

Wildlife Services

Protecting People
Protecting Agriculture
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National Wildlife Research Center

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Methods and Strategies to Monitor and Manage Mammalian Invasive Species with Special Emphasis on Rodents



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Major Cooperators

- Hawaii Agriculture Research Center
- US Fish and Wildlife Service
- US Department of Defense
- Hawaii Department of Land and Natural Resources
- Hawaii Department of Agriculture
- University of Hawaii
- Kamehameha Schools (Bishop Estate)
- Nature Conservancy
- Tropical Fruit Growers of Hawaii
- Monsanto Corporation
- Syngenta Corporation
- Pioneers Seed
- MacFarms of Hawaii
- Mauna Loa Mac Nut
- Hawaii Macadamia Nut Growers Association
- Hawaiian Commercial and Sugar

Groups Affected By These Problems:

- Farmers/Homeowners
- Horticulture industry
- Natural resource managers
- Tropical fruit and nut producers
- Seed crop industry
- Wildlife and refuge managers

National Wildlife Research Center Scientists Develop Methods to Reduce Damage Caused by Invasive Species to Agriculture, Natural Resources, and Human Health and Safety

Wildlife Services' (WS) National Wildlife Research Center (NWRC) is the only Federal research facility devoted exclusively to resolving conflicts between people and wildlife through the development of effective, selective, and acceptable methods, tools, and techniques. NWRC's field station in Hilo, HI, is ideally located to allow research biologists to develop methods needed to control invasive species damage to Hawaiian agricultural crops and native ecosystems, as well as other areas throughout the Pacific.

Oceanic islands like the Hawaiian archipelago are more susceptible to the impacts of invasive species than mainland areas because remote islands evolved in ecological isolation and have few predators or competitors, have a lot of air and sea traffic, and typically provide a favorable habitat and climate for many introduced species. Further, native species on the islands have evolved in the absence of many introduced threats and usually respond poorly to invasive animals or disease.

Invasive species are the single greatest threat to Hawaii's agricultural economy, natural environment, and the health and lifestyle of Hawaii's people. Invasive vertebrate species cause millions of dollars worth of crop losses, the extinction of native species, the destruction of native forests, the spread of disease, and the reduction of the health and safety of residents. NWRC scientists at the Hilo, HI, field station are investigating a variety of methods to reduce damage caused by invasive species such as rodents, Coqui frogs, brown treesnakes, invasive birds, mongooses, and feral ungulates.

Applying Science & Expertise to Wildlife Challenges

Rodent Management and Eradication—To better manage rodent damage to Hawaii's agricultural resources, NWRC scientists are identifying and evaluating various rodenticide baits. As part of this process, NWRC scientists are compiling the necessary data to obtain federal registration for these baits. Field tests were conducted on roof rats, a species that decimates native ecosystems as well as agricultural crops throughout the Pacific region. Results show that only certain rodenticides are effective on Hawaiian mice and rats. The first rodenticide for tropical fruits and seed crops in Hawaii, Rozol Mini Blocks containing chlorophacinone, was approved for use by the EPA in 2008. In addition, the State of Hawaii granted a state registration for Diphacinone 50 Conservation in 2007, and WS and the U.S. Fish and Wildlife Service conducted a rodent eradication project on the 16-acre Mokapu Island for conservation purposes in February 2008. Rodent monitoring on the island will continue for two years to ensure the eradication was successful.

Introduced Invasive Species—The negative impacts of introduced species on island ecosystems are severe. In Guam, brown treesnakes continue to impact the local economy, power grids, native plants and animals, and military operations. NWRC scientists are attempting to reduce the chance of snakes spreading to new areas such as Hawaii, and to reduce the impact of snakes on Guam. NWRC scientists are evaluating the use of female snake pheromones to attract more snakes to traps. Alternative baits, such as a treated beef mixture, have also been evaluated to help reduce the cost and improve trapping effectiveness. To reduce snake populations over large or remote areas and deliver baits to tree canopies, scientists successfully deployed mouse baits attached to paper streamers from helicopters. The streamers landed in the canopy layer of the forest 85% of the time, thus making the baits accessible to brown treesnakes but inaccessible to nontarget species.

In Hawaii, a species of tree frog was introduced from the Caribbean. In addition to its propensity for reproducing quickly and its piercing loud nighttime call, the species eats the insects and snails that many native forest birds rely on for survival and may have



United States Department of Agriculture
Animal and Plant Health Inspection Service

significant effects on forest dynamics. NWRC scientists are studying ways to manage frog populations, determine the effects of frogs on native ecosystems, and minimize their effects on agriculture. Current efforts are focused on the development and testing of chemical agents, such as citric acid and sodium bicarbonate, that are lethal if sprayed on frogs. The effects of these pesticides on plants and non-target animals are also being studied.

There is a serious concern about the introduction of Indian mongooses to new locations in the Pacific area that have so far remained free of this alien pest. NWRC scientists are identifying candidate bait substrates, lures, and/or attractants that elicit a strong attraction response from mongooses in the field. Preliminary results show that food-based baits are more effective than animal- or food-scents, and that fish-based food baits are the most effective. Findings could aid in optimizing current detection and capture strategies for mongooses and facilitate the development of toxicant baits specific for mongooses.

Seed Crop Protection—Growing plants for seed has emerged as one of Hawaii's biggest industries. In 2007, seed companies spent nearly \$98 million in Hawaii on research and development of new crops. Hawaii's climate enables three to four growing seasons per year, which allows companies to produce up to four generations of seed crops per year and enables crops to move more quickly to market.

With this new industry comes a new interest in protecting seeds from foraging birds. Approximately 40 percent of the bird species in Hawaii are invasive. In addition to the damage they cause to native birds through disease and competition, invasive bird species cause millions of dollars in crop losses annually. For example, pigeons, doves, francolins, turkeys and skylarks feast on a variety of seeds and sprouting crops.

NWRC scientists are developing methods to minimize the damage caused by invasive birds. Recently, scientists developed an integrated management plan to alter farm operations and reduce invasive bird populations on one farm. Birds were killing more than 76 percent of soybeans planted. Nine months after the program was initiated, bird damage was absent.

Selected Publications:

Koopman, M. E. and W. C. Pitt. 2007 Crop diversification leads to diverse bird problems in Hawaiian agriculture. *Human Wildlife Conflicts*. 1(2):235–243

Sin, H., K. H. Beard, and W. C. Pitt. 2008. An invasive frog, *Eleutherodactylus coqui*, increases new leaf production and leaf litter decomposition rates through nutrient cycling in Hawaii. *Biological Invasions* 10 (3):335-345.

Runde, D. E. and W. C. Pitt. 2008. Maui's Mitred Parakeets (*Aratinga mitrata*) Part 1. 'Elepaio 68(1):1-4, Maui's Mitred Parakeets (*Aratinga mitrata*) Part 2. 'Elepaio 68(2):1-2.

Major Assistance Activities:

- WS research is evaluating the effectiveness of sex pheromones as attractants for invasive brown treesnakes on Guam.
- WS continued to develop tools to manage invasive tree frogs. Research efforts have led to collection of registration data for the use of caffeine, citric acid, hydrated lime, and sodium bicarbonate to reduce invasive tree frog populations.

- WS provided the data for two new rodenticide registrations in Hawaii. These rodenticide registrations are the first products to be registered for use on seed crops and tropical fruits in Hawaii.
- WS obtained the data for the registration of aerial broadcast of rodenticides for use in conservation areas and to protect native ecosystems.
- WS investigated ways to reduce damage to valuable seed crops.