exploratory work on Palau. If more funds become available for Palau work, establishing permanent plots within this Ngellil Island habitat is a high priority, as well as determining what insect(s) are the pollinators for the Palau population. The pollinator for Guam and Rota is distinct from the Yap pollinator. There are only two known Lepidoptera cycad pollinators worldwide.

University of Guam entomologist Aubrey Moore continues trying to establish effective biological control agents for CAS in Micronesia. The lady beetle, *Rhizobius lophanthae*, was introduced from Maui and has been established on Guam, Rota and Palau. This predator attacks mature CAS, but it is too large to attack scale insects hiding in many parts of the plant and it does not prey close to the ground, leaving seedlings prone to attack by CAS, resulting in almost 100% mortality. Several attempts at introducing tiny parasitic wasps which might provide more protection than the lady beetle have failed. During 2015, the parasitoid *Coccobius fulvus* was collected from CAS in Florida by Dr. Ron Cave and these were field released on Guam. It is not yet known if these parasitoids became established.

Coconut Rhinoceros Beetle

Coconut rhinoceros beetle (CRB), *Oryctes rhinoceros*, first detected on Guam in 2007 defied containment and eradication efforts. These efforts included the release of the *Oryctes nudivirus* that weakens and kills adults. Later testing showed this virus to be ineffective against the genetically different biotype of CRB (known as CRB-G biotype) on Guam. CRB-G is more vigorous and destructive than the commonly occurring CRB. The Guam biotype was found in Hawaii in 2013. Abundant new breeding sites in the form of decaying vegetation left in the wake of Typhoon Dolphin which passed over Guam in May 2015 has initiated an island-wide CRB-G population explosion. It is feared that this population explosion is self-sustaining, whereby adults kill mature palms, creating even more breeding sites which generate even more adults which kill even more palms. Aubrey Moore, UOG entomologist, and other Pacific entomologists are worried that failure to respond to the CRB-G threat will result in losing 50% or more palms on Guam and other infested islands, and subsequent rapid spread of this pest throughout palm growing areas of the world. The 22 Pacific island countries and territories represented at the Pacific Plant Protection Organization meeting in Fiji during September 2015 approved a resolution requesting assistance from the Pacific Community to help organize and find funding for a regional project to find an effective biological control agent for CRB-G.

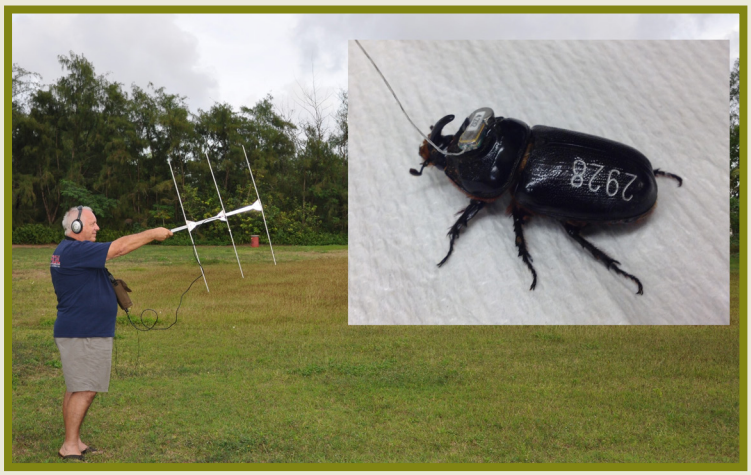

Figure 2. Radio-tracking receiver and coconut rhinoceros beetle with transmitter glued to pronotum.
Source: Dr. Aubrey Moore (in picture), University of Guam

Adult CRB kill palms when they bore into crowns to feed on sap. Rhino beetle larvae feed only on dead plant material at breeding sites and do not damage plants. In order to eradicate rhino beetles, all breeding sites must be found and destroyed. Four dogs were trained to lead handlers to cryptic breeding sites on Guam. This detector dog program was effective but very expensive and it was shut down after a couple of years. Aubrey Moore, UOG entomologist, suggested following radio-tagged rhino beetles to breeding sites as a cost-effective alternative to using detector dogs. In August 2015 this idea was tested in a small feasibility study on Guam, supported by a US Forest Service grant. The research team included Dr. Moore, Dr. Matthew Siderhurst and his students, Kat Lehmann and Diego Barahona from Eastern Mennonite University, VA; Domenick Skabeikis from the USDA Pacific Basin Research Center in Hilo, HI and UOG technician Ian Iriarte. During the 10 day field trial, miniature radio transmitters were glued to the backs of rhino beetles (Figure 2). These beetles were released at the UOG Agricultural Experiment Station in Yigo (Figure 3) and at the Asan Beach Park; their locations were tracked for a few days using special radio receivers equipped with directional antennas. The majority of beetles were tracked to coconut trees which had already been damaged by rhino beetles. A few other beetles quickly

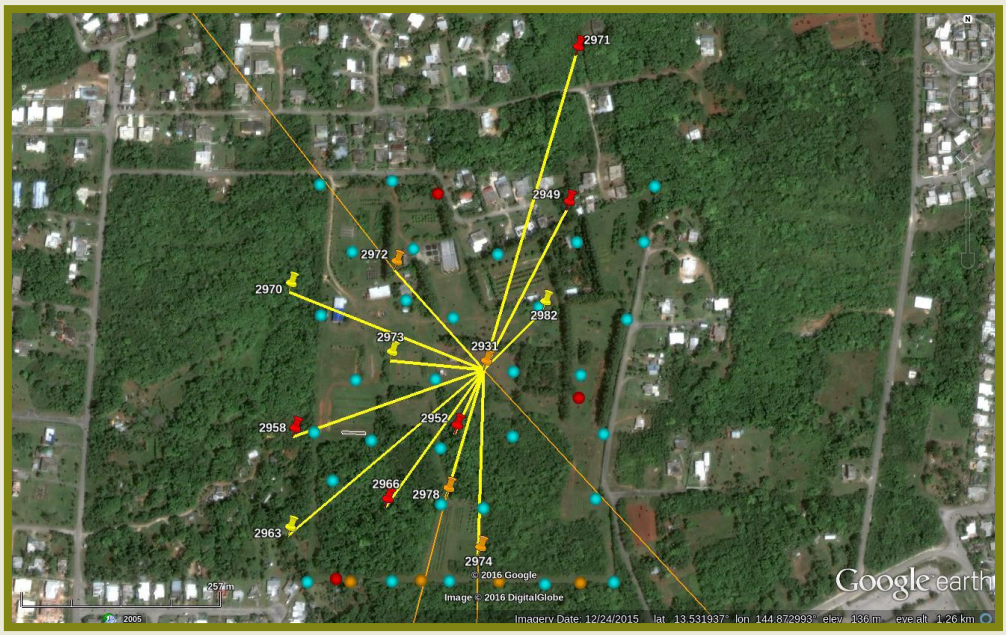

Figure 3. Displacement of radio-tracked beetles at the Yigo release site on Guam. Push pin icons represent end points (red = in tree; yellow = on or below the ground; orange: beetle was lost when it flew beyond the range of radio-tracking receivers. Circles represent pheromone traps. Source: Dr. Aubrey Moore, University of Guam.

flew beyond the detection range of the receivers and were never recovered. As hoped, several beetles led the team to cryptic breeding sites. The transmitter from one of the first beetles to be released was found the next day in a hole in a rotting branch of a breadfruit about 20 feet above the ground. Three other adult beetles were found in the same hole indicating that the beetles had aggregated there to establish a new breeding site. According to Dr. Moore, "it is very likely that the breadfruit branch was broken during Typhoon Dolphin which visited Guam in May 2015". If this is the case, there must be thousands of new, miniature breeding sites in Guam's jungles resulting from typhoon damage. These breeding sites will be generating large numbers of adult rhino beetles within the next several months." Cryptic breeding sites can be found by following radio-tagged beetles; this method may be critical to the success of eradication attempts on newly invaded islands. Another unexpected result from the field trial is that none of the 30 tagged beetles were caught in traps, even though all were released within pheromone trapping grids. This indicates that rhino beetle pheromone traps may be useful for detection and surveillance but are ineffective for population control.

Figure 4. Location (yellow pins) of CRB DeFence traps on Saipan (above) and Tinian (lower).
Source: Dr. Ross Miller, University of Guam

US Forest Service is also supporting CRB detection efforts on Saipan, Tinian and Rota. Typhoon Soudelor struck and severely damaged Saipan in late August 2015, rendering travel there, and to adjacent islands, very difficult. Winds in excess of 120 MPH destroyed or severely damaged all of the CRB traps on Saipan, destroyed office and laboratory facilities used for the CRB detection project, rendered travel within Saipan difficult, and forced airlines to cancel most flights to Tinian and Rota from Saipan until runways could be restored on Saipan. Restoration of most of Saipan's infrastructure took until early December 2015. Following the typhoon, "DeFence" traps, and other trap types, were established and/or repaired on Saipan and Tinian (Figure 4) and Rota. DeFence traps consist of a doubled layer of tekken fish netting with a 1 cm mesh size which is attached to a cyclone fence with plastic ties. A CRB pheromone bait and a solar-powered UV LED are attached to the center of the net. The tekken netting acts similarly to a gill net that entangles the thorax of rhino beetles attracted to the light or pheromone. No CRB detections occurred in 2015.

The little fire ant (LFA)

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. Management of and surveying for LFA on Guam are being supported by the US Forest Service. Several new sites were sampled in 2015 including three sites selected by the Government of Guam to be reception areas for green waste generated throughout Guam by Typhoon Dolphin, which hit in May 2015. These sites were located at the University of Guam's Ija Experiment Station in southern Guam, at Oka Point near Ypao Beach in east-central Guam, and along Wusstig Road in northern Guam. LFA was identified at the Oka Point site and was added as a treatment site. Treatment consists of a granular formulation of Amdro® or the more water-resistant granular formulation of Siesta®, followed a week later by Tango® applied to the upper boles of trees in a gel matrix. A week following the Tango® application delimiting surveys are conducted again. This sequence is repeated every six weeks.

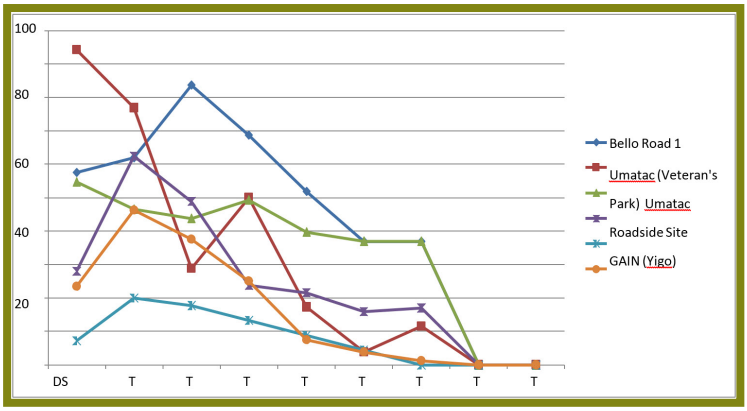

Figure 5. Percentage decrease in the number of baits infested by little fire ant at six treatment sites (X axis = Delimiting Survey and LFA Treatment Episodes, Y axis – Percent Baits with LFA). No little fire ants were detected following the 7th and 8th treatments at any of the sites, and further treatment at all sites was terminated.
Source: Dr. Ross Miller, University of Guam

Sites which had been treated in this manner 8 times as per the University of Hawaii Ant Lab protocol, and in which LFA occurrence in baits fall to 0 (Figures 5 and 6), are removed from treatment, and the property owners/ managers are informed of strategies to keep LFA from re-infesting their property.

Little fire ants are not currently known to be established on Yap. The Yap Invasive Species Task Force has been conducting outreach and education to make people aware of the threat regarding LFA.

Figure 6. Map of the WWII Veteran's Park on Guam showing the results of the initial delimiting survey conducted. Flags in red indicate baits on which LFA were collected; yellow flags indicate sampling sites where no LFA were collected on the baits. No LFA were collected after the 7th treatment episode. Source: Dr. Ross Miller, University of Guam

Recently Arrived Bark Beetles Attacking Guam's Native Trees

In 2011, UOG entomologist, Aubrey Moore, used a coffee berry borer trap baited with ethanol and methanol to survey for bark beetles on Guam. The single trap, placed for two months, caught seven species of bark beetles, 3 of which were new island records. In 2014, US Forest Service funded Ruddy Estoy, Guam Department of Agriculture, Division of Forestry and Soil Resources, to install and monitor bark beetle and woodborer detection traps as part of the US Forest Service Early Detection/ Rapid Response program. Twelve bark beetle species were identified from this effort, 5 are apparently new island records. Impacts of these new bark beetles on Guam's forests are unknown. However, one of the species first detected in 2014, *Xylosandrus compactus*, the black twig borer, was found in 2015 attacking *Serianthes nelsonii* saplings in the Guam Plant Extinction Prevention Program (GPEPP) nursery operated by Dr. James McConnell at the University of Guam (Figure 7). *S. nelsonii* is a critically endangered plant with only a single mature tree remaining on Guam. GPEPP is propagating *S. nelsonii* in an attempt to save this species and other rare, native forest plants. Attacks by invasive species, many of which are recent arrivals, are hampering GPEPP's conservation efforts, both in the nursery and in out-plantings.

Figure 7. Black twig borer (Xylosandrus compactus), exit holes on a Serianthes nelsonii sapling. Source: Dr. Aubrey Moore, University of Guam

New Pest Detections

In February 2015, citrus greening disease or huanglongbing (HLB) (Candidatus sp., bacteria) was detected on Guam, which was the first detection of HLB in the American Affiliated Pacific Islands. Most citrus species, plus orange jasmine (Murraya paniculata), box orange (Severinia buxifolia), and several other species in the family Rutaceae are hosts. Some weeds are also hosts of HLB; limeberry (Triphasia trifoliate) is widespread on Guam, making eradication of the bacterium almost impossible. HLB is vectored by the Asian Citrus psyllid (Diaphorina citri) which is present on the Pacific Islands of Guam, American Samoa and Hawaii, as well as mainland US and in several other countries.

New Mobile Apps for Pest ID

Pacific Pests and Pathogens Phone App

A new phone app was released by Grahame Jackson and his colleagues at PestNet (http://www.pestnet.org/). The app is free and can be downloaded for Apple and Android devices. After choosing a plant of interest, a series of questions are asked to narrow the choices until a pest match is made and compared with thumbnail images. This app gives extension staff and growers information they need to manage pests. There are over 230 fact sheets that provide information on damage, pest biology and life cycle, and management. (Information provided by Dr. Aubrey Moore, University of Guam in Pacific Pest Detector News, Sept. – Nov. 2015)

Hawaiian Scarab ID: Scarab and Stag Beetles of Hawaii and the Pacific mobile App

The USDA APHIS Identification Technology Program (ITP) team announced the latest addition to our mobile app collection: *Hawaiian Scarab ID: Scarab and Stag Beetles of Hawaii and the Pacific* (Figure 8). Developed in cooperation with Wichita State University and Australia's Identic team, this app is based on ITP's recently released web-based tool, Hawaiian Scarab ID. The Hawaiian Scarab ID Lucid Mobile app (free for Android or iOS) allows you to take your Lucid key with you into the field for surveys and screening, even if your field site lacks internet access. This key allows both specialists and novices to easily identify adult scarab beetles that occur or may occur in Hawaii, Guam, and the Pacific, including native scarabs, established pest species, and potential new invasive scarab species. You can help confirm whether you have found the correct species by comparing your specimen with the images and descriptions on the fact sheets, which are included for each species. The app also includes anatomy guides to assist novice coleopterists with important beetle features. The Hawaiian Scarab ID Lucid Mobile app is one of 12 apps ITP has developed for use in field identification of plant pests and diseases.

Figure 8. Screen shot of the new mobile app Hawaiian Scarab ID: Scarab and Stag Beetles of Hawaii and the Pacific.
Source: USDA APHIS Identification Technology Program

Invasive Plants

Partnership Leads to Accomplishing Key Step to Manage Protected Areas Network (PAN) Forests in Palau

In October, 2015 conservation officers from ten states in Palau plus staff of the PAN Office and the Palau Automated Land and Resources Information System (PALARIS) received key training on the methods of surveying invasive plants to establish baseline inventories in Palau's terrestrial Protected Areas Network (PAN) (Figures 9 & 10). Partner agencies Palau Conservation Society and The Nature Conservancy participated in portions of the training. Palau initiated creation of a network of terrestrial and marine protected areas – the Protected Areas Network, or PAN – in 2003. Since that time, twelve terrestrial protected areas all of which are mainly vegetated with native forest have been created, management teams formed, and management plans adopted. This training was organized and overseen by Dr. Joel Miles, the Palau National Invasive Species Coordinator, and was led by Adam Radford, the Operations Manager of the Maui Invasive Species Committee (MISC) in Hawaii with support from Palau's Forestry Division and the PAN Office. A total of eighteen participants completed the entire training and were awarded certificates of completion at the end of the training (Figure 11). Currently, the PAN Office and PALARIS are preparing maps from the data collected during each of the surveys done during the training. Once these are complete the next step will be for Dr. Miles to meet with the state PAN Coordinators to plan how and when to complete surveys of all the terrestrial PAN sites. They expect to initiate surveys early in 2016, with a team of trainees conducting the surveys with support from the PAN Office and Forestry Division.

Figures 9 & 10 (top and center).
Figure 11 (bottom).

New Coordinating Group on Invasive Plant Biocontrol

The Pacific Biocontrol Working Group is a new group of managers and scientists that have come together to try and work cooperatively and to coordinate the development of invasive plant biocontrols throughout the Pacific Basin. This group includes representatives from U.S. federal and state governments, foreign governments, and NGOs. It is hoped that this group, through periodic meetings, can better share information on projects being developed that might be beneficial to the wider Pacific Basin, since many of the target invasive plants are common. An initial list of target invasive plant species has been developed. The group is looking at possibly developing a position to provide overall coordination of biocontrol development; to serve as a hub for information flow.

Phellinus noxius Initiatives

From Oct 25th through Nov. 25th, 2015, Phil Cannon traveled to the Federated States of Micronesia (FSM) (Kosrae, Pohnpei, Chuuk and Yap), the Commonwealth of Northern Marianas Islands (Saipan), and Guam to work on Forest Pathology issues affecting these states and territories. In FSM, CNMI and Guam, the main disease worked on, again, was *Phellinus noxius*, a root and butt rotting fungus that quickly kills a very wide range of tropical tree species. Surveys were made on each island to search for this fungus and even more intensive future surveys were planned for many parts of each island. At most locations where *P. noxius* infection foci were found, samples of fungal fructifications or infected wood or bark were collected and isolations were made from these samples onto artificial media. These isolates were subsequently shipped to the Ned Klopfenstein Lab (US Forest Service, Rocky Mountain Station) so the DNA could be subsequently extracted and characterized using appropriate molecular genetic techniques. This information will, after processing, be added to the genetic information gathered for this fungus in 2013.

During this visit and with good administrative assistance from the University of Guam, mini-grants of $3,000 to $6,000 per island were set up to help facilitate surveys for *Phellinus noxius* on each of five islands and for some initial management trials on foci of this fungus.

Figure 12. A fresh orange and white mycelial weft of the butt-rotting fungus Phellinus noxius advances up the outside of a pengua tree (Macaranga thompsonii) near Ritidian, Guam.

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

Contact
Sheri Smith, Regional Entomologist,
USDA Forest Service, Region 5

Phil Cannon, Regional Pathologist,
USDA Forest Service, Region 5

Dave Bakke, Pesticide Use Specialist and Invasive Plants Program Manager,
USDA Forest Service, Region 5

Publication Design
Meghan Woods, GIS Analyst, Mason, Bruce & Girard, Inc,
USDA Forest Service, Region 5

USDA United States Department