

## Mexican Spotted Owl Distribution and Habitat within Grand Canyon National Park

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### Introduction

Because of significant threats to its habitat, the Mexican spotted owl (*Strix occidentalis lucida*) was listed as a “threatened species” in 1993 by the U.S. Fish and Wildlife Service (USFWS 1995). The Mexican spotted owl is widely distributed in montane and rocky canyonland ecosystems throughout the southwestern United States (Figure 1). The *Recovery Plan for the Mexican Spotted Owl* (USFWS 1995) listed the general inventory of Mexican spotted owls on National Park Service (NPS) lands as a primary research objective. In the Grand Canyon, the Mexican spotted owl uses the myriad tributary canyons of the Colorado River, where it nests and hunts in the steep rocky habitat distinctive of the Colorado Plateau province.



Figure 1. Distribution of the three subspecies of spotted owls inhabiting western North America (from USFWS 1995).

## Natural Resource Management

The patterns of habitat use observed for spotted owls in Grand Canyon contrast sharply with the owl's classic dependence on old-growth conifer forests (Ganey and Balda 1989; Willey 1995). Willey and Spotskey (2000) examined the characteristics of spotted owl breeding habitat at known nesting areas in Grand Canyon National Park using a geographic information system (GIS). They found that spotted owls use narrow, steep-walled canyons where ledges and caves provide cover from high temperatures, as well as nest sites and foraging habitat. In essence, complex, rocky terrain has been substituted for old-growth forest. Willey and Spotskey (2000) used GIS to identify key features of owl habitat and then map the extent of suitable habitat within the park's interior (Figure 2).

Given the owl's threatened status and recent evidence of population declines in the southwestern U.S. (Seamans et al. 1999), understanding the distribution of spotted owls and the extent of suitable breeding habitat in Grand Canyon is germane to the owl's long-term management. Therefore, we conducted this research to meet three main goals: (1) to test predictions of GIS models, and (2)

to understand the distribution and (3) abundance of spotted owls in Grand Canyon National Park. We believe that the success of spotted owls inhabiting the Grand Canyon is relevant to the owl's conservation in the region because these owls may represent an important source population to surrounding areas (USFWS 1995). In addition, information on the distribution and status of the owl is needed by park managers for resource management planning and to construct baseline information on this threatened species.

Our primary goal during this project was to conduct systematic field surveys within predicted suitable breeding habitat within the interior of Grand Canyon National Park. We hoped to locate many new spotted owl territories and determine the distribution of spotted owls in the park. Accordingly, we implemented the following objectives:

1. We identified unsurveyed tributary canyons with accessible canyonland breeding habitat along the main Colorado River corridor through the Grand Canyon between Soap Creek and National Canyon.
2. Using the GIS habitat model, we proposed

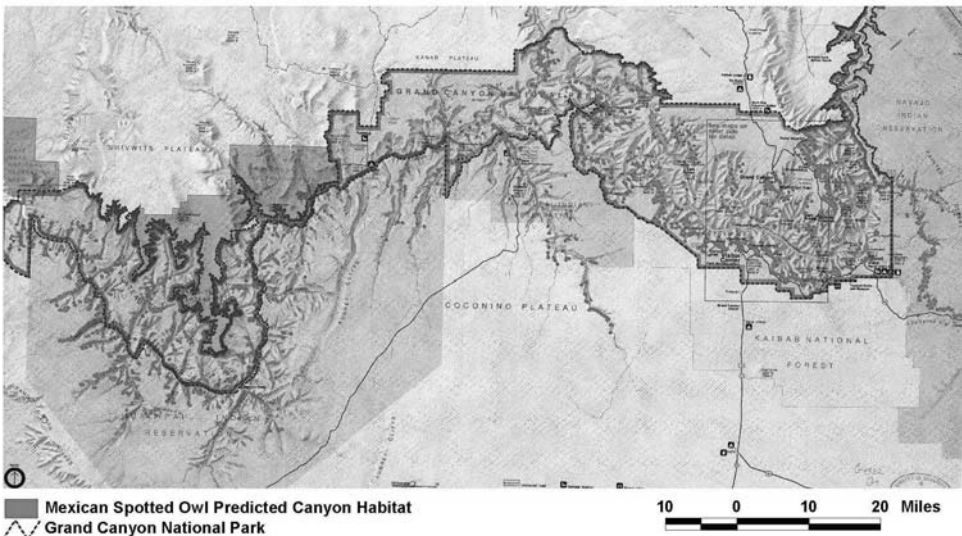


Figure 2. Distribution of predicted Mexican spotted owl breeding habitat, showing the primary cover types in Grand Canyon National Park, Arizona.

three key breeding habitats (strata): high-elevation steep-slope mixed conifer forest; mid-elevation steep canyonlands; and low-elevation steep canyonlands.

3. We selected sampling units within each habitat class within the park.
4. We systematically conducted point calling surveys for Mexican spotted owls within each habitat stratum for those tributary canyons accessible via the Colorado River between Soap Creek and National Canyon. The surveys were done March–August in 2001 and again in 2002.

### Methods

We used a stratified-random sampling procedure in ArcGIS (ESRI 1996) to select 80 survey sites within each of three habitat classes identified by our GIS model (Willey and Spotskey 2000): high-elevation steep-slope mixed conifer forest; mid-elevation steep canyonlands; and low-elevation steep canyonlands. All sites were visited once during the breeding season (March–September) and most sites were accessed using river expeditions starting at Lee’s Ferry and floating downriver to Diamond Creek.

Field survey procedures followed standardized protocols developed by spotted owl field biologists (Willey 1989; Franklin et al 1990; Rinkevich 1991). At each survey area, a team of two to six owl hooters left the river and hiked up the side canyons to establish calling routes within suitable habitat identified at the survey sites by the GIS field maps. At each survey site, we established calling routes that systematically surveyed all suitable habitat. Along routes we placed calling stations every 0.5–1.0 km, and at each calling station we imitated spotted owls by producing a variety of standard calls for 30 minutes (Ganey 1990). All calling points were surveyed once during the field season. We also visited several historical spotted owl territories located along the river to assess occupancy status.

### Results and Discussion

During the first year of field surveys (summer 2001), we conducted four river expeditions. The surveys were completed within 37

tributary canyons using 240 independent calling stations. Mexican spotted owl adults were detected at 15 of the 37 sites (Table 1). Results in 2001 included eight sites with single owls and seven sites with owl pairs (Figure 3). Although no previous nesting evidence had been observed prior to our work, we observed direct evidence of nesting by spotted owls. The first active nest was confirmed in Grand Canyon when two owlets, approximately 50 days old, were observed near Fossil Bay.

During the 2002 field season, surveys were completed at 43 unique study sites using 240 calling stations. Single adults were detected at eight sites and pairs at five sites. Thus, we located 13 new owl territories during the 2002 field season. In addition, from the set of 28 historical owl sites in the park, i.e., sites located during previous study, we randomly selected 13 sites that we visited during the 2002 field season to assess occupancy and nesting status. All 13 sites were occupied, including nine sites used by single owls and four sites occupied by pairs. Although no young owls were observed during the 2002 field season, this was likely a result of visiting too early in the nesting period (i.e., during incubation) to observe young owls.

The surveys in Grand Canyon during 2001 and 2002 located 34 previously unknown spotted owl territories. Twenty-two historical records were already known prior to this study (Willey 1995), bringing the park’s grand total to 56 territories, or approximately 112 owls in the park. All owls were located within mid- and low-elevation steep canyon habitat identified by the GIS model, highlighting canyonlands habitat for this species. To date, surveys have covered about 50% of suitable steep canyon habitat predicted by the GIS models; thus a population of over 200 spotted owls could be present in these habitats in Grand Canyon. All of the territories we located occurred within the upper reaches of large tributary canyons within steep and rugged rocky canyon terrain located below the main canyon rims. Although a single male was heard outside of a canyon (1 km south of Grand View Point), the true level of forest rim use by spotted owls is unknown and will

Table 1. Study site locations of Mexican spotted owl field surveys in the interior wilderness of Grand Canyon National Park, Arizona, 2001.

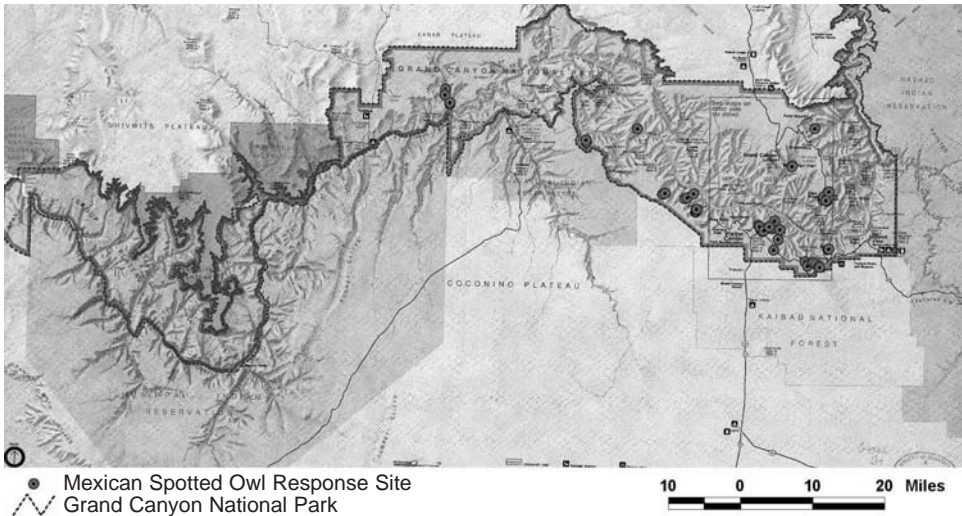
Study site	Number of calling points	Species detected ( <i>spotted owls in italics</i> )
16-Mile Canyon	4	none
Hot Na Na	4	great-horned owl
19-Mile Canyon	3	great-horned owl
24.5-Mile Canyon	4	none
Buckfarm Canyon	4	great-horned owl
Saddle Canyon	5	great-horned owl
Little Nankoweap	5	northern pygmy-owl
Nankoweap	12	<i>male spotted owl</i>
Unkar Creek	12	<i>single male; spotted owl pair (nest)</i>
Red Canyon	6	<i>male spotted owl</i>
Sinking Ship Point	10	<i>spotted owl pair; flammulated owl</i>
Cremation Canyon	8	<i>male spotted owl</i>
Boulder Canyon	8	<i>spotted owl pair</i>
Salt Creek Canyon	5	<i>spotted owl pair</i>
Pipe Creek	8	<i>spotted owl pair</i>
Boucher Canyon	3	<i>spotted owl pair (nest)</i>
Travertine Canyon	5	none
Slate Creek	5	<i>spotted owl pair</i>
Turquoise Canyon	5	<i>male spotted owl</i>
Topaz Canyon	6	none
Ruby Canyon	6	none
Shinumo Canyon	10	none
Waltenburg Canyon	6	<i>male spotted owls</i>
Forster Canyon	4	<i>spotted owl pair; 2 owlets</i>
Tapeats Creek	15	western screech-owl
140-Mile Canyon	8	great-horned owl
Deer Creek	4	none
Fishtail Canyon	7	none
150-Mile Canyon	4	none
Tuckup Canyon	12	<i>single male, spotted owl pair (nest)</i>
National Canyon	15	great-horned owl
Mohawk Canyon	4	none
The Cove	4	none
Spring Canyon	6	none
Parashant Canyon	8	none
Trail Canyon	8	northern pygmy-owl
Indian Creek	8	western screech-owl

require further research.

In addition to locating Mexican spotted owls, the field surveys also detected western screech-owls (*Otus kennicotti*), flammulated owls (*Otus flammeolus*), great-horned owls (*Bubo virginianus*), long-eared owls (*Asio otus*), and pygmy owls (*Glaucidium gnoma*) within Grand Canyon. Great-horned owls were the second most common species located in the park (spotted owls being the most common), and great-horned owls were located in terrain similar to that occupied by Mexican spotted owls, i.e., steep canyonland habitats. During surveys conducted in the forested habitat along the canyon rims, flammulated owls were the most common species

observed, particularly in forests dominated by ponderosa pine.

The project survey results support the GIS-based approach to prioritizing inventory locations and streamlining field efforts. We learned through this process that nesting and roosting areas used by spotted owls are generally located in the upper reaches of steep-walled canyons in the park. Owl sites were located below the main canyon rims within arid vegetation and rocky canyonland terrain. Although spotted owls may travel up to rims and out into plateau forests, most activity appears to concentrate below the rims within the rugged canyonland habitat predicted by our GIS model. Although potential effects of



**Figure 3.** Locations of Mexican spotted owls located during the 2001 and 2002 field seasons in Grand Canyon National Park, Arizona.

rim-based management actions on the owl's habitat are currently unknown, our results suggest that most spotted owl territories are located below areas proposed for management activities, e.g., trail construction along the South Rim and prescribed fire along the North Rim. In a study using radiotelemetry, Willey (1997) examined the effect of prescribed fire on the movement of several spotted owls in Saguaro National Park's Rincon Mountains. Following low-intensity ground fires, spotted owls continued foraging within heavily burned ponderosa pine stands, and no significant influence of fire on home range size and shape was identified. Thus, fire management activities on the rims of Grand Canyon may not pose threats to the owl and its habitat.

The results from our GIS analysis, predictive mapping, and field validation surveys support the concept that spotted owls in Grand Canyon are not dependent on classic old-growth forests (Ganey and Balda 1989; Willey 1998). All known breeding sites in Grand Canyon have been located in steep-walled sandstone canyons, despite many survey points placed in forest habitat. In Grand Canyon, the owl is thus associated with steep sandstone canyons with relatively open Great Basin or Mojave desert scrub or Great Basin conifer woodland vegetation communities

(Brown 1982). The canyonland breeding habitats used by the owl in the park are rather unusual considering the classic, late-seral forest habitat requirements typically reported for the owl (Zwank et al. 1994; Seamans and Gutierrez 1995; Miller et al. 1997). Our results in Grand Canyon provide strong evidence that rocky canyon habitat is an important landscape cover type for the owl. Grand Canyon likely supports an active and important local source of spotted owls.

### Management Recommendations

The potential effects of activities such as trail building, prescribed fire, and construction activities on the owl and its habitat in Grand Canyon are unclear. However, we think that our survey results suggest that effects from rim activities on spotted owls may be minimal or absent because few territories have been detected near or on the rims. Trail building and prescribed fire could affect owls that are located below the rims, but understanding these effects are beyond the scope of this paper. We recommend additional research efforts designed to examine movements and habitat use by spotted owls located below the rims.

Prescribed fires are designed to reproduce natural fire regimes and restore the long-term

health of Grand Canyon forests (Mast et al. 1999; Wolf and Mast 1998). Using radiotelemetry, Willey (1997) examined the effect of prescribed fire on the movement of several spotted owls in Saguaro National Park's Rincon Mountains. Following low-intensity ground fires, several spotted owls continued foraging within ponderosa pine stands, and no significant changes in home range size or shape was detected. Prescribed fire and healthy spotted owl habitat may not be mutually exclusive in Grand Canyon National Park. We see no major threats to spotted owls in the park from planned prescribed fire activity, but we urge the park's scientists to design and support investigations that study the relationship among owls, forest habitat, and fire in Grand Canyon.

Surveys for Mexican spotted owls within the park have located 56 territories, and nesting was confirmed by the observation of young owls in a side canyon below the Great Thumb (Willey and Ward 2001). Habitat at these interior canyon sites ranges from low-elevation desert shrub to higher-elevation mixed conifer forest. Willey and Spotskey (2000) categorized these sites as falling within the "steep canyon habitat cover type." Our results on the rims provide additional support that the owl primarily occupies the interior canyon cover types composed of Great Basin desert scrub and Great Basin conifer woodland vegetation communities (Brown 1982).

In closing, we recommend the following research and management goals for spotted owls in Grand Canyon: (1) continue compliance-clearance surveys in areas with important spotted owl habitat, e.g., forests on the canyon rims where park activities may modify the habitat; (2) continue to use GIS-based approaches to identify habitats that may require additional surveys; (3) continue to survey for spotted owls in interior canyons identified by the GIS model as being potential breeding habitat, and estimate the abundance and nesting status of owls in the park; (4) investigate the relationship between habitat changes related to fire and Mexican spotted owls; and (5) designate protected activity centers (USFWS 1995) around each

spotted owl location in the park. If followed, we believe these recommendations will protect the owls and their habitat. Future research efforts can provide park personnel with information relevant to the owl's management and streamline future decisions for the forests and interior canyonlands in Grand Canyon National Park.

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