

2018 Breeding Bird Surveys on the Idaho National Laboratory Site

Bryan F. Bybee
Bill Doering
Quinn R. Shurtliff

9 July 2019

Veolia Nuclear Solutions – Federal Services
120 Technology Drive
Idaho Falls, ID 83401

Prepared for:

U.S. Department of Energy-Idaho Operations Office
Environmental Surveillance, Education, and Research Program
Contract No. DE-NE-0008477



EXECUTIVE SUMMARY

To monitor bird populations on the Idaho National Laboratory (INL) Site, protocol Breeding Bird Surveys (BBSs) have been conducted annually almost every year since 1985. In 2018, we conducted surveys in June and early July along five routes that are part of a nationwide survey administered by the U.S. Geological Survey (USGS) and eight additional routes near INL Site facilities. We documented 2,840 birds from 53 species during those surveys.

We observed similar bird abundance patterns for those species that are typically the most numerous including horned lark (*Eremophila alpestris*, $n=873$), western meadowlark (*Sturnella neglecta*, $n=481$), sage thrasher (*Oreoscoptes montanus*, $n=376$), Brewer's sparrow (*Spizella breweri*, $n=184$), and sagebrush sparrow (*Artemisiospiza nevadensis*, $n=201$). These five species have been the five most abundant 24 times during the past 32 years of surveys, and in the other years they were among the seven most abundant species.

Species observed during the 2018 BBS that are considered by the Idaho Department of Fish and Game as Species of Greatest Conservation Need included the sage thrasher, sagebrush sparrow, Franklin's gull (*Leucophaeus pipixcan*, $n=50$), common nighthawk (*Chordeiles minor*, $n=26$), ferruginous hawk (*Buteo regalis*, $n=7$), grasshopper sparrow (*Ammodramus savannarum*, $n=7$), long-billed curlew (*Numenius americanus*, $n=5$), and burrowing owl (*Athene cunicularia*, $n=3$).

Brewer's and Sagebrush sparrows continue to be observed at near-historical lows, likely as a result of large fires in 2010 and 2011. In addition, raven (*Corvus corax*) observations continue at high levels.

TABLE OF CONTENTS

EXECUTIVE SUMMARY ii

LIST OF FIGURES iii

LIST OF TABLES iii

ACRONYMS iv

1.0 INTRODUCTION5

 1.1 STUDY AREA.....5

 1.2 METHODS.....7

 1.3 RESULTS AND DISCUSSION8

2.0 SUMMARY AND CONCLUSIONS10

3.0 ACKNOWLEDGEMENTS11

4.0 LITERATURE CITED11

APPENDIX A SUMMARY OF SPECIES BY ROUTE 2018.....12

LIST OF FIGURES

Figure 1. Breeding Bird Survey routes on the Idaho National Laboratory Site. Blue dots represent survey points along facility routes and red dots represent the same for remote routes.6

Figure 2. Number of birds observed during Breeding Bird Surveys on the Idaho National Laboratory Site. The dashed black line indicates the mean number of birds observed from 1985 to 2017. No BBSs were conducted on the INL Site in 1992 or 1993.8

Figure 3. Summary of species assemblage for Breeding Bird Surveys of remote and facility routes on the Idaho National Laboratory Site in 2018.11

Figure 4. Trends of three sagebrush obligates recorded during Breeding Bird Surveys since 1985. Surveys were not conducted in 1992 and 1993.....8

LIST OF TABLES

Table 1. Summary of species from 13 routes, sorted by abundance, that were observed during the 2018 Breeding Bird Survey on the Idaho National Laboratory Site.9

Table 2. Summary numbers for each breeding bird route that was surveyed in 2018 on the Idaho National Laboratory Site.10

Table 3. Values for species richness, Shannon Diversity (*H*), and Equitability (*E_H*) indices for the 2018 Idaho National Laboratory Site Breeding Bird Surveys.10

ACRONYMS

ATR-C	Advanced Test Reactor Complex
BBS	Breeding Bird Survey
CFA	Central Facilities Area
CITRC	Critical Infrastructure Test Range Complex
INL	Idaho National Laboratory
INTEC	Idaho Nuclear Technology and Engineering Center
MFC	Materials and Fuels Complex
NRF	Naval Reactors Facility
PBF	Power Burst Facility
RWMC	Radioactive Waste Management Complex
TAN	Test Area North
USGS	United States Geological Survey

1.0 INTRODUCTION

The North American Breeding Bird Survey (BBS) was developed by the U.S. Fish and Wildlife Service and the Canadian Wildlife Service to document trends in bird populations. Pilot surveys began in 1965 and immediately expanded to cover the U.S. east of the Mississippi and Canada, and by 1968 included all of North America (Sauer and Link 2011). The BBS program in North America is managed by the U.S. Geological Survey (USGS) and currently consists of over 5,100 routes, with approximately 2,500 of these being sampled each year (Sauer and Link 2011).

Breeding bird survey data provide long-term species abundance and distribution trends for > 420 species of birds across a broad-geographic scale (Sauer and Link 2011). These data have been used to estimate population changes for hundreds of bird species, and they are the primary source for regional conservation programs and modeling efforts for birds (Sauer and Link 2011). The BBS provides a wealth of information about population trends of birds in North America and is the foundation for broad conservation assessments extending beyond local jurisdictional boundaries (Sauer and Link 2011).

Five official USGS BBS routes (i.e. remote routes) are on the Idaho National Laboratory (INL) Site and have been surveyed nearly each year since 1985 (except 1992 and 1993). In 1985, the U.S. Department of Energy, Idaho Operations Office (DOE-ID) also established eight additional routes around INL Site facilities to monitor birds near the highest human activity centers (i.e. facility routes) (Figure 1). These routes are also surveyed annually using the same techniques and methods as those indicated by USGS. BBS data can benefit INL Site managers directly by providing information on local breeding bird populations, which may be useful as they consider new activities and comply with the National Environmental Protection Act. This report summarizes results from the 2018 BBS and examines long-term trends.

1.1 STUDY AREA

The INL Site encompasses almost 900 mi² (2,330 km²) on the Upper Snake River Plain in southeast Idaho (Figure 1) and is administered by the DOE-ID. The INL Site was designated a National Environmental Research Park in 1975 to facilitate research assessing environmental impacts from the development of nuclear energy technologies. This area is located within portions of Bingham, Bonneville, Butte, Clark, and Jefferson counties. The INL Site has been designated as an Important Bird Area by the Idaho Comprehensive Wildlife Conservation Strategy (Idaho Department of Fish and Game 2005). This designation recognizes wildlife species that are listed by either state or federal agencies and provides a comprehensive listing of the Idaho species of greatest conservation need (Idaho Department of Fish and Game 2016). The INL Site has also been recognized as a Global Important Bird Area by the National Audubon Society.

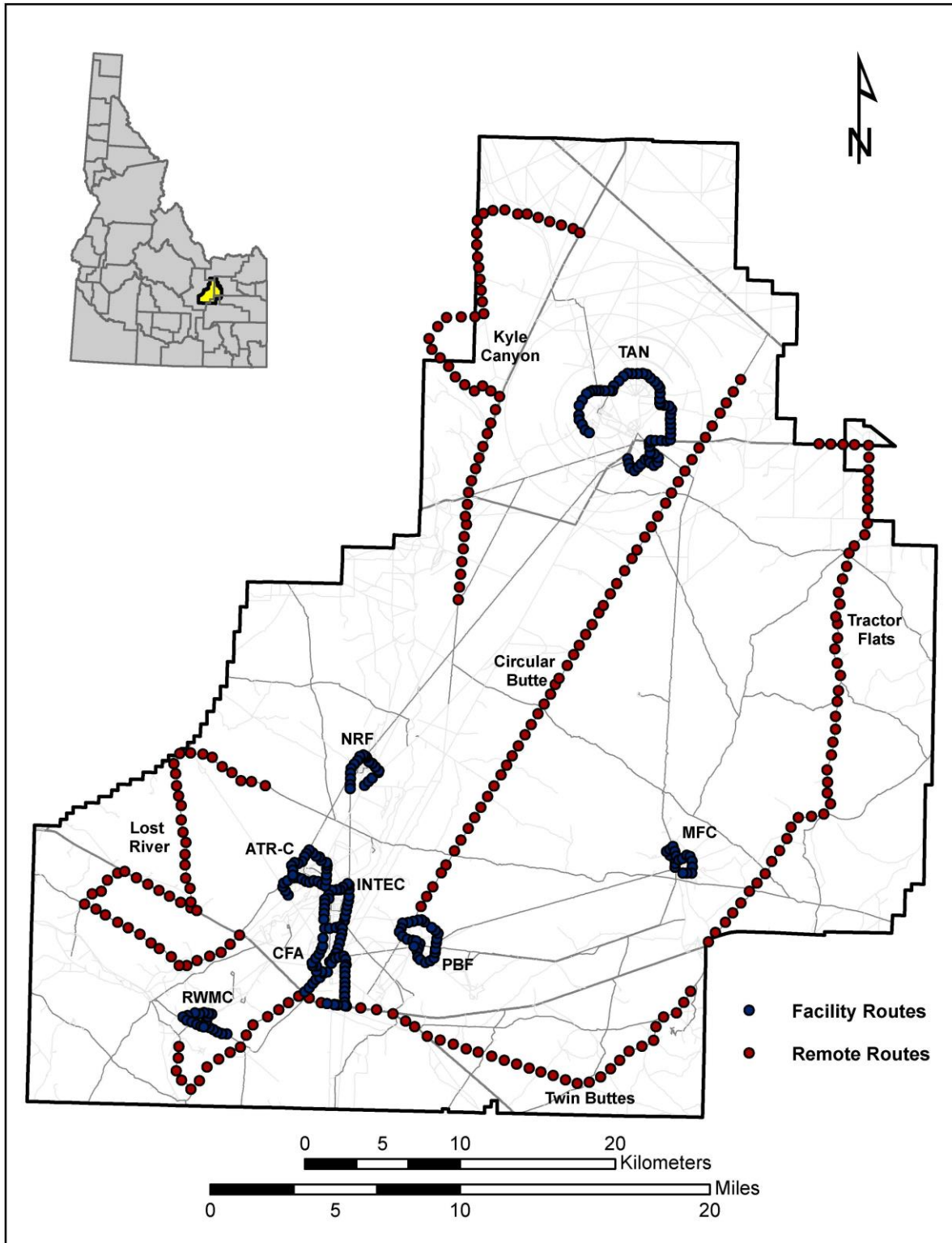


Figure 1. Breeding Bird Survey routes on the Idaho National Laboratory Site. Blue dots represent survey points along facility routes and red dots represent the same for remote routes.

Topography across the INL Site is mostly flat with an average elevation of 4,985 ft (1,519 m). Other than minor topographic variation created by basalt outcrops, the only significant geographical relief occurs around East and Middle Buttes and the southern portion of the Lemhi mountains located near the northwest corner of the INL Site.

The INL Site has a semi-arid climate, characterized by hot, dry summers and cold winters. Annual precipitation on the INL Site averages 8 inches (20 cm), with peak precipitation commonly occurring in spring. The geology is dominated by Quaternary basalt lava flows, including many outcrops and lava tubes. Aeolian soils consisting primarily of silt loam and sandy loam are the most common soil type on the INL Site, while alluvial soils more commonly occur along the flood plain of the Big Lost River. The INL Site is a shrub-steppe ecosystem dominated by a woody shrub over-story and perennial bunchgrass and forb understory. Big sagebrush (*Artemisia tridentata* ssp.) is the most dominant shrub community on the INL Site, while other common species include green rabbitbrush (*Chrysothamnus viscidiflorus*), spiny hopsage (*Grayia spinosa*), shadscale (*Atriplex confertifolia*), winterfat (*Krascheninnikovia lanata*), and other sagebrush species (*A. spp.*). The most common native grasses are streambank wheatgrass (*Elymus lanceolatus*), bottlebrush squirreltail (*E. elymoides*), Indian ricegrass (*Achnatherum hymenoides*), and needle-and-thread grass (*Hesperostipa comata*). More information regarding the climate, geology, and vegetation communities on the INL Site is described in Shive et al. (2011).

Surface water on the INL is limited, especially during the summer months. The Big Lost River and Birch Creek are both diverted upstream for agricultural purposes and consequently little, if any, water from these streams reaches the INL Site. During years of high flow, however, water from the Big Lost River can reach the INL Site where it drains into what used to be an ephemeral wetland known as the Big Lost River Sinks. The sinks provide the only substantial water source for waterfowl and shorebirds on the INL Site, although a number of man-made waste treatment ponds near facilities also provide habitat for aquatic birds as well as a water source for migratory birds.

1.2 METHODS

Data Collection

The BBS is a roadside count of all birds seen or heard along predefined routes. Thirteen BBS routes were surveyed from June 4 to July 2, 2018, consisting of five official USGS BBS routes and eight facility routes developed specifically for the INL Site (Figure 1). Each remote survey route is 24.5 miles (39.2 km), consisting of 50 sampling points systematically spaced every 0.5 mile (0.8 km). Facility routes vary in length between 3.6 miles (5.8 km) and 11.9 miles (19.2 km), depending on the size of the facility. Sampling points along facility routes are separated by approximately 0.2 mile (0.32 km).

During surveys, observers followed the North American BBS protocols provided by the USGS Patuxent Wildlife Research Center (Sauer and Link 2011). At each sampling location (i.e. stop), a trained observer recorded every bird species observed within a quarter-mile radius or heard at any distance during a 3-minute interval. Any bird that was suspected of being counted on the previous stop was not recorded again (Sauer and Link 2011). Additional data such as temperature, wind speed, and sky condition were recorded after every five stops along remote

routes, and at the beginning and end of each facility route. Each route was only surveyed when weather conditions were appropriate (e.g., no heavy rain or strong wind). These surveys began one-half hour before sunrise and continued for up to 6 hours until the route was completed. The number of vehicles that passed observers during the 3-minute sampling period was recorded on all remote routes, and observers noted whether background noise interfered with audible detection of birds.

Shannon's H and E_H were calculated for all BBS routes to show the species diversity, species abundance, measure of evenness, and compared with standard species richness information documented in past reports. We assumed that data obtained from each survey route was an accurate representation of the local bird community.

1.3 RESULTS AND DISCUSSION

Summary Statistics

We documented 2,840 birds and 53 species during the 2018 surveys (Appendix A). Total observations were 40% lower than the 31-year mean of 4,707 birds (1985-2017, 1992 and 1993 excluded; Figure 2), and we recorded fewer species (mean=56 species).

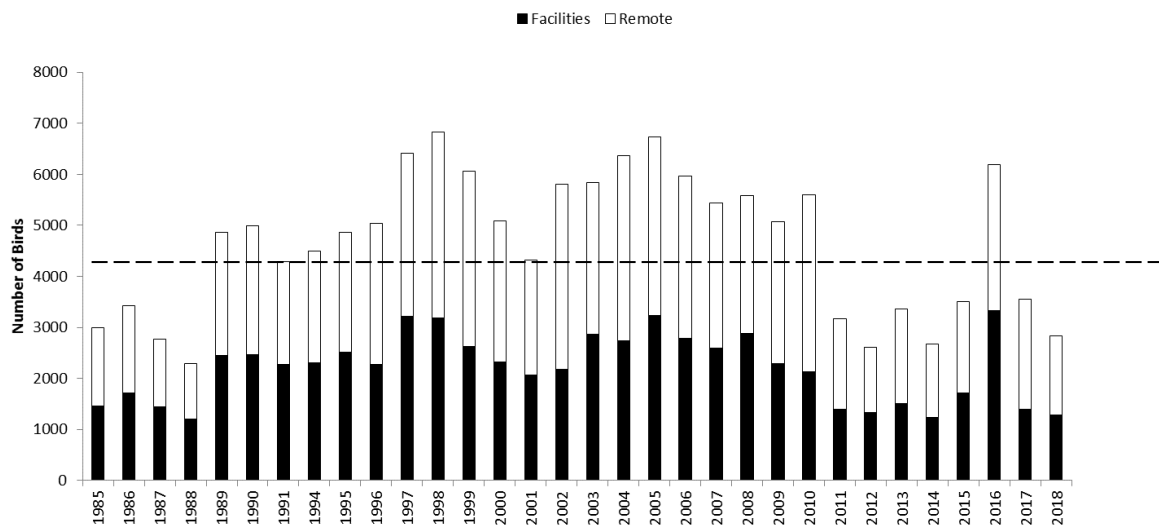


Figure 2. Number of birds observed during Breeding Bird Surveys on the Idaho National Laboratory Site. The dashed black line indicates the mean number of birds observed from 1985 to 2018. No BBSs were conducted on the INL Site in 1992 or 1993.

The five most abundant birds across all routes were horned lark (*Eremophila alpestris*, $n=873$), western meadowlark (*Sturnella neglecta*, $n=481$), sage thrasher (*Oreoscoptes montanus*, $n=376$), sagebrush sparrow (*Artemisiospiza nevadensis*, $n = 201$), and Brewer's sparrow (*Spizella breweri*, $n=184$) (Table 1). These six species comprised >74% of all observations, and each was observed on every remote route (Appendix A). Horned lark, western meadowlark, sage thrasher, sagebrush sparrow, and Brewer's sparrow have been the five most abundant species in 24 of the 32 years of INL Site BBS (in the other years they were among the seven most abundant species).

The horned lark was the most evenly distributed species, observed at 67% (332) of the total stops made during the survey (Table 1). The horned lark is traditionally the most abundant species recorded during BBSs on the INL Site and, apart from 2013 and 2016, has been the most abundant species annually since 1998.

Table 1. Summary of species from 13 routes, sorted by abundance, that were observed during the 2018 Breeding Bird Survey on the Idaho National Laboratory Site.

Common Name	Scientific Name	n	%	Routes ¹	Stops ²	% ³
Horned Lark	<i>Eremophila alpestris</i>	873	30.74	5,8	332	67.07
Western Meadowlark	<i>Sturnella neglecta</i>	481	16.94	5,8	257	51.92
Sage Thrasher	<i>Oreoscoptes montanus</i>	376	13.24	5,8	242	48.89
Sagebrush Sparrow	<i>Artemisiospiza nevadensis</i>	201	7.08	5,7	140	28.28
Brewer's Sparrow	<i>Spizella breweri</i>	184	6.48	5,8	112	22.63
Common Raven	<i>Corvus corax</i>	167	5.88	5,8	67	13.54
Mourning Dove	<i>Zenaida macroura</i>	85	2.99	4,7	60	12.12
Franklin's Gull	<i>Leucophaeus pipixcan</i>	50	1.76	1,0	6	1.21
Barn Swallow	<i>Hirundo rustica</i>	49	1.73	1,7	20	4.04
European Starling	<i>Sturnus vulgaris</i>	39	1.37	0,4	11	2.22
Common Nighthawk	<i>Chordeiles minor</i>	26	0.92	4,3	20	4.04
Vesper Sparrow	<i>Pooecetes gramineus</i>	26	0.92	4,1	22	4.44
Brewer's Blackbird	<i>Euphagus cyanocephalus</i>	25	0.88	1,5	13	2.63
Red-tailed Hawk	<i>Buteo jamaicensis</i>	24	0.85	5,6	22	4.44
Loggerhead Shrike	<i>Lanius ludovicianus</i>	23	0.81	3,5	16	3.23
Willet	<i>Tringa semipalmata</i>	22	0.77	2,0	2	0.40
Mallard	<i>Anas platyrhynchos</i>	17	0.60	0,1	2	0.40
Swainson's Hawk	<i>Buteo swainsoni</i>	16	0.56	3,2	14	2.83
American Robin	<i>Turdus migratorius</i>	14	0.49	1,1	6	1.21
Black-billed Magpie	<i>Pica hudsonia</i>	13	0.46	3,0	8	1.62
House Sparrow	<i>Passer domesticus</i>	12	0.42	1,1	2	0.40
Northern Harrier	<i>Circus hudsonius</i>	11	0.39	3,2	11	2.22
Bank Swallow	<i>Riparia riparia</i>	8	0.28	0,3	6	1.21
Say's Phoebe	<i>Sayornis saya</i>	8	0.28	0,5	8	1.62
Ferruginous Hawk	<i>Buteo regalis</i>	7	0.25	3,1	6	1.21
Grasshopper Sparrow	<i>Ammodramus savannarum</i>	7	0.25	2,0	6	1.21
American Kestrel	<i>Falco sparverius</i>	6	0.21	0,2	2	0.40
Brown-headed Cowbird	<i>Molothrus ater</i>	6	0.21	2,2	5	1.01
Killdeer	<i>Charadrius vociferus</i>	6	0.21	1,2	5	1.01
American Avocet	<i>Recurvirostra americana</i>	5	0.18	0,1	1	0.20
Long-billed Curlew	<i>Numenius americanus</i>	5	0.18	1,0	1	0.20
Lesser Scaup	<i>Aythya affinis</i>	4	0.14	0,1	1	0.20
Prairie Falcon	<i>Falco mexicanus</i>	4	0.14	2,0	2	0.40
American Crow	<i>Corvus brachyrhynchos</i>	3	0.11	1,0	2	0.40
Burrowing Owl	<i>Athene cunicularia</i>	3	0.11	1,1	2	0.40
House Finch	<i>Haemorhous mexicanus</i>	3	0.11	0,1	2	0.40
Northern Flicker	<i>Colaptes auratus</i>	3	0.11	2,0	2	0.40
Rock Wren	<i>Salpinctes obsoletus</i>	3	0.11	0,1	2	0.40
Short-eared Owl	<i>Asio flammeus</i>	3	0.11	1,2	3	0.61
Western Kingbird	<i>Tyrannus verticalis</i>	3	0.11	1,2	3	0.61
Bullock's Oriole	<i>Icterus bullockii</i>	2	0.07	1,1	2	0.40
Canada Goose	<i>Branta canadensis</i>	2	0.07	0,1	1	0.20

Common Name	Scientific Name	n	%	Routes ¹	Stops ²	% ³
Cinnamon Teal	<i>Spatula cyanoptera</i>	2	0.07	0,1	1	0.20
Great-horned Owl	<i>Bubo virginianus</i>	2	0.07	0,1	2	0.40
Spotted Sandpiper	<i>Actitis macularius</i>	2	0.07	0,1	1	0.20
Wilson's Phalarope	<i>Phalaropus tricolor</i>	2	0.07	0,1	1	0.20
American Wigeon	<i>Mareca americana</i>	1	0.04	0,1	1	0.20
Blue-gray Gnatcatcher	<i>Poliophtila caerulea</i>	1	0.04	1,0	1	0.20
Common Poorwill	<i>Phalaenoptilus nuttallii</i>	1	0.04	0,1	1	0.20
Eastern Kingbird	<i>Tyrannus tyrannus</i>	1	0.04	1,0	1	0.20
Green-tailed Towhee	<i>Pipilo chlorurus</i>	1	0.04	1,0	1	0.20
Lark Sparrow	<i>Chondestes grammacus</i>	1	0.04	1,0	1	0.20
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	1	0.04	0,1	1	0.20

1. The first value represents the number of remote routes at which a species was recorded, and the second value represents the number of facility routes at which a species was recorded.

2. Number of stops at which a species was documented.

3. Percent of stops (from a total of 495) at which a species was recorded.

Table 2. Summary numbers for each breeding bird route that was surveyed in 2018 on the Idaho National Laboratory Site.

Route	Stops	# Species	Abundance
Remote Routes			
Lost River	50	13	282
Circular Butte	50	13	304
Kyle Canyon	50	19	221
Tractor Flats	50	23	530
Twin Buttes	50	21	222
Subtotal	250	36*	1,559
Facility Routes			
CFA	42	23	210
INTEC	25	11	72
MFC	18	17	118
NRF	20	13	107
PBF (CITRC)	28	14	166
ATR-C	32	10	186
RWMC	20	22	178
TAN	60	14	244
Subtotal	245	40*	1,281
Total	495	53	2,840

* Total number of unique species.

The Tractor Flats Route had the highest bird abundance of any route (Table 2), and consistently has had the highest abundance among remote routes since 1999, excluding 2010. Mean bird abundance on this route since 1985 was 705 individuals, which is higher than other remote routes. The bird abundance for 2018 on the Tractor Flats Route was 25% lower than the mean bird abundance since 1985. Tractor Flats Route had the highest species richness of the remote routes. The CFA Route and Tractor Flats Route had highest species richness of all routes. The

TAN Route has had the highest mean abundance at a facility since 1985 with 454 birds and CFA had the highest mean richness at a facility route since 1985 with 21 species.

Species Assemblage Summary

Assemblages of bird species in particular habitats, within a region, provide useful insight about general ecological health of such habitats. For example, if a study area contains large shrubland and grassland habitat patches and the corresponding observations of associated bird assemblage for that habitat is low, it may indicate that the local population is experiencing a decline.

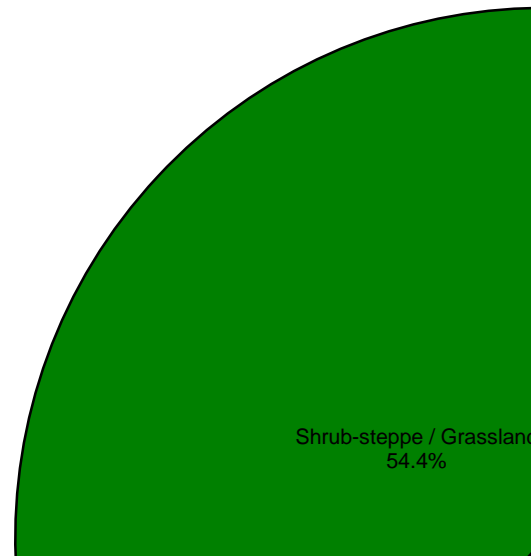


Figure 3. Summary of species assemblage for Breeding Bird Surveys of remote and facility routes on the Idaho National Laboratory Site in 2018.

Each species of bird detected on the INL Site has been assigned to one of seven (7) species assemblage: Shrub-Steppe/Grassland; Sagebrush Obligate; Raptor, Corvid and Shrike; Shorebird; Urban and Exotic; Waterfowl; and Other. The most abundant species assemblage in 2018 was the Shrub-Steppe/Grassland, representing 54.4% of all BBS observations (Figure 3). This assemblage normally has the highest abundance because the majority of the INL Site consists of shrub-steppe and grassland habitats. The second most abundant species assemblage was the Sagebrush Obligate category representing 26.8% of all observations (Figure 3). The third most abundant species assemblage was the Raptors, Corvids, and Shrikes representing 9.9% of all observations.

Shrub-steppe/Grassland

Shrub-steppe/Grassland refers to the dominant plant types in the habitat: shrubs and grasses. Species representing the Shrub-Steppe/Grassland assemblage have always been observed in greatest numbers in past BBSs, and they again dominated observations in 2018 ($n = 1,544$, Figure 3). Common shrub-steppe/grassland species include horned lark, western meadowlark, brown-headed cowbird (*Molothrus ater*), and vesper sparrow (*Pooecetes gramineus*). Horned lark ($n=873$) and western meadowlark ($n=481$) were the most abundant species in this assemblage and were the top two most abundant species for the entire survey (Table 2). Mean bird abundance the Shrub-steppe/Grassland assemblage since 1985 is 2498.

Sagebrush Obligate

The Sagebrush Obligate assemblage had the second highest species abundance with 761 individuals (26.8% of total). This assemblage includes Brewer's sparrow, sagebrush sparrow, sage thrasher, and greater sage-grouse. Sage thrasher was the most abundant sagebrush obligate ($n=376$), followed by sagebrush sparrow ($n=201$) and Brewer's sparrow ($n=184$). Since 1985, sage thrasher counts have fluctuated, but appear to be stable. Sagebrush and Brewer's sparrows, however, are at historically low levels (Figure 4). For the past eight years (since 2011), sagebrush sparrow observations ranged from 161–237, all of which were lower than the previous low count of 241 individuals recorded in 1987. Brewer's sparrow observations in 2018 were 37% lower than in 2017.

In many western states, Sagebrush Obligates are facing significant habitat loss; consequently, many populations are in decline (Knick 1999; Knick et al. 2003). On the INL Site, three large fires in 2010 and 2011 burned 29,944 ha (73,993 acres) of sagebrush-dominated communities, representing over 20% of big sagebrush communities (DOE-ID and USFWS 2014). Sharp declines in the number of observations of Brewer's and sagebrush sparrows correspond with these fires. It is unclear, however, why sage thrasher abundance has apparently not been affected. Across its range in Idaho, sage thrasher populations have declined by 1.6 percent per year (95 percent C.I. is 3.25-0.51 percent) between 1966 and 2013 (Sauer et al. 2014). The sharp reduction in sagebrush-dominated lands on the INL Site most likely has affected the total abundance of birds detected during these surveys. Breeding bird surveys in the western U.S. indicate that populations of horned larks, western meadowlarks, Brewer's sparrows, and sagebrush sparrows have all declined across their range (Knick et al. 2003; Sauer and Link 2011). Mean bird abundance in this assemblage since 1985 is 1524.

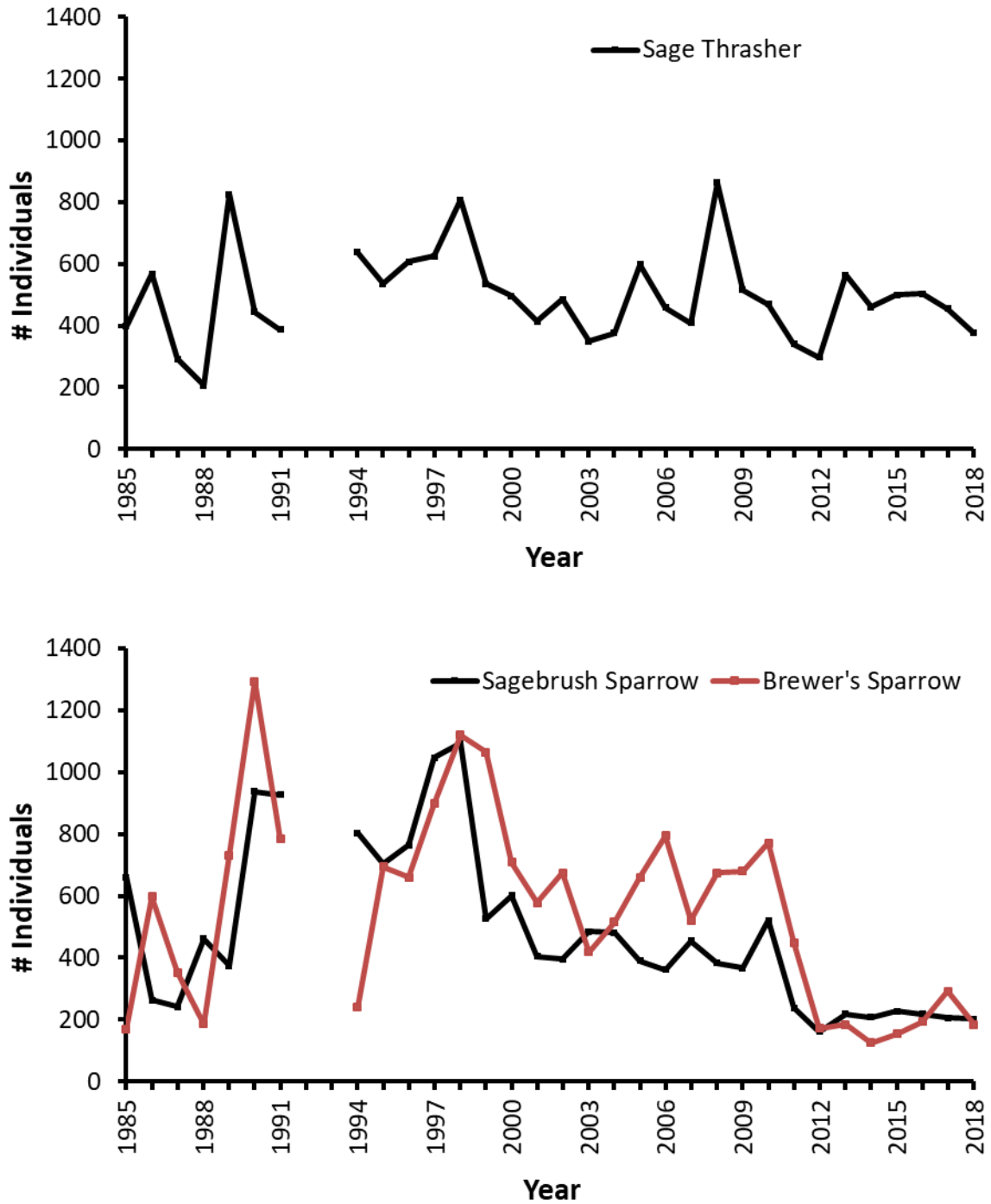


Figure 4. Trends of three sagebrush obligates recorded during Breeding Bird Surveys since 1985. Surveys were not conducted in 1992 and 1993.

Raptor, Corvid, and Shrike

The Raptor, Corvid, and Shrike assemblage consisted of 282 observations representing 9.9% of the total count. Among these were 9 species of raptors (i.e., eagles, hawks, falcons, and owls). Red-tailed hawk (*Buteo jamaicensis*, n=24) and Swainson’s hawk (*Buteo swainsoni*, n=16) were

the most abundant raptors observed. We observed 23 loggerhead shrikes (*Lanius ludovicianus*) in 2018, which was lower than the mean of 29 loggerhead shrikes per year (1985–2017).

The corvid family includes ravens (*Corvus* spp.), crows (*C. spp.*), and magpies (*Pica* spp.). The common raven (*C. corax*) was the most abundant species within this assemblage in 2018 ($n=167$). The number of birds detected in this assemblage is higher than the Mean bird abundance in the Raptor, Corvid, and Shrike assemblage since 1985 is 177.

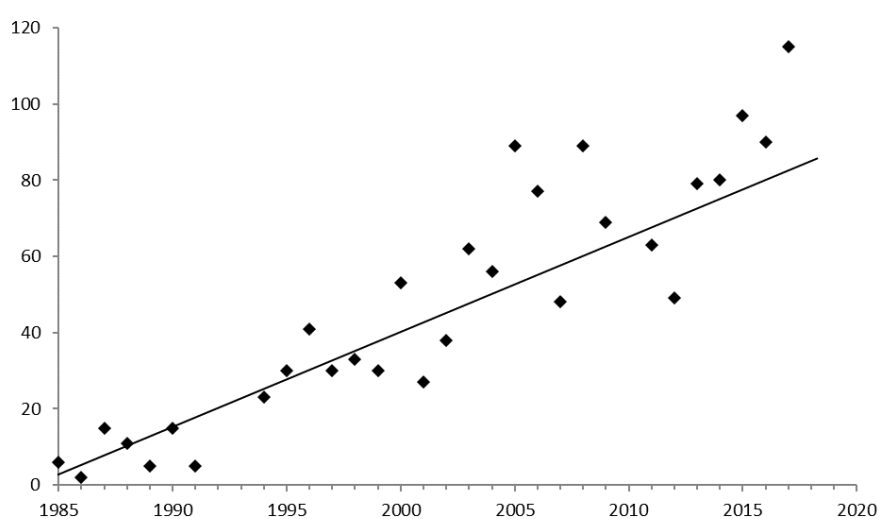


Figure 5. Common raven observations during breeding bird surveys on the INL Site 1985-2018. No surveys were conducted in 1992 and 1993, and the data point in 2010 was removed because it represented an outlier ($n=280$) caused by a single large flock flying overhead during one survey.

Shorebird

We observed 92 individuals representing five species from the Shorebird assemblage, which accounted for 3.2% of the total BBS observations (Figure 3). Because standing water is rare on the INL Site, typically most observations of shorebirds occur in proximity to waste ponds near facility routes. In 2018, Franklin's gull observations ($n=50$) comprised 54% of all shorebird observations. Other shorebirds seen included, willet (*Tringa semipalmatus*, $n=22$), killdeer (*Charadrius vociferous*, $n=6$), American avocet (*Recurvirostra americana*, $n=5$), long-billed curlew (*Numenius americanus*, $n=5$), spotted sandpiper (*Actitis macularius*, $n=2$) and Wilson's phalarope (*Phalaropus tricolor*, $n=2$). Mean Shorebird abundance since 1985 is 243.

Urban and Exotic

The Urban and Exotic assemblage represents birds associated with urban or human-altered environments, which are most commonly found around INL Site facilities. Examples of these species include barn swallow (*Hirundo rustica*), European starling (*Sturnus vulgaris*), Say's phoebe (*Sayornis saya*), and American robin (*Turdus migratorius*). This assemblage constituted 4.4% ($n=125$) of the total observations in 2018. The barn swallow was the most abundant species observed in this assemblage ($n=49$), followed by European starling ($n=39$). Mean Urban and Exotic bird abundance since 1985 is 145.

Waterfowl

Waterfowl are commonly observed during the BBS even though little standing water exists on the INL Site. Apart from the ephemeral Big Lost River and the Big Lost River Sinks wetland, the only standing water bodies on the INL Site during these surveys are wastewater treatment ponds near facilities. These man-made ponds serve as stopover locations for migrating birds and provides nesting opportunity for some Waterfowl species.

We documented 26 individuals from five waterfowl species, mallard (*Anas platyrhynchos*, $n=17$), lesser scaup (*Aythya affinis*, $n=4$), Canada goose (*Branta canadensis*, $n=2$), cinnamon teal (*Anas cyanoptera*, $n=2$), and American wigeon (*Anas americana*, $n=1$) representing 0.9% of total observations.

Other Birds

Two species that were not assigned to any species assemblage were observed in 2018. They were the bank swallow (*Riparia riparia*, $n=8$) and Bullock's oriole (*Icterus bullockii*, $n=2$).

Community Diversity Index

The CFA Route had the most diverse bird community of all 13 routes ($H=2.64$, $E_H=0.84$; Table 3), followed by the RWMC Route ($H=2.51$, $E_H=0.71$). CFA had the highest species richness ($n=23$). Among remote routes, Tractor Flats ($H=2.29$; $E_H=0.73$) had the most diverse bird community, while Lost River was the least diverse based on richness ($n=13$) and on H ($H=1.52$). The INTEC Route was the least diverse of all routes ($H=1.34$; $E_H=0.81$).

Table 3. Values for species richness, Shannon Diversity (H), and Equitability (E_H) indices for the 2018 Idaho National Laboratory Site Breeding Bird Surveys.

Route	Species Richness	Shannon's H	Shannon's E_H
Remote Routes			
Tractor Flats	23	2.29	0.73
Kyle Canyon	19	2.16	0.73
Circular Butte	13	1.78	0.69
Twin Buttes	21	2.06	0.68
Lost River	13	1.52	0.59
Facility Routes			
CFA	23	2.64	0.84
MFC	17	2.36	0.83
INTEC	11	1.34	0.81
RWMC	22	2.51	0.81
NRF	13	1.93	0.75
PBF (CITRC)	14	1.93	0.73
TAN	14	1.81	0.69
ATR-C	10	1.55	0.67

The CFA route has been among the top three regarding diversity nine of the past ten years. RWMC has been among the three most diverse routes during nine of the past 12 years. During the same time, Tractor Flats has been among the top three for species richness. This information

indicates that the area surrounding CFA and RWMC (building, trees, and waste-water ponds) may provide unique habitat for several species of birds. Additionally, the northern stops on the Tractor Flats Route occur in the agricultural areas near State Highway 33, which likely influences the total number of unique birds that are detected in that area.

2.0 SUMMARY AND CONCLUSIONS

Two sagebrush-obligate species continue to be counted at historically low levels on INL Site routes, which is probably a consequence of losing large amounts of sagebrush-dominated communities during recent wildfires. Conversely, common raven observations continue to increase. The combination of loss of sagebrush-dominated communities and increased predators that raid nests of sagebrush obligates may affect the growth potential of some species, especially sage-grouse, which is a conservation concern for DOE.

3.0 ACKNOWLEDGEMENTS

We would like to thank Robert Starck for assistance with data collection.

4.0 LITERATURE CITED

Department of Energy, Idaho Operations Office (DOE), and U.S. Fish and Wildlife Service (USFWS), 2014, *Candidate conservation agreement for greater sage-grouse (Centrocercus urophasianus) on the Idaho National Laboratory Site*, DOE/ID-11514, U.S. Department of Energy Idaho Operations Office, Idaho Falls, Idaho.

Idaho Department of Fish and Game, 2005, Idaho Comprehensive Wildlife Conservation Strategy. Idaho Conservation Data Center, Idaho Department of Fish and Game, Boise, ID. <http://fishandgame.idaho.gov/cms/tech/CDC/cwcs.cfm>

Idaho Department of Fish and Game, 2016, Idaho fish and wildlife information system, Idaho Conservation Data Center, Idaho Department of Fish and Game, Boise, ID. <https://fishandgame.idaho.gov/ifwis/portal/page/species-status-lists>

Knick, S. T., 1999, Requiem for a sagebrush ecosystem, *Northwest Science* 73: 53-57.

Knick, S. T., D. S. Dobkin, J. T. Rotenberry, M. A. Schroeder, W. Matthew, V. Haegen, and C. Van Riper III, 2003, Teetering on the edge of too late? Conservation and research issues for avifauna of sagebrush habitats, *Condor* 105: 611-634.

Sauer, J. R. and W. A. Link, 2011, Analysis of the North American Breeding Bird Survey using hierarchical models, *Auk* 128: 87-98.

Sauer, J. R., J. E. Hines, J. E. Fallon, K. L. Pardieck, D. J. Ziolkowski, Jr., and W. A. Link. 2014. *The North American Breeding Bird Survey, Results and Analysis 1966-2013*. Version 01.30.2015 USGS Patuxent Wildlife Research Center, Laurel, MD

Shive, J. P., A. D. Forman, K. Aho, J. R. Hafila, R. D. Blew and K. T. Edwards, 2011, *Vegetation community classification and mapping of the INL Site*, <http://www.gsseser.com>. GSS-ESER-144, Environmental Surveillance, Education and Research Program, Idaho Falls, Idaho, USA.

APPENDIX A

SUMMARY OF SPECIES BY ROUTE 2018

Survey Route: RWMC		
Survey Date: June 4, 2018		
Species	Abundance	Percentage
Western Meadowlark	29	16.29
Barn Swallow	28	15.73
Horned Lark	27	15.17
Sage Thrasher	23	12.92
Brewer's Sparrow	19	10.67
Sagebrush Sparrow	9	5.06
Common Raven	6	3.37
Mourning Dove	5	2.81
European Starling	4	2.25
Lesser Scaup	4	2.25
Bank Swallow	3	1.69
Brewer's Blackbird	3	1.69
Rock Wren	3	1.69
Loggerhead Shrike	2	1.12
Canada Goose	2	1.12
Cinnamon Teal	2	1.12
Say's Phoebe	2	1.12
Spotted Sandpiper	2	1.12
Wilson's Phalarope	2	1.12
American Wigeon	1	0.56
Red-winged Blackbird	1	0.56
Western Kingbird	1	0.56
Total Individuals 178		
Total Species 22		

Survey Route: Lost River		
Survey Date: June 5, 2018		
Species	Abundance	Percentage
Horned Lark	125	44.33
Western Meadowlark	86	30.50
Sage Thrasher	23	8.16
Brewer's Sparrow	22	7.80
Sagebrush Sparrow	9	3.19
American Robin	3	1.06
Common Raven	3	1.06
Mourning Dove	3	1.06
Vesper Sparrow	3	1.06
Brewer's Blackbird	2	0.71
Ferruginous Hawk	1	0.35
Red-tailed Hawk	1	0.35
Swainson's Hawk	1	0.35
Total Individuals 282		
Total Species 13		

Survey Route: Tractor Flats		
Survey Date: June 7, 2018		
Species	Abundance	Percentage
Horned Lark	122	23.02
Common Raven	101	19.06
Western Meadowlark	88	16.60
Franklin's Gull	50	9.43
Sage Thrasher	34	6.42
Brewer's Sparrow	27	5.09
Sagebrush Sparrow	27	5.09
Willet	21	3.96
Mourning Dove	18	3.40
Northern Harrier	7	1.32
Black-billed Magpie	6	1.13
Long-billed Curlew	5	0.94
Swainson's Hawk	5	0.94
House Sparrow	4	0.75
American Crow	3	0.57
Common Nighthawk	2	0.38
Grasshopper Sparrow	2	0.38
Red-tailed Hawk	2	0.38
Short-eared Owl	2	0.38
Barn Swallow	1	0.19
Brown-headed Cowbird	1	0.19
Burrowing Owl	1	0.19
Loggerhead Shrike	1	0.19
Total Individuals 530		
Total Species 23		

Survey Route: INTEC		
Survey Date: June 11, 2018		
Species	Abundance	Percentage
Horned Lark	20	27.78
Sage Thrasher	18	25.00
Western Meadowlark	9	12.50
Brewer's Sparrow	7	9.72
Sagebrush Sparrow	7	9.72
Brewer's Blackbird	5	6.94
Common Raven	2	2.78
Barn Swallow	1	1.39
Common Nighthawk	1	1.39
Mourning Dove	1	1.39
Red-tailed Hawk	1	1.39
Total Individuals		
	72	
Total Species		
	11	

Survey Route: MFC		
Survey Date: June 12, 2018		
Species	Abundance	Percentage
Western Meadowlark	26	22.03
Horned Lark	23	19.49
Mallard	17	14.41
Brewer's Sparrow	9	7.63
Common Raven	9	7.63
American Avocet	5	4.24
Brewer's Blackbird	5	4.24
Sage Thrasher	5	4.24
Bank Swallow	4	3.39
Killdeer	3	2.54
Red-tailed Hawk	3	2.54
Burrowing Owl	2	1.69
European Starling	2	1.69
Mourning Dove	2	1.69
Barn Swallow	1	0.85
Loggerhead Shrike	1	0.85
Say's Phoebe	1	0.85
Total Individuals		
	118	
Total Species		
	17	

Survey Route: Kyle Canyon		
Survey Date: June 14, 2018		
Species	Abundance	Percentage
Western Meadowlark	45	20.36
Sage Thrasher	40	18.10
Horned Lark	39	17.65
Sagebrush Sparrow	37	16.74
Brewer's Sparrow	22	9.95
Mourning Dove	12	5.43
Ferruginous Hawk	4	1.81
Vesper Sparrow	4	1.81
Black-billed Magpie	3	1.36
Common Raven	3	1.36
Common Nighthawk	2	0.90
Loggerhead Shrike	2	0.90
Prairie Falcon	2	0.90
Blue-gray Gnatcatcher	1	0.45
Green-tailed Towhee	1	0.45
Killdeer	1	0.45
Northern Flicker	1	0.45
Red-tailed Hawk	1	0.45
Western Kingbird	1	0.45
Total Individuals		
	221	
Total Species		
	19	

Survey Route: NRF		
Survey Date: June 18, 2018		
Species	Abundance	Percentage
Horned Lark	36	33.64
Sage Thrasher	24	22.43
Western Meadowlark	14	13.08
Brewer's Sparrow	9	8.41
Sagebrush Sparrow	9	8.41
Common Raven	5	4.67
Barn Swallow	2	1.87
European Starling	2	1.87
Mourning Dove	2	1.87
American Kestrel	1	0.93
Common Nighthawk	1	0.93
Red-tailed Hawk	1	0.93
Say's Phoebe	1	0.93
Total Individuals 107		
Total Species 13		

Survey Route: ATR-C		
Survey Date: June 19, 2018		
Species	Abundance	Percentage
Horned Lark	85	45.70
Western Meadowlark	43	23.12
Brewer's Sparrow	13	6.99
Sage Thrasher	27	14.52
Barn Swallow	6	3.23
Common Raven	3	1.61
Sagebrush Sparrow	3	1.61
Mourning Dove	3	1.61
Red-tailed Hawk	2	1.08
Say's Phoebe	1	0.54
Total Individuals		
	186	
Total Species		
	10	

Survey Route: Circular Butte		
Survey Date: June 21, 2018		
Species	Abundance	Percentage
Horned Lark	134	44.08
Western Meadowlark	48	15.79
Sage Thrasher	46	15.13
Sagebrush Sparrow	17	5.59
Brewer's Sparrow	16	5.26
Common Raven	13	4.28
Mourning Dove	12	3.95
Common Nighthawk	6	1.97
Grasshopper Sparrow	5	1.64
Brown-headed Cowbird	3	0.99
Red-tailed Hawk	2	0.66
Northern Harrier	1	0.33
Vesper Sparrow	1	0.33
Total Individuals 304		
Total Species 13		

Survey Route: CFA		
Survey Date: June 25, 2018		
Species	Abundance	Percentage
Horned Lark	34	16.19
Sage Thrasher	33	15.71
European Starling	31	14.76
Western Meadowlark	18	8.57
Sagebrush Sparrow	13	6.19
American Robin	11	5.24
Brewer's Blackbird	9	4.29
Common Nighthawk	8	3.81
House Sparrow	8	3.81
Brewer's Sparrow	7	3.33
Red-tailed Hawk	7	3.33
American Kestrel	5	2.38
Barn Swallow	5	2.38
Common Raven	5	2.38
House Finch	3	1.43
Say's Phoebe	3	1.43
Killdeer	2	0.95
Loggerhead Shrike	2	0.95
Swainson's Hawk	2	0.95
Bank Swallow	1	0.48
Bullock's Oriole	1	0.48
Mourning Dove	1	0.48
Western Kingbird	1	0.48
Total Individuals 210		
Total Species 23		

Survey Route: Twin Buttes		
Survey Date: June 26, 2018		
Species	Abundance	Percentage
Horned Lark	82	36.94
Western Meadowlark	53	23.87
Sage Thrasher	19	8.56
Sagebrush Sparrow	12	5.41
Vesper Sparrow	10	4.50
Common Raven	7	3.15
Swainson's Hawk	7	3.15
Common Nighthawk	6	2.70
Black-billed Magpie	4	1.80
Brewer's Sparrow	4	1.80
Loggerhead Shrike	4	1.80
Red-tailed Hawk	3	1.35
Northern Flicker	2	0.90
Prairie Falcon	2	0.90
Bullock's Oriole	1	0.45
Eastern Kingbird	1	0.45
Ferruginous Hawk	1	0.45
Lark Sparrow	1	0.45
Northern Harrier	1	0.45
Short-eared Owl	1	0.45
Willet	1	0.45
Total Individuals 222		
Total Species 21		

Survey Route: TAN		
Survey Date: June 28, 2018		
Species	Abundance	Percentage
Horned Lark	79	32.38
Sage Thrasher	68	27.87
Sagebrush Sparrow	40	16.39
Mourning Dove	18	7.38
Brewer's Sparrow	13	5.33
Vesper Sparrow	8	3.28
Barn Swallow	5	2.05
Loggerhead Shrike	4	1.64
Common Raven	3	1.23
Western Meadowlark	2	0.82
Brewer's Blackbird	1	0.41
Brown-headed Cowbird	1	0.41
Northern Harrier	1	0.41
Red-tailed Hawk	1	0.41
Total Individuals		
	244	
Total Species		
	14	

Survey Route: PBF (CITRC)		
Survey Date: July 2, 2018		
Species	Abundance	Percentage
Horned Lark	67	27.46
Western Meadowlark	20	8.20
Sagebrush Sparrow	18	7.38
Sage Thrasher	16	6.56
Brewer's Sparrow	16	6.56
Mourning Dove	8	3.28
Common Raven	7	2.87
Loggerhead Shrike	7	2.87
Great Horned Owl	2	0.82
Brown-headed Cowbird	1	0.41
Common Poorwill	1	0.41
Ferruginous Hawk	1	0.41
Northern Harrier	1	0.41
Swainson's Hawk	1	0.41
Total Individuals		
	166	
Total Species		
	14	