



Ecological Restoration Institute

The Effects of Restoration Thinning on Small Mammals and their Predators

Introduction

Small mammals perform several important ecosystem functions, including increasing soil aeration, dispersing seeds and mycorrhizal fungi, regulating vegetation abundance and composition, and serving as prey for predators. While wildlife ecologists know that small mammal densities often fluctuate in response to disturbances in their environment, there is little understanding about disturbance impacts to the functional roles of these animals. We assessed the effects of restoration thinning treatments by examining responses of the small mammal community before and after treatment, and compared to natural conditions (i.e., those that existed prior to Euro-American settlement), in ponderosa pine forests in northern Arizona. In addition to comparing individual species densities (compositional changes) after treatment, we evaluated their total density and biomass, which are indicators of the amount of prey available to predators. We also measured ectomycorrhizal spore content in small mammal feces, an indication of fungi dispersion potential. Thus, we attempted to understand the implications of restoration thinning to both small mammal community composition and function.

Research Findings

We were able to trap eight species (all rodents; missing only shrews and rabbits) of small mammals on the Coconino National Forest in Arizona from 2006–2009, at 279 sites. We evaluated species densities in stands that were 1) dense, 2) one to six years post-thinning, and 3) reference stands that were open (meadow-like) similar to natural conditions. Our findings were as follows:

- Small mammal community composition differed in each of six years following treatment, with individual species responding differently to changes in habitat (Fig. 1).
- Total animal density and biomass remained constant after thinning and was similar to open sites, indicating that the functional role of small mammals as prey is restored after treatment.
- Three species that decreased in density after thinning (Mexican woodrat, tassel-eared squirrel, Botta's pocket gopher) reached their highest densities at reference stands, suggesting that if restoration treatments can achieve this desired endpoint, it will benefit these species despite short-term losses.

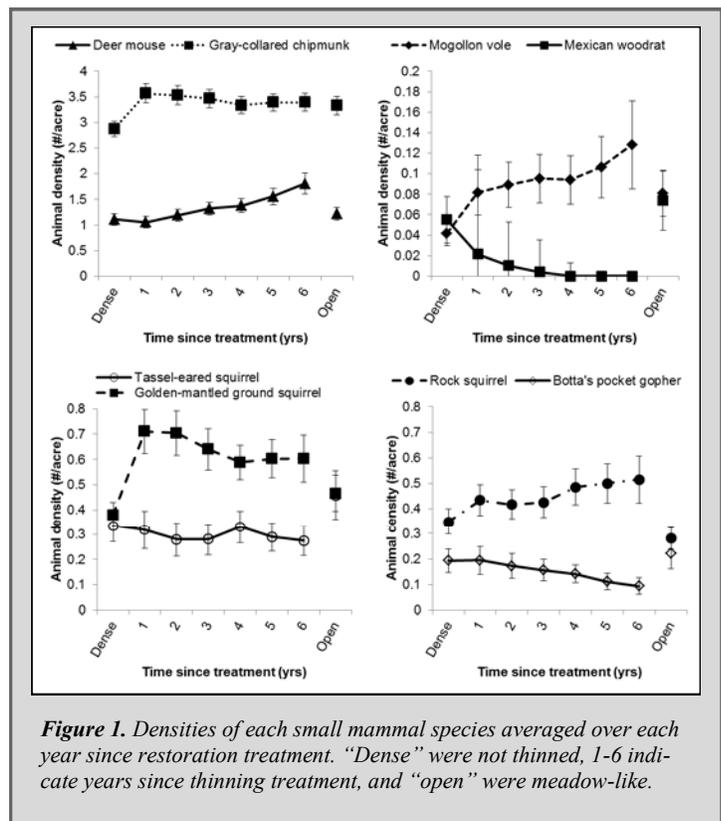


Figure 1. Densities of each small mammal species averaged over each year since restoration treatment. "Dense" were not thinned, 1-6 indicate years since thinning treatment, and "open" were meadow-like.



Figure 2. Photos of predators taken with motion-sensitive cameras at baited sites in ponderosa pine forest. The left photo shows a fox (probability of occupancy = 1.44 ± 0.14), the right a coyote (0.16 ± 0.09). Raccoons were only detected via track plates (0.11 ± 0.06).

To determine how thinning and prey density affected predator occurrence, we assessed relationships between predator occupancy (defined as the probability that a given site is occupied by the species) and the density of small mammals we found in the study. We did this assessment across a range of tree stocking levels (basal area of 45–280 ft²/ac), which is representative of the historical range of variability with respect to forest density. We sampled 33 sites for two weeks each in order to detect presence of predators using two techniques: 1) baited track plates and 2) motion sensor cameras (Fig. 2). Our results were as follows:

- We successfully modeled occupancy and detection rates for gray fox (*Urocyon cinereoargenteus*), coyote (*Canis latrans*), and raccoon (*Procyon lotor*).
- Gray fox was the most common of these predators.
- Restoration thinning may have a positive influence on gray fox and coyote occupancy, but a negative influence on raccoon occupancy (see Barrett et al. 2012 for analysis).
- Predator occupancy was unaffected by prey density, although our ability to assess the impacts of thinning and prey was limited by the small sample size.

Management Implications

Our results indicate that the small mammal community continues to perform important ecosystem functions following restoration treatments (six years post-treatment); however, more research is needed to understand the impacts of treatments in the long term, particularly to predators of small mammals.

This Fact Sheet summarizes information from the following publications:

Kalies, Elizabeth L., and W. Wallace Covington. 2012. Small mammal community maintains stability through compensatory dynamics after restoration of a ponderosa pine forest. *Ecosphere* 3:art78. <http://dx.doi.org/10.1890/ES12-00143.1>

Barrett, K.J., E.L. Kalies, and C.L. Chambers. 2012. Predator occupancy rates in a thinned ponderosa pine forest, Arizona: a pilot study. *Wildlife Society Bulletin* 36(2): 232-239.

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