Response of Birds to Fire in the American Southwest

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Abstract

Fire was a common prehistoric disturbance in most southwestern grasslands, oak savannas, and coniferous forests, but not in Sonoran and Mojave desertscrub, or in riparian ecosystems. Prescribed burning should be applied, but under experimental conditions that facilitate studying its impacts on birds and other components of biodiversity. Fire plays a critical role in maintaining a balance between desert grassland and Chihuahuan desertscrub, but unburned areas also are important for birds dependent upon woody vegetation and/or heavy grass cover. Understory fire probably once played a critical role in maintaining relatively open oak (Quercus spp.), pinyon-juniper (Pinus-Juniperus), and ponderosa pine (Pinus ponderosa) woodlands and their bird assemblages, while stand replacement fires sustained aspen groves (Populus tremuloides) at higher elevations. Carefully controlled prescribed burning, thinnning, and grazing management will be needed to return fire to its prehistoric role in these habitats. There is an urgent need for cooperative effort between managers and researchers to implement replicated burns to quantify avian responses in appropriate habitats.

Key words: birds, desert, fire, grassland, mixed-conifer, pine-oak, prescribed burning, riparian, savanna, Southwest.

The ecological importance of fire in the American Southwest has long been recognized (Leopold 1924), but the nature of these fires has been altered drastically by disturbances such as logging, livestock grazing, and suppression efforts (Moir et al. 1997, McPherson and Weltzin 2000). Southwestern ecosystems range from low desert to high montane, and fire ecology and management issues differ greatly among them (Krammes 1990).

The Sonoran and Mojave Deserts consist of structurally complex vegetation (Turner et al. 1995), and they have correspondingly rich avifaunas dependent upon trees and large succulents (Mills et al. 1991). The spread of exotic grasses such as red brome (Bromus rubens) and buffelgrass (Pennisetum ciliare) have increased the frequency and intensity of fire in these deserts, killing much of the native vegetation (Miller et al. 1995). Fire effects on birds in these deserts therefore are almost entirely negative.

Most southwestern grasslands were invaded by woody plants from the Chihuahuan Desert, beginning especially in the late 1800s, largely because of decreased frequencies and intensities of fire (Archer et al. 1995, McPherson 1995). Birds associated with grasslands have declined more than other avian groups, both nationally and in the Southwest (Brown and Davis 1998, Vickery and Herkert 2001), at least in part because of the conversions of former grassland to desertscrub. Fire has the short term effect in southwestern grasslands of reducing grass cover while stimulating forb cover and seed production for two or three post-fire growing seasons. Such burning favors grassland birds associated with relatively open ground, such as Mourning Dove (Zenaida macroura), Horned Lark (Eremophila alpestris), and Lark Sparrow (Chondestes grammacus), over those requiring heavy grass cover, such as Grasshopper Sparrow (Ammodramus savannarum), Botteri's Sparrow (Amphipola botterii), and Cassin's Sparrow (Amphipola cassini; fig. 1). Prescription fire should be applied in these ecosystems, especially in relatively mesic sites, to restore open grasslands and retard woody encroachment (Bock and Bock 1992, Gordon 2000). However, a balanced approach is called-for, since other species prefer or require woody cover in Chihuahuan shrub/grasslands (Whitford 1997, Pidgeon et al. 2001).

Interior chaparral occurs from northwestern Arizona to southwest Texas and northern Mexico, and supports a variety of shrubland birds (Szaro 1981, Pase and Brown 1982). Drought, livestock grazing, and fire suppression have increased shrub cover and reduced cover of perennial grasses and forbs in Arizona chaparral (Brejda 1997). Virtually nothing is known about avian
responses to fire in this ecosystem (but see Szaro
1981), and experiments with prescribed fire are strongly
recommended.

Fire once maintained oak (Quercus spp.) savannas in
the Mexican borderlands in an open condition, by
frequently killing smaller trees and shrubs (McPherson
1997). These ecosystems became more densely wood­
ed when livestock grazing and fire suppression reduced
fine fuels (McPherson and Weltzin 2000). Typical
birds of southwestern oak savannas include species
specializing on acorns, insect hawkers, foliage glean­
ers, and species dependent on the grassy understory
(Brown 1982). Responses of these birds to prescribed
or wildfire in southwestern oak woodlands are largely
unknown, but studies in Midwestern savannas suggest
that fire would favor insect hawkers and understory
species over foliage gleaners (Davis et al. 2000).

Southwestern riparian woodlands support an abun­
dance and variety of breeding birds vastly greater than
adjacent ecosystems (Carothers et al. 1974), but many
of these woodlands have been damaged or completely
eliminated by anthropogenic forces such as alteration
of natural flooding regimes and the spread of exotic
vegetation (Ellis et al. 1998). The result has been a sub­
stantial decline in abundance and variety of birds in
these ecosystems (Rosenburg et al. 1991), although
remnant patches continue to support high avian biodiv­
sity (Strong and Bock 1990, Skagen et al. 1998).
There is little evidence that fire was a common histori­
cal event in southwestern riparian woodlands, perhaps
because of moisture. Recent fires have been highly
destructive of native riparian vegetation, most particu­
larly the large trees such as cottonwood (Populus spp.)
and sycamore (Platanus spp.) that are especially
important to birds (Bock and Bock 1984, Busch 1995).
Therefore, prescribed fire is not recommended for
these ecosystems.

Pinyon-juniper (Pinus-Juniperus spp) woodland is
widespread throughout the Southwest, but little is
known about fire effects in this ecosystem (Balda and
Masters 1980, Severson and Rinne 1990). We found no
studies related to birds and fire in pinyon juniper wood­
lands. Fire likely would favor species associated with
more open habitats, while negatively impacting species
that depend on trees for foraging or nesting, but this
tenuous conclusion is based on responses of birds to
mechanical clearing of dense stands rather than to fire
itself (Sedgwick and Ryder 1987).

Fire is perhaps the most important natural disturbance
in southwestern ponderosa pine (Pinus ponderosa) for­
est, and frequent low-intensity fires were part of their
evolutionary history (Pyne 1996, Moir et al. 1997).
Suppression efforts, livestock grazing, and logging
have altered natural fire regimes, resulting in dense for­
est and increased risk of unnatural stand replacement
fires. Most studies of fire effects on birds in these for­
est have focused on stand replacement burns, where
woodpeckers and ground foragers are the main short­
term beneficiaries (Dwyer and Block 2000). Species
likely to benefit from cooler understory fires are those
requiring relatively open habitats, such as flycatchers,
swallows, and bluebirds (Marshall 1963, Horton and
Mannan 1988).

Bird numbers and species richness seemed to respond
positively shortly after the 1996 Horseshoe and
Hochderffer fires on the Coconino National Forest
Arizona (table 1). During the breeding season three
years post-fire, more species were detected in areas
where fires were severe (stand-replacement) and mod­
erate (understory) than in adjacent unburned forests
(45, 41, and 31 species, respectively). A similar trend
was found during the nonbreeding season with 33, 35,
and 26 species detected in severe, moderate, and un­
burned forests. Major species groups that increased in
response to fire included woodpeckers, flycatchers, and
thrushes. In contrast, many foliage-gleaning birds
(Mountain Chickadees, Plumbeous Vireo, Pygmy Nut­
hatch, Yellow-rumped Warbler, and Grace’s Warbler)
were detected less frequently within severe fire areas.
Table 1—Simple counts of birds detected during point counts conducted within ponderosa pine forests burned during the 1996 Horseshoe and Hochderffer fires, Coconino National Forest, Arizona (Block, unpubl. data). Counts were conducted in the breeding season of 1999 and nonbreeding season 1999-2000, approximately three years after the fires.

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<th>Breeding</th>
<th>Nonbreeding</th>
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Mixed conifer forests of the Southwest are dominated by Douglas-fir (Pseudotsuga menziesii), white fir (Abies concolor), Engelmann spruce (Picea engelmannii), and aspen (Populus tremuloides; Brown 1982). Many fires that occur at higher elevations in these forests are stand replacing, providing opportunities for establishment of aspen (Moir 1993), and the variety of birds associated with it (Finch and Reynolds 1987, Hutto 1995). However, a variety of other birds, including the threatened Mexican Spotted Owl (Strix occidentalis lucida), depend on substantial conifer forests (Smith 1980, U.S. Department of Interior 1995). More field research specific to Southwestern conditions needs to be conducted to understand fire effects on birds in mixed-conifer forests.

Both deliberately-set prescribed fire and prescribed natural fire (natural ignition, allowed to burn within pre-set limits) are essential approaches in reducing fuels and returning southwestern grass/shrublands, oak savannas, and conifer forests to their prehistoric conditions. Given the historical importance of fire in these ecosystems, there have been surprisingly few studies of the effects of either wildfire or prescribed burning on southwestern bird populations and communities. We call for managers and researchers to cooperate in the design and implementation of replicated, large-scale, properly controlled field experiments to examine avian responses to prescription burning.

Acknowledgments

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Literature Cited


