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Can red squirrel middens influence species diversity?

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Species with high levels of ecological connectedness can be critical to maintenance of diversity and structure in ecological communities. The widespread red squirrel (*Tamiasciurus hudsonicus*), caches conifer cones and mushrooms in piles of discarded cone scales, or middens. The vegetation structure of the area surrounding middens, the thousands of stored cones and conifer seeds dropped by squirrels while feeding, and added structure via cone scale piles, may provide important habitat components for other species. Although a plethora of species is associated with red squirrel middens, what characteristics of middens attract animals remains unclear. Long-term data on midden occupancy for an endangered red squirrel subspecies, the Mount Graham red squirrel (*T. h. grahamensis*), in the Pinaleno Mountains of southeastern Arizona, offers an ideal opportunity to study the relationship between midden characteristics and mammal and avian diversity.

Methods

We conducted small mammal trapping and bird point counts, used camera traps for medium and large mammals, and measured midden characteristics (i.e. vegetation features, food resources, midden structure, and midden microclimate) to determine whether species diversity

differs between middens and random locations. We conducted an analysis of variance to compare total species richness among middens of varying occupancy levels and random locations, and a t-test to compare total species richness between currently occupied middens and random locations. Further comparisons of midden characteristics may determine whether these characteristics affect species diversity.

Results

In 5800 trap nights we captured 706 individuals of 7 species of small mammals, detected 24 species of birds, and obtained photos of 20 species of birds and mammals. While total species richness was not different between groups of various occupancy levels, total species richness differed between currently occupied middens and random locations. We obtained a measure of habitat variability and food resource variability between locations that we will compare to species richness.

Discussion

High species richness of mammals and birds at occupied middens shows the interaction strength of red squirrels with their environment. This information may be used to enhance ongoing recovery efforts for the endangered subspecies, inform decisions in forest management throughout North America, and offer insight on the conservation value of larderhoarding mammals worldwide.