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Prepared for:
Idaho National Laboratory -
Battelle Energy Alliance, LLC
Contract No. 00226967

Idaho National Laboratory Site 2020 Wildland Fires Ecological Resources Recovery Plan

Amy D. Forman, Colby J. Kramer, Sue J. Vilord, Jeremy P. Shive,

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March 2021

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EXECUTIVE SUMMARY

A Wildland Fire Management Environmental Assessment was completed for the Idaho National Laboratory (INL) in 2003 in response to the increasing frequency of wildland fires. One requirement of the Assessment was for INL to establish a Wildland Fire Management Committee (WFMC) and one responsibility of the WFMC is to determine when the development of a post-fire recovery plan for fires larger than 40 ha (99 ac) is warranted. Post-fire recovery plans should address several aspects of site restoration, including: evaluating impacts of fire and fire-suppression activities on natural resources, recontouring and soil stabilization of surfaces disturbed by fire-suppression activities, controlling weeds, gauging the necessity to revegetate using local collections of plant material, and monitoring revegetation activities (INL 2003). Additionally, a conservation measure was developed for inclusion in the Greater Sage-grouse (*Centrocercus urophasianus*) Candidate Conservation Agreement (CCA) between the U.S. Department of Energy – Idaho Operations Office (DOE-ID) and the U.S. Fish and Wildlife Service (USFWS; DOE-ID and USFWS 2014) that stated an assessment evaluating the need for post-fire restoration would be prepared and DOE-ID would guide an approach for hastening sagebrush reestablishment on fires larger than 40 ha (99 ac).

Following the 2019 Sheep Fire, INL's WFMC determined that a post-fire recovery plan should be developed to address impacts of fire suppression activities and the potential effects of the fire on native species recovery and associated wildlife habitat within the burned area. WFMC members expressed an interest in a plan where implementation is phased over five years and in a plan that is flexible, where specific actions can be implemented individually depending on specific resource concerns and funding availability. The Sheep Fire Ecological Resources Post-Fire Recovery Plan reflects input from DOE-ID, stakeholder agencies, and the WFMC. The Sheep Fire Plan summarized the INL natural resource guidance documents that apply to post-fire restoration and it identified four natural resource recovery objectives and restoration options for meeting each objective. A discussion of the current scientific understanding of each restoration option was also presented in the Sheep Fire Plan. Because the WFMC found the framework of the Sheep Fire Plan to be a useful decision-making tool, this fire recovery plan will utilize the same organization framework.

In 2020, there were two very small wildland fires (<1,000 m^2 or ¼ ac) and five wildland fires ranging in size from 11.0 ha (27.1 ac) to 677.9 ha (1,675.1 ac) on the INL Site. The WFMC requested an ecological assessment and fire recovery plan for four of the larger fires. The four fires included in this fire recovery plan are Howe Peak, Telegraph, Lost River, and Cinder Butte. A total of 1,920 ha (4,744 ac) was affected by these four fires. The fires impacted a variety of ecological resources including 16 different soils types, five vegetation classes, and numerous wildlife species, including greater sage-grouse, which is designated as Species of Greatest Conservation Need by the State of Idaho. Several treatment options for improving post-fire recovery are included and, as with the Sheep Fire Plan, natural resource recovery treatment options for the four 2020 wildland fires were organized into four recovery objectives:

1) Soil stabilization for erosion and weed control on areas affected by fire suppression activities,
2) Cheatgrass and noxious weed control within the larger burned area,
3) Native herbaceous recovery, and
4) Sagebrush habitat restoration.

Potential treatments associated with the fire recovery Objective 1 include: recontouring containment lines and seeding with a native grass mix, signing and/or barricading the containment lines to prevent traffic, and monitoring and spraying containment lines for weeds. These actions were completed on all four fires during fall of 2020. Noxious weed monitoring will be ongoing, but vehicle traffic will be limited to established roads. In addition to these actions, "roads" created to access the fires during fire suppression

should be monitored to ensure that they are not continuing to be used and that they are recovering naturally. If they are not recovering naturally, signage and replanting should be considered.

Objective 2 can be addressed with two treatment actions: applying a pre-emergent herbicide to areas at greatest risk for cheatgrass dominance and conducting a weed inventory followed by targeted noxious weed treatments. Cheatgrass was not a major component of the plant community prior to the Telegraph or Cinder Butte Fires. Though pre-fire cheatgrass was more abundant in the areas affected by the Howe Peak and Lost River Fires, they are not optimal candidates for cheatgrass treatment. All four of the 2020 wildland fires should be monitored for cheatgrass and treatment should be reconsidered if natural recovery is not progressing as expected or if conditions change, making treatments potentially more effective. Targeted noxious weed treatments should continue on all four 2020 wildland fires for several growing seasons through the INL noxious weed management program.

Because pre-fire herbaceous understories were generally in good condition, consisting of primarily native perennial species on the Telegraph and Cinder Butte Fires, there are no specific actions necessary to address Recovery Objective 3 for these fires. Pre-fire understory conditions were poorer, with more introduced annuals on the Howe Peak and Lost River Fires and planting native perennial grass could improve condition in some areas of those fires, but other issues, like proposed rangeland improvements and cheatgrass would need to be addressed first. All four 2020 wildland fires are in Bureau of Land Management grazing allotments and the burned portion of the allotment should be rested for at least two growing seasons. All four fires should be monitored to ensure herbaceous recovery is occurring as expected.

Restoration activities to address Objective 4 were considered on all four 2020 wildland fires. Because of the context of the surrounding sagebrush habitat, the proximity of an active sage-grouse lek, and high levels of local sage-grouse use, the Telegraph Fire is the highest priority 2020 fire for sagebrush restoration. Local seed should be collected for use in planting and all areas logistically accessible should be considered for planting. Though sagebrush planting could be considered in the Howe Peak, Lost River, and Cinder Butte Fires, the potential benefit to habitat from replanting sagebrush in those areas is not as great as it would be in other priority restoration areas that were previously affected by wildland fire. A complete list of treatment and monitoring options summarized by fire can be found in Table 2-1 on page 18.

To identify areas that may need to be treated and to evaluate the outcome of any treatments that are implemented on the 2020 wildland fires, an effective monitoring plan should be designed and implemented. Effective monitoring plans are those that establish a process to collect, analyze, and use data to track the status of the natural resources of interest and interpret the effectiveness of any implemented actions or treatments against benchmarks developed to evaluate success. Appropriate monitoring methods may include remote sensing using satellite or airborne-based imagery and field-based rapid assessment techniques. Ideally, monitoring results will be used within an adaptive management framework so that previous results inform future decisions.

ACKNOWLEDGMENTS

We would like to thank our agency stakeholders from the U.S. Fish and Wildlife Service, Bureau of Land Management, U.S. Geological Survey, Idaho Department of Fish and Game, and Idaho Office of Species Conservation. Representatives from each of these agencies have been very generous in sharing their time, expertise, and experiences with sagebrush steppe post-fire recovery. Eric Gosswiller described each of the 2020 wildland fires and Cleve Davis acquired the post-fire imagery. Brande Hendricks provided document layout and formatting. Gregg Losinski designed the cover. The final review team included Betsy Holmes, Charles Ljungberg, Eric Gosswiller, Michael Auble, and Craig Richins. Their thoughtful reviews substantially improved the final document.

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ACRONYMS

BLM	Bureau of Land Management
CCA	Candidate Conservation Agreement
CRMO	Cultural Resource Management Office
DOE-ID	U.S. Department of Energy – Idaho Operations Office
EA	Environmental Assessment
ESER	Environmental Surveillance, Education, and Research
GPS	Global Positioning System
IDFG	Idaho Department of Fish and Game
INL	Idaho National Laboratory
SGCA	Sage-grouse Conservation Area
SGCN	Species of Greatest Conservation Need
USFWS	U.S. Fish and Wildlife Service
WFMC	Wildland Fire Management Committee

1.0 BACKGROUND

Prior to 1994, large wildland fires were relatively infrequent on the Idaho National Laboratory (INL) Site (Anderson et al. 1996). Over the past 25 years, however, several large wildland fires have occurred (Forman and Hafla 2018). As fires began to increase in size and frequency, the INL implemented the "Balanced Fire Protection Approach" alternative in the Wildland Fire Management Environmental Assessment (EA), which established a Wildland Fire Management Committee (WFMC; DOE 2003). One function of the WFMC is to determine when development of a post-fire recovery plan for wildland fires is needed. Post-fire recovery plans should address several aspects of site restoration, including: assessing impacts of fire and fire-suppression activities on natural resources, recontouring and soil stabilization of surfaces disturbed by fire-suppression activities, controlling weeds, evaluating the necessity to revegetate using local collections of plant material, and monitoring revegetation activities. Additionally, a conservation measure was developed for inclusion in the Greater Sage-grouse (*Centrocercus urophasianus*) Candidate Conservation Agreement (CCA) between the U.S. Department of Energy – Idaho Operations Office (DOE-ID) and the U.S. Fish and Wildlife Service (USFWS; DOE-ID and USFWS 2014) that stated an assessment evaluating the need for post-fire restoration would be prepared and DOE-ID would guide an approach for hastening sagebrush reestablishment on fires larger than 40 ha (99 ac).

In 2019, the Sheep Fire burned more than 40,000 ha (98,842 ac) on the INL Site. To address the CCA wildland fire conservation measure and to comply with the INL Wildland Fire EA, INL's WFMC directed the Environmental Surveillance, Education, and Research (ESER) Program to prepare an assessment of ecological impacts and a fire recovery plan for the area impacted by the Sheep Fire. The most recent fire recovery document drafted prior to the Sheep Fire was the guidance document prepared after the 2010 Jefferson Fire (Blew et al. 2010). Over the nine years between the two fires, several factors changed including: implementation of the CCA for sage-grouse, increased stakeholder participation, improved ecological data for assessing impacts, and declines in pre-fire ecological condition of some areas. These changes in both the regulatory environment and the ecological conditions related to post-fire recovery necessitated a change in the structure and content of fire recovery plans for the INL Site.

The Sheep Fire Ecological Resources Post-Fire Recovery Plan (hereafter Sheep Fire Plan) was completed in 2020 (Forman et al. 2020) and it reflects input from DOE-ID, stakeholder agencies, and the WFMC. WFMC members expressed an interest in a plan where implementation is phased over five years and in a plan that is flexible, where specific actions can be implemented individually depending on specific resource concerns and funding availability. The Sheep Fire Plan summarized the INL natural resource guidance documents that apply to post-fire restoration and it identified four natural resource recovery objectives and restoration options for meeting each objective. A discussion of the current scientific understanding of each restoration option was also presented in the Sheep Fire Plan. Because the WFMC found the framework of the Sheep Fire Plan to be a useful decision-making tool, this fire recovery plan will utilize the same organization framework. To avoid redundancy, much of the INL-specific resource guidance and literature-based scientific background that was developed to support various restoration options in the Sheep Fire Plan will simply be cited to support similar recommendations in this plan.

1.1 Fire Summaries

In 2020, there were two very small wildland fires (<1000 m^2 or ¼ ac) and five wildland fires ranging in size from 11.0 ha (27.1 ac) to 677.9 ha (1,675.1 ac) on the INL Site. Only three of the five fires were large enough to meet the wildland fire conservation measure criteria in the CCA; however, the WFMC requested an ecological assessment and fire recovery plan for four of the fires. The 11.0 ha (27.1 ac) fire was included because containment lines (i.e., soil disturbance) were used to control it and it was mapped as sagebrush habitat prior to the fire. It is also partially in the Sage-Grouse Conservation Area (SGCA).

The SGCA is an administrative boundary designated by the CCA, inside of which infrastructure development and human disturbance are limited, protecting approximately 68% of remaining sagebrush-dominated communities on the INL Site. A habitat "trigger" for the CCA was developed based on the SGCA, which if tripped by a loss of sagebrush from more than 20% the baseline, would initiate an automatic response by USFWS and DOE-ID.

The four fires included in this fire recovery plan are Howe Peak, Telegraph, Lost River, and Cinder Butte. Figure 1-1 shows the initial boundaries of each of the four fires, depicted by their primary containment line. Primary containment lines were produced by the Cultural Resource Management Office (CRMO) using GPS (Global Positioning System) field data collected within a few days of containment of each fire. Experience with other recent large fires suggests the actual burned area boundary typically differs from the containment line boundary created immediately post-fire. To support post-fire ecological evaluation and recommendations, as well as habitat distribution estimates for the CCA monitoring report, the WFMC funded the acquisition of high-resolution satellite imagery across the entire INL Site. Imagery was acquired by Digital Globe's Worldview-2 and Worldview-3 satellite sensors on October 4, 2020 and was used to create an estimated burned footprint for each fire (see Shurtliff et al. 2021 for details). The revised footprint more accurately estimates the actual burned area given the patchy nature of many wildland fires in sagebrush steppe.

1.1.1 Howe Peak Fire

The INL, Bureau of Land Management (BLM), and Arco Fire Department responded to a confirmed wildland fire near Howe Peak on July 2, 2020. Upon arrival, crews encountered a fire on BLM property near multiple campers at the base of Howe Peak. Command was turned over to BLM and INL resources were assigned direct suppression tactics. BLM and INL dozers were requested and responded. BLM also requested air support to initiate retardant operations. During the initial attack period the fire exhibited significant wind driven growth and jumped Highway 33 onto INL property, involving the Rocky Mountain Power 69 kV line to Howe. Retardant operations and improved agriculture land limited fire spread to the north, preventing impact to Howe. Dozer lines effectively lined the east flank of the fire on INL property during the initial attack period.

INL resources supported operations on July 3, 2020. BLM hand crews arrived on day two and much of the operation focused on securing hand line in the timber/juniper on the west and north ends of the fire. BLM maintained a continuous presence until declaring the fire contained July 7, 2020 and controlled on July 9, 2020.

Immediately after the fire was contained, official fire size was mapped at 2,678 ha (6,617ac) including 667 ha (1,647.5 ac) of INL property. Estimates of area burned on the INL Site were later reduced slightly, to 664 ha (1,640.8 ac), based on the actual fire footprint mapped using the satellite imagery discussed above. A total of 7.9 km (4.9 mi) of containment lines were constructed on INL property. There were no injuries to personnel or damage to INL property. The fire was declared to be of human origin with an escaped campfire the probable ignition factor.

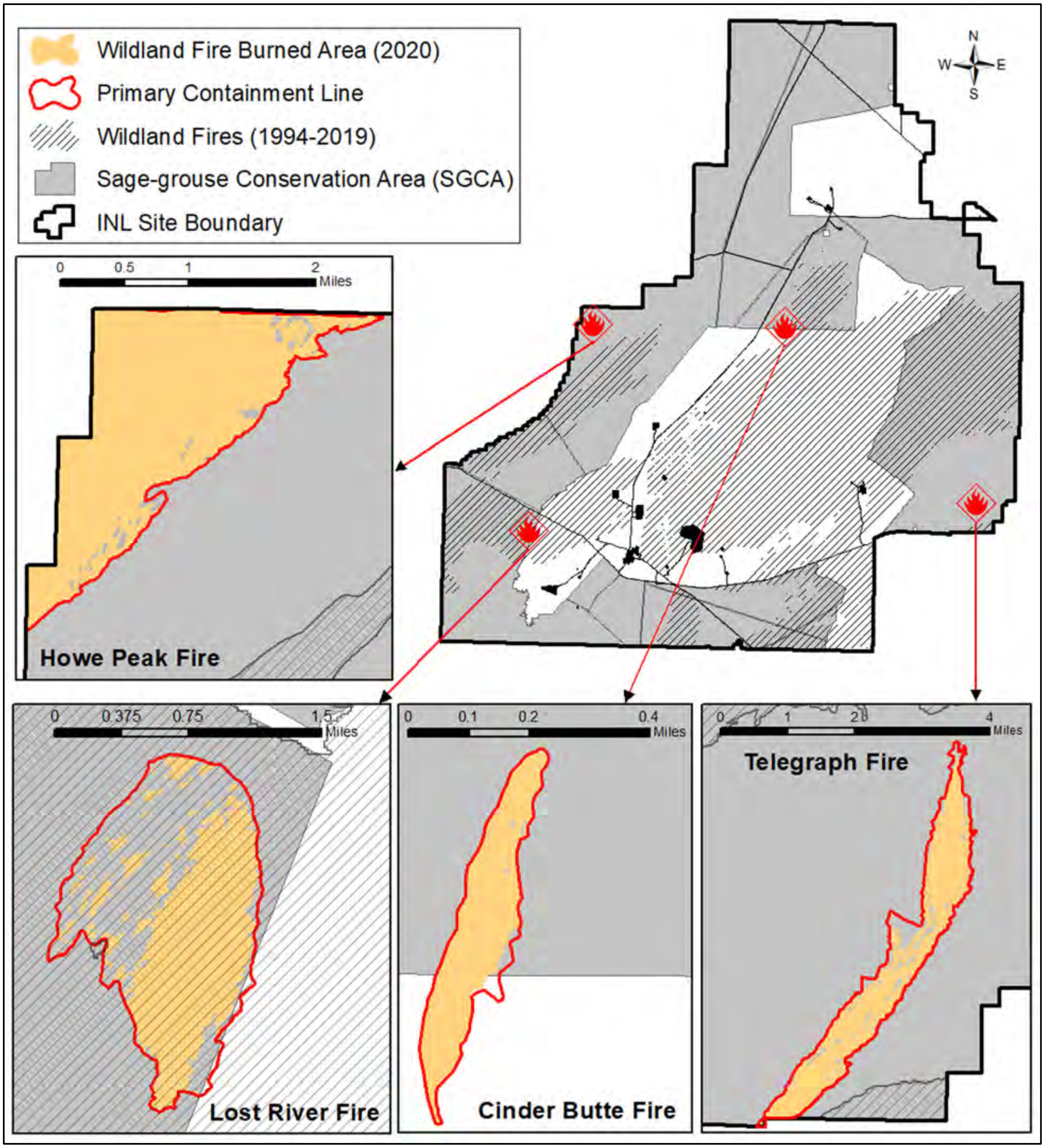

Figure 1-1. Four of the wildland fires that burned on the Idaho National Laboratory Site in 2020 shown with all major wildland fires since 1994 and the boundary for the Sage-grouse Conservation Area.

1.1.2 Telegraph Fire

The INL Fire Department responded to multiple confirmed fires on Highway 20 on July 8, 2020; BLM and Idaho Falls Fire Department also responded. The Telegraph Fire was the western most of two fires. It initiated on the north side of the roadway on BLM land but quickly spread to INL property. The Corral Fire was approximately a mile east on the north side of the roadway and burned entirely on State land.

INL formed a unified command for the initial attack of the Telegraph fire. Air support was requested to initiate retardant operations. Two INL dozers and two BLM dozers arrived to initiate dozer line construction. The fire was driven to the northeast by twenty mile per hour winds with moderate fire behavior observed. Containment lines were completed later that evening. Ground-based resources, with the support of a helicopter, continued to mop up and reinforce containment lines throughout the next two days as high winds were encountered each day. The fire was declared contained July 9, 2020 and controlled July 11, 2020.

Official fire size was mapped at 872 ha (2,154 ac) with 870 ha (2,150 ac) on INL property. After the actual footprint of the fire was mapped using satellite imagery, the estimated burned area was reduced to 678 ha (1,675 ac). Approximately 27 km (17 mi) of containment line were constructed on INL property. The fire was declared to be of human origin with an inconclusive ignition factor. There was no damage or injury to personnel.

1.1.3 Lost River Fire

The INL and BLM responded to a nighttime fire reported on the south side of Highway 20/26, west of the rest area on August 6, 2020. Upon arrival crews encountered an active fire due to low overnight relative humidity recovery and erratic winds. Engines initiated direct suppression tactics. Dozers were ordered and initiated containment line construction. The fire burned erratically during the night with multiple wind shifts. Crews completed dozer lines prior to sunrise the following morning with engines further strengthening lines. A fire attack flyover confirmed no problem areas the following morning and the fire was contained at 9:00 AM. The fire was declared controlled August 7, 2020. The fire cause was determined to be lightning. Official fire size was estimated at 370 ha (914 ac). The actual fire footprint was later mapped at 208 ha (515 ac). Approximately 10.5 km (6.5 miles) of containment line were constructed and there was no damage or injury to personnel.

1.1.4 Cinder Butte Fire

INL responded to a report of a fire east of Gate 4 on August 18, 2020. A Red Flag warning was in place and lightning had been observed in the immediate area. Accordingly, dozers were ordered while the INL Fire Department was en route. Upon arrival, a brief rainstorm had moderated fire growth. BLM was notified of the fire and advised that further assistance would not be necessary during initial attack. INL crews made good progress throughout the evening. Dozer containment lines were constructed out of caution for the Red Flag conditions in effect during the operating period. The fire was declared contained on August 18, 2020 and controlled on August 19, 2020. Official fire size was estimated at 11 ha (28 ac) and subsequent analysis of satellite imagery indicated that amount of area impacted by the actual fire footprint was nearly the same as that reported by the official fire size. Approximately 2.3 km (1.4 mi) of containment line were constructed. There was no damage or injury to personnel.

1.2 Affected Ecological Resources

1.2.1 Soils

Soil data on the INL Site are derived from a general soil map created in 1995. This general soil map was generated using historical soils data from surrounding counties, historical BLM soil surveys, and various smaller scale soil studies within the INL Site (Olson et al. 1995). The soil series and map unit descriptions provided in the soils map project report give broad descriptions; definitions of the areas soils and soil boundaries may not be mapped precisely, but they can lend some insight into understanding the ecology of the areas surrounding the wildland fire footprints. In total there were 16 soil types affected by wildland fires in 2020.

The Howe Peak Fire burned six soil map units (Figure 1-2). A majority of the affected soils were identified as the Coffee-Nargon-Atom Complex and similar soils. These soils are typical of the basalt plains located on the northwestern parts of the INL. They are described as deep, well drained soils with minimal available precipitation. These soils are suitable for rangeland drill seeding and for weed control via spraying in areas where vegetation communities were degraded prior to the fire and native vegetation is not likely to return.

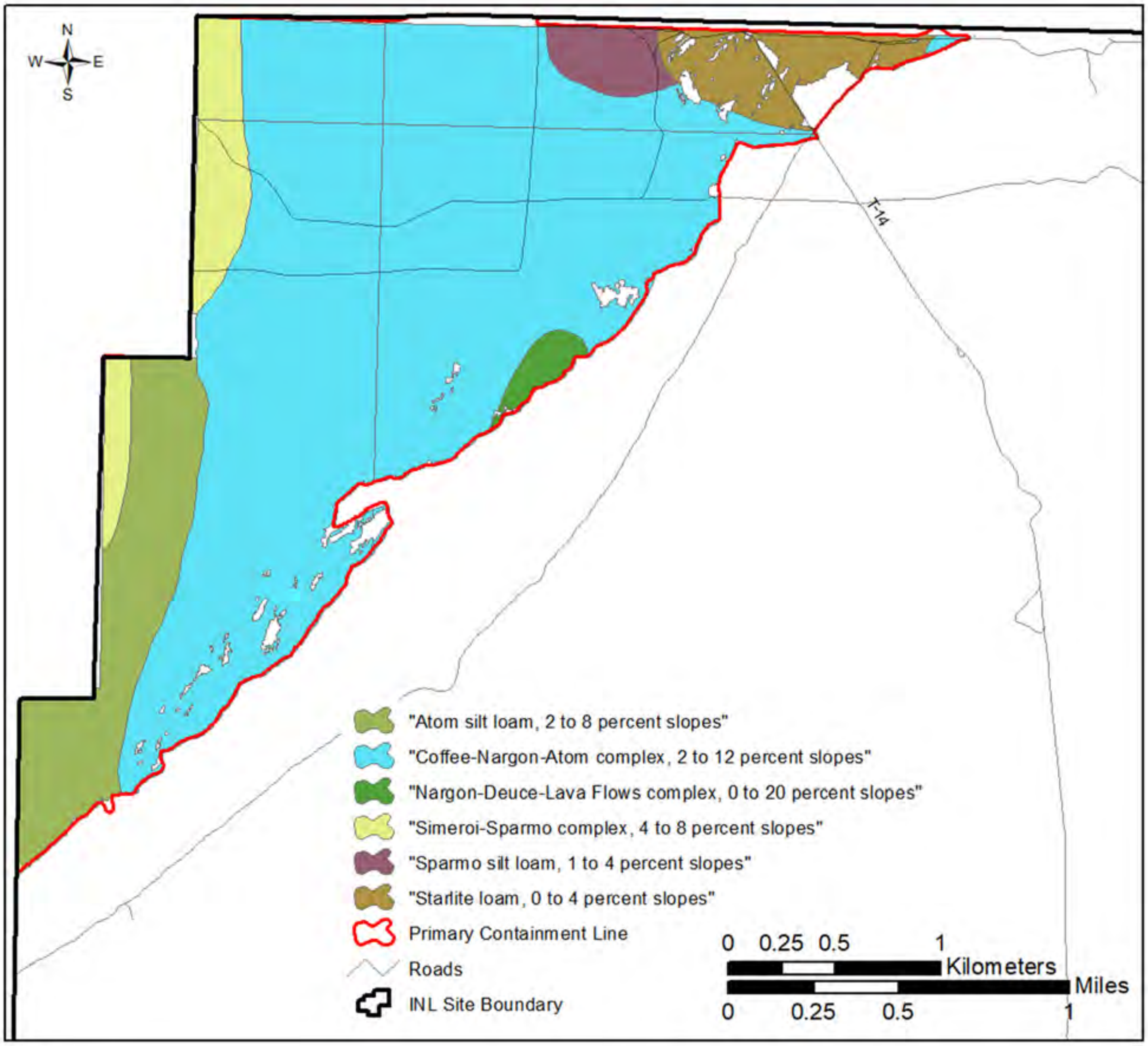

Figure 1-2. Soils in the area impacted by the 2020 Howe Peak Fire on the Idaho National Laboratory Site.

The Telegraph Fire burned eight soil map units (Figure 1-3). A majority of the soil types affected by the Telegraph Fire were Pancheri and Polatis soils described as basalt plains formed in loess at elevations ranging from 1,400 m to 1,646 m (4,600 ft to 5,400 ft). These soils are mostly deep and well drained with some areas containing a stony surface and rock outcrops. The northern part of the burned area contained small segments of Bereniceton, Terreton, and Aecet soils. These soils are also described as deep, well drained and have locations of exposed bedrock or stony surfaces. Rangeland drill seeding may be suitable depending on the absence of a stony surface and bedrock. Aerial spraying for weed management and reseeding is the recommended restoration approach in areas where pre-fire vegetation communities were degraded and mechanical means would not be suitable.

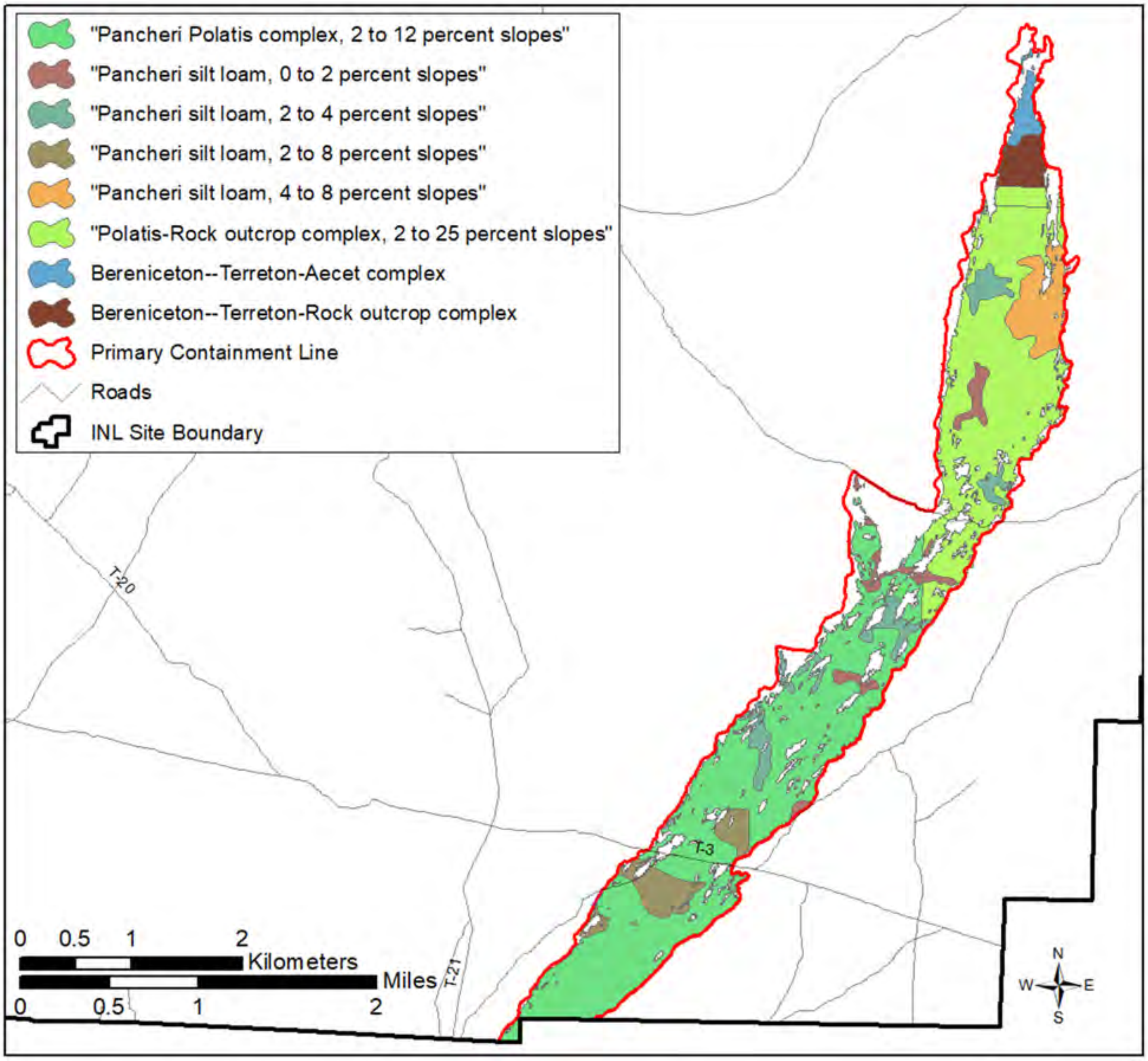

Figure 1-3. Soils in the area impacted by the 2020 Telegraph Fire on the Idaho National Laboratory Site.

The Lost River Fire burned entirely within the confines of one soil map unit, the Malm-Bondfarm-Matheson complex, 2 to 8 percent slopes. The Malm-Bondfarm-Matheson complex is typical for basalt plains with elevations ranging from 1,430 m to 1,675m (4,700 ft to 5,500 ft). They are moderately to well drained sandy loam over bedrock. This soil complex has a high hazard of soil blowing (wind erosion). The high hazard of soil blowing imparts certain limitations to use of these soils (Olson et al. 1995). These soils are classified as Land Capability Class VIIe and have very severe limitations that make them unsuitable for cultivation due to erosion. They are not suited to mechanical rangeland management treatments including seeding. This becomes an important consideration for restoration or long-term erosion control measures.

The Cinder Butte Fire also burned entirely in one soil map unit, Terreton-Zwiefel. Terreton-Zwiefel soils are described as a mixture of fine grained, alkaline lacustrine soils covered in sandy deposits in the form of small dunes ranging from 0 to 20 percent slopes. These soils are generally described as deep and well drained with slow surface runoff and a slight hazard for water erosion. The hazard of soil blowing is very high making mechanical treatments such as drill seeding difficult due to wind erosion and low visibility. Soil stabilization should be considered high priority in these soils. In areas where vegetation is unlikely to recover, revegetation is highly recommended following disturbances, such as a wildland fire.

1.2.2 Vegetation

Distribution and Abundance of Plant Communities

An update to the INL Site Plant Community Classification and Vegetation Map was recently completed (Shive et al. 2019). The new vegetation map shows the pre-fire vegetation classes present within the 2020 wildland fires burned areas. Understanding the pre-fire vegetation composition and distribution gives insight into the plant communities likely to reestablish and will assist in identifying areas that may need active restoration due to an abundance of non-native species.

There were four vegetation classes mapped within the Howe Peak Fire boundary including two grasslands, one shrub grassland, and one shrubland class (Figure 1-4). The majority of area burned was assigned to the Crested Wheatgrass Ruderal Grassland class (Table 1-1). This vegetation class is characterized by a moderate to dense herbaceous layer which is strongly dominated by crested wheatgrass (*Agropyron cristatum*), an introduced, perennial bunchgrass. The second most abundant vegetation class within the Howe Peak Fire was the Big Sagebrush – Green Rabbitbrush (Threetip Sagebrush) Shrubland (Table 1-1). The Big Sagebrush – Green Rabbitbrush (Threetip Sagebrush) Shrubland vegetation class is one of three classes that are combined to represent general sagebrush habitat for sage-grouse. The Cheatgrass Ruderal Grassland was also present prior to the fire, but it was limited in distribution and was located close to the INL boundary, adjacent to private agricultural land.

There were three vegetation classes mapped within the Telegraph Fire boundary including one shrubland, one shrub grassland, and one grassland (Figure 1-5). The majority of area burned was assigned to the Big Sagebrush – Green Rabbitbrush (Threetip Sagebrush) Shrubland class (Table 1-2). This class is composed of a shrub layer along with a mostly native understory. The Big Sagebrush – Green Rabbitbrush (Threetip Sagebrush) Shrubland vegetation class is also one of three classes that are combined to represent general sagebrush habitat for sage-grouse. The second most common vegetation class within the Telegraph Fire was the Cheatgrass Ruderal Grassland (Table 1-2). Cheatgrass (*Bromus tectorum*), an introduced invasive, annual grass species dominates this vegetation class. This class was distributed in small, discontinuous patches throughout the area pre-fire.

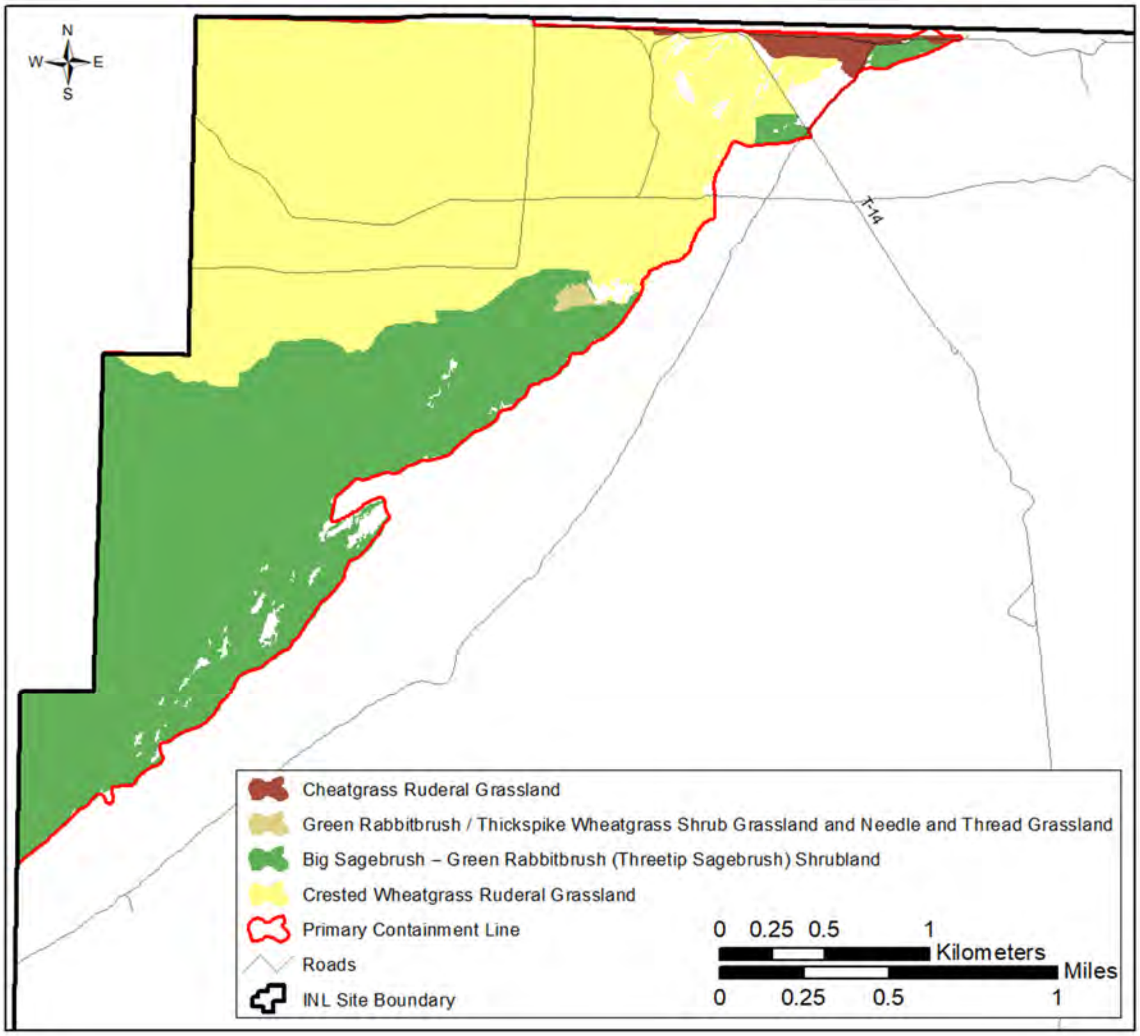

Figure 1-4. Vegetation classes (Shive et al. 2019) burned on the Idaho National Laboratory Site in the 2020 Howe Peak Fire.

Table 1-1. Area of each vegetation class burned in the 2020 Howe Peak Fire. The most recent Idaho National Laboratory Site vegetation map (Shive et al. 2019) was clipped to the boundary of the Howe Peak fire within the Idaho National Laboratory Site to estimate area burned for each class.

Vegetation Class	Area Burned (ac)	Area Burned (ha)
Crested Wheatgrass Ruderal Grassland	886.4	358.7
Big Sagebrush – Green Rabbitbrush (Threetip Sagebrush) Shrubland	713.9	288.9
Cheatgrass Ruderal Grassland	24.5	9.9
Green Rabbitbrush / Thickspike Wheatgrass Shrub Grassland and Needle and Thread Grassland	4.6	1.9

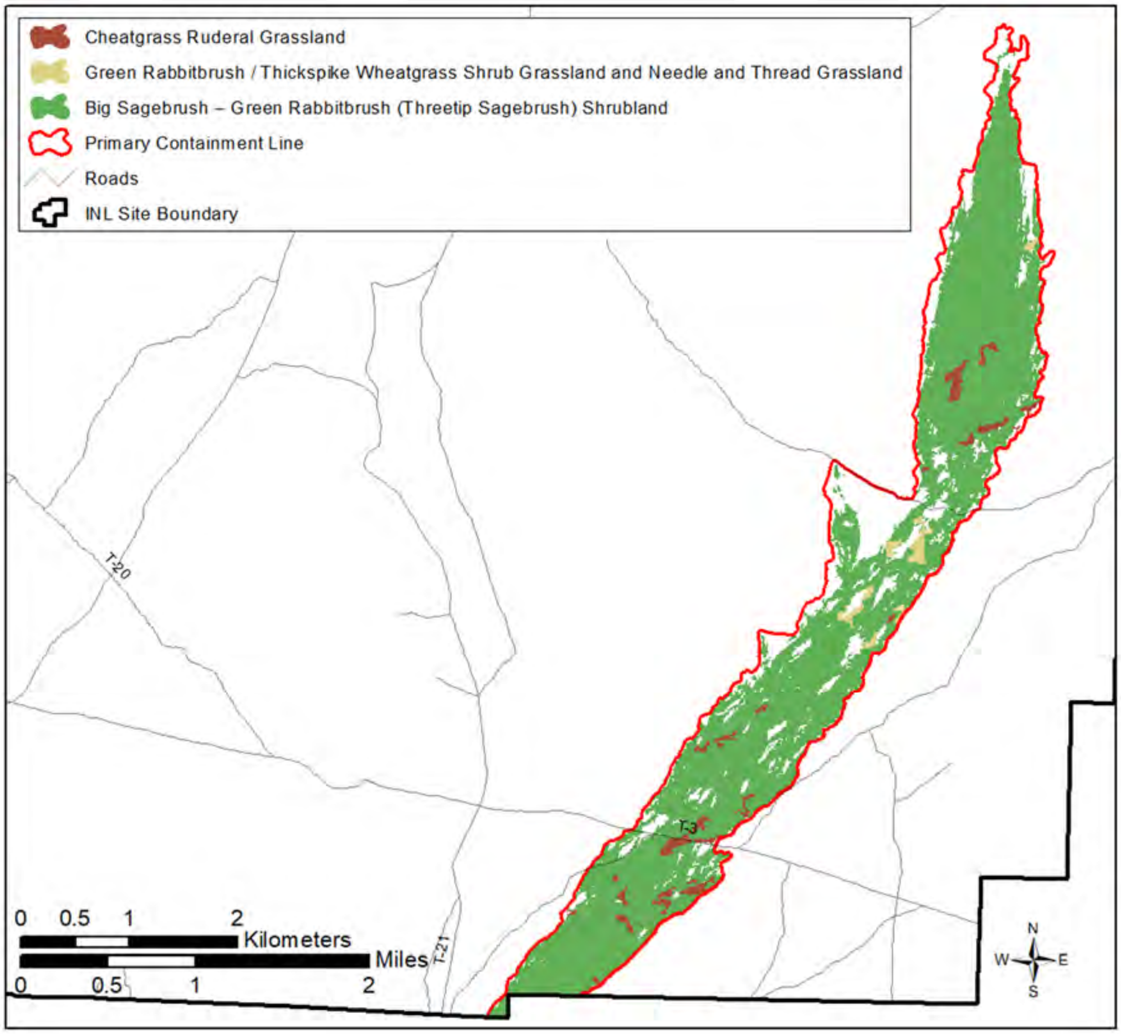

Figure 1-5. Vegetation classes (Shive et al. 2019) burned on the Idaho National Laboratory Site in the 2020 Telegraph Fire.

Table 1-2. Area of each vegetation class burned in the 2020 Telegraph Fire. The most recent Idaho National Laboratory Site vegetation map (Shive et al. 2019) was clipped to the boundary of the Telegraph Fire within the Idaho National Laboratory Site to estimate area burned for each class.

Vegetation Class	Area Burned (ac)	Area Burned (ha)
Big Sagebrush – Green Rabbitbrush (Threetip Sagebrush) Shrubland	1584.8	641.4
Cheatgrass Ruderal Grassland	63.0	25.5
Green Rabbitbrush / Thickspike Wheatgrass Shrub Grassland and Needle and Thread Grassland	27.3	11.1

There were three vegetation classes mapped within the Lost River Fire boundary including two shrublands, and one shrub grassland (Figure 1-6). The majority of area burned was assigned to the Green Rabbitbrush / Desert Alyssum (Cheatgrass) Ruderal Shrubland class (Table 1-3). This class represents plant communities where the shrub stratum is dominated by green rabbitbrush (*Chrysothamnus viscidiflorus*), but the herbaceous understory is dominated by non-native annuals. This class is characteristic of the area that had burned previously in the 2000 Tin Cup Fire. The second most common vegetation class within the Lost River Fire was the Big Sagebrush – Green Rabbitbrush (Threetip Sagebrush) Shrubland (Table 1-3). This class distribution was limited to small patches that had not burned prior to the Lost River Fire. The Big Sagebrush – Green Rabbitbrush (Threetip Sagebrush) Shrubland vegetation class is one of three classes that are combined to represent general sagebrush habitat for sage-grouse.

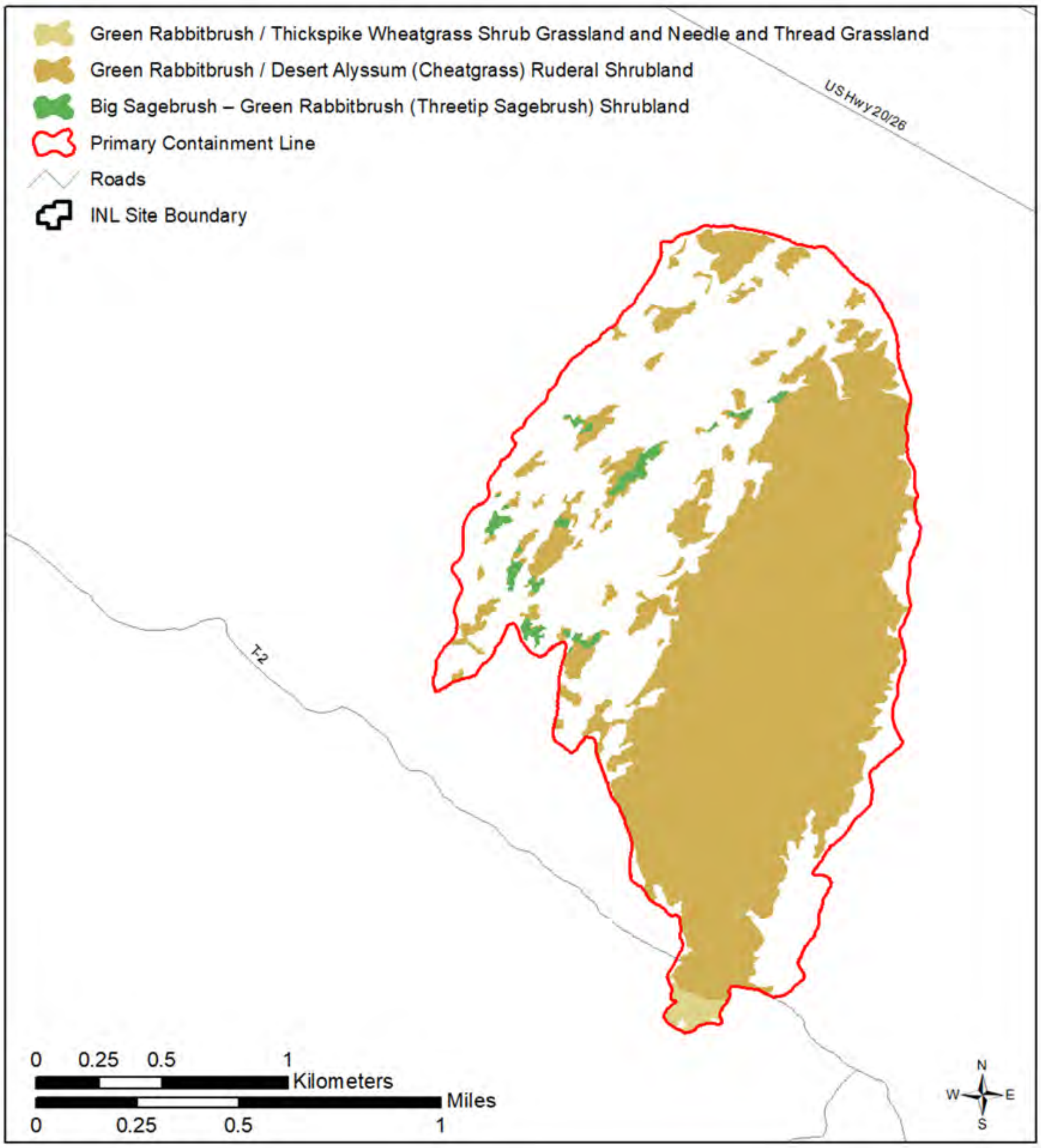

Figure 1-6. Vegetation classes burned in the 2020 Lost River Fire on the Idaho National Laboratory Site.

Table 1-3. Area of each vegetation class burned in the 2020 Lost River Fire. The most recent Idaho National Laboratory Site vegetation map (Shive et al. 2019) was clipped to the boundary of the Telegraph Fire to estimate area burned for each class.

Vegetation Class	Area Burned (ac)	Area Burned (ha)
Green Rabbitbrush / Desert Alyssum (Cheatgrass) Ruderal Shrubland	497.5	201.3
Big Sagebrush – Green Rabbitbrush (Threetip Sagebrush) Shrubland	10.7	4.3
Green Rabbitbrush / Thickspike Wheatgrass Shrub Grassland and Needle and Thread Grassland	6.9	2.8

There were three vegetation classes mapped within the Cinder Butte Fire boundary including two shrublands and one shrub grassland (Figure 1-7). The majority of area burned was assigned to the Big Sagebrush – Green Rabbitbrush (Threetip Sagebrush) Shrubland class (Table 1-4). This class is composed of a shrub layer along with a mostly native understory. The Big Sagebrush – Green Rabbitbrush (Threetip Sagebrush) Shrubland vegetation class is one of three classes that are combined to represent general sagebrush habitat for sage-grouse. The second most common vegetation class within the Cinder Butte Fire was the Green Rabbitbrush / Thickspike Wheatgrass Shrub Grassland and Needle and Thread Grassland (Table 1-4). Overall, there were no classes with a substantial non-native component present in the area prior to the fire.

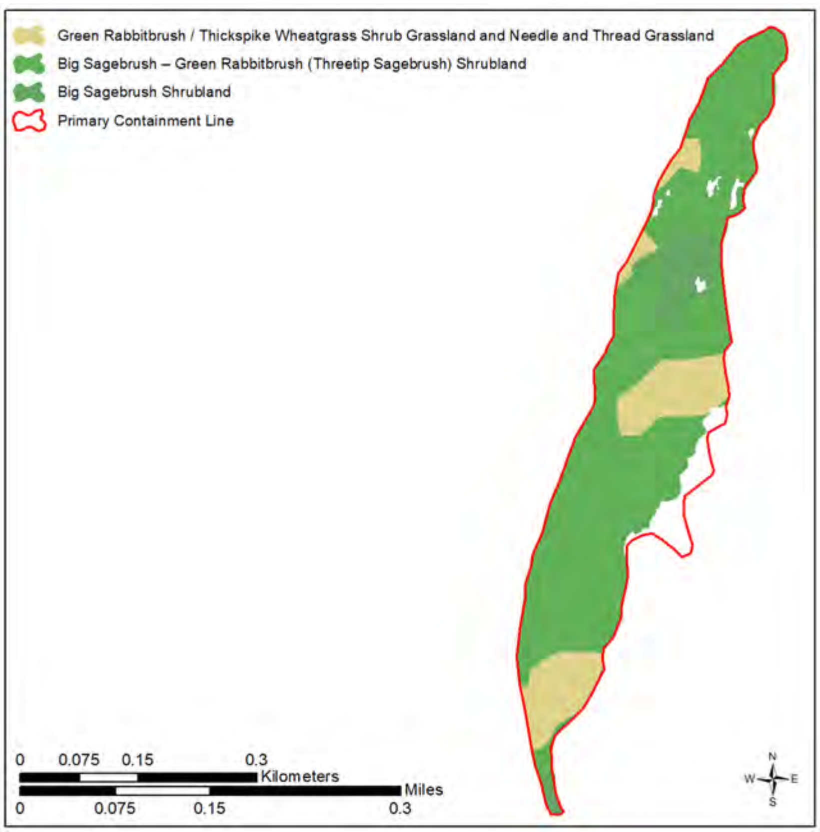

Figure 1-7. Vegetation classes burned in the 2020 Cinder Butte Fire on the Idaho National Laboratory Site.

Table 1-4. Area of each vegetation class burned in the 2020 Cinder Butte Fire. The most recent Idaho National Laboratory Site vegetation map (Shive et al. 2019) was clipped to the boundary of the Cinder Butte Fire to estimate area burned for each class.

Vegetation Class	Area Burned (ac)	Area Burned (ha)
Big Sagebrush – Green Rabbitbrush (Threetip Sagebrush) Shrubland	20.1	8.1
Green Rabbitbrush / Thickspike Wheatgrass Shrub Grassland and Needle and Thread Grassland	5.0	2.0
Big Sagebrush Shrubland	2.0	0.8

Ecological Condition of Vegetation

Pre-fire condition of vegetation in the areas burned by the 2020 wildland fires range from nearly pristine to severely degraded. Each of the four wildland fires had some of the Big Sagebrush – Green Rabbitbrush (Threetip Sagebrush) Shrubland, and Green Rabbitbrush / Thickspike Wheatgrass Shrub Grassland and Needle and Thread Grassland classes prior to burning in 2020. These classes contain plant communities in relatively good pre-fire ecological condition including mature big sagebrush (*Artemisia tridentata*) shrublands that have not recently burned and plant communities that had previously burned and had naturally recovered to a mix of green rabbitbrush shrublands and native grasslands. Dominant and co-dominant native perennial grasses in areas of good ecological condition that were affected by the 2020 wildland fires included the bunchgrasses, needle-and-thread (*Hesperostipa comata*), Indian ricegrass (*Achnatherum hymenoides*), bottlebrush squirreltail (*Elymus elymoides*), and the rhizomatous grass, thickspike wheatgrass (*Elymus lanceolatus*). Native forbs were abundant and diverse in many pre-fire plant communities. Some of the most frequently occurring species included: tapertip hawksbeard (*Crepis acuminata*), shaggy fleabane (*Erigeron pumilus*), Hood’s phlox (*Phlox hoodii*), flatspine stickseed (*Lappula occidentalis*), and western tansymustard (*Descurainia pinnata*). See Shive at al. (2019) for quantitative summaries and a more thorough description of these native plant communities.

Degraded communities that were present before the 2020 wildland fires were characterized by an abundance of non-native species. The Howe Peak Fire contained a large area of Crested Wheatgrass Ruderal Grassland which is dominated by crested wheatgrass, an introduced non-native known to be highly competitive with native vegetation. Other degraded communities within the 2020 wildland fires include Cheatgrass Ruderal Grassland, and Green Rabbitbrush / Desert Alyssum (Cheatgrass) Ruderal Shrubland classes. They tend to occur in areas with recurring disturbance such as low-lying topography that experience occasional flooding, basalt outcroppings with thin unstable soils, and areas that have burned previously. Several non-native species from the mustard family, as well as Russian thistle (*Salsola kali*) and saltlover (*Halogeton glomeratus*) generally dominated low-lying areas in poor ecological condition. Areas dominated or co-dominated by cheatgrass occurred most often on basalt outcroppings and in previous burn scars. However, not all previously burned areas were dominated by cheatgrass. Poor condition cheatgrass-dominated communities ranged from vegetation characterized by cheatgrass monocultures to communities with substantial cover from native grasses and/or green rabbitbrush (Shive et al. 2019).

Of the vegetative community types that were burned in the 2020 wildland fires, sagebrush shrublands were likely the most stable pre-fire. Total cover fluctuates the least from year to year and cover from annual weeds, including cheatgrass is generally the lowest in this vegetation type (Shurtliff et al. 2021). Annual vegetation cover fluctuations are typically greater in grasslands and cover from native, perennial grasses has been near the upper end of its historical range of variability over the past few years (Shurtliff et al. 2021). Cheatgrass cover increased notably in post-fire communities from 2016 through 2019 and has been relatively high in post-fire plant communities over the past few years (Shurtliff et al. 2021), though long-term vegetation data sets suggest cheatgrass cover trends are reversable and large fluctuations may be becoming more typical over the span of a decade (Forman and Hafla 2018). In general, areas without a sagebrush canopy are more susceptible to dominance from cheatgrass. It is widely distributed across the INL Site, occurring in all plant communities, but it rarely dominates within intact sagebrush habitat. Sagebrush plant communities are likely more resistant to cheatgrass dominance than areas recovering from wildland fire, a pattern that is particularly evident in wetter years with weather patterns that favor the invasive non-native annual grass (Shurtliff et al. 2021). Much of the annual variability associated with herbaceous species, both native and introduced, is likely related to total annual precipitation and seasonal timing of precipitation events (Forman and Hafla 2018, Shurtliff et al. 2021).

1.3.3 Summary of Wildlife Use

Numerous wildlife species depend upon the local high desert ecosystem: five species of fish, 48 mammal species, 200 bird species, one amphibian species, 10 reptile species (Vilord, In Preparation), and more than 1,240 invertebrate species (Hampton 2005) have been documented on the INL Site. Many mammal, bird, reptile, and invertebrate species were likely affected by the 2020 wildland fires. This may include the federally listed threatened species yellow-billed cuckoo (*Coccyzus americanus*), and the federally protected bald (*Haliaeetus leucocephalus*) and golden eagle (*Aquila chrysaetos*).

Of the species documented on the INL Site, nine bird and six mammal species are listed as Species of Greatest Conservation Need (SGCN) by the State of Idaho (IDFG 2017; Table 1-2), the majority of which are considered sagebrush obligates, meaning that they rely on sagebrush for survival. Sagebrush obligates listed as SGCN include sage-grouse, sage thrasher (*Oreoscoptes montanus*), sagebrush sparrow (*Artemisiospiza nevadensis*), ferruginous hawk (*Buteo regalis*), and pygmy rabbit (*Brachylagus idahoensis*). Other common or abundant sagebrush obligate species that have been documented on the INL include Brewer's sparrow (*Spizella breweri*), loggerhead shrike (*Lanius ludovicianus*), northern sagebrush lizard (*Sceloporus graciosus*) and sagebrush vole (*Lagurus curtatus*). These species were likely present in fire areas that contained sagebrush habitat. Preferring more grassland habitats, non-obligate SGCN species that were also likely to occur within the burned areas include burrowing owl (*Athene cunicularia*), bobolink (*Dolichonyx oryzivorus*), long-billed curlew (*Numenius americanus*), grasshopper sparrow (*Ammodramus savannarum*) and common nighthawk (*Chordeiles minor*).

Other common resident species on the INL Site that were likely affected by the fires include: elk (*Cervus elaphus*), mule deer (*Odocoileus hemionus*), pronghorn antelope (*Antilocapra americana*), coyote (*Canis latrans*), yellow bellied marmot (*Marmota flaviventris*), Ord's kangaroo rat (*Dipodomys ordii*), black-tailed jackrabbit (*Lepus californicus*), badger (*Taxidea taxus*), horned lark (*Eremophila alpestris*), western meadowlark (*Sturnella neglecta*), mourning dove (*Zenaida macroura*), vesper sparrow (*Pooecetes gramineus*), common raven (*Corvus corax*), short-horned lizard (*Phrynosoma douglassi*), Great Basin rattlesnake (*Crotalus oreganus* ssp. *lutosus*), gopher snake (*Pituophis catenifer*) and many others. Habitats for many of these species consist of both sagebrush and grasslands that were present prior to the 2020 fires.

Table 1-5. Idaho Species of Greatest Conservation Need that have been documented on the Idaho National Laboratory Site.

Common Name	Scientific Name	Ranking*
Burrowing Owl	*Athene cunicularia*	Tier 2
Common Nighthawk	*Chordeiles minor*	Tier 3
Ferruginous Hawk	*Buteo regalis*	Tier 2
Grasshopper Sparrow	*Ammodramus savannarum*	Tier 3
Greater Sage-Grouse	*Centrocercus urophasianus*	Tier 1
Long-billed Curlew	*Numenius americanus*	Tier 2
Sage Thrasher	*Oreoscoptes montanus*	Tier 2
Sagebrush Sparrow	*Artemisiospiza nevadensis*	Tier 2
Short-eared Owl	*Asio flammeus*	Tier 3
Bighorn Sheep	*Ovis canadensis*	Tier 2
Hoary Bat	*Lasiurus cinereus*	Tier 2
Little Brown Myotis	*Myotis lucifugus*	Tier 3
Pygmy Rabbit	*Brachylagus idahoensis*	Tier 2
Townsend's Big-eared Bat	*Corynorhinus townsendii*	Tier 3
Western Small-footed Myotis	*Myotis ciliolabrum*	Tier 3

*Tier 1 SGCN is the highest priority for the State Wildlife Action Plan and represents species with the most critical conservation needs (i.e., an early-warning list of taxa that may be heading toward the need for Endangered Species Act listing).

*Tier 2 SGCN are secondary in priority and represents species with high conservation needs— that is, species with longer-term vulnerabilities or patterns suggesting management intervention is needed but not necessarily facing imminent extinction or having the highest management profile.

*Tier 3 SGCN includes a suite of species that do not meet the above tier criteria, yet still have conservation needs. In general, these species are relatively more common, but commonness is not the sole criterion and often these species have either declining trends range wide or are lacking in information.

Sage-Grouse and the Sage-Grouse Conservation Area

The Telegraph Fire was the only fire that occurred close to a sage-grouse lek. Although the fire did not burn through the actual lek location, it came within 53 meters (174 ft.) of the lek and impacted a good portion of the 1 km protection buffer around the lek.

The entirety of the Lost River, Telegraph and Howe Peak fires and a portion of the Cinder Butte fire occurred within the boundary of the SGCA (Figure 1-1). Except for the Lost River Fire, which contained very little sagebrush habitat, each fire burned some sagebrush resulting in a total of 1,067.4 ha (2,637.6 ac) of sagebrush habitat being removed from the SGCA (see discussion in Section 1.2.2. The current estimated post-fire acreage of sagebrush habitat in the SGCA is 77,486 ha (191,472.1 ac) representing a 1.4% decrease from the original CCA baseline (Shurtliff et al. 2021).

Critical Habitat Areas

Studies conducted by various private and government entities have identified areas on the INL Site that are crucial for winter survival of pronghorn and year-round sage-grouse. In 2009-2010, a study conducted by Lava Lake Institute and Wildlife Conservation Society showed that pronghorn travel from Carey, approximately 50 miles north to winter on the INL Site (personal communication with Todd Stefanic – NPS-Craters of the Moon National Monument). Pronghorn are also known to fawn on the INL Site (personal communication with Brett Panting- IDFG) and reside on the INL Site throughout the entire year. Wintering and fawning areas were likely impacted by the Lost River, Cinder Butte and Howe Peak fires. Additionally, current data collected by BLM show that the eastern portion of the INL Site provides year-round habitat for sage-grouse (Figure 1-8).

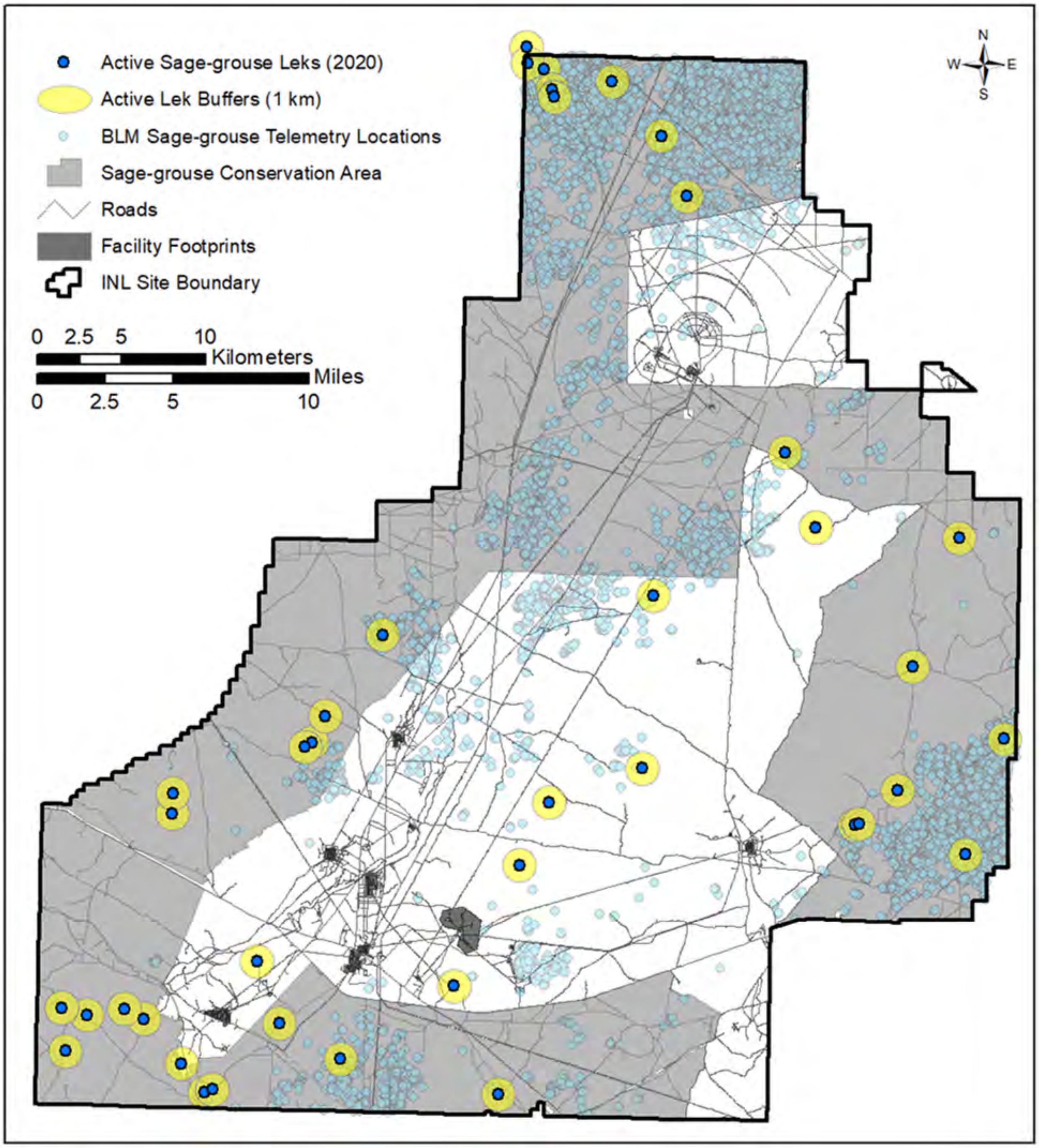

Figure 1-8. Distribution of radio-collared sage grouse, active sage-grouse leks, and the Sage-grouse Conservation Area boundary on the Idaho National Laboratory Site.

2.0 OBJECTIVES

Several restoration options for improving post-fire recovery are addressed for each of the four 2020 wildland fires. As with the Sheep Fire Ecological Resources Recovery Plan, natural resource recovery treatment and/or planting options are organized into four recovery objectives:

1) Soil stabilization for erosion and weed control on areas affected by fire suppression activities,
2) Cheatgrass and noxious weed control within the larger burned area,
3) Native herbaceous recovery, and
4) Sagebrush habitat restoration.

Oftentimes, it is most appropriate to conduct site-specific monitoring to evaluate local conditions and natural vegetation recovery status before deciding to pursue post-fire treatment. Each of the four recovery objectives and associated potential treatment options along with site-specific monitoring needs are thoroughly evaluated below but monitoring needs and treatment options are summarized by fire in Table 2-1. Appropriate monitoring strategies are discussed in Section 3.

Table 2-1. Summary of post-fire monitoring and restoration options for four 2020 wildland fires on the Idaho National Laboratory Site.

Summary of Post Fire Monitoring and Restoration Options
Howe Peak Fire
Monitor containment lines for herbaceous recovery and address deficiencies, as necessary.
Complete a noxious weed inventory throughout the burned area, including containment lines and include results in INL noxious weed management program.
Monitor “roads” created to access the fire during suppression activities for natural recovery. Consider signage and replanting, as necessary.
Monitor burned area for herbaceous recovery and consider cheatgrass treatment, as necessary.
Areas treated for cheatgrass should be evaluated for native perennial recovery and herbaceous replanting should be considered, as necessary.
All weed treatments and revegetation efforts should be monitored for efficacy.
Telegraph Fire
Monitor containment lines for herbaceous recovery and address deficiencies, as necessary.
Complete a noxious weed inventory throughout the burned area, including containment lines and include results in INL noxious weed management program.
Monitor burned area for herbaceous recovery and consider cheatgrass treatment, as necessary.
BLM will adjust allotment grazing permits to allow for post-fire herbaceous recovery; this typically spans two growing seasons or as is consistent with their Allotment Environmental Assessments.
Sagebrush seedlings should be replanted in as much of the fire as is accessible to planting crews, approximately 106.4 ha (263 ac), or 41,300 seedlings.

Summary of Post Fire Monitoring and Restoration Options
All weed treatments and revegetation efforts should be monitored for efficacy.
Lost River Fire
Monitor containment lines for herbaceous recovery and address deficiencies, as necessary.
Complete a noxious weed inventory throughout the burned area, including containment lines and include results in INL noxious weed management program.
Monitor burned area for herbaceous recovery and consider cheatgrass treatment, as necessary. Any proposed cheatgrass treatments should be consistent with current and future grazing utilization of the area, in review with BLM.
Areas treated for cheatgrass should be evaluated for native perennial recovery and herbaceous replanting should be considered, as necessary. Any proposed plantings should be consistent with current and future grazing utilization of the area, in collaboration with BLM.
BLM will adjust allotment grazing permits to allow for post-fire herbaceous recovery; this typically spans two growing seasons or as is consistent with their Allotment Environmental Assessments.
BLM should adjust allotment grazing permits to allow for post-fire herbaceous recovery; this typically spans two growing seasons or as is consistent with their Allotment Environmental Assessments and grazing permits.
All weed treatments and revegetation efforts should be monitored for efficacy.
Cinder Butte Fire
Monitor containment lines for herbaceous recovery and address deficiencies, as necessary.
Complete a noxious weed inventory throughout the burned area, including containment lines and include results in INL noxious weed management program.
Monitor “roads” created to access the fire during suppression activities for natural recovery. Consider signage and replanting, as necessary.
Monitor burned area for herbaceous recovery and consider cheatgrass treatment, as necessary.
BLM will adjust allotment grazing permits to allow for post-fire herbaceous recovery; this typically spans two growing seasons or as is consistent with their Allotment Environmental Assessments.
All weed treatments and revegetation efforts should be monitored for efficacy.

2.1 Soil Stabilization for Erosion and Weeds Control

Soil stabilization is often the first recovery objective for natural resources to be addressed post-fire. Erosion, primarily from wind, can move large volumes of soil in a relatively short post-fire timeframe (Sankey et al. 2012). Soil disturbance in the area affected by the 2020 wildland fires may result in a direct loss of existing native vegetation and will provide opportunities for invasive and other non-native plants to become established. Management actions such as re-grading of the containment lines and preventing vehicle traffic on the disturbed soils can reduce the efforts required for revegetation and weed management. Because of the high hazard for wind erosion in disturbed soils, fugitive dust and blowing sand can be expected and may cause potential off-site impacts downwind of disturbed areas. It is also likely that areas within the fire footprint will erode and down-cut under certain types of precipitation events such as those associated with significant thunderstorms and rain-on-snow events. Instances of needed road repair such as gravel or grading on T-roads impacted by blowing soil and surface water may also result from post-fire erosion.

2.1.1 Summary of Soil Disturbance from Fire Suppression Activities

The Wildland Fire Management EA (DOE 2003) makes the recommendation to "evaluate the necessity to revegetate all or portions of the areas impacted by fire suppression activities." The first step towards stabilizing soils disturbed during fire suppression activities is identifying the extent of impacted area. Field-based data collected during surveys conducted by the CRMO were used for characterizing areas disturbed by containment lines. Table 2-2 displays the total length of containment lines created by fire suppression activities during four of the 2020 wildland fires.

Table 2-2. Length of containment lines created by fire suppression activities during four 2020 wildland fires on the Idaho National Laboratory Site. Lengths were determined by the Cultural Resource Management Office using GPS field data collected within a few days of containment of each fire.

Fire	Length of Containment Lines (km)	Length of Containment Lines (mi)
Howe Peak Fire	7.9	4.9
Telegraph Fire	27	17
Lost River Fire	10.5	6.5
Cinder Butte Fire	2.3	1.4

High resolution imagery was also used to delineate other types of soil disturbance including new two-track access points, damage to existing two-track roads, and staging/laydown areas. This analysis is conducted to support reporting for the CCA and occurs once every two years. Results from 2020 indicate the majority of new two-track features were in proximity to recent wildland fires. In previous years, most new two-tracks consisted of side-loops from existing roads and shortcuts between roads that were generally short distances. However, the most recent analysis shows that two-track linear features have substantially increased in distance and density near containment lines, inside the burned area and also in unburned regions that provide access to the fire (see Figure 2-1 for an example).

2.1.2 Considerations for Improving Post-Fire Recovery of Exposed Soils

Recontour Containment Lines and Seed with Native Grass Mix

Containment lines should be recontoured and planted with a native grass mix. Ideally, containment lines should be recontoured prior to demobilization of the heavy equipment used for fire suppression efforts (INL 2017). Refer to the Sheep Fire Ecological Resource Post Fire Recovery Plan section 2.1.2 (Forman et al. 2020) for recommended recontouring specifications of containment lines.

The INL Site Revegetation Guide (INL 2012) recommends mechanical planting with a drill on disturbed soils. However, it may not be possible or feasible to pull a drill behind a dozer or other heavy equipment available during the effort to recontour the containment lines. Applying seed to the soil surface via hand or mechanical spreader (broadcast seeding) is another option discussed in the INL Revegetation Guide (INL 2012).

A combination of native grasses is recommended for reseeding containment lines on the INL Site. Native grass seed should be used from locally appropriate cultivars and can be obtained commercially at a lower cost and shorter timeframe than site-specific collection. Each of the 2020 wildland fires took place in different vegetation classes which are made up of different native species; however, some species are widely distributed and present across a range of vegetation classes. Table 2-3 contains species that are suitable for revegetation of containment lines on all four fires. Application rates should be calculated according to the INL Revegetation Guide (INL 2012).

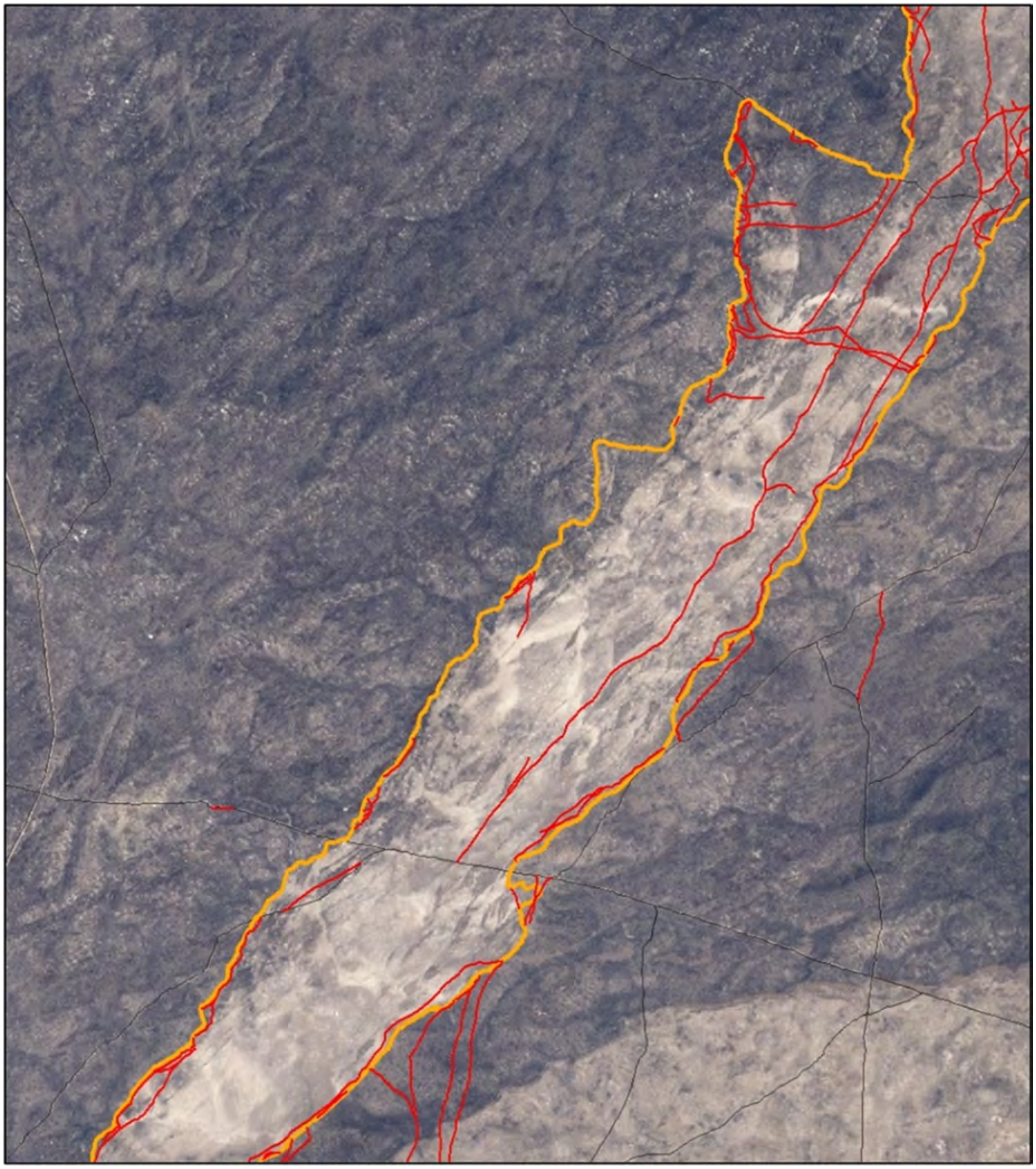

Figure 2-1. A portion of the Telegraph Fire that burned on the Idaho National Laboratory Site in 2020. The bladed containment line boundary is displayed in orange and the red lines represent new two-track linear features mapped using high resolution imagery collected after the fire.

Table 2-3. Species recommended for seeding containment lines created during fire suppression activities and burned areas from the 2020 wildland fires on the Idaho National Laboratory Site.

Scientific Name	Common Name
Poa secunda	Sandberg bluegrass
Elymus elymoides	bottlebrush squirreltail
Elymus lanceolatus	thickspike wheatgrass
*Pseudoroegneria spicata**	bluebunch wheatgrass
Pascopyrum smithii	western wheatgrass
Achnatherum hymenoides	Indian ricegrass
Chrysothamnus viscidiflorus	green rabbitbrush
Artemisia tridentata ssp. *wyomingensis*	Wyoming big sagebrush

*Species not recommended for reseeding in Cinder Butte Fire

It should be noted that containment lines were recontoured and reseeded with native seed the fall following the 2020 wildland fires, prior to completion of this plan. Because these activities are covered under the current EA as emergency post-fire actions, they will often be completed prior to a formal recommendation. Areas that have been reseeded, and any areas where reseeding was not determined to be a priority, should both be monitored for adequate recovery (see Section 3.2.1 for monitoring guidance).

Sign and/or Barricade the Containment Lines to Prevent Traffic

On previous wildland fires, continued use of the containment lines by vehicles, up to several years post-fire, was noted (Blew et al. 2010). Continued use of containment lines and other linear features created for fire suppression such as roads is detrimental to both natural recovery and to active restoration efforts. Traffic on containment lines also reinforces habitat fragmentation and potential weed vectors. Therefore, once the need to access the containment lines to support immediate recontouring and revegetation efforts has been addressed, barriers should be added to all containment lines where they bisect roads to prevent vehicular travel on the recovering lines on all the 2020 wildland fires. This can either be done with signage, jersey barriers, or simply with T-posts placed close enough together to deter traffic. A brief memo reminding all fieldworkers to avoid vehicle travel on containment lines prior to the 2021 field season may also be helpful.

Containment Lines Should be Monitored/Sprayed for Weeds

Because containment lines are a direct effect of the firefighting effort, noxious weeds that appear in the disturbed areas following fire must be managed. Noxious weed management is covered in the INL's Sitewide Noxious Weed Management Plan (INL 2013) and is outlined in Section 2.2.2. Spraying or hand pulling and bagging weeds on containment lines during the recontouring and reseeding efforts would be efficient and would help prevent further spreading of weeds during restoration activities of all the 2020 wildland fires. Revisiting high risk areas at least once annually to assess non-native and noxious plant establishment is recommended (see Section 3.3.1 for monitoring guidance).

Monitor Fire Suppression Access Roads

Two of the 2020 wildland fires, the Telegraph Fire and the Cinder Butte Fire, were accessed through good-condition sagebrush habitat during fire suppression response efforts. The access roads can be visualized as two-track features in the post-fire satellite imagery (Figure 2-2). These roads should be monitored to ensure that they do not continue to be used as they could contribute to sagebrush habitat fragmentation and become a vector for weed spread if they are reinforced and become permanent. If they show signs of continued use, they should be signed or barricaded at the access point. Additionally, if there is no ongoing disturbance, these features should recover naturally and become less visible over time. If monitoring efforts indicate recovery is not occurring as expected after a few growing seasons, the WFMC should consider replanting these areas with native grasses.

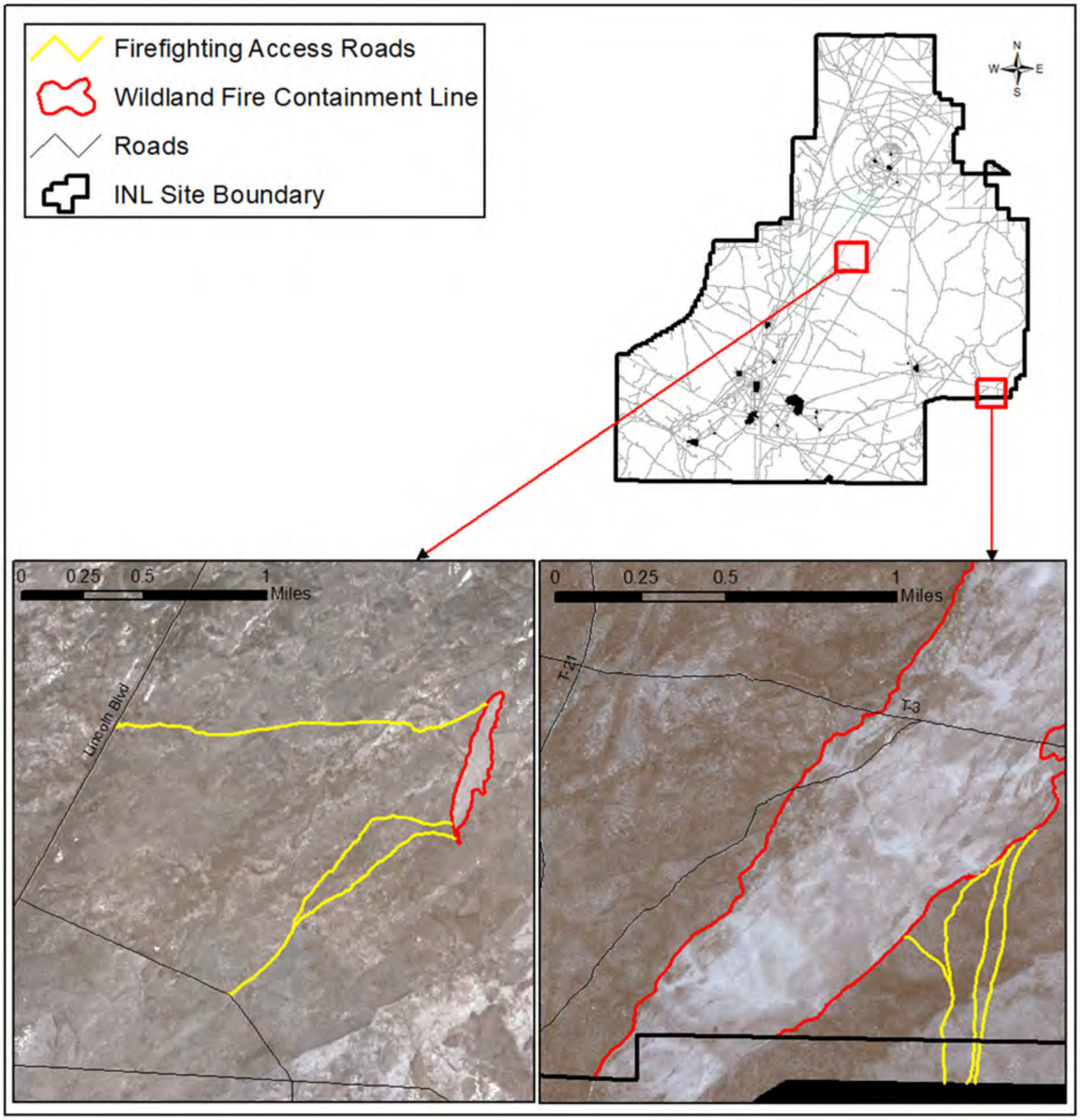

Figure 2-2. Access roads created during fire suppression activities on the 2020 Cinder Butte and Telegraph Fires on the Idaho National Laboratory Site.

2.2 Cheatgrass and Noxious Weed Control

The risk of increased pressure by non-native species is a critical post-fire concern, and reducing that risk is an important natural resource recovery objective. Currently, there are 13 documented noxious weeds species widely distributed on the INL Site (Hafla 2004). There are also several other non-native species of concern (not classified as noxious) that are widely distributed across the INL Site. These are frequently encountered, and are known to form large, degraded stands on the Site (Shive et al. 2019). These species include cheatgrass, crested wheatgrass, and a number of introduced, annual forbs including saltlover, Russian thistle, desert alyssum (*Alyssum desertorum*), kochia (*Bassia scoparia*), and various mustards (*Sisybruim* spp. and *Descurainia* spp.). To successfully address the risks to sagebrush habitat recovery posed by non-native species, control strategies for all noxious weeds and other undesirable non-native species should be addressed as an integral component of the fire recovery plan.

2.2.1 Identification of Areas That May Benefit from Treatment

Within the footprint of the Howe Peak Fire, there was one approximately 9.9 ha (24.5 ac) patch of vegetation that was dominated by cheatgrass prior to the fire (Table 1-1). Although this patch is large enough to consider for treatment, it is adjacent to agriculture. The risk of overspray or drift poses significant liability, and this area is not located within contiguous habitat that would greatly benefit from cheatgrass control. Therefore, this area is not a good candidate for treatment and should be removed from future consideration. Crested wheatgrass dominates more than half of the area affected by the Howe Peak Fire on the INL Site (Figure 1-4). This introduced, perennial grass often forms very stable monocultures (see Forman et al. 2020 for further discussion). While these grasslands provide poor habitat for native animals, they are resistant to cheatgrass invasion and are unlikely to require treatment.

The most abundant pre-fire vegetation classes were characterized by native herbaceous understories in the Telegraph Fire and Cinder Butte Fire. Patches that were dominated by cheatgrass prior to those fires were small and widely distributed (Figure 1-5 and 1-7). Areas that are in good ecological condition pre-fire, as evidenced by diverse native understories, generally recover to healthy post-fire communities naturally on the INL Site (see Forman et al. 2020 for further discussion). For this reason, cheatgrass treatment is not likely to be necessary on the Telegraph Fire and Cinder Butte Fire, but the area should be monitored to ensure natural recovery is occurring as expected.

Much of the area affected by the Lost River Fire was burned previously in the 2000 Tin Cup Fire and approximately 201.3 ha (497.5 ac) is characterized by a green rabbitbrush-dominated shrub overstory and an abundance of introduced annuals in the understory (Figure 1-6). Cheatgrass treatment would be effective long-term only if there are enough remnant perennial grasses and forbs to recover and dominate the plant community post-treatment. Otherwise, the area would need to be planted with native grasses (see Section 2.3.2) and grazing management would need to be considered before planting. The current and planned use as a grazing allotment would need to be reviewed to evaluate the efficacy of planting. If the area is currently overutilized due to salt and/or water placement, or trailing activity, planting natives would not likely have a positive impact on the long-term recovery of the plant community. Likewise, if planned range improvements will increase the livestock traffic to the area in the future due to salt and/or water placement, planting will not likely have a positive impact long-term. A site assessment to evaluate current ground conditions and discussions with BLM would need to occur before this site should be further considered for cheatgrass treatment and possible herbaceous replanting.

Areas affected by wildland fire are at increased risk for invasion by noxious weeds and remain so for several years, until a diverse native community is reestablished. Noxious weeds and other invasive plants are one of the largest disruptors of ecosystem function. Their vigorous growth and prolific reproductive capabilities cause changes in soil chemistry, hydrological conditions, and fire regimes that favor their growth and spread and impede natural succession. All areas impacted by the 2020 wildland fires, including areas disturbed by wildland fire suppression activities should be inventoried and treated for noxious weeds for at least five years post-fire. After fire related monitoring and treatment is complete, these areas should be included in the overall INL Site weed control program.

2.2.2 Considerations for Improving Post-Fire Recovery by Limiting Weed Spread

Apply a Pre-emergent Herbicide to Areas at Greatest Risk for Cheatgrass Dominance

The only area under consideration for post-fire cheatgrass control from the 2020 wildland fires is approximately 201.3 ha (497.5 ac) in the Lost River Fire. Cheatgrass control should only be pursued if there is either enough remnant native, perennial species to recover naturally or the WFMC is willing to follow up with native seeding. BLM should also be engaged prior to any treatment plans to ensure those plans are consistent with the current and planned future grazing use of the area.

Several herbicides have been used in sagebrush steppe to control cheatgrass and have achieved various levels of success. Imazapic is a pre-emergent chemical herbicide that is commonly used for cheatgrass control across the arid West; it is becoming an agency standard and, when used correctly, it can reduce cheatgrass effectively in the short term (Applestein et al. 2018). Weed-suppressive bacteria have also been considered as an option for cheatgrass control on the INL Site. However, at the time of this publication, there were no commercially available sources for these bacteria and results of recent studies have failed to confirm their efficacy (Lazarus and Germino 2019). Cultural practices, like hand-pulling, mowing, and disking, substantially increase the likelihood of successful control, especially when combined with chemical herbicides.

The use of Plateau® or Panoramic® 2SL (Imazapic) is a reasonable approach to cheatgrass control; however, there are additional chemical herbicides that should be considered. Local agencies have recently reported high success rates in controlling cheatgrass using Rejuvra® (Indaziflam). This herbicide is a pre-emergent herbicide which is best applied during the late fall, winter or spring shortly after a fire; at the INL Site the optimal application window is September 15 to October 15. It is most effective when the thatch layer has been reduced, but it should not be applied before soils have stabilized to prevent down-wind movement. This timing also protects established grasses, forbs and shrubs since they are not actively growing. Precipitation is needed to activate the herbicide, but it should not be applied during heavy rain events nor to frozen or snow-covered ground. Rejuvra® has minimal post-emergent activity and generally does not control weeds that have emerged. As always, this product should be applied as specified on the label and in compliance with conditions specified resulting from NEPA review. The benefits of Rejuvra® are:

- Selectively controls cheatgrass and 74 broadleaf weeds including saltlover and Russian thistle
- Established native grasses and forbs are not harmed
- Reports of residual control range from 8 months to 3 years
- Unique mode of action to help manage herbicide resistance
- Odorless and non-staining to surfaces
- Minimal PPE requirements when compared to traditional IVM herbicides
- Low use rates
- Fewer applications required results in reduced costs
- Not a federally restricted-use herbicide
- Is already included on the INL Site list of approved chemicals.

Both Imazapic and Indaziflam are noted to be most effective when good soil contact can be achieved. Therefore, at least a portion of the prioritized treatment area should be sprayed as soon as soils have stabilized post-fire. It will not likely be feasible to treat all at-risk areas within that time-frame and some areas may still benefit from chemical application up to several years post-fire. A phased implementation approach would allow for ongoing cheatgrass treatment. Data from the INL Site suggest that cheatgrass abundance may remain relatively low for several years post-fire before beginning to increase (Forman et al. 2013; Taylor et al. 2014); this allows some lag time during which cheatgrass treatment may be effective in at-risk areas and chemical effectiveness doesn't appear to decrease until cheatgrass cover reaches about 40% absolute cover (Applestein et al. 2018). Treated areas should be monitored and evaluated to determine if additional actions are needed (see Section 3.2.1 for monitoring guidance).

Conduct a Weed Inventory and Treat Noxious Weeds

Noxious weed species that have been documented on the INL Site and are of greatest concern are thistles, knapweeds, and Rush skeletonweed (*Chondrilla juncea*); however, all weeds identified in Table 2-4 should be inventoried and treated to prevent a serious infestation. A noxious weed survey typically includes surveying the target area and documenting the presence of individual weeds or larger infestations of weeds. Weeds should be treated using chemical herbicides or other appropriate control methods. Large infestations within depauperate native communities should also be considered for revegetation after noxious weeds have been controlled as that is the most effective long-term control strategy. Noxious weed surveys should begin on the burned area during late spring/summer 2021 and continue for several years post-fire. All treatments should be implemented following the guidance provided in the INL Site Noxious Weed Management Plan (INL 2013).

Table 2-4. List of Noxious and Invasive Weeds on or around the Idaho National Laboratory Site, Control Methods and Timing of Treatment.

Common Name (Scientific Name)	Difficulty of Control	Administrative Control	Mechanical Control	Best time to apply Chemical Control
Black Henbane (*Hyoscyamus niger*)	Easy	None	Pulling, digging, or mowing repeatedly	Spring
Buffalobur (*Solanum rostratum*)	Easy	Establish healthy competitive vegetation	Pulling, digging, or mowing repeatedly	Spring to early summer (prior to flowering)
Canada Thistle (*Cirsium arvense*)	Moderate to Difficult	None	Mowing every 3-4 weeks	Spring and Fall
Field Bindweed (*Convolvulus arvensis*)	Easy	None	Tilling, every 3 weeks for 2 years.	Late Spring through Fall
Hoary Alyssum (*Berteroa incana*)	Easy	Establish healthy competitive vegetation	Pulling, digging, tilling	Spring
Spotted Knapweed (*Centaurea stoebe*)	Moderate	Establish healthy competitive vegetation	Mowing, pulling, tilling,	Spring and Fall
Russian Knapweed (*Acroptilon repens*)	Moderate			
Leafy Spurge (*Euphorbia esula*)	Moderate to Difficult	Establish healthy competitive vegetation, targeted grazing	Not recommended	When in flower
Musk Thistle (*Carduus nutans*)	Easy	Establish healthy competitive vegetation	Digging or pulling to remove root crown 2-4" beneath soil, mowing repeated every 3-4 weeks	Rosette stage
Bull Thistle (*Cirsium vulgare*)	Easy			
Scotch Thistle (*Onopordum acanthium*)	Easy			

Common Name (Scientific Name)	Difficulty of Control	Administrative Control	Mechanical Control	Best time to apply Chemical Control
Whitetop/Hoary Cress (*Lepidium draba*)	Moderate	Manage for grassland health	Hand-hoeing 4-week intervals	Spring
Rush Skeletonweed (*Chondrilla juncea*)	Difficult	Manage for healthy natural vegetation	Not recommended	Rosette Stage (Fall and Early Spring)
Perennial pepperweed (*Lepidium latifolium*)	Difficult	Establish healthy competitive vegetation, targeted grazing	Not recommended	Spring to early summer (prior to flowering)
Puncture Vine (*Tribulus terrestris*)	Easy	Establish healthy competitive vegetation, 4-6” mulch	Hand-pulling, shallow tilling	Post emergence (prior to seed production)
Cheatgrass* (*Bromus tectorum*)	Difficult	Establish healthy competitive vegetation	Hand pull or hoe small patches	Fall to early spring
Crested Wheatgrass* (*Agropyron cristatum*)	Difficult (need to use two or more control methods)	None. Do not seed with this species.	Mowing prior to seed production (5cm or lower)	When flowering but before they go to seed (typically 8-15 cm tall)
Saltlover (*Halogeton glomeratus*)	Easy	Reduce soil disturbance and establish healthy native vegetation	Tilling and seeding with native species	Early-Summer
Russian Thistle** (*Salsola kali*)	Difficult	Reduce soil disturbance and establish healthy native vegetation	Mowing prior to seed production	Pre-emergent on bare soil (prior to seed germination) Post-emergent (early seedling stage)
Desert Alyssum (*Alyssum desertorum*)	Easy	Reduce soil disturbance and establish healthy native vegetation	Mowing prior to flowering	Late fall or early spring prior to seed production
Kochia** (*Bassia scoparia*)	Difficult	Reduce soil disturbance and establish healthy native vegetation	Light tillage when very young (fall or early spring)	As soon as temps remain above 55°F for a few days
Various Mustards (*Sisybruim* spp. and *Descurainia* spp.)	Easy	Establish healthy competitive vegetation	Mowing prior to seed production	Late fall to early spring while in rosette stage

* not on the state noxious weed list, however an invasive introduced species of concern on the INL Site.

** these species are known to develop herbicide-resistant biotypes. Avoid repeated use of a single use herbicide or herbicides that have the same mode of action.

2.3 Facilitation of Native Herbaceous Recovery

Improving recovery of native herbaceous vegetation post-fire was identified as a natural resource recovery objective for several reasons. A healthy and diverse herbaceous layer can impart resilience to a plant community, which can improve natural recovery after a disturbance like wildland fire or in response to an abiotic stressor like drought. Resistance to weed invasions and infestations is generally much better in vegetation with an abundant native perennial component, and habitat for taxa ranging from plants and invertebrates to birds and mammals is improved by a healthy herbaceous stratum. Additionally, habitat benefits of an herbaceous layer in good ecological condition can include concealment, ameliorated microclimate conditions, improved forage, and improved prey resources.

2.3.1 Identification of Areas with Potentially Poor Native Herbaceous Recovery

As part of an integrated post-fire recovery plan for the 2020 wildland fires, prioritization of areas for planting native, herbaceous species should begin by identifying areas already known to have degraded understories prior to the fire through the most recent mapping effort. The Howe Peak Fire and the Lost River Fire were identified as having large areas with potentially poor native herbaceous recovery. The Howe Peak Fire contained approximately 359.7 ha (886.4 ac) of Crested Wheatgrass Ruderal Grassland (Figure 1-4), which lacks diversity and is of poor habitat value. However, chemical and mechanical suppression treatments are generally not effective long-term, and therefore would not improve native herbaceous recovery through restoration (Fansler and Mangold 2011). Until there are sound technical approaches available for restoring crested wheatgrass monocultures to native communities, there is little that can be done to improve this area.

The Lost River Fire was characterized by mostly degraded vegetation classes pre-fire (Figure 1-6) and could potentially benefit from invasive species suppression and native seed planting. As discussed in Section 2.2, several criteria should be considered prior to pursuing restoration at this location. If the WFMC decides that restoration is feasible on the Lost River Fire, this area should be visited and evaluated to verify that current conditions still justify cheatgrass treatment and native species planting. Along with all areas that are treated, both fires should be monitored for changes in ecological condition (see Section 3.3.1 for monitoring guidance).

2.3.2 Considerations for Improving Post-Fire Recovery of Native Herbaceous Vegetation

Rest the Allotment Portion of the Burn Area for at Least Two Growing Seasons

The 2020 wildland fires burned within four BLM grazing allotments. The Howe Peak Fire burned mostly in the Howe Peak Allotment with a small area burned in the Sinks Allotment. The Telegraph Fire burned entirely within the Twin Buttes Allotment and the Lost River Fire burned entirely within the Deadman Allotment. The Howe Peak Allotment is currently leased to a conservation organization and is not expected to be utilized by domestic livestock in the foreseeable future. Livestock grazing can negatively impact recovering herbaceous communities by damaging recovering herbaceous species and increasing the risk of spread and dominance of undesirable non-natives. Livestock closure in the burned area of the allotments is appropriate to facilitate soil stabilization and natural vegetation recovery. The BLM generally communicates closures to the affected permittees through modifications to grazing permits. The duration of the closure is at the discretion of the BLM, but locally, they often allow for at least two-post fire growing seasons, or until recovery objectives for the area have been met (see Section 3.3.1 for a general discussion of recovery objectives). Although the WFMC does not have authority over BLM grazing policy, they should consider the allotment rest period while planning other restoration strategies. For example, grazing exclusion will be important to allow for vegetation establishment in areas that have been seeded.

Plant Native Perennial Grasses in Areas with Poor Native Recovery

Areas that have been evaluated and determined to be a high priority for planting should first be treated for cheatgrass and other non-natives, if applicable, and then planted with the native grass mix recommended in Table 2-3. The Lost River Fire was the only 2020 wildland fire identified that would benefit from planting native perennial grasses based on evaluation of current vegetation data. Revegetation, if pursued, should be implemented according to the INL Revegetation Guide (INL 2012). Appropriate planting techniques may include using a mechanical drill, broadcasting, or broadcasting followed by imprinting with a roller. Areas planted with native seeds should be monitored to inform adaptive management responses to improve recovery (see Section 3.1.2 for monitoring guidance). For more information on planting detail and techniques refer to the Sheep Fire Plan (Forman et al. 2020) and the INL Revegetation Guide (INL 2012).

2.4 Sagebrush Habitat Restoration

Sagebrush is an essential component of the cold desert ecosystem of the Upper Snake River Plain, which makes hastening its return after a wildland fire a valuable natural resource recovery objective. Big sagebrush has been described as a foundation species, or a species that has disproportionate influence on other species and provides stabilizing effects on ecosystem processes (Prevey et al. 2010). Following wildland fire, sagebrush does not resprout; it must reestablish from seed. It can take from 50 to 120 years for it to return to pre-burn cover levels (Baker 2006). Overcoming these limitations to natural recovery by implementing assisted recovery techniques such as planting sagebrush seedlings may be necessary to address the large tracts of sagebrush habitat lost to wildland fire on the INL Site over the past 25 years.

2.4.1 Identification and Prioritization of Areas that Would Benefit from Planting Sagebrush

Sagebrush planting should be considered where it can improve high priority habitat and/or habitat connectivity; the CCA for sage-grouse (DOE-ID and USFWS 2014) provides additional information about how these areas have been identified and prioritized. Planting should also be considered in areas where risk of poor natural recovery is high and where conditions are unfavorable for sagebrush establishment from seed. Areas in the 2020 wildland fires that would benefit from planting sagebrush were identified based on criteria for planting sagebrush presented in the Sheep Fire Plan (Forman et al. 2020) and the criteria for identifying priority restoration areas in the CCA (DOE-ID and USFWS 2014).

Because much of the Howe Peak Fire within the INL Site boundary was dominated by crested wheatgrass prior to the fire, and because the area that was dominated by sagebrush prior to the fire is only accessible for planting by Highway 33, the Howe Peak Fire is not a high priority for sagebrush planting. Plant communities that are dominated by crested wheatgrass pre-fire are unlikely to return to optimal habitat because the herbaceous understory will continue to lack native diversity. Furthermore, any sagebrush that is planted in crested wheatgrass will not likely persist long-term as crested wheatgrass changes the function of the local ecosystem making water and nutrient resources less available for sagebrush persistence (see Forman et al. 2020 for discussion). Logistically, seedling planters are constrained by access roads and planting the area adjacent to a highway is unlikely to result in a meaningful habitat patch or connectivity between habitat patches; therefore, seedling planting efforts will probably yield more desirable results elsewhere.

The area burned in the Telegraph Fire was dominated by sagebrush with a diverse, native understory prior to the fire. It is also in proximity to an active sage-grouse lek and was used extensively by collared sage-grouse pre-fire. Two unimproved roads bisect the burned area, which provides access for planters (Figure 2-3). Planting sagebrush, where logistically feasible, would improve habitat value in proximity to the active lek, would provide some habitat connectivity across the burned area, and could shorten natural recovery times in areas adjacent to the planting by increasing potential seed sources.

Planters are limited to roughly 400 m – 500 m (0.25 mi – 0.31 mi) from a road. We buffered the unimproved roads that bisect the burned area by 400 m (0.25 mi) to determine the amount of area within this fire that would be accessible, which resulted in an area of 106.4 ha (263 ac). Over the past few years planters hired to install sagebrush on the INL Site have been planting at an average rate of 388 seedling/ha (157 seedlings/acre). At this planting rate, approximately 41,300 seedlings could be planted in the Telegraph Fire (Figure 2-3). As much of this area should be planted as funding allows because of the importance of sagebrush habitat in the area and the high potential for the area to return to a good condition plant community.

Sagebrush seedling planting is not likely to make a substantial impact toward improving sagebrush habitat, increasing habitat connectivity, or reducing habitat recovery time on the Lost River Fire and the Cinder Butte Fire. The Lost River Fire is located within the boundary of the much larger 2000 Tin Cup Fire and reestablishing a relatively small island of sagebrush within a larger area that is not currently dominated by sagebrush or contiguous with an area that is, will not result in high quality habitat. There are also ecological condition concerns and land use priorities that would need to be addressed before planting this area would be recommended (see Section 2.2 and 2.3 for discussion). Because the Cinder Butte Fire is relatively small and linear and in good ecological condition prior to the fire, it has a high likelihood of recovering naturally. It is also still surrounded by good-quality sagebrush shrublands, which provides sufficient habitat and a seed source for sagebrush recovery.

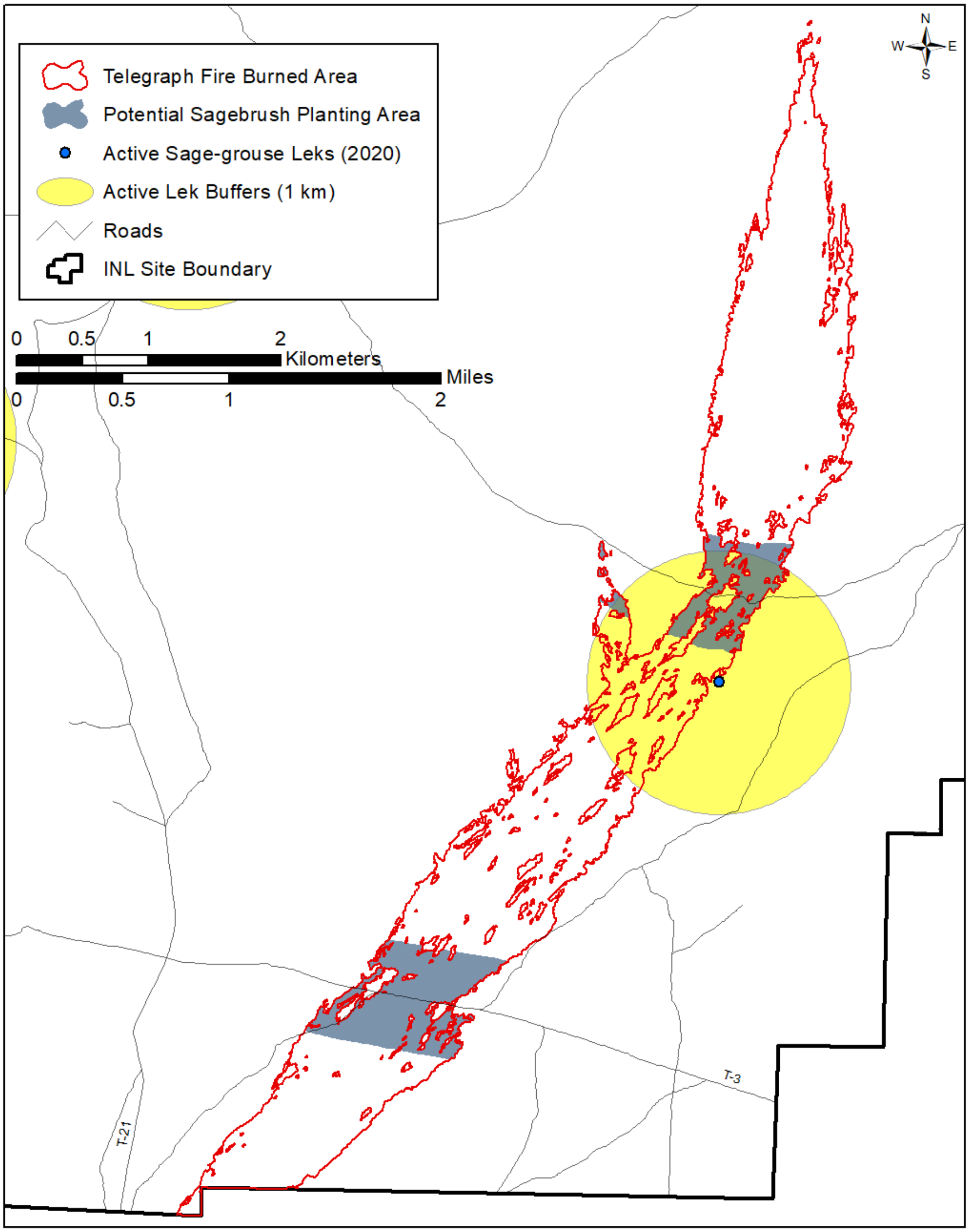

Figure 2-3. Areas proposed for sagebrush seedling planting within the 2020 Telegraph Fire on the Idaho National Laboratory Site.

2.4.2 Considerations for Improving Post-Fire Recovery of Sagebrush Habitat

Coordinate a Local Seed Collection Effort

The INL Wildland Fire Management EA (DOE 2003) and the INL Revegetation Guide (INL 2012) both encourage using locally adapted seed for sagebrush reestablishment. Short-term germination and establishment, and long-term viability are both typically greater for seed that is genetically like stands lost in a wildland fire (Meyer and Monson 1992; Germino et al. 2019). Options for collecting local sagebrush seed depend on the amount needed for the proposed action. If the amount of seed necessary to support sagebrush planting is limited to approximately 90.7 kg (200 lbs.) bulk or less, INL or the ESER Program could collect seed and have it processed at the U.S. Forest Service Region 6 Seed Extractory. Larger amounts of seed would need to be collected using a commercial seed collection company. A commercial company can collect seed on the INL Site with DOE-ID approval or on adjacent BLM land with the appropriate permit. The ESER Program has collected some local seed that is available for growing seedlings; it is currently stored with U.S. Forest Service Region 6 Seed Extractory.

Plant Sagebrush Seedlings Strategically to Address Specific Areas Where Accelerated Recovery Would be Beneficial to Habitat Recovery

Installation of healthy seedlings can reduce the recovery time for sagebrush in the areas they are planted. Seedling plantings require less sagebrush seed but involve more labor and specialized greenhouse facilities than other restoration options, which also make them more expensive than aerial or mechanical seeding. Seedlings should be considered an integral part of the 2020 wildland fires sagebrush recovery strategy, but they should be placed strategically where they can provide the greatest habitat benefit as a form of precision restoration. This approach aims to enhance restoration success by focusing restoration practices on ameliorating adverse conditions when and where they occur and away from applying singular landscape-wide approaches (Copland et al. 2021).

There are several regional greenhouses that specialize in growing sagebrush seedlings. The selected grower would need to be provided with seed collected from the INL Site. If annual funding is not sufficient to address the sagebrush seedling planting recommendations for the Telegraph Fire in one year, a subset of areas could be planted every year until those priority restoration areas best suited to seedling plantings have been addressed. Monitoring of seedling survivorship will help verify that the seed, greenhouse, and planting techniques used are effective (see Section 3.3.1 for monitoring guidance).

3.0 MONITORING

Effective monitoring plans are those that establish a process to collect, analyze, and use data to track the status of the natural resource objectives of interest and the effectiveness of any implemented actions. Monitoring plans that implement these criteria give project personnel the ability to adjust approaches in the form of adaptive management if results do not occur as expected. For this plan, potential monitoring approaches will be addressed in two sections, one for assessing areas at risk of poor natural recovery, and one for evaluating efficacy of treatments in areas that have received active restoration. The information presented here represents a summarized overview of several appropriate monitoring approaches. For a more detailed discussion about the importance of monitoring and options that have been considered, see the Sheep Fire Plan (Forman et al. 2020)

3.1 Measures of Success and Adaptive Management Responses

The primary purpose of monitoring is to detect measurable changes in condition and progress towards meeting clearly defined natural resource management objectives. Before determining if assisted recovery is required and prior to initiating a treatment, a project team should outline its assumptions about what a successful outcome would look like. This outline should include defining measurable benchmarks and expected timeframes so the project team and other stakeholders will have a realistic understanding of when they can expect to see short- and long-term results. The benchmarks defined for monitoring should be realistic, logical, and simple as these benchmarks will ultimately help guide decisions about whether further treatment should be considered.

An adaptive management framework is a common, practical methodology that can be applied to post-fire recovery to determine if a restoration action is necessary to meet natural resource recovery goals. Systematic monitoring is a key feature of any adaptive management framework (Meretsky and Fischman 2014). To determine whether the condition of a specific area warrants active restoration and to determine the success of any post-fire restoration actions, monitoring should be conducted, and results compared to the predetermined benchmarks discussed above. Monitoring results should be used to regularly assess whether recovery goals are being met within the expected timeframe and to adjust actions and expectations accordingly.

3.2 Areas at Risk of Not Recovering Naturally

3.2.1 Cheatgrass and Native Herbaceous Recovery Monitoring

Remote sensing techniques can provide a great overview of cheatgrass status across the areas affected by the 2020 wildland fires; however, finer-scale data will be required to further evaluate the need for treatment at specific locations. Specific areas of poor native herbaceous recovery are not always readily identified in imagery, so field-based techniques will be required to determine if planting is warranted in those at-risk locations. Field-based rapid assessment techniques provide simple field methods that collect useful data on measurable vegetation attributes to evaluate specific areas. All areas affected by the 2020 wildland fires should be monitored at a high level to ensure natural recovery is occurring as expected. Areas identified in Section 2 as being at increased risk of poor recovery should be monitored more closely. This includes areas that are at high risk of poor native recovery and cheatgrass invasion due to poor pre-fire condition and areas where natural recovery is uncertain, like two-tracks used as access points for fire suppression.

3.2.3 Noxious Weed Surveys

Surveys should be routinely conducted within areas impacted by the 2020 wildland fires to determine the presence, relative abundance and distribution of noxious weeds or invasive introduced species of concern. Priority for noxious weed surveys should be directed toward containment lines and those surveys should begin during the fall of 2020; the rest of the burned area should be surveyed beginning late spring of 2021. Ground-based survey methods are most effective and should be conducted when plants are flowering.

3.3 Efficacy of Planting and/or Treatment

This plan contains several treatment options for meeting natural resource recovery objectives after the 2020 wildland fires. Many of the treatment options discussed above include application of chemical herbicides, invasive species or noxious weed control, and planting. An effective approach to adaptive management requires monitoring of these treatments to determine whether they were effective, if they should be repeated, or if an alternate approach to meet recovery objectives should be considered. Field-based rapid assessment techniques are a simple and easy form of monitoring the above treatment options to assess the success of the treatment and aid in informing further adaptive management actions. Specifically, the 2020 wildland fire treatments that should monitored include: native grass recovery on containment lines, cheatgrass abundance in areas treated with chemical herbicide (if necessary), and sagebrush survivorship in areas planted with seedlings.

4.0 COST ESTIMATE

The cost table contains coarse cost estimates based on industry average costs for various treatments. It is only intended to provide the WFMC a starting point for discussions about how to prioritize the various natural resource recovery options provided in the plan. At the time the plan was finalized, costs were unknown for some line items, especially those associated with INL contractor labor. Because the cost table provides a high-level estimate, administrative and project management costs have not been included. Additional costs associated with NEPA analysis, cultural resource surveys, UXO clearance, or similar associated tasks have not been included.

Action Description	Unit Type	Unit Cost	FY20		FY21		FY22		FY23		FY24		Total Cost
			QTY	Cost	QTY	Cost	QTY	Cost	QTY	Cost	QTY	Cost	
Cheatgrass Treatment Herbicide	gallons	$1,220.00											$0.00
Cheatgrass Treatment Application	acres	$14.00											$0.00
Noxious Weed Treatment Herbicide	gallons	$150.00											$0.00
Noxious Weed Survey/Treatment	acres	$5.00			4,744	$23,720.00	4,744	$23,720.00	4,744	$23,720.00	4,744	$23,720.00	$94,880.00
Total				$0.00		$23,720.00		$23,720.00		$23,720.00		$23,720.00	$94,880.00
Native Grass Seed	acres	$171.00											$0.00
Plant Poorly Recovering Areas	acres	Unknown											$0.00
Total				$0.00		$0.00		$0.00		$0.00		$0.00	$0.00
Collect Local Seed	bulk lbs	$120.00					50	$6,000.00					$6,000.00
Seedling Planting	seedlings	$1.50						$0.00	41,300	$61,950.00			$61,950.00
Total				$0.00		$0.00		$6,000.00		$61,950.00		$0.00	$67,950.00
Cheatgrass Imagery Analysis	hours	$80.00					40	$3,200.00		$0.00	40	$3,200.00	$6,400.00
Survey Labor	hours	$30.00			540	$16,200.00	540	$16,200.00	540	$16,200.00	540	$16,200.00	$64,800.00
Survey Equipment/Supplies	total	$2,000.00			1	$2,000.00	0	$0.00	0	$0.00	0	$0.00	$2,000.00
Survey Mileage	miles	$0.56			840	$470.40	1,080	$604.80	1,080	$604.80	1,080	$604.80	$2,284.80
Report Labor	hours	$80.00			120	$9,600.00	120	$9,600.00	120	$9,600.00	120	$9,600.00	$38,400.00
Total				$0.00		$28,270.40		$29,604.80		$26,404.80		$29,604.80	$113,884.80
				$0.00		$51,990.40		$59,324.80		$112,074.80		$53,324.80	$276,714.80

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