Greater Sage-grouse Monitoring and Management on the Idaho National Laboratory Site

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# ACRONYMS

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<th>Acronym</th>
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<tr>
<td>ATRC</td>
<td>Advanced Test Reactor Complex</td>
</tr>
<tr>
<td>BLM</td>
<td>U.S. Bureau of Land Management</td>
</tr>
<tr>
<td>CCA</td>
<td>Candidate Conservation Agreement</td>
</tr>
<tr>
<td>CFA</td>
<td>Central Facilities Area</td>
</tr>
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<td>CITRC</td>
<td>Critical Infrastructure Test Range Center</td>
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<tr>
<td>ESA</td>
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<td>Environmental Surveillance, Education, and Research Program</td>
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<tr>
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<td>INTEC</td>
<td>Idaho Nuclear Technology and Engineering Center</td>
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<tr>
<td>LLW</td>
<td>Remote-handled Low Level Waste</td>
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<tr>
<td>MFC</td>
<td>Materials and Fuels Complex</td>
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<td>The National Security Test Range</td>
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<tr>
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<td>Universal Transverse Mercator</td>
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<td>WCS</td>
<td>Wildlife Conservation Society</td>
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1.0 INTRODUCTION

Populations of sage-grouse (*Centrocercus urophasianus*) have declined in the last 50 years (Connelly et al. 2004, Garton et al. 2011), and the distribution of this species has been reduced to nearly half of its historic extent across western North America (Schroeder et al. 2004, Connelly et al. 2011a). Although the rate of decline of this species has slowed over the past several decades (Connelly et al. 2004, Garton et al. 2011), concern exists for populations of sage-grouse, because of the reliance of this species on sagebrush (*Artemisia* spp.) habitat. Indeed, sagebrush-steppe ecosystems have been greatly altered during the past 150 years, and these areas are currently at risk from multiple threats; such as wildfires, mechanical treatments, agriculture, mining, urbanization, livestock grazing, and energy development (Knick et al. 2003, Connelly et al. 2004).

Over the last four decades, the U.S. Department of Energy-Idaho Operations Office (DOE-ID) has funded important sage-grouse research on the Idaho National Laboratory Site (INL Site) (Figure 1). Those studies covered diverse topics such as seasonal movements (Connelly and Ball 1982, Connelly et al. 1988), habitat use (Connelly and Ball 1982, Connelly 1982), and food habits of this species (Connelly and Ball 1987). Other research has documented the response of sage-grouse to different land-management practices (Connelly et al. 1981, Connelly 1982), identified leks in areas that were recently disturbed (Connelly and Ball 1979, Connelly et al. 1981), tracked potential movements of radionuclides off-Site by these birds (Connelly and Markham 1983), and documented the location of active leks on the INL Site (Connelly 1982).

Currently, DOE-ID is preparing a Candidate Conservation Agreement (CCA) for sage-grouse with the U.S. Fish and Wildlife Service (FWS). The CCA is a voluntary agreement between DOE and the FWS, in which both partners identify threats to sage-grouse and its key habitats and develop conservation measures and objectives to avoid or minimize those threats (DOE-ID and USFWS in review). In 2007, with the sage-grouse having been petitioned multiple times for listing under the Endangered Species Act (ESA) (Connelly et al. 2004), DOE-ID recognized that to maintain flexibility in performing its mission activities on the INL Site it would be beneficial to enter into a CCA with the FWS and implement conservation measures designed to protect sage-grouse and their habitat (DOE-ID and USFWS in review). DOE assigned the task of developing the CCA to the Environmental Surveillance, Education, and Research Program (ESER), which subcontracted the Wildlife Conservation Society (WCS) to assist with that effort (DOE-ID and USFWS in review). Subsequently in 2007, a field study was designed and implemented by WCS, and data were collected concerning sage-grouse that occupy the INL Site.

In this report, we compile information regarding sage-grouse on the INL Site. We searched records from 1978 to 2012 that documented the locations of sage-grouse leks and number of grouse occurring at those leks from data sheets and other documents produced by the U.S. Bureau of Land Management (BLM), Idaho Department of Fish and Game (IDFG), and other researchers. We coupled that information with data collected by WCS to support the CCA and documentation of sage-grouse for National Environmental Policy Act (NEPA) surveys from 2010 to 2012 to provide a current status of sage-grouse on the INL Site.
2.0 LEK LOCATIONS AND DESIGNATIONS/NUMBER OF GROUSE AT LEKS

2.1 Introduction

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 man-made disturbances occur (i.e., roads and areas where the surrounding vegetation has been cleared) (Connelly 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). Therefore, determining the locations of leks, documenting if they are actively attended by grouse, and understanding the number of grouse using those locations can inform sage-grouse management.

2.2 Materials and Methods

Lek locations—We searched historical records (i.e., BLM data from 1982, IDFG lek information, data sheets from past researchers, and data from lek surveys conducted from 2006 to 2007) that contained material regarding potential locations of leks on and near (within 1.5 km [0.93 mi]) the border of the INL Site. This information was used to update our Geographic...
Information System (GIS) layer that depicts all active, inactive, and historical leks on the Site. We recognized that inherent errors existed with the collection of many of these old, potential lek locations. For example, some of those data points were collected before Global Positioning System (GPS) units were available; other data points were collected from an airplane, before GPS Selective Availability was suspended in 2000, or some were collected in an undocumented datum—causing shifts in coordinate locations. When we plotted those points in ArcGIS, we considered these potential errors and used the best data source (i.e., most recent) and our best judgment when making a determination whether a point was considered a new lek or a known active or historical lek. If a point plotted > 1.5 km (0.93 mi) from a known lek (either historical or active), we considered that point a new lek, and updated the GIS layer accordingly. We used the following criteria to determine if a point that plotted near (< 1.5 km [0.93 mi]) a known lek was considered a new lek:

1) If a point plotted within 1.5 km (0.93 mi) of a known historical lek, that location was not considered a new lek, because when we survey historical leks we navigate to that lek and then walk ~100 m (109 yd) in each cardinal direction and listen with a parabolic microphone for grouse (Shurtleff and Whiting 2009, Whiting and Bybee 2011). The parabolic microphone allows us to potentially detect grouse up to 1.5 km (0.93 mi) away; therefore, any point that plotted within 1.5 km (0.93 mi) of a known historical lek would have been sampled according to our survey procedures (Shurtleff and Whiting 2009, Whiting and Bybee 2011).

2) If a point plotted near a known active lek, we measured the distance between that point and the known active lek using a GIS; we also looked at the topography, general characteristics of the vegetation, and used our knowledge of the Site to determine if those points were the same lek or separate leks. When a point plotted within 183 m (200 yd) of a known active lek, and we determined that birds occupying both areas could see and hear each other, we considered both leks as one lek, as detailed in the IDFG guidelines for counting sage-grouse leks (ESER Procedure RP-4).

3) If a point plotted on a road near a known active lek, we considered that point to be the same location as the known active lek, because the locations for some leks were marked based on where researchers would stop vehicles to observe birds.

Lek designation—After the location of leks were identified and the GIS layer updated, we defined whether a lek was historical, inactive, or active. 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) from March 15 to the first week of May. 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. That active designation would not change unless we surveyed for five years and only documented birds at that lek once; then that lek would be considered inactive. The designation of a lek in a given year was determined by what we had observed at that lek during the previous four years. In some years we may have missed sampling a lek due to poor weather conditions or other logistical issues; if this disruption in sampling occurred, we still considered the skipped year in the five-year previous window that was used to determine lek status. If we skipped sampling a lek for two or more years, then the five-year window would restart the next time the lek was sampled. If a lek was not surveyed in a five-year period, regardless of its previous designation, we changed the status of that lek to historical. Status categories for leks were as follows:

1) Historical—leks where birds may have been observed and documented in past decades, but these areas have not been surveyed since 2009, or for five consecutive years, and therefore have not been designated as inactive or active.

2) Inactive—leks that were surveyed for five years, but were not active.
3) Active (Known)—leks at which grouse were observed that were part of established IDFG routes, or leks that were not part of a route but had been surveyed using the protocol from the IDFG guidelines for counting sage-grouse leks on survey routes (i.e., lek survey was conducted ≥ four times in a year, Research Procedure 4).

4) Active (Previously Historical or Newly Active)—leks that were originally designated as Historical (1) or Newly Active (5), but have since been surveyed for a sufficient number of years, or at which grouse have been observed, and now are considered active. These leks also appeared in the IDFG database with an unknown history, and may not have been sampled according to the IDFG protocol, or the sampling intensity was unknown.

5) Active (New)—leks that were newly discovered (since 2007) and were never documented previously as a historical lek.

Starting in 2011, we assigned a status category for all leks, regardless if we surveyed them or not. Some leks were not visited each year; and prior to 2011, in cases where we did not sample a lek in a certain year, the status category ascribed to that lek the previous year was carried forward.

**Historical lek surveys**—From late March to mid-May 2009 to 2012, researchers surveyed locations that were identified previously as possible leks on and near the INL Site (Shurtliff and Whiting 2009, Whiting and Bybee 2011). Many of these sites had not been surveyed in nearly 30 years. In each year, we plotted coordinates for historical leks in ArcGIS and then transferred those coordinates to a hand-held GPS unit that we used to navigate to the lek locations. During each visit to a lek, we collected the following data: date, time, wind speed, temperature, percent cloud cover, and estimated area of the lek. Before approaching a lek, we used binoculars to search the site for sage-grouse. We recorded the number and sex of birds if we observed grouse at the historical lek (Shurtliff and Whiting 2009, Whiting and Bybee 2011). Next, we attempted to detect sage-grouse using both the unaided ear and a parabolic microphone, which allowed us to potentially detect grouse up to 1.5 km (0.93 mi) away (Shurtliff and Whiting 2009, Whiting and Bybee 2011). If no grouse were detected, we walked ~100 m (109 yd) from the center of the lek in each cardinal direction and then listened again for sage-grouse calls for two minutes using the parabolic microphone (Shurtliff and Whiting 2009, Whiting and Bybee 2011). If strutting grouse were heard, we attempted to locate the new lek by walking towards the call. We also photographed each site and searched for sign (e.g., feathers, tracks, and scat) of grouse at those locations (Shurtliff and Whiting 2009, Whiting and Bybee 2011).

Biologists also discovered new leks while driving roads and searching for historical leks (i.e., lek designation #5 above). We recorded GPS coordinates and estimated the number of males and females when sage-grouse were observed or flushed from areas other than those identified as historical lek sites. In most cases, we returned to those new sites on another day in an attempt to document additional activity at leks. Once a lek was discovered, researchers took a GPS coordinate at the lek, and that location was added to the GIS layer.

**Number of grouse on leks and average date of the highest count of lekking grouse**—We reviewed records (i.e., BLM data from 1982, data from Western Air Research [a company that was contracted to provide wildlife survey flights of the INL Site], and data from past researchers) that detailed information regarding the number of sage-grouse observed at leks on and near (within 1.5 km [0.93 mi]) the border of the INL Site from 1978 to 2012 to produce a history of birds observed at those leks. When we encountered discrepancies for counts of sage-grouse at specific leks from old data sheets, we used our best judgment from the information given on the data sheets to decide which lek the counts should be attributed.
Three lek routes (Lower Birch Creek, Tractor Flats, and Radioactive Waste Management Complex [RWMC]) were established by the IDFG in the mid-1990s and have been monitored annually since using protocol developed by the IDFG (ESER Procedure RP-4). In general, those surveys followed IDFG protocol; however, some exceptions occurred due to poor weather and scheduling conflicts. The IDFG protocol indicates that at least 7 days should pass between surveys. For 21 surveys, however, the average ($\pm SD$) number of days between surveys was 6 ($\pm 0.7$ days). During 2001, different observers conducted the RWMC Route; and in 2002, 2006, and 2008 different observers conducted the Tractor Flats and RWMC routes, which differs from IDFG protocol. When surveys of lek routes were conducted by different biologists, however, those observers were familiar with the INL Site and had been on lek surveys previously. Researchers only visited the Tractor Flats Route on three occasions in 2001, which is less than the 4 surveys that are required by IDFG protocol. Also, employees of the IDFG surveyed the Lower Birch Creek Route until 2010; thereafter, biologists from the ESER Program conducted those surveys.

We recognize that using data from lek routes to assess trends of sage-grouse is complex (Garton et al. 2011); however, counting male sage-grouse at leks can provide a valuable index of the minimum number of breeding males in a local area (Garton et al. 2011). As the number of leks surveyed increased from 1999 to 2012 on the three lek routes, we calculated an index of male sage-grouse observed during lek season. We did this by first considering lek routes as the sampling unit and dividing the highest count of breeding males on each route by the number of leks surveyed on those routes in each year. We then calculated the average ($\pm SD$) number of breeding male sage-grouse across all three lek routes in each year (Garton et al. 2011) and plotted that value by year. We also used lek-route data from 1999 to 2012 to calculate a mean date ($\pm SD$) of the highest count of male sage-grouse for each lek route. We did this by first determining the day of the highest count in each year for each of the three lek routes. We then averaged across all years to produce the mean date of the highest count of male attendance for each lek route.

2.3 Results

At the end of spring 2012, 131 locations were identified on the INL Site that could have been leks at some time in the past. Of those locations, 52 were classified as active (Figure 2), 42 as inactive (Figure 3), and 37 as historic (Figure 4). From 2009 to 2012, researchers had surveyed 97 historical lek sites and classified 22 of those leks as active. Also, by 2012, 12 new leks were discovered; 10 of those were located while driving to sample historical leks, and two were observed while conducting surveys on lek routes.

The most sage-grouse counted at one lek occurred in 2006 when we observed 108 birds at INL lek # 17, which is on the Tractor Flats Route (Figure 2). Since 1999, the number of sage-grouse observed on the three lek routes was relatively stable (Figure 5). There may have been an increasing trend through 2006, but considering the variation associated with earlier information, there is no evidence of an overall change in abundance at those leks between 1999 and 2012 (Figure 5). From 1999 to 2012, the mean ($\pm SD$) date of the highest count of male attendance was April 20 ($\pm 10.5$ days, range = March 27 to May 7) on Tractor Flats and April 19 ($\pm 11.5$ days, range = March 23 to May 3) on the RWMC Route. During 2011 and 2012, when ESER biologists began surveying the Lower Birch Creek Route, the mean date of the highest count of male attendance on that route was April 4.
Figure 2. Sage-grouse leks classified as active \((n = 52)\) at the end of spring 2012, as well as the three lek routes monitored annually by ESER.
Figure 3. Sage-grouse leks classified as inactive \((n = 42)\) at the end of spring 2012.
Figure 4. Sage-grouse leks classified as historical (n = 37) at the end of spring 2012.
Figure 5. Average (± SD) number of male sage-grouse on the three lek routes (Lower Birch Creek, Tractor Flats, and RWMC) on the INL Site. The number of leks sampled in each year is above the bars.

3.0 SAGE-GROUSE MOVEMENTS AND HABITAT CHARACTERISTICS FOR NESTING AND WINTER

3.1 Introduction

Understanding seasonal movements of sage-grouse and habitat that these birds use is important for the management of this species and the areas grouse occupy (Connelly et al. 2000). Indeed, whether a population is migratory or non-migratory will determine what actions may be needed to manage and conserve habitat (Connelly et al. 2000). Collecting such data will help biologists better understand sage-grouse movements; as well as the habitat requirements for nesting, brood-rearing, and winter for these birds on the INL Site.

3.2 Materials and Methods

Trapping—To document sage-grouse movements, nesting locations, and seasonal habitat preferences across the INL Site, we captured 52 sage-grouse (31 females and 21 males) during spring 2008 and 2009 at 13 leks. Researchers trapped sage-grouse on and near known leks from mid-March through April using spotlighting at night and walk-in trapping techniques (Wakkinen et al. 1992a, Wakkinen et al. 1992b, Connelly et al. 2003). All captured sage-grouse were fitted with a necklace-mounted radio transmitter (Advanced Telemetry Systems Inc., Isanti, Minnesota, model A4050) equipped with a 4–hour mortality sensor, which had a battery life expectancy of approximately 16 to 18 months. The capture location was
recorded in UTM coordinates using a GPS. The nearest known active lek to the capture point was assigned as the lek of capture for each bird. We also recorded weight (g), sex, age class (yearling or adult, based on the shape of the outermost wing primaries) for each grouse (Eng 1955), as well as the time and date of capture. We assigned each bird a unique identifying number (1 through 52), and all female grouse were marked with numbered leg bands, while most males were not. Birds were then released at the point of capture.

**Telemetry**—We monitored radio-collared sage-grouse year-round from March 2008 through June 2010 using aerial and ground telemetry. Aerial tracking from a fixed-wing aircraft occurred approximately once each month; whereas, ground telemetry was conducted more frequently using handheld receivers ( Communications Specialists Inc., Orange, CA, model R1000) with yagi antennas and omni-directional antennas mounted on the top of a truck. We located birds on the ground by circling the radio signal from approximately 50 m (55 yd) away. Every attempt was made to avoid flushing radio-collared birds while tracking. Once we were confident of the location of the bird, we recorded that location with a GPS unit. We tracked birds until they died or until the transmitter battery was exhausted. Ground telemetry efforts were most intense during laying, nesting, and early brood rearing (April to July), during which time we monitored hens on a nest or with broods at least twice weekly. We located all other birds (males, failed-nesters, and late season broods) approximately once every seven to 10 days. Broods were flushed and counted at > 6 weeks of age, and then again during the late brood rearing season, to determine brood success.

**Nest monitoring and vegetation measurements**—We located nests of radio-collared females by circling the radio signal until the bird could either be observed or the radio signal could be pin-pointed to a specific location. We returned to that site within a few days to confirm the nest location. Nests were then monitored from a suitable vantage point to minimize disturbance to the hen. A GPS location was recorded of that observation point, along with azimuth and estimated distance to the nesting hen.

Nests were monitored until they hatched or failed, at which time a GPS location was recorded for the actual nest site. We determined nest success by inspecting nests as soon as possible after the hen departed. Eggshell fragments with separated membranes and signs of egg shell breakage typical of a hatched egg indicated a successful hatch. A nest was considered successful if one or more eggs in the nest hatched. We also searched the area around the nest site for any eggshell remnants. An attempt was made to determine the cause of nest failure, and depredation sign was recorded. However, videography of sage-grouse nests indicates that depredation sign cannot reliably identify nest predators (Coates and Delehanty 2010). If initial nest failure occurred, the hen was tracked for the remainder of the nesting season to determine if she re-nested. If a second nest was initiated, nest monitoring resumed following the same procedures as described previously.

We quantified habitat characteristics in areas surrounding nests following termination of nesting (June and July) and during winter (December to March). Using the nest as the sampling point, we established four transects of 25 m (27 yd) in each cardinal direction from that point. We measured (cm) all shrubs that intersected each transect using the line-intercept technique (Canfield 1941). We also measured height (cm) from ground to the tallest portion of each shrub that had corresponding intercept data. During winter, we measured habitat surrounding flush locations of sage-grouse that were located using radio-telemetry. We established a sampling point at the flush location and stretched a metric tape above the canopy for 50 m (55 yd) in each cardinal direction. For each transect line, we quantified canopy cover of shrubs along the transect using the line-intercept technique (Canfield 1941). This was done by hanging a plumb
bob on the side of the transect line and quantifying the amount of shrub cover along the transect line by recording the point at which the intercept of the line and the shrub began and ended. Gaps in the shrub cover that had a spacing less than 2 cm (0.79 in) were considered continuous cover; whereas gaps in the shrub cover with spacing more than 2 cm (0.79 in) were considered non-continuous cover and were recorded separately. We measured height (cm) from ground, or snow, to the tallest portion of each shrub that had corresponding intercept data.

3.3 Results

Telemetry—From 2008 to 2010, we tracked sage-grouse to obtain data regarding movements and seasonal habitat use patterns. The maximum seasonal distance (one-way) traveled by a male was ~108 km (67 mi), whereas the maximum seasonal distance (one-way) traveled by a female was ~66 km (41 mi). Investigators relocated birds on 1,221 occasions (range = 1 to 52 locations/bird) (Figure 6). In 2008, 68% of female locations and 55% of male locations occurred on the INL Site. From April 2008 to March 2009, 64% of all locations of male and female sage-grouse occurred on the INL Site. Also, from April 2009 to March 2010, 63% of all locations of both sexes occurred on the INL Site. Occurrence of collared sage-grouse on the INL Site was lowest in September, presumably because the birds migrated to habitat with greater water availability and lower ambient temperatures. Generally, male and female sage-grouse utilized habitat on the INL Site more frequently starting in late fall (October to November) with peak usage occurring in April and March (Figure 7).

Nest monitoring and vegetation measurements—During 2008 and 2009, investigators located 44 sage-grouse nests (20 in 2008 and 24 in 2009) and documented 30% and 46% apparent nest success during those years. Ten of the 44 nests were located off the INL Site, where hens had a total of 30% apparent nest success over the two years. In 2008, 67% of females that hatched at least one egg maintained successful broods through September. In 2009, at least 64% of broods survived until September; however, the fate of two broods was unknown as the batteries in their radio collars expired before the end of the brood-rearing season. Sage-grouse on the INL Site used areas consisting of similar levels of sagebrush height and cover during nesting and winter (Table 1).

Table 1. Characteristics (mean ± SD and % canopy cover) of sagebrush habitat in areas used by sage-grouse on the INL Site for winter (December 2009 to March 2010) and at nests (June to July 2008).

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<th>Nest (n = 11)</th>
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<tr>
<td></td>
<td>Height (cm)</td>
<td>Canopy (%)</td>
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<tr>
<td>Sagebrush</td>
<td>47 (± 16.0)</td>
<td>50 (± 13.1)</td>
</tr>
<tr>
<td>Grass/forb</td>
<td>N/A</td>
<td>21c (± 6.1)</td>
</tr>
</tbody>
</table>

aValues for height and cover of sagebrush were above snow. Average (± SD) snow depth (cm) during winter was 11 (± 12.7).

bGrass/forb category included native, perennial, and annual species.

cHeight of grass only.
Figure 6. Locations of collared sage-grouse from March 2008 to June 2010. Nearly all of the points north of the INL Site are from sage-grouse captured at the northern most leks; whereas most of the points east, south, and south-west are from sage-grouse captured at the southeastern leks.
4.0 SURVEY OF RAVEN NESTS ON INFRASTRUCTURE

Common raven (*Corvus corax*) surveys—Raven populations have increased across the west as humans have altered landscapes in that area (Howe 2012). On the INL Site, annual breeding bird surveys conducted on 13 routes have shown a nine-fold increase in raven counts since the mid-1980s (Figure 8). Although raven populations likely are increasing on the INL Site, the threat to nesting sage-grouse may be predominately from territory-holding (i.e., nesting) ravens. Territory-holding ravens likely reduce sage-grouse nest success by preying on eggs and young chicks. Low sage-grouse nest success is more highly correlated with raven occupancy than density (Bui et al. 2010). Hence, although observations of ravens during the spring continues to increase on the INL Site (Figure 8), the best indicator of the threat level of sage-grouse nest depredation may be the number of active raven nests within sage-grouse nesting areas. Research indicates that anthropogenic structures (power lines, buildings, and transmission towers) may increase raven populations by providing these birds with food and nesting habitat (Howe 2012). From 2007 to 2009, surveys were conducted across the INL Site by searching all suitable substrate (power lines, infrastructure, and roads, as well as in juniper and other habitat types) for nests (Howe 2012). Researchers documented 24 raven nests in 2007, 33 in 2008, and 40 in 2009, and indicated that 78% of nests (*n* = 76) were built on anthropogenic structures, whereas 22% (*n* = 21) were on natural substrates (Figure 9). Fifty-three percent of nests were on utility poles, supporting previous findings that ravens are attracted to these structures (Knight and Kawashima 1993, Steenhof et al. 1993) (Figure 9). The increase in raven numbers on the INL Site may be driven in part by the availability of anthropogenic nest substrates, especially along utility line corridors.
Figure 8. Number of ravens counted during breeding bird surveys on the INL Site from 1985 to 2011.

Figure 9. Number of raven nests ($n = 97$) built on anthropogenic and natural structures on the INL Site from 2007 to 2009.
5.0 DOCUMENTATION OF SAGE-GROUSE FOR NEPA SURVEYS

National Security Test Range (NSTR)—This range was established in 2007 to consolidate ongoing and future explosives testing at the INL Site. Semi-permanent infrastructure was constructed, and a mowed test area was created for conducting those activities. Lay-down areas were also established for staging materials, and roads (especially T-25) were upgraded to allow for easier access to the area. Tests using explosives at NSTR will continue to make use of a variety of conventional materials, the details of which will depend on the type of testing being conducted. Routine activities at the NSTR may impact sage-grouse; therefore each year in spring biologists survey leks and the area around NSTR for sage-grouse.

From 2008 to 2012, biologists conducted audible point surveys and visited active and historical leks in the areas surrounding the NSTR (Figure 10). For the audible point surveys, 49 locations were visited along the roads (T-17, T-20, T-23, and T-25) surrounding NSTR, additional points were surveyed at ground zero of NSTR, and two locations just west of NSTR (Figure 10). Surveys began 30 minutes prior to sunrise and ended 90 minutes after sunrise following IDFG procedures (ESER Procedure RP-4). The observers used GPS units to navigate to the points. The road survey points were spaced about 1 km (0.62 mi) apart. At each point the observer would stop the truck, turn off the engine, and listen for the sage-grouse for about two minutes on each side of the vehicle using a parabolic microphone. If sage-grouse were heard, then the observer would hike towards the groused, in order to visually verify the potential new lek and collect a GPS location of the lek. When visiting the leks around NSTR, observers would use a GPS unit to navigate to the lek and count the number of birds following IDFG protocol for doing such (ESER Procedure RP-4). If no birds were observed, we listened for sage-grouse calls using a parabolic microphone. We would then hike 100 m (109 yd) in each cardinal direction from the lek and listen for grouse. Over the five years of sampling, we observed or heard sage-grouse at 18 points and five leks (Table 2).

T-24 and T-25 Haul Road—In 2010, DOE proposed to provide an alternative route, other than the public highway (US 20), to transport the several thousand shipments of materials and waste expected over the next 10 years between Materials and Fuels Complex (MFC) and other INL Site facilities (Hafla et al. 2010). The proposed action was needed to reduce shipment costs, improve operational efficiency, and reduce impacts to the public by minimizing the closures of US Highway 20. An internal road would allow shipments between facilities rather than using public roadways (Hafla et al. 2010).

We surveyed T-24 and T-25 four times (each survey was separated by ≥ 7 days) for sign of sage-grouse from April 5 to May 6, 2010 (Figure 11). Those surveys entailed driving T-24 and T-25, stopping the vehicle about every kilometer, turning off the engine, and listening for two minutes on each side of the vehicle using a parabolic microphone for mating calls of sage-grouse. Additionally, we hiked to two historical and two active lek locations on four occasions (each survey was separated by ≥ 7 days), scanned the area with binoculars to locate and count grouse according to IDFG procedures (ESER Procedure RP-4), and listened in each cardinal direction for sage-grouse calls using a parabolic microphone. We did not hear or observe any sage-grouse at survey points along T-25, with the exception of four sampling points (Figure 11). We observed or potentially heard sage-grouse at 10 sampling points along T-24 (Figure 11). The most birds seen on T-24 were three males that flushed during surveys, and the most observed on T-25 were two males that flushed. We recorded sage-grouse activity on both active leks and the historical lek south of T-24 (Figure 11). During the four surveys, we observed 12, 9, 25, and 13 grouse at the active lek north of T-24, and 9, 16, 0, and 18 grouse.
Figure 10. Surveys for sage-grouse occurred along T-roads, in the area surrounding the National Security Test Range, and at nine leks from 2008 to 2012.
Table 2. Documentation of sage-grouse at points along roads and at leks near NSTR from 2008 to 2012. Numbers represent the highest count of male and female grouse for that year.

<table>
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* This lek was discovered in 2010.
Figure 11. Locations of sage-grouse leks, historical leks, and areas where birds were observed or heard near T-24 and T-25 during surveys in spring 2010.

at the active lek south of T-24 (Figure 11). We potentially heard grouse at the historical lek south of T-24. No sage-grouse were heard or observed at the historical lek north of T-24 (Figure 11).

Remote-handled Low-level Waste Facility (LLW)—DOE identified a need for disposal of remote-handled low level waste consisting of activated metals and ion exchange resins generated at the INL Site. The ESER Program prepared an ecological review to support the Environmental Assessment of the LLW facility in 2010 (Blew et al. 2010a). Part of that assessment was to survey two small areas (< 5 acres) for sign of sage-grouse (Blew et al. 2010a). Biologists that surveyed the area in June 2010 did not find sign of sage-grouse in those areas (Blew et al. 2010a). No sage-grouse leks were reported in the vicinity of either alternative site (Shurtleff and Whiting 2009, Whiting and Bybee 2011). Additionally, with the loss of big sagebrush in the area burned by the Tin Cup Fire, it is unlikely that suitable nesting, brood rearing, or wintering habitat existed in the general vicinity of the proposed sites for the LLW facility (Blew et al. 2010a).

Radiological Response Training Range—DOE evaluated the construction and operation of training ranges where field exercises would simulate conditions encountered from radiological dispersal devices (i.e., dirty bomb) or an improvised nuclear device. Biologists from the ESER Program prepared an ecological review to support the Environmental Assessment for
the proposed training ranges in 2010 (Blew et al. 2010b). Two areas were surveyed for sign of sage-grouse: Test Area North (TAN) T-28 Training Range and the RWMC Infiltration Pond Training Range (Figure 12). We visited those areas in April and May on three occasions (each survey was separated by ≥ 5 days) to document if grouse were present or if any grouse sign (i.e., scat, feathers, or tracks) was observed (Blew et al. 2010b). We attempted to detect sage-grouse displaying using both the unaided ear and a parabolic microphone (Blew et al. 2010b). If no grouse were detected at a point, we walked outward ~100 m (109 yd) from the center of the sampling point and then listened again for male grouse calls for two minutes using the parabolic microphone and searched the ground for evidence of grouse sign (Blew et al. 2010b).

No historical sage-grouse leks have been reported in the vicinity of either alternative training range (Shurtleff and Whiting 2009, Whiting and Bybee 2011). Sage-grouse were not observed or heard at any of the sampling locations (Figure 12). Grouse sign (scat) was observed at one location at the RWMC Infiltration Pond Training Range (Blew et al. 2010b). The grouse sign consisted of one small pile (11 pellets) of dried and weathered scat that appeared to be several years old (Blew et al. 2010b). The scat was located on the northwest perimeter of the basin approximately 40 m (44 yd) away from the berm of the basin. There was no grouse sign detected at any of the six sampling points at the TAN T-28 Training Range (Blew et al. 2010b).

**ECF Recapitalization**—The Naval Nuclear Propulsion Program considered options to transfer, handle, examine, analyze, temporarily store, and package spent nuclear fuel and other irradiated materials at the INL Site. Initial screening resulted in the identification of two potential alternative locations for construction at Naval Reactor Facility (NRF) (Hafla et al. 2012). Additionally, areas near the Advanced Test Reactor Complex (ATRC) were also potential locations for future construction (Hafla et al. 2012).

Biologists from Gonzales-Stoller Surveillance conducted surveys to determine if sage-grouse used the potential construction areas around NRF and ATRC. In 2011, four listening surveys were conducted at NRF from April 14 to May 4 (Hafla et al. 2012). Those surveys consisted of six locations around the perimeter fence of NRF (Figure 13). Each location was visited for two minutes, during which time we listened for the sounds of displaying sage-grouse with the aid of a parabolic microphone (Hafla et al. 2012). We did not hear or see any displaying sage-grouse within the survey area (Hafla et al. 2012).

We conducted walk-through surveys for sage-grouse sign (scat, feathers, etc.) at NRF on June 29 and 30, 2011, as well as on May 29 and 30, 2012. In both years, two to three people walked 25-45 m (27-49 yd) apart looking for sign of sage-grouse. If any sign was observed, we recorded a point on the GPS unit (Hafla et al. 2012). During the wildlife walk-through surveys in June 2011, we observed three piles of sage-grouse scat, and during surveys at NRF in May 2012, we observed 51 piles of sage-grouse scat (Figure 13).

We also conducted surveys for sage-grouse around the perimeter fence at ATRC. Three people were separated by 25-45 m (27-49 yd) walking parallel with the fence and we recorded any wildlife sign (Hafla et al. 2012). We observed no sign of sage-grouse at ATRC.
Figure 12. Areas sampled for sage-grouse activity around RWMC Infiltration Pond and the TAN T-28 Training Range.
Figure 13. Area surveyed around NRF for sage-grouse from March to June 2011 and in May 2012.
6.0  CURRENT STATUS OF SAGE-GROUSE ON THE INL SITE

   The number of sage-grouse leks known to be active on the INL Site is less than half of what was identified historically as potential leks.  Caution should be used, however, when comparing the number of areas that were identified as potential leks with leks that are active now, because it is unclear if some of those historical leks were actually leks.  In addition, lek locations can change over time as a natural adaptation to a changing environment.  A change in a lek location does not necessarily indicate that the local population abundance has declined, especially if a new lek was established in another area.  On a regional scale (i.e., Snake, Salmon, Beaverhead areas) that includes the INL Site, however, the number of active leks has declined since 1965 (Garton et al. 2011); therefore, a similar decline in number of active leks may be expected on the INL Site.  Also, historical lek surveys conducted from 2009 to 2012 have identified an additional 22 leks on the INL Site.

   Sage-grouse populations have declined, as indicated by male attendance at leks (Garton et al. 2011), by as much as 57% between 1965 and 2007 in the areas (i.e., Snake, Salmon, and Beaverhead regions) surrounding the INL Site.  Recent analyses, however, indicated that population trends have stabilized since 1992 (Garton et al. 2011).  Although caution should be used when interpreting population trends from lek route data, these data indicate that the minimum number of male sage-grouse counted on leks that are a part of the three lek routes has been relatively stable over the past 14 years, with an exception in 2005 and 2006 when almost a doubling of males counted on the Tractor Flats Route occurred (Figure 5).

   Based on our results regarding distances moved by collared birds, many of the sage-grouse on the INL Site migrate seasonally, which has been documented previously (Connelly 1982), and are therefore susceptible to threats outside the control of DOE.  During wintering and breeding seasons, sage-grouse return to the INL Site more so than during other times of the year; therefore, DOE can minimize its impact on the resident population by making land-use decisions that avoid disrupting sage-grouse at leks and altering sagebrush-dominated habitat used for nesting and over-winter survival.  Nest success on the INL Site is within the broad range of 15 to 70%, as reported in other studies (Wallestad and Pyrah 1974, Gregg et al. 1994).  Connelly et al. (2011), however, reported that mean nest success is 51% in relatively non-altered habitats while nest success in altered habitats averages 37%; therefore, nest success on the INL Site from 2008 to 2010 was on the lower end of the reported mean, even though this area is comprised of relatively unaltered habitat.  Additionally, micro-habitat characteristics on the INL Site were generally comparable with those documented in other studies (Connelly et al. 2000), although we recognize that we had a limited number of samples of habitat characteristics.

   Although the number of sage-grouse on the INL Site appears to be stable, concern exists regarding long-term population trends of this species.  This concern centers around several issues including the large amount of sagebrush that has been lost due to wildland fire in recent years (Figure 2), the general decline in sagebrush cover documented in the Long-Term Vegetation Plots, and the eventual loss of habitat by conversion to crested wheatgrass (Agropyron cristatum and A. desertorum) (Forman et al. 2013).  In the meantime, a large amount of suitable nesting and wintering habitat has been lost, reducing habitat for sage-grouse in the short-term on the INL Site.
7.0 LITERATURE CITED


Howe, K. B. 2012. Selection for anthropogenic structures and vegetation characteristics by common ravens (Corvus corax) within a sagebrush-steppe ecosystem. Idaho State University, Pocatello, ID, 89 pp.


