



Use of pinyon-juniper woodlands by bats in New Mexico

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Abstract

In recent years, the demand has grown for information on how to conserve bat populations in forested ecosystems. Many researchers have responded with studies of bats in forests, but few have studied bat communities in arid-adapted forest types, such as pinyon-juniper woodlands, which are widespread and abundant throughout the west. In this study, I evaluated the relative use and importance of pinyon-juniper woodlands to bats in west-central New Mexico by comparing bats captured in pinyon-juniper woodlands with those captured in ponderosa pine forest. I compared species richness and relative abundance of bats captured in these vegetation types and evaluated the relative importance of each based on its use as reproductive habitat by females. Bats were mistnetted over stock tanks in pinyon-juniper woodlands for 55 nights during 1995–1997 and in ponderosa pine forest for 22 nights in 1998–1999. Although overall capture rates (bats per net hour) were not different between study sites, more species were captured in pinyon-juniper woodlands. The bat community of this pinyon-juniper woodland was dominated by species typically found in upper elevation forests, but also included species from lower elevation shrublands and grasslands. A greater proportion of females was reproductively active in pinyon-juniper woodlands than ponderosa pine, suggesting that females prefer woodlands for rearing their young or that fecundity rates of females are higher in this vegetation type. Results of this study demonstrate that pinyon-juniper woodlands support abundant and diverse bat communities and provide important summer habitat to reproductive females. Thus, biologists and land managers should plan activities in pinyon-juniper woodlands with greater attention and consideration to bats and their habitat requirements.

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1. Introduction

Recognizing that bats contribute not only to biodiversity, but also to ecological processes such as insect control and nutrient cycling, public land

management agencies and private landowners have become increasingly interested in protecting bat populations (Lacki, 1996; Marcot, 1996). To conserve bats, biologists and land managers must first understand the distributions, habitat associations, and habitat requirements of bats within their region of interest. Knowing which bat species occur in the target management area, when they are present, and their

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roost requirements in that vegetation type, managers may then design conservation strategies and mitigate potential effects of activities such as logging or mine closure.

Numerous studies have been conducted in the last 5–10 years to provide information on species-habitat associations and summer roost requirements of bats (e.g. Mattson et al., 1996; Vonhof and Barclay, 1996; Callahan et al., 1997; Crampton and Barclay, 1998; Menzel et al., 1998; Lacki and Schwierjohann, 2001; Weller and Zabel, 2001). These studies have shown that forests provide valuable summer foraging and roosting habitat to many bat species, that trees are often used as maternity roosts, and that bats select trees with specific characteristics. However, biologists still do not know the full range of resources and habitats used by bats because not all regions and forest types have been examined. Most studies in North America have focused on bats in mesic habitats such as western coniferous forests or eastern deciduous forests. Few have focused on bat communities in arid habitats, perhaps because these environments are thought to be marginal habitat for most species of bats (due to scarcity of water, sparse vegetation, etc.). Yet, arid-adapted vegetation types are widespread and abundant in the western U.S. (Barbour and Billings, 2000), and land managers need to know the degree to which these vegetation types are used by bats.

Pinyon-juniper woodlands are an arid-adapted, tree-dominated vegetation type that occupy over 55 million acres in 10 western states (Gottfried and Severson, 1993; Mitchell and Roberts, 1999). These openly-spaced woodlands rarely have continuous canopy cover and are composed of trees of small stature in a wide range of densities (Dick-Peddie, 1993; Brown, 1994). Pinyon-juniper woodlands are managed for a variety of purposes, including livestock forage, watershed health, fuelwood, pine nuts, Christmas trees, and wildlife habitat (USDA Forest Service, 1993; Shaw et al., 1994; Monsen and Stevens, 1999). These activities and many of the tools used to manage woodlands (e.g. chaining, roller drum chopping, or prescribed fire) can change the structure and composition of pinyon-juniper woodlands, thus affecting the type, quality, and quantity of resources available to wildlife. Although guidelines are available for managing wildlife habitat in pinyon-juniper woodlands, most are intended for terrestrial small

mammals, birds, and big game and do not consider bats (e.g. Short and McCulloch, 1977; Evans, 1988; USDA Forest Service, 1993; Goodrich, 1999).

To develop management guidelines for bats, biologists and managers first need information on which species use pinyon-juniper woodlands as well as the degree, type, and season(s) of use. Some of this information may be gleaned from distributional and ecological studies of bats in the southwest and surrounding states (e.g. Jones, 1965; Black, 1974; Findley et al., 1975; Hoffmeister, 1986; Armstrong et al., 1994; Mollhagen and Bogan, 1997; Herder and Jackson, 2000). However, studies that have focused specifically on bats in pinyon-juniper woodlands are few and limited in effort or scope (Chung-MacCoubrey, 1996; Rabe, 1999; Chung-MacCoubrey and Bogan, 2003). The goal of this project was to evaluate the relative use and importance of pinyon-juniper woodlands to bats in west-central New Mexico by comparing bats captured in pinyon-juniper woodlands with those captured in ponderosa pine forest. I compared species richness and relative abundance of bats captured and evaluated the relative importance of each vegetation type based on its use as reproductive habitat by females. This project was part of a larger study examining the ecology and management of bats in pinyon-juniper woodlands.

2. Methods

2.1. Study area

This study was conducted on the Cibola National Forest in the Gallinas and San Mateo Mountains west of Magdalena, New Mexico. The San Mateo Mountains are situated approximately 20 km south of the Gallinas Mountains, and the two ranges are separated by the extensive grasslands of the San Augustin Plains. Vegetation of the Gallinas Mountains is composed primarily of pinyon-juniper woodland. The Gallinas study site ranges in elevation from 2133 to 2573 m and comprises Gallinas Peak (elevation 2573 m) in the northwest corner and areas to the east and south of the peak. Primary tree species in these woodlands are Colorado pinyon (*Pinus edulis*), one-seeded juniper (*Juniperus monosperma*) and to a lesser degree, alligator juniper (*J. deppeana*). The Gallinas

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