2013 Monitoring Report in Support of the Candidate Conservation Agreement for Greater Sage-grouse on the Idaho National Laboratory Site

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ACRONYMS

ATRC	Advanced Test Reactor Complex
CCA	Candidate Conservation Agreement
CFA	Central Facilities Area
CITRC	Critical Infrastructure Test Range Complex
DOE-ID	U.S. Department of Energy, Idaho Operations Office
EBR-1	Experimental Breeder Reactor
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
NSTR	National Security Test Range
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

1. BACKGROUND AND PURPOSE

The U.S. Department of Energy, Idaho Operations Office (DOE-ID) and the U.S. Fish and Wildlife Service (USFWS) have collaborated to produce a Candidate Conservation Agreement (CCA; DOE-ID and USFWS in review) for Greater Sage-grouse (*Centrocercus urophasianus*; hereafter sage-grouse) on the Idaho National Laboratory (INL) Site. Though the agreement has yet to be signed, DOE-ID initiated several tasks comprising the CCA monitoring program during 2013 (Section 11 of the CCA).

This report summarizes results from inventory and monitoring tasks that DOE-ID's Environmental Surveillance, Education, and Research (ESER) Program completed in 2013 in support of sage-grouse conservation and the CCA. No data collection occurred for tasks designed to (1) determine changes in sagebrush habitat amount and distribution, and (2) inventory and monitor sage-grouse habitat for areas dominated by non-native annual grasses. Instead, effort on those tasks was directed toward preparing the survey protocols and procedures. We anticipate those procedures to be completed and first data collected in 2014.

The primary purpose of this report is to provide the data and information necessary to enable DOE-ID 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 on the 27 leks within the Sage-grouse Conservation Area (SGCA), averaged over three years, decreases by 20% or more;
- Habitat Trigger: Total area designated as sagebrush habitat within the SGCA has been reduced by 20% or more.

The information provided in this report will inform dialogues between DOE-ID and USFWS as the two agencies work 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.

Inventory and monitoring tasks are grouped into three categories: (1) population trigger monitoring, (2) habitat trigger monitoring, and (3) threat monitoring. Following the individual task reports, we provide conclusions on the status of population and habitat triggers, a synthesis that combines information from population and habitat monitoring tasks, and management recommendations. The final section of this report contains a work plan for 2014 and lists changes that will occur in 2014 to increase effectiveness of tasks in achieving objectives and furthering the goals of the CCA.

2. POPULATION TRIGGER MONITORING

Sage-grouse leks are important displaying and breeding areas that grouse return to each spring (Jenni and Hartzler 1978, Connelly et al. 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 et al. 1981). Leks and their surrounding breeding habitat are crucial for the survival of sage-grouse populations (Connelly et al. 2000), and counting displaying birds at these areas can be a relatively easy method to document population trends 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-ID and USFWS in review), in 2013 DOE-ID 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 a subset of historical leks on the INL Site to determine if grouse 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 lek surveys will provide information 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-ID and USFWS in review). Additional results from lek surveys 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-ID and USFWS in review). Completing historical and systematic lek discovery surveys will provide DOE-ID 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-ID and USFWS in review). Below, we report the results from these three inventory and monitoring tasks for 2013.

2.1 Lek Surveys

2.1.1 Introduction

The lek survey monitoring task involves surveying the following active leks (as defined by Connelly et al. 2000) 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 one of the three IDFG lek routes; 3) leks on the three IDFG routes that are surveyed annually on the INL Site (DOE-ID and USFWS in review). Information from these surveys will allow DOE-ID 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-ID and USFWS in review). These surveys will also allow DOE-ID 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-ID and USFWS in review).

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 lek routes) in the SGCA during 2011 (Figure 2-1, DOE-ID and USFWS in review). 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-ID and USFWS in review). After the 2014 lekking season, we will have a sufficient number of years of counting grouse at these 27 leks to produce a three-year average that we can then compare with the number of males counted in 2011 as described in the CCA. Until 2014, instead of using the three-year average, we will compare the total number of male sage-grouse observed at these 27 active leks in 2012 and 2013 with the number of males observed at these leks in 2011.

In 2013, ESER biologists also surveyed the remaining active leks (*n* = 21) 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-ID with context regarding the number of grouse on all known 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 (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-ID and USFWS in review).

2.1.2 Methods

ESER biologists surveyed the 27 active leks in the SGCA, all other known active leks on the INL Site, and the three IDFG lek routes from late March to early May to count the number of lekking males 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 without disturbing the birds. 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 driving along the lek routes. If new leks were discovered while driving the lek routes, we counted the number of male grouse at these leks using the methods described above (ESER Procedure RP-4).

2.1.3 Results

In 2013, ESER biologists surveyed all 27 active leks in the SGCA at least three times ($\bar{x}$ = 5 surveys, *SD* = 1.3, range = 3 to 7 surveys) to count sage-grouse using those areas (Figure 2-1). The number of lekking males at peak attendance on those 27 leks in the SGCA was higher in 2013 than in 2011 (Table 2-1).

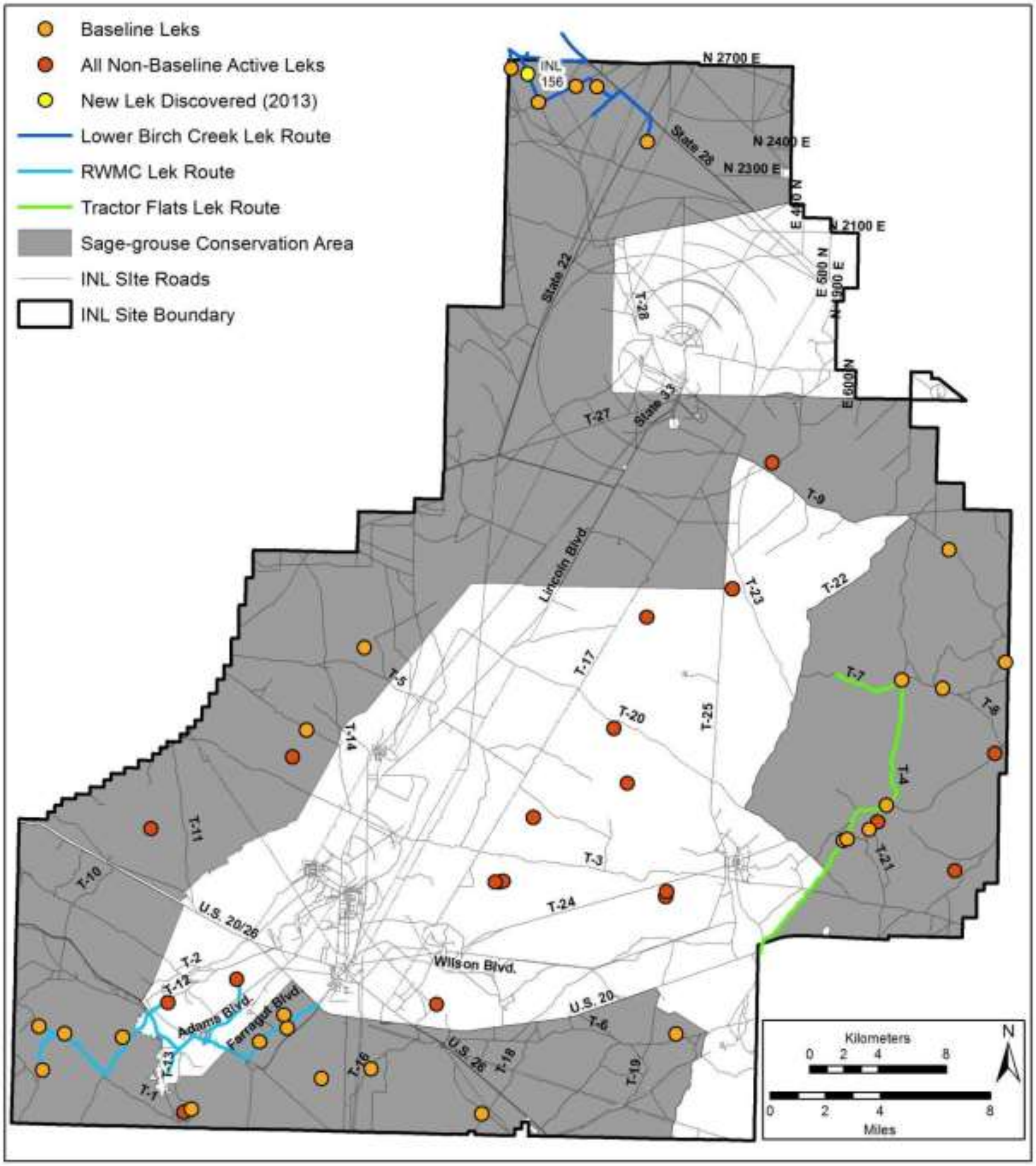

Figure 2-1. Lek routes and the 27 active leks used for the baseline value in the SGCA, as well as other active leks in and out of the SGCA that were surveyed for sage-grouse in 2013. The lek named INL156 was discovered while conducting the lower Birch Creek lek route.

Table 2-1. Number of males counted on the 27 leks in the SGCA in 2011 (baseline year), and the number of males counted on those leks in 2012 and 2013.

Population Trigger	# of Males in 2011	# of Males in 2012	# of Males in 2013
Peak male attendance on active leks in SGCA	316	335	334

In 2013, ESER biologists also surveyed the remaining active leks (*n* = 21) 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 21 active leks an average of four times (*SD* = 1 survey, range = 2 to 6 surveys). The number of lekking males at peak attendance on those 21 leks was 222.

Additionally, we sampled leks on each IDFG lek route at least five times in 2013 (Figure 2-1). The maximum number of males counted during peak male attendance across those three lek routes was 211 (Table 2-2). The number of males observed on those three lek routes in 2013 was similar to the number of birds observed on those routes since 2011, which was the year we used to calculate the baseline value of the population trigger (Figure 2-2). During 2013, we documented one new lek (INL 156) that was discovered while driving the Lower Birch Creek Lek Route (Figure 2-1). We surveyed that lek each time we conducted the Lower Birch Creek Lek Route (6 surveys), and the maximum number of grouse that we counted at that lek was three.

Table 2-2. Descriptive statistics for each IDFG lek survey route on the INL Site in 2013.

Lek Route	# of Surveys	Maximum # of Males Counted	Day of Maximum Count
Tractor Flats	5	53	March 28
RWMC	5	110	April 17
Lower Birch Creek	6	48	April 23

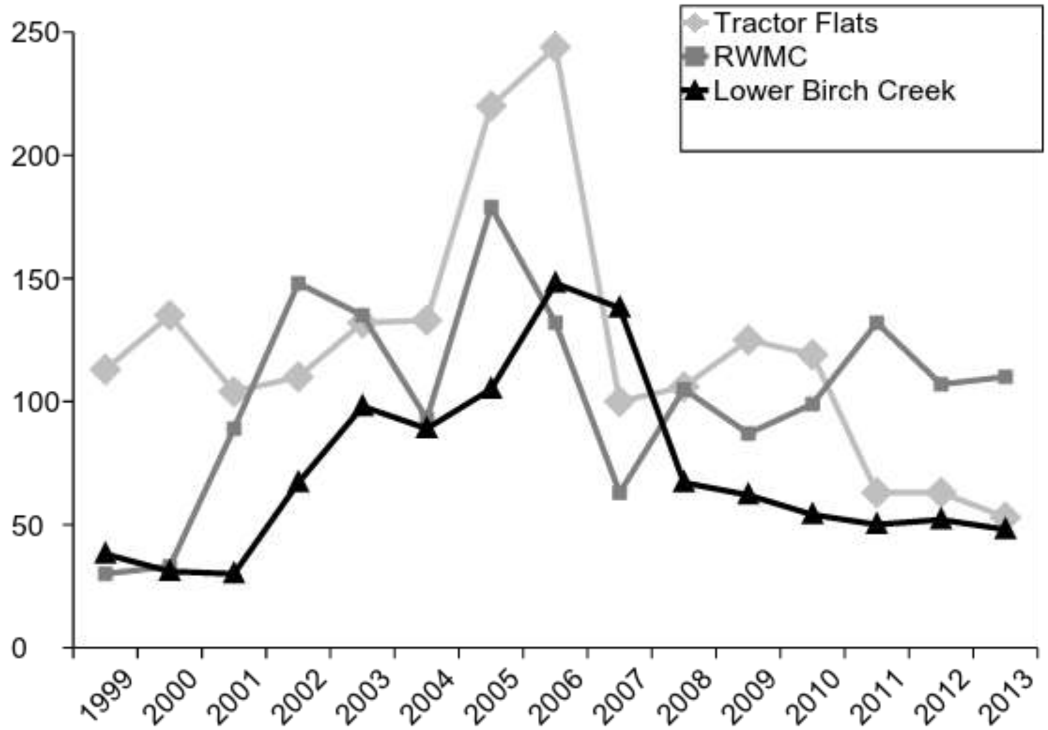

Figure 2-2. Number of male sage-grouse observed at peak attendance across three lek routes on the INL Site from 1999 to 2013.

2.1.4 Discussion

The CCA establishes a population trigger, that if tripped, would initiate an automatic response by DOE-ID and the USFWS to re-assess sage-grouse management on the INL Site (DOE-ID and USFWS in review). The *Lek Surveys* task involves surveying the 27 designated 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-ID and USFWS in review). In 2013, we observed 334 male sage-grouse on the 27 active leks in the SGCA. 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-ID and the USFWS to review sage-grouse management on the INL Site.

Additionally, ESER biologists monitored all other active leks on the INL Site that were not included in the 27 active leks in the SGCA used to calculate the baseline value in 2011. In 2013, we surveyed 21 of those active leks not included in the baseline value and counted 222 male sage-grouse during peak attendance. Although some of these leks are not located in the SGCA, they still have seasonal time-of-day restrictions on activities occurring within 1 km (0.6 mi) of each lek to minimize disturbance of lekking sage-grouse from March 15 to May 15 (DOE-ID and USFWS in review). In addition to seasonal restriction of activities that could disturb sage-grouse, DOE will also avoid erecting permanent infrastructure within 1 km (0.6 mi) of these leks (DOE-ID and USFWS in review). Continually monitoring all active leks on the INL Site, even those not used in calculating the baseline value in the SGCA, will provide DOE-ID with greater context regarding the number and trend of lekking sage-grouse on the INL Site.

The lek survey monitoring task also includes continued surveys of the Tractor Flats, RWMC, and Lower Birch Creek lek routes. Data from these lek routes provide information regarding the trend in sage-grouse abundance in these areas since the 1990s (DOE-ID and USFWS in review). 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 difficult. From 2008 to 2013, however, the number of leks sampled on those routes has only increased from 22 to 24, and the number of birds observed across those routes during that time has remained relatively stable. One exception is the Tractor Flats lek route. The number of sage-grouse counted on that route decreased substantially in 2011 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 (Moser and Lowe 2011).

2.2 Historical Lek Surveys

2.2.1 Introduction

Many historical sage-grouse leks have been documented on the INL Site (Connelly 1982). At these locations, sometime in the past, an individual 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-ID and USFWS in review). 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-ID and USFWS in review).

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. 2000).
- A lek was considered inactive if no grouse were observed at that lek or grouse were observed fewer than two years during a five-year survey period.
- We still designated a lek as active, however, if we observed two or more male sage-grouse and the lek had been surveyed for less than five years (Whiting et al. 2014). That active designation would not change unless we surveyed that lek for five years and only observed birds once; then that lek was considered inactive (Whiting et al. 2014).

ESER biologists surveyed locations that were identified previously as historical leks on the INL Site from March 28 to May 2, 2013 (Figure 2-3), following established methods (ESER Procedure RP-6). These methods included transferring coordinates for each historical lek to a hand-held global positioning system (GPS) unit that we then used to navigate to each lek. 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

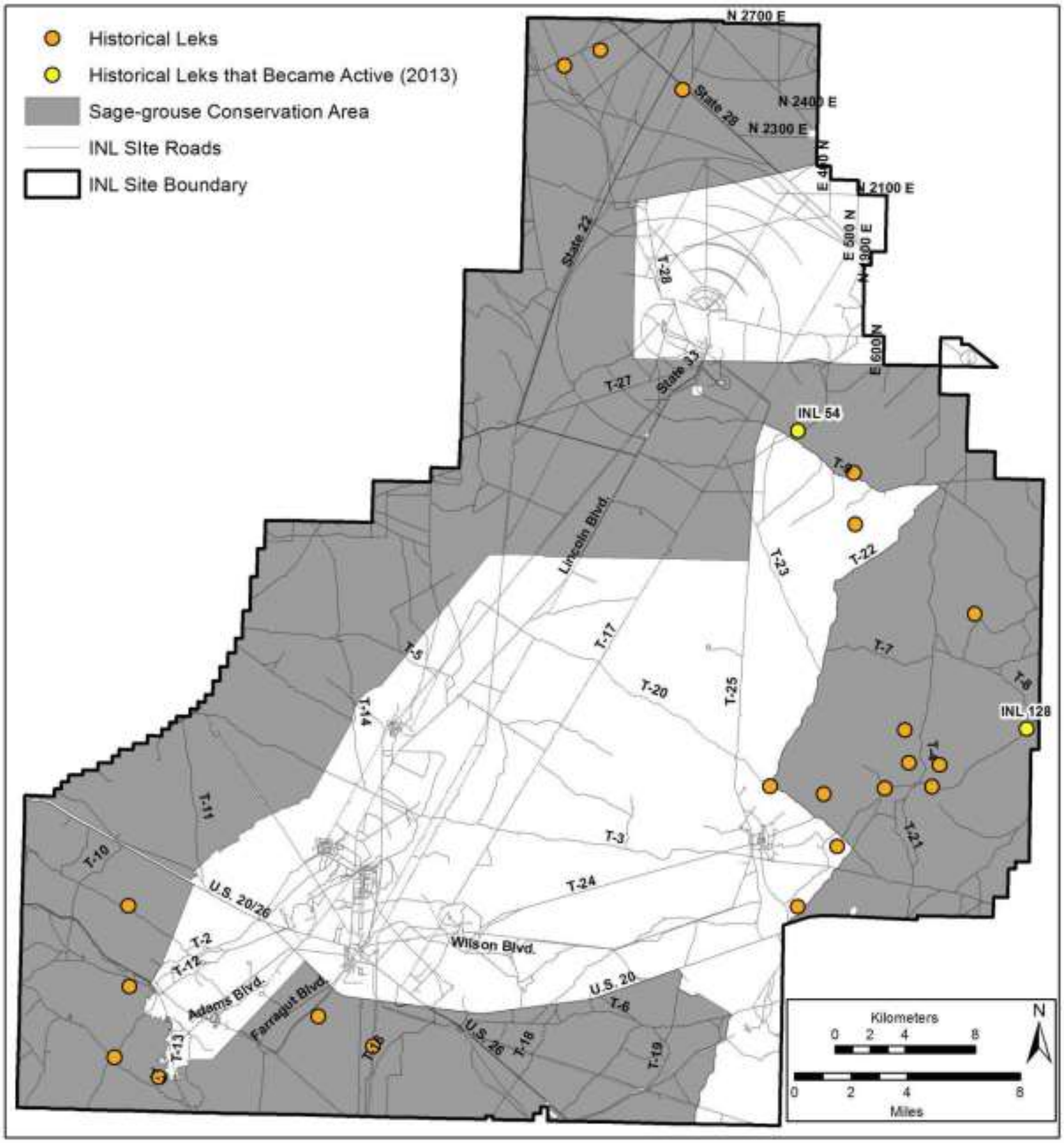

Figure 2-3. Historical leks that were surveyed, as well as the two historical leks at which we observed sage-grouse on the INL Site in 2013.

sage-grouse. If grouse were observed, we counted the birds on the lek four 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 listened for 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 would walk ~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 grouse were heard near the location of a cardinal direction, we attempted to locate the lek by walking towards the call. If birds were located, we counted and recorded the number of grouse observed as described above (ESER Procedure RP-6).

2.2.3 Results

In 2013, ESER biologists visited 18 historical leks that were in the SGCA an average of three times (*SD* = 0.5 survey, range = 2 to 4 surveys). We also visited five historical leks that were not in the SGCA, but were near important areas for grouse (e.g., near lek routes or near the SGCA boundary), two times each to determine if sage-grouse still used those leks (Figure 2-3). Of the 23 historical leks that were surveyed, we observed sage-grouse at two of those leks (Table 2-3), both of which were located in the SGCA (Figure 2-3). Also, three historical leks (INL 58, 59, and 122) in the SGCA now have sufficient number of surveys without observing grouse to be designated inactive.

Table 2-3. Descriptive statistics for historical lek and lek discovery surveys in the SGCA at which we observed male sage-grouse in 2013.

Survey Type and Lek Name	# of Visits	Maximum # of Males Counted	Day of Maximum Count
Historical lek surveys			
INL 54	4	13	April 24
INL 128	3	28	April 17
Lek discovery surveys			
INL 152	3	14	April 26
INL 154	3	18	April 18
INL 155	2	7	April 19

2.2.4 Discussion

The historical lek survey monitoring task involves continued surveys of historical leks, some of which have been surveyed since 2009. The result of this task is to document additional active leks on the INL Site in preparation to potentially establish new lek routes (DOE-ID and USFWS in review). While conducting surveys for this monitoring task during 2013, we identified two new leks in the SGCA. The total number of grouse observed at peak attendance on those two leks was 41. At one of those historical leks (INL 128), our highest count was 28 males, which made that lek the fifth largest on the INL Site in 2013. These two new leks could be used when other lek routes are established on the INL Site before the 2017 lek season (DOE-ID and USFWS in review). Establishing more lek routes will enhance DOE-ID's ability to more accurately track sage-grouse trends, especially within the SGCA (DOE-ID and USFWS in review).

2.3 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-ID and USFWS in review). 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-ID and USFWS in review).

2.3.2 Methods

These lek discovery surveys were accomplished by first designating 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 used a GIS to display roads for the INL Site (except roads used to access facilities) north of U.S. Highway 20 and west of Lincoln Boulevard. We then placed survey locations along T-roads in that area 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 Big Sagebrush habitat 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 Big Sagebrush habitat 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 area (Figure 2-4). We also added one remote-survey location to an area of big sagebrush south of Highway 20 (Figure 2-4).

In 2013, ESER biologists visited 89 road- and remote-survey locations from March 28 to May 2. At each road-survey location, we would turn off 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 four 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 then 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 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. If sage-grouse were located, they were counted and recorded as described above (ESER Procedure RP-6).

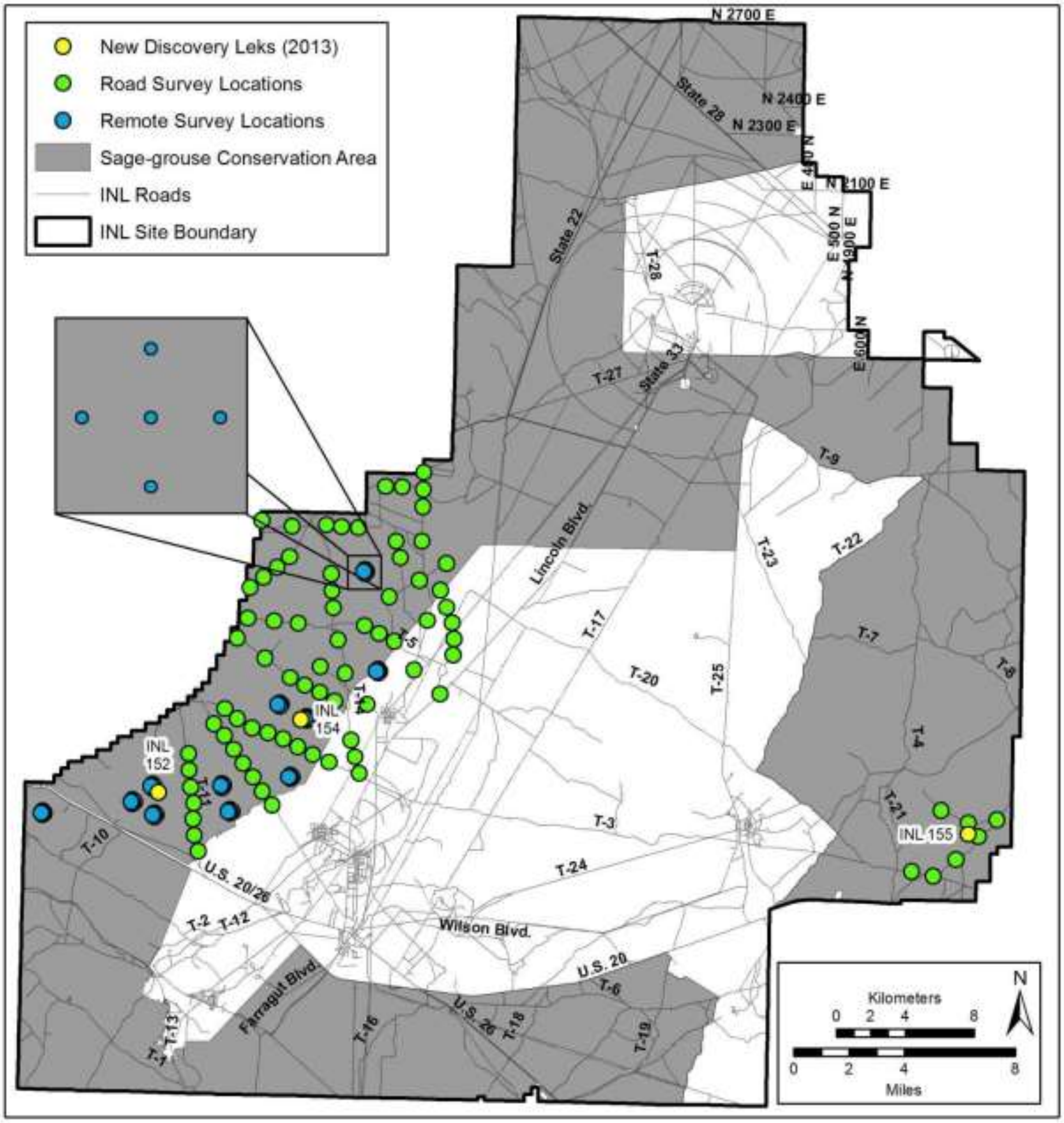

Figure 2-4. Areas on the INL Site where ESER biologists surveyed road and remote locations for sage-grouse leks, as well as the locations of three new leks that were discovered as a result of those surveys in 2013.

2.3.3 Results

ESER biologists visited the 89 road- and remote-survey locations an average of 1 time (*SD* = 0.4 survey, range 1 to 3 surveys) to determine if male sage-grouse were lekking in areas near those survey locations (Figure 2-4). Of those 89 road- and remote-survey locations, we located three new leks in the SGCA (Table 2-3, Figure 2-4).

2.3.4 Discussion

The systematic lek discovery survey task is designed 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-ID and USFWS in review). While conducting surveys for this task during 2013, we identified three new leks in the SGCA, which could be used when other lek routes are established on the INL Site before the 2017 lek season (DOE-ID and USFWS in review). The total number of grouse observed at peak attendance on those three leks was 39. At one of those leks (INL 154), our highest count was 18 males, which made that lek the ninth largest on the INL Site in 2013. Establishing more lek routes will enhance DOE-ID's ability to more accurately track sage-grouse trends, especially within the SGCA (DOE-ID and USFWS in review).

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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:

1) Sagebrush Habitat Condition Trends - The sagebrush habitat quality data will serve to 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, Table 3).

2) 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 quality 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 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 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. Five threats to greater sage-grouse populations at the INL Site were ranked "high" in the CCA and include; wildland fire, infrastructure development, annual grasses and other weeds, livestock, and seeded perennial grasses. These five threats are thought to affect sage-grouse populations partially or wholly through their effects on habitat. Therefore, the habitat quality 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. 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 quantity. In addition the habitat quality data can be used to interpret vegetation characteristics of polygons mapped as habitat in terms current habitat guidelines (i.e. Connelly et al. 2000).

ESER ecologists will continue to 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 which 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 38% 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 from the INL Site 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 has been designed to:

- Characterize habitat quality 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,
- And inform the process used to update the mapped sagebrush habitat distribution.

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 LTV 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 plant community classification 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 burned areas 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 to increase sample sizes in burned areas, 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 original sample design of the plant community classification was revised and augmented to ensure all important data metrics are addressed. The habitat data that are sampled at each plot include: vegetation cover by species, vegetation height for shrubs and herbaceous species, sagebrush density, frequency of juvenile sagebrush occurrence, comprehensive species lists, photographic documentation, sign of use by sage-grouse, indicators of anthropogenic disturbance, and documentation of the current local plant community.

A complete description of sample site selection and plot sampling methodology can be found in the study plan and sample protocol for this monitoring project.

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 (burned areas, grazing allotments, etc.). Formal trend analysis on data collected from the annual plots will begin in three to 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.

Analysis of data collected in 2013 will focus on generating summary statistics for the annual plots. 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. Summary statistics from the annual monitoring plots can be compared to similar data from the LTV plots to determine how vegetation composition in polygons designated as habitat compares to vegetation composition generalized across numerous plant communities sampled by the LTV plots as well. Finally, analysis of the 2013 data will include an overview of precipitation and the potential effects of precipitation patterns on the 2013 habitat condition monitoring data. It will be important to understand whether vegetation data from the first year of monitoring reflect relatively normal precipitation patterns and totals, or are representative of extreme conditions.

3.1.3 Results

Data were collected on a total of 125 plots between June and August of 2013; 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 designated as current sagebrush habitat, and 27 are located in polygons where habitat status is non-sagebrush dominated, referred to as non-habitat plots hereafter. All plots located in polygons not designated as current sagebrush habitat have burned at least once since 1994. None of the plots located in polygons designated as current sagebrush habitat have burned in the last 20 years. Of the 75 annual plots, all but seven are co-located with plots that were sampled in 2008 to support the plant community classification and mapping effort.

Using a dichotomous plant community key, which was developed based on the 2008 classification effort (Shive et al. 2011), all of the annual plots located in polygons designated as current habitat were assigned to communities characterized by sagebrush dominance (Table 3-1a). During the 2013 sample period, 40 of the 48 annual plots were dominated by big sagebrush, three were dominated by three-tip sagebrush, and five were dominated by low and/or black sagebrush. The proportion of each of the sagebrush plant communities assigned to the annual sagebrush habitat plots in 2013 is roughly representative of the spatial extent of each of those sagebrush community types, or vegetation map classes, across the INL Site.

Of the 27 annual non-habitat plots, 15 were assigned to shrublands or shrub herbaceous communities and the remaining were assigned to communities which were dominated entirely by herbaceous vegetation during the 2013 sample period (Table 3-1b). With the exception of one plot, the plant communities in non-sagebrush habitat plots that were assigned to shrublands or shrub herbaceous communities, were characterized by an abundance of green rabbitbrush. This particular plot is located in the Butte City Fire (burned in 1994), and although sagebrush are conspicuous in the plot, cover is not high enough to be consistent with optimal sage-grouse habitat, nor is the sagebrush cover in the plot consistently representative of the landscape around it. Of the 12 plots assigned to herbaceous vegetation communities, half were dominated by native, perennial grasses, and the other half were dominated by cheatgrass or crested wheatgrass in 2013.

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 27 of the 48 annual plots that are located in polygons designated as current sagebrush habitat; at least some scat was from the current year in three of those plots. Sage-grouse scat, all from previous seasons, was only noted on four of the 27 plots that are located in non-sagebrush dominated plant communities.

Anthropogenic influence was noted on 21 of the 75 annual habitat condition monitoring plots and livestock manure was present in at least 13 of those 21 plots. All 21 plots with documented anthropogenic influence are located within, or immediately adjacent to (in the case of one plot,) Bureau of Land Management grazing allotment boundaries and 19 of the 21 plots noted to show signs of anthropogenic influence are located in polygons designated as current sagebrush habitat. For comparison, 52 of the 75 total annual habitat condition monitoring plots, and 37 of the 48 annual plots located in polygons designated as sagebrush habitat, are located within allotment boundaries. This ratio generally reflects the distribution of current sagebrush habitat as it relates to allotment boundaries across the INL Site (Figure 3-1). Thus, more than one third of the plots sampled in allotments showed signs of anthropogenic influence while none of the plots sampled outside of allotments were noted to have signs of anthropogenic influence. However, there are a greater number of monitoring plots within allotments and a greater number of sagebrush habitat plots within allotments because the relative spatial distribution of the INL Site and of sagebrush habitat is greater in allotments.

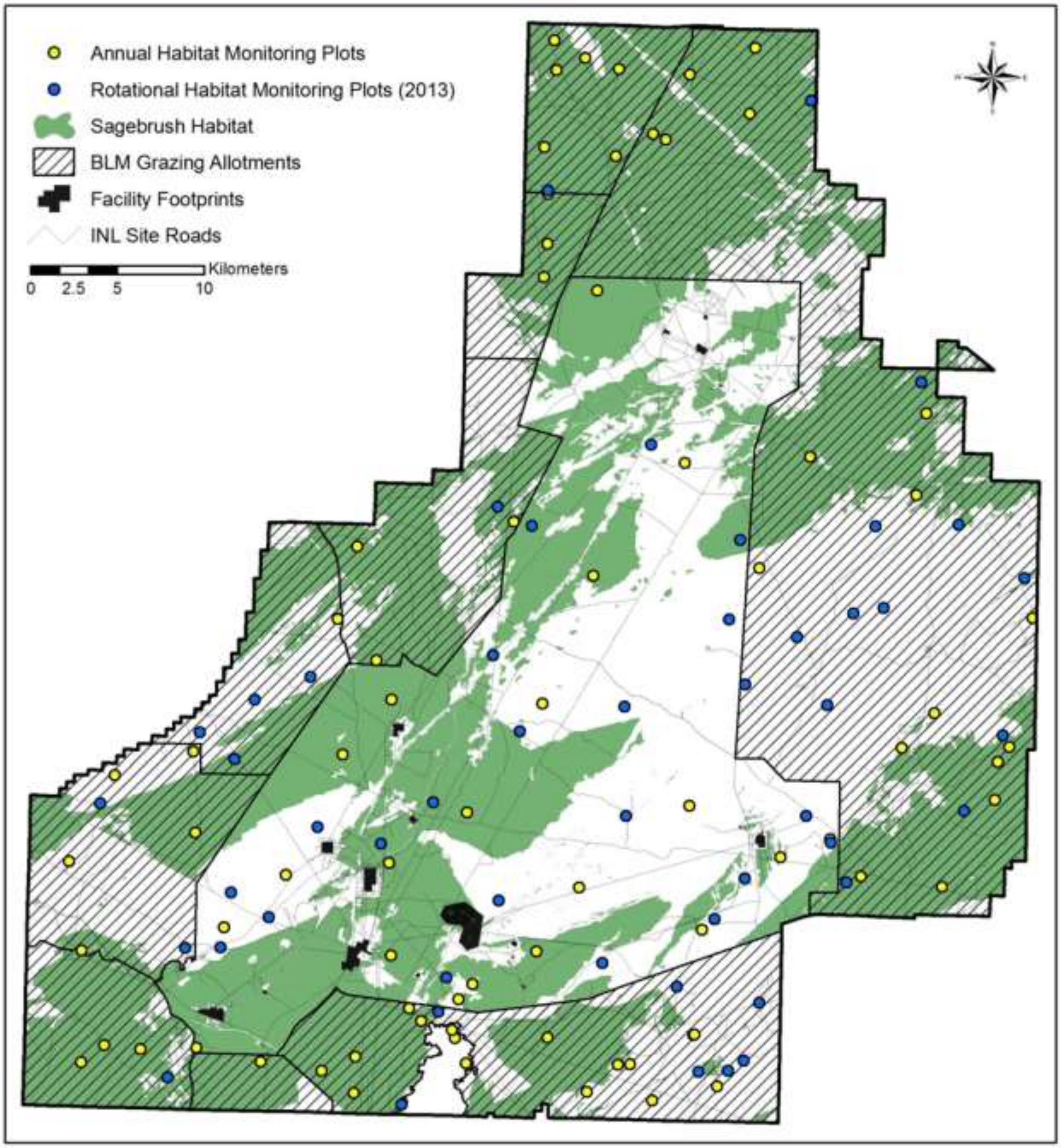

Figure 3-1. CCA sage-grouse habitat condition monitoring plots sampled in 2013 on the INL Site.

Table 3-1a. Results of a dichotomous plant community key (Shive et al. 2011) in 2013 for 48 sage-grouse habitat condition monitoring plots located in polygons designated as current sagebrush habitat on the INL Site.

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

Table 3-1b. Results of a dichotomous plant community key (Shive et al. 2011) in 2013 for 27 sage-grouse habitat condition monitoring plots located in polygons designated as non-sagebrush dominated on the INL Site.

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

In 2013, absolute cover from sagebrush species averaged approximately 20% across the annual monitoring plots that were located in polygons designated as sagebrush habitat (Table 3-2). This is a little more than double the absolute sagebrush cover averaged across the 43 “core” LTV plots, last sampled in 2011 (Forman et al. 2013). Absolute sagebrush cover averaged less that 0.1% across plots located in polygons not currently designated as sagebrush habitat and the few sagebrush individuals that were present on those plots were shorter, on average, than sagebrush individuals on plots located in sagebrush habitat (Table 3-2). Conversely, average cover and height of perennial grasses and forbs were greater on plots in non-sagebrush dominated polygons than on plots in polygons designated as sagebrush habitat.

Sagebrush density estimated across the annual sagebrush habitat plots (Table 3-2) was consistent with 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).

Table 3-2. Summary of selected vegetation measurements for characterization of condition, or quality, of plant communities located in polygons designated as sagebrush habitat and in polygons designated as non-sagebrush dominated for potential sage-grouse habitat 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

Total vascular plant cover was similar between sagebrush habitat plots and plots located in polygons not designated as habitat (Tables 3-3a and 3-3b). Absolute cover averaged across each subset of plots was about 40%. On sagebrush habitat plots, three quarters of the total vegetation cover was from shrubs, and two thirds of the shrub cover was from *Artemisia* species. Overall, sagebrush contributed about half of the total vegetation cover on sagebrush habitat plots. As expected, big sagebrush was the most abundant and widespread sagebrush species. Threetip, black, and low sagebrush were much more limited in the number of plots on which they occurred, but were locally abundant on the plots where they were present, as evidenced by cover normalized by constancy (Table 3-3a). Sandberg bluegrass (*Poa secunda*) was the most abundant perennial grass averaged across the sagebrush habitat plots. Bluebunch wheatgrass (*Pseudoroegneria spicata*) was locally abundant on the plots were it occurred, as was the non-native, crested wheatgrass. Total cover from introduced species was about 2% and cheatgrass cover was less than 1% when averaged across the all sagebrush habitat plots (Table 3-3a). In comparison, mean cheatgrass cover was nearly 5% across the 43 “core” LTV plots, last sampled in 2011 (Forman et al. 2013).

Plots located in polygons not designated as sagebrush habitat had an average green rabbitbrush cover similar to that of sagebrush habitat plots (Tables 3-3a and 3-3b). However, total shrub cover was much lower due to lack of sagebrush on the non-habitat plots. Average absolute cover from native, perennial grasses on non-habitat plots was more than double that on sagebrush habitat plots, and cover from introduced herbaceous species averaged four times 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. At over 5% average absolute cover, cheatgrass was also much more abundant on non-habitat plots than on habitat plots. It is worth mentioning, however, that even on non-habitat plots, the average total cover from native, perennial grasses was nearly three times greater than cover from cheatgrass (Table 3-3b).

Table 3-3a. Absolute cover by species summaries for 48 sage-grouse habitat condition monitoring plots located in polygons designated as current sagebrush habitat on the INL Site in 2013.

	Absolute Cover (%)	Constancy	Cover (%) Normalized by Constancy
Native			
Shrubs			
Artemisia tridentata	16.75	42	19.14
Chrysothamnus viscidiflorus	8.59	42	9.82
Artemisia tripartita	2.33	6	18.65
Artemisia arbuscula	0.84	4	10.03
Artemisia nova	0.77	3	12.36
Atriplex confertifolia	0.70	7	4.80
Krascheninnikovia lanata	0.45	8	2.67
Linanthus pungens	0.37	13	1.35
Eriogonum microthecum	0.12	7	0.83
Others (n = 4)	0.09		
Total Native Shrub Cover	**31.01**		
Succulents			
Opuntia polyacantha	**0.11**	12	0.43
Perennial Grasses			
Poa secunda	2.04	33	2.96
Pseudoroegneria spicata	1.57	10	7.52
Achnatherum hymenoides	1.30	36	1.73
Elymus elymoides	0.86	33	1.24
Elymus lanceolatus	0.74	15	2.37
Hesperostipa comata	0.35	6	2.80
Others (n = 3)	0.11		
Total Native Perennial Grass Cover	**6.95**		
Perennial Forbs			
Phlox hoodii	0.73	24	1.45
Others (n = 16)	0.40		
Total Native Perennial Forb Cover	**1.13**		
Annuals and Biennials			
Chenopodium leptophyllum	**0.01**	1	0.27
Total Native Cover	**39.20**		
Introduced			
Perennial Grasses			
Agropyron cristatum	**1.23**	7	8.47
Annuals and Biennials			

	Absolute Cover (%)	Constancy	Cover (%) Normalized by Constancy
Halogeton glomeratus	0.41	8	2.48
Bromus tectorum	0.21	6	1.69
Alyssum desertorum	0.13	2	3.12
Total Introduced Annual and Biennial Cover	**0.75**		
Total Introduced Cover	**1.99**		
Total Vascular Plant Cover	**41.19**		

Table 3-3b. Absolute cover by species summaries for 27 sage-grouse habitat condition monitoring plots located in polygons designated as non-sagebrush dominated on the INL Site in 2013.

	Absolute Cover (%)	Constancy	Cover (%) Normalized by Constancy
Native			
Shrubs			
Chrysothamnus viscidiflorus	9.92	22	12.18
Tetradymia canescens	0.26	3	2.31
Atriplex confertifolia	0.21	1	5.69
Others (n = 5)	0.20		
Total Native Shrub Cover	**10.59**		
Succulents			
Opuntia polyacantha	**0.05**	3	0.46
Perennial Grasses			
Pseudoroegneria spicata	4.70	15	8.47
Poa secunda	3.86	21	4.96
Hesperostipa comata	2.13	8	7.20
Elymus lanceolatus	2.11	9	6.32
Achnatherum hymenoides	1.33	13	2.76
Elymus elymoides	0.91	16	1.54
Pascopyrum smithii	0.63	3	5.64
Others (n = 1)	0.03		
Total Native Perennial Grass Cover	**15.70**		
Perennial Forbs			
Crepis acuminata	0.91	13	1.89
Phlox hoodii	0.51	14	0.99
Phlox longifolia	0.48	6	2.15
Erigeron pumilus	0.18	8	0.60
Astragalus filipes	0.13	6	0.60

	Absolute Cover (%)	Constancy	Cover (%) Normalized by Constancy
Others (n = 15)	0.56		
Total Native Perennial Forb Cover	**2.77**		
Annuals and Biennials			
Others (n = 5)	**0.24**		
Total Native Cover	**29.35**		
Introduced			
Perennial Grasses			
Agropyron cristatum	**0.35**	2	4.79
Annuals and Biennials			
Bromus tectorum	5.41	17	8.59
Halogeton glomeratus	1.31	6	5.88
Salsola kali	1.12	4	7.53
Alyssum desertorum	0.32	6	1.43
Sisymbrium altissimum	0.14	2	1.87
Descurainia sophia	0.11	1	3.05
Others (n = 1)	0.02		
Total Introduced Annual and Biennial Cover	**8.42**		
Total Introduced Cover	**8.77**		
Total Vascular Plant Cover	**38.12**		

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). On current sagebrush habitat plots, shrub height estimates were from sagebrush species more than 80% of the time and sagebrush tends to be the tallest functional group. On non-habitat plots, shrub height estimates were from other species, primarily green rabbitbrush more than 90% of the time. It is notable that many non-habitat 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 current habitat plots, most of the herbaceous height in those plots is from perennial grasses, which tend to be taller than annuals. Conversely, nearly 40% of the herbaceous height estimate on non-habitat plots is from shorter-statured annual species. Although the mean height of perennial grasses and forbs is higher in non-habitat plots (Table 3-2), overall height of all species in the herbaceous layer is lower, due to the greater abundance of annuals in the non-habitat plots (Table 3-4b).

In 2013, sagebrush density ranged from approximately one individual per three square meters to 16 individuals per square meter in the sagebrush habitat plots. In the non-habitat plots, sagebrush density ranged from zero to a maximum of about one individual per three 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 of four sample transects. In non-habitat plots, the average falls to about one of 50 transects (Table 3-5).

Table 3-4a. Vegetation height by functional group summaries for 48 sage-grouse habitat condition monitoring plots located in polygons designated as current sagebrush habitat on the INL Site in 2013.

	Mean Height (cm)	Proportion of Sample
Shrubs		
Sagebrush Species	44.87	0.82
Other Species	26.20	0.18
Herbaceous Species		
Perennial Grasses	15.69	0.76
Perennial Forbs	7.24	0.14
Annual Grasses	7.60	0.04
Annual Forbs	3.61	0.06

Table 3-4b. Vegetation height by functional group summaries for 27 sage-grouse habitat condition monitoring plots located in polygons designated as non-sagebrush dominated on the INL Site in 2013.

	Mean Height (cm)	Proportion of Sample
Shrubs		
Sagebrush Species	29.81	0.08
Other Species	24.85	0.92
Herbaceous Species		
Perennial Grasses	21.15	0.52
Perennial Forbs	10.97	0.11
Annual Grasses	9.62	0.19
Annual Forbs	9.00	0.19

Table 3-5. Sagebrush density and juvenile frequency summaries from sage-grouse habitat condition monitoring plots located in polygons designated as sagebrush habitat and in polygons designated as non-sagebrush dominated 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 2013 was less than one quarter of average annual precipitation (Figure 3-2). With only about half of the total precipitation of 2003, 2013 became the new driest year on the 63-year record from Central Facilities Area (CFA). It also marks the third consecutive year with below average annual precipitation. Precipitation timing, in terms of monthly totals, has also deviated from average monthly precipitation quite substantially over the past three years (Figure 3-3). The wettest month or season of the year was different from the monthly or seasonal mean in each of the last three years, and the months with the highest precipitation relative to annual totals tended to occur in mid-summer (July-August) or fall (October-December). Historically, the wettest months of the year occurred in the spring (April-June).

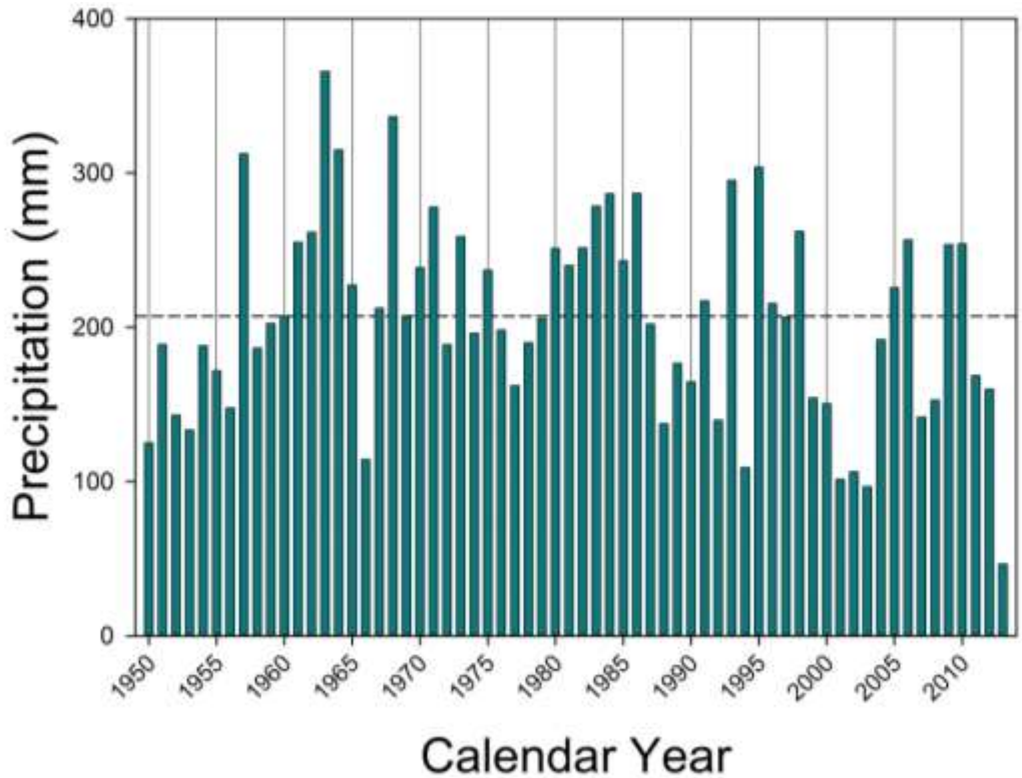

Figure 3-2. Total annual precipitation from 1950 through 2013 at the Central Facilities Area, INL Site. The dashed line represents mean annual precipitation.

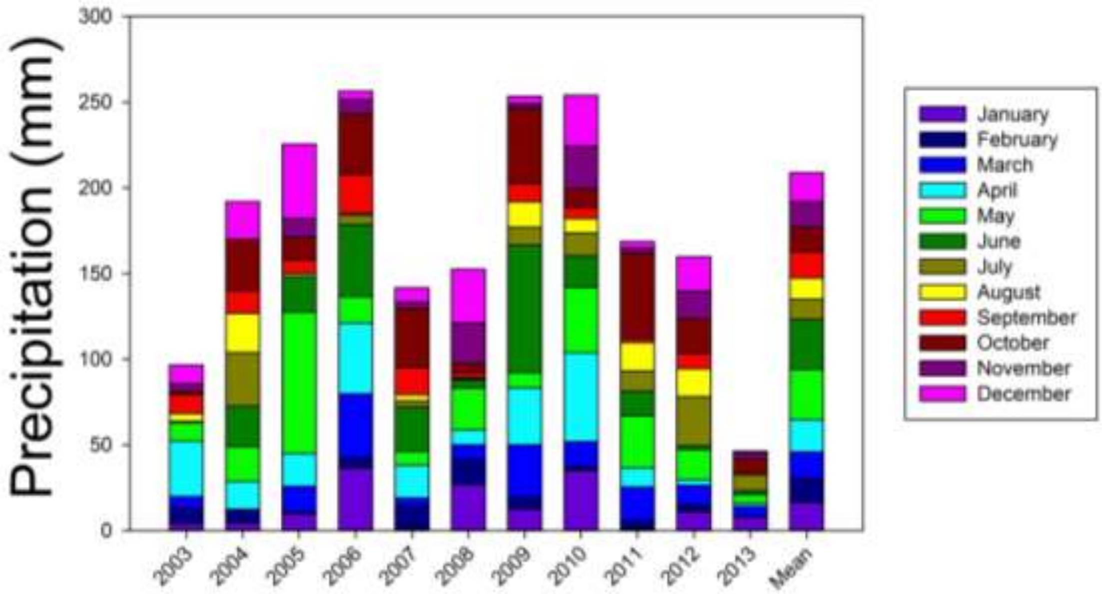

Figure 3-3. Annual precipitation by month from the CFA, INL Site. Mean monthly precipitation includes data from 1950 through 2013.

3.1.4 Discussion

Based on the use of the plant community key to assign a current plant community to each plot location, the 2013 results support the designation of the polygons represented by each plot as current sagebrush habitat or non-habitat. All 48 annual monitoring plots located in polygons designated as sagebrush habitat keyed to a sagebrush-dominated plant community. Likewise, 26 of the 27 plots designated as non-habitat keyed to a green rabbitbrush-dominated or herbaceous community type. Results from sage-grouse sign data also generally support that plots in polygons designated as sagebrush habitat have experienced more past use than plots in polygons designated as non-habitat. In fact, more than half of the plots representing sagebrush habitat contained sage-grouse sign, and of the plots with sage-grouse sign in 2013, 87% are located in polygons designated as current sagebrush habitat.

The single non-habitat plot that keyed to a Wyoming big sagebrush community in the 2013 was located in area burned by the Butte City Fire in 1994. Although the plant community on this plot isn't necessarily representative of landscape around it, it does indicate at least some potential for big sagebrush recovery in the burned area. This result demonstrates the type of scenario where habitat condition data can be used to guide habitat quantity monitoring efforts. This plot, other plots in this burned area, and the polygons around them will be monitored closely because of the potential for recovery to sagebrush habitat in at least portions of this burned area.

Anthropogenic disturbance was noted more often within grazing allotment boundaries than in areas outside of allotment boundaries and was noted more often on habitat plots than on non-habitat plots. These generalizations hold true even when normalized over the relative amount of area designated by land use and habitat status. Though anthropogenic influence certainly occurs in the central areas of the INL Site, it is often more localized and sporadic in nature than it is in the grazing allotments. The greater incidence of anthropogenic influence on sagebrush habitat plots in allotments when compared to non-habitat plots in allotments should be noted. It is not yet clear whether this pattern is a coincidence, an artifact of sample location selection, or a result of livestock operations on the allotments.

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 somewhat 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 total precipitation in 2013 was only about one quarter of average annual precipitation. For the same reason, mean cheatgrass cover and cover from all annual species was uncharacteristically low in 2013. 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.

Once several years of annual monitoring data have been collected, and trend analyses become appropriate, it will be important to understand the pitfalls of oversimplifying data summaries. Table 3-2 presents summaries of several data metrics in a format which can be compared to guidance documents and other sage-grouse habitat literature. Because these summary numbers provide much generalized, though easily recognized benchmarks, they don’t provide a complete picture of sagebrush habitat, either in terms of vertical structure or relative species composition. For example, simply reporting sagebrush height may be misleading if vertical structure of the plant community, as a whole, is the variable which most influences the use of an area by sage-grouse. On average, sagebrush only contributes about half of the total vegetative cover in the sagebrush habitat plots, and sagebrush cover is highly variable from one location to another. A sagebrush stand with an average height of 40 cm, 12% sagebrush cover, and a depauperate herbaceous stratum has very different habitat value than a sagebrush stand with an average height of 40 cm, 22% sagebrush cover, and a diverse and abundant herbaceous stratum. On the other hand, given the estimates in Table 3-2, it would be easy to assume that very little of the vertical structure in non-habitat plots is from shrubs, when in fact many non-habitat plots are green rabbitbrush dominated (Tables 3-3b and 3-4b), and may provide some cover for birds moving through the area. Vegetation height and resulting vertical structure may also be quite variable from one year to the next because of the stochasticity of annuals, a pattern which may cause difficulty in interpreting trends, but which isn’t necessarily apparent in the generalized summary statistics.

Using 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, or quantity, but not all of these changes are easily identified in the summary statistics.

Finally, sagebrush density and juvenile frequency metrics were specifically collected to facilitate monitoring the health and population status of sagebrush stands. Like vegetation height, sagebrush density becomes a much more meaningful measurement when interpreted within the context of cover. Two stands with similar density estimates can have very different cover values depending on the size and maturity of the individual shrubs in the stand. Stands with relatively high cover and relatively low density may be comprised mostly of mature individuals, with few juveniles available to maintain the stand in the future. Conversely, a stand with relatively low sagebrush cover and relatively high density may have an abundance of seedlings and juveniles. The juvenile frequency metric was added to the habitat condition monitoring plan to further refine characterizations of the population status of sagebrush stands because understanding the population status of a sagebrush stand is one of the first steps to anticipating changes in sagebrush habitat condition.

In summary, several years of monitoring will be required to establish reasonable baselines and begin tracking trends in sagebrush habitat condition, as well as the potential for recovery in non-sagebrush habitat communities. In addition to generalized summary statistics, it will be important to interpret habitat condition data within the context of the entire data set to fully understand trends and the possible influence of threats or other stressors on those trends. The 2013 data indicate that vegetative characteristics of polygons designated as sagebrush habitat on the INL Site are generally consistent with criteria for sage-grouse habitat throughout its range. However, results from 2013, particularly for herbaceous species, may be skewed by unusually low precipitation values.

3.2 Monitoring to Determine Changes in Sagebrush Habitat Amount and Distribution

There was no work performed for this monitoring task in 2013. The INL Site did not experience any large wildland fires or disturbances which altered the amount and distribution of sagebrush habitat. The total area of sagebrush habitat remains unchanged from the baseline value established at the end of 2012.

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4. THREAT MONITORING

4.1 Raven Nest Surveys

4.1.1 Introduction

Section 10.8 of the CCA (DOE-ID and USFWS in review) 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 species that 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 there is likely competition with raptors for some of them. Most raven pairs on the INL Site now select anthropogenic structures, primarily power poles, as nesting substrates (Howe et al. 2014). In the CCA, DOE-ID committed to support research aimed at developing methods for deterring raven nesting on utility structures (*Conservation Measure 12*; DOE-ID and USFWS in review). To do so, DOE-ID must first know the spatial distribution of raven nests and in what areas they tend to build nests each year. DOE-ID must also obtain baseline nest numbers so that continued monitoring after installing deterrents would 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 anthropogenic structures on the INL Site that could potentially be used by ravens as a nesting substrate 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, isolated structures, and ornamental trees that could potentially support a raven nest (Figure 4-1). Surveys occurred between 29 April and 28 May, 2013, following established procedures (sampling protocol available upon request). We completed two surveys of the approximately 317 km of transmission and distribution power lines that 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), generally leaving 14 days between surveys of the same power line section. Approximately 125 km of power lines are located in the SGCA and 193 km are outside the SGCA. We surveyed four facilities and three towers (Figure 4-1) once and seven facilities twice, with 9 to 17-day intervals between the first and second surveys (Table 4-1). Some facilities were only surveyed once due to limited access.

Surveys occurred from sunrise to late afternoon. To survey power lines, technicians drove along access roads or nearby paved roads, stopping whenever a nest was observed to record its location and the species occupying the nest on a Trimble Juno SB GPS receiver. Facilities, towers, and other discreet structures, including ornamental trees, were surveyed by vehicle or on 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 show an ESER technician 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. We characterized a nest as “active” if a bird was present and displaying behaviors typical of a nest occupant (e.g. incubating). Thus, the number of active nests reported could be higher than the actual number of nesting pairs that utilized 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.

Table 4-1. Facilities surveyed for raven nests in 2013. "Days Between Surveys" indicates the time between systematic surveys of the infrastructure, though individual nests with an unknown activity status may have been revisited more frequently.

Facility	Times Surveyed	Days Between Surveys	Raven Nest Confirmed
Advanced Test Reactor Complex (ATRC)	2	10	Yes
Specific Manufacturing Capability/Test Area North (SMC/TAN)	2	9	No
Critical Infrastructure Test Range Complex (CITRC)	2	14	No
CFA	2	13	No
RWMC	2*	14	No
Experimental Breeder Reactor (EBR-I)	2	17	No
NRF	1	N/A	Yes
Experimental Sheep Station	2	11	Yes
Materials & Fuel Complex/Transient Reactor Test Facility (MFC/TREAT)	1	N/A	Yes
Idaho Nuclear Technology and Engineering Center (INTEC)	1	N/A	Yes
National Security Test Range (NSTR)	1	N/A	No

*One survey was outside the fence, the other was inside the fence with an escort.

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 occurred until 11 June, 2013, and resulted in some nests being revisited five or six times throughout the season.

4.1.3 Results

Twenty-four active raven nests were found on anthropogenic structures across the INL Site (Figure 4-1). Nineteen (79%) were on power poles, three (13%) were on effluent stacks within facilities, and two (8%) were on platforms attached to buildings. No active raven nests were observed on towers or ornamental trees at facilities. Seven (29%) of the raven nests were located within the SGCA and 17 (71%) were outside of the SGCA. Of the 11 facilities surveyed, five supported a single active raven nest. The mean density of raven nests along power poles was similar both in (17.8 km power lines/nest) and out (16.1 km power lines/nest) of the SGCA.

In addition to raven nests, we documented six nests occupied by hawks and owls. All owl nests were at facilities, while raptor nests were on power poles. Two additional nests associated with facilities were confirmed active, but the species were not positively identified (Table 4-2).

Table 4-2. Active nests observed on anthropogenic features in 2013, including occupant species and nesting substrates.

Species	# Active Nests	Substrate
Common Raven	19	Power Line
	3	Stack
	2	Building Platform
Red-tailed Hawk	1	Power Line
Unidentified *Buteo* hawk	2	Power Line
Great-horned Owl	1	Ornamental Tree
	1	Building Platform
Unidentified Owl	1	Ornamental Tree
Unknown	1	Ornamental Tree
	1	Building Platform
Total	**32**	

4.1.4 Discussion

Similar to results from previous raven nest surveys (Howe et al. 2014), we found that power poles are the predominant anthropogenic features used by ravens as nesting substrates on the INL Site. This result supports DOE's assertion that installing nest deterrents on power poles is likely the most effective way to achieve long-term success controlling raven occupancy on the INL Site (DOE-ID and USFWS in review). As the SGCA is the focus of most of the conservation measures outlined in the CCA, it is encouraging that only a small proportion of power-line nests occurred within the SGCA. Of the seven raven nests that were on power poles within and on the border of the SGCA, five were located along two sections of transmission lines stretching southeast and northwest from CFA (Fig. 4-1). These sections may be appropriate focal areas for testing and installing raven nest deterrents if future surveys find similar results.

Though only seven raven nests occurred within the SGCA, we cannot rule out that ravens nesting outside the SGCA foraged within the SGCA. In the Mojave Desert, parent ravens primarily remained within 0.4 km of their nests, but breeding ravens have the ability to travel large distances daily if food and water resources are not nearby (Sherman 1993). A greater understanding of nesting raven resource selection and use in sagebrush steppe is necessary to determine if sections of power lines outside the SGCA pose a threat to sage-grouse nesting habitat within the SGCA.

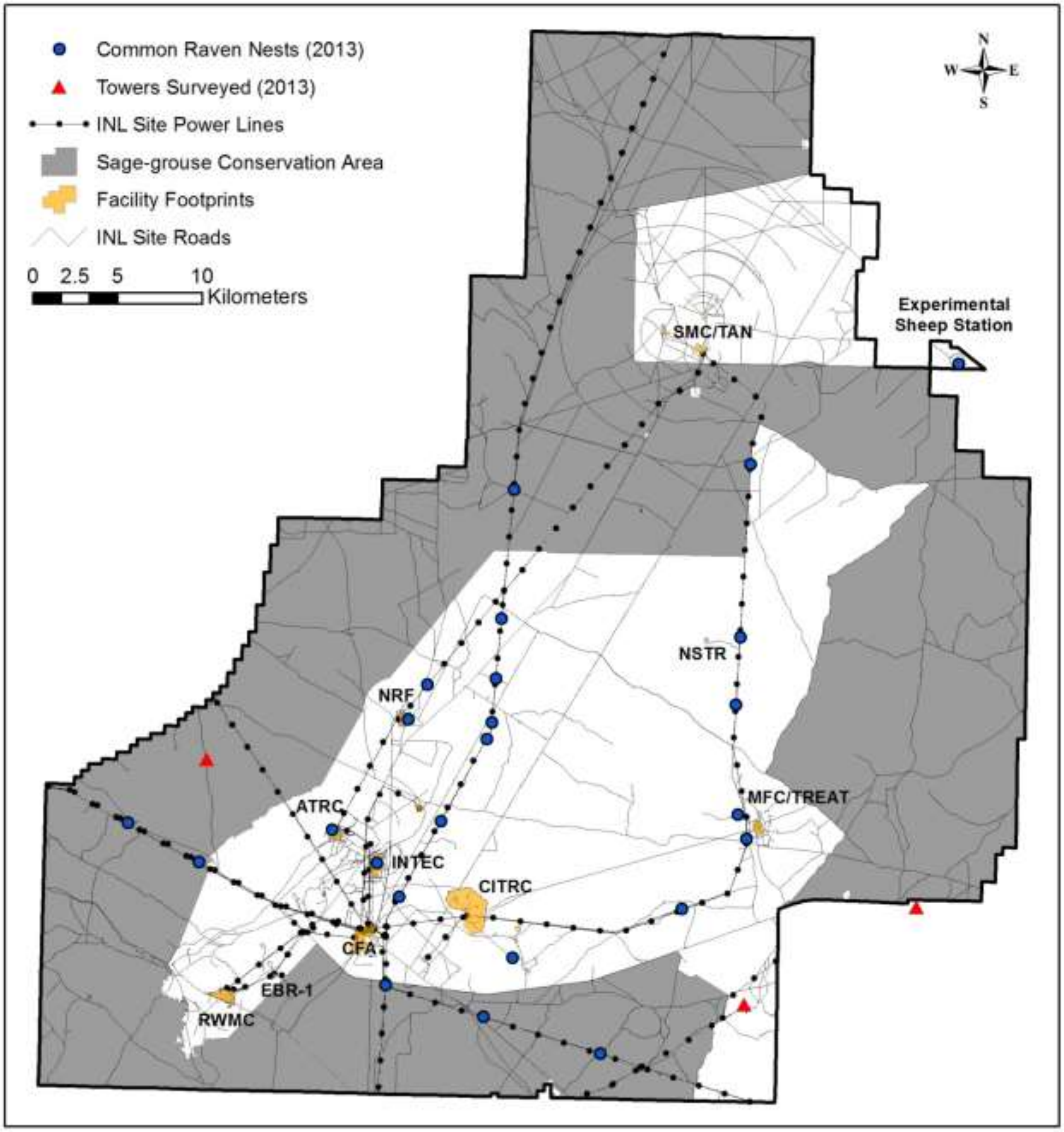

Figure 4-1. Results of raven nest surveys during 2013.

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5. MANAGEMENT IMPLICATIONS

Status of Population and Habitat Triggers

The population trigger for sage-grouse would be tripped if the number of grouse counted during peak male attendance on 27 active leks decreases by 20% or more compared with the 316 males counted in 2011 (DOE-ID and USFWS in review). In 2013, we observed 334 male sage-grouse on the 27 active leks in the SGCA. The habitat trigger would be tripped if the total area designated as sagebrush habitat within the SGCA (78,145 ha; 154,480 acres) is reduced by 20% from the 2012 baseline. In 2013, there were no wildland fires or other activities that reduced the area of sagebrush habitat in the SGCA. Because the number of males observed on those 27 leks has increased since 2011, and the area and distribution of sagebrush habitat in the SGCA remains unchanged from the baseline, it is unnecessary to initiate a meeting this year between DOE and the USFWS to review sage-grouse management on the INL Site.

Synthesis and Conclusions

Wildland fire has been identified as one of the greatest threats to sage-grouse and their habitat on the INL Site in the near term (DOE-ID and USFWS in review). On the INL Site, the number of sage-grouse counted on the Tractor Flats lek route decreased the year following the Jefferson Fire in July 2010, and the number of birds on that route may continue to decline due to the lack of sagebrush for nesting. A similar reduction in lekking grouse was documented after the Murphy Complex Fire that burned in south-central Idaho (Moser and Lowe 2011). Additionally, the amount of potential sage-grouse nesting and wintering habitat is reduced when sagebrush-dominated areas burn (DOE-ID and USFWS in review). For example, three large fires burned 20% of the sagebrush habitat on the INL Site in 2010 and 2011 (DOE-ID and USFWS in review). Large fires on the INL Site in the future could negatively affect sage-grouse populations and habitat. Indeed, many researchers, land and wildlife managers, and policy-makers agree that the loss of sagebrush cover resulting from wildland fire is among the greatest threats to the persistence of sage-grouse in the western USA (Federal Register 2010; Connelly et al. 2011).

In terms of habitat condition, mean sagebrush cover and height estimates from annual sagebrush habitat monitoring plots (n = 48) were in the middle of the range suggested for optimal breeding and brood-rearing habitat for arid sites; perennial grass/forb mean cover and height values were marginally lower than those recommended in current sage-grouse habitat guidelines (Connelly et al. 2000). 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). More than one half 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.

Precipitation in 2013 was about ¼ of the average annual precipitation; therefore, results from the 2013 habitat condition monitoring task should be interpreted with current weather patterns in mind. Because conditions have been drier than average over the past three years, native, perennial grass and forb cover was lower than average (Blew and Forman 2010) and native annual species, as well as cheatgrass were much less abundant than they would be in a year with more normal precipitation conditions. Therefore, rather than considering 2013 vegetative characteristics a “baseline” for habitat quality across the INL Site, they should be considered representative of the lower end of a range of variability. In a year where total precipitation and precipitation timing are closer to average, native, perennial herbaceous cover and diversity for breeding and brood-rearing habitat will generally be higher, but cover from non-natives like cheatgrass will increase as well.

Management Recommendations

Because 2013 was the first year that the CCA monitoring tasks were implemented and baselines and trends are not yet established, no management recommendations are forthcoming apart from what has already been outlined in the CCA (DOE-ID and USFWS in review).

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6. WORK PLAN FOR 2014

Task	Schedule and Changes in 2014
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 2013.
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.
Systematic Lek Discovery Surveys	• Same methods as 2013 except that another area within the SGCA will be targeted.
Raven Nest Surveys	• Surveys will commence at the beginning rather than end of April, allowing four full surveys instead of two by the end of May. • Additional towers will be added to the survey route. • All facilities will be monitored multiple times.
Sagebrush Habitat Condition Trends	• Sample all annual monitoring plots (n=75). • Sample set #2 of the rotational monitoring plots (n=50).
Monitoring to Determine Changes in Sagebrush Habitat Amount and Distribution	• Update wildland fire boundaries and sagebrush habitat distribution using new high resolution imagery collected in 2013. • Initiate field sampling across Jefferson Fire to determine the current vegetation class(es) establishing post-fire.
Inventory and Monitoring of Sage-grouse Habitat for Areas Dominated by Non-native Annual Grasses.	• Complete field sampling plan and protocol. • Initiate surveys to identify areas dominated or at risk of domination by invasive non-native annual plants.