

sws business***SWS International***

Jim Allen wrote this month's International Column. Although Jim is based in the United States, his professional life keeps him traveling around the Pacific. For more information, contact Jim Allen (jallen/psw_ipif@fs.fed.us) or Kathy Ewel (kewel/psw_ipif@fs.fed.us), U.S.D.A. Forest Service, Institute of Pacific Islands Forestry, 1151 Punchbowl St., Rm. 323, Honolulu, HI 96813. U.S.A.; 808 522-8230; fax 808-522-8236. —*Bill Streever*, SWS International Committee

Research on the Ecology and Management of Micronesian Mangroves

The Mangrove Resource

Mangroves are a vitally important natural resource on the high islands of Micronesia. This importance is especially valid in the Federated States of Micronesia (FSM) and the Republic of Palau, where mangroves cover 10-15% of the total land area and are used heavily by islanders as sources of wood, crabs, fish, thatching material, and other products. Fortunately, wholesale conversions of mangrove swamps to shrimp ponds, landfills, etc., which have been common around the Pacific Rim, have not occurred in the FSM or Palau. Even compared to wetlands in other parts of Micronesia (*SWS Bulletin* 14(3): 8-9), mangroves in the FSM and Palau are still relatively intact. However, several developments, including increased harvesting, construction of roads and tourism infrastructure, and sea level rise, may soon pose serious threats to mangroves in the two nations.

Forest Service Research

Because FSM and Palau are affiliated with the United States via Compacts of

Free Association, many federal agencies provide services there. The Forest Service, for example, has been conducting research, training forestry personnel, and providing natural resource programs to the region for more than 20 years, mostly through the Institute of Pacific Islands Forestry, which is based in Honolulu. In 1994, the Institute formed a research team on tropical forested wetlands to focus greater attention on some of the most important emerging issues affecting forests in the region. The team is led by Dr. Katherine Ewel and currently consists of two research ecologists, a postdoctoral hydrologist, two foresters, and two research assistants.

Most of the team's research is organized around two themes. The first is the difference in forest structure and function (and therefore responses to management) among three hydrogeomorphic

zones: fringe, riverine, and interior. A system of plots was installed in the three zones in each of four river basins on the island of Kosrae, FSM, to investigate these differences (Ewel et al. 1998a). A second theme is the effects of canopy gaps on environmental characteristics and mangrove regeneration (Pinzón 1998; Ewel et al. 1998b).

Whereas differences in parameters such as porewater salinity and regeneration have been found among zones and between gaps and areas under intact forest canopies, the scale of the differences tends to be smaller than expected. One reason may be the high amounts of rainfall Kosrae (and many of the other high islands) receives, which may exceed 5 m per year and in turn lead to significant groundwater inflow to the mangroves. The team's hydrologist is investigating this relationship with a system of



Figure 1. Mangrove swamp in Kosrae, Federated States of Micronesia. The large (>2m dbh), epiphyte-laden trees in the foreground are *Sonneratia alba*.

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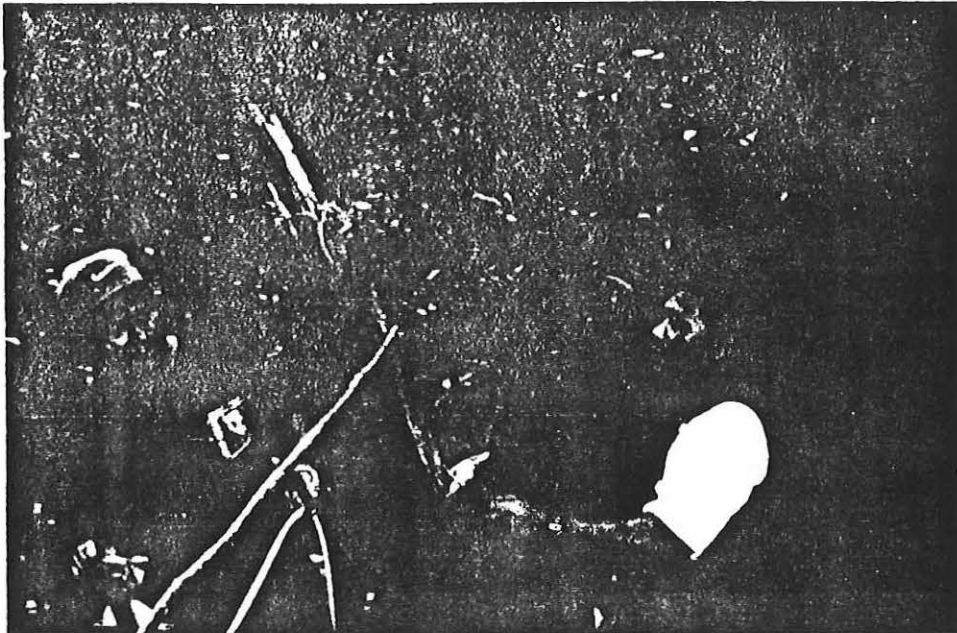


Figure 2. Kosraean state forester, Erick Waguk (r), and former student intern Tara Tara (l) participating in a study of mangrove harvesting practices.

piezometer clusters, water level recorders and salinity sensors in the mangroves, a transitional zone, and in a freshwater swamp immediately upstream from the mangroves. She is also employing other approaches, such as using barium as a tracer of groundwater influence.

The team is actively expanding its research program to incorporate other issues, such as the ecology of key species (e.g., *Rhizophora apiculata* and *Xylocarpus granatum*), soil nutrient status, and the interaction between harvesting and crab populations. Its program is also beginning to encompass freshwater forested wetlands, some of which contain endemic species and are at considerable risk of conversion to agriculture and other uses. A program on mangroves in Hawaii is also developing. Mangroves are not native to Hawaii, and since their introduction in the early 1900s they have spread to nearly all the main islands, greatly altering existing wetlands and affecting the habitat of native waterbirds (Allen 1998).

Emphasis on Collaboration

Because of the small size of the team relative to the amount and diversity of research needs, the team has collaborated

extensively with other researchers. A forest ecologist from the University of Canterbury, New Zealand, has analyzed structural differences among island mangrove forests and developed volume equations. Wetland ecologists from the USGS Biological Resources Division are investigating patterns of tree growth (using dendrometer bands), sedimentation and soil surface elevation change (using sedimentation-erosion tables and associated techniques), crab abundance and diversity, and the effects of a typhoon. A mangrove ecologist from Australia recently joined team members on a trip through FSM and Palau to address taxonomic relationships among *Rhizophora* spp. on the islands and collaborated on taxonomic work on *Bruguiera* spp. in Hawaii, Micronesia, and Australia.

The team has also collaborated with two natural resource economists from Stanford University on surveys of how Kosraeans use and value mangroves (Naylor and Drew 1998) and freshwater swamps. More recently, Kathy Ewel, along with colleagues from Stanford and Princeton Universities, received a grant from the MacArthur Foundation to use a modeling approach to help develop strategies for decreasing the environ-

mental impact of harvesting given different scenarios for population change and economic conditions.

Information Transfer

The team recognizes that its work might well be for naught without continuing transfer of its results to Micronesians. All research to date has been closely coordinated with state or national forestry personnel on each island, some whom have spent many hours in the field with team members and have provided invaluable assistance. Team members and collaborators have also worked with Micronesian student interns, participated in community meetings and training workshops for resource managers, and assisted with the production of educational videos. An exciting project just getting underway will involve a close association with the Ponape Agriculture and Trade School (<http://pats.edu>), a high school for students from throughout Micronesia. In addition to giving classroom lectures and involving students in their field research, team members and collaborators are developing educational modules on mangroves and forestry. Full participation of Micronesians in both research and information transfer is the goal of the tropical forested wetlands team.

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