Riparian Dependence, Biogeographic Status, and Likelihood of Endangerment in Landbirds of the Southwest

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Abstract—Riparian habitats and wetlands represent less than 2 percent of the land area of the Southwest, but they support the highest density and abundance of plants and animals in that region (Dahms and Geils 1997). Since the latter part of the 19th century, riparian and wetland ecosystems have been severely impacted by human activities such as woodcutting, mining, livestock grazing, and water diversion and pumping (Phillips and Monson 1964, Johnson and Carothers 1982, Tellman and others 1997). In this paper, we examine the likelihood of species endangerment in obligate and preferential riparian-nesting landbirds of the Southwest. Population trends are also reviewed with respect to biogeography, as we distinguish between birds that reach the end of their distribution in the Southwest and those that do not. We report local extirpations and/or population declines for a higher proportion of those species occurring at the northern periphery of their geographic range. We also show an increased likelihood of endangerment for obligate vs. preferential riparian birds. Ultimately, the large number of Southwestern species depending on riparian habitats and/or represented by peripheral populations only underscores the sensitivity of the regional avifauna to riparian habitat degradation.

With a disproportionate percentage of the nation's vertebrate species, the southwestern United States is known as a region of high biodiversity (Hubbard 1977). A relatively low latitude, a varied topography, a unique biogeographic and geologic history (MacMahon 1985, Flather and others 1994), and the local occurrence of most of the vegetative life zones/biotic communities of the western U.S. (Carleton and others 1991, Brown 1994) all contribute towards high species richness. An important feature of biodiversity in the Southwest, however, is that much of the wildlife is concentrated in riparian habitats and wetlands, which constitute less than 2 percent of the land area (Johnson and Haight 1985, Szaro and Jakle 1985, Dahms and Geils 1997). Birds in particular show a close association with riparian habitats and wetlands, as 78 (47 percent) of the 166 avian species nesting in the Southwest lowlands are completely dependent on these habitats during the breeding season (Johnson and others 1977).

Another important feature of the regional wildlife relates to biogeography: many of the vertebrate species (for example, birds, bats) represented in the Southwest reach the end of their distribution in this region. Because population density tends to decline (Hengeveld and Haeck 1982, Rapoport 1982, Brown 1984, Emlen and others 1986, Teleria and Santos 1993, Maurer and Villard 1994, Brown and others 1995) and distribution may be patchier (Brown 1984) towards the edge of the geographic range, peripheral populations tend to be small and isolated. Hence, they may be associated with a higher risk of occasional decline or even local extirpation due to stochastic variation in local conditions (see Petterson 1985, Simberloff 1988, Clark and others 1990). Ultimately, the high concentration of wildlife in only a small portion of the land area, combined with the large number of species represented by peripheral populations - which, too, may concentrate near bodies of water- suggests that biological diversity in the Southwest may be particularly vulnerable to the loss of riparian habitat and wetlands.

In this study, we examine the influence of biogeography and extent of riparian dependence on the prevalence and/or likelihood of endangerment in landbirds nesting at low and mid elevations in Arizona and New Mexico. As it turns out, riparian habitats have been severely altered by human activities since the end of the 19th century. Due to groundwater pumping, livestock grazing, water management activities, urban expansion, woodcutting, invasion by exotic species, and mining (Phillips and Monson 1964, Rea 1983, Johnson and Simpson 1988, Tellman and others 1997), an estimated 90 to 95 percent of the original riparian habitat has been lost or degraded (Johnson and Carothers 1982, Fleishner 1994). Altogether, the history of riparian habitats in the Southwest has been called one of destruction and desertification (Phillips and Monson 1964, Johnson and Simpson 1988).

Methods

We first compiled a list of all 74 obligate and preferential riparian/wetland landbird species breeding at low or mid elevations (i.e., desertscrub and desert grasslands) in Arizona and New Mexico (table 1). Obligate riparian species were those nesting (almost) exclusively in riparian habitats, while preferential riparian birds were those breeding most frequently and in highest numbers along rivers and streams. The differentiation between obligates and preferentials, as

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Table 1—List of obligate and preferential riparian and wetland landbird species nesting at low and mid-elevations in the Southwest (Arizona and New Mexico).

Species (Federal and State status)[a]	Geographic status[b]	Population decline/extirpation[c]
Obligate riparian and wetland		
Mississipi Kite (AZ)		
Bald Eagle (FT)	SE	
Cooper's Hawk		EEE
Common Black-Hawk (AZ, NM)	NE	E
Gray Hawk (AZ)	NE	E
Zone-tailed Hawk	NE	E
Yellow-billed Cuckoo (AZ)		DDDD
Broad-billed Hummingbird (NM)	NE	
Violet-crowned Hummingbird (AZ)	NE	
Belted Kingfisher (AZ)	SE	extirpated in the lowlands
Northern Flicker (Red-shafted race)		
Northern Beardless-Tyrannulet (NM)	NE	
Western Wood Pewee		
Willow Flycatcher (FE)	SE	EEEE
Black Phoebe		
Vermilion Flycatcher	NE	EEED
Tropical Kingbird (AZ)	NE	
Cassin's Kingbird		
Thicked-billed Kingbird (AZ, NM)	NE	
Western Kingbird		
Rose-throated Becard (AZ)	NE	E
Bank Swallow	SE	
Cliff Swallow		
White-breasted Nuthatch		
Bewick's Wren		
Marsh Wren	SE	
Yellow Warbler		
Common Yellowthroat		
Yellow-breasted Chat		EED
Red-winged Blackbird		
Yellow-headed Blackbird	SE	
Summer Tanager	NE	EEED
Blue Grosbeak		
Lazuli Bunting	SE	
Indigo Bunting	SE	
Painted Bunting	NE	
Song Sparrow		
Abert's Towhee (NM)		
Bronzed Cowbird	NE	
Northern Oriole		
Lesser Goldfinch		
Preferential riparian		
Harris' Hawk	NE	EEEE
American Kestrel		
Peregrine Falcon (FE)		
Gambel's Quail		
White-winged Dove	NE	
Mourning Dove		
Common Ground Dove (NM)	NE	
Greater Roadrunner		
Common Barn Owl		
Western Screech-Owl		
Ferruginous Pygmy-Owl (FE)	NE	EEEE
Elf Owl	NE	DDDD
Black-chinned Hummingbird		
Anna's Hummingbird	NE	
Gila Woodpecker (NM)	NE	D
Ladder-backed woodpecker		
Ash-throated Flycatcher		
Brown-crested Flycatcher	NE	EEE

(con.)

Table 1 (Con.)

Species (Federal and State status)[a]	Geographic status[b]	Population decline/extirpation[c]
Preferential riparian (con.)		
Northern Rough-winged Swallow		
Verdin	NE	
Black-tailed Gnatcatcher	NE	
Northern Mockingbird		
Curve-billed Thrasher		
Crissal Thrasher	NE	
Phainopepla	NE	
European Starling		
Bell's Vireo	NE	DDED-E
Lucy's Warbler		
Northern Cardinal	NE	
Pyrrhuloxia	NE	
Brown-headed Cowbird		
Hooded Oriole	NE	EEE
House Finch		

Data compiled from Monson and Phillips (1981), Hunter and others (1987), Johnson and others (1987), Arizona Game and Fish Department (1988, 1996), U.S. Fish and Wildlife Service (1996), New Mexico Department of Game and Fish (1997).

[a]FE: federally listed as endangered in Arizona and/or New Mexico, FT: federally listed as threatened in Arizona and/or New Mexico, AZ: listed by the Arizona Game and Fish Department as endangered, threatened, or candidate (i.e., species or subspecies for which threats are known or suspected and substantial population declines probably occurred but have not been documented), NM: listed by the New Mexico Department of Game and Fish as endangered, threatened, or sensitive.

[b]NE: occurs at the northern edge of its geographic range in the Southwest, SE: occurs at the southern edge of its geographic range in the Southwest.

[c]E: extirpated from the upper basin of one major river (Salt, Verde, Gila, Colorado, Santa Cruz, San Pedro rivers, Rio Grande) and its tributaries, EE: extirpated from the upper basin of two major rivers,… D: population decline documented within the upper basin of one major river, DD: population decline documented within the upper basin of two major rivers,…

presented here, was specific both to low and mid-elevations and to Arizona and New Mexico only. The Yellow-billed Cuckoo (*Coccyzus americanus*), for example, is widespread in a variety of mesic habitats in the eastern states, but it is restricted to riparian woodlands in the Southwest. The Cassin's Kingbird (*Tyrannus vociferans*) is an obligate riparian bird at lower elevations, but in pinyon-juniper woodlands it often nests away from water.

We also determined the biogeographic status of each species in relation to the northern and southern ends of its distribution. Birds were divided into three categories: a) species that reach the northern end of their range in the Southwest, b) species that reach the southern end of their range in the Southwest, and c) all other species. For each species, likelihood of endangerment was then examined using two indicators: (1) population decline or local extirpation documented in the lower basin of one or several major watersheds (Colorado, Gila, Salt, Verde, San Pedro, Santa Cruz, Rio Grande) and (2) federal or state listing as endangered, threatened, candidate, or sensitive species. The second indicator did not reflect endangerment per se, as listing can also be based on scarcity in the absence of population decline. However, scarcity may determine the potential risk for future population decline and/or extirpation (see introduction). Differences in the number of species exhibiting population decline or local extirpation were tested across the categories defined above. Differences in the number of species listed on the Federal Register and/or by states were tested between obligate and preferential birds. All statistical tests consisted of Chi-square analyses of contingency tables.

Results and Discussion

Of all 74 species listed in our table (table 1), 41 (55 percent) were found to be riparian obligates, 33 (45 percent) preferentials. A total of 37 (50 percent) birds reached the northern or the southern end of their geographic range in the Southwest. Population decline and/or extirpation was documented for 18 (24 percent) species, while federal or state listing was reported for 18 (24 percent) birds -but not necessarily the same species exhibiting decline or extirpation. Results indicated a significantly higher ($P<0.005$) proportion of species exhibiting population decline and/or local extirpation among those occurring at the northern end of their geographic range than among those not occurring at the end of their distribution (fig. 1). The difference in the proportion of species showing population decline/local extirpation between biogeographic categories b -represented by only 8 species- and c was three-fold, but failed to achieve significance ($P>0.05$). No significant difference ($P>0.05$) was detected in the proportion of obligate versus preferential riparian species showing population decline and/or local extirpation. However, the proportion of species listed versus not listed was significantly higher ($P<0.05$) in obligate birds than in preferential birds. Combining indicators 1 and 2 (see methods), the proportion of obligate species exhibiting endangerment and/or scarcity was marginally significantly higher ($P<0.1$) than that of preferential species (fig. 2).

Overall, our study underlines the fragile nature of the southwestern avifauna: if biogeographic status and extent of riparian dependence influence the likelihood of

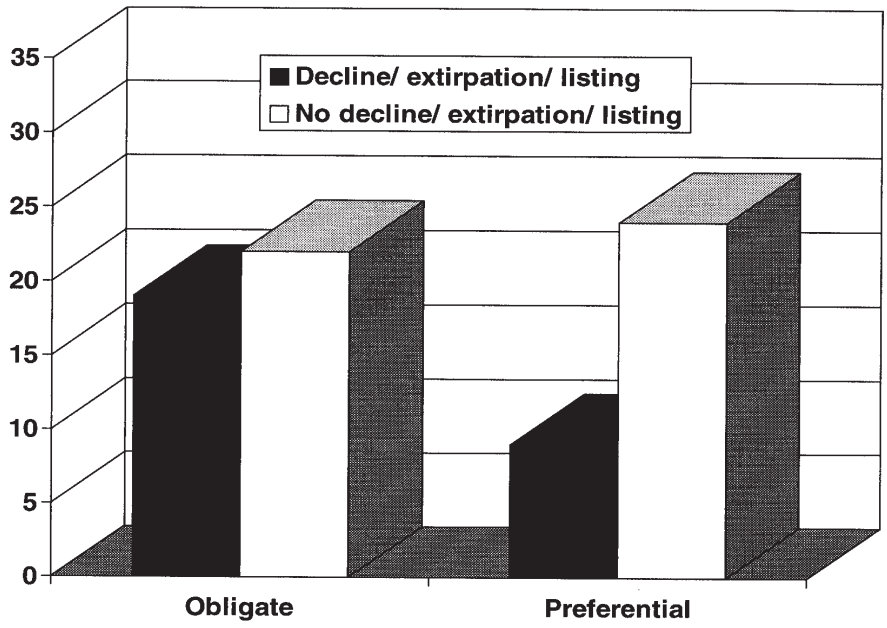

Figure 1—The influence of biogeography. The Y axis represents the number of bird species exhibiting versus not exhibiting population decline and/or local extirpations across three biogeographic categories: (1) birds that reach the northern end of their range in the Southwest (Periph. [N]), (2) birds that reach the southern end of their range in the Southwest (Periph. [S]), and (3) all other species.

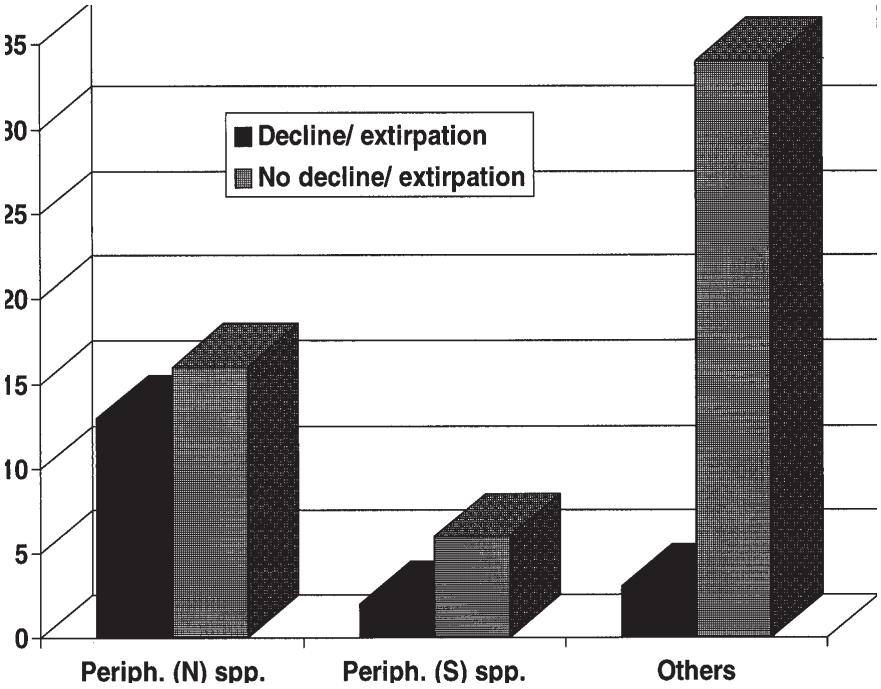

Figure 2—The relationship between extent of riparian dependence and population scarcity and/or endangerment. The Y axis represents the number of riparian birds state/federally listed and/or exhibiting population decline or local extirpation across two categories: (1) obligate riparian birds and (2) preferential riparian birds.

endangerment, then a high number of species—those exhibiting a high degree of dependence on riparian habitats and/or those represented by peripheral populations—may be at risk for becoming extirpated in the Southwest if habitat degradation continues. The study may also be useful for predicting which birds may be vulnerable to further degradation of riparian habitats. In our view, conservation planning for peripheral populations may be more important than generally advocated by biologists: reduced gene flow between isolated peripheral populations and core populations may well signify a greater potential for speciation at the edge of the geographic range (Brown 1984). Continued habitat loss may then mean not only reduced biodiversity but also decreased potential for speciation—arguably one key determinant of future biodiversity.

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