2017 Breeding Bird Surveys on the Idaho National Laboratory Site

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EXECUTIVE SUMMARY

Breeding bird surveys (BBSs) have been conducted almost every year since 1985 to monitor bird populations on the Idaho National Laboratory (INL) Site. In 2017, we conducted surveys in June along five routes that are part of a nationwide survey administered by the U.S. Geological Survey (USGS) and eight routes near INL Site facilities. We documented 3,314 birds from 50 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*=936), western meadowlark (*Sturnella neglecta*, *n*=660), sage thrasher (*Oreoscoptes montanus*, *n*=455), Brewer's sparrow (*Spizella breweri*, *n*=292), and sagebrush sparrow (*Artemisiospiza nevadensis*, *n*=205). In addition, we observed a large number of Franklin's gulls (*Larus pipixcan*, *n*=213). With the exception of the Franklin's gull, the five species listed above have been the five most abundant 23 times during the past 31 years of surveys, and in the other years they were among the seven most abundant species.

Investigators observed three species that were previously not recorded during the INL surveys: one Dark-eyed Junco (unidentified race) (*Junco hyemalis*), one long-eared owl (*Asio otus*), and two western bluebirds (*Sialia mexicana*). One species was observed during the surveys that had been recorded in two of the past 31 years. This species was the Eurasian collared-dove (*Streptopelia decaocto*, *n*=1), it was also observed in 2016 and is considered an invasive species.

Species observed during the 2017 BBS that are considered by the Idaho Department of Fish and Game as Species of Greatest Conservation Need included the sage thrasher (*Oreoscoptes montanus*, *n*=455), sagebrush sparrow (*Artemisiospiza nevadensis*, *n*=205), Franklin's gull (*Larus pipixcan*, *n*=213), common nighthawk (*Chordeiles minor*, *n*=23), ferruginous hawk (*Buteo regalis*, *n*=16), grasshopper sparrow (*Ammodramus savannarum*, *n*=6), burrowing owl (*Athene cunicularia*, *n*=4), and long-billed curlew (*Numenius americanus*, *n*=1).

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

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ACRONYMS

ATRC	Advanced Test Reactor Complex
BBS	Breeding Bird Survey
CFA	Central Facilities Area
INL	Idaho National Laboratory
INTEC	Idaho Nuclear Technology and Engineering Center
MFC	Materials and Fuels Complex
NRF	Naval Reactor 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 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). The U.S. Department of Energy, Idaho Operations Office (DOE) also established and annually surveys eight additional routes around INL Site facilities to monitor birds near the highest human activity centers (i.e. facility routes)(Fig. 1). The DOE supports BBS efforts in part because the agency aims to contribute to the international effort to track bird population trends. In addition, 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. Currently, DOE is interested in tracking abundance trends of songbirds that are sagebrush specialists because this bird assemblage uses the same habitat as greater sage-grouse, a bird that DOE is invested in conserving (DOE and USFWS 2014). Similarly, common raven abundance trends may indicate nest depredation risk for sage-grouse. This report summarizes results from the 2017 BBS and examines long-term trends.

1.1 STUDY AREA

The INL Site encompasses almost 900 mi^2 (2,330 km^2) on the Upper Snake River Plain in southeast Idaho (Fig. 1) and is administered by the U. S. Department of Energy. 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 2013). The INL Site has also been recognized as a Global Important Bird Area by the National Audubon Society.

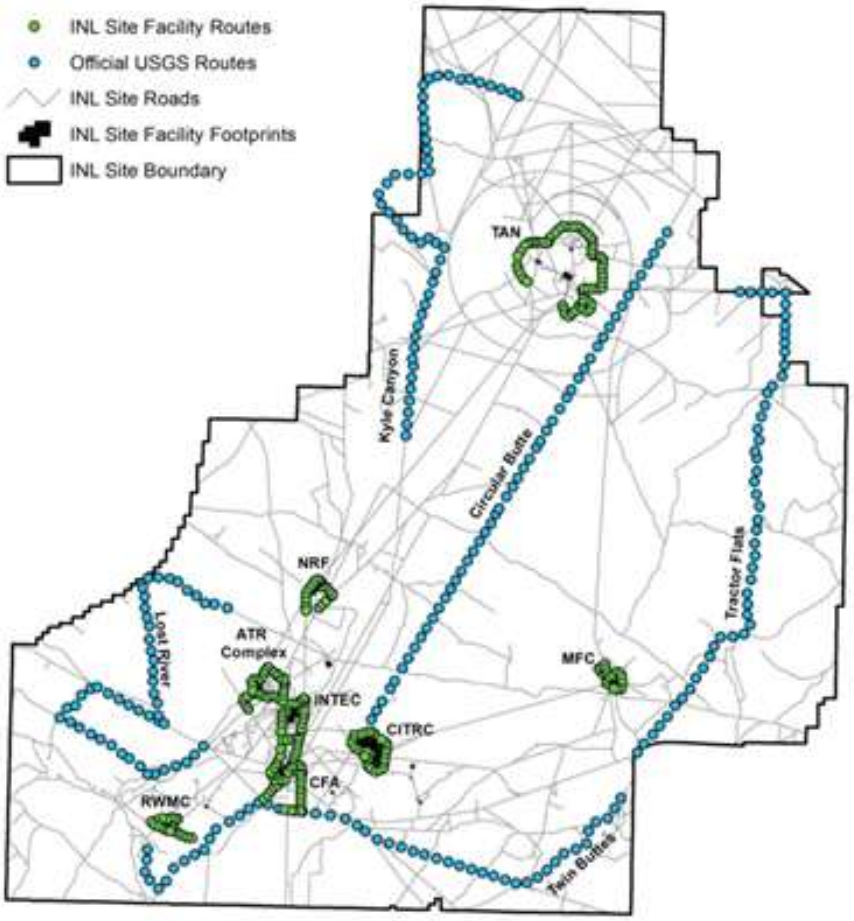

Figure 1. Breeding Bird Survey routes on the Idaho National Laboratory Site. Blue dots represent survey points along facility routes and red dots represent the same for remote routes.

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 is located in a semi-arid desert 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).

Little surface water exists during spring and summer on the INL Site. 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 aquatic habitat for migrating 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 1 to June 27, 2017, consisting of five official USGS BBS routes and eight facility routes developed specifically for the INL Site (Fig. 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 observed 3,314 birds and 50 species during the 2017 surveys (Appendix A). Total observations were 30% lower than the 29-year mean of 4,754 birds (1985-2016, 1992 and 1993 excluded; Fig. 2), and we recorded fewer species (mean=56 species).

The six most abundant birds across all routes were horned lark (*Eremophila alpestris*, *n*=936), western meadowlark (*Sturnella neglecta*, *n*=660), sage thrasher (*Oreoscoptes montanus*, *n*=455), Brewer's sparrow (*Spizella breweri*, *n*=292), Franklin's gulls (*Larus pipixcan*, *n* = 213), and sagebrush sparrow (*Artemisiospiza nevadensis*, *n* = 205). These six species comprised >83% of all observations, and with the exception of Franklin's gull, each was observed on every remote route (Table 2, Appendix A). Horned lark, western meadowlark, sage thrasher, sagebrush sparrow, and Brewer's sparrow have been the five most abundant species in 23 of the 31 years of INL Site BBS (in the other years they were among the seven most abundant species).

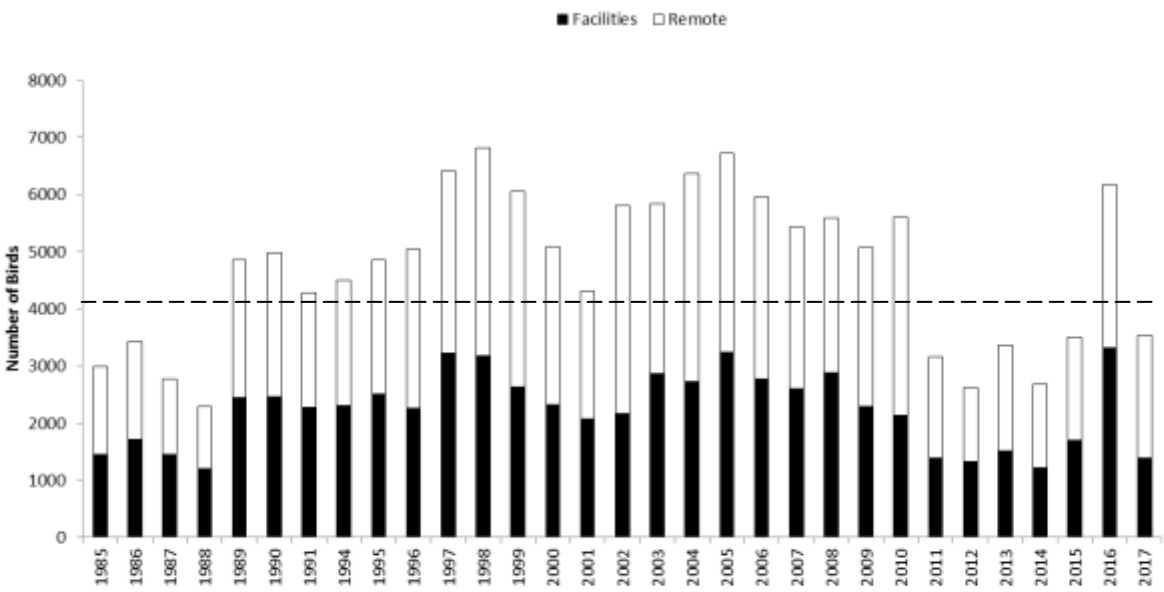

Figure 2. Number of birds observed during Breeding Bird Surveys on the Idaho National Laboratory Site. The dashed black line indicates the mean number of birds observed from 1985 to 2016. No BBSs were conducted on the INL Site in 1992 or 1993.

The horned lark was the most evenly distributed species, observed at 67.5% (334) of the total stops made during the survey (Table 2). The horned lark is traditionally the most abundant species recorded during BBSs on the INL Site and, with the exception of 2013 and 2016, has been the most abundant species annually since 1998.

The Tractor Flats Route had the highest bird abundance of any route (Table 1), and consistently has had the highest abundance among remote routes since 1999, excluding 2010. Mean bird abundance on this route since 1985 was 710 individuals, which is higher than other remote routes. The bird abundance for 2017 on the Tractor Flats Route was 17% lower than the mean bird abundance since 1985. Twin Buttes Route had the highest species richness of the remote routes. The CFA Route had highest species richness of all routes. The TAN Route has had the highest mean abundance at a facility since 1985 with 461 birds and CFA had the highest mean richness at a facility route since 1985 with 21 species.

Table 1. Summary numbers for each breeding bird route that was surveyed in 2017 on the Idaho National Laboratory Site.

Route	Stops	# Species	Abundance
Remote Routes			
Lost River	50	12	414
Circular Butte	50	14	394
Kyle Canyon	50	17	231
Tractor Flats	50	21	589
Twin Buttes	50	22	288
Subtotal	**250**	**32***	**1,916**
Facility Routes			
CFA	42	23	224
INTEC	25	9	170
MFC	18	16	173
NRF	20	11	111
PBF	28	14	154
ATRC	32	15	225
RWMC	20	20	180
TAN	60	13	161
Subtotal	**245**	**37***	**1,398**
Total	**495**	**50**	**3,314**

*Total number of unique species.

Species Assemblage Summary

The most abundant species assemblage in 2017 was the shrub-steppe/grassland, representing 53.6% of all BBS observations (Fig. 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 28.7% of all observations (Fig. 3). The third most abundant species assemblage was the shorebirds representing 7.3% of all observations. As indicated earlier in this report, recent fires on the INL Site have reduced the amount of sagebrush habitat. Such reduction in sagebrush most likely has affected the abundance of sagebrush-obligate species. Further analyses needs to be conducted to verify this relationship.

Table 2. Summary of species from 13 routes, sorted by abundance, that were observed during the 2017 Breeding Bird Survey on the Idaho National Laboratory Site.

Common Name	Scientific Name	n	%	Routes[1]	Stops[2]	%[3]
Horned Lark	*Eremophila alpestris*	936	28.24	5,8	334	67.47
Western Meadowlark	*Sturnella neglecta*	660	19.92	5,7	301	60.81
Sage Thrasher	*Oreoscoptes montanus*	455	13.73	5,8	290	58.59
Brewer's Sparrow	*Spizella breweri*	292	8.81	5,8	166	33.54
Franklin's Gull	*Larus pipixcan*	213	6.43	3,0	15	3.03
Sage Sparrow	*Amphispiza belli*	205	6.19	5,8	122	24.65
Common Raven	*Corvus corax*	115	3.47	5,8	83	16.77
Mourning Dove	*Zenaida macroura*	76	2.29	5,6	49	9.90

Common Name	Scientific Name	n	%	Routes[1]	Stops[2]	%[3]
Barn Swallow	*Hirundo rustica*	62	1.87	1,7	21	4.24
Vesper Sparrow	*Pooecetes gramineus*	31	0.94	4,3	22	4.44
Bank Swallow	*Riparia riparia*	29	0.88	0,4	8	1.62
Red-tailed Hawk	*Buteo jamaicensis*	29	0.88	5,3	25	5.05
Common Nighthawk	*Chordeiles minor*	23	0.69	4,4	20	4.04
Killdeer	*Charadrius vociferus*	21	0.63	0,5	8	1.62
European Starling	*Sturnus vulgaris*	20	0.60	1,2	11	2.22
Ferruginous Hawk	*Buteo regalis*	16	0.48	3,2	13	2.63
Brewer's Blackbird	*Euphagus cyanocelphalus*	15	0.45	0,5	10	2.02
Say's Phoebe	*Sayornis saya*	12	0.36	0,5	11	2.22
Black-billed Magpie	*Pica pica*	11	0.33	3,0	5	1.01
Western Kingbird	*Tyrannus verticalis*	9	0.27	2,2	6	1.21
Loggerhead Shrike	*Lanius ludovicianus*	8	0.24	2,2	8	1.62
Swainson's Hawk	*Buteo swainsoni*	8	0.24	4,1	8	1.62
American Avocet	*Recurvirostra americana*	6	0.18	0,1	1	0.20
Grasshopper Sparrow	*Ammodramus savannarum*	6	0.18	2,1	4	0.81
House Sparrow	*Passer domesticus*	6	0.18	0,2	2	0.40
Burrowing Owl	*Athene cunicularia*	4	0.12	3,0	3	0.61
Northern Harrier	*Circus cyaneus*	4	0.12	1,2	4	0.81
Red-winged Blackbird	*Agelaius phoeniceus*	4	0.12	0,2	2	0.40
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*	4	0.12	0,2	4	0.81
Brown-headed Cowbird	*Molothrus ater*	3	0.09	0,3	3	0.61
Mallard	*Anas platyrhynchos*	3	0.09	0,1	1	0.20
Rock Wren	*Salpinctes obsoletus*	3	0.09	1,1	3	0.61
American Kestrel	*Falco sparverius*	2	0.06	0,1	1	0.20
American Robin	*Turdus migratorius*	2	0.06	0,1	1	0.20
Northern Flicker	*Colaptes auratus*	2	0.06	2,0	2	0.40
Prairie Falcon	*Falco mexicanus*	2	0.06	2,0	2	0.40
House Finch	*Carpodacus mexicanus*	2	0.06	0,1	1	0.20
House Wren	*Troglodytes aedon*	2	0.06	0,1	2	0.40
Western Bluebird	*Sialia mexicana*	2	0.06	0,1	1	0.20
American Crow	*Corvus brachyrhynchos*	1	0.03	1,0	1	0.20
Chipping Sparrow	*Spizella passerina*	1	0.03	0,1	1	0.20
Dark-eyed Junco	*Junco hyemalis*	1	0.03	1,0	1	0.20
Eurasian Collared-Dove	*Streptopelia decaocto*	1	0.03	1,0	1	0.20
Gadwall	*Anas strepera*	1	0.03	0,1	1	0.20
Great Blue Heron	*Ardea herodias*	1	0.03	0,1	1	0.20
Green-tailed Towhee	*Pipilo chlorurus*	1	0.03	1,0	1	0.20
Long-billed Curlew	*Numenius americanus*	1	0.03	1,0	1	0.20
Long-eared Owl	*Asio otus*	1	0.03	1,0	1	0.20
Northern Mockingbird	*Mimus polyglottos*	1	0.03	1,0	1	0.20
Violet-green Swallow	*Tachycineta thalassina*	1	0.03	1,0	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.

Shrub-steppe/Grassland

Species representing the shrub-steppe/grassland assemblage have always been observed in greatest numbers in past BBSs, and they again dominated observations in 2017 (*n* = 1,776, Fig. 3). Common shrub-steppe/grassland species include horned lark, western meadowlark, brown-headed cowbird (*Molothrus ater*), and vesper sparrow (*Pooecetes gramineus*). Western meadowlark (*n*=660) and horned lark (*n*=936) 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 in this assemblage since 1985 is 2528.

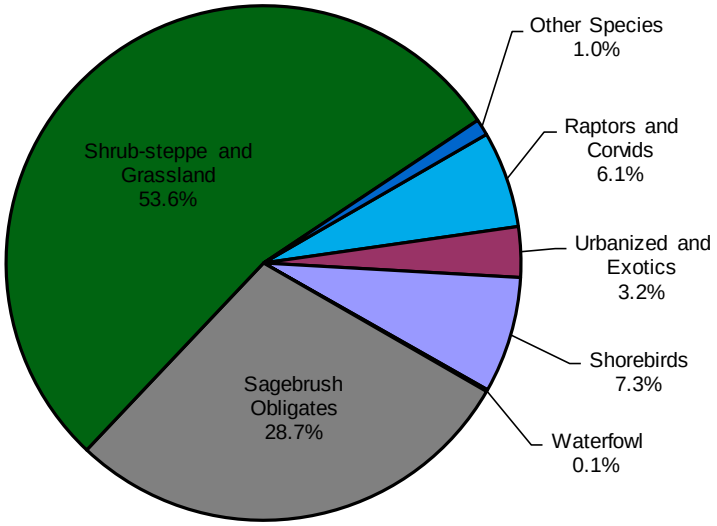

Figure 3. Summary of species assemblage for Breeding Bird Surveys of remote and facility routes on the Idaho National Laboratory Site in 2017.

Sagebrush Obligates

The sagebrush obligate assemblage had the second highest species abundance with 952 individuals (28.7% 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*=455), followed by Brewer's sparrow (*n*=292) and sagebrush sparrow (*n*=205). Since 1985, sage thrasher counts have fluctuated, but appear to be stable. Sagebrush and Brewer's sparrows, however, are at historically low levels (Fig. 4). For the past seven 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 2017 were 51% higher than in 2016, this was the first year since 2012 that it has been above 200 birds.

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 not clear, 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, including sagebrush obligates in this area. 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). As sagebrush obligates are experiencing population declines from habitat loss and disturbance (Knick et al. 2003), it is encouraging to see the relatively high abundance of these species each year on the INL Site. Recent fires on the INL Site, however, have reduced the amount of sagebrush habitat. Such reduction in habitat most likely has affected the total abundance of birds, including sagebrush obligates in this area. Mean bird abundance in this assemblage since 1985 is 1549.

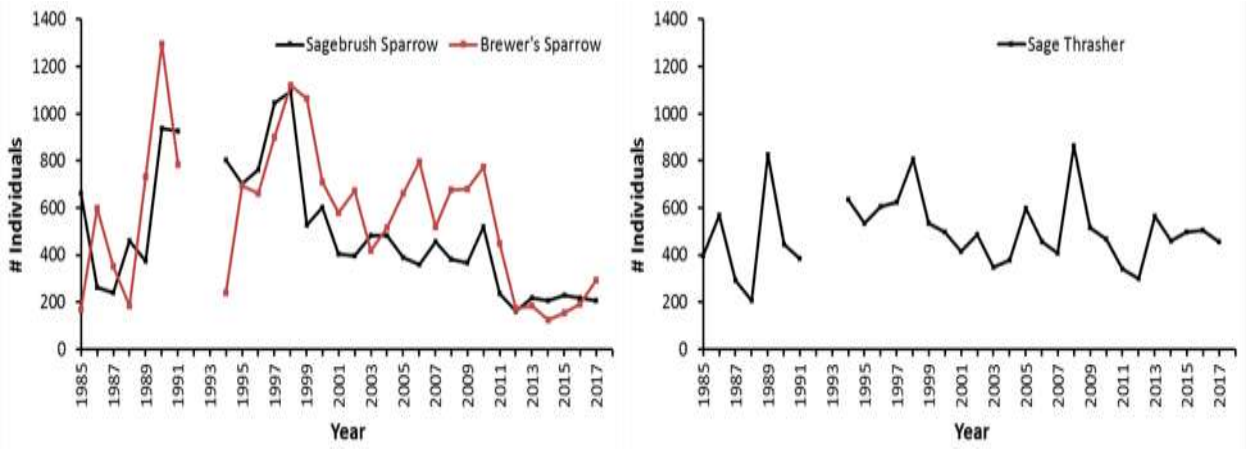

Figure 4. Trends of three sagebrush obligates recorded during Breeding Bird Surveys since 1985. Surveys were not conducted in 1992 and 1993.

Shorebirds

We observed 242 individuals representing five species from the shorebird assemblage, which accounted for 7.3% of the total BBS observations (Fig. 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 2017, Franklin's gull observations (*n*=213) comprised 88% of all shorebird observations. Other shorebirds seen included, killdeer (*Charadrius vociferous, n* = 21), long-billed curlew (*Numenius americanus, n*=1), American Avocet (*Recurvirostra americana, n*=6), and great blue heron (*Ardea herodias, n*=1). Mean bird abundance in this assemblage since 1985 is 248.

Raptors, Corvids, and Shrikes

The raptor and corvid assemblage consisted of 201 observations representing 6.1% of the total count. Among these were 8 species of raptors (i.e. eagles, hawks, falcons, and owls). Red-tailed hawk (*Buteo jamaicensis, n*=29) and Ferruginous hawk (*Buteo regalis, n*=16) were the most abundant raptors observed. We observed only 8 loggerhead shrikes (*Lanius ludovicianus*) in

2017, which was substantially lower than the mean of 30 loggerhead shrikes per year (1985–2016).

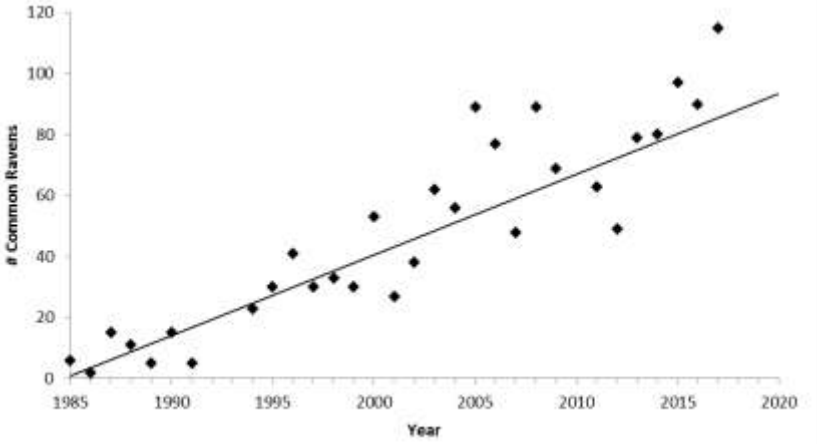

Figure 5. Common raven observations during breeding bird surveys on the INL Site 1985-2017. No surveys were conducted in 1992 and 1993, and the data point in 2010 was removed because it represented an outlier (*n*=280) caused by a single large flock flying overhead during one survey.

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 2017 (*n*=115). The number of common ravens observed in 2017 was higher than any other year except 2010 (Fig. 5) (for clarity of presentation, data from 2010 were excluded as an outlier in the figure because 280 ravens were observed, mostly in a single, large flock). Though native to Idaho, the common raven is an effective nest predator of sage-grouse, and DOE is concerned about the potential impact common ravens may have on nesting sage-grouse (DOE and USFWS 2014). There is some evidence that territory-holding mated pairs may be primarily responsible for sage-grouse nest predation, rather than non-territorial juvenile flocks (Bui et al 2010). It is unclear how many common ravens observed during the breeding bird survey are mated pairs and how many are unmated, but the trend reported here may not be a good indicator of the level of nest predation risk to sage-grouse. Mean bird abundance in this assemblage since 1985 is 173.

Urbanized and Exotics

The urbanized and exotics 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 3.2% (*n*=105) of the total observations in 2017. The barn swallow was the most abundant species observed in this assemblage (*n*=62 individuals), followed by European starling (*n*=20 individuals). Mean bird abundance in this assemblage since 1985 is 146.

Waterfowl

Waterfowl are commonly observed during the BBS even though little standing water exists on the INL Site. With the exception of the ephemeral Big Lost River and the Big Lost River Sinks wetland, the only standing water bodies on the INL Site are wastewater treatment ponds near

facilities. These man-made ponds serve as stopover locations for migrating birds and a number of different species have been observed using these areas since 1985.

We documented 4 individuals from two waterfowl species, mallard (*Anas platyrhynchos, n*=2) and gadwall (*Anas strepera, n*=1) representing 0.1% of total observations.

Other Birds

Five species that were not assigned to any species assemblage were observed in 2017. They were the bank swallow (*Riparia riparia, n*=29) house wren (*Troglodytes aedon, n*=2), dark-eyed junco (*Junco hyemalis, n*=1), northern mockingbird (*Mimus polyglottos, n*=1), and Violet-green swallow (*Tachycineta thalassina, n*=1).

Community Diversity Index

The RWMC Route had the most diverse bird community of all 13 routes (H=2.42, E_H=0.81; Table 3), followed by the CFA Route (H=2.22, E_H = 0.71). CFA had the highest species richness (n=23). Among remote routes, Twin Buttes (H=2.20; E_H=0.71) had the most diverse bird community, while Lost River was the least diverse based on richness (n=12) and on H (H=1.76). The NRF Route was the least diverse of all routes (H=1.69; E_H=0.71).

The CFA route has been among the top three in regard to diversity eight of the past nine years. RWMC has been among the three most diverse routes during eight of the past 11 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.

Table 3. Values for species richness, Shannon Diversity (H), and Equitability (E_H) indices for the 2017 Idaho National Laboratory Site Breeding Bird Surveys.

Route	Species Richness	Shannon's H	Shannon's E_H
Remote Routes			
Twin Buttes	22	2.20	0.71
Tractor Flats	21	2.01	0.66
Kyle Canyon	17	2.03	0.72
Circular Butte	14	1.92	0.73
Lost River	12	1.76	0.71
Facility Routes			
CFA	23	2.22	0.71
RWMC	20	2.42	0.81
MFC	16	2.14	0.77
TAN	15	1.85	0.70
PBF	14	1.83	0.69
ATRC	12	1.77	0.65
NRF	11	1.69	0.71
INTEC	9	2.07	0.78

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

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APPENDIX A

SUMMARY OF SPECIES BY ROUTE
2017

Survey Route: **RWMC**
Survey Date: **May 30, 2017**

Species	Abundance	Percentage
Western Meadowlark	37	20.56
Horned Lark	29	16.11
Barn Swallow	26	14.44
Sage Thrasher	21	11.67
Sagebrush Sparrow	14	7.78
Brewer's Sparrow	13	7.22
Common Raven	6	3.33
European Starling	6	3.33
Mourning Dove	5	2.78
Say's Phobe	5	2.78
Red-winged Blackbird	3	1.67
American Robin	2	1.11
Bank Swallow	2	1.11
House Wren	2	1.11
Killdeer	2	1.11
Rock Wren	2	1.11
Western Bluebird	2	1.11
Brown-headed Cowbird	1	0.56
Gadwall	1	0.56
Yellow-headed Blackbird	1	0.56
Total Individuals	***180***	
Total Species	***20***	

Survey Route: **Lost River**
Survey Date: **June 1, 2017**

Species	Abundance	Percentage
Horned Lark	144	34.78
Western Meadowlark	100	24.15
Sage Thrasher	38	9.18
Brewer's Sparrow	61	14.73
Sagebrush Sparrow	26	6.28
Common Raven	26	6.28
Red-tailed Hawk	11	2.66
Common Nighthawk	2	0.48
Mourning Dove	2	0.48
Vesper Sparrow	2	0.48
Barn Swallow	1	0.24
Swainson's Hawk	1	0.24
Total Individuals	***414***	
Total Species	***12***	

Survey Route: **INTEC**
Survey Date: **June 5, 2017**

Species	Abundance	Percentage
Horned Lark	51	30.00
Sage Thrasher	36	21.18
Western Meadowlark	28	16.47
Brewer's Sparrow	22	12.94
Sagebrush Sparrow	19	11.18
Barn Swallow	9	5.29
Common Nighthawk	2	1.18
Brewer's Blackbird	2	1.18
Common Raven	1	0.59
Total Individuals	***170***	
Total Species	***9***	

Survey Route: **Tractor Flats**
Survey Date: **June 6, 2017**

Species	Abundance	Percentage
Franklin's Gull	162	27.50
Western Meadowlark	122	20.71
Horned Lark	118	20.03
Brewer's Sparrow	55	9.34
Sage Thrasher	44	7.47
Common Raven	26	4.41
Mourning Dove	18	3.06
Sagebrush Sparrow	16	2.72
Black-billed Magpie	8	1.36
Common Nighthawk	3	0.51
Grasshopper Sparrow	3	0.51
Western Kingbird	3	0.51
Brown-headed Cowbird	2	0.34
Red-tailed Hawk	2	0.34
American Crow	1	0.17
Eurasian Collared-Dove	1	0.17
European Starling	1	0.17
Ferruginous Hawk	1	0.17
Long-billed Curlew	1	0.17
Swainson's Hawk	1	0.17
Violet-green Swallow	1	0.17
Total Individuals	***589***	
Total Species	***21***	

Survey Route: **MFC**
Survey Date: **June 8, 2017**

Species	Abundance	Percentage
Western Meadowlark	44	25.43
Horned Lark	43	24.86
Bank Swallow	20	11.56
Sage Thrasher	19	10.98
Killdeer	13	7.51
American Avocet	6	3.47
Brewer's Blackbird	5	2.89
Brewer's Sparrow	5	2.89
Sagebrush Sparrow	4	2.31
Say's Phobe	4	2.31
Mallard	3	1.73
Yellow-headed Blackbird	3	1.73
Common Raven	1	0.58
Mourning Dove	1	0.58
Red-winged Blackbird	1	0.58
Red-tailed Hawk	1	0.58
Total Individuals	***173***	
Total Species	***16***	

Survey Route: **Kyle Canyon**
Survey Date: **June 9, 2017**

Species	Abundance	Percentage
Western Meadowlark	69	29.87
Sage Thrasher	42	18.18
Sagebrush Sparrow	38	16.45
Horned Lark	26	11.26
Brewer's Sparrow	23	9.96
Ferruginous Hawk	8	3.46
Common Raven	6	2.60
Mourning Dove	6	2.60
Western Kingbird	3	1.30
Red-tailed Hawk	2	0.87
Vesper Sparrow	2	0.87
Black-billed Magpie	1	0.43
Green-tailed Towhee	1	0.43
Loggerhead Shrike	1	0.43
Northern Flicker	1	0.43
Prairie Falcon	1	0.43
Swainson's Hawk	1	0.43
Total Individuals	***231***	
Total Species	***17***	

Survey Route: **CFA**
Survey Date: **June 12, 2017**

Species	Abundance	Percentage
Sage Thrasher	61	27.23
Western Meadowlark	52	23.21
Horned Lark	36	16.07
European Starling	13	5.80
Sagebrush Sparrow	11	4.91
Brewer's Sparrow	10	4.46
Common Raven	8	3.57
Brewer's Blackbird	5	2.23
Mourning Dove	5	2.23
Red-tailed Hawk	4	1.79
Barn Swallow	3	1.34
American Kestrel	2	0.89
House Finch	2	0.89
Vesper Sparrow	2	0.89
Western Kingbird	2	0.89
Brown-headed Cowbird	1	0.45
Chipping Sparrow	1	0.45
Common Nighthawk	1	0.45
Ferruginous Hawk	1	0.45
House Sparrow	1	0.45
Killdeer	1	0.45
Say's Phobe	1	0.45
Swainson's Hawk	1	0.45
Total Individuals	***224***	
Total Species	***23***	

Survey Route: **RTC**
Survey Date: **June 20, 2017**

Species	Abundance	Percentage
Horned Lark	95	42.22
Western Meadowlark	51	22.67
Brewer's Sparrow	23	10.22
Sage Thrasher	21	9.33
Barn Swallow	10	4.44
House Sparrow	5	2.22
Vesper Sparrow	5	2.22
Common Raven	4	1.78
Sagebrush Sparrow	4	1.78
Bank Swallow	2	0.89
Brewer's Blackbird	1	0.44
Brown-headed Cowbird	1	0.44
Killdeer	1	0.44
Say's Phobe	1	0.44
Western Kingbird	1	0.44
Total Individuals	***225***	
Total Species	***15***	

Survey Route: **Circular Butte**
Survey Date: **June 21, 2017**

Species	Abundance	Percentage
Horned Lark	156	39.59
Franklin's Gull	50	12.69
Sage Thrasher	50	12.69
Western Meadowlark	43	10.91
Brewer's Sparrow	27	6.85
Sagebrush Sparrow	19	4.82
Mourning Dove	17	4.31
Common Raven	15	3.81
Vesper Sparrow	7	1.78
Common Nighthawk	4	1.02
Red-tailed Hawk	3	0.76
Burrowing Owl	1	0.25
Long-eared Owl	1	0.25
Prairie Falcon	1	0.25
Total Individuals	***394***	
Total Species	***14***	

Survey Route: **PBF**
Survey Date: **June 22, 2017**

Species	Abundance	Percentage
Horned Lark	55	35.71
Western Meadowlark	44	28.57
Sage Thrasher	16	10.39
Brewer's Sparrow	10	6.49
Mourning Dove	8	5.19
Barn Swallow	6	3.90
Sagebrush Sparrow	4	2.60
Vesper Sparrow	4	2.60
Common Raven	2	1.30
Common Nighthawk	1	0.65
Grasshopper Sparrow	1	0.65
Loggerhead Shrike	1	0.65
Northern Harrier	1	0.65
Say's Phobe	1	0.65
Total Individuals	***154***	
Total Species	***14***	

Survey Route: **TAN**
Survey Date: **June 23, 2017**

Species	Abundance	Percentage
Sage Thrasher	50	31.06
Horned Lark	42	26.09
Brewer's Sparrow	24	14.91
Sagebrush Sparrow	21	13.04
Bank Swallow	5	3.11
Barn Swallow	5	3.11
Common Raven	4	2.48
Ferruginous Hawk	3	1.86
Mourning Dove	2	1.24
Northern Harrier	2	1.24
Great Blue Heron	1	0.62
Loggerhead Shrike	1	0.62
Red-tailed Hawk	1	0.62
Total Individuals	***161***	
Total Species	***13***	

Survey Route: **Twin Buttes**
Survey Date: **June 26, 2017**

Species	Abundance	Percentage
Horned Lark	86	29.86
Western Meadowlark	62	21.53
Sage Thrasher	38	13.19
Sagebrush Sparrow	22	7.64
Brewer's Sparrow	14	4.86
Common Raven	14	4.86
Common Nighthawk	9	3.13
Vesper Sparrow	9	3.13
Mourning Dove	6	2.08
Red-tailed Hawk	5	1.74
Loggerhead Shrike	5	1.74
Swainson's Hawk	4	1.39
Ferruginous Hawk	3	1.04
Black-billed Magpie	2	0.69
Grasshopper Sparrow	2	0.69
Burrowing Owl	1	0.35
Dark-eyed Junco (unid. race)	1	0.35
Franklin's Gull	1	0.35
Northern Flicker	1	0.35
Northern Harrier	1	0.35
Northern Mockingbird	1	0.35
Rock Wren	1	0.35
Total Individuals	***288***	
Total Species	***22***	

Survey Route: **NRF**
Survey Date: **June 27, 2017**

Species	Abundance	Percentage
Horned Lark	55	49.55
Sage Thrasher	19	17.12
Killdeer	4	3.60
Mourning Dove	6	5.41
Western Meadowlark	8	7.21
Brewer's Sparrow	5	4.50
Sagebrush Sparrow	7	6.31
Brewer's Blackbird	2	1.80
Barn Swallow	2	1.80
Common Raven	2	1.80
Common Nighthawk	1	0.90
Total Individuals	***111***	
Total Species	***11***	