

Desert Southwest CESU Final Report 2005

Project Title: Forest structure and squirrel populations in relation to fire history: habitat
use of endemic tree squirrels in Parque Nacional Sierra San Pedro
Martir and Saguaro National Park

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Introduction:

In the western United States and Mexico, fire is often considered to be *the* major disturbance under heavy anthropogenic influence (Pyne 1982, Flannigan et al. 2000, Kapler-Smith 2000). Policies of fire suppression for nearly a century in the United States and portions of Mexico have resulted in significant changes in cool fire frequency, catastrophic fire frequency, and forest structure (Pyne 1982). The implications of these changes have only recently been realized (Pyne 1982) and very few forests with natural fire regimes remain where an appropriate comparison can be made. Saguaro National Park (SAGU) practiced fire suppression for more than 50 years before initiating controlled burns in 1985; the importance of park-wide fire strategy has been summarized with the release of a '*Draft Saguaro National Park Fire Management Plan Environmental Impact Statement*' in February 2004. The Parque Nacional Sierra San Pedro Martir (SSPM) is an isolate of forest that has never received substantial timber harvest or fire suppression in part due to its rugged terrain and isolation (Minnich et al. 2000, Stephens et al. 2003). As a result, the forest structure is considerably more open than in fire suppressed systems found within many parts of the United States (Minnich et al. 2000). Additionally, SSPM presents a landscape that consists of a mosaic of past natural fires and this history has been well-mapped (Bojorquez-Tapia et al. 2003, Minnich et al. 2000, Stephens et al. 2003) thus providing an excellent natural 'experiment' for the study of fire impacts on forest wildlife.

Tree squirrels have been suggested as excellent indicators of forest health and forest structure (Carey 2000, Koprowski and Steele 1998, Steele and Koprowski 2001)

due to their dependence on mature forests for tree seed foods, nest sites, cover from predators, and maintenance of appropriate microclimates for food storage (Gurnell 1987, Steele and Koprowski 2001). As a result, the presence, demographics, and habitat use of tree squirrels can provide an indication of the status of the forested ecosystem. Two native endemic tree squirrels of special concern are found in these two parks, Mearns's squirrel (*Tamiasciurus mearnsi*) and Santa Catalina gray squirrels (*Sciurus arizonensis catalinae*). Ecological information is necessary to maximize the efficacy of management and interpretive efforts within these two national parks for the species are uncommon and unknown members of the forest ecosystems of these sky islands and likely excellent indicators of mature forest conditions for managers.

Conservation of endemic organisms presents one of the greatest challenges for ecologists. Northwestern Mexico harbors one of the greatest diversities of taxa in the world, in part due to the montane sky islands that often harbor endemics (Turner et al., 1995; Koprowski, 2005). Fauna of peninsular Baja California is especially distinct given its' long evolutionary history in isolation (e.g. Welsh, 1988; Hafner and Riddle, 1997). In many cases, knowledge of peninsular endemics, especially montane species, is extremely poor. Mearns's squirrel (*Tamiasciurus mearnsi*) of the Sierra de San Pedro Mártir of Baja California, Mexico (Wilson and Cole, 2000) is one such example. Mearns's squirrels are closely related to Douglas's squirrels (*T. douglasii*) in the Sierra Nevada of California, U.S.A. (Lindsay, 1981; Arbogast et al., 2001). Despite over 100 years since Mearns's squirrels were first described (Allen, 1893; Townsend, 1897) and recently listed as threatened under Mexican law (Ceballos et al., 2002), not a single ecological paper has been published on the species and knowledge of the basic ecology

such as diet, habitat, and reproduction is poorly known (Yensen and Valdés-Alarcón, 1999). In addition, introduction of eastern gray squirrels (*Sciurus carolinensis*) in 1946 may pose a threat (Huey, 1964). Herein, we present observations on the reproduction, food habits, vocalizations, and interspecific interactions of the endemic Mearns's squirrel as the final product from our initial one year pilot project. This project has received 2 years of additional funding through the NPS's IMRICO program.

Study Area and Methods

Our study area was the 65,000 ha Parque Nacional Sierra de San Pedro Mártir located about 100 km east of San Telmo, Baja California, Mexico. Open forested parklands (Minnich et al., 2000) at elevations above 2100 m are dominated by Jeffrey Pine (*Pinus jeffreyi*), lodgepole pine (*P. contorta*), ponderosa pine (*P. ponderosa*), sugar pine (*P. lambertiana*), and white fir (*Abies concolor*). We visited forests in the Vallecitos, La Corona de Abajo, Arroyo Los Alamillos, La Grulla, and La Zanja areas of the national park from 4 to 7 November 2004 and 16 to 20 March, 23 to 24 April, and 19 to 24 May 2005. We systematically traversed forests in search of Mearns's squirrels as well as sign to include leaf nests (Young et al., 2002) and larderhoards of cones known as middens (Finley, 1969) that indicate squirrel presence in other species of *Tamiasciurus*. Once we located an individual, we noted behavior of squirrels and attempted to determine sex and reproductive condition from external genitalia. Research was conducted under permits from Parque Nacional Sierra de San Pedro Mártir, Dirección General de Vida Silvestre (SEMARNAT), and The University of Arizona's Institutional Animal Care and Use Committee.

Findings:

We observed Mearns's squirrels (Fig. 1) on 17 occasions (5 female, 6 male, 6 unknown sex) in the Vallecitos and Arroyo Los Alamillos areas as we surveyed approximately 4000 ha of forest. Notably, we did not detect any middens or leaf nests in our surveys and *T. mearnsi* appears not to rely on larderhoards of cones or leaf nests. Other *Tamiasciurus* may scatterhoard and larderhoard in logs or snags (reviewed in Gurnell, 1987; Steele, 1998, 1999) and these may be tactics that Mearns's squirrels use. Furthermore, *T. hudsonicus* may nest in cavities or burrows (Yahner, 1980).

All male squirrels possessed scrotal testes (1 male on 20 May, 1 male on 21 May, 4 males on 22 May 2005). A female Mearns's squirrel possessed an enlarged pink vulva and was pursued by 2 or possibly 3 males on 22 May 2005 in a mating chase. These scant observations on reproductive males and female in late spring suggest similarity with other *Tamiasciurus* (Steele, 1998, 1999).

Mearns's squirrels were observed to feed on cones of the current year of Jeffrey pine (2 females, 2 males) and white fir (1 male), branch tips of white fir (1 female), and veiled polypores (*Cryptoporus volvatus*) found on the upper trunk of white fir (2 females, 3 males). Feeding sign on Jeffrey pine was commonly found in areas that we visited, with the exception of La Zanja. Other *Tamiasciurus* also feed heavily on fungi, conifer seed, and conifer branch tips during spring and early summer (Steele, 1998, 1999).

At least 6 distinct types of vocalizations are known from members of *Tamiasciurus* (Gurnell, 1987). We discerned 3 calls during our limited opportunities to detect vocalizations. On 3 occasions (1 male, 2 unknown sex) we heard a call similar to the territorial 'rattle' of *T. hudsonicus* and *T. douglasii* (Smith, 1978) but of seemingly higher pitch. Mearns's squirrels also gave a 'chirp' call (Smith, 1978) on 3 occasions (2

females, 1 male) when aggravated and a woofing bark or 'buzz' call (Smith, 1978) when startled and mildly aggravated (1 female, 1 male).

We observed 4 interspecific interactions. On 7 November 2004, a red-tailed hawk (*Buteo jamaicensis*) chased a *T. mearnsi* through the canopy of sugar and lodgepole pines for < 10 sec before disappearing from sight. Western bluebirds (*Sialia mexicana*) mobbed adult female Mearns's squirrels on two occasions (20 and 22 May 2005). A coyote (*Canis latrans*) passed under a tree in which a Mearns's squirrel was resting on a branch at 8 m aboveground on 22 May 2005 eliciting only a raised head from the adult male squirrel.

Mearns's squirrels appear to be uncommon and reclusive in the Sierra de San Pedro Mártir similar to the Catalina gray squirrels of Saguaro National Park. Most biologists have referred to the species as occurring in low densities (Leopold, 1959; Huey, 1964; Yensen and Valdés-Alarcón, 1999). Our brief observations on the ecology of *T. mearnsi* suggest that some aspects of their biology such as food habits, reproduction, and vocalizations are similar to the ecology of other members of *Tamiasciurus* (Steele, 1998, 1999). However, absence of obvious larderhoards and leaf nests indicates that Mearns's squirrels may have unique adaptations to dry and open forests of this southernmost extension of the genus *Tamiasciurus*.

Eastern gray squirrels were introduced at La Zanja and Arroyo San Rafael on the western slopes of the Sierra de San Pedro Mártir (Yensen and Valdés-Alarcón, 1999). However, we did not observe sign during our visit to La Zanja. The last report of eastern gray squirrels at La Zanja is from 1956 (Huey, 1964). Further investigations on the ecology of endemic Mearns's squirrel and the status of introduced eastern gray squirrels

are necessary to formulate effective conservation strategies in the Sierra de San Pedro Mártir.

Conclusions:

Our initial observations on the ecology of Mearns's squirrels suggest a very uncommon species widely dispersed in the open parklands of the Sierra de San Pedro Mártir. The issues that impact the conservation of this species will be similar to some currently faced in SAGU with the uncommon native. Introduced Abert's squirrels appear to vastly outnumber the native Catalina gray squirrel in SAGU. Additionally, Anthropogenic impacts to include fire, grazing, illegal activity, and development pressures all are of import to conservation of the threatened Mearns's squirrel of the Sierra de San Pedro Mártir. Collaboration and communication between SSPM and SAGU would appear to be quite fruitful as staff share solutions and approaches to common problems.

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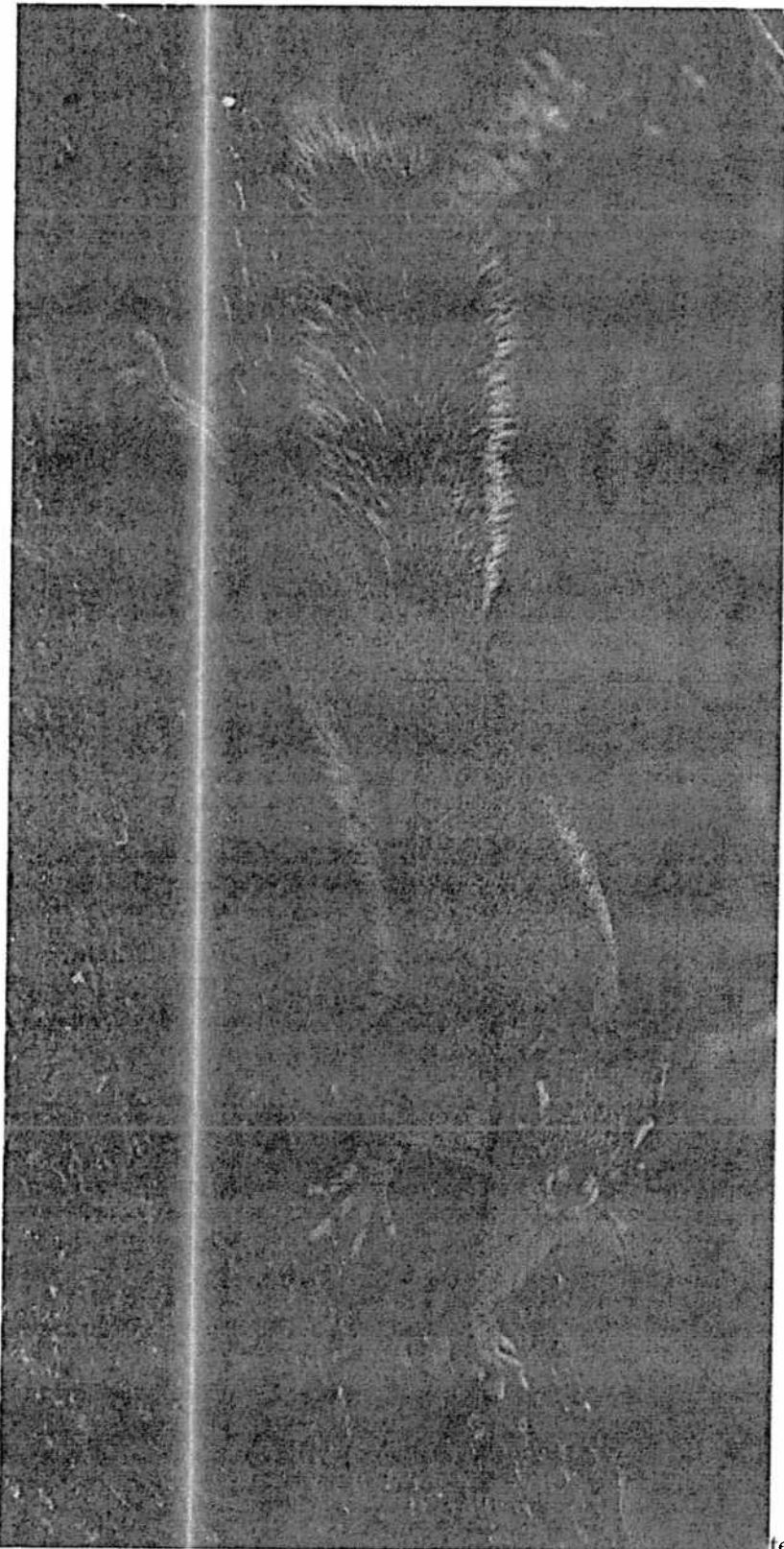
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FIG. 1. An adult female Mearns's squirrel (*Tamiasciurus mearnsi*) descending a white fir (*Abies concolor*) on 22 May 2005, Parque Nacional Sierra de San Pedro Mártir, Baja

California, Mexico. Photograph



coun

tesy of Bret Pasch.