

Breeding Bird Surveys on the Idaho National Laboratory Site

2025

MARCH 2026

Terrah Owens, PhD

Idaho National Laboratory

INL/RPT-26-91144

Natural Resources Group



DISCLAIMER

This information was prepared as an account of work sponsored by an agency of the U.S. Government. Neither the U.S. Government nor any agency thereof, nor any of their employees, makes any warranty, expressed or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness, of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. References herein to any specific commercial product, process, or service by trade name, trade mark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the U.S. Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the U.S. Government or any agency thereof.

Breeding Bird Surveys on the Idaho National Laboratory Site

2025

Terrah Owens, PhD

March 2026

**Idaho National Laboratory
Idaho Falls, Idaho 83415**

<http://www.inl.gov>

**Prepared for the
U.S. Department of Energy
Office of Nuclear Energy
Under DOE Idaho Operations Office
Contract DE-AC07-05ID14517**

Foreword

This 2025 Breeding Bird Surveys on the Idaho National Laboratory Site report is a departure from the traditional formatting of this document. Beginning this annual reporting cycle, the traditional Executive Summary will be changed to a Plain Language Summary that is intended for a non-technical audience that contains concise information related to the background, data collection, and results from Breeding Bird Surveys.

Plain Language Summary

Introduction

Many bird species are highly sensitive to changes in their surroundings, making them excellent early indicators for environmental issues. By keeping track of bird populations, the diversity of species, and changes to the structure of bird communities, we can detect potential environmental problems early. This allows us to be proactive before issues become more serious, ensure regulatory compliance, reduce impacts to mission, and protect wildlife and their habitats on the Idaho National Laboratory Site (INL).

The INL Site is recognized as a Global Important Bird Area by the National Audubon Society and is designated as an Important Bird Area by Idaho Partners in Flight and the Idaho Audubon Council. The INL is likely one of the largest blocks of least-disturbed sagebrush habitat in the Western U.S. and provides habitat for several bird species with elevated conservation status identified by the U.S. Fish and Wildlife Service, Bureau of Land Management, and Idaho Department of Fish and Game.

The North American Breeding Bird Survey was developed in 1966, is currently managed by the U.S. Geological Survey, and consists of over 5,000 survey routes, with approximately 3,000 of these being sampled each year. The Breeding Bird Survey (BBS) provides insight into long-term species abundance and distribution trends for more than 500 species of birds across a broad geographic area. These data are the primary sources for regional conservation programs and modeling efforts.

Five official BBS routes, along with eight facilities routes, are on the INL Site and have been surveyed each year since 1985, except in 1992 and 1993. These bird surveys aid the INL Site in compliance with Migratory Bird Treaty Act of 1918¹ and the Memorandum of Understanding between the Department of Energy and the U.S. Fish and Wildlife Service² by monitoring migratory bird species present on the INL Site to ensure that activities are not detrimental to bird populations. Moreover, data collected during these surveys are used to inform determinations made for the National Environmental Policy Act.

Methods

The BBS is a roadside count of birds observed or heard along designated routes. Official BBS routes (hereafter, remote routes) are 24 miles long with 50 stops spaced every 0.5 miles, while facility routes vary in length, with stops spaced every 0.2 miles. Observers follow strict protocols provided by the U.S. Geological Survey³, recording bird species within a set radius during three-minute intervals and noting environmental data like weather conditions. Surveys are conducted in good weather, starting just before sunrise, and include precautions to avoid double-counting birds or missing observations due to noise or traffic. For more detailed information about methods see Section 2.1.1. of this report.

In 2025, INL biologists piloted the use of autonomous recording units (ARUs) on four facility routes. ARUs are a cost-effective, passive tool used to monitor bird species, providing insights into diversity, population size, and habitat use. Recent advancements in machine learning have significantly reduced processing times of recorded data from days or weeks to a few hours. ARUs have proven useful in supplementing or even outperforming traditional count surveys, depending on the species and environment being studied. This pilot project showcased the potential of ARUs to gather valuable bird

¹ 16 U.S.C. §§ 703-712 (1918).

² U.S. Department of Energy and the U.S. Fish and Wildlife Service. 2013. Memorandum of Understanding between the United States Department of Energy and the United States Fish and Wildlife Service Regarding Implementation of Executive Order 13186, "Responsibilities of Federal Agencies to Protect Migratory Birds", 20 pp.

³ U.S. Geological Survey. 2025. Instructions for conducting the North American Breeding Bird Survey. U.S. Geological Survey, Patuxent Wildlife Research Center, Laurel, MD, USA.

population data efficiently and with fewer resources. For more detailed information about ARU methods see Section 2.1.2. of this report.

Bird Species Diversity and Assemblages

An ecological community consists of all species interacting within a specific environment, and its diversity can indicate the health and stability of the ecosystem. High species diversity is often associated with healthy ecosystems, while low diversity may signal problems. To measure diversity, indices are used that consider both the total number of unique species and the abundance of each species in the community. Diversity metrics were calculated for all BBS routes to evaluate local bird community diversity and compare trends over time. For more detailed information methods used to determine species diversity, see Section 2.2. of this report.

Bird species on the INL Site are divided into eight groups based on their habitat needs. These groups are: Generalist, which includes species that thrive in various habitats and often adapt to human-altered environments; Non-native, consisting of species introduced to North America and are not tied to specific habitats; Riparian, featuring birds reliant on wetland habitats and insect-rich environments; Sagebrush-obligate, which includes species dependent on sagebrush for survival; Shorebird, made up of wading birds and gulls primarily found near water sources; Shrub-steppe/Grassland, containing species that inhabit open areas with grasses and non-sagebrush shrubs; Shrub-steppe/Woodland, associated with open woodlands and areas with shrubs and tree cover; and Waterfowl, comprising ducks, geese, and coots that rely on water bodies for nesting and stopovers. Evaluating count data within these groups helps contextualize bird population trends and provide valuable indicators of habitat health and ecological changes on the INL Site. For more detailed information about species assemblages at the INL Site, see Section 2.3. of this report.

2025 Breeding Bird Survey Results

INL Site-wide Summary

All 13 BBS routes on the INL Site were surveyed in June and we recorded 3,746 individual birds representing 60 species. While the species count was slightly higher than the long-term average of 56, the total count of individuals was 18.4% below the 38-year average of 4,588 total observations. The five most abundant species—horned lark, western meadowlark, Brewer’s sparrow, sagebrush sparrow, and common raven—accounted for 73.8% of all observations and have consistently been among the top five species over the last 38 years. Of the 60 species observed in 2025, twelve species are of elevated conservation concern by either the Idaho Department of Fish and Game, the Bureau of Land Management, or the U.S. Fish and Wildlife Service. For more details about INL Sitewide results, see Section 3.1. and Appendix A of this report.

Species Diversity

Species diversity appears stable across all routes with facility routes tending to have more diverse bird communities than remote routes due to the greater habitat complexity, including buildings, trees, and water features that create varied environments. The Tractor Flats and Circular Butte routes recorded the highest individual counts among remote routes, though none exceeded the 38-year mean. The Tractor Flats and Kyle Canyon remote routes recorded the highest number of species for remote routes (26 and 23 species, respectively). For facility routes, the Critical Infrastructure Test Range Complex and the Central Facilities Area had the highest individual counts and three facility routes⁴ exceeded their respective 38-

⁴ Critical Infrastructure Test Range Complex, Advanced Test Reactor, and Idaho Nuclear Technical and Engineering Center

year means. The Materials and Fuels Complex and Central Facilities Area routes had the highest number of species for facility routes with 28 and 24 species, respectively. Of note, the Wilson's phalarope, a shorebird species observed on the Materials and Fuels Complex route, is currently under a 12-month review by the U.S. Fish and Wildlife Service to consider it for listing as a threatened or endangered species⁵. For more details about BBS routes and species diversity, see Section 3.2. of this report.

Species Assemblages

The Shrub-steppe/Grassland assemblage had the highest abundance, with 13 species accounting for 60.1% of all bird observations, reflecting the dominance of shrub-steppe and grassland habitats on the INL Site. This assemblage included notable species such as horned lark and western meadowlark along with four conservation-priority species being observed. The Sagebrush-obligate assemblage, consisting of three species with elevated conservation status, contributed 19.2% of observations but was below its long-term average. The Generalist assemblage made up 11.1% of observations, with common raven being the most abundant species, though no conservation-priority species were detected. The Riparian, Shorebird, Waterfowl, Non-native, and Shrub-steppe/Woodland assemblages had lower counts because they consist of species associated with specific habitats that are uncommon on the INL Site. Observations in these groups included several conservation-priority species, such as cinnamon teal, Wilson's phalarope, and gull species, which rely on unique habitats near water or croplands. Overall, the diversity and abundance of birds observed across the assemblages reflect the varied habitats and ecological dynamics of the INL Site. For more details about species assemblage results, see Section 3.3. of this report.

Autonomous Recording Units (ARUs)

ARUs were deployed in June and overlapped with the BBS surveys at the Advanced Test Reactor, Central Facilities Area, Materials and Fuels Complex, and Radioactive Waste Management Complex. ARUs detected between 11 and 31 species with the common nighthawk, horned lark, and western kingbird being the most detected species. Species overlap between BBS surveys and ARU recordings from the same morning and location ranged from 20–60%, increasing to 40–80% when considering adjacent BBS stops. Over the full two-week deployment of ARU's, species overlap between ARUs and BBS routes ranged from 30–48%, with ARUs detecting 11 species not observed during BBS surveys, such as Bullock's oriole, long-billed curlew, and yellow warbler. Additionally, ARUs detected ten conservation-priority species, including Brewer's sparrow, sagebrush sparrow, common nighthawk, and willet. For more details about ARU results, see Section 3.4 and Appendix B of this report.

Discussion

General patterns of the most frequently detected species and assemblages remained consistent on BBSs in 2025, and total observation in three of the eight species assemblages exceeded their long-term means. However, total observations on BBS routes across the INL Site have been below average for 12 of the past 15 years. This overall decrease in abundance corresponds to an increase in the amount of area affected by wildland fire on the INL Site. These lower counts may also be representative of broader declines in bird populations across North America. Sagebrush-obligate songbirds, including Brewer's sparrow, sage thrasher, and sagebrush sparrow, continue to experience declines tied to habitat loss and fragmentation. While conservation efforts aimed at restoring sagebrush ecosystems and supporting greater sage-grouse populations have had mixed impacts on songbirds, ongoing restoration efforts may benefit

⁵ U. S. Fish and Wildlife Service. 2026. 50 CFR Part 17 Endangered and Threatened Wildlife and Plants; 90-day findings of 10 species. (proposed rule). Federal Register 91:3096–3101. U.S. Department of Interior, Fish and Wildlife Service, Washington, DC.

them long-term. ARUs deployed at facilities in 2025 detected 11 species not observed during BBS surveys, demonstrating the value of ARUs in capturing additional data. We plan to continue to leverage this technology and deploy multiple ARUs in 2026 for better habitat coverage. Despite long-term declines in bird abundance, species diversity remains stable, suggesting the INL Site continues to support a diverse bird community including many conservation-priority species. Continued monitoring and habitat restoration are recommended to support bird populations and mitigate impacts from infrastructure and habitat loss. For a more detailed discussion, see Section 4.0 of this report.

Acknowledgements

This report was authored by Battelle Energy Alliance, LLC (BEA) Natural Resources Group. Terrah M. Owens, Samuel R. Williams, Bryan F. Bybee, and Sarah A. Baccus conducted the fieldwork and Terrah M. Owens authored the report. Samuel R. Williams and Amy D. Forman assisted with editing and document formatting.

Recommended Citation

Owens, T. M. 2026. Breeding Bird Surveys on the Idaho National Laboratory Site: 2025. Idaho National Laboratory Environmental, Safety, Health & Quality Organization, Idaho Falls, ID. INL/RPT-26-91144.

Contents

1.	Introduction.....	1-1
1.1.	Study Area	1-1
2.	Methods	2-1
2.1.	Data Collection	2-1
2.1.1.	Point Count Surveys.....	2-1
2.1.2.	Autonomous Recording Units	2-1
2.2.	Data Analyses	2-3
2.2.1.	Community Diversity Indices.....	2-3
2.3.	Species Assemblages	2-3
2.3.1.	Generalist.....	2-4
2.3.2.	Non-native	2-4
2.3.3.	Riparian	2-4
2.3.4.	Sagebrush-obligate	2-4
2.3.5.	Shorebird	2-4
2.3.6.	Shrub-steppe/Grassland.....	2-4
2.3.7.	Shrub-steppe/Woodland	2-4
2.3.8.	Waterfowl.....	2-4
3.	Results.....	3-1
3.1.	Site-wide.....	3-1
3.2.	Routes and Community Diversity Indices	3-4
3.3.	Species Assemblages	3-5
3.3.1.	Shrub-steppe/Grassland.....	3-6
3.3.2.	Sagebrush-obligate	3-7
3.3.3.	Generalist.....	3-7
3.3.4.	Riparian	3-7
3.3.5.	Shorebird	3-8
3.3.6.	Waterfowl.....	3-8
3.3.7.	Non-native	3-8
3.3.8.	Sage-steppe/Woodland.....	3-8
3.4.	Autonomous Recordings Units	3-8
4.	Discussion.....	4-1
4.1.	Future Data Analyses.....	4-2
5.	Literature Cited.....	5-1

Figures

Figure 1-1. Map of the Idaho National Laboratory Site showing current sagebrush habitat, areas affected by wildland fire from 1994–2024, and man-made storage lagoons and natural areas that provide water resources for birds..... **Error! Bookmark not defined.**

Figure 2-1. Breeding Bird Survey (BBS) routes on the Idaho National Laboratory Site. Yellow dots represent survey points along U.S. Geological Survey BBS routes and orange dots represent the same for facility routes. Blue dots indicate where autonomous recording units (ARUs) were deployed during the 2025 survey season. 2-2

Figure 3-1. The total number of birds observed each year on all Breeding Bird Survey routes on the Idaho National Laboratory (INL) Site. The dashed line indicates the mean number of birds observed from 1985 to 2024. No surveys were conducted on the INL Site in 1992 and 1993. 3-1

Figure 3-2. Summary of Breeding Bird Survey observations among assemblages for remote and facility routes on the Idaho National Laboratory Site in 2025. 3-6

Figure 3-3. Common raven observations on the Idaho National Laboratory Site from 1985–2025. No surveys were conducted in 1992 and 1993. 3-7

Tables

Table 3-1. Summary of observations by species from all Breeding Bird Survey routes on the Idaho National Laboratory Site in 2025. Species assemblages are Generalist (G), Non-native (NN), Riparian (R), Shorebird (S), Sagebrush-obligate (SO), Shrub-steppe/Grassland (SSG), Shrub-steppe Woodland (SW), and Waterfowl (W)..... 3-2

Table 3-2. Comparison of total observations and species richness to their perspective 38-year means for each Breeding Bird Survey route on the Idaho National Laboratory Site in 2025. Means are from 1985–2024. No surveys were completed in 1992 and 1993. The Naval Reactors Facility Route was altered in 2019 due to construction. The number of stops has varied on the route therefore accurate comparisons cannot be made..... 3-4

Table 3-3. Values for Shannon’s Diversity (H), and Equitability (E_H) indices for each Breeding Bird Survey route on the Idaho National Laboratory Site in 2025..... 3-5

Table 3-4. Comparison of total observations and species richness to their perspective 38-year means for each species assemblage on the Idaho National Laboratory Site in 2025. Means are from 1985–2024. No surveys were completed in 1992 or 1993..... 3-6

Table 3-5. Total number of species detected by autonomous recording units (ARUs) and Breeding Bird Surveys (BBSs) at selected facility routes in 2025. Percent overlap is the number of species detected by both the ARU and the BBS divided by the total number of species detected at each facility..... 3-9

Table A-1. Abundance and percentage of species observed on the Advanced Test Reactor Complex Breeding Bird Survey Route at the Idaho National Laboratory Site on June 12, 2025..... A-1

Table A-2. Abundance and percentage of species observed on the Central Facilities Area Breeding Bird Survey Route at the Idaho National Laboratory Site on June 13, 2025. A-2

Table A-3. Abundance and percentage of species observed on the Circular Butte Breeding Bird Survey Route at the Idaho National Laboratory Site on June 5, 2025. A-3

Table A-4. Abundance and percentage of species observed on the Critical Infrastructure Test Range Complex Breeding Bird Survey Route at the Idaho National Laboratory Site on June 13, 2025..... A-4

Table A-5. Abundance and percentage of species observed on the Idaho Nuclear Technology and Engineering Center Breeding Bird Survey Route at the Idaho National Laboratory Site on June 11, 2025. A-5

Table A-6. Abundance and percentage of species observed on the Kyle Canyon Breeding Bird Survey Route at the Idaho National Laboratory Site on June 12, 2025.	A-6
Table A-7. Abundance and percentage of species observed on the Lost River Breeding Bird Survey Route at the Idaho National Laboratory Site on June 10, 2025.	A-7
Table A-8. Abundance and percentage of species observed on the Materials and Fuels Complex Breeding Bird Survey Route at the Idaho National Laboratory Site on June 16, 2025.	A-8
Table A-9. Abundance and percentage of species observed on the Naval Reactors Facility Breeding Bird Survey Route at the Idaho National Laboratory Site on June 5, 2025.	A-9
Table A-10. Abundance and percentage of species observed on the Radioactive Waste Management Complex Breeding Bird Survey Route at the Idaho National Laboratory Site on June 9, 2025.	A-10
Table A-11. Abundance and percentage of species observed on the Test Area North Breeding Bird Survey Route at the Idaho National Laboratory Site on June 6, 2025.	A-11
Table A-12. Abundance and percentage of species observed on the Tractor Flats Breeding Bird Survey Route at the Idaho National Laboratory Site on June 11, 2025.	A-12
Table A-13. Abundance and percentage of species observed on the Twin Buttes Breeding Bird Survey Route at the Idaho National Laboratory Site on June 9, 2025.	A-13
Table B-1. Species detected by autonomous recording unit at Stop #11 of the Advanced Test Reactor Complex Breeding Bird Survey Route at the Idaho National Laboratory Site between June 4 and June 17, 2025.	1
Table B-2. Species detected by autonomous recording unit at Stop #6 of the Central Facilities Area Breeding Bird Survey Route at the Idaho National Laboratory Site between June 4 and June 17, 2025.	2
Table B-3. Species detected by autonomous recording unit at Stop #6 of the Materials and Fuels Complex Breeding Bird Survey Route at the Idaho National Laboratory Site between June 4 and June 17, 2025.	3
Table B-4. Species detected by autonomous recording unit at Stop #5 of the Radioactive Waste Management Complex Breeding Bird Survey Route at the Idaho National Laboratory Site between June 3 and June 16, 2025.	4

Acronyms

ARU	Autonomous Recording Unit
ATR	Advanced Test Reactor
BBS	Breeding Bird Survey
BCC	Bird of Conservation Concern
BCR	Bird Conservation Region
BLM	Bureau of Land Management
CCA	Candidate Conservation Agreement
CFA	Central Facilities Area
CITRC	Critical Infrastructure Test Range Complex
INL	Idaho National Laboratory
MFC	Materials and Fuels Complex
NEPA	National Environmental Policy Act
RWMC	Radioactive Waste Management Complex
SGCN	Species of Greatest Conservation Need
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

Breeding Bird Surveys on the Idaho National Laboratory Site

2025

1. Introduction

The North American Breeding Bird Survey (BBS) was developed by the U.S. Fish and Wildlife Service (USFWS) and the Canadian Wildlife Service to document continental trends in bird populations. Surveys began in 1966 in the eastern United States and by 1968 included the entire contiguous United States and southern Canada (Sauer et al. 2017). The BBS program in North America is now managed by the U.S. Geological Survey (USGS) and currently consists of over 5,000 routes, with approximately 3,000 of these being sampled each year (Ziolkowski et al. 2023). BBS data provides long-term species abundance and distribution trends for >500 species of birds across a broad geographic scale (Ziolkowski et al. 2023). These data are the primary sources for regional conservation programs and modeling efforts.

Five official USGS BBS routes are on the Idaho National Laboratory (INL) Site and have been surveyed each year since 1985, except in 1992 and 1993. In 1985, the U.S. Department of Energy–Idaho Operations Office also established eight additional routes around INL Site facilities to monitor birds near the highest human activity centers. These routes are also surveyed annually using the same techniques and methods as those used by the USGS. BBS data benefits INL Site managers by providing information on local breeding bird populations, which is useful as they consider new activities and inform documentation for the National Environmental Policy Act (NEPA). Additionally, the BBS complies with the direction to promote monitoring of migratory birds as described in the Memorandum of Understanding between the Department of Energy and the USFWS outlining responsibilities of federal agencies to protect migratory birds (DOE and USFWS 2013).

1.1. Study Area

The INL Site encompasses almost 2,305 km² (890 mi²) of land on the Upper Snake River Plain in southeast Idaho and is administered by the U.S. Department of Energy. This area is located within portions of Bingham, Bonneville, Butte, Clark, and Jefferson counties. Topography across the INL Site is mostly flat with an average elevation of 1,519 m (4,985 ft). 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.

Surface water on the INL Site is limited, which may influence bird distribution during the summer breeding season. 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 some of it is diverted into the spreading areas to the south and the rest drains into an ephemeral playa known as the Big Lost River Sinks to the north. The Big Lost River, Big Lost River Sinks, and the spreading areas provide the only substantial natural water source for waterfowl and shorebirds, however, several man-made storage lagoons near facilities also provide habitat for aquatic birds, as well as a water source for migratory species (Figure 1-1).

The INL Site has a semi-arid climate, characterized by hot, dry summers and cold winters. Annual precipitation on the INL Site averages 207 mm (7.9 in), with peak precipitation historically occurring in the spring. The INL Site is composed primarily of a mosaic of shrublands and open grassland within the sagebrush-steppe ecosystem. Big sagebrush (*Artemisia tridentata*) is the dominant shrub species while other common species include green rabbitbrush (*Chrysothamnus viscidiflorus*), spiny hopsage (*Grayia spinosa*), shadscale saltbrush (*Atriplex confertifolia*), winterfat (*Krascheninnikovia lanata*), and other sagebrush species (*A. spp.*). The most common native grasses are Sandberg bluegrass (*Poa secunda*), thickspike wheatgrass (*Elymus lanceolatus*), bottlebrush squirreltail (*Elymus elymoides*), Indian ricegrass (*Achnatherum hymenoides*), and needle-and-thread (*Hesperostipa comata*). Stands of Utah juniper (*Juniperus osteosperma*) form pockets of woodlands around and on East and Middle Buttes, and on the foothills of the Lemhi Range which extend onto the northwest portion of the INL Site.

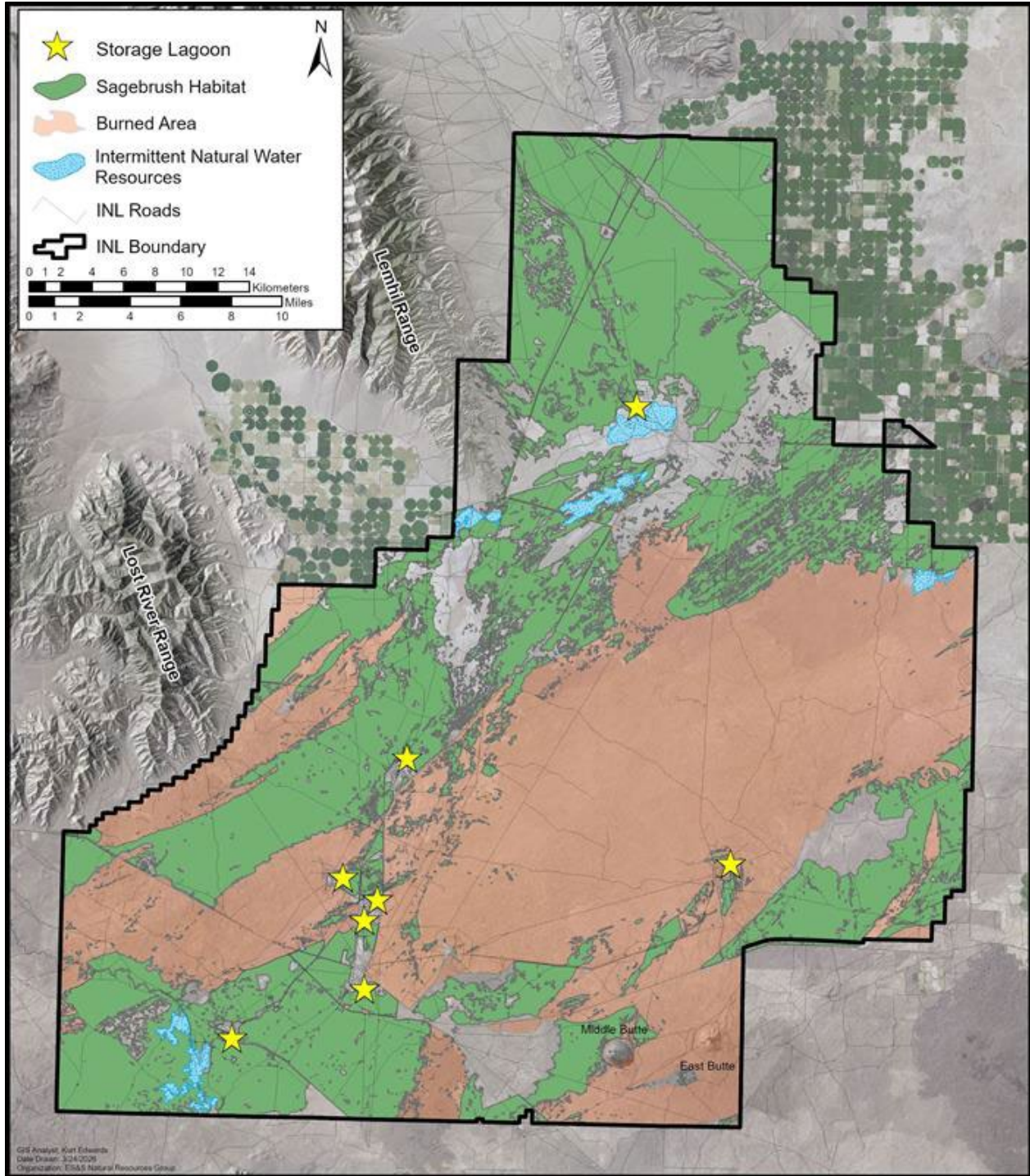


Figure 1-1. Map of the Idaho National Laboratory Site showing current sagebrush habitat, areas affected by wildland fire from 1994–2024, and man-made storage lagoons and natural areas that provide water resources for birds.

The total area of the INL Site that has been impacted by wildland fire between 1994 and 2021 is estimated to be 97,620 ha (241,225 ac; Forman et al. 2024; Figure 1-1). Vegetation maps of the INL Site prior to 1994 (Kramber et al. 1992) indicate that plant communities across much of the landscape were dominated by big sagebrush. More recent vegetation maps reflect a transition to more grasslands and green rabbitbrush dominated communities that result after sagebrush has been lost to wildland fire (Shive et al. 2011, Shive et al. 2019). These changes can impact the community structure of breeding birds on the INL Site over time.

The INL Site is designated as an Important Bird Area by Idaho Partners in Flight and the Idaho Audubon Council because it is likely one of the largest blocks of least-disturbed sagebrush habitat in the western U.S. (IDFG 2005) and provides habitat for several Idaho Species of Greatest Conservation Need (SGCN; IDFG 2024). The INL Site has also been recognized as a Global Important Bird Area by the National Audubon Society (2013). The INL Site is located within Bird Conservation Region (BCR) 9 – Great Basin. BCRs were developed in 1998 as part of the U.S. North American Bird Conservation Initiative to promote integrated bird conservation (NABCI 2021). They are distinct ecological units that combine Commission for Environmental Cooperation ecoregions with knowledge of bird distributions and life history requirements. BCRs function as the primary conservation units for birds in North America. The USFWS designates certain bird species as Birds of Conservation Concern (BCCs) (USFWS 2021) either within specific BCRs or across the entirety of the species' range in the contiguous U.S. and Alaska. Lastly, the INL Site is located adjacent to land managed by the Bureau of Land Management (BLM) and monitors bird species that are considered Special Status Species (BLM 2022) by the agency.

2. Methods

2.1. Data Collection

2.1.1. Point Count Surveys

The BBS is a roadside count of all birds seen or heard along predefined routes. There are thirteen BBS routes on the INL Site consisting of five official USGS BBS (hereafter, remote routes) and eight facility routes developed specifically for the INL Site (Figure 2-1). Each remote route is 39.2 km (24 mi) long, consisting of 50 sampling points systematically spaced every 0.8 km (0.5 mi). INL BBSs are largely conducted on remote two-track roads with restricted public access and minimal traffic. Facility routes vary in length between 5.8 km (3.6 mi) and 19.2 km (11.9 mi), depending on the size of the facility. Sampling points along facility routes are separated by approximately 0.32 km (0.2 mi).

During the surveys, observers followed the North American BBS protocols provided by the USGS Patuxent Wildlife Research Center (USGS 2025). At each sampling location (i.e., stop), a trained observer recorded every bird species observed within a 400 m (0.25 mi) radius or heard at any distance during a three-minute interval. Any bird that was suspected of being counted on the previous stop was not recorded again (USGS 2025). Additional data such as temperature, wind speed, and sky condition were recorded after every ten stops along the remote routes, and at the beginning and end of each facility route. Surveys were only conducted when weather conditions were appropriate (e.g., no heavy rain or strong wind). Surveys began one-half hour before sunrise and continued until the route was completed. While most stops on remote routes are on dirt two-track roads, a few stops are along major roads (e.g., Highway 20). In these cases, the number of vehicles that passed observers during the three-minute sampling period was recorded on all remote routes and observers noted whether background noise interfered with audible detection of birds.

2.1.2. Autonomous Recording Units

The use of autonomous recording units (ARUs) is a passive, cost-effective sampling technique that is now widely used to assess bird species diversity, occupancy, and abundance (Shonfield and Bayne 2017, Darras et al. 2019). Advancements in machine learning have reduced the time needed to process data and identify species from days to a few hours, with multiple reliable software packages developed in the last decade (Kahl et al. 2021, Manzano-Rubio et al. 2022, Van Doren et al. 2023). ARUs have been used to augment traditional point count surveys, like those used for BBSs, or in some cases have outperformed these surveys depending on target species and ecosystem (Klingbeil and Willig 2015, Drake et al. 2021, Pérez-Granados and Traba 2021). Given their ability to capture more data with fewer personnel hours, INL biologists piloted using ARUs on facility routes during the 2025 season.

ARUs were deployed at Stop 11 at the Advanced Test Reactor (ATR) Complex, Stop 6 at the Central Facilities Area (CFA), Stop 6 at the Materials and Fuels Complex (MFC), and Stop 5 at the Radioactive Waste Management Complex (RWMC; Figure 2-1). These routes and stops were chosen due to their high Shannon's diversity indices (see Section 2.2 for methods) in previous sample periods. Deployed ARUs were Titley Scientific® Ranger Model AAAB024 with a Titley Scientific® side-mounted omnidirectional microphone Model AAAB028 with a frequency range of 20 Hz – 20 kHz. Each ARU was set to use the GPS enabled Dusk and Dawn Mode which records for 90 minutes before and after dusk or dawn using a mono recording channel at 44.1 Ksps with +12 dB gain and a WAV file format output. The ARU was mounted on a tripod at a height of 1 m (3 ft) and recorded for two weeks. This time period overlapped with the BBSs so that results could be compared between the two methods.

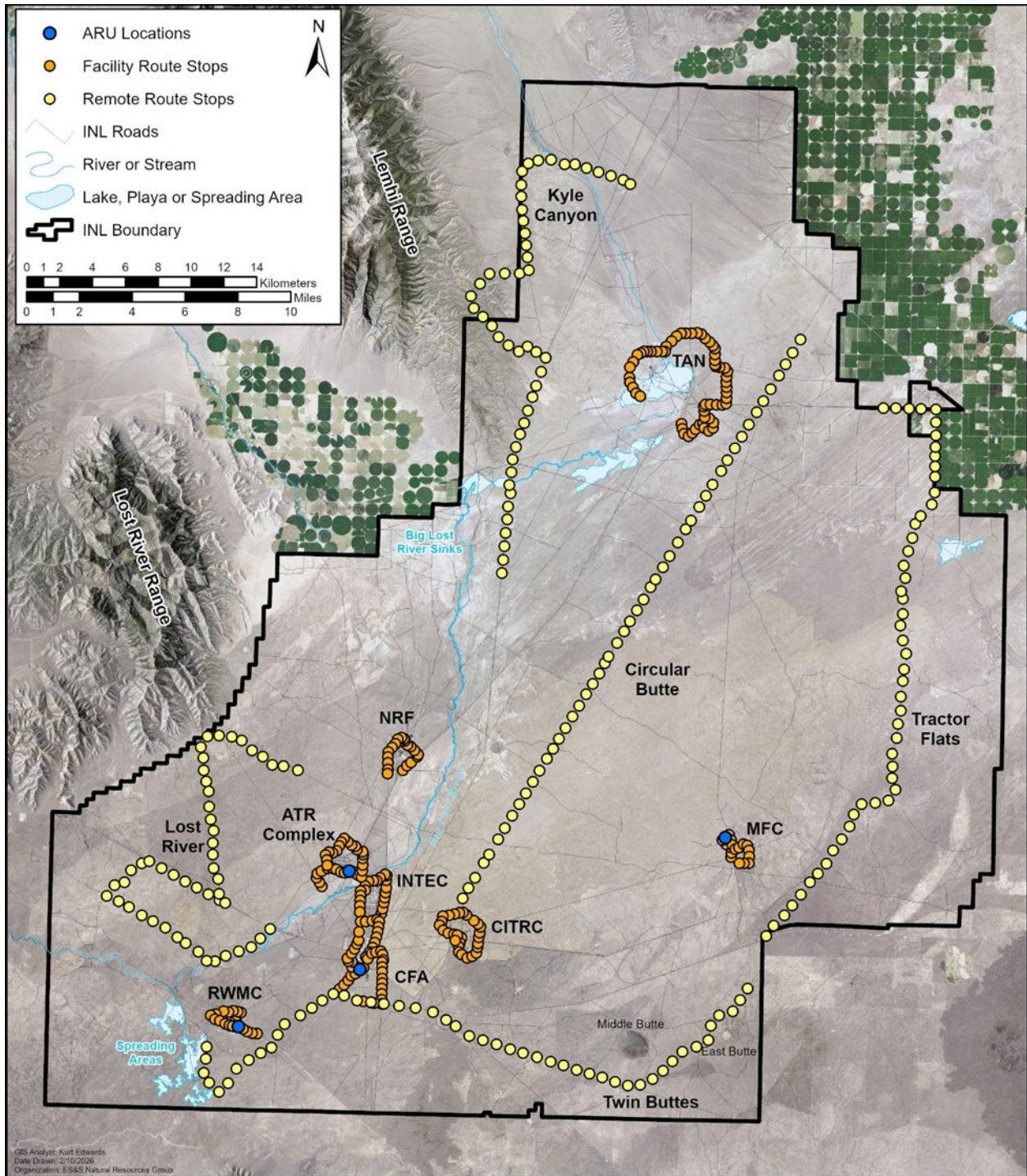


Figure 2-1. Breeding Bird Survey (BBS) routes on the Idaho National Laboratory Site. Yellow dots represent survey points along U.S. Geological Survey BBS routes and orange dots represent the same for facility routes. Blue dots indicate where autonomous recording units (ARUs) were deployed during the 2025 survey season.

Recordings from the ARUs were analyzed using BirdNET Analyzer model version V2.4 and GUI version 2.1.1 (Kahl et al. 2021) developed by the K. Lisa Yang Center for Conservation Bioacoustics at Chemnitz University of Technology in Chemnitz, Germany. BirdNET is a deep artificial neural network currently trained on calls from over 6,000 species of birds worldwide and utilizes geographic data from eBird (Cornell Lab of Ornithology, Cornell University, Ithaca, NY) to enhance accuracy. Call files were analyzed using the widest bandpass filter (0 – 15,000

Hz), a minimum confidence limit of 0.80 (range 0.05 – 0.95), and sensitivity set to 0.90 (range 0.75 – 1.25). Spatial and temporal information included the latitude and longitude of the detector location, the week of the year of deployment, and a location filter threshold of 0.50 (the species should have a 50% chance of being near the location during the specified time of year). After the initial analysis, a maximum of 25 files were randomly selected from each species identified by the software and manually vetted to ensure proper identification.

2.2. Data Analyses

2.2.1. Community Diversity Indices

An ecological community is comprised of all interacting species within a given environment. A community with low species diversity may indicate that an ecosystem is unhealthy or improperly functioning, whereas high species diversity is often used as an indicator of a healthy and stable ecosystem. Consequently, maintaining a meaningful range of variability for diversity is the goal of many management activities.

Species diversity indices are mathematical methods used to quantify community composition. Many diversity indices are commonly used in ecology, and each has particular strengths depending on the data to be analyzed and the questions asked. The simplest estimate of community diversity is species richness, which represents the total number of unique species present. Although species richness is a useful measure of diversity, it does not account for differences in abundance between communities. For example, if there are many species for which one individual is observed, richness will be high, but its overall composition may not be comparable to another community with the same number of species and higher abundances of each of those species. Diversity indices that consider both species richness and species abundance provide a more useful measure of community diversity.

Shannon's diversity index (H) is a method for quantifying diversity of species in an area. This index accounts for both species richness (S) and relative abundance of each species in a community. Shannon's diversity index is derived by first calculating the proportion of each species (i) relative to the total number of species (p_i) and then multiplying this proportion by the natural logarithm ($\ln p_i$). Shannon's H can range from 0 to about 4.6, where higher values represent higher diversity.

$$H = -\sum_{j=1}^S p_j \ln p_j$$

Another useful measure is Shannon's equitability (E_H). Shannon's equitability represents a measure of evenness, which is how similar species abundance is within a community. E_H ranges from 0 to 1, with 1 representing a completely even community where all species abundances are equal.

$$E_H = H / \ln S$$

Shannon's H and E_H were calculated for all BBS routes using data collected at point count surveys only and were compared to past reports. It was assumed that data obtained from each survey route is an accurate representation of the local bird community.

2.3. Species Assemblages

Bird species can be placed into assemblages based on habitat requirements. The composition and abundance of these assemblages can be used as indicators regarding the general ecological health of the associated habitats. For example, if a study area contains emergent wetland (riparian) habitat and the corresponding bird assemblage begins declining even though the vegetation community hasn't changed, it may indicate additional problems such as a decline in the insect population the birds rely on for food, a change in the predator population, or an invasive species may be displacing native species in the assemblage.

There are eight assemblages identified on the INL Site: Generalist, Non-native, Riparian, Sagebrush-obligate, Shorebird, Shrub-steppe/Grassland, Shrub-steppe/Woodland, and Waterfowl. Except for the Non-native assemblage, species were placed in assemblages based on breeding habitat requirements provided in species accounts by the Cornell Lab of Ornithology's Birds of the World (2022). The species assemblages recognize all habitat types present on the INL Site and place species in ecologically meaningful categories that provide context for population trends.

2.3.1. Generalist

Species in this assemblage may use a variety of habitats including grasslands, shrublands, and woodlands. Many of these species are tolerant of human disturbance and may be found in exurban, suburban, or even urban areas. Some of these species directly benefit from humans by utilizing artificial structures for nesting and perching or by consuming food subsidies at bird feeders, trash bins, landfills, or road-killed animals. Common species in this assemblage include the common raven (*Corvus corax*), house finch (*Haemorhous mexicanus*), and Swainson's hawk (*Buteo swainsoni*).

2.3.2. Non-native

This assemblage is not tied to specific vegetation communities and only includes species that are not native to North America. Common species in this assemblage include Eurasian collared dove (*Streptopelia decaocto*), European starling (*Sturnus vulgaris*), house sparrow (*Passer domesticus*), and rock pigeon (*Columba livia*).

2.3.3. Riparian

Species in this assemblage have diets that primarily consist of flying or aquatic insects during the breeding season. Habitat for these insects is often associated with shallow water with abundant emergent vegetation where the insects can lay their eggs. Bird species in this assemblage have a variety of nesting strategies including building nests out of mud on cliffs or man-made structures, weaving together nests out of reedy vegetation, or nesting in tree cavities or burrows. This habitat type is primarily found at facilities where storage lagoons and trees are present and buildings provide vertical structure. Common species in this assemblage include barn swallow (*Hirundo rustica*), cliff swallow (*Petrochelidon pyrrhonota*), and red-winged blackbird (*Agelaius phoeniceus*).

2.3.4. Sagebrush-obligate

Species in this assemblage require sagebrush to fulfill all or part of their life history requirements and populations are negatively affected by loss and fragmentation of sagebrush dominated communities. There are four species in this assemblage: Brewer's sparrow (*Spizella breweri*), greater sage-grouse (*Centrocercus urophasianus*), sage thrasher (*Oreoscoptes montanus*), and sagebrush sparrow (*Artemisospiza nevadensis*).

2.3.5. Shorebird

Species in this assemblage include wading birds and gulls that usually nest on bare ground in marsh habitats or immediately adjacent uplands. Standing water and marsh habitats are rare on the INL Site and typically most observations of shorebirds occur in proximity to storage lagoons along facility routes or near the Mud Lake Landfill and agricultural fields adjacent to the INL Site boundary. Common species in this assemblage include California gull (*Larus californicus*), Franklin's gull (*Leucophaeus pipixcan*), and great blue heron (*Ardea herodias*).

2.3.6. Shrub-steppe/Grassland

Bird species in this assemblage are associated with open areas with few trees like those represented in shrub-steppe vegetation communities. Species within this assemblage may use sagebrush dominated communities that include open areas with forbs and grasses but may also use areas recovering from wildland fire that are comprised of non-sagebrush shrubs (e.g., green rabbitbrush) and herbaceous vegetation. While some species in this assemblage benefit from intact sagebrush dominated communities, they do not necessarily need sagebrush to fulfill all or part of their life history requirements. Common species in this assemblage include common nighthawk (*Chordeiles minor*), horned lark (*Eremophila alpestris*), and western meadowlark (*Sturnella neglecta*).

2.3.7. Shrub-steppe/Woodland

Species in this assemblage breed in open woodlands like those found at the ecotone of shrub-steppe and juniper woodlands. Some nest in trees, however, others nest on the ground or in shrubs and therefore require adequate ground and shrub cover to conceal their nests. Habitat for this assemblage is limited to the buttes on the southern end of the INL Site, the foothills of Lemhi mountains to the north, and around some facilities. Common species in this assemblage include blue-gray gnatcatcher (*Polioptila caerulea*), gray flycatcher (*Empidonax wrightii*), and lark sparrow (*Chondestes grammacus*).

2.3.8. Waterfowl

Species in this assemblage include coots, ducks, and geese. Most of these species build nests out of vegetation that either float on top of the water, are hidden in vegetation near a water body, or nest in upland habitats adjacent to

bodies of water. A few species in this assemblage nest in tree cavities or man-made nest boxes near aquatic habitats. Apart from the ephemeral Big Lost River, the Big Lost River Spreading Area, and the Big Lost River Sinks playa, the only standing water bodies on the INL Site during the summer are at storage lagoons near facilities. These man-made ponds serve as stopover locations for migrating birds and upland habitat occasionally provides nesting opportunities for some waterfowl species. Common species in this assemblage include American coot (*Fulica americana*), Canada goose (*Branta canadensis*), and mallard (*Anas platyrhynchos*).

3. Results

3.1. Site-wide

All thirteen BBS routes were surveyed between 5 June and 16 June in 2025 and documented 3,746 individuals from 60 species (Table 3-1). Total observations were 18.4% lower than the 38-year mean of 4,588 birds (1985–1991 and 1994–2023; Figure 3-1) while species richness was higher (38-year mean = 56). Total observations for 12 of the last 15 years have been below the long-term mean (Figure 3-1).

The five most abundant birds across all routes were horned lark (n = 1,495), western meadowlark (n = 505), Brewer’s sparrow (n = 328), sagebrush sparrow (n = 251), and common raven (n = 188). All of these species were observed at least once on all 13 BBS routes (Table 3-1, Appendix A). Horned lark, western meadowlark, Brewer’s sparrow, sagebrush sparrow, and common raven have frequently been among the five most abundant species in the 38 years of INL Site BBS. These five species comprised 73.8% of all observations in 2025.

Twelve species of conservation concern were documented during the 2025 BBS. Ten of these are considered by the Idaho Department of Fish and Game as SGCN (IDFG 2024) and include the Brewer’s sparrow (n = 328), sagebrush sparrow (n = 251), sage thrasher (n = 141), common nighthawk (n = 75), Franklin’s gull (n = 34), loggerhead shrike (*Lanius ludovicianus*, n = 18), grasshopper sparrow (*Ammodramus savannarum*, n = 11), California gull (n = 7), ferruginous hawk (*Buteo regalis*, n = 6), and cinnamon teal (*Anas cyanoptera*, n = 1). Ferruginous hawk, grasshopper sparrow, loggerhead shrike, sage thrasher, and sagebrush sparrow are also considered Special Status Species by the BLM. California and Franklin’s gulls and willets (*Tringa semipalmata*, n = 1) are BCCs throughout their ranges in the contiguous U.S. and Alaska while sage thrashers are a BCC in BCR 9. It should also be noted that the USFWS completed a 90-Day Finding for Wilson’s phalarope (*Phalaropus tricolor*, n = 40) and concluded that there is substantial information indicating that listing it as a threatened or endangered species may be warranted (USFWS 2026).

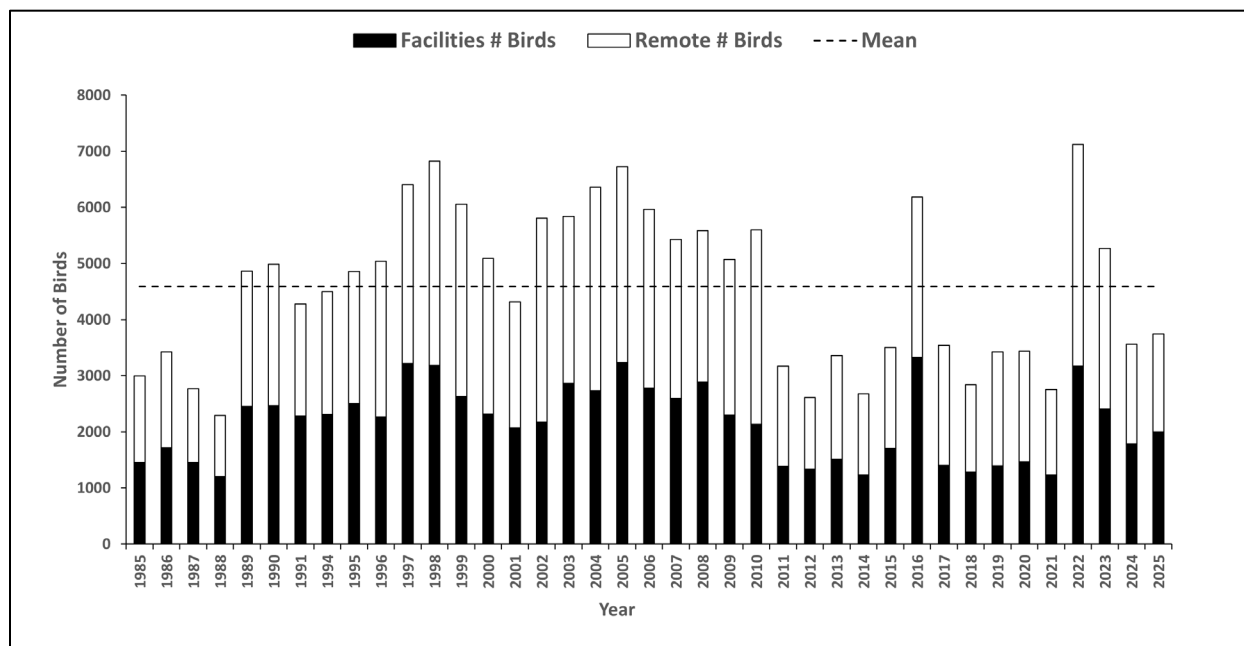


Figure 3-1. The total number of birds observed each year on all Breeding Bird Survey routes on the Idaho National Laboratory (INL) Site. The dashed line indicates the mean number of birds observed from 1985 to 2024. No surveys were conducted on the INL Site in 1992 and 1993.

Table 3-1. Summary of observations by species from all Breeding Bird Survey routes on the Idaho National Laboratory Site in 2025. Species assemblages are Generalist (G), Non-native (NN), Riparian (R), Shorebird (S), Sagebrush-obligate (SO), Shrub-steppe/Grassland (SSG), Shrub-steppe Woodland (SW), and Waterfowl (W).

Common Name	Scientific Name	Assemblage	Total Observed (%)	Routes ¹	Stops Observed (%)
horned lark	<i>Eremophila alpestris</i>	SSG	1,495 (39.91)	5, 8	409 (83.30)
western meadowlark	<i>Sturnella neglecta</i>	SSG	505 (13.48)	5, 8	270 (54.99)
Brewer's sparrow ³	<i>Spizella breweri</i>	SO	328 (8.76)	5, 8	219 (44.60)
sagebrush sparrow ^{3,5}	<i>Artemisiospiza nevadensis</i>	SO	251 (6.70)	5, 8	169 (34.42)
common raven	<i>Corvus corax</i>	G	188 (5.02)	5, 8	87 (17.72)
sage thrasher ^{3,4,5}	<i>Oreoscoptes montanus</i>	SO	141 (3.76)	5, 8	111 (22.61)
mourning dove	<i>Zenaida macroura</i>	G	86 (2.30)	4, 8	65 (13.24)
common nighthawk ³	<i>Chordeiles minor</i>	SSG	75 (2.00)	4, 6	48 (9.78)
barn swallow	<i>Hirundo rustica</i>	R	68 (1.82)	1, 7	25 (5.09)
vesper sparrow	<i>Pooecetes gramineus</i>	SSG	67 (1.79)	5, 4	47 (9.57)
mallard	<i>Anas platyrhynchos</i>	W	41 (1.09)	1, 3	7 (1.43)
Wilson's phalarope ⁶	<i>Phalaropus tricolor</i>	S	40 (1.07)	0, 1	2 (0.40)
cliff swallow	<i>Hirundo pyrrhonota</i>	R	35 (0.93)	0, 3	11 (2.24)
Franklin's gull ^{3,4}	<i>Larus pipixcan</i>	S	34 (0.91)	1, 0	2 (0.40)
house finch	<i>Carpodacus mexicanus</i>	G	32 (0.85)	0, 5	12 (2.44)
Brewer's blackbird	<i>Euphagus cyanocephalus</i>	G	29 (0.77)	1, 4	9 (1.83)
Say's phoebe	<i>Sayornis saya</i>	SSG	28 (0.75)	2, 7	23 (4.68)
American robin	<i>Turdus migratorius</i>	G	27 (0.72)	2, 5	18 (3.67)
European starling	<i>Sturnus vulgaris</i>	NN	26 (0.69)	1, 4	12 (2.44)
house sparrow	<i>Passer domesticus</i>	NN	20 (0.53)	1, 2	7 (1.43)
loggerhead shrike ^{3,5}	<i>Lanius ludovicianus</i>	SSG	18 (0.48)	4, 4	15 (3.05)
western kingbird	<i>Tyrannus verticalis</i>	SSG	16 (0.43)	3, 2	10 (2.04)
Swainson's hawk	<i>Buteo swainsoni</i>	G	15 (0.40)	3, 5	14 (2.85)
brown-headed cowbird	<i>Molothrus ater</i>	G	14 (0.37)	2, 4	11 (2.24)
killdeer	<i>Charadrius vociferus</i>	S	13 (0.35)	0, 4	10 (2.04)
red-winged blackbird	<i>Agelaius phoeniceus</i>	R	12 (0.32)	1, 3	10 (2.04)
black-billed magpie	<i>Pica hudsonia</i>	G	11 (0.29)	2, 0	7 (1.43)
grasshopper sparrow ^{3,5}	<i>Ammodramus savannarum</i>	SSG	11 (0.29)	3, 1	11 (2.24)
northern harrier	<i>Circus hudsonius</i>	SSG	11 (0.29)	3, 3	10 (2.04)
chipping sparrow	<i>Spizella passerina</i>	SW	10 (0.27)	1, 2	8 (1.63)
gadwall	<i>Mareca strepera</i>	W	9 (0.24)	0, 2	3 (0.60)

Table 3-1. Continued.

Common Name	Scientific Name	Assemblage	Total Observed (%)	# of Routes ¹	Stops Observed (%)
rock wren	<i>Salpinctes obsoletus</i>	SSG	9 (0.24)	1, 3	7 (1.43)
savannah sparrow	<i>Passerculus sandwichensis</i>	SSG	8 (0.21)	3, 1	7 (1.43)
California gull ^{3,4}	<i>Larus californicus</i>	S	7 (0.19)	1, 0	1 (0.20)
yellow-headed blackbird	<i>Xanthocephalus xanthocephalus</i>	R	7 (0.19)	0, 1	6 (1.22)
American kestrel	<i>Falco sparverius</i>	G	6 (0.16)	3, 2	5 (1.01)
bank swallow	<i>Riparia riparia</i>	R	6 (0.16)	1, 0	3 (0.60)
ferruginous hawk ^{3,5}	<i>Buteo regalis</i>	SSG	6 (0.16)	2, 0	4 (0.80)
lark sparrow	<i>Chondestes grammacus</i>	SW	6 (0.16)	2, 0	5 (1.01)
dusky flycatcher	<i>Empidonax oberholseri</i>	SW	4 (0.11)	1, 0	3 (0.60)
northern shoveler	<i>Spatula clypeata</i>	W	4 (0.11)	0, 2	2 (0.40)
northern mockingbird	<i>Mimus polyglottos</i>	G	3 (0.08)	0, 2	3 (0.60)
western tanager	<i>Piranga ludoviciana</i>	SW	3 (0.08)	1, 2	3 (0.60)
Canada goose	<i>Branta canadensis</i>	W	2 (0.05)	1, 1	2 (0.40)
gray flycatcher	<i>Empidonax wrightii</i>	SW	2 (0.05)	1, 0	1 (0.20)
red-tailed hawk	<i>Buteo jamaicensis</i>	G	2 (0.05)	2, 0	2 (0.40)
western wood-pewee	<i>Contopus sordidulus</i>	SW	2 (0.05)	1, 0	1 (0.20)
American goldfinch	<i>Carduelis tristis</i>	G	1 (0.03)	0, 1	1 (0.20)
black-necked stilt	<i>Himantopus mexicanus</i>	S	1 (0.03)	0, 1	1 (0.20)
blue-gray gnatcatcher	<i>Poliophtila caerulea</i>	SW	1 (0.03)	1, 0	1 (0.20)
cinnamon teal ³	<i>Anas cyanoptera</i>	W	1 (0.03)	0, 1	1 (0.20)
dark-eyed junco	<i>Junco hyemalis</i>	SW	1 (0.03)	0, 1	1 (0.20)
gray catbird	<i>Dumetella carolinensis</i>	R	1 (0.03)	0, 1	1 (0.20)
great blue heron	<i>Ardea herodias</i>	S	1 (0.03)	0, 1	1 (0.20)
great horned owl	<i>Bubo virginianus</i>	G	1 (0.03)	0, 1	1 (0.20)
hermit thrush	<i>Catharus guttatus</i>	SW	1 (0.03)	0, 1	1 (0.20)
northern flicker	<i>Colaptes auratus</i>	G	1 (0.03)	0, 1	1 (0.20)
prairie falcon	<i>Falco mexicanus</i>	SSG	1 (0.03)	1, 0	1 (0.20)
rock pigeon	<i>Columbo livia</i>	NN	1 (0.03)	0, 1	1 (0.20)
willet ⁴	<i>Catoptrophorus semipalmatus</i>	S	1 (0.03)	1, 0	1 (0.20)
Total			3,746		491²

1. Number of remote routes at which a species was recorded, Number of facility routes at which a species was recorded

2. Total number of stops surveyed

3. Species of Greatest Conservation Need

4. Bird of Conservation Concern

5. Identified as a Special Status Species by the Bureau of Land Management

6. Under Review for listing under the Endangered Species Act

3.2. Routes and Community Diversity Indices

The Tractor Flats (n = 542) and Circular Butte (n = 346) routes had the highest number of observations for remote routes surveyed in 2025 (Table 3-2). No remote routes had an annual count that was greater than the 38-year mean. The Critical Infrastructure Test Range Complex (CITRC) had the highest number of observations for facility routes (n = 361) followed by CFA (n = 315). Three facility routes, CITRC, ATR, and Idaho Nuclear Technology and Engineering Center, had annual counts higher than the 38-year mean (Table 3-2).

On remote routes, the Tractor Flats route had the highest number of observed species (n = 26), followed closely by the Kyle Canyon route (n = 23). The MFC route had the highest number of observed species on a facility route (n = 28) followed by CFA (n = 24, Table 3-2). For all routes, the number of species observed appears to be stable and the species present on the INL Site remain relatively the same.

Table 3-2. Comparison of total observations and species richness to their perspective 38-year means for each Breeding Bird Survey route on the Idaho National Laboratory Site in 2025. Means are from 1985–2024. No surveys were completed in 1992 and 1993. The Naval Reactors Facility Route was altered in 2019 due to construction. The number of stops has varied on the route therefore accurate comparisons cannot be made.

Route	Stops	Species Richness	Mean Species Richness	Total Observations	Mean Observations ¹
Remote Routes					
Tractor Flats	50	26	23	542	739 (-26.7%)
Circular Butte	50	14	15	346	458 (-24.5%)
Lost River	50	15	17	324	416 (-22.1%)
Twin Buttes	50	20	21	269	425 (-36.7%)
Kyle Canyon	50	23	23	265	395 (-32.9%)
Subtotal	250	40²		1,746	
Facility Routes					
Critical Infrastructure Test Range Complex	28	15	15	361	254 (42.1%)
Central Facilities Area	42	24	22	315	326 (-3.4%)
Advanced Test Reactor Complex	32	21	17	312	283 (10.2%)
Test Area North	60	12	17	277	435 (-36.3%)
Idaho Nuclear Technology and Engineering Center	25	19	16	222	208 (6.7%)
Materials and Fuels Complex	18	28	21	206	259 (-20.5%)
Radioactive Waste Management Complex	20	22	19	172	176 (-2.3%)
Naval Reactors Facility	16	19	19	135	-
Subtotal	241	45²		2,000	
Total	491	60²		3,746	

1. Mean number of observations 1985–2024 and percent difference from mean.

2. Total combined number of unique species.

Based on both Shannon’s measures of diversity, the Kyle Canyon route had the most diverse and even bird community for remote routes ($H=2.33$, $E_H=0.74$, Table 3-3) while the Circular Butte route had the least diverse and least even bird community ($H=1.00$, $E_H=0.39$; Table 3-3). For facility routes, MFC had the most diverse community ($H=2.53$) and RWMC had the most even community. ($E_H=0.81$, Table 3-3) while CITRC had the least diverse and least even community ($H=1.47$, $E_H=0.54$). Generally, facility routes have more diverse bird communities than remote routes. This is because facilities have more habitat complexity due to the presence of buildings, trees, storage lagoons, and corresponding edge with shrub and grassland vegetation.

Table 3-3. Values for Shannon's Diversity (H), and Equitability (E_H) indices for each Breeding Bird Survey route on the Idaho National Laboratory Site in 2025.

Route	Shannon's H	Shannon's E_H
Remote Routes		
Circular Butte	1.00	0.39
Kyle Canyon	2.33	0.74
Lost River	1.71	0.63
Tractor Flats	2.22	0.68
Twin Buttes	2.14	0.71
Facility Routes		
Advanced Test Reactor Complex	2.03	0.67
Central Facilities Area	2.51	0.79
Critical Infrastructure Test Range Complex	1.47	0.54
Idaho Nuclear Technology and Engineering Center	1.95	0.66
Materials and Fuels Complex	2.53	0.76
Naval Reactors Facility	2.15	0.73
Radioactive Waste Management Complex	2.50	0.81
Test Area North	1.55	0.62

3.3. Species Assemblages

The species assemblage with the highest bird abundance in 2025 was the Shrub-steppe/Grassland assemblage, which consisted of 13 species and represented 60.1% of all BBS observations (Figure 3-2). This assemblage normally has the highest number of observations because the majority of the INL Site consists of shrub-steppe and grassland habitats. The second most abundant species assemblage was the Sagebrush-obligate assemblage that consisted of three species and represented 19.2% of all observations. The third most abundant species assemblage was the habitat Generalist assemblage, which consisted of 13 species and represented 11.1% of all observations.

Table 3-4. Comparison of total observations and species richness to their perspective 38-year means for each species assemblage on the Idaho National Laboratory Site in 2025. Means are from 1985–2024. No surveys were completed in 1992 or 1993.

Species Assemblage	Number of Species	Mean Number of Species	Total Observations	Mean Observations ¹
Shrub-steppe/Grassland	13	17	2,250	2,172 (3.6%)
Sagebrush-obligate	3	4	720	1,421 (-49.3%)
Generalist	13	12	415	520 (-20.2%)
Riparian	6	6	129	115 (12.2%)
Shorebird	7	5	97	275 (-64.7%)
Waterfowl	5	6	57	42 (35.7%)
Non-native	3	3	47	64 (-26.6%)
Shrub-steppe/Woodland	10	4	31	25 (24.0%)

1. Mean number of observations 1985–2024 and percent difference from mean.

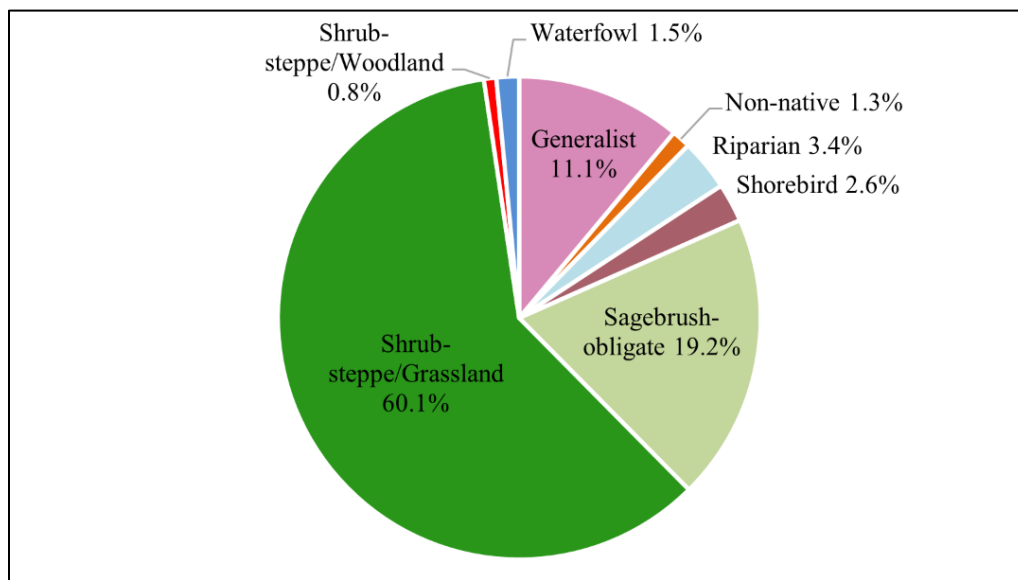


Figure 3-2. Summary of Breeding Bird Survey observations among assemblages for remote and facility routes on the Idaho National Laboratory Site in 2025.

3.3.1. Shrub-steppe/Grassland

The Shrub-steppe/Grassland assemblage had the highest number of observations in 2025 ($n = 2,250$; Table 3-4). Common shrub-steppe/grassland species include horned lark, western meadowlark, common nighthawk, and vesper sparrow (*Pooecetes gramineus*, Table 3-1). Horned lark and western meadowlark were the most abundant species in this assemblage and were in the top five most abundant species observed across the INL Site in 2025 (Table 3-1). The total number of individuals observed within the Shrub-steppe/Grassland assemblage in 2025 was higher than the 38-year mean of 2,172 but the number of species documented was lower (Table 3-4). Four SGCN, BCC, or BLM Special Status species were observed from this assemblage in 2025 including the common nighthawk, loggerhead shrike, grasshopper sparrow, and ferruginous hawk.

3.3.2. Sagebrush-obligate

The Sagebrush-obligate assemblage had the second highest number of observations with 720 individuals. However, it was 49.3% below the 38-year mean of 1,421 observations (Table 3-4). The Brewer’s sparrow was the most abundant (n = 328), followed by the sagebrush sparrow (n = 251), and sage thrasher (n = 141). All three species are designated as SGCN, BCC, or BLM Special Status. No greater sage-grouse were observed during the 2025 surveys.

3.3.3. Generalist

The Generalist assemblage consisted of 415 observations of 13 species (Table 3-4). Among these were three species of raptors (i.e., eagles, hawks, falcons, and owls) which included red-tailed hawk (*Buteo jamaicensis*, n = 2), Swainson’s hawk (n = 15), and American kestrel (*Falco sparverius*, n = 6) and two species of corvids, the common raven (n = 188) and black-billed magpie (*Pica hudsonia*, n = 11). Common ravens, the most abundant species of this assemblage and the fourth most abundant species overall, have expanded their range and populations have increased throughout the western United States (Coates et al. 2020, Dinkins et al. 2021, Harju et al. 2021). They are documented nest predators of several sensitive avian species (Coates et al. 2021). Common raven observations have increased on the INL Site over the years (Figure 3-3), but it is unclear if this increase has affected local populations of other species. There were no SGCN, BCC, or BLM Special Status species detected for this assemblage in 2025.

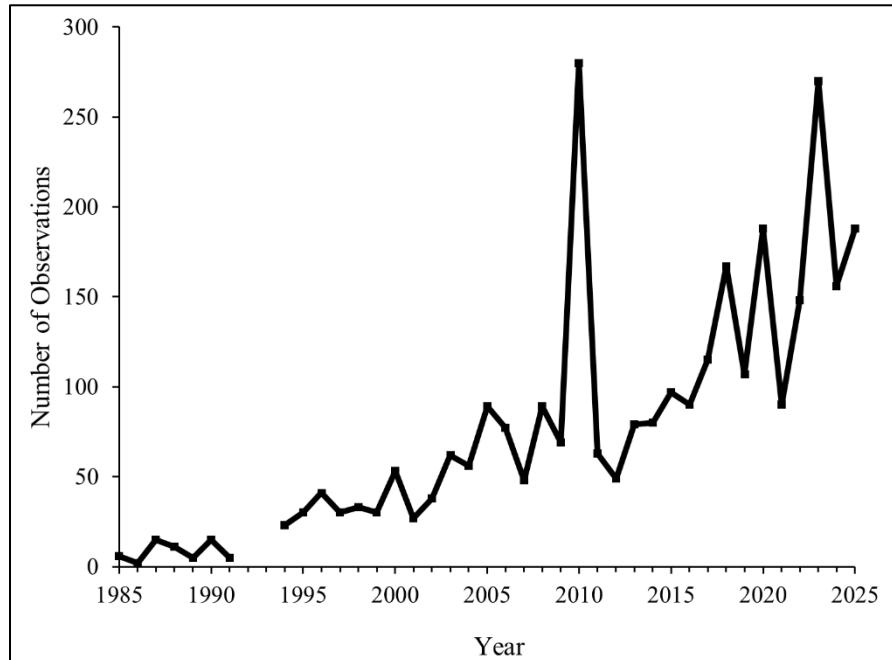


Figure 3-3. Common raven observations on the Idaho National Laboratory Site from 1985–2025. No surveys were conducted in 1992 and 1993.

3.3.4. Riparian

The Riparian assemblage consisted of 129 observations of six species (Table 3-4). The most common species was the barn swallow (n = 68), followed by cliff swallow (n = 35), red-winged blackbird (n = 12), yellow-headed blackbird (*Xanthocephalus xanthocephalus*, n = 7), bank swallow (*Riparia riparia*, n = 6), and gray catbird (*Dumetella carolinensis*, n = 1). All observations of these species occurred on facility routes or at the end of the Tractor Flats remote route. Bank swallows were only detected at the end of the Tractor Flats route, where canal systems associated with local agriculture provide elevated banks that support nesting for this species. Gray catbirds are rare on the INL Site but have been documented on BBSs in previous years. While many insectivorous and riparian-associated birds are declining across North America (Ziolkowski et al. 2023), the total number of observations from this assemblage was above the 38-year mean (Table 3-4). There were no SGCN, BCC, or BLM Special Status species detected for this assemblage in 2025.

3.3.5. Shorebird

The shorebird assemblage consisted of 97 observations of seven species (Table 3-4). In 2025, Wilson's phalarope was the most detected species (n = 40), followed by Franklin's gull (n = 34), killdeer (*Charadrius vociferus*, n = 13), California gull (n = 7), black-necked stilt (*Himantopus mexicanus*, n = 1), great blue heron (n = 1), and willet (n = 1).

Franklin's gulls, California gulls, and willets are BCCs throughout their range in the contiguous U.S and both gull species are also designated as SGCN in Idaho. Both gull species are colonial nesters, and no breeding habitat exists on the INL Site that can accommodate a colony of these species. All observations of both gull species were on stops 47 and 48 of the Tractor Flats route. This section of the route passes through cropland and is adjacent to a landfill that provides foraging opportunities. This route also ends approximately five miles from the Mud Lake Wildlife Management Area that does have habitat that supports breeding colonies for these two species.

Willetts nest in sagebrush edges and grasslands near ponds or other water sources and may also utilize croplands when available (Lowther et al. 2020). This species has been documented on previous BBSs, usually near the croplands on the Tractor Flats route and was considered relatively uncommon on the INL Site. However, willets were detected on ARUs at two facilities in 2025 (Section 3.5, Appendix B) suggesting that they may use areas near facilities more often than previously thought. It is likely that this species is breeding where appropriate habitat exists on the INL Site.

Wilson's phalaropes are semi-colonial nesters and breed in upland habitats near shallow ponds and lakes with emergent vegetation. They may also use disturbed areas like roadside ditches, hay meadows, and pastures (Carle et al. 2026). All observations in 2025 occurred at the storage lagoons at MFC, where adjacent upland habitats and scattered marsh-like and disturbed grasslands may provide breeding habitat.

3.3.6. Waterfowl

This assemblage consisted of 57 observations of five species (Table 3-4). Species observed included mallard (n = 41), gadwall (*Mareca strepera*, n = 9), northern shoveler (*Spatula clypeata*, n = 4), Canada goose (n = 2), and cinnamon teal (*Spatula cyanoptera*, n = 1).

The cinnamon teal was the only SGCN species detected in this assemblage. Cinnamon teals are ground nesters that nest in dense vegetation near water (Gammonley 2020). While it is possible that the species is nesting on the INL Site, given the limited amount of habitat and detections on BBS routes, it is more likely that the observed individual was transient.

3.3.7. Non-native

This assemblage consisted of 47 observations of three species (Table 3-4). Species observed included European starling (n = 26), house sparrow (n = 20), and rock pigeon (n = 1). Observations of these species occurred on facility routes or in cropland on the Tractor Flats route and were 26.6% lower than the 38-year mean.

3.3.8. Sage-steppe/Woodland

This assemblage consisted of 31 observations of ten species (Table 3-4). Species observed included chipping sparrow (*Spizella passerina*, n = 10), lark sparrow (n = 6), dusky flycatcher (*Empidonax oberholseri*, n = 4), western tanager (*Piranga lucoviciana*, n = 3), gray flycatcher (n = 2), western wood-pewee (*Contopus sordidulus*, n = 2), blue-gray gnatcatcher (n = 1), dark-eyed junco (*Junco hyemalis*, n = 1), hermit thrush (*Catharus guttatus*, n = 1), and northern flicker (*Colaptes auratus*, n = 1). Observations occurred on the Kyle Canyon and Twin Buttes remote routes where there is limited habitat for these species, and at several facilities where trees are present as part of the landscaping. None of the species detected are considered SGCN, BCC, or BLM Special Status.

3.4. Autonomous Recordings Units

Autonomous recordings units were deployed at the four pre-selected facility route stops on 4 June and were retrieved on 17 June. Each unit recorded for a total of 14 days which spanned the entire BBS survey period (5 June–16 June). Over the two-week period, 11 total species were recorded at ATR and MFC, 12 species at RWMC, and 31 species at CFA (Appendix B). The most detected species were the common nighthawk (ATR and RWMC), horned lark (MFC), and western kingbird (CFA) (Appendix B).

The overlap of the number of species detected on the BBS compared to the corresponding ARU recordings from the same morning at the same point ranged between 20–60%. However, facility route stops are relatively close together (320 m), and BBSs do not recount individuals that were documented at a previous stop if they are also detected at a subsequent stop. Depending on the type of call and the acoustics of the immediate landscape, ARUs may pick up calls beyond 320 m. When we considered species detected during the BBS at the two adjacent points to the ARU, species overlap increased to 40–80% depending on location.

Species overlap between the total number of species detected on a BBS route and the total number detected by the ARU over its two week deployment ranged from 30–48%, depending on facility (Table 3-5). The ARUs detected 11 species that were not detected during BBSs on any of the facility or remote routes. These included Bullock’s oriole (*Icterus bullockii*), Cassin’s finch (*Haemorhous cassinii*), common poorwill (*Phalaenoptilus nuttallii*), eastern kingbird (*Tyrannus tyrannus*), lesser goldfinch (*Spinus psaltria*), long-billed curlew (*Numenius americanus*), pine siskin (*Spinus spinus*), western bluebird (*Sialia mexicana*), willow flycatcher (*Empidonax traillii*), yellow warbler (*Setophaga petechia*), and yellow-rumped warbler (*Setophaga coronata*). Ten SGCN, BCC, or BLM Special Status species were detected by the ARUs. These species were Brewer’s sparrow, Cassin’s finch, common nighthawk, loggerhead shrike, long-billed curlew, sage thrasher, sagebrush sparrow, willet, and willow flycatcher.

Table 3-5. Total number of species detected by autonomous recording units (ARUs) and Breeding Bird Surveys (BBSs) at selected facility routes in 2025. Percent overlap is the number of species detected by both the ARU and the BBS divided by the total number of species detected at each facility.

Route	Unique Species on Route	Unique Species on ARU	Species Detected on ARU and Route	Total Species Detected	Percent Overlap (%)
Advanced Test Reactor Complex	12	2	9	23	39.1
Materials and Fuels Complex	19	2	9	30	30.0
Radioactive Waste Management Complex	11	1	11	23	47.8
Central Facilities Area	9	16	15	40	37.5

4. Discussion

General patterns of the most frequently detected species and assemblages remained consistent on BBSs in 2025, and total observation in three of the eight species assemblages exceeded their long-term means. However, total observations on BBS routes across the INL Site have been below average for 12 of the past 15 years. This overall decrease in abundance corresponds to increased wildland fire size and severity on the INL site beginning with the Jefferson Fire in 2011. Big sagebrush cover on the INL Site has decreased to its lowest levels since records began in 1950, primarily due to these wildland fire impacts (Forman 2024). Changes in precipitation patterns, recurring drought, and the reburning of previously impacted areas have altered the vegetation community (Forman 2024). These changes represent ongoing disturbances that influence habitat availability and quality, potentially reducing nest, chick, and adult survival for many breeding bird species.

In addition to localized habitat loss and fragmentation, decreases in bird abundance likely also reflect widespread declines across North America. Rosenberg et al. (2019) reported a nearly 29% reduction in North American bird populations since 1970, resulting in the loss of approximately 3.2 billion birds. Within the Aridlands Biome, which includes the INL Site, bird abundance has declined by 17% (equivalent to 35.6 million individuals) during the same period.

Observations of sagebrush-obligate songbirds on the INL Site remain below the long-term mean, mirroring documented declines across their broader ranges (Ziolkowski et al. 2023). These declines are attributed to habitat loss and fragmentation of sagebrush ecosystems caused by factors such as wildland fire, land conversion, rural expansion, energy infrastructure development, resource extraction, and the spread of invasive annual grasses (Doherty et al. 2022; Pyke and Boyd 2023). Population trend analyses conducted in 2024 (Owens 2025) indicated that Brewer's sparrow and sage thrasher populations on the INL Site are stable to slightly declining. These trends may reflect the positive impacts of management actions aimed at conserving and restoring sagebrush habitat to promote greater sage-grouse population growth, as outlined in the *Candidate Conservation Agreement for Greater Sage-grouse on the Idaho National Laboratory Site (CCA)* (DOE-ID and USFWS 2014). Both Brewer's sparrow and sage thrasher are associated with a higher occurrence probability of greater sage-grouse (Timmer et al. 2019) and may exhibit greater tolerance to some forms of habitat degradation (Miller et al. 2017; Dinkins and Beck 2019).

In contrast, sagebrush sparrow populations on the INL Site are declining (Owens 2025) and appear to respond differently to conservation efforts targeting greater sage-grouse. Research by Timmer et al. (2019) documented lower densities of sagebrush sparrows in areas with high greater sage-grouse occurrence probability in Colorado, while Dinkins and Beck (2019) found no difference in sagebrush sparrow trends between core and non-core conservation areas in Wyoming. These findings suggest that sagebrush sparrows may not fully benefit from the "umbrella effect" of sage-grouse conservation strategies due to differing habitat requirements, such as sagebrush height and structure. However, Kumar et al. (2024) reported that core sagebrush areas, as designated in the *Sagebrush Conservation Design* (Doherty et al. 2022), promoted higher densities of all three sagebrush-obligate songbird species, despite not explicitly accounting for their distribution or abundance. Therefore, ongoing restoration and conservation of sagebrush habitat, as outlined in the CCA, the *Wildland Fire Recovery Framework* (Forman et al. 2024), and the *Revegetation Guide* (INL 2012), may help support sagebrush sparrow populations in the future.

Autonomous recording units (ARUs) were successfully integrated into facility routes in 2025 and recorded 11 species not detected during BBS surveys. Species overlap at specific points was relatively high, except for the MFC route, where overlap was only 20% (40% when adjacent points were considered). This low overlap is partially attributed to the ARU being displaced by an elk prior to the BBS survey. Total species overlap between ARUs and BBSs was below 50% across all routes, likely due to the deployment of only one ARU per facility. Facilities on the INL Site encompass a variety of habitats, including buildings, storage lagoons, riparian areas, landscaping, and adjacent sagebrush, shrub, and grassland habitats. Consequently, a single ARU placed near one or two habitat types may not effectively capture all species present at a facility. To address this limitation, multiple ARUs will be deployed at facilities in 2026 to ensure comprehensive coverage of all habitat types. Additionally, point counts will be conducted during the deployment and retrieval of each ARU, and counts will be specifically completed at storage lagoons and riparian areas to document species less likely to vocalize, such as raptors, waterfowl, and shorebirds.

Although bird observations on the INL Site have declined since 2011, species richness and diversity indices have remained relatively stable. This consistency suggests that the INL Site continues to support a diverse

assemblage of breeding bird species, including many designated as BCC, SGCN, or BLM Special Status species. Continued monitoring of bird populations on the INL Site is recommended, along with engagement in conservation activities such as native vegetation restoration and measures to reduce electrocution events and collisions with infrastructure.

4.1. Future Data Analyses

Given the steep decline of bird populations in North America (Rosenberg et al. 2019), trend analyses for the INL Site should be completed for all species that have sufficient observations, regardless of conservation status. Additionally, finer scale analyses that use individual stops rather than entire routes should be completed to investigate the link between vegetation communities and relative abundance of species commonly observed on the INL Site and to investigate changes in bird communities after disturbance (e.g., wildland fire). Results from these analyses will help to inform restoration actions, planning of new activities, siting of infrastructure, and compliance with both NEPA, Nuclear Regulatory Commission, and Migratory Bird Treaty Act regulations.

5. Literature Cited

- Birds of the World. 2022. Edited by S. M. Billerman, B. K. Keeney, P. G. Rodewald, and T. S. Schulenberg. Cornell Laboratory of Ornithology, Ithaca, NY, USA.
- Bureau of Land Management. 2022. Special Status Species Animal List. Bureau of Land Management.
- Carle, R. D., M. Castellino, K. Tarr, A. E. McKellar, S. M. Miller, R. J. Larson, P. Gigy Gregoret, N. D. Van Schmidt, A. J. Lesterhuis, R. P. Clay, B. W. Abbott, M. A. Colwell, J. R. Jehl Jr., and P. Pyle. 2026. Wilson's phalarope (*Phalaropus tricolor*), version 2.0 In Birds of the World edited by N. D. Sly, Cornell Lab of Ornithology, Ithaca, NY.
- Coates, P. S., S. T. O'Neil, B. E. Brussee, M. A. Ricca, P. J. Jackson, J. B. Dinkins, K. B. Howe, A. M. Moser, L. J. Foster, and D. J. Delehanty. 2020. Broad-scale impacts of an invasive native predator on a sensitive native prey species within the shifting avian community of the North American Great Basin. *Biological Conservation* 243:108409.
- Coates, P. S., W. C. Webb, S. J. Dettenmaier, S. M. Harju, and D. J. Delehanty. 2021. Synthesis of nest predation impacts of common ravens on sensitive avian species. *Human-Wildlife Interactions* 15:3.
- Darras, K., P. Batáry, B. J. Furnas, I. Grass, Y. A. Mulyani, and T. Tschardt. 2019. Autonomous sound recording outperforms human observation for sampling birds: a systematic map and user guide. *Ecological Applications* 29(6):e01954.
- 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, ID. https://inl.gov/content/uploads/2023/08/CCA_2014-1.pdf.
- Dinkins, J. B., and J. L. Beck. 2019. Comparison of conservation policy benefits for an umbrella and related sagebrush-obligate species. *Human-Wildlife Interactions* 13(3):13.
- Dinkins, J. B., L. R. Perry, J. L. Beck, and J. D. Taylor. 2021. Increased abundance of the common raven within the ranges of greater and Gunnison sage-grouse: influence of anthropogenic subsidies and fire. *Human-Wildlife Interactions* 15(3):6.
- Doherty, K., D. M. Theobald, J. B. Bradford, L. A. Weichman, G. Bedrosian, C. S. Boyd, M. Cahill, P. S. Coates, M. K. Creutzburg, M. R. Crist, S. P. Finn, A. V. Kumar, C. E. Littlefield, J. D. Maestas, K. L. Prentice, B. G. Prochazka, T. E. Remington, W. D. Sparklin, J. C. Tull, Z. Wurtzback, and K. A. Zeller. 2022. A sagebrush conservation design to proactively restore America's sagebrush biome. U.S. Geological Survey Open-File Report 2022-1081. <https://doi.org/10.3133/ofr20221081>.
- Drake, A., D. R. de Zwaan, T. A. Altamirano, S. Wilson, K. Hick, C. Bravo, J. T. Ibarra, and K. Martin. 2021. Combining point counts and autonomous recording units improves avian survey efficacy across elevational gradients on two continents. *Ecology and Evolution* 11(13):8654-8682.
- Forman, A. D. 2024. The Idaho National Laboratory Site Long-Term Vegetation transects: updates through 2022. Idaho National Laboratory, Natural Resources Group, Idaho Falls, ID. INL/RPT-24-80913. <https://inl.gov/content/uploads/2023/07/The-Idaho-National-Laboratory-Site-Long-Term-Vegetation-Transects-Updates-Through-2022.pdf>.
- Forman, A. D., C. J. Kramer, J. P. Shive, S. R. Williams, K. N. Kaser, and B. F. Bybee. 2024. Idaho National Laboratory Site Natural Resources Wildland Fire Recovery Framework. Idaho National Laboratory, Natural Resources Group, Idaho Falls, ID. INL/RPT-24-76050. <https://inl.gov/content/uploads/2024/03/INL-Natural-Resources-Fire-Recovery-Framework-Final.pdf>.
- Gammonley, J. H. 2020. Cinnamon teal (*Spatula cyanoptera*), version 1.0 In Birds of the World edited by A. F. Poole, Cornell Lab of Ornithology, Ithaca, NY.
- Harju, S. M., P. S. Coates, S. J. Dettenmaier, J. B. Dinkins, P. J. Jackson, and M. P. Chenaille. 2021. Estimating trends of common raven populations in North America, 1966-2018. *Human-Wildlife Interactions* 15(3):5.

- IDFG. 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>
- IDFG. 2024. Idaho State Wildlife Action Plan. 2023 rev. ed. Boise (ID): Idaho Department of Fish and Game. <https://idfg.idaho.gov/>.
- INL. 2012. INL Revegetation Guide. GDE-8525. Idaho National Laboratory Site, Idaho Falls, ID.
- Kahl, S., C. M. Wood, M. Eibl, and H. Klinck. 2021. BirdNET: A deep learning solution for avian diversity monitoring. *Ecological Informatics* 61:101236.
- Klingbeil, B. T., and M. R. Willig. 2015. Bird biodiversity assessments in temperate forests: the value of point count versus acoustic monitoring protocols. *PeerJ* 3:e973.
- Kramber, W. J., R. C. Rope, J. E. Anderson, J. E. Glennon, and A. Morse. 1992. Producing a vegetation map of the Idaho National Engineering Laboratory using Landsat thematic mapper data. Page 217–226 in American Society for Photogrammetry and Remote Sensing/American Congress on Surveying and Mapping Annual Meeting Technical Papers. Vol. 1.
- Kumar, A. V., J. D. Tack, K. E. Doherty, J. T. Smith, B. E. Ross, and G. Bedrosian. 2024. Defend and grow the core for birds: how a sagebrush conservation strategy benefits rangeland birds. *Rangeland Ecology and Management* 97:160–168.
- Lowther, P. E., H. D., Douglass III, and C. L. Gratto-Trevor. 2020. Willet (*Tringa semipalmata*), version 1.0 In *Birds of the World* edited by A. F. Poole and F. B. Gill, Cornell Lab of Ornithology, Ithaca, NY.
- Manzano-Rubio, R., G. Bota, L. Brotons, E. Soto-Largo, and C. Pérez-Granados. 2022. Low-cost open-source recorders and ready-to-use machine learning approaches provide effective monitoring of threatened species. *Ecological Informatics* 72:101910.
- Miller, R. A., L. Bond, P. N. Migas, J. D. Carlisle, and G. S. Kaltenecker. 2017. Contrasting habitat associations of sagebrush-steppe songbirds in the intermountain west. *West Birds* 48:35–55.
- National Audubon Society. 2013. Important Bird Areas in the U.S. Retrieved from <https://www.audubon.org/important-bird-areas/idaho-national-laboratory-inl>.
- North American Bird Conservation Initiative. 2021. Bird Conservation Regions. U.S. North American Bird Conservation Initiative (NABCI). Washington D.C., USA. <https://nabci-us.org/resources/bird-conservation-regions/> Accessed November 18, 2024.
- Owens, T. M. 2025. 2024 Breeding Bird Surveys on the Idaho National Laboratory Site. Idaho National Laboratory, Natural Resources Group, Idaho Falls, ID. INL/RPT-25-83402. <https://inl.gov/content/uploads/2025/04/2024-Breeding-Bird-Survey-Report.pdf>.
- Pérez-Granados, C., and J. Traba. 2021. Estimating bird density using passive acoustic monitoring: a review of methods and suggestions for further research. *Ibis* 163(3):765–783.
- Pyke, D. A., and C. S. Boyd. 2023. Manipulation of rangeland wildlife habitats. In *Rangeland Wildlife Ecology and Conservation*, edited by L. B. McNew, J. L. Beck, and D. K. Dahlgren, 107–146. Cham, Switzerland: Springer.
- Rosenberg, K. V., A. M. Dokter, P. J. Blancher, J. R. Sauer, A. C. Smith, P. A. Smith, J. C. Stanton, A. Panjabi, L. Helft, M. Parr, and P. P. Marra. 2019. Decline of the North American avifauna. *Science* 366:120–124.
- Sauer, J. R., K. L. Pardieck, D. J. Ziolkowski, A. C. Smith, M-A. R. Hudson, V. Rodriguez, H. Berlanga, D. K. Niven, and W. A. Link. 2017. The first 50 years of the North American Breeding Bird Survey. *The Condor* 119:576–593.
- 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 Idaho National Laboratory Site. GSS-ESER-144, Environmental Surveillance, Education, and Research Program Report, Gonzales-Stoller Surveillance LLC, Idaho Falls, ID. <https://inl.gov/content/uploads/2023/08/VegMap2011.pdf>.
- Shive, J. P., A. D. Forman, A. Bayless-Edwards, K. Aho, K. N Kaser, J. R. Hafila, and K. T. Edwards. 2019. Vegetation community classification and mapping of the Idaho National Laboratory Site 2019. VSF-ID-ESER-

- LAND-064. Environmental Surveillance, Education, and Research Program, Idaho Falls, ID.
<https://inl.gov/content/uploads/2023/09/Vegetation-Community-Classification-and-Mapping-of-the-INL-Site-2019.pdf>.
- Shonfield, J., and E. M. Bayne. 2017. Autonomous recording units in avian ecological research: current use and future applications. *Avian Conservation & Ecology* 12(1):14.
- Timmer, J. M., C. L. Aldridge, and M. E. Fernández-Giménez. 2019. Managing for multiple species: greater sage-grouse and sagebrush songbirds. *The Journal of Wildlife Management* 83(5):1043–1056.
- U.S. Department of Energy and the U.S. Fish and Wildlife Service. 2013. Memorandum of Understanding between the United States Department of Energy and the United States Fish and Wildlife Service Regarding Implementation of Executive Order 13186, “Responsibilities of Federal Agencies to Protect Migratory Birds”, 20 pp.
- U.S. Fish and Wildlife Service. 2021. Birds of Conservation Concern 2021. United States Department of the Interior, U.S. Fish and Wildlife Service, Migratory Birds, Falls Church, VA.
- U. S. Fish and Wildlife Service. 2026. 50 CFR Part 17 Endangered and Threatened Wildlife and Plants; 90-day findings of 10 species. (proposed rule). Federal Register 91:3096–3101. U.S. Department of Interior, Fish and Wildlife Service, Washington, DC.
- U.S. Geological Survey. 2025. Instructions for conducting the North American Breeding Bird Survey. U.S. Geological Survey, Patuxent Wildlife Research Center, Laurel, MD, USA.
- Van Doren, B. M., A. Farnsworth, K. Stone, D. M. Osterhaus, J. Drucker, and G. Van Horn. 2023. *Nighthawk*: Acoustic monitoring of nocturnal bird migration in the Americas. *Methods in Ecology and Evolution* 15(2):329–344.
- Ziolkowski, Jr., D. J., M. Lutmerding, W. B. English, V. I. Aponte, and M-A. R. Hudson. 2023. North American Breeding Bird Survey dataset 1966–2022. U.S. Geological Survey data release, <https://doi.org/10.5066/P9GS9K64>

Appendix A: Summary of Species by Route 2025

Table A-1. Abundance and percentage of species observed on the Advanced Test Reactor Complex Breeding Bird Survey Route at the Idaho National Laboratory Site on June 12, 2025.

Common Name	Scientific Name	Abundance	Percentage
horned lark	<i>Eremophila alpestris</i>	122	39.10
western meadowlark	<i>Sturnella neglecta</i>	69	22.12
Brewer's sparrow	<i>Spizella breweri</i>	26	8.33
barn swallow	<i>Hirundo rustica</i>	20	6.41
common raven	<i>Corvus corax</i>	13	4.17
vesper sparrow	<i>Pooecetes gramineus</i>	12	3.85
house finch	<i>Carpodacus mexicanus</i>	9	2.88
mourning dove	<i>Zenaida macroura</i>	7	2.24
American robin	<i>Turdus migratorius</i>	5	1.60
brown-headed cowbird	<i>Molothrus ater</i>	5	1.60
common nighthawk	<i>Chordeiles minor</i>	4	1.28
sagebrush sparrow	<i>Artemisiospiza nevadensis</i>	4	1.28
house sparrow	<i>Passer domesticus</i>	3	0.96
red-winged blackbird	<i>Agelaius phoeniceus</i>	3	0.96
sage thrasher	<i>Oreoscoptes montanus</i>	3	0.96
Swainson's hawk	<i>Buteo swainsoni</i>	2	0.64
dark-eyed junco	<i>Junco hyemalis</i>	1	0.32
European starling	<i>Sturnus vulgaris</i>	1	0.32
hermit thrush	<i>Catharus guttatus</i>	1	0.32
rock pigeon	<i>Columbo livia</i>	1	0.32
Say's phoebe	<i>Sayornis saya</i>	1	0.32
Total Observations		312	
Total Species		21	

Table A-2. Abundance and percentage of species observed on the Central Facilities Area Breeding Bird Survey Route at the Idaho National Laboratory Site on June 13, 2025.

Common Name	Scientific Name	Observations	Percentage
horned lark	<i>Eremophila alpestris</i>	100	31.75
Brewer's sparrow	<i>Spizella breweri</i>	33	10.48
western meadowlark	<i>Sturnella neglecta</i>	21	6.67
European starling	<i>Sturnus vulgaris</i>	17	5.40
sagebrush sparrow	<i>Artemisospiza nevadensis</i>	17	5.40
house sparrow	<i>Passer domesticus</i>	16	5.08
sage thrasher	<i>Oreoscoptes montanus</i>	16	5.08
cliff swallow	<i>Hirundo pyrrhonota</i>	15	4.76
house finch	<i>Carpodacus mexicanus</i>	15	4.76
American robin	<i>Turdus migratorius</i>	12	3.81
common raven	<i>Corvus corax</i>	9	2.86
mourning dove	<i>Zenaida macroura</i>	8	2.54
common nighthawk	<i>Chordeiles minor</i>	7	2.22
western kingbird	<i>Tyrannus verticalis</i>	7	2.22
killdeer	<i>Charadrius vociferus</i>	5	1.59
barn swallow	<i>Hirundo rustica</i>	4	1.27
Brewer's blackbird	<i>Euphagus cyanocephalus</i>	4	1.27
northern harrier	<i>Circus hudsonius</i>	2	0.63
Say's phoebe	<i>Sayornis saya</i>	2	0.63
American kestrel	<i>Falco sparverius</i>	1	0.32
loggerhead shrike	<i>Lanius ludovicianus</i>	1	0.32
northern flicker	<i>Colaptes auratus</i>	1	0.32
Swainson's hawk	<i>Buteo swainsoni</i>	1	0.32
western tanager	<i>Piranga ludoviciana</i>	1	0.32
Total Observations		315	
Total Species		24	

Table A-3. Abundance and percentage of species observed on the Circular Butte Breeding Bird Survey Route at the Idaho National Laboratory Site on June 5, 2025.

Common Name	Scientific Name	Observations	Percentage
horned lark	<i>Eremophila alpestris</i>	264	76.30
western meadowlark	<i>Sturnella neglecta</i>	28	8.09
Brewer's sparrow	<i>Spizella breweri</i>	15	4.34
common raven	<i>Corvus corax</i>	12	3.47
sagebrush sparrow	<i>Artemisiospiza nevadensis</i>	9	2.60
vesper sparrow	<i>Poocetes gramineus</i>	5	1.45
northern harrier	<i>Circus hudsonius</i>	4	1.16
grasshopper sparrow	<i>Ammodramus savannarum</i>	2	0.58
loggerhead shrike	<i>Lanius ludovicianus</i>	2	0.58
Canada goose	<i>Branta canadensis</i>	1	0.29
ferruginous hawk	<i>Buteo regalis</i>	1	0.29
sage thrasher	<i>Oreoscoptes montanus</i>	1	0.29
savannah sparrow	<i>Passerculus sandwichensis</i>	1	0.29
willet	<i>Catoptrophorus semipalmatus</i>	1	0.29
Total Observations		346	
Total Species		14	

Table A-4. Abundance and percentage of species observed on the Critical Infrastructure Test Range Complex Breeding Bird Survey Route at the Idaho National Laboratory Site on June 13, 2025.

Common Name	Scientific Name	Observations	Percentage
horned lark	<i>Eremophila alpestris</i>	220	60.94
western meadowlark	<i>Sturnella neglecta</i>	49	13.57
Brewer's sparrow	<i>Spizella breweri</i>	27	7.48
vesper sparrow	<i>Pooecetes gramineus</i>	14	3.88
Brewer's blackbird	<i>Euphagus cyanocephalus</i>	12	3.32
mourning dove	<i>Zenaidura macroura</i>	10	2.77
sage thrasher	<i>Oreoscoptes montanus</i>	8	2.22
Say's phoebe	<i>Sayornis saya</i>	6	1.66
rock wren	<i>Salpinctes obsoletus</i>	4	1.11
common nighthawk	<i>Chordeiles minor</i>	3	0.83
sagebrush sparrow	<i>Artemisiospiza nevadensis</i>	3	0.83
Swainson's hawk	<i>Buteo swainsoni</i>	2	0.55
Canada goose	<i>Branta canadensis</i>	1	0.28
great horned owl	<i>Bubo virginianus</i>	1	0.28
northern harrier	<i>Circus hudsonius</i>	1	0.28
Total Observations		361	
Total Species		15	

Table A-5. Abundance and percentage of species observed on the Idaho Nuclear Technology and Engineering Center Breeding Bird Survey Route at the Idaho National Laboratory Site on June 11, 2025.

Common Name	Scientific Name	Observations	Percentage
horned lark	<i>Eremophila alpestris</i>	106	47.75
Brewer's sparrow	<i>Spizella breweri</i>	25	11.26
sage thrasher	<i>Oreoscoptes montanus</i>	18	8.11
common nighthawk	<i>Chordeiles minor</i>	17	7.66
western meadowlark	<i>Sturnella neglecta</i>	15	6.76
sagebrush sparrow	<i>Artemisiospiza nevadensis</i>	8	3.60
American robin	<i>Turdus migratorius</i>	4	1.80
common raven	<i>Corvus corax</i>	4	1.80
Say's phoebe	<i>Sayornis saya</i>	4	1.80
barn swallow	<i>Hirundo rustica</i>	3	1.35
killdeer	<i>Charadius vociferus</i>	3	1.35
mallard	<i>Anas platyrhynchos</i>	3	1.35
red-winged blackbird	<i>Agelaius phoeniceus</i>	3	1.35
brown-headed cowbird	<i>Molothrus ater</i>	2	0.90
chipping sparrow	<i>Spizella passerina</i>	2	0.90
house finch	<i>Carpodacus mexicanus</i>	2	0.90
Brewer's blackbird	<i>Euphagus cyanocephalus</i>	1	0.45
loggerhead shrike	<i>Lanius ludovicianus</i>	1	0.45
mourning dove	<i>Zenaida macroura</i>	1	0.45
Total Observations		222	
Total Species		19	

Table A-6. Abundance and percentage of species observed on the Kyle Canyon Breeding Bird Survey Route at the Idaho National Laboratory Site on June 12, 2025.

Common Name	Scientific Name	Observations	Percentage
western meadowlark	<i>Sturnella neglecta</i>	65	24.53
sagebrush sparrow	<i>Artemisospiza nevadensis</i>	55	20.75
horned lark	<i>Eremophila alpestris</i>	47	17.74
sage thrasher	<i>Oreoscoptes montanus</i>	16	6.04
mourning dove	<i>Zenaida macroura</i>	14	5.28
Brewer's sparrow	<i>Spizella breweri</i>	12	4.53
common raven	<i>Corvus corax</i>	8	3.02
chipping sparrow	<i>Spizella passerina</i>	7	2.64
ferruginous hawk	<i>Buteo regalis</i>	5	1.89
lark sparrow	<i>Chondestes grammacus</i>	5	1.89
loggerhead shrike	<i>Lanius ludovicianus</i>	5	1.89
black-billed magpie	<i>Pica hudsonia</i>	4	1.51
Brewer's blackbird	<i>Euphagus cyanocephalus</i>	4	1.51
dusky flycatcher	<i>Empidonax oberholseri</i>	4	1.51
common nighthawk	<i>Chordeiles minor</i>	3	1.13
gray flycatcher	<i>Empidonax wrightii</i>	2	0.75
western kingbird	<i>Tyrannus verticalis</i>	2	0.75
western wood-pewee	<i>Contopus sordidulus</i>	2	0.75
American robin	<i>Turdus migratorius</i>	1	0.38
blue-gray gnatcatcher	<i>Polioptila caerulea</i>	1	0.38
red-tailed hawk	<i>Buteo jamaicensis</i>	1	0.38
vesper sparrow	<i>Pooecetes gramineus</i>	1	0.38
western tanager	<i>Piranga ludoviciana</i>	1	0.38
Total Observations		265	
Total Species		23	

Table A-7. Abundance and percentage of species observed on the Lost River Breeding Bird Survey Route at the Idaho National Laboratory Site on June 10, 2025.

Common Name	Scientific Name	Observations	Percentage
horned lark	<i>Eremophila alpestris</i>	155	47.84
western meadowlark	<i>Sturnella neglecta</i>	53	16.36
Brewer's sparrow	<i>Spizella breweri</i>	41	12.65
sagebrush sparrow	<i>Artemisospiza nevadensis</i>	28	8.64
vesper sparrow	<i>Pooecetes gramineus</i>	13	4.01
sage thrasher	<i>Oreoscoptes montanus</i>	8	2.47
common nighthawk	<i>Chordeiles minor</i>	6	1.85
common raven	<i>Corvus corax</i>	5	1.54
American robin	<i>Turdus migratorius</i>	3	0.93
grasshopper sparrow	<i>Ammodramus savannarum</i>	3	0.93
Swainson's hawk	<i>Buteo swainsoni</i>	3	0.93
American kestrel	<i>Falco sparverius</i>	2	0.62
mourning dove	<i>Zenaida macroura</i>	2	0.62
brown-headed cowbird	<i>Molothrus ater</i>	1	0.31
northern harrier	<i>Circus hudsonius</i>	1	0.31
Total Observations		324	
Total Species		15	

Table A-8. Abundance and percentage of species observed on the Materials and Fuels Complex Breeding Bird Survey Route at the Idaho National Laboratory Site on June 16, 2025.

Common Name	Scientific Name	Observations	Percentage
Wilson's phalarope	<i>Phalaropus tricolor</i>	40	19.42
horned lark	<i>Eremophila alpestris</i>	37	17.96
mallard	<i>Anas platyrhynchos</i>	36	17.48
cliff swallow	<i>Hirundo pyrrhonota</i>	18	8.74
mourning dove	<i>Zenaida macroura</i>	10	4.85
western meadowlark	<i>Sturnella neglecta</i>	10	4.85
barn swallow	<i>Hirundo rustica</i>	8	3.88
gadwall	<i>Mareca strepera</i>	7	3.40
yellow-headed blackbird	<i>Xanthocephalus xanthocephalus</i>	7	3.40
red-winged blackbird	<i>Agelaius phoeniceus</i>	5	2.43
European starling	<i>Sturnus vulgaris</i>	4	1.94
common nighthawk	<i>Chordeiles minor</i>	3	1.46
common raven	<i>Corvus corax</i>	3	1.46
Brewer's sparrow	<i>Spizella breweri</i>	2	0.97
killdeer	<i>Charadrius vociferus</i>	2	0.97
sagebrush sparrow	<i>Artemisiospiza nevadensis</i>	2	0.97
American robin	<i>Turdus migratorius</i>	1	0.49
black-necked stilt	<i>Himantopus mexicanus</i>	1	0.49
cinnamon teal	<i>Anas cyanoptera</i>	1	0.49
gray catbird	<i>Dumetella carolinensis</i>	1	0.49
great blue heron	<i>Ardea herodias</i>	1	0.49
loggerhead shrike	<i>Lanius ludovicianus</i>	1	0.49
northern shoveler	<i>Spatula clypeata</i>	1	0.49
sage thrasher	<i>Oreoscoptes montanus</i>	1	0.49
Say's phoebe	<i>Sayornis saya</i>	1	0.49
Swainson's hawk	<i>Buteo swainsoni</i>	1	0.49
vesper sparrow	<i>Pooecetes gramineus</i>	1	0.49
western kingbird	<i>Tyrannus verticalis</i>	1	0.49
Total Observations		206	
Total Species		28	

Table A-9. Abundance and percentage of species observed on the Naval Reactors Facility Breeding Bird Survey Route at the Idaho National Laboratory Site on June 5, 2025.

Common Name	Scientific Name	Observations	Percentage
horned lark	<i>Eremophila alpestris</i>	44	32.59
western meadowlark	<i>Sturnella neglecta</i>	30	22.22
Brewer's sparrow	<i>Spizella breweri</i>	12	8.89
sagebrush sparrow	<i>Artemisospiza nevadensis</i>	11	8.15
common raven	<i>Corvus corax</i>	7	5.19
Say's phoebe	<i>Sayornis saya</i>	7	5.19
house finch	<i>Carpodacus mexicanus</i>	5	3.70
sage thrasher	<i>Oreoscoptes montanus</i>	4	2.96
barn swallow	<i>Hirundo rustica</i>	3	2.22
mourning dove	<i>Zenaida macroura</i>	2	1.48
northern mockingbird	<i>Mimus polyglottos</i>	2	1.48
American robin	<i>Turdus migratorius</i>	1	0.74
brown-headed cowbird	<i>Molothrus ater</i>	1	0.74
European starling	<i>Sturnus vulgaris</i>	1	0.74
grasshopper sparrow	<i>Ammodramus savannarum</i>	1	0.74
mallard	<i>Anas platyrhynchos</i>	1	0.74
rock wren	<i>Salpinctes obsoletus</i>	1	0.74
Swainson's hawk	<i>Buteo swainsoni</i>	1	0.74
western tanager	<i>Piranga ludoviciana</i>	1	0.74
Total Observations		135	
Total Species		19	

Table A-10. Abundance and percentage of species observed on the Radioactive Waste Management Complex Breeding Bird Survey Route at the Idaho National Laboratory Site on June 9, 2025.

Common Name	Scientific Name	Observations	Percentage
western meadowlark	<i>Sturnella neglecta</i>	37	21.51
Brewer's sparrow	<i>Spizella breweri</i>	24	13.95
barn swallow	<i>Hirundo rustica</i>	22	12.79
horned lark	<i>Eremophila alpestris</i>	22	12.79
common nighthawk	<i>Chordeiles minor</i>	12	6.98
sage thrasher	<i>Oreoscoptes montanus</i>	9	5.23
Brewer's blackbird	<i>Euphagus cyanocephalus</i>	8	4.65
sagebrush sparrow	<i>Artemisiospiza nevadensis</i>	6	3.49
mourning dove	<i>Zenaidura macroura</i>	5	2.91
Say's phoebe	<i>Sayornis saya</i>	5	2.91
common raven	<i>Corvus corax</i>	4	2.33
killdeer	<i>Charadrius vociferus</i>	3	1.74
northern shoveler	<i>Spatula clypeata</i>	3	1.74
cliff swallow	<i>Hirundo pyrrhonota</i>	2	1.16
gadwall	<i>Mareca strepera</i>	2	1.16
rock wren	<i>Salpinctes obsoletus</i>	2	1.16
American goldfinch	<i>Carduelis tristis</i>	1	0.58
American kestrel	<i>Falco sparverius</i>	1	0.58
brown-headed cowbird	<i>Molothrus ater</i>	1	0.58
chipping sparrow	<i>Spizella passerina</i>	1	0.58
house finch	<i>Carpodacus mexicanus</i>	1	0.58
northern mockingbird	<i>Mimus polyglottos</i>	1	0.58
Total Observations		172	
Total Species		22	

Table A-11. Abundance and percentage of species observed on the Test Area North Breeding Bird Survey Route at the Idaho National Laboratory Site on June 6, 2025.

Common Name	Scientific Name	Observations	Percentage
horned lark	<i>Eremophila alpestris</i>	122	44.04
sagebrush sparrow	<i>Artemisospiza nevadensis</i>	70	25.27
Brewer's sparrow	<i>Spizella breweri</i>	32	11.55
sage thrasher	<i>Oreoscoptes montanus</i>	32	11.55
common raven	<i>Corvus corax</i>	5	1.81
mourning dove	<i>Zenaida macroura</i>	4	1.44
vesper sparrow	<i>Pooecetes gramineus</i>	3	1.08
loggerhead shrike	<i>Lanius ludovicianus</i>	2	0.72
northern harrier	<i>Circus hudsonius</i>	2	0.72
savannah sparrow	<i>Passerculus sandwichensis</i>	2	0.72
western meadowlark	<i>Sturnella neglecta</i>	2	0.72
barn swallow	<i>Hirundo rustica</i>	1	0.36
Total Observations		277	
Total Species		12	

Table A-12. Abundance and percentage of species observed on the Tractor Flats Breeding Bird Survey Route at the Idaho National Laboratory Site on June 11, 2025.

Common Name	Scientific Name	Observations	Percentage
horned lark	<i>Eremophila alpestris</i>	164	30.26
common raven	<i>Corvus corax</i>	104	19.19
western meadowlark	<i>Sturnella neglecta</i>	75	13.84
Brewer's sparrow	<i>Spizella breweri</i>	51	9.41
Franklin's gull	<i>Larus pipixcan</i>	34	6.27
sagebrush sparrow	<i>Artemisiospiza nevadensis</i>	16	2.95
mourning dove	<i>Zenaida macroura</i>	14	2.58
sage thrasher	<i>Oreoscoptes montanus</i>	12	2.21
vesper sparrow	<i>Pooecetes gramineus</i>	9	1.66
common nighthawk	<i>Chordeiles minor</i>	8	1.48
barn swallow	<i>Hirundo rustica</i>	7	1.29
black-billed magpie	<i>Pica hudsonia</i>	7	1.29
California gull	<i>Larus californicus</i>	7	1.29
bank swallow	<i>Riparia riparia</i>	6	1.11
grasshopper sparrow	<i>Ammodramus savannarum</i>	5	0.92
western kingbird	<i>Tyrannus verticalis</i>	5	0.92
European starling	<i>Sturnus vulgaris</i>	3	0.55
loggerhead shrike	<i>Lanius ludovicianus</i>	3	0.55
savannah sparrow	<i>Passerculus sandwichensis</i>	3	0.55
Swainson's hawk	<i>Buteo swainsoni</i>	3	0.55
American kestrel	<i>Falco sparverius</i>	1	0.18
house sparrow	<i>Passer domesticus</i>	1	0.18
mallard	<i>Anas platyrhynchos</i>	1	0.18
northern harrier	<i>Circus hudsonius</i>	1	0.18
red-winged blackbird	<i>Agelaius phoeniceus</i>	1	0.18
Say's phoebe	<i>Sayornis saya</i>	1	0.18
Total Observations		542	
Total Species		26	

Table A-13. Abundance and percentage of species observed on the Twin Buttes Breeding Bird Survey Route at the Idaho National Laboratory Site on June 9, 2025.

Common Name	Scientific Name	Observations	Percentage
horned lark	<i>Eremophila alpestris</i>	92	34.20
western meadowlark	<i>Sturnella neglecta</i>	51	18.96
Brewer's sparrow	<i>Spizella breweri</i>	28	10.41
sagebrush sparrow	<i>Artemisiospiza nevadensis</i>	22	8.18
common raven	<i>Corvus corax</i>	14	5.20
sage thrasher	<i>Oreoscoptes montanus</i>	13	4.83
common nighthawk	<i>Chordeiles minor</i>	12	4.46
mourning dove	<i>Zenaida macroura</i>	9	3.35
vesper sparrow	<i>Pooecetes gramineus</i>	9	3.35
brown-headed cowbird	<i>Molothrus ater</i>	4	1.49
loggerhead shrike	<i>Lanius ludovicianus</i>	3	1.12
rock wren	<i>Salpinctes obsoletus</i>	2	0.74
savannah sparrow	<i>Passerculus sandwichensis</i>	2	0.74
Swainson's hawk	<i>Buteo swainsoni</i>	2	0.74
American kestrel	<i>Falco sparverius</i>	1	0.37
lark sparrow	<i>Chondestes grammacus</i>	1	0.37
prairie falcon	<i>Falco mexicanus</i>	1	0.37
red-tailed hawk	<i>Buteo jamaicensis</i>	1	0.37
Say's phoebe	<i>Sayornis saya</i>	1	0.37
western kingbird	<i>Tyrannus verticalis</i>	1	0.37
Total Individuals		269	
Total Species		20	

Appendix B: Summary of Species for Autonomous Recording Units by Stop 2025

Table B-1. Species detected by autonomous recording unit at Stop #11 of the Advanced Test Reactor Complex Breeding Bird Survey Route at the Idaho National Laboratory Site between June 4 and June 17, 2025.

Common Name	Scientific Name	Number of Detections	Percentage of Detections
common nighthawk	<i>Chordeiles minor</i>	7,261	92.17
Brewer's sparrow	<i>Spizella breweri</i>	456	5.79
horned lark	<i>Eremophila alpestris</i>	37	0.47
willet	<i>Catoptrophorus semipalmatus</i>	31	0.39
brown-headed cowbird	<i>Molothrus ater</i>	29	0.37
western meadowlark	<i>Sturnella neglecta</i>	28	0.36
sage thrasher	<i>Oreoscoptes montanus</i>	18	0.23
killdeer	<i>Charadius vociferus</i>	8	0.10
mourning dove	<i>Zenaida macroura</i>	8	0.10
American robin	<i>Turdus migratorius</i>	1	0.01
Swainson's hawk	<i>Buteo swainsoni</i>	1	0.01
Total		7,878	

Table B-2. Species detected by autonomous recording unit at Stop #6 of the Central Facilities Area Breeding Bird Survey Route at the Idaho National Laboratory Site between June 4 and June 17, 2025.

Common Name	Scientific Name	Number of Detections	Percentage of Detections
western kingbird	<i>Tyrannus verticalis</i>	5,100	63.02
house finch	<i>Carpodacus mexicanus</i>	1,608	19.87
common nighthawk	<i>Chordeiles minor</i>	201	2.48
house sparrow	<i>Passer domesticus</i>	188	2.32
American robin	<i>Turdus migratorius</i>	187	2.31
Bullock's oriole	<i>Icterus bullockii</i>	163	2.01
European starling	<i>Sturnus vulgaris</i>	107	1.32
Brewer's blackbird	<i>Euphagus cyanocephalus</i>	105	1.30
western wood-pewee	<i>Contopus sordidulus</i>	72	0.89
brown-headed cowbird	<i>Molothrus ater</i>	71	0.88
mourning dove	<i>Zenaida macroura</i>	57	0.70
killdeer	<i>Charadrius vociferus</i>	47	0.58
Say's phoebe	<i>Sayornis saya</i>	44	0.54
western tanager	<i>Piranga ludoviciana</i>	32	0.40
barn swallow	<i>Hirundo rustica</i>	22	0.27
cliff swallow	<i>Hirundo pyrrhonota</i>	15	0.19
eastern kingbird	<i>Tyrannus tyrannus</i>	13	0.16
western bluebird	<i>Sialia mexicana</i>	12	0.15
lesser goldfinch	<i>Spinus psaltria</i>	9	0.11
common poorwill	<i>Phalaenoptilus nuttallii</i>	6	0.07
willow flycatcher	<i>Empidonax traillii</i>	6	0.07
yellow warbler	<i>Setophaga aestiva</i>	6	0.07
willet	<i>Tringa semipalmata</i>	5	0.06
Swainson's hawk	<i>Buteo swainsoni</i>	4	0.05
gray flycatcher	<i>Empidonax wrightii</i>	3	0.04
pine siskin	<i>Spinus pinus</i>	3	0.04
loggerhead shrike	<i>Lanius ludovicianus</i>	2	0.02
yellow-rumped warbler	<i>Setophaga coronata</i>	2	0.02
Cassin's finch	<i>Haemorhous cassinii</i>	1	0.01
dusky flycatcher	<i>Empidonax oberholseri</i>	1	0.01
great horned owl	<i>Bubo virginianus</i>	1	0.01
Total		8,093	

Table B-3. Species detected by autonomous recording unit at Stop #6 of the Materials and Fuels Complex Breeding Bird Survey Route at the Idaho National Laboratory Site between June 4 and June 17, 2025.

Common Name	Scientific Name	Number of Detections	Percentage of Detections
horned lark	<i>Eremophila alpestris</i>	713	56.99
common nighthawk	<i>Chordeiles minor</i>	363	29.02
western meadowlark	<i>Sturnella neglecta</i>	49	3.92
sage thrasher	<i>Oreoscoptes montanus</i>	31	2.48
killdeer	<i>Charadrius vociferus</i>	29	2.32
yellow-headed blackbird	<i>Xanthocephalus xanthocephalus</i>	29	2.32
gadwall	<i>Mareca strepera</i>	18	1.44
Say's phoebe	<i>Sayornis saya</i>	8	0.64
long-billed curlew	<i>Numenius americanus</i>	5	0.40
common raven	<i>Corvus corax</i>	4	0.32
Canada goose	<i>Branta canadensis</i>	2	0.16
Total		1,251	

Table B-4. Species detected by autonomous recording unit at Stop #5 of the Radioactive Waste Management Complex Breeding Bird Survey Route at the Idaho National Laboratory Site between June 3 and June 16, 2025.

Common Name	Scientific Name	Number of Detections	Percentage of Detections
common nighthawk	<i>Chordeiles minor</i>	4,493	88.25
Brewer's sparrow	<i>Spizella breweri</i>	240	4.71
sagebrush sparrow	<i>Artemisiospiza nevadensis</i>	190	3.73
house finch	<i>Carpodacus mexicanus</i>	42	0.82
barn swallow	<i>Hirundo rustica</i>	40	0.79
killdeer	<i>Charadrius vociferus</i>	26	0.51
horned lark	<i>Eremophila alpestris</i>	23	0.45
gadwall	<i>Mareca strepera</i>	17	0.33
Say's phoebe	<i>Sayornis saya</i>	10	0.20
western meadowlark	<i>Sturnella neglecta</i>	6	0.12
sage thrasher	<i>Oreoscoptes montanus</i>	3	0.06
mallard	<i>Anas platyrhynchos</i>	1	0.02
Total		5,091	