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

2016 Summary Report

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Implementing the Candidate Conservation Agreement for Greater Sage-Grouse on the Idaho National Laboratory Site: 2016 Summary Report

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

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ACRONYMS

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
IDFG	Idaho Department of Fish and Game
INL	Idaho National Laboratory
MFC	Materials & Fuels Complex
MPLS	Males per lek surveyed
NAIP	National Agricultural Imaging Program
NEPA	National Environmental Policy Act
NOAA	National Oceanic and Atmospheric Administration
RWMC	Radioactive Waste Management Complex
SGCA	Sage-grouse Conservation Area
UAV	Unmanned Aerial Vehicle
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

1. 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 summarizing results from eight monitoring tasks (Section 11), updating the USFWS on DOE's progress toward achieving stated conservation objectives (Section 10), and providing other relevant information prior to an annual meeting between the two agencies. This report briefly summarizes results from the 2016 inventory and monitoring tasks completed by DOE's Environmental Surveillance, Education, and Research (ESER) Program, and provides other information supporting sage-grouse conservation and the CCA. A companion report that includes a full description of methods, data, and discussion about results, was also prepared by ESER (Shurtliff et al. 2017) and can be found at http://www.idahoeser.com/Publications_Wildlife.htm.

The primary purpose of this report is to summarize monitoring and inventory results and conclusions so DOE and USFWS can track population and habitat trends and make informed decisions relative to adaptive regulatory triggers outlined in the CCA. On the INL Site, the two triggers and criteria that define them, which would initiate responsive action by both agencies, are:

- Population Trigger: Peak male attendance, averaged over three years on the 27 leks within the Sage-grouse Conservation Area (SGCA), decreases by 20 percent or more (i.e., ≤ 253 males) compared with the 2011 baseline of 316 males;
- Habitat Trigger: Total area designated as sagebrush habitat within the SGCA is reduced by 20 percent or more (i.e. ≥15,712 ha [38,824 ac]) of the 2013 baseline of 78,558 ha (194,120 ac).

Information provided here will inform a 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 will ensure 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.

This document groups related inventory and monitoring task reports into three chapters: Population Trigger Monitoring (Chapter 2), Habitat Trigger Monitoring (Chapter 3), and Threat Monitoring (Chapter 4). Each of these chapters summarizes results of pertinent monitoring tasks outlined in section 11.1 of the CCA. Chapter 5 documents how DOE and its contractors implemented the 13 conservation measures listed in the CCA during 2016. Chapter 6 brings together the main results and conclusions from the eight monitoring tasks and addresses them in light of the ultimate goal of the CCA, which is to conserve sage-grouse. Finally, Chapter 7 outlines ESER's work plan for the upcoming year and highlights changes that will be made to the past year's activities.

2. POPULATION TRIGGER MONITORING

In 2013, DOE initiated the following three monitoring tasks designed to track the number of male sage-grouse at active leks and document additional active leks on the INL Site (DOE and USFWS 2014):

1) Lek Surveys—Surveys of all active leks on the INL Site. These include leks located in and out of the SGCA and leks on the three Idaho Department of Fish and Game (IDFG) survey routes;
2) Historical Lek Surveys—Surveys of historical leks on the INL Site to determine if sage-grouse still use those areas;
3) Systematic Lek Discovery Surveys—Surveys of poorly sampled regions of the INL Site to discover additional active leks, especially in the SGCA.

Task 1 produces an index of peak male attendance across the 27 leks in the SGCA that were used to establish the baseline value of the population trigger (DOE and USFWS 2014). Task 1 also provides information about abundance trends across the three IDFG lek routes and all other active leks on the INL Site (DOE and USFWS 2014). The purpose of Tasks 2 and 3 is to identify unknown active leks on the INL Site. Our goal is to use information from the three tasks to track population trends and establish new, permanent lek routes on the INL Site before the 2017 lek season (DOE and USFWS 2014).

2.1 Task 1—Lek Census and Lek Route Surveys

Summary of Results: *The 3-year average peak male attendance (2014-2016) across the 27 baseline leks in the SGCA was 13 percent higher than last year and is now 152 percent of the population trigger threshold. Lek route data suggest that the sage-grouse breeding population on the INL Site was stable or increasing from 1999–2006, after which it declined, perhaps until 2012. Male lek attendance has increased steadily during the past three years.*

2.1.1 Introduction

Task 1 consists of surveying all known active leks on the INL Site, including the 27 baseline leks located in the SGCA and all other known active leks on the INL Site (DOE and USFWS 2014). Leks on three IDFG survey routes (monitored annually since 1999; Fig. 2-1) fall into one of these two categories, but are analyzed separately as well to maintain historical context. The primary purpose of Task 1 is to provide information that will allow us to track trends on the 27 baseline leks and monitor the population trigger.

We analyzed historical data from IDFG lek routes differently this year. In past reports, we simply displayed peak male attendance per route from 1999 to present. This method did not account for the increasing number of leks that had been visited during the survey period. A more useful approach is to calculate the mean number of males per lek (or per active lek) for each route at peak male attendance, which produces a metric similar to that used by the IDFG for setting sage-grouse hunting bag limits. We were unable to calculate these averages in the past for the Lower Birch Creek route because the ESER database lacked information about the number of leks visited each year prior to 2010 when the IDFG performed the lek route surveys. Recently, we obtained the missing data from the IDFG, enabling us to improve the analysis.

2.1.2 Results and Discussion

SGCA Baseline Leks

We surveyed each of the 27 SGCA baseline leks 3–7 times ($\bar{x}$=4.9 surveys, *s*=1.7; Fig. 2-1). The sum of peak male attendance counts across the 27 leks was 471, a 41 percent increase over 2015. The three-year mean (2014-2016) is now 384 males, which is 13 percent higher than last year's 2013-2015 mean (Fig. 2-2), and 152 percent of the threshold (153 males) that would trigger prescribed action by DOE and the USFWS (DOE and USFWS 2014). The three-year mean has been stable or has increased each of the past three years.

Following the 2016 field season, 19 baseline leks remain classified as active (one was reclassified as inactive). In each of the past four years, at least one baseline lek per year has been reclassified as inactive. These results should not be interpreted as evidence that eight leks have been abandoned in the past four years but rather that at least five years of data have accumulated for most leks, allowing for more precise lek classifications (Whiting et al. 2014). As noted above, the total number of male sage-grouse attending the active leks is higher than it has been since the baseline was established.

Other Active Leks

We surveyed 30 additional (i.e. non-baseline) active leks a mean of 3.8 times each (range=1–7, *s*=1.5), and serendipitously, discovered one new lek (INL 162, Fig. 2-1). Average peak male attendance was 10.1 males per lek (range: 0–38, *s*=11.5), down from 10.6 males per lek in 2015 (*n*=23) and 13.2 males per lek in 2014 (*n*=20). The apparent downward trend is a reflection on the size of leks that have been added to the survey list in recent years. For example, the average peak male attendance at nine active leks surveyed in 2016 that were not classified as active in 2015 was 6.4 males.

IDFG Lek Routes

The average number of males per lek surveyed (MPLS) decreased on the Tractor Flats route from a 3-year mean of 39.1 (1999–2001) to a low of 7.6 in 2013 (Fig. 2-3). During the past three years, however, male attendance has increased steadily to 16.4 MPLS in 2016, which is the highest level since 2010 (19.8 MPLS). The Radioactive Waste Management Complex (RWMC) lek route has been stable since 2008, ranging from 10.7–15.7 MPLS. The Lower Birch Creek route has exhibited low variability between consecutive years during the past nine years, and after declining from 8.4–6.0 MPLS between 2008 and 2013, the route has steadily increased each of the past three years, reaching 13.3 MPLS in 2016. Only three of the past 18 years had a higher MPLS than in 2016.

The downward trend on the Tractor Flats route since 1999 likely reflects local impacts of wildland fire on sage-grouse nesting habitat near the lek route. A 164 km^2 (40,539 acres) fire burned over a lek that was at the northern end of the route in 1999. By 2004, this lek, which was one of five on the route, was vacated. In 2010, the Jefferson fire burned 52 percent of the lek route (9.7 km) and one more of the six leks that were surveyed annually at that time. Thus, by 2011, a third of the leks that were part of the official route were within a large burned area. No other lek routes had fires that burned over any leks or any part of the lek route.

Taken together, lek route data on the INL Site suggest that the sage-grouse breeding population was stable to increasing between 1999 and 2006, with a peak occurring from 2005–2007. By 2008, male attendance (and presumably abundance) was substantially lower and may have continued to decline through 2012. Male attendance has increased steadily during the past three years.

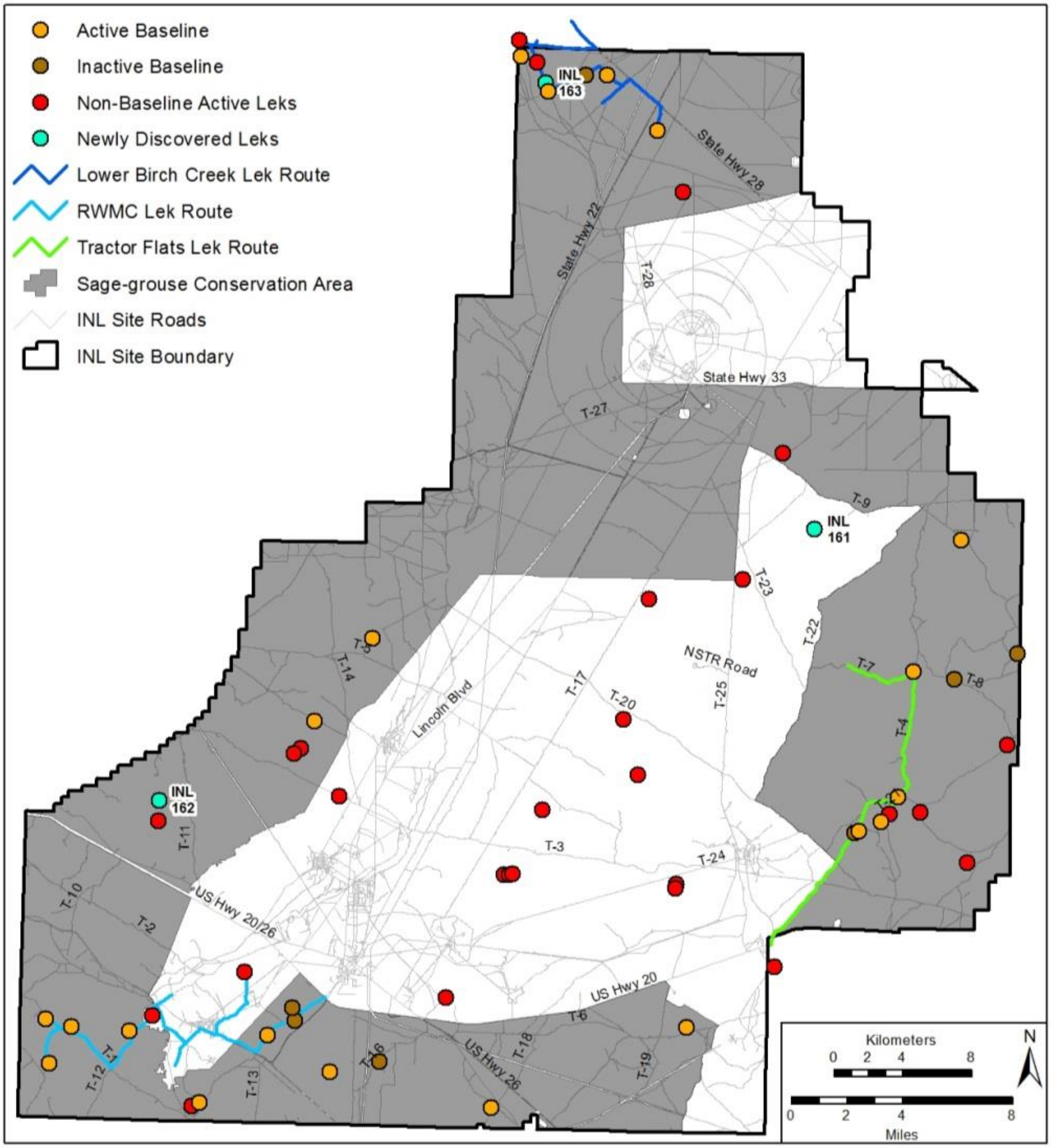

Figure 2-1. Twenty-seven baseline leks (both active and non-active) and other active leks that were surveyed in 2016. One baseline lek was subsequently reclassified as inactive following the surveys. Also shown are three new leks discovered or classified as active in 2016.

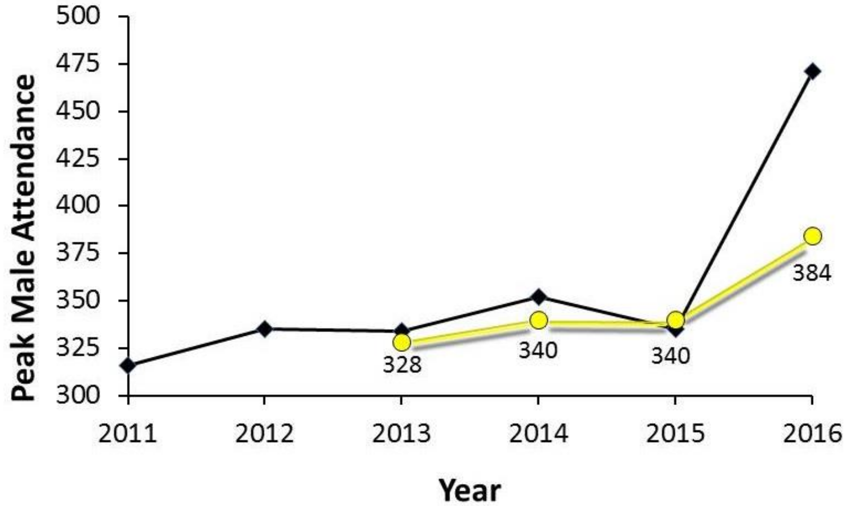

Figure 2-2. Peak male attendance on 27 leks in the SGCA used to calculate the original baseline value. Black diamonds represent annual counts, and yellow dots represent the 3-year running average.

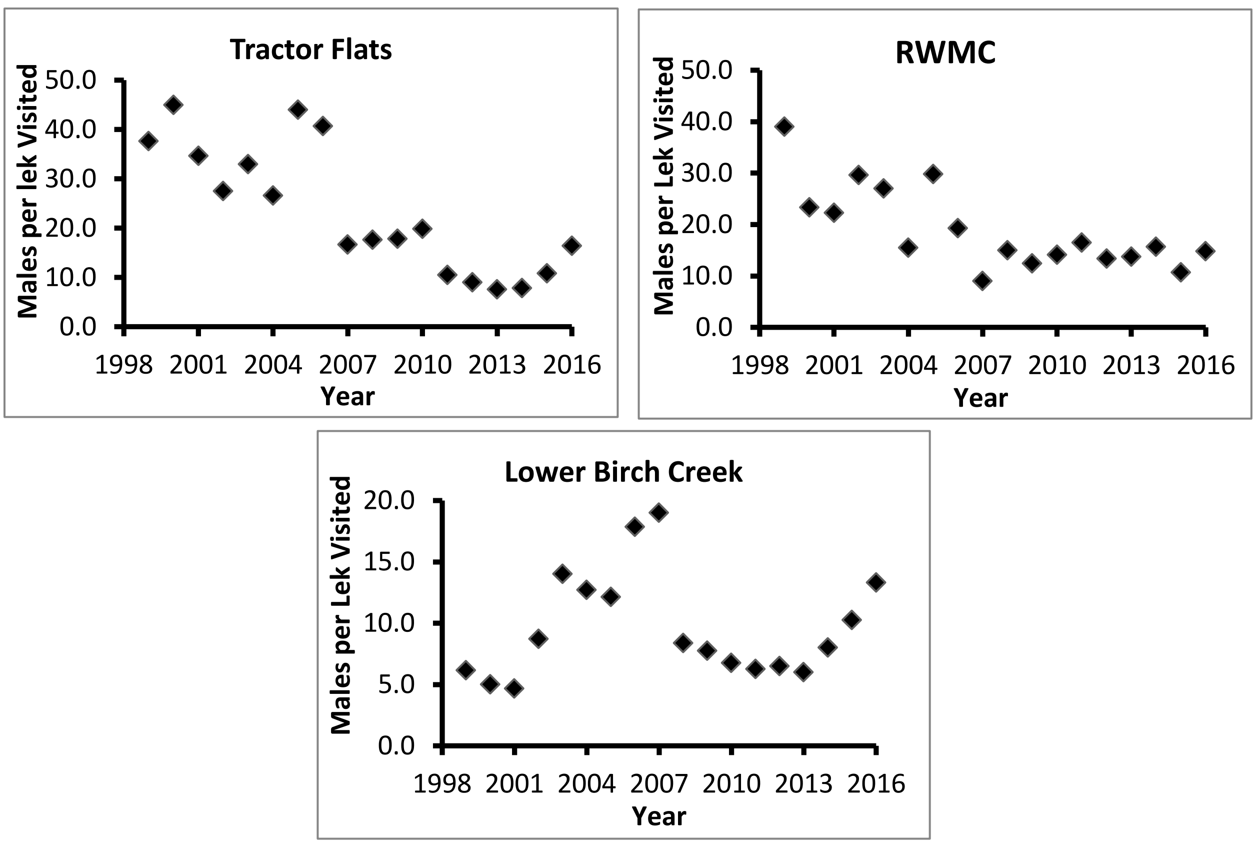

Figure 2-3. Mean number of males per lek surveyed at peak male attendance on three IDFG lek routes from 1999-2016 on the INL Site. The number of leks visited each year increased over time as follows: Tractor Flats (3-7 leks), RWMC (2-9 leks), and Lower Birch Creek (6-10 leks). Note that the Y-axis is at a different scale in the Lower Birch Creek panel.

2.2 Task 2—Historical Lek Surveys

<u>Summary of Results</u>: No sage-grouse were observed on any of the 15 historical lek sites surveyed in 2016. Following the breeding season, ten of these lek sites were reclassified as inactive, and five remain to be surveyed in 2017.

2.2.1 Introduction

During the past several decades, many leks have been documented on the INL Site as a result of surveys and opportunistic observations of displaying sage-grouse (Whiting and Bybee 2011). Prior to 2009, many of these historical lek sites had not been surveyed for nearly 30 years. Since 2009, ESER biologists have revisited a subset of historical leks each spring to determine if the leks remain active based on current criteria (DOE and USFWS 2014). The objective of Task 2 was to determine which historical leks are active before establishing new lek routes (DOE and USFWS 2014).

2.2.2 Results and Discussion

We surveyed all historical leks two times each, both inside (*n*=7) and outside (*n*=8) the SGCA. No sage-grouse were observed on any of these 15 potential lek sites. Following the 2016 surveys, we reclassified ten historical leks as inactive because they have been surveyed for five years without at least two years of recorded breeding activity (Whiting et al. 2014). Five historical leks remain, all of which will require one additional survey season before they can be reclassified. Because the status of these five leks remains in question, and because all of these are well outside the SGCA, none of the five leks were considered when we created new lek routes this year (see section 2.5).

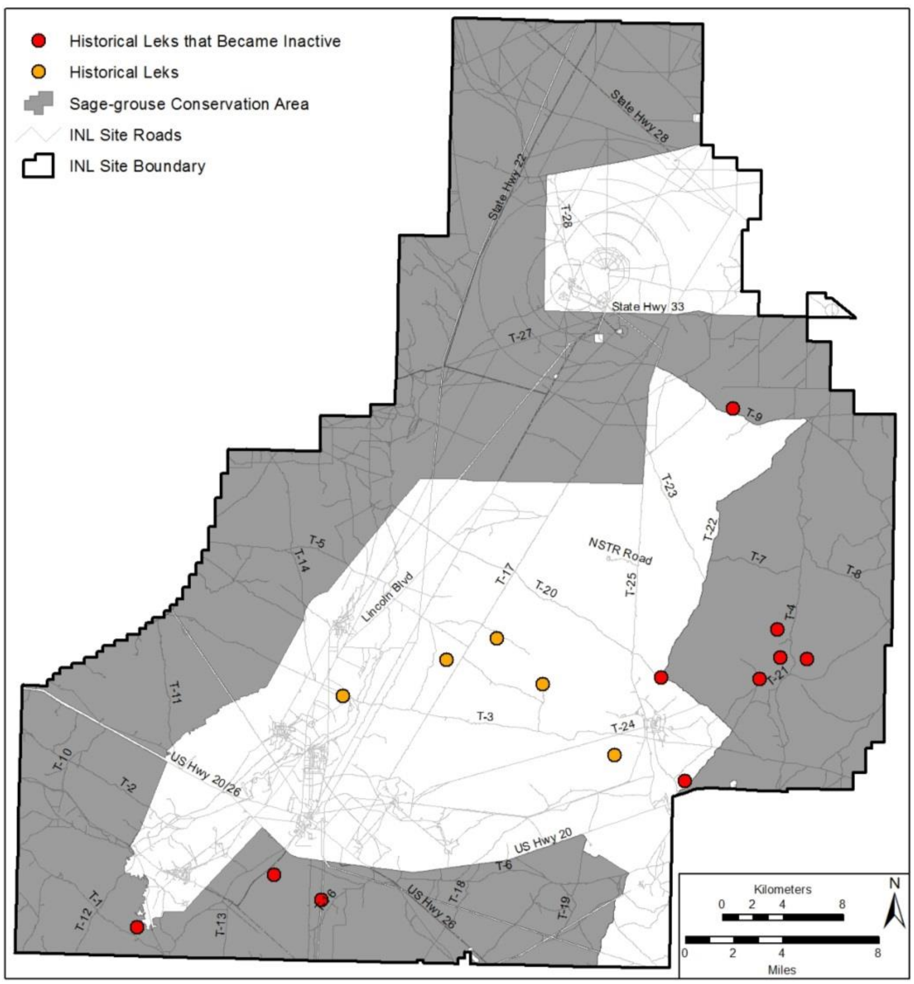

Figure 2-4. Historical leks surveyed in 2016. Those reclassified as inactive following the field season are shown in red.

2.3 Task 3—Systematic Lek Discovery Surveys

Summary of Results: Two active leks were discovered in 2016. Five leks have been documented on the INL Site under Task 3 since 2013.

2.3.1 Introduction

Known lek sites are few or absent across large portions of the SGCA (Fig. 2-1), even though habitat in these areas often appears to be adequate to support sage-grouse breeding and nesting activities (DOE and USFWS 2014). The objective of Task 3 is to survey suitable sage-grouse habitat within the SGCA where no leks are known to exist. Since 2013, ESER has systematically searched for unknown leks each spring. If a lek is discovered, it is included thereafter in ESER's annual monitoring program.

2.3.2 Results and Discussion

Between 28 March and 3 May, 2016, we completed 85 surveys (66 road, 19 remote) within the northeastern and southeastern sections of the INL Site and discovered one active sage-grouse lek (INL161, Fig. 2-5). After two surveys, the high count on INL161 was 7 males. Since surveys began in 2013, we have discovered five leks through Task 3.

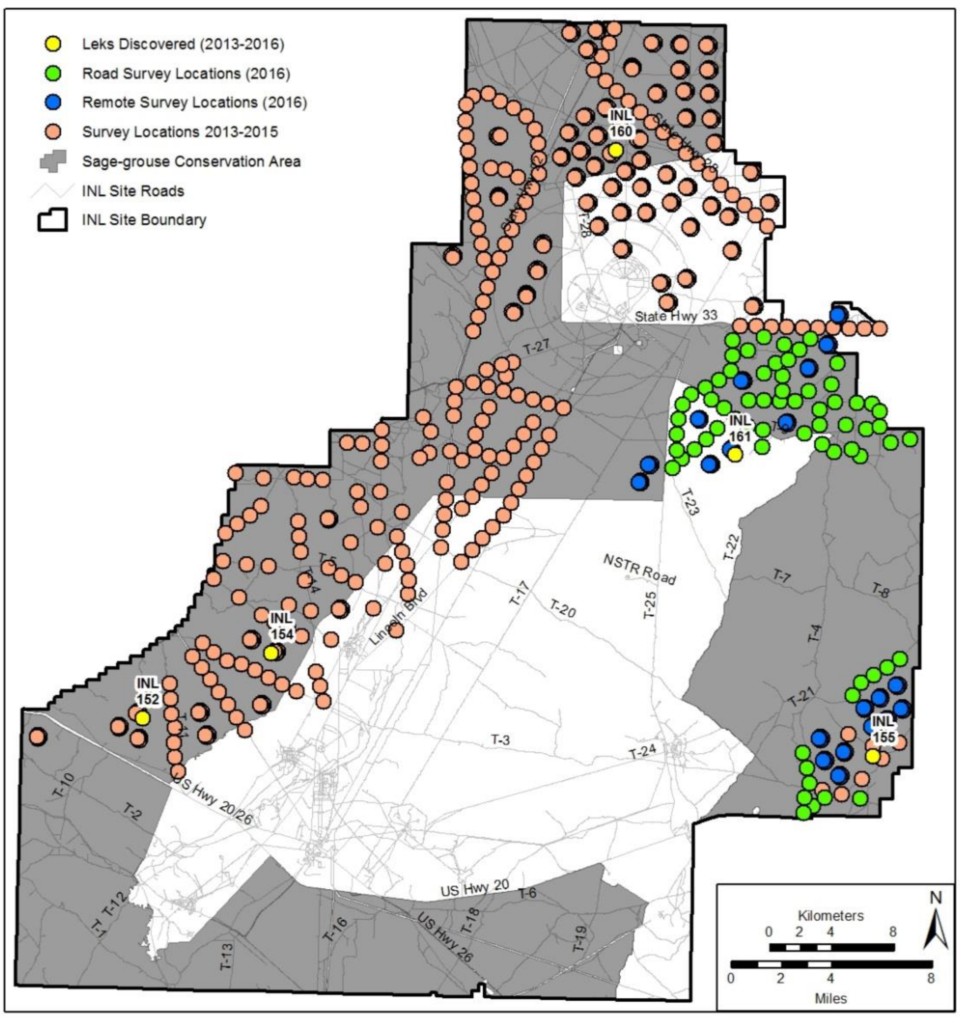

Figure 2-5. Locations of Task 3 surveys conducted since 2013. All active leks discovered as a result of these surveys are indicated by yellow dots.

2.4 Summary of Known Active Leks and of Changes in Lek Classification

At the end of the 2015 field season, 48 leks were classified as active on or near the INL Site, including two just outside the Site boundaries that are part of the IDFG survey routes. In 2016, two leks, INL 18 and INL 144, were downgraded to inactive status. Lek INL 18 was burned during the 2011 Jefferson fire, and no males have been seen at that site since 2013. Lek INL 144 was formerly a historical site where three males and 26 sage-grouse of unknown gender were seen once in 2014. No more than one sage-grouse has been observed at that site before or since that day during the past five years.

Three new leks were discovered in 2016 (two during discovery surveys and one during an IDFG lek route survey; Fig. 2-1). Thus, the total number of known active leks on or near the INL Site is currently 49 (Fig. 2-6).

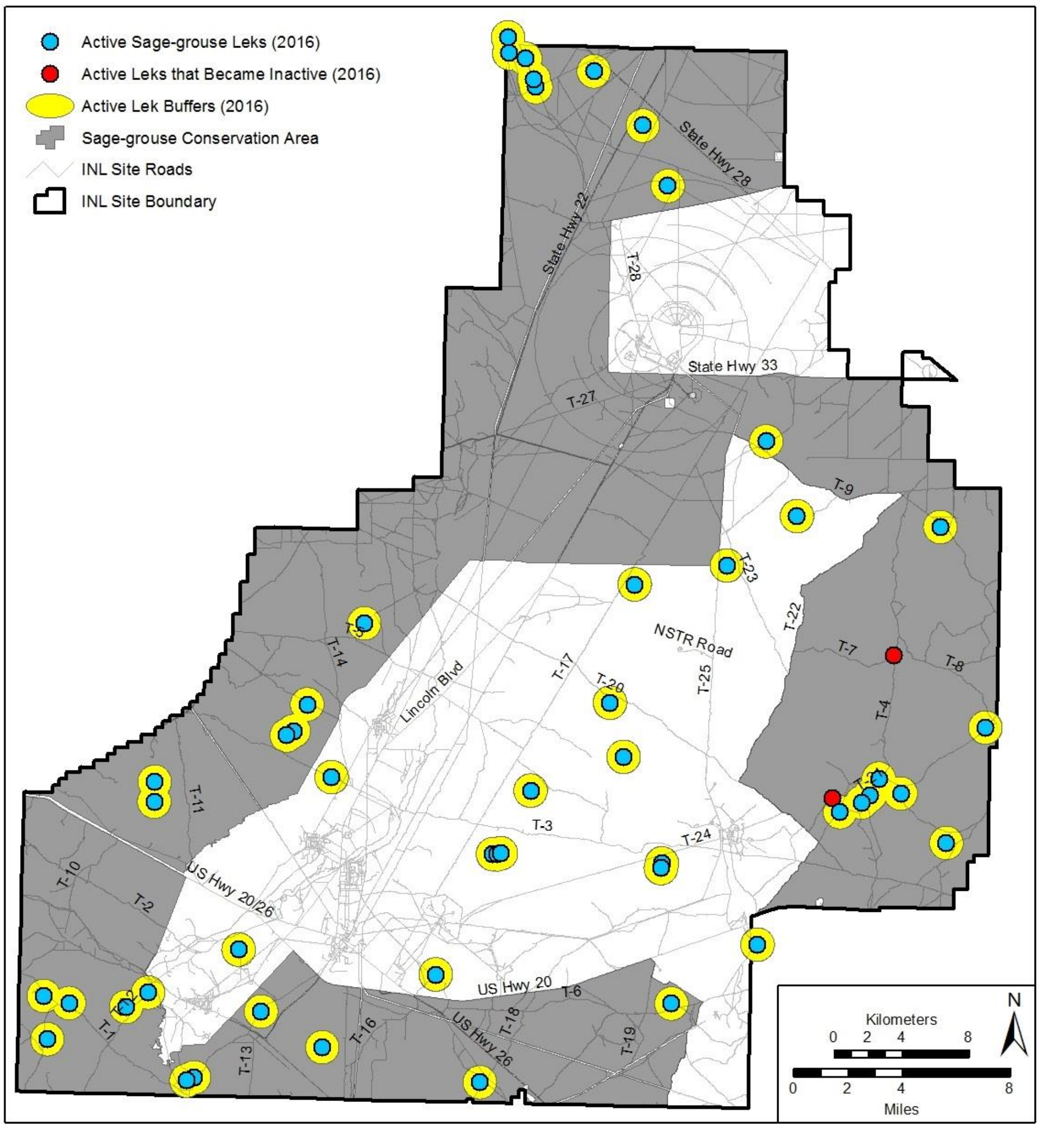

Figure 2-6. Following the 2016 field season, the locations of 49 active leks and two that were reclassified as inactive on or near the INL Site.

2.5 Adaptive Management—New Lek Routes for 2017

The CCA stipulates that following the 2016 field season, DOE would establish (in consultation with the IDFG) at least two new lek routes within the SGCA (Section 9.4.1, DOE and USFWS 2014). The advantage of assigning leks to routes is that route surveys ensure that each group of leks is surveyed in the same order and at roughly the same time relative to sunrise each visit. This temporal consistency is important because the time of morning that leks are visited, even within the traditional two-hour survey period, potentially influences the number of males counted (Fremgen et al. 2016). In addition, lek route data are comparable to regional IDFG data, and route surveys facilitate future repetition by others (Connelly et al. 2003).

Following the 2016 field season, ESER biologists used lek data from the past several years and knowledge of the roads and terrain to create five new lek routes on the INL Site (Fig. 2-7). Nearly all of the 17 leks that are part of these new lek routes are within the SGCA and are currently active. Guidelines provided by the IDFG were followed when establishing lek routes. In 2017, the five new routes and the three traditional IDFG routes will be surveyed (along with all other active leks on the INL Site). Following the 2017 season, DOE and the USFWS will reevaluate what an appropriate population trigger level should be based on new methods of data collection.

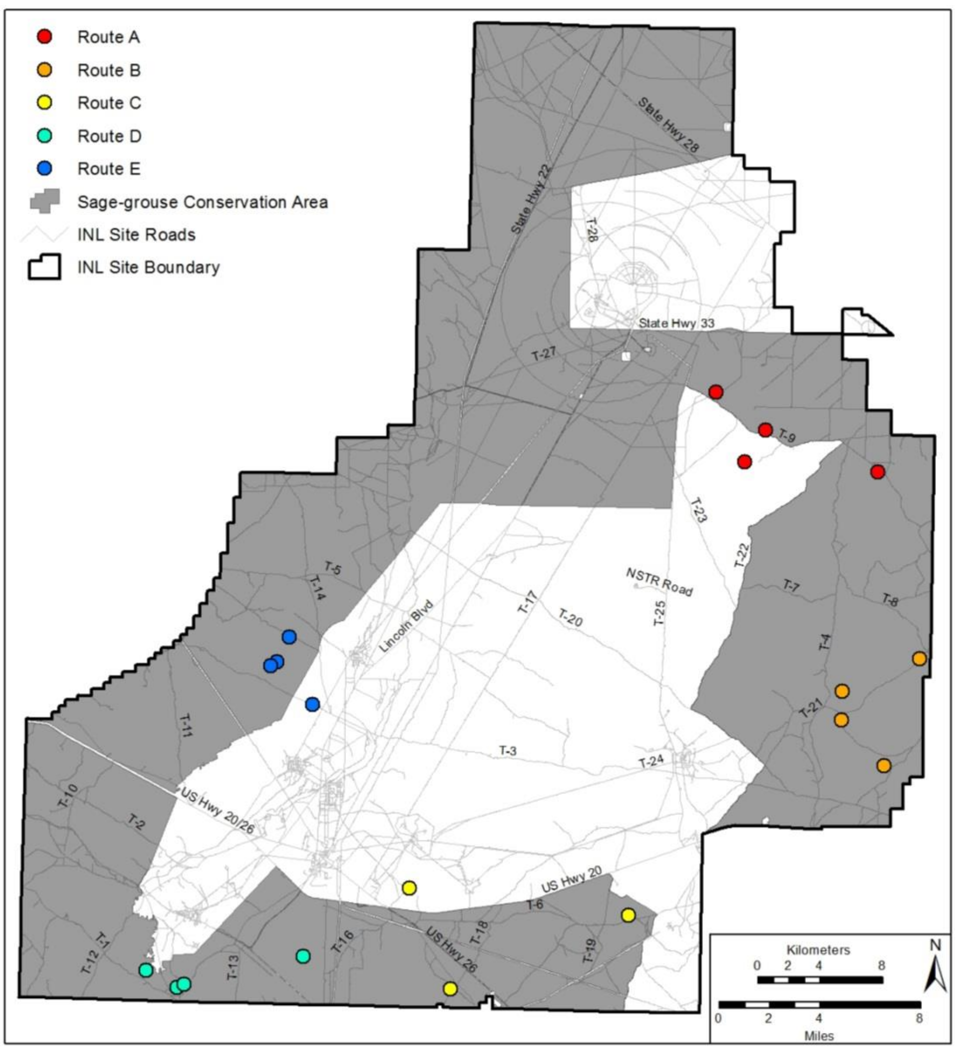

Figure 2-7. New lek routes that will be surveyed in conjunction with the three IDFG routes (Fig. 2-1) and other active leks, beginning in 2017.

3. HABITAT TRIGGER MONITORING

All vegetation-based estimates of sagebrush habitat 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 is 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 wildfire.

The current baseline value of the habitat trigger is defined as the total area designated as sagebrush habitat within the SGCA at the beginning of 2013, or 78,558 ha (194,120 ac). The trigger will trip if there is a 20 percent reduction in sagebrush habitat (i.e. a loss of >15,712 ha [38,824 ac]) within the SGCA. If the trigger trips, the USFWS will evaluate current habitat management on the INL Site and arrange a meeting with DOE to discuss plans for maintaining compliance with the CCA.

Two monitoring tasks 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—Sagebrush habitat quality data will document gains in habitat as non-sagebrush map polygons transition back into sagebrush classes, or when compositional changes occur within sagebrush polygons that may require a change in the assigned map class. This task also allows for ongoing assessment of habitat quality, or condition, within polygons mapped as sagebrush habitat, which facilitates comparisons between sagebrush habitat on the INL Site and sage-grouse habitat guidelines (e.g. Connelly et al. 2000).

Task 6: Monitoring to Determine Changes in Sagebrush Habitat Amount and Distribution—The sagebrush habitat quantity monitoring task is intended to provide an update to the current sagebrush habitat distribution, and primarily deals with losses to sagebrush habitat following events that alter vegetation communities. As updates are made to the 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 reflect the original mapping process and 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 big 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 enough area to redefine the polygon as a big 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

Summary of Results: *In map areas currently identified as sagebrush habitat, mean sagebrush cover and height are within suggested optimal ranges for sage-grouse breeding and brood-rearing habitat; perennial herbaceous height also meets habitat recommendations, but perennial herbaceous cover was lower than guideline minimums. All areas burned within the last two decades largely lack sagebrush; many have otherwise recovered healthy native plant communities while a few have non-native weed concerns. Habitat condition is similar across most allotments and is comparable to non-allotment areas.*

3.1.1 Introduction

The habitat condition monitoring task was developed to allow biologists to characterize broad-scale trends in habitat condition over time and to link vegetation composition data to map polygons that represent sagebrush habitat on the INL Site. We sample 75 plots, 48 of which are located in polygons currently identified as sagebrush habitat and 27 of which are located in previously burned areas recovering to sagebrush habitat, annually for cover, height, sagebrush density, sage-grouse sign, and anthropogenic disturbance. The annually-sampled plots are used to address current habitat condition and will eventually be used for habitat trend analysis. We sample an additional 150 plots on a rotational basis, using the same methodology, to increase sample sizes and to address potential habitat threats, specifically fire and livestock use.

3.1.2 Results and Discussion

We collected data on a total of 75 annual plots between June and August of 2016 (Fig. 3-1). We summarize these data below and compare them to previous years' values. We also summarize all rotational plot data sampled between 2013 and 2015.

General Habitat Condition – Annual Plots

Mean sagebrush cover from annual sagebrush habitat plots, and for the sagebrush habitat polygons they represent, is near the upper end of the range suggested for optimal breeding (15-25 percent) and brood-rearing (10-25 percent) habitat in arid sites (Connelly et al. 2000). Mean sagebrush height is also within the optimal range (40-80 cm; Table 3-1). Perennial grass/forb mean height values are above the minimum value recommended (18 cm) in current sage-grouse habitat guidelines (Connelly et al. 2000). Average perennial grass/forb cover on sagebrush habitat plots was about 2.5 percent lower in 2016 than specified for breeding and brood-rearing habitat (15 percent), but was much higher than it was on the same plots in 2013, the first year data were collected. Low herbaceous cover values, relative to habitat guidelines, do not appear to be a result of poor ecological condition, but rather the effect of soils and climate on the local ecosystem (Forman et al. 2013).

In the plots from recovering burned areas, about 12 percent absolute cover was from shrubs in 2016 and green rabbitbrush provided nearly all of that cover. Perennial grasses and forbs were responsible for much of the cover from native species on these plots in 2016 with about 21 percent absolute cover. Cover from non-native herbaceous species was about the same as that of native herbaceous species, but cover from non-natives was primarily from annuals, while cover from natives was primarily from perennials. Average cover and height of perennial grasses and forbs were greater in recovering habitat plots than in current sagebrush habitat plots (Table 3-1), but herbaceous cover was also much more annually variable in recovering habitat plots from 2013 through 2016, which had a greater impact on year-to-year stability of total vegetation cover in areas of recovering habitat.

Herbaceous functional groups are highly influenced by precipitation, and precipitation for three years prior to and up through most of the 2014 growing season, including sampling for this task, was below average. Total precipitation eventually exceeded annual averages in 2014 and approached annual averages in 2015 and 2016, but the timing of precipitation from August of 2014 through August 2016 was unusual for the region and affected vegetation on the INL Site during the 2015 and 2016 growing seasons (see Shurtliff et. all 2017 for details). Cover from perennial herbaceous species, mean cheatgrass (*Bromus tectorum*) cover, and cover from all annual forbs was probably uncharacteristically low in 2013 and 2014 (Shurtliff et al. 2015) and was probably much higher than expected in 2015 and 2016 due to the anomalous precipitation patterns in those years. Increases in cheatgrass and Russian thistle (*Salsola kali*) between 2014 and 2016 are notable, particularly in the plots that are in recovering burned areas (details available in Shurtliff et al. 2017).

Assessment of Potential Threats to Habitat – Rotational Plots

The threat of wildland fire to habitat condition is two-fold: it removes sagebrush from plant communities and it increases the risk for dominance by non-native annuals. Rotational plot summaries indicate green rabbitbrush provided most of the shrub cover in burned areas and sagebrush cover was less than one percent in all burns sampled, even those more than twenty years old. Perennial grass cover in burned areas was about double that of unburned habitat, which is consistent with patterns from annual habitat condition plots. Cover from non-native annuals, primarily cheatgrass and Russian thistle, was quite variable from one burn to another and ranged from about 2 percent to nearly 14 percent; non-native annual cover from unburned habitat was 1.7 percent. Though they still lack sagebrush, some burns like the 1994 Butte City fire and the 2000 Tin Cup fire are in good ecological condition with high native herbaceous cover and diversity and very low cover from introduced annuals. Others aren't recovering as well. Burned areas of concern include the 1996 fire with relatively low perennial grass cover (8.3 percent) and relatively high cheatgrass cover (6.3 percent), and the 2010 Middle Butte fire with more than 10 percent cover from cheatgrass.

Livestock use poses a threat to habitat condition because of its potential to alter the composition of the herbaceous component of sage-grouse habitat. Grazing and associated activities may cause loss of native, perennial species and increases in non-native annuals, which could reduce the habitat value of an area. Vegetation composition was compared among allotments and between each allotment and analogous non-allotment areas. Recovering burned areas and current sagebrush habitat were analyzed separately within each allotment and within non-allotment comparisons. Although areas of specific, localized degradation were observed in several allotments, rotational plot summaries didn't indicate broad declines in habitat condition across any of the allotments surveyed. In current sagebrush habitat, the only notable exception is the Sinks Allotment, which had less than 5 percent native, perennial grass cover compared to about 11 percent in non-allotment areas and between 7 percent and 9 percent in other allotments (Twin Buttes, Mahogany Butte, and Quaking Aspen). Recovering habitat generally had higher cover from non-native annuals than current sagebrush habitat, but non-native cover was similar among allotments (Twin Buttes, Dead Man, and Howe Peak) and non-allotment areas.

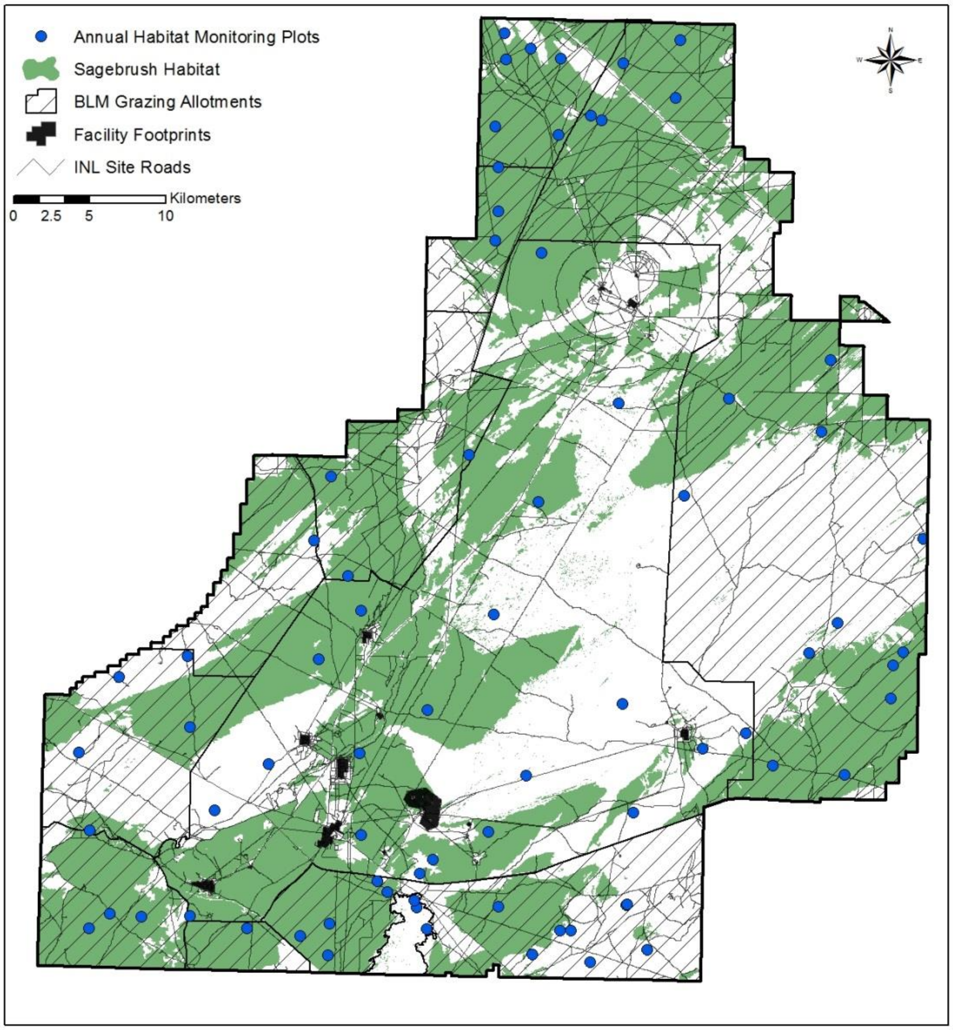

Figure 3-1. CCA sage-grouse habitat condition monitoring plots sampled in 2016 on the INL Site.

Table 3-1. Summary of selected vegetation measurements for characterizing condition of current sagebrush habitat and post-fire recovering non-sagebrush areas on the INL Site in 2016. The mean marked by an * is elevated because it includes seven plots with notable seedling germination events (most seedlings will fail due to self-thinning); the adjusted mean sagebrush density (without the seven high-germination plots) is 3.09 individuals/m^2.

	Mean Absolute Cover (percent)	Mean Height (cm)	Mean Density (individuals/m^2)
Sagebrush Habitat Plots (n=48)			
Sagebrush	21.89	49.44	11.41*
Perennial Grass/Forbs	12.64	24.49	
Non-sagebrush Plots (n=27)			
Sagebrush	0.25	39.72	0.08
Perennial Grass/Forbs	23.05	33.65	

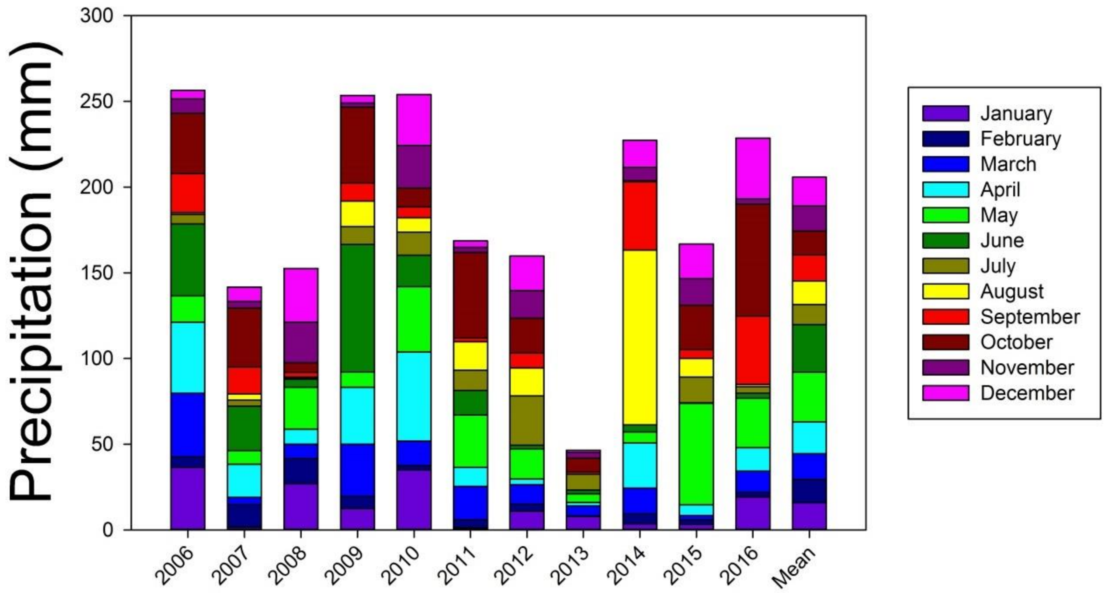

Figure 3-2. Annual precipitation by month from the Central Facilities Area, INL Site. Mean monthly precipitation includes data from 1950 through 2016.

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

<u>Summary of Results</u>: The sagebrush habitat baseline value remains unchanged in 2016 with no mapped loss within the SGCA.

3.2.1 Introduction

A 20 percent loss of sagebrush habitat from the 2012 baseline has been identified as a conservation trigger in the CCA (DOE-ID and USFWS 2014). The goal of Task 6 is to maintain an updated INL Site vegetation map to accurately document changes in sagebrush habitat area and distribution. Accomplishments on this monitoring task in 2016 included delineating one small fire that burned in summer of 2015 and removed sagebrush habitat, and collecting field data at plots distributed within the 2011 T-17 Fire to assist with mapping the reestablished vegetation classes.

3.2.2 Results and Discussion

"268 Fire" Mapping

On June 18, 2015 there was one small fire located north of the roadside, southwest of Central Facilities Area (CFA). This was a small human-caused wildland fire named the "268 Fire" that burned prior to the collection of the 2015 Idaho National Agricultural Imaging Program (NAIP) imagery. The point coordinates for the general location were provided by the INL Fire Chief, but the actual footprint of the burned area was not mapped. We digitized the burned area boundary and found that 1.5 ha (3.7 ac) of sagebrush habitat was lost (Fig. 3-3). However, the burned area was outside of the SGCA, so the baseline acreage of sagebrush habitat remains unchanged.

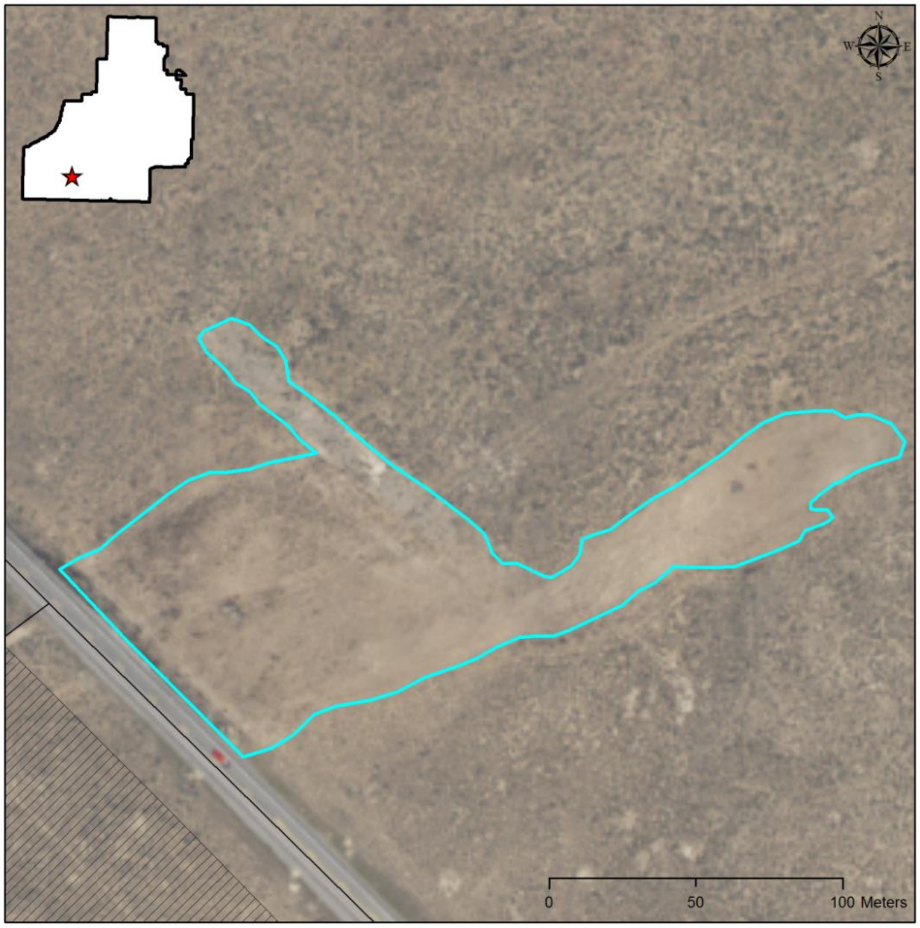

Figure 3-3. The mapped burned area boundary of the 2015 “268 Fire” on the INL Site. The striped polygon in the lower left corner represents the SGCA boundary.

Updates to Baseline Value

We discovered that there were a couple of unburned sagebrush habitat polygons that were omitted from the updated sagebrush habitat baseline calculation in 2015. Once the area of those polygons was added, the sagebrush habitat baseline value slightly increased to 78,557.5 ha (194,119.8 ac). The baseline value has had two minor updates since the signing of the CCA, but the changes are a result of this task improving the accuracy of the sagebrush habitat distribution rather than any real changes due to disturbances that caused a loss.

T-17 Fire Field Sampling

We sampled 80 plot arrays distributed within the 2011 T-17 fire. Each plot array contains 5 subplots, resulting in 400 points of data to help identify the vegetation classes naturally establishing following fire (Fig. 3-4). The vegetation class recorded most often at plot arrays was the Green Rabbitbrush/Streambank Wheatgrass (Western Wheatgrass) Shrub Herbaceous Vegetation class, documented at 146 (36.5 percent) subplots. The second most abundant class was the Needle and Thread Herbaceous Vegetation class, recorded at 88 (22 percent) subplots. The most common non-native herbaceous class was the Cheatgrass Semi-natural Herbaceous Vegetation, though it only occurred at 14 (3.5 percent) subplots. Although there were other subplots where non-native annual species were noted, the vast majority of locations within the T-17 fire are naturally recovering with native shrubs and grasses.

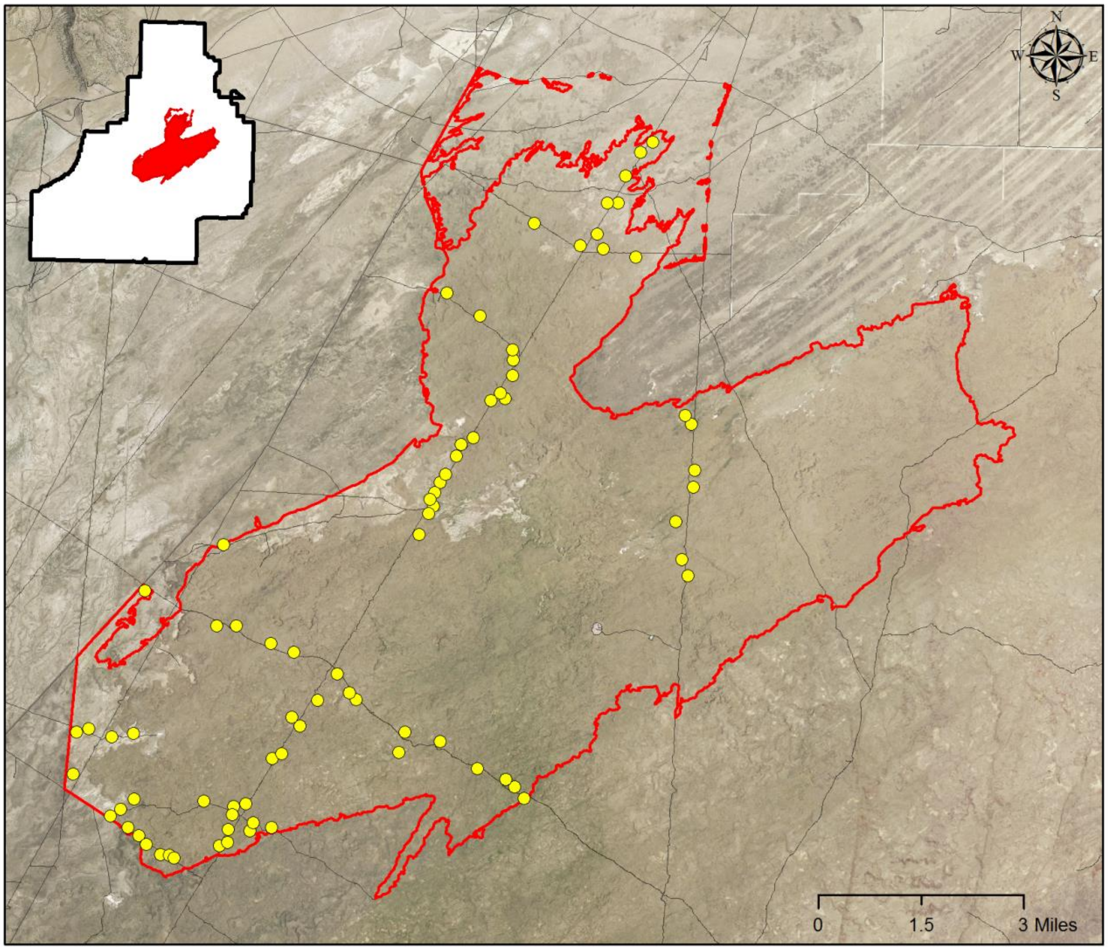

Figure 3-4. The distribution of 2016 field plot arrays (yellow points) sampled within the 2011 T-17 Fire on the INL Site.

4. THREAT MONITORING

The CCA identifies and rates eight threats that impact sage-grouse and its habitats on the INL Site, either directly or indirectly. All threats are addressed to some extent by the 13 conservation measures that DOE is striving to implement (Chapter 5). Task 5, which was reported above (Section 3-1), provides information on the status of sagebrush habitat, but it also monitors potential impacts of wildland fire and livestock threats. Some tasks, however, were designed specifically to gather baseline and continuing information about a threat because associated conservation measures could not be implemented without this *a priori* information. The following sections report on Tasks 4, 7, and 8, which were developed to address the threats of raven predation (Task 4), annual grasslands (Task 7), and infrastructure development (Task 8). Over time, these tasks will provide crucial information needed by DOE to make decisions about how to implement threat reduction measures.

4.1 Task 4—Raven Nest Surveys

Summary of Results: *Raven nesting on INL Site infrastructure increased 34 percent over three years, at an average rate of 7.5 nests per year. Power line nesting increased over the same period at an even higher rate—43 percent. We predict that two or three times the current number of raven nesting pairs could occupy INL Site infrastructure in the future. It is unclear if this substantial increase in nest predators would impact sage-grouse reproductive success, but ravens have been found to be effective nest predators elsewhere.*

4.1.1 Introduction

In the CCA, DOE committed to support research aimed at developing methods for deterring raven nesting on utility structures (*Conservation Measure 10*; DOE and USFWS 2014). The objective of Task 4 is to annually survey all man-made structures on the INL Site that could potentially be used by ravens as nesting substrates and document the number and location of active nest sites. These data will allow DOE to determine the trend of raven nesting and decide how and when to begin testing nest deterrent designs.

4.1.2 Results

Survey Results

We observed 46 active raven nests on man-made structures (Table 4-1), 35 of which (76 percent) were on power line structures. All power line nests were on transmission structures, including one on a large lattice structure next to a transmission line that is used for power grid tests. Eight active nests were at facilities (Table 4-2) and three were on towers (two meteorological towers and one cellular tower; Fig. 4-1). Ravens nested on the same two towers within the SGCA that they occupied last year, despite efforts by the National Oceanic and Atmospheric Association (NOAA) to deter nesting on at least one of these towers by wrapping the top portion with wire (Shurtliff et al. 2017).

Trend Analysis

To analyze raven nesting trends on infrastructure from 2014 to 2016, we first reduced the total nest count for each year by disqualifying from analysis active nests that blew down during the nesting season, but for which there was evidence that the nest occupants rebuilt a second or third nest during the same season (Shurtliff et al. 2017). This adjusted value more precisely approximates the actual number of breeding pairs, compared to a simple count of active nests.

We removed one to six nests per year (all power-line nests) from the three-year dataset prior to analysis (Table 4-1). From 2014–2016, adjusted nest counts increased 34 percent, an average of 7.5 nests per year. The increase in nesting on power lines was 43 percent over the same timeframe.

Nearest-Nest Distances

Using data from 2014-2016, we determined the straight-line distance from each active raven nest on the INL Site to the nearest active raven nest from the same year. Our aim was to learn how close territory-holding raven pairs would nest to each other so that we could estimate how many pairs could potentially occupy the INL Site. The shortest distance between any two active raven nests was 1,525 m in both 2014 (*N*=26) and 2015 (*N*=28) and 1,216 m in 2016 (*N*=41).

Table 4-1. Summary of raven nest data collected during surveys of INL Site infrastructure. Nests suspected of being second or third nest-building attempts by a single breeding pair were removed from columns labeled "Adjusted".

Year	Active Nests: (Total)	Active Nests: (Adjusted)	Active Nests: percent Increase (Adjusted)	Power Line Nests: (Total)	Power Line Nests: (Adjusted)	Power Line Nests: Percent increase (Adjusted)	Nearest Nests (m)	Mean (σ) nest distance (m)
2014	35	29	N/A	29	23	N/A	1,525	3,366 (1,440)
2015	39	38	31	31	30	23	1,525	2,803 (1,282)
2016	46	44	16	35	33	10	1,216	3,220 (2,200)
Total / Mean	**120**	**111**	***34**	**95**	**86**	***43**	****1,422**	

*Percent increase from 2014 to 2016.
**Mean from 2014 to 2016.

4.1.3 Discussion

Raven use of infrastructure for nesting on the INL Site increased substantially (34 percent) over the past three years, and use of power lines was even higher (43 percent). Most ravens that nest on the INL Site occupy infrastructure rather than natural substrates (Howe et al. 2014), and although we did not survey natural substrates, it is probable that the increase we documented represents a general nesting trend on the INL Site (for more details, see Shurtliff et al. 2017).

Several years ago, Howe (2012) used methods similar to ours to monitor raven nests on INL Site infrastructure. Howe recorded 21, 26, and 29 active raven nests on man-made structures in 2007, 2008, and 2009, respectively. Beginning five years later, we recorded 35, 39, and 46 nests on infrastructure (unadjusted counts, 2014–2016; Table 4-3). Although it would be inappropriate statistically to combine the results from the two studies into a single analysis (Shurtliff et al. 2017), together, they suggest that increasing use of INL Site infrastructure by ravens for nesting is probably a long-term trend.

Looking to the future, we anticipate that the number of raven nests on INL Site infrastructure will continue to increase. Results from our nearest-neighbor analysis suggest that raven pairs defend territories on the INL Site that are probably at least 1,200 m in diameter (for simplicity, we assume the nest is the center of the territory). Based on availability of transmission structures and other assumptions (Shurtliff et al. 2017), we estimate that transmission structures on the INL Site could support as many as 133 raven nests simultaneously, or two to three times as many nests as we observed in 2016. Across the sage-grouse range, predation by ravens is not believed to limit population growth. However, evidence is mounting that at a local scale, raven predation may negatively affect sage-grouse reproductive success and population growth (Bui et al. 2010; Coates and Delehanty 2010; Lockyer et al. 2013). The raven nest monitoring task on the INL Site does not directly address impacts of raven predation on sage-grouse reproduction. However, ravens are opportunistic foragers, and we know they depredate sage-grouse nests on the INL Site (Howe and Coates 2015). It is unclear if increasing occupancy of the INL Site by ravens will reach a point where it substantially limits sage-grouse reproductive success. It may be prudent to address raven nesting now rather than wait until there is clear evidence that raven predation is impacting sage-grouse abundance on the INL Site.

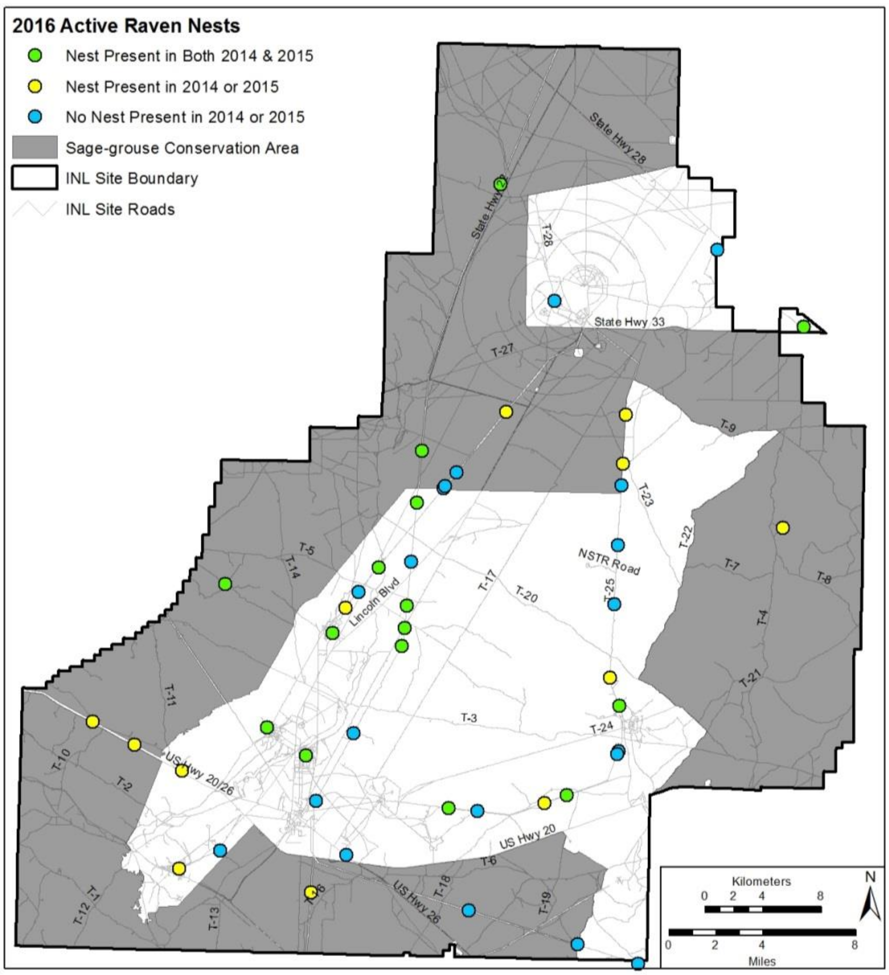

Figure 4-1. Results of 2016 raven nest surveys. Each dot represents an active raven nest in 2016 (unadjusted nest locations). The color of the dot indicates if an active raven nest in 2014 or 2015 was present within 711 m of the 2016 nest (711 m is the radius of 1,422 m—the mean distance separating the two nearest raven nests in each year [Table 4-1]).

Table 4-2. Facilities surveyed for raven nests in 2016.

Facility	Active Raven Nest Confirmed	Substrate Supporting Active Nest
Advanced Mixed Waste Treatment Project (AMWTP)	Yes	Building Platform
Advanced Test Reactor (ATR) Complex	Yes	Effluent Stack
Central Facilities Area (CFA) Main Gate	Yes	Building Platform
Experimental Breeder Reactor I (EBR-1)	Yes	Airplane Engine
Experimental Sheep Station	Yes	Ornamental Tree
Idaho Nuclear Technology and Engineering Center (INTEC)	Yes	Effluent Stack
Naval Reactors Facility (NRF)	Yes	Effluent Stack
Specific Manufacturing Capability (SMC)/Test Area North (TAN)	Yes	Building Platform
CFA	No	N/A
Critical Infrastructure Test Range Complex (CITRC)	No	N/A
Materials & Fuels Complex (MFC)/Transient Reactor Test Facility (TREAT)	No	N/A
Radioactive Waste Management Complex (RWMC)	No	N/A

4.2 Task 7—Identifying Non-Native Annual Grass Priority Restoration Areas

Summary of Results: *DOE redefined the objective of Task 7 in 2016 and commenced the first of a three-phase project. We mapped 847.4 km (526.5 mi) of bladed wildfire containment lines across the INL Site. Approximately 310–387 ha (766–957 acres) had been affected by containment line construction. In subsequent years, ESER will survey potential weedy areas on containment lines and determine the potential for successful restoration, including any actions that may reduce the infestation in the future. DOE will use this information to determine if treatment and revegetation are feasible and appropriate.*

4.2.1 Introduction

Habitat loss due to dominance by non-native grasses, primarily cheatgrass, is a substantial threat to sage-grouse across its range and was identified as a threat to sage-grouse at the INL Site in the CCA. When CCA Task 7 was developed, the primary goals were to (1) delineate areas both affected by anthropogenic disturbance and dominated by cheatgrass within the SGCA, and (2) identify the source of disturbance that made it possible for cheatgrass to dominate. The premise was that if DOE knew what caused the disturbance, it could reduce or eliminate the stressor, or work with partners to do so. In 2016, DOE recognized that Task 7 was not achieving its desired outcome because in nearly all cases during the previous two field seasons, the source of disturbance was unknown. Consequently, DOE was unable to take action to address the source of weed introduction, and it made no progress toward reducing the threat of annual grasslands to sage-grouse.

To better address the threat of annual grasslands, DOE developed a new objective for Task 7 during 2016, which is to inventory and delineate cheatgrass-dominated areas on wildfire containment lines on the INL

Site. When firefighters construct fire containment lines, they scrape away all vegetation, leaving swaths of disturbed bare ground that are susceptible to non-native annual grass domination. Many containment lines on the INL Site have not had any post-fire restoration to stabilize the soil and promote native vegetation communities. Consequently, those areas, which are often adjacent to relatively intact sagebrush and other native plant communities, have the potential to threaten sage-grouse (indirectly) by reducing habitat productivity and become a vector for the spread of non-native annual grasses.

The redefined objective of Task 7 will allow ESER to quantify the effects of a single, known source of anthropogenic disturbance (i.e. containment lines) and to visualize these effects spatially. This information will allow DOE to maximize its conservation impact if the agency chooses to revegetate degraded areas along containment lines.

4.2.2 Results and Discussion

We mapped 847.4 km (526.5 mi) of bladed containment lines on the INL Site that were observable on high-resolution digital imagery from the USDA National Agricultural Imaging Program (NAIP) dating back to 2004 (Shurtliff et al. 2017; Fig. 4-2). Most containment lines were created when a bulldozer made a single pass through an area, though it was evident that many times two or more passes were made. The largest percentage of mapped containment lines was single blade-width lines totaling 429.1 km (266.6 mi) and representing 50.6 percent of the total mapped containment line length (Table 4-3). Two blade-width lines were the second largest percentage with 380.8 km (236.6 mi) of line representing 44.9 percent. The largest blade-width class mapped was six blades wide (Table 4-3). That particular line segment was located on the

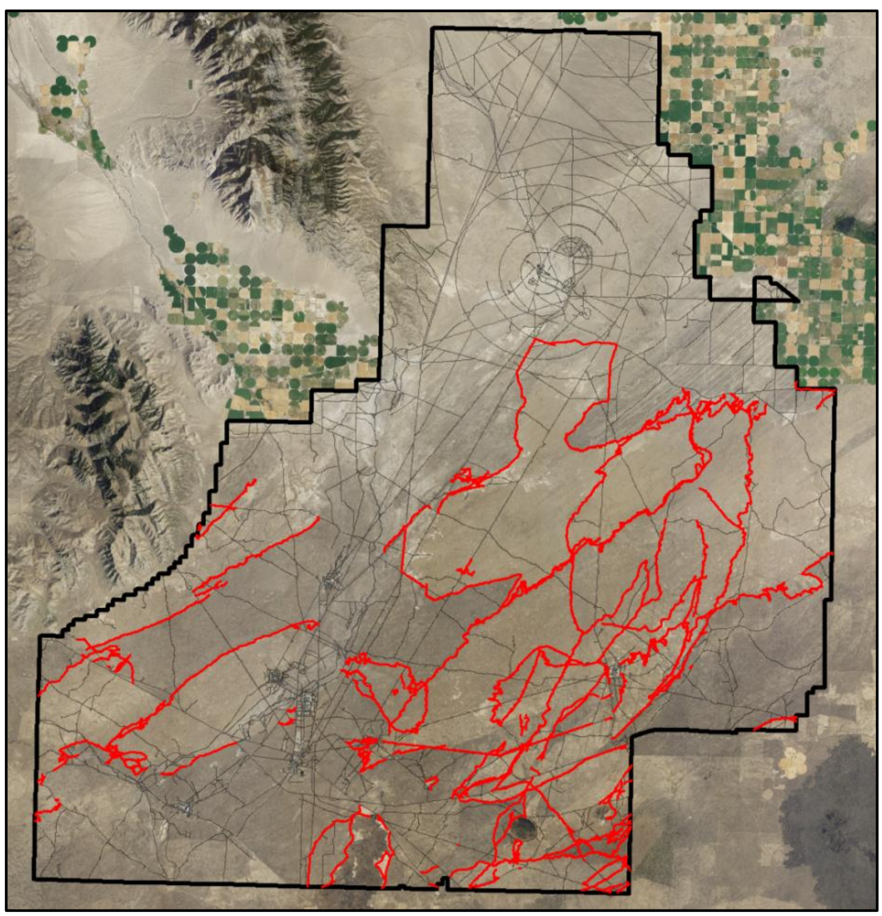

Figure 4-2. Distribution of bladed containment lines (plotted in red) mapped on the INL Site as of fall 2016.

Table 4-3. Summary statistics for mapped containment lines on the INL Site. The disturbed area range was calculated using 12 ft–15 ft as the estimated blade size used by the INL Site Fire Department.

Blade Width	Distance (km)	Distance (mi)	Disturbed Area Range (ha)	Disturbed Area Range (acres)
1	429.1	266.6	156.9 – 196.2	387.8 – 484.8
2	380.8	236.6	139.3 – 174.1	344.2 – 430.2
3	34.7	21.6	12.7 – 15.9	31.4 – 39.2
4	0.5	0.3	0.18 – 0.23	0.45 – 0.56
6	2.3	1.4	0.84 – 1.1	2.1 – 2.6
TOTAL	847.4	526.5	309.9 – 387.4	765.9 – 957.4

northeast side of the INL Site at the agricultural interface where three blade widths were created on each side of an existing two-track road.

Blade sizes used on bulldozers at the INL Site range from approximately 12–15 ft in length (Pers. Comm., Eric Gosswiller, INL Fire Chief). The actual measured width of bladed footprints for many of the mapped containment lines is generally within this range. We used the lower and upper length of this range to calculate the estimated area of vegetation removed from containment line construction as 309.9–387.4 ha (765.9–957.4 acres). We observed segments where the disturbed area was slightly thinner or wider than the known range of blade sizes. However, we believe the blade-width area calculation is a reasonable estimate of disturbed ground because, along the length of the entire line segment, it is likely that minor deviations are averaged out and the mean width falls within the reported size range.

The mapping results represent the majority of bladed containment lines from the most recent large wildland fires, but they are not intended to represent a comprehensive mapping of all containment lines ever bladed on the INL Site. There is a substantial amount of linear features that resemble containment lines in proximity to facilities and other infrastructure. Many of these features are present in all years of imagery and it is difficult to know whether they were bladed as wildland fire containment lines or for other purposes. We also lack high resolution imagery through the 1990’s when numerous large fires burned on the INL Site. Many of those bladed containment lines have had over a decade of natural recovery prior to the first Idaho NAIP image dataset being collected, and are now difficult to detect and map.

How Task 7 Reduces the Impact of Non-Native Annual Grasslands

To reduce the threat of annual grasslands, Task 7, as amended, will be implemented in three phases, the first of which (to quantify the extent of containment lines) was described above. During Phase 2, which will begin in summer 2017, ESER will survey potential weedy areas identified from Phase 1 to verify presence and calculate abundance of non-native annual grasses. This information will be used to develop a prioritized list of candidate restoration areas for future rehabilitation. Phase 3 will occur as DOE funding allows, and will include treating and revegetating prioritized areas.

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

Summary of Results: *There were 7.4 km (4.6 mi) of new two-track linear features mapped within the SGCA or sagebrush habitat. In addition, 2.6 ha (6.4 acres) of sagebrush habitat was removed between 2013 and 2015 during borrow source expansion. The sagebrush habitat loss was outside the SGCA and occurred prior to the CCA being signed.*

4.3.1 Introduction

Infrastructure development is one of the two top threats to sage-grouse on the INL Site (see Table 3, DOE and USFWS 2014). Infrastructure expansion on the INL Site occurs when facility or project footprints encroach into adjacent patches of sagebrush habitat or when new two-track linear features are created in otherwise undisturbed areas. The goal of Task 8 is to identify where expansion of infrastructure has occurred and/or removed sagebrush habitat. There has been authorized expansion at some facilities (e.g. new Materials and Fuels Complex [MFC] ponds) that was not present when the INL Site vegetation map was originally completed (Shive et al. 2011). In many cases, observed expansions have been approved through the National Environmental Policy Act (NEPA) process, and rather than attempt to classify infrastructure expansion as either unauthorized or authorized, all expansions where sagebrush habitat has been removed will be mapped and documented to maintain a more accurate distribution of sagebrush habitat. Because the estimated amount of sagebrush habitat is generated from the vegetation map by combining all map classes dominated by sagebrush, there are regions currently mapped as sagebrush habitat which are not reflective of current ground conditions and should be updated periodically.

4.3.2 Results and Discussion

We mapped 7.4 km (4.6 mi) of new two-track linear features within the SGCA or sagebrush habitat outside the SGCA (Fig. 4-3). The majority of new linear features are dead-end spurs and short-cuts between two existing roads. There were 24.4 km (15.2 mi) of additional two-track linear features mapped this year, but after further review of the 2013 NAIP imagery, they were verified to be present and missed in the 2015 results (Fig. 4-3). Some of the two-track linear features present in the 2013 NAIP imagery were more easily observed in the newer imagery because of differences in lighting or vegetation growth that partially obscured the features previously. In an effort to accurately document and update the baseline ground conditions, we added all of the linear features which are identifiable in the 2013 imagery and updated the baseline (Shurtliff et al. 2016). In 2015, we documented 505.5 km (314.1 mi) of new two-track linear features not included in the most recent INL Site roads data layer. When these newly mapped features are combined, an updated total of 529.9 km (329.3 mi) two-track linear features were mapped and the current 2013 ground condition baseline is 3,617.2 km (2,247.6 mi) of two-track linear features and paved roads on the INL Site.

In addition to a minor increase in two-track linear features, we documented four locations where sagebrush habitat had been removed between the summers of 2013 and 2015 during expansion of borrow sources. The total area of sagebrush habitat removed was 2.6 ha (6.4 acres), and the largest single expansion was 1.3 ha (3.1 acres). Last year, we reported that one gravel pit (T-12) had been expanded by approximately one half acre, although vegetation had been cleared from the expanded area in 2014 prior to the CCA being signed (Shurtliff et al. 2016, pg. 5-5). Thus, it appears all sagebrush habitat loss resulting from borrow source expansion between the summers of 2013 and 2015 occurred before the CCA was signed in September, 2014, so the “no net loss of sagebrush” clause in the CCA (DOE and USFWS 2014, pg. 54) does not apply to these actions. The sagebrush habitat loss referred to above was outside the SGCA and did not affect the habitat trigger baseline.

The substantial length of two-track linear features mapped in 2015 (Shurtliff et al. 2016) likely represents many years of accumulated unauthorized expansion rather than activities that have occurred in the last few years. The distance of two-track linear features mapped during this analysis shows that there are still new features being created although the rate of increase within a two-year window appears low. There have not been enough years of monitoring to know whether the length of two-track linear features reported this year is indicative of an average amount of expansion, or if this year is not representative of common rates of expansions in the past.

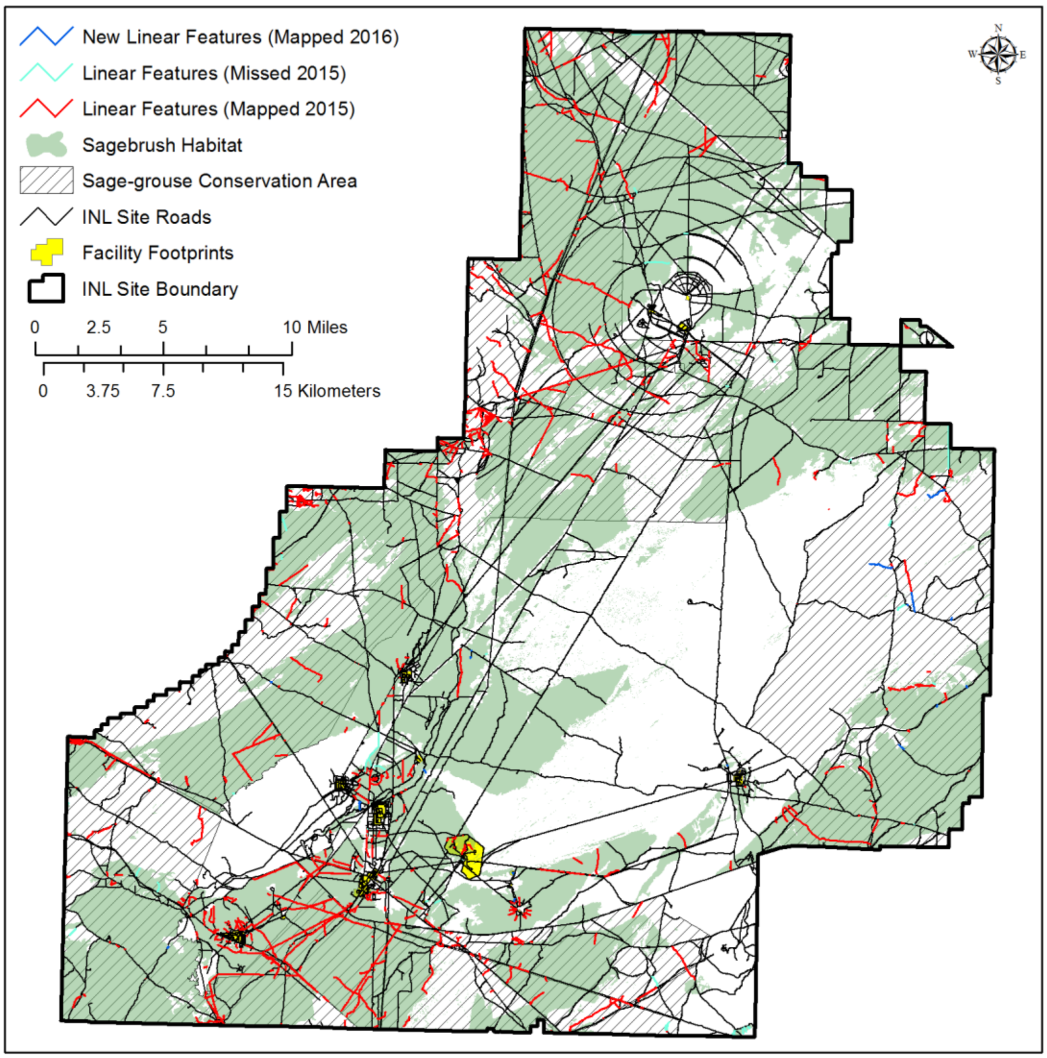

Figure 4-3. Two track linear feature expansion mapping results from 2016 at the INL Site.

5. IMPLEMENTATION OF CONSERVATION MEASURES

5.1 Summary of 2016 Implementation Progress

Section 10 of the CCA describes eight threats to sage-grouse and its habitats on the INL Site. DOE committed to implement 13 conservation measures to mitigate and reduce these threats where possible. Below, we summarize action that DOE took in 2016 to ameliorate threats to sage-grouse and its habitats. For a more complete description of DOE's actions, see Shurtliff et al. (2017).

THREAT: WILDLAND FIRE
Objective**:** Minimize the impact of habitat loss due to wildland fire and firefighting activities.

Conservation Measure 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 ac).

Accomplishments and Noteworthy Events:

- Two fires burned on the INL Site in 2016, impacting a total of seven acres. Both had origins next to public highways and were apparently human-caused (Unpublished wildland fire statistics summary for 2016; Eric Gosswiller, INL Fire Chief). Because the fires were small, no post-fire assessment or sagebrush reestablishment were required.

  Note: Only 11 acres have burned on the INL Site during the past four years in seven separate incidents. Fewer acres have burned during the current four-year period than in any other four-year period since at least the early 1990s (the current annual INL wildfire report contains data dating back to 1994).

Associated Conservation Actions that Address the Wildland Fire Threat:

- ESER planted 6,000 sagebrush seedlings in a priority restoration area (See Section 5.2).

THREAT: INFRASTRUCTURE DEVELOPMENT
Objective**:** Avoid new infrastructure development within the SGCA and 1 km of active leks, and minimize the impact of infrastructure development on all other seasonal and potential habitats on the INL Site.

Conservation Measure 2: Adopt BMPs outside facility footprints for new infrastructure development.

Accomplishments and Noteworthy Events:

- Spinning deflectors were installed on the High Frequency Sounder antenna guy wires at Water Reactor Research Test Facility, replacing old, weathered deflectors.
- New power poles installed at the High Frequency Test Bed and at the Smart Grid Test Bed were equipped with anti-perch devices.
- When evaluating options and designing the Smart Grid Test Bed (which is outside of the SGCA, but would damage sagebrush), National and Homeland Security added new overhead circuits (double hung) on existing or replaced poles, reducing the need to install new poles. This design and decision process minimized disturbance to sagebrush, other vegetation, and the landscape and reduced the potential number of new raptor perches. (Pers. Comm., Robert A. Montgomery, National & Homeland Security 10/17/16).

Conservation Measure 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.

Accomplishments and Noteworthy Events:

The United States Geological Survey (USGS) installed two new monitoring wells outside facility fences in 2016. Both were originally sited within the SGCA, though neither was within 1 km of a lek. One well (USGS 144) near CFA was deliberately placed near a power line so as to be in an area excluded from the SGCA. Nonetheless, sagebrush was destroyed when the well pad was created (Pers. Comm., Roy Bartholomay, USGS INL Project Chief, Idaho Falls; 25 Oct. 2016). To mitigate the loss, USGS will fund reciprocal sagebrush planting to ensure no net loss occurs. (Betsy Holmes, DOE Environmental Resource Officer, Idaho Falls, 28 Dec. 2016).

Another well was installed six miles northeast of MFC within the 2010 Jefferson Fire scar. No sagebrush was near the well pad. (Pers. Comm., Roy Bartholomay, 25 Oct. 2016).

THREAT: ANNUAL GRASSLANDS

Objective**:** Maintain and restore healthy, native sagebrush plant communities.

Conservation Measure 4: Inventory and delineate cheatgrass-dominated areas on wildfire containment lines on the INL Site.

Accomplishments and Noteworthy Events:

- See Section 4.2 of this report.

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 Measure 5: Encourage 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.

Accomplishments and Noteworthy Events:

- Livestock or evidence of livestock were observed on or near five leks during April and early May, 2016 (Shurtliff et al. 2017). Reports of livestock on or near leks in 2016 was higher than ESER has recorded since 2012, though livestock-related observations remain relatively infrequent, as over 200 individual lek surveys were completed at active lek sites in 2016.

  When DOE reports to the BLM that livestock have been seen on or near leks during the sage-grouse breeding season, BLM staff immediately notify livestock operators and ask them to move the livestock. Assuming that repeat occurrences are not common, this process may be the most feasible way to minimize disturbance of sage-grouse on leks by livestock during the breeding season. In regard to establishing terms and conditions for livestock use during the permit renewal process, BLM has focused on restricting concentrated livestock use in proximity of leks, such as camps, water hauls, or temporary corrals (Pers. Comm., Bret Herres, Rangeland Management Specialist, BLM, Nov. 17, 2016).

- ESER provided updated lek maps to the BLM by Feb. 1, 2016.

Conservation Measure 6**:** Communicate and collaborate with BLM to adequately maintain that the herbaceous understory on the INL Site to promote sage-grouse reproductive success and rangeland improvements follow guidelines in the 2006 State Plan and the current agreement.

Accomplishments and Noteworthy Events:

- An assessment of resource conditions relative to Idaho Standards for Rangeland Health began in the Wigwam Butte and Mahogany Butte grazing allotments in 2016. An ESER biologist attended one of the field assessments and had a good discussion with a BLM representative. Following the assessment, DOE sent a note to the BLM requesting that the agency send DOE the scope of proposed activities once they are developed so that the INL Land Use Committee and ESER staff can review them in light of the CCA and the forthcoming Conference Report (Jack Depperschmidt, NEPA Compliance Officer [DOE], Oct. 25, 2016).
- Wigwam Butte assessment/evaluation was completed in November of 2016 and found that, overall, allotment conditions are meeting applicable rangeland health standards. Mahogany Butte assessment/evaluation is ongoing. Through the process, several data gaps were identified and additional information is needed to complete the document (Pers. Comm., Bret Herres, Nov. 17, 2016).

THREAT: SEEDED PERENNIAL GRASSES

Objective**:** Maintain the integrity of native plant communities by limiting the spread of crested wheatgrass.

Conservation Measure 7**:** Cultivate partnerships with other agencies to investigate the mechanisms of crested wheatgrass invasion so that effective control strategies can be developed**.**

Accomplishments and Noteworthy Events:
No measurable progress has been made on this conservation measure.

THREAT: LANDFILLS AND BORROW SOURCES

Objective**:** Minimize the impact of borrow source and landfill activities and development on sage-grouse and sagebrush habitat.

Conservation Measure 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 of active leks).

Accomplishments and Noteworthy Events:

- In 2016, Battelle Energy Alliance conducted periodic surveillance of operations in the pits throughout the year and did not observe any violations of the restrictions (Pers. Comm., Brenda Pace, INL Borrow Source Coordinator, 10/25/2016).
- Fluor Idaho initiated a considerable source material study at the Spreading Areas A and B (ICP-16-002). Several sage-grouse leks are located in and near the Spreading Areas as identified in the original CCA. Project personnel followed the conservation measures and guidelines from the CCA including the seasonal time-of-day restrictions (Pers. Comm., Wendy Savkranz, NEPA Technical Lead [Fluor Idaho], 1/10/2017).

Conservation Measure 9**:** Ensure that no net loss of sagebrush habitat occurs due to new borrow pit or landfill development. DOE accomplishes this measure by (1) avoiding new borrow pit and landfill development in undisturbed sagebrush habitat, especially within the SGCA; (2) ensuring reclamation plans incorporate appropriate seed mix and seeding technology, and (3) implementing adequate weed control measures throughout the life of an active borrow source or landfill.

Accomplishments and Noteworthy Events:

- No new borrow pits were developed or existing pits expanded at the INL in 2016; however, Environmental Checklist INL-16-036 allowed expansion of the CFA landfill. The CFA Landfill Complex, which is approximately 35 acres and is within the approved landfill footprint, has undisturbed native vegetation. However, it is outside the SGCA and is co-located with existing infrastructure (Pers. Comm., Jenifer Nordstrom, NEPA Technical Lead [INL], 10/13/16; Brenda Pace, INL Borrow Source Coordinator, 10/25/2016).

Site-wide Facilities and Operations did not report any activities that would have disturbed the SCGA or altered vegetation near a landfill that was not covered by an approved Environmental Checklist during 2016 (Pers. Comm., Steven Christensen, Site-wide Facilities and Operations Manager, 10/25/2016).

THREAT: RAVEN PREDATION

Objective**:** Reduce food and nesting subsidies for ravens on the INL Site.

Conservation Measure 10**:** Support research to develop methods for deterring raven nesting on utility structures.

Accomplishments and Noteworthy Events:

- DOE is considering the feasibility of funding a proposal by ESER to partner with INL Power Management and test nest deterrent devises on power transmission structures.
- Dr. Kirk Clawson, Director of the National Oceanic and Atmospheric Administration Air Resources Laboratory, had his staff install hardware cloth near the top of one of the 50 ft NOAA towers that held a raven nest in 2015. Ravens did not nest where the cloth was installed, but instead built a nest lower down (about 25 ft above the ground) on the tower near a solar panel arm. It is probable that having a good perch site, such as the solar panel, is important to ravens when choosing a nest location. Towards the end of 2016, NOAA staff removed the nest and lowered the solar panel to about 6 ft. above the ground.
- Early in 2016, INL Power Management installed a commercial nest deterrent on a single-pole distribution structure near the Critical Infrastructure Test Range Complex (CITRC) that had supported a raven or raptor nest in past years. No nesting occurred on the structure during 2016.

Conservation Measure 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.

Accomplishments and Noteworthy Events:

- Training described in Conservation Measure 11 was developed and implemented in 2015. This training will be perpetually delivered as part of an annual refresher course for INL employees.
- Fluor Idaho developed a Company Environmental Requirement (CER-107) that prohibits feeding of wildlife and incorporated this requirement into a company-wide procedure. Fluor Idaho also sent e-mail (ICliPs) communication to all employees to not feed wildlife, citing the Sage Grouse CCA that requires eliminating food subsidies to ravens and other wildlife near facilities (Pers. Comm, Shawn Rosenberger, Environmental Engineer [Fluor Idaho], 1/11/2017).

THREAT: HUMAN DISTURANCE

Objective**:** Minimize human disturbance of sage-grouse courtship behavior on leks and nesting females within the SGCA and 1 km Lek Buffers.

Conservation Measure 12**:** Seasonal guidelines (March 15 –May 15) for human-related activities within 1 km Lek Buffers both in and out of the SGCA (exemptions apply—see section 10.9.3 of the CCA):

- Avoid erecting portable or temporary towers, including Meteorological, SODAR, and cellular towers.
- Unmanned aerial vehicle (UAV) 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 of a 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.

Accomplishments and Noteworthy Events:

- No portable or permanent towers were erected within the SGCA or within 1 km of leks by the research and development division of the INL during the sage-grouse breeding season (15 March–15 May) in 2016 (Pers. Comm., Robert A. Montgomery, Program Environmental Lead for Research and Development; 10/17/2016; Richard Watson, Laboratory Space Coordinator, National & Homeland Security Division of the INL; 10/17/2016).
- A provision was added to the work control document for operating UAVs requiring a 1-km clearance, both horizontal and vertical, to leks during the breeding season between 6 p.m. and 9 a.m. (Pers. Comm., Robert A. Montgomery, 10/18/16).
- No Environmental Checklists were completed for activities involving UAVs (Pers. Comm., Jenifer Nordstrom, 10/13/16).
- No explosives >1,225 kg were detonated outside the seasonal guidelines in 2016 (Pers. Comm., Desiree Saupe, Materials and Physical Security Department Engineer, National and Homeland Security, 10/28/16).
- All Environmental Checklists for projects with the potential to disrupt lek activity contain conditions that include time-of-day restrictions (Pers. Comm., Jenifer Nordstrom, 10/13/16).

Conservation Measure 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.

Accomplishments and Noteworthy Events:

- No portable or permanent towers were erected within the SGCA by the research and development division of the INL during the sage-grouse breeding season (15 March–15 May) in 2016 (Pers. Comm., Robert A. Montgomery; 10/17/2016; Richard Watson, 10/17/2016).

5.2 Reports on Projects Associated with Conservation Measures

5.2.1 Conservation Measure 1—Sagebrush Seedling Planting for Habitat Restoration

Summary of Results: *ESER managed the planting of approximately 6,000 sagebrush seedlings in fall of 2016 in and near an area prioritized for restoration. Survivorship of seedlings planted in 2015 was estimated to be from 73 percent to 86 percent.*

Introduction

The objective of Conservation Measure 1 is to minimize the impact of habitat loss due to wildland fire and firefighting activities (Table 5-1). Although no wildfires >40 ha (99 acres) have burned on the INL Site since 2012, DOE began implementing an annually recurring task in 2015 that would facilitate planting at least 5,000 sagebrush seedlings each fall in priority restoration areas 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.

The ESER program oversees the planting of sagebrush seedling and monitors survivorship to evaluate the effectiveness of the task. Each year, seeds collected on the INL Site are germinated and grown in greenhouses in 10-in^3 containers, and each fall the crop is planted in pre-determined areas. Our aim is to plant at least 80 sagebrush seedlings per acre, resulting in a coverage of ≥62.5 acres (25 ha) per year (Shurtliff et al. 2016).

Results and Discussion

We planted approximately 6,000 seedlings on 63.9 acres (25.9 ha; ~94 seedlings per acre) from 24 October to 29 October, 2016 in the southwestern part of the INL Site (Figure 5-1) and collected sub-meter resolution GPS coordinates of 737 (~12 percent) seedlings for future monitoring. The preliminary planting site was located within a Priority Restoration Area (DOE and USFWS 2014), but after considering accessibility and proximity to the seedling storage location, the final site selected allowed less than half of the seedlings to be planted within the Priority Restoration Area (Shurtliff et al. 2016). Substantial rain fell before and during planting, creating favorable conditions for seedling growth and development.

To assess 2015 seedling survivorship and condition, we revisited 501 sagebrush seedlings in August 2016 where the location was marked during planting in 2015. We relocated 428 seedlings, of which 129 (30 percent) were healthy, 238 (56 percent) were stressed, and 61 (14 percent) were dead (Fig. 5-2). Thus, 86 percent of seedlings that we relocated survived the first year. Eight of the dead plants were located within areas devoid of vegetation near ant mounds (western harvester ants, genus *Pogonomyrmex*) and it is possible that these seedlings were killed by ants in the denuded areas (Soulé and Knapp 1996).

We were unable to locate 63 of the seedlings marked in 2015. Given the precision our Global Positioning System 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 these 63 seedlings did not survive, lowering our estimate of seedling survivorship to 73 percent. Though we are unable to give a precise estimate of survivorship, we conclude that 73–86 percent of seedlings planted in 2015 survived the first year. ESER will revisit these seedlings again 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.

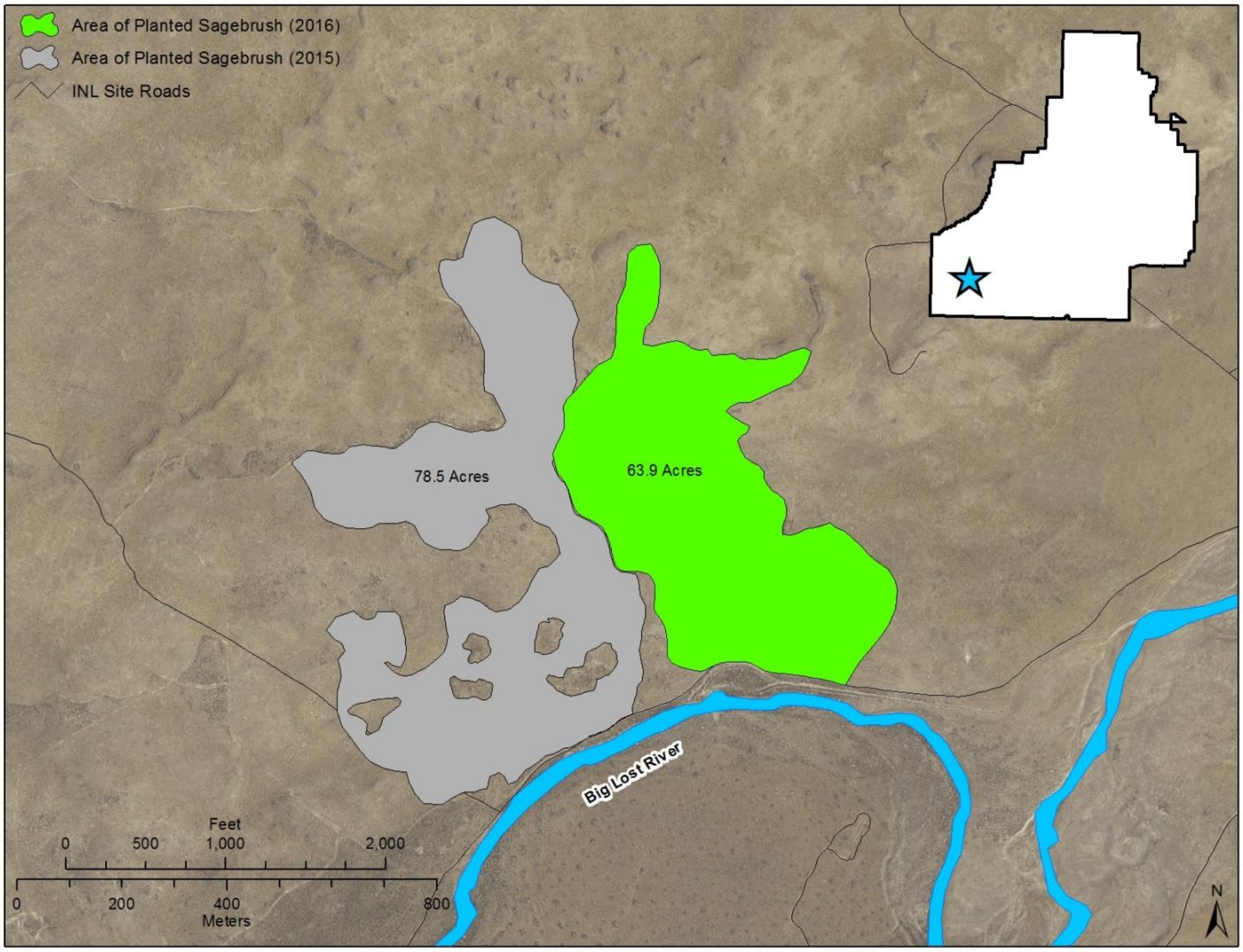

Figure 5-1. Areas planted with big sagebrush seedlings in 2015 and 2016. The star on the inset map shows the general location of the plots.

Precipitation patterns from fall 2015 to fall 2016 were not characteristic of a good recruitment year (Shurtliff et. al. 2017). Although fall and spring precipitation was above or near average, the summer growing season was far below average (Shurtliff et al. 2017). This lack of moisture during summer can strain young plants, and is probably responsible for the high levels of stressed plants we observed, as well as some of the seedling deaths. Though some of the stressed seedlings may perish in upcoming years, young sagebrush plants experience the highest mortality during the first year (Dettweiler-Robinson et al. 2013). In a review of 18 projects where containerized sagebrush seedlings were planted and survivorship was measured after one year, researchers found that seven projects (39 percent) reported survivorship of at least 73 percent (range 73–94 percent, mean 79 percent). Thus sagebrush establishment following the 2015 planting on the INL Site was higher than may be expected given the dry summer conditions.

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 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 5-2: Examples of sagebrush seedling conditions. From left to right: healthy, stressed, and dead.

6. SYNTHESIS AND ADAPTIVE MANAGEMENT RECOMMENDATIONS

6.1 Sage-Grouse and Sagebrush Habitat Trends

Sage-grouse abundance has been trending upward on the INL Site for the past several years. On two of the three IDFG lek routes, peak male attendance increased successively each of the past three years, and the three-year running average across the 27 baseline leks has been steady or increased each year since 2013. Simultaneously, wildland fire has been nearly absent from the INL Site landscape since 2012, marking the longest period of time since 1994 (when comprehensive fire statistics were first recorded) where <12 acres total burned. Although a few small fires burned a combined 11 acres in the past four years, no sagebrush habitat within the SGCA has been impacted. Habitat has also remained in relatively high condition in terms of both sagebrush and herbaceous cover and height.

These positive short-term results and the wildland fire report are encouraging and should not be discounted; however, it is important to interpret this information within the context of long-term population and climatic cycles. Studies in Wyoming have shown that sage-grouse populations exhibit regular periodicity of 6-9 years (Fedy and Aldridge 2011, Fedy and Doherty 2011), similar to other grouse species (Williams et al. 2004). Lek route data are insufficient to allow us to evaluate if sage-grouse abundance on the INL Site fluctuates cyclically. If it does, the apparently positive gains made in the past three or four years may not represent the true, long-term subpopulation trajectory.

The lack of wildland fire can probably best be explained as a consequence of above- or nearly-average annual precipitation and unusual seasonal precipitation patterns. In each of the past three years, the INL Site experienced above-average late summer and fall precipitation. When conditions become drier, the likelihood of larger wildland fires will increase. DOE's approach of planting sagebrush seedlings annually even when no additional sagebrush habitat has been lost demonstrates the agency's foresight, because it will take decades before the planted areas become habitat for sage-grouse.

6.2 Threats Assessment

This year, we detected more than seven kilometers of two-track road features on the INL Site that were created between 2013 and 2015. It is unclear if this amount of expansion is typical, because this year's analysis of 2015 imagery was the first to be performed since we established baseline infrastructure features from 2013 imagery (Shurtliff et al. 2016). In the next few years, continued monitoring via Task 8 will allow us to answer two fundamental questions—are new two-track roads regularly being created on the INL Site, and at what rate? These answers will help DOE determine whether the threat to sage-grouse habitat from infrastructure expansion is significant on the INL Site. It is worth noting, however, that it is easier to document if a threat is expanding or contracting than to quantify the effects of the threat on what ultimately matters for the conservation of sage-grouse: the impact of the threat on sage-grouse survival or reproductive success.

Similar to the threat of infrastructure expansion, we documented increasing numbers of ravens using INL Site infrastructure to support nesting. Although raven occupancy will probably continue to increase, the more critical issue is whether raven occupancy on the INL Site could reach levels and impact sage-grouse reproductive success to a degree that they begin to depress population growth potential above otherwise natural levels. Results from raven nest monitoring suggest that CCA conservation measure 10, wherein DOE committed to support research aimed at deterring raven nesting on power lines, remains relevant, and perhaps is increasing in urgency. In addition, given that raven nests continue to increase on facilities and towers, it may also be useful for DOE, its contractors, and other partners to not only investigate how to deter raven nesting on power lines, but to also take action to reduce nesting opportunities on other non-linear features.

Non-native plant cover in 2015 and 2016 was much higher than we have observed in recent years. High cover values may be an artifact of the unusual timing of precipitation that has occurred on the INL Site, rather than an ecological shift. If precipitation patterns more closely approximate historical seasonal timing in the future, the observed increases in non-native plant cover may be reversed. Continued data collection will be useful for determining whether cover by non-natives is trending upward, fluctuating around a flat value, or fluctuating around an upward trend.

7. WORK PLAN FOR 2017

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

Task	Schedule and Changes for 2017
1. Lek Surveys	• Survey eight lek routes, including five new routes. All other active leks will be monitored as well.
2. Historical Lek Surveys	• Five historical leks remain unclassified and will be surveyed again in 2017, perhaps for the last time under Task 2.
3. Systematic Lek Discovery Surveys	• Survey sagebrush habitat south of Highway 20 on the INL Site, primarily in sagebrush habitat within the SGCA.
4. Raven Nest Surveys	• Repeat efforts to deter raven nesting on two NOAA towers occupied in 2015 and 2016. • Potentially initiate a research project aimed at testing the effectiveness of raven nest deterrents on transmission structures.
5. Sagebrush Habitat Condition Trends	• Sample all annual monitoring plots (n=75). • Explore analytical approach to trend analyses as five years of data will be available after 2017 data collection.
6. Monitoring to Determine Changes in Sagebrush Habitat Amount and Distribution	• Collect field data within the 2010 Midway Fire. • Begin mapping draft updates to the vegetation class boundaries within recent wildland fires.
7. Inventory and Monitoring of Sage-grouse Habitat for Areas Dominated by Non-native Annual Grasses.	• Field crews will survey locations identified in a 2016 Geographic Information System exercise to (1) determine the presence and abundance (or relative abundance) of non-native annual grasses and (2) develop a prioritized list of candidate restoration areas for future restoration activities.
8. Monitoring Unauthorized Expansion of the Infrastructure Footprint within the SGCA and Other Areas Dominated by Big Sagebrush	• No planned activities for 2017. Update again after 2017 Idaho NAIP imagery becomes available in early 2018.

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