Small Mammal Module

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Introduction:

Small mammals provide critical food sources for many carnivores, including the American marten, California spotted owl, and Northern goshawk. As a result, changes in small mammal abundances could have affects on many species throughout the forest. Understanding the demographics, habitat requirements, and natural fluctuations of small mammals is critical to the management of Sierra Nevada forests. Alterations in habitat structure can directly affect small mammals by increasing habitat quality allowing greater small mammal density, higher reproduction, and increased survival. In addition, changes in the spatial distribution of habitat characteristics can lead to differences in small mammal distribution patterns (e.g. more clumping).

Determining which components of the habitat are important in structuring the dynamics of small mammal populations requires close monitoring of several independent populations through multiple years combined with measuring habitat characteristics. In addition, the requirements of key prey species (woodrats and flying squirrels) must be understood in detail. In particular, daily activity and habitat use of key prey species within specific habitat types is necessary to understand the link between small mammal and predator populations.

In addition to understanding small mammal population dynamics and habitat relationships, we will investigate the phylogenetic relationship between the chipmunk species living in the study site. Several of the chipmunk species are virtually identical in appearance and can only be identified by differences in their baculum. As a result, we will look for molecular techniques to identify species using a small of ear tissue. This will allow proper identification of the species without killing individuals being studied.

Finally, chipmunks represent a primary prey species for diurnal predators, such as the Northern goshawk. Alterations in habitat structure may affect the quality of small mammals by altering their ability to build fat layers in anticipation for hibernation. We will look at changes in the fat content of chipmunks throughout the year and relate that to habitat structure. The results of this aspect of the study would provide a possible link between habitat structure and population dynamics.

Objectives:

Research objectives for the small mammal unit are to evaluate small mammal responses to different forest management practices. Specifically we will investigate:

1. spatial and temporal patterns of small mammal populations inhabiting a variety of habitat types.
2. habitat associations of small mammal populations.
3. spatial and temporal activity patterns and habitat use for two species of concern (woodrats and flying squirrels).
4. phylogenetic relationship of chipmunks in the study area.
5. differences in the development of fat layers in chipmunks inhabiting different habitats.

Methods:

Small mammal populations will be sampled monthly using established trap grids. Two different grids will be set to overlap each other with a 10 x 10 grid containing a single Sherman live-trap at 10m intervals inside a 6 x 6 grid containing 2 Tomahawk live-traps at 30m intervals. Tomahawk and Sherman traps will be opened in the late afternoon and checked the following morning. All Sherman traps will be closed during the day to prevent deaths from heat exposure. All Tomahawk traps will continue to be opened and checked throughout the day to capture diurnal species. All traps will be baited with peanut butter coated oats and sunflower seeds. Trapping grids will be established using a system of 3 tree sizes (size class 2, 3, and 4) and 2 understory (open and brushy) Categories. Grids will be established, in triplicate, in each of the combinations of categories, for example, 3 grids in size class-small, understory-open. In addition, 3 grids will be established in meadow, or grassland habitats.

All individuals captured will be weighed, sexed, given ear tags for identification, and have their reproductive condition noted. All animals will be released at the site of capture. Population demographics will be modeled by species using program MARK or another appropriate computer program. Monthly survival and population densities will be modeled for each species on each site. These parameters can then be used to identify habitat variables that are linked to population parameters using multivariate analyses. To supplement species habitat relationships, individual woodrats and flying squirrels will be captured and fitted with radio-collars. These individuals will be followed throughout the year to identify activity patterns and specific patterns of habitat use. Locations obtained from radio-tracking will be entered into a GIS database of habitat types and will be associated with a number of vegetation characteristics.

Habitat characteristics will be measured at every point of the trap grids. Characteristics that will be measured include nearest tree species and size, canopy cover, shrub cover, amount of course woody debris, and amount of bare ground. Characteristics will be measured using a 5m radius circle centered on each trap station. Habitat characteristics will be measured during late spring when trees and shrubs are at their full bloom, and the majority of annuals are also flowering.

We will collect a sample of chipmunks from areas throughout the study site and bring them back to U. C. Davis for use in the phylogenetic study. Individuals collected will have standard morphological measures taken and a portion of the ear will be taken for use in molecular analyses. All individuals will be preserved in the museum at U. C. Davis. Species will be identified using the unique shape of the baculum. Molecular techniques will be used to determine methods for describing species using non-lethal molecular techniques.

We will follow the development of fat layers in chipmunks throughout the year in a number of different habitat types using non-lethal techniques. We will use a portable device (TOBEC machine) to measure the proportion of fat found in the entire body of chipmunks. The development of fat in chipmunks will be related to differences in habitat quality and structure, and will be compared through time between sites at varying elevations.

Field Season Progress (2002):

The 2002 season began in September with the hiring of a postdoctoral fellow and 4 technicians. Work began in the study site on 1 September and continued through November 2002. During this period, 12 trap grids were established and preliminary trapping was initiated. Mark-recapture was used to provide a preliminary estimate of the numbers and diversity of small mammal residing on each grid. In addition, preliminary habitat characteristics were measured on each of the grids. Each night that a grid was trapped represented 172 trapnights accounting for the 100 Sherman and 72 Tomahawk traps. The twelve sites, with the number of days trapped in parentheses, are called Barrel (6), Bear Holler (6), Beesting (5), Buck (5), Cedar (5), Greenbottom (9), Gulch (5), Lassen (16), Loop (16), Soloman's Meadow (9), Steep (9), and Trippin' Falls (9). The sites at Lassen and Loop were established first and were used to identify potential problems with the live-trapping techniques and grid design before additional sites were established. From these sites we discovered that trap death was unreasonably high for chipmunks during the daytime. As a result modifications were made to the trapping protocol to prevent unnecessary deaths. These modifications included closing Sherman traps during the daytime, checking traps multiple times during the day, and providing artificial cover for shade. A summary of the elevation and number of individuals trapped on each grid, are provided in Table 1.

Habitat characteristics were also measured at major grid points on all grids. At each Tomahawk trap station (n = 36) a 5-m radius plot was used to measure several habitat characteristics. We measured the percent cover of tree canopy, shrubs, dead branches (< 10 cm), small logs (10-50 cm), large logs (> 50 cm), rocks, forbs, and trees and snags. The distance to the nearest tree and shrub were measured as well as the circumference of the tree, shrub height and shrub width. A summary of the habitat characteristics for each grid can be found in Table 2. These characteristics will be used to determine how varied each of the sites are and where we need to focus site selection next season. In addition, we will begin to investigate relationships between small mammal distributions and habitat characteristics.