Habitat Management Plan for Lost Creek Meadow (formerly Eagle's Rest)

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Management Plan prepared for the Bureau of Land Management, Northwest District

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Institute for Applied Ecology

PREFACE

IAE is a non-profit organization whose mission is conservation of native ecosystems through restoration, research and education. IAE provides services to public and private agencies and individuals through development and communication of information on ecosystems, species, and effective management strategies. Restoration of habitats, with a concentration on rare and invasive species, is a primary focus. IAE conducts its work through partnerships with a diverse group of agencies, organizations and the private sector. IAE aims to link its community with native habitats through education and outreach.

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Cover photographs: The Lost Creek Meadow *Sisyrinchium* site and a close-up of the flower of *Sisyrinchium hitchcockii*. Photos by IAE staff.

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Habitat Management Plan for Lost Creek Meadow (formerly Eagle's Rest)

A SISYRINCHIUM HITCHCOCKII SITE

1. INTRODUCTION

Lost Creek Meadow (Lost Creek, formerly referred to as Eagle's Rest) is located east of Eugene, in the southern part of the Willamette Valley, in northwestern Oregon. This site is managed by the Northwest Oregon District of the Bureau of Land Management (BLM). Restoration efforts at the site have been funded both directly through the BLM and the through the Interagency Special Status/ Sensitive Species Program (ISSSSP). The Institute for Applied Ecology (IAE) has been involved with monitoring this species and restoration of the site since 2005.

Figure 1. Sisyrinchium hitchcockii flower.

Lost Creek is one of the few remaining forest meadows in northwestern Oregon, and hosts a population of BLM species of concern, *Sisyrinchium hitchcockii* (Hitchcock's blue-eyed grass, Figure 1). The goal of this habitat management plan (Plan) is to identify and detail the management actions necessary for the continued conservation of both the *S. hitchcockii* population and the rare woodland meadow habitat found at this site.

Note: This plan was originally drafted in 2014, but due to a series of staff turnovers, was not finalized at that time. Upon realizing this lapse, IAE updated and finalized the draft plan, and it is now current through 2018.

2. GOALS AND OBJECTIVES

The goal of this management plan is to provide recommendations for management activities to improve habitat conditions and support a stable and/or increasing population of *S. hitchcockii* at Lost Creek.

In order to achieve this goal, this plan outlines seven primary management objectives:

1) Maintain open meadow structure and prevent woody encroachment in the *S. hitchcockii*-occupied meadow.
2) Expand *S. hitchcockii*-occupied meadow footprint and increase connectivity between this and a nearby unoccupied meadow.
3) Reduce abundance of non-native invasive species to less than 50% in *S. hitchcockii*-occupied meadow.
4) Maintain less than 5% cover of the following high-priority target weeds: *Brachypodium sylvaticum* (false brome), *Rubus bifrons (Himalayan* blackberry), *and Festuca arundinacea* (tall fescue)
5) Increase the number of reproductive individuals (genets) of *S. hitchcockii* to 500 individuals within the next five years, through meadow expansion and augmentation with propagated plants.
6) Enhance native plant community through seeding and outplanting.
7) Implement annual monitoring and meadow maintenance schedule.

3. BACKGROUND

3.1 Species description and habitat

Sisyrinchium hitchcockii is a rhizomatous perennial forb in the Iris family (Iridaceae). The plant reproduces by seed as well as by clonal vegetative growth, which can make individual plants difficult to differentiate in the field. Flowers will only open in bright sun, and prefer open prairie habitat in floodplains and lowlands.

It should be noted that there has been confusion about the identification and taxonomic status of *S. hitchcockii*. The species does not appear in western Oregon's standard reference "Flora of the Pacific Northwest" (Hitchcock and Cronquist 1973). The genus *Sisyrinchium* was revised in 1976 by Douglas Henderson, at which point *S. hitchcockii* was described as a new species (Henderson 1976). Henderson's monograph is still the most complete key for differentiating the species of *Sisyrinchium*. The second edition of The Jepson Manual now includes *Sisyrinchium hitchcockii*, but it was absent from the first edition (Baldwin 2012).

The primary reason for *S. hitchcockii*'s exclusion from earlier taxonomic guides is that it can be very difficult to differentiate *S. hitchcockii*, *S. idahoense,* and *S. bellum,* and their ranges overlap considerably. *S. hitchcockii* was previously suspected to be a subspecies one of the other two species. However, after attempting to hybridize *S. hitchcockii* with *S. idahoense* and *S. bellum,* Henderson determined that *S. hitchcockii* is almost completely isolated genetically from all other *Sisyrinchiums* of the Pacific Northwest (Henderson 1976). Henderson further notes that *S. hitchcockii* is an octoploid (n=32) and is completely self-incompatible. Similar studies by Groberg et al. have further affirmed these findings (Groberg et al. 2013). *S. hitchcockii* frequently coexists with *S. bellum* in western Oregon; however, the absence of

yellow at the base of the perianths and other morphological characteristics distinguish *S. hitchcockii* from *S. bellum* (Meyers et al. 2015).

3.2 Species range, distribution, abundance, and trends

Sisyrinchium hitchcockii is a listed federal Species of Concern and an Oregon Biodiversity Information Center (ORBIC) List 1 species (taxa which are endangered or threatened throughout their range or which are presumed extinct) (ORBIC 2016). A helpful species fact sheet is available through the Oregon Flora Project website (http://oregonflora.org/pdf/rarepdfs/sishit.pdf) (Appendix B).

Endemic to the Willamette and Umpqua Valleys, *S. hitchcockii* is restricted to grassy areas, wooded openings, and wet meadows with soils that dry out later in the growing season. Herbarium records at Oregon State University in Corvallis, Oregon indicate two *S. hitchcockii* population centers near Eugene and Roseburg, Oregon. The two occurrences of the species near Corvallis, Oregon are at the northern extent of its documented range (Figure 2). There are only 11 vouchered specimens for *S. hitchcockii* at the Oregon State University Herbarium, which may be a result of this species' rarity, difficulty in pressing, and confusing taxonomic status. There are nine known populations of this species ranging in size from two individuals to approximately 500 reproductive individuals (Alverson 2012). Six of these nine known populations are found on BLM lands in the Northwest Oregon District: four in the West Eugene Wetlands (WEW) and two in the Upper Willamette Resource Area (UWRA).

Little is known about population trends at most of these *S. hitchcockii* sites, or whether there are other as yet unidentified populations throughout the species' range, but the decline of forest meadow habitat in general in western Oregon suggests that the species may also be declining. Of the BLM-managed populations, only Lost Creek and Upper Oak Basin have been routinely monitored since 2012. The population at Upper Oak Basin has declined from 80 reproductive individuals to 12 since 2012 (Giles et al. 2016).

Since monitoring began at Lost Creek in 2005, this population of *S. hitchcockii* has expanded from 74 to a peak of 368 plants in 2013 (**Error! Reference source not found.**). Much of this increase occurred b etween 2008 and 2010, when an extensive tree removal project expanded the meadow. The population has declined slightly since 2013, likely due to increased blackberry and *Pteridium aquilinum* (bracken fern) regrowth in the main area of the meadow.

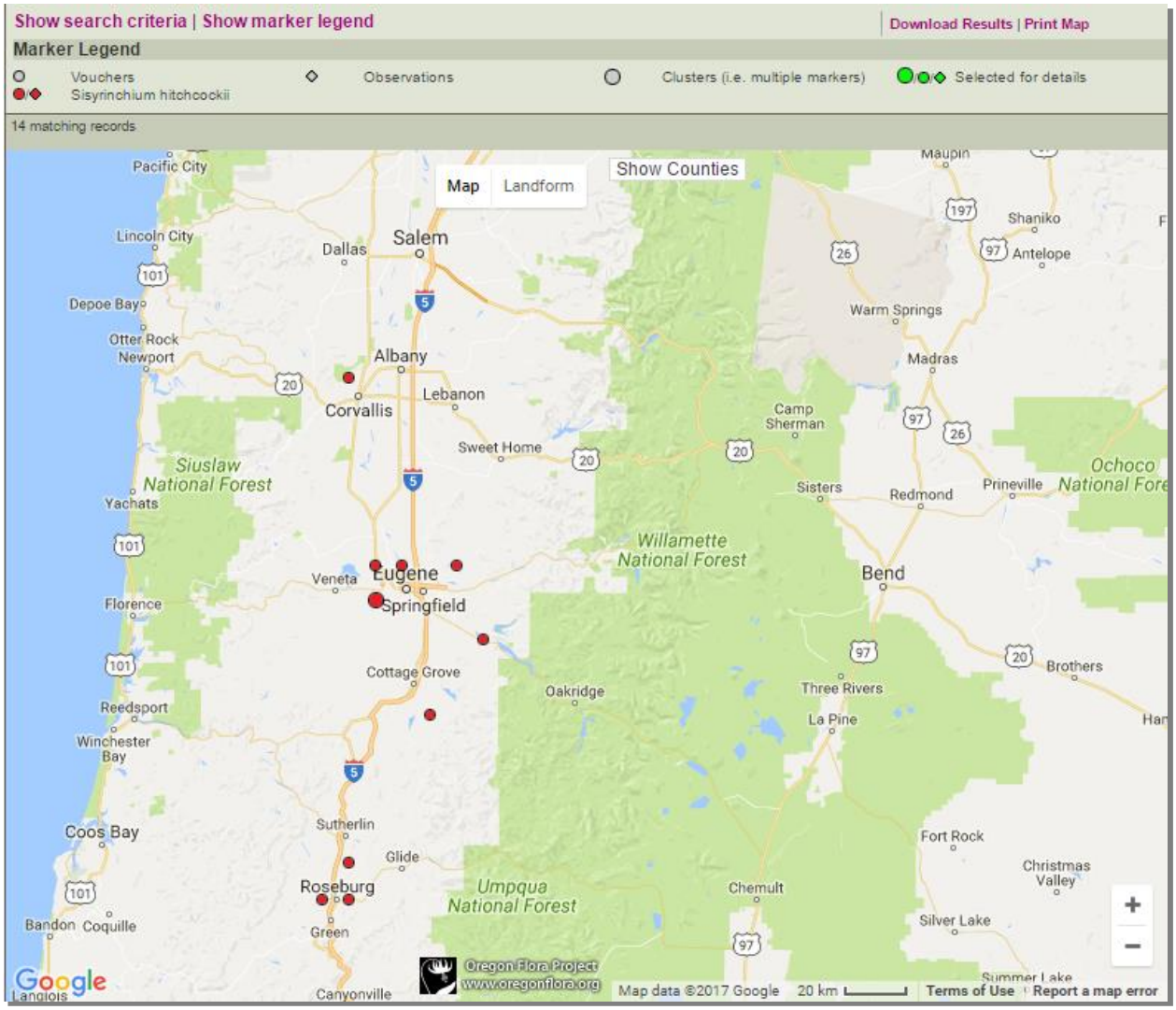

Figure 2. *Sisyrinchium hitchcockii* occurrences in western Oregon. This map shows both vouchered specimens and observations. Map created with the Oregon Flora Project Plant Atlas (OFP 2017)

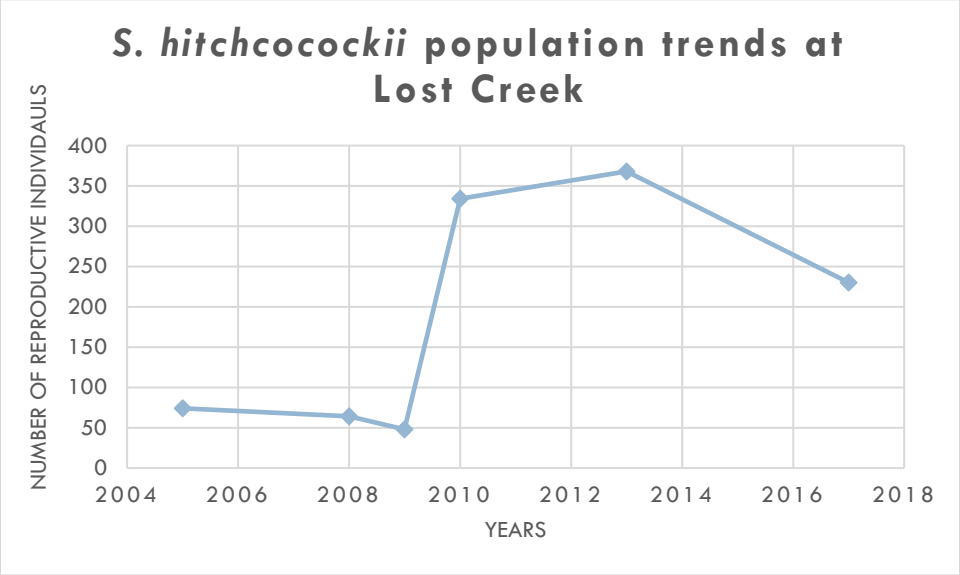

Figure 3. *Sisyrinchium hitchcockii* population trend at Lost Creek Meadow.

3.3 Site description and ecological processes

Site Name: Lost Creek Meadow, wet meadow habitat.
Legal Description: Lost Creek Meadow is located in the Cascade foothills southeast of Pleasant Hill, OR (T20S R1W sec 3). See Appendix A for detailed information.
UTM: 10T 516134.00m E 4856693.59 m N.
Elevation: 997 ft
Common Name: Hitchcock's blue-eyed grass
Scientific Name: *Sisyrinchium hitchcockii* Douglass M. Hend.

The Lost Creek site is comprised of two small meadows in the cascade foothills southeast of Dexter, Oregon (Figure 4). Only the smaller of the two meadows (Small Meadow) to the southeast is occupied by *S. hitchcockii*. As result, all of the habitat restoration and *S. hitchcockii* monitoring conducted in the past 14 years has occurred in the Small Meadow, making it the primary focus of this Plan.

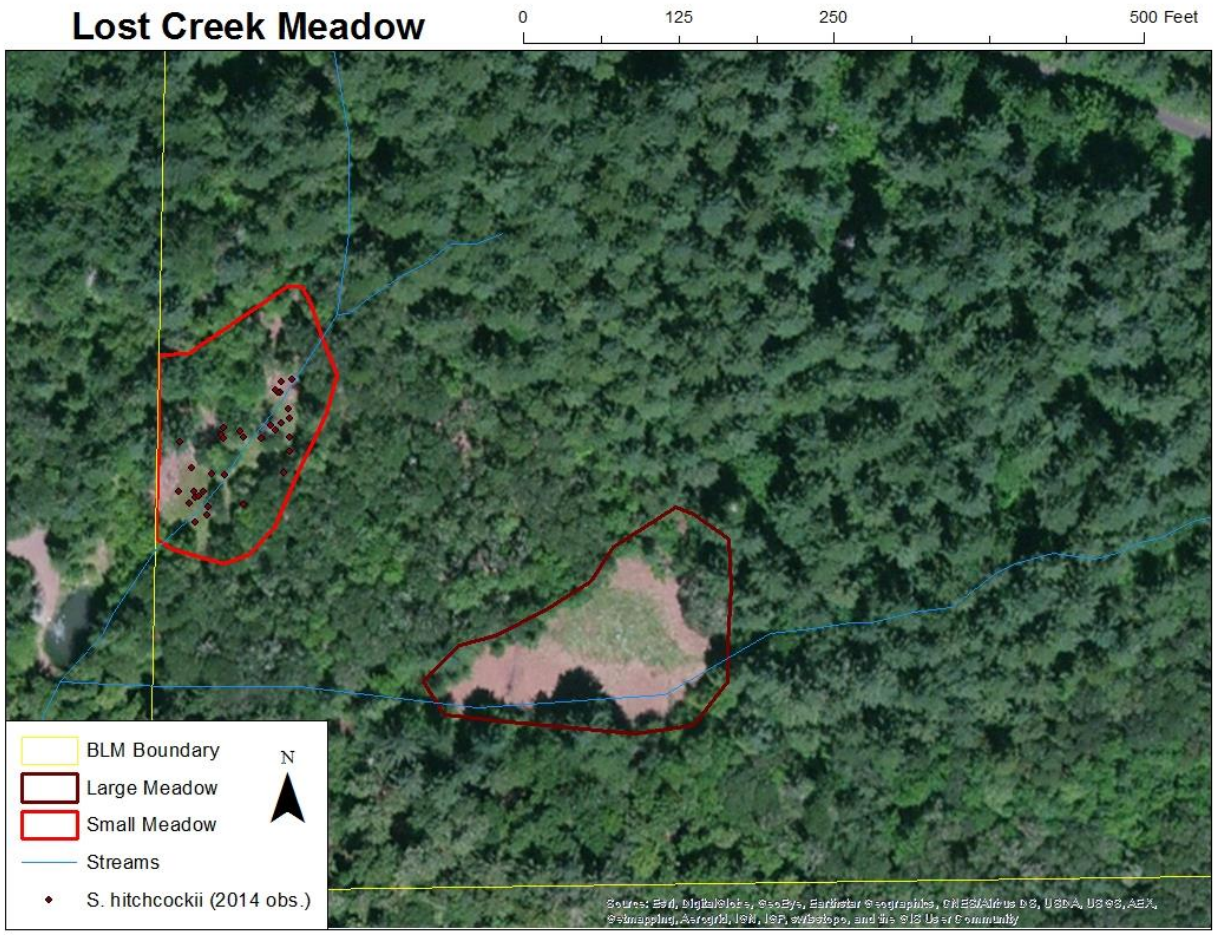

Figure 4. Aerial map of Lost Creek, with the two meadows outlined in red. The Small Meadow (lower right) is occupied by *Sisyrinchium hitchcockii*.

Small Meadow: The Small Meadow is dominated by introduced perennial grasses such as tall fescue, *Holcus lanatus* (velvet grass), and *Anthoxanthum odoratum* (sweet vernal grass). Despite the predominance of introduced species, a number of native species co-exist in small numbers. A list of common species for the site can be found in Appendix D. This is the meadow occupied by *S. hitchcockii*.

This meadow has a very gentle slope of about 3% and has a slight westerly aspect. In 2005 the meadow measured about 0.4 acres.

Large Meadow: This meadow is located about 100 meters to the east of the Small Meadow, and may have been a former pasture for livestock. This meadow is approximately 0.6 acres in area and is dominated by introduced grasses and Himalayan blackberry, as well as being encroached upon by Oregon ash and Douglas-fir.

The small size of the meadows makes it difficult to accurately determine the specific soil type from the county soil maps, but the general area is mapped as Hazelair silty clay loam. An ephemeral stream runs along the northern edge of the Small Meadow, where there are a number of *Populus trichocarpa* (black cottonwood). On the drier portions of the small meadow, there are a few young *Quercus garryana* (Oregon white oak) measuring less than 10 inches diameter breast height (DBH).

The western and southern edges of the Lost Creek site are bordered by private property (Figure **4**) and marked with a derelict fence. The neighboring property has a man-made pond which appears to intercept water originating from BLM property. It is unclear how the neighboring pond impacts the hydrology of the Lost Creek site.

3.4 Past restoration actions

In collaboration with the BLM, IAE began monitoring *S. hitchcockii* and assessing weed populations at Lost Creek in 2005. At this time seed collected from four individual plants were submitted to Berry Botanic Garden for long term storage (Blakeley-Smith and Kaye 2005). Management activities at Lost Creek began in 2009. A summary of the history of restoration at the site is available in Appendix E.

Restoration activities at Lost Creek Meadow have been limited to mechanical removal of weeds due to regulations prohibiting the use of herbicides on BLM lands in the Upper Willamette Resource Area of the Northwest Oregon District. False brome, bull thistle, teasel, and Himalayan blackberry have been hand pulled by IAE employees and a contract crew. Multiple reentries with gas powered brushcutters have removed Himalayan blackberry and tree resprouts. Oregon ash, English hawthorn, and Douglas-fir have been girdled or felled and piled within and along the edges, doubling the area of the meadow.

4. THREATS

4.1 Limited Genetic Pool and Genetic Isolation

The genetic consequences of a small population are a concern in the management of the Lost Creek population of *S. hitchcockii*. The most recent census of the population there found 230 (± 159) reproductive individuals. At peak in 2013, this population was recorded at 368 (± 139) reproductive. Small population size coupled with habitat fragmentation may result in a severe inbreeding depression that could result in population extinction, and may make *S. hitchcockii* more susceptible to stochastic events that could eliminate the population. These concerns were reinforced by a 2011 attempt at seed collection and grow-out, where 78 seeds were collected from 12 individual *S. hitchockii* plants at Lost Creek (Blakeley-Smith 2011). Of these 78 seeds, only 12 germinated, and only 10 of the resulting plants survived to be transplanted back at Lost Creek. While this may partially be the result of imperfect propagation procedure, it does raise concerns about the reproductive compatibility and gene flow between individuals at the site.

In addition to the small size of the *S. hitchcockii* population at Lost Creek, the site's isolation from other populations also limits the possibility of gene flow and increases the chance of inbreeding depression. The landscape characteristics and disturbance regimes of the Willamette Valley have changed drastically over the last two hundred years. As a result, the meadow that supports *S. hitchcockii* is now an extremely rare habitat type throughout its entire range. While there are active pollinators at Lost Creek, it is unlikely that they are moving between the Lost Creek population of *S. hitchcockii* and other populations of this species due to distance and physical barriers such as forest habitat.

4.2 Encroaching native vegetation

Forest succession poses a significant threat to the meadows at Lost Creek. The meadow area declines as trees expand from the perimeter and convert meadow habitat into forest. The aerial map shows two

small meadows surrounded by forest. Historically, this was likely one large open meadow that was potentially populated by sparse trees. The dominant tree species at Lost Creek are Oregon white oak, *Fraxinus latifolia* (Oregon ash), *Pseudotsuga menziesii* (Douglas-fir), and *Acer macrophyllum* (bigleaf maple). The small area of the *S. hitchcockii*-occupied meadow limits the total number of *S. hitchcockii* individuals that this meadow could support. A larger meadow or a network of meadows could provide more suitable microsites that would support a larger population of *S. hitchcockii*.

Without a regular disturbance regime, both meadows are being rapidly encroached by woody plants. There are numerous Oregon ash seedlings and English hawthorn growing in the meadows, and surrounding tree canopies shade the meadow. Mowings of seedlings and blackberrys in 2013-2015 helped to maintain a more open habitat, but limited funding in the past three years has prevented this treatment from being repeated. Several small diameter Douglas-fir are growing in the meadow among Oregon white oak and along the edges. Large diameter conifers and bigleaf maple dominate the forest structure surrounding the meadow. The small size of the meadows, particularly Small Meadow, and abundance of woody plants increases the likelihood of canopy closure without tree removal and thinning.

In the Small Meadow, bracken fern currently poses the most direct threat to *S. hitchcockii* plants as it is encroaching directly on the *S. hitchcockii*-occupied northeastern corner of the meadow. The fern grows aggressively and is able to shade out most of the forbs beneath it. The bracken fern patch will likely continue to expand until it is treated by pulling, mowing, or herbicide.

4.3 Invasive species

Invasive species pose an obvious threat to the ecological integrity of Lost Creek. Native species persist at moderate levels, but competitive displacement by introduced species has likely reduced native species abundance and diversity. There are a large number of introduced species growing in both meadows, which can be classified into three tiers based on priority for control.

Tier 1 includes species that form monocultures, competitively exclude all other species, and have the potential to convert the entire habitat to a different ecological state. Species in Tier 1 include false brome, tall fescue, and Himalayan blackberry. These species should be removed from the site as completely as possible.

False brome is a highly invasive grass found within and in surrounding forest habitat at Lost Creek. As of 2015, most of the plants had been removed from the meadow but more remained in the surrounding forest. The presence of false brome in neighboring clear-cuts and roadsides suggests that it may be spreading throughout the watershed. False brome is capable of forming monotypic stands to the exclusion of all other species in both open meadows and shaded forest.

There are multiple patches of Himalayan blackberry on the edges of the meadow and many solitary plants throughout the meadow. Himalayan blackberry dominates the larger meadow to the east and will quickly dominate the project site if left unmanaged.

Although tall fescue is unlikely to form a monoculture at Lost Creek, it is abundant and heavily interspersed with *S. hitchcockii*, making it risky to remove manually. Competition posed by this species will be a complication in any efforts to establish native species as it can rapidly colonize bare ground.

Other potential Tier 1 invasive species that occur in the region have not yet been observed at Lost Creek include *Cirsium arvense* (Canada thistle) and *Cytisus scoparius* (Scotch broom). These species are to be treated quickly and aggressively if they are observed on the project site.

Tier 2 invasive species compete and suppress native species, but may not form complete monocultures and often co-exist with native species. The potential risk posed by these species differs between sites due to local growing conditions. Tier 2 species include: *Cirsium vulgare* (bull thistle), *Daucus carota, Hypericum perforatum* (St. John's wort), *Leucanthemum vulgare, velvet grass, Hypochaeris radicata* (hairy cat's ear), and *Dactylis glomerata* (orchardgrass). We recommend opportunistic removal of Tier 2 invasive species in high priority areas. The small area of Lost Creek makes removal of these species possible; however, potential disturbance to *S. hitchcockii* due to mechanical removal should be minimized.

Tier 3 invasive species are ruderals that may not persist for a long period of time, appear to be weak competitors at this particular site, or do not sustain large populations. A partial list of species in Tier 3 include: *Centaurium erythraea* (European centaury), *Dianthus armeria* (grass pink), and *Linum bienne* (pale flax). Species in Tier 3 may not warrant control at this stage. As our knowledge of invasive species develops and growing conditions change, species in Tier 3 may shift to a category deserving greater concern and control efforts.

4.4 Wildlife grazing

Wildlife grazing is a potential risk for *S. hitchcockii* at Lost Creek. Since the population of *S. hitchcockii* is so small, any loss of flowering stems due to grazing could result in lost reproduction opportunities for the entire year. Deer and rodents are the most likely wildlife species to pose a grazing threat. There is no active livestock grazing in this area.

5. MANAGEMENT RECOMMENDATIONS

5.1 Reduce woody species encroachment

Woody encroachment is the dominant threat to Lost Creek and the persistence of a reproducing population of *S. hitchcockii*. All trees within the Small Meadow, except Oregon white oak, should be cleared from the meadow. Of the remaining Oregon white oak, clumps could be thinned to one or two trunks to reduce prairie shading while maintaining desirable, more open-grown trees. Trees less than 10-inches DBH surrounding the meadow should also be felled and piled to increase the size of the meadow. Trees greater than 10-inches DBH located in forest expansion areas could also be felled. Trees should be felled away from core *S. hitchcockii* habitat to minimize disturbance to the meadow and avoid trampling of plants. Stumps should then be cut as close to the ground as possible. Woody debris should be piled outside of the core *S. hitchcockii* habitat to prevent harming the plants or accidental piling over the plants. Debris piles could be left as habitat piles or burned during fall months. If piles are burned, they should be seeded with an appropriate seed mix as soon as possible to limit spread of non-native species. Cutting of trees within the forest matrix adjacent to the meadow restoration should be avoided. An attempt should be made to identify priority areas for tree and shrub removal since past clearing efforts have exposed *S. hitchcockii* plants not previously identified (Blakeley-Smith 2011). Without the use of herbicides to treat stumps, re-sprouts may need to be removed yearly for several years to fully kill

trees. Herbicide such as triclopyr should be used to treat fresh stumps to ensure death of roots, if this tool becomes available.

It is possible that the Small Meadow and Large Meadow were once connected but have since been disconnected by encroachment of trees and shrubs. After invasive species have been sufficiently eradicated in the Large Meadow, reconnecting the two meadows should considered as a means of expanding potential habitat. Significant effort will be required to remove trees and shrubs that occupy the area between the meadows; however, if done correctly this could double potential *S. hitchcockii* habitat at Lost Creek.

5.2 Invasive Species Control

Restoration activities should begin with the removal of Tier 1 invasive species.

False brome at Lost Creek Meadow is at an early stage of invasion. There should be a zero tolerance threshold for false brome in this meadow. As of 2015, false brome was limited to the forested areas near the meadow and a few plants identified within the meadow. However, due to limited funding for weed removal in recent years more work will be required to return to this state. It is probable that the majority of the false brome can be removed from the adjacent forest if regular efforts are made to identify and remove patches. Manual removal using hand tools in forest soils can be extremely effective if conducted in November or April when above ground material is visible and root systems are most easily removed.

If plants cannot be pulled during the dormant season, removing flowering stems by manually clipping or mowing can arrest seed development for an entire season if done in mid-June, before seed matures. However, mowing can make it more difficult to locate plants in fall, so manual removal should take place in April after fall mowing. Clipping seed heads and leaving the basal leaves intact allows for easier re-location of the plant in the fall. If seed removal is not conducted, a new population can establish from seed in the seed-bank following hand removal. False brome can produce seed in the first year of growth, so repeated hand pulling in the fall without seed removal in June will not likely result in eradication. These principles can also apply to herbicide applications, pending BLM approval.

Studies have shown that application of glyphosate to false brome in mid-October is an effective chemical control method for this species. The timing of the application in fall can reduce the negative effects of herbicide on native plants that have already set seed or become dormant. The addition of pre-emergent herbicide to a fall glyphosate treatment can provide effective control of both mature plants and seedlings that germinate during the following six months. This could be an effective approach in the forest surrounding the meadow where false brome is relatively dense. The pre-emergent herbicide remains active in the soil and could suppress native seedlings as well as false brome seedlings. Spring treatment of seedlings could potentially be conducted with a weed wipe to reduce risk to native species. Conversely, grass specific herbicides are less effective than glyphosate at killing false brome but have the advantage of avoiding harm to native broadleaf species. Grass specific herbicides become more effective if applied multiple times during the growing season.

Managing the seed-bank should be a high priority when controlling false brome, since the primary mode of population expansion is by seed. False brome can be found throughout this watershed. The seed is spread by humans on boots, vehicles, and equipment. All personnel should clean their boots and

equipment prior to entering and exiting Lost Creek to avoid future introductions and spread of this pest plant beyond this meadow.

Tall fescue is ubiquitous across Lost Creak and will be difficult to eradicate without the use of herbicides. Any herbicide or mechanical treatments of tall fescue should be limited to discrete portions of the meadow. Treatment of tall fescue follows the same prescription as false brome. Since the grass is intermixed with native species other techniques such as solarization are not recommended. Repeated mowing is not likely to reduce the abundance of tall fescue but may limit seed production. Mowing should precede seed set of tall fescue which can coincide with the flowering of *S. hitchcockii* and other native plants. Tall fescue is wide spread when compared to false brome, therefore, foliar herbicide treatments with glyphosate will likely have significant negative impacts on the native vegetation. However, this could potentially be mitigated using a weed wiper. Grass-specific herbicides may be more appropriate treatment but the effects to native grasses at Lost Creek Meadow will need to be considered prior to application. The site is small enough that careful spot spraying could be used to reduce risk to native grasses. Since tall fescue is so widespread at Lost Creek, the disturbance to *S. hitchcockii* and other native plants should be strongly considered prior to pulling. Hand removal of tall fescue in dense patches of *S. hitchcockii* should be avoided. Appropriate native seeds should be added to areas following disturbance to prevent spread of non-native species.

Himalayan blackberry is found as large patches along the edges of the meadow and smaller patches within the meadow and should be removed completely. Manual removal of Himalayan blackberry is most effective between November and April, and is done most easily by cutting stems a foot above ground level and removing the root systems with a rogueing hoe with rake teeth or other suitable hand tool. Cut stems and roots should be removed from the site to prevent resprouting. Because removing the entire root system is extremely difficult and even small root fragments can resprout, multiple years of treatment are required to control blackberry. Himalayan blackberry removal typically involves a large amount of soil disturbance; therefore, seeding exposed soil with fast-growing native species immediately after ground disturbance is recommended. Cutting stems creates less soil disturbance than hand pulling and reduces the amount of seed that will germinate from the seed-bank. However, hand removal of weeds, in general, can disturb the soil and effort should be taken to minimize negative effects on S. hitchcockii.

Foliar application of herbicide can be effective at controlling Himalayan blackberry. Himalayan blackberry can be controlled with comparatively less herbicide if cut or mowed in the summer and the regrowth is sprayed in the fall. Alternatively, stems can be cut at ground level and immediately treated with concentrated herbicide using a brush, sponge, or small spray bottle, to increase root kill. Triclopyr (Garlon 3a) targets woody plants and is best applied in late summer for foliar applications or can be used for stump treatment, while other formulations with Triclopyer (Garlon 4) are most effective as a foliar treatment in October prior to the first frost. Herbicides have the advantage of leaving the soil undisturbed, but dead stems should be mowed the following year in order to re-establish herbaceous meadow structure. Follow-up treatments will be required to control Himalayan blackberry. These can involve combinations of multiple herbicide applications and manual removal. Seeding in disturbed or recently cleared areas is highly recommended.

Although it is a native species, bracken fern should also be included in weed control efforts. This species can form dense populations within meadow, which shade out other high-light adapted meadow species

such as *S. hitchcockii*. It is recommended that this species be pulled or mowed to prevent monocultures of bracken fern where the *S. hitchcockii* is growing. For best results this should be done twice over the course of the season, as this will allow the plant to regrow and thus deplete energy stores in the rhizome. Use of herbicides for control of native plants is not currently permited on BLM lands. However, if this tool were to become available, treatment with glyphosate may be used as a supplement to mowing and pulling.

Herbicide Applications

Up to this point, herbicide use has not been allowed on Upper Willamette Resource Area. However, recent changes in regulations may allow for the use of this tool in the near future. As of 2019 potential use of herbicide on BLM land will not allow for treatment of native species, such as bracken fern or stump treatments of native tree species. However, the potential use of glyphosate, triclopyr, and grass-specific herbicides for invasive species control would significantly improve efficiency of invasive species control at this site. In particular, the use of glyphosate to control false brome and Himalayan blackberry would be especially useful. For a small area like Lost Creek, targeted herbicide application with backpack sprayers would be efficient.

Treatment with backpack sprayers allows for a relatively selective usage of herbicide. Additional protective measures such as the use of plastic shields or weed wipers can reduce the risk to native species. IAE also requires all applicators to be licensed through the Oregon Department of Agriculture and to abide by label application rate and use restrictions, further reducing the risk of damage to non-target vegetation.

Extra care should be taken at this site to avoid herbicide treatments near *S. hitchcockii* plants. However, for both false brome and Himalayan blackberry, treatments in fall and winter months are effective and can be done when native species are dormant. Grass-specific herbicides can effectively control grasses in the meadow during the growing season and are not likely to harm *S. hitchcockii*. This method is suggested for control of tall fescue.

Control of woody plants can be accomplished by wiping or squirting freshly cut stems or stumps with concentrated selective herbicides such as triclopyr. This method uses relatively little herbicide, would have minimal negative effects on *S. hitchcockii*, and would prevent trees and shrubs from re-sprouting after being cut. This method is suggested after treatment of encroaching woody species; however, the use of herbicide on native plants would first have to be permitted in order for this to be an option for treatment of encroaching native species.

5.3 Increase native species abundance and diversity

The native plant community at Lost Creek (in the Small Meadow) is already diverse, but augmenting the meadow with seed, bulbs, plugs, and bareroots of native plants following removal of weeds will increase genetic and species diversity. Planting bulbs, plugs, and bare-root plant material is recommended for species that are slow growing and difficult to establish from seed (see Appendix F or a list of recommended species for introduction at Lost Creek). For growing and outplanting plugs, we recommend using conetainers and matching planting dibbles to increase efficiency and promote strong root development. Individuals of a species should be planted in small, dense patches since pollinators show preference for short travel distances and high concentrations of a single species.

Species planted as plugs, bulbs, or bareroot may not require extensive site preparation since the existing plant density at Lost Creek Meadow is not very high. The perennial species recommended in Appendix F include plants that can co-exist with the introduced species already present in the meadow.

Seeded species require soil contact to establish, which will require removal of thatch and unwanted, pre-existing vegetative material. Many meadow restoration projects use prescribed fire to prepare sites for seeding, the size and location of the meadow surrounded by forest matrix at Lost Creek would likely make this impractical for this site. Flame weeding could be a potential alternative to broadcast burning. The safest alternative is the creation of discrete seeding patches where grasses can be cut in mid-May and raked to remove thatch. If herbicide becomes available, these sites can also be pre-treated with glyphosate before mowing to reduce the weed root bank. These areas should be broadcast seeded in mid-October with appropriate native seed (Appendix F). Immediately following seeding, the area should be lightly raked to increase soil-to-seed contact. The plots should be sprayed with a grass-specific herbicide after the non-native grasses germinate and again the following April to reduce competition for seeded native forbs. If herbicide is not an option, careful hand weeding of nonnatives should be done in the fall after regrowth and prior to seeding and again the following spring.

The growing conditions at Lost Creek generally favor plant establishment. The meadow is small and surrounded by trees which shade the meadow for part the day, which can prevent desiccation, and deep soils tend to hold water during the growing months. If the seeding coincides with a dry spring, the seedlings may fail to establish. To reduce risk associated with annual fluctuations in precipitation and temperatures, seeding over the course of two years is recommend.

5.4 Augment *Sisyrinchium hitchcockii* at Lost Creek Meadow

It is generally accepted that a stable population of plants requires a minimum of 500 reproductive individuals (Given 1994). This number is thought to provide as much genetic variation as an indefinitely large population. As of 2017, there were a projected 230 (± 159) individual *S. hitchcockii* plants at Lost Creek.

Plants can be established by seed or outplanting of nursery grown plugs. When seed is available in large quantities, it is typically much cheaper to establish plants by sowing seed directly onto a prepared site. This can also allow germinants to self-select based on favorable growing conditions on the small scale. A large quantity of diverse, mid-elevation seed does not currently exist and establishment rates from seed can be extremely low for a variety of reasons. Efforts at nursery grow-out of Lost Creek *S. hitchcockii* from seed collected on site in 2011 were not successful, with 78 seeds yielding only 10 successful germinant (Blakely-Smith 2012). Relatively low viability of seed collected from Lost Creek Meadow may be due to self-incompatibility of the species and low genetic diversity within collected seed (Henderson 1976). This is also likely considering that all of the seeds used for this growout came from only 12 individuals (Blakely-Smith 2012). The NRCS Corvallis plant materials center has had success germinating *S. hitchcockii* seed collected from southern Oregon by alternating warm and cold conditions and was ultimately able to establish multiple seed increase beds (Bartow 2015). Augmentation of the population with plants grown from seed collected from other populations is worth exploring as a means of increasing genetic diversity and higher germination rates. If sufficient *S. hitchcockii* seed can be

obtained, a comparison of germination rates between sites with variable population sizes, could inform recovery efforts of *S. hitchcockii* at Lost Creek and across its range.

***Sisyrinchium hitchcockii* seed collection, assessment, and growout**

To establish a reproductive population of at least 500 individuals and to account for transplant mortality outplanting of at least 2,000 plugs from at least three source populations. The closest known populations of *S. hitchcockii* to Lost Creek Meadow are in the West Eugene Wetlands managed by Northwest Oregon District BLM. Population information collected by Alverson (2012) suggests that of these populations of *S. hitchcockii*, the two largest, Vinci and Greenhill Ash Grove, were the most likely to support seed collection without harming the native population. More than one augmentation of *S. hitchcockii* may be needed to reach target population size.

Seed Collection

The current lack of locally collected seed or nursery grown plugs of *S. hitchcockii* means these products will need to be produced by the BLM or associated partners. For greater genetic diversity and increased potential volume of seed, this should be a range-wide collection. Convention suggests that no more that 20% of the available seed should be collected from any particular population of plants per year. However, seed collection limits can be also influenced by population size, rarity, and by state or federal status of a plant species. Annual seed collection limits of *S. hitchcockii* at Lost Creek Meadow and any other population should be determined by BLM staff prior to collection.

Seed scouting during the plant flowering season will also help in assessing how much seed is likely to be available in a given year. Seed collection should occur in late summer and early fall after seeds have matured but before the first rains and before they disseminate naturally. Seed should be air dried then stored in cool, dry conditions to maximize seed longevity and minimize mold growth. Dry weight of harvested seed, harvest date, location, population size, and number of plants from which seed is collected should recorded and tracked.

Seed Assessment and Growout

If provided with sufficient seed, the IAE plant materials farm has the capacity to establish a bed for the amplification of *S. hitchcockii* production. This strategy has several advantages, including increasing potential genetic diversity, creating ongoing potential for seed production, and potentially producing seed for multiple recovery sites.

To establish a seed amplification bed, seed should be started in sterile conetainers in a greenhouse setting. For best germination results, *S. hitchcockii* plugs should be moistened in water and kept under lights at 72°F for a month. The plugs should then be transferred into cool (50-60°F), wet, and dark conditions for two to three months (Bartow 2015). Conetainers should then be transferred back into a greenhouse for continued growout. Seed from different ascensions should be seeded separately and germination rates should be noted to assess viability of seed from each population. Plugs can be transplanted into the field in spring. For additional information on propagation of *S. hitchcockii*, consult the Natural Resource Conservation Service Corvallis PMC *Native Seed Production Manual for the Pacific Northwest* (Bartow 2015).

5.5 District level management activities

The *S. hitchcockii* population in the Small Meadow is limited by the area of the meadow, though there is potential for habitat expansion. This expansion would require significant resources over multiple years to complete, but would allow the habitat to support more plants, thus increasing the likelihood of recovery of *S. hitchcockii* at this site.

S. hitchcockii is included in the 2010 USFWS Recovery Plan for the Prairie Species of Western Oregon and Southwestern Washington as a non-listed species. However, as of the writing this report, there is no range-wide conservation plan or effort specifically aimed at the conservation of *S. hitchcockii* (USFWS 2010). The little information available on population trends of *S. hitchcockii* across its range suggests that without significant restoration efforts and habitat maintenance, this species will continue to decline on BLM lands. B ased on what is known about the decline of *S. hitchcockii* and the species' self-incompatibility in pollinating, the BLM should consider taking a district-wide approach in managing this species. The process for augmenting the Lost Creek population, presented in this report, is transferrable to a number of other meadows, either with existing populations or potential for reintroduction of the species. The Northwest Oregon BLM district manages several such sites, including Camp Creek Ridge, Oak Basin (current population), Coburg Hills, Horse Rock Ridge, WEW (four current populations), and others. Conducting a District-wide reintroduction effort could mitigate the impacts of population isolation, catastrophic events, and reduce genetic issues such as inbreeding depression and genetic drift. A District-wide approach also offers significant cost saving benefits for activities such as seed collection and plug production.

6. MONITORING

6.1 Monitoring objectives

For efficiency, a monitoring plan, including overall condition of the meadow in terms of plant community composition and structure, meadow size and openness, and size and condition of the *S. hitchcockii* population was implemented at the onset of the project. Additional monitoring should be implemented if the population of *S. hitchcockii* at Lost Creek is augmented with nursery grown plants, to assess survival rates and guide additional augmentation efforts Since monitoring of *S. hitchcockii* has been conducted previously at Lost Creek Meadow specific monitoring protocols and recommendations are provided below.

6.2 Site photo points

Photopoints should be established at multiple locations within and along the edges of the meadow. Repeated photographs of the same area over time can capture changes in vegetation and detail restoration activity accomplishments. Photos should be taken from each location at the same time annually, during peak *S. hitchcockii* bloom (Late May to Mid-June) and at multiple points throughout the year. Photopoint pictures should also be taken before and after any site-wide restoration activity such as mowing, tree removal, or broadcast herbicide application. This will help to document seasonal changes in vegetation and direct effects of restoration activities.

6.3 *Sisyrinchium hitchcockii* population monitoring

IAE has been monitoring *S. hitchcockii* at Lost Creek Meadow since 2005. Typically, *S. hitchcockii* at Lost Creek Meadow has been monitored in early to mid-June to coincide with the flowering of *S. hitchcockii*. From 2005 to 2010 the population was fully censused, using a 1x1 meter quadrat and a grid-pattern to survey the site. In 2013 and 2017 monitoring methods switched to a subsampling strategy to account for increasing population size. Because *S. hitchcockii* can reproduce rhizomatously, stems found within 10 centimeters of each other were counted as the same individual. More information on past sampling methods is available in site reports for 2013 and 2016.

In order to increase consistency between surveyors and years and decrease the amount of resources needed for each monitoring event, *S. hitchcockii* monitoring methodology should be adjusted. Based on the high variability in past subsampling results, monitoring should return to a full census of the population. The speed of such a census could be increased by switching from the previous grid system to a narrow transect protocol such as those suggested by Salzer (1998) or Enzinga (1998).

When considering future monitoring protocols, we recommend moving away from trying to differentiate between individuals, as the 10cm rule is arbitrary and this may have caused inconsistencies in past data collection. Focusing on numbers of vegetative and flowering stems instead will help to reduce potential variances in count by eliminating the need for interpretation. Data on total number of vegetative and flowering stems has been collected in the past and is available for comparison.

To save time and focus resources on restoration, it is also suggested that the monitoring schedule changed from a yearly occurrence to a three-year rotation.

Sisyrinchium *hitchcockii* introduction survival

Outplanted *S. hitchcockii* should be monitored for two to three years after introduction/seeding to gauge establishment success. This may be done by flagging planted areas and running narrow transects through this area, in a small-scale version of general population monitoring. Number and vigor of observed plants should be recorded during June. Unless, there is low germination success and need for secondary planting, plants can be recorded within the general population census after the first two years.

6.4 Plant community monitoring

Sub-sampling of plant community composition in both the small and large meadows should be incorporated into *S. hitchcockii* monitoring protocols. This will help to establish a baseline for vegetation restoration as well as a means of quantifying success rates of any seeding efforts. Ten 1x1meter monitoring plots should be evaluated, based on randomly generated locations. Species name, percent cover, origin (native or non-native), and functional group should be recorded for each species observed. Vegetation data should be analyzed using statistical measures that are consistent with IAE threatened and endangered species monitoring protocols.

This method should be sufficient to capture changes in vegetation cover based on seeding. However, if more accurate tracking of seed success is desired, seeded areas should be delineated with flags and this method should be repeated within the boundaries of the planted area.

6.5 Weed mapping

Monitoring extent cover of Tier 1 and 2 weeds should be done to document the degree of success of extermination efforts. Periodic weed mapping is suggested as the most effective means of assessing total weed cover in the prairie. This should be conducted in conjunction with population and community monitoring on a three-year rotation. As time and funding allow, it may also be conducted after weed removal efforts to measure progress and weed regeneration over time. Polygons can then be analyzed in ArcMap to determine change in cover over time.

7. FIVE YEAR TIMELINE FOR RESTORATION

2019

Small Meadow

- Aggressively remove blackberries and false brome from center and immediate edges of meadow, either by hand pulling or brush cutter for blackberries. (April).
- Limb trees immediately adjacent to small meadow, thin oaks within the meadow to one or two stems per tree. (Spring or Fall).
- Remove down logs from meadow (Fall-Spring).
- Conduct glyphosate treatment of false brome and blackberry if permitted. If not, pull these species (Fall).
- Thin trees from meadow edge. Thin Oregon white oak within meadow down to one stem per tree (Fall-Spring).

Large Meadow

- Conduct visual assessment of large meadow vegetation community, invasive species cover, and soil quality (Spring, Early summer).

2020

Small Meadow

- Aggressively remove blackberries and false brome from center and immediate edges of small meadow, either by hand pulling or brush cutter for blackberries (April).
- If available, conduct grass specific herbicide treatment for tall fescue. Otherwise mow this species before seed matures (Late May, Early June).
- Conduct population census for *S. hitchcockii* and gather plant community data (Mid-June).
- If allowable, collect approximately 20% of *S. hitchcockii* seed from Lost Creek Populations. Begin collecting seed from other available populations (Late summer).
- Conduct glyphosate treatment of false brome and blackberry if permitted. If not, pull these species (Fall).
- Thin trees from meadow edge. Thin Oregon white oak within meadow down to one stem per tree (Fall-Spring).

Large Meadow

- If time and funding allow- begin weed and brush removal (Spring).
- Follow up with glyphosate treatment or additional handweeding (Fall).
- Seed treated area with native species (Fall).

2021

Small Meadow

- Aggressively remove blackberries and false brome from center and immediate edges of small meadow, either by hand pulling or brush cutter for blackberries.
- Treat fasle brome in forest surrounding small meadow with glyphosate, if approved for use (April).
- If available, conduct grass specific herbicide treatment for tall fescue. Otherwise mow this species before seed matures (Late May, Early June).
- Collect approximately 20% of *S. hitchcockii* seed from Lost Creek as well as any other appropriate populations (Late summer).
- If enough *S. hitchcockii* has been collected, start plants for seed production bed (Late Fall, Winter).
- Thin trees from meadow edge. Thin Oregon white oak within meadow down to one stem per tree (Fall-Spring).

Large Meadow

- If time and funding allow- Mow regrowth of brush and invasive species. If appropriate, conduct spot spray glyphosate treatment in spring before mowing. (Spring).
- Follow up brush treatments with glyphosate treatment or additional handweeding (Fall).
- If invasive species and shrub cover seem sufficiently reduced, seed with native forbs after brush treatments (Fall).
- Limb and thin trees from forest edge. Thin Oregon white oak to 1-2 stems per tree.

2022

Small Meadow

- Plant *S. hitchcockii* into seed production field (Spring).
- Treat blackberry and false brome as necessary (April).
- If available, conduct grass specific herbicide treatment for tall fescue. Otherwise mow this species before seed matures (Late May, Early June).
- If necessary, collect approximately 20% of S. hitchcockii seed from Lost Creek as well as any other appropriate populations (Late summer).
- Conduct herbicide treatment of blackberry and false brome as needed. Follow with seeding of native species (Fall).
- Start addition plants for seed production field, as necessary (Fall).
- Limb and thin trees from forest edge. Thin Oregon white oak to 1-2 stems per tree.

Large Meadow

- Treat invasive species as necessary (Spring and Fall).
- Limb and thin trees from forest edge. Thin Oregon white oak to 1-2 stems per tree (Fall-Spring).

2023

- Outplant replacement plugs in seed production field (Spring)
- Treat blackberry and false brome as necessary (April).
- Conduct population census for *S. hitchcockii* and gather plant community data. (Mid-June)
- If available, conduct grass specific herbicide treatment for tall fescue. Otherwise mow this species before seed matures (Late May, Early June)
- If necessary, collect approximately 20% of S. hitchcockii seed from Lost Creek as well as any other appropriate populations (Late summer).
- Harvest any seed from production field. This will likely be minimal in first year of production. (Late Summer).
- Conduct herbicide treatment of blackberry and false brome as needed (Fall).
- Apply harvested *S. hitchcockii* seed if available (Fall).

Large Meadow

- Reassess suitability of meadow for *S. hitchcockii* (June).
- Treat invasive species as necessary (Spring and Fall).
- Limb and thin trees from forest edge. Thin Oregon white oak to 1-2 stems per tree (Fall-Spring).

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APPENDICES

Appendix A: Site map and location

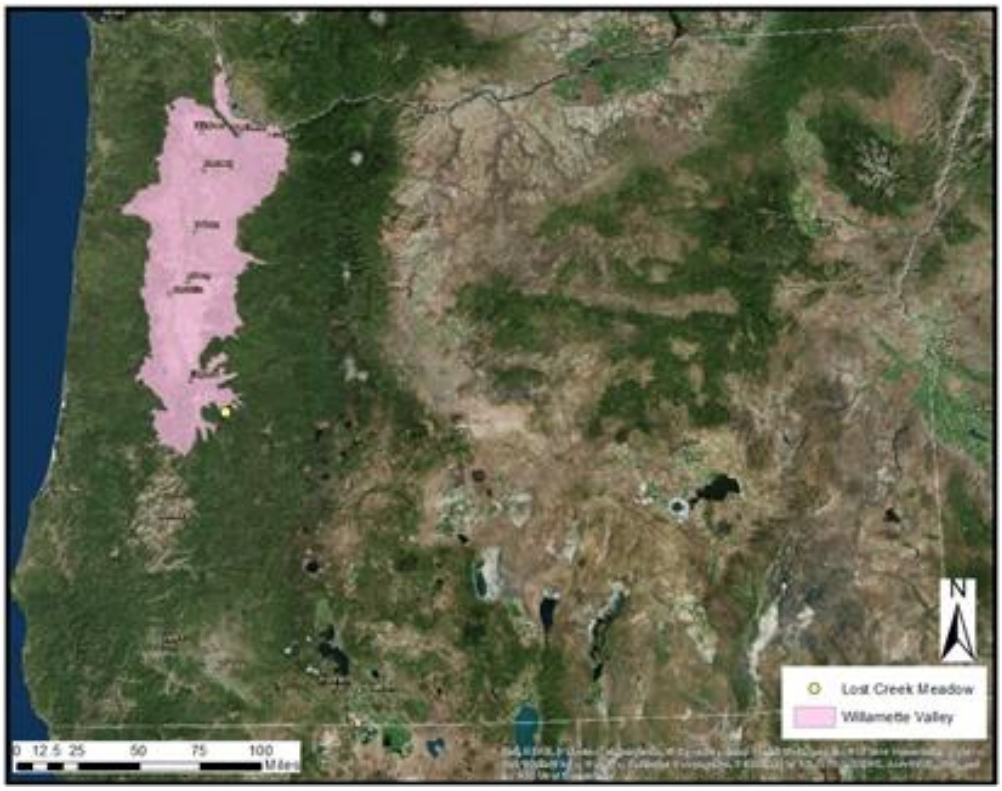
Legal Location and GPs coordinates

TSR: T20S R1W sec 3 UTM: East 0516141 North 4856548 Zone: 10T NAD 27 ConUS

Driving directions

Take Hwy 58 east and pass partway through the town of Dexter (milepost 11). Near the eastern edge of town turn right onto unmarked Rd 6120 which turns into Lost Creek Rd. Follow this road for about three miles and turn left on a sharp bend in the road onto Eagle's Rest Rd (19-1-33.1). Follow this paved road for 0.7 miles to a small parking area on the left (spur 19-1-3.1). From here use aerial photos or GPS coordinates to locate the small meadow which is about 300 meters south of the parking area. The western edge of the meadow abuts private property which is marked by a decrepit fence. No locked gates or dirt roads have been encountered.

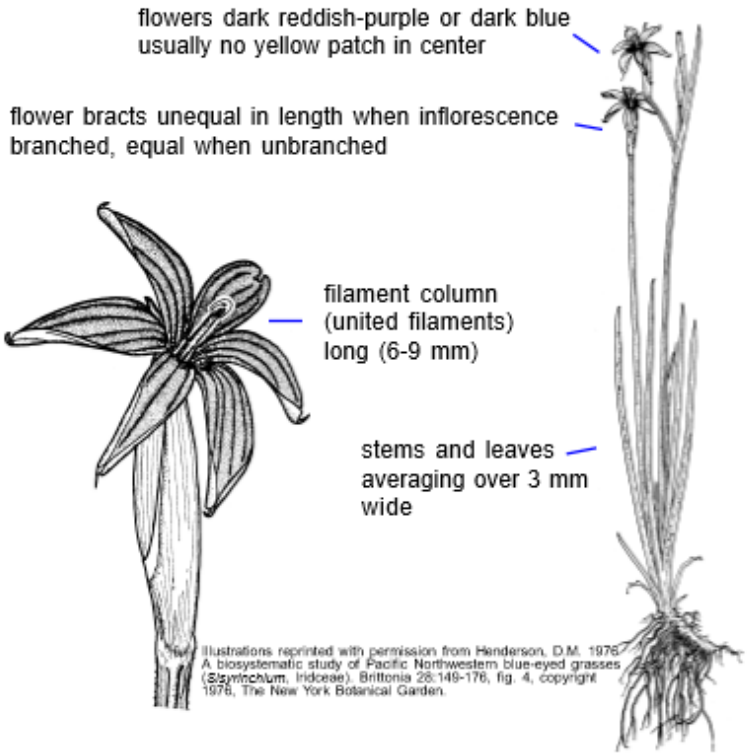
Maps



Appendix A.1. Small Meadow S. Hitchcockii 1

Appendix A.2. Small Meadow *Sisyrinchium hitchcockii* population 2014.

Appendix B: Oregon Flora Project Species Description



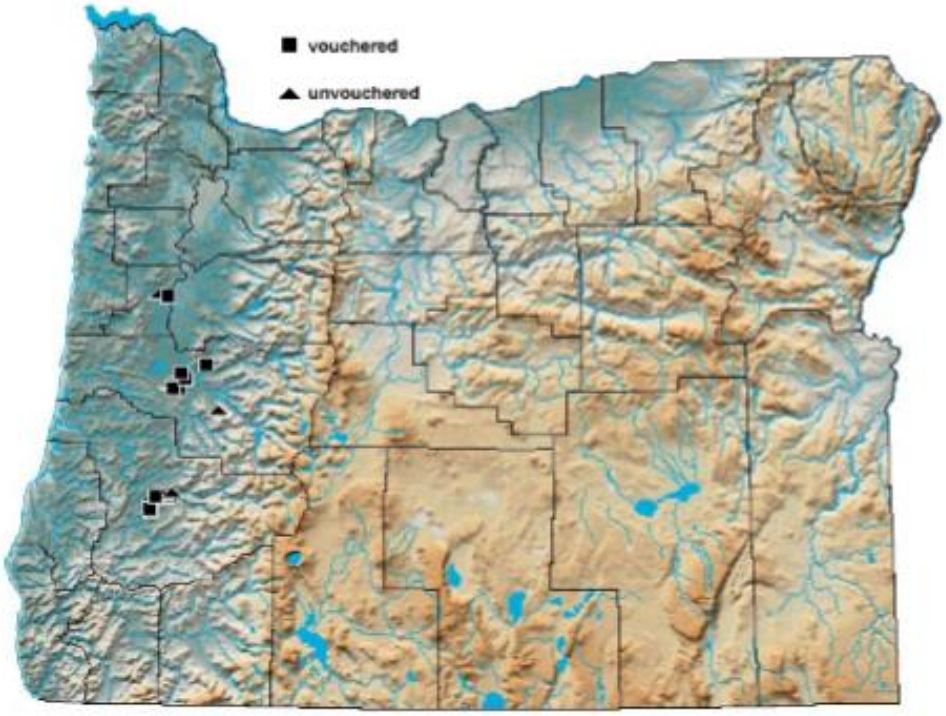
Rhizomatous, pale glaucous green, perennial herb. **Stems** 1-3, erect to ascending, simple or branched with a leaf-like bract subtending one of two pedunculate spathes, conspicuously 2-winged, (1.5)2.5-4(4.5) mm, to 55 cm tall, the margins smooth or occasionally with minute, widely spaced teeth. **Leaves** shorter than the stems, lax to ascending or strict, (2.2)3-4(6.0) mm wide, the margins smooth to finely denticulate. **Inflorescence** terminal on the stem or pedunculate; spathe bracts very unequal when simple-stemmed or sub-equal when pedunculate; inner bract 20-25(28) mm long, the outer margin entire to finely toothed, the inner margins narrowly hyaline for ca. 2/3 the length of the bract; outer bract 23-37(45) mm long, often abruptly to an acute, in-curved apex, outer margin entire to finely toothed, the inner margins narrowly hyaline 1/2-3/4 the length of the bract, connate at the base for (3.1)5.0-6.0(7.5) mm. **Flowers** 2-7 on stout, glabrous, slightly spreading pedicels generally exceeding the inner bract; perianth dark reddish-purple, rarely dark blue, the yellow eye infrequent or lacking, the segments narrowly elliptic to narrowly oblanceolate, often truncate, aristulate, emarginate, (12)15-18(20) m long; outer tepals with a length/width ratio greater than 3; filament column 6.0-9.0 mm long, purple, glandular proximally for (1.5)2.0-3.5(4.0) mm; anthers yellow-orange, 1.5-2.8 mm long; ovary at anthesis, 2-3 mm long, spherical, stipitate-glandular. **Fruits** capsules, (5)6-7(8) mm long, globose.

Lookalikes	**Differ by**
Sisyrinchium spp ..... (blue eyed grasses)	other species have smaller flowers, lighter colored flowers, are not rhizomatous, and/or have stamen filaments that are not united the full length

Source: Oregon Flora Project. 2002

Appendix C: Oregon Flora project species distribution

***Sisyrinchium hitchcockii* D.M. Hend.**
Hitchcock's blue eyed grass
PLANTS symbol: SIHI4
April 2002 status Federal:SoC; ONHIC:1



Distribution: Endemic to Willamette and Umpqua Valleys.

Habitat: Prairies, oak savannas.

Elevation: 200-650 feet

Best survey time(in flower): May-early June

Source: Oregon Flora Project. 2002

Appendix D: Partial list of plant species at Lost Creek *S. hitchcockii* site

Scientific Name	Common Name	Type	Duration	Origin
Aquilegia formosa	western columbine	Forb	Perennial	Native
Brachypodium sylvaticum	false brome	Graminoid	Perennial	Introduced
Camassia quamash	common camas	Forb	Perennial	Native
Cirsium vulgare	bull thistle	Forb	Biennial	Introduced
Danthonia californica	California oatgrass	Graminoid	Perennial	Native
Daucus carota	Queen Anne's lace	Forb	Biennial	Introduced
Deschampsia cespitosa	tufted hairgrass	Graminoid	Perennial	Native
Elymus glaucus	blue wildrye	Graminoid	Perennial	Native
Fragaria virginiana	Virginia strawberry	Forb	Perennial	Native
Fraxinus latifolia	Oregon ash	Tree	Perennial	Native
Geranium oreganum	Oregon geranium	Forb	Perennial	Native
Geum macrophyllum	largeleaf avens	Forb	Perennial	Native
Grindelia species	gumweed	Forb	Perennial	Native
Holcus lanatus	common velvetgrass	Graminoid	Perennial	Introduced
Leucanthemum vulgare	oxeye daisy	Forb	Perennial	Introduced
Lilium columbianum	tiger lily	Forb	Perennial	Native
Plectritis congesta	shortspur seablush	Forb	Annual	Native
Populus trichocarpa	black cottonwood	Tree	Perennial	Native
Potentilla gracilis	slender cinquefoil	Forb	Perennial	Native
Prunella vulgaris ssp. lanceolata	lance selfheal	Forb	Perennial	Native
Pseudotsuga menziesii	Douglas-fir	Tree	Perennial	Native
Quercus garryana	Oregon white oak	Tree	Perennial	Native
Rubus bifrons	Himalayan blackberry	Shrub	Perennial	Introduced
Rubus laciniatus	cutleaf blackberry	Shrub	Perennial	Introduced
Schedonorus arundinaceus	tall fescue	Graminoid	Perennial	Introduced
Sisyrinchium angustifolium	narrowleaf blue-eyed grass	Forb	Perennial	Native
Sisyrinchium hitchcockii	Hitchcock's blue-eyed grass	Forb	Perennial	Native
Symphoricarpos albus	common snowberry	Shrub	Perennial	Native
Toxicodendron diversilobum	poison oak	Vine	Perennial	Native
Trillium chloropetalum	giant wakerobin	Forb	Perennial	Native
Vancouveria hexandra	white insideout flower	Forb	Perennial	Native

Appendix E: Summary of restoration activities at Lost Creek Meadow (2005-2017)

2005

- Site survey and weed assessment.
- Hitchcock's blue-eyed grass (*Sisyrinchium hitchcockii*) monitoring.
- Hitchcock's blue-eyed grass seeds collected and sent to Berry Botanical Garden for long term storage.

2006

- No activities

2007

- No activities

2008

- Site assessment and Hitchcock's blue-eyed grass monitoring with Cheshire Mayrsohn.
- Collected seed of Hitchcock's blue-eyed grass.

2009 (Start of restoration activities at Lost Creek)

- Began growing Hitchcock's blue-eyed grass from seed collected in 2008.
- Felled ~30 trees to expand the perimeter of the meadow.
- Used brushcutter to remove Himalayan blackberry and other shrubs from the perimeter of the meadow.

2010

- Hitchcock's blue-eyed grass monitoring.
- Collected seed of Hitchcock's blue-eyed grass.
- Removed ~20 trees to expand the perimeter of the meadow.

2011

- Site assessment and coordination.
- Collected seed of Hitchcock's blue-eyed grass.
- Planted 10 Hitchcock's blue-eyed grass plants grown from seed collected in 2008.
- Used brushcutter to remove Himalayan blackberry and pulled false brome (Walama Restoration).

2012

- Site assessment and coordination.
- Girdled Douglas-fir on east side of meadow ~20 feet in the woods.
- Hitchcock's blue-eyed grass monitoring.
- Collected seed of Hitchcock's blue-eyed grass.
- Used brushcutter to remove Himalayan blackberry.

2013

- Seeding of bare areas created in 2012 with Seeds of Success seed collections.
- Site assessment and coordination.
- Hand pulling of false brome and thistle.

- Monitoring of Hitchcock's blue-eyed grass.
- Used brushcutter to remove Himalayan blackberry, English hawthorn, and Oregon ash.

2014

- Site assessment and coordination.
- Mapped extent of Hitchcock's blue-eyed grass population with GPS.
- Used brushcutter to remove Himalayan blackberry and Oregon ash and fruit tree stump resprouts.
- Hand pulled false brome.
- Consolidated slash piles.

2015

- Site assessment and coordination.
- Hand pulled false brome.
- Used brushcutter to remove Himalayan blackberry and Oregon ash resprouts.

2016

- Site assessment and coordination.

2017

- Site assessment and coordination.
- Census of Hitchcock's blue-eyed grass population in the meadow.

2018

- Site assessment and coordination.
- Hand pulling of false brome, and Himalayan blackberry

2019 (Planned)

- Site assessment and coordination.
- Fell and remove Oregon ash from the meadow.
- Use brushcutter to remove overgrown bracken fern, Himalayan blackberry, Oregon ash, and fruit tree stump resprouts.
- Hand pulling of false brome, teasel, and bull thistle.
- Potential seed collection and grow-out of Hitchcock's blue-eyed grass.

Appendix F: Potential list for plant community augmentation at Lost Creek Meadow

Scientific Name	Common Name	Type	Duration	Habitat	Method
Achillea millefolium	common yarrow	Forb	Perennial	Prairie	Seed
*Aquilegia formosa**	western columbine	Forb	Perennial	Edge	Seed
Calochortus tolmiei	Tolmie star-tulip	Forb	Perennial	Prairie	Bulb
*Camassia quamash**	common camas	Forb	Perennial	Prairie	Bulb
Castilleja hispida	harsh Indian paintbrush	Forb	Perennial	Prairie	Plug
Clarkia amoena	farewell to spring	Forb	Annual	Prairie	Seed
Collinsia grandiflora	giant blue-eyed Mary	Forb	Annual	Prairie	Seed
Cynoglossum grande	Pacific hound's tongue	Forb	Perennial	Edge	Plug
Eriophyllum lanatum	woolly sunflower	Forb	Perennial	Prairie	Seed
*Fragaria virginiana**	Virginia strawberry	Forb	Perennial	Prairie	Bareroot
*Geranium oreganum**	Oregon geranium	Forb	Perennial	Prairie	Bareroot
*Geum macrophyllum**	largeleaf avens	Forb	Perennial	Edge	Seed
*Grindelia species**	gumweed	Forb	Perennial	Prairie	Seed
Iris tenax	toughleaf iris	Forb	Perennial	Edge	Bareroot
*Lilium columbianum**	tiger lily	Forb	Perennial	Edge	Seed
Lomatium hallii	Hall's biscuitroot	Forb	Perennial	Prairie	Bareroot
Lomatium utriculatum	common lomatium	Forb	Perennial	Prairie	Bareroot
Nemophila menziesii	baby blue eyes	Forb	Annual	Edge	Seed
*Plectritis congesta**	shortspur seablush	Forb	Annual	Prairie	Seed
*Potentilla gracilis**	slender cinquefoil	Forb	Perennial	Prairie	Seed
*Prunella vulgaris ssp. lanceolata**	lance selfheal	Forb	Perennial	Prairie	Seed
Ranunculus occidentalis	western buttercup	Forb	Perennial	Prairie	Seed
Sidalcea virgata	dwarf checkerbloom	Forb	Perennial	Prairie	Seed
*Sisyrinchium hitchcockii**	Hitchcock's blue-eyed grass	Forb	Perennial	Prairie	Plug
Trifolium microcephalum	smallhead clover	Forb	Annual	Prairie	Seed
Trifolium willdenovii	tomcat clover	Forb	Annual	Prairie	Seed
*Wyethia angustifolia**	narrowleaf mule ears	Forb	Perennial	Prairie	Plug
Achnatherum lemmonii	Lemmon's needlegrass	Graminoid	Perennial	Prairie	Seed
Carex tumulicola	splitawn sedge	Graminoid	Perennial	Prairie	Bareroot
*Danthonia californica**	California oatgrass	Graminoid	Perennial	Prairie	Seed
Festuca californica	California fescue	Graminoid	Perennial	Edge	Seed
Festuca roemeri	Roemer's fescue	Graminoid	Perennial	Prairie	Seed
Koeleria macrantha	prairie junegrass	Graminoid	Perennial	Prairie	Seed
Luzula comosa	hairy wood rush	Graminoid	Perennial	Prairie	Seed
*Deschampsia cespitosa**	tufted hairgrass	Graminoid	Perennial	Prairie	Seed
*Elymus glaucus**	blue wildrye	Graminoid	Perennial	Prairie	Seed

*Species is already present on the site