Poster Presentation

Invasive Frogs' Influence on Lowland Forest Arthropod Communities and Ecological Processes in Hawaii

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The coqui frog *Eleutherodactylus coqui*, endemic to Puerto Rico, was accidentally introduced to Hawaii in the late 1980s, where they can reach densities of 55,000/ha and attain sound levels of 80 decibels. Such high sound levels have caused sleep loss of residents and tourists and have negatively affected Hawaii's nursery industries and real estate values.

The effects of this introduced predator on invertebrate communities and ecological processes, such as nutrient cycling, are largely unknown. There is concern that *E. coqui* will affect Hawaii's endemic and endangered invertebrates; *E. coqui*, on average, consume 7 prey items per day in Hawaii and at high densities can potentially consume over 500,000 invertebrates every two days per hectare.

We conducted an enclosure experiment at two lowland sites on the eastern side of the Island of Hawaii for 6 months (September 2004 to February 2005) to determine the effect of *E. coqui* on 1) three invertebrate communities (aerial, herbivorous, and leaf litter), 2) nutrient cycling rates and leaf litter decomposition rates, and 3) native and non-native plant growth rates. At each site, 20 enclosures ($1 \times 1 \times 1\text{-m}^3$) were placed on the forest floor in pairs. One in each pair of enclosures contained no frogs while the other was stocked with seven adult males. Each enclosure had sticky traps to monitor aerial and herbivorous insects that were collected bi-weekly and leaf litter trays to monitor leaf litter invertebrates collected monthly. Each enclosure also contained 2 native plant species, *Metrosideros polymorpha* and *Psychotria hawaiiensis*, and 2 invasive plant species, *Melastoma candidum* and *Psidium cattleianum*, which were all measured at the initiation and termination of the experiment for leaf surface area, number of leaves, stem height and diameter, below- and above-ground biomass and percent herbivory. Leaf wash leachates of all plants in enclosures were also collected monthly as an indicator of throughfall chemistry changes in the presence of *E. coqui*. Leaf litter nutrient concentrations and decomposition rates at 3 and 6 months were assessed by leaf litter bags placed in the enclosures, containing *M. polymorpha* leaves.

E. coqui was found to reduce all invertebrate communities at one study site, while the other site did not have any difference with treatment. At both sites, herbivory rates were lower in the presence of *E. coqui* than in their absence. At both sites, *E. coqui* was associated with increased NH_4^+ in leaf washes, increased K, Mg, N, and P concentrations in the leaf litter, and increased decomposition of leaf litter. *P. cattleianum* had more new leaves in presence of the *E. coqui* than in the absence of *E. coqui* across sites. Non-native plants had higher survivorship than native plants.

In summary, invertebrate community responses to *E. coqui* differed by site but ecological processes responded similarly across sites. Path analyses suggest that the *E. coqui* increases leaf litter decomposition and non-native plant growth rates by making nutrients more available to microbes and plants. These findings are of concern in Hawaii, where *E. coqui* can potentially affect the 44 endangered invertebrates and potentially increase non-native plant growth. This study suggests that the ecological effects of the *E. coqui* are measurable, and thus control measures may be justified.