

***Pre-restoration bird surveys on
meadows of Modoc National Forest,
Ash Creek State Wildlife Area, and
nearby private lands***

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ABSTRACT

With funding from the National Fish and Wildlife Foundation in 2009-2010, The Institute for Bird Populations developed a monitoring protocol to assess how bird populations respond to meadow restoration activities in the Sierra Nevada. During summer 2010 we field-tested the protocol by conducting pre-restoration bird surveys at 28 meadows proposed for restoration and 32 reference meadows in the Sierra Nevada. Study sites were identified in collaboration with personnel at National Forests, National Parks, California State lands, and private landowners. Monitoring visits included point count surveys, broadcast surveys, area searches, and vegetation and soil moisture assessments. This report describes results of the pre-restoration monitoring completed at 6 meadows (3 intended restoration sites, and 3 paired reference sites) on the Modoc National Forest, Ash Creek State Wildlife Area and nearby private lands. We surveyed all meadows twice during the 2010 breeding season, conducting a total of 74 point count and broadcast surveys, and over 17 person-hours of area searching. Results of these surveys will provide baseline information for assessing the effects of future restoration activities on bird populations at each of the 3 intended restoration sites.

BACKGROUND

Montane meadows in the Sierra Nevada form ecological islands within the surrounding forest matrix (Ratliff 1985, Fites-Kaufman et al. 2007). They provide abundant water, food, and cover for birds and other wildlife, and are among the most important breeding and foraging habitats for birds in the Sierra Nevada (Grinnell and Miller 1944, Orr and Moffit 1971, Gaines 1992, Graber 1996, Heath and Ballard 2003). However, at many Sierra meadows human activities and historic management practices have altered meadow hydrology, which in turn has changed the characteristics of meadow plant communities, and often diminished the value of meadow habitat for native bird populations (Klebenow and Oakleaf 1984, Allen-Diaz 1991, Kattlemann and Embury 1996, Cicero 1997, Siegel et al. 2008).

Throughout the Sierra Nevada, many public and private land managers are seeking win-win solutions for humans and wildlife by restoring or enhancing meadow habitats, in many cases addressing the historical legacy of hydrological impacts that have led to poorly watered meadows (Rood and Mahoney 1990, Loheide and Gorelick 2006, Skidmore et al. 2009). Restoring meadow hydrology is often a critical first step in restoring the full complement of native biodiversity to a meadow (Poff et al. 1997, Dwire et al. 2006).

Well-functioning hydrologic processes in montane meadows not only yield improved habitat for wildlife, but may also provide tangible benefits for humans, including:

- increased water storage capacity (Loheide and Gorelick 2006, Skidmore et al. 2009),
- improved water quality (Alexander et al. 2007, Simon et al. 2006),
- downstream flood attenuation (Gurnell et al. 1995, Skidmore et al. 2009),
- increased duration of summer flows (Alexander et al. 2007), and
- improved forage quality for livestock (Ratliff 1985).

One way to assess the success of meadow restoration is to monitor the responses of bird populations that inhabit the meadow. Birds can respond rapidly and dramatically to meadow restoration efforts, with populations of meadow-associated bird species increasing in or even colonizing meadows within as little as one year after restoration efforts are implemented (Taylor and Littlefield 1986, Larison et al. 2001, Stanley and Knopf 2002, McCreedy and Heath 2004, Heltzel and Earnst 2006, Borgmann 2010).

Each of the meadow-associated bird species that utilizes montane meadows in the Sierra Nevada has its own particular habitat needs, and the presence or absence of those specific habitat components largely predicts which species utilize a particular meadow (Wiens 1985). When meadow habitats are degraded the number of individual birds and the number of bird species occupying them tends to decline.

The primary objective of this project was to collect pre-restoration data on bird populations at meadows where future restoration projects are planned (and at associated reference sites). These data will allow assessment of the response of bird populations to future restoration activities. Such assessments are valuable both for documenting successes of restoration activities and for facilitating improvement of restoration techniques in an adaptive management context.

We used a draft bird survey protocol (Loffland et al. 2011) under development with funding from the National Fish and Wildlife Foundation designed specifically for pre- and post-restoration bird monitoring at meadow restoration sites. The protocol includes a combination of multi-species and single-species survey techniques, and incorporates point counts, species-specific broadcast surveys, area searches, and vegetation and soil moisture plots.

The use of a standardized survey protocol will help managers and researchers to glean important lessons from restoration monitoring efforts—lessons that cannot be learned from monitoring at any single site. Standardized data from diverse sites that undergo a variety of restoration measures will facilitate comparison of bird responses across sites and projects. Such comparisons will lead to an improved understanding of which restoration efforts most effectively produce high-quality bird habitat, and will allow future meadow restoration efforts to incorporate those findings.

METHODS

All of our methods adhered to Loffland et al.'s (2011) *Avian Monitoring Protocol for Sierra Nevada Meadows*. **Here we provide a cursory summary of methods, but readers seeking more detail or a discussion of the merits and limitations of particular methods should refer to the protocol itself.**

Monitoring Scheme

Loffland et al. (2011) suggest a BACI (Before, After, Control, Impact) monitoring scheme. Under this scheme all monitoring sites where restoration activities are planned are paired with one or more reference sites with similar hydrology and vegetation, but where no restoration activities are imminent. All monitoring activities are then conducted at both the restoration and reference sites in at least one year prior to restoration and at least one year after restoration. This design improves the manager's ability to separate local population changes that are the result of restoration from regional changes that may be due to annual weather variation or other factors. Comparing change in bird populations at the restoration site with the reference site will allow managers to see how individual bird species and suites of species respond to restoration activities, and how the response varies by type of restoration activity, locality, and, if multiple years of post-restoration monitoring are conducted, time since restoration activity (Smucker et al. 2005, Ward et al. 2010).

Site Selection

During early spring of 2010 we met with USDA Forest Service Region 5 staff to discuss how best to identify meadow restoration projects in the planning stage on National Forest lands, and worked closely with the Regional Hydrologist as he queried forests in Region 5. We also consulted with personnel at Yosemite and Sequoia/Kings Canyon National Parks and state agencies, and private landowners. We placed a higher priority on restoration projects that were already in the planning stage, but also included some sites that were identified as needing restoration, but for which the NEPA/CEQA process had not yet begun. Following guidance from the National Fish and Wildlife Foundation, we made restoration projects with a hydrologic component our highest priority. The resulting set of 30 restoration projects was distributed across 6 National Forests, 2 National Parks, 2 California State Wildlife Area, X California State Park, and 1 private parcel. After identifying the restoration projects, we worked with local contacts to identify suitable reference sites to pair with each restoration site. These collaborations yielded 32 reference sites (in 2 instances multiple small sites were paired with a single restoration site). **This report details the subset of our 2010 study sites that were located within the Pit River Conservation District on the Modoc National Forest, Ash Creek State Wildlife Area, and nearby private lands.**

Conversations with Todd Sloat, Watershed Coordinator for the Pit Resource Conservation District identified 3 meadow restoration projects in various stages of planning. For each restoration site, we selected one or more reference sites based on Mr. Sloat's advice and through review of aerial photography (Table 1: Figure 1).

Table 1. Restoration and associated reference sites on Modoc National Forest, Ash Creek State Wildlife Area, and nearby private lands where pre-restoration bird surveys were conducted during the 2010 breeding season.

| <i>Restoration Site (land manager)</i> | <i>Reference Site(s) (land manager)</i> |
|---|--|
| Lower Ash Creek (Ash Creek S.W.A) | Upper Ash Creek (Ash Creek S.W.A) |
| Rose Creek (private) | Upper Rose Creek (Modoc N.F.) |
| McBride/Willow Springs (Modoc N.F./Private) | Smith Flat (Modoc N.F.) |

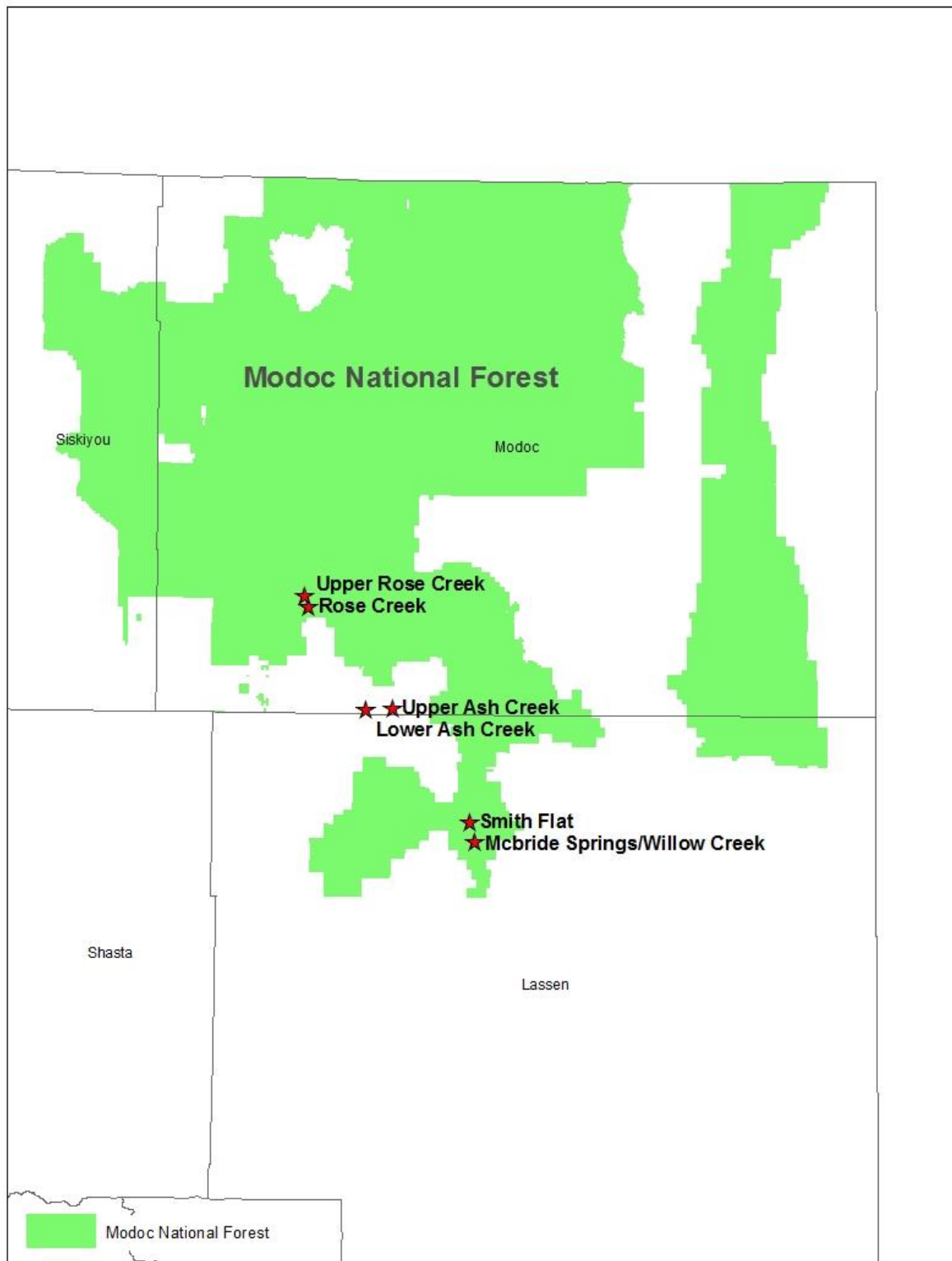


Figure 1. Locations of restoration and reference meadows surveyed for birds in 2010 on the Modoc National Forest, Ash Creek State Wildlife Area, and nearby private lands.

At the time of our surveys the 3 restoration projects in this region had most or all of their planning documents completed and were awaiting approval/funding. Restoration efforts at Rose Creek were completed after our surveys during the fall of 2010, and restoration of McBride Springs/ Willow Creek and Lower Ash Creek are planned for fall of 2011 and 2012, respectively.

All 6 sites are at relatively low elevations between 4100 ft. (1250 m) and 5200 ft. (1585 m). Large meadows at this elevation are relatively rare and most are privately owned – sites like this were generally not incorporated into national forests when their boundaries were delineated, but were instead retained in private land ownership as base ranches for grazing allotments (Allen-Diaz et al. 1999). Additionally, many meadows of this type were popular with developers of residential and recreational areas. These sites have a historical legacy of mining, logging, agriculture, and/or grazing use. The Ash Creek SWA sites are bordered by intensively managed upland grazing and agricultural areas on 3 sides, and Big Swamp and the Pit River on the fourth side, while the higher elevation Modoc NF and Private sites have a mix of pine/oak woodland and sagebrush chaparral at the meadow edges. Areas of volcanic rock outcrop make up a portion of the surrounding upland areas.

The Lower Ash Creek restoration meadow and its reference site along Upper Ash Creek are unique within the set of Sierra Nevada meadows visited in 2010. This site is a large and complex system of meadows, marshes, and agricultural lands. Because of its long history as grazing and agricultural uses it is braided with water diversions canals, and historic borrow pits, roadways and structures. The reference site is quite similar due to its placement directly upstream of the restoration site, however the proportion of marsh area is less, and the amount of riparian woody vegetation is greater.

The 2 remaining restoration sites at Rose Creek and McBride Creek/Willow Creek (Table 1) are located on privately owned land and the Modoc N.F. These sites and their nearby reference sites also occur at elevation below 5200 ft., but lack the large marshland component of Ash Creek. These sites are smaller and more geologically restricted to the floodplain directly adjacent to the stream. Stream channels are generally incised with a dominant dry meadow community.

Crew Training and Certification

All data were collected by full-time crew members working or volunteering for The Institute for Bird Populations. At the beginning of the 2010 field season, crew members underwent an intensive 3-week training session that followed the guidelines in Loffland et al. (2011) for ensuring surveyors are fully competent and qualified to collect reliable data. At the end of the training session all crew members passed a rigorous bird identification exam that tested the skills necessary to conduct point counts and area searches.

Data Collection

All sites were surveyed within the May 20-July 15 temporal window specified by the Loffland et al. (2011) protocol; at most meadows we were able to complete 2 full surveys (excluding the vegetation and soil moisture plots which we only completed once, in accordance with the survey protocol).

Establishing Survey Stations

At restoration and reference meadows we established survey stations 250 m apart along transects that followed the general course of stream channels within meadows, as well as in areas of meadows with no adjacent stream. Where possible, survey stations were placed at least 25 m from streams that were large enough to cause substantial noise interference during surveys – this will also help ensure that if stream restoration results in inundation or widening of the channel, survey stations do not end up under water in future years. In narrow meadows (<100 m wide), stations were placed every 250 m along a transect that traveled along the center of the meadow, regardless of where the stream channel was located. In most cases survey stations were delineated prior to the first field visit using digital aerial photos (DOQQs) and ArcMap software. Geographic coordinates of individual survey stations are provided in Appendix A and site maps with survey station locations are provided in Appendix B. In a few instances stations were inaccessible due to the unusually high water conditions in June and July of 2010. For those stations that could not be reasonably relocated to a more accessible area nearby, surveys were not completed in 2010. Nonetheless, their coordinates remain in Appendix A, and the points should be surveyed if possible during future monitoring visits.

Point Counts

We utilized 10-minute point counts, divided into 4 smaller time intervals to facilitate estimating detection probability and modeling occupancy rates (MacKenzie et al. 2002) in the future, if desired. All birds were classified as being either ≤ 50 m from the survey station at first detection, or at a distance >50 m.

Species-Specific Broadcast Surveys

Immediately following each 10-min point count, we remained at the survey station and conducted broadcast surveys for 3 rare or hard to detect species that may be particularly likely to respond to meadow restoration efforts: Willow Flycatcher, Sora, and Virginia Rail. Vocalizations for a particular species were broadcast only if we did not first detect the species within 50 m of the survey station during the preceding 10-minute point count.

Area Searches

When all of the point count and broadcast surveys were completed, surveyors remained at the meadow and began the area search portion of the survey. The amount of time spent area searching was dependent on the size of the meadow; surveyors spent at least 10 minutes area-searching for every survey station the meadow accommodated. One of the objectives of the areas search was to increase the likelihood of detecting rarer or more secretive species that were present at the site, particularly species that may have been missed during the point count and broadcast portions of the survey. When conducting the area search, surveyors moved through the meadow slowly and quietly, counting all birds detected at the site. Special attention was paid to areas along stream channels or other flooded/ponded areas, and locations where restoration activities were planned. Additionally, areas of the meadow where sight and sound were obstructed by dense vegetation were observed carefully. Although more time may have been spent in these specific portions of the meadow, all areas and vegetation communities were systematically covered. We tallied individual birds based on their location at the time of first detection, either within the meadow, or within the surrounding forest or other upland vegetation community.

Vegetation and soil moisture plots

After completing bird surveys we assessed the vegetative structure and vegetative community types at each survey station to characterize the meadow and provide context for bird survey results. We recorded relative cover and vegetation height for a variety of vegetative and surface water components in each of the 4 quadrants formed by four 50-m transects extending away from the station in each of the cardinal directions (N, S, E, W). For each quadrant (NW, NE, SE, SW), we recorded cover for each vegetation type after first walking the quadrant to observe the entire area. Cover was estimated as if one was looking down on the site from above. Totals of all cover types combined sometimes exceeded 100% because values were combined over multiple overlapping levels of the canopy: herbaceous, shrub, and tree.

Data Analysis

Because only one year of baseline monitoring has been completed, the analysis reported here is relatively simple. From point count results at each meadow, we tabulated the number of species detected, the number of individuals of each species detected, and the number of individuals detected per point for all species combined. Results are provided separately for birds detected within 50 m of the survey station, and birds detected at any distance from the survey station. From area search results we provide numbers of individuals of each species, as well as the number of additional species detected that were not detected during point count surveys. We also tallied total number of individuals (of all species combined) counted and total number of species detected as the average across both visits (when 2 visits were completed). From broadcast surveys, we report the number, species and locations of any target species detected. Mean vegetation measurements are reported at the meadow scale, and are

intended to characterize the areas of the meadows where we conducted point counts and broadcast surveys.

RESULTS

During the late winter and early spring of 2010 the Sierra Nevada experienced heavier than average snowfall, and unusually late snowmelt. These conditions made planning and implementation of the monitoring work more difficult because many sites and access roads were under snow well into June and, in some cases, July. Many of our monitoring efforts had to be delayed until sites became accessible. Nonetheless, we were able to visit all sites twice within our survey window of May 20 through July 15 (Table 2). Loffland et al. (2011) encourages 2 visits, but the second visit is considered optional. In total, 3 restoration sites, and 3 reference sites (6 total) within the Modoc N.F. and Ash Creek S.W.A. region received 2 visits during 2010 breeding season. We established 37 survey stations at the 6 study sites.

Table 2. Site location information and survey dates for meadows on Modoc National Forest, Ash Creek State Wildlife Area, and nearby private lands.

| <i>Meadow Name^a</i> | <i>Site Type</i> | <i>UTM Easting</i> | <i>UTM Northing</i> | <i>UTM Zone</i> | <i>Elev. (ft.)</i> | <i>USGS Quadrangle</i> | <i>Visit 1 Date</i> | <i>Visit 2 Date</i> | <i>No. of Survey Stations</i> |
|-------------------------------------|------------------|--------------------|---------------------|-----------------|--------------------|------------------------|---------------------|---------------------|-------------------------------|
| Lower Ash Creek | Restore | 667650 | 4562456 | 10 | 4100 | Adin | 6/2/2010 | 7/9/2010 | 10 |
| Upper Ash Creek | Reference | 668931 | 4562466 | 10 | 4150 | Adin | 6/1/2010 | 7/8/2010 | 7 |
| McBride Springs/Willow Creek | Restore | 684692 | 4540073 | 10 | 5000 | Said Valley | 5/31/2010 | 7/7/2010 | 6 |
| Smith Flat | Reference | 684023 | 4543263 | 10 | 5200 | Lane Reservoir | 6/1/2010 | 7/10/2010 | 4 |
| Rose Creek | Restore | 655556 | 4578568 | 10 | 4200 | Donica Mtn | 6/1/2010 | 7/10/2010 | 5 |
| Upper Rose Creek | Reference | 654899 | 4580173 | 10 | 4318 | Donica Mtn | 5/31/2010 | 7/7/2010 | 5 |

^aRestoration sites are indicated in bold text with associated reference sites directly below them in plain text.

Point Counts

Among the meadows with survey results reported here, Upper and Lower Ash Creek sites showed the greatest relative abundance of individual birds at an unlimited radius (Table 3). These are the 2 largest sites monitored in the survey region, and are also the sites associated with the largest streams. The relatively large sites resulted in a greater diversity of habitat conditions surveyed. When only the results within 50 m of survey stations were included and the number of individuals was averaged across the number of stations, some of the effects of meadow size were diminished. Results for the number of species detected at each site did not show a discernible pattern (Table 3).

Table 3. Number of individual birds and number of species detected during point count surveys at all study sites.

| <i>Meadow Name^a</i> | <i>No. of Survey Stations</i> | <i>Avg. No. Birds Detected^b</i> | | <i>Avg. No. Birds Per Station^b</i> | | <i>Species Detected (Visits Pooled)</i> | |
|-------------------------------------|-------------------------------|--|-------------------------|---|-------------------------|---|-------------------------|
| | | <i><50m</i> | <i>Unlimited Radius</i> | <i><50m</i> | <i>Unlimited Radius</i> | <i><50m</i> | <i>Unlimited Radius</i> |
| Lower Ash Creek | 10 | 10.0 | 122.0 | 2.0 | 24.4 | 7 | 29 |
| Upper Ash Creek | 7 | 21.5 | 144.0 | 3.1 | 20.6 | 17 | 46 |
| McBride Springs/Willow Creek | 6 | 15.0 | 96.0 | 2.5 | 16.0 | 12 | 31 |
| Smith Flat | 4 | 2.5 | 65.0 | 0.6 | 16.3 | 5 | 25 |
| Rose Creek | 5 | 14.0 | 94.5 | 2.8 | 18.9 | 15 | 45 |
| Upper Rose Creek | 5 | 8.0 | 65.5 | 1.6 | 13.1 | 10 | 36 |

^aRestoration sites are in bold text with associated reference sites directly below them in plain text.

^bReported for individuals detected within a 50-m radius of the survey station and for all individuals detected at all distances from the station (unlimited radius). Number of birds detected and number of birds per station are reported as the mean value averaged across 2 visits, except for sites where only one visit was completed.

Loffland et al. (2011) identify 18 meadow-associated focal species. These species were selected because of their affinity to meadow and riparian communities, and based on the expectation that their numbers would increase if meadow restoration efforts improved the quantity or quality of habitat components important to them. One exception is the Brown-headed Cowbird. While often found in meadows, this species also uses many other open or disturbed habitats with human or livestock use. Brown-headed Cowbirds were selected by Loffland et al. (2011) as focal species because of the role they play as nest parasites of other meadow-associated birds, and the association between their relative abundance and human disturbance. Of the 18 focal species identified for Sierra Nevada meadows, 10 were detected during point counts in the Modoc N.F. and Ash Creek S.W.A study region (Table 4).

Table 4. Relative abundance^a of strongly meadow-associated focal bird species detected during point counts at each meadow. Focal species were identified by Loffland et al. (2011).

| <i>Meadow^b</i> | <i>Survey radius</i> | <i>Virginia Rail</i> | <i>Sandhill Crane</i> | <i>Spotted Sandpiper</i> | <i>Wilson's Snipe</i> | <i>Red-breasted Sapsucker</i> | <i>Yellow Warbler</i> | <i>MacGillivray's Warbler</i> | <i>Song Sparrow</i> | <i>White-crowned Sparrow</i> | <i>Brown-headed Cowbird</i> |
|-------------------------------------|----------------------|----------------------|-----------------------|--------------------------|-----------------------|-------------------------------|-----------------------|-------------------------------|---------------------|------------------------------|-----------------------------|
| Lower Ash Creek | 50 m | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | unlimited | 0.10 | 1.60 | 0.20 | 1.30 | 0.00 | 0.00 | 0.00 | 0.60 | 0.00 | 0.40 |
| Upper Ash Creek | 50 m | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.07 | 0.00 | 0.00 | 0.00 | 0.21 |
| | unlimited | 0.00 | 0.43 | 0.14 | 0.36 | 0.00 | 1.00 | 0.00 | 0.57 | 0.00 | 0.86 |
| McBride Springs/Willow Creek | 50 m | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.08 |
| | unlimited | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.50 |
| Smith Flat | 50 m | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | unlimited | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.13 | 0.75 |
| Rose Creek | 50 m | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.40 | 0.00 | 0.00 | 0.00 | 0.00 |
| | unlimited | 0.00 | 0.00 | 0.00 | 0.10 | 0.10 | 0.80 | 0.10 | 0.10 | 0.00 | 1.90 |
| Upper Rose Creek | 50 m | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | unlimited | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.20 | 0.00 | 0.00 | 0.00 | 0.10 |

^aNumber of individuals of each species divided by the number of visits and number of survey points, based on all point count detections within 50m of a survey station and at an unlimited survey radius.

^bRestoration sites are indicated in bold text.

The number of focal species detected at a given site ranged from a low of 1 at McBride Springs/Willow Creek to a high of 6 at Lower Ash Creek. Of the focal species detected, only 1 was detected at more than 3 sites. Brown-headed cowbird was detected at all 6 sites. The average number of individuals detected for each species, and the average number per survey station are reported for all species at each restoration site and its associated reference site in Appendix C.

Broadcast Surveys

Broadcast surveys for Sora, Virginia Rail, and Willow Flycatcher were completed at all survey stations. Vocalizations were only broadcast if the species was not spontaneously singing or calling within 50m of the survey station during the preceding point count. One Willow Flycatcher was detected at survey station 2 at Upper Ash Creek on 6/1/2010. No other target species were detected using broadcast surveys in the Modoc N.F. and Ash Creek S.W.A. region.

Area Searches

In most cases, we conducted area searches immediately following point count and broadcast surveys, but no later than 4.5 hours after sunrise. At large meadows, area searches were sometimes completed by a separate observer concurrent with point count surveys. In all but a few cases area searches were completed on the same morning as point counts. Area searches resulted in the mean detection of 7.2 (SD = 5.4) additional species per meadow in the Stanislaus/Yosemite study region, over species totals based on point count surveys alone (Table 5). Species-specific area search results for each restoration site and its associated reference site are provided in Appendix D. Appendix E contains a list of all species detected (point counts and areas searches combined) at each meadow.

Table 5. Number of species detected at each site based on combined area search and point count results^a.

| <i>Meadow Name^b</i> | <i>No. Species Detected - Area Searches</i> | <i>No. Species Detected - Point Counts</i> | <i>No. Species Detected Only During Area Searches</i> | <i>No. Species - Both Methods Combined</i> |
|---------------------------------------|--|---|--|---|
| Lower Ash Creek | 40 | 29 | 15 | 44 |
| Upper Ash Creek | 40 | 46 | 4 | 50 |
| McBride Springs/Willow Creek | 25 | 31 | 3 | 34 |
| Smith Flat | 31 | 25 | 9 | 34 |
| Rose Creek | 42 | 45 | 11 | 56 |
| Upper Rose Creek | 24 | 36 | 1 | 37 |

^aResults are pooled across all visits. ^bRestoration sites are indicated in bold text.

Vegetation Assessment

Vegetation and water measurements were collected at each survey station for the purpose of assessing the 50-m radius area surrounding each survey station, and to provide information characterizing the general vegetation communities and hydrologic conditions within the overall meadow. Table 6 provides the average cover values for each meadow, calculated from the means of the 4 quadrants at each survey station.

Tree and snag cover is typically greatest at smaller sites where the forest edge regularly falls within 50 m of the survey stations. Tree cover within the meadow can be an indicator of lowered water tables and conifer encroachment. Although meadow associated birds will utilize trees for foraging and territory advertisement, brown-headed cowbirds and nest predators also use trees within the meadow as hunting perches. Tree cover was low at all sites in this study region and no sites exceeded 5% cover (mean = 2.48; SE = 0.78). Only Upper Ash Creek, Rose Creek, and Upper Rose Creek had any riparian deciduous shrub cover within 50-m plots. Rose Creek had the highest cover at 11.15%. Extent of riparian shrub cover is particularly important for many shrub-nesting bird species. Sagebrush cover, often an indicator of lowered water tables, occurred at all study sites in this region. With the exception of McBride Springs/ Willow Creek at 56.58%, all sites had sagebrush cover values ranging from 0.5 – 5.7% .

We quantified the amount of flowing and standing water around survey stations to assess habitat quality for bird species that are associated with water or saturated conditions. This is also a measurement expected to change with restoration activities. Cover from flowing and standing water was very low at all sites (Table 6). Average flowing water cover was 2.94% (S.E. = 0.84) and standing water cover was 0.82% (S.E. = 0.37)

Table 6. Average vegetative and water cover characteristics for 50-m plots surrounding survey stations at each meadow.

| <i>Meadow Name^a</i> | <i>No. Stations</i> | <i>Measure^b</i> | <i>Percent Cover</i> | | | | | | | | |
|--|---------------------|----------------------------|----------------------|--------------|------------------------|------------------|-----------------------------|--------------------|-------------------|----------------------|-----------------------|
| | | | <i>Trees</i> | <i>Snags</i> | <i>Riparian Shrubs</i> | <i>Sagebrush</i> | <i>Non-Woody Vegetation</i> | <i>Bare Ground</i> | <i>Gravel Bar</i> | <i>Flowing Water</i> | <i>Standing Water</i> |
| Lower Ash Creek | 10 | Mean | 0.00 | 0.00 | 0.00 | 1.80 | 90.53 | 1.85 | 0.00 | 3.35 | 2.50 |
| | | (S.E.) | 0.00 | 0.00 | 0.00 | 1.13 | 2.57 | 0.98 | 0.00 | 2.28 | 1.18 |
| Upper Ash Creek | 6 | Mean | 3.54 | 0.04 | 0.92 | 3.42 | 87.67 | 3.04 | 0.42 | 7.21 | 0.08 |
| | | (S.E.) | 2.35 | 0.04 | 0.82 | 2.34 | 2.69 | 1.49 | 0.42 | 2.50 | 0.08 |
| McBride Springs/ Willow Creek | 6 | Mean | 4.50 | 0.00 | 0.00 | 56.58 | 65.00 | 21.93 | 0.11 | 0.00 | 0.29 |
| | | (S.E.) | 2.19 | 0.00 | 0.00 | 12.01 | 12.18 | 8.11 | 0.11 | 0.00 | 0.29 |
| Smith Flat | 4 | Mean | 0.69 | 0.00 | 0.00 | 0.50 | 89.44 | 9.56 | 0.00 | 0.00 | 0.00 |
| | | (S.E.) | 0.69 | 0.00 | 0.00 | 0.50 | 3.39 | 3.54 | 0.00 | 0.00 | 0.00 |
| Rose Creek | 5 | Mean | 4.75 | 0.00 | 11.15 | 1.00 | 88.85 | 5.55 | 1.15 | 2.55 | 0.40 |
| | | (S.E.) | 3.86 | 0.00 | 7.20 | 0.88 | 3.47 | 1.52 | 0.71 | 1.18 | 0.40 |
| Upper Rose Creek | 5 | Mean | 2.90 | 0.10 | 3.95 | 5.70 | 90.35 | 4.65 | 2.10 | 3.25 | 0.05 |
| | | (S.E.) | 0.82 | 0.10 | 1.59 | 1.38 | 2.91 | 1.75 | 1.47 | 0.85 | 0.05 |
| 6 Sites Pooled | 36 | Mean | 2.48 | 0.02 | 2.25 | 11.49 | 85.42 | 7.16 | 0.54 | 2.94 | 0.82 |
| | | (S.E.) | 0.78 | 0.02 | 1.14 | 3.92 | 2.65 | 1.81 | 0.25 | 0.84 | 0.37 |

^aRestoration sites are indicated in bold text. ^bMean and standard error averaged over four 50-m radius quadrants at each survey point.

For those survey stations with riparian deciduous shrub cover, we also assessed the proportion of the shrub occurring within different height and age classes, as well as taxonomic group (Table 7). Immature shrubs in the lowest height class are indicative of shrub recruitment, an important factor in maintaining suitable habitat for shrub-nesting birds. Mature shrubs in the shortest height class can indicate certain low growing species, as well as situations where livestock or native ungulates are regulating growth patterns. These factors, as well as the proportion of the shrub community in the taller height classes, are relevant to certain focal bird species that prefer to nest at heights greater than 1 m above the ground. Shrub height class composition differed at each of the 3 sites with riparian deciduous shrubs. The majority of shrubs at Upper Rose Creek were less than 2 m in height with no seedlings, while at Rose Creek half the shrubs were in the > 2 m height class, again with no seedlings (Table 7). Upper Ash Creek was split between seedlings and shrubs in the > 2 m height class. On average, willows made up over 70% of the riparian shrub species at these 3 sites.

Table 7. Average characteristics of riparian deciduous shrubs in 50-m plots surrounding survey stations. Vegetation plots on the 3 study sites not listed had no riparian deciduous shrubs.

| Meadow Name ^a | No. Stations | Measure ^b | Height and Age Class of Riparian Shrubs (%) | | | | Taxonomic Composition of Riparian Shrubs | | |
|--------------------------|--------------|----------------------|---|----------------------------|------------------------------|------------------------------|--|----------------------------|----------------------------|
| | | | <1m (seedling) | <1m (mature) | 1 - 2m | >2m | % Willow | % Alder | % Other Riparian Shrub |
| Rose Creek | 3 | Mean (S.E.) | 0 0 | 9.58 8.00 | 43.54 14.91 | 46.25 20.75 | 96.67 3.33 | 0.00 0.00 | 3.33 3.33 |
| Upper Rose Creek | 4 | Mean (S.E.) | 0 0 | 41.42 21.17 | 56.92 20.41 | 1.67 1.67 | 82.08 13.39 | 0.00 0.00 | 17.92 13.39 |
| Upper Ash Creek | 2 | Mean (S.E.) | 50 50 | 0.00 0.00 | 0.00 0.00 | 50.00 50.00 | 50.00 50.00 | 0.00 0.00 | 50.00 50.00 |
| 3 Sites Pooled | 10 | Mean (S.E.) | 10 10 | 20.40 10.12 | 40.18 11.58 | 29.17 13.02 | 71.83 13.17 | 0.00 0.00 | 18.17 10.66 |

^aRestoration sites are in bold text. ^bMean and standard error averaged over four 50m-radius quadrants at each survey point

Discussion

We strongly recommend continuing bird monitoring activities at meadows in the Modoc N.F./ Ash Creek S.W.A region in as many pre- and post-restoration years as feasible. One way that we might alter monitoring methods from what was completed in 2010 would be to decrease the distance between survey stations to as little as 200 m if doing so would allow for the addition of even one more survey station at small meadows. Many of the meadows in other survey regions contained 3 or fewer survey stations. These small sample sizes can be problematic for some analyses, and if one or more stations were added it could strengthen the monitoring results. Nevertheless we do not recommend altering station locations for the sites listed in this report where surveys occurred in 2010. Rather, any new small reference or restoration sites could benefit from maximizing the number of stations. We also assessed our 2010 results and decided that decreasing point count duration from 10 minutes to 7 minutes would provide reliable results while balancing the amount of time and effort necessary per point count. In addition, we did not find much benefit from species-specific broadcast surveys for Willow Flycatcher, Sora and Virginia Rail. Not surprisingly, these species were not often detected at sites in need of restoration, but even when detected there were only 3 instances during our surveys across the entire Sierra Nevada where broadcast surveys detected an individual that had not already been detected during point counts. While single-species broadcast surveys may still be useful for some projects, detection probabilities of Sora and Virginia Rail may be adequately high with passive survey methods that do not incorporate broadcasts, and Willow Flycatchers are likely to be surveyed with full-protocol surveys (Bombay et al. 2003) prior to restoration as part of the state and federal permitting processes.

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Appendix A. Geographic coordinates of survey station locations

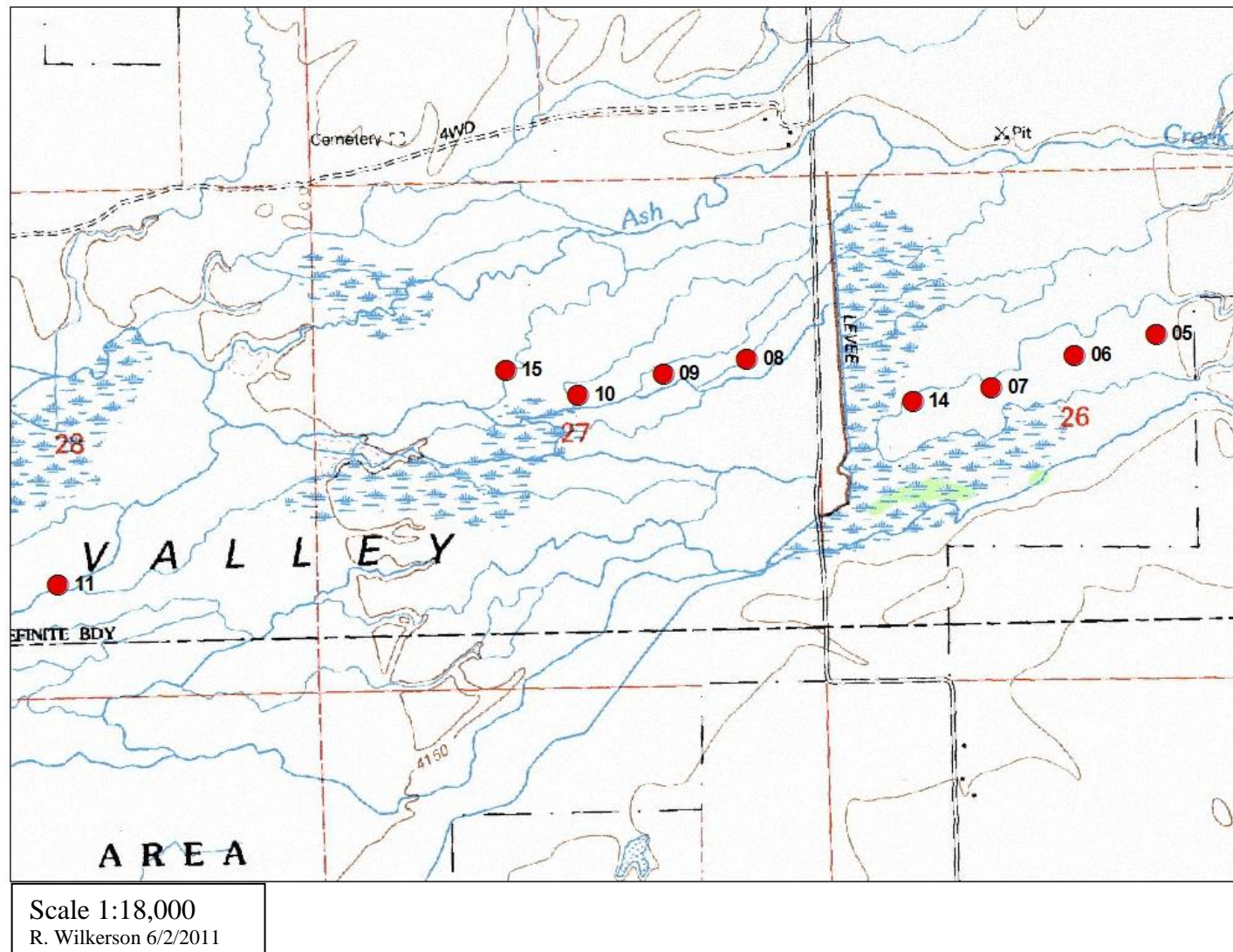
Table A-1. Geographic coordinates of survey station locations^a.

| Meadow Name | Station Number | UTM Zone | UTM Easting | UTM Northing |
|-------------------------------------|-----------------------|-----------------|--------------------|---------------------|
| Lower Ash Creek | 05 | 10 | 666399 | 4562036 |
| Lower Ash Creek | 06 | 10 | 666140 | 4561969 |
| Lower Ash Creek | 07 | 10 | 665875 | 4561863 |
| Lower Ash Creek | 08 | 10 | 665093 | 4561954 |
| Lower Ash Creek | 09 | 10 | 664827 | 4561909 |
| Lower Ash Creek | 10 | 10 | 664554 | 4561841 |
| Lower Ash Creek | 11 | 10 | 662892 | 4561235 |
| Lower Ash Creek | 14 | 10 | 665623 | 4561819 |
| Lower Ash Creek | 15 | 10 | 664322 | 4561919 |
| Upper Ash Creek | 01 | 10 | 670830 | 4562278 |
| Upper Ash Creek | 02 | 10 | 670573 | 4562230 |
| Upper Ash Creek | 03 | 10 | 670333 | 4562170 |
| Upper Ash Creek | 04 | 10 | 670115 | 4562054 |
| Upper Ash Creek | 05 | 10 | 669844 | 4562041 |
| Upper Ash Creek | 06 | 10 | 669644 | 4562080 |
| Upper Ash Creek | 07 | 10 | 669425 | 4562064 |
| McBride Springs/Willow Creek | 01 | 10 | 685376 | 4539758 |
| McBride Springs/Willow Creek | 02 | 10 | 685148 | 4539863 |
| McBride Springs/Willow Creek | 03 | 10 | 684965 | 4540033 |
| McBride Springs/Willow Creek | 04 | 10 | 684763 | 4540231 |
| McBride Springs/Willow Creek | 05 | 10 | 684533 | 4540080 |
| McBride Springs/Willow Creek | 06 | 10 | 684536 | 4539828 |
| Smith Flat | 01 | 10 | 684007 | 4542872 |
| Smith Flat | 02 | 10 | 684005 | 4543141 |
| Smith Flat | 03 | 10 | 683999 | 4543401 |
| Smith Flat | 04 | 10 | 684038 | 4543661 |
| Rose Creek | 01 | 10 | 655810 | 4578900 |
| Rose Creek | 02 | 10 | 655651 | 4578683 |
| Rose Creek | 03 | 10 | 655389 | 4578806 |
| Rose Creek | 04 | 10 | 655269 | 4579033 |
| Rose Creek | 05 | 10 | 655116 | 4579241 |
| Upper Rose Creek | 01 | 10 | 654976 | 4580025 |
| Upper Rose Creek | 02 | 10 | 654929 | 4580269 |
| Upper Rose Creek | 03 | 10 | 655040 | 4580505 |
| Upper Rose Creek | 04 | 10 | 655068 | 4580760 |
| Upper Rose Creek | 05 | 10 | 655178 | 4580979 |

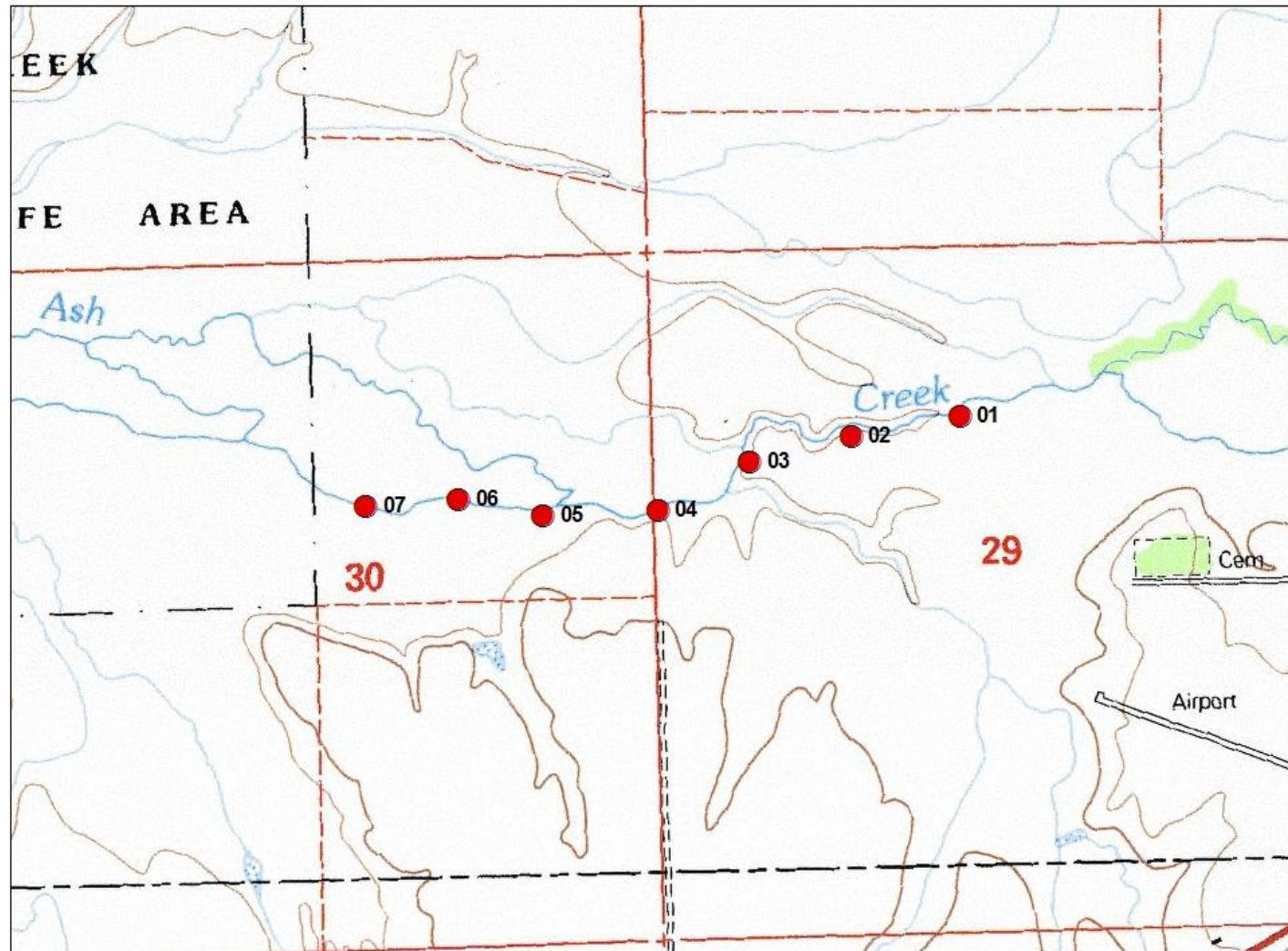
^aUTM coordinates projected in NAD 83.

Appendix B. Maps of meadows with survey station locations

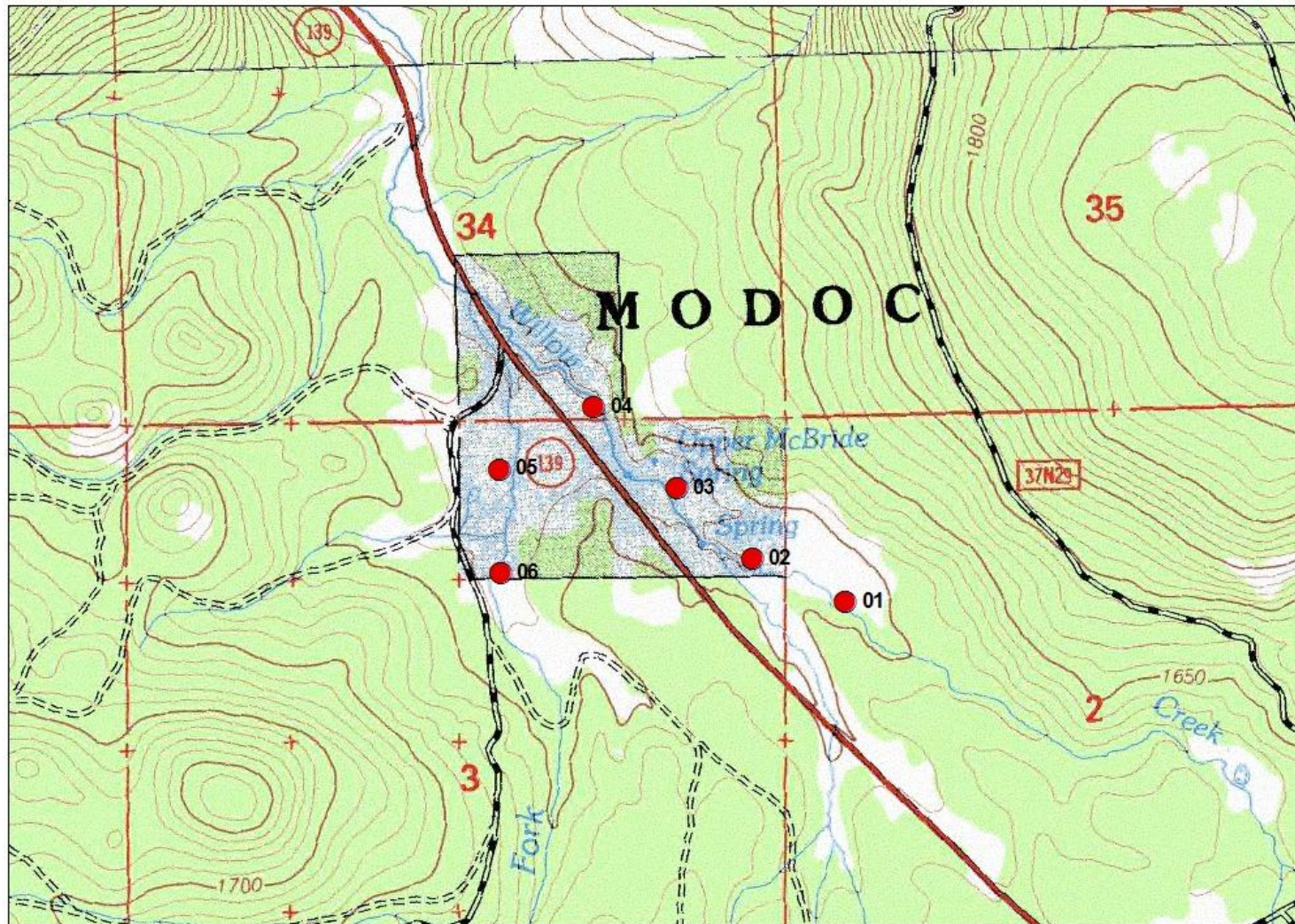
Map B-1. Lower Ash Creek



Map B-2. Upper Ash Creek

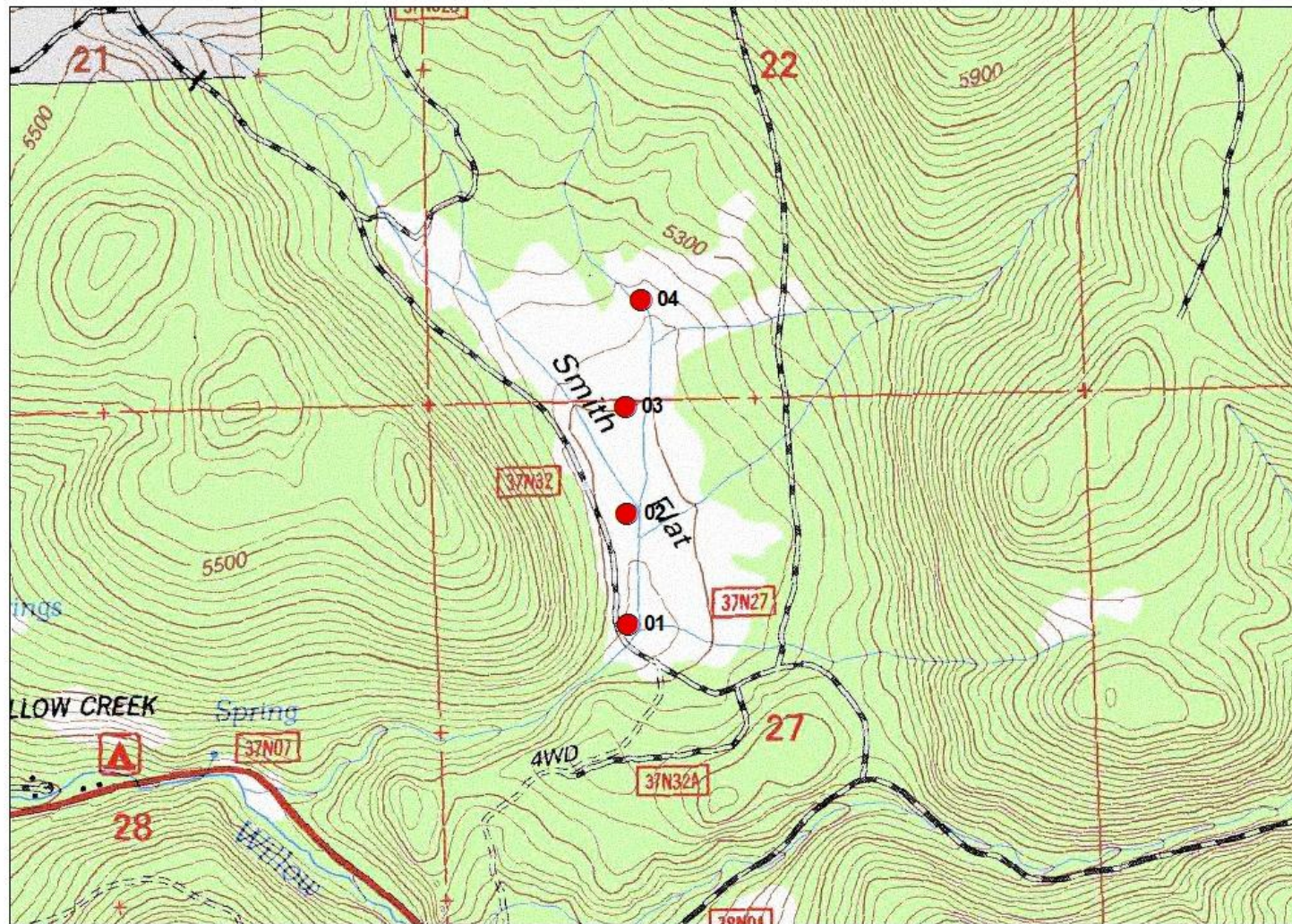


Map B-3. McBride Springs/ Willow Creek



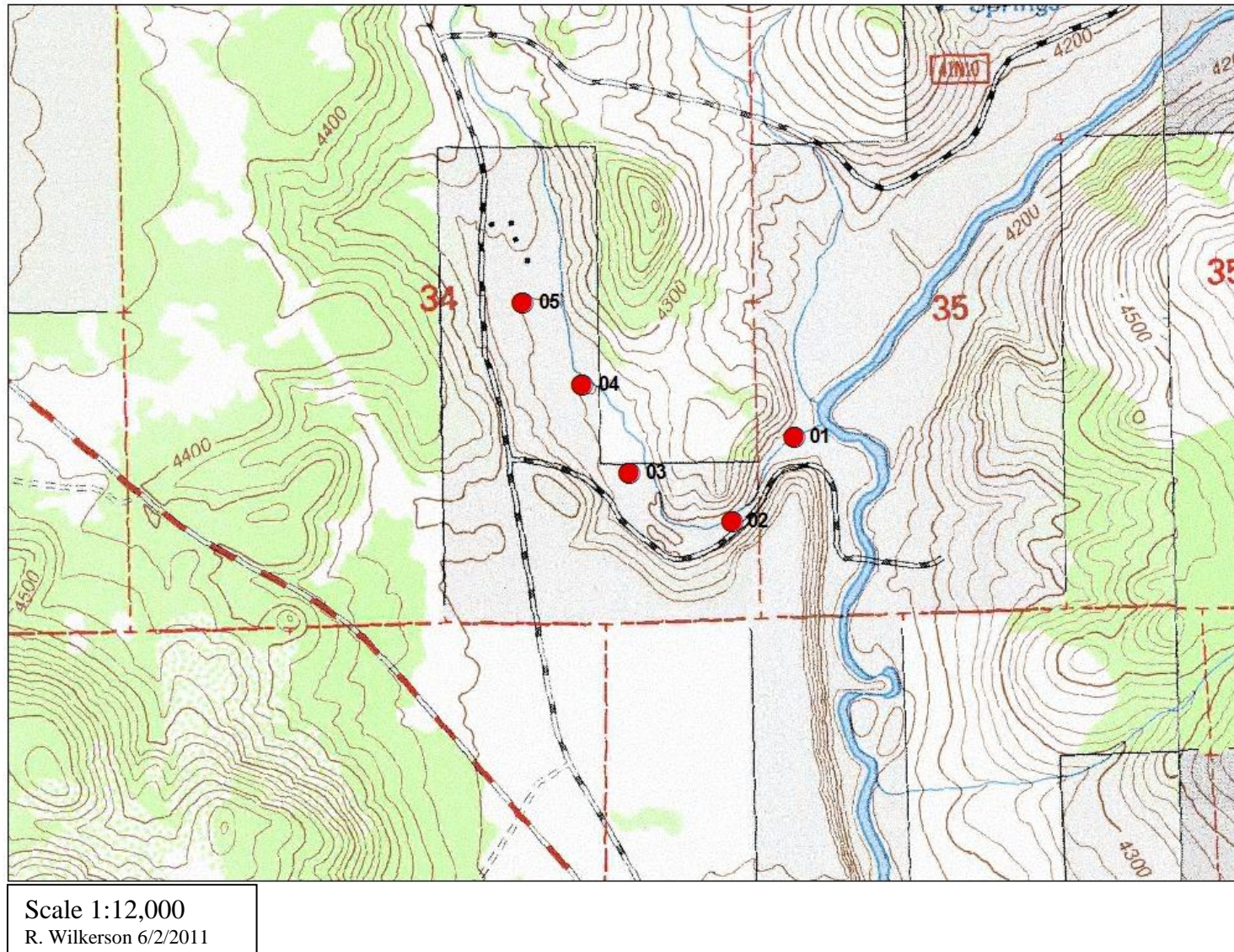
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R. Wilkerson 6/2/2011

Map B-4. Smith Flat

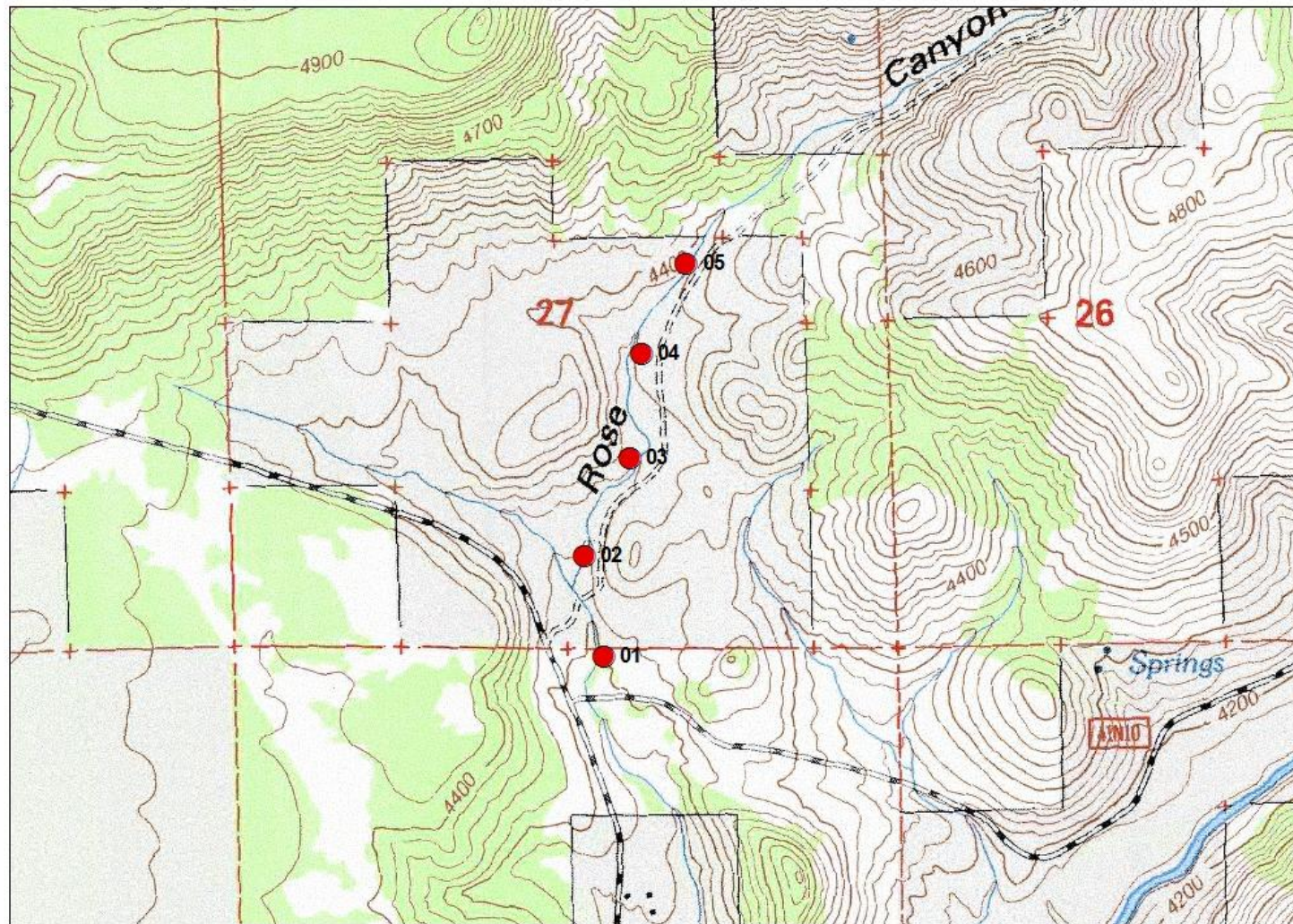


Scale 1:12,000
R. Wilkerson 6/2/2011

Map B-5. Rose Creek



Map B-6. Upper Rose Creek



Scale 1:12,000
R. Wilkerson 6/2/2011

Appendix C. Number of birds detected during point counts at each meadow

Table C-1. Number of birds detected during point counts at Lower Ash Creek and Upper Ash Creek.

| Species ^e | Lower Ash Creek (n = 10 survey station) | | | | Upper Ash Creek (n = 7 survey stations) | | | |
|--------------------------|--|----------------------------------|---|----------------------------------|--|----------------------------------|---|----------------------------------|
| | Avg. No. of Birds Detected ^a | | Avg. No. of Birds per Station ^b | | Avg. No. of Birds Detected ^a | | Avg. No. of Birds per Station ^b | |
| | <50m ^c | Unlimited Radius ^d | <50m ^c | Unlimited Radius ^d | <50m ^c | Unlimited Radius ^d | <50m ^c | Unlimited Radius ^d |
| Canada Goose | 0.00 | 0.50 | 0.00 | 0.10 | 0.00 | 7.50 | 0.00 | 1.07 |
| Mallard | 0.00 | 10.50 | 0.00 | 2.10 | 0.00 | 0.00 | 0.00 | 0.00 |
| Blue-winged Teal | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.50 | 0.00 | 0.07 |
| Unidentified Teal | 0.00 | 0.50 | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 |
| Common Merganser | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.50 | 0.00 | 0.07 |
| Sooty Grouse | 0.00 | 0.50 | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 |
| Mountain Quail | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.14 |
| California Quail | 0.00 | 0.00 | 0.00 | 0.00 | 2.00 | 13.00 | 0.29 | 1.86 |
| American White Pelican | 0.00 | 3.50 | 0.00 | 0.70 | 0.00 | 0.00 | 0.00 | 0.00 |
| Great Blue Heron | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.14 |
| Northern Harrier | 0.00 | 0.50 | 0.00 | 0.10 | 0.00 | 0.50 | 0.00 | 0.07 |
| Sharp-shinned Hawk | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.50 | 0.00 | 0.07 |
| Red-tailed Hawk | 0.00 | 1.50 | 0.00 | 0.30 | 0.00 | 1.00 | 0.00 | 0.14 |
| American Kestrel | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 4.50 | 0.14 | 0.64 |
| Virginia Rail | 0.50 | 0.50 | 0.10 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sandhill Crane | 0.00 | 8.00 | 0.00 | 1.60 | 0.00 | 3.00 | 0.00 | 0.43 |
| Killdeer | 0.50 | 2.00 | 0.10 | 0.40 | 0.50 | 3.00 | 0.07 | 0.43 |
| Spotted Sandpiper | 0.00 | 1.00 | 0.00 | 0.20 | 0.00 | 1.00 | 0.00 | 0.14 |
| Willet | 0.00 | 1.50 | 0.00 | 0.30 | 0.00 | 0.50 | 0.00 | 0.07 |
| Wilson's Snipe | 0.00 | 6.50 | 0.00 | 1.30 | 0.00 | 2.50 | 0.00 | 0.36 |
| California Gull | 0.00 | 0.50 | 0.00 | 0.10 | 0.50 | 5.50 | 0.07 | 0.79 |
| Forster's Tern | 0.00 | 0.50 | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 |
| Mourning Dove | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 3.00 | 0.14 | 0.43 |
| Great Horned Owl | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.50 | 0.00 | 0.07 |
| Belted Kingfisher | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.50 | 0.00 | 0.07 |
| Acorn Woodpecker | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.00 | 0.00 | 0.29 |
| Northern Flicker | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.50 | 0.00 | 0.36 |
| Western Wood-Pewee | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 3.00 | 0.00 | 0.43 |
| Western Kingbird | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.50 | 0.00 | 0.21 |
| Steller's Jay | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.50 | 0.00 | 0.07 |
| Western Scrub-Jay | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 4.00 | 0.00 | 0.57 |

| Species ^e | Lower Ash Creek (n = 10 survey station) | | | | Upper Ash Creek (n = 7 survey stations) | | | |
|-----------------------------|--|----------------------------------|---|----------------------------------|--|----------------------------------|---|----------------------------------|
| | Avg. No. of Birds Detected ^a | | Avg. No. of Birds per Station ^b | | Avg. No. of Birds Detected ^a | | Avg. No. of Birds per Station ^b | |
| | <50m ^c | Unlimited Radius ^d | <50m ^c | Unlimited Radius ^d | <50m ^c | Unlimited Radius ^d | <50m ^c | Unlimited Radius ^d |
| Black-billed Magpie | 0.00 | 1.00 | 0.00 | 0.20 | 1.00 | 5.50 | 0.14 | 0.79 |
| American Crow | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 4.00 | 0.00 | 0.57 |
| Common Raven | 0.00 | 1.00 | 0.00 | 0.20 | 0.00 | 0.00 | 0.00 | 0.00 |
| Horned Lark | 0.00 | 1.00 | 0.00 | 0.20 | 0.00 | 2.50 | 0.00 | 0.36 |
| Tree Swallow | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 6.50 | 0.14 | 0.93 |
| Violet-green Swallow | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.14 |
| Cliff Swallow | 1.50 | 2.00 | 0.30 | 0.40 | 1.50 | 2.00 | 0.21 | 0.29 |
| Bewick's Wren | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.50 | 0.00 | 0.07 |
| House Wren | 0.00 | 0.00 | 0.00 | 0.00 | 1.50 | 10.00 | 0.21 | 1.43 |
| Marsh Wren | 1.50 | 4.00 | 0.30 | 0.80 | 0.00 | 0.00 | 0.00 | 0.00 |
| American Robin | 0.00 | 0.00 | 0.00 | 0.00 | 0.50 | 3.00 | 0.07 | 0.43 |
| Yellow Warbler | 0.00 | 0.00 | 0.00 | 0.00 | 0.50 | 7.00 | 0.07 | 1.00 |
| Hermit Warbler | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.50 | 0.00 | 0.07 |
| Common Yellowthroat | 0.00 | 0.50 | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 |
| Yellow-breasted Chat | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.50 | 0.00 | 0.07 |
| Western Tanager | 0.00 | 0.00 | 0.00 | 0.00 | 0.50 | 1.50 | 0.07 | 0.21 |
| Brewer's Sparrow | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.50 | 0.00 | 0.21 |
| Savannah Sparrow | 1.00 | 4.50 | 0.20 | 0.90 | 0.00 | 0.00 | 0.00 | 0.00 |
| Song Sparrow | 0.00 | 3.00 | 0.00 | 0.60 | 0.00 | 4.00 | 0.00 | 0.57 |
| Black-headed Grosbeak | 0.00 | 0.00 | 0.00 | 0.00 | 0.50 | 0.50 | 0.07 | 0.07 |
| Red-winged Blackbird | 1.50 | 26.50 | 0.30 | 5.30 | 1.50 | 2.50 | 0.21 | 0.36 |
| Western Meadowlark | 3.50 | 23.00 | 0.70 | 4.60 | 5.00 | 15.50 | 0.71 | 2.21 |
| Yellow-headed Blackbird | 0.00 | 5.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Brewer's Blackbird | 0.00 | 10.00 | 0.00 | 2.00 | 1.50 | 6.00 | 0.21 | 0.86 |
| Brown-headed Cowbird | 0.00 | 2.00 | 0.00 | 0.40 | 1.50 | 6.00 | 0.21 | 0.86 |
| Lesser Goldfinch | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.50 | 0.00 | 0.07 |
| Unidentified Bird | 0.00 | 0.50 | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 |

^aNumber of individuals detected at the meadow, averaged across 2 survey visits. ^bNumber of individual birds detected divided by the number of survey stations and visits. ^cOnly includes birds detected within 50m of a survey point. ^dAll birds detected regardless of distance from survey station. ^eMeadow focal species recorded in bold text.

Table C-2. Number of birds detected during point counts at McBride Springs/Willow Creek and Smith Flat.

| <i>Species^e</i> | <i>McBride Springs / Willow Creek (n = 6 survey stations)</i> | | | | <i>Smith Flat (n = 4 survey stations)</i> | | | |
|------------------------------|---|---|--|---|---|---|--|---|
| | <i>Avg. No. of Birds Detected^a</i> | | <i>Avg. No. of Birds per Station^b</i> | | <i>Avg. No. of Birds Detected^a</i> | | <i>Avg. No. of Birds per Station^b</i> | |
| | <i><50m^c</i> | <i>Unlimited Radius^d</i> | <i><50m^c</i> | <i>Unlimited Radius^d</i> | <i><50m^c</i> | <i>Unlimited Radius^d</i> | <i><50m^c</i> | <i>Unlimited Radius^d</i> |
| Mountain Quail | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.25 |
| Red-tailed Hawk | 0.00 | 2.00 | 0.00 | 0.33 | 0.00 | 0.00 | 0.00 | 0.00 |
| Mourning Dove | 0.00 | 3.50 | 0.00 | 0.58 | 0.00 | 0.00 | 0.00 | 0.00 |
| Williamson's Sapsucker | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.50 | 0.00 | 0.38 |
| Hairy Woodpecker | 0.00 | 0.50 | 0.00 | 0.08 | 0.00 | 1.00 | 0.00 | 0.25 |
| Northern Flicker | 0.00 | 2.50 | 0.00 | 0.42 | 0.00 | 3.50 | 0.00 | 0.88 |
| Unidentified Woodpecker | 0.00 | 1.50 | 0.00 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 |
| Western Wood-Pewee | 0.50 | 12.50 | 0.08 | 2.08 | 0.50 | 9.50 | 0.13 | 2.38 |
| Hammond's Flycatcher | 0.00 | 0.50 | 0.00 | 0.08 | 0.00 | 0.50 | 0.00 | 0.13 |
| Gray Flycatcher | 0.00 | 5.00 | 0.00 | 0.83 | 0.00 | 2.00 | 0.00 | 0.50 |
| Hutton's Vireo | 0.00 | 1.00 | 0.00 | 0.17 | 0.00 | 0.00 | 0.00 | 0.00 |
| Steller's Jay | 0.00 | 5.00 | 0.00 | 0.83 | 0.00 | 1.50 | 0.00 | 0.38 |
| Clark's Nutcracker | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 3.00 | 0.00 | 0.75 |
| Common Raven | 0.00 | 0.50 | 0.00 | 0.08 | 0.00 | 0.00 | 0.00 | 0.00 |
| Mountain Chickadee | 1.00 | 7.50 | 0.17 | 1.25 | 0.00 | 4.50 | 0.00 | 1.13 |
| Red-breasted Nuthatch | 0.00 | 0.50 | 0.00 | 0.08 | 0.00 | 1.00 | 0.00 | 0.25 |
| White-breasted Nuthatch | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.50 | 0.00 | 0.38 |
| Pygmy Nuthatch | 1.50 | 2.50 | 0.25 | 0.42 | 0.00 | 1.50 | 0.00 | 0.38 |
| Western Bluebird | 0.00 | 0.50 | 0.00 | 0.08 | 0.00 | 0.00 | 0.00 | 0.00 |
| Mountain Bluebird | 0.50 | 2.00 | 0.08 | 0.33 | 0.50 | 2.00 | 0.13 | 0.50 |
| Townsend's Solitaire | 0.00 | 1.00 | 0.00 | 0.17 | 0.00 | 0.00 | 0.00 | 0.00 |
| American Robin | 5.50 | 17.50 | 0.92 | 2.92 | 0.00 | 6.00 | 0.00 | 1.50 |
| Yellow-rumped Warbler | 0.00 | 0.50 | 0.00 | 0.08 | 0.00 | 0.00 | 0.00 | 0.00 |
| Black-throated Gray Warbler | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.50 | 0.00 | 0.13 |
| Hermit Warbler | 0.00 | 0.00 | 0.00 | 0.00 | 0.50 | 0.50 | 0.13 | 0.13 |
| Western Tanager | 0.00 | 4.00 | 0.00 | 0.67 | 0.00 | 3.00 | 0.00 | 0.75 |
| Green-tailed Towhee | 0.50 | 0.50 | 0.08 | 0.08 | 0.00 | 0.00 | 0.00 | 0.00 |
| Chipping Sparrow | 0.50 | 2.00 | 0.08 | 0.33 | 0.00 | 3.00 | 0.00 | 0.75 |
| Brewer's Sparrow | 1.50 | 4.50 | 0.25 | 0.75 | 0.00 | 2.50 | 0.00 | 0.63 |
| Vesper Sparrow | 1.50 | 4.00 | 0.25 | 0.67 | 0.50 | 8.50 | 0.13 | 2.13 |
| White-crowned Sparrow | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.50 | 0.00 | 0.13 |

| Species ^e | McBride Springs / Willow Creek (n = 6 survey stations) | | | | Smith Flat (n = 4 survey stations) | | | |
|-----------------------------|---|----------------------------------|---|----------------------------------|--|----------------------------------|---|----------------------------------|
| | Avg. No. of Birds Detected ^a | | Avg. No. of Birds per Station ^b | | Avg. No. of Birds Detected ^a | | Avg. No. of Birds per Station ^b | |
| | <50m ^c | Unlimited Radius ^d | <50m ^c | Unlimited Radius ^d | <50m ^c | Unlimited Radius ^d | <50m ^c | Unlimited Radius ^d |
| Dark-eyed Junco | 0.50 | 4.50 | 0.08 | 0.75 | 0.00 | 0.00 | 0.00 | 0.00 |
| Black-headed Grosbeak | 0.00 | 0.50 | 0.00 | 0.08 | 0.00 | 0.00 | 0.00 | 0.00 |
| Brewer's Blackbird | 0.00 | 0.50 | 0.00 | 0.08 | 0.00 | 0.00 | 0.00 | 0.00 |
| Brown-headed Cowbird | 0.50 | 3.00 | 0.08 | 0.50 | 0.00 | 3.00 | 0.00 | 0.75 |
| Purple Finch | 0.00 | 0.50 | 0.00 | 0.08 | 0.00 | 1.50 | 0.00 | 0.38 |
| Cassin's Finch | 1.00 | 5.00 | 0.17 | 0.83 | 0.50 | 2.00 | 0.13 | 0.50 |
| Lesser Goldfinch | 0.00 | 0.50 | 0.00 | 0.08 | 0.00 | 0.00 | 0.00 | 0.00 |

^aNumber of individuals detected at the meadow, averaged across 2 survey visits. ^bNumber of individual birds detected divided by the number of survey stations and visits. ^cOnly includes birds detected within 50m of a survey point. ^dAll birds detected regardless of distance from survey station. ^eMeadow focal species recorded in bold text.

Table C-3. Number of birds detected during point counts at Rose Creek and Upper Rose Creek.

| Species ^e | Rose Creek (n = 5 survey stations) | | | | Upper Rose Creek (n = 5 survey stations) | | | |
|-------------------------------|--|----------------------------------|---|----------------------------------|---|----------------------------------|---|----------------------------------|
| | Avg. No. of Birds Detected ^a | | Avg. No. of Birds per Station ^b | | Avg. No. of Birds Detected ^a | | Avg. No. of Birds per Station ^b | |
| | <50m ^c | Unlimited Radius ^d | <50m ^c | Unlimited Radius ^d | <50m ^c | Unlimited Radius ^d | <50m ^c | Unlimited Radius ^d |
| Canada Goose | 0 | 3.00 | 0.00 | 0.60 | 0.00 | 0.00 | 0.00 | 0.00 |
| Mallard | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.50 | 0.00 | 0.10 |
| Mountain Quail | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.20 |
| California Quail | 0 | 1.00 | 0.00 | 0.20 | 0.00 | 0.00 | 0.00 | 0.00 |
| Red-tailed Hawk | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.50 | 0.00 | 0.10 |
| American Kestrel | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.50 | 0.00 | 0.10 |
| Killdeer | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.50 | 0.00 | 0.10 |
| Wilson's Snipe | 0 | 0.50 | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 |
| Rock Pigeon | 0 | 1.50 | 0.00 | 0.30 | 0.00 | 0.00 | 0.00 | 0.00 |
| Mourning Dove | 0 | 1.00 | 0.00 | 0.20 | 0.00 | 2.50 | 0.00 | 0.50 |
| Common Nighthawk | 0 | 1.50 | 0.00 | 0.30 | 0.00 | 0.50 | 0.00 | 0.10 |
| Calliope Hummingbird | 0 | 0.00 | 0.00 | 0.00 | 0.50 | 0.50 | 0.10 | 0.10 |
| Williamson's Sapsucker | 0 | 0.50 | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 |
| Red-breasted Sapsucker | 0 | 0.50 | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 |
| Hairy Woodpecker | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.50 | 0.00 | 0.10 |
| Northern Flicker | 0.5 | 2.50 | 0.10 | 0.50 | 0.00 | 3.00 | 0.00 | 0.60 |
| Unidentified Woodpecker | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.50 | 0.00 | 0.10 |
| Western Wood-Pewee | 1 | 9.50 | 0.20 | 1.90 | 0.50 | 5.50 | 0.10 | 1.10 |
| Pacific-slope Flycatcher | 0.5 | 1.00 | 0.10 | 0.20 | 0.00 | 0.00 | 0.00 | 0.00 |
| Ash-throated Flycatcher | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.50 | 0.00 | 0.10 |
| Western Kingbird | 0 | 0.00 | 0.00 | 0.00 | 1.50 | 1.50 | 0.30 | 0.30 |
| Cassin's Vireo | 0 | 1.00 | 0.00 | 0.20 | 0.00 | 0.00 | 0.00 | 0.00 |
| Steller's Jay | 0 | 1.00 | 0.00 | 0.20 | 0.00 | 3.00 | 0.00 | 0.60 |
| Western Scrub-Jay | 0 | 0.50 | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 |
| American Crow | 0 | 6.50 | 0.00 | 1.30 | 0.00 | 0.50 | 0.00 | 0.10 |
| Tree Swallow | 0 | 0.50 | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 |
| Cliff Swallow | 0 | 0.50 | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 |
| Mountain Chickadee | 1.5 | 6.50 | 0.30 | 1.30 | 0.50 | 2.00 | 0.10 | 0.40 |
| Bushtit | 1.5 | 1.50 | 0.30 | 0.30 | 0.00 | 0.00 | 0.00 | 0.00 |
| Rock Wren | 0 | 0.50 | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bewick's Wren | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.20 |

| Species ^e | Rose Creek (n = 5 survey stations) | | | | Upper Rose Creek (n = 5 survey stations) | | | |
|-------------------------------|--|----------------------------------|---|----------------------------------|---|----------------------------------|---|----------------------------------|
| | Avg. No. of Birds Detected ^a | | Avg. No. of Birds per Station ^b | | Avg. No. of Birds Detected ^a | | Avg. No. of Birds per Station ^b | |
| | <50m ^c | Unlimited Radius ^d | <50m ^c | Unlimited Radius ^d | <50m ^c | Unlimited Radius ^d | <50m ^c | Unlimited Radius ^d |
| House Wren | 0 | 1.00 | 0.00 | 0.20 | 0.00 | 1.00 | 0.00 | 0.20 |
| Mountain Bluebird | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.50 | 0.00 | 0.10 |
| Townsend's Solitaire | 0 | 0.50 | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 |
| Unidentified Thrush | 0 | 0.50 | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 |
| American Robin | 0.5 | 5.50 | 0.10 | 1.10 | 0.50 | 6.00 | 0.10 | 1.20 |
| European Starling | 0 | 1.00 | 0.00 | 0.20 | 0.00 | 0.00 | 0.00 | 0.00 |
| Yellow Warbler | 2 | 4.00 | 0.40 | 0.80 | 0.00 | 1.00 | 0.00 | 0.20 |
| Hermit Warbler | 0 | 0.50 | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 |
| MacGillivray's Warbler | 0 | 0.50 | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 |
| Yellow-breasted Chat | 0.5 | 1.50 | 0.10 | 0.30 | 0.00 | 0.00 | 0.00 | 0.00 |
| Western Tanager | 0 | 1.50 | 0.00 | 0.30 | 0.00 | 1.00 | 0.00 | 0.20 |
| Green-tailed Towhee | 0 | 0.50 | 0.00 | 0.10 | 0.00 | 1.50 | 0.00 | 0.30 |
| Spotted Towhee | 2 | 7.00 | 0.40 | 1.40 | 1.50 | 7.50 | 0.30 | 1.50 |
| Chipping Sparrow | 0 | 4.00 | 0.00 | 0.80 | 0.00 | 0.50 | 0.00 | 0.10 |
| Brewer's Sparrow | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.50 | 0.00 | 0.10 |
| Song Sparrow | 0 | 0.50 | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dark-eyed Junco | 0 | 0.50 | 0.00 | 0.10 | 0.00 | 0.50 | 0.00 | 0.10 |
| Black-headed Grosbeak | 0.5 | 1.50 | 0.10 | 0.30 | 0.00 | 1.00 | 0.00 | 0.20 |
| Lazuli Bunting | 1.5 | 6.50 | 0.30 | 1.30 | 1.50 | 4.50 | 0.30 | 0.90 |
| Red-winged Blackbird | 0.5 | 0.50 | 0.10 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 |
| Western Meadowlark | 0 | 1.50 | 0.00 | 0.30 | 1.00 | 8.00 | 0.20 | 1.60 |
| Brewer's Blackbird | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 4.50 | 0.00 | 0.90 |
| Brown-headed Cowbird | 0 | 9.50 | 0.00 | 1.90 | 0.00 | 0.50 | 0.00 | 0.10 |
| Bullock's Oriole | 0.5 | 0.50 | 0.10 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 |
| Purple Finch | 0.5 | 0.50 | 0.10 | 0.10 | 0.50 | 0.50 | 0.10 | 0.10 |
| Cassin's Finch | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 1.50 | 0.00 | 0.30 |
| Pine Siskin | 0 | 0.50 | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 |
| Lesser Goldfinch | 0.5 | 2.00 | 0.10 | 0.40 | 0.00 | 0.50 | 0.00 | 0.10 |
| House Sparrow | 0 | 1.50 | 0.00 | 0.30 | 0.00 | 0.00 | 0.00 | 0.00 |

^aNumber of individuals detected at the meadow, averaged across 2 survey visits. ^bNumber of individual birds detected divided by the number of survey stations and visits. ^cOnly includes birds detected within 50m of a survey point. ^dAll birds detected regardless of distance from survey station. ^eMeadow focal species recorded in bold text.

Appendix D. Average number of birds detected during area searches at each site

Table D-1. Average number of birds detected during area searches at Lower Ash Creek (1278 ac./517 ha).

| <i>Species^a</i> | <i>Avg. No. Of Birds Detected</i> | | |
|-----------------------------|-----------------------------------|---------------|--------------|
| | <i>Meadow</i> | <i>Upland</i> | <i>Total</i> |
| Mallard | 7.0 | 0.0 | 7.0 |
| Blue-winged Teal | 2.0 | 0.0 | 2.0 |
| Cinnamon Teal | 3.0 | 0.0 | 3.0 |
| Sooty Grouse | 2.0 | 0.0 | 2.0 |
| California Quail | 3.0 | 0.0 | 3.0 |
| Pied-billed Grebe | 2.0 | 0.0 | 2.0 |
| American White Pelican | 14.0 | 0.0 | 14.0 |
| American Bittern | 1.5 | 0.0 | 1.5 |
| Great Blue Heron | 3.0 | 0.0 | 3.0 |
| Bald Eagle | 1.0 | 0.0 | 1.0 |
| Northern Harrier | 1.0 | 0.0 | 1.0 |
| Red-tailed Hawk | 5.0 | 0.0 | 5.0 |
| Unidentified Rail | 1.0 | 0.0 | 1.0 |
| Virginia Rail | 5.0 | 0.0 | 5.0 |
| American Coot | 4.0 | 0.0 | 4.0 |
| Sandhill Crane | 4.0 | 0.0 | 4.0 |
| Killdeer | 3.5 | 0.0 | 3.5 |
| Spotted Sandpiper | 1.5 | 0.0 | 1.5 |
| Willet | 7.0 | 0.0 | 7.0 |
| Wilson's Snipe | 7.0 | 0.0 | 7.0 |
| Wilson's Phalarope | 1.0 | 0.0 | 1.0 |
| Caspian Tern | 4.0 | 0.0 | 4.0 |
| Black Tern | 1.0 | 0.0 | 1.0 |
| Forster's Tern | 1.0 | 0.0 | 1.0 |
| Black-billed Magpie | 2.0 | 0.0 | 2.0 |
| Common Raven | 3.0 | 0.0 | 3.0 |
| Horned Lark | 5.0 | 0.0 | 5.0 |
| Tree Swallow | 8.0 | 0.0 | 8.0 |
| Cliff Swallow | 71.5 | 0.0 | 71.5 |
| Barn Swallow | 4.0 | 0.0 | 4.0 |
| Marsh Wren | 13.5 | 0.0 | 13.5 |
| Yellow Warbler | 1.0 | 0.0 | 1.0 |
| Common Yellowthroat | 1.0 | 0.0 | 1.0 |
| Savannah Sparrow | 3.5 | 0.0 | 3.5 |
| Song Sparrow | 10.0 | 0.0 | 10.0 |
| Red-winged Blackbird | 23.0 | 12.5 | 35.5 |
| Western Meadowlark | 29.5 | 0.0 | 29.5 |
| Yellow-headed Blackbird | 4.0 | 0.0 | 4.0 |
| Brewer's Blackbird | 19.5 | 0.0 | 19.5 |
| Brown-headed Cowbird | 9.0 | 0.0 | 9.0 |

^aMeadow-associated focal species are recorded in bold text.

Table D-2. Average number of birds detected during area searches at Upper Ash Creek (354 ac./ 143 ha).

| <i>Species^a</i> | <i>Avg. No. Of Birds Detected</i> | | |
|-----------------------------|-----------------------------------|---------------|--------------|
| | <i>Meadow</i> | <i>Upland</i> | <i>Total</i> |
| Canada Goose | 8.0 | 0.0 | 8.0 |
| Mallard | 2.0 | 0.0 | 2.0 |
| California Quail | 15.0 | 0.0 | 15.0 |
| Great Blue Heron | 1.0 | 0.0 | 1.0 |
| Sharp-shinned Hawk | 1.0 | 0.0 | 1.0 |
| Red-tailed Hawk | 2.0 | 0.0 | 2.0 |
| American Kestrel | 3.5 | 0.5 | 4.0 |
| Sandhill Crane | 2.0 | 0.0 | 2.0 |
| Killdeer | 4.0 | 0.0 | 4.0 |
| Spotted Sandpiper | 4.5 | 0.0 | 4.5 |
| Wilson's Snipe | 2.5 | 0.0 | 2.5 |
| California Gull | 9.0 | 0.0 | 9.0 |
| Mourning Dove | 0.0 | 1.0 | 1.0 |
| Great Horned Owl | 1.0 | 0.0 | 1.0 |
| Belted Kingfisher | 1.0 | 0.0 | 1.0 |
| Acorn Woodpecker | 0.0 | 5.0 | 5.0 |
| Northern Flicker | 3.5 | 0.0 | 3.5 |
| Western Wood-Pewee | 3.0 | 0.5 | 3.5 |
| Willow Flycatcher | 2.0 | 0.0 | 2.0 |
| Western Kingbird | 2.5 | 0.0 | 2.5 |
| Steller's Jay | 1.0 | 0.0 | 1.0 |
| Western Scrub-Jay | 4.0 | 1.0 | 5.0 |
| Black-billed Magpie | 6.0 | 0.0 | 6.0 |
| American Crow | 2.0 | 0.0 | 2.0 |
| Horned Lark | 5.0 | 0.0 | 5.0 |
| Tree Swallow | 11.0 | 0.0 | 11.0 |
| Violet-green Swallow | 1.0 | 0.0 | 1.0 |
| Cliff Swallow | 3.0 | 0.0 | 3.0 |
| House Wren | 6.0 | 2.5 | 8.5 |
| American Robin | 6.0 | 0.0 | 6.0 |
| Orange-crowned Warbler | 2.0 | 0.0 | 2.0 |
| Yellow Warbler | 5.5 | 0.0 | 5.5 |
| Yellow-breasted Chat | 1.0 | 0.0 | 1.0 |
| Western Tanager | 3.0 | 0.0 | 3.0 |
| Song Sparrow | 6.0 | 0.0 | 6.0 |
| Red-winged Blackbird | 5.0 | 0.0 | 5.0 |
| Western Meadowlark | 16.5 | 0.0 | 16.5 |
| Brewer's Blackbird | 15.0 | 0.0 | 15.0 |
| Brown-headed Cowbird | 8.5 | 0.0 | 8.5 |
| Pine Siskin | 2.0 | 0.0 | 2.0 |

^aMeadow-associated focal species are recorded in bold text.

Table D-3. Average number of birds detected during area searches at McBride Springs/Willow Creek (135 ac./55 ha).

| <i>Species^a</i> | <i>Avg. No. Of Birds Detected</i> | | |
|-----------------------------|-----------------------------------|---------------|--------------|
| | <i>Meadow</i> | <i>Upland</i> | <i>Total</i> |
| Red-tailed Hawk | 0.0 | 2.0 | 2.0 |
| White-headed Woodpecker | 0.0 | 1.0 | 1.0 |
| Northern Flicker | 0.0 | 3.0 | 3.0 |
| Western Wood-Pewee | 0.0 | 8.5 | 8.5 |
| Hammond's Flycatcher | 0.0 | 1.0 | 1.0 |
| Gray Flycatcher | 0.0 | 2.0 | 2.0 |
| Steller's Jay | 0.0 | 5.0 | 5.0 |
| Mountain Chickadee | 1.0 | 4.0 | 5.0 |
| Pygmy Nuthatch | 0.0 | 4.0 | 4.0 |
| Bewick's Wren | 0.0 | 1.0 | 1.0 |
| Mountain Bluebird | 1.0 | 0.0 | 1.0 |
| Townsend's Solitaire | 0.5 | 0.5 | 1.0 |
| American Robin | 12.0 | 1.5 | 13.5 |
| Yellow-rumped Warbler | 1.0 | 0.0 | 1.0 |
| Western Tanager | 0.5 | 2.0 | 2.5 |
| Green-tailed Towhee | 0.0 | 2.0 | 2.0 |
| Chipping Sparrow | 0.0 | 4.0 | 4.0 |
| Brewer's Sparrow | 7.0 | 0.0 | 7.0 |
| Vesper Sparrow | 5.0 | 0.0 | 5.0 |
| Dark-eyed Junco | 3.0 | 6.0 | 9.0 |
| Black-headed Grosbeak | 0.0 | 3.0 | 3.0 |
| Western Meadowlark | 0.0 | 1.0 | 1.0 |
| Brown-headed Cowbird | 3.0 | 0.0 | 3.0 |
| Purple Finch | 1.0 | 0.0 | 1.0 |
| Cassin's Finch | 1.5 | 2.0 | 3.5 |

^aMeadow-associated focal species are recorded in bold text.

Table D-4. Average number of birds detected during area searches at Smith Flat (110ac./45 ha).

| <i>Species^a</i> | <i>Avg. No. Of Birds Detected</i> | | |
|------------------------------|-----------------------------------|---------------|--------------|
| | <i>Meadow</i> | <i>Upland</i> | <i>Total</i> |
| Common Nighthawk | 1.0 | 0.0 | 1.0 |
| Williamson's Sapsucker | 0.0 | 1.0 | 1.0 |
| Hairy Woodpecker | 0.0 | 1.0 | 1.0 |
| White-headed Woodpecker | 0.0 | 2.0 | 2.0 |
| Northern Flicker | 0.0 | 2.5 | 2.5 |
| Western Wood-Pewee | 0.0 | 5.0 | 5.0 |
| Hammond's Flycatcher | 0.0 | 1.0 | 1.0 |
| Gray Flycatcher | 0.0 | 4.0 | 4.0 |
| Western Kingbird | 0.0 | 1.0 | 1.0 |
| Steller's Jay | 0.0 | 2.0 | 2.0 |
| Clark's Nutcracker | 0.0 | 4.5 | 4.5 |
| Mountain Chickadee | 0.0 | 2.5 | 2.5 |
| Red-breasted Nuthatch | 0.0 | 1.0 | 1.0 |
| White-breasted Nuthatch | 0.0 | 2.0 | 2.0 |
| Pygmy Nuthatch | 0.0 | 7.0 | 7.0 |
| House Wren | 0.0 | 1.0 | 1.0 |
| Mountain Bluebird | 4.0 | 0.0 | 4.0 |
| American Robin | 0.5 | 4.5 | 5.0 |
| Orange-crowned Warbler | 0.0 | 1.0 | 1.0 |
| Yellow-rumped Warbler | 0.0 | 2.0 | 2.0 |
| Hermit Warbler | 0.0 | 1.0 | 1.0 |
| Western Tanager | 0.0 | 5.0 | 5.0 |
| Chipping Sparrow | 0.0 | 3.0 | 3.0 |
| Brewer's Sparrow | 3.0 | 2.0 | 5.0 |
| Vesper Sparrow | 2.5 | 0.5 | 3.0 |
| White-crowned Sparrow | 0.0 | 2.0 | 2.0 |
| Dark-eyed Junco | 0.0 | 2.0 | 2.0 |
| Black-headed Grosbeak | 0.0 | 1.0 | 1.0 |
| Brewer's Blackbird | 9.0 | 0.0 | 9.0 |
| Brown-headed Cowbird | 5.5 | 0.5 | 6.0 |
| Cassin's Finch | 0.5 | 1.5 | 2.0 |

^aMeadow-associated focal species are recorded in bold text.

Table D-5. Average number of birds detected during area searches at Rose Creek (30 ac./12 ha).

| <i>Species^a</i> | <i>Avg. No. Of Birds Detected</i> | | |
|-------------------------------|-----------------------------------|---------------|--------------|
| | <i>Meadow</i> | <i>Upland</i> | <i>Total</i> |
| Canada Goose | 16.0 | 0.0 | 16.0 |
| Gadwall | 1.0 | 0.0 | 1.0 |
| Great Blue Heron | 2.0 | 0.0 | 2.0 |
| American Kestrel | 0.0 | 1.0 | 1.0 |
| Rock Pigeon | 2.0 | 0.0 | 2.0 |
| Mourning Dove | 1.0 | 1.0 | 2.0 |
| Common Nighthawk | 3.0 | 0.0 | 3.0 |
| Rufous Hummingbird | 1.0 | 0.0 | 1.0 |
| Red-breasted Sapsucker | 3.0 | 0.0 | 3.0 |
| Northern Flicker | 0.0 | 2.0 | 2.0 |
| Western Wood-Pewee | 0.0 | 6.5 | 6.5 |
| Western Kingbird | 2.0 | 0.0 | 2.0 |
| Cassin's Vireo | 0.5 | 1.0 | 1.5 |
| Warbling Vireo | 1.0 | 0.0 | 1.0 |
| Steller's Jay | 0.0 | 1.0 | 1.0 |
| Clark's Nutcracker | 0.0 | 1.0 | 1.0 |
| American Crow | 3.5 | 2.0 | 5.5 |
| Cliff Swallow | 3.0 | 0.0 | 3.0 |
| Mountain Chickadee | 0.5 | 6.0 | 6.5 |
| Bushtit | 0.0 | 3.0 | 3.0 |
| White-breasted Nuthatch | 0.0 | 1.0 | 1.0 |
| Rock Wren | 0.0 | 1.0 | 1.0 |
| House Wren | 0.0 | 2.0 | 2.0 |
| Townsend's Solitaire | 0.0 | 1.0 | 1.0 |
| American Robin | 2.0 | 5.5 | 7.5 |
| European Starling | 2.0 | 0.0 | 2.0 |
| Orange-crowned Warbler | 3.0 | 0.0 | 3.0 |
| Yellow Warbler | 3.5 | 1.5 | 5.0 |
| Western Tanager | 0.0 | 3.0 | 3.0 |
| Spotted Towhee | 3.5 | 5.5 | 9.0 |
| Chipping Sparrow | 0.0 | 3.0 | 3.0 |
| Dark-eyed Junco | 0.0 | 2.0 | 2.0 |
| Black-headed Grosbeak | 0.0 | 3.0 | 3.0 |
| Lazuli Bunting | 6.0 | 5.0 | 11.0 |
| Red-winged Blackbird | 3.0 | 0.0 | 3.0 |
| Western Meadowlark | 2.0 | 0.0 | 2.0 |
| Brewer's Blackbird | 5.0 | 0.0 | 5.0 |
| Brown-headed Cowbird | 6.5 | 1.5 | 8.0 |
| Cassin's Finch | 0.5 | 1.0 | 1.5 |
| Pine Siskin | 0.0 | 1.0 | 1.0 |
| Lesser Goldfinch | 0.0 | 3.0 | 3.0 |
| House Sparrow | 3.0 | 0.0 | 3.0 |

^aMeadow-associated focal species are recorded in bold text.

Table D-6. Average number of birds detected during area searches at Upper Rose Creek (27 ac./11 ha).

| <i>Species^a</i> | <i>Avg. No. Of Birds Detected</i> | | |
|-----------------------------|-----------------------------------|---------------|--------------|
| | <i>Meadow</i> | <i>Upland</i> | <i>Total</i> |
| Mallard | 1.0 | 0.0 | 1.0 |
| Red-tailed Hawk | 0.0 | 1.0 | 1.0 |
| Killdeer | 1.0 | 0.0 | 1.0 |
| Mourning Dove | 0.0 | 1.5 | 1.5 |
| Common Nighthawk | 2.0 | 0.0 | 2.0 |
| Northern Flicker | 0.0 | 2.0 | 2.0 |
| Western Wood-Pewee | 0.0 | 2.0 | 2.0 |
| Western Kingbird | 3.0 | 0.0 | 3.0 |
| Steller's Jay | 1.5 | 1.5 | 3.0 |
| Mountain Chickadee | 0.0 | 4.0 | 4.0 |
| Red-breasted Nuthatch | 0.0 | 1.0 | 1.0 |
| House Wren | 0.0 | 1.0 | 1.0 |
| Mountain Bluebird | 0.5 | 0.5 | 1.0 |
| American Robin | 10.0 | 0.0 | 10.0 |
| Yellow Warbler | 1.0 | 0.0 | 1.0 |
| Green-tailed Towhee | 1.0 | 0.0 | 1.0 |
| Spotted Towhee | 4.0 | 0.0 | 4.0 |
| Brewer's Sparrow | 1.0 | 0.0 | 1.0 |
| Lazuli Bunting | 4.0 | 0.5 | 4.5 |
| Western Meadowlark | 7.0 | 0.0 | 7.0 |
| Brewer's Blackbird | 5.0 | 5.0 | 10.0 |
| Brown-headed Cowbird | 3.0 | 0.0 | 3.0 |
| Cassin's Finch | 0.0 | 2.0 | 2.0 |
| Lesser Goldfinch | 0.0 | 3.0 | 3.0 |

^aMeadow-associated focal species are recorded in bold text.

Appendix E. All bird species detected during point counts and area searches at each meadow

Table E-1. All bird species detected during point counts and area searches at each meadow.

| Species^a | No. of Meadows with Detections | Lower Ash Creek | Upper Ash Creek | McBride Springs/ Willow Creek | Smith Flat | Rose Creek | Upper Rose Creek |
|----------------------------|---------------------------------------|------------------------|------------------------|--|-------------------|-------------------|-------------------------|
| Canada Goose | 3 | X | X | | | X | |
| Gadwall | 1 | | | | | X | |
| Mallard | 3 | X | X | | | | X |
| Blue-winged Teal | 2 | X | X | | | | |
| Cinnamon Teal | 1 | X | | | | | |
| Unidentified Teal | 1 | X | | | | | |
| Common Merganser | 1 | | X | | | | |
| Sooty Grouse | 1 | X | | | | | |
| Mountain Quail | 3 | | X | | X | | X |
| California Quail | 3 | X | X | | | X | |
| Pied-billed Grebe | 1 | X | | | | | |
| American White Pelican | 1 | X | | | | | |
| American Bittern | 1 | X | | | | | |
| Great Blue Heron | 3 | X | X | | | X | |
| Bald Eagle | 1 | X | | | | | |
| Northern Harrier | 2 | X | X | | | | |
| Sharp-shinned Hawk | 1 | | X | | | | |
| Red-tailed Hawk | 4 | X | X | X | | | X |
| American Kestrel | 3 | | X | | | X | X |
| Virginia Rail | 1 | X | | | | | |
| Unidentified Rail | 1 | X | | | | | |
| American Coot | 1 | X | | | | | |
| Sandhill Crane | 2 | X | X | | | | |
| Killdeer | 3 | X | X | | | | X |
| Spotted Sandpiper | 2 | X | X | | | | |
| Willet | 2 | X | X | | | | |
| Wilson's Snipe | 3 | X | X | | | X | |
| Wilson's Phalarope | 1 | X | | | | | |
| California Gull | 2 | X | X | | | | |
| Caspian Tern | 1 | X | | | | | |
| Black Tern | 1 | X | | | | | |
| Forster's Tern | 1 | X | | | | | |
| Rock Pigeon | 1 | | | | | X | |
| Mourning Dove | 4 | | X | X | | X | X |
| Great Horned Owl | 1 | | X | | | | |

| Species^a | No. of Meadows with Detections | Lower Ash Creek | Upper Ash Creek | McBride Springs/ Willow Creek | Smith Flat | Rose Creek | Upper Rose Creek |
|-------------------------------|---|------------------------|------------------------|--|-------------------|-------------------|-----------------------------|
| Common Nighthawk | 3 | | | | X | X | X |
| Calliope Hummingbird | 1 | | | | | | X |
| Rufous Hummingbird | 1 | | | | | X | |
| Belted Kingfisher | 1 | | X | | | | |
| Acorn Woodpecker | 1 | | X | | | | |
| Williamson's Sapsucker | 2 | | | | X | X | |
| Red-breasted Sapsucker | 1 | | | | | X | |
| Hairy Woodpecker | 3 | | | X | X | | X |
| White-headed Woodpecker | 2 | | | X | X | | |
| Northern Flicker | 5 | | X | X | X | X | X |
| Unidentified Woodpecker | 2 | | | X | | | X |
| Western Wood-Pewee | 5 | | X | X | X | X | X |
| Willow Flycatcher | 1 | | X | | | | |
| Hammond's Flycatcher | 2 | | | X | X | | |
| Gray Flycatcher | 2 | | | X | X | | |
| Pacific-slope Flycatcher | 1 | | | | | X | |
| Ash-throated Flycatcher | 1 | | | | | | X |
| Western Kingbird | 4 | | X | | X | X | X |
| Cassin's Vireo | 1 | | | | | X | |
| Hutton's Vireo | 1 | | | X | | | |
| Warbling Vireo | 1 | | | | | X | |
| Steller's Jay | 5 | | X | X | X | X | X |
| Western Scrub-Jay | 2 | | X | | | X | |
| Clark's Nutcracker | 2 | | | | X | X | |
| Black-billed Magpie | 2 | X | X | | | | |
| American Crow | 3 | | X | | | X | X |
| Common Raven | 2 | X | | X | | | |
| Horned Lark | 2 | X | X | | | | |
| Tree Swallow | 3 | X | X | | | X | |
| Violet-green Swallow | 1 | | X | | | | |
| Cliff Swallow | 3 | X | X | | | X | |
| Barn Swallow | 1 | X | | | | | |
| Mountain Chickadee | 4 | | | X | X | X | X |
| Bushtit | 1 | | | | | X | |
| Red-breasted Nuthatch | 3 | | | X | X | | X |
| White-breasted Nuthatch | 2 | | | | X | X | |
| Pygmy Nuthatch | 2 | | | X | X | | |
| Rock Wren | 1 | | | | | X | |

| <i>Species^a</i> | <i>No. of Meadows with Detections</i> | <i>Lower Ash Creek</i> | <i>Upper Ash Creek</i> | <i>McBride Springs/ Willow Creek</i> | <i>Smith Flat</i> | <i>Rose Creek</i> | <i>Upper Rose Creek</i> |
|-------------------------------|---|------------------------|------------------------|--|-------------------|-------------------|-----------------------------|
| Bewick's Wren | 3 | | X | X | | | X |
| House Wren | 4 | | X | | X | X | X |
| Marsh Wren | 1 | X | | | | | |
| Western Bluebird | 1 | | | X | | | |
| Mountain Bluebird | 3 | | | X | X | | X |
| Townsend's Solitaire | 2 | | | X | | X | |
| Unidentified Thrush | 1 | | | | | X | |
| American Robin | 5 | | X | X | X | X | X |
| European Starling | 1 | | | | | X | |
| Orange-crowned Warbler | 3 | | X | | X | X | |
| Yellow Warbler | 4 | X | X | | | X | X |
| Yellow-rumped Warbler | 2 | | | X | X | | |
| Black-throated Gray Warbler | 1 | | | | X | | |
| Hermit Warbler | 3 | | X | | X | X | |
| MacGillivray's Warbler | 1 | | | | | X | |
| Common Yellowthroat | 1 | X | | | | | |
| Yellow-breasted Chat | 2 | | X | | | X | |
| Western Tanager | 5 | | X | X | X | X | X |
| Green-tailed Towhee | 3 | | | X | | X | X |
| Spotted Towhee | 2 | | | | | X | X |
| Chipping Sparrow | 4 | | | X | X | X | X |
| Brewer's Sparrow | 4 | | X | X | X | | X |
| Vesper Sparrow | 2 | | | X | X | | |
| Savannah Sparrow | 1 | X | | | | | |
| Song Sparrow | 3 | X | X | | | X | |
| White-crowned Sparrow | 1 | | | | X | | |
| Dark-eyed Junco | 4 | | | X | X | X | X |
| Black-headed Grosbeak | 5 | | X | X | X | X | X |
| Lazuli Bunting | 2 | | | | | X | X |
| Red-winged Blackbird | 3 | X | X | | | X | |
| Western Meadowlark | 5 | X | X | X | | X | X |
| Yellow-headed Blackbird | 1 | X | | | | | |
| Brewer's Blackbird | 6 | X | X | X | X | X | X |
| Brown-headed Cowbird | 6 | X | X | X | X | X | X |
| Bullock's Oriole | 1 | | | | | X | |
| Purple Finch | 4 | | | X | X | X | X |
| Cassin's Finch | 4 | | | X | X | X | X |
| Pine Siskin | 2 | | X | | | X | |

| Species^a | No. of Meadows with Detections | Lower Ash Creek | Upper Ash Creek | McBride Springs/ Willow Creek | Smith Flat | Rose Creek | Upper Rose Creek |
|----------------------------|---|------------------------|------------------------|--|-------------------|-------------------|-----------------------------|
| Lesser Goldfinch | 4 | | X | X | | X | X |
| House Sparrow | 1 | | | | | X | |
| Unidentified Species | 1 | X | | | | | |

^aMeadow-associated focal species are indicated in bold text.