

Migratory Songbirds & Grazing

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Historically shrublands dominated by sagebrush (*Artemisia* spp.) covered over 62 million acres in western North America (West and Young 2000). Significant losses to this community type were first documented almost 40 years ago and continue today (Braun et al. 1976, Knick 1999). Conversion of sagebrush lands to agriculture, fragmentation resulting from energy or subdivision development, and modifications, such as prescribed fire, herbicides, and some grazing practices that lead to exotic, annual grass establishment, are significant stressors on sagebrush systems (Rich et al. 2004, MTSWAP 2015). In Montana, sagebrush is considered a Tier 1 community or community in greatest need of conservation (MTSWAP 2015). Big Sagebrush Steppe, the most widely distributed sagebrush system in Montana, is typically characterized by Wyoming big sage (*Artemisia tridentate* ssp. *wyomingensis*) with perennial grasses and forbs dominating at least 25% of cover (Montana Natural Heritage Program 2011).

Concomitant with a decline in sagebrush systems is a decline in birds associated with sagebrush habitat. Approximately 76% of birds that are sagebrush-associated species are declining nationally (North American Bird Conservation Initiative 2009). Sagebrush-nesting species make up the largest number of Species of Continental Importance within the Intermountain West (Rich et al. 2004). The Greater Sage-grouse (*Centrocercus urophasianus*), has shown significant declines over the last 30-40 years (Garton et al. 2010). The U.S. Fish and Wildlife service recently decided not to list this species under the Endangered Species Act, but its status will be re-evaluated in five years. Several other bird species found in Montana's sagebrush systems are migratory songbirds that are of conservation concern because of declining populations and high threats including Brewer's Sparrow (*Spizella breweri*), Sage Thrasher (*Oreoscoptes montanus*), McCown's Longspur (*Calcarius mccownii*), Chestnut-collared Longspur (*Calcarius ornatus*), and Lark Bunting (*Calamospiza melanocorys*; Casey 2000, Rich et al. 2004). Songbirds respond quickly to habitat changes by shifting their distributions and adapting their reproductive performance. Changes in songbird abundance are also ecologically important because they interact with other species such as predators, prey, pollinators and seed dispersers (Murphy and Romanuk 2012). Specific to sagebrush systems, songbirds exhibit a varying degree of reliance on grassland vegetation, an important component of sagebrush ecosystems (Rich et al. 2005). They range from: grassland obligates such as McCown's Longspur and Chestnut-collared Longspur, species that use grassland for the majority of their life history needs; to facultative grassland species (e.g., Vesper Sparrow, *Pooecetes gramineus*) which use grassland in addition to other vegetation to meet their life history needs; to sagebrush obligates such as Brewer's Sparrow and Sage Thrasher, species that use sagebrush for the majority of their life history needs. Thus, sagebrush-associated songbirds can serve as an initial barometer for system integrity and assist in evaluating the effectiveness of management actions.

Livestock grazing is the most widespread land use across the range of sagebrush ecosystems (Knick et al. 2010) and offers many benefits to a variety of stakeholders ranging from

conservation practitioners to private land owners. Through the consumption of vegetation, livestock grazing directly and indirectly affects the amount of vegetation in a system. Livestock grazing also provides a type of disturbance needed for many systems. There is a growing recognition that livestock grazing can be manipulated to positively affect sagebrush-associated birds. Depending on the timing and utilization rates of livestock, livestock grazing can directly increase sagebrush size, cover, and density; decrease forb cover and density; and decrease grass cover and density (Beck and Mitchell 2000, Crawford et al. 2004). Heavy livestock grazing can also decrease invertebrate biomass (Krausman et al. 2009), which is important because invertebrates are a food source for several bird species. Rest-rotation grazing strategies are currently the most common grazing strategy used to improve habitat for wildlife in sagebrush systems. For example, Montana Fish, Wildlife and Parks (FWP) currently manages 89,000 acres of grazed habitats on state-owned lands using rest-rotation grazing. More recently, due to emphasis on conservation for the Greater Sage-grouse, the Natural Resources Conservation Service (NRCS) has developed a Sage Grouse Initiative (SGI). In Montana, delivery of this initiative includes implementation of rest-rotation management to control the location and timing of grazing on areas with relatively high sage-grouse densities, called “core” areas. To date >400,000 acres have been enrolled across Montana, and this program is likely to continue to grow.

Despite the ubiquitous distribution of livestock grazing in sagebrush ecosystems and the widespread and growing use of rest-rotation grazing management to benefit wildlife in these areas, little data exist to demonstrate links between grazing management and wildlife populations (Krausman et al. 2009). For example, an empirical link between livestock grazing, sage-grouse habitat, and sage-grouse populations has not been established (Connelly and Braun 1997, Beck and Mitchell 2000, Connelly et al. 2004, Knick et al. 2010). Limited data suggest that rest-rotation grazing may not have large short-term effects on the density of songbirds (Lapointe et al. 2003). In addition, many studies that examine the effect of livestock grazing on wildlife tend to compare livestock grazing in an area to an area without livestock grazing (e.g., Bock & Webb 1984; Harrison et al. 2010; Nelson et al. 2011). Given the economic, social, and ecological value of livestock grazing in sagebrush systems, livestock grazing is likely going to continue to be a widespread land use in these systems. However, livestock grazing techniques that produce high quality habitats for a diversity of wildlife species while providing economic benefits for land managers need further investigation. Thus, a clear need exists to evaluate the benefits of rest-rotation livestock grazing management on sagebrush-associated songbird populations.

Considerable effort is currently directed towards identifying the impacts of livestock grazing on greater sage-grouse (*Centrocercus urophasianus*) management and conservation. Greater sage-grouse may exhibit a “lag” effect in response to habitat management due to their life history strategy of investing more in survival and less in reproduction relative to other species (i.e., they live longer and reproduce less per breeding season than other grouse species). In comparison, sagebrush-associated migratory songbirds respond more quickly to habitat changes by shifting their distributions and adapting their reproductive performance. Thus, migratory birds are among the few groups of organisms in which community reassembly (e.g.,

Lemoine et al. 2007, Zuckerberg et al. 2009), adaptation of species to climate change (Schaefer et al. 2008), and effectiveness of conservation actions have been documented. Management strategies that incorporate monitoring of songbirds will be alerted to changes in habitat much more quickly through changes in these songbird populations than sage-grouse populations. Thus a goal of this project is to determine if the response of migratory songbirds can serve as an initial indicator of the impacts of grazing management. If so, monitoring population status of songbirds may be a tool to assess the health of sagebrush systems and management actions.

We began this study in 2012, to evaluate the relationship between grazing and avian community composition and demographic parameters as related to SGI’s rest-rotation regime. We define rest-rotation grazing as a period of ‘rest’ over multiple years by alternating livestock grazing at 15 to 18-month intervals within a given area. In contrast we define season long grazing as the continuous presence of livestock in the same area repeatedly over multiple years, primarily during a vegetative growing season. We propose to continue data collection for the next five years, 2016 to 2020, with final products completed in 2021.

To date, a species suggested to be a ‘grassland obligate’, McCown’s Longspurs, has shown relatively more dramatic positive response to rest-rotation grazing when compared to season long grazing; (Fig. 1).

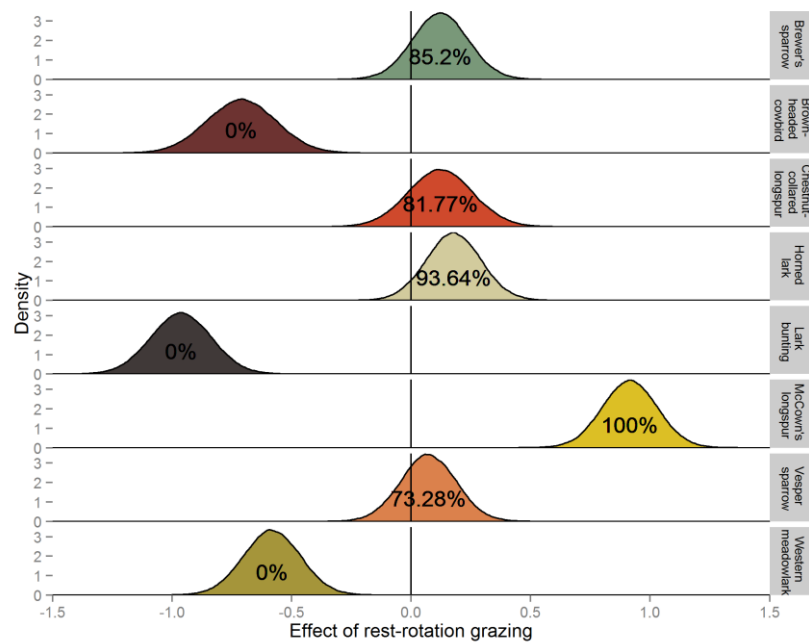


Figure 1. The distribution of the estimated effect of rest-rotation grazing compared to season long grazing on the abundance per 25 ha of eight migratory songbird species in sagebrush ecosystem. The percentages in each distribution represent the percent chance that the effect of rest-rotation grazing is positive. For instance, the abundance of McCown’s Longspur, a grassland obligate, had a strong positive response of rest-rotation grazing. Whereas, Brewer’s sparrow, a sagebrush obligate, has a slight positive response to rest-rotation grazing based on the distribution overlapping 0.0 and this slight positive response is 85.2% more likely than a negative response.

We will continue to assess how avian community composition changes using adult abundance of multiple avian species. Avian abundance is known to change with vegetation heterogeneity and grazing is known to affect vegetation heterogeneity, therefore, we can track vegetative patterns that occur as a result of grazing by measuring changes in avian abundance.

In addition, we will link songbird abundance and breeding activity to understand the fitness consequences for avian communities with respect to grazing regimes. Breeding effort can influence the persistence of populations and existing community structure. It is therefore important to understand how grazing can affect breeding activity. By altering vegetation that songbirds use for nesting, grazing may have a direct effect on breeding outcomes. From 2013 to 2015 we monitored nesting activity of three songbird species within each of these grazing systems. We selected these species because they represent the range of vegetation characteristics used by breeding songbirds: Brewer's sparrow (a shrub nester), vesper sparrow (*Pooecetes gramineus*; a generalist ground nester), and McCown's longspur (*Rhynchophanes mccownii*; a grassland ground nester).

The specific goals of this project are to:

1. Describe migratory songbird species abundance/density, species richness, species diversity, and community composition between SGI's rest-rotation regime and season long grazing during the migratory songbird breeding season.
2. Differentiate between distributional shifts and population responses of migratory songbirds to grazing treatments over time.
3. Identify reproductive responses to SGI's rest-rotation grazing regime of three songbird species that represent the range of vegetation characteristics used by breeding songbirds. Variables that may describe differences in the dependent variables include, but are not limited to, biotic factors (e.g., grazing treatment, arthropod densities/biomass, vegetation structure) and abiotic factors (e.g., soil, temperature, precipitation).
4. Determine if the response of songbirds is an initial indicator of change in sagebrush systems to land management actions.