INL/RPT-24-76154

Implementing the Candidate Conservation Agreement for Greater Sage-Grouse on the Idaho National Laboratory Site

January 2024

2023 Full Report

Idaho National Laboratory

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2023 Full Report

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Idaho National Laboratory
Idaho Falls, Idaho 83415

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EXECUTIVE SUMMARY

In 2014, the United States Department of Energy, Idaho Operations Office (DOE-ID) and the U.S. Fish and Wildlife Service (USFWS) entered into a Candidate Conservation Agreement (CCA) for the benefit of greater sage-grouse (*Centrocercus urophasianus*) on the Idaho National Laboratory (INL) Site. As mandated by the CCA, a report is produced annually with the primary purposes of (1) documenting current year monitoring activities and results in support of the CCA, (2) addressing greater sage-grouse (hereafter 'sage-grouse') population and habitat regulatory triggers in the context of those results, and (3) documenting progress toward achieving CCA objectives associated with the conservation measures.

Population Monitoring

The sage-grouse population trigger baseline for the INL Site is equivalent to the number of males counted in 2011 during peak male attendance on 27 leks within the Sage-grouse Conservation Area (SGCA; i.e., 316 males). The population trigger was set to trip if the three-year running average of males on those 27 leks (hereafter 'baseline leks') decreased ≥20% (i.e., ≤253 males).

In 2023, 304 males were counted on baseline leks during peak attendance—a 23.6% (n = 58) increase over 2022. This resulted in an increase of the three-year running average to 259 males which exceeded the population trigger threshold.

Other key results from lek monitoring were as follows:

- Counts on six lek routes were up 13.5% from 2022.
- Three leks were downgraded to inactive status and one lek became active. With a net reduction of two active leks in 2023, 34 leks are currently classified active on or near the INL Site.

  7 inactive leks that are not visited annually were surveyed to verify activity status. No sage-grouse were found.

Habitat Monitoring

The baseline value of the habitat trigger is equivalent to the amount of area within the SGCA that was characterized as sagebrush-dominated (*Artemisia* spp.). This habitat trigger will trip if there is a reduction of ≥20% (14,460 ha [35,731 ac]) of sagebrush habitat within the SGCA. Total sagebrush habitat area and distribution are monitored using aerial or satellite imagery and a geographic information system.

There were two small wildland fires that burned on the INL Site in 2023 and both were ≤ 4.2 ha (10.5 ac). These two fires did not meet the size criteria for development of post-fire recovery plans or post-fire mapping. The total area of sagebrush habitat in the SGCA on the INL Site remains unchanged from 2022 with 71,358.8 ha (176,331.4 ac).

The condition of two habitat types—sagebrush-dominated lands and areas without sagebrush as they are recovering from wildland fires—is monitored by surveying 75 annual vegetation plots. The sagebrush habitat plots and non-sagebrush plots are distributed across both habitat types. The following is a summary of results from habitat distribution and condition monitoring tasks:

- Sagebrush habitat plots are sagebrush-dominated plant communities and they continue to resist introduced species dominance because native functional group cover estimates are more abundant compared to introduced functional group cover and sagebrush cover is trending upward. Additionally, native annual and biennial forbs have significantly greater abundance in years with average or above average precipitation. The cover from native perennial grasses is above average but continues to change each season and lacks a clear directional trend. Cover from the introduced functional groups is a minor part of sagebrush dominated plant communities but the observed greater cover for introduced annuals was also associated with wetter than average years.

- Non-sagebrush plots within plant communities recovering from wildland fire are slowly showing signs of recovery because native functional group cover is trending upward and is more abundant than introduced functional groups, but patches of weedy invasive species are still a considerable concern. Sagebrush species cover is a component of the upward trend in native cover, but their abundance is well below general habitat guidelines (Connelly et al. 2000). Cover from introduced perennial non-native crested wheatgrass (*Agropyron cristatum*) is also slowly trending upward. This season had a substantial increase in cover from introduced annual and biennial forb functional group which was likely due to this year's late season precipitation events because this group is highly responsive to precipitation timing and amount. Cheatgrass (*Bromus tectorum*) is near average cover in 2023 but lacks a directional trend and continues to be a concern for land management because its abundance can significantly fluctuate.

Threat Monitoring

Raven Nesting—The most effective way for the INL to address potential raven predation of sage-grouse eggs and chicks is to reduce raven nesting on INL infrastructure, especially near areas where sage-grouse are most likely to nest. In 2023, eight power transmission structures were retrofitted so they would no longer support raven nests. These retrofits were selected based on maintenance needs, but serendipitously, one retrofitted structure was 400 m northeast of a raven nesting hot spot. With that retrofit complete, the three structures immediately northeast of the hot spot have now been rendered unusable for raven nesting, and 10 of 14 structures along a 2.6-km stretch of the line that includes this hot spot are retrofitted. Other minor actions were taken to discourage raven nesting on the INL Site, but the transmission structure retrofits were the most permanent.

Infrastructure Expansion— There was no work conducted on this task in 2023 because no new high-resolution imagery was available for the INL Site prior to reporting. The U.S. Department of Agriculture National Agriculture Imagery Program collected high resolution imagery across the State of Idaho during the summer of 2023 and those data are typically made available the following winter/spring. We will systematically review the INL Site for expansion of linear features and losses of sagebrush habitat due to facility or project footprint expansions, and those results will be presented in 2024.

Threats to Habitat Condition—Analysis are expected to be reported between 2024 and 2025.

Conservation Measures Associated with Habitat Restoration

In response to several 2020 fires and the 2019 Sheep Fire, INL continued implementing post-fire recovery plans in 2023. Noxious weed control efforts were ongoing along containment lines and within burned footprints and sagebrush restoration efforts using containerized stock continued in some older burned areas. Additionally, INL is partnering with neighboring agencies to mechanically replant sagebrush in high-priority habitat restoration areas around Tractor Flats, burned in the 2010 Jefferson Fire, using Bipartisan Infrastructure Law funding to collect local seed and matching labor for planting.

INL managed the planting of 74,875 sagebrush seedlings in fall of 2023 in areas prioritized for restoration. To inform and to improve future plantings, different methods or materials were tested in each area planted. The different methods or materials include the use of vermiculite in the soil medium, the use of a hydrogel in the soil medium, the use of a mycorrhizal inoculant in the soil medium, and the use of protective cages around a subset of the control group of seedlings. All seedlings were planted in burned areas of the 2007 and 2010 Twin and Middle Butte Fires. Monitoring revealed that approximately

13% of seedlings planted in 2022 survived. Approximately 67% of seedlings planted in 2018 were still alive after five years.

Programmatically, the INL has identified the need to update their fuels management, fire suppression, and wildland fire recovery approach and associated National Environmental Policy Act evaluation. The INL Fire Department is updating the current fuels management and fire suppression plan and the Natural Resources Group is drafting a new post-fire recovery framework. Combined, these documents will facilitate a more comprehensive and efficient planning and response effort for future wildland fires on the INL Site.

Synthesis

Over the past decade, sage-grouse abundance on the INL Site and across the bird's distribution in Idaho has followed a pattern consistent with a cyclic trend. That is, abundance increased to a peak in 2016, decreased to a low point between 2019 and 2021, and in the last two or three years abundance on the INL Site and in Idaho has steadily increased. The INL Site population trigger tripped in spring 2022, and DOE-ID and the USFWS subsequently reevaluated the INL management approach to determine if additional conservation measures were warranted. Because sage-grouse abundance patterns on the INL Site and across Idaho have fluctuated closely, DOE-ID and USFWS determined that no immediate action was necessary, as population drivers are clearly operating at a broad scale. In 2023, the baseline lek count increased enough to reset the population trigger.

Sage-grouse habitat condition and distribution is monitored in some places in Idaho, but not at a scale and frequency that would facilitate direct comparison of state and INL Site habitat trends. However, a report published in 2020 by a multi-stakeholder team in Idaho estimated that landscape sagebrush cover immediately south and east of the INL Site was approximately the same as on the INL Site. The team reported two other relevant findings. First, they identified the Tractor Flats area on the INL Site as a regionally important wintering area for sage-grouse, which prompted the sagebrush habitat restoration efforts discussed above. Second, they recommended that land managers prioritize cheatgrass control where it could negatively affect habitat. Although cheatgrass is locally abundant in some areas on the INL Site, post-fire monitoring has demonstrated that most burned areas are dominated by native, perennial plants. Because cheatgrass has become dominant in some areas, INL and agency stakeholders are pursuing Bipartisan Infrastructure Law funding to treat cheatgrass in these areas before it becomes sufficiently dominant at a scale widespread enough to alter the fire regime on the INL Site.

Proposed and Adopted Changes to the CCA

No changes to the CCA were proposed or adopted during 2023.

ACKNOWLEDGMENTS

Information and data in this document were collected, analyzed, and reported by the Battelle Energy Alliance Natural Resources Group, their interns, and subcontractor staff. Meta Schmitz, Bryan F. Bybee, Sarah A. Baccus, and Samuel R. Williams performed greater sage-grouse lek surveys, and the latter two authored the corresponding report (Section 2.0). Austin Housley, Nina Keck, McKenna Mason, Azzayah Wall, Samuel Earnest, and Jessica Day completed sampling for habitat condition and assisted in collecting sagebrush seedling survivorship data. Kristin N. Kaser analyzed the habitat data and summarized results for sagebrush habitat condition (Section 3.1) and potential threats to sagebrush habitat (Section 4.3). Jeremy P. Shive wrote the sections describing changes to sagebrush habitat amount and distribution (Section 3.2) and monitoring of the infrastructure footprint for expansion (Section 4.2). Colby J. Kramer gathered updates from stakeholders and assembled a table listing progress made on CCA conservation measures (Section 5.1.1). He also coordinated the sagebrush seedling planting and monitoring and authored the associated section (Section 5.2.2). Amy D. Forman reported on post-fire recovery planning, implementation, and monitoring (Section 5.2.1). Quinn R. Shurtliff summarized efforts to deter raven nesting (Section 4.1) and he, Samuel R. Williams, and Amy D. Forman produced the synthesis of results and analyses (Section 6.1). Quinn R. Shurtliff also served as document editor, assisted by George J. Krauszer II who coordinated the CCA reporting process. Kurt T. Edwards supported all authors with data collection processes, data management, and producing map figures for the document. Brande M. Hendricks assisted with document formatting.

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ACRONYMS

BEA	Battelle Energy Alliance
BIL	Bipartisan Infrastructure Law
BLM	Bureau of Land Management
CCA	Candidate Conservation Agreement
CFA	Central Facilities Area
DOE-ID	U.S. Department of Energy, Idaho Operations Office
EA	Environmental Assessment
EC	Environmental Checklist
ECP	Environmental Compliance Permit
GIS	Geographic Information System
IDFG	Idaho Department of Fish and Game
INL	Idaho National Laboratory
MFC	Materials and Fuels Complex
MPLS	Males Per Lek Surveyed
NAIP	National Agriculture Imagery Program
NEPA	National Environmental Policy Act
NRF	Naval Reactors Facility
NRG	Natural Resources Group
NSTR	National Security Test Range
SGCA	Sage-grouse Conservation Area
UAS	Unmanned Aerial Systems
USFWS	U.S. Fish and Wildlife Service
WFMC	Wildland Fire Management Committee

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1.0 INTRODUCTION, BACKGROUND, AND PURPOSE

In October 2014, the United States Department of Energy Idaho Operations Office (DOE-ID) and the U.S. Fish and Wildlife Service (USFWS) entered into a Candidate Conservation Agreement (CCA) for greater sage-grouse (*Centrocercus urophasianus*; hereafter referred to as "sage-grouse") on the Idaho National Laboratory (INL) Site (DOE-ID and USFWS 2014). The CCA includes monitoring tasks designed to track sage-grouse abundance and habitat indicators, key threats, and conservation measures intended to reduce these threats. This report, produced by the Battelle Energy Alliance (BEA) Natural Resources Group (NRG), documents year-end results of CCA monitoring tasks and DOE-ID and INL contractor activities associated with CCA conservation measures. A summary of this report is provided each January to the USFWS and can be found at https://inl.gov/environmental-publications/#conservationplanning.

A primary purpose of this report is to update sage-grouse population and habitat estimates as they apply to adaptive regulatory triggers established in the CCA. If a regulatory trigger is tripped, a responsive action by DOE-ID and USFWS will be initiated (DOE-ID and USFWS 2014, Section 9.4.3). The two triggers and criteria that define them are:

Population Trigger: The three-year running average of peak male attendance, summed across 27 leks within the Sage-grouse Conservation Area (SGCA). This trigger will trip if the average falls below 253 males—a 20% decrease from the 2011 baseline of 316 males.

Habitat Trigger: Total area designated as sagebrush habitat within the SGCA. This trigger will trip if total area falls below 57,840 ha (142,925 ac)—a 20% drop from the updated 2019 baseline of 72,300 ha (178,656 ac; see Section 3.2).

Reports of related monitoring tasks described in Section 11.1 of the CCA (DOE-ID and USFWS 2014) are grouped into three sections in this report: Population Monitoring (Section 2), Habitat Monitoring (Section 3), and Threat Monitoring (Section 4). Section 5 reports how DOE-ID, contractors, and other stakeholders implemented conservation measures listed in the CCA during the past year. Section 6 synthesizes results from all monitoring tasks and discusses results and their implications in the context of regional trends and future management directions. This section also documents changes and updates to the CCA that have been approved by both signatories during the past year and outlines the upcoming CCA annual work plan.

This report and associated summary report (DOE-ID 2024) inform a continuing dialogue between DOE-ID and USFWS as the two agencies cooperate to achieve CCA objectives for sage-grouse conservation on the INL Site. Consistent re-evaluation and analysis of new information ensures that the CCA continues to benefit sage-grouse on the INL Site, is grounded in the best available science, and retains its value to both signatories.

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2.0 POPULATION TRIGGER MONITORING

2.1 Task 1—Lek Counts and Lek Route Surveys

2.1.1 Introduction

The monitoring strategy outlined in the CCA (DOE-ID and USFWS 2014, Section 11.1) included a task (Task 1) to track sage-grouse abundance on the INL Site, allowing DOE-ID and USFWS to evaluate population trends relative to the population trigger. Counts from 27 leks located in the SGCA (hereafter 'baseline leks') are the basis of the population trigger (Figure 2-1). These leks are surveyed annually, either individually or as part of a lek route. The baseline value for the population trigger is 316 males—the sum of peak male attendance in 2011 when all baseline leks were classified active. The population trigger will trip if the three-year running average of peak male attendance at these baseline leks falls below 253, a 20% decrease from the 2011 value.

In addition to baseline lek counts, six lek routes are surveyed annually—three that have been surveyed since the late 1990s and three that were established in 2017—to evaluate long-term sage-grouse abundance trends. Surveying a cluster of leks in the same order in a single day (i.e., lek routes) reduces some of the confounding issues inherent in surveys of individual leks; thus, lek route data are considered more suitable for tracking abundance trends across relatively small spatial extents than data from individual lek surveys (Connelly et al. 2003; DOE-ID and USFWS 2014). Data from these routes continue to build on more than 25 years of sage-grouse monitoring on the INL Site, providing context to interpret relatively short-term results derived from baseline lek monitoring.

Lastly, Task 1 monitoring includes surveys of a subset of inactive leks (hereafter 'rotational surveys') that are not visited annually because they are not baseline leks and are not assigned to lek routes. The goal is to revisit all inactive leks at least once every five years to determine if sage-grouse have reoccupied the sites. This, and other monitoring activities described above, helps maintain accurate records of the number and location of active leks on the INL Site.

2.1.2 Methods

2.1.2.1 Field Methods

Lek counts begin each year on or soon after March 20 and typically end about the first week of May. For lek routes, if the last scheduled survey produces the peak male count of the year, an additional survey is performed one week later to ensure the final count is lower than the seasonal peak. Counts occur from 30 minutes before until 90 minutes after sunrise and are not conducted during adverse weather (e.g., heavy precipitation or winds >19 km [12 mi] per hour). If sage-grouse are present at a lek, an observer tallies the number of visible males three or four times over a 5–10-minute period. If males flush as an observer approaches the survey location or previously unseen males flush during the count, that number is added to the subsequent high count during the lek visit. The highest tally is recorded as the lek count for the day. Visits to single leks are separated by at least seven days, and lek routes are visited every 7–10 days. The primary goal each year is to survey all known active leks on the INL Site and lek routes (including inactive leks on routes) ≥4 times, inactive baseline leks ≥3 times, and inactive leks not assigned to lek routes or designated as baseline leks (i.e., rotational surveys) ≥2 times.

Lek routes are comprised of 3–10 leks each, encompassing 38 active and inactive leks across the six routes (Figure 2-1). During each survey, all leks on a route are visited in a single day, in the same order, and usually by the same observer during a field season. Three traditional routes have been surveyed annually since the mid-1990s (Lower Birch Creek, Tractor Flats, and Radioactive Waste Management Complex), and three additional routes established in 2017 have been surveyed in each of the following years (West T-3, T9, and Frenchmans Cabin[1]). Tractor Flats and Lower Birch Creek routes each include a lek located off the INL Site within 1.58 km (0.98 mi) of the boundary.

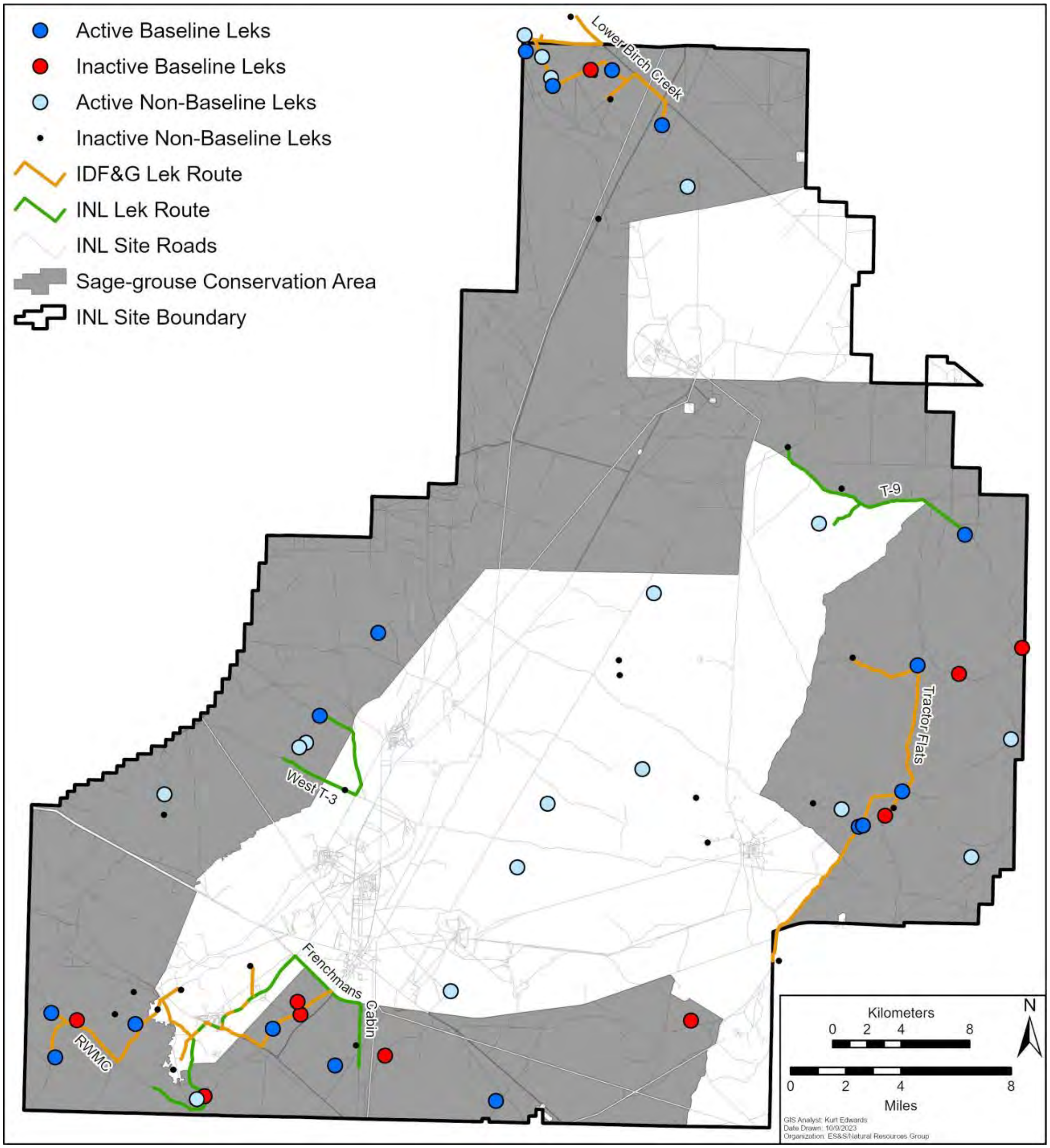

Figure 2-1. Sage-grouse leks surveyed on the Idaho National Laboratory Site in 2023. Lek activity designations (active vs. inactive) refer to lek status at the end of 2023. Inactive non-baseline leks include inactive leks assigned to lek routes (visited annually) and a subset of other inactive leks visited once every five years (rotational leks).

[1] "Frenchmans Cabin" is a recognized map feature by the U.S. Board on Geographic Names and is not misspelled.

2.1.2.2 Lek Status

Leks are classified as active if two or more male sage-grouse were observed displaying on the lek in at least two of the previous five years (Connelly et al. 2000, Whiting et al. 2014). Leks that did not meet these criteria were classified as inactive. If two or more males were observed displaying at a new location at least 400 m (437 yd) from a known lek, the location was assigned a lek number and classified as active in the current year. It will remain classified as active until at least four years of surveys without sage-grouse observations have accumulated within a five-year period. Following the field season, we examined data from the past five years for each lek and adjusted its activity status as necessary.

Dozens of inactive leks occur on the INL Site that are not baseline leks and are not assigned to a route. Over a five-year period, we surveyed 13–20 of these annually on a rotational basis, visiting each lek twice in April. Some inactive leks are visited more frequently because the Idaho Department of Fish and Game (IDFG) classifies them as priority leks for state-wide monitoring.

2.1.2.3 Analysis

Summary statistics were calculated separately for baseline leks and lek routes, although 19 baseline leks (50% of leks on routes) contributed to both summaries. Separating the two summaries is necessary because baseline leks are used in the calculation of the population trigger stated in the CCA while lek routes allow for a comparison in regional observations and long-term population trends.

To evaluate current sage-grouse abundance relative to the critical threshold of 253 males, we identified peak male attendance for each baseline lek (i.e., the highest male count recorded during any visit after March 20) and summed individual peak counts across all 27 leks. The annual total was then averaged with the preceding two years to produce a three-year running average—the population trigger metric (DOE-ID and USFWS 2014).

We assessed long-term abundance trends by examining the number of males per lek surveyed (MPLS) for each of the six lek routes. This was done by identifying annual peak male attendance for each route (i.e., the highest number of males observed on a route in a single morning) and dividing the total by the number of leks visited, including inactive leks.

2.1.3 Results and Discussion

2.1.3.1 Data Collection, Timing, and Methodology

The spring of 2023 presented challenges for field crews tasked with data collection. Precipitation data collected on the INL Site at the Central Facilities Area (CFA) by the National Oceanic and Atmospheric Administration snowfall levels 609.6 mm (24 in) above 30-year normal values between October 2022 and April 2023 (Table 2-1). These above-normal levels of snowfall contributed to March snow depths up to 370.8 mm (14.6 in), which were 320.0 mm (12.6 in) above the 30-year normal recorded at CFA. This above normal winter/spring precipitation and snow accumulation delayed access to some lek routes by as many as 5 weeks when compared to prior years. As a result, field crews prioritized surveys of baseline leks, as they are the primary metric for the population trigger. Baseline leks surveys began on March 23 and focused on leks that were accessible via tracked utility terrain vehicles and/or snowshoes. In some cases, only one lek was visited per day due to time and fuel required to access the location, a limited survey window, and distance to the next lek. Multiple spring storms also forced the cancelation of surveys as the weather conditions were outside those deemed acceptable by standardized survey protocols.

Table 2-1. Total snowfall and snow accumulation recorded from October 2022 to April 2023 at the Central Facilities Area, Idaho National Laboratory Site.

Month	Snowfall (mm)			Snow Depth (mm)		
	30 yr. mean	2022-2023	Δ	30 yr. mean	2022-2023	Δ
October	10.2	0.0	-10.2	0.0	0.0	0.0
November	66.0	190.5	124.5	7.6	50.8	43.2
December	188.0	342.9	154.9	71.1	139.7	68.6
January	170.2	266.7	96.5	144.8	266.7	121.9
February	114.3	101.6	-12.7	154.9	276.9	122.0
March	48.3	330.2	281.9	50.8	370.8	320.0
April	25.4	0.0	-25.4	0.0	48.3	48.3

The prioritized initial surveys of baseline leks revealed little to no lek attendance during the first two weeks of surveys. As survey efforts continued into April, male attendance began to increase with peaks occurring from late April to mid-May. Of note, access issues required deviation from survey frequency protocols during the following instances:

- The Tractor Flats route was only completed three times with peak male attendance occurring during the first survey on April 24. Surveys targeting baseline leks on this route revealed increasing lek attendance in the two weeks leading up to the completion of the first lek route, which suggests peak male attendance likely occurred during this week as subsequent weeks demonstrated a decline in male attendance.

- The Lower Birch Creek route was only completed three times with peak male attendance occurring on the final week. However, this route was surveyed a total of five times apart from a lek which had been inactive since 1989. Observations of 20 males along the lek route during the final week of surveys resulted in a shift of the peak week to the final surveys. Due to logistical and time constraints, a follow-up surveys the week after peak route attendance was not able to be completed.

- The Frenchmans Cabin route was only completed three times with peak male attendance occurring during the first survey on April 18.

2.1.3.2 SGCA Baseline Lek and Population Trigger

Summed peak attendance across the baseline leks in 2023 was 304 males—58 (23.6%) more than in 2022 (Figure 2-2). This value is higher than the previous three years but remains equal to or lower than any other year since 2011—the basis year for the population trigger.

The three-year (2021–2023) running average of peak male attendance on baseline leks increased 11.2% to 259 males (SD = 40.1), exceeding the population trigger threshold of 253 males. This was the first year since 2018 that the three-year average has increased, returning the running average above the population threshold which effectively reset the population trigger (Figure 2-2).

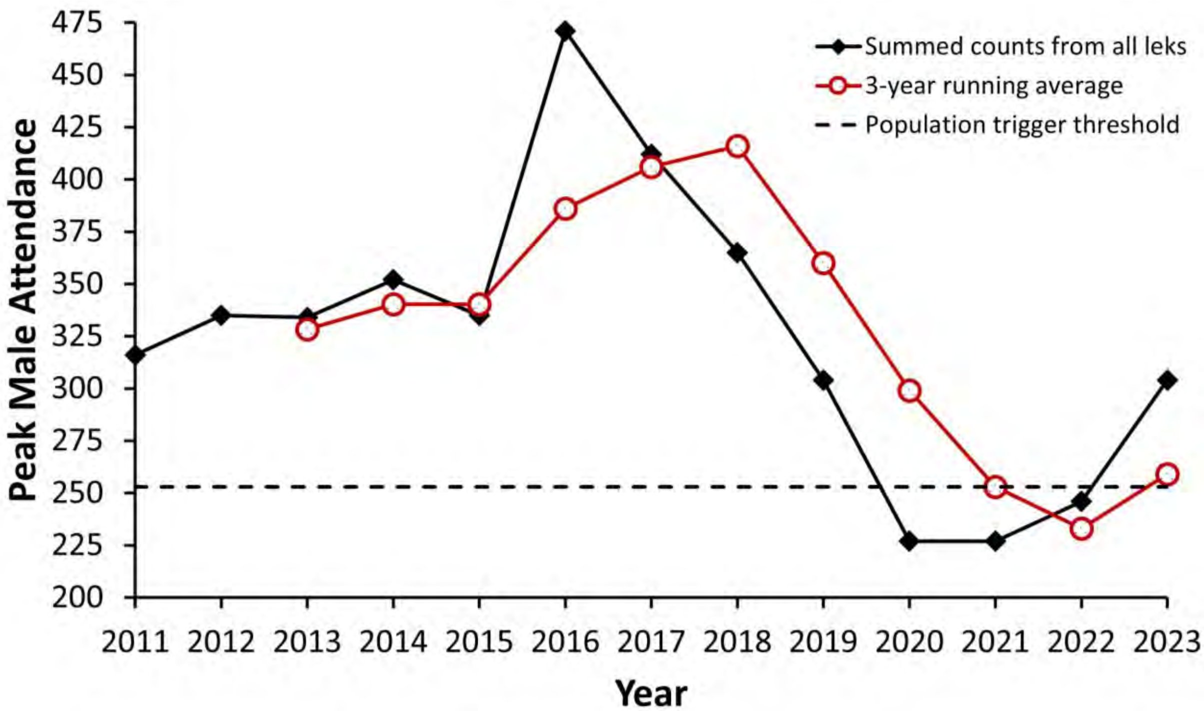

Figure 2-2. Peak male attendance of greater sage-grouse at baseline leks in the Sage-grouse Conservation Area. Black squares represent the annual sum of peak male attendance at all baseline leks.

2.1.3.3 Lek Routes

We surveyed lek routes three to five times each. The sum of peak male attendance across all routes increased in 2023 to 312 males (13.5%) with a MPLS value of 8.2. Individually, MPLS increased on three routes when compared to 2022; the Radioactive Waste Management Complex (RWMC) route showed the largest growth (63.1%) (Table 2-2). The Frenchmans Cabin and T-9 routes showed an increase of MPLS when compared to 2022, with the T-9 route being the highest it has been since its inception in 2017 (Table 2-3). The remaining three lek routes—Tractor Flats, T-3, and Lower Birch Creek— decreased in MPLS in 2023 with Lower Birch Creek showing the largest decline of 12%. Both Tractor Flats and T-3 MPLS values declined 5.8% and 9.1%, respectively (Table 2-2). At face value, these declines from 2022 seem substantial. However, when comparing total male observations, the three routes combined had 12 fewer males in 2023 than in 2022 (Table 2-3).

Table 2-2. Lek route data from 2023 surveys on the Idaho National Laboratory Site and multi-year means for each route.

Lek Route	2023 Peak Count	Multi-Year Mean* (Range; SD)	Leks Surveyed	Males per Lek Surveyed (MPLS)	MPLS % Change from 2022	Occupied Leks†	Surveys Performed
Tractor Flats	55	67.8 (51–115; 19.7)	8	6.9	–5.8	4	3
Radioactive Waste Management Complex	91	88.7 (28–141; 37.1)	9	10.1	63.1	5	4
Lower Birch Creek	44	80.8 (29–133; 34.8)	10	4.4	–12	5	3
West T-3	32	30.8 (16–49; 14.9)	4	8	–9.1	3	4
T-9	55	37.5 (31–48; 5.9)	4	13.8	14.6	2	5
Frenchmans Cabin	35	30.2 (15–46; 10.3)	3	11.7	25.4	2	3
Total	312		38			21	22
Mean				8.2	14.0		

*For the first three routes, the 10-year mean (2013–2022) is displayed; for the last three, it is a 6-year mean (2017–2022).

† Leks on routes are considered occupied if two or more males were observed displaying during the current year's survey. This is different from an active lek designation that BEA's Natural Resources Group uses to characterize leks on the Idaho National Laboratory Site, which is based on five years of data. Here, we report the number of leks occupied on the day the route count peaked.

The increase of peak male attendance on lek routes (13.5%) from 2022 to 2023 (Table 2-3) was notably different than the 23.6% increase of peak male attendance on baseline leks during the same period. This difference is an artifact of the distinct methods used to calculate peak male attendance on lek routes and baseline leks. For example, in 2023, peak attendance for the Lower Birch Creek route was 44 males; INL 2, a lek along this route, had a peak count of 16 males during this week. By contrast, INL 2 saw its individual peak male attendance of 22 birds a full two weeks prior to the peak calculated for the Lower Birch Creek route (INL 2 count was 16 males during this week).

Table 2-3. Historical data of peak male attendance on lek routes since 2011. The latter three routes, West T3, T9, and Frenchmans Cabin, were founded in 2017.

Year	Tractor Flats	Radioactive Waste Management Complex	Lower Birch Creek	West T3	T9	Frenchmans Cabin	Total	% Change from Previous Year
2011	63	132	50	-	-	-	245	-
2012	63	107	52	-	-	-	222	-9.4
2013	53	110	48	-	-	-	211	-5.0
2014	55	141	64	-	-	-	260	23.2
2015	76	96	82	-	-	-	254	-2.3
2016	115	133	133	-	-	-	381	50.0
2017	84	112	132	49	34	46	457	19.9
2018	74	94	100	47	39	36	390	-14.7
2019	69	60	94	16	35	28	302	-22.6
2020	56	28	76	19	31	15	225	-25.5
2021	51	57	29	19	38	28	222	-1.3
2022	58	56	50	35	48	28	275	23.9
2023	55	91	44	32	55	35	312	13.5

2.1.3.4 Rotational Surveys of Inactive Leks

In addition to routine surveys of active and inactive baseline and route leks, 17 inactive leks were scheduled to be visited in 2023. However, only seven were visited due to inclement weather and time constraints. These seven leks were each visited twice, and no sage grouse were observed; therefore, they will remain classified inactive. Five of the leks visited this season were last visited in 2018; the remaining two were visited in 2022. The 10 inactive leks that were not visited this season will be visited during the 2024 season.

2.1.3.5 Changes of Lek Status

Two baseline leks, INL 1 and INL 35, and two non-baseline leks, INL 10 and INL 54, changed status following the 2023 field season. INL 1 is part of the Lower Birch Creek route and has been inactive since 2021. Peak male attendance at INL 1 was four in 2020 and five in 2023, changing its status to active. INL 35, part of the Frenchmans Cabin route, was downgraded to inactive status as no males have been observed since 2019. INL 10 has been designated as an inactive lek as no males have been observed since 2019. INL 54 has been changed to inactive status as no more than one male was recorded in 2023, 2022, 2021, and 2020. There were eight males recorded in 2019 but this does not meet the criteria to keep INL 54 status as active. With the status changes of INL 1, INL 35, INL 10, and INL 54, there are 17 active baseline leks (no change from 2022) and a total of 34 active leks on or near the INL Site at the end of the 2023 field season (a decrease of two from 2022).

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3.0 HABITAT TRIGGER MONITORING

All vegetation-based estimates of sagebrush habitat distribution for the CCA were initially determined using a vegetation map completed in 2010 (Shive et al. 2011). Sagebrush habitat was designated by selecting all map polygons assigned to stand-alone big sagebrush or low sagebrush classes, and all map class complexes where one of the two classes was either a big sagebrush or low sagebrush class. Areas designated as sagebrush habitat may change over time based on gradual changes in vegetation composition and from abrupt changes caused by wildland fire.

The original baseline value of the habitat trigger was defined as the total area designated as sagebrush habitat within the SGCA at the beginning of 2013 (DOE-ID and USFWS 2014). DOE-ID and USFWS mutually agreed to adjust the sagebrush habitat trigger baseline in 2022 to incorporate the best available vegetation data. A new vegetation classification and map for the INL Site was published in 2019 which included updates to map class boundaries delineated at a finer scale to improve spatial accuracy (Shive et al. 2019). The newly established baseline value is estimated at 72,300 ha (178,656 ac). The sagebrush habitat trigger will be tripped if there is a loss of > 14,460 ha (35,731 ac) within the SGCA (i.e., a 20% reduction in sagebrush habitat). If the trigger is tripped, DOE-ID will compensate for sagebrush habitat loss by implementing one or more of the following mitigation actions: (1) alter the boundary of the SGCA to include more sagebrush habitat, (2) participate in the State's "Framework for Mitigation of Impacts From Infrastructure Projects on Sage-Grouse and Their Habitats", or (3) initiate habitat restoration on Priority Restoration Areas at the INL Site.

Two monitoring tasks are designed to identify vegetation changes across the landscape and assist in maintaining an accurate record of the condition and distribution of all current sagebrush habitat particularly within the SGCA to facilitate annual evaluation of the habitat trigger:

Task 5: Sagebrush Habitat Condition Trends—This task provides information to support ongoing assessment of habitat condition within polygons mapped as sagebrush habitat and facilitates comparison of current-year sagebrush habitat on the INL Site with site-specific expected values. Data collected to support this task may also be used in Task 6 to document gains in habitat as non-sagebrush map polygons transition back into sagebrush classes, or to document losses when compositional changes occur within sagebrush polygons that may require a change in the assigned map class.

Task 6: Monitoring to Determine Changes in Sagebrush Habitat Amount and Distribution—This task is intended to provide an update to the current sagebrush habitat distribution map by reconciling losses to sagebrush habitat following events that alter vegetation communities. As updates are made to map classes (vegetation polygon boundaries), the total area of sagebrush habitat available will be compared to the baseline value established for the habitat trigger to determine status with respect to the habitat threshold.

Together, these two monitoring tasks provide the basis for maintaining an accurate map and estimate of condition and quantity of sagebrush habitat on the INL Site. For example, imagery of burned areas may show changes in vegetation class boundaries immediately or several years post-burn, or sagebrush cover may be evaluated using habitat condition monitoring data from plots located within that burned area. Once substantial increases in sagebrush cover have been identified from either the plot data or the imagery, field-based sampling will be conducted within affected polygons to determine whether it has enough big sagebrush cover over a substantial area to redefine the polygon as a sagebrush class, or whether re-delineating smaller sagebrush-dominated polygons within the burn area is appropriate.

3.1 Task 5—Sagebrush Habitat Condition Trends

3.1.1 Introduction

Characterization and monitoring of sagebrush habitat condition was identified as an integrated component of the CCA monitoring plan to address conservation efforts for sage-grouse on the INL Site. Annual monitoring of sagebrush habitat is necessary to track trends in the condition of habitat available for sage-grouse and to understand the potential for declines in habitat quality associated with threats. Wildland fire was ranked as a high-level threat in the CCA. The potential negative effects from annual grasses and other weeds, infrastructure development, and seeded perennial grasses are ranked as a mid-level threat (Shurtliff et al. 2019). Livestock operations are also recognized as a potential threat and are ranked as a low-level threat. These five threats are thought to affect sage-grouse populations directly and indirectly through their effects on habitat. The habitat condition monitoring task allows biologists to characterize broad-scale trends in habitat condition over time and to identify annual changes in condition associated with post-fire recovery, surface disturbance, livestock operations, and spread of introduced weedy species.

The habitat condition monitoring task was specifically designed to allow biologists to:

- characterize the vegetative component of habitat condition each year,
- relate vegetative characteristics of habitat on the INL Site to conservation goals and/or management guidelines,
- track trends in habitat decline and/or recovery,
- interpret changes to habitat condition within the context of regional vegetation and weather patterns,
- continue to assess progress toward recovery in areas that were lost from current habitat status due to wildland fire or other disturbances,
- understand the effects of various threats on habitat condition,
- provide a link between areas mapped as habitat and the vegetative characteristics of the plant communities in those polygons, and
- inform the process used to update the estimate of sagebrush habitat distribution.

3.1.2 Methods

3.1.2.1 Sampling

In 2013, we established 225 vegetation sampling plots for the purpose of monitoring sagebrush habitat condition on the INL Site. All sagebrush habitat condition monitoring plot locations were selected using a stratified random sampling design (Shurtliff et al. 2016). A subset of 75 plots is surveyed annually (hereafter ‘annual plots’), about two-thirds of which are in map polygons designated as current sagebrush habitat (hereafter ‘sagebrush habitat plots’). The remaining one-third of the annual plots are in burned areas, where the plant community prior to the wildland fire events was thought to include sagebrush habitat (hereafter ‘non-sagebrush plots’). An additional 150 plots are surveyed on a rotational basis (hereafter ‘rotational plots’) with a subset of 50 plots sampled each of three years over the span of five years to increase sample sizes within burned areas, grazing allotments, and areas likely to be impacted by non-native plants (see section 4.3). The most recent rotational plot sampling period was between 2018 to 2020.

The vegetation monitoring data metrics selected for collection at the sagebrush habitat condition monitoring plots facilitate characterization of general habitat condition (Connelly et al. 2000). The main purpose of collecting and summarizing these characterization metrics is to support basic description and assessment of habitat quality available to sage-grouse (Shurtliff et al. 2019). The data are also used to track trends, which allows for characterization of compositional change in vegetation through time. The quantitative metrics sampled at each plot include vegetation cover by species, vegetation height for shrubs and herbaceous species, sagebrush density, frequency of juvenile sagebrush occurrence, and comprehensive species lists. A complete description of sample site selection, habitat condition metrics, and plot sampling methodology can be found in the study plan and sample protocol for this monitoring task in Appendix B from Shurtliff et al. 2016.

3.1.2.2 Data Analyses

Data analyses for annual plots compare annual habitat condition against established baseline values and evaluate trends in habitat condition through time. Precipitation patterns are summarized seasonally in water year to provide insight into certain growth patterns of certain vegetation functional groups.

From 2013 through 2017, annual plot summaries were used to compare habitat condition on the INL Site to general regional guidelines (Connelly et al. 2000). Beginning in 2018, we transitioned to using locally derived habitat condition baseline values against which we evaluate the current year habitat condition data. These baseline values were established over five years (2013–2017) of monitoring the 75 annual plots. These established baseline values (hereafter 'baseline') provide a more accurate estimation for evaluating annual habitat condition than the generalized regional guidelines (Connelly et al. 2000) due to the large variation across the diverse sagebrush steppe ecosystem. Vegetation cover and height values for the current year are compared to baseline values according to vegetation functional groups (e.g., shrubs, grasses, forbs) and nativity (e.g., native, introduced). Sagebrush density and juvenile frequency are also summarized and compared to baseline values each year.

The precipitation data has been summarized by water year using data collected at CFA to provide additional insight into available water to vegetation throughout the growing season (https://niwc.noaa.inl.gov/climate.htm). Water year is calculated by summing annual precipitation from October 1 through September 30 of the following year, and the water year is denoted by the year in which it ends.

Trend analyses summarize cover data collected since 2013 to the present season to assess changes in vegetative composition of functional groups, nativity, and habitat types. Cover data were analyzed for differences between years within each functional group using One-way Repeated Measure of Analysis of Variance (Zar 1999). Sample sizes have changed through the sample period. Since 2019, five sagebrush plots have burned, and they were reassigned to non-sagebrush habitat status. Data collected from those plots prior to burning were analyzed as sagebrush habitat whereas data collected after wildland fire were then analyzed as non-sagebrush plots. Sample sizes are still adequate for meaningful interpretation of statistical results (Zar 1999). Significance was determined at the $\alpha = 0.05$ level. Multiple pairwise comparisons were evaluated using the Holm-Sidak method (Šidák 1967).

3.1.3 Results and Discussion

3.1.3.1 Habitat Condition

We collected data on 75 annual plots and 50 rotational plots from May 22 through August 9, 2023. Results for annual plots are reported here and results for rotational plots are reported once every five years after the sample period has been collected (e.g., INL 2023). For annual plots, there are 43 sagebrush habitat plots located within current sagebrush habitat polygons and 32 non-sagebrush plots located within map polygons where sagebrush has been lost to wildland fire (Figure 3-1). The sagebrush habitat plots are in map polygons that have not burned in at least the last 20 years, and many of them have likely not burned for at least a few centuries (Forman et al. 2013). All non-sagebrush plots have burned at least once since 1994 and have the potential to recover to sagebrush habitat.

The following metrics enable biologists to summarize the current conditions of vegetative characteristics that are important to habitat types used by sage-grouse. Vascular plant cover is the amount of ground covered by vegetation and is used to estimate plant species composition and to track trends for plant functional groups to understand the quality of habitats available to sage-grouse. The height of vegetation is the vertical structure and associated visual cover of plant functional groups and is used to infer shelter available to sage-grouse. Sagebrush density and juvenile frequency are used to infer the growth or decline of the sagebrush populations. Precipitation data patterns are used to understand habitat condition trend patterns.

3.1.3.2 Annual Habitat Condition Overview

Overall, the annual cover, height, and sagebrush density metrics are compared against the baseline to evaluate habitat condition on the INL Site for plots within sagebrush habitat and for plots in non-sagebrush areas (Table 3-1a, Table 3-1b). In 2023, sagebrush habitat plots had substantially greater cover and height for the sagebrush and perennial grass/forb functional groups when compared to the baseline, but sagebrush density was well below the baseline in 2023. The overview comparison for non-sagebrush plots focuses on the perennial grass/forb functional group because this group provides the greatest amount of vegetative cover to these post-fire communities. Perennial grass/forb functional group cover between this year and the baseline was comparable. The abundance of the sagebrush functional group remains extremely low in these plots, but it had 1.22% cover in 2023 which is greater than the baseline of 0.22% cover. Heights for functional groups within non-sagebrush plots were considerably taller for the perennial grass/forb and the sagebrush functional groups this year when compared to the baseline. Finally, non-sagebrush plots had similar sagebrush density compared to the baseline in 2023.

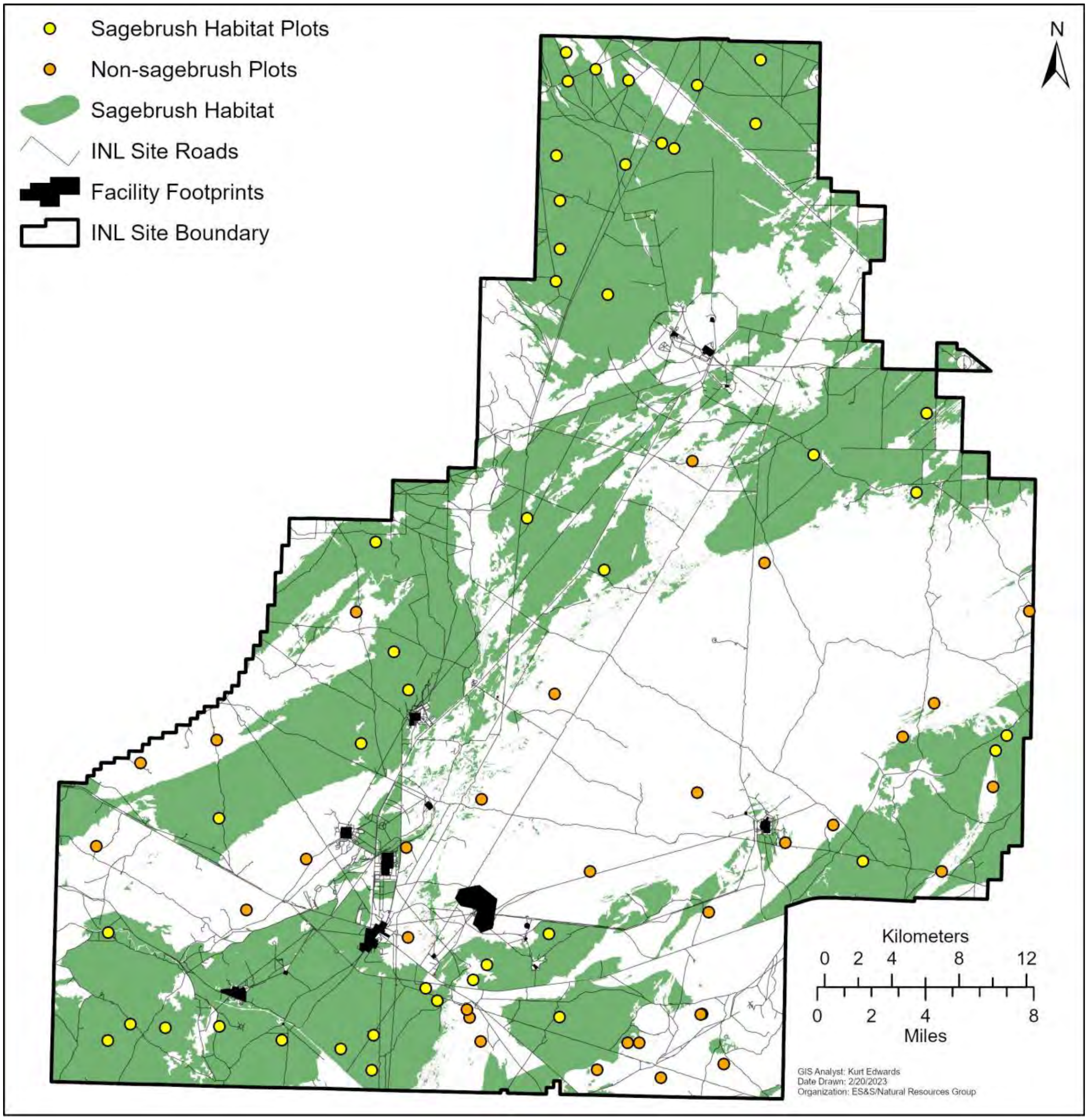

Figure 3-1. The 75 annual sagebrush habitat condition monitoring plots sampled on the Idaho National Laboratory Site in 2023 to support the Candidate Conservation Agreement in relation to sagebrush habitat.

Table 3-1a. Summary of vegetation measurements used to characterize the condition of sagebrush habitat monitoring plots and non-sagebrush plots on the Idaho National Laboratory Site in 2023.

2023 Summary			
Sagebrush Habitat Plots (*n* = 43*)	Mean Cover (%)	Mean Height (cm)	Mean Density (individuals/m^2)
Sagebrush	24.58	51.38	2.29
Perennial Grass/Forb	14.58	28.94	—
Non-sagebrush Plots (*n* = 32*)	Mean Cover (%)	Mean Height (cm)	Mean Density (individuals/m^2)
Sagebrush	1.22	47.49	0.06
Perennial Grass/Forb	19.19	36.38	—

*indicates sample size difference from past sampling efforts.

Table 3-1b. Baseline values of selected vegetation measurements for characterization of condition of sagebrush habitat and non-sagebrush monitoring plots on the Idaho National Laboratory Site. Baseline values were generated from five years of data (2013–2017). SE is the standard error around the mean.

Baseline Summary						
Sagebrush Habitat Plots (*n* = 48)	Mean Cover (%)	SE	Mean Height (cm)	SE	Mean Density (individuals/m^2)	SE
Sagebrush	21.27	±0.33	47.81	±0.98	5.19	±1.80
Perennial Grass/Forb	9.99	±2.53	20.70	±3.67	—	—
Non-sagebrush Plots (*n* = 27)	Mean Cover (%)	SE	Mean Height (cm)	SE	Mean Density (individuals/m^2)	SE
Sagebrush	0.22	±0.05	33.54	±1.94	0.07	±0.01
Perennial Grass/Forb	19.73	±2.17	29.77	±3.81	—	—

3.1.3.3 Cover: Sagebrush Habitat Plots

Cover by species is summarized by nativity and by functional groups within sagebrush habitat plots and it is compared to baseline values for the same functional groups (Table A-1). Overall, total vascular plant cover in both native and introduced groups was greater in 2023 than the baseline. In terms of total cover, native functional groups were more abundant than introduced functional groups and the shrub and native perennial graminoid functional groups contributed the greatest amount to total cover. The introduced functional groups did have greater cover in 2023 when compared to baseline but contributed very little to total vegetative cover.

Native shrubs were the most abundant functional group in the sagebrush habitat plots, which includes multiple species of sagebrush (*Artemisia* spp.). Big sagebrush (*A. tridentata*) is the most abundant species. Although threetip sagebrush (*A. tripartita*) and black sagebrush (*A. nova*) were some of the least abundant when averaged across all plots, they were locally abundant on the limited number of plots where they each occurred. Low sagebrush (*A. arbuscula*) was not recorded in 2023. The absence of this species from the dataset is more likely a field misidentification during one or more of the years during which the baseline was established rather than a loss of the species from the plots. Sagebrush identification in the field is challenging because sagebrush species hybridize and share key morphological characteristics across species (Shultz 2009). Green rabbitbrush (*Chrysothamnus viscidiflorus*) cover was lower in 2023 than the baseline but was the second most abundant shrub species overall. Shadscale saltbush (*Atriplex confertifolia*), winterfat (*Krascheninnikovia lanata*), granite prickly phlox (*Linanthus pungens*), and shrubby buckwheat (*Eriogonum microthecum*) contribute to the diversity of shrubs in the baseline and in 2023 but are not major contributors to total shrub cover.

The cover of the native perennial graminoid functional group was greater than the baseline within sagebrush habitat plots in 2023 (Table A-1). It was notable that cover for a single species, bottlebrush squirreltail (*Elymus elymoides*), was substantially greater than baseline, and cover for a variety of other species was generally comparable to baseline. While the less abundant species contributed little to overall cover individually, they collectively were as abundant as bottlebrush squirreltail. Of those species, Douglas's sedge (*Carex douglasii*) cover was greater than the baseline, Sandberg's bluegrass (*Poa secunda*) and Indian ricegrass (*Achnatherum hymenoides*) cover was comparable to the baseline, and bluebunch wheatgrass (*Pseudoroegneria spicata*), needle-and-thread (*Hesperostipa comata*), and thickspike wheatgrass (*Elymus lanceolatus*) cover was below the baseline.

Within sagebrush habitat plots, introduced functional groups remained a minor component of total vascular plant cover even when considering that the total introduced annual and biennial cover was two times greater than the baseline in 2023. The introduced perennial grasses functional group is composed of a single species, crested wheatgrass, and its 2023 cover was comparable to the baseline. Cheatgrass (*Bromus tectorum*), desert alyssum (*Alyssum desertorum*), and saltlover (*Halogeton glomeratus*) each had greater cover than the baseline. It is notable, that total vascular cover on the sagebrush habitat plots was 55% in 2023 and cheatgrass cover in those same plots averaged only about 3.5%.

3.1.3.4 Cover: Non-sagebrush Habitat Plots

Total vascular cover on non-sagebrush plots was higher in 2023 when compared to the baseline. The overall greater cover in 2023 was from introduced functional groups. The composition of native vascular cover was only slightly more than half of the total vascular cover in 2023, while nearly two thirds of vascular cover is from native species in the baseline cover values. This change in composition represents higher cover values from introduced species but greater introduced cover does not appear to be at the expense of cover from the native functional groups because total native cover values are similar between 2023 and baseline (Table A-2).

Non-sagebrush plots had comparable cover from native shrubs between the baseline and 2023 (Table A-2). Plant species capable of resprouting from underground structures are among the first species to reestablish after a wildland fire (INL 2023). The native shrub stratum in non-sagebrush plots is dominated by green rabbitbrush because it is capable of resprouting following wildland fire, but in 2023 this species had substantially less cover than the baseline. There are a variety of other shrub species found in non-sagebrush habitat and, while they each contribute less to the overall cover, they are collectively important to habitat diversity and recovery. Sagebrush species are uncommon within these areas because they are typically unable to resprout following wildland fire. Interestingly, areas with sagebrush species had markedly greater cover in 2023 than the baseline. This result is a sign of progress toward sagebrush habitat recovery, but sagebrush cover is likely not ecologically meaningful or beneficial to sagebrush obligates because it is still considerably below general habitat guidelines for sage-grouse (Connelly et al. 2000).

Native perennial graminoids, grasses and grass-like plant species, were the most abundant native functional group across non-sagebrush plots because they resprout after wildland fire (INL 2023). Needle-and-thread and thickspike wheatgrass were the most abundant grasses in 2023 and cover of each was greater than the baseline. Sandberg's bluegrass, Douglas's sedge, and Indian ricegrass were comparable to baseline. Cover from bluebunch wheatgrass and western wheatgrass was lower in 2023 compared to the baseline.

In 2023, the total cover from introduced species was greater than the baseline. Cover values for Russian thistle (*Salsola tragus*) and saltlover were considerably greater than the baseline. Cheatgrass was the most abundant species, contributing about a quarter of the total vegetative cover to non-sagebrush plots, but cheatgrass cover in 2023 remained comparable to the baseline. Cheatgrass cover has been documented to fluctuate over time (Forman and Hafla 2018; INL 2023) and the amplitude of those fluctuations is much greater in non-sagebrush plots than in sagebrush habitat plots (INL 2023). Cheatgrass is a non-native annual grass that is highly responsive to variable environmental conditions. It is invading the western U.S and changing ecosystem dynamics across much of the sagebrush steppe (Mealor et al. 2013, De Stefano et al. 2024). Though it does not yet dominate large expanses of the INL Site (Shive et al. 2019), it remains a concern and will continue to be closely monitored.

3.1.3.5 Vegetation Height: Sagebrush Habitat Plots

The vegetation height metric provides a measure of vertical structure available to sage-grouse for shelter and compares functional groups in sagebrush habitat plots and non-sagebrush plots (Table 3-2a; Table 3-2b). In 2023, nearly all functional groups were substantially taller than the baseline. The species composition is presented by the portion of the sample measured and indicates that the overall vegetative structure. Sagebrush habitat plots have an overstory of sagebrush with an herbaceous understory that is dominated by perennial grasses. In 2023, sagebrush species were taller on average compared to the baseline and were the tallest of the shrub species. Sagebrush species were measured more frequently within the shrub functional groups in sagebrush habitat plots, as indicated by the proportion of the sample measured. Within herbaceous functional groups, perennial grasses were considerably taller than other herbaceous groups and taller than the baseline, but in 2023 this group was measured less frequently compared to the baseline. The only species within the annual grasses functional group is cheatgrass. Although the annual grass was below baseline height, this group was measured more frequently in 2023 than baseline.

3.1.3.6 Vegetation Height: Non-sagebrush Plots

In 2023, non-sagebrush plot shrub canopy was taller than the baseline and dominated by species other than sagebrush, as noted in the proportion of sample, but the few individual sagebrush species measured were substantially taller than the baseline (Table 3-2b). The average height for herbaceous perennial species was taller than the baseline and they were the most frequently measured herbaceous individuals. The average height for herbaceous annual species was comparable to the baseline but annual forbs were more frequently measured compared to the baseline while annual grasses were less frequently measured than the baseline.

3.1.3.7 Sagebrush Density

To understand how general sagebrush population trends may affect habitat condition, the baseline sagebrush density and juvenile frequency are compared to 2023 data from sagebrush habitat plots and non-sagebrush plots (Table 3-3). Overall, sagebrush habitat plots had lower densities and juvenile frequencies in 2023 when compared to the baseline. The baseline juvenile frequency values indicate that individuals occur in four out of 10 belt transects whereas the number of belt transects containing juvenile sagebrush was lower at two out of 10 belt transects in 2023.

Densities and juvenile frequencies for sagebrush in non-sagebrush plots were similar in 2023 when compared to the baseline. Mean juvenile frequency was the same for the baseline and 2023 results which indicate that individuals occur in about two out of 100 belt transects. As expected, sagebrush density and juvenile frequency remains low within non-sagebrush plots where habitats have not had sufficient time to recover to sagebrush steppe.

Table 3-2a. Vegetation height by functional group for 43 annual sagebrush habitat plots on the Idaho National Laboratory Site in 2023. Baseline values are summarized by functional groups for height (cm) and were generated from five years of data (2013–2017; *n* = 5).

Sagebrush Habitat Plots				
	Baseline		2023	
Functional Group	Mean Height (cm)	Proportion of Sample	Mean Height (cm)	Proportion of Sample
Shrubs				
Sagebrush	47.81	0.72	51.38	0.70
Other Species	25.57	0.28	28.06	0.30
Herbaceous				
Perennial Grasses	22.49	0.67	30.34	0.57
Perennial Forbs	9.98	0.12	16.58	0.06
Annual Grasses	18.95	0.04	14.84	0.12
Annual Forbs	9.09	0.17	10.55	0.25

Table 3-2b. Vegetation height by functional group for 32 annual non-sagebrush plots on the Idaho National Laboratory Site in 2023. Baseline values are summarized by functional groups for height (cm) and were generated from five years of data (2013–2017; *n* = 5).

Non-sagebrush Plots				
	Baseline		2023	
Functional Group	Mean Height (cm)	Proportion of Sample	Mean Height (cm)	Proportion of Sample
Shrubs				
Sagebrush	33.54	0.08	47.49	0.08
Other Species	26.82	0.92	29.26	0.92
Herbaceous				
Perennial Grasses	31.49	0.55	37.87	0.49
Perennial Forbs	11.64	0.06	17.88	0.04
Annual Grasses	16.96	0.25	17.22	0.20
Annual Forbs	10.94	0.15	9.89	0.27

Table 3-3. Sagebrush density (individuals/m^2) and juvenile frequency from sagebrush habitat monitoring plots (n = 43) and non-sagebrush monitoring plots (n = 32) on the Idaho National Laboratory Site in 2023 compared to baseline values. Baseline values were generated from five years of monitoring data (2013–2017; n = 5).

Sagebrush Density	Sagebrush Habitat Plots		Non-sagebrush Plots	
	Baseline	2023	Baseline	2023
Mean Density (individuals/m^2)	5.19	2.29	0.07	0.06
Minimum Density (individuals/m^2)	0.43	0.80	0.00	0.00
Maximum Density (individuals/m^2)	47.60	4.38	0.74	0.68
Mean Juvenile Frequency	0.38	0.19	0.02	0.02

3.1.3.8 Precipitation

Long-term precipitation data are provided by National Oceanic and Atmospheric Administration and data from are used to facilitate the interpretation of changes in habitat condition on the INL Site. Over the last two decades, there have been more years with precipitation below the long-term average than years with precipitation above the long-term average and total precipitation in those dry years has departed farther from the average than it has in wet years (Forman and Hafla 2018; Figure 3-2). Seasonality of precipitation has also departed from long term-averages since the initiation of habitat condition monitoring. Historically, April, May, and June are the wettest months on average (Clawson et al. 2018) but over the last ten years, August, September, and October are substantially wetter than long-term monthly averages (Figure 3-3). If late summer and early fall seasons continue to be wetter than spring, some plant species and functional groups would certainly favor a shift in precipitation over others.

The total precipitation for 2023 was similar to the 72-year average (Figure 3-3). During the 2023 water year, monthly precipitation in late fall and late winter was substantially above the long-term average but the early parts of these seasons were at or well below the long-term average. Precipitation was near average in spring and early summer, but an unseasonably wet late summer was well above average. The average spring to early summer precipitation likely contributed to the taller vegetation structure. The above average precipitation later in the growing season meant water was more available to species that have peak growth periods later in the growing season and may have influenced abundance in weedy species like Russian thistle and saltlover. The continued deviation of precipitation patterns from the long-term averages highlights potential implications of shifting weather patterns on ecological condition.

Semi-arid plant species are adapted to surviving with limited resources (Smith et al. 1997). Species within different plant functional groups rely on different life history strategies to compete for water and nutrients in extreme conditions. The average precipitation for each season was at or above the long-term average and contributed to greater cover, heights, and densities because water was more available this season where it is typically the limited resource in the sagebrush steppe ecosystem. The above average precipitation likely influenced the overall greater abundance in many functional groups in 2023 and have the potential to impact future seasonal growth patterns in all functional groups because most of the native functional groups are adapted to withstand years of harsh conditions until more favorable conditions arrive.

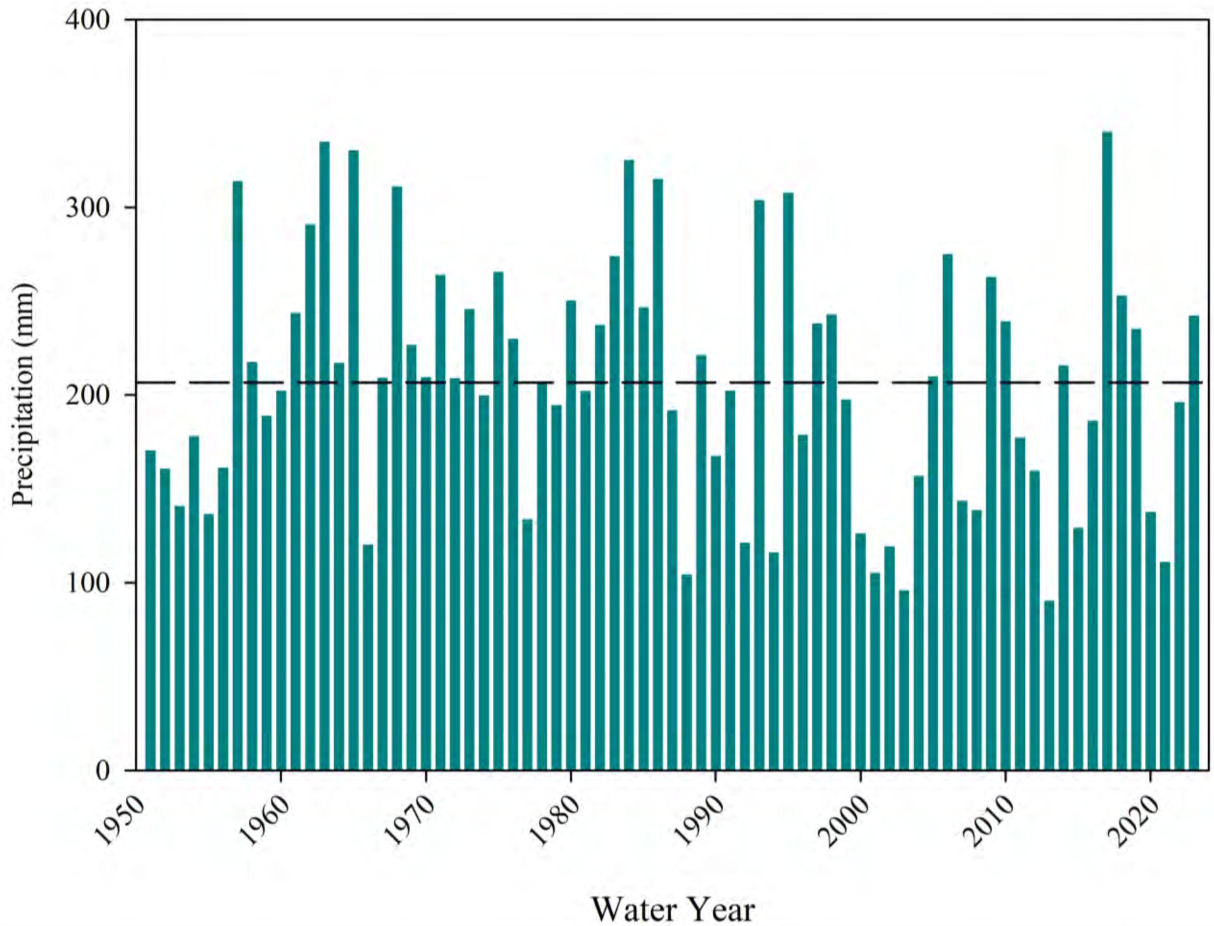

Figure 3-2. Total precipitation by water-year (October 1–September 30) from 1951 through 2023 at the Central Facilities Area, Idaho National Laboratory Site. The dashed line represents the mean annual precipitation (206 mm).

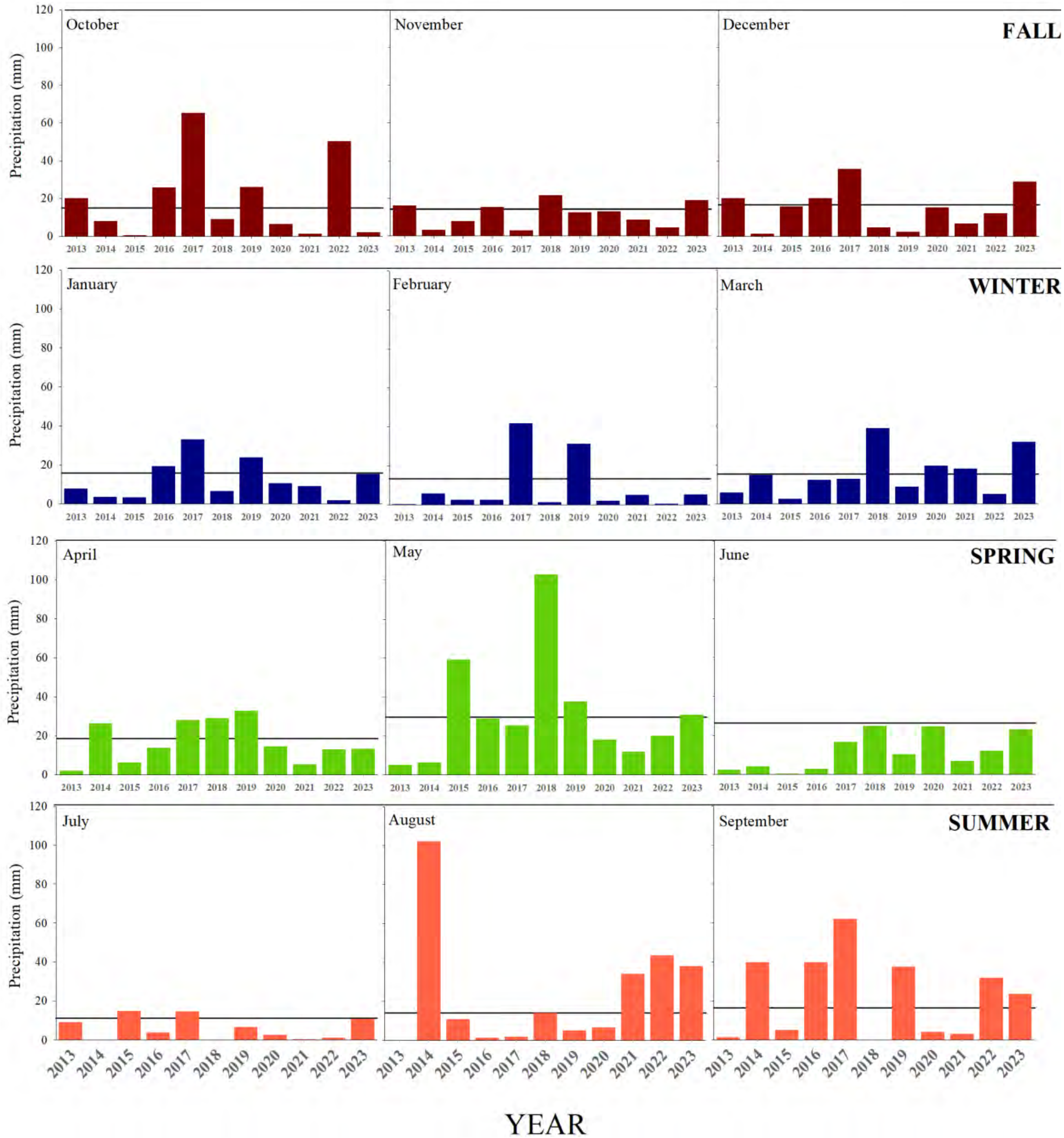

Figure 3-3. Monthly precipitation totals, organized by water-year (October 1–September 30), from 2013 to 2023. Means are depicted with a solid line and were calculated from precipitation data collected between 1951 to 2023. Data are from the Central Facilities Area on the Idaho National Laboratory Site and were provided by The National Oceanic and Atmospheric Administration.

3.1.3.9 Habitat Condition Trend Analyses: Sagebrush Habitat Plots

Monitoring of the condition of habitat plots has spanned eleven consecutive years and cover data are analyzed to evaluate plant functional groups trends, which can be used to infer changes in habitat status at the INL Site. From 2013–2023, cover trends differed among native functional groups (Figure 3-4a). Cover from sagebrush species has trended upward in the last six years and there is 4% greater sagebrush cover in 2023 than 2013 (Table 3-4a). Differences in sagebrush cover over the past 11 years are significant ($p < 0.02$) and results of pairwise multiple comparisons indicate that mean cover values from the latter part of the sample period are significantly greater than mean cover values from the early part of the sample period (Table 3-4a). The cover from other shrub species, which includes all shrubs except sagebrush species and is the second most abundant functional group, was significantly greater in 2013 compared to the past 11 years except for two of those years (2017, 2019; $p<0.04$). There does not appear to be a directional trend in this group. The mean cover of native perennial graminoids significantly differed between the highest years and lowest years by nearly an order of magnitude ($p < 0.001$, Table 3-4a), but mean cover of this functional group currently appears to be returning to the middle of the normal range of variation. The cover of native perennial forbs has generally been near 1% throughout the decade of monitoring; the three years with the highest mean cover are significantly greater than the three years with the lowest mean cover ($p < 0.001$). There does not appear to be a discernable directional trend in the cover of native annual and biennial forbs but in years with average or above average precipitation correspond to the significantly greater years of cover over the eleven-year sample period.

Cover contributed by introduced functional groups has remained low on sagebrush habitat plots throughout the monitoring period (Figure 3-4b). Introduced perennial grass cover has been consistently low since monitoring began with no apparent trend (Table 3-4b). Cover for introduced annual grasses has fluctuated but changes in the eleven-year cover values indicate no pattern or directional trend. Annual grass cover was significantly greater in years with the highest cover values than years with the lowest cover values ($p < 0.001$). Introduced annual forb cover was significantly greater in the three years with the highest cover values than the years with the lowest cover values ($p < 0.001$). There does appear to be significantly greater introduced annual forb cover in years with above average precipitation but remains a minor component within intact sagebrush habitats.

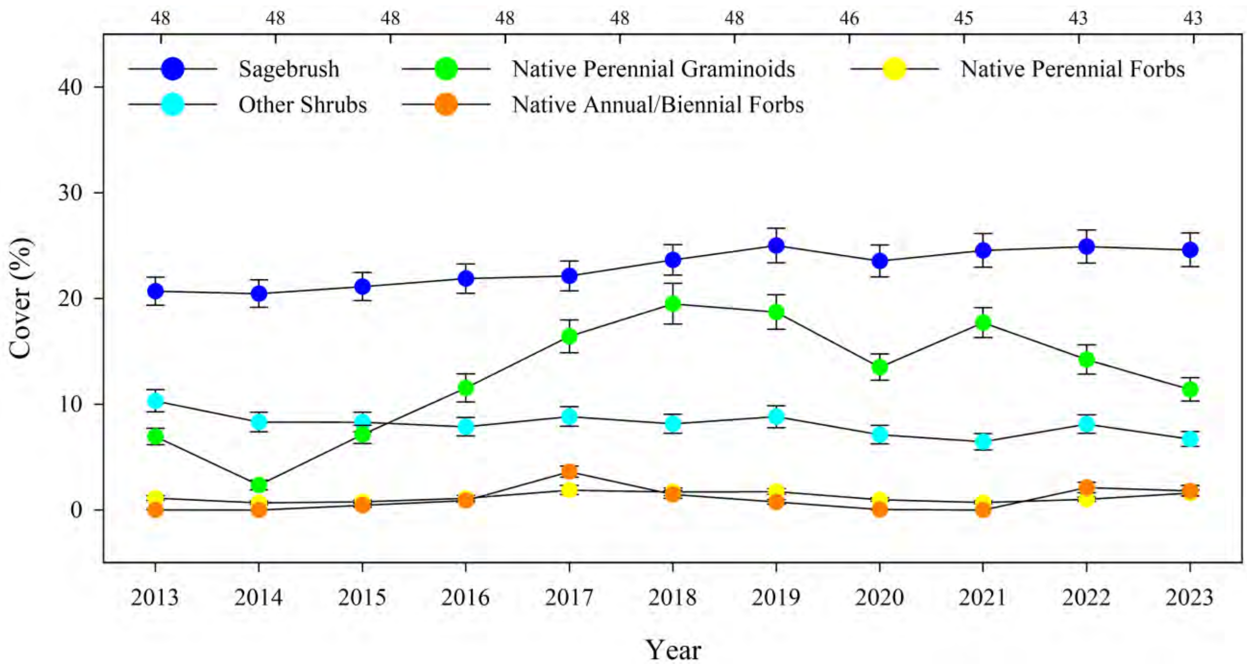

Figure 3-4a. Sagebrush habitat plot cover summarized by plant functional groups composed of native species on the Idaho National Laboratory Site from 2013 through 2023. Cover is the absolute mean. Error bars represent ±1 SE. Sample size is denoted along the top at corresponding tick marks.

Table 3-4a. Sagebrush habitat plot cover summarized by plant functional groups composed of native species on the Idaho National Laboratory Site from 2013 through 2023. Minimum significant difference indicates the value at which the difference between two means becomes significant at α < 0.05.

Sagebrush Habitat Plots: *Native Functional Groups* Mean Cover (%)					
Year	Sagebrush	Other Shrubs	Native Perennial Graminoids	Native Perennial Forbs	Native Annual/Biennial Forbs
2013	20.7	10.3	7.0	1.1	0.0
2014	20.5	8.3	2.4	0.7	0.0
2015	21.1	8.3	7.1	0.8	0.4
2016	21.9	7.9	11.5	1.1	0.9
2017	22.1	8.8	16.4	1.9	3.6
2018	23.7	8.2	19.5	1.7	1.5
2019	25.0	8.8	18.7	1.7	0.8
2020	23.6	7.1	13.5	1.0	0.0
2021	24.6	6.5	17.7	0.7	0.0
2022	24.9	8.1	14.2	1.0	2.1
2023	24.6	6.7	11.4	1.6	1.8

Sagebrush Habitat Plots: *Native Functional Groups* Mean Cover (%)					
Minimum Significant Difference	2.7	2.1	4.5	1.0	1.3

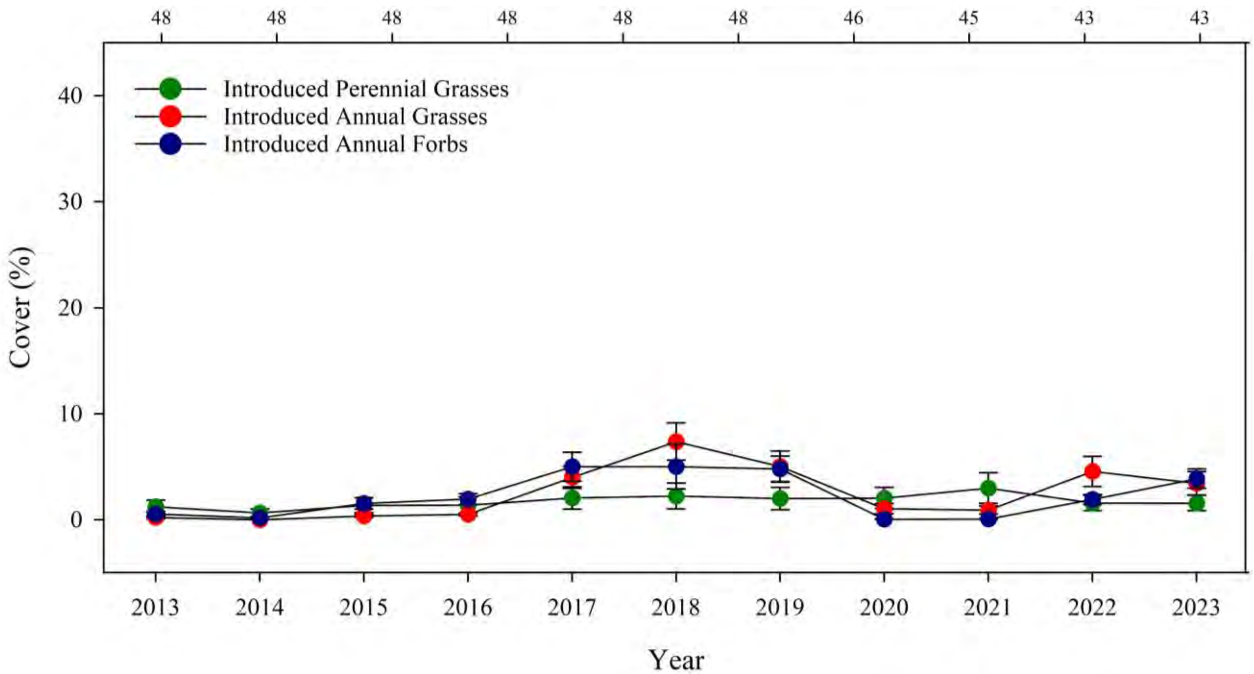

Figure 3-4b. Sagebrush habitat plot cover summarized by plant functional groups composed of introduced species on the Idaho National Laboratory Site from 2013 through 2023. Error bars represent ±1 SE. Sample size is denoted along the top at corresponding tick marks.

Table 3-4b. Sagebrush habitat plot cover summarized by functional groups composed of introduced species on the Idaho National Laboratory Site from 2013 through 2023. Minimum significant difference indicates the value at which the difference between two means becomes significant at $\alpha < 0.05$.

Sagebrush Habitat Plots: *Introduced Functional Groups* Mean Cover (%)			
Year	Introduced Perennial Grasses	Introduced Annual Grasses	Introduced Annual Forbs
2013	1.2	0.2	0.5
2014	0.7	0.0	0.2
2015	1.4	0.4	1.5
2016	1.4	0.5	2.0
2017	2.1	4.0	5.0
2018	2.2	7.4	5.0
2019	2.0	5.0	4.8

Sagebrush Habitat Plots: *Introduced Functional Groups* Mean Cover (%)			
2020	2.1	1.0	0.1
2021	3.0	0.9	0.1
2022	1.6	4.6	1.9
2023	1.6	3.4	3.9
Minimum Significant Difference	2.3	3.1	3.0

3.1.3.10 Habitat Condition Trend Analyses: Non-sagebrush Plots

The native perennial grasses and other shrubs functional groups are substantially more abundant than shrubby sagebrush species and native forb functional groups through the sample period in non-sagebrush plots and they generally lack directional cover trends (Figure 3-5a). Although sagebrush species cover has been below 1% since this sampling effort was initiated, cover appears to be trending upward as cover has generally increased since 2013 and cover in 2023 is significantly greater than the first two years ($P = 0.02$; Table 3-5a). The native perennial, biennial, and annual forb functional groups exhibit no discernable trends and abundance fluctuations appear to coincide with precipitation events but exhibit a relatively narrow range of variability.

The cover for introduced perennial grasses has consistently remained below 1% through the monitoring period and variation between years is narrow (Figure 3-5b). The cover from introduced annual forbs has increased since 2020. Notably, there are significantly higher cover values in above average precipitation years compared to the drought periods between 2013-2014 and 2020-2021 ($P = 0.001$; Table 3-5b). Cover for introduced annual grasses has fluctuated substantially over the eleven-year sample period. Although introduced annual grass cover in 2023 was similar to 2022, it remains significantly lower than the three years with the greatest mean cover from 2017-2019 ($p < 0.001$, Table 3-5b).

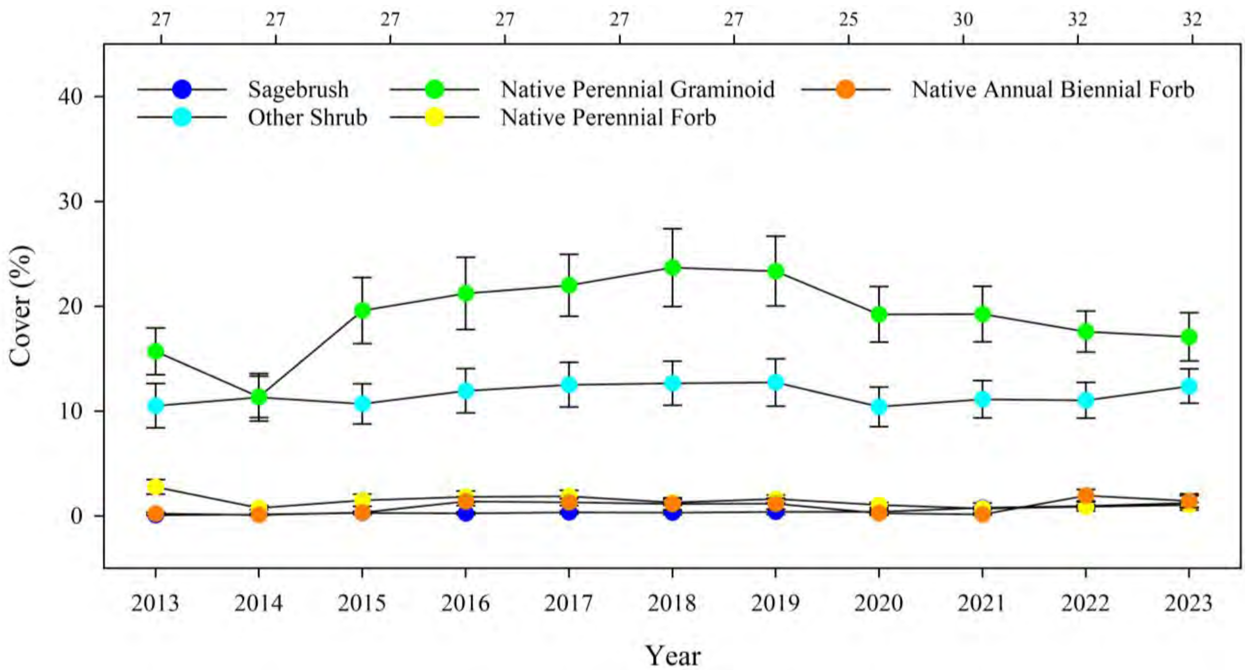

Figure 3-5a. Non-sagebrush plot cover summarized by plant functional groups composed of native species on the Idaho National Laboratory Site from 2013 through 2023. Error bars represent ± 1 SE. Sample size is denoted along the top at corresponding tick marks.

Table 3-5a. Non-sagebrush plot cover summarized by plant functional groups composed of native species on the Idaho National Laboratory Site from 2013 through 2023. Minimum significant difference indicates the value at which the difference between two means becomes significant at α < 0.05.

Non-sagebrush Plots: *Native Functional Groups* Mean Cover (%)					
Year	Sagebrush	Other Shrubs	Native Perennial Graminoids	Native Perennial Forbs	Native Annual/Biennial Forbs
2013	0.1	12.3	15.7	2.8	0.2
2014	0.1	12.2	11.4	0.8	0.1
2015	0.3	12.6	19.6	1.5	0.3
2016	0.3	14.0	21.2	1.8	1.4
2017	0.3	14.7	22.0	1.9	1.3
2018	0.3	14.9	23.7	1.3	1.2
2019	0.4	15.2	23.3	1.6	1.2
2020	0.4	12.0	19.2	1.1	0.3
2021	0.8	11.8	19.6	0.7	0.1
2022	1.0	12.6	17.6	0.9	1.9

Non-sagebrush Plots: *Native Functional Groups* Mean Cover (%)					
2023	1.2	10.8	17.1	1.1	1.4
Minimum Significant Difference	1.2	N/A	5.7	1.7	1.8

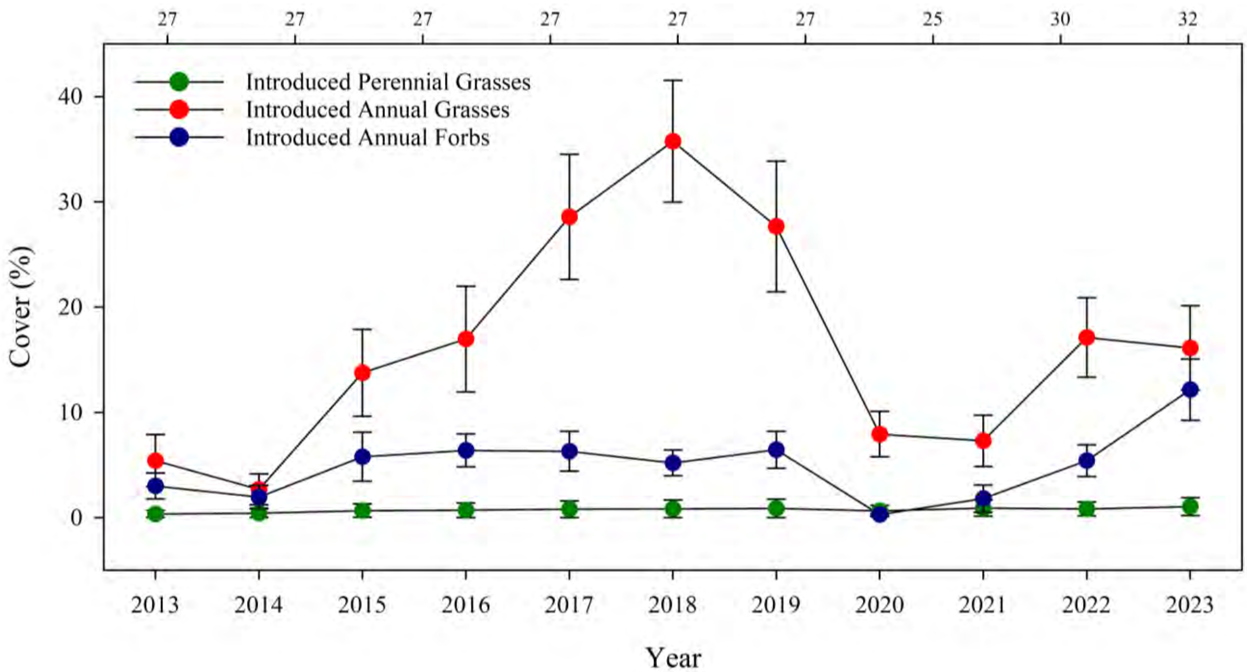

Figure 3-5b. Non-sagebrush plot cover summarized by plant functional groups composed of introduced species on the Idaho National Laboratory Site from 2013 through 2023. Error bars represent ±1 SE. Sample size is denoted along the top at corresponding tick marks.

Table 3-5b. Non-sagebrush plot cover summarized by plant functional groups composed of introduced species on the Idaho National Laboratory Site from 2013 through 2023. Minimum significant difference indicates the value at which the difference between two means becomes significant at α < 0.05.

Non-sagebrush Plots: *Introduced Species* Mean Cover (%)			
Year	Introduced Perennial Grasses	Introduced Annual Grasses	Introduced Annual Forbs
2013	0.4	5.4	3.0
2014	0.4	2.7	2.0
2015	0.7	13.8	5.8
2016	0.7	17.0	6.4
2017	0.8	28.6	6.3
2018	0.8	35.8	5.2

Non-sagebrush Plots: *Introduced Species* Mean Cover (%)			
2019	0.9	27.7	6.5
2020	0.6	7.9	0.4
2021	0.9	7.3	1.8
2022	0.8	17.1	5.4
2023	1.1	16.1	12.2
Minimum Significant Difference	N/A	9.8	9.2

3.1.4 Summary of Habitat Condition

The annual results of cover, height, and density are compared to the baseline between sagebrush habitat plots and non-sagebrush plots to characterize the habitat types available to sage-grouse. The results from the sagebrush habitat plots are summarized below and then followed by result summaries from the non-sagebrush plots. Overall, the condition of sagebrush habitat plots is representative of intact sagebrush habitat because these areas are dominated with a woody sagebrush overstory and a native herbaceous grass/forb understory (Table 3-1a). Sagebrush habitat plots total vascular cover was greater, and plants tended to be taller than the baseline this season but sagebrush density was lower than the baseline (Table 3-1a). In general, native functional groups were more abundant and more species contributed to total vascular cover than introduced functional groups (Table A-1). Cover in introduced functional groups was twice baseline in 2023, but introduced cover was a much smaller percentage of total vascular cover than native cover.

Within non-sagebrush plots, perennial grass/forb species were the most abundant functional group and the cover values were comparable to the baseline, but the functional groups heights were considerably taller than the baseline (Table 3-1a, Table 3-1b). Although non-sagebrush plots have few individual sagebrush, their cover and heights were greater than baseline and their density was similar to baseline in 2023. Introduced species cover was greater than baseline in 2023 and was largely the result of higher cover for a few species, including cheatgrass, Russian thistle, and saltlover (Table A-2). Crested wheatgrass cover is consistently within a narrow range of variability despite environmental conditions and is the only species within the introduced perennial grass functional group.

Precipitation is summarized to infer signals and patterns from habitat condition trends. The total precipitation in 2023 was above the 72-year average and there were considerable differences in precipitation timing when compared to historical patterns. Idaho's natural climate baseline patterns are shifting and local precipitation intensities are more evident in eastern Idaho than other regions within the state (Abatzoglou et al. 2021). Precipitation intensities have generally increased across the Northwest (USGCRP 2018). The late summer and fall precipitation recorded at CFA may be explained by the projected increase of precipitation events in magnitude and duration noted in the Idaho Climate-Economy Impacts Assessment (Abatzoglou et al. 2021). The cover increase in annual and biennial functional groups is likely in response to the intensity and timing of discrete weather events because species in these functional group complete their life cycle only under favorable conditions, so their abundance often changes in response to short-term weather events. It is not surprising that cover was greater for cheatgrass, Russian thistle, and saltlover as precipitation timing likely disproportionately affected annual functional groups over other functional groups.

Trend analysis from sagebrush habitat plots and non-sagebrush plots are discussed below to understand the quality of habitats available to sage-grouse over time. Sagebrush species are the most abundant functional group in sagebrush habitat plots and their abundance is trending upward across the INL Site. Native perennial grasses are a major functional group that has been fluctuating between the mid- to upper range of variability over the past four years but appears to be returning toward the middle of their range of variability. Native perennial forb cover contributes little to total vascular cover, but since monitoring began in 2013, the years with above average precipitation coincided with significantly greater cover in this functional group. Cheatgrass has been a minor component of INL Site plant communities for several decades; however, because cheatgrass can become much more abundant in plant communities affected by wildland fire, it is more likely to dominate non-sagebrush plant communities post-fire. Patterns from this analysis are consistent with other studies conducted on the INL Site, which show that although most post-fire communities are generally dominated by native resprouting shrubs and grasses, cheatgrass can dominate localized patches (Forman and Hafla 2018). Cheatgrass cover has been more variable and fluctuates in response to seasonal precipitation patterns (Forman and Hafla 2018) which results in a large range of annual variation (INL 2024a). Intact sagebrush plant communities appear to be more resistant to cheatgrass dominance than recovering habitats (De Stefano et al. 2024). This pattern is particularly evident in years where weather patterns are favorable for the invasive introduced annual grass because non-sagebrush plots have substantially amplified cover fluctuations compared to intact sagebrush habitat plots.

3.2 Task 6—Monitoring to Determine Changes in Sagebrush Habitat Amount and Distribution

3.2.1 Introduction

Loss of sagebrush-dominated habitat has been identified as one of the primary causes of decline in sage-grouse populations (Idaho Sage-grouse Advisory Committee 2006, USFWS 2013). Direct loss of sagebrush habitat on the INL Site has occurred through several mechanisms including wildland fire and infrastructure development. In the future, we expect the total area and extent of sagebrush habitat to change following wildland fires, as new facilities are developed on the INL Site, and as lands recover naturally or are restored. Changes in land cover can be determined using airborne or satellite imagery that is readily available at little or no cost. Natural Resources Group geographic information system (GIS) analysts routinely compare new imagery as it becomes available with results from the most current vegetation classification and mapping project. Ground-based point surveys and changes in plant species cover and composition documented through Task 5 (Section 3.1) are also used to provide spatial information to assist with periodic map updates needed to monitor the habitat trigger in the CCA.

A 20% loss of sagebrush habitat from the 2013 baseline has been identified as a habitat trigger in the CCA (DOE-ID and USFWS 2014). The purpose of Task 6 is to maintain and update regions of the INL Site vegetation map to accurately document changes in sagebrush habitat area and distribution. This task documents changes in sagebrush habitat following losses due to wildland fire or other disturbances that remove or significantly alter vegetation across the landscape. In addition to documenting losses of sagebrush habitat, this monitoring task is also used to map the addition of sagebrush habitat when sagebrush cover increases within a mapped polygon and warrants a new vegetation map class designation, or to refine existing vegetation map class boundaries when changes in species cover and composition are documented through Task 5. Lastly, this task supports post-fire mapping when the fire extent is unknown and allows for modifying existing wildland fire boundaries and unburned patches of vegetation when mapping errors are observed on the ground.

3.2.2 Methods

Documentation of current sagebrush habitat area and distribution on the INL Site results from updates to the vegetation map following a standardized process. The process of maintaining the INL Site vegetation map following wildland fire involves two steps. The first step is to verify, update, or edit existing wildland fire boundaries using a GIS and remote sensing imagery. Wildland fire boundaries are produced by different contractors or agencies (e.g., Bureau of Land Management) using a variety of methods such as collecting Global Positioning System data on the ground or via helicopter, or through manual delineations using digital imagery. The quality and accuracy of wildland fire boundaries can vary considerably depending on the method used to delineate the burned area extent. Prior to delineating new vegetation class boundaries within the burned area, the mapped fire boundaries first need to be generated at similar mapping scales as the original vegetation map to maintain consistency in the dataset.

The second step requires an adequate number of growing seasons for vegetation communities to reestablish before recently burned areas are updated with new, remapped vegetation class polygons representative of the recovering post-fire classes. New wildland fires are sampled to identify the vegetation classes present across the burned area. It can be difficult to assess which vegetation classes establish immediately after a fire, especially during drought years. Identifying and delineating post-fire communities occurs after a couple growing seasons, and possibly longer if the years following fire were excessively dry and delayed normal reestablishment of vegetation communities. Field surveys also commence when a map polygon or burned area begins to show signs (i.e., via habitat condition monitoring data) that the current vegetation class has changed to another class and warrants reassignment. When it becomes available, either through the National Agriculture Imagery Program (NAIP) or from INL Site specific acquisitions, high resolution imagery is used as the source data layer to delineate new vegetation class boundaries within recent wildland fire boundaries.

The mapped wildland fire boundaries are used to directly calculate losses in sagebrush habitat. ArcGIS geoprocessing tools are used to clip and remove areas mapped as sagebrush habitat that have recently burned. In addition to documenting losses from wildland fire, any loss of sagebrush habitat from infrastructure expansion is also included in the summary of total sagebrush habitat removed. See Section 4.2 for additional details regarding methods and results from infrastructure expansion mapping.

3.2.3 Results

There were two small fires that occurred on the INL Site in 2023. On July 9, the Howe Junction Fire occurred near mile marker 259 along U.S. Highway 20/26. The fire started at a power line pole and spread through grass and sagebrush below the power line. The fire was controlled the same day, burning 1.3 ha (3.3 ac). On July 10, the Underpass Fire started on U.S. Highway 20/26 near mile marker 271 after a camp trailer tire blew out. An associated spot fire was identified to the west of the main fire but was only found smoldering with no further spread. The main fire was controlled the same day by creating a 24.4 m (80 ft) wet line perimeter after burning approximately 4.2 ha (10.5 ac). Neither fire required dozer lines and were suppressed with hand tools and water lines.

The two 2023 wildland fires did not meet the size criteria for development of post-fire recovery plans or post-fire mapping, and there was no work performed on the Infrastructure Expansion task in 2023. Therefore, the total area of sagebrush habitat in the SGCA on the INL Site remains unchanged from 2022 with 71,358.8 ha (176,331.4 ac; Figure 3-6). The sagebrush habitat outside of the SGCA is considered a "conservation bank" that could be incorporated into the SGCA to replace lost sagebrush habitat resulting from wildland fire or new infrastructure development (DOE-ID and USFWS 2014). The current estimated area of sagebrush habitat outside the SGCA also remains unchanged with 28,306.5 ha (69,947 ac).

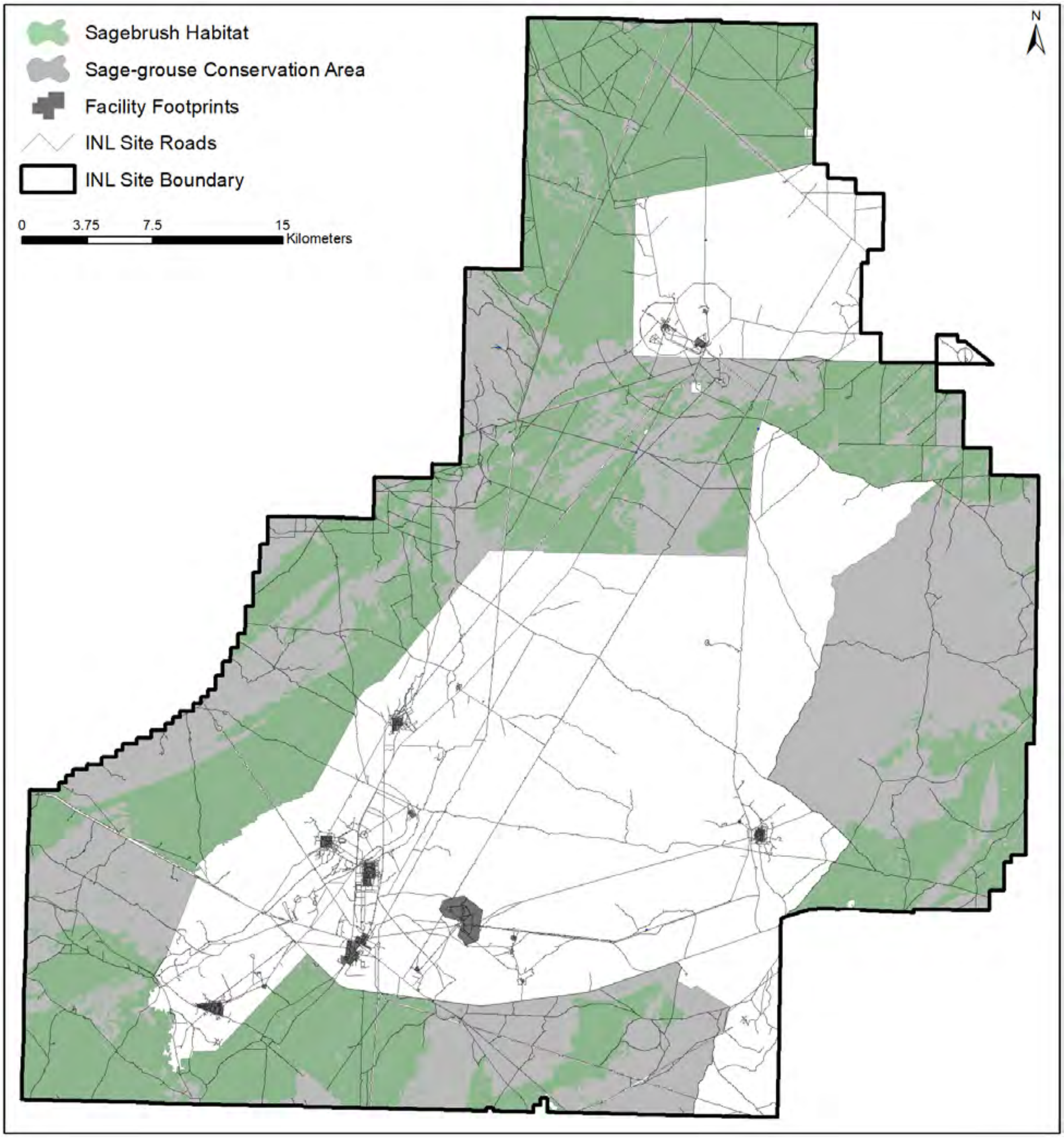

Figure 3-6. Current sagebrush habitat distribution within the Sage-grouse Conservation Area on the Idaho National Laboratory Site.

4.0 THREAT MONITORING

The CCA identified and rated eight threats that potentially impact sage-grouse and its habitats on the INL Site (ratings updated in Shurtliff et al. 2019). Most are addressed by conservation measures DOE-ID has implemented or continues to implement (see Section 5.0). Others, including raven predation, infrastructure development, wildland fire, livestock, and annual grasslands, have been or are currently monitored regularly to inform DOE-ID of changing conditions and to allow evaluation of results after mitigation or other treatments are applied.

Section 4 summarizes results of threats that are regularly monitored and provides updates on actions taken by DOE-ID and its contractors to reduce threats. Raven predation and infrastructure development are addressed in Sections 4.1 and 4.2. The condition of habitats affected by wildland fires and livestock grazing are evaluated in Section 4.3. Although annual grasslands are recognized as a medium-level threat to sage-grouse on the INL Site, cheatgrass control is currently being addressed as a component of post-fire restoration by the INL Wildland Fire Management Committee (WFMC). Continued monitoring of the abundance of cheatgrass (Section 3.1) through CCA habitat condition monitoring is necessary to continue to understand the abundance of cheatgrass in areas that have not recently burned.

4.1 Task 4—Address Raven Predation

4.1.1 Introduction

In 2022, an analysis was performed that identified raven nesting hot spots on INL Site infrastructure based on an eight-year annual nest survey (INL 2023). The analysis produced a prioritized list of facilities, power lines sections, and towers where installation of nest deterrents was recommended. The primary criteria used in the analysis was proximity of nesting hot spots to active sage-grouse leks and potential sage-grouse nesting habitat.

The analysis identified 33 hot spots, the highest priority of which was at the Experimental Breeder Reactor I. Medium-priority hot spots on government-controlled infrastructure included the Naval Reactors Facility (NRF), Advanced Mixed Waste Treatment Project, CFA main gate, two sections of transmission lines southeast of the Specific Manufacturing Capability facility (Hot Spots 19 and 20), and a power line section northeast of NRF (Hot Spot 7; Figure 4-1).

The purpose of this section is to report on actions taken during 2023 to reduce or deter raven nesting on the INL Site, with special emphasis on actions taken within or near raven nesting hot spots.

4.1.2 Activities to Reduce or Deter Raven Nesting

Retrofits of Electrical Power Transmission Lines—BEA Power Management replaced wooden double crossarms with narrow, single-side metal crossarms on eight transmission structures between NRF and Test Area North in 2023. Although structures were selected based on maintenance priority, one structure was only 400 m northeast of Hot Spot 7—a medium-priority hot spot (Figure 4-1). With that retrofit complete, the three structures immediately northeast of Hot Spot 7 are all retrofitted, and 10 of 14 structures along a 2.6-km stretch of line that includes Hot Spot 7 are now retrofitted.

Environmental Breeder Reactor-I (High Priority)—Raven nesting has historically occurred on the two aircraft engines on display at this museum. Nesting on these structures is difficult to manage because engines are in a radiation controlled area (only certified individuals may enter) and because their design affords numerous nesting substrates. Covering the entire structure with netting has been discussed, but no actions have been taken. Incidentally, facility personnel cleaned nesting materials off the engines during the springs of 2022 and 2023 prior to the start of the tourist season. Although follow-up nest monitoring did not occur in either year, the fact that nesting materials were again present in 2023 indicates that merely clearing nesting materials off the substrates is not an effective way to deter raven nesting.

NRF (Medium Priority)—The building on which ravens have nested the most in the past at NRF is scheduled to come down in 2025.

CFA Main Gate (Medium Priority)—A nest was built in the spring of 2023 on a moveable ladder under a lean-to structure behind the badging station at Gate 1. After ensuring no eggs were in the nest, it was removed. In the past, ravens primarily built nests under the eaves of this lean-to, and Facilities and Site Services staff intend to install deterrents under the eaves in 2024.

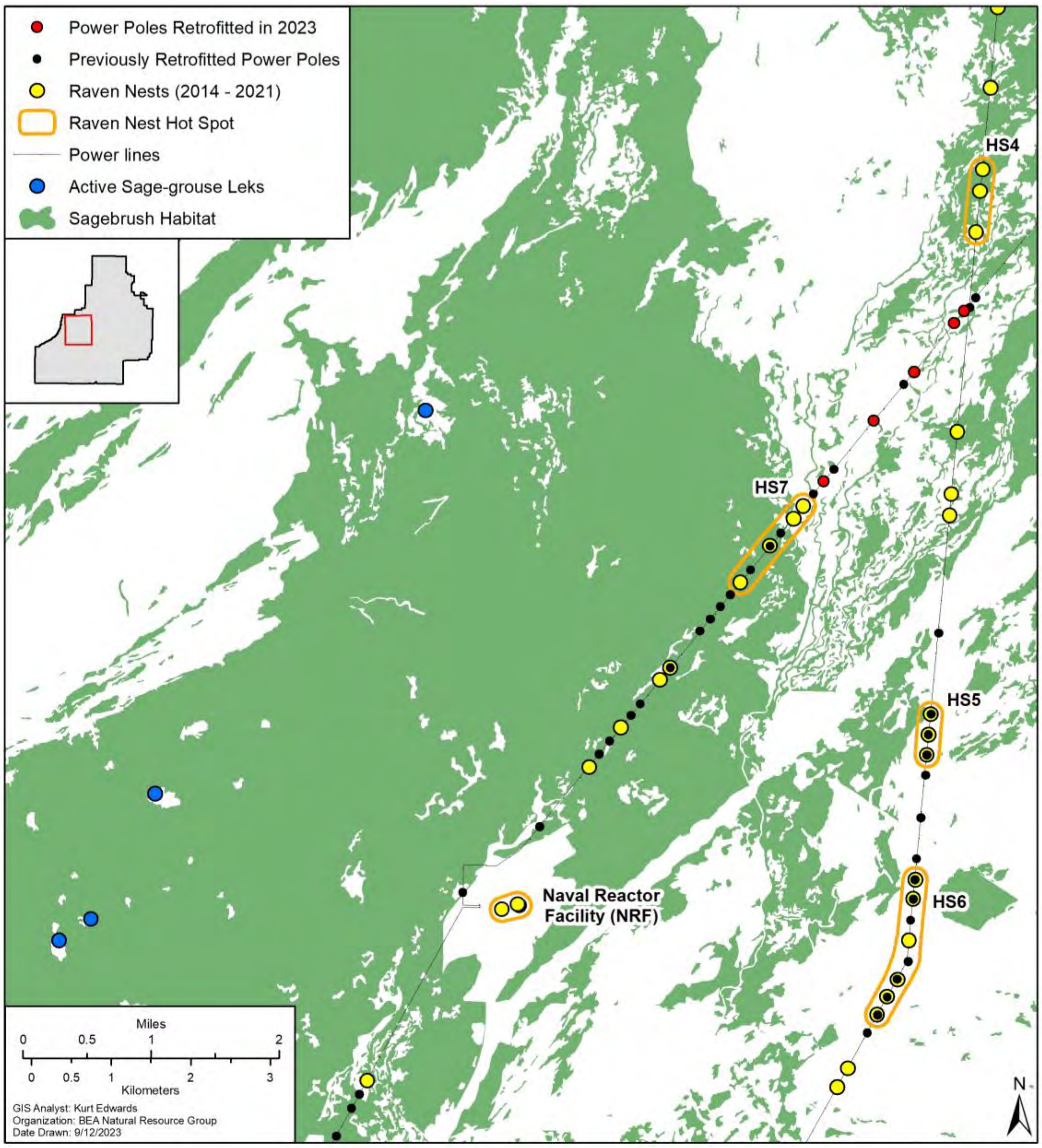

Figure 4-1. Locations of previously-documented raven nests and retrofitted power line structures relative to active sage-grouse leks and sagebrush-dominated plant communities on the west side of the Idaho National Laboratory Site.

4.2 Task 8—Monitor Expansion of the Infrastructure Footprint within the SGCA and Other Areas Dominated by Big Sagebrush

4.2.1 Introduction

Infrastructure development is considered a medium-ranked threat to sage-grouse on the INL Site (DOE-ID and USFWS 2014). Infrastructure promotes habitat fragmentation, and construction of new infrastructure nearly always disturbs soil. If proper controls are not in place, soil disturbance can facilitate the introduction and spread of invasive weeds, which in turn can increase the risk of wildland fire. Weeds may also replace native plants and reduce plant diversity in localized areas, which impacts habitat condition.

Prior to the start of an INL Site construction project that may affect undeveloped land, a National Environmental Policy Act (NEPA) analysis is conducted on the proposed footprint of the project. Approved NEPA projects that remove sagebrush habitat can offset long-term impacts through the implementation of best management practices and compensatory mitigation, however short-term losses are likely. Evidence from remotely sensed images of the INL Site suggests that sometimes infrastructure footprints expand beyond what was originally reviewed during the NEPA process. Thus, there is a possibility that an unplanned impact to sagebrush habitat and other native plant communities could occur following infrastructure development. Occasionally, soil stabilization or revegetation following the completion of a construction project fails to meet its objectives. If no overarching plan for soil stabilization or revegetation is developed, infrastructure may continue to slowly expand, without new structures and disturbances being considered as new or additional scope.

Inappropriate vehicle use associated with trespass and livestock grazing management can also cause habitat degradation in localized areas. Remote sensing imagery shows that the number of linear features (e.g., two-track roads) on the INL Site, especially within grazing allotments, continues to increase since the establishment of baseline condition for this monitoring task (unpublished data; Shurtliff et al. 2020). It is likely that many of these two-tracks were established by allotment permittees to strategically distribute water troughs and mineral salt stations, create shortcuts between roads, and avoid areas with deep ruts that might be impassable under wet conditions. Once a new two-track appears, other drivers may follow it, further establishing a new unauthorized road. Although many named two-track roads are marked with small signs on the INL Site, no official road map has been developed to unambiguously identify authorized roads.

The primary goal of this task is to update sagebrush habitat distribution (see Section 3.2) by identifying where expansion of infrastructure has removed sagebrush habitat within the SGCA and other areas of existing sagebrush habitat. For example, there has been approved expansions at facilities (e.g., MFC ponds) that were not present when the last INL Site vegetation map was published (Shive et al. 2019). Changes in sagebrush habitat distribution are generated from the vegetation map, and areas like these were originally mapped as sagebrush habitat, which is not reflective of current ground conditions and need to be updated periodically. Updates like these represent losses that have been evaluated through the NEPA process and mitigated using best management practices.

An important secondary goal of Task 8 is to continually monitor the increase in linear features (e.g., two-track roads) across the INL Site landscape, specifically within sagebrush habitat and the SGCA. New linear features can provide vehicle access to formerly undisturbed areas. Vehicle use can serve as a vector for non-native species and can also result in direct disturbance to sagebrush habitat by damaging or removing sagebrush. When numerous two-tracks begin to appear in areas previously void of road access, it can serve as an early indication that further habitat degradation is possible.

The availability of high-resolution imagery collected across Idaho, at no cost to the user, provides an invaluable tool to monitor the INL Site landscape and identify changes over time using a GIS. The U.S.

Department of Agriculture NAIP collects digital imagery across the State of Idaho every two years. The publicly available image dataset consists of four spectral bands (i.e., blue, green, red, and near- infrared) usually collected around 1 m spatial resolution. Occasionally, the State will contribute additional funds to have higher resolution imagery collected.

4.2.2 Methods

The GIS analysis workflow for this task includes four steps: (1) download new aerial imagery when available and mosaic a new basemap dataset, (2) review the entire INL Site and mark potential infrastructure expansions and new linear features, and (3) delineate all new infrastructure footprints and digitize linear features, and (4) modify sagebrush habitat polygons where expansion has removed sagebrush.

Two GIS analysts systematically zoom into regions of the INL Site and looked for evidence of surface disturbance throughout the SGCA and within sagebrush habitat outside of the SGCA. Occasionally, image properties are adjusted to accentuate pixel values in an area of interest or add more contrast to help with feature identification. The image review process occurs at fine map scales (i.e., 1:1,000 or less) so minor changes on the landscape, such as a new set of vehicle two-tracks, are more easily detected. GIS analysts visually scan around facilities, borrow sources and new project areas to investigate whether the infrastructure footprint has expanded and now overlaps regions previously mapped as sagebrush habitat. Anytime a potential location is identified by an analyst, it is marked for a secondary review.

Once each GIS analyst thoroughly reviews the entire INL Site, all potential infrastructure expansion locations are reconciled into a single list for final review. The monitoring task lead investigates each marked location and determines if the feature warrants delineation. Whenever infrastructure expansion removes sagebrush habitat, or linear features are observed, the area of disturbance and total linear distance are manually delineated using editing tools within a GIS. The new polygon and line features are managed within a geodatabase to maintain accurate area and length statistics. Lastly, all sagebrush habitat polygons are manually updated using GIS editing tools to create the most current sagebrush distribution on the INL Site, which is then used to evaluate habitat status against the baseline (see Section 3.2).

4.2.3 Results

There was no work conducted on this task in 2023 because no new high-resolution imagery was available for the INL Site prior to reporting. The U.S. Department of Agriculture NAIP collected high resolution imagery across the State of Idaho during the summer of 2023 and those data are typically made available the following winter/spring. Once we download and process the new 2023 NAIP imagery, we will systematically review the INL Site for expansion of linear features and losses of sagebrush habitat due to facility or project footprint expansions, and those results will be presented in 2024.

4.3 Task 5— Assessment of Potential Threats to Sagebrush Habitat

4.3.1 Introduction

Wildland fire is ranked as a high-level threat and livestock operations is ranked as a low-level threat to sage-grouse and their habitats on the INL Site (DOE-ID and USFWS 2014). The primary goal of this task is to assess habitat condition in response to potential threats of wildland fire and livestock operations on habitats at the INL Site. Vegetation abundance is compared among fire footprints, grazing allotments, and areas where both activities have occurred. The analysis uses vegetation monitoring plot data from 75 annual and 150 rotational plots and is conducted over a five-year cycle. Vegetation monitoring plots are distributed such that the number of plots in each burned area, allotment, or combination thereof are roughly proportional to the amount of area they occupy (Figure 4-2, Figure 4-3). Data are binned into their respective sample period and differentiated by their habitat status for the analyses.

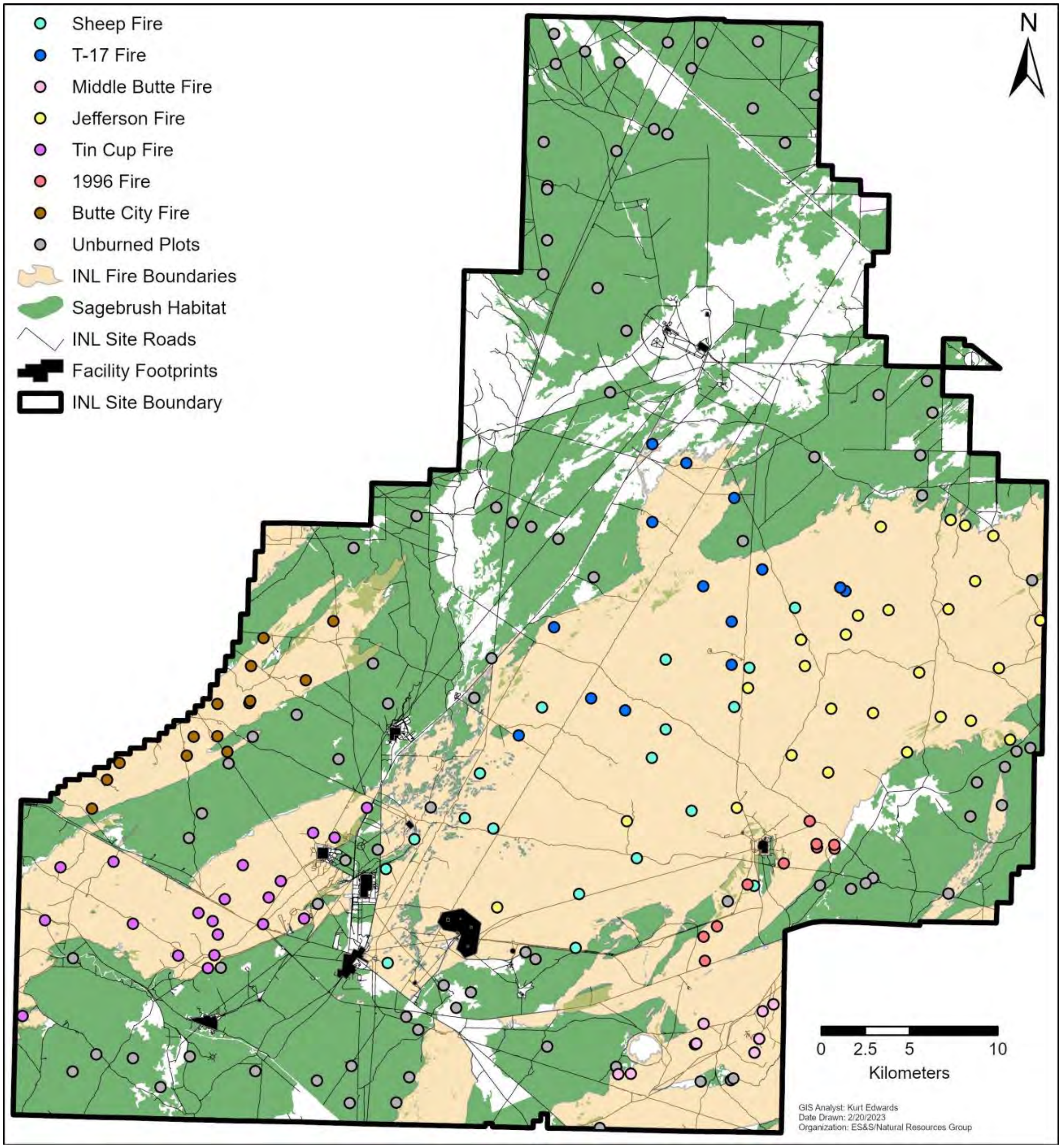

Figure 4-2. Distribution of sage-grouse habitat condition monitoring plots sampled on the Idaho National Laboratory Site with respect to areas burned since 1994.

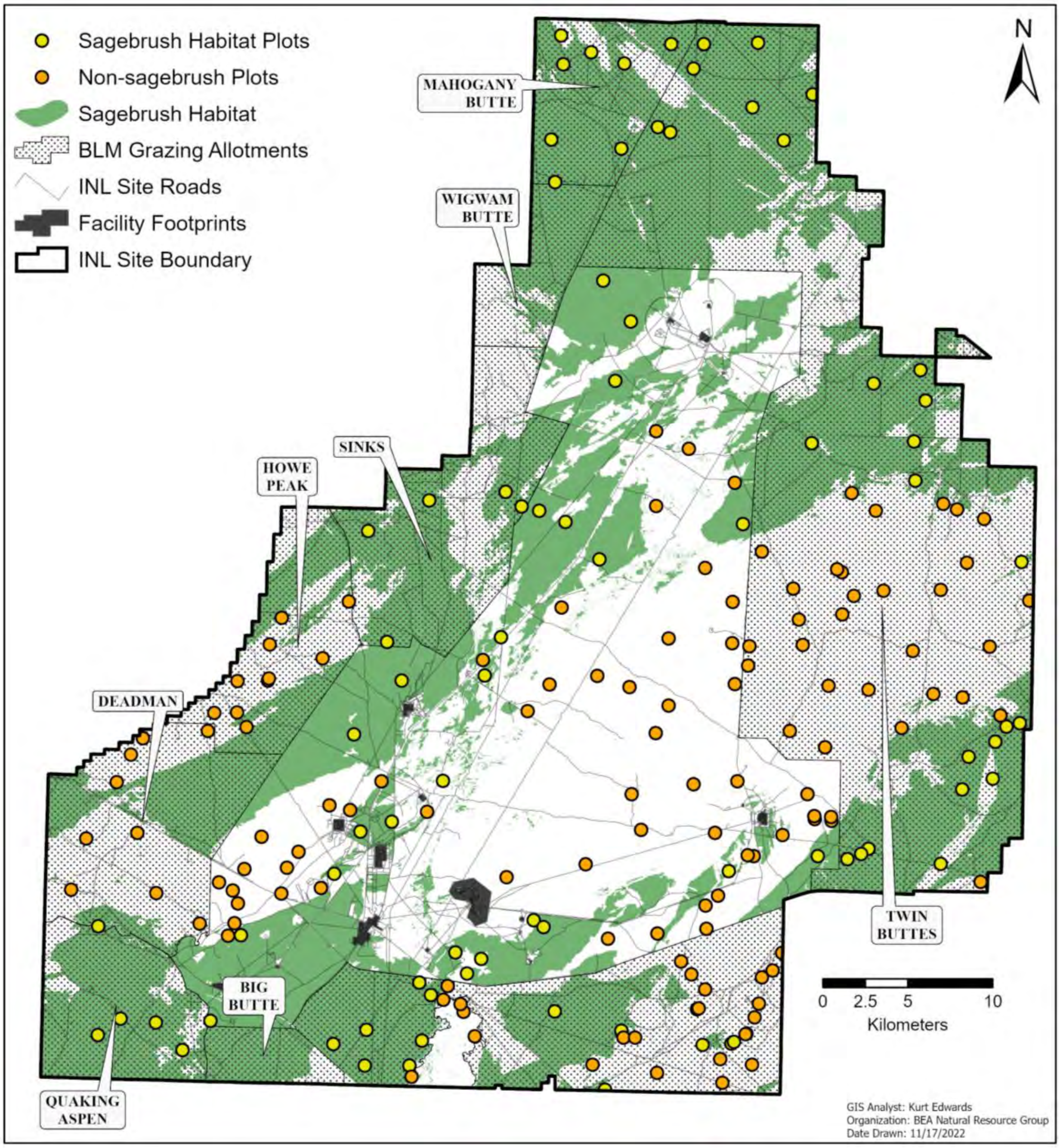

Figure 4-3. Distribution of sage-grouse habitat condition monitoring plots sampled on the Idaho National Laboratory Site with respect to boundaries of grazing allotments administered by the Bureau of Land Management.

4.3.2 Methods

In 2013, there were 225 permeant habitat condition monitoring plots established across the INL Site and they are allocated into groups that are sampled on either an annual or a rotational basis. There are 75 annual plots and an additional 150 rotational plots and the roational plots are subdivided into three subsets of 50 plots and each set of 50 plots is sampled per year over a three-year sample period. Sample period one for rotational plots occurred from 2013–2015 and data collected from the annual plots in 2015 were also included in the analyses. Sample period two for rotational plots occurred from 2018–2020 and analyses from this second period also include data from the annual plots collected in 2020. Further sample periods will follow this pattern. A complete description of sample site selection and plot sampling methodology can be found in the study plan and sample protocol for this monitoring project in Appendix B within Shurtliff et al. 2016.

Data from the sample periods are used to address progress toward habitat recovery in specific burned areas and the potential effects of livestock operations on habitat condition in burned and unburned areas. Cover is summarized by plant species and then grouped into vegetation functional groups (e.g., shrubs, perennial grasses, introduced forbs, etc.). Comparisons are made among plots potentially affected by fire and/or livestock through time using those functional group abundance values. Sample periods from burned areas are compared with unburned habitat and with one another using Two-way Repeated Measure of Analysis of Variance (One Factor Repetition) and Holm-Šidák (Šidák 1967) tests for all pairwise comparisons. The same statistical approach is used to compare functional groups within allotments and ungrazed areas outside of allotments.

4.3.3 Results and Discussion

There work conducted on this task in 2023 sampled 50 rotational plots. Once the vegetation monitoring data is completed for the third sample period from 2023 to 2025, we will conduct the assessment on potential threats to habitat condition and those results will be presented in 2026 to 2027.

Table 4-1. Habitat condition monitoring schedule to conduct vegetation sampling and report results for the third sample period.

Assessment of Potential Threats to Sagebrush Habitats Schedule		
Year	Vegetation Sampling Efforts	Reporting Efforts
2023	Annual + Rotational Set I	Sagebrush Habitat Condition Trends
2024	Annual + Rotational Set II	Sagebrush Habitat Condition Trends
2025	Annual + Rotational Set III	Sagebrush Habitat Condition Trends
2026	Annual	Sagebrush Habitat Condition Trends + Assessment of Potential Threats to Sagebrush Habitats
2027	Annual	

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5.0 IMPLEMENTATION OF CONSERVATION MEASURES

5.1 Summary of 2023 Implementation Progress

The CCA identifies eight threats to sage-grouse and its habitats on the INL Site and outlines 13 conservation measures designed to mitigate and reduce these threats. The agreement also articulates DOE-ID's desire to achieve no net loss of sagebrush due to infrastructure development. The following table (Table 5-1) summarizes actions and accomplishments associated with each conservation measure that DOE-ID, contractors, and stakeholders achieved during 2023 to reduce threats to sage-grouse and its habitats on the INL Site.

Table 5-1. Accomplishments in 2023 for each conservation measure listed in the Candidate Conservation Agreement for the greater sage-grouse on the Idaho National Laboratory Site.

<table>
<tr><td>Threat:</td><td>Wildland Fire</td></tr>
<tr><td>Objective:</td><td>Minimize the impact of habitat loss due to wildland fire and firefighting activities.</td></tr>
<tr><td>Conservation Measures:</td><td>1) Prepare an assessment for the need to restore the burned area. Based on that assessment, DOE-ID would prepare an approach for hastening sagebrush reestablishment in burned areas and reduce the impact of wildland fires >40 ha (99 ac).</td></tr>
<tr><td colspan="2">Conservation Measure 1—Accomplishments in 2023:

BURN ASSESSMENT— Two fires occurred on the INL Site that burned approximately 5.6 ha (14 acres). Because they were below the minimum size, neither fire warranted an assessment for the need to restore the burned areas.

Associated Actions that Addressed the Wildland Fire Threat:
WILDLAND FIRE PREPAREDNESS—In order to slow wildland fire and provide for a better defense area, fire breaks/buffers have been created and are routinely maintained around facilities and along the major roadways. In 2023, BEA Facilities and Site Services mowed 6–12 m (20–40 ft) firebreaks along 190 km (118 mi) of roadways and around 27 facilities and other infrastructure.

UPDATE THE INL APPROACH TO FUELS MANAGEMENT, FIRE SUPRESSION, AND FIRE REOCOVERY—To better address preparedness, response, and recovery from wildland fires, the INL Fire Department is updating an existing plan for fuels management and fire suppression and the NRG is drafting a fire recovery framework for the INL Site. A new Environmental Assessment (EA) will evaluate the proposed actions contained in both plans.

SAGEBRUSH REESTABLISHMENT—INL planted 74,850 seedlings within the 2010 Middle Butte Fire and 2007 Twin Butte Fire to support habitat restoration efforts. Weed control efforts continue in recently burned areas. A subset of sagebrush seedlings planted in 2022 and 2018 were revisited in 2023, and 1-year and 5-year survivorship was assessed (Section 5.2.2).</td></tr>
<tr><td>Threat:</td><td>Infrastructure Development</td></tr>
<tr><td>Objective:</td><td>Avoid new infrastructure development within the SGCA and 1 km (0.6 mi) of active leks and minimize the impact of infrastructure development on all other seasonal and potential habitats on the INL Site.</td></tr>
</table>

Conservation Measures:	2) Adopt best management practices outside facility footprints for new infrastructure development. 3) Infrastructure development within the SGCA or within 1 km (0.6 mi) of an active lek will be avoided unless there are no feasible alternatives.

Conservation Measure 2—Implementation of Best Management Practices in 2023:

In 2023 multiple projects outside facility footprints adopted and implemented best management practices to minimize the impacts to both seasonal and potential habitats on the INL Site. The following infrastructure projects were designed so that the total distance of habitat edge caused by construction activities was minimized.

- Test Area North-691 maintenance and vehicle-storage building (Environmental Compliance Permit [ECP] INL-20-035 R4) was sited immediately adjacent to the Specific Manufacturing Capability fence.
- The Advanced Test Reactor Complex Parking Lot Refurbishment and Expansion project (ECP INL-22-045) was sited within and around the existing Advanced Test Reactor parking lot.
- The Consolidated Training Facility at the Live Fire Range Complex (ECP INL-22-078 R1) was sited immediately adjacent to the existing range, roads, and power infrastructure.
- The Unmanned Aerial Systems (UAS) Testing project (ECP INL-22-093) installed an additional gravel pad immediately adjacent to existing infrastructure located at the UAS runway.
- Nesting structures at Materials and Fuels Complex and CFA (ECP INL-23-020) were sited directly adjacent to their respective facilities. Power upgrades for potable water systems at the Idaho Nuclear Technology and Engineering Center (EC ICP-23-014) were sited adjacent to previously disturbed areas.

The following infrastructure projects were co-located with existing infrastructure and/or were sited in areas dominated by non-native grasses and other exotic species.

- Infrastructure associated with the Cyprus Yeti project (ECP INL-21-087 R4) was sited within the previously developed Bode test bed and all additional testing locations are in previously disturbed areas.
- The Radiological dispersal Device/ Improvised Nuclear Device Material Training Activities and Evaluations Using Radiation Emitting Sources/Materials/Devices project (ECP INL-17-069 R3) was sited within the Radiological Response Training Range located in the previously defined administrative area of the T-28 south borrow pit.
- Areas Associated with USG #121 Test (ECP INL-22-022 R1) were sited only in previously disturbed footprints.
- The GANNETT project (ECP INL-18-059 R4) testing locations were sited in areas dominated by crested wheatgrass or within previously disturbed footprints.
- The West CFA Power Infrastructure & CF-686 buildout project (ECP INL-23-007) sited new infrastructure within existing power infrastructure corridors.

Best Management Practices employed in INL Power Management Activities 2022 (ECP INL-21-067 R1) included the installation of avian protection devices where possible. Of note is the installation of two new power transmission structures near NRF. These were installed so lines could be rerouted toward a substation built in 2023 at NRF. Both structures were tubular in design and were without crossarms, so they cannot be used for nesting by ravens or hawks. A nearby transmission structure with double wooden crossarms was removed as part of the process.

<u>COMPENSETORY MITIGATION</u>: The sagebrush seedlings discussed in Conservation Measure 1 were planted in anticipation of compensatory mitigation being needed for future infrastructure projects at the INL Site. Multiple projects currently taking place on the INL Site are going to be required to

carry out compensatory mitigation for existing and potential sagebrush habitat destruction. These projects will be assessed following their activities to determine the amount of area requiring compensatory mitigation per the INL compensatory mitigation strategy.

Conservation Measure 3—Accomplishments in 2023:

Only one project, the Carbon Free Power Project Site Characterization activities (ECP INL-19-067 R5), continued to conduct activities associated with infrastructure development within the SGCA in 2023. This project has consulted DOE-ID and USFWS on how to mitigate risks to sage-grouse including adhering to additional seasonal and time of day restrictions for those activities to take place. In 2023 this project was discontinued. Revegetation and compensatory mitigation for the removal of potential sagebrush habitat will take place in the years following.

Threat:	Annual Grasslands
Objective:	Maintain and restore healthy, native sagebrush plant communities.
Conservation Measures:	4) ~~Inventory areas dominated or co-dominated by non-native annual grasses, work cooperatively with other agencies as necessary to identify the actions or stressors that facilitate annual grass domination, and develop options for eliminating or minimizing those actions or stressors.~~ (See Section 6.2.4, Shurtliff et al. 2019).

Conservation Measure 4—Discontinued

Threat:	Livestock
Objective:	Limit direct disturbance of sage-grouse on leks by livestock operations and promote healthy sagebrush and native perennial grass and forb communities within grazing allotments.
Conservation Measures:	5) Encourage the Bureau of Land Management (BLM) to seek voluntary commitments from allotment permittees and to add stipulations during the permit renewal process to keep livestock at least 1 km away from active leks until after May 15 of each year. Regularly provide updated information to BLM on lek locations and status to assist in this effort. 6) Communicate and collaborate with BLM to ensure that the herbaceous understory on the INL Site is adequately maintained to promote sage-grouse reproductive success and that rangeland improvements follow guidelines in the BLM Land Use Plan and the CCA.

Conservation Measure 5—Accomplishments and Disturbances in 2023:

LEK DISTURBANCE - During the 2023 sage-grouse lek counts, biologists observed livestock on one lek along the Frenchmans cabin lek route between March 20 and May 15.

Conservation Measure 6—Accomplishments in 2023:

COMMUNICATION & COLLABORATION - DOE-ID and BLM continued to collaborate on updating their Memorandum of Understanding for management of land currently occupied by the INL Site.

Bipartisan Infrastructure Law funding was allocated for a local sagebrush seed collection to take place on the INL Site in 2023 in collaboration between INL, BLM and USFWS. This seed is intended to be planted on previously burned areas on the INL Site and adjacent BLM lands to promote the recovery of sagebrush habitat.

Threat:	Seeded Perennial Grasses
Objective:	Maintain the integrity of native plant communities by limiting the spread of crested wheatgrass.
Conservation Measure:	7) Inform INL contractors about negative ecological consequences resulting from crested wheatgrass and persuade them to rehabilitate disturbed land using only native seed mixes that are verified to be free of crested wheatgrass contamination.

Conservation Measure 7—Accomplishments in 2023:

The NRG assisted projects by recommending a project-specific native perennial seed mix list for revegetation work. It is mandatory that all seed mixes exclude intentional use of crested wheatgrass seed. Because crested wheatgrass is not native, it is never included as acceptable plant materials in INL Site revegetation plans.

Threat:	Landfills and Borrow Sources
Objective:	Minimize the impact of borrow source and landfill activities and development on sage-grouse and sagebrush habitat.
Conservation Measures:	8) Eliminate human disturbance of sage-grouse that use borrow sources as leks (measure applies only to activities from 6 p.m. to 9 a.m., March 15–May 15, within 1 km [0.6 mi] of active leks). 9) Ensure that no net loss of sagebrush habitat occurs due to new borrow pit or landfill development. DOE-ID accomplishes this measure by: • avoiding new borrow pit and landfill development in undisturbed sagebrush habitat, especially within the SGCA; • ensuring reclamation plans incorporate appropriate seed mix and seeding technology; • implementing adequate weed control measures throughout the life of an active borrow source or landfill.

Conservation Measure 8—Accomplishments in 2023:

INL complied with seasonal and time-of-day restrictions associated with sage-grouse. Per "Idaho National Laboratory Gravel/Borrow Pits (Overarching) Environmental Checklist [EC]" (EC INL-19-155), projects must complete Form 450.AP01, "Gravel/Borrow Source Request Form," before removing gravel. This form reminds gravel pit users of restrictions in place to protect sage-grouse. Projects must also submit, in writing to Environmental Support and Services personnel, that they complied with the directives in this EC. The borrow sources at Adams Boulevard, Lincoln Boulevard, Monroe Boulevard, Ryegrass Flats, T-12, and T-28 South are covered by this Environmental Checklist. Historically, sage-grouse leks have been observed in three borrow pits: T-12, Adams Blvd., and Ryegrass Flats. Source material was removed from the Ryegrass Flats, T-12, and Adams Blvd borrow pits after 9 a.m. and before 6 p.m., complying with seasonal restrictions.

Conservation Measure 9—Accomplishments in 2023:

No new borrow pits or landfills were opened in 2023.

Expansion of existing borrow sources and landfills is limited to footprints approved in Appendix C of the Spent Nuclear Fuel Environmental Impact Statement (DOE/EIS-0203) or the EA for Silt/Clay Development and Use (DOE-EA-1083) with the exception of the T-12 pit. An expansion beyond the defined boundary of T-12 pit was conducted in 2023 under the Subsurface Disposal Area Borrow Source Actions (EC ICP-22-004) located at T-12 pit and Adams Blvd. pit. This expansion extended the T-12 pit 100 m to the north, east, and south of the existing pit. The expansion of the T-12 pit required a Cultural Resource Review by the Cultural Resource Management Office and Biological Resources Review by the NRG. Facilities and Site Services personnel

<table>
<tr><td colspan="2">assist in the identification of approved footprints. The expansion did not occur in the SGCA but is in existing sagebrush habitat. To achieve no net loss of sagebrush because of this expansion the project will follow the INL compensatory mitigation strategy.

All landfills and borrow sources are planned to have reclamation activities completed when they are deemed to be no longer of use.</td></tr>
<tr><td>Threat:</td><td>Raven Predation</td></tr>
<tr><td>Objective:</td><td>Reduce food and nesting subsidies for ravens on the INL Site.</td></tr>
<tr><td>Conservation Measures:</td><td>10) DOE-ID will work with INL contractors and the National Oceanic and Atmospheric Administration to opportunistically reduce raven nesting on power lines and towers and at facilities.
11) Instruct the INL to include an informational component in its annual Environment, Safety, and Health training module by January 2015 that teaches the importance of eliminating food subsidies to ravens and other wildlife near facilities.</td></tr>
<tr><td colspan="2">Conservation Measure 10—Accomplishments in 2023:

During 2023, double crossarms were replaced on eight INL-controlled transmission structures, permanently excluding future raven nesting at these sites (Section 4.1.1). In total, 64 INL-controlled transmission structures have been retrofitted (10.9%).

Conservation Measure 11: Completed</td></tr>
<tr><td>Threat:</td><td>Human Disturbance</td></tr>
<tr><td>Objective:</td><td>Minimize human disturbance of sage-grouse courtship behavior on leks and nesting females within the SGCA and 1 km (0.6 mi) Lek Buffers.</td></tr>
<tr><td>Conservation Measures:</td><td>12) Seasonal guidelines (March 15–May 15) for human-related activities within 1 km (0.6 mi) Lek Buffers both in and out of the SGCA (exemptions apply—see Section 10.9.3):
• Avoid erecting portable or temporary towers, including meteorological, SODAR, and cellular towers.
• Unmanned aerial vehicle flights conducted before 9 a.m. and after 6 p.m. will be programmed so that flights conducted at altitudes <305 m (1,000 ft) will not pass over land within 1 km (0.6 mi) of an active lek.
• Detonation of explosives >1,225 kg (2,700 lb) will only occur at the National Security Test Range (NSTR) from 9 a.m.–6 p.m.
• No non-emergency disruptive activities allowed within Lek Buffers March 15–May 15.
13) Seasonal guidelines (April 1–June 30) for human-related activities within the SGCA (exemptions apply—see Section 10.9.3):
• Avoid non-emergency disruptive activities within the SGCA.
• Avoid erecting mobile cell towers in the SGCA, especially within sagebrush-dominated plant communities.</td></tr>
<tr><td colspan="2">Conservation Measures 12 and 13—Accomplishments in 2023:

The Carbon Free Power Project site is located within the SGCA. Multiple site characterization activities took place between April 1 and June 30 of 2023. All activities were approved by DOE-ID following consultation with USFWS on how to mitigate risks to sage-grouse. In 2023 this project was discontinued. Revegetation and compensatory mitigation for the removal of potential sagebrush habitat will take place in the years following the discontinuation.</td></tr>
</table>

All unmanned aerial vehicle flights conducted at the UAS runway or at the NSTR met all CCA requirements by conducting flights above 305 m (1,000 ft), after 9 a.m. and before 6 p.m., or beyond the 1 km (0.6 mi) sage-grouse active lek buffer distance. All other overflights planned their flight paths to avoid sage-grouse leks and lek buffers.

Detonations of explosives greater than 1,225 kg did not occur at the NSTR between 6 p.m. and 9 a.m. from March 15 to May 15.

No meteorological, sound detection and ranging, or other cell towers were erected within 1 km (0.6 mi) of a sage-grouse lek or within the SGCA during 2023.

5.2 Reports on Projects Associated with Conservation Measures

Since the CCA was signed, DOE-ID and contractors have implemented activities on an as-needed or recurring basis to reduce impacts to sage-grouse habitats and to support the objectives of all Conservation Measures.

5.2.1 Post-fire Recovery Planning, Implementation, and Monitoring— Conservation Measure 1

5.2.1.1 Background

The threat level of wildland fire was ranked as high in the CCA (DOE-ID and USFWS 2014), and wildland fire is one of the top threats to sage-grouse across their range (Federal Register 2010). Wildland fire impacts sage-grouse habitat by removing sagebrush and by making the recovering plant community less resistant to invasion and dominance by non-native weeds like cheatgrass (Connelly et al. 2011, Bradley 2010). Annual grasslands were independently ranked as a medium-level threat to sage-grouse in the CCA. Cheatgrass is currently the primary introduced annual grass of concern on the INL Site. Although cheatgrass can become dominant under a variety of conditions, post-fire plant communities are particularly susceptible (see Section 3.1), making the threats of wildland fire and cheatgrass interrelated.

Wildland fires on the INL Site were relatively infrequent prior to 1994; only a few large fires were known to have occurred or could be seen in imagery prior to that time (Shive et al. 2011). Over the past 25 years, several large fires (>40 ha [>99 ac]) have burned across the INL Site. Potential effects of wildland fire on natural resources were initially addressed in the Wildland Fire Management Plan and Environmental Assessment (hereinafter INL Wildland Fire EA; DOE-ID 2003), which was drafted after four notable fires. The CCA represented the next major effort to address the effects of wildland fire on natural resources and it included a conservation measure by which DOE-ID committed to prepare an assessment evaluating the need for post-fire restoration and present options for hastening sagebrush reestablishment on fires larger than 40 ha (99 ac; Table 5-1).

After the CCA was signed, the INL Site did not experience any wildland fires meeting the conservation measure criteria for nearly five years. In 2019, the Sheep Fire burned more than 40,000 ha (98,842 ac), which prompted development of the first ecological resources recovery plan for the INL Site since the CCA was signed. The recovery plan was designed to address the CCA wildland fire conservation measure and to comply with the INL Wildland Fire EA. This plan was phased for implementation over five years and allowed the Wildland Fire Management Committee (WFMC) flexibility in prioritizing recovery actions based on available funding and other wildland fire management priorities.

Several natural resource recovery goals were identified within the Sheep Fire Ecological Resources Post-Fire Recovery Plan (Forman et al. 2020). These recovery goals incorporated results of a post-fire ecological impacts assessment and they were organized into four primary recovery objectives: (1) soil stabilization for erosion and weed control on containment lines immediately post-fire, (2) cheatgrass and noxious weed control within the larger burned area, (3) native herbaceous recovery, and (4) sagebrush habitat restoration. To achieve natural resource recovery goals, several treatment options were provided within each recovery objective. The structure and organization of the plan, as well as the process of prioritizing treatment actions, were useful to the WFMC for identifying which treatment actions to implement. Therefore, subsequent post-fire ecological recovery plans continue to utilize this framework.

There are two active fire recovery plans on the INL Site, one for the 2019 Sheep Fire and one for four wildland fires that burned in 2020. The Sheep Fire Recovery Plan will expire at the end of FY 2024 and the 2020 Fires Recovery Plan will expire at the end of FY 2025. Occasionally, restoration activities are also completed in areas impacted by wildland fires that occurred more than five years ago, for which the wildland fire recovery plan has expired or for which a plan was never drafted. This section of the report contains a summary of the current fire recovery plans, ongoing restoration actions, and initial monitoring results for all wildland fires requiring ecological resource recovery plans within the past five years and for older wildland fires with any ongoing treatment activity.

5.2.1.2 2020 – Multiple Fires

Fire Summary and Post-Fire Restoration Planning

A post-fire ecological resource assessment and an ecological resources post-fire recovery plan was completed for four fires that occurred in 2020 (Forman et al. 2021). The WFMC met to review the 2020 Wildland Fires Ecological Resources Recovery Plan and prioritize several of the restoration options provided therein. Most emergency soil stabilization actions were completed immediately after the 2020 wildland fires, prior to completion of the plan. Additional post-fire recovery actions prioritized by the committee included noxious weed treatment throughout the burned areas of each fire and sagebrush seedling planting to expedite habitat recovery in the Telegraph Fire.

Emergency Stabilization and Noxious Weed Control

A soil stabilization recommendation that is still outstanding includes monitoring temporary fire suppression access roads for natural recovery and considering signage and replanting if necessary. This recommendation requires evaluation after a few growing seasons to determine whether further action is necessary. Initial evaluations are scheduled to be completed during the summer 2024 field season.

Post-fire noxious weed control continues to be implemented through the INL Site weed control programs. Spraying efforts focus on rush skeletonweed (*Chondrilla juncea*) because it was identified as being of particular concern by neighboring stakeholder agencies. Musk thistle (*Carduus nutans*) is also widespread throughout post-fire plant communities at the INL Site and Canada thistle (*Cirsium arvense*), black henbane (*Hyoscyamus niger*), Russian knapweed (*Acroptilon repens*), and spotted knapweed (*Centaurea stoebe*) have also been identified and treated within areas affected by wildland fires over the past few years.

Cheatgrass Control

There were no specific recommendations related to cheatgrass treatment made in the 2020 Wildland Fires Ecological Resource Recovery Plan. Cheatgrass was a substantial component of the plant community prior to wildland fire in two of the 2020 fires, increasing the likelihood of post-fire cheatgrass dominance. Cheatgrass treatment was not recommended in the Howe Peak Fire because areas at high risk of post-fire cheatgrass dominance are adjacent to agricultural properties that could be impacted by inadvertent chemical drift. In the Lost River Fire, the areas at high risk of post-fire cheatgrass dominance are used regularly by livestock. Livestock water and supplements would need to be moved before cheatgrass treatment would be effective at this location. Cheatgrass treatments were not considered for the Telegraph and Cinder Butte Fires because cheatgrass was a minor component of the pre-fire plant community.

Sagebrush Habitat Restoration

The area burned in the Telegraph Fire was dominated by sagebrush with a diverse, native understory prior to the fire. It is also in proximity to an active sage-grouse lek and was used extensively by BLM radio-collared sage-grouse pre-fire. Planting sagebrush, where logistically feasible, would improve habitat value in proximity to the active lek, would provide some habitat connectivity across the burned area, and could shorten natural recovery times in areas adjacent to the planting by increasing potential sagebrush seed sources. In contrast, sagebrush planting is not likely to make a substantial impact toward improving sagebrush habitat condition on the Howe Peak Fire, Lost River Fire, and Cinder Butte Fire because of current herbaceous conditions or the distribution of habitat surrounding the burned area. See Forman et al. (2021) for more detailed discussion.

Sagebrush seedling planting on the Telegraph Fire was completed in October 2022 using local seed collected in November 2020. Approximately 41,300 seedlings were planted where there were not abundant unburned islands and access was feasible. See Section 5.2.2 for additional details and initial estimates of sagebrush seedling survivorship.

5.2.1.3 2019 - Sheep Fire

Fire Summary and Post-fire Restoration Planning

A post-fire ecological resources recovery plan was developed for the Sheep Fire and proposed recovery actions were based on a post-fire ecological resource assessment. The WFMC prioritized several recovery actions addressing emergency stabilization, noxious weed control, areas at high risk for cheatgrass dominance, and hastening the recovery of sagebrush habitat. For details about the Sheep Fire, the post-fire ecological assessment, and the recovery options recommended to facilitate wildland fire recovery, see Forman et al. (2020). In 2023, ongoing recovery actions included noxious weed control and monitoring of sagebrush seedling plantings.

Emergency Soil Stabilization and Noxious Weed Control

The INL began addressing soil stabilization and noxious weed control on the Sheep Fire containment lines during the fall of 2019. These actions are prescribed by the INL's Wildland Fire EA (DOE-ID 2003), so they were initiated prior to completion of the Sheep Fire Ecological Resources Post-Fire Recovery Plan. Recontouring efforts were completed on the Sheep Fire containment lines in 2020.

During a post-Sheep Fire scoping meeting in 2019, local stakeholders raised a concern about rush skeletonweed invading recently burned areas on the INL Site as this noxious weed is becoming increasingly problematic in adjacent rangelands. Noxious weed control is an annual land management task across the INL Site; however, the Sheep Fire burned area has been a primary focus since 2020. Noxious weed control will continue to be implemented through the Sheep Fire Ecological Resources Post-Fire Recovery Plan and other INL Site weed control programs.

Cheatgrass Control

The Sheep Fire Ecological Resources Post-Fire Recovery Plan identified approximately 4,347 ha (10,741 ac) that had a substantial cheatgrass component prior to the Sheep Fire. Optimal treatment areas would have enough cheatgrass to warrant control measures and enough remnant native perennials to facilitate desirable herbaceous recovery after herbicide application. Much of the area identified in the recovery plan was sampled during August 2020 to verify suitability of conditions for treatment. Results from ground-based monitoring were used to identify four polygons, approximately 810 ha (2,000 ac) each, meeting the criteria for herbicide application. Details regarding sampling, criteria for prioritization, and treatment recommendations can be found in the Sheep Fire Ecological Resources Post-Fire Monitoring Report (Forman et al. 2020). Using the recommendations made in the monitoring report, the INL began addressing processes and work controls necessary to perform this type of work and sprayed some initial test patches in 2021 using a tank and boom along accessible roadways. Additional NEPA evaluations will be required before pre-emergent chemicals can be aerially applied to treat cheatgrass at a broader scale across the INL Site, however, NRG and agency partners are pursuing funding for a ground-based application in the near-term (see additional discussion below).

Sagebrush Habitat Restoration

In the winter of 2019/2020, DOE-ID worked with stakeholders to aerially seed 10,100 ha (25,000 ac) of the Sheep Fire within and adjacent to the SGCA with sagebrush seed. Unfortunately, in 2020 and 2021 extensive monitoring efforts did not yield any seedlings that could be attributed to the aerial seeding effort. Additional details about the aerial seeding and initial monitoring efforts can be found in the Sheep Fire Ecological Resources Post-Fire Monitoring Report (Forman et al. 2020).

The Sheep Fire Ecological Resources Post-Fire Recovery Plan suggested replanting areas where sagebrush seed did not establish with sagebrush seedlings and that seedlings should be placed strategically where they can provide the greatest benefit to habitat recovery. Six areas were identified as a high priority for sagebrush seedling planting in the Sheep Fire. The proposed planting sites were selected based on CCA priority restoration areas, logistics and access, ecological condition of the recovering herbaceous plant community, and agency stakeholder input (Kramer et al. 2021). A total of 45,000 seedlings were planted in the Sheep Fire in October 2021 and another 45,000 were planted in October 2022, completing the Sheep Fire sagebrush habitat restoration efforts that were prioritized by the WFMC. Section 5.2.2 contains additional information about planting rates, site conditions, and initial estimates of survivorship.

5.2.1.4 Pre-2018 – Older Fires

There is ongoing treatment activity on several older wildland fires for which recovery plans were not written or have expired. Noxious weeds continue to be treated and monitored across the INL Site, and previously burned areas are typically prioritized because areas lacking sagebrush tend to be less resilient to weed invasion. Occasionally, sagebrush is also planted in areas that burned more than five years ago. The reasons for planting within older burned areas may vary but are often related to restoring important habitat. In 2021, for example, sagebrush was planted in the 2010 Jefferson Fire as part of a collaborative partnership with IDFG and Pheasants Forever to improve sage-grouse wintering habitat. Approximately 12,000 seeding were planted in 2022 in an area between East Butte and Middle Butte that burned in 2007 and 2010 and hosted active sage-grouse leks prior to wildland fire. The seedlings were planted to address compensatory mitigation for construction of a new power line. An additional 74,875 seedlings were planted in the same area in 2023 in anticipation of upcoming infrastructure projects that will require compensatory sagebrush mitigation.

In 2022, DOE-ID, INL, USFWS, and BLM partnered to pursue Bipartisan Infrastructure Law (BIL) funding to support sagebrush habitat restoration in the Tractor Flats area of the INL Site and adjacent BLM land, some of which burned most recently in the 2010 Jefferson Fire. This area is recognized as a high-priority habitat restoration location because long-term lek count data and more recent movement data from radio collared sage-grouse indicate that despite declines in habitat condition, Tractor Flats continues to be used for breeding, nesting, and overwintering. Funding was awarded to the multiagency partnership beginning in 2023. Mechanical sagebrush planting began on BLM land adjacent to the eastern INL border during fall of 2023 and a commercial seed collection vendor collected sagebrush seed within the unburned areas of the southern and eastern portion of the INL Site (Figure 5-1). The seed was cleaned and stored in a BLM seed warehouse and will be used for mechanical planting of approximately 810 ha (2,000 ac) on the INL Site in 2024 as well as a slightly larger area on adjacent BLM land. Seed collection will occur again in 2024, and both agencies will plant again in 2025 (Figure 5-1). In addition to improving local sagebrush habitat, fostering collaboration among agencies, and continuing to demonstrate INL's commitment to land stewardship, benefits of this partnership will include knowledge and skills transfer which will ultimately facilitate developing backcountry land management capabilities at INL.

In addition to the sagebrush restoration efforts at Tractor Flats, DOE-ID and INL requested BIL funding to procure Open Range © (granular) Imazapic herbicide for cheatgrass dominated areas in the Sheep Fire. Funding would be sufficient to treat a total of 3,683 ha (9,100 ac), or about 40% of the area dominated by cheatgrass on the INL Site. The treatment area was divided into four polygons, approximately 810 ha (2,000 ac) each, and the polygons were prioritized according to probability of successful outcome without additional restoration efforts. The treatment would be phased in over four years and the areas with the greatest potential for a successful outcome would be treated first. If funding becomes available for the herbicide, the treatment would be implemented by INL Facilities and Site Services and monitored by INL NRG.

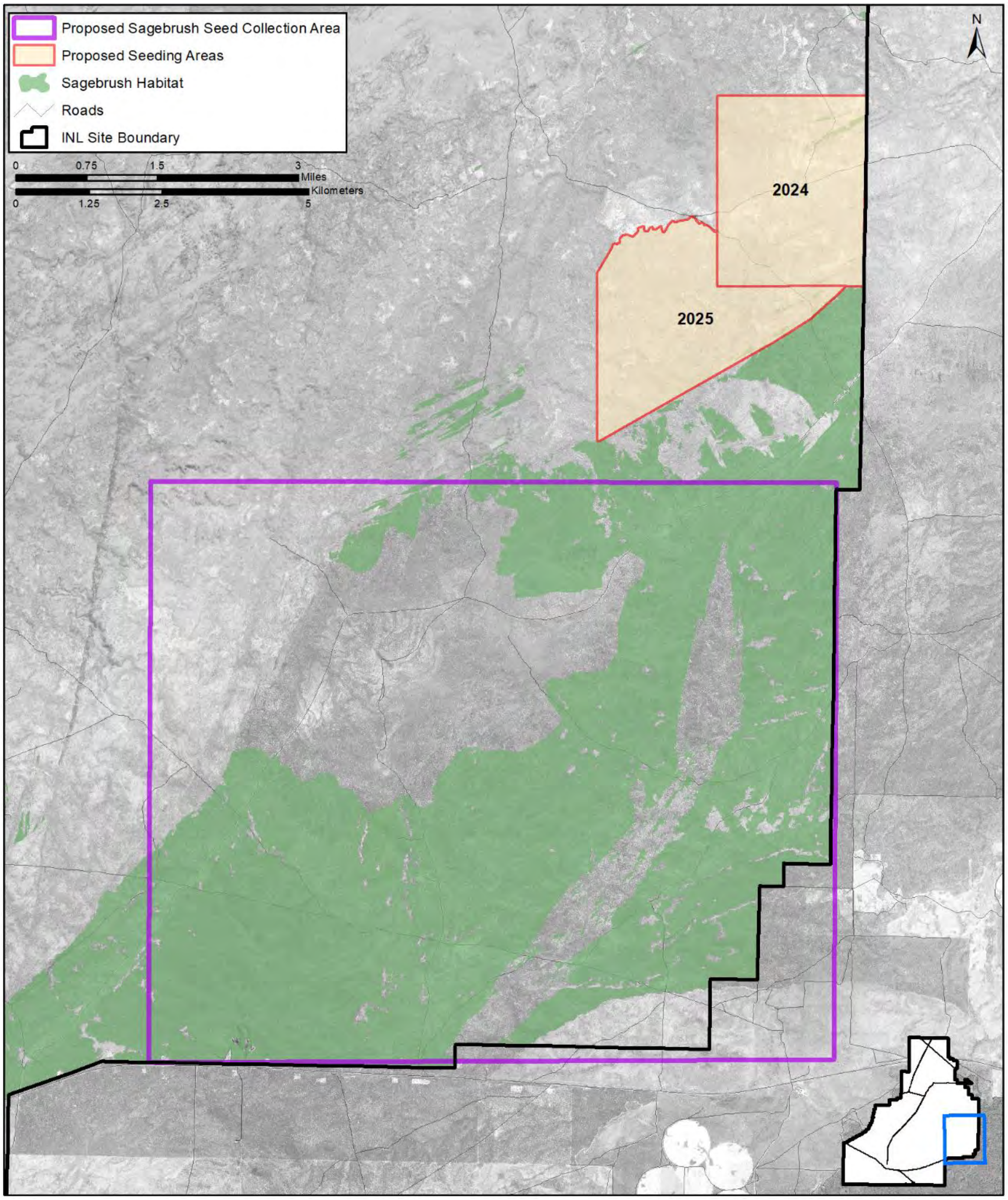

Figure 5-1. Sagebrush seed collection and proposed mechanical seeding locations for sagebrush habitat restoration efforts within the Tractor Flats area of the INL Site.

5.2.1.5 Programmatic Changes to Facilitate Treatment and Improve Ecological Recovery

Emergency wildland fire response and associated soil stabilization actions are addressed in the INL Wildland Fire EA; however, many of the post-fire recovery options presented in the Sheep Fire Ecological Resources Post-Fire Recovery Plan and the INL 2020 Wildland Fires Ecological Resources Recovery Plan are not. Currently each non-emergency post-fire recovery action is subject to additional NEPA review. Although this approach was adequate at the time the INL Wildland Fire EA was signed, there have been changes in fire frequency and land cover over the past twenty years, making this approach to wildland fire recovery less effective. A much larger portion of the INL Site has burned since the INL Wildland Fire EA was implemented, and the resulting vegetative changes across the INL landscape require different fire preparedness and suppression strategies than have been used in the past. Recent sagebrush habitat loss has also resulted in an increased focus on the importance of habitat protection.

Given the changing ecological conditions at the INL Site and the number of post-fire recovery actions that were recommended by the WFMC after the Sheep Fire and the 2020 Fires, the INL has identified the need to update their wildland fire management approach and associated NEPA assessment. In August 2023 DOE-ID issued an Environmental Assessment Determination (EAD) for a new EA to analyze potential impacts of wildland fire prevention, management, and recovery activities at the INL site. Actions analyzed in the EA will provide for a more comprehensive and efficient planning and response effort for fuels management, fire suppression, and post-fire restoration in the future. The INL Fire Department and the Natural Resources Group were tasked with scoping the fire management and ecological restoration tools considered appropriate for use in preparation for and in response to future fires.

The NRG is developing a generalized post-fire ecological resources recovery framework that will include all post-fire restoration actions that should be considered to improve post-fire recovery, including emergency post-fire stabilization and ongoing habitat restoration. Through a series of internal stakeholder meetings, the restoration options included in the framework were discussed and approved by several INL and DOE-ID technical professionals representing a range of organizations that may be involved in drafting and implementing specific post-fire recovery plans. The recovery framework along with updates to INL Wildland Fire Management Plan (PLN-14401) are being evaluated in a new EA. Not all actions would be appropriate on all fires and an evaluation of post-fire ecological impacts will still be required to determine which actions may be appropriate for each fire. However, developing a generalized framework that has been evaluated through the NEPA process will substantially improve the restoration options available and the efficiency of implementing them.

5.2.2 Sagebrush Seedling Planting for Habitat Restoration—Conservation Measure 1 and 2

5.2.2.1 Introduction

The objective of Conservation Measure 1 is to minimize the impact of habitat loss due to wildland fire and firefighting activities and the objective for Conservation Measure 2 is to minimize the impact of habitat loss due to infrastructure development and disturbance (see Table 5-1). The CCA includes three related strategies for addressing sagebrush habitat loss. The first is periodic sagebrush seedling planting to address legacy habitat loss from fires that occurred prior to signing the CCA. The second strategy is developing a post-fire ecological recovery plan that includes reestablishing sagebrush specific to each new wildland fire. These two strategies relate directly to Conservation Measure 1. The final strategy for minimizing sagebrush habitat losses on the INL Site includes compensatory mitigation for infrastructure development, which relates directly to Conservation Measure 2. To address potential impacts from infrastructure development on sagebrush habitat distribution, DOE-ID has a no-net-loss sagebrush habitat goal (DOE-ID and USFWS 2014). It states that for every acre of sagebrush habitat or potential sagebrush habitat that is impacted, BEA will contribute funds to replant approximately 1,000 sagebrush seedlings as compensatory mitigation (INL 2022). Seedlings from all funding sources are grown concurrently and planted in priority restoration areas identified in the CCA (DOE-ID and USFWS 2014) and in post-fire ecological recovery plans.

The NRG oversees the planting of sagebrush seedlings and monitors their survivorship to evaluate its effectiveness. The target density at which seedlings are planted varies depending on the project restoration goals, and the actual planting density can vary due to weather conditions, topography, planting conditions, travel, and planter ability. The intent of sagebrush restoration is not to plant sagebrush at densities that typify sage-grouse habitat, but rather to establish sagebrush seed sources over larger priority areas to shorten the time interval between a fire and the reestablishment of sagebrush habitat. To achieve this target, planting rates on the INL Site range from approximately 198 to 494 seedlings/hectare (80 to 200 seedlings/acre).

5.2.2.2 Methods

Desert Sage Farms, LLC, located in Oakley, Idaho, was contracted to grow approximately 80,000 sagebrush seedlings from seed collected on the INL Site in 2020. Seedlings were funded and acquired in anticipation of the need for compensatory mitigation in response to future INL projects. To inform and to improve future plantings, four different methods or materials (hereafter 'treatments') were tested in 2023. Each treatment was approximately 20,000 seedlings. The subset of seedlings planted in 2023 contained the same growth medium and were planted the same way as previous INL Site sagebrush plantings were intended to act as a control to the other treatments (hereafter 'control seedlings'). Of the control seedlings planted, protective mesh cages were installed on an additional subset (hereafter 'caged seedlings') of approximately 500 seedlings. The other three treatments included the use of various supplemental materials in the growing medium; the supplemental materials are Terra-Sorb hydrogel (hereafter 'hydrogel seedlings'), Am 120 mycorrhizal inoculant (hereafter 'mycorrhizal seedlings'), and vermiculite (hereafter 'vermiculite seedlings'). The planting site location was selected using the wildland fire boundaries, priority restoration areas, existing datasets showing where habitat existed and was utilized by sage-grouse prior to wildland fire, consistency in soil types, and logistical constraints, such as accessibility. The 2023 planting was located within portions of the 2010 Middle Butte Fire and the 2007 Twin Buttes Fire. In 2023, MP Forestry of Medford, OR, installed the seedlings over a four-day period using a hodad, traveling on foot from existing roads and utilized a single pass of a utility terrain vehicle to transport seedlings further from the road (see Figure 5-2). A subset of approximately 500 seedlings within each treatment were marked for future monitoring and will be revisited one and five years to assess survivorship.

Figure 5-2. Planting crew from MP Forestry planting big sagebrush (*Artemisia tridentata*) seedlings on the Idaho National Laboratory Site during October 2023.

In addition to planting seedlings in 2023, monitoring was completed on seedlings planted in previous years. Survivorship of seedlings planted in fall 2022 was determined by revisiting and evaluating the condition of individual seedlings one year after planting. During the fall 2022 planting, we collected GPS locations of a subset of seedlings in all planting locations. In September 2023, those seedlings were revisited, and we determined if each seedling was healthy, stressed, dead, or missing. Stressed individuals are considered alive, while missing individuals are considered dead for assessment purposes. After five years, seedlings will again be revisited to evaluate the planting's longer-term survivorship.

Seedlings planted in the fall of 2018 were revisited in the fall of 2023 to assess survivorship at five years. In September of 2023, seedlings initially assessed in 2019 were revisited, regardless of whether they were determined missing or dead on the initial revisit. Each revisited seedling was determined to be healthy, stressed, dead, or missing. Revisited seedlings were also evaluated for the presence of reproductive structures.

5.2.2.3 Results and Discussion

Between October 10-13, 2023, 74,875 sagebrush seedlings were planted on approximately 170.6 ha (421.7 ac), divided into four different areas to ensure the treatments were separated (see Figure 5-3). In the control area 18,000 seedlings were planted across 45.1 ha (111.4 ac) and of those 18,000, approximately 500 were planted with protective mesh cages around them. In the other treatment areas 16,500 hydrogel seedlings were planted across 40.3 ha (99.5 ac), 20,175 vermiculite seedlings were planted across 42.2 ha (104.2 ac), and 20,200 mycorrhizal seedlings were planted across 43.1 ha (106.6 ac). For future monitoring, at least 500 seedling locations from each treatment were marked except for the caged seedlings in which only 480 were relocated and marked following installation.

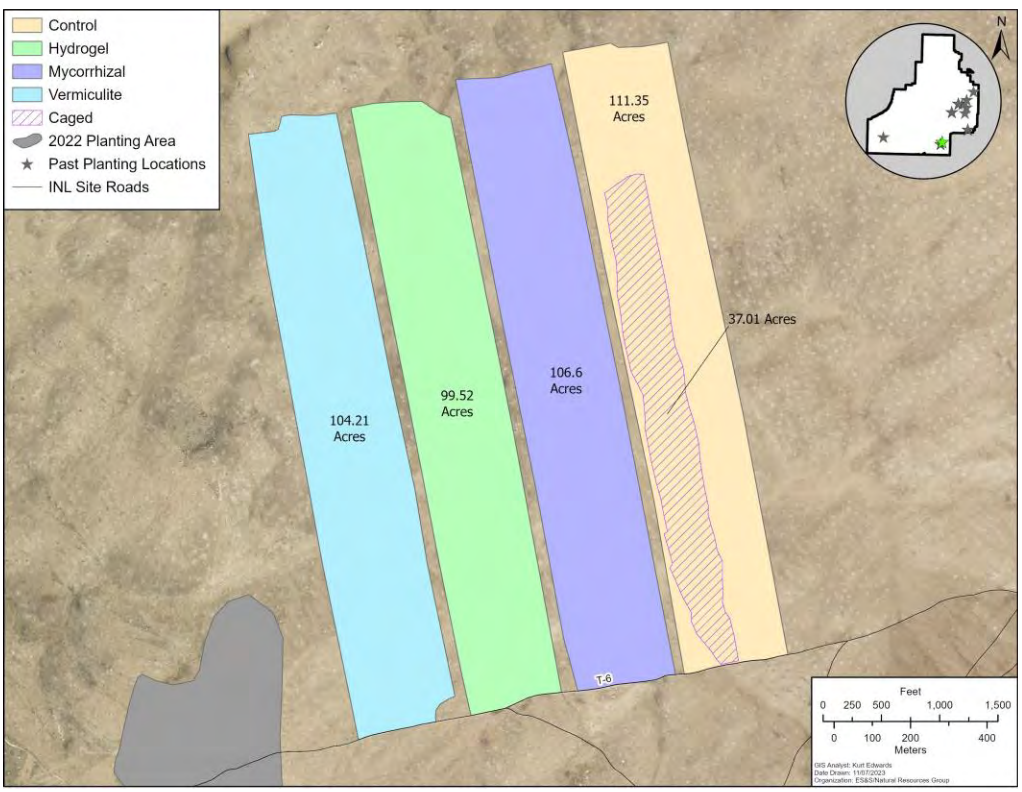

Figure 5-3. Areas planted with big sagebrush (*Artemisia tridentata)* seedlings in 2023 with reference to previous years plantings on the Idaho National Laboratory Site. Seedlings were grown using three different growth medium supplements, a control subset, and protective mesh cages were installed on a subset of control seedlings.

Since 2015, sagebrush seedling planting on the INL Site has been completed on 1159.3 ha (2864.7 ac). Over the past nine years, a total of 330,625 seedlings have been planted from multiple funding sources, including DOE-ID, BEA, the Idaho Governor's Office of Species Conservation, and IDFG.

Survivorship surveys of the subset of seedlings planted across three locations within the Sheep Fire footprint in 2022 indicated that 4 seedlings were healthy, 3 were stressed, 15 were dead, and 647 were missing. Survivorship surveys of the subset of seedlings planted in the Telegraph Fire footprint in 2022 indicated that 94 seedlings were healthy, 25 were stressed, 3 were dead, and 378 were missing. Survivorship surveys of the subset of seedlings planted in the Middle Butte Fire and Twin Buttes Fire footprints in 2022 indicated that 104 seedlings were healthy, 10 were stressed, 2 were dead, and 384 were missing. Assuming the missing seedlings were dead, approximately 13.4% of all seedlings planted in 2022 survived the first year. This result is higher than the 2019 and 2020 plantings, and around the same as the 2021 planting but remains much lower than the plantings between 2015 and 2018 (see Figure 5-4).

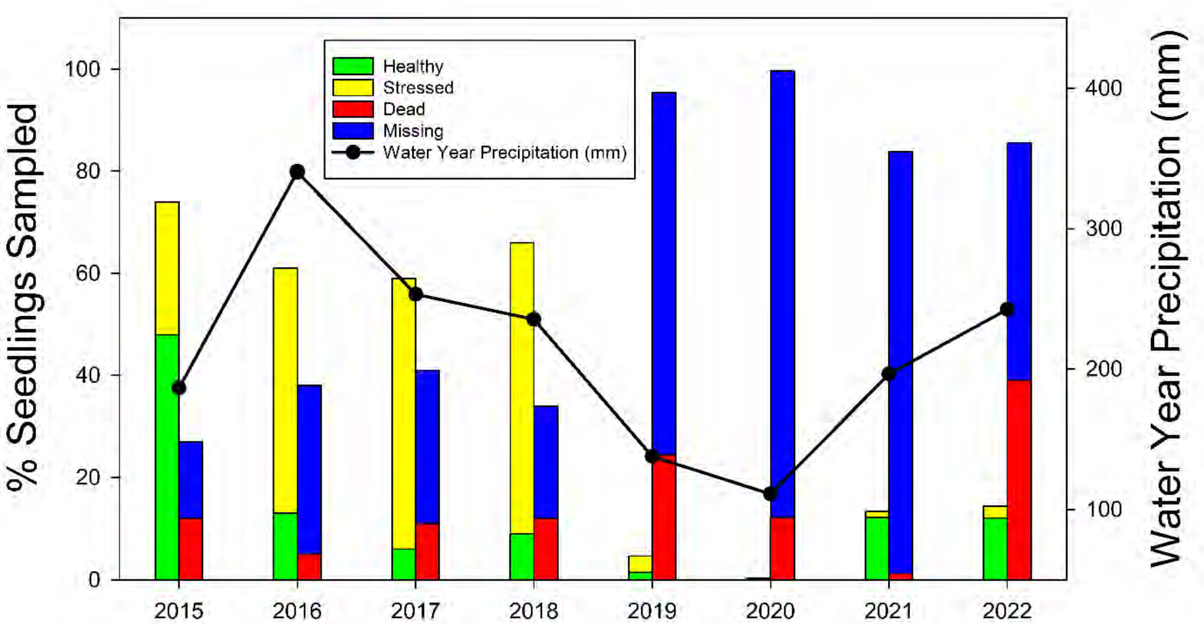

Figure 5-4. Sagebrush seedling survivorship one year after planting on the Idaho National Laboratory Site. The yellow and green bar represents the observed living seedlings. The blue and red bar represents seedlings presumed to be dead. The black dots indicate the total water year precipitation, and the black line denotes precipitation trends. Water year is calculated as precipitation received in October of the planting year to September of the following year.

The water year precipitation following the 2022 seedling planting was relatively higher than the previous three planting years but remains around the average for the INL Site (see Figure 5-4). In 2022, monthly precipitation was atypical in both timing and amount compared to the long-term monthly averages (see Figure 3-3). An unseasonably wet fall in 2022 followed by a wet late winter, average spring and early summer, and unseasonably wet mid to late summer more than likely shortened periods of time with little to no precipitation. The 2022 seedling survivorship was greater than the 2019 and 2020 plantings and around the same as the 2021 planting and may be attributed to the wetter-than-average fall of 2022 that likely supplied available water to seedlings during a critical stage in their development. Overall, low seedling survivorship could be due to many variables, but it appears that sustained deviations in both precipitation timing and amount are likely contributing factors to the past three years of lower-than-average seedling survivorship. When comparing the notable differences of the seedling survivorship among planting locations in 2022, it appears that the condition of the planting site (i.e. soil type) could be an additional variable influencing survivorship.

Young sagebrush plants experience the highest mortality during the first year (Dettweiler-Robinson et al. 2013). In a review of 24 projects where containerized sagebrush seedlings were planted and survivorship was measured after one year, researchers reported first year survival of stock ranged from 14% to 94% (median = 59%, weighted average = 57%; Dettweiler-Robinson et al. 2013). Thus, prior to the four most recent plantings, sagebrush establishment one-year post planting on the INL Site was above average, with an average survivorship of 65% (2015–2018). It is unfortunate that the 2019, 2020, 2021 and 2022 plantings have deviated from this trend of successful plantings, but it can provide an opportunity to better inform the planting process and allow us to explore new techniques or approaches, such as the ones tested this year, to increase the success of future planting efforts.

To evaluate five-year survivorship, 896 seedlings planted in the fall of 2018 were revisited in the fall of 2023. In total, 644 seedlings were located, of which 469 were healthy and 136 were stressed. This means that over the last five years, 605 (67.5%, n = 896) of the marked seedlings continue to grow after five years. Initial results of the 2018 planting found that 66% (n = 899) of the seedlings had survived to the fall of 2019 (Shurtliff et al. 2019). The higher survivorship from the five-year survey compared to the one year is likely an artifact of the difficulty of locating the small seedlings one year after planting and the similar survivorship rates between one-year and five-year monitoring efforts suggests plantings only require one year of ideal conditions to become established and persist. In addition to revisiting seedlings for condition and survivorship, development of reproductive structures was noted. Of the observed surviving seedlings, 398 (61.8%) had developed reproductive structures. Some seedlings were noted to have several smaller sagebrush individuals surrounding them, which suggests the recruitment of seedlings is occurring around the planted individuals and the planted seedlings are likely the seed source. This evidence supports the chosen method of planting at a density to establish sagebrush seed sources in priority areas to shorten the recovery time interval between a fire and the reestablishment of sagebrush habitat (Shurtliff et al. 2016).

One of the reasons that DOE-ID continues to plant seedlings over a relatively small area each year, rather than drill or broadcast sagebrush seeds over a much larger area, is because successful seed germination and establishment is affected by several climatic factors, including timing and amount of precipitation (Young et al. 1990; Boudell et al. 2002). The suite of factors that facilitate successful germination of seed and establishment of new plants in burned areas fluctuates from year to year (Colket 2003; Blew and Forman 2010), and in many years, few or no seeds may germinate and survive the summer (Forman et al. 2020; Brabec et al. 2015). The decision from DOE-ID to plant containerized seedlings in old burns instead of broadcasting or drilling seeds was justified previously, because high survivorship of seedlings was consistently achieved. After recent years of lower survivorship, alternative seeding and planting methods are being evaluated to determine if there are successful options or alternatives to the current annual sagebrush seedling planting efforts (Forman et al. 2020). INL has begun exploring alternative methods of seeding sagebrush seed through mechanical means with assistance from multiple agency partners, though any planting method is less likely to be successful under drought conditions. Details about these efforts are described in section 5.2.1.

6.0 SYNTHESIS AND ADAPTIVE MANAGEMENT RECOMMENDATIONS

6.1 Trends and Threats in a Regional Context

The IDFG annually compiles data and shares results from hundreds of sage-grouse lek counts conducted by its staff and partners. The INL contributes to this dataset by providing lek and route count information on an annual basis (i.e., IDFG lek routes, Figure 2-1). Comparing these two data sets allows the NRG to evaluate if trends observed on the INL Site are like those observed on statewide and/or regional levels. As an example, during the past decade, male attendance on leks across Idaho and on the INL Site have followed a pattern consistent with a cyclic trend, which is common for the species (Rich 1985, Row and Fedy 2017). Specifically, lek route counts in both State and INL datasets increased to a peak in 2016, then declined until 2019 or 2021, then increased each of the past two or three years. State-defined hard and soft population triggers (Idaho 2021) tripped for all important and priority habitat management areas north of the Snake River in central and eastern Idaho in 2018 and 2019 because of the multi-year decline (Kemner 2023). Likewise, in 2022, the three-year running average of baseline lek attendance on the INL Site dropped below the CCA-designated threshold, tripping the INL's population trigger. As stipulated in the CCA, the DOE-ID and USFWS discussed current management approaches and changes in site activities and implementation of additional conservation measures. Upon completion of this review, it was determined by both parties that the population decline on the INL was consistent with regional and statewide trends, and as such, no immediate action was to be taken.

In 2023, male sage-grouse attendance on Idaho lek routes increased 8% when compared to 2022 (Kemner 2023) with the NRG observing a lek route attendance increase of 13.5% during the same period (Section 2.1.2). Male sage-grouse attendance at INL baseline leks also increased 11.2% in 2023, resulting in a subsequent increase of the running three-year average sufficient to reset the INL population trigger. Of note, peak male attendance at baseline leks has increased each year since 2021, suggesting that INL sage-grouse populations may be entering a growth phase of a population cycle.

Although the State has established habitat distribution triggers (Idaho 2021) like the INL Site, and the State recommends managing habitat condition so that it meets the same general guidelines as those used for the INL Site, results of local and/or regional summaries are not annually published for management areas at a fine enough scale to facilitate direct comparisons of habitat distribution and/or condition every year. The most recent summaries were published in 2020 as part of a causal factor analysis (Idaho Adaptive Management Team 2020). Of the fine-scale management areas that overlap the INL Site, the adaptive management team reported that a soft habitat trigger (a decrease in distribution of >10% but < 20%) was tripped in the Mountain Valley Important Habitat Management Area, which extends onto approximately the northern one-quarter of the INL Site. This trigger was tripped due primarily to two wildland fires that did not directly affect the INL Site.

There were no habitat triggers tripped within the Desert Conservation Area, which includes the southern three-quarters of the INL Site. Within the Desert Conservation Area, much of the INL Site is included in the Twin Buttes Target Fine Scale Area. Landscape cover of sagebrush across this Fine Scale Area was estimated to be between 60% and 70% across all seasonal habitat types, which is comparable to the distribution of sagebrush habitat across the INL Site. The Idaho Adaptive Management Team has identified the Tractor Flats area within the Twin Buttes Target Fine Scale Area as important winter habitat and has recommended that minimizing any further loss of sagebrush and restoring sagebrush where it has been lost, particularly from the 2010 Jefferson Fire, should be considered top management priorities. They have also recommended identifying priority areas where cheatgrass control can be used to improve nesting habitat. INL habitat condition data and spatial vegetation distribution data (Shive et al. 2019) indicate the most extensive cheatgrass-dominated areas within the Jefferson Fire footprint are also within Sheep Fire footprint, located west of Tractor Flats. Four potential cheatgrass treatment areas have been identified within the overlapping footprints of these two fires.

Although habitat condition data from the INL Site indicate that cheatgrass is more abundant in burned areas than intact sagebrush habitat, post-fire areas on the INL Site are still largely dominated by native, perennial species. Cheatgrass cover can fluctuate considerably from one year to the next and a decrease in cover is as likely as an increase (Forman and Hafla 2018), so it is important to interpret annual changes within the context of longer-term patterns. Because cheatgrass cover generally does not increase at the expense of cover from native perennial species, it does not appear to be affecting overall habitat condition. There are localized areas on the INL Site where cheatgrass has become dominant (Shive et al. 2019), but they are limited in extent and are not yet widespread enough to influence the fire regime. Although the fire regime at the INL Site is not driven by cheatgrass dominance, fires have been more frequent in the past 30 years when compared to the previous 30 years, most likely due to changes in weather patterns and other anthropogenic influences. Therefore, the INL continues to prioritize reducing wildland fire impacts to habit by minimizing fire size and by implementing post-fire recovery strategies.

The CCA and resulting relationship between its signatories have helped DOE-ID and its contractors take proactive, focused measures (Section 5.1, Appendix A) to conserve sage-grouse while still pursuing DOE-ID's mission. The agreement and conservation measures therein have also been the impetus for strengthening relationships with natural resource partners to collaborate on projects relevant to sage-grouse. For example, in 2023, BIL funding was awarded to USFWS, BLM, and DOE-ID to facilitate a large-scale sagebrush seed collection effort on the INL Site and adjacent BLM property. The seed will be used to support sagebrush restoration in important winter habitat than spans DOE-ID/BLM boundaries. Additionally, DOE-ID shares habitat data with BLM when allotments are reassessed, and BLM invites DOE-ID to participate in grazing allotment assessments on the INL Site. This increased collaboration and pursuit of common land management goals are among the benefits that has resulted from DOE-ID's efforts, via the CCA, to join with federal and state partners to conserve sage-grouse and sagebrush lands in eastern Idaho.

6.2 Proposed Changes to the CCA

No changes to the CCA were proposed during 2023.

6.3 Adopted Changes

No changes to the CCA were adopted during 2023.

6.4 Work Plan for Upcoming Year

The following table (Table 6-1) describes activities or changes that are planned for the upcoming year. The purpose of this table is to highlight activities and analyses that will be different than the regular annual activities associated with each task.

Table 6-1. Natural Resources Group work plan for 2024.

CCA Monitoring Task	Schedule for 2024
1. Lek Counts and Lek Route Surveys	Continue to monitor all active leks and a rotational subset of inactive leks.
4. Raven Nest Surveys	Limited monitoring of infrastructure where nest deterrents have been installed may be performed to determine if they were effective at excluding ravens.
5. Sagebrush Habitat Condition Trends	Sample all annual and rotational set II monitoring plots (n = 125). Update annual habitat condition analyses. Continue to explore cover trend analyses.
6. Monitoring to Determine Changes in Sagebrush Habitat Amount and Distribution	New wildland fires will be mapped when imagery becomes available to document sagebrush habitat loss as needed.
8. Monitoring Expansion of the Infrastructure Footprint within the SGCA and Other Areas Dominated by Big Sagebrush	New Idaho NAIP imagery will be available again in 2024, and we will systematically review the INL Site to document evidence of expansion of linear features and losses of sagebrush habitat from new project footprints and expansions.

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APPENDIX A.

Table A-1. Absolute cover (%) for observed species† within 43 annual sagebrush habitat plots. Baseline cover values are compared to 2023 cover values by species and functional groups. Baseline values were generated from five years of data (2013–2017; *n* = 5). A species cover must be equal or greater than 0.05% to be reported and those with less than the minimum cover were summed within their respective 'others' category for the sake of brevity.

Plant Species	Baseline Cover (%)	2023 Cover (%)
Native		
Shrubs		
Artemisia tridentata	17.41	21.53
Chrysothamnus viscidiflorus	6.64	4.54
Artemisia tripartita	1.80	2.09
Artemisia arbuscula	1.16	*
Atriplex confertifolia	0.95	1.18
Artemisia nova	0.90	0.97
Krascheninnikovia lanata	0.72	0.57
Linanthus pungens	0.22	0.22
Eriogonum microthecum	0.10	0.08
Tetradymia canescens	0.04	0.10
Others (*n* = 3, 2)	0.05	0.03
Total Native Shrub Cover	**29.99**	**31.31**
Succulents		
Opuntia polyacantha	0.10	0.05
Perennial Graminoids		
Elymus elymoides	2.15	5.44
Poa secunda	2.03	2.33
Achnatherum hymenoides	1.85	1.64
Pseudoroegneria spicata	1.21	0.91
Elymus lanceolatus	0.80	0.60
Hesperostipa comata	0.51	0.27
Pascopyrum smithii	0.21	*
Carex douglasii	0.11	0.22
Others (*n* = 1,0)	0.02	*
Total Native Perennial Graminoid Cover	**8.88**	**11.41**
Perennial Forbs		
Phlox hoodii	0.47	0.43
Schoenocrambe linifolia	0.24	0.15
Sphaeralcea munroana	0.12	*
Erigeron pumilus	0.04	0.45
Astragalus filipes	0.03	0.09
Phlox longifolia	0.03	0.12
Allium textile	*	0.06

Plant Species	Baseline Cover (%)	2023 Cover (%)
Astragalus curvicarpus	*	0.06
Others (*n* = 22, 14)	0.18	0.23
Total Native Perennial Forb Cover	**1.11**	**1.60**
Annual and Biennial Forbs		
Lappula occidentalis	0.34	0.43
Descurainia pinnata	0.27	0.23
Cordylanthus ramosus	0.15	0.52
Chenopodium leptophyllum	0.08	0.37
Cryptantha scoparia	0.03	0.07
Eriastrum wilcoxii	0.02	0.05
Others (*n* = 11, 25)	0.09	0.11
Total Annual and Biennial Forb Cover	**0.99**	**1.78**
Total Native Cover	**41.07**	**46.15**
Introduced		
Perennial Grasses		
Agropyron cristatum	1.34	1.57
Annual and Biennial Grasses and Forbs		
Alyssum desertorum	1.08	2.45
Bromus tectorum	1.02	3.44
Halogeton glomeratus	0.74	1.42
Others (*n* = 7, 3)	0.03	0.02
Total Introduced Annual and Biennial Cover	**2.87**	**7.32**
Total Introduced Cover	**4.21**	**8.89**
Total Vascular Plant Cover	**45.28**	**55.04**

* Species that were undetectable using the current sampling methodology.
† Appendix A provides a complete species list with scientific and common names.

Table A-2. Absolute cover (%) for observed species† within 32 annual non-sagebrush plots. Baseline values are compared to 2023 cover values by species and functional groups. Baseline values were generated from five years of data (2013–2017, *n* = 5). A species cover must be equal or greater than 0.05% to be reported and those with less than the minimum cover were summed within their respective 'others' category for the sake of brevity.

Plant Species	Baseline Cover (%)	2023 Cover (%)
Native		
Shrubs		
Chrysothamnus viscidiflorus	10.72	9.81
Artemisia tridentata	0.33	1.14
Atriplex confertifolia	0.21	0.59
Tetradymia canescens	0.18	0.23
Eriogonum microthecum	0.07	0.03
Gutierrezia sarothrae	0.02	0.05
Krascheninnikovia lanata	0.02	0.07
Artemisia tripartita	0.01	0.09
Others (*n* = 2, 4)	0.06	0.08
Total Native Shrub Cover	**11.62**	**12.08**
Succulents		
Opuntia polyacantha	0.10	0.07
Perennial Graminoids		
Pseudoroegneria spicata	4.82	2.83
Poa secunda	3.01	2.72
Hesperostipa comata	2.68	3.60
Achnatherum hymenoides	2.45	2.37
Elymus lanceolatus	2.08	3.02
Elymus elymoides	1.42	1.97
Pascopyrum smithii	0.84	0.39
Leymus flavescens	0.58	*
Carex douglasii	0.08	0.08
Leymus cinereus	0.03	0.10
Others (*n* = 1, 0)	0.03	*
Total Native Perennial Graminoid Cover	**17.98**	**17.08**
Perennial Forbs		
Phlox hoodii	0.40	0.30
Sphaeralcea munroana	0.31	0.04
Crepis acuminata	0.29	0.12
Erigeron pumilus	0.15	0.20
Phlox aculeata	0.11	0.01
Phlox longifolia	0.10	0.05
Astragalus filipes	0.06	0.04
Machaeranthera canescens	0.07	0.02

Plant Species	Baseline Cover (%)	2023 Cover (%)
Lomatium foeniculaceum	0.02	0.05
Psoralidium lanceolatum	0.02	0.05
Pteryxia terebinthina	0.01	0.11
Others (*n* = 17, 10)	0.21	0.07
Total Native Perennial Forb Cover	**1.75**	**1.06**
Annual and Biennial Forbs		
Lappula occidentalis	0.26	0.40
Descurainia pinnata	0.11	0.24
Mentzelia albicaulis	0.09	0.03
Eriastrum wilcoxii	0.09	0.03
Gnaphalium palustre	<0.00	0.61
Ipomopsis minutiflora	<0.00	0.09
Others (*n* = 10, 5)	0.13	0.05
Total Native Annual and Biennial Cover	**0.67**	**1.44**
Total Native Cover	**32.12**	**31.73**
Introduced		
Perennial Grasses and Forbs		
Agropyron cristatum	0.59	1.05
Others (*n* = 1, 0)	0.01	*
Total Introduced Perennial Cover	**0.60**	**1.05**
Annuals and Biennial Grasses and Forbs		
Bromus tectorum	13.48	16.13
Salsola tragus	1.78	5.26
Alyssum desertorum	1.40	0.97
Halogeton glomeratus	1.22	5.15
Sisymbrium altissimum	0.21	0.76
Descurainia sophia	0.06	0.01
Tragopogon dubius	0.01	0.11
Others (*n* = 2, 1)	0.01	0.02
Total Introduced Annual and Biennial Cover	**18.17**	**28.41**
Total Introduced Cover	**18.78**	**29.46**
Total Vascular Plant Cover	**50.90**	**61.19**

* Species that were undetectable using the current sampling methodology.
† Appendix A provides a complete species list with scientific and common names.

Table A-3. A complete list of all species documented on the 75 annual habitat monitoring plots in 2023. Nomenclature follows the U.S. Department of Agriculture Plants National Database (2023).

Scientific Name	Common Name
Achnatherum hymenoides	Indian ricegrass
Agoseris glauca	pale agoseris
Agropyron cristatum	crested wheatgrass
Allium acuminatum	Hooker's onion/ tapertip onion
Allium textile	textile onion
Alyssum desertorum	desert alyssum/ desert madwort
Antennaria microphylla	littleleaf pussytoes
Arabis holboellii	Holboell's rockcress
Arabis lignifera	desert rockcress
Arabis microphylla	littleleaf rockcress
Arenaria franklinii	Franklin's sandwort
Artemisia nova	black sagebrush
Artemisia tridentata	big sagebrush
Artemisia tripartita	threetip sagebrush
Astragalus agrestis	purple milkvetch
Astragalus calycosus	Torrey's milkvetch
Astragalus ceramicus	painted milkvetch
Astragalus convallarius	lesser rushy milkvetch
Astragalus curvicarpus	curvepod milkvetch
Astragalus filipes	basalt milkvetch
Astragalus geyeri	Geyer's milkvetch
Astragalus lentiginosus	freckled milkvetch
Astragalus purshii	woollypod milkvetch
Atriplex confertifolia	shadscale saltbush
Atriplex falcata	sickle saltbush/ Nuttall saltbush
Balsamorhiza sagittata	arrowleaf balsamroot
Bassia scoparia	kochia/ summer cypress/ burningbush
Bromus arvensis	field brome
Bromus tectorum	cheatgrass
Calochortus bruneaunis	Bruneau mariposa lily
Camelina microcarpa	littlepod false flax
Camissonia minor	small evening primrose
Carex douglasii	Douglas' sedge
Castilleja angustifolia	northwestern Indian paintbrush
Ceratocephala testiculata	bur buttercup/ curveseed butterwort
Chaenactis douglasii	Douglas' dustymaiden
Chenopodium leptophyllum	slimleaf goosefoot/ narrowleaf goosefoot
Chenopodium species	unknown goosefoot
Chondrilla juncea	rush skeletonweed/ hogbite
Chorispora tenella	purple mustard/ crossflower

Chrysothamnus viscidiflorus	yellow rabbitbrush/ green rabbitbrush
Comandra umbellata	bastard toadflax
Cordylanthus ramosus	bushy bird's beak
Crepis acuminata	tapertip hawksbeard
Cryptantha interrupta	Elko cryptantha
Cryptantha scoparia	Pinyon Desert cryptantha
Cymopterus acaulis	biscuit-root/ plains springparsley
Delphinium andersonii	Anderson's larkspur/ desert larkspur
Descurainia pinnata	western tansymustard
Descurainia sophia	herb sophia
Elymus elymoides	bottlebrush squirreltail
Elymus lanceolatus	thickspike wheatgrass
Epilobium brachycarpum	tall annual willowherb
Eriastrum wilcoxii	Wilcox's woollystar
Ericameria nana	dwarf goldenbush
Ericameria nauseosa	rubber rabbitbrush/ gray rabbitbrush
Erigeron filifolius	threadleaf fleabane
Erigeron pumilus	shaggy fleabane
Eriogonum caespitosum	matted buckwheat
Eriogonum cernuum	nodding buckwheat
Eriogonum microthecum	shrubby buckwheat/ slender buckwheat
Eriogonum ovalifolium	cushion buckwheat
Erodium cicutarium	redstem stork's bill
Escobaria missouriensis	Missouri foxtail cactus
Gayophytum decipiens	deceptive groundsmoke
Gayophytum diffusum	spreading groundsmoke
Gilia sinuata	rosy gilia
Gilia tweedyi	Tweedy's gilia
Gnaphalium palustre	western marsh cudweed
Grayia spinosa	spiny hopsage
Gutierrezia sarothrae	broom snakeweed
Halogeton glomeratus	saltlover
Hesperostipa comata	needle and thread grass
Ionactis alpina	Lava aster
Ipomopsis congesta	ballhead gilia
Ipomopsis minutiflora	littleflower gilia/ littleflower ipomopsis
Krascheninnikovia lanata	winterfat
Lactuca serriola	prickly lettuce
Langloisia setosissima	spotted langloisia/ Great Basin langloisia
Lappula occidentalis	flatspine stickseed
Lappula squarrosa	European stickseed
Lepidium perfoliatum	clasping pepperweed
Leptosiphon harknessii	Harkness' flaxflower
Leptosiphon septentrionalis	northern linanthus

Leymus cinereus	basin wildrye
Linanthus pungens	granite prickly phlox
Lomatium dissectum	fernleaf biscuitroot
Lomatium foeniculaceum	desert biscuitroot
Lomatium triternatum	nineleaf biscuitroot
Lupinus argenteus	silvery lupine
Lupinus holosericeus	holo lupine/ silvery lupine
Lupinus pusillus	rusty lupine/ small lupine
Lygodesmia grandiflora	largeflower skeletonplant
Machaeranthera canescens	hoary tansyaster
Mentzelia albicaulis	whitestem blazingstar
Oenothera caespitosa	tufted evening primrose
Oenothera pallida	pale evening primrose
Opuntia polyacantha	plains pricklypear
Orobanche corymbosa	flat-top broomrape
Orobanche fasciculata	clustered broomrape
Packera cana	woolly groundsel
Pascopyrum smithii	western wheatgrass
Penstemon cyaneus	blue penstemon
Penstemon deustus	hot rock penstemon/ scabland penstemon
Penstemon pumilus	Salmon River beardtongue
Penstemon radicosus	matroot penstemon
Phacelia glandulifera	sticky phacelia
Phacelia hastata	silverleaf phacelia
Phlox aculeata	sagebrush phlox/ pricklyleaf phlox
Phlox hoodii	Hood's phlox/ spiny phlox
Phlox longifolia	longleaf phlox
Pleiacanthus spinosus	thorn skeletonweed
Poa secunda	Sandberg bluegrass
Pseudoroegneria spicata	bluebunch wheatgrass
Psoralidium lanceolatum	lemon scurfpea
Pteryxia terebinthina	turpentine wavewing
Purshia tridentata	antelope bitterbrush
Salsola tragus	prickly Russian thistle
Sarcobatus vermiculatus	greasewood
Schoenocrambe linifolia	flaxleaf plainsmustard
Sisymbrium altissimum	Jim Hill mustard/ tall tumblemustard
Sphaeralcea munroana	Munro's globemallow/ whitestem globemallow
Sporobolus cryptandrus	sand dropseed
Stanleya viridiflora	green princesplume
Stenotus acaulis	stemless mock goldenweed
Taraxacum officinale	common dandelion
Tetradymia canescens	spineless horsebrush
Tetradymia spinosa	shortspine horsebrush

Thelypodium laciniatum	cutleaf thelypody
Townsendia florifer	showy Townsend daisy
Tragopogon dubius	yellow salsify
Vulpia myuros	annual fescue
Zigadenus venenosus	meadow deathcamas

USDA, NRCS. 2023. The PLANTS Database (http://plants.usda.gov, October 25, 2023). National Plant Data Team, Greensboro, NC 27401-4901 USA.