FINAL REPORT

Archiving of data on occurrence of breeding birds associated with fire treatments and controls

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ABSTRACT

Since 2001, we have collected data on occupancy and relative abundance of Greater Sage-Grouse (*Centrocercus urophasianus*) and other species of breeding birds in the central Great Basin, and characterized the vegetation structure and composition of breeding birds' habitats, through four projects supported by the Joint Fire Science Program (00-2-15, 01B-3-3-01, 05-2-1-94, and 09-1-08-4). These projects collectively have generated dozens of refereed publications, dozens of invited papers or presentations, multiple M.S. theses and Ph.D. dissertations, and many workshops and field tours. Bird data included in refereed publications to date were based on point counts with a fixed radius of 75 or 100 m and a duration of 5 minutes per visit. These data previously were archived with the USDA Forest Service's Research Data Archive. Since 2004, however, we also have conducted 100-m fixed-radius point counts with a duration of 8 minutes per visit. Furthermore, starting in 2002, we recorded birds detected beyond the fixed radius and during travel among point-count locations or at other times of day or night.

We archived data on the incidental and longer-distance detections of birds, which included more than 22,600 records. We also archived all data on vegetation structure and the composition of dominant trees and shrubs collected through 2012. There are few sets of long-term, spatially extensive data on distributions and abundance of fauna or extensive characterizations of vegetation in the Great Basin. These data have considerable capacity to inform understanding and management of fire dynamics; changes in land cover, including conversion of native vegetation to cheatgrass (*Bromus tectorum*); and the status of species proposed for listing under the Endangered Species Act.

BACKGROUND AND PURPOSE

Incidental and long-distance data on birds

For the past 13 years, we have conducted standardized surveys of breeding birds in the central Great Basin to achieve the goals of multiple research projects supported by the Joint Fire Science Program and by other government agencies and nonprofit organizations. We established 370 survey points during that time: 60 in the Shoshone Mountains, 152 in the Toiyabe Range, 75 in the Toquima Range, and 83 in the Monitor Range (Lander, Eureka, and Nye counties, Nevada). Survey points were located along the full elevational gradient of each canyon we sampled, typically with two or three points per 100 m of vertical elevation change. Points were positioned to sample, in approximate proportion to areal extent, the dominant land-cover types throughout the canyons (e.g., pinyon and juniper woodland, mixed deciduous and coniferous woodland, shrubland dominated by sagebrush). We added bird-survey points over time to increase the sample size of points treated with prescribed fire or wildfire. Thirteen points were treated in 2000, two in 2002, eight in 2004, ten in 2005, four in 2006, and four in 2008. We also added points to serve as controls for the new treated points. A small number of additional canyons were visited in one year, but not at fixed points.

Data on detections of breeding birds during 5-minute, fixed-radius point counts within 100 m of the observer from 2001 through 2012 were archived with the USDA Forest Service's Research Data Archive (Fleishman 2011a, 2013a). The latter data meet strict criteria or standards with respect to, for example, sampling methods, bird behavior, location, and age class, and have been or will be included in published analyses.

From 2002–2012, we collected a substantial volume of data that are reliable, but do not meet those strict criteria. Among the reasons these data are considered incidental or long distance include but are not limited to the following. The bird was detected during a fixed-radius point count but the observer did not record the distance from the point center (thus it is unclear whether the detection was within 100 m of the observer, which is a criterion for many analyses); the bird was detected during point counts but at > 75 meters (2002–2004) or > 100 meters (2005–2012) from the point center (the limit for inclusion in many analyses); the bird was not detected during point counts (e.g., the bird was observed while traveling between sampling locations or in the afternoon or evening rather than during morning point-counts); the bird was a juvenile rather than an adult (most analyses are restricted to adults assumed to be breeding in the vicinity). The incidental and long-distance data remain useful for documenting species composition and distribution across space and time, and some species included in the incidental data are not represented in the data from the fixed-radius point counts. Therefore, we sought support to archive the incidental and long-distance data on breeding birds.

Vegetation data

From 2002 through 2012, we documented vegetation structure and composition of trees and shrubs in canyons at the point-count locations where breeding birds were detected annually from 2001 through 2013, or at the ends of 100-meter transects along which we searched for Greater Sage-Grouse (*Centrocercus urophasianus*) scats from 2010 through 2013. Vegetation at most points was measured once. Vegetation at points treated with fire (prescribed fire or wildfire), or at points intended to serve as controls for the fire treatments, was measured in multiple years.

The vegetation data were collected primarily to examine relations between probabilities of detection and occupancy of breeding birds and vegetation covariates. Data also have been used to train and validate models of vegetation (e.g., presence of riparian vegetation, potential changes in distribution of dominant species) that were based on remotely sensed data. Additionally, data are being used to examine responses of vegetation following fire treatments and post-fire land use. The vegetation data potentially also could serve as covariates for archived data on butterflies (Fleishman 2011b, 2013b).

STUDY DESCRIPTION AND LOCATION

Data were collected in the Shoshone Mountains and Toiyabe, Toquima, and Monitor Ranges (Lander, Nye, and Eureka Counties, Nevada). Bounding coordinates for the bird data were -117.547 (west), -116.412 (east), 39.488 (north), 38.647 (south), with an elevational range from 1892 to 3211 m. For the vegetation data, north and south bounding coordinates were 39.443 and 38.645, respectively.

Birds

We surveyed birds during the breeding seasons (late May through June) with 75-meter (2002–2004) or 100-meter (2005–2012) fixed-radius point counts. We established 179 survey points in 2001 that also were visited in 2002, and added additional points in most years through 2010. Most point centers were placed >350 meters apart. During each visit, we recorded by sound or sight all birds using terrestrial habitat within the survey area. Point counts were conducted only in calm weather, and few were conducted >3.5 hours after dawn. Points were sampled three times per year for five minutes (2002–2004) or eight minutes (2005–2012) per visit. Survey points were located along the full elevational gradient of the canyons we sampled, typically with two or three points per 100 meters of vertical elevation change. Points were positioned in order to sample the dominant vegetation types in proportion to the approximate extent of each vegetation type. Dominant vegetation was consistent within the point. We estimated the geographic coordinates (measured in Universal Transverse Mercator units; UTMs) of each survey point with a global positioning system.

As reflected in the incidental and long-term data, numerous birds were detected during fixed-radius point counts but outside the radius of the sample point or flying over the point rather than apparently using resources within the point. Birds were detected before or after point counts, while observers were traveling to point-count locations, or at other times while observers were in the field. In some cases, juveniles (individuals that are not included within the current year's breeding population) were recorded. Observers were encouraged to document all incidental observations in as much detail as possible (e.g., time of day, location, age class).

Vegetation

We used a 50-m surveyor's tape to measure three radial 30-m lines from the center of the bird survey point or end point of a 100-m transect along which field teams searched for Greater Sage-Grouse scats. Lines were separated from each other by 120 degrees. The distal end of each line was the center of a circle (referenced as a plot in the tree data) with 11.3-m radius (0.04 hectare). Within each circle, identities and sizes (either diameter at breast height or basal diameter, depending on plant morphology) of all live trees and standing dead trees were recorded. Each circle was divided into four quadrants to simplify field measurements (i.e., field personnel found it easier to measure trees within four successive quadrants than to measure trees within one circle).

We used a concave spherical densiometer was used to estimate proportion of canopy cover. The proportion of squares marked on the densiometer (of 24) in which a given species was observed allows one to estimate the proportion of canopy cover of that species. To estimate frequency of shrubs and ground vegetation, we used an ocular tube (piece of a PVC pipe about 11.5 centimeters long and 2.5 cm diameter) and took measurements at a 45˚ angle downward from the line of sight. We recorded the occurrence of approximately 20 dominant tree, shrub, and herbaceous taxa. We collected 21 densiometer and ocular tube readings at each plot: one each at 8 m, 16 m, and 24 m, along the 30-m line from the center of the plot to the perimeter of each circle, and one while facing in four directions, separated by 90 degrees, from the center of each circle.

Data from 2002 are at the level of point-count locations because raw data from the 21 sampling locations with each bird-survey point are not available. Whether a canopy, shrub layer, and ground layer was present was assessed with an ocular tube. The observer looked upward at a 45° angle and noted whether canopy was present, then downward at a 45 degree angle and noted whether a shrub layer (greater than or equal to 1 m in height) and ground layer (less than 1 m in height) were present. Cover class of each species as seen from above the point was estimated visually within each of the 3 circles, then averaged. There were five cover classes: 1: 0-5%; 2: 6-25%, 3: 26-50%; 4: 51-75%; 5: >75%.

From 2006 through 2012, we collected data on presence or absence of cheatgrass (*Bromus tectorum*) along a 50-m transect extending 25 m on either side of the center of the bird-survey point or end point of a Greater Sage-Grouse transect. The transect was oriented at random. The observer noted whether cheatgrass was present (1) or absent (0) at 5, 10, 15, 20, and 25 m on either side of the line.

KEY FINDINGS

The archived incidental and long-distance bird data include 20 species of birds that are not represented in the previously archived data, and create a more complete record of the regional fauna (Fleishman 2013a): Canada Goose (*Branta canadensis*), Northern Pintail (*Anas acuta*), Common Merganser (*Branta canadensis*), Mountain Quail (*Oreortyx pictus*), California Quail (*Archilochus alexandri*), Dusky Grouse (*Branta canadensis*), Swainson's Hawk (*Buteo swainsoni*), American Avocet (*Recurvirostra americana*), Wilson's Snipe (*Gallinago delicata*), Western Screech-Owl (*Megascops kennicottii*), Great Horned Owl (*Bubo virginianus*), Northern Pygmy-Owl (*Glaucidium gnoma*), Long-eared Owl (*Asio otus*), Northern Saw-whet Owl (*Aegolius acadicus*), Black-chinned Hummingbird (*Archilochus alexandri*), Red-naped x Red-breasted Sapsucker hybrid (*Sphyrapicus nuchalis* x *ruber*), American Dipper (*Cinclus mexicanus*), American Pipit (*Anthus rubescens*), American Redstart (*Setophaga ruticilla*), and Magnolia Warbler (*Setophaga magnolia*). The incidental and long-distance bird data include a total of 22,603 detections of 127 species of birds. By comparison, previously archived data exclusively from fixed-radius point counts (Fleishman 2013a) include 44,571 detections of 118 species. A total of 137 species are represented in the two archived data products.

The archived vegetation data illustrate temporal trends in areas treated with fire, such as colonization by cheatgrass and decreases in number of standing dead trees in response to treefall and human removal. Associations between occupancy of birds, measures of spatial and temporal heterogeneity in bird assemblages, and numerous measures of vegetation are described in the publications listed below. For example, we found that guilds of birds classified on the basis of dependence on riparian vegetation and on nest location had consistent associations with selected attributes of vegetation structure and composition, but there was considerable variation in associations among species within a guild (Mac Nally et al. 2008). Similarly, we found that different components of riparian vegetation were most closely associated with occupancy, colonization, and local extinction of three obligate riparian species of songbirds (MacGillivray's Warbler, Broad-tailed Hummingbird, and Song Sparrow; Dickson et al. 2009).

MANAGEMENT IMPLICATIONS

Management that is informed by credible scientific data requires access to data. Maintaining data and standardized metadata in publicly available archives is among the best mechanisms to ensure data access, transparency and repeatability of analyses and decisions informed by those analyses, and improvements in data analysis and inference over time.

RELATION TO OTHER RECENT FINDINGS AND ONGOING WORK

The data archived as deliverables for this project complement the following archived sets of data.

Fleishman, E. 2011a. Detections of breeding birds in the Shoshone, Toiyabe, Toquima, and Monitor ranges, Nevada. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fort Collins, Colorado. http://dx.doi.org/10.2737/RDS-2011-0002

Fleishman, E. 2011b. Presence and absence of butterflies in the Shoshone Mountains and Toiyabe and Toquima ranges, Nevada. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fort Collins, Colorado. http://dx.doi.org/10.2737/RDS-2011-0003

Fleishman, E. 2013a. Detections of breeding birds in the Shoshone, Toiyabe, Toquima, and Monitor ranges, Nevada. 2nd Edition. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fort Collins, Colorado. http://dx.doi.org/10.2737/RDS-2011-0002.2

Fleishman, E. 2013b. Presence and absence of butterflies in the Shoshone Mountains and Toiyabe and Toquima ranges, Nevada. 2nd Edition. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fort Collins, Colorado. http://dx.doi.org/10.2737/RDS-2011-0003.2

The archived vegetation data have been included in the following publications.

Bulluck, L.P., E. Fleishman, C.J. Betrus, and R.B. Blair. 2006. Spatial and temporal variation in species occurrence rate affects the accuracy of occurrence models. Global Ecology and Biogeography 15:27–38.

Fleishman, E. and R. Mac Nally. 2006. Patterns of spatial autocorrelation of assemblages of birds, floristics, physiognomy, and primary productivity in the central Great Basin, USA. Diversity and Distributions 12:236–243.

Thomson, J.R., E. Fleishman, R. Mac Nally, and D.S. Dobkin. 2006. Comparison of predictor sets for species richness and the number of rare species of butterflies and birds. Journal of Biogeography 34:90–101.

Mac Nally, R., E. Fleishman, J.R. Thomson, and D.S. Dobkin. 2008. Use of guilds for modeling avian responses to vegetation in the Intermountain West (U.S.A.). Global Ecology and Biogeography 17:758–769.

Dickson, B.G., E. Fleishman, D.S. Dobkin, and S.R. Hurteau. 2009. Relationship between avifaunal occupancy and riparian vegetation in the central Great Basin (Nevada, U.S.A.). Restoration Ecology 17:722–730.

Fleishman, E. and D.S. Dobkin. 2009. Current and potential future elevational distributions of birds associated with pinyon–juniper woodlands in the central Great Basin, U.S.A. Restoration Ecology 17:731–739.

FUTURE WORK NEEDED

If support allows, we will continue to archive data and metadata from standardized point counts, incidental and long-distance data, vegetation measurements, and other research conducted on USDA Forest Service and other public lands in the Great Basin.

DELIVERABLES

Both deliverables identified in our proposal are complete.

Fleishman, E. 2013c. Incidental and long-distance bird observations in the Shoshone, Toiyabe, Toquima, and Monitor ranges, Nevada. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fort Collins, Colorado. http://dx.doi.org/10.2737/RDS-2013-0012

Fleishman, E. 2013d. Vegetation structure and composition in the Shoshone Mountains and Toiyabe, Toquima, and Monitor ranges, Nevada. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fort Collins, Colorado. http://dx.doi.org/10.2737/RDS-2013-0007