

Fire on the Mountain: Birds and Burns in the Rocky Mountains¹

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The diversity of climate and topography across the Rocky Mountains has resulted in a broad spectrum of fire regimes ranging from frequent, low-severity fires to infrequent stand-replacement events. Such variation in fire history contributes to landscape structure and dynamics, and in turn can influence subsequent fire behavior (Allen et al. 2002). In essence, landscapes across the Rocky Mountains are shifting mosaics that reflect variation in disturbance frequency, severity, and time since the last disturbance. Superimposed on, and interacting with, fire regimes are other natural disturbances (e.g., insect outbreaks) and the influence of human activities. In turn, the collective influence of fire and human activities on the landscape influences avian community structure and dynamics.

Here we review the current state of knowledge about past fire regimes and how they have been altered by human activities. We also highlight the limited information on how avian communities respond to fire. We conclude with implications for fire management programs in the Rocky Mountains. See Kotliar et al. (in review) for more extensive discussion of these topics.

The degree to which human activities have altered fire regimes is not consistent across Rocky Mountain landscapes or through time (Veblen and Lorenz 1991, Knight et al. 2000). During Euro-American settlement, a number of activities collectively influenced fire frequency including grazing, logging, human-caused fires, and active fire suppression (Allen et al. 2002). More recently there has been unprecedented rapid growth of communities in many forested regions of the Rocky Mountains (Theobald 2000). Attempts to restore natural fire regimes are constrained by the ever-increasing wildland-urban interface; in Colorado, for example, ~80% of forests are within 3 km of private lands (Theobald 2000). Thus, historic and current settlement and land use patterns have substantially altered the structure and dynamics of fire-dominated landscapes.

The degree of deviation from historic landscape functioning, and the persistence of such changes, varies among disturbance regimes (Romme 1982, Romme et al. 2000, Veblen et al. 2000). In general, alteration of historic fire regimes has been most pronounced in ponderosa pine (*Pinus ponderosa*) forests. At lower elevations and in the southwest, ponderosa pine systems were characterized by frequent, understory fires (Veblen et al. 2000, Allen et al. 2002). Historically, the frequent fires helped to maintain open stands (Brown et al. 1999, Veblen et al. 2000, Allen et al. 2002). At higher elevations, where ponderosa pine is mixed with Douglas-fir (*Pseudotsuga menziesii*), fire occurred less frequently, resulting in a mixed regime that included both understory and crown fire events (Brown and Sieg 1996, Brown et al. 1999, Veblen et al. 2000). Fire exclusion, caused by active suppression or grazing, and subsequent increase in tree density have been more pronounced in forests that burned frequently (Veblen et al. 2000). Thus, the greater continuity of fuels resulting from a century of fire exclusion is believed to have resulted in more extreme fire behavior over the past several decades (Allen et al. 2002). However, the relative influence of climate (e.g., extreme drought, high winds) versus fuels (i.e., fire suppression) on recent fire behavior in forests characterized by mixed regimes is unclear (Veblen et al. 2000).

Fire suppression in subalpine forests is generally presumed to have been less effective than in montane forests because of limited accessibility and strong climatic drivers of fire behavior (i.e., extreme drought and high winds), which characterize high-elevation forests (Romme 1982, Romme and Despain 1989, Romme et al. 2000, Veblen 2000). Furthermore, even in areas where fire frequency may have declined, burn severity may remain unchanged (Romme and Despain 1989). However, logging and other landscape disturbance during Euro-American settlement may have altered subsequent landscape dynamics by creating more homogeneous forests and a preponderance of subalpine forests ca. 200 yr old (Veblen and Lorenz 1991).

Our understanding of how avian communities respond to burned forests is quite rudimentary. In a recent review of the literature, Kotliar et al. (2002) summarized general patterns for 41 bird species observed in at least three of 12 studies comparing burned and unburned forests in the western United States. They found that many woodpeckers and aerial insectivores are generally more abundant in recently burned forests,

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including Back-backed (*Picoides arcticus*), Three-toed (*P. tridactylus*), and Hairy Woodpeckers (*P. villosus*), Olive-sided Flycatchers (*Contopus cooperi*), and Mountain Bluebirds (*Sialia currucoides*). In contrast, foliage gleaners and other species preferring closed canopy forests, such as Varied Thrush (*Ixoreus naevius*), Townsend's Warbler (*Dendroica townsendi*), Mountain Chickadee (*Poecile gambeli*), and Ruby-crowned Kinglets (*Regulus calendula*), are more abundant in unburned forests (Kotliar et al. 2002). These patterns were consistent across a wide geographic area and a variety of conifer cover types.

However, most species exhibit varied responses to burns, such as Western Tanagers (*Piranga ludoviciana*), Townsend's Solitaire (*Myadestes townsendi*), Chipping Sparrow (*Spizella passerina*), and Dark-eyed Junco (*Junco hyemalis*). Several factors may contribute to this variation, including burn severity and spatial heterogeneity in burn patterns, geographic variation, edge effects, time since fire, and cover types (Huff and Smith 2000, Kotliar et al. 2002). Several studies have been initiated to begin to tease apart the effects of these factors. Preliminary data from a study of burns across the southern Rocky Mountains indicate that burn severity and cover type can influence how birds respond to burned forests. For example, the White-breasted Nuthatch (*Sitta carolinensis*) was most abundant in low-severity burns compared to unburned or severely burned forests (Kotliar, unpubl. data). However, some species (e.g., Townsend's Solitaire) showed similar abundance across a range of burn severities, including unburned forest. Many generalist species preferring a mixed open canopy exhibited an apparent tolerance to a wide variety of burned conditions (Kotliar, unpubl. data).

The variation observed in the response of avian communities to fire, coupled with variation in, and uncertainty about, historic fire regimes (Baker and Ehle 2001), argues for caution in the implementation of recent fire initiatives to reduce fuel loads. These initiatives are based on the premise that millions of acres are susceptible to uncharacteristically large and severe wildland fires due to decades of fire suppression (Allen et al. 2002). However, there are a number of untested assumptions about historic fire regimes and forest structure that affect the validity of the fire-management initiatives. Moreover, it is assumed that specific forest structures will ensure the integrity of natural communities (e.g., avian communities). These assumptions, which are unlikely to be valid across the broad spatial scales at which the fire initiatives are implemented, have ramifications for the ecological integrity of avian communities of the Rocky Mountains. Because the lack of information on the effects of fire on wildlife is a major stumbling block for developing ecologically

sound fire management policies, basic research on fire effects is urgently needed.

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