

Habitat requirements for successful nesting of hummingbird species in the Madrean Pine-Oak Woodlands of southeastern Arizona

PROJECT NEEDS AND LOCATION: Hummingbirds live in virtually all wooded habitats but reach their highest diversity in forest habitats where they use different age structure forests. Often, they nest in mature growth but forage in areas of disturbance where many of their nectar plants grow (Schuchmann 1999). A review of the Birds of North America (BNA) species accounts for hummingbirds indicates that at least nine of North American species rely on forests for breeding and seven of these nest in the Madrean Pine-Oak Woodlands (Baltosser and Russell 2000, Baltosser and Scott 1996, Calder, 1993, Calder and Calder 1992,1994, Powers 1996, Powers and Wethington 1999, Russell 1996, Scott 1994, Wethington 2002, Williamson 2000).

Two recent studies have shown that sites in southeastern Arizona support large numbers of hummingbirds, particularly during southbound migration (Wethington and Russell 2003, Wethington et al. in press). Results from HMN's monitoring work in southeastern Arizona suggest that the Madrean Pine-Oak Woodlands, a region recently defined as an ecological hotspot by Conservation International, support the largest number of hummingbird species in the Sonoran Joint Venture region. Species that breed in this habitat include Black-chinned, Magnificent, Blue-throated, Broad-billed, Violet-crowned, Broad-tailed, and Anna's Hummingbirds. In addition, migrating species such as Rufous and Calliope rely on this habitat and Costa's Hummingbird use it during the hot dry summer months. Lucifer Hummingbirds and other rare species also use this habitat. Since southeastern Arizona supports high hummingbird richness, high abundance, and most North American hummingbird species rely on forests for breeding, habitats within the Madrean Pine-Oak Woodland are likely the most critical for maintaining hummingbird diversity in North America. However, little is known about habitat requirements for nesting and long-term reproductive success of most hummingbird species (see BNA accounts).

PROJECT OBJECTIVES AND OUTCOMES: The Hummingbird Monitoring Network (HMN) and the Southwestern Research Station (SWRS) (owned by the American Museum of Natural History) in the Chiricahua Mountains are developing a partnership to study habitat requirements for successful nesting of breeding hummingbird species in the Madrean Pine-Oak Woodlands in conjunction with the HMN's monitoring program. Two primary goals of the study are 1) to determine if there are specific habitat requirements for nesting of hummingbird species in this zone and 2) if grazing alters the habitat sufficiently to effect change in nesting success. Primary goals of the monitoring program are to determine the best long-term monitoring sites for all North American hummingbirds and to estimate abundance so trends in their populations can be detected.

The HMN is a science-based, project-driven, nonprofit organization dedicated to the conservation of hummingbird diversity and abundance throughout the New World. The HMN's objectives are to: 1) maintain long-term monitoring sites that represent a region's hummingbird diversity and estimate hummingbird abundance so trends in their populations can be detected, 2) encourage and support research projects that promote hummingbird conservation, 3) support efforts that preserve hummingbird habitats, and 4) educate by disseminating information about hummingbirds to land management agencies, land owners/managers, the scientific community, students, and the public. In 2002, the HMN began monitoring hummingbird populations at California and Arizona sites and expanded to British Columbia in 2004. We work on both public and private lands.

The HMN evaluates sites as contenders for long-term monitoring using diversity patterns, level of breeding success, and migration stopover use. The information used to evaluate levels of breeding success includes the numbers of breeding females and juveniles that are captured at our monitoring sites, but we suspect that this measure is biased. It is likely that the willingness of gravid females to enter our traps varies among species and that all juveniles entering our traps may not be locally hatched. The proposed research will help evaluate and develop a better measure of breeding success for our monitoring program.

The SWRS is a year-round field station under the direction of the Center for Biodiversity and Conservation at the American Museum of Natural History (New York, NY). The Southwestern Research Station's vision is to add to the existing diversity and strengths of the American Museum of Natural History by providing scientists and educators from the Museum and other institutions across the country and around the

world the opportunity to participate in research, workshops, and classes in one of the most biologically rich environments in the United States. The Station seeks to face the challenges of the future by promoting knowledge and understanding of our ever changing world and by evolving to meet the current needs of individuals and groups that strive to conserve the world's biodiversity – all through the benefits of an outdoor laboratory that enhances research and education.

The SWRS welcomes scientists and advanced students from all parts of the country and from abroad to carry out their research projects. Facilities in the Osborn Memorial Laboratory complex of the station include library, insect collection, herbarium, and vertebrate collections. Completed in 1992, the Technical Equipment Laboratory provides excellent microscopic facilities, constant temperature chambers, chemical hood, precision balances, and centrifuges. Recent additions of outdoor aviary complexes and an Animal Behavior Observatory afford outstanding facilities for behavioral and behavioral ecology studies.

The SWRS volunteer program offers students and citizens outstanding opportunities to observe and become involved with scientists conducting field research. Food and lodging are provided to volunteers in exchange for 24 hours/week of routine chores, with remaining time available for research activities or simply enjoying the beautiful surroundings. The program is open to non-students as well as undergraduate and graduate students (the latter may pursue their own research projects).

Methodology: *Study sites:* Comparable grazed and ungrazed sites will be identified in the Chiricahua Mountains of southeastern Arizona. Additionally, the HMN monitors hummingbird populations at multiple sites in the area.

Target species: Black-chinned, Broad-tailed, and Magnificent Hummingbirds. Blue-throated Hummingbirds also commonly breed in the Chiricahua Mountains but all known nests occur on man-made structures. See Table 1 for hummingbird species of concern for Partners in Flight and SJV.

Nest searching: During the breeding season, SWRS Interns under the guidance of local naturalist, David Jasper, will search the study sites for nests. Mr. Jasper is well-known for his ability to find nests.

Nest Success Evaluation: Each nest will be followed to determine if the chicks fledge and if not, at what stage the nest failed and the likely cause. We will use the same protocol that Baltosser developed for his nest studies in Guadalupe Canyon of southeastern Arizona and southwestern New Mexico (Baltosser 1986).

Habitat characterization: We will characterize vegetation study plots around each nest site and around analogous “non-nest” sites. This vegetation characterization will follow the same protocol used to evaluate the nesting habitat requirements for the critically endangered hummingbird species, Juan Fernandez Firecrown (*Stepanoides fernandensis*) (Hodum et al. 2004). This protocol successfully identified important habitat requirements and led to conservation efforts that have improved nest success for this critically endangered species. Another benefit of using this protocol is that we can compare habitat requirements of North American species with those of a South American island endemic species.

Analysis: Spatial statistical methods will be employed to determine vegetation structure associated with successful/unsuccessful nests. Vegetation characteristics of nest-plots and non-nest plots will be compared to determine nest site preferences.

Timetable: A pilot study will be conducted during 2005. Nest searches and following nesting cycles will be conducted during the spring and summer. Feeder watches at the SWRS will be conducted in conjunction to the bi-weekly monitoring at five sites in the Chiricahua Mountains. In the fall of 2005, we will determine the grazing history of sites within the Chiricahuas that will allow us to identify study sites for 2006. In 2006, we will initiate the full study as described. Data analysis, reports, and professional papers will be prepared and submitted by mid-2007.

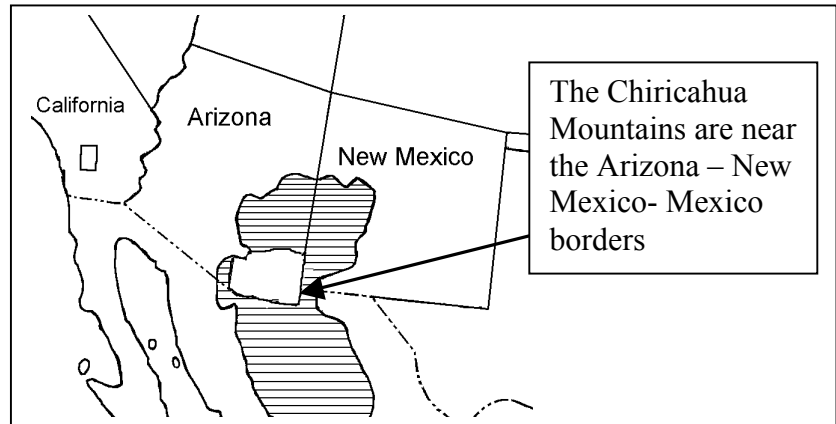
Map of project location: See Figure 1.

Evaluation: A summary report for the pilot study will evaluate the study's methodology and provide preliminary information about nest success rates near the SWRS. A report describing the grazing history of areas in the Chiricahuas will be submitted and used to determine appropriate study sites in 2006. A final report and professional papers will be submitted during 2007.

List of partners and their contributions: The Hummingbird Monitoring Network and the Southwestern Research Station owned by The American Museum of Natural History are building a research partnership. The HMN is responsible for designing the study, developing protocols and data sheets and for training. The SWRS will provide interns to assist with fieldwork. In addition to this research partnership in the Chiricahua

Mountains, the monitoring program for the HMN maintains partnerships with the United States Forest Service, the National Park Service, and private individuals.

FIGURE 1. The following map shows the location of the Chiricahua Mountains in southeastern Arizona. The hatched area in Arizona, New Mexico, and Mexico outlines the Madrean Archipelago region. The clear area within this region indicates the area where the HMN monitors hummingbird populations. The Chiricahua Mountains occur in the extreme southeastern corner of Arizona.



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