

Appendix VIII:

Impacts of alien rodents on Hawaiian plant communities

Scientific Research Proposal to the U.S. Army Environmental, Hawaii

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Project Summary

Seed predation and seed dispersal are two critical components for vegetation regeneration in ecosystems world-wide. Tropical forests exhibit a wide range of seed dispersers and seed predators that influence vegetation structure and community dynamics. In Hawaii, there is little quantitative evidence of the effects of rodents on native and non-native plant communities. In this study, I will determine the impact of alien rodents (rats and mice) on plant communities in the Wai'anae and Ko'olau Mountains, Oahu. Common fruits, seeds, and seedlings of both native and non-native plant species will be arranged in three types of treatments (total animal exclusion, access for rodents only, and open sites) in mesic montane forest. Rats (*Rattus exulans* and *Rattus rattus*) are anticipated to be the most pervasive rodent (rather than mice) at the study site, and preliminary studies at Lyon Arboretum suggest that rats are removing fruits and seeds (secondary dispersal) rapidly and possibly damaging seedlings of both native and alien species. At three study locations in Makaha Valley, I will first determine rodent densities using the mark-and-recapture technique. The densities of rodents will

enable comparisons across the three sites, as well as with sites both within and outside of Hawaii. In order to determine the home-ranges of rats, individuals at each site will be captured and tracked after attaching collars containing radio transmitters. Radio-tracking will also help uncover the locations of both nesting sites and husking stations. Obtaining the locations of husking stations, which are sites that rats take seeds and fruits for consumption and disposal, is particularly important for determining the fate of seeds removed from the forest floor. These sites will be observed using night vision to associate the rat behavior with the fate of rat-manipulated seeds. Feeding trials, followed by germination studies, will also be conducted on captured rats in order to determine seed fate of important seeds. The findings from this study will reveal how rodents are affecting forest structure in Hawaii by removing, destroying, and potentially dispersing fruits and seeds. Additionally, this novel research has direct and important implications for the conservation of Hawaiian plants, native tropical forests, and islands worldwide.

Projected Time Line

Year 1: August 1, 2006 – July 31, 2007. The three sites in the Wai'anae Mountains will be established, measured for various forest attributes, and microclimate data loggers will be installed. Rodent densities at the three sites will be determined using mark-and-recapture techniques. Determination of rat homeranges will begin by use of radio telemetry. Exclosures will be constructed and set up to begin testing fruit/seed and seedling removal of dominant plant species by rodents. Seeds found in rat feces (recovered from live-traps) will be identified, and germination/viability of the seeds will be determined. Summary reports for these results will be completed, and will contain information on the densities of rodents at each of the three sites and the rat home-ranges of the marked individuals. Indices of plant species 'vulnerability' to rodents will be established based on the seed and seedling trials. This information will be used to focus rat baiting and conservation efforts in Makaha Valley. I will give an oral presentation based on the results of this work at the international conference ("Rats, humans, and their impacts on islands: Integrating historical and contemporary ecology"; UH campus) in Spring 2007.

Year 2: August 1, 2007 – June 28, 2008. Determining rodent impacts on specific plant species will be expanded using exclosures. Rat home ranges will be finalized and husking sites will be located, both of which will be mapped using arcview GIS. Sites in the Ko'olau Mountains will be established and measurements similar to those in year 1 will begin. Feeding trials of captive rats will begin in effort to determine the direct effects rats have on particular seeds. Viability of seeds passed through the gut will be determined. Rodent densities will be measured again to determine seasonal effects. Summary reports for these results will be completed and will include the rodent densities and home-ranges in the Ko'olau Mountains sites, and a revised plant species 'vulnerability' list for both mountain ranges. Scientific publication 1 will be submitted.