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VFS-ID-ESER-CCA-074

Implementing the Candidate Conservation Agreement for Greater Sage-Grouse on the Idaho National Laboratory Site: 2019 Full Report

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EXECUTIVE SUMMARY

This document satisfies the reporting requirement of the *Candidate Conservation Agreement* (CCA) *for Greater Sage-grouse (Centrocercus urophasianus) on the Idaho National Laboratory* (INL) *Site*, signed by the U.S. Department of Energy, Idaho Operations Office (DOE) and the U.S. Fish and Wildlife Service (USFWS) in 2014. The primary purposes of this report are to (1) document 2019 monitoring activities and results in support of the CCA, (2) address greater sage-grouse (hereafter sage-grouse) population and habitat regulatory triggers in the context of those results, and (3) document progress toward achieving CCA objectives associated with the conservation measures.

Population Monitoring

The sage-grouse population trigger baseline for the INL Site equals the number of males counted in 2011 during peak male attendance on 27 active leks within the Sage-grouse Conservation Area (SGCA) (i.e., 316 males). The population trigger will be tripped if the three-year running average of males on those 27 leks (hereafter, baseline leks) decreases ≥20% (i.e., ≤253 males). In 2019, we surveyed baseline leks, six lek routes, all other active leks on the INL Site, and a few inactive leks that had not been surveyed for several years. Key results from population monitoring are as follows:

- Peak male attendance summed across baseline leks was 304 males—a 16.7% decrease from 2018 and the lowest value recorded on these leks since we began analyzing them as a unit in 2011. The three-year average (2017–2019) was 360 males, a 13.5% decrease from 2018 and the first time the three-year average has decreased.
- Male attendance on six lek routes was on average 27.5% lower (range −7.5% to −66.0%) than in 2018.
- The number of leks classified as active on and near the INL Site decreased from 44 in 2018 to 40 in 2019.

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 habitat at the beginning of 2013. This habitat trigger will trip if there is a reduction of ≥20% (15,712 ha [38,824 ac]) of sagebrush habitat within the SGCA. Total sagebrush habitat area and distribution are monitored using aerial imagery and a geographic information system. To monitor the condition of sagebrush-dominated lands and areas recovering from wildland fire, we surveyed 119 vegetation plots distributed across both habitat types. The following is a summary of results from habitat distribution and condition monitoring tasks:

- In polygons currently identified as sagebrush habitat, the mean cover for sagebrush and perennial herbaceous functional groups was greater than the five-year local mean (2013 to 2017). Additionally, the height estimate for grasses and forbs was greater, while sagebrush species remained unchanged. Trend analyses depicted sagebrush steadily trending upward and native perennial grasses experienced a sharp increase in 2015; they have likely reached the upper end of their normal range of variability.
- In areas without sagebrush, the annual mean for cover and height of sagebrush and perennial herbaceous functional groups was greater than the local mean. Trend analyses show cover for native species remained stable in non-sagebrush areas. After four consecutive years of increases,

cheatgrass cover decreased from 2018 to 2019. It is unclear if cheatgrass will trend downward or fluctuate; it is not likely that seven years of annual data capture the nuances of invasion dynamics.

- Mapping results using high resolution imagery indicate the 2019 Sheep Fire burned approximately 40,403.3 ha (99,838.8 acres). However, the distribution and area of sagebrush habitat in the SGCA remains virtually unchanged in 2019, with a loss of only 2.3 ha (5.7 acres) resulting from the Sheep Fire.
- The Sheep Fire burned approximately 10,402 ha (25,703 acres) of sagebrush habitat outside the SGCA, reducing the sagebrush "conservation bank" by 28.6%.

Threat Monitoring

Raven Nest Surveys—Thirty-two active common raven nests were observed on the INL Site in 2019. Three of these appeared to be second nests, reducing the final count to 29 nests. This is 33% fewer active nests than in 2018, matching the lowest number recorded since monitoring began in 2014. Eighteen nests were on power line structures, seven were at facilities, and four were on towers outside of facilities.

Infrastructure Expansion—No high resolution imagery was available for the INL Site in 2019, so we did not perform work on this task.

Conservation Measures Associated with Habitat Restoration

The Environmental Surveillance, Education, and Research Program (ESER) managed the planting of approximately 10,000 sagebrush seedlings in fall of 2019 in an area prioritized for restoration. Survivorship of seedlings planted in 2018 was at least 66%.

During fall of 2019, ESER drafted a post-fire recovery plan for the Sheep Fire, and stakeholders including the USFWS, the Bureau of Land Management, and the Idaho Office of Species Conservation acquired sagebrush seed to be broadcast aerially on a portion of the burned area early in 2020.

Synthesis and Conclusions

Like sage-grouse lek counts on the INL Site, lek counts across Idaho declined for the third straight year and at roughly the same proportion as those on the INL Site. This directional and proportional similarity suggests that regional rather than INL Site-specific factors are predominately influencing sage-grouse abundance on the INL Site. In 2019, the Sheep Fire eliminated thousands of hectares of sagebrush-dominated communities on the INL Site, including areas near three lek sites. Male sage-grouse may continue to display at these sites for the next few years, but lek abandonment over the long term is likely. In response to the Sheep Fire, the Environmental Surveillance, Education, and Research Program completed a fire recovery plan and DOE and stakeholders secured sagebrush seed that will be applied aerially in winter 2020.

Adaptive Management

We propose three changes to the CCA and associated reports for DOE and U.S. Fish and Wildlife Service (USFWS) to consider:

1. Adapt the population trigger so that it is based on leks counts from all leks within the SGCA, or across the entire INL Site, rather than the 27 baseline leks within the SGCA;

2. Adjust the sagebrush habitat trigger baseline so it is consistent with a recently-updated vegetation classification and map for the INL Site;
3. Add a short section to the annual CCA monitoring reports that summarizes the status of cheatgrass on the INL Site using data collected for the habitat condition monitoring task.

Changes Made to the CCA in 2019

The USFWS and DOE made no changes to the CCA or associated monitoring tasks in 2019.

ACKNOWLEDGEMENTS

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RECOMMENDED CITATION

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ACRONYMS

BEA	Battelle Energy Alliance, LLC
BLM	Bureau of Land Management
CCA	Candidate Conservation Agreement
CFA	Central Facilities Area
DOE	U.S. Department of Energy, Idaho Operations Office
ESER	Environmental Surveillance, Education, and Research Program
GIS	geographic information system
GPS	global positioning system
IDFG	Idaho Department of Fish and Game
INL	Idaho National Laboratory
LTV	Long-Term Vegetation
MFC	Materials and Fuels Complex
MPLS	males per lek surveyed
NAIP	National Agricultural Imaging Program
NOAA	National Oceanic and Atmospheric Association
RWMC	Radioactive Waste Management Complex
SGCA	Sage-grouse Conservation Area
USFWS	U.S. Fish and Wildlife Service

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1.0 INTRODUCTION, BACKGROUND, AND PURPOSE

In October 2014, the U.S. Department of Energy, Idaho Operations Office (DOE) and the U.S. Fish and Wildlife Service (USFWS) entered into a Candidate Conservation Agreement (CCA) for Greater Sage-Grouse (*Centrocercus urophasianus*; hereafter sage-grouse) on the Idaho National Laboratory (INL) Site (DOE and USFWS 2014). The CCA stipulates that DOE submit a report annually to USFWS documenting monitoring activities that occurred within the preceding twelve months (DOE and USFWS 2014, Section 11.3). This report, produced by DOE's Environmental Surveillance, Education, and Research Program (ESER), satisfies this requirement. In addition, it documents actions taken by DOE and INL contractors during the preceding year to meet objectives of 13 conservation measures designed to reduce threats to sage-grouse and its habitats.

An important purpose of this report is to provide an update on sage-grouse population and habitat trends as they apply to adaptive regulatory triggers established in the CCA. If a regulatory trigger is tripped, a responsive action by DOE and USFWS will be initiated (DOE 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), 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 falls below 62,846 ha (155,296 acres)—a 20% drop from the 2013 baseline of 78,558 ha (194,120 acres).

This report informs a continuing dialogue between DOE 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 continuously grounded in the best available science, and retains its value to both signatories.

Related monitoring tasks are grouped into three sections: Population Trigger Monitoring (Section 2), Habitat Trigger Monitoring (Section 3), and Threat Monitoring (Section 4). Section 5 reports how DOE and contractors 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 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.

2.0 POPULATION TRIGGER MONITORING

2.1 Task 1—Lek Counts and Lek Route Surveys

2.1.1 Introduction

In 2013, a sage-grouse population monitoring task (Task 1—CCA Section 11.1.1) was designed to track abundance trends on the INL Site and provide information to DOE and USFWS regarding the direction of trends relative to the population trigger threshold. Counts from 27 leks located in the SGCA (hereafter, baseline leks) are the basis for the population trigger (Figure 2-1; DOE and USFWS 2014). 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 be tripped if the three-year running average of peak male attendance at these baseline leks falls below 253, a 20% decrease from the 2011 value (DOE and USFWS 2014).

In addition to baseline lek counts, we survey six lek routes 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. Data from these routes continue to build on more than two decades of sage-grouse monitoring on the INL Site, providing context to interpret short-term results derived from baseline lek monitoring. The CCA stipulates that following the completion of historical lek surveys (Monitoring Task 2) and lek discovery surveys (Monitoring Task 3), additional lek routes would be established, and the basis for the population trigger would be converted from baseline leks to lek routes. These surveys were completed in 2017, the same year the three additional lek routes were established (Shurtliff et al. 2018).

Surveying a cluster of leks in the same order and on the same day each year (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 scales than data from individual lek surveys (Connelly et al. 2003, DOE and USFWS 2014). A proposal to use lek routes instead of baseline leks as the population trigger metric was considered during the 2018 annual CCA stakeholders meeting; however, the USFWS suggested it would be best to table the discussion until ongoing revisions of Bureau of Land Management (BLM) and U.S. Forest Service land use plans for sage-grouse were complete.

Finally, this task includes rotational surveys of inactive leks that are not included in annual baseline lek and lek routes surveys. Our intent is to revisit all leks classified as inactive at least once every five years to determine if sage-grouse have reoccupied the sites. This, and other monitoring activities described above, help us maintain accurate records of the number and location of active leks on the INL Site.

2.1.2 Methods

Field Methods

We performed lek counts from March 21 to May 10 following Idaho Department of Fish and Game procedures (Shurtliff et al. 2015; ESER Research Procedure, 2019). Lek counts occurred between 30 minutes before and 90 minutes after sunrise, and only during reasonably clear and calm weather (i.e., no precipitation and winds <12 miles per hour). If sage-grouse were present at a lek, an observer tallied the number of visible males three or four times over a five- to 10-minute period. The highest tally was recorded as the lek count for the day. Visits to single leks and lek routes were separated by at least seven 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 ≥2 times.

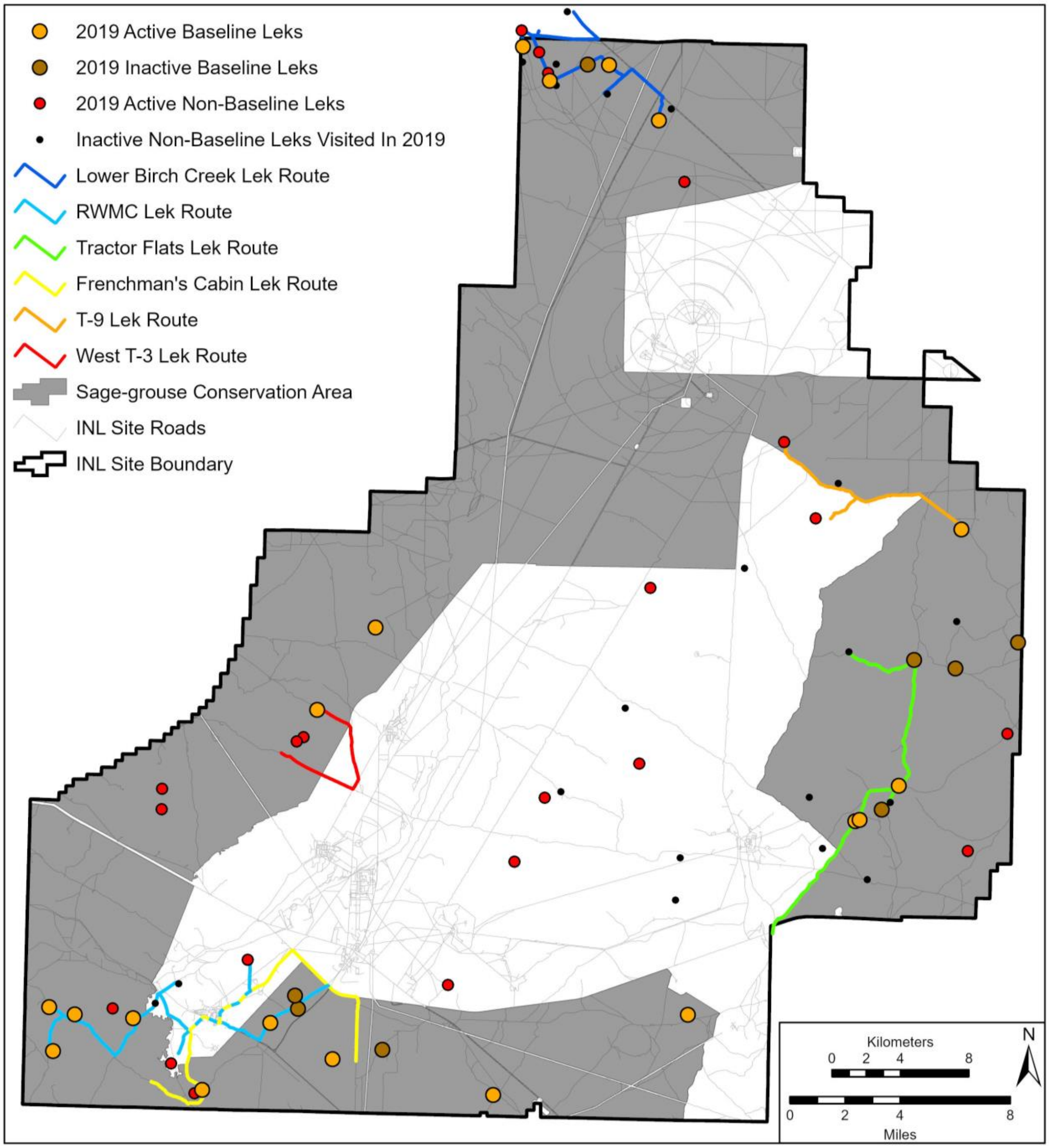

Figure 2-1. An overview of sage-grouse leks surveyed on the Idaho National Laboratory Site in 2019. Lek activity designations (active vs. inactive) refer to lek statuses when surveys commenced in March 2019.

We surveyed six lek routes primarily located within the SGCA (Figure 2-1). Routes consisted of three to 10 active and inactive leks, all surveyed on the same day. Three routes have been surveyed annually since the mid-1990s (Lower Birch Creek, Tractor Flats, and Radioactive Waste Management Complex [RWMC]), and three routes have been surveyed since 2017 (West T-3, T9, and Frenchmans Cabin). Tractor Flats and Lower Birch Creek routes each include a lek located outside, but ≤0.5 km from the INL Site boundary.

In 2019, we began surveys of five routes in late March, but lingering snow made it impossible to survey the RWMC route until April 11. Typically, each route is surveyed in a single morning, and the individual assigned to a route repeats the survey each week. This year, however, water from the Big Lost River was diverted through a channel that bisected the RWMC route during March and April, requiring two observers to complete each half of the route separately. Results from the two surveys were combined to produce a single route observation for the day. Leks on Lower Birch Creek, Tractor Flats, and RWMC were visited in the same order each survey (except when two individuals surveyed RWMC). In contrast, West T-3, T9, and Frenchmans Cabin were not necessarily visited in the same order each time due to a lack of communication with observers; however, each was surveyed throughout the season by the same observer.

Following each route survey, counts of males were summed across all leks to produce a single route value. Following the field season, we determined peak male attendance for each route based on the survey with the highest count.

Lek Status

We classify a lek as active if it was attended by two or more male sage-grouse that were displaying in at least two of the previous five years of surveys (Connelly et al. 2000, Whiting et al. 2014). Leks that do not meet these criteria are classified inactive. Following each sage-grouse breeding season, we examine data from the past five years for each surveyed lek and, as necessary, we adjust its activity status.

To ensure that our list of active leks is accurate, we visit inactive leks that are not one of the baseline or route leks on a rotational basis. Our goal is to visit each inactive, non-baseline lek at least once every five years to determine if its status has changed. Prior to the start of the field season, we search our database for all inactive leks and select a number that can be reasonably added to our upcoming workload. We also survey other inactive leks as requested by the Idaho Department of Fish and Game (IDFG).

Analysis

Under *Results and Discussion* below, we report summary statistics for baseline leks and lek routes separately, but some baseline lek counts contribute to both summaries. This is because some baseline leks are counted singly, whereas others are part of lek routes (Figure 2-1).

To assess whether the population trigger is above or below the critical threshold of 253 males, we identified peak male attendance on each baseline lek (i.e., the highest male count recorded during any visit between March 15 and May 15) and summed those counts across all 27 leks. This annual count was then averaged with the preceding two years to produce a three-year running average, which is the population trigger metric (DOE 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

SGCA Baseline Leks

We surveyed each baseline lek 3–7 times ($\bar{x}$ = 4.9 surveys, SD = 1.3) in 2019. Peak male attendance, summed across all baseline leks, was 304, a 16.7% decrease from 365 individuals recorded in 2018, and the lowest value recorded on these leks since we began analyzing them as a unit in 2011 (Figure 2-2). Peak male attendance decreased at least 11% each of the past three years, and the 2019 count is 35.5% lower than the 471 males recorded in 2016.

The three-year (2017–2019) running average of peak male attendance on baseline leks was 360 males (SD = 54.2), a 13.5% decrease from 2018 (Figure 2-2). This result marks the first year a decrease in the three-year average has occurred. The average, however, remains higher than pre-2016 values and is 142% of the threshold (253 males) that would trigger specified action by DOE and the USFWS (DOE and USFWS 2014).

Lek Routes

We surveyed each of the six lek routes 4–7 times ($\bar{x}$ = 5.8 surveys, SD = 1.0; Table 2-1) during the official IDFG survey period. For all routes, MPLS values were lower in 2019 than in 2018, with reductions ranging from −7.5% to −66.0% (Table 2-1). On average, lek route counts declined 27.5% (SD = 22.8%). This is similar to the 25% decline over the same time period reported by the IDFG, although the IDFG uses different analyses to arrive at this estimate[1].

Table 2-1. Lek Route data from 2019 surveys on the Idaho National Laboratory Site.

Lek Route	Highest Single-Day Count	Total Leks Surveyed	Males / Lek Surveyed (MPLS)	MPLS % change from 2018	Occupied Leks*	Surveys Conducted
Tractor Flats	69	8	8.6	−7.5	4	6
Radioactive Waste Management Complex	60	9**	6.7	−43.2	5	4
Lower Birch Creek	94	10**	9.4	−15.3	6	6
West T-3	16	4	4.0	−66.0	3	6
T-9	35	4	8.8	−10.2	3	7
Frenchmans Cabin	28	3	9.3	−22.5	3	6

*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 DOE's Environmental Surveillance, Education, and Research Program uses to characterize leks on the Idaho National Laboratory Site, which is based on five years of data.

**One additional lek was surveyed in 2019 compared to 2018. A recently established lek was added to the Lower Birch Creek route, and a lek on the Radioactive Waste Management Complex Route that was inaccessible in 2018 was accessible in 2019.

[1] Unpublished data, personal communication with Ann Moser, Wildlife Staff Biologist, IDFG; Oct. 15, 2019

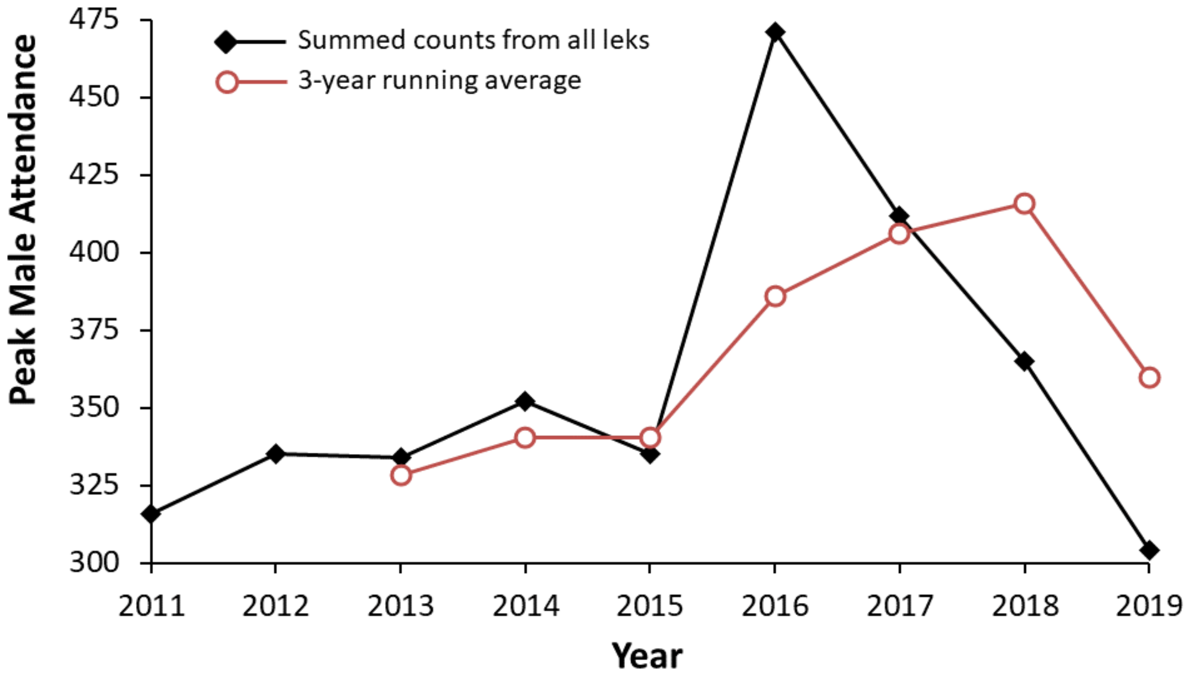

Figure 2-2. Peak male attendance of sage-grouse on 27 leks in the Sage-grouse Conservation Area that are the basis for the population trigger (i.e. baseline leks).

Inactive Leks

We surveyed 13 leks at least two times each (range 2–5), which are a subset of inactive leks surveyed once every few years to verify activity status. Nine of these leks had not been visited since 2015, and the other four were last surveyed in 2017 or 2018. We did not record observations of male sage-grouse at any of the leks, so each will retain its inactive status.

Changes in Lek Classification

Following the 2019 field season, two leks assigned to routes were downgraded to inactive status—leks INL159 (West T-3) and INL20 (Tractor Flats; Figure 2-3). Lek INL159 has never been documented as a well-attended lek—males were recorded only twice (maximum = 3 males) since it was first identified in 2014. In contrast, males were consistently documented on INL20 from 2002 until 2015 (maximum = 34 males), but no males have been recorded in the past four years.

Activity status of baseline leks did not change in 2019, as 19 of 27 remained active. Last year, we incorrectly reported that 17 leks were active at the end of the 2018 season, but the real number was 19 (Shurtliff et al. 2019). This error was a result of misclassifications in the database that we discovered after the report was finalized.

Two non-baseline leks (INL147 and INL148) that are not assigned to a lek route were reclassified as inactive following the 2019 field season (Figure 2-3). We do not know why attendance has declined at these leks, but Lek INL148 is within 300 m of an active lek. Reduced occupancy by breeding sage-grouse at INL148 may represent a reduction in the number of activity centers on a single lek (Connelly et al. 2004) rather than a functional loss of a lekking area.

Before the 2019 field season, 44 leks were designated active on or near the INL Site, including two just outside the Site boundaries that are part of the IDFG survey routes. After the field season, the four leks described above were downgraded from active to inactive status, and none were upgraded to active status (Figure 2-3). Therefore, total known active leks on or near the INL Site is currently 40.

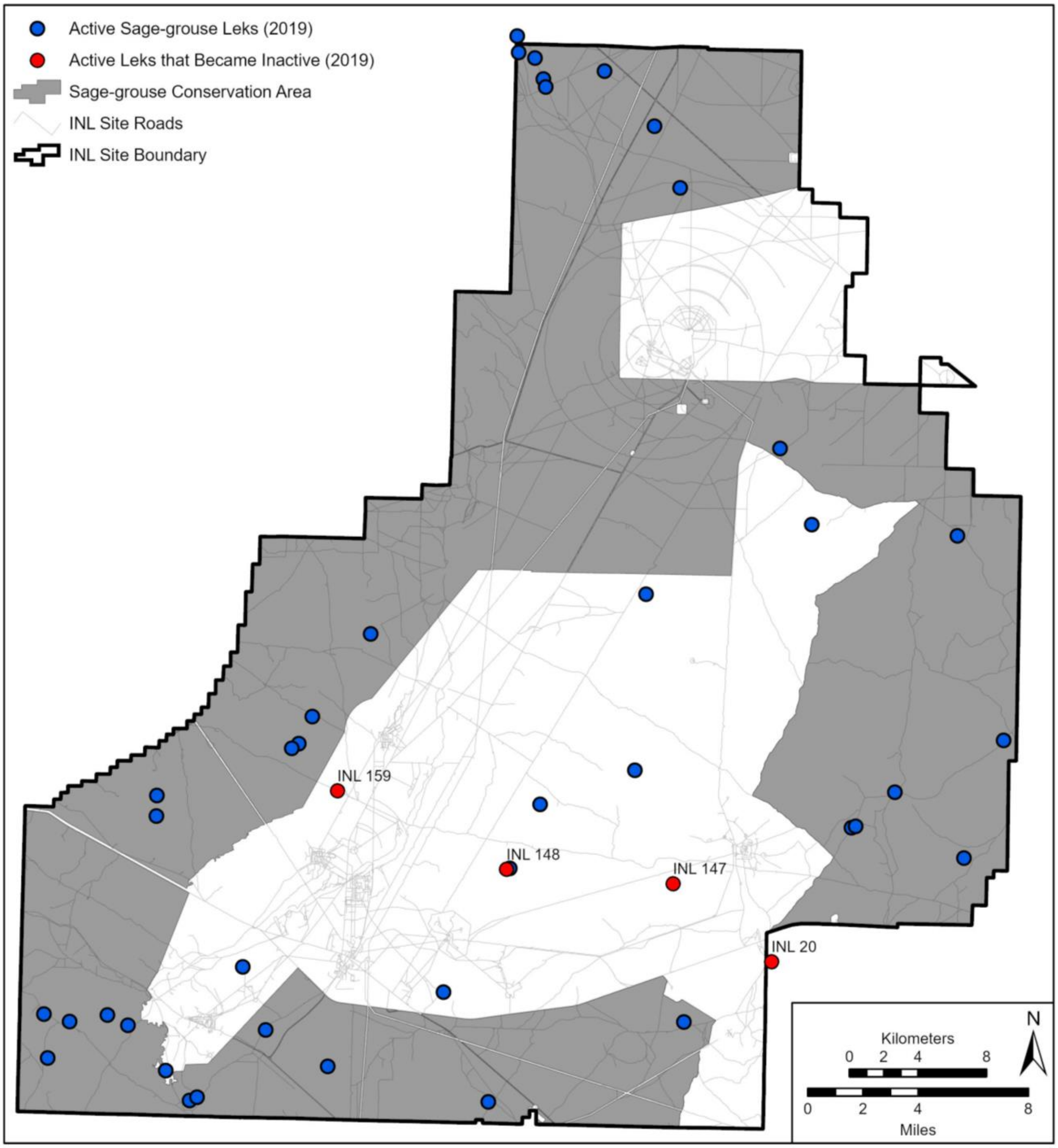

Figure 2-3. Locations of 40 active leks and four leks downgraded to inactive status on or near the Idaho National Laboratory Site.

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 will change through time based on gradual changes in vegetation composition and also from abrupt changes caused by wildland fire.

The baseline value of the habitat trigger is defined as the total area designated as sagebrush habitat within the SGCA at the beginning of 2013 (DOE and USFWS 2014). Currently, this baseline value is estimated at 78,558 ha (194,120 acres). Although no real changes in the amount of sagebrush habitat within the SGCA have been recorded since the CCA was signed, the habitat trigger baseline value was increased twice following improved fine-scale mapping of recent fires (Shurtliff et al. 2016, 2017). Based on updated habitat estimates, the trigger will be tripped if there is a loss of >15,712 ha (38,824 acres) within the SGCA (i.e., a 20% reduction in sagebrush habitat). If the trigger is tripped, the USFWS will ask DOE to compensate for the loss of habitat.

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 sagebrush habitat 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 average site-specific values. Data collected to support this task may also be used 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, and primarily deals with 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, if imagery from burned areas suggests there have been changes in vegetation classes or distribution of those classes several years post-burn, sagebrush cover will be assessed using habitat condition monitoring data from plots located within a 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 complex, 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 also important, with each being ranked as a mid-level threat. The threat of livestock is ranked as low. 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 herbaceous 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

Sampling

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

The data metrics collected at each of the habitat monitoring plots were selected to address characterization of general habitat condition (Connelly et al. 2000). The main purpose is to support basic description and assessment of sage-grouse habitat quality (See Table 3-2b in Shurtliff et al. 2019). The primary uses of the data are to track trends, which allow for characterization of compositional change in vegetation through time, and aid in assessing potential threats. Data sampled at each plot include: vegetation cover by species, vegetation height for shrubs and herbaceous species, sagebrush density, frequency of juvenile sagebrush occurrence, comprehensive species lists, photographic documentation, sign of use by sage-grouse, indicators of anthropogenic disturbance, and documentation of the current local plant community. 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 (Shurtliff et al. 2016, Appendix B).

Data Analyses

Annual plots are used to assess and characterize habitat condition each year, while rotational plots are used to address specific threats or concerns related to more localized areas (burned areas, grazing allotments, etc.). Analysis of rotational plots are completed once every five years, after data have been collected on all three plot subsets (150 total plots). The most recent analysis of rotational plots was completed in 2016 (see Shurtliff et al. 2017 for details) and they won't be completed again until after the third set of rotational plots are sampled in 2020. Therefore, only data from annual plots are analyzed to characterize habitat condition.

From 2013 through 2017, annual plot summaries were compared to current habitat condition on the INL Site to general regional guidelines (i.e. Connelly et al. 2000, Table 3). Beginning in 2018, we transitioned to using average local habitat condition benchmarks to evaluate the current year's habitat condition data. These average local habitat condition values, hereafter referred to as local means, were collected over five years (2013-2017) from the 75 annual plots. These local means provide a more accurate estimation to evaluate annual habitat condition when compared to the generalized regional guidelines due to the large variation within the diverse sagebrush steppe ecosystem (Connelly et al. 2000).

Data analysis includes comparisons of plant communities, habitat condition metrics, trend analysis, and precipitation overview. Plant community results from the current year are compared to the previous year. Habitat condition metrics are evaluated against local means. Trend analysis focuses on cover data for vegetation functional groups from data collected over seven years (2013 – 2019). An overview is included on precipitation and the potential effects of precipitation patterns on the habitat condition monitoring data. In addition, vegetation trends over the past seven years were interpreted with respect to associated precipitation patterns and within the context of longer-term vegetation trends on the INL Site.

3.1.3 Results and Discussion

Current Habitat Condition

We collected data on 71 of the 75 annual sagebrush habitat condition monitoring plots and 48 of the second set of 50 rotational plots between May 31 through August 19, 2019 (Figure 3-1). Plots that were not surveyed were burned during the Sheep Fire event. The fire started July 22 burning 6 annual and 11 rotational plots; however, nearly 95% of all the annual plots were successfully sampled providing enough data to accurately describe habitat condition for 2019 (Figure 3-2). This section analyzes the 71 annual plots surveyed. These are divided into two subgroups defined by their location relative to sagebrush habitat polygons. There are 46 sagebrush habitat plots located within current sagebrush habitat polygons and 25 non-sagebrush plots located within non-sagebrush polygons. The sagebrush habitat plots are in 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 the non-sagebrush plots have burned at least once since 1994 and were thought to have been dominated by sagebrush prior to fire. Future monitoring will reflect updated habitat status changes to annual plots from recent wildland fires.

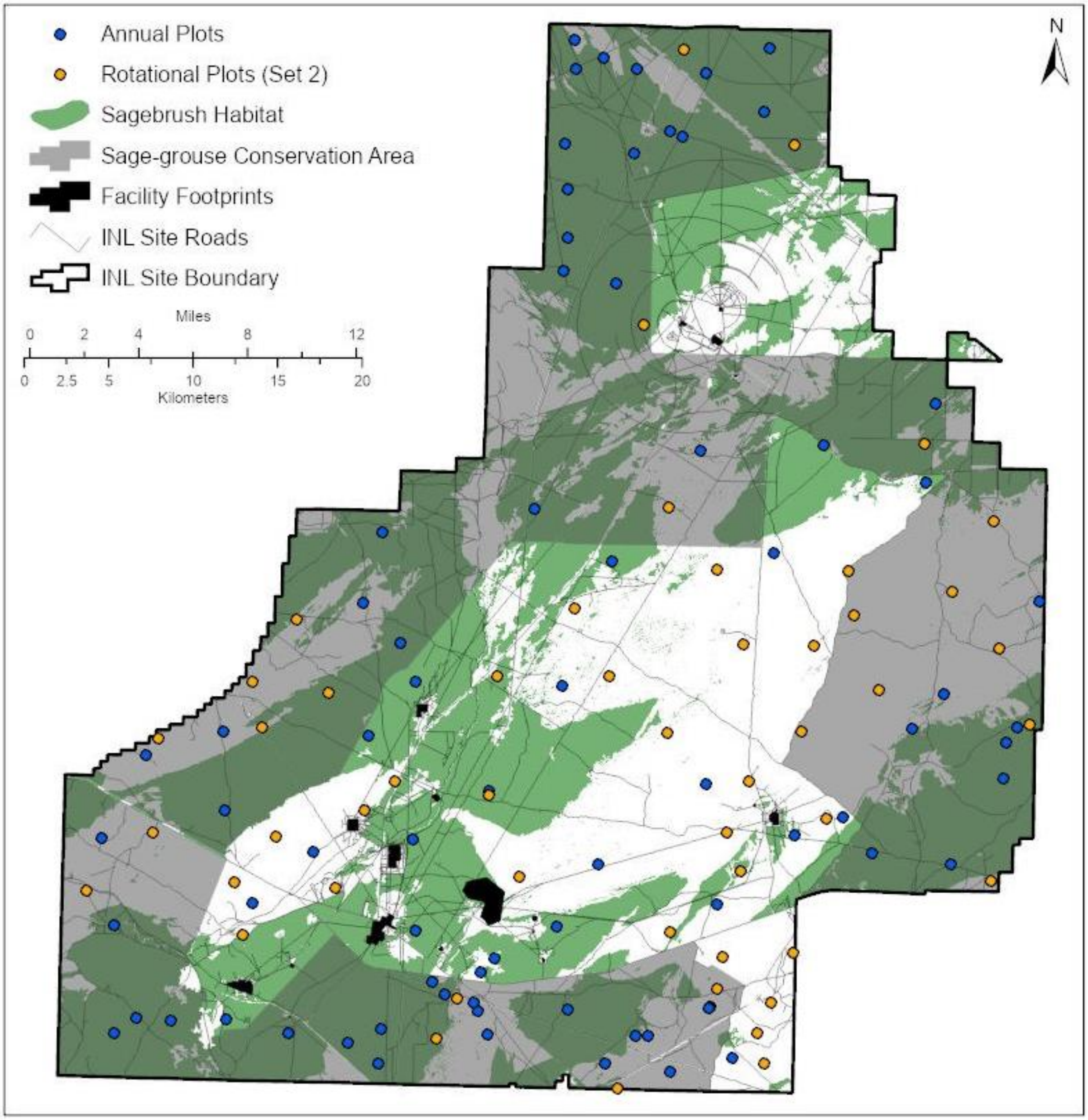

Figure 3-1. Sage-grouse habitat condition monitoring plots sampled on the Idaho National Laboratory Site in 2019 to support the Candidate Conservation Agreement. Both annual and rotational set 2 plots are displayed over sagebrush habitat and the Sage-grouse Conservation Area.

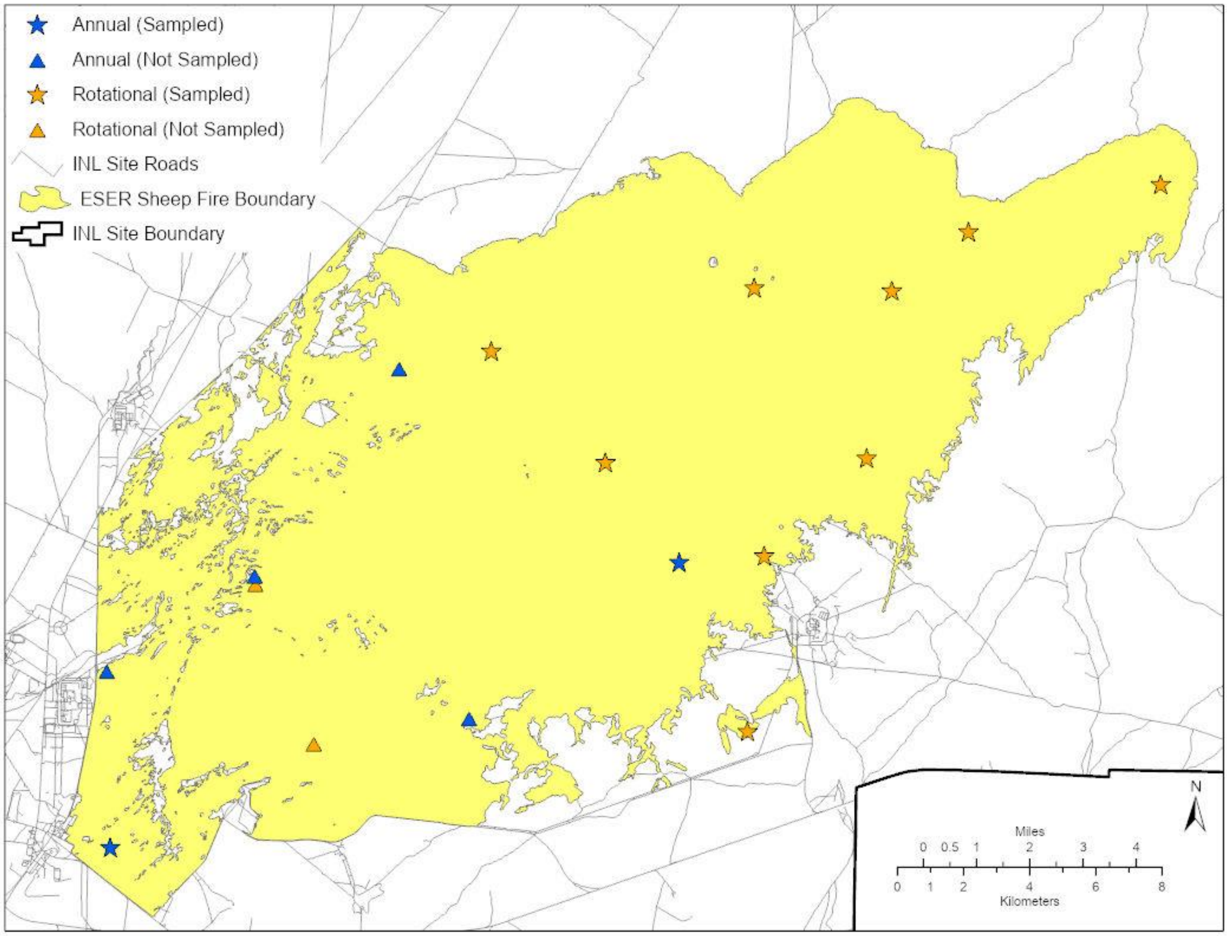

Figure 3-2. Annual and rotational sage-grouse habitat condition monitoring plots scheduled to be sampled that were affected by the Sheep Fire. Plots are denoted for both their annual and rotation status and if they were sampled before they burned.

In 2019, all 46 annual sagebrush habitat plots were assigned a plant community using a dichotomous key developed for the recently updated INL Site vegetation map (Shive et al. 2019). The majority of plots (31) were assigned to the big sagebrush (*Artemisia tridentata*) dominated vegetation class, 12 plots were classified as a mixed shrubland, and the three remaining plots were assigned to black sagebrush (*Artemisia nova*), low sagebrush (*Artemisia arbuscula*), and shadscale saltbush (*Atriplex confertifolia*) shrublands (Table 3-1a). A single plot was reclassified from sagebrush dominated to shadscale saltbush co-dominated possibly due to the use of the updated plant community key, an artifact of crew's interpretation of the plant community key, or reflected a slight change in dominance to shadscale saltbush. Several other plots were assigned to big sagebrush dominant vegetation classes versus low sagebrush dominant partly due to the availability of diagnostic phenological characteristics for improved species identification. The Sheep Fire burned two plots before they were sampled that were most likely sagebrush dominated plots because these plots were always assigned to a sagebrush dominant class over the six previous seasons they were visited. Overall, the 2019 results were highly similar to 2018 results where the majority of plots remained classified as sagebrush dominated shrublands.

Table 3-1a. Comparative results of a dichotomous plant community key (Shive et al. 2019) for annual sagebrush habitat plots sampled on the Idaho National Laboratory Site.

Vegetation Class	2019 Number of Plots (*n* = 46)**	2018 Number of Plots (*n* = 48)
Big Sagebrush Shrubland	31	31
Big Sagebrush – Green Rabbitbrush (Threetip Sagebrush) Shrubland	12	11
Low Sagebrush Shrubland	1	4
Black Sagebrush Shrubland	1	2
Shadscale Saltbush – Winterfat Shrubland	1	*

*indicates classes not identified.
**indicates sample size difference.

Within the 25 non-sagebrush plots, there were both native and non-native vegetation classes assigned (Table 3-1b). Of the native vegetation classifications, seven were assigned to shrub grasslands, another seven plots were assigned to grasslands, and two plots were assigned to shrublands. Of the non-native vegetation classes assigned, eight where ruderal grasslands and two were ruderal shrublands. In 2019, there were fewer ruderal shrublands and more native grasslands than in 2018, suggesting ephemeral forbs were less abundant in the understory and allowed native grasses to be the dominant component of the herbaceous stratum. Overall, the results were similar in comparison between 2018 to 2019, where more than half of the plots were dominated by native plant communities.

Table 3-1b. Comparative results of a dichotomous plant community key (Shive et al. 2019) for annual non-sagebrush plots sampled on the Idaho National Laboratory Site.

Vegetation Class	2019 Number of Plots (*n* = 25)**	2018 Number of Plots (*n* = 27)
Cheatgrass Ruderal Grassland	7	6
Green Rabbitbrush / Sandberg Bluegrass – Bluebunch Wheatgrass Shrub Grassland	6	9
Western Wheatgrass Grassland	3	2
Indian Ricegrass Grassland	3	*
Green Rabbitbrush / Desert Alyssum (Cheatgrass) Ruderal Shrubland	2	6
Green Rabbitbrush / Thickspike Wheatgrass Shrub Grassland	1	3
Shadscale Saltbush – Winterfat Shrubland	1	1
Crested Wheatgrass Ruderal Grassland	1	*
Needle and Thread Grassland	1	*

*indicates classes not identified.
**indicates sample size difference.

Several other qualitative variables were collected at each plot to help describe plot context in terms of potential use by sage-grouse and to document any notable anthropogenic impacts, especially as they relate to the threats identified in the CCA. These qualitative data show that in 2019, sage-grouse sign was present on 19 of the 46 sagebrush habitat plots, which is two times more than 2018 observations where scat was recorded at nine plots (Shurtliff et al. 2019). Sage-grouse scat ranged in age from this current season to at least one year or older on these plots. Sage-grouse feathers were noted on two of the 25 non-sagebrush plots. Overall, plots located in polygons mapped as sagebrush habitat have generally more sage-grouse sign over the past seven years than plots in non-sagebrush polygons. Anthropogenic influence was noted on 14 of the annual habitat condition monitoring plots in 2019. All anthropogenic disturbances were recorded within allotment areas. Types of disturbances recorded were livestock or wild game trails with a few plots also containing cattle dung or sheep pellets. Ten of the 14 plots were also located in areas currently designated as sagebrush habitat. One of the four plots located in a non-sagebrush polygon had active grazing while the other three contained a combination of trails and feces.

In 2019, nearly all summarized quantitative metrics were higher on average than the local means for both sagebrush and non-sagebrush plots (Table 3-2a, Table 3-2b). Within sagebrush habitat plots, absolute cover for sagebrush species was higher than the five-year local mean at 25% and 21%, respectively. Perennial grass/forb cover was two times greater at nearly 21% compared to the local mean of 10%. When comparing height for the current sample year, sagebrush was nearly the same as the local mean; however, the height for perennial grass/forb was generally taller when compared to the local mean. Sagebrush density in 2019 was slightly lower with approximately 4 individuals/m^2 versus the local mean of just over 5 individuals/m^2.

Non-sagebrush plots predictably had lower sagebrush cover in relation to total vegetative cover. Despite the normally low cover, 2019 results indicated slightly greater sagebrush cover than the local mean at 0.4% and 0.2%, respectively. On average, cover of perennial grass/forb was greater than the local mean while height was nearly equal at approximately 30 cm (12 in). Sagebrush individuals were taller, on average, when compared to local mean by nearly 8 cm (3.5 in). Additionally, sagebrush density was slightly higher than the local mean with 0.16 individuals/m^2 (1.7 individuals/ft^2). Summarized metrics of vegetation composition continued to differ between sagebrush plots and non-sagebrush plots (Table 3-2a). As expected, sagebrush cover and density were considerably greater on sagebrush plots than non-sagebrush plots. The average cover and height of perennial grass/forb was greater on non-sagebrush plots than on sagebrush plots and mean sagebrush height was higher on sagebrush plots than non-sagebrush by approximately 7 cm (3 in).

Table 3-2a. Summary of selected vegetation measurements for characterization of condition of sagebrush habitat plots and non-sagebrush plots on the Idaho National Laboratory Site in 2019.

2019	Mean Cover (%)	Mean Height (cm)	Mean Density (individuals/m^2)
Sagebrush Habitat Plots (*n* = 46*)			
Sagebrush	25.02	47.78	4.01
Perennial Grass/Forb	20.46	26.33	
Non-sagebrush Plots (*n* = 25*)			
Sagebrush	0.40	41.14	0.16
Perennial Grass/Forb	24.98	30.08	

*indicates sample size difference from past sampling efforts.

Table 3-2b. Local means of selected vegetation measurements for characterization of condition of sagebrush habitat plots and non-sagebrush plots on the Idaho National Laboratory Site. Local means were generated from five years of data (2013–2017).

Local Means	Mean Cover (%)	Mean Height (cm)	Mean Density (individuals/m²)
Sagebrush Habitat Plots (*n* = 48)			
Sagebrush	21.27	47.81	5.19
Perennial Grass/Forb	9.99	20.70	
Non-sagebrush Plots (*n* = 27)			
Sagebrush	0.22	33.54	0.07
Perennial Grass/Forb	19.73	29.76	

In 2019, absolute total vegetation cover averaged across sagebrush habitat plots was higher (67%) than the local mean (45%, Table 3-3a). About half of the total vegetation cover was from shrubs in 2019. Nearly three quarters of the shrub cover was from sagebrush (*Artemisia* spp.) species while the remaining quarter of shrub cover was mostly composed of green rabbitbrush (*Chrysothamnus viscidiflorus*) and shadscale saltbush (*Atriplex confertifolia*). Sagebrush species cover contributed two fifths of the total vegetation cover on sagebrush habitat plots where big sagebrush was the most abundant and widespread sagebrush species; however, threetip (*Artemisia tripartita*), black sagebrush, and low sagebrush were locally abundant on the limited number of plots where each occurred. Overall, total shrub cover remained stable compared to the local mean at approximately 30% absolute cover whereas perennial grass cover (19%) was two times higher than the local mean (9%). Sandberg bluegrass (*Poa secunda)* was the most abundant native, perennial grass contributing one third of total perennial graminoid cover. Absolute cover for both Sandberg bluegrass and bottlebrush squirreltail (*Elymus elymoides*) was substantially higher than the local mean (Table 3-3a). Overall, native vegetation cover was higher than the local mean. Additionally, absolute cover from introduced species was also greater than the local mean. Total cover from introduced species was nearly threefold higher than the local mean of 4%. Two of the largest contributors were cheatgrass (*Bromus tectorum*) and desert alyssum (*Alyssum desertorum*), which contributed most of the total introduced cover. While mean cheatgrass cover was substantially higher than the local mean, a slight decrease was detected from 2018 to 2019; cheatgrass cover decreased from 7% to 5% absolute cover (Shurtliff et al. 2019). This result suggests that these introduced annual species continued to be locally abundant in sagebrush habitat plots in 2019.

Table 3-3a. Absolute cover (%) for observed species within 46 annual sagebrush habitat plots. Local means are compared to 2019 absolute cover values by species and functional groups.

Plant Species**	Local Means (%)	Absolute Cover (%) 2019
Native		
Shrubs		
Artemisia tridentata	17.41	21.96
Chrysothamnus viscidiflorus	6.64	6.64
Artemisia tripartita	1.80	1.84
Artemisia arbuscula	1.16	0.34
Atriplex confertifolia	0.95	1.00

Plant Species**	Local Means (%)	Absolute Cover (%) 2019
Artemisia nova	0.90	0.88
Krascheninnikovia lanata	0.72	0.53
Linanthus pungens	0.22	0.39
Eriogonum microthecum	0.10	0.13
Tetradymia canescens	0.04	0.07
Ericameria nauseosa	0.02	0.06
Others (*n* = 2,1)	0.03	0.00
Total Native Shrub Cover	**29.99**	**33.85**
Succulents		
Opuntia polyacantha	**0.10**	**0.12**
Perennial Graminoids		
Elymus elymoides	2.15	6.62
Poa secunda	2.03	6.91
Achnatherum hymenoides	1.85	1.74
Pseudoroegneria spicata	1.21	1.85
Elymus lanceolatus	0.80	0.82
Hesperostipa comata	0.51	0.28
Pascopyrum smithii	0.21	0.22
Carex douglasii	0.11	0.29
Others (*n* = 1,0)	0.02	*
Total Native Perennial Graminoid Cover	**8.88**	**18.73**
Perennial Forbs		
Phlox hoodii	0.47	0.47
Schoenocrambe linifolia	0.24	0.27
Sphaeralcea munroana	0.12	0.07
Erigeron pumilus	0.04	0.12
Astragalus filipes	0.03	0.30
Arabis cobrensis	0.02	0.11
Astragalus lentiginosus	0.01	0.12
Astragalus agrestis	*	0.05
Others (*n* = 23,12)	0.18	0.23
Total Native Perennial Forb Cover	**1.11**	**1.73**
Annuals and Biennials		
Lappula occidentalis	0.34	0.25
Descurainia pinnata	0.27	*
Cordylanthus ramosus	0.15	0.35
Chenopodium leptophyllum	0.08	*
Mentzelia albicaulis	0.02	0.06
Others (*n* = 12,3)	0.12	0.09
Total Annual and Biennial Forb Cover	**0.99**	**0.74**

Plant Species**	Local Means (%)	Absolute Cover (%) 2019
Total Native Cover	**41.07**	**55.16**
Introduced		
Perennial Grasses		
Agropyron cristatum	**1.34**	**2.00**
Annuals and Biennials		
Alyssum desertorum	1.08	4.13
Bromus tectorum	1.02	5.02
Halogeton glomeratus	0.74	0.26
Descurainia sophia	0.02	0.16
Sisymbrium altissimum	0.00	0.24
Others (*n* = 5,2)	0.01	0.01
Total Introduced Annual and Biennial Cover	**2.87**	**9.83**
Total Introduced Cover	**4.21**	**11.84**
Total Vascular Plant Cover	**45.28**	**67.00**

*indicates that this species was undetectable using the current sampling methodology.
**complete list of species names with scientific and common names are provided in Appendix A.

As expected, non-sagebrush plots contained substantially more herbaceous cover than shrub cover in 2019 (Table 3-3b). Shrub cover was just one fifth of the total vegetation cover within recovering habitat. Shrub cover was slightly greater than the local mean at 13% to 11%, respectively. Green rabbitbrush remained the dominant shrub contributing nearly all of the shrub cover. When compared to sagebrush habitat plots, absolute cover from native perennial grasses on non-sagebrush plots were two times greater (Table 3-3a, Table 3-3b). Perennial grasses in recovering habitat provided more than half of the cover from native species. The most abundant native species were Sandberg bluegrass, bluebunch wheatgrass, and western wheatgrass (*Pascopyrum smithii*) at 6%, 5%, and 5% cover, respectively. In 2019, introduced species cover was double the local means despite total native species providing slightly more cover than introduced species in non-sagebrush plots. Cheatgrass continued to be the most abundant introduced species in recovering plot in 2019. Although cover from this invasive winter annual was double the local mean of 14%, it decreased from 36% in 2018 (Shurtliff et al. 2019).

Table 3-3b. Absolute cover (%) for observed species within 25 annual non-sagebrush plots. Local means are compared to 2019 absolute cover values by species and functional groups.

Plant Species**	Local Means (%)	Absolute Cover (%) 2019
Native		
Shrubs		
Chrysothamnus viscidiflorus	10.72	11.94
Atriplex confertifolia	0.33	0.47
Artemisia tridentata	0.21	0.33
Tetradymia canescens	0.18	0.23
Eriogonum microthecum	0.07	0.02
Artemisia tripartita	0.01	0.07

Plant Species**	Local Means (%)	Absolute Cover (%) 2019
Others (*n* = 2,5)	0.10	0.08
Total Native Shrub Cover	**11.62**	**13.13**
Succulents		
Opuntia polyacantha	**0.10**	**0.13**
Perennial Graminoids		
Pseudoroegneria spicata	4.82	4.60
Poa secunda	3.01	5.75
Hesperostipa comata	2.68	1.39
Achnatherum hymenoides	2.45	2.79
Elymus lanceolatus	2.08	0.60
Elymus elymoides	1.42	2.43
Pascopyrum smithii	0.84	4.68
Leymus flavescens	0.58	1.02
Carex douglasii	0.08	0.04
Others (*n* = 2,1)	0.03	0.04
Total Native Perennial Graminoid Cover	**17.98**	**23.35**
Perennial Forbs		
Phlox hoodii	0.40	0.51
Sphaeralcea munroana	0.31	0.03
Crepis acuminata	0.29	0.22
Erigeron pumilus	0.15	0.10
Phlox aculeata	0.11	0.02
Phlox longifolia	0.10	0.03
Machaeranthera canescens	0.07	0.08
Schoenocrambe linifolia	0.07	0.06
Astragalus filipes	0.06	0.10
Psoralidium lanceolatum	0.02	0.06
Astragalus lentiginosus	0.01	0.31
Others (*n* = 17,6)	0.16	0.10
Total Native Perennial Forb Cover	**1.75**	**1.63**
Annuals and Biennials		
Lappula occidentalis	0.26	0.35
Descurainia pinnata	0.11	*
Mentzelia albicaulis	0.09	0.40
Eriastrum wilcoxii	0.09	0.22
Cryptantha scoparia	0.02	0.05
Ipomopsis minutiflora	0.00	0.07
Others (*n* = 10,4)	0.12	0.07
Total Native Annual and Biennial Cover	**0.67**	**1.17**
Total Native Cover	**32.12**	**39.41**

Plant Species**	Local Means (%)	Absolute Cover (%) 2019
Introduced		
Perennial Grasses		
Agropyron cristatum	**0.59**	**0.89**
Perennial Forbs		
Carduus nutans	**0.01**	*
Annuals and Biennials		
Bromus tectorum	13.48	27.65
Salsola kali	1.78	*
Alyssum desertorum	1.40	3.94
Halogeton glomeratus	1.22	0.05
Sisymbrium altissimum	0.21	2.15
Descurainia sophia	0.06	0.27
Others (*n* = 3,3)	0.02	0.08
Total Introduced Annual and Biennial Cover	**18.17**	**34.13**
Total Introduced Cover	**18.78**	**35.02**
Total Vascular Plant Cover	**50.90**	**74.43**

*indicates that this species was undetectable using the current sampling methodology.
**complete list of species names with scientific and common names are provided in Appendix A.

Vegetation height was summarized by functional groups to provide a more complete assessment of vertical structure on the habitat condition monitoring plots for 2019 (Tables 3-4a and 3-4b). On sagebrush habitat plots, nearly three quarters of height measurements were from sagebrush species which, on average, represented the tallest functional group (Table 3-4a). Compared to local means, the herbaceous species mean was higher for perennial plants while the mean for annuals was shorter. When considered as a proportion of the sample, perennial grasses were sampled three fifths of the time, leaving the remaining three functional groups sampled less frequently. Averaged heights for perennial functional groups were markedly taller than either annual grasses or forbs, but when compared to local means, annuals were sampled more frequently in 2019. These results suggest shrub and perennial grass heights remained stable while perennial forbs were taller when compared to local means; annual grasses and forbs were shorter but were measured more often.

On non-sagebrush plots, the majority of shrub height measurements were estimated from species other than sagebrush species, primarily green rabbitbrush. Vertical vegetation structures often exist within recovering shrublands because some species can resprout after fire like green rabbitbrush and spineless horsebrush (*Tetradymia canescens*) (Young and Evans 1978). Unfortunately, all sagebrush species found on the INL Site are unable to resprout after wildland fires (Harvey 1981). Height estimates for both sagebrush species and other shrubs were taller when compared to the local means at 41 cm and 31 cm, respectively. The perennial grass functional group remained stable while the other groups were substantially taller than the local means. Proportionately, the grasses functional groups were encountered nearly all of the time resulting in very few instances for either forb functional group. The annual grass functional group was encountered nearly twice as often when compared to the local mean. These results suggest the sagebrush species occurred substantially less often where both grass functional groups occurred more often within recovering habitats.

Table 3-4a. Vegetation height by functional group for 46 sagebrush habitat plots on the Idaho National Laboratory Site in 2019. Local means for height (cm) was generated from five years (*n* = 5) of monitoring data (2013–2017) from 48 annual sagebrush habitat plots.

Sagebrush Habitat Plots	Local Means		2019	
Functional Group	Mean Height (cm)	Proportion of Sample	Mean Height (cm)	Proportion of Sample
Shrubs				
Sagebrush Species	47.81	0.72	47.78	0.72
Other Species	25.57	0.28	24.89	0.28
Herbaceous				
Perennial Grasses	22.49	0.67	27.27	0.61
Perennial Forbs	9.98	0.12	17.14	0.06
Annual Grasses	18.96	0.04	15.54	0.14
Annual Forbs	9.09	0.17	8.89	0.18

Table 3-4b. Vegetation height by functional group for 25 non-sagebrush plots on the Idaho National Laboratory Site in 2019. Local means for height (cm) was generated from five years (*n* = 5) of monitoring data (2013–2017) from 27 annual non-sagebrush plots.

Non-sagebrush Plots	Local Means		2019	
Functional Group	Mean Height (cm)	Proportion of Sample	Mean Height (cm)	Proportion of Sample
Shrubs				
Sagebrush Species	33.54	0.08	41.14	0.05
Other Species	26.82	0.92	30.46	0.95
Herbaceous				
Perennial Grasses	31.49	0.55	31.32	0.47
Perennial Forbs	11.64	0.06	15.12	0.04
Annual Grasses	16.96	0.25	19.62	0.39
Annual Forbs	10.94	0.15	17.96	0.10

As expected, sagebrush density was higher in sagebrush habitat plots than non-sagebrush plots in 2019 (Table 3-5). On the sagebrush habitat plots, sagebrush density ranged from less than one individual per square meter to approximately 34 individuals per square meter. Although mean density on sagebrush habitat plots was below the local mean, the value was within the reported range of variability for this monitoring effort. On the non-sagebrush plots, sagebrush density ranged from zero to a maximum of more than one individual per square meter. Mean density for sagebrush on non-sagebrush plots was slightly higher than the local mean. Juvenile sagebrush frequency is a proportion of transects containing juvenile shrubs from the eight density transects sampled within each plot. Averaged across all sagebrush habitat plots, juvenile shrubs were present on half of all transects sampled, which is slightly higher than the local mean. Although non-sagebrush plots had slightly higher juvenile frequency than the local mean, just three out of every 50 transects contained juveniles. Overall, sagebrush remained stable in both sagebrush and non-sagebrush habitat plots.

Table 3-5. Sagebrush density and juvenile frequency from sagebrush habitat plots (*n* = 46) and non-sagebrush plots (*n* = 25) on the Idaho National Laboratory Site in 2019. Local means for density (individual/m²) and juvenile frequency was generated from five years (*n* = 5) of monitoring data (2013–2017) on both sagebrush habitat and non-sagebrush plots.

	Sagebrush		Non-sagebrush	
	Local Means	**2019**	**Local Means**	**2019**
Mean Density (individuals/m²)	5.19	4.01	0.07	0.16
Minimum Density (individuals/m²)	0.43	0.58	0.00	0.00
Maximum Density (individuals/m²)	47.60	33.78	0.74	1.58
Mean Juvenile Frequency	0.38	0.55	0.02	0.06

Precipitation

Over the last decade, there have been several years with well below average precipitation and those dry years have departed farther from the mean than wet years (Figure 3-3, Forman and Hafla 2018). Historically, the wettest season generally occurred during April, May and June on the INL Site (Figure 3-4). However, 2013 through 2017 contained altered precipitation patterns where some of the wettest months of the year occurred in August, September, and October. This shift deviates from the 70-year average and would certainly favor some plant species and functional groups over others (e.g. annual grasses).

Total annual precipitation for 2019 was slightly below average due to a dryer summer season (Figure 3-3). In addition to April and May, which receive higher monthly precipitation, February was one of the wetter months of the year with twice the average snow fall (Figure 3-4). The first year of data collection for Task 5, 2013, was the driest year on record with only about a quarter of average annual precipitation. Much of the sampling in 2014 was completed prior to August precipitation. Almost half of the total precipitation from 2014 fell in August. Mean August precipitation, calculated from the 68-year Central Facilities Area (CFA) record, is about 13 mm; total August precipitation from 2014 was 102 mm. In 2015, May was abnormally wet, with a total of nearly 60 mm, which is twice the historical monthly average. September and October of 2016 had more than three times average historical precipitation for the same time period and more than half of the annual precipitation fell after the summer growing season. Snowpack through the winter of 2016/2017 was much higher than average and is reflected in the December 2016 through February 2017 precipitation data. In 2018, May had the second highest recorded precipitation since 1958 of 103 mm, which is three times the monthly average. During late fall of 2017 through the spring of 2018, precipitation was well below the normal monthly averages. After a slightly wetter than average spring in 2019, precipitation was below long-term monthly averages during the summer months.

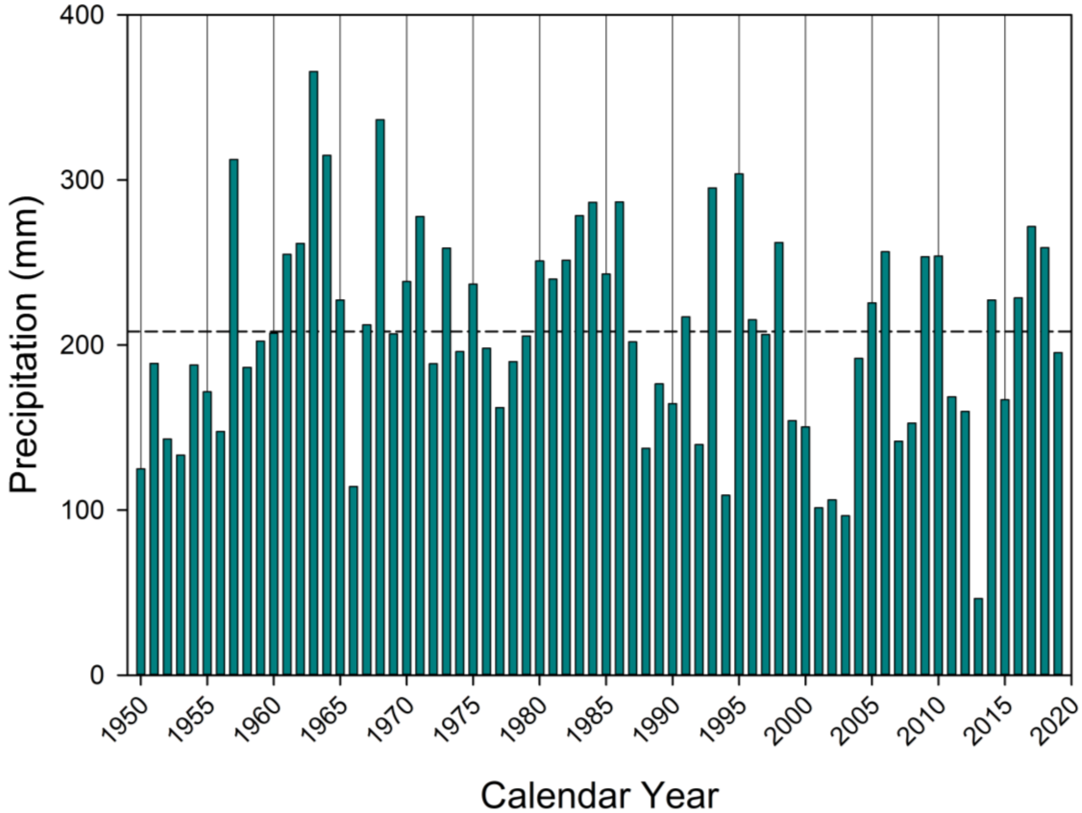

Figure 3-3. Total annual precipitation from 1950 through 2019 at the Central Facilities Area, Idaho National Laboratory Site. The dashed line represents mean annual precipitation (208 mm [8.2 in]).

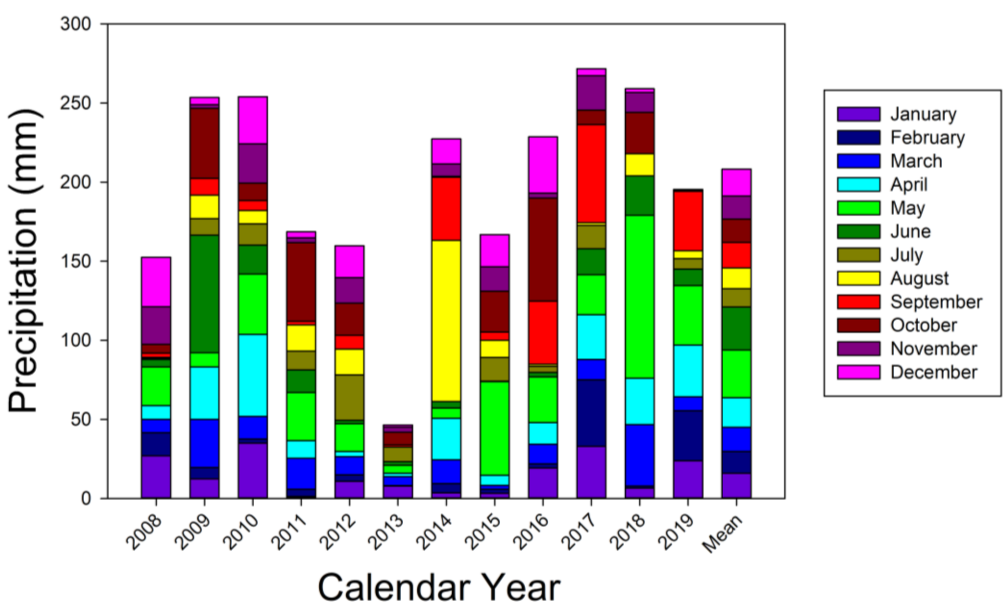

Figure 3-4. Annual precipitation by month from the Central Facilities Area, Idaho National Laboratory Site (data provided by NOAA 2019). Mean monthly precipitation includes data from 1950 through 2019.

Habitat Condition Trends

From 2013 through 2019, sagebrush cover and cover from all other shrub species has remained stable on sagebrush habitat plots (Figure 3-5a). Native perennial grass cover increased substantially and within the last few years it has stabilized. Native annual and biennial forbs increased slightly in 2017 but returned to previous levels in 2019 (Figure 3-5a). Cover from introduced species on sagebrush habitat plots has been relatively low compared to native species. A slight upward trend from previous seasons occurred in 2018, but cover has declined to values closer to means from previous years (Figure 3-5b).

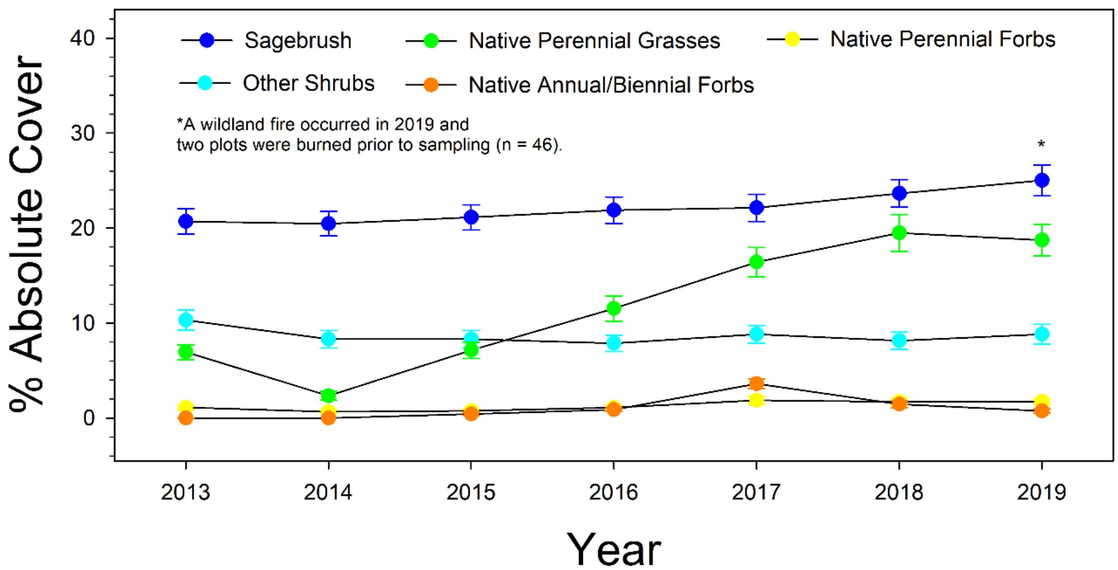

Figure 3-5a. Mean cover from functional groups of native species in sagebrush habitat plots (*n* = 48) on the Idaho National Laboratory Site from 2013 through 2019. Error bars represent ± 1 SE.

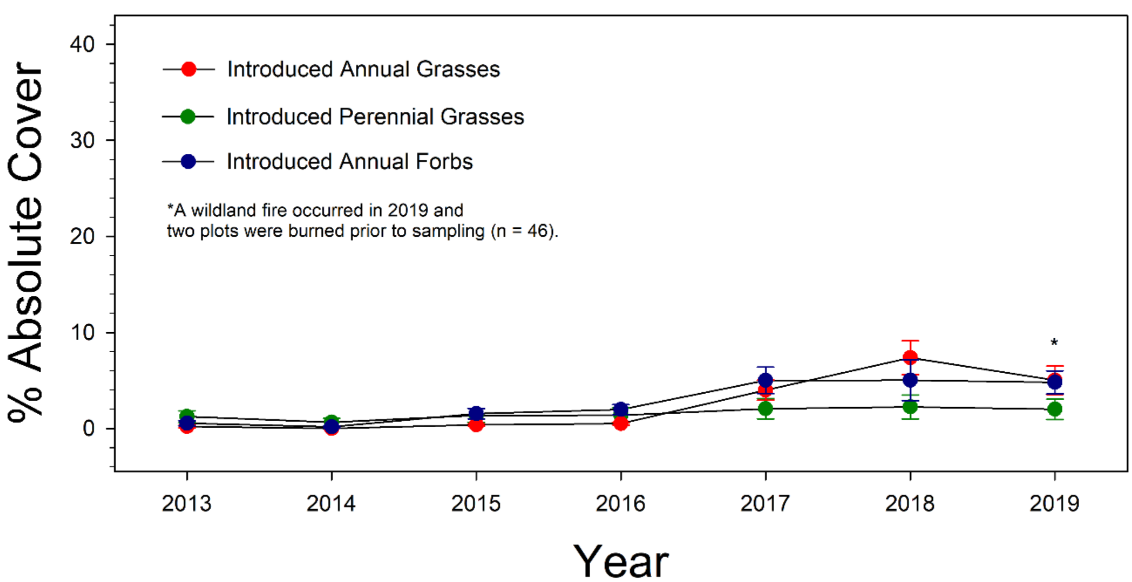

Figure 3-5b. Mean cover from functional groups of introduced species in sagebrush habitat plots (*n* = 48) on the Idaho National Laboratory Site from 2013 through 2019. Error bars represent ± 1 SE.

On non-sagebrush monitoring plots, cover from shrubs, primarily green rabbitbrush, has remained stable from 2013 through 2019 (Figure 3-6a), and is comparable to cover from the same functional group on sagebrush habitat monitoring plots (Figure 3-5a). Native perennial grass cover increased notably from 2014 to 2015 and has remained at about 20% since 2015. Cover from introduced annual forbs also increased from 2014 to 2015 and has remained at about the same cover level since (Figure 3-6b). The introduced annual grass, cheatgrass, had the most substantial change in cover on the non-sagebrush plots (Figure 3-6b). Cheatgrass increased from about 3% absolute cover in 2013, reached a high of 35% in 2018, and decreased in 2019. The decrease in cheatgrass cover between 2018 and 2019 does not appear to be reflected within any other functional groups.

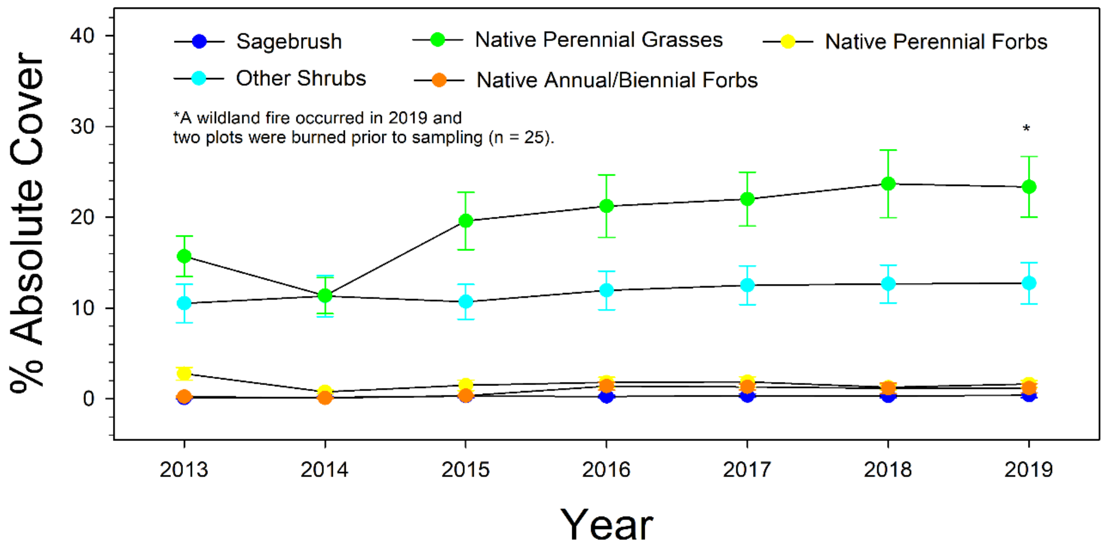

Figure 3-6a. Mean cover from functional groups of native species in non-sagebrush plots (*n* = 27) on the Idaho National Laboratory Site from 2013 through 2019. Error bars represent ± 1 SE.

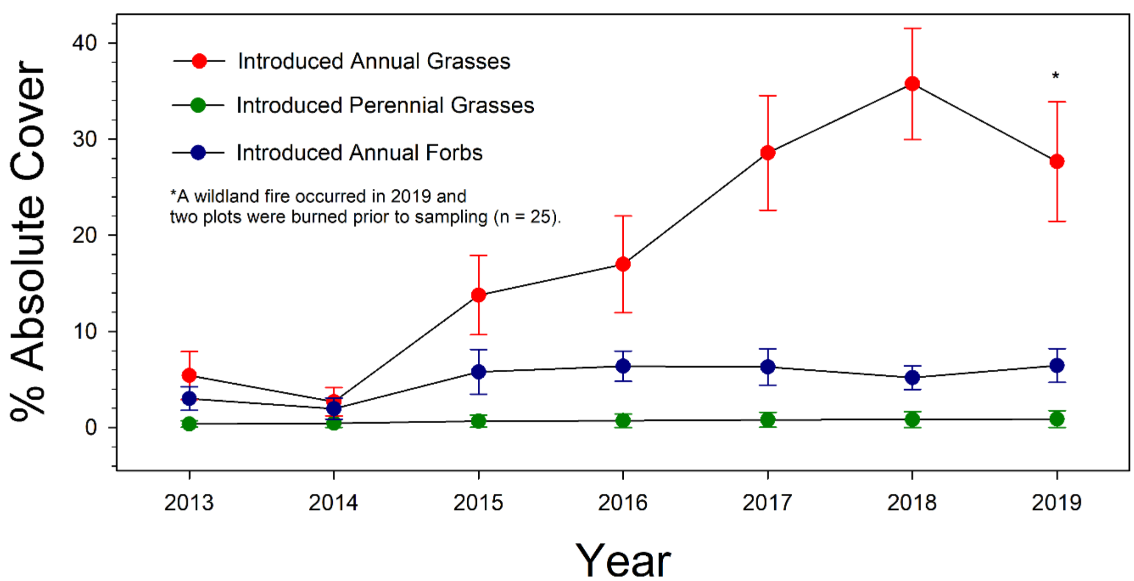

Figure 3-6b. Mean cover from functional groups of introduced species in non-sagebrush plots (*n* = 27) on the Idaho National Laboratory Site from 2013 through 2019. Error bars represent ± 1 SE.

3.1.4 Summary of Habitat Condition

Overall, vegetation values generally were near or above the local means except for a decrease in introduced annual grasses within non-sagebrush plots. Sagebrush cover in sagebrush habitat plots remained stable at about 25%. Perennial grass/forb height and cover values were greater than the local means where perennial grasses were the driving functional group. Cover remained low for introduced species suggesting intact sagebrush habitat had some resilience to those non-native species. In non-sagebrush plots, cover for native species remained stable (Figure 3-6a), while introduced species cover decreased, a change that was driven by non-native annual grasses (Figure 3-6b). While this functional group had been trending rapidly upward since 2014, the decrease between 2018 and 2019 marks the first notable decline over seven years. Recently published data by Forman and Hafla (2018) from the Long-Term Vegetation (LTV) study suggested that introduced annual grasses are capable of both upward and downward trends due to the life strategy of annuals which ebbs and flows in response to abiotic conditions.

Recent weather patterns have been highly variable and herbaceous functional groups are influenced by precipitation events. Precipitation during the 2014 growing season was far below average. Although annual precipitation approximated annual averages in 2014 through 2015, a few abnormally wet months at the end of summer in 2014 and at the end of spring in 2015 affected vegetation on the INL Site during the 2015 growing season. The effects of these precipitation events on herbaceous vegetation may have carried over into 2016 as well. The above average snowpack of the winter of 2016/2017 and the second highest recorded precipitation in May of 2018 provided ample spring moisture for both growing seasons, benefiting herbaceous species. It is likely that the reduced precipitation during the late spring and early summer of 2019 may have impacted annual plants. As with perennial herbaceous species, mean cheatgrass cover and cover from all annual species was probably uncharacteristically low in 2014 and was probably higher than normal in 2016 through 2018. Because more of the vegetation cover on non-sagebrush (i.e. previously burned) plots is from herbaceous species, they appear to be more responsive to precipitation and less stable in terms of total cover and species composition from one year to another.

It is difficult to directly compare herbaceous cover values from this monitoring effort to long-term averages across the INL Site because this monitoring effort measures canopy cover, while the LTV transect sampling measures basal cover, but we can reasonably extrapolate trends for general functional groups. Overall trends in herbaceous cover on the LTV plots indicate that perennial grass and forb cover is at the high end of its range of variability on the INL Site (Forman and Hafla 2018). Introduced annual grasses, such as cheatgrass, have been trending upward but have fluctuated downward in 2019. Similar fluctuations in the abundance of introduced herbaceous functional groups have been noted in the LTV dataset. Cheatgrass cover decreased from about 5% average cover to about 1.5% average cover between the 2011 and 2016 LTV sample periods (Forman and Hafla 2018). A similar decrease in cheatgrass cover from 37% to 28% was noted in the non-sagebrush plots from 2018 to 2019 in this monitoring effort. Similar patterns between these two projects provide better ecological context to understand invasive species; however, seven years of annual data are likely not enough to capture the nuances of invasion dynamics.

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 following decommissioning of existing facilities. Changes in land cover can be determined using airborne or satellite imagery that is readily available at little or no cost. ESER 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 conservation 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 also maps 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 also allows for modifying existing wildland fire boundaries and unburned patches of vegetation when mapping errors are observed on the ground.

There was one large wildland fire that burned on the INL Site in 2019 and altered existing vegetation map class distribution including sagebrush habitat. The Sheep Fire was first reported in the evening of July 22, 2019. The lighting-caused fire started in the east-central region of the INL Site within the 2010 Jefferson Fire footprint and initially spread primarily south and southwest. High, sustained winds the following day promoted the continued expansion generally to the southwest towards the CITRC and INTEC facilities. The fire was fully contained on July 26 and it was one of the largest fires in INL Site history.

3.2.2 Methods

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 (GPS) 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 initiating the second step of delineating new vegetation class boundaries within the burned area, the mapped fire boundaries first need to be generated at the same mapping scale 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 delineations representative of the post-fire vegetation classes present. New wildland fires are sampled to identify the vegetation classes present across the burned area to assist with the mapping update. It can be difficult to assess the vegetation classes that establish immediately after a fire, especially during drought years. We allow for a few growing seasons, and possibly longer if the years following fire were excessively dry and hinder normal reestablishment of vegetation communities. Field surveys also commence when a map polygon or burned area begins to show sign (i.e., via habitat quality monitoring data) that the current vegetation class has changed to another class and warrants reassignment. High resolution imagery is used as the source data layer to delineate new vegetation class boundaries within recent wildland fire boundaries when it becomes available, either through the National Agricultural Imaging Program (NAIP) or from INL Site specific acquisitions.

The initial boundary for the Sheep Fire was produced from limited field data collected by the BLM and some data from INL Site. However, experience with other recent large fires suggests the actual burned area boundary typically differs from the generalized boundary created immediately post-fire. To assist with post-fire evaluation and mapping, high resolution commercial satellite imagery was acquired on September 15, 2019 by Digital Globe's GeoEye-1 sensor. The GeoEye-1 sensor collected four spectral bands in the visible and near-infrared region of the electromagnetic spectrum with 2 m resolution, and a panchromatic band with 0.5 m resolution. Digital Globe delivered raw and processed imagery data products that were radiometrically corrected, pan-sharpened, orthorectified, and georeferenced for easy integration into a GIS.

An ESER GIS Analyst first investigated the spatial accuracy by overlaying the GeoEye-1 imagery on the 2017 Idaho NAIP image dataset. Reference points around facilities were compared and the new satellite imagery was so closely aligned that no further coregistration spatial adjustments were deemed necessary. The Sheep Fire perimeter and burned areas were manually digitized in a GIS at a 1:6,000 mapping scale. This matches the mapping scale used to produce the most recent INL Site vegetation classification map (Shive et al. 2019) and will enable the fire boundary to be used to clip the vegetation map for future post-fire mapping updates. We primarily relied on the color-infrared image composite to help identify areas that burned or partially burned in the Sheep Fire. The color-infrared imagery displays recently burned areas with a blue hue while unburned vegetation appears as red tones (Figure 3-7).

There were multiple regions within the burned area where a mosaic of observable unburned patches of vegetation remained after the fire (Figure 3-8). The vast majority of the Sheep Fire moved through areas previously burned in the 2010 Jefferson and 2011 T-17 Fires. In areas where sagebrush habitat had already been removed and vegetation communities were in good ecological condition before the fire, the post-fire vegetation classes most likely to naturally establish after the fire will be the same vegetation classes mapped before the fire (Ratzlaff and Anderson 1995, Blew and Forman 2010). Therefore, we focused mapping efforts in the southwest region of the Sheep Fire that hadn't been burned previously, and where large stands of sagebrush habitat were recently mapped (Shive et al. 2019). After each patch of unburned vegetation in the southwest region was delineated, we used the Intersect geoprocessing tool in ArcGIS to automatically assign the class codes and boundaries from the vegetation map to each mapped polygon.

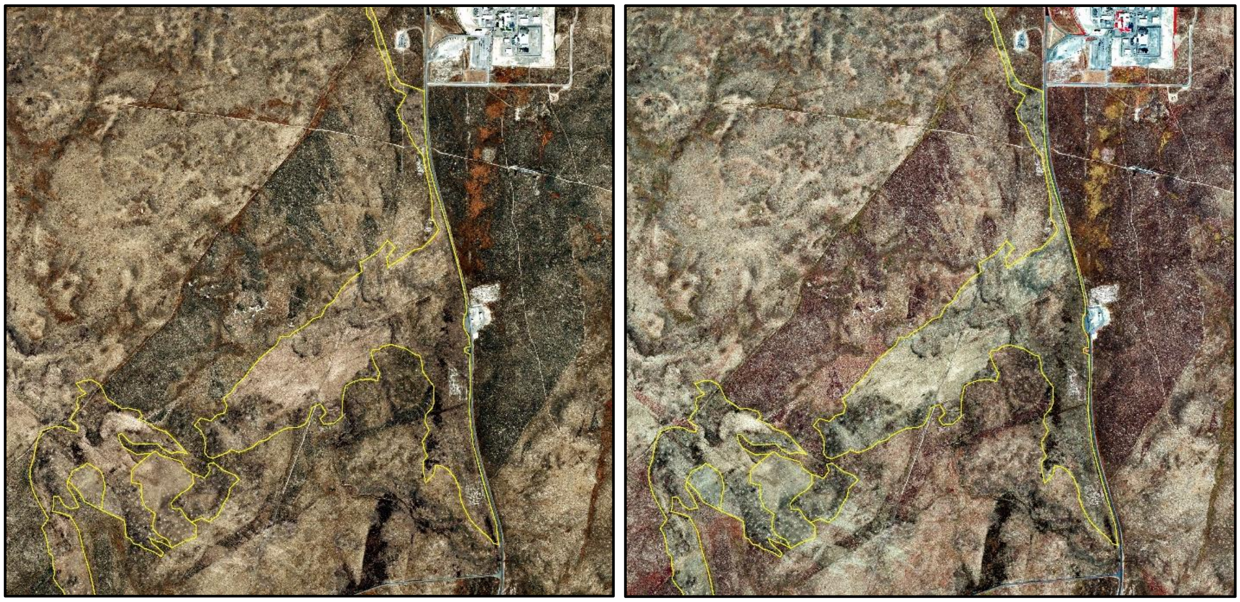

Figure 3-7. An imagery subset displaying a prescribed backburn south of the Materials and Fuels Complex facility. The image on the left is a true-color composite with the recently burned area delineated in yellow. In the true-color composite, the newly burned areas do not appear that different than areas in the vicinity that burned in the 1990s. The image on the right shows the color-infrared composite where the recently burned areas have a light-blue hue that helps differentiate those areas from older burns.

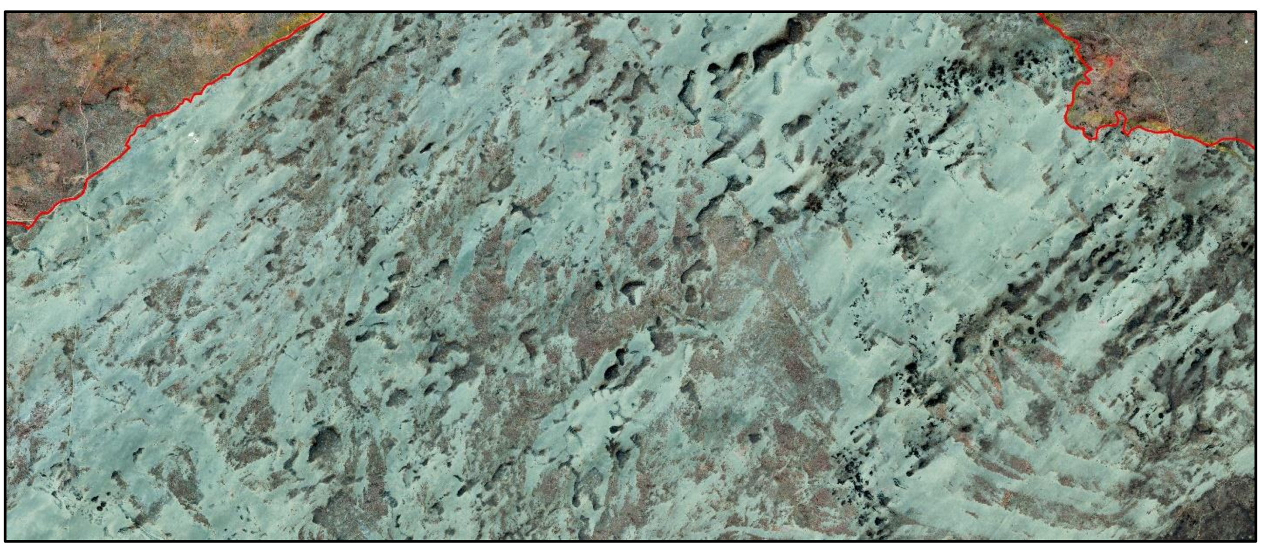

Figure 3-8. A subset of high resolution imagery displayed as a false color composite from the northern extent of the Sheep Fire on the Idaho National Laboratory Site. The Sheep Fire boundary is delineated with a red line. The light blue color represents areas burned in the fire, and the light red patches represent vegetation patches not burned in the fire.

3.2.3 Results and Discussion

Mapping results indicate the Sheep Fire burned approximately 40,403.3 ha (99,838.8 acres), which is a reduction from the initial estimate of 45,368 ha (112,106.7 acres) using the original BLM boundary (Figure 3-9). Throughout the northern region of the Sheep Fire, there were many unburned patches of vegetation in previously burned areas where sagebrush is absent, and therefore not a focus for our mapping effort. Thus, the mapping results, while improving upon the initial estimate, still overestimate the actual burned area. There were 4,753.8 ha (11,746.9 acres) of vegetation burned within the SGCA, representing 11.8% of the total burned area (Figure 3-9). The only sagebrush habitat lost within the SGCA were a few unburned patches of sagebrush that remained within the footprint of the 2010 Jefferson Fire boundary totaling 2.3 ha (5.7 acres).

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 and USFWS 2014). Prior to the Sheep Fire, the total area of sagebrush habitat outside the SGCA was 38,742.5 ha (95,734.8 acres). The Sheep Fire burned 10,401.7 ha (25,703.1 acres) of sagebrush habitat outside the SGCA thus reducing the ”bank” by 28.6% (Figure 3-10).

There were three other small fires that burned on the INL Site in 2019, none of which were located within sagebrush habitat[2]. On July 13, 2019, the Howe Junction fire burned 0.1 ha (0.25 acre) on the north side of Highway 20/26. On September 11, 2019, there were two separate lightning-caused fires near the ATR Complex. The Monroe 1 Fire was a small creeping fire totaling approximately 0.2 ha (0.5 acre). The Monroe 2 Fire occurred west of the ATR Complex and burned approximately 21 ha (52 acres).

Currently, the SGCA sagebrush habitat baseline value is defined as 78,558 ha (194,120 acres) and has remained virtually unchanged since the signing of the CCA. In 2018, we reported that infrastructure expansion removed 2.3 ha (5.7 acres) of sagebrush habitat. The Sheep Fire burned another 2.3 ha (5.7 acres), resulting in a current estimated sagebrush habitat area of 78,553.4 ha (194,109.7 acres). The reduction in sagebrush habitat within the SGCA is less than a 0.01% change from the baseline value, and even though a significant amount of habitat was burned in the Sheep Fire, the losses do not impact the habitat trigger status.

[2] Unpublished wildland fire statistics summary for 2019; Eric Gosswiller, INL Fire Chief

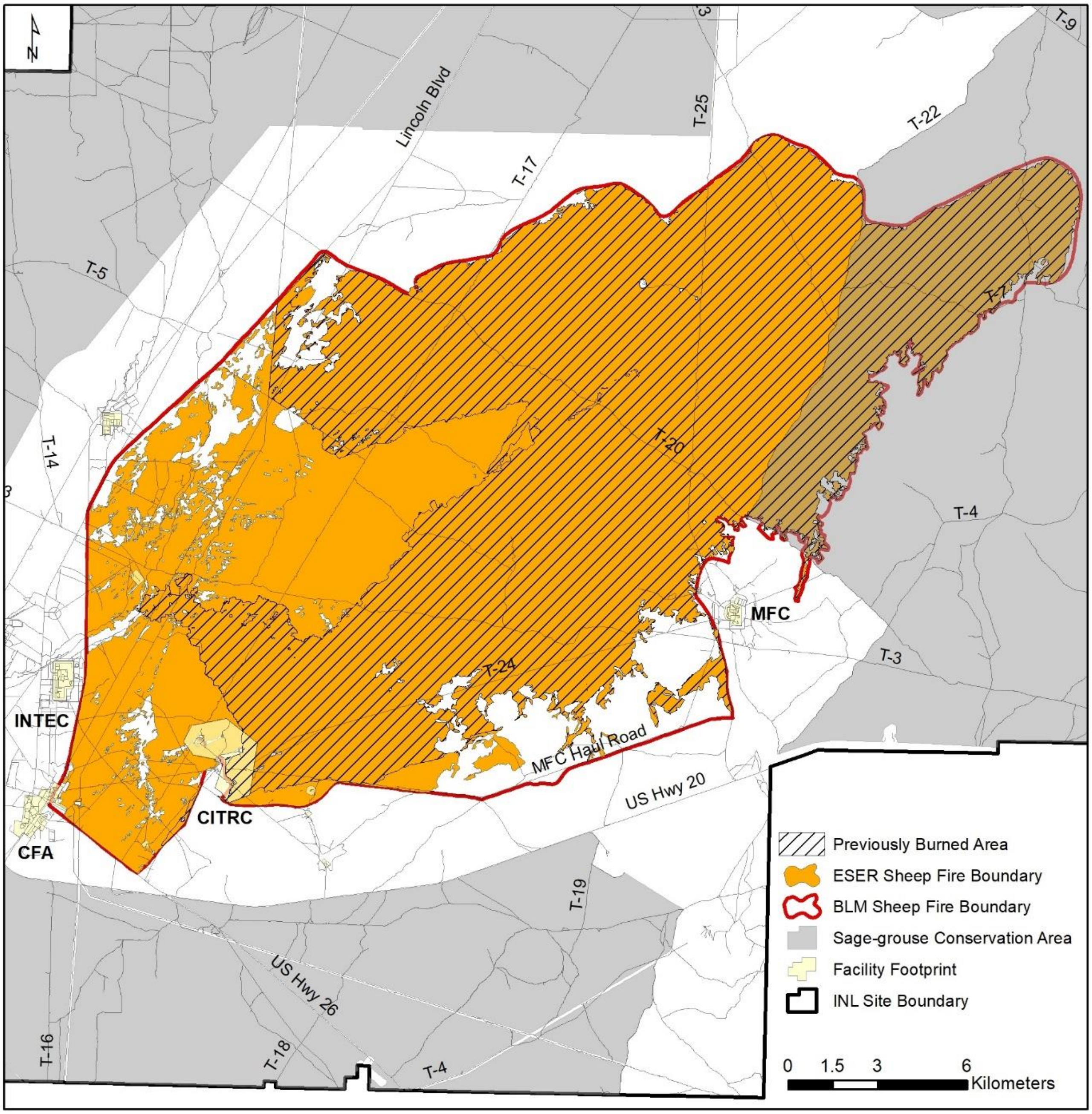

Figure 3-9. Sheep Fire boundary on the Idaho National Laboratory Site mapped from high resolution satellite imagery plotted over the original fire boundary produced by the Bureau of Land Management. Areas within the Sheep Fire footprint that have burned since 1994 and removed sagebrush habitat are denoted with cross-hatching.

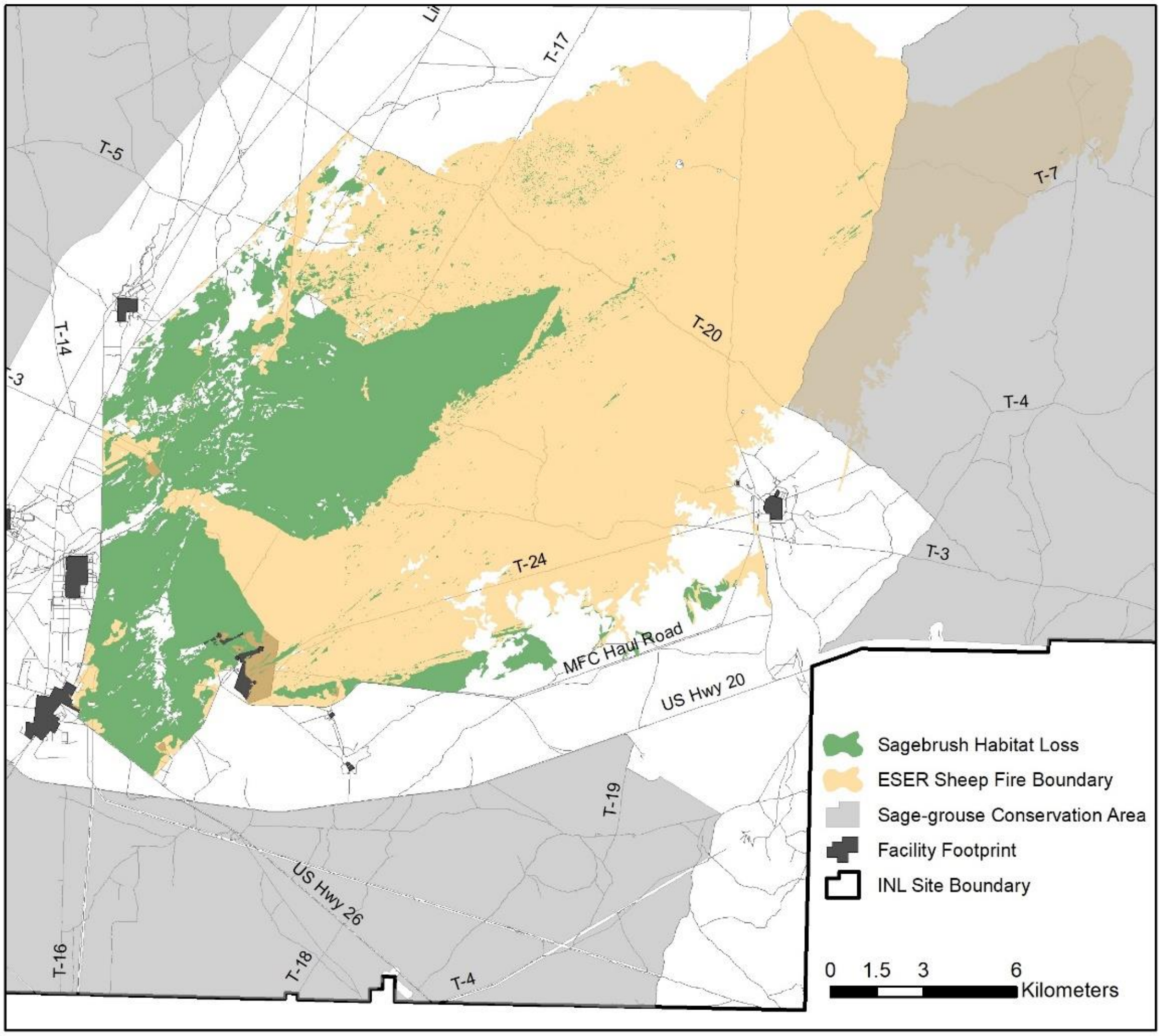

Figure 3-10. Distribution of sagebrush habitat burned in the 2019 Sheep Fire on the Idaho National Laboratory Site.

4.0 THREAT MONITORING

The CCA identifies and rates eight threats that potentially impact sage-grouse and its habitats on the INL Site. Most threats are addressed by conservation measures DOE has implemented or continues to implement (see Section 5.0). Some threats require monitoring to understand the extent of the problem and to establish baseline evidence so the success of interventions, once implemented, can be evaluated. These threats include wildland fire, livestock, raven predation, annual grasslands, and infrastructure development. The potential impacts of wildland fire and livestock on sage-grouse habitat are assessed once every five years and were last reported in 2017 (Shurtliff et al. 2017). Raven predation and infrastructure development are addressed in Sections 4.1 and 4.2. Although annual grasslands are recognized as a medium-level threat to sage-grouse on the INL Site (DOE and USFWS 2014), proven treatment methods are not currently available to apply to large landscapes like the INL Site (Shurtliff et al. 2019). Therefore, continued monitoring of the abundance and spatial distribution of cheatgrass (see Section 3.1) is necessary to appropriately respond when feasible treatments become available.

4.1 Task 4—Raven Nest Surveys

4.1.1 Introduction

During the last century, common raven (*Corvus corax*, hereafter raven) abundance has greatly increased throughout the historic range of sage-grouse (Larsen and Dietrich 1970, Andrén 1992, Engel and Young 1992, Boarman et al. 1995, Sauer et al. 2011), and in recent years, increasing raven densities have been negatively associated with sage-grouse nest success and lek count trends (Bui et al. 2010, Coates and Delehanty 2010, Dinkins et al. 2016, Peebles et al. 2017, Coates et al. 2018). In some studies where raven predation has been associated with sage-grouse declines, other factors such as poor concealment cover or adverse weather during the brooding period contributed to the negative results (Coates 2007, Peebles et al. 2017). This is one reason why raven predation by itself is not considered a high-level threat to sage-grouse on the INL Site or across its range (DOE and USFWS 2014, Federal Register 2010). Unlike the primary threats of wildfire and conversion to exotic plant monocultures, which are unlikely to be abated with current technologies and climate patterns (Federal Register 2010), reducing nesting opportunities for ravens as a strategy for reducing pressure on sage-grouse reproductive success is a feasible strategy that could have localized positive effects.

Most raven breeding pairs on the INL Site nest on anthropogenic structures including towers, building platforms, and electric power transmission structures, with the latter supporting the most nests (Howe et al. 2014; Shurtliff et al. 2018). Originally, the CCA indicated that research aimed at developing methods to deter raven nesting on utility structures would be supported (*Conservation Measure 10*, DOE and USFWS 2014). In 2018, this scope was broadened to include a commitment by DOE to work with INL contractors and the National Oceanic and Atmospheric Administration (NOAA) to reduce raven nesting on power lines, towers and at facilities (Shurtliff et al. 2019).

To support the original design of Conservation Measure 10 and the broadened scope, nearly all infrastructure on the INL Site are monitored during the core raven nesting period (Monitoring Task 4). The purpose of the task is three-fold: (1) to determine how many raven nests are supported each year by anthropogenic structures on the INL Site so DOE may be alerted to directional trends; (2) to identify structures or stretches of power line favored by ravens for nesting year after year, which may be candidates for retrofitting; and (3) to allow us to evaluate the effectiveness of deterrents after they are installed.

Task 4 is also useful for purposes outside of the primary objectives listed above. For example, raptor nests are identified and recorded during surveys, which supports National Environmental Policy Act compliance and other regulatory compliance issues. Another benefit is that we can quantify distances between nearest nests of ravens to gain insights into potential density-dependent limitations. Raven breeding pairs defend territories (Boarman and Heinrich 1999), but it is unknown how close a raven pair would allow another pair to build a nest in sagebrush steppe communities such as those found on the INL Site. Because we record the locations of all active raven nests on infrastructure each year, we can determine which two nests are closest each year and thus learn something about the minimum distance between nests raven pairs are willing to tolerate, which has rarely been assessed (but see Steenhof et al. 1993). This information may be useful for estimating how many raven pairs can be expected to nest on linear sections of infrastructure on the INL Site.

4.1.2 Methods

We conducted systematic surveys of power lines, towers, INL Site facilities and associated ornamental trees, and raptor nesting platforms, all of which could potentially support a raven nest. Surveys were performed between April 1 and June 5, 2019, and we allowed at least 14 days between repeat surveys. During April and the first few days of May, surveys commenced approximately 1.5–2.0 hours after sunrise (following sage-grouse lek surveys) and typically concluded by early afternoon. After sage-grouse lek surveys were completed for the year on May 10 (see Section 2.1.2), raven nest surveys were performed between sunrise and late afternoon. Inclement weather did not restrict survey activity if roads were passable, as we assumed ravens would display nest-tending behaviors regardless of weather conditions.

When a stick nest was observed on a structure, we identified the associated corvid or raptor species, if present, and determined if the nest was active. Nests were classified active if one or more of a breeding pair were observed incubating (i.e., sitting in the nest bowl), perched on or near the nest, carrying nesting materials to the nest, or engaging in other behavior that suggested they were tending or defending the nest. Presence of eggs or chicks also confirmed the activity status of a nest, and adults were always observed in these cases to confirm the species identify. A single positive observation was sufficient for a nest to be classified as active; however, at the end of the season, any nest classified as active solely as a result of a single observation of a raven perched on a structure (but not on the nest) was downgraded to unknown status.

After each complete survey of INL Site infrastructure, we revisited most nests with an unconfirmed activity status before the next survey commenced to try again to verify the nest's status. Some unconfirmed nests at facilities were not revisited because it was logistically difficult to reschedule an escort (six fenced facilities require such) or because an unconfirmed nest was dilapidated and on a structure that protected it from being blown off by strong winds (e.g., building platforms). Because of this extra effort to revisit nests, those that remained unconfirmed throughout the nesting season typically were visited twice as often as nests with confirmed activity. Thus, we concluded at the end of the season that remaining unconfirmed nests likely had not been occupied by ravens during the breeding season.

We surveyed power lines four times, twice in April and twice in May, whereas facilities and towers were surveyed only twice, primarily in April. This discrepancy in survey effort is because the primary purpose of the monitoring task when it was first initiated was to find and track nests on power lines as a precursor to testing the effectiveness of nest deterrents on those structures (DOE and USFWS 2014).

Power Lines

For logistical purposes, power lines were divided into survey sections where they intersected convenient access roads. We surveyed the same power lines (transmission = 231 km [144 mi], distribution = 37 km [23 mi]) on the INL Site that were surveyed in 2017 and 2018 (e.g., Shurtliff et al. 2018). In 2014 and 2015, surveys occurred along an additional 49 km (30 mi) of distribution lines, but these sections were removed from survey routes in 2016 when it became clear that ravens would be unable to maintain a nest on the structures because they were primarily comprised of single cross arms (Shurtliff et al. 2017). In 2017, an additional 4.3 km (2.7 mi) of distribution line was removed from survey routes for the same reason (Shurtliff et al. 2018).

We surveyed all powerline segments four times by driving along utility access or other nearby roads and scanning frequently for nests through binoculars. When a nest was observed, the location was recorded and an activity status was assigned as described above.

Facilities

We surveyed 13 facilities, which we define as any non-linear feature that includes at least one building. Since surveys began in 2014, the list of facilities surveyed has been augmented to include the CFA main gate area (Shurtliff et al. 2017) and a parcel of INL Site land occupied by the Idaho Transportation Department (Shurtliff et al. 2018). Facilities were surveyed at least twice, primarily in April. We have found that if ravens nest at a facility, nest status can be confirmed in April and there is no need for repeated surveys in May.

Towers

Many towers that could support a raven nest are within facility footprints and are examined during facility surveys. If a nest is observed on a tower at a facility, it is reported as a facility-based nest. Conversely, towers outside facilities are surveyed as discreet structures and we report nest observations on these structures separately. Surveyed towers are usually lattice structures conducive for supporting nests, and most are equipped with cellular network or meteorological equipment. We surveyed eleven towers outside of facilities twice during April, not including revisits to confirm nest activity. Like facility-based structures, nests on towers would be difficult or impossible for wind to dislodge; as such, active nests on towers are usually documented as such during April.

Three towers are outside INL Site boundaries. One, northwest of the U.S. Sheep Experiment Station (Figure 4-1), is approximately 40 m outside the boundary. Two others are near the southeastern border immediately north of U.S. Highway 20, the farthest of which is approximately 400 m outside the boundary. Because ravens that occupy these towers probably forage on the INL Site, we include them in the surveys.

Trend Analysis

The number of raven nests classified as active each year is an index of the number of mated pairs on the INL Site that use infrastructure as a nesting substrate. Throughout the two-month survey period, nests on power line structures occasionally blow down. If a mated pair loses one or more nests and rebuilds during the survey period, our sampling method records at least two active nests, even though only one could possibly fledge young. This artifact of our sampling scheme produces an unknown level of variability that potentially affects the accuracy of raven nest trend data. To reduce this variability, we adjusted the number of raven nests considered active as in past years (e.g., Shurtliff et al. 2017) by examining each nest on a power line structure that was initially characterized as active, but later in the nesting season had fallen to the ground. For each of these failed nests, we noted the period during which we collected evidence that the nest was active. We assumed that the nest may have fallen at any time following the last recorded active observation. We then examined dates during which activity was recorded at all other active nests within a 6-km (3.7 mi) radius. If a nest within this radius was recorded as active for the first time after the last activity was recorded of the failed nest, we assumed that the occupants of the failed nest renested at that location. If a series of three nests fit these criteria (i.e., three nests are observed then destroyed in series), as happened once in 2014 (unpublished data), we conclude that a raven pair rebuilt its failed nest a total of three times.

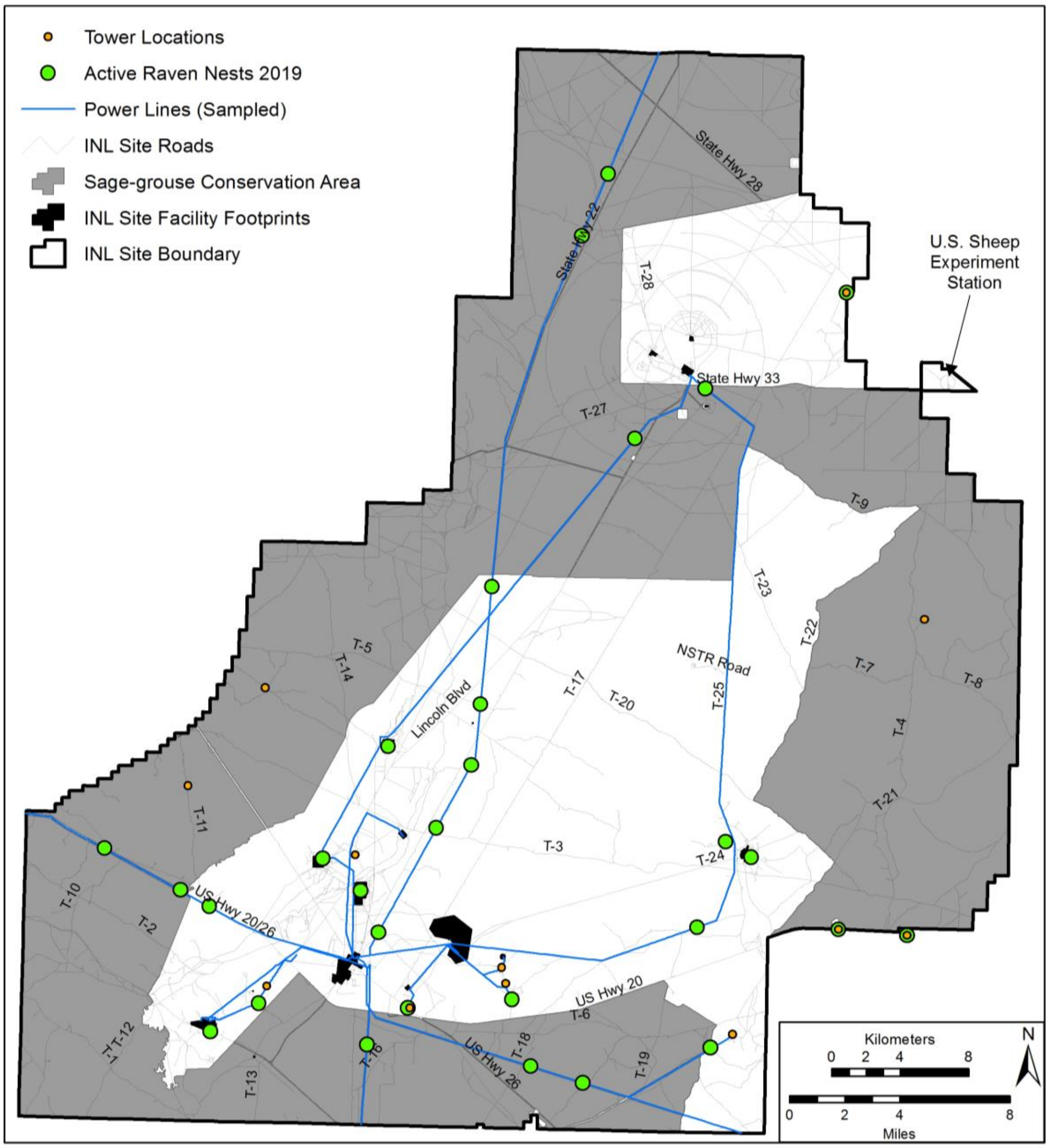

Figure 4-1. Results of the 2019 raven nest survey depicting all documented active raven nests on infrastructure, after accounting for nests that were potentially occupied by the same breeding pair. For clarity, towers associated with facilities are not shown.

The 6-km threshold was chosen somewhat arbitrarily, but our intent was to have the threshold large enough to encompass the entire breeding territory of nest occupants, as we assumed breeding pairs are likely to renest within their territory. In Iceland where ravens nested along cliffs, most renesting attempts (four of seven) were within 200 m of failed nests, and none were more than 2.5 km from the failed nest (Skarphédinsson et al. 1990). We also wanted to be conservative in our estimate of the number of breeding pairs (i.e. a higher number of second nests identified results in a lower estimate of breeding pairs). When we first developed this method (Shurtliff et al. 2017), we chose 6 km as the threshold after considering that the median distance from an active raven nest to the nearest active conspecific nest over the previous three years had been 2.7–3.1 km (1.7–1.9 mi). Although it is unknown how large raven breeding territories are in sagebrush steppe or how far they move to renest after losing a nest, a 6-km radius typically overlaps several raven nests on the INL Site, and therefore we felt the distance is reasonable given our assumptions and objectives.

Nearest-Nest Analysis

To calculate the minimum distance between any two active raven nests on the INL Site in 2019, we used a GIS measuring tool at a scale of 1:2,000. For each active nest, we identified the first and last dates when active-nest criteria were observed, and we assumed the nest was active during the intervening period (i.e. activity periods). For each active nest on the INL Site, we measured distances between all nearby nests in which activity periods overlapped the nest of interest by at least one day. Even if the nearest nest was one that would later fall down and be rebuilt elsewhere, if the activity periods overlapped, distances were compared to obtain the overall nearest-nest distance. If an active nest was closer to the INL Site boundary than to another active raven nest, it was excluded from the analysis because we could not be sure a nest off the INL Site was closer.

4.1.3 Results

We observed 32 active raven nests on anthropogenic structures along survey routes or in trees associated with facilities in 2019. An additional nest occupied by ravens was observed in July on a tower that is not part of the survey route, so it was not included in the total. Additionally, on a large structure next to the EBR-1 museum, two nests were initially recorded as active because ravens were observed perched nearby on more than one occasion (a nest is considered active based on several criteria, including two or more observations of ravens perched nearby). The nests were only a few meters apart, and we never observed ravens using the nests, so we only designated one of them active in the final analysis.

Twenty-one of the 32 raven nests were on power line structures. We merged three pairs of nests, because they met our criteria of having been likely occupied by the same nesting pair (Shurtliff et al. 2017). Thus, the total number of active raven nests (i.e., adjusted total) was 29, including 18 (62%) on power line structures (Table 4-1; Figure 4-2). Ten (56%) of the 18 power line nests were in the SGCA or within 75 m of the SGCA.

We recorded 19 instances where an unoccupied nest was observed at least once, but we were never able to confirm if the nest was active by the end of the survey period. In such cases, we cannot reject a hypothesis that the nest was active, at least temporarily. Such nests are therefore classified as "unconfirmed". In 2019, 12 of 19 unconfirmed nests were on structures that can support inactive nests for many years, including building platforms, ornamental trees, or raptor platforms. On transmission lines, we failed to confirm activity status for seven nests. At six of these, a nest was observed once, but was absent on subsequent surveys. For the seventh, a nest with an unknown activity status appeared on the fourth survey, but remained unconfirmed on the subsequent, final survey.

Table 4-1. Summary of active raven nests (adjusted) on the Idaho National Laboratory Site, observed on anthropogenic structures within and without the Sage-Grouse Conservation Area (SGCA) during 2019 surveys. Those on the border of the SGCA were counted as being within the SGCA.

# Active Nests	Structure	Within SGCA	Outside SGCA
18	Power Line	10	8
5	Building Platform	0	5
1	Effluent Stack	0	1
4	Tower	1	3
1	Ornamental Tree	0	1
Totals 29		**11**	**18**

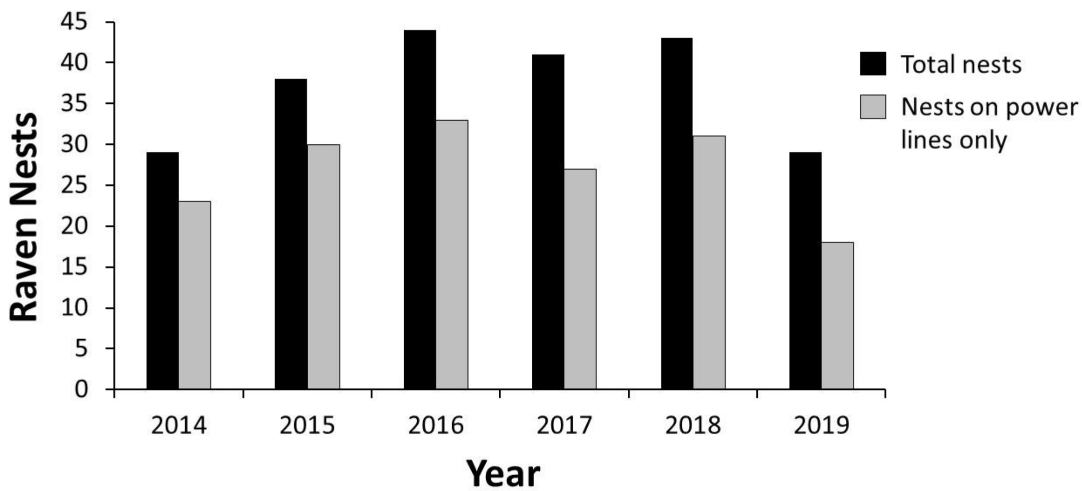

Figure 4-2. Raven nests observed on Idaho National Laboratory Site infrastructure (adjusted values).

Power Lines

From April 1 through May 28, 2019, we completed four surveys of all transmission and distribution lines on the INL Site that could potentially support a raven nest. Of 18 power line nests (adjusted), two were on distribution structures where they were supported by equipment attached to the pole. Rocky Mountain Power removed one of these nests early in May as it posed a fire hazard. Five nests were on “Closed H Cable” structures, 10 were on “Sloped H”, and one was on an unidentified transmission structure (see Shurtliff et al. 2017 for pictures of structures).

Facilities

Between April 3 and April 30, 2019, we completed two surveys of 13 facilities on the INL Site. Additional partial or complete surveys were performed where necessary to check the status of unconfirmed nests. We documented seven active raven nests at seven facilities (Table 4-2).

Towers

Among towers located outside facilities, we surveyed seven towers twice, one tower three times, and three towers five times between April 2 and June 5, 2019. Most surveys were performed in April, but we conducted extra surveys (i.e., more than two) when a nest was present on a tower and the activity level of that nest remained unknown after two surveys.

We confirmed active raven nests on four of the 11 towers surveyed (Table 4-1, Figure 4-1). One was a 50-ft NOAA meteorological tower near the Materials and Fuels Complex (MFC) east fence. The others were on the three towers outside but adjacent to the INL Site.

Nest Distances

The nearest two raven nests for which we had records of concurrent occupancy were estimated to be 1,734 m (1,896 yds) apart (Table 4-3). One of these nests was at the Transient Reactor Test Facility building and the other was on a tower immediately east of MFC. Only one other pair of nests (on power line structures) were separated by less than two kilometers (1.94 km [1.21 mi]).

Table 4-2. Results of raven nest surveys at facilities in 2019.

Facility	# Times Surveyed	Days Between Surveys	Active Raven Nest Confirmed	Substrate Supporting Active Nest
Advanced Mixed Waste Treatment Project	2	14	Yes	Building Platform
Advanced Test Reactor Complex	2	19	Yes	Building Platform
Central Facilities Area	2	18	No	N/A
Central Facilities Area Main Gate	2	25	Yes	Building Platform
Critical Infrastructure Test Range Complex	2	25	No	N/A
Experimental Breeder Reactor I	4	14	Yes	Building Platform
Highway Department	2	15	No	N/A
Idaho Nuclear Technology and Engineering Center	2	15	Yes	Effluent Stack
Materials and Fuel Complex /Transient Reactor Test Facility	2	20	Yes	Building Platform
Naval Reactors Facility (NRF)	2[a]	22	Yes	Ornamental Tree
Radioactive Waste Management Complex	2	14	No	N/A
Specific Manufacturing Capability/Test Area North	2	20	No	N/A
U.S. Sheep Experiment Station	2	15	No	N/A

[a] Environmental Surveillance, Education, and Research personnel are restricted from entering the NRF. Therefore, several years ago we trained an NRF representative to report to ESER two times each season on raven nest observations.

Table 4-3. Summary of raven infrastructure nest survey data since full surveys began on the Idaho National Laboratory Site. "Adjusted" totals (columns 3–4, 6–7) account for assumed renesting due to nest destruction. The distance between the two closest, concurrently active raven nests is listed in the last column.

Year	Total Active Nests Observed	Adjusted Active Nests	Change from past year (Adjusted)	Total Power Line Nests Observed	Adjusted Power Line Nests	Change from past year (Power lines)	Nearest Nests (m)
2014	35	29	N/A	29	23	N/A	1,525
2015	39	38	31%	31	30	23%	1,525
2016	46	44	16%	35	33	10%	1,216
2017	43	41	−7%	28	26	−21%	378*
2018	45	43	5%	33	31	15%	1,033
2019	32	29	−33%	21	18	−42%	1,734

*Nearest nests may have been American crow nests, erroneously classified as ravens. The nearest two confirmed raven nests were estimated to be 1,841 m apart (Shurtliff et al. 2018).

4.1.4 Discussion

The adjusted number of raven nests recorded on infrastructure associated with the INL Site was 33% lower in 2019 than 2018, matching the lowest number of raven nests recorded since 2014. The number of raven nests observed on power lines was 42% lower than in 2018 and 21% lower than in any other year (Figure 4-2).

Nesting at Facilities and on Towers

During 2019, ravens nested at the same facilities as in 2018, except no nest was observed in the Specific Manufacturing Capability/Test Area North area (a first since surveys began in 2014), and a nest was observed for the first time since 2016 at the Advanced Test Reactor Complex. Ravens have nested each of the past six years at INTEC and NRF, each of the past five years at AMWTP/RWMC, each of the past four years at the CFA main gate and EBR-1, and each of the past three years at MFC/Transient Reactor Test Facility. We are not aware of recent efforts by contractors to deter nesting at facilities, so it is not surprising that these facilities, which provide a lot of suitable nesting substrates, are nearly continuously occupied.

At some facilities, installing nest deterrents would be logistically difficult, whereas at others it would be relatively easy. For example, at NRF, it would be difficult to dissuade ravens from nesting because several suitable substrates are available, and most are relatively inaccessible to maintenance personnel. Conversely, nesting at AMWTP typically occurs on elevated platforms attached to buildings that are accessible and could probably be retrofitted to discourage nesting without much cost in materials. Nests at the CFA main gate area have always been in a covered area behind the badging office or in a covered structure maintained by the Idaho Department of Transportation near the intersection of Highways 20 and 26. Neither location would be difficult to retrofit, but cooperation with the Idaho Department of Transportation would be necessary. Nest sites at EBR-1 are always on the large engines displayed outside the building. Ravens have several platforms to choose from, but they may be discouraged from occupying those substrates if wire or netting were strategically placed.

Efforts have been made for the past several years by NOAA to discourage raven nesting on two of its towers on the western and eastern edges of the INL Site. After the 2018 nesting season, NOAA staff installed additional wire mesh to at least one of the towers. In 2019, ravens did not nest during the survey period on either tower, although we serendipitously discovered an active raven nest on one of them on 2 July, 2019. Because the nest was observed outside the April-May timeframe, we did not count this nest in our final summary. We suspect that the addition of wire made the tower less desirable as a nesting location, but ravens clearly overcame the barrier.

Of the four nests on towers that we observed, two were located high on cellular or other communication towers, and three of the towers (including the two on tall towers) are immediately outside INL Site boundaries. These towers are not operated by the INL or DOE. The only tower within the boundaries of the INL Site that was used for nesting in 2019 is located immediately outside the MFC fence. It could be retrofitted, similar to the NOAA towers described above, to reduce the desirability of the structure as a nesting substrate. However, eliminating this tower as a nesting substrate may force the raven pair to move to substrates at MFC, which may not be a desirable outcome for the MFC facility.

Nearest-Nest Distances

We documented fewer raven nests in 2019 than in most previous years of the survey. We also observed that the minimum distance between two active raven nests was greater in 2019 than in most of the past years (Table 4-3). These results lead us to hypothesize that as densities of raven nests decrease, distances between nests (and probably the size of the home range) increase.

Raven Nesting and Abundance on the INL Site

Every year, we perform breeding bird surveys in June along 13 routes, and a single-day raptor count in January along roads, on and adjacent to the INL Site. During these surveys, all raven observations are recorded, providing additional points of reference to evaluate local raven abundance. In 2019, raven observations were 36% fewer during breeding bird surveys and 25% fewer during the raptor count compared to 2018 (ESER, unpublished data). These results closely mirror the 33% reduction in raven nests we documented in 2019 (Table 4-3). The breeding bird and raptor surveys differ from raven nest surveys because they may include roving individuals and flocks of non-territorial ravens. However, the directional concurrence of the three datasets suggests that fewer observations of raven nests in 2019 may be a result of reduced raven abundance locally.

An alternative explanation for the low number of raven nests documented is that nesting may have been delayed because of a prolonged winter season (Griffee 1937 [not seen]; cited in Boarman and Heinrich 1999). The INL Site received above-average snowfall in February, and snow remained on the ground much later into March than in many past years. If the breeding season was substantially delayed by a late spring, we may not have observed some late nesters before surveys were completed at the end of May. One *post-hoc* way to test this hypothesis is to compare the median day when incubation behavior (i.e., a raven was sitting in the nest bowl) was first observed relative to past years. We found that the median date when incubation behavior was first recorded for a nest was 29 April 2019 (n = 25). This date is one of the later dates recorded for median date of first incubation, but it falls within the range observed since 2014 (range= April 17–May 2). This evidence suggests that if nesting was delayed, it was not to a degree that we would expect substantially more nests to go undetected during April and May than in past years.

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 one of the top five threats to sage-grouse and its habitat on the INL Site (DOE and USFWS 2014). Infrastructure can promote 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 may increase the risk of wildland fire. Weeds may also outcompete native plants reducing plant diversity in localized areas and degrade sage-grouse habitat quality. Occasionally, mitigation following the completion of a construction project fails to meet its objectives, or infrastructure requirements may continue to expand as a project moves forward without new structures and disturbances being taken into account.

Inappropriate vehicle use, such as driving off existing roads, may also cause habitat degradation in localized areas. Remote sensing imagery shows that the number of roads within grazing allotments on the INL Site has increased over time (Shurtliff et al. 2016, Shurtliff et al. 2017, Shurtliff et al. 2019). It is likely that most of these roads were established by BLM livestock grazing 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 the new 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 from unauthorized ones more recently created.

The goal of this monitoring task is to identify where expansion of infrastructure has occurred and document and map all road features within the SGCA and other areas dominated by big sagebrush. This task serves as the mechanism to identify and report on new infrastructure and two-track linear features being developed and to update the sagebrush habitat distribution data layer due to changes not associated with wildland fires. This monitoring task is conducted whenever new high resolution imagery that encompasses the entire INL Site becomes available. Currently, this task is reliant on the U.S. Department of Agriculture NAIP, which typically collects aerial digital imagery in Idaho every two years and is made publicly available for no cost. The frequency of high resolution NAIP imagery allows DOE to avoid the cost of funding an image acquisition through a commercial vendor specifically to support this task. As high resolution imagery becomes available opportunistically (e.g. INL Site image acquisition following a large wildland fire), we will also incorporate those data to monitor infrastructure changes.

4.2.2 Results and Discussion

There was no work conducted on this task in 2019 because no new high resolution imagery was available for the INL Site prior to reporting. The U.S. Department of Agriculture NAIP program collected high resolution imagery across the State of Idaho during the summer of 2019 and those data are typically made available the following winter/spring. Once we download and process the new 2019 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 2020.

5.0 IMPLEMENTATION OF CONSERVATION MEASURES

5.1 Summary of 2019 Implementation Progress

The CCA identifies eight threats to sage-grouse and its habitats on the INL Site, and it outlines 13 conservation measures designed to mitigate and reduce these threats. The agreement also articulates DOE'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, contractors, and stakeholders achieved in the past year to ameliorate threats to sage-grouse and its habitats on the INL Site. Sagebrush losses, if any, are documented under Conservation Measure 2 with a description of contractor plans and current activities to mitigate those losses.

Table 5-1. Accomplishments in 2019 for each CCA conservation measure.

Threat:	Wildland Fire
Objective:	Minimize the impact of habitat loss due to wildland fire and firefighting activities.
Conservation Measures:	1) Prepare an assessment for the need to restore the burned area. Based on that assessment, DOE would prepare an approach for hastening sagebrush reestablishment in burned areas and reduce the impact of wildland fires >40 ha (99 acres).
Conservation Measure 1—Accomplishments in 2019: BURN ASSESSMENT—Four lightning-caused wildland fires occurred on the INL Site in 2019[3]. Two were 0.4 ha (1 acre) or less and one was 21 ha (52 acres). A fourth, the Sheep Fire, burned primarily in the center of the INL Site and was initially estimated at 45,368 ha (112,106 acres); however, we analyzed imagery obtained after the fire which revealed that much of area within the fire footprint burned incompletely, leaving thousands of unburned patches. Our updated estimate of area burned is 40,403 ha (99,839 acres; Section 3.2.3). The Sheep Fire is the first fire to have burned over 40 ha since the CCA was signed, and it therefore represents the first for which a burn assessment is necessary to comply with Conservation Measure 1. The INL Wildland Fire Committee recommended that a post-fire recovery plan be developed, and a plan was drafted during fall/winter of 2019. The plan includes an assessment of the natural resources impacted by the fire, and it provides numerous restoration options for improving habitat recovery. DOE invited the USFWS, BLM, and Idaho Office of Species Conservation to participate in a scoping meeting for the post-fire recovery plan, during which agency staff stressed the importance of controlling cheatgrass and reestablishing sagebrush. Initial post-fire restoration activities include assessing and prioritizing containment lines to address soil stabilization and aerial seeding of sagebrush on about 25,000 acres, including all the area in the SGCA that was affected by the Sheep Fire. DOE and agency stakeholders cooperated to purchase sagebrush seed and are planning to aerially broadcast the seed in early 2020. **Associated Conservation Actions that Addressed the Wildland Fire Threat:** INFORMATION DISSEMINATION—The INL Fire Chief sent out iNotes via email to all INL employees on July 9 and 30, 2019, and September 24, 2019. These notes informed employees of any changes to the fire danger rating, whether Stage I or Stage II Fire Restrictions were in place, what those restrictions were, other fire prevention strategies, and what actions employees should take if they observe smoke/fire. The iNote on July 9, 2019, also included a link to a YouTube video about sage-grouse on the INL Site.	

[3] Unpublished wildland fire statistics summary for 2019; Eric Gosswiller, INL Fire Chief.

Threat:	Infrastructure Development
Objective:	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.
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 2019:

Multiple projects in FY 2019 co-located new infrastructure with existing infrastructure to avoid damage to sagebrush. The Sample Preparation Laboratory project (Environmental Checklist [EC] INL-16-075) is constructing a 4,552 m^2 (49,000 ft^2) building within a previously disturbed portion of the MFC and is tying into existing utilities. The parking area, laydown area, and guardhouse will be placed just outside the facility fence. SMC Parking Lot Repaving, ATR Complex Parking Lot Reconstruction, and MFC Parking Lot Expansion and Reconfiguration (ECs INL-18-079, INL-19-055, and INL-19-088 respectively) kept their footprints, including material piles and equipment, within gravel areas. These projects limited the disturbance of vegetation to previously disturbed areas on the side of the roads. The project to Relocate [the] Power Management Laydown Yard (EC INL-19-071) moved equipment from the Scoville substation to within the Central Facilities Area boundary.

The GANNETT project (EC INL-18-059) installed a 32-m (106-ft) tower within the SGCA, about 3 km from the nearest lek buffer area. However, the tower was installed on a paved road surface at the south end of Fillmore Boulevard, near ARA-1. Per the project manager, this tower is taken down at the end of every project workday. Demobilization prevents birds from nesting on the tower.

The Versatile Test Reactor Preconceptual Design project drilled two seismic boreholes to the south and southeast of MFC, just outside the facility fence (EC INL-18-014). According to the EC, an area of 76 m x 76 m (250 ft × 250 ft), which equals 0.57 ha (1.4 acres), was estimated to be mowed for a well pad and support trailer. U.S. Geological Survey (USGS) measured the actual mowed area to be 0.5 ha (1.25 acres), and Veolia determined that to be sagebrush habitat, which requires revegetation. The location to the east of MFC (USGS-148) is between the facility fence and concrete barriers that mark the facility boundary. Per the Project Manager, it is not scheduled for mowing or revegetation since it is the proposed footprint for Versatile Test Reactor. USGS is still working in the location to the southeast of MFC (USGS-149), so the final disturbed area will be calculated after the well has been completed. Per USGS, an area large enough to allow vehicular access and sampling will remain cleared around USGS-149. The project plans to revegetate in FY 2020.

Utah Associated Municipal Power Systems is testing suitability of the INL Site for a small modular reactor. Currently, the project is focusing on an area near Highway 33 and T-11, which is within the SGCA. The current EC (INL-19-067) estimates that the Carbon Free Power Project Site Characterization impacted 1.9 ha (4.8 acres) of sagebrush in FY 2019. The project will span multiple years and may expand up to 809 ha (2,000 acres) if the location is chosen to build small modular reactor. Revegetation plans for this project will be included in a future report and based on actual disturbances.

Conservation Measure 3—Accomplishments in 2019:

INL Environmental Support and Services staff are unaware of any infrastructure built outside exempted corridors in FY 2019.

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.~~ DISCONTINUED (See Section 6.2.4, Shurtliff et al. [2019]).

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 2019:

MINIMIZING LEK DISTURBANCE— A new stipulation was included in the Mahogany Butte lease stating that cattle are not to be trailed along Birch Creek, and water and salt stations are required to be set back at least one mile from the dry creek bed. Although the stipulation was put in place to protect cultural resources, it will help to reduce the potential for disturbance of sage-grouse on leks near the creek bed.

LEK DISTURBANCE—On 17 April 2019, an ESER biologist observed a sheep camp early in the morning on a lek on the Tractor Flats lek route. By 8:30 a.m. sheep were being moved to a nearby lek where water troughs were being placed and filled. DOE contacted BLM staff, who immediately responded by reaching out to permittees.

UPDATED INFORMATION TO BLM—In an effort to improve the usefulness of updated lek maps DOE provides BLM each year for conveyance to permittees, ESER drafted several alternative products for BLM to consider. ESER and BLM discussed an alternative strategy, which is that ESER would send updated GIS lek data each year to the BLM so the agency's staff could print maps or disseminate the information in a manner that they feel is most appropriate.

Conservation Measure 6—Accomplishments in 2019:

COMMUNICATION & COLLABORATION—The annual meeting among BLM, DOE, and ESER staff did not occur in 2019 as it has the past couple of years. However, DOE and BLM actively communicated and collaborated to manage livestock grazing in a way that would reduce pressure on sage-grouse on the INL Site and within the region. The following are highlights from 2019:

- ESER reviewed and provided comments on allotment permit renewal proposals for the Twin Buttes and Mahogany Butte Allotments
- ESER reviewed and provided comments on a range improvement proposal for the Deadman and Quaking Aspen Allotments.
- DOE and ESER participated in allotment assessments (field days) for the Deadman and Sinks Allotments and ESER provided data from the Long-Term Vegetation monitoring database and from the CCA Habitat Condition Monitoring Task to support permit renewal Environmental Assessments.
- ESER provided data from the CCA Habitat Condition Monitoring Task to the BLM state biologist to support causal factor analysis on declining sage-grouse populations east of the INL Site. Later, ESER staff participated in a stakeholder meeting aimed at identifying causal factors.
- DOE and ESER engaged BLM in the post-fire activities related to the Sheep Fire. BLM provided feedback about areas of sage-grouse conservation concern based on their telemetry data and they have provided support for planning post-fire restoration activities.

<table>
<tr><td colspan="2">POST SHEEP FIRE ADAPTIVE MANAGEMENT—In fall of 2019, BLM decided it will reduce Animal Unit Month levels for the Twin Buttes Allotment by 9% to compensate for lost fodder due to the Sheep Fire that burned on July 22, 2019.

RANGELAND IMPROVEMENTS—DOE supported a decision by BLM to permit installation of an underground pipe to maintain water troughs. This improvement will reduce the amount of water-hauling traffic on two-track roads.</td></tr>
<tr><td>Threat:</td><td>Seeded Perennial Grasses</td></tr>
<tr><td>Objective:</td><td>Maintain the integrity of native plant communities by limiting the spread of crested wheatgrass.</td></tr>
<tr><td>Conservation Measure:</td><td>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.</td></tr>
<tr><td colspan="2">Conservation Measure 7—Accomplishments in 2019:
ESER has a native perennial seed mix list that is recommended whenever contractors request information prior to revegetation work.</td></tr>
<tr><td>Threat:</td><td>Landfills and Borrow Sources</td></tr>
<tr><td>Objective:</td><td>Minimize the impact of borrow source and landfill activities and development on sage-grouse and sagebrush habitat.</td></tr>
<tr><td>Conservation Measures:</td><td>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 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.</td></tr>
<tr><td colspan="2">Conservation Measure 8—Accomplishments in 2019:
INL complied with the seasonal and time of day restrictions. Per “Idaho National Laboratory Gravel Source and Borrow Pit Operations (Overarching) Environmental Checklist” (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. Adams Boulevard, Lincoln Boulevard, Monroe Boulevard, Ryegrass Flats, T-12, and T-28 South are covered by this EC.

Conservation Measure 9—Accomplishments in 2019:
No new borrow pits or landfills were opened in 2019. Expansion of existing borrow sources and landfills is limited to footprints approved in Appendix C of the Spent Nuclear Fuel Environmental Impact Statement (EIS) (DOE/EIS-0203) or the Environmental Assessment (EA) for Silt/Clay Development and Use (DOE-EA-1083). Any expansion of gravel/borrow pits that would disturb surface soil/vegetation also requires a biological resources survey by ESER. INL Facilities and Site Services personnel assist in the identification of approved footprints.</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 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>
</table>

Conservation Measure 10—Accomplishments in 2019:

INL Power Management operates and maintains 130 miles of overhead power lines. This includes installation of nest deterrents, sometimes referred to as plastic tents, on existing power poles. In 2015, the U.S. Fish and Wildlife Service reviewed and agreed with a cooperative agreement between the ESER contractor, INL, and National and Homeland Security to install nest deterrents only on dead-end and corner poles and not to install any nest or perch deterrents on other poles. These deterrents are installed during the performance of maintenance activities as funds allow. New power lines go through the EA/EC process to determine if nesting deterrents are required.

In 2018, NOAA staff added an additional layer of wire mesh to two of its towers on the INL Site that had been occupied by ravens every year since 2014 and 2015 (Shurtliff et al. 2019). During nest surveys of towers in April 2019, no raven nests were found on either tower (see Section 4.1.4). We checked one of the towers again at the end of May and it remained unoccupied. On July 2, 2019, we serendipitously discovered that a pair of ravens nesting on the other tower. Thus, it appears that the wire mesh was partly successful at discouraging nesting on towers.

Conservation Measure 11: Completed

Threat:	Human Disturbance
Objective:	Minimize human disturbance of sage-grouse courtship behavior on leks and nesting females within the SGCA and 1 km (0.6 mi) Lek Buffers.
Conservation Measures:	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 lbs) will only occur at the National Security Test Range from 9 a.m.–9 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.

Conservation Measures 12 and 13—Accomplishments in 2019:

TOWERS—No meteorological, SODAR, or other cell towers were erected within 1 km (0.6 mi) of a sage-grouse lek or within the SGCA during FY 2019.

EXPLOSIVES—No National Security Test Range detonations >1,225 kg (2,700 lbs) occurred between March 15 and May 15, 2019.

UNMANNED AERIAL VEHICLES— All unmanned aerial vehicle flights complied with the requirements for FY 2019. Per INL-16-149, “Unmanned Aerial Vehicle Operations Environmental Checklist,” flights are prohibited within 1 km (0.6 mi) (vertical and horizontal) of a sage-grouse lek during breeding season.

DISRUPTIVE ACTIVITIES—INL Environmental Support and Services staff are unaware of any other Site activities that could have disrupted nesting sage-grouse within the SGCA.

5.2 Reports on Projects Associated with Conservation Measures

5.2.1 Conservation Measure #1—Sagebrush Seedling Planting for Habitat Restoration

Introduction

The objective of Conservation Measure 1 is to compensate for the impact of habitat loss due to wildland fire and firefighting activities (Table 5-1). In 2015, DOE began implementing an annually recurring task that would facilitate planting at least 5,000 sagebrush seedlings each fall on the INL Site (DOE and USFWS 2014, Section 9.4.4). Planting sagebrush seedlings annually is a proactive measure that will hasten the reestablishment of sage-grouse habitat lost during past fires. In addition, Battelle Energy Alliance, LLC (BEA) has committed to mitigate the loss of sagebrush associated with project activities where sagebrush may be damaged. For every acre impacted, BEA will contribute funds to replant 946 seedlings and the seedlings will be grown and planted concurrently with DOE's seedlings.

The ESER program oversees the planting of sagebrush seedlings from all sources and monitors survivorship to evaluate the effectiveness of the task for DOE and BEA. Our aim is to plant at least 80 sagebrush seedlings per acre, resulting in a coverage of ≥25 ha (63 acres) per year (Shurtliff et al. 2016), although the acreage planted can be highly variable due to weather conditions, topography, planting conditions, travel, and planter ability. Typical sagebrush density planting rates in sage-grouse habitat is one to three plants per square meter, meaning that an acre normally contains 4,000–12,000 sagebrush plants. The intent of this sagebrush restoration task is not to plant sagebrush at densities that typify sage-grouse habitat, but rather to establish sagebrush seed sources in priority areas to shorten the time interval between a fire and the reestablishment of sage-grouse habitat.

Methods

Desert Sage Farms LLC, located in Oakley, ID, provided seedlings grown from seed collected on the INL Site in 2018. Information about growing the seedlings, and details about procedures followed during the planting process, are described in the 2015 CCA Annual Report (Shurtliff et al. 2016). Ten thousand seedlings were planted on approximately 36.8 ha (91 acres) in a single day by MP Forestry of Medford, OR (Figure 5-1).

Figure 5-1. Planting crew from MP Forestry, with Kurt Edwards of ESER marking a subset of seedlings for future survivorship monitoring in October 2019.

Although potential planting sites are focused on the priority restoration areas; other practical factors often determine the ultimate outcome. Often, logistical constraints are a factor in seeding location. The area chosen for restoration in 2019 was on the northeastern edge of the Jefferson Fire, a northern INL Site location, just south of Highway 33 (Figure 5-2). This area is within the SGCA as well as within the priority restoration area identified in the 2015 CCA Annual Report (Shurtliff et al. 2016). We chose this site to continue diversifying our planting areas across the INL Site, its proximity to sage grouse leks, and importance to sage grouse winter range, and to continue rehabilitation on the Jefferson Fire.

Survivorship of seedlings planted in fall 2018 was determined by revisiting and evaluating the condition of individual seedlings one year after planting. During the fall 2018 planting, we collected sub-meter GPS locations for nearly 17% of the seedlings planted. In August 2019, we revisited approximately 10% of those seedlings (randomly selected from marked individuals) and determined if each seedling was healthy, stressed, or dead (Figure 5-3). After five years, seedlings will again be revisited, and longer-term survivorship will be assessed.

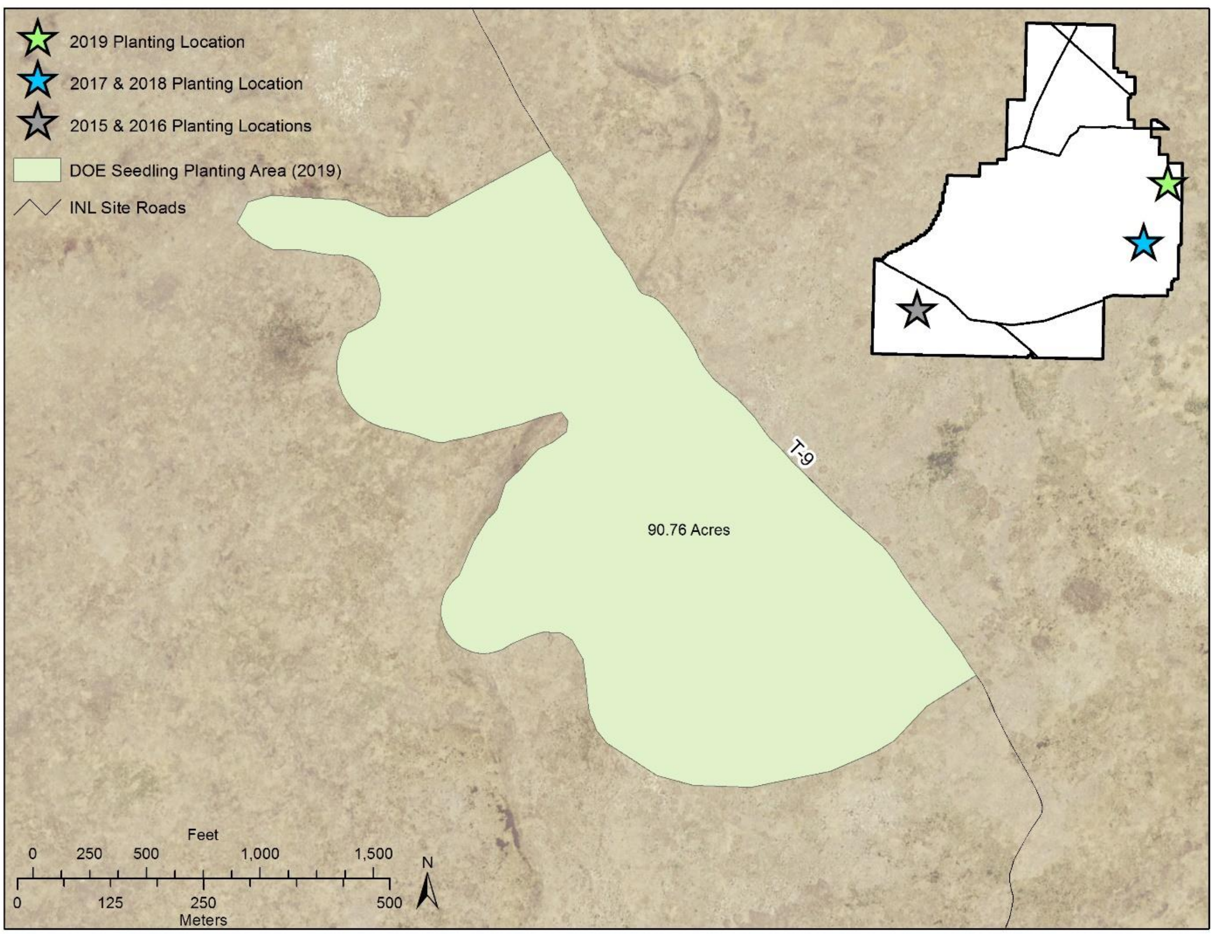

Figure 5-2. Areas planted with big sagebrush seedlings in 2019 with reference to previous years plantings.

Results and Discussion

We planted approximately 10,000 seedlings on 36.8 ha (91 acres) or ~272 seedlings per ha (110 seedlings per acre) on October 16, 2019, in the northeast part of the INL Site (Figure 5-2). We marked the locations of 501 (5%) seedlings for future monitoring. Although the INL Site had a relatively normal precipitation year, rain fell just days before the planting, creating favorable conditions for both planting and seedling growth and development.

There were no seedlings planted to mitigate potential sagebrush loss by BEA project activities in 2019. Over the past five years, a total of 52,000 seedlings have been planted from all funding sources. Sagebrush restoration has now been initiated on 172 ha (424.9 acres).

To quantify 2018 seedling survivorship and condition, we revisited 899 sagebrush seedlings in August 2019. The seedlings were assessed as 509 (57%) were healthy, 85 (9%) were stressed, 108 (12%) were dead, and 197 (22%) were missing (Figure 5-3). Assuming the missing seedlings were dead, a total of 66% of the seedlings survived the first year. For comparison, years 2015-2018 are also shown in Figure 5-3.

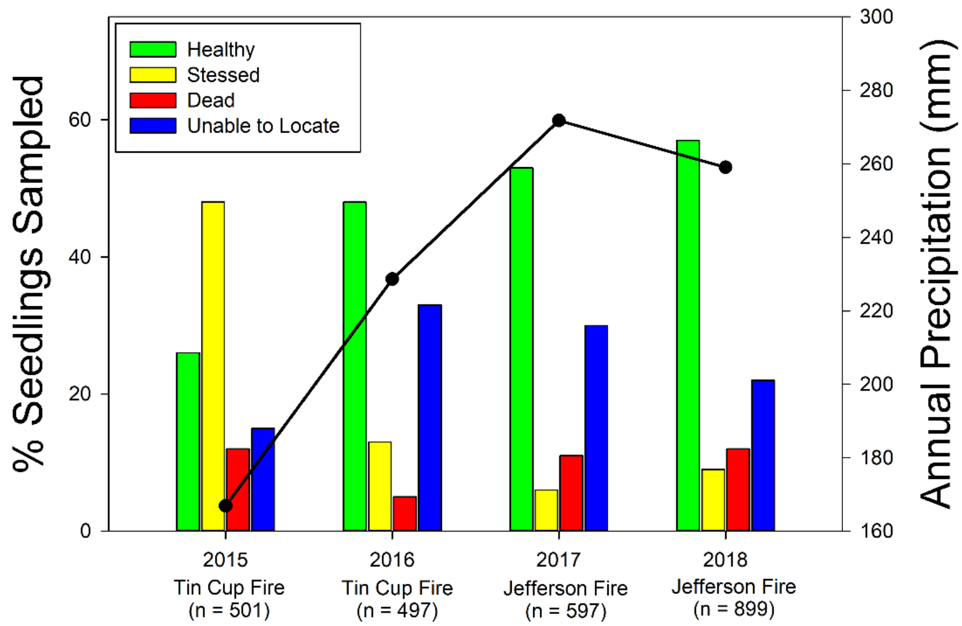

Figure 5-3. One year post planting survivorship results.

Interestingly, many of these seedlings were growing in a lateral direction (Figure 5-4). Some were lying directly on the ground but were alive. While the cause is ultimately unknown, these seedlings were exceptionally tall at the time of planting and were snowed on almost immediately after planting (5+ inches of heavy wet snow). The weight of the snow combined with the lack of structure of the plant may have been partially at fault for the more decumbent growth seen in the seedlings planted in 2018.

Figure 5-4. Examples of sagebrush seedling conditions. Left: laterally growing healthy seedling. Right: stressed upright seedling.

The number of missing seedlings has been trending downward since 2016, although 2015 was the lowest of the four monitoring years. Given the accuracy of our GPS units, it is likely that many of these missing seedlings did not survive, though we may have missed some live seedlings, especially if they were stressed and in areas with relatively high grass and forb cover. A conservative assessment would assume the missing seedlings did not survive. However, it is notable that most of the revisited seedlings that were found were labeled as healthy. ESER will revisit all locations again, even those marked as missing, five years post-planting to refine estimates of survivorship and to evaluate the success of this project in hastening the return of sagebrush to the landscape.

Precipitation patterns from fall 2018 to fall 2019 were characteristic of a good recruitment year. As a whole, 2019 was typical in both time and amount of precipitation. Late summer (July and August) was drier than normal, but a wetter than normal September normalized the precipitation totals. Spring precipitation was ideal for helping the seedlings to establish. The summer growing season was slightly below average (Figure 3-3). Despite the lack of moisture during summer, the majority of the plants relocated were labeled as being healthy (57%) and very few were stressed or dead (9% and 12%, respectively). 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, sagebrush establishment one-year post planting on the INL Site is at or above average even when the missing plants are considered dead.

One of the reasons DOE chose to plant seedlings over a relatively small area each year rather than to 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 fluctuates from year to year (Colket 2003; Forman et al. 2013), and in many years, few or no seeds may germinate and survive the summer (Brabec et al. 2015). DOE's decision to plant containerized seedlings in old burns instead of broadcasting or drill-planting seeds will continue to be justified as long as high survivorship of seedlings is consistently achieved, particularly during years in which establishment following seeding would be low (Figure 5-5). However, alternative seedling/planting methods are being evaluated and may be utilized in the future. All proposed seeding efforts will help DOE determine if such methods can be successful supplements and/or alternatives in addition to the current annual sagebrush seedling planting efforts.

Figure 5-5. Examples of a typical seedling installation process and a healthy recently planted seedling.

6.0 SYNTHESIS AND ADAPTIVE MANAGEMENT RECOMMENDATIONS

6.1 Sage-Grouse and Sagebrush Habitat Trends

Across Idaho, sage-grouse lek counts were approximately 25% lower in 2019 compared to 2018, marking the third consecutive year of state-wide sage-grouse declines[4]. These results closely mirror lek count results documented in the present report. The similarity between regional and local trends suggests either sage-grouse abundance on the INL Site is being driven by broad-scale environmental, ecological, or anthropogenic factors, or unique local pressures are generally having the same impact on the population as related factors elsewhere across the state.

As described previously in this report, the Sheep Fire eliminated thousands of hectares of sagebrush-dominated communities in the center of the INL Site, including on and around three leks. In 2019, prior to the fire, these locations ranked among the top 13 most-attended leks and had peak male attendance ranging from 13–21 individuals. Male sage-grouse may continue to congregate at these leks in the near term, but the probability of lek abandonment has been shown to increase when areas close to leks burn (Hess and Beck 2012).

In areas like the INL Site that receive low levels of annual precipitation, mature sagebrush stands do not regenerate quickly after a large wildfire; thus, short-term effects of habitat loss are inevitable. Following the Sheep Fire, ESER produced a fire recovery plan that addresses sagebrush recovery and threat mitigation. In addition, DOE and other stakeholders have secured sagebrush seed and will aerially seed a portion of the burned area early in 2020. To the degree that seeding and other remedial actions succeed, the time between sagebrush elimination and restoration of sage-grouse habitat in seeded areas will be reduced.

6.2 Proposed Changes

Restructure the Population Trigger

The CCA describes what we currently use for the sage-grouse population trigger (i.e., male counts on 27 leks in the SGCA) as an “interim population trigger” (DOE and USFWS 2014). The intent was that the interim population trigger would be replaced by a trigger framework based on lek route data following establishment of additional lek routes. As reported last year (Shurtliff et al. 2019), DOE and the USFWS decided during their 2018 annual stakeholders meeting that it would be best to postpone restructuring the population trigger until after the BLM Land Use Plan is released. As of this writing, the Land Use Plan has not yet been released.

In preparation for a conversation about population trigger restructuring, we have begun to investigate if lek route data from six routes are the most appropriate basis for the trigger. The lek monitoring program on the INL Site is unique because ESER carried out a sustained, systematic effort (2009–2017) to search for lekking sage-grouse near roads and in remote areas where few active leks were known (DOE and USFWS 2014, Shurtliff et al. 2018). Due to this effort, we are confident that we know of and monitor most, if not all major lek sites on the INL Site annually. We are currently investigating whether sage-grouse abundance trends would be more appropriately based on an analysis of all active leks on the INL Site, rather than on lek routes. The population trigger was designed to focus only on leks within the SGCA, and at a minimum it may be best to update the baseline leks to include all active leks within the SGCA. Alternatively, a trend

[4] Unpublished data, personal communication with Ann Moser, Wildlife Staff Biologist, Idaho Department of Fish and Game; Oct. 15, 2019.

analysis based on all INL Site leks may serve the dual purpose of providing long-term context and supporting population trigger monitoring. We are aware that the Western Association of Fish and Wildlife Agencies grouse technical team and other grouse researchers are working on a Population Monitoring and Analysis Guidelines document[5]. When those guidelines become available and the BLM Land Use Plan is released, it may be appropriate for DOE and USFW to revisit the topic of restructuring the population trigger.

Update the Habitat Trigger Baseline

The previous INL Site vegetation community classification and map was published in 2011 (Shive et al. 2011), and represented the first significant effort to standardize vegetation community classification and independently quantify map accuracy. The INL Site vegetation map is used to support numerous monitoring projects and was the basis for defining the sagebrush habitat conservation trigger in the CCA (DOE-ID and USFWS 2014).

In 2017, the ESER program initiated an update that included a new vegetation classification and map delineating vegetation class distribution across the INL Site. Three main factors justified updating the vegetation classification and map. First, four large wildland fires burned approximately 23% of the INL Site after the 2011 mapping was completed, leaving the map outdated in those regions. Second, there were numerous map polygons assigned to two-class complexes, which can overestimate the area of some individual classes and can make it more difficult to directly target sampling or monitoring in one specific vegetation class. Finally, field observations and habitat monitoring data, especially within recently burned areas, suggest that vegetation communities had begun to shift in composition, and in some regions non-native annual grass and forb abundance had increased considerably.

The methods for the vegetation map update remained the same as the previous vegetation map and consisted of manual delineations using high resolution aerial imagery, image-derived layers (e.g., Normalized Difference Vegetation Index) and ancillary GIS data layers. The only major change in methods was that the manual delineations were performed at a 1:6,000 scale compared to the previous 1:12,000 (Shive et al. 2019). The finer scale mapping allowed for two-class complexes to be split into individual map classes and improved the spatial accuracy for vegetation classes of interest (e.g., big sagebrush).

Previously, there were four vegetation classes combined to produce the CCA sagebrush habitat layer, which included Wyoming Big Sagebrush Shrubland, Basin Big Sagebrush Shrubland, Big Sagebrush Shrubland, and Low Sagebrush Dwarf Shrubland (DOE and USFWS 2014). The new classification simplified the number of vegetation classes with each class encompassing a broader range of variability. The new classification resulted in only three sagebrush-dominated vegetation classes that, when combined, represent sagebrush habitat (Big Sagebrush – Green Rabbitbrush (Threetip Sagebrush) Shrubland, Big Sagebrush Shrubland, Low Sagebrush Shrubland).

When the three new vegetation map classes were combined to produce a new estimate of sagebrush habitat across the INL Site, the total area was 109,822.7 ha (271,377.9 acres). This is approximately 6.4% lower than the original sitewide sagebrush habitat estimate of 117,300 ha (289,854.7 acres). Figure 6-1 shows where sagebrush habitat distribution differs between the 2011 baseline and the new 2019 vegetation map. However, the CCA sagebrush habitat trigger only considers area inside the SGCA. The sagebrush

[5] Personal communication with Ann Moser, Wildlife Staff Biologist, Idaho Department of Fish and Game; November 14, 2019.

habitat area within the SGCA was originally calculated at 78,557.5 ha (194,119.9 acres), and the new 2019 estimate of sagebrush habitat is 72,299.6 ha (178,656.2 acres). The new sagebrush habitat estimate is 8% lower within the SGCA following the map update.

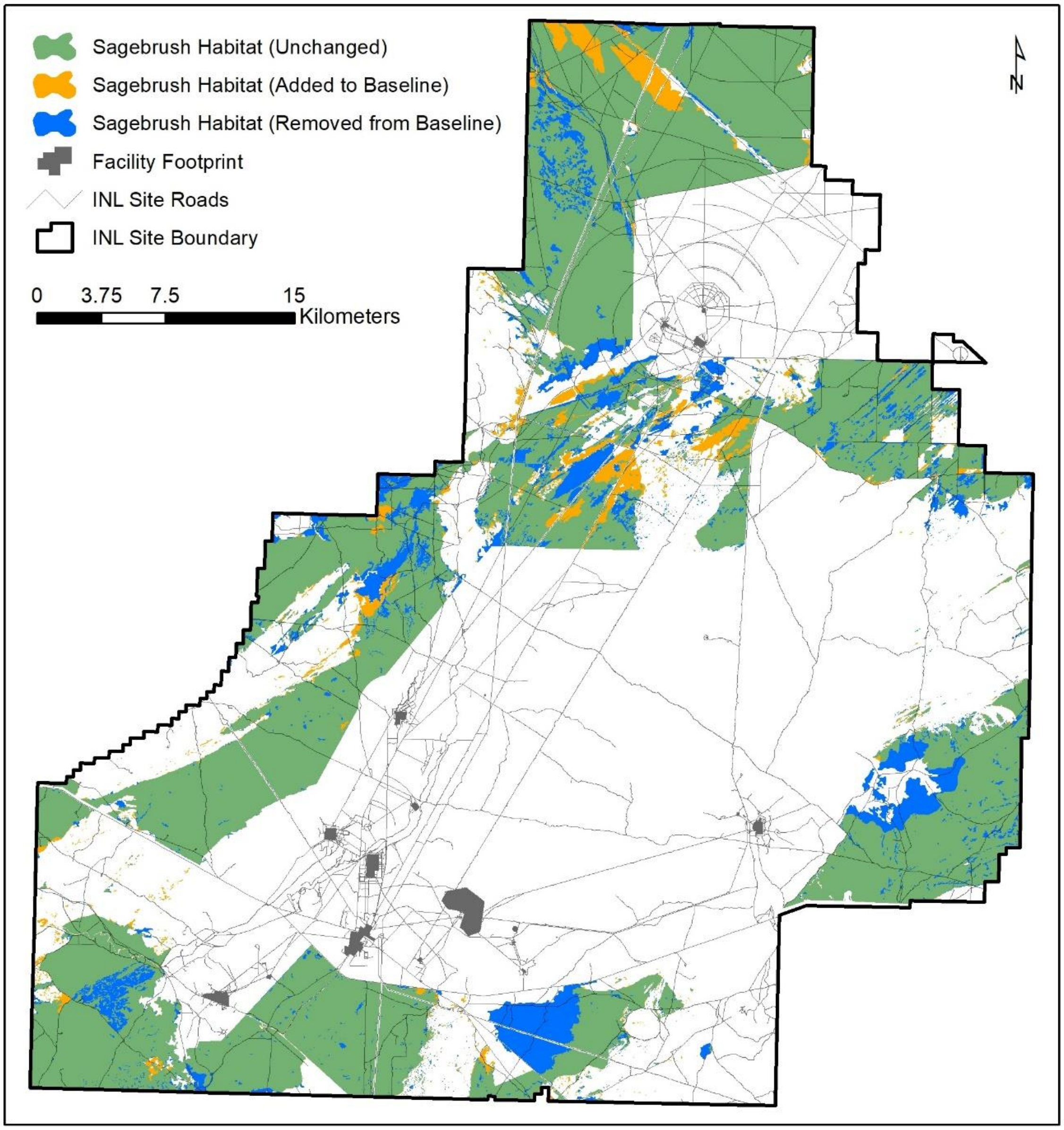

Figure 6-1. Sagebrush habitat within the Sage-grouse Conservation Area on the Idaho National Laboratory Site. The map shows sagebrush habitat distribution in 2019 relative to the 2011 baseline.

It is important to note that the difference in sagebrush habitat area is not caused by actual loss of habitat but rather the mapping scale used to define the new distribution. Because the 2011 vegetation map included polygons assigned to two-class complexes, it is likely that our initial estimate of sagebrush habitat was an overestimate. The 2019 vegetation map has eliminated all two-class complexes by increasing the mapping scale, thus allowing those polygons to be separated and mapped as two individual map classes. The reduction in sagebrush habitat area is more reflective of the true distribution on the ground, and as we continue to improve upon the INL Site vegetation map, the data will become increasingly accurate. It is unlikely that remote sensing methods will ever be as detailed and accurate as field-based mapping, but given the size and extent of the INL Site, mapping with high resolution imagery is the only cost-effective, feasible way to maintain and accurately monitor changes to sagebrush habitat through time.

We propose to update the habitat trigger to 72,299.6 ha (178,656.2 acres) to incorporate the best available data. Because there has been negligible loss of sagebrush habitat (< 0.01%) within the SGCA due to wildland fire or infrastructure expansion since the signing of the CCA, a change to the baseline should not be interpreted as a way to reset the trigger while ignoring true losses to habitat from natural disturbances or INL Site mission activities.

Add a Cheatgrass Status Update to the Threats Section of Future CCA Reports

Conservation Measure 4 and related Monitoring Task 7 addressed the risk of cheatgrass spread through a targeted inventory effort. When it became apparent the inventory approach was not achieving its intended objectives, the annual inventory effort was curtailed and the concerns previously targeted by Conservation Measure 4 were redirected through Conservation Measures 1 and 2 (Shurtliff et al. 2019), which address cheatgrass risk as a component of wildland fire and infrastructure development. Although Conservation Measures 1 and 2 sufficiently address the primary drivers for cheatgrass risk, they lack a cheatgrass monitoring component. Given the importance of the cheatgrass risk and its potential impacts on recovering sagebrush habitat, adding a brief section about cheatgrass status to the threats section of the annual monitoring report may be warranted. Drafting this section would require relatively minimal effort, as data already collected through the habitat condition and distribution monitoring could be used. Including a cheatgrass report in the threats section of the report would enhance our ability to discuss cheatgrass specifically as a threat, and not just as a component of habitat condition.

6.3 Changes made to the CCA in 2019

The USFWS and DOE made no changes to the CCA or associated monitoring tasks in 2019.

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. ESER workplan for 2020.

Task	Schedule and Changes for 2020
1. Lek Counts and Lek Route Surveys	• We will continue to monitor all active leks and a rotational subset of inactive leks.
4. Raven Nest Surveys	• No changes to the surveys are anticipated.
5. Sagebrush Habitat Condition Trends	• Sample all annual monitoring plots (*n* = 75) and set 3 of the rotational plots (*n* = 50). • Update annual habitat condition analyses and continue to explore trend analyses.
6. Monitoring to Determine Changes in Sagebrush Habitat Amount and Distribution	• No work to be conducted on this task inside recently burned area until this region has a few years to naturally reestablish. 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	• Updated Idaho NAIP imagery will be available in 2020, and we will systematically review the INL Site to document evidence of expansion of linear features and losses of sagebrush habitat from project footprint expansions.

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APPENDIX A.

A complete list of all species documented on the 71 annual habitat monitoring plots (46 sagebrush plots and 25 non-sagebrush plots) in 2019. Nomenclature follows the U.S. Department of Agriculture PLANTS National Database (2019).

Scientific Name	Common Name
Achnatherum hymenoides	Indian ricegrass
Agropyron cristatum	crested wheatgrass
Allium acuminatum	Hooker's onion/ tapertip onion
Allium textile	textile onion
Alyssum desertorum	desert alyssum/ desert madwort
Arabis cobrensis	sagebrush rockcress
Arabis holboellii	Holboell's rockcress
Artemisia arbuscula	low sagebrush/ little sagebrush
Artemisia nova	black sagebrush
Artemisia tridentata	big sagebrush
Artemisia tridentata Nutt. ssp. tridentata	basin big sagebrush
Artemisia tripartita	threetip sagebrush
Astragalus agrestis	purple milkvetch
Astragalus curvicarpus	curvepod milkvetch
Astragalus filipes	basalt milkvetch
Astragalus lentiginosus	freckled milkvetch
Astragalus purshii	woollypod milkvetch
Atriplex confertifolia	shadscale saltbush
Atriplex falcata	sickle saltbush/ Nuttall saltbush
Bromus arvensis	field brome
Bromus tectorum	cheatgrass
Carex douglasii	Douglas' sedge
Castilleja angustifolia	northwestern Indian paintbrush
Chaenactis douglasii	Douglas' dustymaiden

Scientific Name	Common Name
Chenopodium leptophyllum	slimleaf goosefoot/ narrowleaf goosefoot
Chrysothamnus viscidiflorus	yellow rabbitbrush/ green rabbitbrush
Cordylanthus ramosus	bushy bird's beak
Crepis acuminata	tapertip hawksbeard
Cryptantha interrupta	Elko cryptantha
Cryptantha scoparia	Pinyon Desert cryptantha
Descurainia sophia	herb sophia
Elymus elymoides	bottlebrush squirreltail
Elymus lanceolatus	thickspike wheatgrass
Eriastrum wilcoxii	Wilcox's woollystar
Ericameria nauseosa	rubber rabbitbrush/ gray rabbitbrush
Erigeron filifolius	threadleaf fleabane
Erigeron pumilus	shaggy fleabane
Eriogonum microthecum	shrubby buckwheat/ slender buckwheat
Eriogonum ovalifolium	cushion buckwheat
Gayophytum diffusum	spreading groundsmoke
Grayia spinosa	spiny hopsage
Gutierrezia sarothrae	broom snakeweed
Halogeton glomeratus	saltlover
Hesperostipa comata	needle and thread grass
Ipomopsis congesta	ballhead gilia
Ipomopsis minutiflora	littleflower gilia/ littleflower ipomopsis
Krascheninnikovia lanata	winterfat
Lactuca serriola	prickly lettuce
Lappula occidentalis	flatspine stickseed
Leymus cinereus	basin wildrye
Leymus flavescens	yellow wildrye

Scientific Name	Common Name
Linanthus pungens	granite prickly phlox
Machaeranthera canescens	hoary tansyaster
Mentzelia albicaulis	whitestem blazingstar
Oenothera pallida	pale evening primrose
Opuntia polyacantha	plains pricklypear
Packera cana	woolly groundsel
Pascopyrum smithii	western wheatgrass
Phlox aculeata	sagebrush phlox/ pricklyleaf phlox
Phlox hoodii	Hood's phlox/ spiny phlox
Phlox longifolia	longleaf phlox
Poa secunda	Sandberg bluegrass
Pseudoroegneria spicata	bluebunch wheatgrass
Psoralidium lanceolatum	lemon scurfpea
Salsola kali	Russian thistle
Schoenocrambe linifolia	flaxleaf plainsmustard
Sisymbrium altissimum	Jim Hill mustard/ tall tumblemustard
Sphaeralcea munroana	Munro's globemallow/ whitestem globemallow
Stenotus acaulis	stemless mock goldenweed
Tetradymia canescens	spineless horsebrush
Townsendia florifer	showy Townsend daisy
Tragopogon dubius	yellow salsify

U.S. Department of Agriculture, Natural Resources Conservation Service. 2017. The PLANTS Database (http://plants.usda.gov, December 6, 2017). National Plant Data Team, Greensboro, NC 27401-4901 USA.