Chapter X

Next Logical Steps in Forest Pathology Activities for Guam, Saipan, Yap, Palau, Pohnpei, and Kosrae

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As a result of the forest pathology trip that occurred during September of 2013, advances were made on several important fronts, and future activities were also identified as critical for addressing threats to forest health in Micronesia. The purpose of this chapter is to list and briefly describe each of these activities.

Activities to be performed by the local forestry staff

The first forest pathology activity that should occur on each of the islands of Micronesia, except for Guam, is to develop better information on the distribution and damage caused by *Phellinus noxius*. Several foresters on each of the islands indicated their willingness to participate in the development of this information, and suggested activities that address how this development could proceed are as follows:

1) Adapt the "*Phellinus noxius* poster" (Chapter IV; Fig. 7) to improve its effectiveness on each particular island. For instance, if one is working in Yap, one could produce this poster in Yapese.
2) Assign a local forester (or team of foresters) to be responsible for distributing, generating, and recording *P. noxius* information for every village on the island.
3) Distribute locally adapted "*Phellinus noxius* posters" to all of the villages on each island, and provide contact information for the responsible local forester or other professional, who should be contacted if anyone knows of a tree that is potentially infected with *P*. *noxius*.
4) Encourage the local forester/professional to visit each of the reported locations to confirm the presence (or absence) of *P. noxius*.
5) Ensure that the geographic coordinates of *P. noxius* infection centers are determined using GPS and that this information is recorded.
6) The *P. noxius*-affected trees within each infection center should be mapped. For example, gridded paper could be used, the distance between grid lines could represent 2 m or another appropriate distance.

7) Record the species and diameter of each tree that has been affected, and further note whether the tree is still alive, dead, or already fallen.

Activities planned by Phil Cannon, Regional Forest Pathologist

1) Compile a list of all the tree species known to be susceptible or resistant to *P. noxius* (started)
2) Contribute to the development of a locally adapted "*P. noxius* poster" for each island or island nation, as needed (initial example provided in Chapter IV; Fig. 7)
3) Devise a test for determining whether a tree species is susceptible or resistant to *P. noxius* (completed)
4) Develop and continuously update maps that denote all known infection foci of *P. noxius* in Micronesia (started)
5) Compile a compendium of all known treatments that have been used to control *P. noxius*, and conduct preliminary evaluations to help determine which of these treatments merit further testing in Micronesia (started)
6) Deliver a presentation on *P. noxius* to the Pacific Island Commission (recent opportunity was missed)

Activities to be performed by the Regional Pathologist and local forestry staffs

1) Record and map the known locations of *P. noxius*
2) Test potential control measures for efficacy
3) Hold *P. noxius* workshops on each island
4) Help arrange and participate in an international butt-rot workshop
5) Seek supplemental funding if any of the activities listed above cost more than the available funding.

Other forest (and plant) health activities

1) Establish a liaison to coordinate among the groups (e.g., USA and Japan) conducting molecular genetic studies on *P. noxius* (collected from Micronesia and other regions) and other butt-rot fungi. Molecular genetic approaches can be applied to identify species, evaluate genetic diversity, and determine potential pathways of spread, etc. Two specific molecular genetics activities seem likely to occur in the near future:

a. The USDA Forest Service-Rocky Mountain Research Station will conduct the DNA extractions for ~ 50 *P. noxius* isolates that were collected in Yap, Palau, Guam, Saipan, Pohnpei, and Kosrae. PCR and DNA sequencing (e.g., ITS1-5.8S-ITS2, LSU, rpb2 or *tef-1α*) will help confirm identification of fungal species, and phylogenetic analyses will examine evolutionary relationships among the isolates.
b. Mee-Sook Kim (Kookmin University) and Jane Stewart (Colorado State University) plan to develop genetic markers for examining genetic diversity, gene flow, and other population genetic parameters for the *P. noxius* isolates. The potential for genomic sequencing will also be considered, although multiple efforts focused on Asian isolates are reportedly already underway.

2) Arrange for an international workshop on butt rot fungi and their management. Hopefully, part of this workshop can be conducted in Malaysia or Indonesia, where there is a history of managing *P. noxius*.

3) Complete the metagenomic study based on mangrove soils. The soil samples that were collected from the surface soils in the healthy and unhealthy mangrove tree plots for the purposes of doing soil metagenomic analyses arrived in Moscow, Idaho and are currently in a freezer. Metagenomic analyses can proceed if supporting funding is obtained. The basic steps in the analysis are as follows: DNA will be isolated from replicate sediment cores from healthy and declining mangroves, and DNA will be analyzed via amplicon sequencing targeting bacteria and manglicolous fungi via the Illumina MiSeq system (using 2 x 300-bp, paired-end processing). Sequences will be associated with specific sediment samples via barcodes and will be grouped into discrete taxa based on comparison to reference databases. Community composition and diversity will be related to environmental metrics and ultimately mangrove health.

4) Continue surveys of Myrtaceae to monitor for the potential occurrence of the myrtle rust caused by *Puccinia psidii*.

5) Locate appropriate contacts for information that will lead to better control of some additional plant health problems, including the stinky corm problem in taro, anthracnose disease of betel

(*Piper betel*), the white fly problem on Kosrae, and the emerging termite (*Neotermes rainbowii*) problem on Kosrae. Each of these is described in Chapter XI.

Source:
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