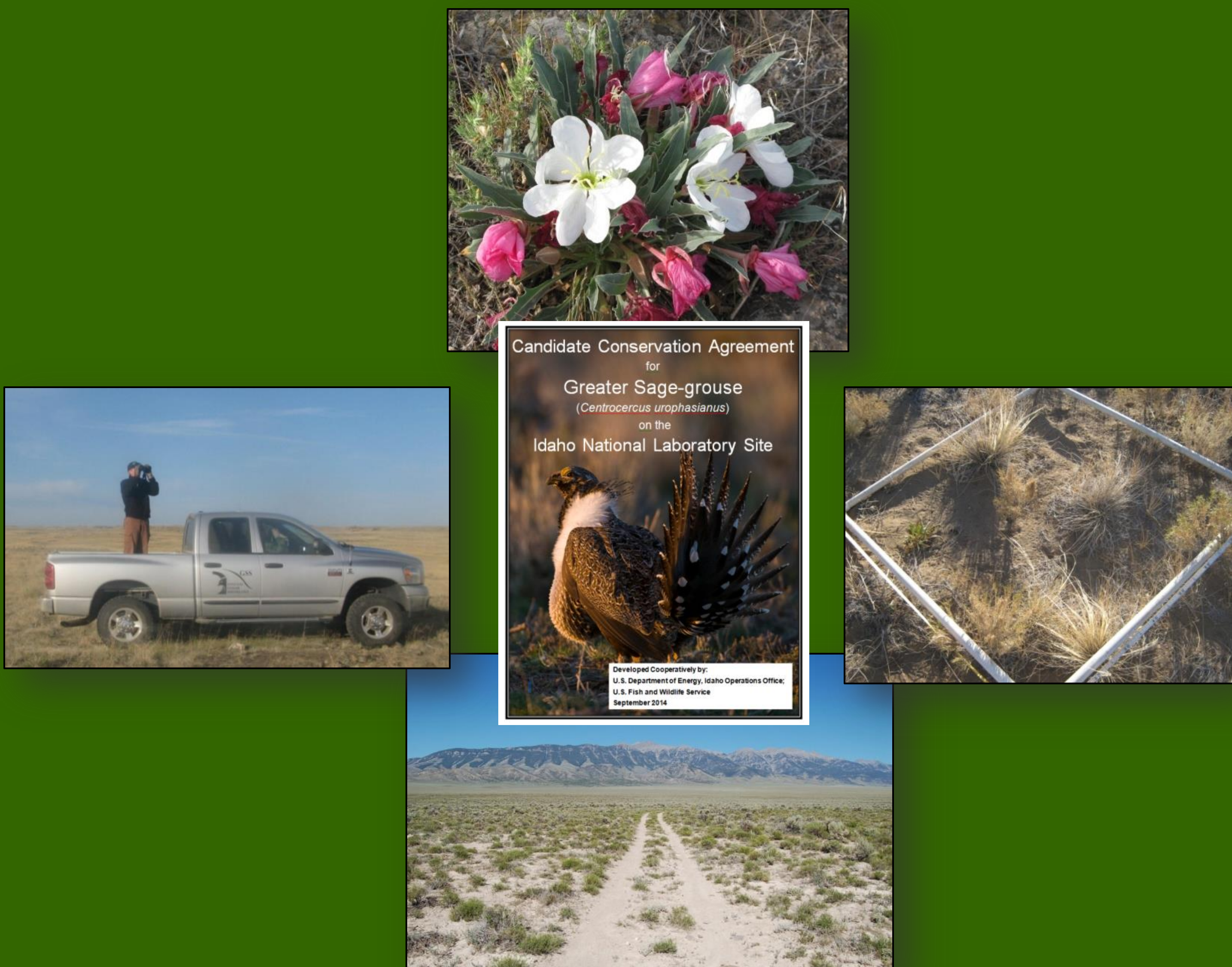
2014 Monitoring Report in Support of the Candidate Conservation Agreement for Greater Sage-Grouse on the Idaho National Laboratory Site



Environmental Surveillance, Education, and Research Program
January 2015
DOE/ID-11527

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Prepared for:

U.S. Department of Energy, Idaho Operations Office
Environmental Surveillance, Education, and Research Program
Contract No. DE-NE-0000300

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACRONYMS

ATRC	Advanced Test Reactor Complex
CCA	Candidate Conservation Agreement
CFA	Central Facilities Area
CITRC	Critical Infrastructure Test Range Complex
DOE	U.S. Department of Energy, Idaho Operations Office
ESER	Environmental Surveillance, Education, and Research
GIS	Geographic Information System
GPS	Global Positioning System
IDFG	Idaho Department of Fish and Game
INL	Idaho National Laboratory
INTEC	Idaho Nuclear Technology and Engineering Center
LTV	Long-Term Vegetation
MFC/TREAT	Materials & Fuel Complex/Transient Reactor Test Facility
NRF	Naval Reactors Facility
RWMC	Radioactive Waste Management Complex
SGCA	Sage-grouse Conservation Area
SMC/TAN	Specific Manufacturing Capability/Test Area North
USFWS	U.S. Fish and Wildlife Service

RECOMMEDED CITATION

Shurtliff, Q.R., A.D. Forman, J.C. Whiting, J.P. Shive, J.R. Hafla, K.T. Edwards, R.D. Blew. 2015. 2014 monitoring report in support of the candidate conservation agreement for greater sage-grouse on the Idaho National Laboratory Site. DOE/ID-11527. Gonzales-Stoller Surveillance, LLC, Idaho Falls, ID. January 2015.

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*, entered into 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 DOE's 2014 inventory and monitoring activities and results in support of the CCA, (2) address 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. This summary highlights key results and conclusions as they relate to population, habitat, and threats monitoring.

Population Monitoring

The population baseline on the INL Site is 316 males, which was the number of males counted in 2011 during peak attendance on 27 active leks within the Sage-grouse Conservation Area (SGCA). The population trigger would be tripped if the three-year average of males on those 27 leks decreased by ≥ 20% (i.e. <253 males). In 2014, we surveyed the 27 baseline leks, three Idaho Department of Fish and Game survey routes, and all other active leks on the INL Site. Key results from population monitoring include:

- We observed 647 males on a total of 44 active leks.
- The average peak male attendance from 2012 to 2014 on the 27 baseline leks was 340; therefore, the population trigger was not tripped.
- We discovered 3 new leks.

Habitat Monitoring

Following the mapping updates made in 2014, the estimated 2013 SGCA sagebrush habitat baseline value was slightly reduced with a total of 78,457 ha (193,872 acres). The habitat trigger would be tripped if a net of 15,691 ha (38,773 acres), representing 20% of the sagebrush habitat baseline within the SGCA, were lost or converted to a non-sagebrush-dominated vegetation class. Key results from habitat monitoring include:

- In 2014, no wildland fires or other activities reduced the area of sagebrush habitat within the SGCA, so the habitat trigger was not tripped.
- Mapping updates were made to the 2012 Midway, 2011 T-17, and the 2010 Middle Butte wildland fire boundaries and unburned vegetation patches, which increased the accuracy of the current sagebrush habitat amount and distribution.
- Sagebrush cover and height were within current suggested habitat guidelines.
- Herbaceous cover and height were below suggested guidelines but likely reflect low soil moisture due to lack of precipitation.
- In both sagebrush habitat and non-sagebrush polygons, ecological condition remained high as evidenced by low cover values of introduced annuals relative to native herbaceous species.

Threats Monitoring

The CCA identifies eight threats that directly or indirectly impact sage-grouse and its habitats on the INL Site. Two threats – raven predation and annual grasslands – require baseline inventory and monitoring information before conservation measures can be initiated. In 2014, we surveyed all anthropogenic structures on the INL Site in search of active raven nests. We also surveyed selected areas to determine the level of cheatgrass occurrence. Key results and conclusions from these two monitoring tasks are as follows:

- 37 active raven nests were observed on anthropogenic substrates, 31 of which were on power line structures.
- Transmission poles, rather than distribution poles, were preferred as nesting substrates by ravens.
- A total of 24 new sites were mapped as being dominated by annual grasses.
- Abnormal weather patterns in 2014 (very dry spring and summer followed by very wet fall) made surveys for cheatgrass difficult.

Other noteworthy events regarding threats and DOE's efforts to initiate conservation measures:

- No wildland fires >40 ha (99 acres) occurred in 2014.
- DOE received no reports of livestock on leks before May 15.
- Sagebrush seed was collected on the INL Site and will be grown into 5,000 seedlings, which will be planted in fall 2015.

Synthesis and Conclusions

Results from lek surveys provide no evidence that the local sage-grouse population is in decline. However, wildland fire remains one of the greatest threats to sage-grouse and its habitats, because a single large fire can remove tens of thousands of acres of sagebrush habitat and can significantly impact local sage-grouse abundance within one or two years post fire. Not surprisingly, the amount of area classified as sagebrush habitat did not change based on 2014 monitoring, because natural habitat changes occur slowly. Even a recalculation of sagebrush habitat based on improved mapping of wildland fire boundaries did not substantially change the original baseline value. Thus, we have no expectation that either the population or habitat triggers will be tripped in the near term unless a large fire burns sagebrush habitat.

1. 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 towards achieving stated conservation objectives (Section 10), and providing other relevant information prior to an annual meeting between the two agencies. Here, we summarize results from the 2014 inventory and monitoring tasks completed by DOE's Environmental Surveillance, Education, and Research (ESER) Program, and provide other information in support of sage-grouse conservation and the CCA.

The primary purpose of this report is to provide data and information necessary to enable DOE and USFWS to track population and habitat trends relative to adaptive regulatory triggers outlined in the CCA. On the INL Site, the two triggers and criteria that would have to be demonstrated to initiate an automatic response 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% or more compared with the 2011 baseline;
- Habitat Trigger: Total area designated as sagebrush habitat within the SGCA has been reduced by 20% or more compared with the 2013 baseline.

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.

In this document, we group 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 chapter summarizes results of pertinent monitoring tasks outlined in section 11.1 of the CCA. Chapter 5 lists all conservation measures and associated objectives that DOE committed to implement in the CCA, and reports on 2014 achievements and overall progress toward accomplishing stated objectives. In Chapter 6, we summarize the status of the population and habitat triggers in a synthesis that combines information from monitoring tasks and conservation measures. Finally, we provide a succinct workplan (Chapter 7) listing what ESER will do in the upcoming year, including what changes will be made, to continue implementing the CCA monitoring program effectively.

2. POPULATION TRIGGER MONITORING

Sage-grouse leks are important displaying and breeding areas that grouse return to each spring (Jenni and Hartzler 1978, Connelly 1981). Some leks may be used by sage-grouse for long periods of time, whereas others may be established after recent, small-scale disturbances occur (Connelly 1981). Leks and their surrounding breeding habitat are crucial for the survival of sage-grouse populations (Connelly et al. 2000b), and counting displaying birds at these areas can be a relatively easy method to document trends in population abundance of grouse (Jenni and Hartzler 1978, Connelly et al. 2003, Garton et al. 2011). Therefore, determining the locations of leks, documenting if they are actively attended by grouse, and then tracking the number of grouse across time at these locations can provide important information for sage-grouse management (Jenni and Hartzler 1978, Connelly et al. 2003, Garton et al. 2011).

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

1) Lek Surveys – Surveys of all active leks on the INL Site. These include leks that are 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 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.

Results from monitoring task 1 will provide an index concerning the number of grouse lekking at the 27 active leks in the SGCA that were used to calculate the baseline value of the population trigger (DOE and USFWS 2014). Additional results from monitoring task 1 will provide data regarding the number and trend of lekking sage-grouse on the three IDFG lek routes, as well as at all other active leks on the INL Site (DOE and USFWS 2014). Completing monitoring tasks 2 and 3 will provide DOE with information about additional active leks on the INL Site. These new leks could be used to establish other lek routes on the INL Site before the 2017 lek season (DOE and USFWS 2014). Below, we report the results from these three monitoring tasks for 2014.

2.1 Task 1 – Lek Surveys

2.1.1 Introduction

The first monitoring task includes surveying all of the following active leks on the INL Site: 1) the 27 active leks located in the SGCA that were used to calculate the baseline value of the population trigger; 2) other active leks located in and out of the SGCA that are not on the three IDFG lek routes; 3) leks on the three IDFG routes that are surveyed annually on the INL Site (DOE and USFWS 2014). Information from these surveys will allow DOE and USFWS to evaluate the number of male sage-grouse on the 27 active leks in the SGCA relative to baseline value of the population trigger (DOE and USFWS 2014). These surveys will also allow DOE to continue to track trends of breeding male sage-grouse at all leks on the INL Site to document if declines occur in the number of males at these leks (DOE and USFWS 2014).

The current baseline value of the population trigger is defined as the maximum number of male sage-grouse (n = 316) counted on 27 active leks (15 of those leks are on the three IDFG lek routes) in the SGCA during 2011 (Figure 2-1, DOE and USFWS 2014). This trigger would be tripped if the three-year average of the peak male attendance at these 27 leks decreases by 20% or more (i.e., ≤ 253 males) compared with the number of males counted in 2011 (DOE and USFWS 2014).

In 2014, ESER biologists also surveyed the remaining active leks (n = 20) on the INL Site that were not in the SGCA, or that were in the SGCA but were not included in the baseline value calculated from the 27 active leks in 2011 (Figure 2-1). These leks were not included in the baseline value, because they were not sampled in each year from 2011 to 2013 or they were discovered in the SGCA after 2011. Monitoring these leks will provide DOE with context regarding the number of grouse on all active leks on the INL Site.

Counting male sage-grouse on lek routes can provide a valuable index of the minimum number of breeding males in a local area (Connelly et al. 2003, Garton et al. 2011). Three lek routes (Tractor Flats, Radioactive Waste Management Complex [RWMC], and Lower Birch Creek) were established on the INL Site by the IDFG in the 1990s and have been monitored annually since that time (Figure 2-1). Data collected from these lek routes provide important information regarding the trend in sage-grouse abundance in these three areas on the INL Site since the 1990s (Garton et al. 2011, DOE and USFWS 2014).

2.1.2 Methods

ESER biologists surveyed all leks from late March to early May following methods used by the IDFG for surveying sage-grouse leks (ESER Procedure RP-4). We started surveys ½ hour before sunrise and completed surveys within 1½ hours after sunrise. Lek surveys were not conducted during inclement weather (i.e., rain, snow, or high winds). At each lek, we observed birds from a location that provided good visibility of the lek. We then counted the birds on each lek 4 times over a 10-minute period and recorded the highest number of males and females observed at each lek (ESER Procedure RP-4). Additionally, ESER biologists opportunistically searched for new leks while surveying active leks. If new leks were discovered, we counted the number of male grouse at these leks using the methods described above (ESER Procedure RP-4).

2.1.3 Results

In 2014, ESER biologists surveyed all 27 active leks in the SGCA at least 3 times ($\bar{x}$ = 5 surveys, *SD* = 1.5, range = 3 to 7 surveys) to count sage-grouse using those areas (Figure 2-1). We counted 352 males at peak attendance during those surveys. The three-year average from 2012 to 2014 at peak attendance on those 27 leks in the SGCA was 340 male sage-grouse, which was higher than the 316 males counted at those leks in 2011.

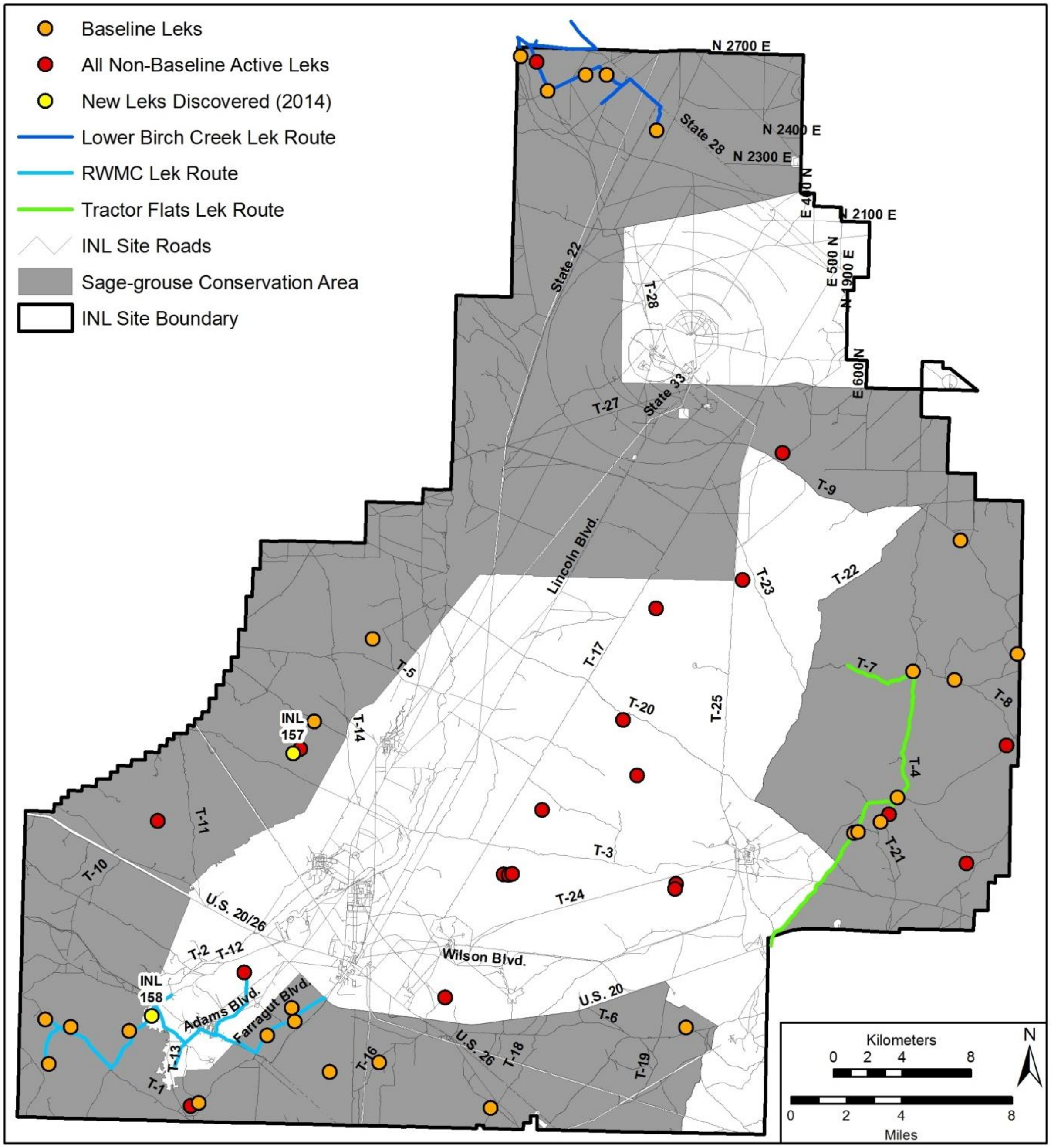

Figure 2-1. Lek routes and the 27 active leks used for the baseline value in the SGCA, and other active leks in and out of the SGCA that were surveyed for sage-grouse in 2014.

In 2014, ESER biologists also surveyed the remaining active leks (*n* = 20) on the INL Site that were not in the SGCA or that were in the SGCA but were not included in the baseline value calculated from the 27 active leks in 2011 (Figure 2-1). We surveyed those 20 active leks an average of 4 times (*SD* = 1.1 surveys, range = 3 to 7 surveys). The number of lekking males at peak attendance on those 20 leks was 264. Additionally, we sampled leks on each IDFG lek route at least 6 times in 2014 (Figure 2-1). The maximum number of males counted during peak male attendance across those three lek routes was 260 (Table 2-1). The number of males observed on the Tractor Flats lek route in 2014 was similar to the number of birds observed on that route since 2011 (Figure 2-2). We did, however, observe more male sage-grouse on the RWMC and Lower Birch Creek routes than we have since 2011, which was the year we used to calculate the baseline value of the population trigger (Figure 2-2). We also discovered one new lek (INL 157) while hiking to an active lek and one new lek (INL 158) while conducting the RWMC Lek Route (Figure 2-1). We surveyed those two leks at least 3 times and our highest count on those leks were 27 males on INL 157 and 3 males on INL 158.

Table 2-1. Descriptive statistics for each IDFG lek survey route on the INL Site in 2014.

Lek Route	# of Surveys	Maximum # of Males Counted	Day of Maximum Count
Tractor Flats	7	55	May 1
RWMC	7	141	April 30
Lower Birch Creek	6	64	April 3

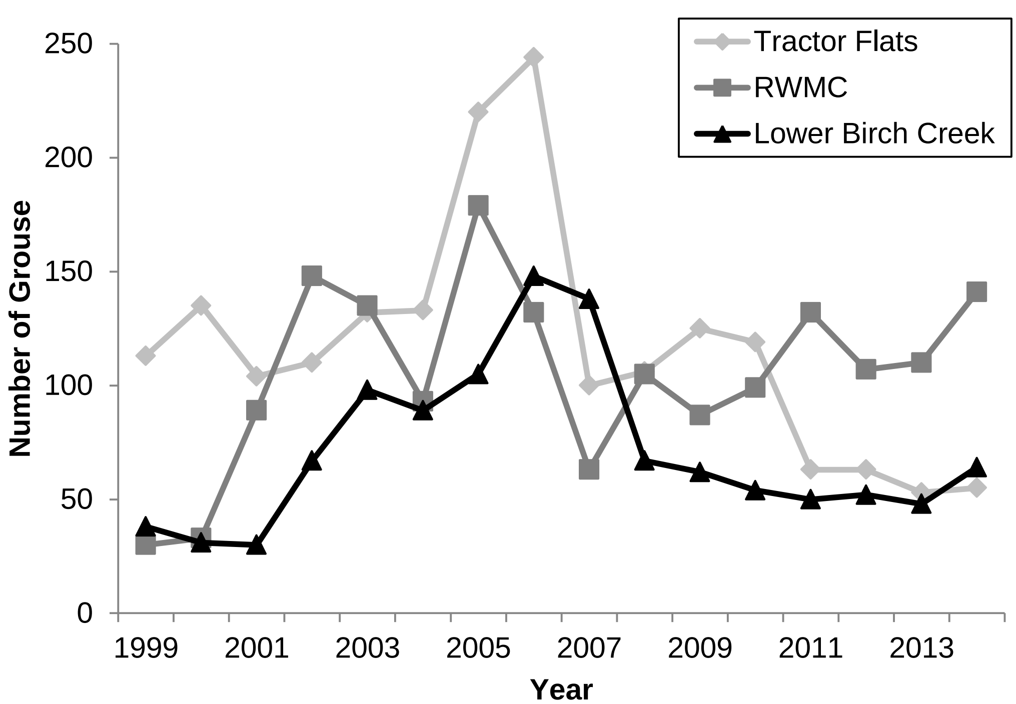

Figure 2-2. Number of male sage-grouse observed at peak attendance across three lek routes on the INL Site from 1999 to 2014.

2.1.4 Discussion

The CCA establishes a population trigger that if tripped would initiate an automatic response by DOE and the USFWS to assess sage-grouse management on the INL Site (DOE and USFWS 2014). The first monitoring task includes surveying all active leks in the SGCA that were used to calculate the baseline value of the population trigger. This trigger would be tripped if the number of grouse counted during peak male attendance on the 27 active leks in the SGCA decreased by 20% or more compared with the 316 males counted in 2011 (DOE and USFWS 2014). The three-year average from 2012 to 2014 on those 27 leks in the SGCA was 340 male sage-grouse, which was higher than the 316 males counted at those leks in 2011. Because the number of males observed on those 27 leks has increased since 2011, it is unnecessary to initiate a meeting this year between DOE and the USFWS to review sage-grouse population management on the INL Site.

Additionally, ESER biologists monitored all other active leks on the INL Site that were not used to establish the baseline value. In 2014, we surveyed 20 of those active leks and counted 264 male sage-grouse during peak attendance. Continually monitoring all active leks on the INL Site, even those not used in calculating the baseline value in the SGCA, will provide DOE with greater context regarding the number and trend of lekking sage-grouse on the INL Site.

The first monitoring task also includes surveying the Tractor Flats, RWMC, and Lower Birch Creek lek routes. Data from these lek routes provide an index regarding the trend in sage-grouse abundance in these areas since the 1990s (DOE and USFWS 2014). From 1999 to 2007, the number of leks surveyed on those routes has increased from 12 to 21; therefore, comparing the number of male sage-grouse across those years with counts from more recent years is problematic. From 2008 to 2014, however, the number of leks sampled on those routes has only increased from 22 to 24. During that time, the number of male sage-grouse on the Tractor Flats Lek Route decreased substantially the year following the Jefferson Fire in July 2010. The number of birds on that route may continue to decline. A similar reduction in lekking grouse was documented after the Murphy Complex Fire that burned in south-central Idaho and in areas that burned south of the INL Site in the Big Desert (Connelly et al. 2000a, Moser and Lowe 2011). In 2014, we observed more male sage-grouse on the RWMC and Lower Birch Creek routes than we have since 2009.

During our surveys of active leks on the INL Site in 2014, we documented two new leks (INL 157 and INL 158). Those new leks could be used when other lek routes are established on the INL Site before the 2017 lek season (DOE and USFWS 2014). Establishing more lek routes will enhance DOE’s ability to more accurately track sage-grouse trends, especially within the SGCA (DOE and USFWS 2014).

2.2 Task 2 – Historical Lek Surveys

2.2.1 Introduction

Many historical sage-grouse leks have been documented on the INL Site. At these locations, sometime in the past, an observer recorded male sage-grouse on what was thought to be a lek (Whiting and Bybee 2011). Many of these sites have not been surveyed in nearly 30 years. Since 2009, ESER biologists have revisited a subset of these historical leks each spring to determine if sage-grouse still congregate at these locations (DOE and USFWS 2014). Conducting these surveys allows ESER biologists to determine if historical leks on the INL Site are active or inactive. For a limited number of years, the ESER program will survey historical leks in preparation for potentially establishing additional lek routes before the 2017 lek season (DOE and USFWS 2014).

2.2.2 Methods

We used the following criteria to designate if a historical lek was active or inactive on the INL Site. A lek was considered 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. 2000b). A lek was considered inactive if these criteria were not met. We still designated a lek as active, however, if we observed two or more male sage-grouse once and the lek had been surveyed for less than five years (Whiting et al. 2013). That active designation would not change until we surveyed that lek for five years and only observed birds once; then that lek was considered inactive (Whiting et al. 2013).

ESER biologists surveyed locations that were identified previously as historical leks on the INL Site from March to May 2014 (Figure 2-3), following established methods (ESER Procedure RP-6). We started surveys ½ hour before sunrise and completed surveys within 1½ hours after sunrise. Lek surveys were not conducted during inclement weather (i.e., rain, snow, or high winds). Before approaching a lek, we used binoculars to search the site for sage-grouse. If grouse were observed, we counted the birds on the lek 4 times over a 10-minute period and then recorded the number and sex of the birds (ESER Procedure RP-6). If no grouse were observed, we attempted to hear lekking sage-grouse using a parabolic microphone. That microphone allowed us to potentially detect grouse up to 1.5 km (0.93 mi) away. If no grouse were detected at the historical lek, we walked ~100 m (109 yd) from the center of the lek to four locations in each cardinal direction. We then listened again for sage-grouse calls for two minutes using the parabolic microphone at those four locations in each cardinal direction (ESER Procedure RP-6). If lekking grouse were heard near the location of a cardinal direction, we attempted to locate the lek by walking towards the call. We then counted and recorded the number of grouse observed as described above (ESER Procedure RP-6).

2.2.3 Results

In 2014, ESER biologists visited 17 historical leks that were in the SGCA an average of 3 times (*SD* = 1.6 survey, range = 2 to 9 surveys). We also visited 13 historical leks that were not in the SGCA an average of 3 times (*SD* = 0.6 survey, range = 2 to 4 surveys) to determine if sage-grouse still used those leks (Figure 2-3). Of the 30 historical leks that were surveyed, we did not observe sage-grouse at any of those leks in 2014. Also, historical leks (INL 42 and 109) in the SGCA now have sufficient number of surveys without observing grouse to be designated inactive.

2.2.4 Discussion

Monitoring task 2 involves continued surveys of historical leks, some of which have been surveyed since 2009. The objective of this task is to document additional active leks on the INL Site in preparation for potentially establishing new lek routes (DOE and USFWS 2014). We did not observe sage-grouse at the 30 historical leks that were surveyed in 2014. This is the first year since we started the histocial lek surveys in 2009, in which we did not observe lekking grouse. Many of these leks have only been surveyed during one or two years. As additional surveys are conducted we anticipate that fewer active leks will be discovered each year.

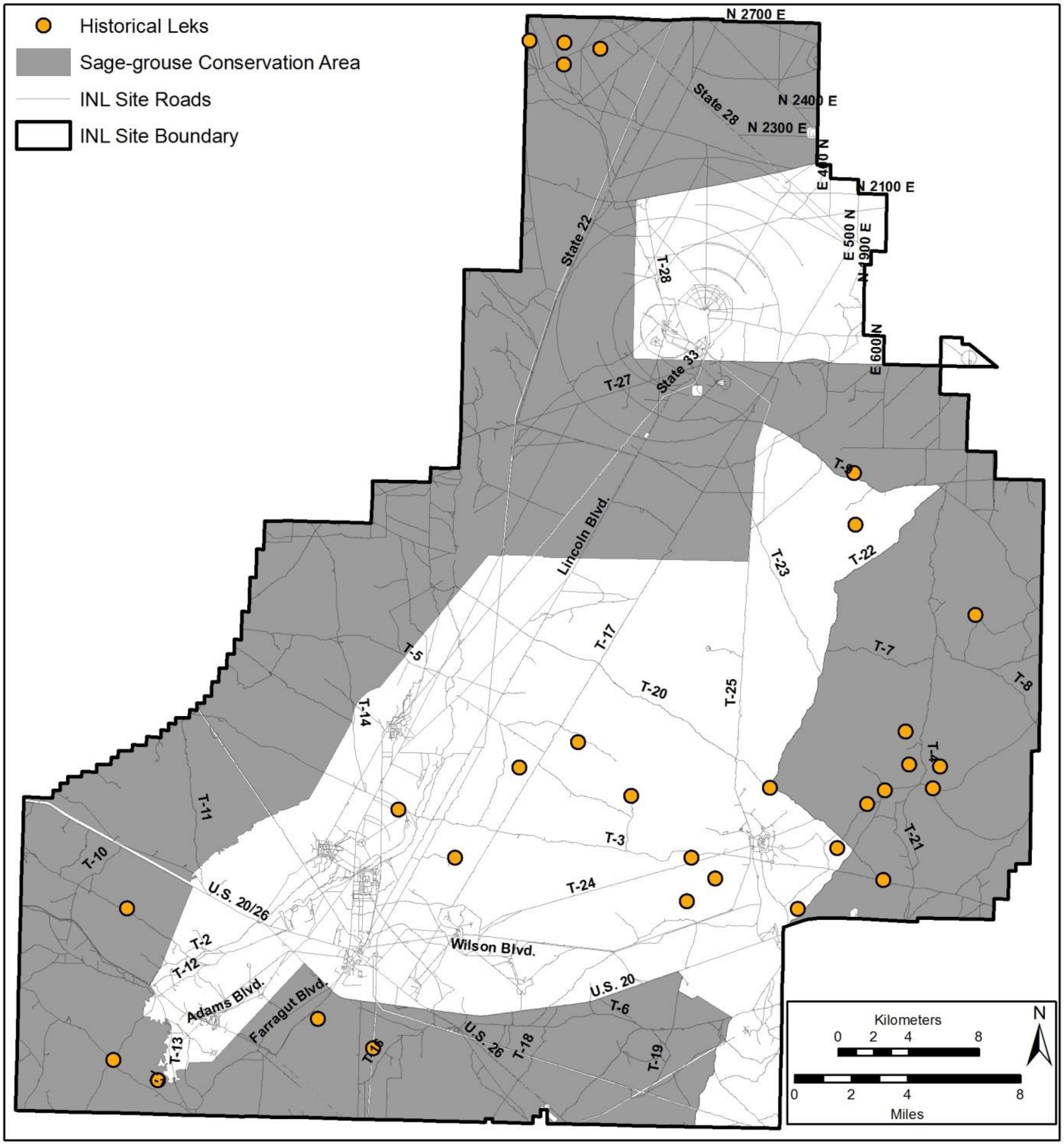

Figure 2-3. Historical leks surveyed on the INL Site in 2014.

2.3 Task 3 – Systematic Lek Discovery Surveys

2.3.1 Introduction

There are large portions of the INL Site in the SGCA where few or no active leks have been identified (e.g., the west side of the INL Site), even though a cursory examination indicates that the habitat in these areas may be adequate for breeding and nesting sage-grouse (DOE and USFWS 2014). For a limited number of years, the ESER program will survey these poorly sampled regions on the INL Site to identify additional active leks in preparation for potentially establishing additional lek routes before the 2017 lek season (DOE and USFWS 2014).

2.3.2 Methods

We designated road- and remote-survey locations in a Geographic Information System (GIS) at which to stop, or hike to, and listen for lekking grouse using a parabolic microphone. To create road-survey locations, we first displayed the roads GIS Layer for the INL Site (except roads used to access facilities). We then placed survey locations along T-roads at 1-km (0.62 mi) intervals, starting with a survey location at the beginning of each T-road (Figure 2-4). We selected intervals of 1 km (0.62 mi) for survey locations based on recommendations for searching for leks on roads (Connelly et al. 2003). We then overlaid our road-survey locations with the most current GIS layer of the big sagebrush habitat derived from the 2011 Vegetation Community Classification and Mapping of the INL Site (Shive et al. 2011). All road-survey locations falling outside of the big sagebrush habitat GIS Layer were removed, unless the survey location was adjacent to patches of sagebrush. We then buffered each road-survey location by 1.5 km (0.93 mi), which was the maximum distance that we were able to detect sage-grouse with the parabolic microphone. We deleted survey locations in areas where roads were close together, and therefore had overlapping areas that would be sampled by other road-survey locations (Figure 2-4).

After each road-survey location was buffered by 1.5 km (0.93 mi), we identified road-less areas that overlapped the big sagebrush habitat GIS Layer and were too far removed (> 1.5 km [0.93 mi]) from our road-survey locations to be sampled. In those inaccessible areas, we created remote-survey locations that would allow us to sample most of the remaining remote areas (Figure 2-4). We also revisited three locations that were surveyed last year at which biologists potentially heard lekking sage-grouse (Figure 2-4).

In 2014, ESER biologists visited 95 road- and remote-survey locations from March to May. At each road-survey location, we would stop the truck and listen for sage-grouse calls on each side of the truck for two minutes with a parabolic microphone. If grouse were heard, we would hike to the area and count the birds on the lek 4 times over a 10-minute period and then record the number and sex of the birds (ESER Procedure RP-6). For the remote-survey locations, we would hike to each location and then attempt to hear lekking sage-grouse using a parabolic microphone. If no grouse were detected at the remote-survey location, we would walk to four, new locations in each cardinal direction that were ~100 m (109 yd) from the center of the remote-survey location (Figure 2-4). We then listened again for sage-grouse calls for two minutes using the parabolic microphone at each new location in the cardinal directions (ESER Procedure RP-6). If strutting grouse were heard in any cardinal direction, we attempted to locate the new lek by walking towards the call. We then counted and recorded the number of grouse observed as described above (ESER Procedure RP-6).

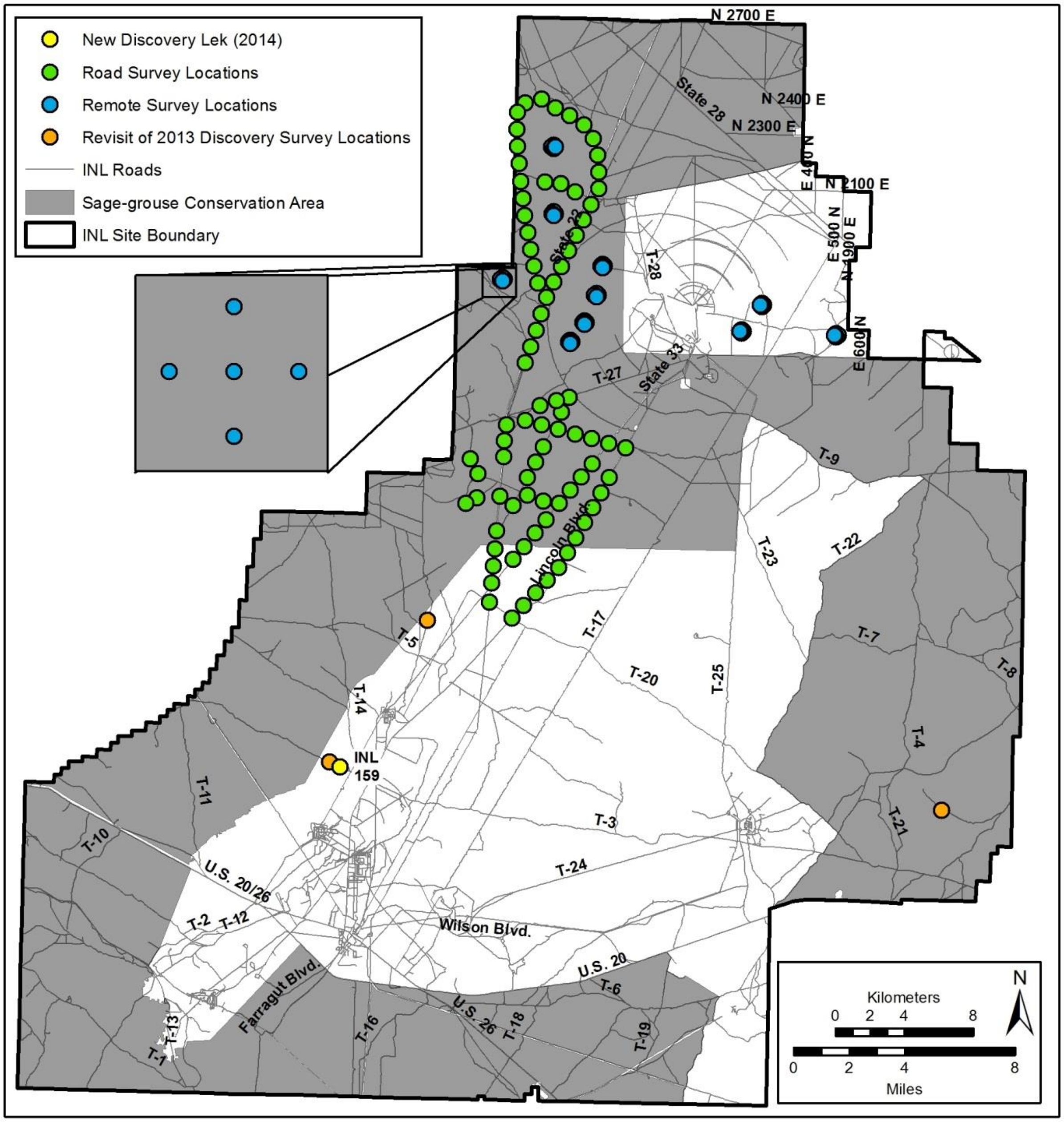

Figure 2-4. Areas on the INL Site where ESER biologists surveyed road and remote locations for sage-grouse leks, as well as the location of one new lek that was discovered as a result of those surveys in 2014.

2.3.3 Results

ESER biologists visited the 95 road- and remote-survey locations an average of 1 time (*SD* = 0.1 survey, range 1 to 2 surveys) to determine if male sage-grouse were lekking in areas near those survey locations (Figure 2-4). Of those 95 road- and remote-survey locations, we located one new lek (INL 159) near a point that was sampled in 2013 and revisited in 2014 (Figure 2-4). We counted 2 males and 1 female at that lek on April 16.

2.3.4 Discussion

The third monitoring task involved performing surveys to discover new leks in areas that have not been sampled extensively on the INL Site. The purpose of this task is to document additional active leks on the INL Site in preparation to potentially establish new lek routes (DOE and USFWS 2014). While conducting surveys for this task during 2014, we identified one new lek. That new lek could be used when other lek routes are established on the INL Site before the 2017 lek season (DOE and USFWS 2014). Establishing more lek routes will enhance DOE's ability to more accurately track sage-grouse trends, especially within the SGCA (DOE and USFWS 2014).

2.4 Summary of Known Active Leks

At the beginning of 2014, 49 leks were classified as active on or near the INL Site, including two leks that are part of IDFG survey routes, which are just outside the INL Site boundary. Following the 2014 field season, six of these were reclassified as inactive. With the discovery of three new leks, the total number of known active leks on or near the INL Site currently is 47 (Figure 2-5).

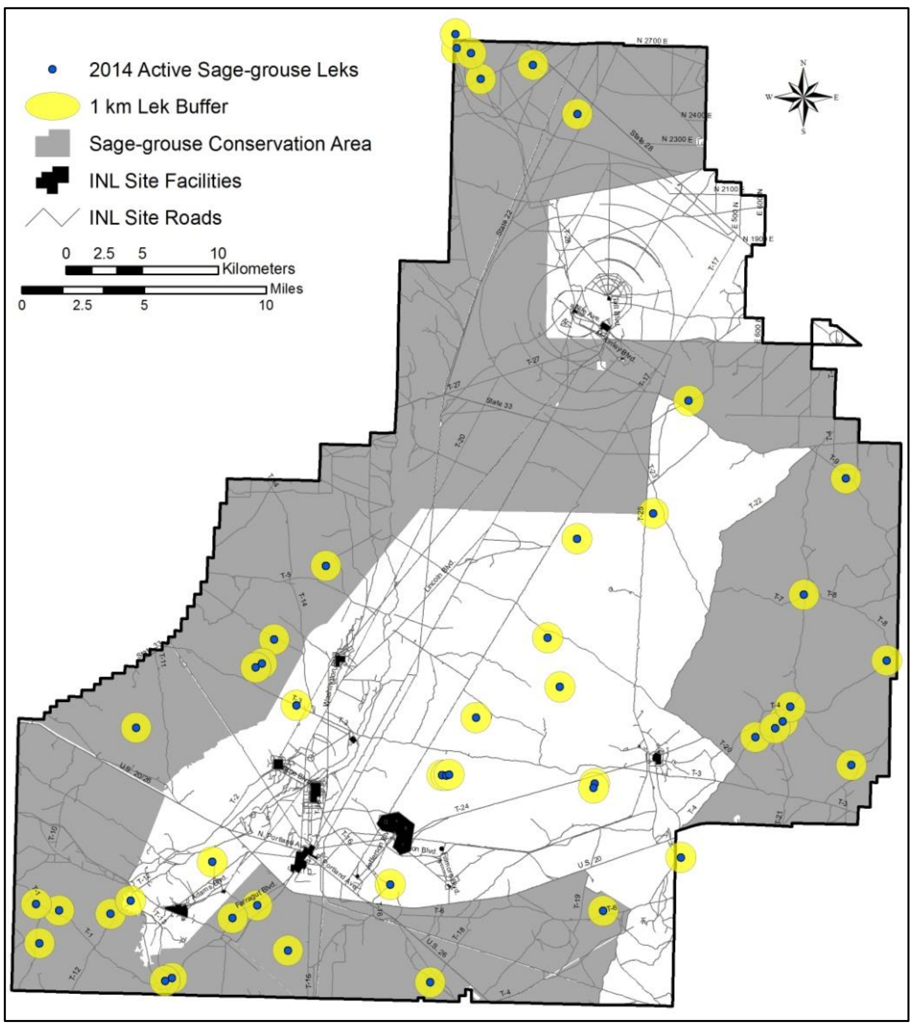

Figure 2-5. Leks classified as active on or near the INL Site following the 2014 field season.

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3. HABITAT TRIGGER MONITORING

All vegetation-based estimates for 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. The spatial extent of sagebrush habitat is dynamic and will reflect changes in plant communities or vegetation classes. Areas designated as sagebrush habitat will change through time based on gradual changes in vegetation composition and also from abrupt changes in land cover, such as those observed after a wildland fire.

The current baseline value of the habitat trigger is defined as the total area designated as sagebrush habitat within the SGCA at the end of 2012. The trigger would be considered tripped when there is a 20% reduction in sagebrush habitat within the SGCA. The habitat trigger baseline value is 78,145 ha (154,480 acres) of sagebrush habitat. If a net of 15,629 ha (38,620 acres) of sagebrush habitat were lost, the USFWS will conduct an evaluation of current habitat management on the INL Site and arrange a meeting with DOE to discuss plans for maintaining compliance with the CCA.

There are two monitoring tasks used to identify vegetation changes across the landscape and maintain an accurate record of the quantity and distribution of sagebrush habitat within the SGCA to annually evaluate the habitat trigger:

Task 5: Sagebrush Habitat Condition Trends - The sagebrush habitat quality data will document gains in habitat as non-sagebrush map polygons transition back into sagebrush classes, or when compositional changes occur (e.g. non-native grass density) within existing 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 deals with losses to sagebrush habitat following events that alter vegetation communities. As updates are made to the map classes and/or 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.

These two monitoring tasks together reflect the original mapping process and provide the basis for maintaining an accurate map and estimate of quality 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, a dichotomous key to vegetation classes will be used at numerous locations within the polygon 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

3.1.1 Introduction

Characterization and monitoring of sagebrush habitat quality, or condition, was identified as an integrated component of the CCA monitoring plan to address conservation efforts for sage-grouse on the Idaho National Laboratory (INL) Site. Annual monitoring of sagebrush habitat will be necessary to track long-term trends in the condition of habitat available for sage-grouse and to understand the potential for declines in habitat quality associated with threats. Two threats to greater sage-grouse on the INL Site, wildland fire and infrastructure development, were ranked "high" in the CCA. Additionally, annual grasses and other weeds, livestock, and seeded perennial grasses were ranked as medium. These five threats are thought to affect sage-grouse populations partially or wholly through their effects on habitat. Therefore, the habitat condition monitoring task was developed to allow biologists to characterize broad-scale trends in habitat condition over time as well as to identify annual changes in condition associated with post-fire recovery, surface disturbance, livestock operations, and introduced herbaceous species.

Trends in plot-level vegetation composition, which will be assessed as a component of this task, will also be used to support the habitat quantity and distribution task (Task 6). Increasing or decreasing trends in sagebrush cover, which will be monitored with the habitat condition data set, will be used to help determine where sagebrush habitat distribution may be changing. Specifically, increases or decreases in sagebrush cover in some plots or groups of plots may prompt reevaluation of a map class around that location and subsequent changes to map classes may change estimates of habitat distribution. In addition the habitat condition data can be used to interpret vegetation characteristics of polygons mapped as habitat in terms current habitat guidelines (i.e. Connelly et al. 2000).

Monitoring task 5 will also utilize data from the existing Long-Term Vegetation (LTV) Transect plots to provide historical context and gross trends for vegetation community change on the INL Site. The LTV plots can be used to assess habitat condition or changes in condition within the framework of general trends for vegetation. Analyses of the LTV plots can elucidate whether directional trends in species abundance can be expected based on long-term patterns, how quickly vegetation composition changes, and how different precipitation scenarios affect various functional groups. Sampling occurs once every five years for this purpose. The next data collection effort on the LTV plots is scheduled in 2016. For a comprehensive review of the LTV Project and results current through the most recent 2011 sampling effort see Forman et al. (2013).

3.1.2 Methods

Study Site

INL Site vegetation is typical of the greater sagebrush steppe ecosystem in North America. Big sagebrush dominated communities generally host a diverse component of native forbs and perennial grasses, including both rhizomatous and bunch grasses. Across the INL Site, Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) is abundant and widespread, while basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*) occurs in a more localized distribution, where soils are deeper and have greater available soil moisture (Shumar and Anderson 1986). Plant communities that are not dominated by big sagebrush, either because they have been burned in recent wildland fires or because they do not have the appropriate abiotic resources to support big sagebrush stands, are often dominated by native grasses (e.g. *Hesperostipa comata*, *Achnatherum hymenoides*, *Elymus lanceolatus*, *Elymus elymoides*), green rabbitbrush (*Chrysothamnus viscidiflorus*), salt desert shrubs (*Atriplex confertifolia*, *Grayia spinosa*, and *Atriplex falcata*), threetip sagebrush (*Artemisia tripartita*), dwarf sagebrush species (*Artemisia nova* and *Artemisia arbuscula*), or Utah Juniper (*Juniperus osteosperma*). Non-native species, the most common of which are crested wheatgrass (*Agropyron cristatum* or *Agropyron desertorum*), cheatgrass (*Bromus tectorum*), and desert alyssum (*Alyssum desertorum*), are locally abundant in some INL Site plant communities.

Over the past few decades, the INL Site and greater regional landscape have undergone some dramatic changes. These changes include shifts in land cover, land use, and weather. Wildland fires have affected plant communities across about 37% of the INL Site since 1994. Several large fires have altered much of the sagebrush steppe vegetation to the south and to the east of the INL Site during the same time period. Increases in the use of remote backcountry areas are notable at the INL Site and across the region as well. Finally, some of the hottest and driest years during the 60-year weather record occurred during the past decade. The seasonality of precipitation during the past five years also appears to deviate from historical monthly averages (Forman et al. 2013).

Study Design

The habitat condition monitoring task was designed to:

- Characterize habitat condition each year,
- Relate vegetative characteristics of habitat on the INL Site to conservation goals and/or management guidelines,
- Begin tracking 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,
- Inform the process used to update the “habitat map.”

To the extent possible, the habitat condition monitoring plan utilizes plots established to support the plant community classification for the INL Site vegetation map (established in 2008) and existing Long-Term Vegetation plots (established in 1950). Use of pre-existing plots for sage-grouse habitat monitoring is important because they represent data spanning back at least five years and are associated with statistical classifications which characterize the plant communities at each plot, providing a link between the habitat condition (quality) and habitat distribution (quantity) tasks.

A subset of 75 of the habitat condition monitoring plots are surveyed annually; about two-thirds of the plots are located in polygons designated as current sagebrush habitat and the remaining plots are located in fire scars where the plant community prior to the wildland fire was thought to include sagebrush habitat. An additional 150 plots are scheduled to be surveyed on a rotational basis with a subset of 50 plots sampled each of three years over the span of five years. The rotational plots are located so as to increase sample sizes in fire scars, grazing allotments, and areas likely to be impacted by non-native plants.

The data metrics collected at each of the habitat monitoring plots were selected for two purposes. The first is to support basic description and assessment of sage-grouse habitat quality (e.g. Connelly 2000). The second is to track trends which allow for characterization of compositional change in vegetation through time, and with respect to potential threats. The habitat 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.

Two minor changes were made to the study design of this task prior to the 2014 sampling period. First, the methodology for sampling vegetation height was changed from 120 individuals per plot (40 shrubs and 80 herbaceous individuals) to 80 individuals per plot (40 shrubs and 40 herbaceous individuals). Additionally, all individuals sampled are to be located along the transect line instead of within a 1m radius of the sample location. This change increases sampling efficiency in the field and standardizes height measurements by the relative abundance of each species without skewing the sample effort toward larger individuals. The second change was to add counts of active ant mounds within each plot. This adjustment is a coarse measure of abundance, but adds very little total sampling effort. Ants have been noted as a component of the diet of sage-grouse chicks (Klebenow and Gray 1967) and ant abundance has been sampled to support characterizations of habitat condition (Nelle et al. 2000) by others. 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.

Data Analyses

Plots that are sampled annually will be used to track trends in general habitat condition across the INL Site, while rotational plots will be used to address specific threats or concerns related to more localized areas (fire scars, grazing allotments, etc.). Formal trend analysis on data collected from the annual plots will begin when data are available for at least five years, after enough temporal variability has been captured to make those analyses meaningful. Likewise, characterization of the habitat status of specific areas of interest will be reasonable only after all rotational plots have been sampled at least once, to ensure adequate sample sizes in those areas.

Data collected in 2014 will be used to update habitat summary statistics from 2013. These summary statistics will eventually form the basis for trend analyses. They will also allow for updated comparisons between vegetative characteristics of polygons currently designated as sage-grouse habitat on the INL Site and those recommended for optimal sage-grouse habitat in guidance documents. Analysis of the 2014 data will include an overview of precipitation and the potential effects of precipitation patterns on the 2014 habitat condition monitoring data. The 2014 summary data will be informally compared to the 2013 summary data to begin developing an understanding of the potential annual variability of sage-grouse habitat on the INL Site.

3.1.3 Results

Data were collected on a total of 125 plots between June and August of 2014; sampling was completed on all 75 annual plots and 50 of the rotational plots (Figure 3-1). For this report, results will focus on data from the annual plots, as discussed previously. With respect to the annual plots, 48 are located in polygons currently designated as sagebrush habitat (referred to as sagebrush habitat plots hereafter), and 27 are located in polygons where habitat status is currently non-sagebrush dominated (referred to as non-sagebrush plots hereafter). All of the non-sagebrush plots are located in polygons that have burned at least once since 1994 and were thought to have been dominated by sagebrush prior to fire. The sagebrush habitat plots are located in polygons that have not burned in at least the last 20 years, and many of them have likely not burned for a few centuries.

Using a dichotomous plant community key, which was developed based on the 2008 classification effort (Shive et al. 2011), 46 of the 48 annual sagebrush habitat plots were assigned to communities characterized by sagebrush dominance in 2014 (Table 3-1a.). The remaining two plots were assigned to communities characterized by the dominance of green rabbitbrush. Compared with 2013 results, notable differences include a shift away from keying communities as being dominated by mixed and/or hybridized big sagebrush subspecies to keying communities as being dominated by Wyoming big sagebrush.

Of the 27 annual non-sagebrush plots, 11 were assigned to shrublands or shrub herbaceous communities and the remaining 16 were assigned to communities which were dominated entirely by herbaceous vegetation during the 2014 sample period (Table 3-1b). With the exception of one plot, green rabbitbrush dominance characterized the plant communities in non-sagebrush habitat plots that were assigned to shrublands or shrub herbaceous communities. The remaining shrubland plot was assigned to a shadscale-dominated plant community. Of the 16 plots assigned to herbaceous vegetation communities, 12 were dominated by native perennial grasses, and the other four were dominated or co-dominated by cheatgrass in 2014. In general, more non-sagebrush plots keyed to herbaceous-dominated communities and fewer keyed to green rabbitbrush-dominated communities in 2014 than in 2013, but the number of plots dominated by cheatgrass was unchanged between the two years.

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 sage-grouse sign (scat) was present on 21 of the 48 annual sagebrush habitat plots; at least some scat was from the current year in four of those plots. Sage-grouse scat, all from previous seasons, was only noted on two of the 27 non-sagebrush plots. Scat was noted on 27 of the sagebrush plots and four of the non-sagebrush plots in 2013, indicating that in 2014 scat presence was similar, if slightly lower than the previous year on both sagebrush habitat and non-sagebrush plots.

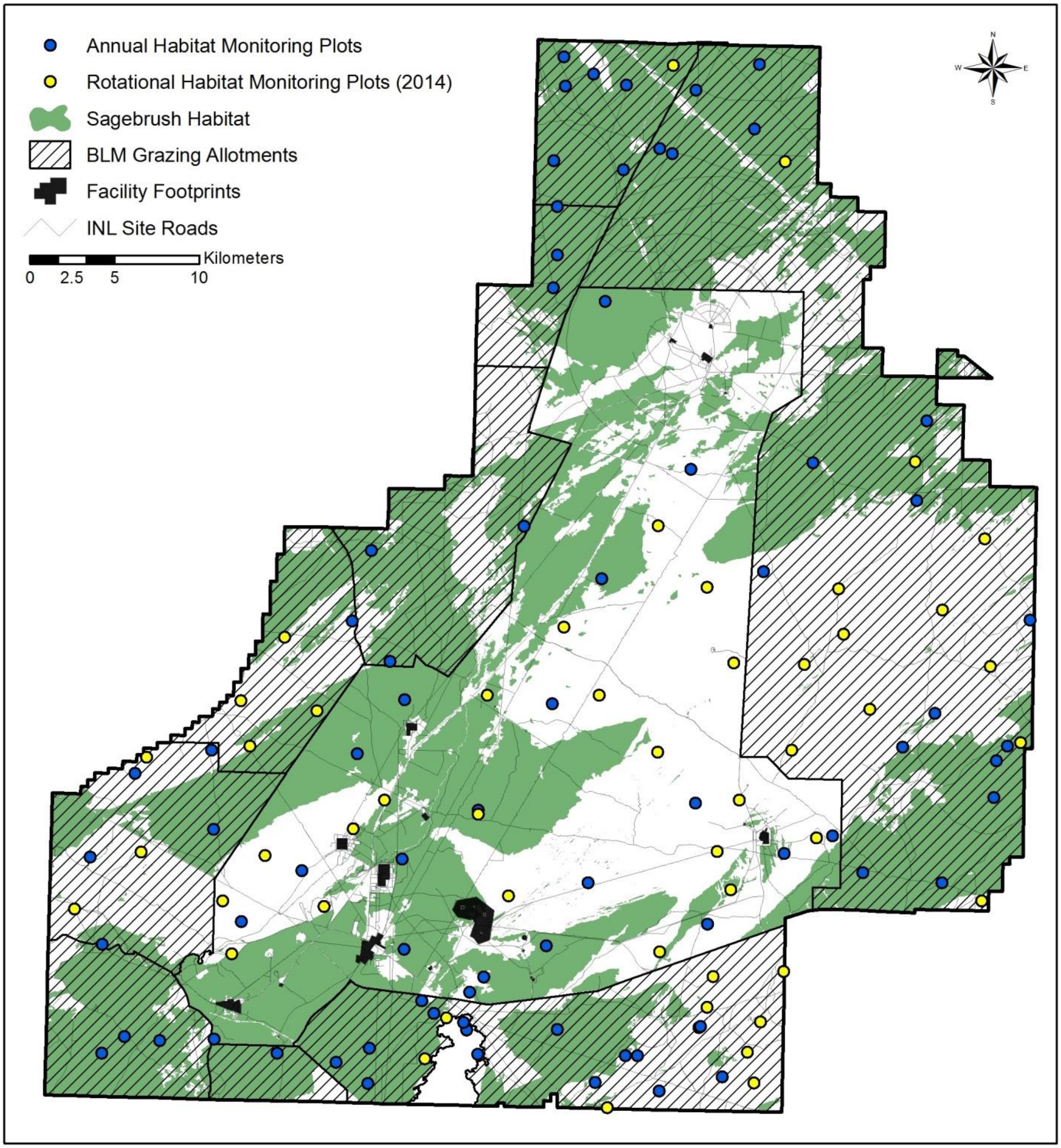

Figure 3-1. CCA sage-grouse habitat condition monitoring plots sampled in 2014 on the INL Site.

Table 3-1a. Results of a dichotomous plant community key (Shive et al. 2011) for 48 sage-grouse habitat condition monitoring plots sampled in 2013 and 2014 on the INL Site.

Plant Community	Number of Plots 2014	Number of Plots 2013
Wyoming Big Sagebrush Shrubland	39	25
Low Sagebrush Dwarf Shrubland	3	3
Black Sagebrush/Sandberg Bluegrass Dwarf-shrub Herbaceous Vegetation	2	2
Three-tip Sagebrush Shrubland	2	3
Green Rabbitbrush Shrubland	2	0
Big Sagebrush Shrubland (mixed subspecies)	0	11
Basin Big Sagebrush Shrubland	0	4

Table 3-1b. Results of a dichotomous plant community key (Shive et al. 2011) for 27 non-sagebrush habitat condition monitoring plots sampled in 2013 and 2014 on the INL Site.

Plant Community	Number of Plots 2014	Number of Plots 2013
Bluebunch Wheatgrass – Sandberg Bluegrass Herbaceous Vegetation	10	2
Green Rabbitbrush Shrubland	5	6
Cheatgrass Semi-natural Herbaceous Vegetation	3	3
Green Rabbitbrush/Bluebunch Wheatgrass Shrub Herbaceous Vegetation	3	3
Green Rabbitbrush/Streambank Wheatgrass (Western Wheatgrass) Shrub Herbaceous Vegetation	2	4
Needle and Thread Herbaceous Vegetation	1	1
Sandberg Bluegrass Herbaceous Vegetation	1	1
Tall Tumblemustard – Cheatgrass Semi-natural Herbaceous Vegetation	1	1
Shadscale Dwarf Shrubland	1	0
Crested Wheatgrass Semi-natural Herbaceous Vegetation	0	2
Western Wheatgrass Herbaceous Vegetation	0	1
Wyoming Big Sagebrush Shrubland	0	1
Green Rabbitbrush – Winterfat Shrubland	0	1
Indian Ricegrass Herbaceous Vegetation	0	1

Active ant mounds were added to the sample protocol in 2014. Twenty-one of the 75 annual habitat condition monitoring plots had active ant mounds at the time of sampling. The maximum number of mounds counted in a single 20m x 20m plot was three. Of the twenty-one plots with active ant mounds, eight were sagebrush habitat plots and 13 were non-sagebrush plots. Thatch ($\bar{x}$ = 0.77) and crater ($\bar{x}$ = 0.77) mounds were equally abundant in non-sagebrush plots, while crater mounds ($\bar{x}$ = 0.88) were generally more abundant than thatch mounds ($\bar{x}$ = 0.25) in sagebrush habitat plots.

Anthropogenic influence was noted on 14 (19%) of the annual habitat condition monitoring plots in 2014. Livestock manure was present in 11 of those 14 plots, and livestock trails were identified as the type of disturbance affecting the remaining three plots. All 14 plots with documented anthropogenic influence are located within, or immediately adjacent to (in the case of one plot) allotment boundaries. Fifty-two of the 75 annual monitoring plots are located within allotment boundaries; therefore, approximately ¼ of the annual monitoring plots located within allotment boundaries were noted to have been influenced by livestock operations in 2014. Ten of the 14 affected plots were sagebrush habitat plots. The total number of plots noted to have signs of anthropogenic influence was lower in 2014 (n = 14) than in 2013 (n = 21). However, the types of disturbance noted and the allocation of plots, in terms of allotment boundaries and current habitat status, were consistent between sample years.

In 2014, absolute cover from sagebrush species averaged approximately 20% across the annual sagebrush habitat monitoring plots (Table 3-2a), which is unchanged from 2013 sagebrush cover values (Table 3-2b). This is a little more than double absolute sagebrush cover averaged across the 43 “core” LTV plots, last sampled in 2011 (Forman et al. 2013). In non-sagebrush monitoring plots, absolute sagebrush cover averaged approximately 0.1% and contributed very little to total vegetative cover in both 2013 and 2014. The few sagebrush individuals that were present in those plots in both years were shorter, on average, than sagebrush individuals in sagebrush habitat plots (Tables 3-2a and 3-2b). Conversely, average cover and height of perennial grasses and forbs were greater in non-sagebrush plots than in sagebrush habitat plots during both 2013 and 2014. Sagebrush density estimated across the annual sagebrush habitat plots was lower in 2014 than in 2013 (Tables 3-2a and 3-2b), but was still consistent with the range of density estimates from big sagebrush stands previously sampled to support characterization of sagebrush demography on the INL Site (Forman et al. 2013) as well as density estimates from the LTV (unpublished data).

Total vascular plant cover was similar between sagebrush habitat plots and non-sagebrush plots in 2014 (Tables 3-3a and 3-3b). Absolute cover averaged across each subset of plots was about 30%, which is about 10% lower than in 2013. On sagebrush habitat plots, nearly 90% of the total vegetation cover was from shrubs, and more than two thirds of the shrub cover was from *Artemisia* species. Overall sagebrush contributed about 60% of the total vegetation cover on sagebrush habitat plots. Big sagebrush was the most abundant and widespread sagebrush species; however, threetip, black, and low sagebrush were locally abundant on the limited number of plots where they each occurred. Mean shrub cover only decreased slightly in the sagebrush habitat plots between 2013 and 2014, but native perennial grasses and forbs were about half as abundant in 2014 as in 2013. Indian ricegrass (*Achnatherum hymenoides*) was the most abundant perennial grass across the sagebrush habitat plots in 2014; Sandberg bluegrass (*Poa secunda*) was the most abundant perennial grass in 2013. Total cover from introduced species on sagebrush habitat plots was less than 1% in 2014 and cheatgrass cover was undetectable using the current sampling methodology. This represents a decline from 2013 to 2014, although mean cover from introduced species was only about 2% in 2013 (Table 3-3a).

Table 3-2a. Summary of selected vegetation measurements for characterization of condition of sagebrush habitat monitoring plots and non-sagebrush monitoring plots on the INL Site in 2014.

	Mean Cover (%)	Mean Height (cm)	Mean Density (individuals/m^2)
Sagebrush Habitat Plots (n = 48)			
Sagebrush	20.47	46.70	1.98
Perennial Grass/Forbs	3.02	12.10	n/a
Non-sagebrush Plots (n = 27)			
Sagebrush	0.15	29.11	0.05
Perennial Grass/Forbs	12.14	21.96	n/a

Table 3-2b. Summary of selected vegetation measurements for characterization of condition of sagebrush habitat monitoring plots and non-sagebrush monitoring plots on the INL Site in 2013.

	Mean Cover (%)	Mean Height (cm)	Mean Density (individuals/m^2)
Sagebrush Habitat Plots (n = 48)			
Sagebrush	20.69	44.87	3.24
Perennial Grass/Forbs	8.08	14.37	n/a
Non-sagebrush Plots (n = 27)			
Sagebrush	0.08	29.81	0.05
Perennial Grass/Forbs	18.47	19.41	n/a

In the non-sagebrush plots, only about 40% of total vascular plant cover was from shrubs in 2014 and green rabbitbrush provided more than 90% of the cover from shrubs. Perennial grasses and forbs were responsible for about half of the cover from native species on non-sagebrush plots in 2014; perennial herbaceous species were more than twice as abundant as non-native herbaceous species. Bluebunch wheatgrass (*Pseudoroegneria spicata*) was the most abundant herbaceous species in both 2013 and 2014 at about 5% absolute cover in both years. Average absolute cover from native, perennial grasses on non-habitat plots was more than triple that on sagebrush habitat plots, and cover from introduced herbaceous species was greater on non-habitat plots (Table 3-3b). Crested wheatgrass was abundant enough to be represented in the cover data of only two of the non-habitat plots, but it was dominant or co-dominant where it occurred. Cheatgrass was also much more abundant on non-habitat plots than on sagebrush

Table 3-3a. Mean absolute cover by species for 48 sagebrush habitat monitoring plots on the INL Site in 2013 and 2014. Asterisk indicates that this species was undetected using the current sampling methodology in a given sample year.

Plant Species	Absolute Cover(%) 2014	Absolute Cover(%) 2013
Native		
Shrubs		
Artemisia tridentata	17.28	16.75
Chrysothamnus viscidiflorus	6.67	8.59
Artemisia tripartita	1.70	2.33
Artemisia arbuscula	0.92	0.84
Atriplex confertifolia	0.77	0.70
Artemisia nova	0.57	0.77
Krascheninnikovia lanata	0.50	0.45
Linanthus pungens	0.22	0.37
Eriogonum microthecum	0.08	0.12
Others (n = 2, 4)	0.06	0.09
Total Native Shrub Cover	**28.77**	**31.01**
Succulents		
Opuntia polyacantha	**0.10**	**0.11**
Perennial Grasses		
Achnatherum hymenoides	0.80	1.30
Poa secunda	0.57	2.04
Pseudoroegneria spicata	0.56	1.57
Elymus elymoides	0.15	0.86
Hesperostipa comata	0.14	0.35
Elymus lanceolatus	0.13	0.74
Others (n = 0, 3)	*	0.11
Total Native Perennial Grass Cover	**2.35**	**6.95**
Perennial Forbs		
Phlox hoodii	0.57	0.73
Others (n = 16)	0.10	0.40
Total Native Perennial Forb Cover	**0.67**	**1.13**
Annuals and Biennials		
Chenopodium leptophyllum	*	**0.01**
Total Native Cover	**31.89**	**39.20**
Introduced		
Perennial Grasses		
Agropyron cristatum	**0.66**	**1.23**
Annuals and Biennials		

Plant Species	Absolute Cover(%) 2014	Absolute Cover(%) 2013
Halogeton glomeratus	0.18	0.41
Bromus tectorum	*	0.21
Alyssum desertorum	*	0.13
Total Introduced Annual and Biennial Cover	**0.18**	**0.75**
Total Introduced Cover	**0.84**	**1.99**
Total Vascular Plant Cover	**32.73**	**41.19**

Table 3-3b. Mean absolute cover by species for 27 non-sagebrush monitoring plots on the INL Site in 2013 and 2014. Asterisk indicates that this species was undetectable using the current sampling methodology in a given sample year.

Plant Species	Absolute Cover(%) 2014	Absolute Cover(%) 2013
Native		
Shrubs		
Chrysothamnus viscidiflorus	10.52	9.92
Atriplex confertifolia	0.41	0.21
Tetradymia canescens	0.25	0.26
Artemisia tridentata	0.15	0.07
Others (n = 3, 4)	0.14	0.13
Total Native Shrub Cover	**11.47**	**10.59**
Succulents		
Opuntia polyacantha	**0.06**	**0.05**
Perennial Grasses		
Pseudoroegneria spicata	4.93	4.70
Poa secunda	2.63	3.86
Hesperostipa comata	1.31	2.13
Achnatherum hymenoides	1.13	1.33
Elymus elymoides	0.67	0.91
Elymus lanceolatus	0.63	2.11
Pascopyrum smithii	*	0.63
Others (n = 1, 1)	0.07	0.03
Total Native Perennial Grass Cover	**11.37**	**15.70**
Perennial Forbs		
Phlox hoodii	0.52	0.51
Crepis acuminata	0.12	0.91
Erigeron pumilus	0.08	0.18
Astragalus filipes	0.01	0.13

Plant Species	Absolute Cover(%) 2014	Absolute Cover(%) 2013
Phlox longifolia	*	0.48
Others (n = 3, 15)	0.04	0.56
Total Native Perennial Forb Cover	**0.77**	**2.77**
Annuals and Biennials		
Others (n = 2, 5)	0.09	0.24
Total Native Cover	**23.76**	**29.35**
Introduced		
Perennial Grasses		
Agropyron cristatum	**0.44**	**0.35**
Annuals and Biennials		
Bromus tectorum	2.68	5.41
Salsola kali	1.20	1.12
Halogeton glomeratus	0.75	1.31
Alyssum desertorum	*	0.32
Sisymbrium altissimum	*	0.14
Descurainia sophia	*	0.11
Others (n = 0, 1)	*	0.02
Total Introduced Annual and Biennial Cover	**4.63**	**8.42**
Total Introduced Cover	**5.07**	**8.77**
Total Vascular Plant Cover	**28.83**	**38.12**

habitat plots in both 2013 and 2014. It is worth mentioning, however, that even on non-habitat plots average total cover from native, perennial grasses was nearly three times greater than cover from cheatgrass (Table 3-3b).

Vegetation height was summarized by functional group to provide a more complete assessment of vertical structure on the habitat condition monitoring plots (Tables 3-4a and 3-4b). In sagebrush habitat plots, shrub height estimates were from sagebrush species nearly 70% of the time and sagebrush tended to be the tallest functional group. In 2013, more than 80% of the shrubs sampled for height were sagebrush species. The difference between the two sample years is most likely due to a change in the sampling protocol rather than a real difference in the plant community. On non-sagebrush plots shrub height estimates were from other species, primarily green rabbitbrush, more than 90% of the time. It is notable that many non-sagebrush plots did have a substantial shrub component that provides more vertical structure than herbaceous plant communities that lack shrubs entirely. Because cover from annual species was relatively low on sagebrush habitat plots, most of the herbaceous height in those plots was from perennial grasses, which tend to be taller than annuals. A greater proportion of the herbaceous height estimate (more than 20%) in non-sagebrush plots is from shorter-statured annual species. For both sagebrush habitat plots and non-sagebrush plots, height estimates from annuals were primarily from introduced species in 2014. Overall, mean height for most functional groups in both sagebrush habitat and non-sagebrush plots were only slightly lower in 2014 than in 2013.

Table 3-4a. Vegetation height by functional group for 48 sagebrush habitat monitoring plots on the INL Site in 2013 and 2014.

Plant Species	Mean Height (cm) 2014	Proportion of Sample 2014	Mean Height (cm) 2013	Proportion of Sample 2013
Shrubs				
Sagebrush Species	46.70	0.69	44.87	0.82
Other Species	23.48	0.31	26.20	0.18
Herbaceous Species				
Perennial Grasses	14.31	0.72	15.69	0.76
Perennial Forbs	4.53	0.21	7.24	0.14
Annual Grasses	*	0.00	7.60	0.04
Annual Forbs	4.01	0.07	3.61	0.06

Table 3-4b. Vegetation height by functional group for 27 non-sagebrush monitoring plots on the INL Site in 2013 and 2014.

Plant Species	Mean Height (cm) 2014	Proportion of Sample 2014	Mean Height (cm) 2013	Proportion of Sample 2013
Shrubs				
Sagebrush Species	29.11	0.07	29.81	0.08
Other Species	23.70	0.93	24.85	0.92
Herbaceous Species				
Perennial Grasses	22.98	0.74	21.15	0.52
Perennial Forbs	6.85	0.05	10.97	0.11
Annual Grasses	14.87	0.10	9.62	0.19
Annual Forbs	5.66	0.12	9.00	0.19

In 2014, sagebrush density ranged from approximately one individual per three square meters to approximately 7 individuals per square meter in the sagebrush habitat plots (Table 3-5a). In the non-sagebrush plots, sagebrush density ranged from zero to a maximum of about one individual per two square meters. Juvenile sagebrush frequency is a proportion of the eight density transects in each plot that contain juvenile shrubs. Averaged across all sagebrush habitat plots, juvenile shrubs were present in about one out of every two sample transects. In non-habitat plots, the average falls to about one out of every 30 transects. Compared with 2013 (Table 3-5b), mean sagebrush density and juvenile frequency values in 2014 were mostly unchanged in non-sagebrush plots. In sagebrush habitat plots, mean density decreased, but mean juvenile frequency increased between the two sample years. Juveniles were present in more monitoring plots in 2014 as well; they were recorded in at least one transect of 34 out of the 48 sagebrush habitat plots in 2013, and at least one transects of 41 out of the 48 sagebrush habitat plots in 2014.

Table 3-5a. Sagebrush density and juvenile frequency from sagebrush habitat monitoring plots and non-sagebrush monitoring plots on the INL Site in 2014.

	Sagebrush (n = 48)	Non-sagebrush (n = 27)
Mean Density (individuals/m^2)	1.98	0.05
Minimum Density (individuals/m^2)	0.28	0.00
Maximum Density (individuals/m^2)	6.73	0.43
Mean Juvenile Frequency	0.46	0.03

Table 3-5b. Sagebrush density and juvenile frequency from sagebrush habitat monitoring plots and non-sagebrush monitoring plots on the INL Site in 2013.

	Sagebrush (n = 48)	Non-sagebrush (n = 27)
Mean Density (individuals/m^2)	3.24	0.05
Minimum Density (individuals/m^2)	0.35	0.00
Maximum Density (individuals/m^2)	16.08	0.33
Mean Juvenile Frequency	0.27	0.02

Total annual precipitation for 2014 was roughly equivalent to average annual precipitation (Figure 3-2). However, the timing of precipitation in 2014 deviated markedly from historical patterns (Figure 3-3). Almost half of the total precipitation from 2014 fell in August. Mean August precipitation, calculated from the 64-year record from Central Facilities Area (CFA), is about 14 mm; total August precipitation from 2014 was 102 mm. Most of the sampling for this monitoring effort had been completed prior to August and cumulative precipitation through July was much lower than average, 61 mm in 2014 compared to 121 mm on average. Therefore, vegetation on the INL Site experienced drought conditions through most of the 2014 growing season and associated sampling effort. The three years prior to the 2014 sample effort were also below average in terms of total annual precipitation, and 2013 was the driest year on record with only about ¼ of average annual precipitation. Historically, the wettest months of the year occurred in the spring (April-June). Over the past decade, the seasonality of precipitation has varied dramatically; during many years the months with the highest precipitation relative to annual totals tended to occur in mid-summer (July-August) or fall (October-December).

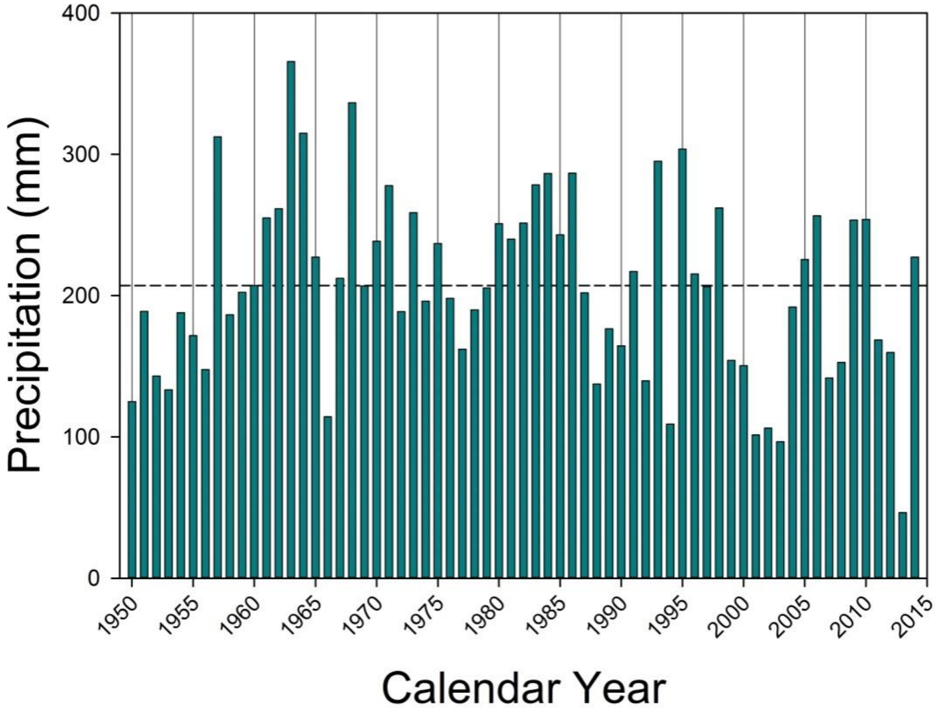

Figure 3-2. Total annual precipitation from 1950 through 2014 at the Central Facilities Area, INL Site. The dashed line represents mean annual precipitation.

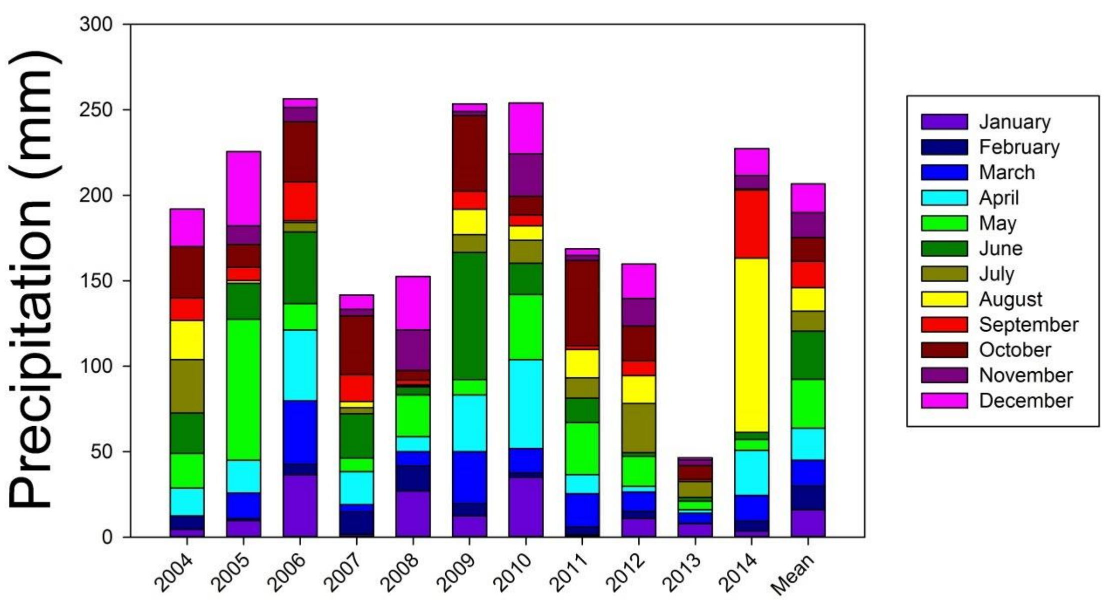

Figure 3-3. Annual precipitation by month from the Central Facilities Area, INL Site. Mean monthly precipitation includes data from 1950 through 2014.

3.1.4 Discussion

Mean sagebrush cover from annual sagebrush habitat plots, and likely for the sagebrush habitat polygons they represent, is in the middle of the range suggested for optimal breeding and brood-rearing habitat (Connelly et al. 2000). Mean sagebrush height is within, but at the lower end of the suggested optimal range. This result is to be expected, as most INL Site sagebrush communities are dominated by Wyoming big sagebrush or even shorter statured species. Perennial grass/forb mean cover and height values were lower than those recommended in current sage-grouse habitat guidelines (Connelly et al. 2000). These results should be interpreted cautiously because herbaceous functional groups are highly influenced by precipitation, and precipitation for three years prior to and up through most of the 2014 growing season was far below average. For the same reason, mean cheatgrass cover and cover from all annual species was probably uncharacteristically low in 2014. Continued monitoring during years with precipitation levels closer to normal will be required to determine whether or not cover and height of herbaceous species on sagebrush habitat plots are within optimal suggested ranges. Several years of monitoring, through a range of precipitation scenarios, will also be necessary to establish a reasonable “baseline” for herbaceous species across both habitat and non-habitat plots.

Many perennial forbs which have been identified as important forage species for sage-grouse, either directly or through the invertebrates grouse eat (Beck et al. 2009, Rhodes et al. 2010), are well represented in sagebrush habitat monitoring plots across the INL Site. Individually, each forb species tends to occur at low cover values, but total cover and species richness within this functional group is consistent with values reported for sage-grouse habitat (Beck et al. 2009, Rhodes et al. 2010). Low mean cover from introduced herbaceous species suggests high ecological condition across most of the 48 monitoring plots in sagebrush habitat.

The 27 monitoring plots in polygons not currently designated as sagebrush habitat represent burn ages ranging from one to 20 years. In terms of sage-grouse breeding and brood-rearing habitat, plant communities represented by these plots lack the adequate structural cover provided by sagebrush, but have, on average, recovered sufficient forage and cover resources provided by perennial forbs and grasses. This pattern is consistent with post-fire recovery of sage-grouse habitat both locally and regionally (Nelle et al. 2000, Beck et al. 2009, Rhodes et al. 2010). Many of the non-sagebrush habitat plots were located in green rabbitbrush-dominated communities, and while sage-grouse will nest under shrubs other than sagebrush, those nests tend to be less successful (Connelly et al. 1991). Because green rabbitbrush is a native shrub which tends to be quite abundant across post-fire plant communities in good condition and elsewhere across the INL Site (Blew and Forman 2010, Forman et al. 2013), and rabbitbrush provides more vertical cover than herbaceous species alone, the dominance of this species in post-fire communities is preferable to non-natives. Wyoming big sagebrush stands could take up to a century to recover to pre-burn sagebrush cover levels on the INL Site (Colket 2003), so maintaining native vegetative cover from both shrubs and herbaceous species will be important to the long-term ecological condition and potential recovery of those areas to optimal sage-grouse habitat.

Based on the use of the plant community key to assign a current plant community to each plot, the 2014 results differed from the 2013 result more than expected. In general most of the sagebrush habitat plots still keyed to sagebrush-dominated communities and non-sagebrush plots keyed to non-sagebrush dominated shrublands or communities dominated by herbaceous species. Most of the differences between 2013 and 2014 results for the sagebrush habitat plots were from the tendency of the 2014 field crew to assign a plant community to dominance by a specific big sagebrush subspecies, while the 2013 filed crew were more likely to classify a big sagebrush community as mixed and/or hybridized in terms of the big sagebrush dominant. More of the non-sagebrush plots keyed to herbaceous communities in 2014 than in 2013, which may have been due to a perceived loss of green rabbitbrush. Because of the ongoing drought through much of 2014, green rabbitbrush did not leaf out across much of the INL Site during the normal spring green-up, making it much less conspicuous across the landscape. Overall, there was a greater shift between sample years for assigned communities among the non-sagebrush plots. This result is not unreasonable as herbaceous communities tend to be more immediately responsive to seasonal weather conditions than sagebrush communities.

Sagebrush density and juvenile frequency metrics were specifically collected to facilitate monitoring the health and population status of sagebrush stands sampled by sagebrush habitat plots. Between 2013 and 2014, sagebrush density changed more than would be expected for a relatively stable woody species. However, sagebrush density becomes a little easier to understand when interpreted within the context of cover. Because sagebrush cover was unchanged between the two sample periods, it is likely that there were fewer small seedlings in 2014 than 2013, but established individuals changed very little. An increase in juvenile frequency between the two sample periods indicates that although there were fewer total seedlings, they were more widely distributed within and across sagebrush plots. Future monitoring data will be very useful in characterizing the annual variability associated with the sagebrush density and juvenile frequency metrics and will form the basis for understand the difference between stochasticity and ecologically meaningful change.

Results from sage-grouse sign data indicate that in 2014 scat presence was similar, if slightly lower than the previous year on both sagebrush habitat and non-sagebrush plots. The scat abundance results continue to support the pattern that plots in polygons designated as sagebrush habitat have experienced more past use than plots in polygons designated as non-habitat. In 2014, almost half of the plots representing sagebrush habitat contained sage-grouse sign, and 90% of sage-grouse sign documented in 2014 occurred in plots that are located in polygons designated as current sagebrush habitat.

After the first year of data collection for this metric, there doesn't appear to be a specific pattern in occurrence of ant mounds. Proportionally, ant mounds were more abundant in non-sagebrush plots than in sagebrush habitat plots; they occurred in 48% of non-sagebrush plots and 17% of sagebrush habitat plots. However, the annual stability of this estimate and the relationship between it and other biotic and abiotic factors are unknown and can only be elucidated after several years of data are available.

All anthropogenic influence noted in the annual habitat condition monitoring plots during the 2014 growing season was associated with livestock operations and was located within and immediately adjacent to allotment boundaries. About ¼ of the annual monitoring plots within allotment boundaries were noted to have signs of livestock use (manure and/or trails) and the proportion of sagebrush habitat plots to non-sagebrush plots that were affected was related to the allocation of these plot types within the allotment boundaries. Though anthropogenic influence certainly occurs in the central areas of the INL Site, it is often more localized and sporadic in nature than in the grazing allotments, making it less detectable within the monitoring plots located there.

Ultimately, several years of monitoring will be required to establish reasonable baselines and begin tracking trends in all of the metrics measured to assess sagebrush habitat condition, as well as the potential for recovery in non-sagebrush habitat communities. Characterizing trends in relative species composition will also be an important component of identifying changes in both sagebrush and non-sagebrush habitat, as those changes may reflect responses to stressors and/or the threats identified in the CCA. Increases in introduced annuals, decreases in native perennial forb diversity, increases in crested wheatgrass, and decreases in native, perennial grasses are all trends indicating decreases in habitat condition. All of these compositional changes have the potential to affect the use of an area as habitat and may eventually affect total habitat distribution.

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 implicated as one of the primary causes of decline in sage-grouse populations (ISAC 2006, USFWS 2013). Direct loss of sagebrush habitat has occurred through several mechanisms including infrastructure development and wildland fire. 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 are naturally restored or recover following decommissioning of existing facilities. These changes in land cover can be determined using airborne or satellite imagery that is readily available at little or no cost. ESER GIS analysts will compare new imagery as it becomes available with existing land cover data from the recently completed vegetation classification and mapping project to document changes in the distribution of sagebrush habitat. Ground-based point surveys and changes in species cover and composition documented through the sagebrush habitat condition monitoring data will also 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 goal of Task 6 is to maintain an updated INL Site vegetation map to accurately document changes in sagebrush habitat area and distribution. This task is designed to document changes in sagebrush habitat following losses due to wildland fire or other disturbances which remove or significantly alter vegetation across the landscape. In addition, this monitoring task will add additional sagebrush habitat by providing updates to the vegetation map when sagebrush cover increases and warrants a new map class designation, or to refine existing boundaries of vegetation classes when changes in species cover and composition are documented through the sagebrush habitat condition monitoring data (Task 5). Lastly, Task 6 will include post-fire mapping when the fire extent is unknown and will also allow for modifying existing wildland fire boundaries and unburned patches when errors on the ground are observed.

Updating the INL Site vegetation map is a two-step process. The first step is to verify, update, or edit existing wildland fire boundaries using a GIS. 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 may also vary considerably depending on the method used to delineate the boundary. There are examples of wildland fire boundary variability and inaccuracy evident in some of the older INL Site GIS fire layers (Figure 3-4). During the development of the most recent INL Site vegetation map (Shive et al. 2011), older wildland fire GIS layers were disregarded and the actual fire edge was digitized from high resolution imagery to maintain spatial consistency across the map. Before new vegetation class delineations are produced inside the fire boundary, recent mapped boundaries need to be updated or created at the same mapping scale (i.e. 1:12,000) as the original vegetation map.

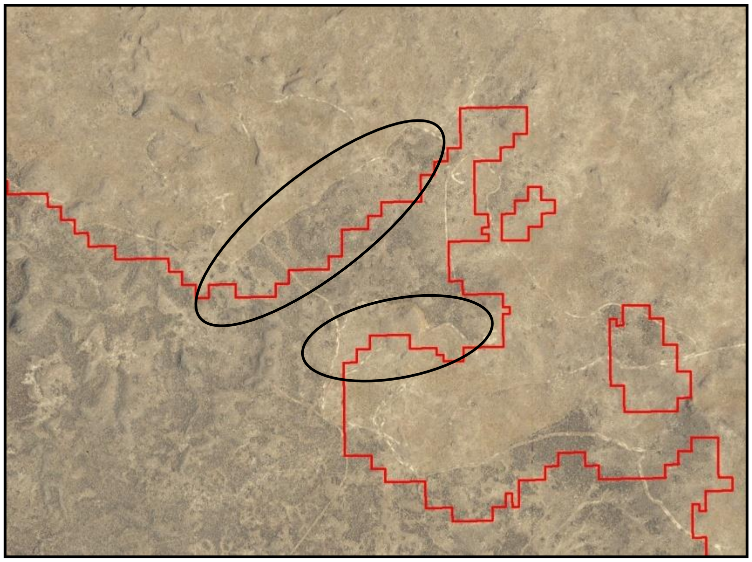

Figure 3-4. An example wildland fire boundary from 2000 (plotted in red) that was produced using an automated mapping algorithm applied to Landsat 7 TM satellite imagery with 30 m spatial resolution. The two regions circled highlight where the boundary is offset from the actual fire edge resulting in an inaccurate delineation. The boundary is also produced in a raster (pixel-based) format which creates the stair-stepped edge rather a more sinuous and realistic edge.

The second step is to spatially delineate new vegetation classes within wildland fire boundaries. When high resolution imagery becomes available, either through the National Agricultural Imaging Program (NAIP) or from INL Site specific acquisitions currently being considered by BEA, it will be used as the source data layer for manual delineations. The mapping methods follow those described in Shive et al. (2011), where imagery and various image-derived data layers (e.g. vegetation indices, measures of texture), and other spatial data layers (e.g. digital elevation models) are all used to help spatially define vegetation class boundaries. During the original development of the INL Site vegetation map, we observed that many of the statistically defined vegetation classes are not spectrally unique. This means vegetation classes of different species composition and cover values appear similar in the spectral bands recorded by the digital sensor. This scenario represents the primary reason we cannot rely solely on imagery to define class boundaries and must incorporate additional datasets into the mapping process.

The work accomplished on this monitoring task in 2014 focused on updating the recent wildland fire boundaries and internal unburned patches of vegetation in the Midway, T-17, and Middle Butte fires (Figure 3-5). The existing mapped boundaries for these three fires were produced from different data sources, digitized at different mapping scales, and contained a limited number of unburned vegetation patches. The digitized fire boundaries are used to “clip” the most recent INL Site vegetation map, and remove the previously delineated vegetation class(es) present. Functionally, the clipped areas represent outdated holes in the vegetation map where new post-fire vegetation boundaries have not been delineated nor have map classes been assigned. After an adequate number of growing seasons for vegetation communities to reestablish, the holes in the map will be filled with new, remapped vegetation class delineations.

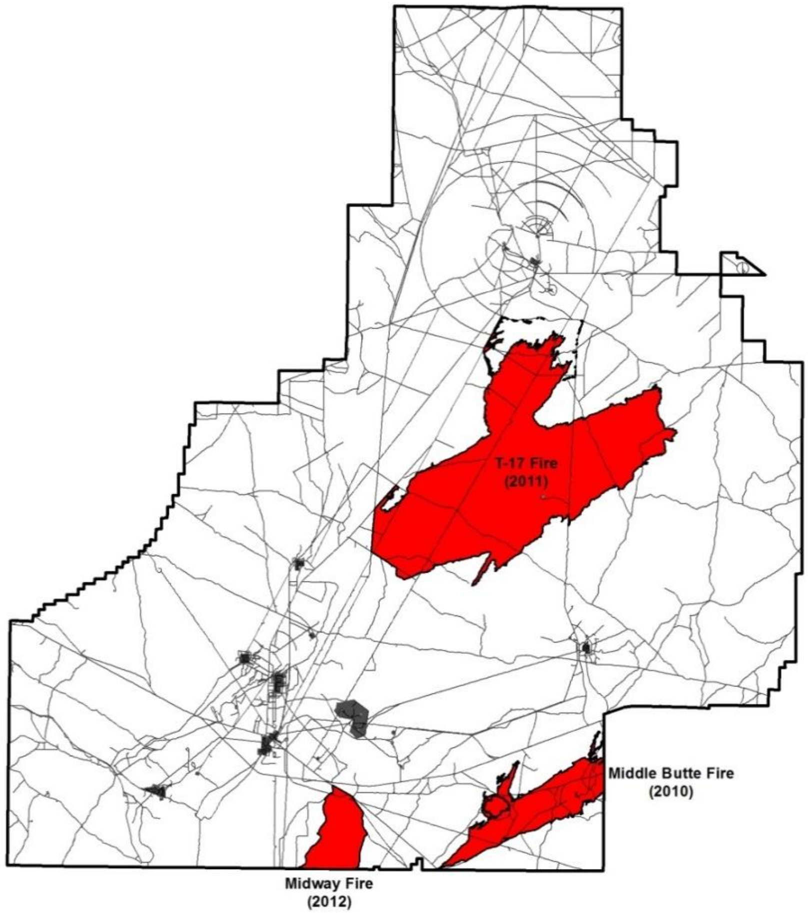

Figure 3-5. The distribution and year of three recent wildland fires on the Idaho National Laboratory Site. Fire boundaries were updated and mapped at a 1:12,000 scale using high resolution digital imagery.

3.2.2 Methods

Digital Imagery

Two datasets of multispectral imagery were used to conduct post-fire mapping. DigitalGlobe is the image vendor who currently owns and operates the GeoEye-1 multispectral satellite sensors. DigitalGlobe was not tasked specifically to collect imagery in 2013 because there were no new wildland fires. However, previous discussions with BEA about the possibility of obtaining site-wide imagery on an annual basis has prompted DigitalGlobe to opportunistically collect imagery over the INL Site so data are available upon request. DigitalGlobe collected six image tiles in 2013, including one collected horizontally and five other adjacent and vertical oriented tiles collected on four separate dates. The image acquisition dates range from August 17- September 8. Cloud cover in the images varied from 0% to about 25%; however the area over the fires was generally cloud free.

DigitalGlobe delivered the GeoEye-1 imagery pre-processed to their 'GeoProfessional' product standards, meaning image tiles were already mosaicked and orthorectified to remove the influence of topography on spectral values. GeoEye-1 imagery consist of four spectral bands covering the visible portion of the electromagnetic spectrum and also a single near-infrared (NIR) band. The spatial resolution of the GeoEye-

1 imagery is 2 m for all spectral bands, with an additional panchromatic grayscale band collected 0.5 m resolution. All spectral bands were delivered with an 8-bit (i.e. 0-255) radiometric resolution range of spectral values. ArcMap has a number of algorithms available to integrate the higher resolution panchromatic band with the lower resolution spectral bands. The Gram-Schmidt sharpening method was used to produce pan-sharpened images of each image tile, thus providing sub-meter resolution imagery for more fine scale mapping.

The NAIP collected airborne color-infrared multispectral imagery at 0.5 m spatial resolution across the entire State of Idaho in 2013. The imagery tiles were collected by USDA-FSA Aerial Photography Field Office between August 16 – September 20 employing three Cessna 441 aircrafts equipped with Leica Geosystem's ADS100/SH100 digital sensors acquiring imagery in three look angles (i.e. backward 19 degrees, forward 26 degrees, and nadir). The data have been orthorectified and have had atmospheric-BRDF radiometric corrections to compensate for atmospheric absorption, sun illumination angle and bi-directional reflectance. The image data were provided with an 8-bit radiometric resolution. The NAIP data for the INL Site are cloud-free and were downloaded free of charge as quarter quadrangles and imported to an ESRI Mosaic Dataset for further analysis.

Delineation Process

Wildland fire boundaries were manually digitized in a GIS at a 1:12,000 mapping scale, using the two image data sources described above as the background basemap layers. The GIS Analyst uses visual interpretation, image stretches to accentuate pixel values, and different band combinations to identify fire edge and unburned vegetation. In some areas the fire boundary was coincident with the bladed containment line, while in other areas the actual burn edge stopped short of the containment line. Once the outer fire boundary was complete, all identifiable unburned islands of vegetation were delineated at a finer spatial scale. Unburned vegetation patches were digitized at a 1:2,000 mapping scale, and at times up to 1:1,000 for smaller isolated patches. Occasionally, it is easier to determine the patch edge when zoomed out to a slightly coarser scale for context of the surrounding area. The ArcMap Editing Toolbar was used during the delineation process and whenever an unburned island was directly adjacent to the fire boundary edge, the Trace tool was used to maintain topological integrity with the boundary polygon.

Once all of the unburned vegetation patch delineations were completed, the ArcMap Spatial Join function was used to automatically assign the existing vegetation map class code to all unburned patch polygons. Any unburned vegetation patch polygon that overlapped a previous map class boundary, was not assigned to a class by ArcMap because it split two existing classes. All unassigned polygons were manually edited and split along existing map class boundaries, and the map class code was entered for each polygon. Next, all vegetation classes that contained a big sagebrush class were queried and exported as a sagebrush habitat layer. The new sagebrush habitat polygons were imported to an ESRI File Geodatabase where area and perimeter values are automatically calculated for each record in the attribute table.

3.2.3 Results

2012 Midway Fire

Low vegetation cover and an abundance of exposed basalt rock across the lava flow within the Midway Fire makes it difficult to discern vegetation presence in digital imagery. Initial observations using the GeoEye-1 pan-sharpened imagery showed that there were textural cues which appeared to identify unburned sagebrush on the lava. After some initial draft delineations were completed, we visited the field to validate the presence of sagebrush and verify whether the spectral cues visible in the imagery are actual sagebrush communities on the ground. We found the vegetation patches initially delineated were, in fact, sagebrush on the ground (Figure 3-6). Surprisingly, there was much more unburned sagebrush on the western region of the Midway fire than expected. We also recognized that the textural cues on the western side of the fire were slightly different or absent on the eastern side of the fire. We visited some representative locations distributed across the eastern side of the Midway Fire, and discovered that unburned sagebrush islands were less frequent and occurred primarily as smaller isolated patches. The large patches common on the western side of the fire were mostly absent on the east side.

The fire boundary was updated resulting in 1,646.6 ha (4,068.9 acres) of area burned excluding unburned patches (Figure 3-7). A total of 884 polygons of unburned vegetation patches were delineated within the Midway Fire, representing 108 ha (266.9 acres). The unburned vegetation patch total area includes polygons that are not big sagebrush classes and represented juniper woodlands or native grassland vegetation classes. The exported sagebrush habitat layer contained 770 polygons representing 93.3 ha (230.5 acres; Figure 3-7).

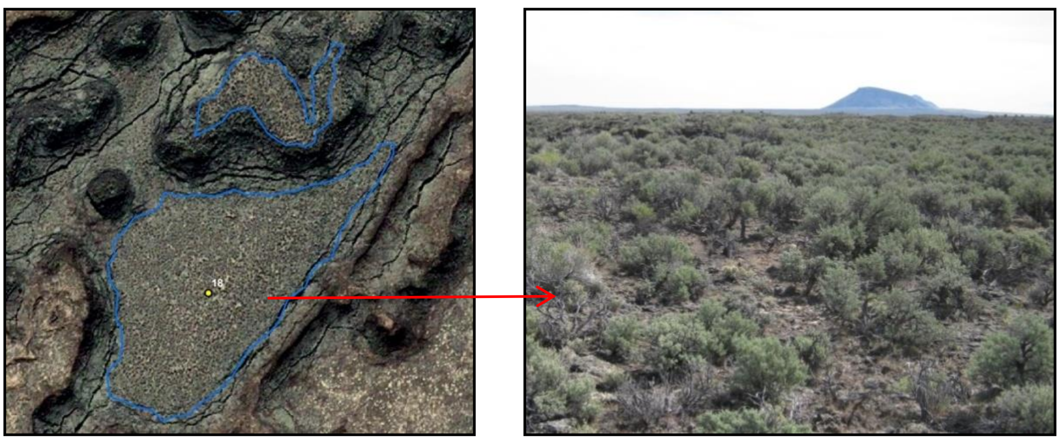

Figure 3-6. Example unburned sagebrush islands within the 2012 Midway Fire boundary on the Idaho National Laboratory Site. The labeled yellow point represents a validation waypoint visited in the field, and the photo on the right was taken at that location looking east.

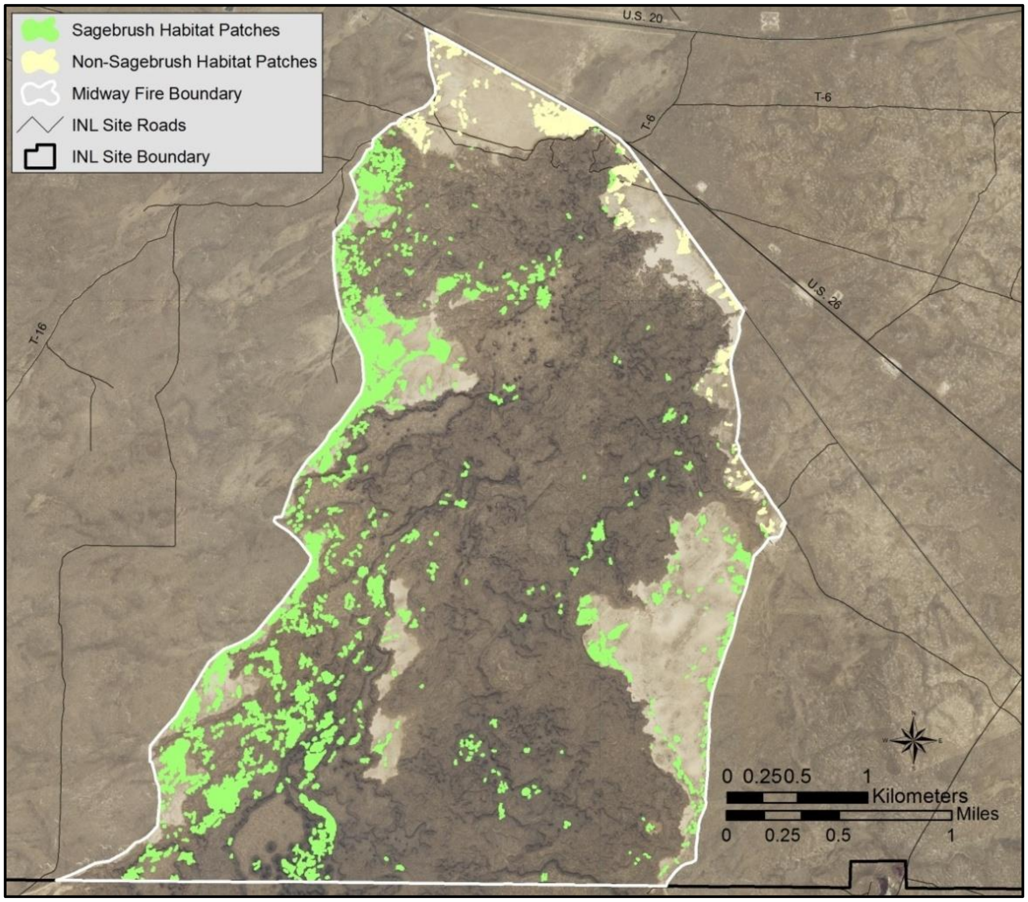

Figure 3-7. The mapped 2012 Midway Fire on the Idaho National Laboratory Site showing the distribution of unburned vegetation patches within the fire boundary. Note the fire began off-Site to the south and additional burned area and unburned patches are present but were not mapped.

2011 T-17 Fire

There have been three growing seasons since the T-17 fire burned in 2011. The area within the fire boundary has stabilized and primarily native grasses have begun to reestablish naturally. Initial delineations were made on patches of unburned vegetation that appeared distinctly different from the burned areas throughout the fire. There were many patches that appeared much less dense and were initially left unmapped because they were assumed to represent a few remnant individual plants that lacked the density typically found in other mapped unburned patches. After visiting some of the less dense patches in the field, it became apparent those patches were indeed unburned sagebrush shrubs with an adequate amount of cover to warrant further delineation (Figure 3-8). A second round of delineations was made to include patches dismissed or overlooked during the first round of delineations.

The updated T-17 Fire extent encompassed 16,688.7 ha (41,239 acres) of area burned excluding unburned patches (Figure 3-9). A total of 4,256 polygons of unburned vegetation patches were initially delineated within the T-17 fire extent, representing 816.3 ha (2,017 acres). The unburned vegetation patch total area includes polygons which are not big sagebrush classes and represented native shrubland and grassland vegetation classes. The exported sagebrush habitat layer contained 3,529 polygons representing 691.9 ha (1,709.8 acres; Figure 3-9).

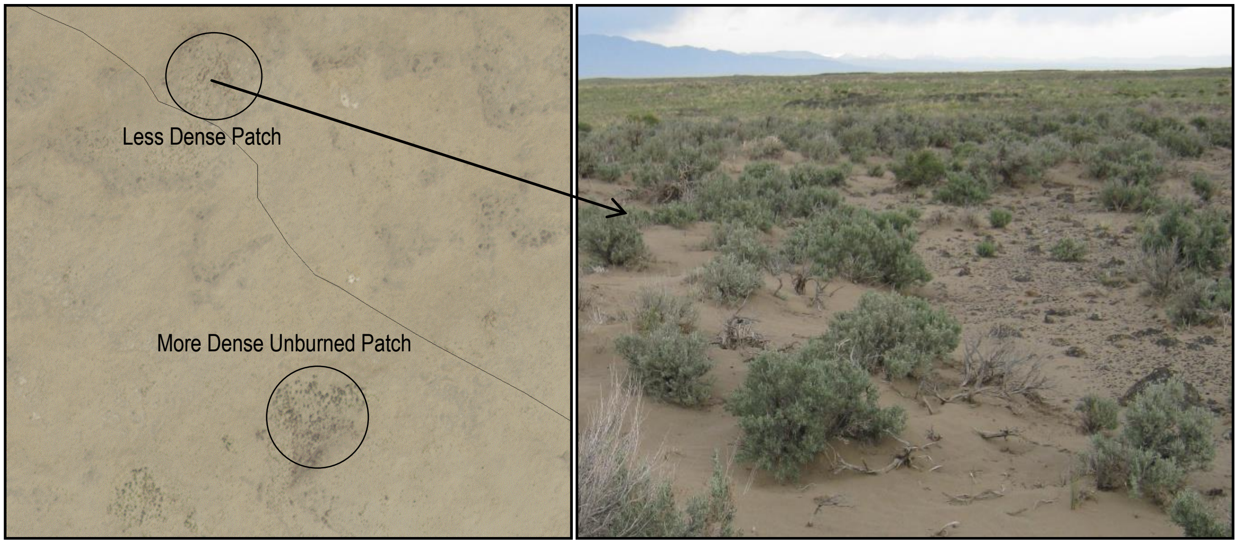

Figure 3-8. Example unburned vegetation patch within the T-17 Fire boundary that was overlooked during first round of delineations. The photo on the right represents the less dense unburned patch circled on the left image.

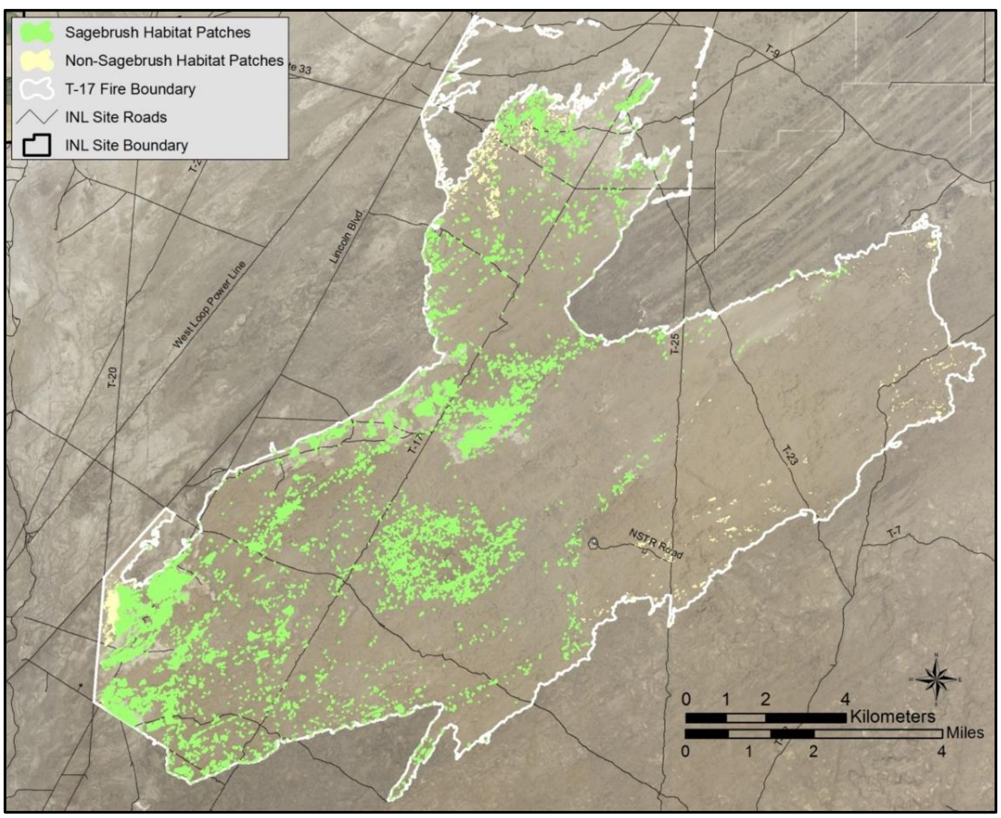

Figure 3-9. The mapped 2011 T-17 Fire on the Idaho National Laboratory Site showing the distribution of unburned vegetation patches within the fire boundary.

2010 Middle Butte Fire

The Middle Butte Fire burned late in the summer of 2010 and was unfortunately not imaged when the 2010 Jefferson Fire satellite tasking request was submitted and post-fire mapping was conducted that fall. The extent of the Middle Butte Fire included a large amount of area that had previously burned in the past due to different fires, and consequently the amount of sagebrush habitat lost was much less than the previous two fires described in this report. However, there was still sagebrush habitat lost in proximity to Middle Butte in addition to the loss of some remaining tracts of juniper communities.

The updated Middle Butte Fire extent encompassed 3,166.8 ha (7825.4 acres) of area burned, excluding unburned patches (Figure 3-10). A total of 548 polygons of unburned vegetation patches were delineated within the Middle Butte Fire extent, representing 183.8 ha (454.2 acres). The unburned vegetation patch total area includes polygons which are not big sagebrush classes and represented juniper woodlands, native shrublands, and native grassland vegetation classes. The exported sagebrush habitat layer contained a total of 212 polygons representing 35.5 ha (87.8 acres; Figure 3-10).

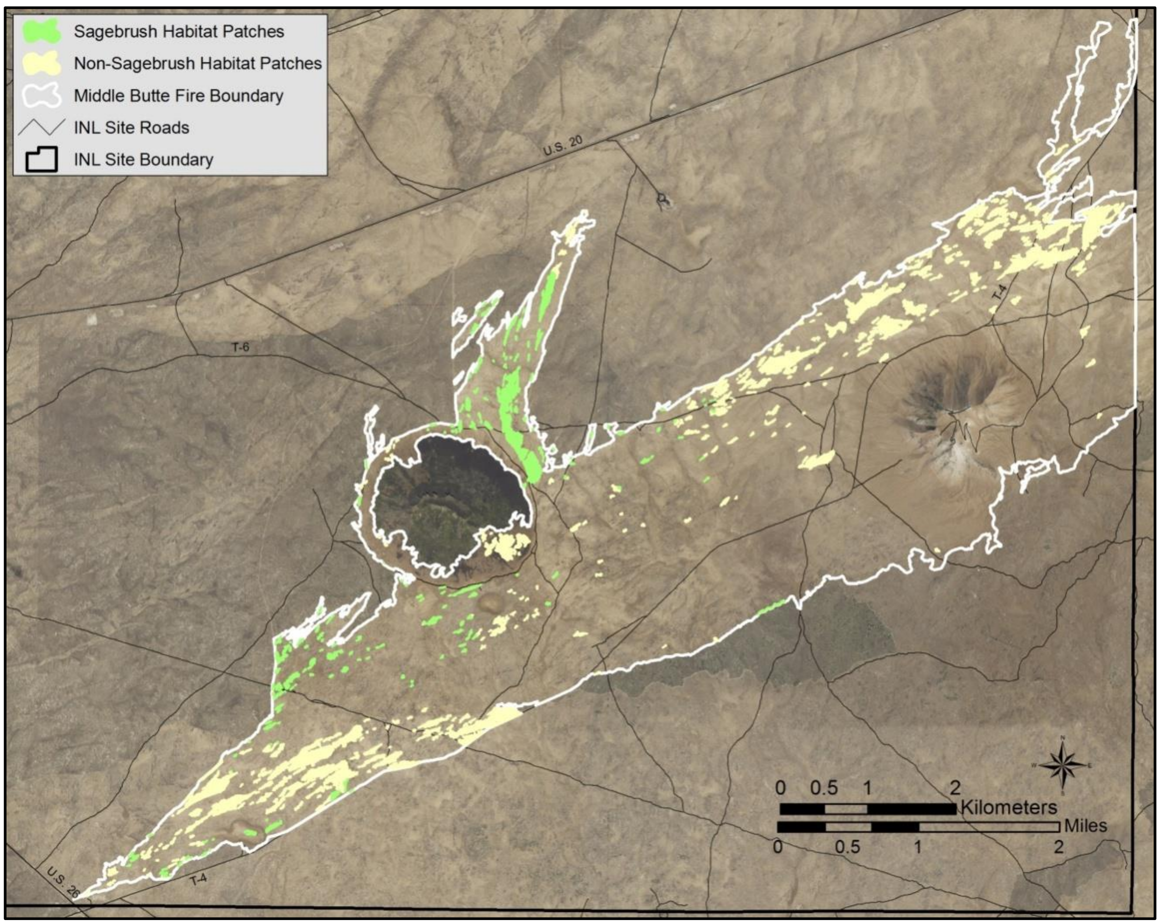

Figure 3-10. The mapped 2010 Middle Butte Fire on the Idaho National Laboratory Site showing the distribution of unburned vegetation patches within the fire boundary. Note that the fire continued to burn off-Site to the east, but the additional burned area and unburned vegetation patches were not mapped.

Sagebrush Habitat Update

In the CCA, the baseline area for the habitat trigger was selected to be the end of 2012 because that was the last year of any significant fires on the INL Site (DOE-ID and USFWS 2014). Prior to making the updates described in this report, the total area of sagebrush habitat was estimated to be 78,882 ha (194,922 acres) within the SGCA. We clipped the INL Site vegetation map using the updated fire boundaries and unburned vegetation patches of recent fires that were not accounted for in the development of the original map. All big sagebrush stand-alone and complex classes were selected and exported across the INL Site to represent sagebrush habitat. The comprehensive, Site-wide sagebrush habitat layer was then clipped to the SGCA boundary to recalculate the habitat area baseline as of 2013. The updated SGCA sagebrush habitat baseline value is slightly less with a total of 78,457 ha (193,872 acres). Although the updated sagebrush habitat total area is only a minimal adjustment of the overall amount, the current distribution is considerably more accurate and provides a finer scale mapping of potentially important unburned sagebrush habitat patches (Figure 3-11).

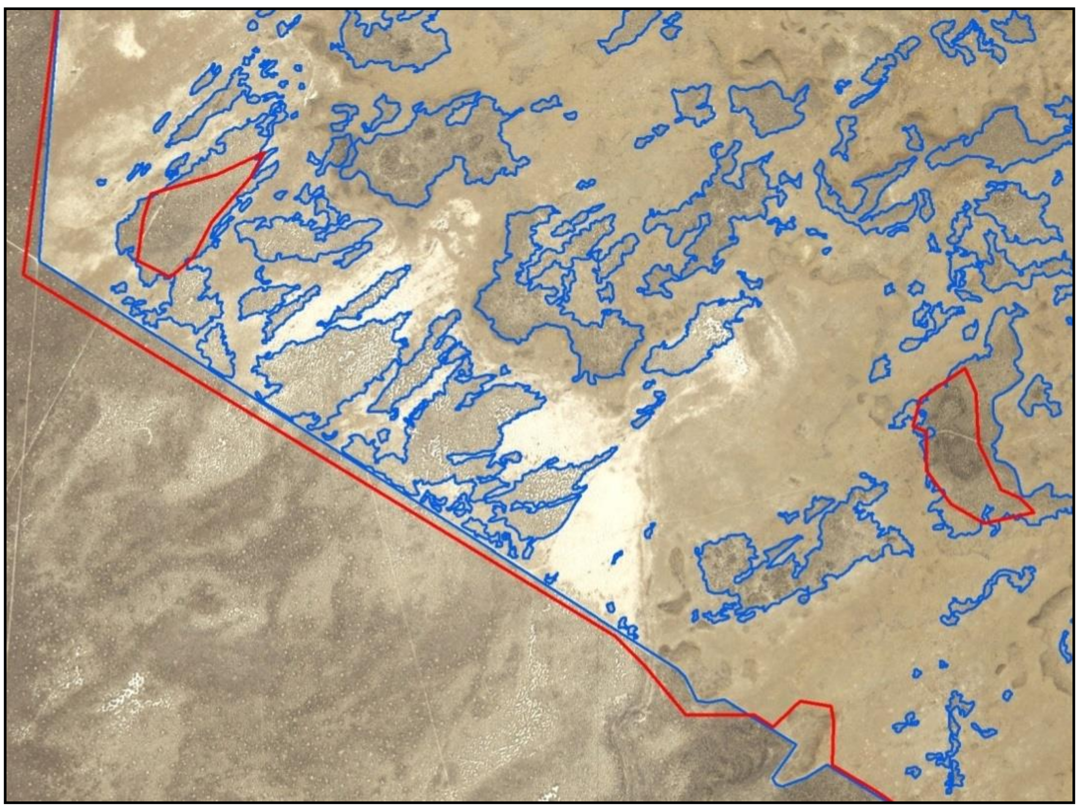

Figure 3-11. Example post-fire mapping comparison of the southwest corner of the T-17 fire. The red polygons are the original 2012 mapped T-17 fire boundary with two unburned islands delineated at a coarser scale with lower resolution imagery. The blue polygons are the updated 2014 results of the current fire boundary mapping conducted at a 1:12,000 scale, and unburned patches delineated up to a 1:1,000 scale using high-resolution imagery. The inaccurate offset of the original fire edge is visible along the southwestern border, and the added detail of unburned vegetation patches is also clearly evident in this region.

3.2.4 Discussion

Maintaining an up-to-date amount and distribution of sagebrush habitat on the INL Site is important to support the current CCA (DOE-ID and USFWS 2014). Sagebrush habitat is one of the adaptive regulatory thresholds that will be monitored annually and serves to identify when modification to conservation actions might be required or mitigation is necessary. Therefore, it is important that the established baseline amount of sagebrush habitat and subsequent changes (increases and decreases) are documented accurately and regularly.

When a wildland fire boundary is produced by different methods and is then used to clip the existing vegetation map, the localized spatial accuracy becomes different for that fire. To maintain the accuracy and quality of the original map, it is imperative to make any edits or updates to the dataset using the same methods and mapping scales. This allows the vegetation map to be a dynamic dataset which is updated continuously through time, rather than a static map product that can become outdated quickly when there are changes across the landscape. It is easier and more cost effective to make minor incremental updates, rather than waiting until there are enough changes to warrant the development of an entirely new map which can take a significant amount of time and funding.

Understanding the current distribution of unburned sagebrush patches at a finer scale allows for a more accurate estimation of total sagebrush habitat on the INL Site, and can assist with other conservation efforts. Knowing where unburned sagebrush patches are distributed across the landscape may help with selecting future restoration sites where planting seedlings in strategic gaps could effectively connect habitat islands and create larger contiguous patches of functional habitat.

3.3 Literature Cited

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4. THREAT MONITORING

The CCA identifies and rates eight threats that directly or indirectly impact sage-grouse and its habitats on the INL Site. All threats are addressed to some extent by the 13 conservation measures that DOE is now striving to implement (see Chapter 5 below). Each year, DOE will monitor and report progress toward achieving objectives associated with conservation measures. Measures developed for two threats – raven predation and annual grasslands – require baseline inventory and monitoring information before the conservation measures can be initiated. Therefore, DOE included two threat monitoring and inventory tasks within its CCA monitoring program to support future implementation of conservation measures.

4.1 Task 4 – Raven Nest Surveys

4.1.1 Introduction

Section 10.8 of the CCA (DOE and USFWS 2014) addresses the threat to sage-grouse from common raven (*Corvus corax*; hereafter raven) nest predation on the INL Site. Currently, our understanding of raven population trends on the INL Site is based solely on breeding bird surveys that have been conducted most years since the mid-1980s (Whiting and Bybee 2013). The weakness of this approach is that breeding bird surveys count all ravens, but territory-holding ravens (i.e. nesting pairs) likely are responsible for the majority of sage-grouse nest depredation (Bui et al. 2010).

The raven is a native to Idaho and historically constructed nests on natural substrates such as rock ledges and juniper trees. In many areas of the INL Site, these substrates are limited and ravens likely compete with raptors for some of them. Today, most raven nesting pairs on the INL Site select anthropogenic structures, primarily power poles, as nesting substrates (Howe et al. 2014). 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). To do so, DOE must first know the spatial distribution of raven nests and in what areas they tend to build nests each year. DOE must also obtain baseline nest numbers so that continued monitoring following deterrent installation can address whether actions had an impact on the amount of raven nesting on utility structures.

The objective of the raven nest survey task is to annually survey all anthropogenic 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.

4.1.2 Methods

We conducted systematic surveys of power lines, towers, INL Site facilities and associated ornamental trees, and remote raptor nesting platforms, all of which could potentially support a raven nest (Figure 4-1). Surveys occurred between March 31 and May 19, 2014, and in most cases, we allowed at least 14 days between surveys of the same feature or power line section. Approximately 317 km (197 mi) of transmission and distribution power lines intersect the INL Site, not including linear line distances within substations. (see Howe et al. 2014 for a description of power line dimensions and attributes). Approximately 125 km (78 mi) of power lines are located within the SGCA and 193 km (120 mi) are outside the SGCA.

We conducted surveys from sunrise to late afternoon. To survey power lines, we drove along access roads or nearby paved roads, stopping whenever a nest was observed to record its location and the species attending the nest on a Trimble Juno SB GPS receiver. We surveyed all other features by vehicle or on

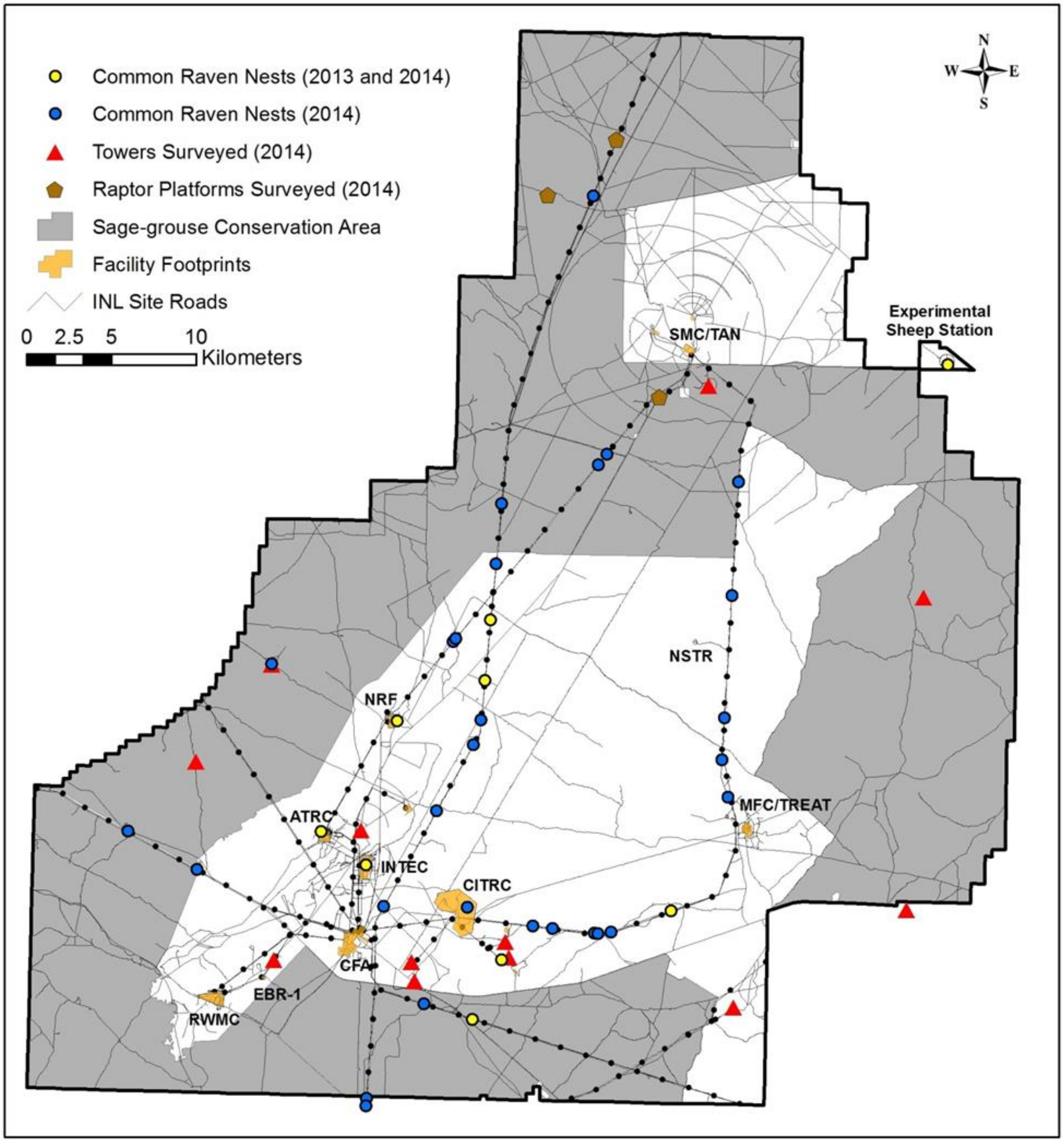

Figure 4-1. Results of 2014 raven nest surveys. Yellow dots represent raven nests that were classified as active during 2013 and 2014. Nearly all nests are on transmission lines. The only nest that has been observed on a distribution line during the past two seasons is represented by the yellow dot slightly southeast of CITRC.

foot. We were not allowed access inside Naval Reactors Facility (NRF), but an NRF employee, who was trained by ESER, agreed to search the facility for nests and then report the location of any active nests.

We did not attempt to determine success or failure of nesting or nest-building attempts, but simply documented whether a nest was active during the survey period. We characterized a nest as active if at least one bird was present and exhibiting behaviors typical of a nest occupant (e.g. incubating, carrying sticks to the nest). The number of active nests reported is probably greater than the actual number of nesting pairs that use anthropogenic structures on the INL Site. For example, a raven pair could have been observed building a nest, but if the nest blew down and the pair moved to a nearby site to begin construction anew, the new site would also be counted in a subsequent survey. Thus, the number of active nests is an index of nesting pairs.

If an unattended nest was observed one or more times during the survey period, and was later found on the ground without bird activity having been documented, we classified the nest as inactive. If a nest remained intact throughout the survey period but nest activity was never confirmed, its status was classified as unknown. Throughout the survey period, we made extra visits to nests for which the activity status or occupant species had yet to be verified. These targeted nest surveys resulted in some nests being revisited five or six times throughout the season.

4.1.3 Results

We completed two surveys of 10 INL Site facilities, two raptor platforms, and 12 isolated towers that could conceivably support a raven nest (Table 4-1). An additional tower was surveyed only once. Nearly all surveys of facilities, platforms, and towers were completed between March 31 and April 29, though revisits to nests with an unconfirmed status and a second survey of Advanced Test Reactor Complex (ATRC) were performed through 19 May, 2014.

Table 4-1. Facilities surveyed for raven nests in 2014. The number of days between surveys is indicated, though individual nests with unconfirmed activity statuses were usually revisited more frequently.

Facility	# Times Surveyed	Days Between Surveys	Active Raven Nest Confirmed	Substrate Supporting Active Nest
ATRC	2	38	Yes	Effluent Stack
Specific Manufacturing Capability/Test Area North (SMC/TAN)	2	17	No	N/A
Critical Infrastructure Test Range Complex (CITRC)	2	18	Yes	Building Platform
CFA	2	14	No	N/A
RWMC	2	14	No	N/A
Experimental Breeder Reactor I (EBR-I)	2	16	No	N/A
NRF	2	15	Yes	Effluent Stack
Experimental Sheep Station	2	17	Yes	Building Platform
Materials & Fuel Complex/Transient Reactor Test Facility (MFC/TREAT)	2	14	No	N/A
Idaho Nuclear Technology and Engineering Center (INTEC)	2	16	Yes	Effluent Stack

We surveyed all power lines twice, completing the second survey by 1 May. In addition, we surveyed all transmission lines a third time between 28 April and 1 May and a fourth time from 15-20 May. Our decision not to survey distribution lines more than twice was based on logistical constraints and a knowledge that only one distribution pole has been used as a nesting site during six years of data collection, dating back to 2007 (incidentally, that distribution pole supported an active nest in 2014, which was confirmed by the end of the second survey).

We observed 37 active raven nests on anthropogenic structures. Two of these were off the INL Site within 550 m of the south boundary (Figure 4-1). Thirty-one nests (84%) were on power line structures, including the two nests off the INL Site. Active raven nests were also observed on three other types of anthropogenic structures (Table 4-2). In five of 10 surveyed facilities, we observed a single active raven nest on a building platform or effluent stack (Table 4-1). No facility supported more than one nest.

Eleven (35%) of the raven nests on power lines were effectively within the SGCA (including one that was ~120m south of the INL Site boundary). Technically, nests on power lines are not within the SGCA because infrastructure corridors are exempt from SGCA-specific restrictions (see Sec. 10.2.3 of the CCA). However, we assume that ravens nesting within 150m of the SGCA boundary (including those outside the INL Site boundary) forage in the SGCA. The mean density of raven nests along power lines within the SGCA was 11.3 km/nest (n=11).

Twenty (65%) of the 31 nests on power lines were outside the SGCA, including one that was 550m south of the INL Site boundary. Mean density of non-SGCA raven nests on power lines was 9.66 km/nest (n=20).

We were unable to confirm nesting activity at 18 nests, though we visited them multiple times throughout the survey period. Most of these were probably unoccupied this year, though it is possible that we failed to detect nest activity, especially if birds attended and then abandoned the nest early in the season.

Table 4-2. Active nests observed on anthropogenic features in 2014, including attendant species and nesting substrates.

Species	# Active Nests	Substrate	Within SGCA	Outside SGCA
Common Raven	31	Power Line	11*	20*
	3	Stack	0	3
	2	Building Platform	0	2
	1	Tower	1	0
Red-tailed Hawk	2	Power Line	2	0
Ferruginous Hawk	2	Power Line	1	1
	1	Raptor Platform	1	0
Great-horned Owl	1	Ornamental Tree	0	1
	1	Building Platform	0	1
Total	**44**		**16**	**28**

*One nest was outside the INL Site boundary.

In addition to raven nests, we documented seven nests attended by hawks and great horned owls. All owl nests were at facilities, whereas raptor nests were on power poles and a remote nesting platform (Table 4-2).

4.1.4 Discussion

Similar to our findings in 2013 and other raven nest surveys on the INL Site (Howe et al. 2014), power poles are the predominant anthropogenic features used by ravens as nesting substrates. However, it appears that not all power pole types are suitable for nesting. All but one raven nest (97%) on power poles were associated with transmission lines. Thus, the presence of transmission lines is a more precise indicator of raven nest suitability than the presence of power lines in general.

Several transmission pole designs are in service on the INL Site (Figure 4-2). All structures are characterized by two-pole vertical supports, and they are usually much taller than single-pole distribution poles. Most transmission structures also have a double cross-arm feature, with two parallel beams positioned either horizontally or slanted, which provides a broad, level surface or an angle suitable for initiating a nest. In contrast, distribution poles generally have no cross arm, a single cross-arm forming a "T", or three non-parallel extensions (other types of distribution poles occasionally anchor the end of the line or support equipment). We hypothesize that ravens prefer some transmission-line structures over others for nest sites, but our data do not distinguish among transmission poll designs. In 2015, we will characterize all power line structures so that we may refine our analysis.

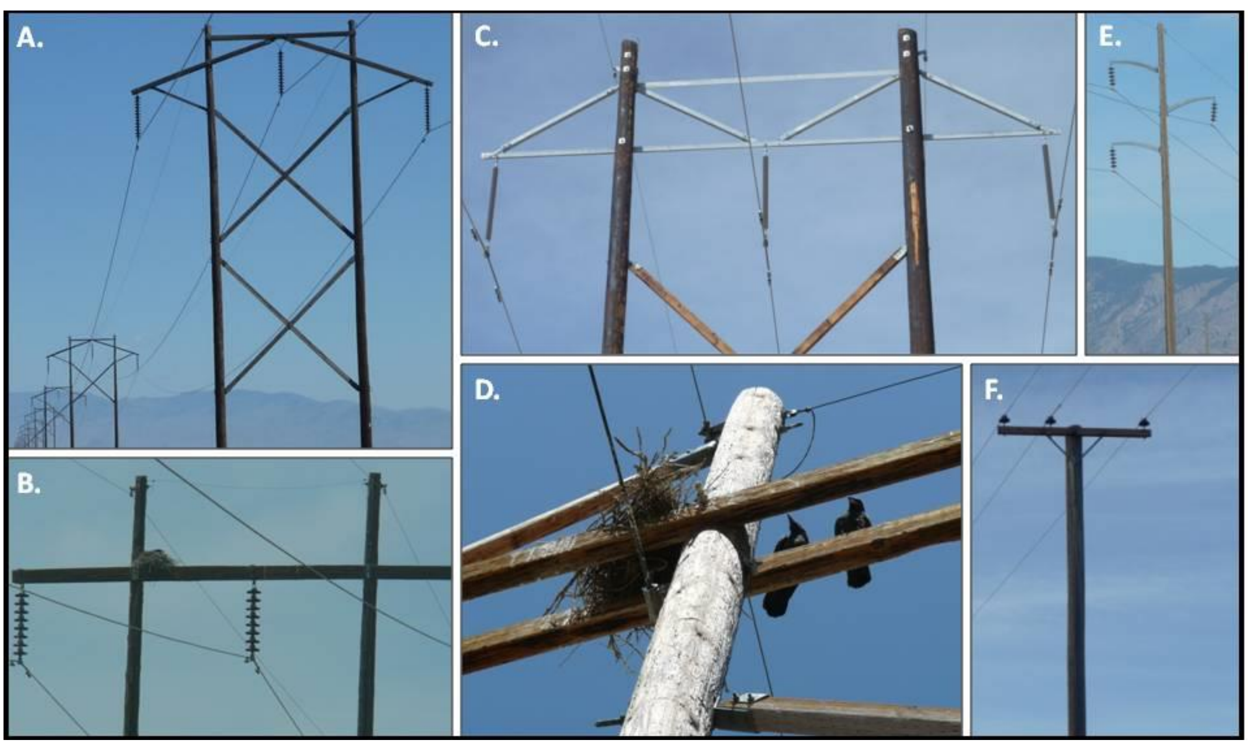

Figure 4-2. Examples of transmission (A-D) and distribution (E-F) pole designs on the INL Site.

Our results confirming ravens' preference to nest on power line structures over other anthropogenic substrates support DOE's assertion that installing nest deterrents on power poles may be the most effective way to achieve long-term success in controlling raven occupancy of anthropogenic structures on the INL Site (DOE and USFWS 2014). Ravens also are attracted to effluent stacks and other structures at facilities. These areas are generally a long distance from the SGCA, but it is feasible that DOE could deter raven nesting at these locations without a large output of resources. What is not known, however, is where ravens would nest if they were deterred from using structures at facilities. It is possible that they would move to nest sites on nearby power lines or to power lines within the SGCA, thus exacerbating the threat within these areas. Ideally, if DOE determined to deter nesting within facilities, such actions would be accompanied by a study that tracked impacted ravens so that the effects of the action could be evaluated.

In 2013, we observed 32 active raven nests (compare to 37 in 2014), 19 of which were on power line structures (compare to 31 on power lines in 2014). The difference in observations between years may be at least partially explained by an earlier survey start date in 2014. In 2013, we were unable to begin surveys until 29 April, whereas in 2014 we began surveys nearly one month earlier. During April 2014, five of the raven nests that we confirmed to be active were subsequently surveyed 1-3 more times throughout the season, but we found either no further evidence that the nest was active, or the nest had blown down. Thus, these five nests would not have been recorded as active if surveyed during the same period as in 2013. It is also possible that the number of raven nesting pairs is increasing, but we have insufficient data to address that hypothesis. In the future, we will consistently monitor substrates as in 2014, beginning at the end of March or first of April.

4.2 Task 7 – Inventory and Monitoring of Sage-Grouse Habitat for Areas Dominated by Non-Native Annual Grasses

4.2.1 Introduction

The loss of habitat 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 in the CCA. Domination by annual grasses generally follows the loss of native herbaceous species, often due to soil disturbance associated with land use activities. Cheatgrass alters the fire regime by increasing fire frequency, which further reinforces cheatgrass dominance. Increased fire frequency also means that big sagebrush recovery following fire is unlikely, essentially making this loss of sage-grouse habitat permanent. Native perennial grasses and forbs are also unlikely to recover in cheatgrass dominated areas.

Understanding the status of cheatgrass on the INL Site is an important aspect of tracking this threat. The vegetation map provides a guide to larger areas that are presently in vegetation class types or complexes of class types that are dominated or co-dominated by non-native annual grasses. However, there are additional areas smaller than the minimum mapping unit size and don't show up in the vegetation map, but are points from which annual grass invasions may expand.

Smaller areas of invasion have experienced some form of vegetation or soil disturbance that has caused the loss of native perennial plants. This disturbance may have been due to livestock management activities, road construction, firefighting, environmental remediation, or similar activities. Although the surveys will begin in areas that are presumed nesting habitat for sage-grouse, they will expand into areas that are likely to become nesting habitat in the future.

The goals of this inventory are to better understand the extent of annual grasses and other invasive plants on the INL Site associated with sage-grouse habitat and to provide information on areas that may require additional management attention. These may be areas that have experienced vegetation or soil disturbance associated with INL Site activities, livestock management, or disturbances that occurred prior to DOE's management of the area. The objectives of this task are to identify those areas that have been substantially affected by cheatgrass and attempt to identify the stressor that allows cheatgrass to continue to dominate. The results will be used to gain a better understanding of the extent of this threat on the INL Site.

4.2.2 Methods

Identifying Survey Areas

We focused our initial search in areas most likely used by sage-grouse for nesting. That included areas with sagebrush habitat and in close proximity to active leks where probability of nesting would be higher. A GIS was used to identify potential survey areas by intersecting polygons representing areas within 5 km of known active sage-grouse leks (Holloran and Anderson 2005) and located within sagebrush habitat polygons (Figure 4-3).

We further focused the survey to areas that have likely experienced disturbance to vegetation and/or soil. GIS staff digitized points of interest using ArcMap 10.2 and 2013 NAIP aerial imagery. This year, the primary points of interest were located within the Tractor Flats area of the survey boundaries. Two types of points of interest were digitized. The first type was linear disturbances, such as fire containment lines, two-track roads, and gullies. There were 47 linear disturbances covering 49.4 km digitized. Each linear feature was marked by two endpoints where the linear feature began and either ended or extended beyond the survey boundaries. The second interest type was point features, such as water trough locations or playas. Seventy-eight point features were digitized using the 2013 NAIP imagery. These areas were considered points of interest as they were located within sagebrush habitat but were devoid of shrubs or showed sign of possible soil disturbance. Each point feature was placed in the estimated center of the disturbance as seen in imagery. Endpoints and estimated center points were used to create GPS waypoints for easier navigation to points of interest by the field crew (Figure 4-3). There were 78 points digitized.

Data Collection

Once a field crew navigated to a point of interest, a general pedestrian survey was conducted for areas dominated or co-dominated by cheatgrass or other annual weeds. Field crews also visited known and suspected areas (based on imagery) of disturbance, such as sheep camps, gravel pits, livestock feeding/bedding areas, and drove roads which make up the RWMC and Tractor Flats lek routes (Figure 4-4). These surveys were conducted primarily within, but not limited to, the SGCA and focused first on nesting habitat within 5 km of leks. Once an area was located that was dominated by cheatgrass or other annual weeds, an attempt was made to identify the stressor that resulted in the loss of native perennials.

Field crews recorded a point feature for areas less than approximately 400 m^2 (20m x 20m). Field crews walked the perimeter and recorded a polygon feature for areas larger than 400 m^2. A track line feature was recorded when navigating to points of interest to record the effort of the field crews. Field crews also conducted opportunistic surveys for Idaho Noxious Weeds.

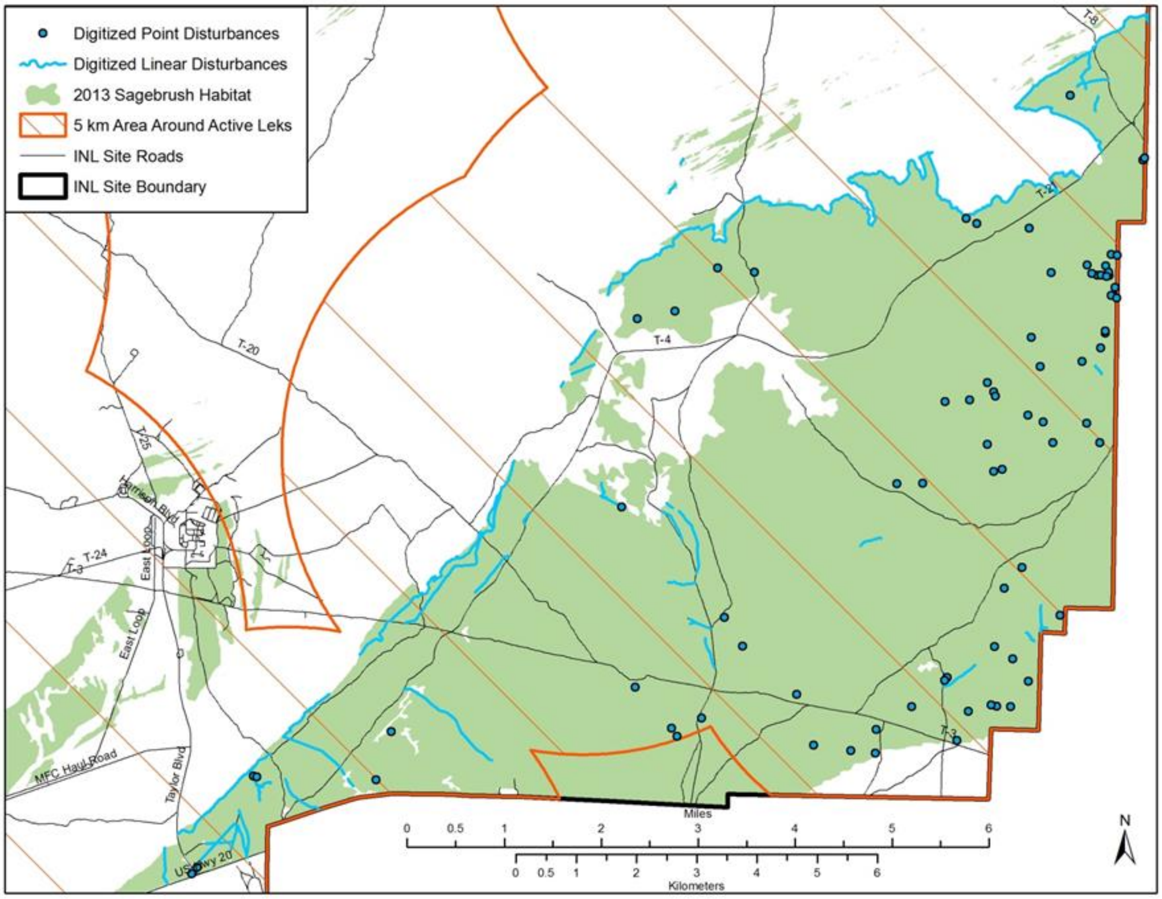

Figure 4-3. Digitized disturbances prior to field work. These disturbances were mapped within 5 km of active sage-grouse leks and within sagebrush habitat in the Tractor Flats area on the Idaho National Laboratory Site.

Field crews recorded the following information at each of the point, line, and polygon features:

- Date: The date an infestation is located. Generated automatically when a point feature is created on the GPS unit.
- Easting: Easting coordinate at an area dominated or co-dominated by cheatgrass or other annual weeds. UTM zone 12, NAD83. Generated automatically when a point feature is created on the GPS unit.
- Northing: Northing coordinate at an area dominated or co-dominated by cheatgrass or other annual weeds. UTM zone 12, NAD83. Generated automatically when a point feature is created on the GPS unit.
- Observer: Initials of person collecting data.
- Species 1:
    - Species Code
    - Abundance (Dominant, Co-dominant or Present)

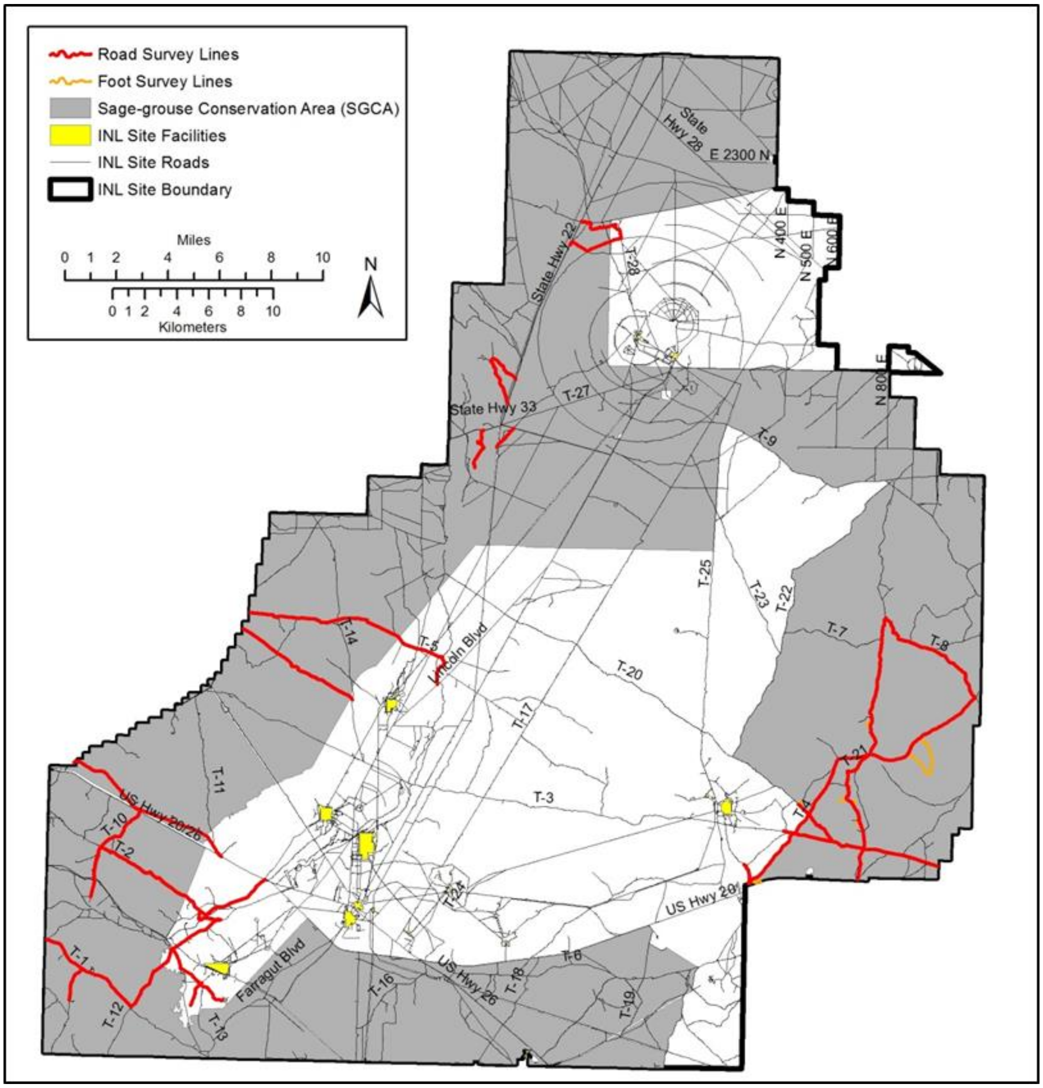

Figure 4-4. Extent of road and foot surveys across the entire INL Site, primarily within the SGCA in search of both cheatgrass and other invasive annual species.

- Species 2:
  - Species Code
  - Abundance (Dominant, Co-dominant or Present)
- Species 3:
  - Species Code
  - Abundance (Dominant, Co-dominant or Present)
- Disturbance Type or Evidence: (Firefighting, Livestock Water, Livestock Salt, Livestock Bedding, Livestock Feeding, Animal Trail, Environmental Remediation, Roadside, Old Field, Playa, Outcrop, Other).
  - Comment Field for Other Disturbance Type
- Stressor Still Present: Yes or No.

The species category was included in the data dictionary to differentiate between areas dominated by cheatgrass or some other annual/weedy species. The code designates the plant specifically and the abundance indicates the level of dominance at the location. Often times, the weedy species is co-dominating with a native plant and this list allows us to separate those areas that are partially weedy from those that are a monoculture of invasive plants.

After the species specific questions were answered, we tried to determine the type of disturbance. It was extremely difficult to know exactly what had caused the disturbance while in the field unless we were in a known location, such as a containment line or standing next to a livestock water trough.

Data Management

The GIS data collected in the field were downloaded, post-processed, and stored on the ESER GIS Archive each week. All GPS data were reviewed by a GIS Analyst and evaluated for accuracy and errors.

4.2.3 Results

The summer of 2014 experienced abnormal weather and precipitation. After being one of the driest years on record, late summer rainfall in August and September turned the desert into spring like conditions. A summer with nearly no annual species suddenly became a fall of full bloom flowers and late production from other perennial species that had already given up producing seed for the year. Annual grasses, primarily cheatgrass, are straw-colored after they senesce. This normally makes it easy to find on the ground amid perennial species. Unfortunately, the late precipitation in 2014 changed the search from dry straw-colored grass to bright green, amid a sea of more green.

We began our search at Tractor Flats and quickly realized that we were looking for the wrong colors and areas we would normally expect to have some amount of cheatgrass were different than they had looked in past growing seasons. Annual grass areas, while still dominated by cheatgrass, also contained some crested wheatgrass and other native perennial grass, all of which were actively growing, green and very lush. In addition, areas that were dominated by other weedy species were also actively growing and it was difficult to differentiate between areas of annual grass, areas of annual forbs, and areas of mixed native and non-native species. After checking a number of mapped locations from the GIS activities, it became clear that finding cheatgrass may be more a matter of luck as opposed to prior knowledge and pre-digitized disturbance locations.

Many of the known disturbance locations in the Tractor Flats area were dominated by crested wheatgrass as opposed to cheatgrass or other annual weedy species. However, the edges of burned areas, often as a containment line, seemed highly susceptible to cheatgrass invasion and one location attributed to fire related disturbance was mapped in the Tractor Flats area (Figure 4-5). In addition, there were two weedy areas that were found by following low lying water runoff pathways. While many of these dry beds were shrouded in sagebrush, they would periodically open up into small clearings that were either dominated by cheatgrass, field penny cress, *(Thlaspi arvense)*, or a combination of both. In total, mapped disturbance areas that were dominated by cheatgrass or some combination of weedy species include the following designations: 6 livestock related, 3 animal use, 2 water related, 1 fire, and 12 unknown. Total area and distance appear in Table 4-3.

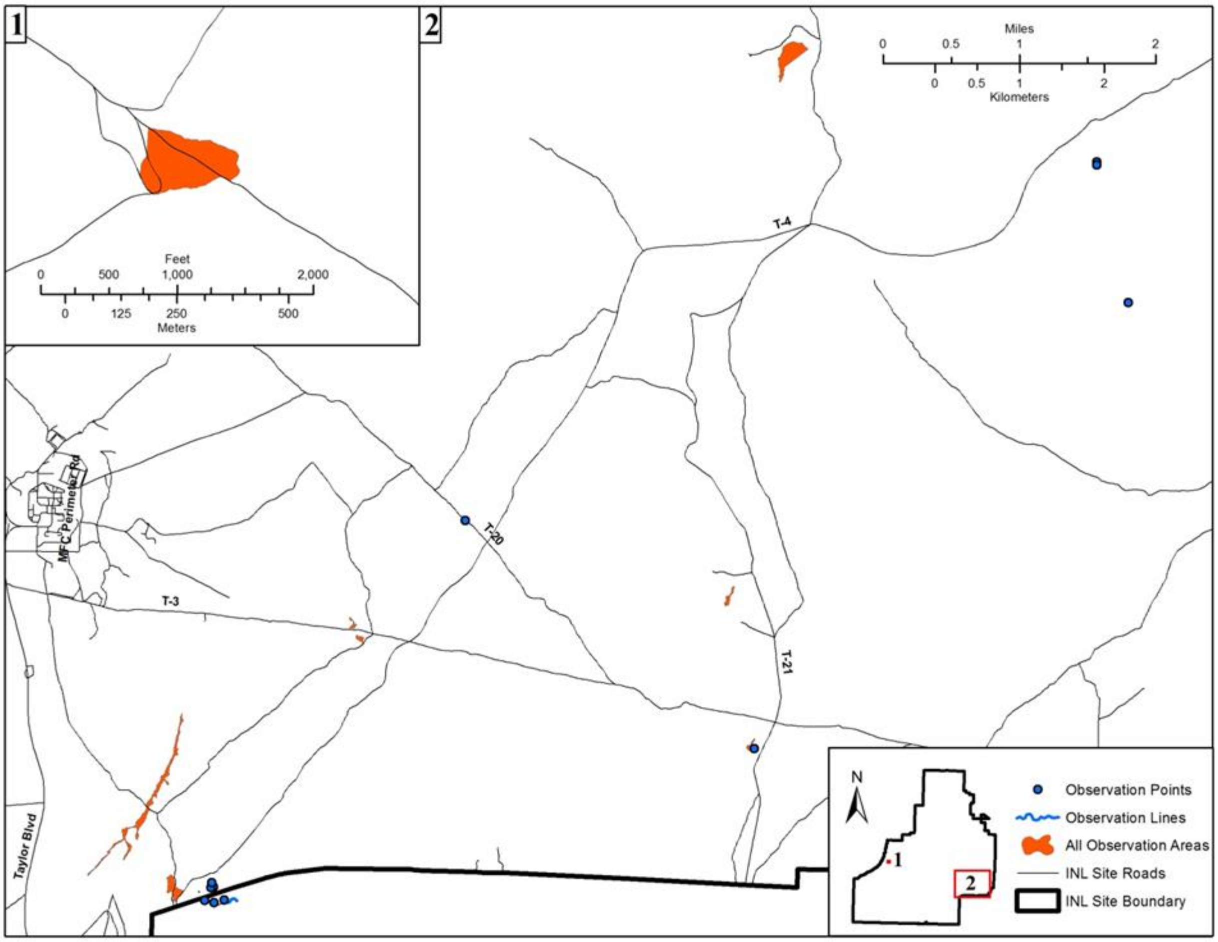

Figure 4-5. Results from field surveys. Areas of non-native annual grass smaller than a 20m X 20m are mapped as a point, while areas larger than 20m X 20m are mapped as an area. Linear areas of non-native annual grass are mapped as lines.

After traversing most of the T-roads in the Tractor Flats area, we expanded our search into areas across the INL Site that have known disturbances or cheatgrass dominated areas, while staying mostly within the SGCA. While we did manage to locate some additional annual grass dominated locations, they were not as abundant as we had expected them to be (Figure 4-5).

Table 4-3. Results summary showing the number of each GPS/GIS feature mapped and the total distance or area of each.

	# Mapped	Total (Length/Area)
Points	12	N/A
Lines	1	211 m (692 ft)
Polygons	11	217461 m² (53.7 ac)

During field surveys, 12 points, one line, and 11 polygons dominated by cheatgrass were recorded. The average polygon area was 19,769 m^2 (4.9 acres). The largest and smallest polygons mapped were 66,624 m^2 (16.5acres) and 384 m^2 (0.1 acres) respectively. Points were areas under 20m x 20m so a total acreage is not available for point locations. The only line mapped was 211 m (692ft) in total length.

4.2.4 Discussion

Total annual precipitation for 2014 was roughly equivalent to average annual precipitation. However, the timing of precipitation in 2014 deviated markedly from historical patterns in such that almost half of the total precipitation fell in August. Mean August precipitation, calculated from the 64-year CFA record, is about 14 mm; total August precipitation from 2014 was 102 mm. Cumulative precipitation through July was much lower than average, 61 mm compared to 121 mm on average. Vegetation on the INL Site experienced drought conditions through most of the 2014 growing season as well as the three years prior, and especially 2013 which was the driest year on record with only about ¼ of average annual precipitation.

Whether the odd weather played a great part in our ability to locate cheatgrass, or the extended drought has caused a decline in production, or there are not as many areas dominated by cheatgrass as we initially expected, there is a need to continue this survey into the future to understand the factors determining cheatgrass abundance and how they can be predicted and/or mitigated in the future.

In moving forward, we plan to resurvey all the areas visited in 2014. We will double check these areas in the spring/summer of 2015 to see what exactly is growing during a typical year. We do not expect to see the extreme weather pattern continue, although that is always a possibility.

We will monitor areas known to be dominated by annual grass species, as well as search for additional locations to be mapped for future reference. It is important to understand where these monocultures occur and if/why they persist or disappear.

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

4.3.1 Introduction

Infrastructure development is one of the two top threats to sage-grouse on the INL Site (see Table 3 in the CCA). Infrastructure promotes habitat fragmentation, and construction of new infrastructure nearly always disturbs soil, sometimes drastically. If proper controls are not in place, soil disturbance can facilitate the introduction and spread of invasive weeds, which in turn increases the risk of wildland fire. Weeds may also replace native plants and reduce plant diversity in localized areas.

Prior to the start of an INL Site construction project that may affect undeveloped land, a NEPA analysis is conducted on the portion of land slated for the project. Evidence from remotely sensed images of the INL Site spanning a decade suggests that sometimes infrastructure footprints expand beyond what was originally authorized in the NEPA evaluation. Thus, there is a possibility that an unauthorized impact to sagebrush-dominated and other native plant communities could be realized.

Inappropriate vehicle use associated with livestock grazing management may also cause habitat degradation in localized areas. Remote sensing imagery shows that the number of roads within grazing allotments on the INL Site continues to increase. It is likely that most of these roads were established by 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 two-track trail appears, other drivers may follow it, further establishing the route. Although named two-track roads are marked with small signs on the INL Site, no official road map has been developed to unambiguously identify authorized roads.

The objective of task 8 is to use GIS tools to monitor the INL Site for unauthorized expansion of the infrastructure footprint, especially within the SGCA and other areas dominated by big sagebrush. In the SGCA, unauthorized road expansion is the most likely impact of the threat *infrastructure development*.

4.3.2 Results

ESER GIS analysts will quantify the INL Site infrastructure footprint once every two to five years as described in Section 11.1.8 of the CCA. Therefore, between 2016 and 2019, ESER GIS analysts will evaluate the INL Site infrastructure footprint to determine if any non-authorized expansion occurred that has not already been identified by other sources.

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5. CONSERVATION OBJECTIVES

Section 10 of the CCA describes eight threats to sage-grouse and its habitats on the INL Site. DOE is committed to implementing conservation measures to mitigate and reduce these threats where possible. Even though the CCA was not signed until October 2014, during the past year DOE performed several activities and initiated conservation measures to ameliorate threats. Table 5-1 summarizes DOE's accomplishments and other relevant events occurring during the past year.

Table 5-1. Conservation measures listed in the CCA that were designed to ameliorate threats to sage-grouse and its habitats on the INL Site (adapted from Table 5 in the CCA).

Threat	Objective	Conservation Measure	Accomplishments in 2014 / Projected Activities in 2015
Wildland Fire	Minimize the impact of habitat loss due to wildland fire and firefighting activities.	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).	No fires >40 ha occurred in 2014. ESER collected sagebrush seeds from the INL Site. These will be grown in a greenhouse to produce 5,000 seedling that will be planted in priority restoration areas in fall 2015. Seeds will also produce container stock so that the same number of seedlings can be planted in each subsequent year (See Section 5.1).
Infrastructure Development	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.	2) Adopt BMPs outside facility footprints for new infrastructure development.	Measure will be promoted in 2015.
		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.	Not aware of any infrastructure development within the SGCA or within 1 km of active leks in 2014.
Annual Grasslands	Maintain and restore healthy, native sagebrush plant communities.	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.	Inventory work commenced in 2014 under CCA monitoring task 7 (Section 4.2). A total of 24 new sites were mapped as being dominated by annual grasses. Abnormal weather patterns in 2014 (very dry spring and summer followed by very wet fall) made surveys for cheatgrass difficult.

Threat	Objective	Conservation Measure	Accomplishments in 2014 / Projected Activities in 2015
Livestock	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.	5) Encourage 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.	ESER provided updated lek maps to the BLM in winter 2014. Neither DOE nor ESER received reports of livestock being on leks before May 15.
		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 rangeland improvements follow guidelines in the 2006 State Plan and the current agreement.	ESER provided habitat condition monitoring data to the BLM for consideration prior to the Twin Butte grazing allotment renewal process. It is unknown if or how BLM used these data. ESER staff accompanied BLM colleagues on a field trip to visit the T-17 and Jefferson fire scars. Their purpose was to examine the status of fire recovery.
Seeded Perennial Grasses	Maintain the integrity of native plant communities by limiting the spread of crested wheatgrass.	7) Cultivate partnerships with other agencies to investigate the mechanisms of crested wheatgrass invasion so that effective control strategies can be developed**.**	Interactions have proven unsuccessful at generating funding.
Landfills and Borrow Sources	Minimize the impact of borrow source and landfill activities and development on sage-grouse and sagebrush habitat.	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).	This conservation measure will be first implemented in 2015.
		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.	No new borrow pits or landfills were established in 2014.
Raven Predation	Reduce food and nesting subsidies for ravens on the INL Site.	10) Support research that aims to develop methods for deterring raven nesting on utility structures.	No research proposals have been submitted to DOE because the first priority is to establish a baseline of raven nesting activity on the INL Site so that raven reaction to nesting deterrents can be analyzed in proper context. Annual raven nest monitoring began in 2013.
		11) Instruct the INL to include an informational component in its annual Environment, Safety, and Health training module by	INL worked with ESER to produce a 2-minute video on sage-grouse for INL Site employee training.

Threat	Objective	Conservation Measure	Accomplishments in 2014 / Projected Activities in 2015
		January 2015 that teaches the importance of eliminating food subsidies to ravens and other wildlife near facilities.	Among other things, the video teaches that ravens prey on sage-grouse eggs and that employees should avoid leaving out food scraps and keep garbage bins closed to avoid providing food subsidies. INL will work with its Training Department to include this information in its annual training refresher course by the end of 2015. Meanwhile, it will seek other ways to get the message out to INL employees and subcontractors. The sage-grouse video in now linked to web-based training (INL935) for new INL employees and subcontractors. The video is awaiting approval for release and is not required as part of the course, but interested individuals will have access to it. INL will also add the video to an instructor-led course (INL636), which is required for managers including those over facilities, environmental restoration, construction, and other activities. The course is also required for others including environmental professionals, and work planners. Approval for this change is pending. In 2015, INL will develop an iNote to be sent to all employees that introduces the CCA as a new requirement for the laboratory and include access to the video.
Human Disturbance	Minimize human disturbance of sage-grouse courtship behavior on leks and nesting females within the SGCA and 1 km Lek Buffers.	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): • Avoid erecting portable or temporary towers, including Meteorological, SODAR, and cellular towers. • UAVs 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	This conservation measure will be first implemented in 2015.

Threat	Objective	Conservation Measure	Accomplishments in 2014 / Projected Activities in 2015
		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.	This conservation measure will be first implemented in 2015.

5.1 Conservation Measure #1 – Sagebrush Seedling Planting for Habitat Restoration on the INL Site

5.1.1 Goals and Objectives

No wildland fires >40 ha (99 acres) occurred on the INL Site in 2014, so no action was necessary to complete Conservation Measure 1. However, DOE understands that planting sagebrush seedlings will hasten the reestablishment of sage-grouse habitat lost during past fires, which is the intent of the objective associated with Conservation Measure 1 (Table 5-1). Therefore, DOE funded a task in 2014 to collect sagebrush seeds from the INL Site and grow seedlings for planting in fall 2015.

The overarching goal of this conservation measure is to re-establish habitat for sage-grouse in areas where big sagebrush has been lost due to fire, and are currently dominated by native perennial grasses and/or green rabbitbrush. These community types were chosen for restoration because they are in high ecological condition and require only the addition of sagebrush to the community to restore habitat suitable for sage-grouse.

Two approaches to planting design were considered for this measure. Planting at full stocking rates for Wyoming big sagebrush would have a goal of 400 sagebrush individuals per acre (1000 per hectare). Assuming a conservative survival rate of 50 percent, 800 seedlings would have to be planted per acre to ensure sufficient recruitment to achieve this goal. The planted area would likely meet the goal of providing habitat within about 10 years if weather conditions allow. However, we would be able to plant only about 6.25 acres (2.5 hectares) each year at this planting rate if 5,000 seedlings were planted.

The other approach considered would be to plant at a rate of 80 plants per acre with a conservative survival estimate of 40 plants per acre. It would require 10 to 20 years to achieve the goal of providing habitat while the area fills in with natural recruitment. At this planting rate, however, about 62.5 acres (25.3 hectares) could be treated each year if 5,000 seedlings were planted. Given the large number of acres requiring treatment, this approach is considered to be the most expedient.

Our objective is to plant 5000 seedlings each of the next five years. At the end of five years, this should provide a start on habitat restoration on 312.5 acres (126.5 hectares).

5.1.2 Seed Collection

While in the field conducting other tasks, we opportunistically collected seed heads from mature big sagebrush. We had two goals for seed collection. The first goal was to collect seed from a wide area of the INL Site to ensure we captured a broad representation of big sagebrush genotypes. Because these seeds would be used for planting across a large part of the INL Site, it was important to ensure that the plantings would not be limited by collecting a localized genotype that might not be adapted to the breadth of conditions likely found on the INL Site (Figure 5-1). The second goal was to collect enough seed this year to provide sufficient container stock for planting efforts over the next five years. Seed collection was hampered somewhat this year by low seed production due to the below normal precipitation of the preceding year.

When sagebrush bearing seed heads were found, field crews gathered seed by clipping off the seed heads using gardening shears and placing them in plastic mesh bags. A GPS location was then recorded to identify where each seed source was located. When gathering seed the field crew spread out and collected seed from many individual sagebrush plants, while leaving some seed uncollected. Three bags of sagebrush seed heads were collected each weighing about five pounds. Each bag was filled and tied, and then brought into the office where they were prepared for shipping. All bags of seed were shipped to the growers to check for viability of the seed and to prepare them for growing seedlings.

After cleaning, the seed collection effort resulted in about 2.27 kg (5 lbs.) of seed. With an estimated Pure Live Seed content of 6-8 percent, we should have enough seed to produce 150,000 to 250,000 plants. This is more than enough for this five-year restoration plan. It would also provide seed for any additional planting that may be necessary on the INL Site during that same time period.

5.1.3 Planting Site Selection

The CCA designates certain areas on the INL Site as Priority Restoration Areas (Figure 5-2). These areas are generally areas that burned and are now dominated by perennial native grasses or green rabbitbrush. The Priority Restoration Areas were selected using a spatial analysis process that first filtered the INL Site landscape based on vicinity to leks to include areas likely to be used as sage-grouse nesting habitat. Next, these areas were filtered again by using information on those areas where sagebrush has been lost due to fire. This resulted in a total area of 60,008 acres (24,284 ha).

To further prioritize locations where we might begin planting, we further filtered the CCA Priority Restoration Areas using the following criteria:

- Potential for successful revegetation based on soil type, weed infestations, livestock disturbance, infrastructure, etc.
- Proximity to leks that have high attendance and are likely to persist.
- Accessibility for planting crews and equipment.
- Minimize potential to impact cultural resources.

We reviewed maps of the CCA Priority Restoration Areas, soil information, active leks, and roads to determine sites that would best meet these additional criteria. We identified three possible sites (Figure 5-2). These three sites include one near Tractor Flats and two in the Butte City Burn on the west side. Of these, we determined the greatest potential to meet the goal criteria was the site near Tractor Flats. We will further investigate this location to determine the exact planting area in cooperation with INL Cultural Resources Program staff to ensure that our planting does not pose a risk to cultural resources.

5.1.4 Growing and Planting Container Stock

In January 2015, we will extend our contract with our restoration consultant, Foothills Botanical, Inc. of Hamilton, Montana. Foothills Botanical provides coordination for procurement of the plant materials and planting services. They also provide coordination between seed collector, seed cleaner, seedling grower, and planting crew. They also provide plant inspection of seedling for acceptance prior to shipping, and provide communication between GSS and all subcontractors.

In January 2015, we will also establish a Purchase Order with Tribal Forestry Department of the Confederated Salish and Kootenai Tribes in Ronan, Montana to produce containerized seedlings. We will specify 10 cubic inch containers to improve the potential for successful establishment and expect to purchase 5,000 seedlings. Planting will occur in October. We will establish a contract with FGR, Inc. of Plains, Montana to plant the seedlings on the INL Site.

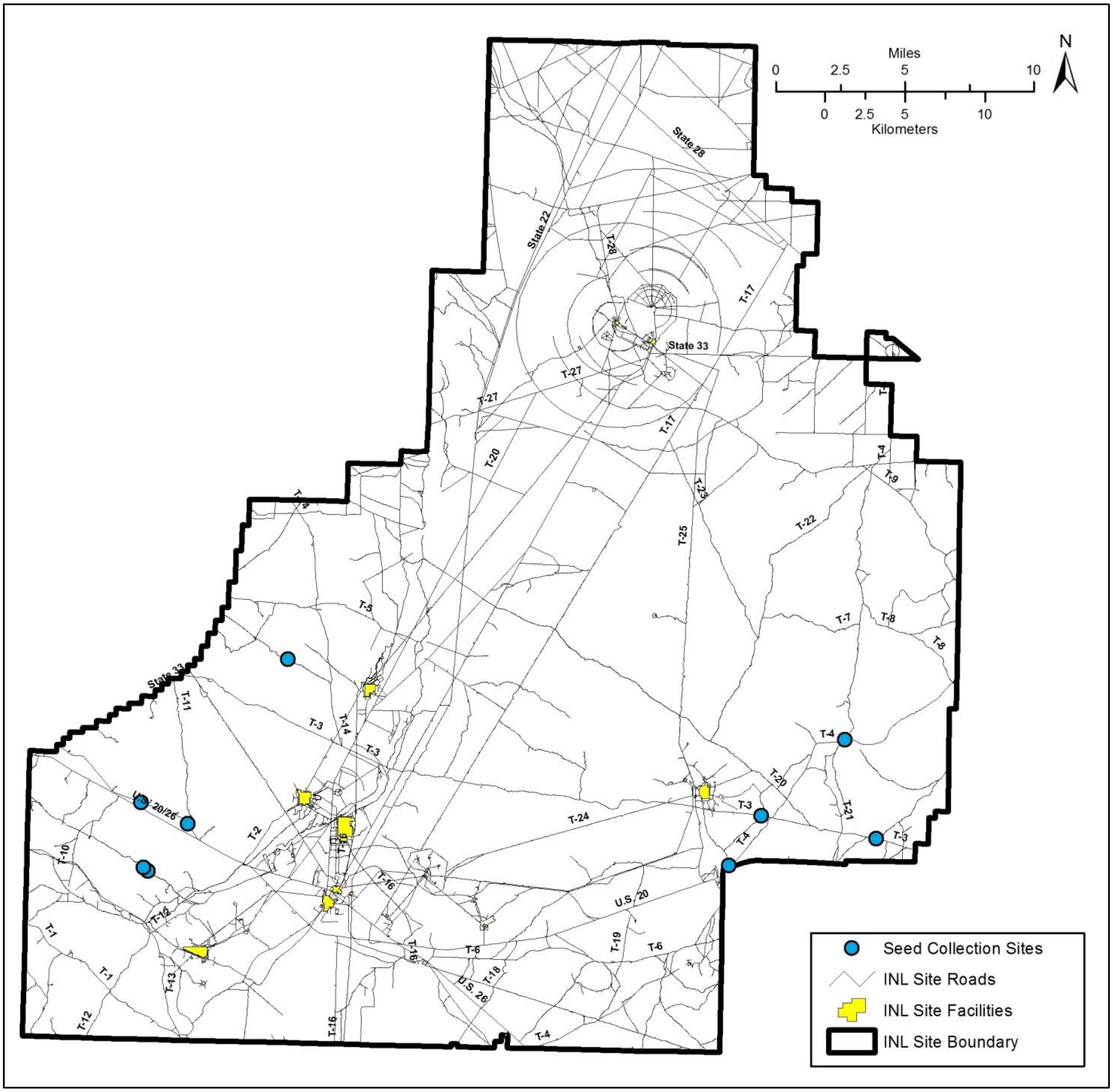

Figure 5-1. Locations of seed collection sites in 2014.

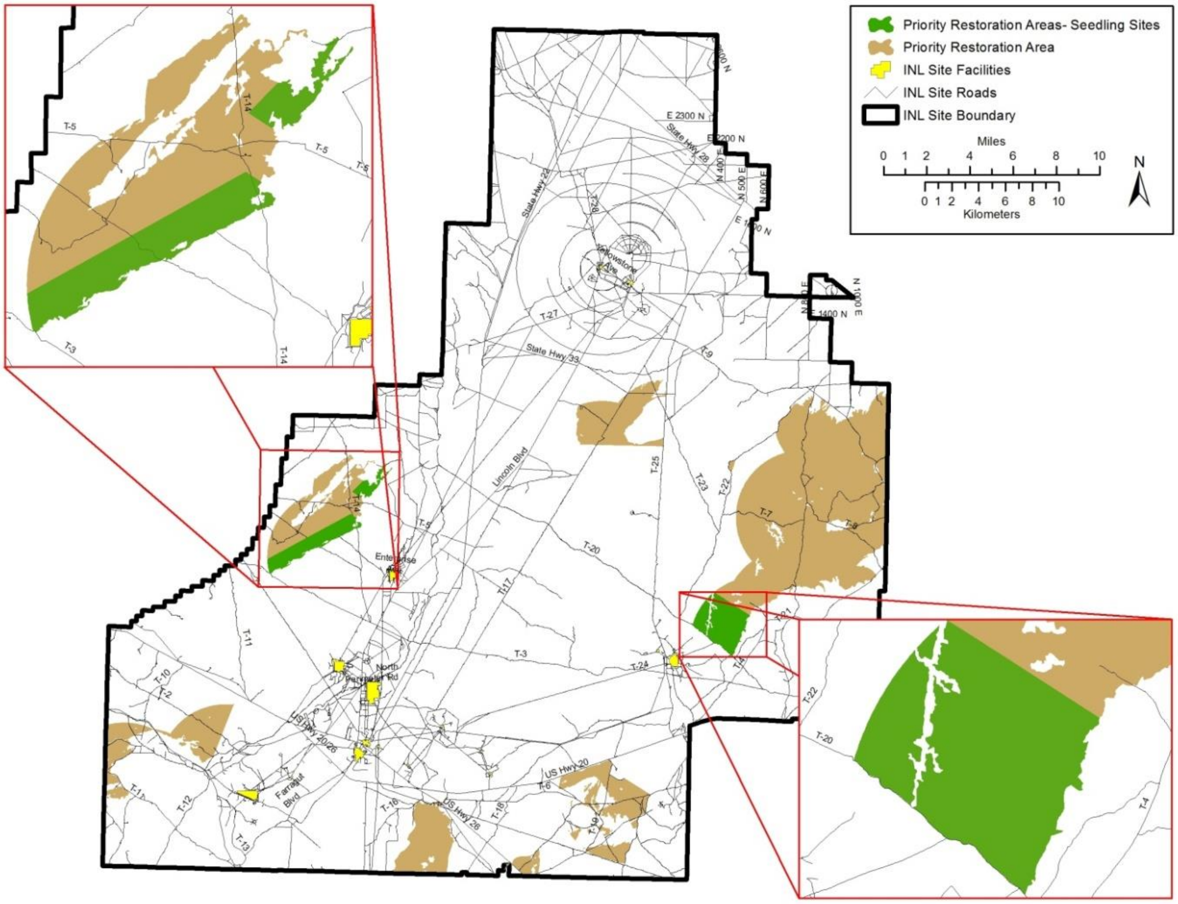

Figure 5-2. Three sites within the CCA Priority Restoration Area that best met criteria for initial successful habitat restoration.

5.1.5 Monitoring

Monitoring will be initiated by determining condition of individual seedlings at specific time intervals. At the time of planting, we will collect sub-meter GPS locations on 5 to 10 percent of the seedlings. We will return to these seedlings in August of the following year and again at five years. We will record the condition of each seedling using the ranking system in Table 5-2. We will also record the height and whether or not the individual is producing seed.

Table 5-2. Condition Rating for determining success of sagebrush seedling planting.

Rating	Condition Description
1	Shrub is completely dead or is absent
2	Approximately ¼ of the shrub’s biomass is alive
3	Approximately ½ of the shrub’s biomass is alive
4	Approximately ¾ of the shrub’s biomass is alive
5	Shrub is completely alive

6. MANAGEMENT IMPLICATIONS

6.1 Status of Population and Habitat Triggers

The population trigger for sage-grouse would be tripped if the three-year average of peak male attendance fell below 253 males across the 27 baseline leks within the SGCA. This would represent a decrease of over 20% of the 316 males counted in 2011. The average peak male attendance from 2012 to 2014 on the 27 baseline leks was 340 individuals. Thus, this index shows no evidence that sage-grouse abundance is declining on the INL Site, and it is currently unnecessary for DOE and the USFWS to adjust adaptive management strategies for sage-grouse on the INL Site.

Following the mapping updates made in 2014, the estimated 2012 SGCA sagebrush habitat baseline value was slightly reduced with a total of 78,457 ha (193,872 acres). The habitat trigger would be tripped if a net of 15,691 ha (38,773 acres), representing 20% of the sagebrush habitat baseline within the SGCA, was lost or converted to a non-sagebrush-dominated vegetation class. In 2014, no wildland fires or other activities reduced the area of sagebrush habitat within the SGCA, so there is no need for DOE to compensate for habitat loss as outlined in section 9.4.3 of the CCA.

6.2 Synthesis and Conclusions

Results from lek surveys provide no evidence that sage-grouse on the INL Site are in decline. Although encouraging, we recognize that wildland fire remains one of the greatest threats to sage-grouse and its habitats (DOE and USFWS 2014), as this threat has the greatest potential to cause sage-grouse declines over a short period of time. For example, in 2010 the three-year average peak male attendance on the Tractor Flats Lek Route was 117 males. That summer, the Jefferson Fire burned 16,726 ha (41,330 acres) of big sagebrush-dominated communities on the INL Site, including several of the leks on the Tractor Flats Route. The current (2012-2014) three-year average of peak male attendance on that route is 57 males, representing more than a 50% decrease across those years. A similar reduction in the number of lekking grouse was documented after the Murphy Complex Fire that burned in south-central Idaho (Moser and Lowe 2011). The Tractor Flats Route, however, is only one of three IDFG routes on the INL Site, and since the Jefferson Fire, the three-year average peak male attendance on the RWMC route (which was not impacted by the fire) has increased 23%. We hypothesize that this increase is due to sage-grouse moving from the Tractor Flats Route to areas near the RWMC Route.

Although the 2013 sagebrush habitat baseline value was slightly reduced based on new mapping updates, it is important to note that this reduction does not constitute a loss of sagebrush habitat. The original sagebrush habitat amount and distribution was based on less accurate wildland fire mapping, and the current baseline reflects a more accurate estimate of the distribution including where unburned patches of sagebrush habitat are located within fire boundaries. A more accurate understanding of sagebrush habitat distribution allows for more informed conservation planning, predictive modeling, improved site selection for field sampling, and it provides fine scale information useful for future sagebrush planting and restoration efforts across the INL Site.

The habitat condition monitoring data has not identified any map polygons where species cover and composition would suggest a current sagebrush habitat polygon needs to be removed and assigned to a non-sagebrush vegetation class. There is also no indication from the habitat condition data that there are any non-sagebrush polygons that have recovered to the point where they may warrant a map class change to sagebrush habitat. There is some evidence of natural sagebrush reestablishment in the 1994 Butte City fire and we intend to more closely review the plot cover data over the next few years to determine where it may be appropriate to delineate new sagebrush habitat polygons.

Mean sagebrush cover from annual sagebrush habitat plots and the sagebrush habitat polygons they represent is in the middle of the range suggested for optimal breeding and brood-rearing habitat (Connelly et al. 2000). Herbaceous cover and height remain low, but this likely reflects very dry conditions over the past three years rather than a true decline in condition. In both sagebrush habitat and non-sagebrush polygons ecological condition remains high as evidenced by low cover values of introduced annuals relative to native herbaceous species.

6.3 Management Recommendations

No results from the 2014 habitat distribution and condition monitoring tasks would indicate a need to adjust current adaptive management strategies. Both sage-grouse and habitat monitoring data appeared to remain stable in 2014. Continued monitoring will facilitate the development of baseline values and help characterize the annual range of variability around those values.

6.4 Literature Cited

Connelly, J. W., M. A. Schroeder, A. R. Sands, and C. E. Braun. 2000. Guidelines to manage sage grouse populations and their habitats. Wildlife Society Bulletin 28:967-985.

Department of Energy, Idaho Operations Office (DOE), and U.S. Fish and Wildlife Service (USFWS). 2014. Candidate conservation agreement for greater sage-grouse (Centrocercus urophasianus) on the Idaho National Laboratory Site. DOE/ID-11514, U.S. Department of Energy Idaho Operations Office, Idaho Falls, Idaho.

Moser, A. and B. Lowe. 2011. Wildlife monitoring on the Murphy Complex Fire - Final Report. Idaho Department of Fish and Game, Boise, ID.

7. WORK PLAN FOR 2015

Task	Schedule and Changes in 2015
1. Lek Surveys	• Same 27 baseline leks will be monitored. • All other active leks in and out of the SGCA will be monitored. • The three IDFG lek routes will be monitored as in 2014.
2. Historical Lek Surveys	• The same historical leks within the SGCA will be monitored. • Other historical leks outside the SGCA will be monitored as time permits.
3. Systematic Lek Discovery Surveys	• Same methods as 2014 except that another area within the SGCA will be targeted.
4. Raven Nest Surveys	• Surveys will commence at the beginning of April and will be nearly identical in effort to the 2014 surveys. • We will begin recording the type of power line structures used by nesting raven so we may test our hypothesis that ravens only nest on certain structure types that are able to support nests securely during high winds.
5. Sagebrush Habitat Condition Trends	• Sample all annual monitoring plots (n=75). • Sample set #3 of the rotational monitoring plots (n=50).
6. Monitoring to Determine Changes in Sagebrush Habitat Amount and Distribution	• Make minor updates to the 'partially burned' patches of vegetation within the 2010 Jefferson Fire. • Import sagebrush habitat condition plot dichotomous key results to a GIS and start identifying new vegetation class distribution within recent fires. • Initiate field sampling across Jefferson Fire to determine the current vegetation class(es) establishing post-fire.
7. Inventory and Monitoring of Sage-grouse Habitat for Areas Dominated by Non-native Annual Grasses.	• Resurvey all areas visited in 2014.
8. Monitoring Unauthorized Expansion of the Infrastructure Footprint within the SGCA and Other Areas Dominated by Big Sagebrush	• No activities will be planned until funding is secured.