7.6.2.6 Arthropod Composition and Abundance Sampling (Kahanahaiki MU & Pahole NAR)

Arthropod response to rat trapping was summarized in a poster presentation at the 2010 Hawaii Conservation Conference. The text and figures are provided here, however, the poster may be viewed on-line at: http://manoa.hawaii.edu/hpicesu/DPW/HCC-2010/Rat_arthropod_poster.pdf. Below is a condensed version of the poster.

Title: Patterns of Arthropod Diversity in Natural Areas Undergoing Rodent Management on Oahu

Author: P.D. Krushelnycky, Ph.D Plant Environmental Protection Sciences, University of Hawaii at Manoa

Above: native arthropods collected as part of this project.

Overview

Arthropods constitute a majority of the biodiversity in most terrestrial ecosystems. In addition, these animals often play important roles in ecosystem processes such as decomposition, soil turnover and pollination, and form critical links in food webs. Obtaining basic measures of the status and trends of native and invasive arthropod diversity should therefore be a fundamental component of any natural area management program.

The Oahu Army Natural Resource Program (OANRP) is implementing or planning rat removal operations in three areas in the Waianae Mountains. In conjunction with these efforts, I am conducting standardized, quantitative arthropod sampling before and after rat removal in two of these areas (Kahanahaiki and Palikea), as well as in adjacent control sites where rats will not be immediately removed, to estimate the impacts of rats on arthropod populations. This sampling will also serve as an arthropod inventory, providing important information on the biodiversity of these management areas.

Study design

I report here some preliminary results from a pair of sites in the northern Waianae Mountains: Kahanahaiki Valley, where a rat snapping grid has been implemented beginning in May 2009, and the adjacent Pahole Natural Area Reserve, where little or no rat management is currently being conducted.

Arthropod sampling was conducted at both sites in May/June 2009 (immediately prior to rat trapping), December 2009, and May/June 2010. Standardized sampling at each site included 16 pitfall traps, plus vegetation beating on 8 individuals of four plant species: *Charpentiera tomentosa*, *Pipturus albidus*, *Pisonia umbellifera* and *Psidium cattleianum*.

Does rat trapping result in recovery of arthropods?

Stomach contents from rats and mice caught at Kahanahaiki commonly include remains of caterpillars (immature Lepidoptera), beetles (Coleoptera) and spiders (Araneae), among other groups (A. Shiels unpub. data). But does this predation suppress arthropod populations?
I compared samples collected in May/June 2009, prior to rat trapping, with those collected in May/June 2010, to see if beetle, spider or caterpillar populations recovered at Kahanahaiki (where rats were trapped) relative to Pahole (where rats were not trapped). These samples included a total of 2149 specimens belonging to 87 species or morphospecies (in these three orders).

Early results suggest that neither native nor adventive beetle abundances on the trees sampled increased at Kahanahaiki relative to Pahole (Figure 1, top). This appeared to be true for changes in beetle richness as well (Figure 2, top). In contrast, changes in spider abundances and richness tended to increase at Kahanahaiki relative to Pahole, although the differences between trends at these two sites were not statistically significant (Figs. 1 and 2, middle panels). The strongest evidence for potential recovery after rat trapping involved caterpillars, which increased significantly more in both abundance and richness at Kahanahaiki relative to Pahole (Figs. 1 and 2, bottom panels).

While not definitive at this point, these results indicate that continued sampling is warranted, to track possible further arthropod community changes as rodent populations are suppressed over longer time periods. Replication at additional sites, such as Palikea, will help clarify whether these changes are likely to be due to rodent removal.

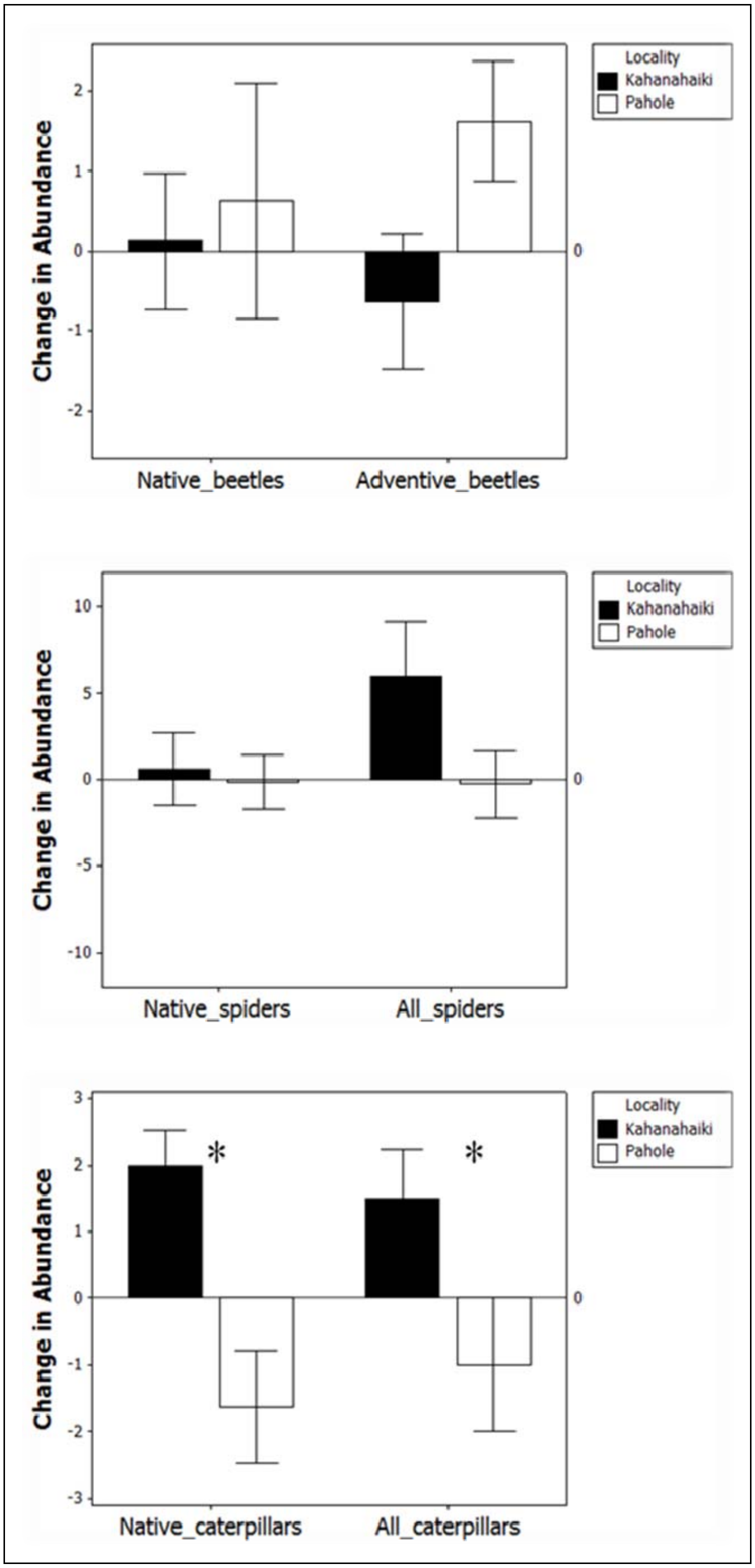

Figure 1. Changes in abundances in three arthropod orders from vegetation beating samples collected in May/June 2010 relative to those collected in May/June 2009 at Kahanahaiki and Pahole. Starred comparisons are significantly different (Mann-Whitney U test).

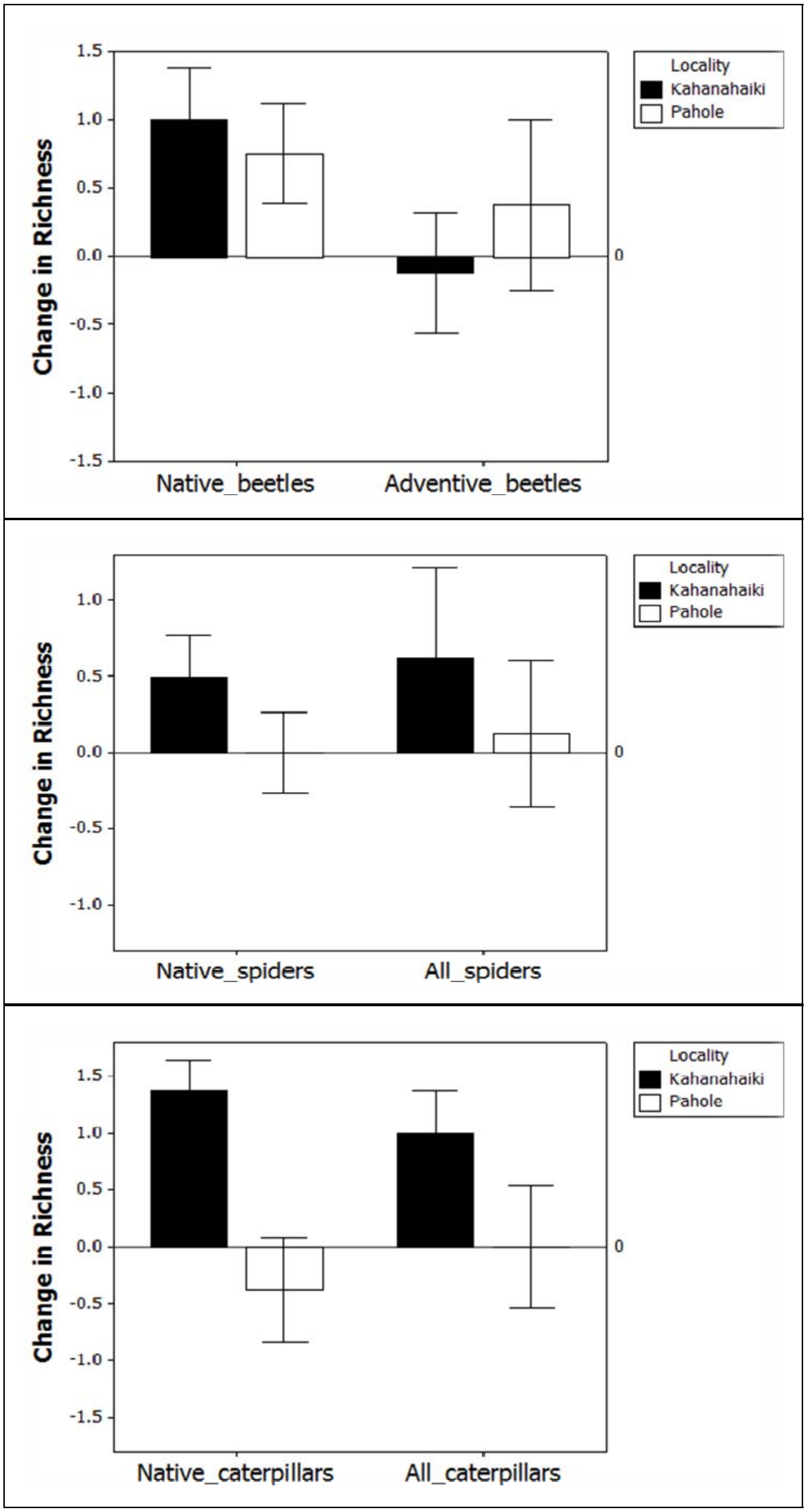

Figure 2. Changes in richness in three arthropod orders from vegetation beating samples collected in May/June 2010 relative to those collected in May/June 2009 at Kahanahaiki and Pahole. Starred comparisons are significantly different (Mann-Whitney U test).

Patterns in arthropod diversity

Native arthropods made up a much larger proportion of samples collected on four focal plant species, compared to those collected with pitfall traps, in terms of both richness and especially abundance (Figure 3). Perhaps somewhat surprisingly, the abundance and diversity of native arthropods was similar or higher on strawberry guava (*P. cattleianum*) relative to the three native tree species. However, this result applies only to three arthropod orders (Araneae, Coleoptera, Lepidoptera), and could change substantially when orders containing abundant and host-specific plant feeders (such as Hemiptera) are included.

The extensive sampling at the Palikea site (not shown) will also provide excellent information on relationships between plant community composition and patterns in diversity of native and introduced arthropods. These collections have already resulted in the discovery of at least one new endemic carabid beetle species.

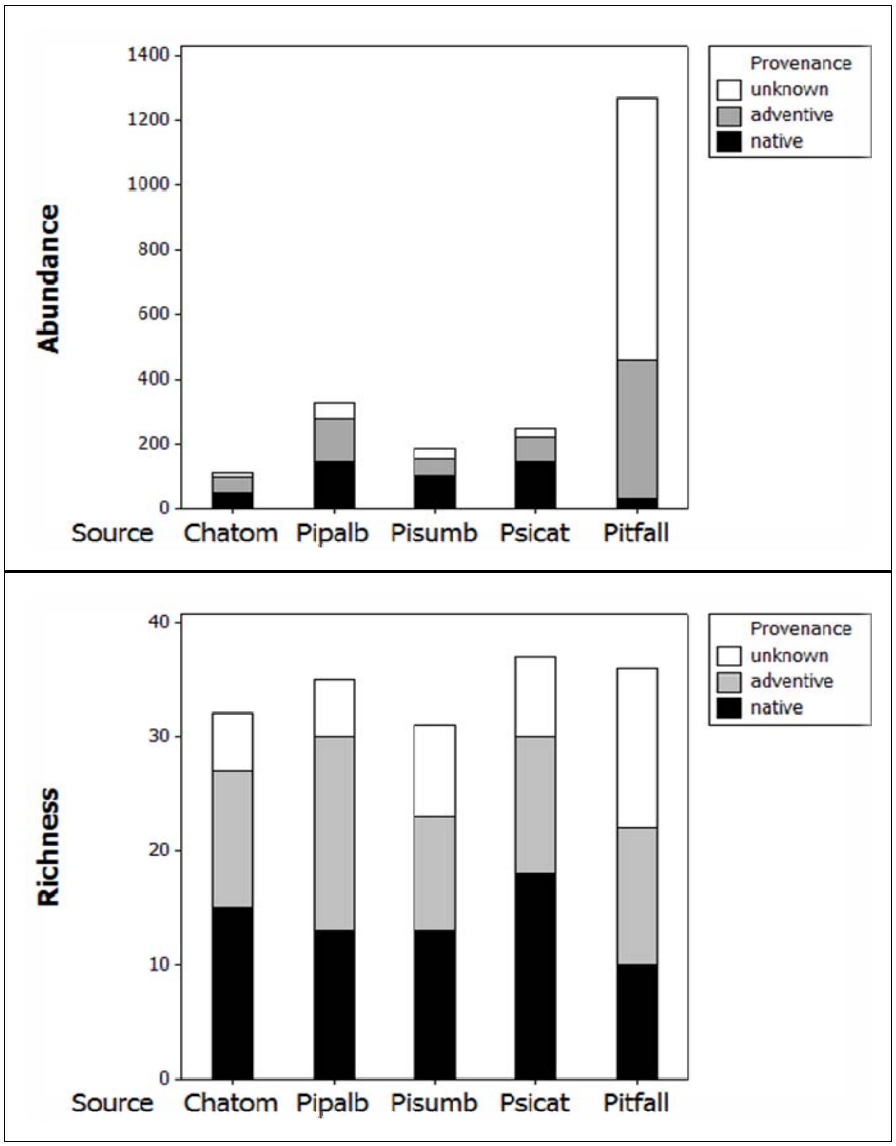

Figure 3. Patterns of abundance and richness of arthropods of native, adventive and unknown provenance on the four focal plant species sampled and in pitfall traps. Results are for Araneae, Coleoptera and Lepidoptera only (orders combined).