Chapter 9: Natural and Cultural Resources Conservation and Monitoring

CHAPTER 9

Natural resource information is used to demonstrate compliance with applicable rules and regulations and to ensure that the mission and goals of the Idaho National Laboratory (INL) Site can be achieved with few-to-no impacts to natural resources in four key areas of emphasis: (1) conservation planning, (2) special status species, (3) natural resource monitoring and research, and (4) land stewardship.

For species of elevated concern or with extensive populations and key habitats on the INL Site, the United States (U.S.) Department of Energy, Idaho Operations Office (DOE-ID) has developed conservation plans to protect species and the valuable ecosystems they inhabit. Conservation planning efforts include: (1) the Candidate Conservation Agreement (CCA) for Greater sage-grouse (*Centrocercus urophasianus*) on the INL Site, (2) the INL Site Bat Protection Plan, (3) the Sagebrush Steppe Ecosystem Reserve (SSER), and (4) the Migratory Bird Conservation Plan (MBTA) and Avian Protection Planning documents. In addition, DOE-ID addresses conservation concerns by continually evaluating regulatory rankings, abundance, and distribution of special status plant and animal species, which allows for prompt action in response to emerging concerns.

Natural resource monitoring and research have been conducted for more than 70 years on the INL Site, with some studies dating back to the 1950s. The focus of this work is to better understand the INL Site's ecosystem and biota and to determine the impact on these species' populations from activities conducted at the INL Site. Natural resource monitoring activities include: (1) breeding bird surveys, (2) a midwinter raptor survey, (3) long-term vegetation transects, and (4) vegetation mapping. Additionally, the INL Site was designated as a National Environmental Research Park (NERP) in 1975 and serves as an outdoor laboratory for environmental scientists to study Idaho's native plants and wildlife in an intact and relatively undisturbed ecosystem. Ongoing NERP activities include: (1) addressing ecohydrology in sagebrush steppe, (2) identifying high-quality foodscapes critical to sage-grouse, and (3) validating pygmy rabbit habitat distribution models.

Land stewardship involves managing ecosystems on the INL Site through planning, assessment, restoration, and rehabilitation activities. Areas where DOE-ID is actively employing land stewardship activities include: (1) wildland fire protection planning, management, and recovery; (2) restoration and revegetation; and (3) weed management.

The INL Cultural Resource Management Office (CRMO) coordinates cultural resource-related activities at the INL Site and implements the 2023 Programmatic Agreement (DOE-ID 2023b) and the INL Cultural Resource Management Plan (DOE-ID 2016) with oversight by DOE-ID's Cultural Resource Coordinator. The cultural resource identification and evaluation studies in 2024 included: (1) archaeological field surveys, (2) cultural resource monitoring and site record updates related to INL Site project activities and research, (3) comprehensive evaluations of 45-year-old and greater in age built-environment resources, and (4) meaningful collaboration with members of the Shoshone-Bannock Tribes and public stakeholders.

9. NATURAL RESOURCES CONSERVATION AND MONITORING

The INL Site is in the Upper Snake River Plain, near the southern extent of the Beaverhead Mountains and the Lemhi and Lost River Ranges. It is host to a variety of wildlife species including, but not limited to, large ungulates, such as elk (*Cervus canadensis*) and pronghorn (*Antilocapra americana*); ten species of bats, commonplace being the western small-footed myotis (*Myotis ciliolabrum*); and sagebrush obligates, such as the sagebrush lizard (*Sceloporus graciosus*)

and the greater sage-grouse. Herpetofauna, such as the Great Basin rattlesnake (*Crotalus oreganus* ssp. *lutosus*) and the Great Basin spadefoot toad (*Spea intermontana*), use locally appropriate habitats, as do over 100 species of birds (e.g., raptor, waterfowl, passerine, upland game species). The natural vegetation of the INL Site consists of an overstory of shrubs and an understory of grasses and forbs, or wildflowers. Big sagebrush (*Artemisia tridentata*) and green rabbitbrush (*Chrysothamnus viscidiflorus*) are the most common shrubs, while perennial grasses, such as needle and thread (*Hesperostipa comata*), Sandberg bluegrass (*Poa secunda*), and thickspike wheatgrass (*Elymus lanceolatus*), are generally the most abundant understory species. A diversity of flowering herbaceous forbs occurs in most plant communities, especially under favorable precipitation conditions.

Over the past two decades, wildland fire has affected natural resources across a substantial portion of the INL Site. The INL Site is also susceptible to nonnative species invasion and stressors like changes in precipitation patterns. Because of threats like these, the sagebrush ecosystem is considered one of the most imperiled ecosystems in the U.S. (Noss et al.1995), and these ecosystems are being lost at an alarming rate. Consequently, natural resources on the INL Site are a high conservation priority for the survival of species that are dependent upon sagebrush steppe (Smith et al. 2023), some of which may be at the risk of local extirpation or even regional loss (Davies et al. 2011). As such, effective natural resource monitoring and land stewardship programs are imperative to executing the INL Site's mission with minimal impacts to the local flora and fauna.

The primary focus of INL's natural resources program is supporting mission critical operations across the INL Site. Support for operations ranges from implementing processes to ensure compliance with environmental requirements for existing facilities to providing information for permitting and environmental review of new industry partner projects and other federal initiatives. Natural resources conservation, monitoring, and land stewardship activities on the INL Site can be organized in four categories: (1) planning and implementing conservation efforts for high-priority natural resources; (2) evaluating the regulatory rankings, distribution, and populations for special status species; (3) ongoing monitoring and research to provide baseline and trend data for specific taxa and for broader ecological communities; and (4) conducting land stewardship activities to minimize impacts to natural resources and restore ecological condition, where appropriate. Natural resource data collected on vegetation and key wildlife species provide DOE-ID with an understanding of how species use the INL Site and provide context for analyzing trends. These data are used in National Environmental Policy Act (NEPA) analyses and enable DOE-ID to make informed decisions for project planning and to maintain up-to-date information on potentially sensitive species on the INL Site. The data are also summarized and reported to support DOE-ID's compliance with environmental regulations, agreements, policies, and Executive Orders (EOs). Finally, conservation management, wildland fire recovery, and vegetation management plans are developed and maintained to provide land management guidance for a variety of land stewardship concerns.

9.1 Conservation Planning

9.1.1 Candidate Conservation Agreement for Greater Sage-grouse

Populations of greater sage-grouse (hereafter, sage-grouse) have declined in recent decades (Coates et al. 2022), and the species range-wide distribution across western North America has been reduced to nearly half of its historical distribution (Schroeder et al. 2004, Connelly et al. 2011a). Additionally, the sagebrush habitats upon which sage-grouse rely have been greatly altered during the past 150 years and are currently at risk from a variety of pressures (Connelly et al. 2004; Davies et al. 2011; Knick et al. 2011, Doherty et al. 2022). Because of population declines and habitat losses, sage-grouse have been petitioned for listing under the Endangered Species Act of 1973 (ESA) several times. To reduce the potential for a listing to impact existing and future mission activities, DOE-ID entered a CCA with U.S. Fish and Wildlife Service (USFWS) in 2014. The CCA provides the framework to manage threats to sage-grouse and their habitat on the INL Site, and to develop conservation measures and best management practices to avoid or minimize impacts from natural phenomena like wildfire and from mission-related activities like infrastructure development. This Agreement also established a Sage-Grouse Conservation Area (SGCA), and DOE-ID committed to deprioritize the SGCA when planning infrastructure development (DOE-ID and USFWS 2014).

To evaluate sage-grouse population status with respect to their natural range of variation, the CCA established population and habitat triggers. The baseline value for the sage-grouse population trigger for the INL Site is 316 males across 27 leks. The population trigger will be tripped if the three-year running average of males on those 27 baseline leks

decreases ≥ 20% (i.e., ≤ 253 males). The current baseline value for sagebrush habitat is 72,300 ha (178,656 ac) and the habitat trigger will trip if there is a reduction of ≥ 20% (14,460 ha [35,731 ac]) of sagebrush habitat within the SGCA. If a trigger is tripped, an automatic response by both DOE and USFWS would be initiated, as described in the CCA (DOE-ID and USFWS 2014).

Every year, INL contractor biologists monitor sage-grouse populations, sagebrush habitats, and activities that are considered threats to sage-grouse survival on the INL Site. During 2024, the peak male attendance on baseline leks was 502—a 65.1% increase of males observed in 2023. The three-year (2022–2024) running average of peak male attendance on baseline leks increased by 35.5% to 351 males, exceeding the population trigger threshold of 253 males. Male sage-grouse attendance on the six lek routes monitored by the INL contractor also increased by 60.3% during 2024. Lek route data are used to evaluate long-term population trends and are supplied to the Idaho Department of Fish and Game (IDFG) for regional population assessments.

The habitat trigger is assessed annually with results from two monitoring tasks: (1) sagebrush habitat condition, and (2) sagebrush habitat distribution. Sagebrush habitat condition data, from field-based sampling, are used to ensure that the quality of habitat available to sage-grouse is sufficient to support the seasonal requirements of the species. The sagebrush habitat distribution task is a Geographic Information System (GIS) mapping exercise designed to track losses to sagebrush habitat following events that alter vegetation communities, such as wildland fires and land development. Habitat gains from natural or active restoration may also be captured during analyses for this task. As updates are made to vegetation polygon boundaries, the total area of mapped sagebrush habitat is compared to the baseline value established for the habitat trigger to determine the status with respect to the habitat threshold. The condition of sagebrush habitat remained high in 2024; sagebrush cover was near the upper range of its historical range of variability, herbaceous cover exceeded its range of variability, and the abundance of non-natives was generally low. The current estimated area of sagebrush habitat in the SGCA is 71,322.2 ha (176,240.9 ac) representing a 1.4% decrease from the habitat baseline.

For details about the most recent annual monitoring results, refer to Implementing the Candidate Conservation Agreement for Greater Sage-Grouse on the Idaho National Laboratory Site 2024 Full Report (Williams et al. 2025).

9.1.2 Bat Protection Plan

Over the past several decades, newly identified threats to bat populations (e.g., white-nose syndrome and large-scale commercial wind energy development) have caused widespread mortality events in bats and resulted in precipitous declines of numerous common bat species and elevated conservation concern for bats across the U.S., including additional listings under the ESA. Bats represent over 30% of mammal species described for the INL Site. Large undisturbed areas of shrub-steppe habitat, basalt outcrops, lava caves, juniper uplands, ponds and landscape trees at industrial facilities provide complex and abundant foraging and roosting habitat for a variety of resident and transient bat species. In 2011, DOE-ID and the Naval Reactors Laboratory Field Office/Idaho Branch Office decided to increase the attention they give to bat resources and initiate the development of a comprehensive INL Site-wide bat protection and monitoring program. In 2018, the INL Site Bat Protection Plan was finalized (DOE-ID 2018), which provides a framework for eliminating mission impacts associated with protected bat species, monitoring the status of bat populations, providing current data for environmental analyses, and engaging resource agency stakeholders such as the USFWS, Bureau of Land Management (BLM), and IDFG on bat issues. The INL Bat Protection Plan was also established and is being utilized to reduce the potential of bats being listed under the ESA.

Acoustic monitoring stations are used for much of the bat monitoring conducted on the INL Site. During 2024, five caves were monitored year-round, six caves were monitored seasonally, four locations around Middle Butte were monitored seasonally, and eight facilities were monitored during the summer months. Of the total number of files identifiable as bats 339,636 were from facilities, while the remaining 350,168 were from caves or around Middle Butte. Ongoing monitoring efforts show consistent patterns in seasonal bat distribution. The summer resident bat community consists predominantly of western small-footed myotis, Townsend's big-eared bat (*Corynorhinus townsendii*), big brown bat (*Eptesicus fuscus*), and western long-eared myotis (*Myotis evotis*) with some little brown myotis (*Myotis lucifugus*) and silver-haired bat (*Lasionycteris noctivagans*) detected at moderate levels at a few locations. Low levels of summer activity of hoary bat (*Lasiurus cinereus*) were detected at many monitoring locations. Western small-footed myotis was the most detected bat species at all surveyed features (e.g., facilities and caves). Little brown myotis and tree bats (e.g., hoary bats and silver-

haired bats) were more frequently detected at facilities than at cave sites. The INL Site also participated in the North American Bat Monitoring program, facilitated by the U.S. Geological Survey (USGS) in 2024, collecting acoustic data in two priority grid cells as part of a nationwide sampling framework. These data were provided to IDFG to support regional monitoring efforts.

In addition to acoustic bat monitoring at the INL Site, several other activities were conducted to address bat conservation. To support surveillance for white-nose syndrome (a disease impacting hibernating bats), humidity/temperature dataloggers were checked and reset in eight monitored hibernacula during the summer of 2024. Three live bats that were disrupting work were relocated to safe areas. Thirty-nine bat carcasses were recovered from facilities and submitted for radiological testing. Multiple public events were held at the Idaho Falls Zoo, Harriman State Park, and Museum of Idaho.

The Idaho National Laboratory Site Bat Protection Plan Annual Report 2024 provides the most detailed information about the INL Site Bat Protection Plan Monitoring Program (DOE-ID 2024a).

9.1.3 Sagebrush Steppe Ecosystem Reserve

On July 19, 2004, DOE-ID signed a Finding of No Significant Impact for an Environmental Assessment and Management Plan that outlined a framework to collaboratively manage the Idaho National Engineering and Environmental Laboratory (now INL) SSER with the BLM, USFWS, and IDFG. The SSER includes 29,945 ha (74,000 ac) of high desert land in the north central portion of the INL Site. In the 1999 Proclamation establishing the SSER, then U.S. Secretary of Energy Bill Richardson recognized that the “Reserve is a valuable ecological resource unique to the Intermountain West and contains lands that have had little human contact for over 50 years.” The sagebrush steppe ecosystem across its entire range was listed as a critically endangered ecosystem by the National Biological Service in 1995, having experienced greater than a 98% decline since European Settlement.” Because the SSER represents a unique ecological resource, “conservation management of the area is intended to maintain the current plant community and provide the opportunity for study of an undisturbed sagebrush steppe ecosystem.” The Proclamation also specified that traditional rangeland uses will be allowed to continue under the SSER management designation and that Public Land Orders, which withdrew INL lands, would supersede SSER management objectives if the land was needed to support INL’s nuclear energy research mission (DOE-ID 2004).

For more information about the SSER Environmental Assessment, the Finding of No Significant Impact, and the approved actions in the final management plan see (DOE-ID 2004).

9.1.4 Migratory Bird Conservation and Avian Protection Planning

Most activities at the INL Site are conducted within fenced, industrial complexes. General actions from day-to-day operations that may affect migratory birds include mowing vegetated areas for wildland fire protection, maintenance of utilities and infrastructure, and moving equipment such as trailers and nuclear fuel casks. As directed in EO 13186 (2001) and outlined in a 2013 Memorandum of Understanding between the DOE and USFWS (2013), DOE-ID has developed a Migratory Bird Conservation Plan (DOE-ID 2022) that provides a framework for protecting and conserving migratory birds and their habitat in accordance with the Migratory Bird Treaty Act of 1918 and the Bald and Golden Eagle Protection Act of 1940.

DOE-ID also maintains a Special Purpose Permit issued by the USFWS that allows for the destruction or relocation of a predetermined number of migratory bird nests, when permit conditions are met. Additionally, a Scientific Collection Permit issued by the IDFG allows for the retrieval or harvest of certain migratory birds with the intent of using them for scientific and monitoring purposes. All practicable minimization and avoidance efforts identified in the Migratory Bird Conservation Plan are to be implemented before parties exercise their ability to take migratory birds under these permits. The conservation plan identifies measures that are designed to eliminate or minimize impacts on migratory birds and to protect their habitat. These measures include the protection of native vegetation, avoiding disturbing nesting birds, reducing the potential for conflicts with INL missions, and enhancing native habitat as practical.

In 2019, DOE-ID established a Migratory Bird/Wildlife Conservation Working Group to provide a forum for discussing, resolving, and collaborating on all activities related to migratory bird and other wildlife matters arising on the INL Site. The primary task of this group is to promote the conservation of migratory birds, share ideas to minimize the impact of

nesting birds to operations, and ensure compliance with permit requirements. Accomplishments to date include the development of online Migratory Bird Awareness Training for environmental staff, facility maintenance, operations, and program managers; mitigation actions, such as incorporating critical equipment inspections into daily operations orders to identify nesting activities; use of window dressings to reduce mortality from window collisions; and exchanging information regarding the use of relocating bird eggs or young to licensed rehabilitators in lieu of unavoidable destruction and take situations.

Finally, the INL contractor has developed an Avian Protection Plan and Bird Management Policy (INL 2016) in accordance with Avian Power Line Interaction Committee requirements (Avian Power Line Interaction Committee 2006). This plan includes documenting, tracking, and correcting conditions that resulted in a migratory bird's death. When birds are electrocuted, power poles are either retrofitted or modified with avian protection devices during the next scheduled power outage. These efforts help to reduce future electrocution events. Avian interactions are also considered when siting new power line locations and when replacing existing power poles to reduce risks to migratory birds through proactive and innovative resolutions.

9.2 Special Status Species

9.2.1 Wildlife

The INL Site provides breeding and foraging habitat for a variety of species, including 28 species of birds and 11 species of mammals, one reptile, and one amphibian species that are of elevated conservation concern by state or federal agencies. Several of these species are sagebrush obligates, while others use habitats that are very localized on the INL Site, such as juniper woodlands or surface water features. Many of these species are detected or monitored during annual survey efforts, including the midwinter raptor counts, sage-grouse lek counts, breeding bird surveys, and bat acoustic monitoring.

Several species currently listed according to the ESA have been documented in the state of Idaho, including the North American wolverine (*Gulo gulo* ssp. *luscus*) and the Canada lynx (*Lynx canadensis*); however, due to habitat requirements and the restricted ranges of these and other listed species, they are not likely to occur on the INL Site. Several species that have either been proposed for listing under the ESA or have been recovered and delisted occur seasonally or are considered residents of the INL Site. The bald eagle (*Haliaeetus leucocephalus*), delisted in 2007, is commonly seen during the winter months on or near the INL Site. Species associated with sagebrush habitats, such as the pygmy rabbit (*Brachylagus idahoensis*) and the sage-grouse, have been proposed for listing under the ESA in recent years.

While no wildlife species currently listed under the ESA are known to occur on the INL Site, there are at least 27 wildlife species of conservation concern identified by the BLM as special status species (Type 2) that have been documented on the INL Site. A BLM ranking of Type 2 indicates that a species is a candidate, was delisted within the past five years, is an experimental population, or has a proposed critical habitat by the USFWS (BLM 2008). Some of these species would also be considered sensitive if they were assigned a global or state conservation status ranking of three or less by NatureServe (2024). Of these BLM Type 2 species, some of the most common at the INL Site include the sage thrasher (*Oreoscoptes montanus*), the loggerhead shrike (*Lanius ludovicianus*), the ferruginous hawk (*Buteo regalis*), and the sage-grouse. Based on habitat requirements, an additional three birds and four invertebrates that are considered federally sensitive are likely to occur onsite but have not been formally documented.

At least 36 wildlife species identified in the Statewide Wildlife Action Plan (SWAP; IDFG 2024a) by the IDFG as Species of Greatest Conservation Need (SGCN) or Species of Greatest Information Need (SGIN) have been documented on the INL Site. These include occasional sightings of species, such as the American white pelican (*Pelecanus erythrorhynchos*) and the ring-billed gull (*Larus delawarensis*), to more commonly observed species, such as the sage-grouse and the burrowing owl (*Athene cunicularia*). State-designated species that have not been formally documented but are likely to occur on the INL Site include four birds, seven invertebrates, and four mammals.

A current list of special status wildlife species can be found here.

9.2.2 Plants

On the INL Site, a concerted effort to survey rare and sensitive plant species was undertaken in the early 1980s, and another similar effort was completed during the early 1990s to fill data gaps and to inform both state and federal assessments (Cholewa and Henderson 1984; Anderson et al. 1996). The INL contractor continues to conduct botanical surveys for special status plant species to support state and federal conservation efforts, to provide information for NEPA assessments, and to facilitate mission activities in a manner that minimizes impacts to sensitive species (Atwood 1969; Cholewa and Henderson 1984; Anderson et al. 1996; Forman 2015). Currently, 64 special status plant and bryophyte species are documented or are likely to occur on the INL Site. Many species that are recognized as likely to occur were identified as such due to documented nearby occurrences or the presence of appropriate habitat. Among the documented species, many are restricted in distribution by unique habitat requirements, while a few special status plants have broader distributions across the INL Site.

Idaho has five federally listed plant species under the ESA, but none are known to be present on the INL Site. While populations of Ute ladies'-tresses (*Spiranthes diluvialis*) have been documented near the INL Site, its specific habitat type is negligible or nonexistent within the INL Site's cold desert steppe. Although appropriate habitat for slickspot peppergrass (*Lepidium papilliferum*) is available on the INL Site, the closest known populations are located hundreds of miles to the west. Occurrences of whitebark pine (*Pinus albicaulis*) near the INL Site, coupled with limited botanical surveys and the coarse resolution of suitable habitat models (Chang et al. 2014), suggest botanical surveys should be conducted to determine whether this species is present in the atypical, low-elevation microhabitats available on the INL Site. Eight BLM-ranked plant species are documented on the INL Site, and nine others are likely to occur.

In addition to those species that receive federal regulatory support, state agencies also maintain a list of sensitive species; a special status plant list is published biennially by the Idaho Native Plant Society (INPS 2024). The list is a tool for agencies to prioritize conservation efforts, promote unified conservation approaches, and proactively avoid ESA listings. Idaho manages spatial data within the Idaho Fish and Wildlife Information Systems program (IDFG 2024b), disseminating species-specific information data to support conservation and assess potential environmental impacts. The Idaho Native Plant Society list reflects the NatureServe (2024) conservation rankings where species are ranked globally (e.g., Global Rank) – occasionally at the subspecies level (e.g., Trinomial Rank) – and subnationally (e.g., State Rank). Species ranked as vulnerable (G3/T3/S3), imperiled (G2/T2/S3), or critically imperiled (G1/T1/S1) are considered special status species. The Idaho SWAP has also been updated to include plants, and species considered to be special status are ranked as either SGCN or SGIN.

The INL Site's sagebrush steppe supports documented occurrences of 29 special status plant species, including 23 wildflowers, four grasses, one shrub, and a cactus. There are an additional 35 special status plan species that are likely to occur, but for which surveys have not been completed. They include 25 wildflowers, two grasses, two shrubs, one tree, four lichens, and one moss. Most of these species have very limited distributions and are restricted to areas with unique soils, topography, and associated plant communities. Two species – white sand verbena (*Abronia mellifera*), which has been documented on the INL Site, and whitebark pine, which has not been documented, but may occur in very limited distribution – are also designated as SGCN under the Idaho SWAP.

A current list of special status plant species can be found at here.

9.3 Natural Resource Monitoring and Research

9.3.1 Breeding Bird Surveys

The Breeding Bird Survey (BBS) program in North America is managed by the USGS and currently consists of over 5,100 routes, with approximately 3,000 of these being sampled each year (Ziolkowski et al. 2023). These data have been used to estimate population changes for hundreds of bird species, and they are the primary source for regional conservation programs and modeling efforts. Five official USGS BBS routes (i.e., remote routes) are on the INL Site and have been surveyed nearly every year since 1985 (except 1992 and 1993). In 1985, DOE-ID also established eight additional routes around INL Site facilities to monitor birds near human activity centers (i.e., facility routes). BBS data can directly benefit INL Site managers by providing information on local breeding bird populations, which may be useful as they consider new activities and comply with the NEPA assessment process.

A total of 3,561 birds and 61 species were documented during the 2024 surveys. Total observations were 22.9% lower than the 37-year mean of 4,615 birds (e.g., 1985–1991 and 1994–2023). The total number of species recorded was higher than the 37-year mean of 56 species. Horned lark (*Eremophila alpestris*, n = 1,534), sage thrasher (n = 312), Brewer's sparrow (*Spizella breweri*, n = 300), western meadowlark (*Sturnella neglecta*, n = 283), and sagebrush sparrow (*Artemisiospiza nevadensis*, n = 211) were the five most common species observed in 2024.

Fifteen species observed during the 2024 BBS are considered by IDFG as SGCN or as Birds of Conservation Concern by USFWS. These species included the Brewer's sparrow, sage thrasher, sagebrush sparrow, common nighthawk (*Chordeiles minor*, n = 71), Franklin's gull (*Leucophaeus pipixcan*, n = 46), grasshopper sparrow (*Ammodramus savannarum*, n = 25), loggerhead shrike (*Lanius ludovicanus*, n = 18), California gull (*Aythya americana*, n = 11), ferruginous hawk (n = 8), sage-grouse (n = 8), short-eared owl (*Asio flammeus*, n = 8), burrowing owl (n = 7), white-faced ibis (*Plegadis chichi*, n = 4), golden eagle (*Aquila chrysaetos*, n = 2), and northern pintail *(Anas acuta*, n = 1).

For more details about sampling, analyses, and results see Owens (2025).

9.3.2 Midwinter Raptor Survey

Midwinter eagle surveys were initiated during 1979 by the USGS to develop a population index of bald eagles in the lower 48 states, determine bald eagle distribution, and identify previously unrecognized areas of important wintering habitat. In 1983, two midwinter eagle survey routes were established on the INL Site. Initially, the counts focused on eagle populations; however, biologists recognized the importance of collecting data on raptor abundance during this survey and started recording all raptors, including owls, hawks, and falcons in 1985. In 1992, the list of recorded species expanded to include corvids and shrikes.

In early January of each year, biologists survey the two established routes to detect any target species perched, hovering, or soaring. The number of individuals per species is counted for each of the target species detected. A total of 269 birds representing eight species were observed during the 2024 midwinter raptor surveys. Common ravens and rough-legged hawks are typically the most observed species during this survey and made up 49% and 27% of the observations in 2024, respectively. The species observed were American kestrel (*Falco sparverius*, n = 3), black-billed magpie (*Pica hudsonia*, n = 32), common raven (*Corvus corax*, n = 131), golden eagle (n = 6), northern harrier (*Circus hudsonius*, n = 8), rough-legged hawk (*Buteo lagopus*, n = 73), red-tailed hawk (*Buteo jamaicensis*, n = 13), and Swainson's hawk (*Buteo swainsoni*, n = 3).

More information about the 2024 midwinter raptor survey can be found here.

9.3.3 Long-term Vegetation Transects

The Long-term Vegetation (LTV) transects and associated permanent plots were established on what is now the INL Site in 1950 for the purpose of assessing the impacts of nuclear energy research and development on the surrounding ecosystems (Singlevich et al. 1951). As the mission of the INL Site has grown and changed over the past 70 years, so too has the purpose and utility of the LTV project. Although the LTV project was initiated to address energy development at the INL Site, it is unique in its capacity to allow investigators to observe long-term vegetation change from various sources. Consequently, the LTV project has been used to document vegetative changes from wildfire, different types of land use, and in response to shifts in weather patterns. The LTV also provides a unique context for understanding resilience in the local sagebrush steppe.

Regular vegetation data collection occurs on the LTV plots about once every five years. Eighty-nine LTV plots are still accessible, and most have been sampled consistently between 1950–2022, making the resulting dataset one of the oldest, largest, and most comprehensive for sagebrush steppe ecosystems in North America. Data were collected across the LTV plots for the fourteenth time between June and August of 2022. Plots were sampled for cover and density by species according to methodologies developed in 1950, with supplemental sampling protocols added in 1985 (see Forman and Hafla (2018) for details of the project sample design). The 2022 data were integrated into the larger LTV dataset, and summary results were presented in a 2024 technical report.

Notable changes between the 2016 and 2022 sample periods include decreases in shrub cover, particularly big sagebrush; decreases in native grass cover; and no significant changes in the densities of introduced annual grasses

and forbs. With respect to long-term trends, big sagebrush cover is at its lowest point in the 72-year history of the data set. Declines in big sagebrush cover are due to direct losses from wildland fire and delayed natural post-fire recovery from reduced germination and establishment due to below average spring precipitation on the INL Site over the past decade.

Introduced annuals remain much more abundant than native annuals across the LTV plots and the composition of the functional group has changed so that the most abundant introduced annual is Russian thistle (*Salsola tragus*) rather than cheatgrass. Introduced annuals have also been exhibiting fluctuations with greater magnitudes of change from one sample period to the next over the past two decades when compared with earlier sample periods. Coincidentally, average annual precipitation has declined over the past two decades and seasonal timing of precipitation has shifted away from wet spring periods to elevated precipitation in late summer and fall. Increased pressure from nonnative species, including annuals like cheatgrass and perennials like crested wheatgrass, will undoubtedly persist over the next few decades. Some of the more recent changes in vegetation distribution and structure across the LTV plots may suggest the beginning of a shift to INL Site plant communities that are less resilient than they have been in the past.

For more information about the LTV, including results from the most recent sampling effort see Forman (2024).

9.3.4 Vegetation Map

Following the publication of the last vegetation map in 2019 (Shive et al. 2019), the Sheep Fire burned 40,403 ha (99,839 ac) across the interior region of the INL Site. Five more fires (i.e., Telegraph, Lost River, Howe Peak, and Cinder Butte, and Central Facilities Area Complex Fires) burned in 2020 and affected an additional 1,578.5 ha (8,537.2 ac). Combined, the 2019–2020 fires burned about 18% of the Site, effectively outdating those areas of the 2019 map. New map class boundaries were updated only within the 2019–2020 burned areas because in the absence of abrupt disturbances like wildland fires, vegetation composition tends to change slowly.

Idaho National Agriculture Imagery Program imagery, consisting of four spectral bands with a spatial resolution of 0.6 m (2 ft), was acquired during the summer of 2023 and it served as the primary basemap dataset for mapping updates. Map delineations were produced through manual imagery interpretation and digitizing at a 1:6,000 mapping scale using a suite of GIS editing tools. During the summer of 2023, a total of 100 independent validation plots were also collected and used to support an accuracy assessment of the updated map areas. A standard error matrix was used to calculate map accuracy metrics including user's and producer's accuracy, overall accuracy, and the Kappa statistic.

Eight map classes were delineated within the updated map area and the Green rabbitbrush/Thickspike Wheatgrass Shrub Grassland/Needle and Thread Grassland class represented the greatest amount of area with 26,069.2 ha (64,418.5 ac). The map class with the second largest mapped area was the Green rabbitbrush/Sandberg Bluegrass – Bluebunch Wheatgrass Shrub Grassland class with 9,287.7 ha (22,950.3 ac). These two native shrubland classes account for 84.2% of the updated map area, suggesting most of the burned area is recovering well post-fire and non-native species are not becoming dominant across burned areas. The Cheatgrass Ruderal Grassland showed a 16.6% decrease in mapped area compared to the 2019 map.

The accuracy assessment results of the updated map area showed an overall accuracy of 60% and a Kappa value of 0.59 which is lower than the full map assessment conducted in 2019. The previous two map accuracy assessments in 2011 and 2019 showed that post-fire vegetation communities generally exhibited lower class accuracies than other intact classes not altered by fire. Individual class accuracies varied considerably and low sample sizes for some classes contributed to a wide range of results. The map class with the greatest sample size was the Green rabbitbrush/Thickspike Wheatgrass Shrub Grassland/Needle and Thread Grassland; this class had a producer's accuracy of 71.9% and a user's accuracy of 73%, which are both higher than the 2019 results suggesting a slight improvement in post-fire mapping accuracy throughout most of the burned area.

Additional detail about the most recent map products can be found in the INL Site Vegetation Map Update (Shive 2024).

9.3.5 National Environmental Research Park

The INL Site was designated as a NERP in 1975 through a NERP Charter, the Energy Reorganization Act, and the Non-nuclear Energy Research and Development Act. The Idaho NERP and NERPs at other DOE sites are outdoor

laboratories that provide opportunities for environmental studies on protected lands that act as buffers around DOE facilities. The objective of the NERP system is to facilitate research and education, particularly to demonstrate the compatibility of energy technology development and a quality environment. The Idaho NERP provides exceptional opportunities for research because of its established facilities, a security buffer that protects research areas, extensive historical data, and partnerships with universities. In 2024, the INL contractor facilitated university-led research on three ecological research projects through the NERP: (1) addressing ecohydrology in sagebrush steppe, (2) identifying high-quality foodscapes critical to sage-grouse, and (3) validating pygmy rabbit habitat distribution models.

The INL Site and other landscapes with sagebrush steppe vegetation are experiencing a simultaneous change in climate and plant community composition that is impacting habitat for wildlife, wildfire risks, and ecosystem services such as forage. Determining the separate and combined/interactive effects of climate and vegetation change is important for assessing future changes on the landscape and for hydrologic processes. Since the early 2000s, investigators have used an existing INL ecohydrology research facility, the former Protective Cap/Biobarrier Experiment, to study vegetation change with respect to precipitation regime, vegetation type, and soil depth. The focus of the current research is to compare the impacts of grass invasion and shifts in timing of precipitation to the function of the whole ecosystem, including biogeochemistry, carbon storage, and other attributes that relate to resistance and resilience in a changing environment. The experiment site was burned in its entirety by the 2019 Sheep Fire, which created an exceptional opportunity to test the underlying basis for the theory on resistance to exotic annual-grass invasion (cheatgrass) and resilience of sagebrush steppe. The long-term treatments conveniently create a gradient of pre-fire climate differences, and the cessation of treatment application has induced large differences in simulated drought conditions on the experiment. Researchers continue to sample the differences in cheatgrass among the treatments along with the corresponding soil nutrients and water. The research team includes Dr. Matthew Germino from the USGS Forest and Rangeland Ecosystem Science Center and Dr. Toby Maxwell and Dr. Marie-Anne DeGraff from Boise State University; their research continues to use a facility that has been in operation since 1994.

The Idaho NERP is collaborating in a multiagency research project focused on identifying high-quality foodscapes critical to sage-grouse habitat conservation across the sagebrush steppe ecosystem. The research team aims to identify the chemical phenotype (or chemotype) of sagebrush species linked with high sage-grouse forage fidelity to identify which habitats are crucial dietary hotspots for sage-grouse that should be prioritized for conservation and where seed collection should occur for local restoration of plants that are palatable to local sage-grouse populations. Field research is conducted during the winter and spring months to identify seasonal compositional changes in chemotypes of sagebrush consumed by sage-grouse. Browsed vegetation and excreta of sage-grouse are collected and used to determine diet quality using Near Infrared Spectroscopy and analytical chemistry of plants, diet composition using DNA barcoding of feces, digestibility of food using a particle size analysis of feces, and detoxification capacity by analyzing renal metabolites in uric acid. Overall, the project is focused on supporting preventative management actions, protecting functional biodiversity and palatable sagebrush, and improving the availability of locally adapted seed sources most appropriate in habitat restoration projects that aim to promote healthy populations of sage-grouse. The Principal Investigator is Boise State University researcher, Dr. Jennifer Forbey.

Pygmy rabbits are a sagebrush specialist, endemic to the western U.S., and are considered threatened by habitat alteration, habitat loss, climate change, and disease (Rachlow et al. 2021; Crowell et al. 2023). Formalized pygmy rabbit surveys were last conducted on the INL Site in 2009; however, the current distribution and habitat usage of the pygmy rabbit on the INL Site is relatively unknown. With the proposed listing of the species under the ESA in 2023, current data regarding pygmy rabbit occurrence on the INL Site is invaluable. University of Idaho researchers have developed statewide pygmy rabbit habitat distribution models (Rush et al. 2023) and validating those models in the field provides an opportunity to collect some INL Site-specific occurrence data and to understand the utility of occupancy models locally. A subset of fecal pellet samples collected on the INL Site during 2023-2024 have been tested in the lab to confirm the species identification and of 21 samples tested to date, 16 samples were molecularly confirmed as pygmy rabbit. After species identifications of the remaining pellet samples have been confirmed in the lab, pygmy rabbit occupancy rates and dynamics will be estimated using detection/non-detection surveys. By refining existing pygmy rabbit habitat modeling methodologies, this study will allow for the estimation of potential pygmy rabbit habitat in Idaho that is currently occupied, the ability to model trends in occupancy over the last 20 years (i.e., extinction/colonization rates), and assess if fine-scale climate and weather variables predict occupancy, extinction, or colonization rates. The research team for this project

includes Dr. Janet Rachlow, professor in the Department of Fish and Wildlife Sciences at University of Idaho; Dr. Leona Svancara, researcher at USGS and University of Idaho; and Fiona McKibben, doctoral student at University of Idaho.

9.4 Land Stewardship

9.4.1 Wildland Fire Protection Planning, Management, and Recovery

The INL Fire Department provides wildland fire suppression services on the rangeland within the INL Site boundary, as well as a five-mile buffer outside of the INL Site boundary. The INL Fire Department employs pre-incident strategies, such as the identification of special hazards, mitigation procedures, and mapping necessary to facilitate response to fires. DOE-ID maintains mutual aid agreements with regional agencies, including the BLM, to assist in response to high-challenge wildland fires. Additionally, the INL contractor implements PLN-14401 (INL 2022), "Idaho National Laboratory Wildland Fire Management Plan," which incorporates essential elements of various federal and state fire management standards, policies, and agreements. A balanced fire management approach has been adopted to ensure the protection of improved laboratory assets in a manner that minimizes effects on natural, cultural, and biological resources.

Additionally, the INL contractor has established a Wildland Fire Management Committee (WFMC) to review seasonal fuel management activities and the potential impact of all fires greater than 40.5 ha (100 ac), or fires for which containment lines have been constructed. A primary responsibility of the WFMC is to determine whether a post-fire-recovery plan is warranted for a given fire. Once an ecological resources post-fire-recovery plan is requested, the INL Natural Resources Group (NRG) completes an ecological resource assessment to evaluate the resources potentially impacted by a wildland fire and drafts a recovery plan for treatment prioritization and implementation by the WFMC. To standardize and streamline the process of developing natural resource recovery plans, the NRG recently developed a Wildland-Fire-Recovery Framework for the INL Site. This framework identifies INL's fire recovery goals, defines the fire recovery planning process, describes a post-fire ecological resource assessment process for quantifying fire impacts, presents all potential post-fire treatments that may be considered for improving natural resource recovery, establishes the basis for an annual post-fire monitoring program, and provides a template for future fire recovery plans.

The are two active wildland fire recovery plans for the INL Site, one for four fires that burned in 2020 and one that is being drafted to address the 2024 Dry Channel Fire. In 2020, an ecological resources post-fire-recovery plan was completed for four of the fires that burned that year, the Howe Peak Fire, the Telegraph Fire, the Cinder Butte Fire, and the Lost River Fire. Monitoring and treatment are ongoing within the Telegraph Fire footprint and activities to date include monitoring temporary fire suppression access roads and containment lines for natural recovery, ongoing noxious weed inventory and treatment, and sagebrush restoration. The Dry Channel Fire burned on June 26, 2024, and was likely caused by a lightning strike. Although, the recovery plan for this fire will not be finalized until the WFMC has approved it during the spring 2025 meeting, there are several actions that can and should be taken prior to completion of the plan. Emergency stabilization actions that were implemented prior to finalization of the fire-recovery plan include containment line recontouring and noxious weed control.

Click here to see INL's wildland fire recovery framework (Forman et al. 2024), and the 2020 fires recovery plan (Forman et al. 2021).

9.4.2 Restoration and Revegetation

Revegetation for Soil Stabilization

Revegetation with native species is required on the INL Site for areas where soil or vegetation are disturbed, and the area will not be physically stabilized and maintained as sterile. These areas are left exposed and vulnerable to erosion and to infestations of invasive or noxious weeds. Revegetation plans are developed for areas requiring revegetation based on site condition and disturbance size. Revegetation strategies on the INL Site include, but are not limited to, seedbed preparation, soil augmentation, drill seeding, hydroseeding, hand-broadcasting seed, planting nursery stock, mulching, and applying supplemental water.

In 2024, one revegetation project was initiated to stabilize soils and prevent the introduction of invasive species on approximately 9.5 ha (23.5 ac) disturbed by construction activities for a waterline that was constructed in 2023. A revegetation plan was drafted in the summer of 2024, and it included seedbed preparation, soil sampling to inform soil

amendments, preferred methods of seeding, seed mix recommendations, and recommended post-planting care. Due to time and logistical constraints, INL's Facilities and Site Services management chose to forgo the seedbed preparations, soil sampling, and soil amendments. The recommended seed mix was procured, and drill seeding took place beginning in the late summer of 2024. Conditions will be assessed throughout the spring of 2025 to determine if supplemental water would be advantageous for germinating and establishing seeds.

Revegetation projects on the INL Site are revisited at least one growing season after the initial revegetation effort, and revegetation assessments are used to determine whether further actions need to be taken. One revegetation assessment was completed in 2024 on the Birch Creek site, totaling approximately 0.20 ha (0.5 ac). The initial assessment of this area indicated that vegetative cover was relatively high across the revegetation area; however, the dominant species was cheatgrass. In the areas where they did occur, native species abundance lower, but their presence was encouraging. Native annual species, such as flatspine stickseed (*Lappula occidentalis*) were distributed across most of the area. These species typically function as early successional species, which suggests there is some progress toward a desirable end state. Initial restoration efforts at this site were competed in collaboration with DOE-ID, INL (NRG, Facilities and Site Services, CRMO), Heritage Tribal Office (HeTO), and BLM staff, and included nutrient supplements, hydroseeding and mulching with appropriate native grass species, planting containerized sagebrush seedlings, installing juniper wildings, and supplemental watering. Because stabilization efforts were not entirely successful, additional stabilization efforts will be proposed for 2025, and monitoring will continue.

Sagebrush Habitat Restoration

Sagebrush habitat restoration on the INL Site is conducted in response to DOE-ID's goal of no net loss of sagebrush habitat. The potential to lose sagebrush habitat on the INL Site occurs primarily from two mechanisms. The first is loss due to wildland fire (see Section 9.4.1), and the second is loss due to infrastructure expansion. The INL contractor implements multiple best management practices to minimize infrastructure-related sagebrush habitat loss, such as co-locating infrastructure, but in some cases, removal of sagebrush habitat is necessary to support the INL mission. Habitat loss associated with infrastructure development is addressed through a compensatory sagebrush mitigation strategy that provides an approach for projects to provide funds for sagebrush to be restored in areas where it can provide the greatest habitat benefit. Sagebrush habitat restoration has been conducted using containerized sagebrush seedlings and aerially applying sagebrush seed. Due to the semiarid nature of the ecosystem, planting sagebrush seedlings often results in higher survivorship than trying to establish sagebrush from seed, but DOE-ID and the INL contractor continue to partner with agencies to test and develop additional planting methods.

In 2024, INL planted containerized seedlings to address infrastructure expansion-related losses and applied sagebrush seed to improve habitat in an area affected by wildfire. A total of 19,050 sagebrush seedlings were planted in portions of the Twin Buttes Fire (burned in 2007) and Middle Butte Fire (burned in 2010) burned areas. These seedlings were funded through compensatory mitigation for infrastructure development that took place in 2023. As a result of sagebrush habitat restoration on the INL Site since 2015, 349,675 sagebrush seedlings have been planted across 1,209.9 ha (2,972.4 ac). Seedlings planted on the INL Site are monitored one year and five years after planting to assess survivorship, and planting strategies are adjusted according to past survivorship data.

In addition to planting sagebrush seedlings, INL continued to pursue sagebrush habitat restoration in the Tractor Flats area of the INL Site (last burned in the 2010 Jefferson Fire), contiguous with BLM restoration efforts. In 2023, DOE-ID, INL, USFWS, and BLM received Bipartisan Infrastructure Law funding to collect sagebrush seed within the unburned areas of the southern and eastern portion of the INL Site and on adjacent BLM land. In 2024, a portion of this seed was applied to approximately one-third, or about 280 ha (700 ac) of the area scheduled to be planted on the INL Site. Seed was planted using a broadcast spreader followed by an imprinter at a rate of approximately 0.7 kg (1.5 lb) of pure live seed per 0.4 ha (1 ac).

For details about sagebrush restoration in 2024, refer to Subsection 5.2.2 of "Implementing the Candidate Conservation Agreement for Greater Sage-Grouse on the Idaho National Laboratory Site 2024 Full Report" (Williams et al. 2025).

9.4.3 Weed Management

The INL contractor maintains and funds a noxious and invasive weed-management program to address the requirements of federal agencies described in EO 13112, "Invasive Species," as amended by EO 13751, "Safeguarding the Nation

from the Impacts of Invasive Species." The Noxious and Invasive Weed Species Management program on the INL Site fulfills these requirements by preventing the introduction, establishment, and spread of invasive species to the extent possible during all activities. The INL contractor often focuses treatment efforts along potential vectors, such as perimeter roads, and along highways, interior two-track roads, and within facility footprints. All pesticide applications on the INL Site are conducted according to specific pesticide label instructions in compliance with the Federal Insecticide, Fungicide, and Rodenticide Act (1996). All records associated with pesticide applications on the INL Site are kept for a minimum of three years in accordance with Idaho Administrative Procedures Act (IDAPA) 02.03.03, "Rules Governing Pesticide and Chemigation Use and Application" (Idaho State Department of Agriculture 2022).

In cooperation with NRG, INL applicators prioritize annual weed treatments. INL Applicators use integrated pest management principles that determine whether treatment actions are required and what type of treatment is needed (i.e., biological, cultural, physical, mechanical, or chemical). Noxious weeds are generally treated with pesticide application when the pesticide label allows but, in some cases, certain species are treated using manual or mechanical treatments. Most treatments targeting invasive species, that are not designated noxious, take place in the form of mechanical removal, such as mowing or trimming. INL applicators monitor known noxious weed and invasive species locations along with the results of any treatments that have been conducted. In 2024, 94 new noxious weed observations were made, and 116 pesticide applications were conducted. Additionally, weeds were controlled via shoveling and hand-pulling when appropriate. Noxious weed species targeted and controlled in 2024 were rush skeletonweed (*Chondrilla juncea*), scotch thistle (*Onopordum acanthium*), musk thistle (*Carduus nutans*), Russian knapweed (*Acroptilon repens*), spotted knapweed (*Centaurea stoebe*), leafy spurge (*Euphorbia esula*), plumeless thistle (*Carduus acanthoides*), Canada thistle (*Cirsium arvense*), black henbane (*Hyoscyamus niger*), and houndstongue (*Cynoglossum officinale*).

The risks from noxious weeds and invasive species are also minimized by discouraging unnecessary actions that can create spreading vectors or new introductions. Along with directly targeting and treating weeds, INL has implemented programmatic strategies to reduce the potential introduction and spread of weeds. These include both employee education and work controls. Every year, employees are provided briefings and training material about how to identify, report, and minimize the spread of weeds. Work controls to limit risks of weed introduction and spread during work activities are implemented through the Biological Resource Review process. During the Biological Resource Review process, a natural resource scientist reviews and identifies projects with the potential to create weed vectors or that may require monitoring for noxious weeds and invasive species and provides strategies for addressing those concerns.

9.5 INL Site Cultural Resource Management

The INL CRMO is managed by the INL contractor. Cultural resource professionals in the INL CRMO coordinate cultural resource-related activities at the INL Site and implement the INL Cultural Resource Management Plan (DOE-ID 2016) with oversight by the DOE-ID Cultural Resource Coordinator. Provisions to protect the unique cultural resources of the land and facilities at the INL Site are included in environmental policies issued by Battelle Energy Alliance, LLC (BEA), and other INL Site contractors and in company procedures that guide work completion. Cultural resource identification and evaluation studies in 2024 included archaeological field surveys, monitoring, and updates related to INL Site project activities, as well as studies supported by DOE-ID in facilitating meaningful collaboration with members of the Shoshone-Bannock Tribes and public stakeholders. Please see the INL Site Cultural Resource Management Annual Reports for Fiscal Years 2023 and 2024 (DOE-ID 2023a and DOE-ID 2024b) and visit the INL Cultural Resources website for more information (Cultural Resources at INL).

9.5.1 INL Section 106 Project Reviews

During 2024, the INL CRMO reviewed approximately 687 projects under Section 106 of the National Historic Preservation Act. This review included CRMO-specific programming updates developed collaboratively with an Environmental Review Process (ERP) software developer. As a result of the implementation of the 2023 Programmatic Agreement (PA) (DOE-ID 2023b), the INL CRMO revised MCP-8008, "Section 106 Compliance" (INL 2023), to better guide the project review process within the one-stop, multidisciplinary ERP system. The review process includes an analysis for possible exclusions regarding activities that do not require a Section 106 review, either because they do not rise to the level of a federal undertaking or they meet certain activity and property types, thus requiring no project-specific consultation. If no appropriate exclusions are applicable, a Section 106 Cultural Resource Review is prepared

for the assessment of effects, with outcomes limited to the following three regulatory options: (1) No Historic Properties Affected; (2) No Adverse Effect to Historic Properties; or (3) Adverse Effect to Historic Properties, which requires the mitigation of that effect. Note that no activities at the Experimental Breeder Reactor-I (EBR-I), other than ground disturbance within the fenced facility perimeter, are excluded due to its National Historic Landmark status. The results of the CRMO ERP Screening are depicted in Figure 9-1.

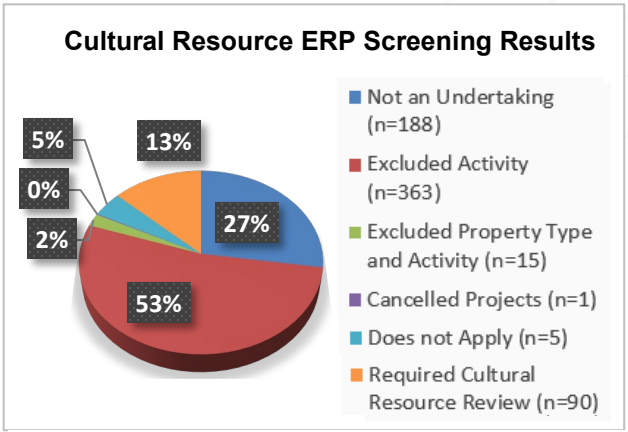

Figure 9-1. CRMO ERP screening and application of exclusions in 2024.

A "No Historic Properties Affected" finding means there are no historic properties present within the Area of Potential Effects or those that are present will not be impacted by the proposed project activities. A finding of "No Adverse Effect to Historic Properties" means there will be some level of impact to a historic property, but it is not significant enough to warrant additional management considerations. An "Adverse Effect to a Historic Property" finding means the impact to the property has risen to a level that cannot be resolved within the scope of the project activities (e.g., the demolition of a National Register of Historic Places-eligible building, irreversible alteration or destruction of character defining features of a historic property).

Two projects resulted in a finding of "Adverse Effect to Historic Properties," so mitigation efforts were pursued as a means of resolving the adverse effects. The INL CRMO supported DOE-ID in developing creative public-facing Memoranda of Agreement to resolve the deleterious effects, as indicated in Figure 9-2.

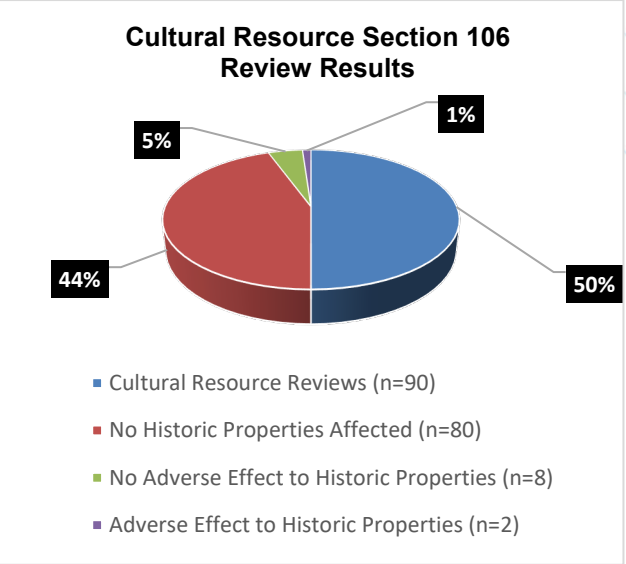

Figure 9-2. Section 106 Reviews conducted in 2024.

Precontact Context

As part of DOE-ID commitments to strengthen the historic preservation program at the INL Site and in adherence to the commitments outlined in the 2023 PA (DOE-ID 2023b), as well as the *Secretary of Interior's Standards and Guidelines for Archaeology and Historic Preservation* (Federal Register 1983), the INL CRMO, DOE-ID, and Shoshone-Bannock HeTO staff continued work on the Precontact Context (PCC) in 2024, which identifies the time span as roughly 13,000 years before the present to contact with Lewis and Clark in 1805. The original 8-million-acre study area was expanded to 15 million acres and realigned to a larger region in consideration of the possibility that other Tribes visited the Eastern Snake River Plain during those years. The final document will serve as a framework for: (1) the identification and characterization of Precontact archaeological resources/properties within the study area; (2) guidelines regarding the criteria used to evaluate the National Register of Historic Places significance for that area; and (3) comprehensive preservation planning at the INL Site.

Pre–World War II Historic Contexts at INL

As with the PCC, INL CRMO staff continued their work in 2024 on the pre–World War II (WWII) historic context that covers a 6-million-acre study area. The purpose of this context is to present the breadth and depth of historic activities at the INL Site during the 1852–1942 period in two separate context statements: (1) "*Historic Networks: Migration, Transportation, and Trade across the Eastern Snake River Plain, 1852-1942*;" and (2) "*Home on the Plain: Homesteading and Agricultural Settlement on the Eastern Snake River Plain, 1855-1942*." These time periods were identified for their abilities to convey the rich history at and surrounding the INL Site. A review of the inventory of historic resources at INL allowed for the assignment of property types and guidelines in interpreting Euro-American settlement and development in the study area. Akin to the PCC, the scope of investigation expanded to include the development of a framework for the evaluation of Euro-American resources for eligibility in the National Register of Historic Places.

Other Active Research

During 2024, the INL CRMO continued work on four multiyear Section 110 research projects involving CRMO staff, offsite contractors, and a doctoral candidate student. Please see the "INL Site Cultural Resource Management Annual Report for Fiscal Year 2024" (DOE-ID 2024b), and visit the INL Cultural Resources website for more information (Cultural Resources at INL).

Built-Environment Comprehensive Inventory

In 2024, the INL CRMO continued its efforts to update the Built-Environment Inventory on the INL Site. A proposed inventory strategy for the Radioactive Waste Management Complex was prepared, and inventory updates for the Specific Manufacturing Capability and Test Area North were completed by INL CRMO Architectural Historians in accordance with the State Historic Preservation Office Guidelines and Procedures for Cultural Resource Review and Consultation in Idaho (Vihlene 2015). In total, 18 buildings, three structures, one linear resource, three objects, and three historic districts were recorded and evaluated. DOE-ID submitted these inventories to the State Historic Preservation Office on January 31, 2024, and the concurrence was received on April 10, 2024.

9.5.2 Cultural Resource Monitoring

Field work in 2024 also included a broad, annual program involving routine visits to monitor current conditions at select previously recorded archaeological resources across the INL Site. In 2024, INL CRMO Archaeologists, Shoshone-Bannock Tribes HeTO, and DOE-ID staff monitored conditions at 11 locations on the INL Site. No impact to historic properties were observed during these 2024 monitoring visits.

9.5.3 Stakeholder, Tribal, Public, and Professional Outreach

In support of the INL Historic preservation program in 2024, the CRMO successfully engaged roughly 15,700 individuals representing all ages from youth to senior citizens that were representative of stakeholders, Tribal members, the public, and professionals as part of continued public outreach. Activities included combining virtual opportunities to expand reach and accommodate schedules with in-person meetings and INL Site visits, as well as presentations and activities at the Museum of Idaho (MOI), surrounding schools, at EBR-I, and at special invitation to events, which included interviews with East Idaho News. Some highlights of these outreach efforts include presentations centering on "Architectural Ghosts" at MOI, "Wait, You Collect What?!? Obsolete Media" at the Registrars Committee Western Region, "Architectural Oddities of EBR-I" and "Ask an Architectural Historian" at EBR-I, and the "My Amazing Future" event at INL, as well as participation in school career fairs, visits to Idaho State University, the University of Nevada, Reno, and Washington State University as part of university engagement and a recruitment pipeline for interns and young professionals interested in the cultural resource management industry and potential future INL employment. In coordination with the Shoshone-Bannock HeTO, INL CRMO staff also presented virtual tours that provided a detailed history of the Precontact period on the Eastern Snake River Plain with Tribal perspectives interwoven with archaeological information in 2024.

The INL CRMO staff presented an additional virtual tour for the INL early historical period (1805–1905). These discussions covered early explorers and fur trappers, the Jeffrey-Goodale cutoff of the Oregon Trail, development of railroads, and settlement by early homesteaders. Additionally, INL CRMO staff provided two days of training at the MOI for the Wasden Archaeology Educator Camp and led two tours to the Wasden Site. Engaging face-to-face with visitors at EBR-I, and enhancing the educational exhibits at the EBR-I Visitor's Center and the Big Lost River Rest Area on U.S. Highway 20/26 within the boundaries of the INL Site, are vital public outreach tools. EBR-I has maintained the infrastructure necessary for self-guided tours through the free TravelStorys app. INL CRMO staff also supported tours for the Environmental Safety, Health and Quality group and the Idaho Cleanup Project Citizens Advisory Board, which included visits to several Precontact and Euro-American sites, as well as EBR-I.

On April 22, 2024, the Shoshone-Bannock Tribes hosted an Earth Day celebration for students from the Shoshone-Bannock Junior-Senior High School at the INL Site. The event began with a morning visit and ceremony at Middle Butte Cave, which was attended by over forty students, five Tribal elders, and several Tribal community members. At the cave, Shoshone-Bannock Tribal Elder Louie Martin and Fort Hall Business Council Secretary Ladd Edmo offered a prayer, followed by a speech from Council Chairman Lee Juan Tendoy on the significance of the INL Site lands to the Tribes.

After this visit to the INL Site, the group convened at the INL Energy Innovation Laboratory (EIL) for a ceremony featuring speeches from Juan Alvarez, the INL Deputy Laboratory Director for Management and Operations and Chief Operating Officer; Lance Lacroix, the DOE-ID Manager; and Mark Brown (DOE ICP Manager; in addition to Chairman Tendoy. The ceremony included a traditional song and concluded with a Friendship or Round Dance.

On May 15, 2024, INL CRMO staff and representatives from the INL Communications organization supported DOE-ID in hosting a tour of sites of Tribal and cultural significance. Attendees included Shoshone-Bannock Tribal elders, the Language and Culture Department, and the HeTO, as well as researchers from the University of Utah American West Center, who are collaborating on a DOE-ID Ethnohistory study with the Tribes.

On November 20, 2024, DOE-ID and the Fort Hall Business council signed a Memorandum of Agreement (MOA) that provides access to sacred sites and traditional use areas on the INL Site. The MOA is designed to last in perpetuity, unless terminated by mutual agreement. The INL CRMO is committed to supporting DOE-ID in facilitating the MOA.

80th Anniversary Commemoration of B24-J Liberator Heavy Bomber Crash

Instrumental to American victory during WWII, the U.S. Navy operated the Arco Naval Proving Ground, which was the only proving ground of its kind west of the Mississippi River for testing, research, and experiments involving the safe storage and transportation of live ordnance. The U.S. Navy shared this land with the Pocatello Army Air Base, which used it for training heavy bomber and fighter jet pilots, specifically B-17 and B-24 bombers and P-39 and P-47 fighters at the Arco High-Altitude Bombing Range (overlapping the INL) and the Twin Buttes Bombing Range.

On January 8, 1944, shortly after 9:05 p.m., a B-24J Liberator (42-73365) performing a nighttime bombing run at an elevation of 20,000 feet began a rapid descent, crashed into the desert, and erupted into a fiery inferno. All seven of the U.S. Army Air Forces crew members on the B-24J Liberator lost their lives: 2nd Lt. Richard Hedges (age 25), 2nd Lt. Lonnie Keepers (age 23), 2nd Lt. Robert Madsen (age 28), 2nd Lt. Richard Pitzner (age 23), Sgt. Louis H. Rinke (age 19), Sgt. Charles Eddy (age 22), and Sgt. George Pearce, Jr. (age 25).

On June 29, 2024, the INL CRMO staff organized a commemoration event in recognition of the crew members who lost their lives in this accident 80 years ago. The event was hosted by the INL Fire Department and included opening and closing remarks, as well as featuring a series of speakers, including Lance Lacroix, the DOE-ID Manager; two INL CRMO Archaeologists who investigated the crash site and provided ongoing preservation monitoring activities; and Marc McDonald of Project Remembrance, who was responsible for the relocation of the crash site in 2016 and provided additional details regarding that effort. The guest of honor was Dr. Roberta Armstrong, who is the daughter of 2nd Lt. Robert Madsen. The U.S. Air Force Auxiliary Civil Air Patrol Color Guard from the Eagle Rock Composite Squadron, Rocky Mountain Region, Unit 97, provided the presentation and retirement of the colors. The Veterans of Foreign Wars Post 2146 and the Idaho Falls Memorial Team honored the fallen airmen with a Three Volley Salute and the playing of Taps.

The event was attended by local media, BEA, and DOE-ID, resulting in significant public outreach and internal INL Laboratory media coverage. This included a statewide newspaper insert titled INL's 75 Years of Energy Innovation: Celebrating INL's Past, Present and Future, "WWII Bomber Crash Crew to be Honored on 80th Anniversary;" an INL article by Paul Menser entitled, "Daughter of World War II Airman Killed in Training Accident Visits Idaho Crash Site" (Menser 2024); and an East Idaho News article and interview by Andrea Olson entitled, "What If? Woman Who Lost Father in WWII Bomber Crash at INL Reflects on His Life" (Olson 2024).

9.5.4 INL Archives and Special Collections

Following the Bomber Crash Commemoration Event, Archives Staff began digitizing Dr. Roberta Armstrong's family history. A virtual three-dimensional (3D) scanner was purchased, which enabled the capture of varied textures and relief of items that could not be captured with a flatbed scanner. In addition, the INL Archives and Special Collections group was featured in an article published in the East Idaho News entitled, "INL's Cultural Resources Management Office Provides A Historic Look At Nuclear-Related Artifacts. Here Is A Look Inside" (Nelson 2024).

INL Archives Staff completed 37 accessions, including approximately 700 archival photographs, 105 INL programs-specific booklets, articles, logbooks, reports, manuals, a map, 115 architectural and engineering drawings, 15 awards, 60 analog and digital media, and 30 archival objects. Metadata for the architectural and engineering drawings was

completed as well. A total of 349 scans were conducted in support of the INL Site Record Center transfer/destruction process, while repairs were made to 60 damaged architectural drawings.

In addition, the INL Archives and Special Collections Oral History program completed two interviews in 2024:

- Leslie Guy Backstrom of the DOE Radiological and Environmental Sciences Laboratory was interviewed on January 9, 2024. Mr. Backstrom was selected as an oral history candidate due to his long history at INL as a DOE employee (intern to management), his extensive involvement in Radiological and Environmental Sciences Laboratory's programs, and his knowledge relating to the creation, use, and history of the first Alpha Spectrometer, which will be accessioned to the INL Archives and Special Collections.
- Robert Boston, the current DOE-ID Manager, was interviewed on February 2, 2024. Mr. Boston was chosen due to his extensive and varied career at DOE-ID and INL from the Naval Reactors Facility Nuclear Sub Program to DOE-ID upper management, as well as his perspective as a leader for DOE at INL.

A list of potential oral history candidates is continuously updated, and two additional oral histories are planned for 2025.

9.6 References

7 USC § 136. 1947. "Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)." Public Law 110-94. United States Code, Washington, DC.

16 USC § 668-668d. 1940. "Bald and Golden Eagle Protection Act." Public Law 86-70. United States Code, Washington, DC.

16 USC § 703 et seq. 1918. "Migratory Bird Treaty Act (MBTA) of 1918, as amended." United States Code, Washington, DC.

16 USC § 1531 et seq. 1973. "Endangered Species Act (ESA) of 1973." Public Law 93-205. United States Code, Washington, DC.

Anderson, J. E., K. T. Ruppel, J. M. Glennon, K. E. Holte, and R. C. Rope. 1996. "Plant Communities, Ethnoecology, and Flora of the Idaho National Engineering Laboratory." ESRF-005. Environmental Science and Research Foundation, Idaho Falls, ID.

Atwood, N. D. 1969. "Flora of the National Reactor Testing Station." M.S. thesis, Brigham Young University, Provo, UT.

Avian Power Line Interaction Committee. 2006. "Suggested Practices for Avian Protection on Power Lines: The State of the Art in 2006." Edison Electric Institute, Avian Power Line Interaction Committee, and the California Energy Commission, Washington, DC, and Sacramento, CA.

BLM. 2008. "Special Status Species Management," Manual 6840, Bureau of Land Management, Grand Junction, CO.

Chang, T., A. J. Hansen, N. Piekielek, B. Bond-Lamberty. 2014. "Patterns and Variability of Projected Bioclimatic Habitat for *Pinus albicaulis* in the Greater Yellowstone Area." *PLoS ONE* 9(11): e111669.

Cholewa, A. F., and D. M. Henderson. 1984. "A Survey and Assessment of the Rare Vascular Plants of the Idaho National Engineering Laboratory Site." *The Great Basin Naturalist* 44(1): 140–144.

Coates, P. S., B. G. Prochazka, C. L. Aldridge, M. S. O'Donnell, D. R. Edmunds, A. P. Monroe, S. E. Hanser, L. A. Wiechman, and M. P. Chenaille. 2022. "Range-wide Population Trend Analysis for Greater Sage-grouse (*Centrocercus urophasianus*)—Updated 1960–2021." U.S. Geological Survey Scientific Investigations Report No. 1165, U.S. Geological Survey, Ft. Collins, CO.

Connelly, J. W., S. T. Knick, M. A. Schroeder, and S. J. Stiver. 2004. "Conservation Assessment of Greater Sage-grouse and Sagebrush Habitats." Unpublished Report. Western Association of Fish and Wildlife Agencies, Cheyenne, WY.

Connelly, J. W., S. T. Knick, C. E. Braun, W. L. Baker, E. A. Beever, T. J. Christiansen, K. E. Doherty, E. O. Garton, C. A. Hagen, S. E. Hanser, D. H. Johnson, M. Leu, R. F. Miller, D. E. Naugle, S. J. Oyler-McCance, D. A. Pyke, K. P. Reese, M. A. Schroeder, S. J. Stiver, B. L. Walker, and M. J. Wisdom. 2011a. "Conservation of Greater Sage-grouse: A Synthesis of Current Trends and Future Management." In: Knick, S. T., and J. W. Connelly (Eds.), *Greater Sage-grouse: Ecology and Conservation of a Landscape Species and its Habitats*, Studies in Avian Biology 38, University of California Press, Berkeley, CA. pp. 549–563.

Crowell, M. M., N. LaHue, E. Heath, K. Shoemaker, and M. Matocq. 2023. "Detection of *Rabbit hemorrhagic disease virus 2* in the pygmy rabbit (*Brachylagus idahoensis*), Nevada, USA." *Journal of Wildlife Diseases* 59(2): 342–346.

Davies, K. W., C. S. Boyd, J. L. Beck, J. D. Bates, T. J. Svejcar, and M. A. Gregg. 2011. "Saving the sagebrush sea: An ecosystem conservation plan for big sagebrush plant communities." *Biological Conservation* 144: 2573–2584.

DOE-ID. 2004. "INEEL Sagebrush Steppe Ecosystem Reserve: Final Management Plan, and Finding of No Significant Impact," EA ID-074-02-067. U.S. Department of Energy, Idaho Operations Office, Idaho Falls, ID.

DOE-ID. 2016. "Idaho National Laboratory Cultural Resource Management Plan." DOE/ID-10997, Rev. 6, February 2016. U.S. Department of Energy, Idaho Operations Office, Idaho Falls, ID.

DOE-ID. 2018. "Idaho National Laboratory Site Bat Protection Plan." DOE/ID-12002, September 2018. U.S. Department of Energy Idaho Operations Office, Idaho Falls, ID.

DOE-ID. 2022. "Migratory Bird Conservation Plan for Department of Energy Idaho Operations Office, Naval Reactors Laboratory Field Office/Idaho Branch Office Activities, and All Other Authorized INL Site Entities." DOE/ID-12059, March 2022. U.S. Department of Energy, Idaho Operations Office, Idaho Falls, ID.

DOE-ID. 2023a. "Idaho National Laboratory Site Cultural Resource Management Annual Report for Fiscal Year 2023." INL/RPT-23-75727, Revision 1. Idaho National Laboratory, Idaho Falls, ID.

DOE-ID. 2023b. "Programmatic Agreement Among the Department of Energy, Idaho Operations Office, the Idaho State Historic Preservation Office, and the Advisory Council on Historic Preservation Concerning Management of the Manner in which the Department of Energy will meet its National Historic Preservation Act Responsibilities on the Idaho National Laboratory Site." U.S. Department of Energy, Idaho Operations Office, Idaho Falls, ID.

DOE-ID. 2024a. "Idaho National Laboratory Site Bat Protection Plan 2024." INL/RPT-2482177. U.S. Department of Energy, Idaho Operations Office, Idaho Falls, ID.

DOE-ID. 2024b. "Idaho National Laboratory Site Cultural Resource Management Annual Report for Fiscal Year 2024." INL/RPT-24-82057. Idaho National Laboratory, Idaho Falls, ID.

DOE and USFWS. 2013. "Memorandum of Understanding Regarding the Implementation of Executive Order 13186. 'Responsibilities of Federal Agencies to Protect Migratory Birds." U.S. Department of Energy, U.S. Fish and Wildlife Service, Washington, DC.

DOE-ID and USFWS. 2014. "Candidate Conservation Agreement for Greater Sage-grouse (*Centrocercus urophasianus*) on the Idaho National Laboratory Site in Southeast Idaho, Idaho Falls, Idaho." DOE/ID-11514, September 2014. U.S. Department of Energy, U.S. Fish and Wildlife Service, Washington, DC.

Doherty, K., D. M. Theobald, J. B. Bradford, L. A. Wiechman, G. Bedrosian, C. S. Boyd, M. Cahill, P. S. Coates, M. K. Creutzburg, M. R. Crist, and S. P. Finn. 2022. "A Sagebrush Conservation Design to Proactively Restore America's Sagebrush Biome." U.S. Geological Survey Open-File Report 2022-1081. U.S. Geological Survey, Reston, VA.

Executive Order 13112. 1999. "Invasive Species." February 1999. Washington, DC.

Executive Order 13186. 2001. "Responsibilities of Federal Agencies to Protect Migratory Birds." January 2001. Washington, DC.

Executive Order 13751. 2016. "Safeguarding the Nation from Impacts of Invasive Species." December 2016. Washington, DC.

Federal Register. 1983. "Secretary of Interior's Standards and Guidelines for Archaeology and Historic Preservation," September 29, 1983, Federal Register, Vol. 48, No. 190.

Federal Register. 2013. "Memorandum of Understanding between the United States Department of Energy and the United States Fish and Wildlife Service Regarding Implementation of Executive Order 13186, Responsibilities of Federal Agencies to Protect Migratory Birds," November 13, 2013, Vol. 78, No. 219.

Federal Register. 2015. "Endangered and Threatened Wildlife and Plants; 12-Month Finding on a Petition to List Greater Sage-Grouse (*Centrocercus urophasianus*) as an Endangered or Threatened Species," October 2, 2015, Federal Register, Vol. 80, No. 191.

Forman, A. D. 2015. "A Review of Special Status Plant Species on the Idaho National Laboratory Site." GSS-ESER-187, April 2015. Environmental Surveillance, Education, and Research Program, Gonzales-Stoller Surveillance, LLC, Idaho Falls, ID.

Forman, A. D. and J. R. Hafla. 2018. "The Idaho National Laboratory Site Long-Term Vegetation Transects: Updates through 2016," VSF-ID-ESER-LAND-003, September 2018. Environmental Surveillance, Education, and Research Program, Veolia Nuclear Solutions – Federal Services, Idaho Falls, ID.

Forman, A. D., C. J. Kramer, S. J. Vilord, J. P. Shive. 2021. "INL Site 2020 Wildfires Ecological Resources Recovery Plan," VSF-ID-ESER-LAND-092, March 2021. Environmental Surveillance, Education, and Research Program, Veolia Nuclear Solutions – Federal Services, Idaho Falls, ID.

Forman, A. D., C. J. Kramer, J. P. Shive, S. R. Williams, K. N. Kaser, and B. F. Bybee. 2024. "Idaho National Laboratory Site Natural Resources Wildland Fire Recovery Framework." INL/RPT-24-76050. Idaho National Laboratory, Idaho Falls, ID.

Forman, A. D. 2024. "The Idaho National Laboratory Site Long-Term Vegetation Transects: Updates Through 2022," INL/RPT-24-80913. Idaho National Laboratory, Idaho Falls, ID.

IDAPA 02.03.03. 2025. "Rules Governing Pesticide and Chemigation Use and Application." Idaho Administrative Procedures Act, Idaho Department of Environmental Quality, Boise, ID.

IDFG. 2024a. "Idaho State Wildlife Action Plan 2023." January 2024. Idaho Department of Fish and Game, Boise, ID.

IDFG. 2024b. "Species Diversity Data Partners" webpage. Idaho Fish and Game Natural Heritage, Boise, ID.

INL. 2016. "BEA Power Management Avian Protection Plan and Bird Management Policy." MCP-3367. Idaho National Laboratory, Idaho Falls, ID.

INL. 2022. "Idaho National Laboratory Wildland Fire Management Plan." PLN-14401, Rev 6, February 2022. Idaho National Laboratory, Idaho Falls, ID.

INL. 2023. "Section 106 Compliance." MCP-8008, Rev. 1. Idaho National Laboratory, Idaho Falls, ID.

INPS. 2024. "Rare Plant Conference, Rare Plant List, and Working Groups" webpage. Idaho Native Plant Society.

Knick, S. T., S. E. Hanser, R. F. Miller, M. J. Pyke, M. J. Wisdom, S. P. Finn, T. E. Rinkes, and C. J. Henny. 2011. "Ecological Influence and Pathways of Land Use in Sagebrush," In: Knick, S. T., and J. W. Connelly (Eds.), *Greater Sage-Grouse: Ecology and Conservation of a Landscape Species and Its Habitats*, Studies in Avian Biology 38, University of California Press, Berkeley, CA. pp. 203–251.

Menser, P. 2024. "Daughter of World War II Airman Killed in Training Accident Visits Idaho Crash Site." August 19, 2024. Idaho National Laboratory, Idaho Falls, ID.

NatureServe. 2024. "NatureServe Network Biodiversity Location Data web application." NatureServe Explorer, NatureServe, Arlington, VA.

Nelson, R. 2024. "INL's Cultural Resources Management Office Provides a Historic Look at Nuclear-Related Artifacts. Here's a Look Inside." June 12, 2024. East Idaho News, Idaho Falls, ID.

Noss, R. F., E. T. LaRoe III, and J. M. Scott. 1995. "Endangered Ecosystems of the United States: A Preliminary Assessment of Loss and Degradation," Biological Report 28, February 1995, National Biological Service, U.S. Department of the Interior, Washington, DC.

Olson, A. 2024. "What if? Woman who lost father in WWII bomber crash at INL reflects on his life." July 24, 2024. East Idaho News, Idaho Falls, ID.

Owens, T. M. 2025. "2024 Breeding Bird Surveys on the Idaho National Laboratory Site." INL/RPT-25-83402, March 2025. Idaho National Laboratory, Idaho Falls, ID.

Rachlow, J. L., I. T. Smith, and M. D. Matocq. 2021. "Chapter E. Pygmy rabbit," In: Remington, T. E., P. A. Deibert, S. E. Hanser, D. M. Davis, L. A. Robb, and J. L. Welty (Eds.), *Sagebrush Conservation Strategy—Challenges to Sagebrush Conservation*, Open-File Report 2020–1125, U.S. Geological Survey, Reston, VA. pp. 31–35.

Rush, L. M., L. K. Svancara, I. T. Smith, S. J. Knetter, J. W. Karl, and J. L. Rachlow. 2023. "Intraspecific Variation in Habitat Relationships for Pygmy Rabbits: Implications for Conservation of Habitat Specialists." *Ecosphere*, 14(7): e4625.

Schroeder, M. A., C. L. Aldridge, A. D. Apa, J. R. Bohne, C. E. Braun, S. D. Bunnell, J. W. Connelly, P. A. Deibert, S. C. Gardner, M. A. Hilliard, G. D. Kobriger, S. M. McAdam, C. W. McCarthy, J. J. McCarthy, D. L. Mitchell, E. V. Rickerson, and S. J. Stiver. 2004. "Distribution of Sage-Grouse in North America." *The Condor* 106(2): 363–376.

Shive, J. P., A. D. Forman, A. Bayless-Edwards, K. Aho, K. N. Kaser, J. R. Hafla, and K. T. Edwards. 2019. "Vegetation Community Classification and Mapping of the Idaho National Laboratory Site 2019." VFS-ID-ESER-LAND-064. Environmental Surveillance, Education, and Research Program, Veolia Nuclear Solutions – Federal Services, Idaho Falls, ID.

Shive, J. P. 2024. "Idaho National Laboratory Site Vegetation Map Update 2024." INL/RPT-24-80957, November 2024. Idaho National Laboratory, Idaho Falls, ID.

Singlevich, W., J. W. Healy, H. J. Paas, and Z. E. Carey. 1951. "Natural Radioactive Materials at the Arco Reactor Test Site." Radiological Sciences Department, Atomic Energy Commission, Richland, WA.

Smith, J. T., B. W. Allred, C. S. Boyd, K. W. Davies, A. R. Kleinhesselink, S. L. Morford, and D. E. Naugle. 2023. "Fire Needs Annual Grasses More Than Annual Grasses Need Fire," *Biological Conservation*, 286: 110299.

Vihlene, S. 2015. "Consulting with the Idaho State Historic Preservation Office." Guidelines and Procedures and Cultural Resource Review and Consultation in Idaho, Boise, ID.

Williams, S. R., T. M. Owens, K. N. Kaser, J. P. Shive, A. D. Forman, C. J. Kramer, S. A. Baccus, and K. T. Edwards. 2025. "Implementing the Candidate Conservation Agreement for Greater Sage-grouse on the Idaho National Laboratory Site: 2024 Full Report." INL/RPT-25-82779, January 2025. Idaho National Laboratory, Idaho Falls, ID.

Ziolkowski, Jr., D. J., M. Lutmerding, W. B. English, V. I. Aponte, and M-A. R. Hudson. 2023. "North American Breeding Bird Survey dataset 1966–2022." U.S. Geological Survey data release, Idaho Falls, ID.

Imperfect buckwheat.