



Rehabilitate and Restore Plaikni Falls Trail Landscape

2022 Annual Report





ON THIS PAGE

The Crater Lake National Park Botany crew planting native species in barren, trampled areas at the end of the Plaikni Falls trail. Photo by Carrie Wyler.

ON THE COVER

New fence installation to keep visitor damage from occurring above the Plaikni Falls trail terminus. Photo by Carrie Wyler.

Rehabilitate and Restore Plaikni Falls Trail Landscape

2022 Annual Report

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This annual report series is intended for the timely release of basic data sets and data summaries. Care has been taken to assure accuracy of raw data values, but a thorough analysis and interpretation of the data has not been completed. Consequently, the initial analyses of data in this report are provisional and subject to change.

All manuscripts in the series receive the appropriate level of peer review to ensure that the information is scientifically credible, technically accurate, appropriately written for the intended audience, and designed and published in a professional manner.

This report received informal peer review by a subject matter expert who was not directly involved in the collection, analysis, or reporting of the data.

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Abstract

The Rehabilitate and Restore Plaikni Falls Trail Landscape project corrects issues stemming from visitor use damage along a popular park trail. This includes disturbance from trail erosion, vegetation trampling, and continual social trail creation. The goals of this project are to restore the riparian area, restrict visitor travel into sensitive areas, and discourage further vegetation trampling to allow for site recovery. Work completed during the 2022 field season includes installation of fencing; collection of 61 grams of native seed; care of 833 propagated containerized native plants; planting of 461 native plants in restoration areas; invasive vegetation surveys in the project area; and social trail obliteration.

Acknowledgments

This project was made possible through funding support provided by the National Park Service Recreation Fee program. The Crater Lake National Park Facility Management staff facilitated use of the Ball Diamond and South Yard staging areas for storage of plant materials and related infrastructure. Assistance with seed collection and planting was received from members of the Crater Lake National Park Terrestrial Ecology staff and the Northwest Youth Corps, especially Scott Heisler, Hamilton Hasty, Casey Allen, Samantha Ulrich, Kyle Bianchi, David Larkin, Brian Pitt, and Javonn Sims.

Introduction

The Rehabilitate and Restore Plaikni Falls Trail Landscape is a two-year effort to address heavy visitor use and resulting damage along the Plaikni Falls Trail corridor. The Plaikni Falls Trail is the park's newest trail, constructed in 2010-2011 to provide access to the cascading falls of Sand Creek below its source at Anderson Spring. The Plaikni Falls Trail is a short, approximately two mile long out-and-back trail, beginning at a trailhead accessed from Pinnacles Road and terminating at the Sand Creek cascades. It traverses a relatively flat route through a high elevation montane mixed conifer forest dominated by Shasta red fir (*Abies magnifica* x *Abies procera*), mountain hemlock (*Tsuga mertensiana*), and western white pine (*Pinus monticola*) that is accessible to all-terrain wheelchairs except for the last quarter-mile where the trail climbs 100 feet to the base of Plaikni Falls.

Crater Lake National Park staff named the waterfall "Plaikni Falls" after the traditional Klamath name "*plai*" which refers to the creek's high elevation origins. The goals of creating the Plaikni Falls Trail were numerous (DOI NPS 2010):

1. Create a transitional experience between the park's front and backcountry.
2. Create new opportunities for interpreting the park's natural and cultural resources.
3. Create a trail accessible by visitors with differing physical abilities.
4. Provide more opportunities for visitors to experience solitude and primitive recreation.
5. Create a trail showcasing outstanding scenery and natural beauty.
6. Support goals articulated in the park's General Management Plan that spread visitor use patterns outside of the Rim Village area.

The Rehabilitate and Restore Plaikni Falls Trail Landscape project is a two-year effort to restore vegetation cover in heavily trampled areas (Figure 1) by preventing visitor trespass and social trail creation in sensitive riparian habitat and reestablishing native plant populations. An estimated 2,551 ft² of disturbed area will be restored as part of this project (Figure 1). This will help address deteriorating conditions detracting from the outstanding beauty that justified the trail's creation and improve the visitor experience.

The current rehabilitation project is tasked with:

1. Developing revegetation prescriptions and a revegetation plan for disturbed areas to be restored.
2. Protecting sensitive areas from continued damage through installation and maintenance of fencing and signage.
3. Collecting native plant materials for revegetation efforts.
4. Surveying for and controlling nonnative, invasive plant species within the project area.

5. Obliterating social trails and deterring creation of new areas of disturbance.
6. Planting of native vegetation and distributing seed in areas of disturbance.
7. Monitoring restored areas for revegetation efficacy and augmenting restoration actions.

The 2022 field season focused on documenting restoration site prescriptions, gathering plant materials, obliterating social trails, installing temporary fencing, planting native plants, and seeding restoration sites. Five seasonal Biological Science Technicians (Plants) were partially funded by this project in 2022; season length was from May 24 – September 30. The project area was divided into four sections to facilitate organization and work flow (Table 1 and Figure 2).

Table 1. Plaikni Falls Trail Landscape restoration sites, sizes, and obliteration types.

ID #	Location	Type	Size (ft ²)	Obliteration Type
PF1	Disturbed area left of falls to lower rock wall	Social trail	581	STO, seed, and plant
PF2	Large, disturbed area left of trail end	Social trail	624	STO, seed, and plant
PF3	Social trail on far-right side of falls	Social trail	840	STO, seed, and plant
PF4	Social trail down to lower river area	Social trail	506	STO, seed, and plant

*Social trail obliteration (STO)



Figure 1. Park staff and Northwest Youth Corps planting in area disturbed by heavy visitor use.

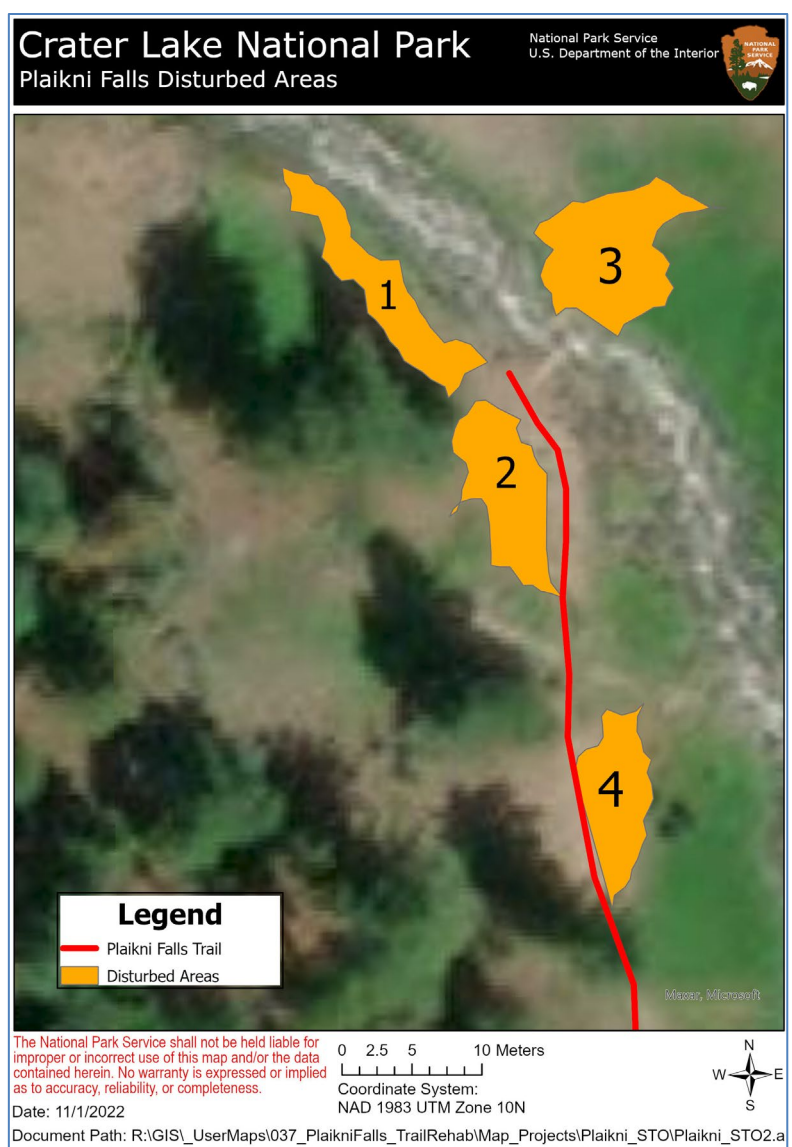


Figure 2. Location of Plaikni Falls trail in the park (left). Map by Carrie Wyler. Location of Plaikni Falls restoration sites in disturbed area (right). Map by Scott Heisler.

Methods

Rehabilitation efforts for this project consist of three components: (1) revegetation: site prescriptions, seed collection, native plant nursery work, and planting and seeding; (2) social trail obliteration and fencing (Figure 3); and (3) invasive vegetation management.

Revegetation

Site Prescriptions

Revegetation prescriptions were developed for disturbed areas within the Plaikni Falls Trail landscape by documenting and recording native vegetation cover in adjacent undisturbed plant communities. These prescriptions serve to document the disturbance, site features, and plant community composition unique to the area. Prescriptions were developed by visiting the site and recording the dominant plant species with an ocular estimate of each species' relative cover. This documentation informed revegetation efforts by providing a baseline from which to determine the number of plants by species and amount of seed to be used at each site. The revegetation prescriptions guide the planting and seeding plans for restoration work. Revegetation prescriptions and the revegetation plan are housed on the Botany program file server at park headquarters.

Seed Collection

Using the 2022 revegetation prescriptions as a reference, seed was collected from graminoids, forbs, and shrubs within the project area. Seed collection in 2022 targeted the most abundant plant species in the project area, and ones that the Botany program has experienced the most success with propagating and planting in prior restoration projects. Some revegetation will be accomplished by relying on the existing seed bank and seed rain from adjacent native plant populations. A list of seed collection species can be found in Table 2. The seed collection process commenced in 2022 by observing and documenting the phenology of each targeted species in the project area.



Figure 3. The condition of the trail terminus prior to fence installation. Photo by Jen Hooke.

Table 2. Seed collection plant taxa list for the Rehabilitate Plaikni Falls Trail Landscape project.

Scientific Name	Common Name
<i>Anaphalis margaritacea</i>	Pearly everlasting
<i>Drymocallis glandulosa</i> var. <i>reflexa</i>	Montana sticky cinquefoil
<i>Carex</i> spp.	<i>Carex</i> species mix
<i>Chamaenerion angustifolium</i> ssp. <i>circumvagum</i>	Fireweed
Graminoid Mix: <i>Bromus sitchensis</i> var. <i>carinatus</i> ; <i>Cinna latifolia</i> ; <i>Elymus elymoides</i> ssp. <i>elymoides</i> ; <i>Elymus glaucus</i> ssp. <i>glaucus</i>	California brome; slender woodreed; common squirreltail; blue wildrye
Forb Mix 1: <i>Aquilegia formosa</i> ; <i>Castilleja suksdorfii</i> ; <i>Dicentra formosa</i> ssp. <i>formosa</i> ; <i>Erigeron glacialis</i> var. <i>glacialis</i> ; <i>Hackelia micrantha</i> ; <i>Osmorhiza berteroi</i>	Red columbine; Suksdorf's paintbrush; Pacific bleeding heart; peregrine fleabane; blue stickseed; mountain sweet cicely
Forb Mix 2: <i>Arnica cordifolia</i> ; <i>Arnica longifolia</i> ; <i>Eucephalus ledophyllus</i> ; <i>Hieracium albiflorum</i> ; <i>Senecio triangularis</i>	Heart-leaved arnica; longleaf arnica; Cascade aster; white-flowered hawkweed; arrowleaf groundsel
<i>Erythranthe lewisii</i>	Great purple monkeyflower
<i>Lupinus latifolius</i> var. <i>latifolius</i>	Broad leaved lupine
<i>Phacelia mutabilis</i>	Changeable phacelia
<i>Ribes erythrocarpum</i>	Crater Lake currant
<i>Ribes lacustre</i>	Swamp currant

A single bag was used to collect seed from an individual species if the species was to be used for plant propagation purposes (Figure 4); otherwise seed from various species were combined into seed mixes for ease of collection. Bags of seed were labelled with plant species code and collection date. After collection, seeds were transported to the seed drying and storage facility in the Nine Stall garage at park headquarters (Figure 4). Collected seed was placed inside 30-gallon plastic storage totes secured with window screen at the top, allowing ventilation while reducing chances of predation. Plant species with very small seeds were first placed in smaller plastic bins before being stored within the larger 30-gallon tubs. The tubs were labelled and organized on shelves by project, seed zone or restoration site ID, and plant species (Figure 4).



Figure 4. Collected seed before drying (left). Seed drying and storage facility at park headquarters (middle). Seed drying in a container inside a drying bin with ventilated lid (right). Photos by Carrie Wyler.

Native Plant Nursery Work

Plants propagated were cold stratified during the winter months at the Ball Diamond nursery at park headquarters (Figure 5) by allowing them to overwinter under the snowpack. After snowmelt in June 2022, plants were covered with a shade house (40' x 20' x 10' – Figure 5).

Fertilizer was applied at the beginning of the season when plants emerged from the snow at a rate of 1/8 tsp per planting tube with Osmocote 14-14-14 slow-release fertilizer. Descriptions of fertilization procedures can be found in Botany program files in the “Nursery Activities” binder. Any reproductive structures were removed to promote root development and prevent excess evapotranspiration, and dead growth was removed to discourage fungal growth.



Figure 5. Propagated plants melting out in spring 2022 (left). Shadehouse at the Ball Diamond (right). Photos by Carrie Wyler.

Planting and Seeding

A variety of plant species was planted in the disturbance areas in accordance with the revegetation prescriptions and availability of plant materials. Plants, seed, park-sourced compost (to serve as mulch), and hand tools were hauled one mile into the site by staff and via wagon (Figure 6). At restoration sites, holes for planting were dug to a depth equal to or greater than the length of the planting tubes. Plants were carefully removed from the tubes by pressing on the sides of the tubes or tapping the rim of the tubes while they were inverted over the planting holes. After the plants had been removed from tubes, the roots were inspected for any signs of being root bound, having roots growing upward in the tube (“J”-rooting), or root girdling. If any of these were found, the roots were either trimmed or gently teased apart to encourage root growth and plant establishment. The plants were then placed in planting holes, ensuring they were upright perpendicular to the pull of gravity (not relative to the local topography). Soil was then pushed back into the planting holes and tamped down gently to remove any air pockets in the soil. Plantings were installed so that the root collars of the plants were just at or slightly below the surface of the soil. Remaining soil or additional soil from the surrounding area was used to create a berm wall around the plants to facilitate water retention and help stabilize and protect plants. One or two handfuls of park-sourced compost were then placed in the center of the rings around plants (Figure 6). After mulching the plants were watered from water on site.

Planting rates were determined by planting one third of the area, with plants being spaced 12-24" from each other (measured from plant center; plus 10% added to account for plant mortality). Once these plants have become established, they should revegetate the remaining area with seed rain and vegetative growth over time.

A site-specific seed mix combined with compost (Figure 6) was prepared and hand-broadcast over planted areas and raked into the soil after planting was complete. Common target rates of seed application in revegetation projects are 60 to 90 live seeds per square foot. Each restoration area receives a custom seed mix that matches its revegetation prescription. After hand broadcasting, seed is raked into the upper ¼ to ½ inch of topsoil. Revegetation sites will be monitored, and barren or failed areas will be filled in as needed in future years.



Figure 6. Plants being transported via wagon to planting site (left). Outplanted plant with berm and mulch from park-sourced compost (middle). Prepared seed mixed with compost (right). Photos by Carrie Wyler.

Social Trail Obliteration and Fencing

Areas disturbed by social trails (Figure 7) were restored by re-shaping and scarifying compacted soils with McCleod hand tools. All areas of visitor trespass were restored via light woody debris placement and obstruction of paths with fencing.

Temporary fencing and signage measures were put into place to encourage desired foot traffic and to deter further destruction of disturbed sites (Figure 7). The same fencing materials used to protect other revegetation sites in the park were utilized along the Plaikni Falls Trail landscape to maintain a consistent look throughout the park. In the winter and spring, the area to be fenced is covered with a layer of deep, packed snow. If a fence was left in place over the winter, it would likely become damaged by the weight and shifting nature of the snowpack and could also pose a safety hazard to visitors while partially buried. To ensure the stability of fencing posts, it was determined that in-ground post receivers were necessary to support posts and facilitate installation each spring. Information on suppliers, product numbers, order specifications, and installation procedures is on file in the Botany office at park headquarters.



Figure 7. Area disturbed by a social trail along the Plaikni Falls Trail (left). Installed signage and fencing at the base of a social trail leading to the waterfall (right). Photos by Carrie Wyler

Invasive Vegetation Management

The Rehabilitate Plaikni Falls Trail Landscape project area contains no known invasive plant species. Potential exists for invasive plant introduction via visitor use; any invasive plants detected will be managed aggressively.

Invasive plant surveys, monitoring, and control will be conducted annually by the botanical staff. All invasive species encountered will be treated according to established park protocols. Since the area contains no known invasive plants, invasive plant populations within the project area have an eradication strategy. The park utilizes manual and chemical control methods; the Invasive Vegetation Management Plan (DOI NPS 2017) guides invasive plant treatments in the park. Any invasive plant infestations that are detected in restored areas will be promptly treated so they do not outcompete the native plantings and/or spread to adjacent areas.

Results

Revegetation

Site Prescriptions

As of November 2022, four restoration sites have been defined, documented, and recorded with a unique revegetation prescription based on the condition of adjacent undisturbed vegetation communities. An example site prescription can be found in Table 3. Complete site documentation and monitoring forms for all sites can be found on the Botany file server at park headquarters.

Table 3. Example revegetation site prescription for the Rehabilitate Plaikni Falls Trail Landscape project.

Seed Zone: Plaikni Falls		ID: PF1	Unplanned site
Location: Trampled area left of falls – down to end of trail rock wall			
Site Description: Social trails up around falls and down to river			
Pre-Disturbance Site Information			
Plant Taxa	Common Name	Relative % Cover	
<i>Anaphalis margaritacea</i>	Pearly everlasting	5	
<i>Arnica longifolia</i>	Longleaf arnica	25	
<i>Hackelia micrantha</i>	Blue stickseed	5	
<i>Veratrum viride</i> var. <i>eschscholziaenum</i>	Green false-hellebore	2	
<i>Phacelia mutabilis</i>	Changeable phacelia	2	
<i>Carex</i> sp. (riparian)	Sedges	10	
Grass Mix: <i>Elymus elymoides</i> ssp. <i>elymoides</i> , <i>Bromus sitchensis</i> var. <i>carinatus</i> , <i>Elymus glaucus</i> ssp. <i>glaucus</i> , <i>Cinna latifolia</i>	Common squirreltail, California brome, blue wildrye, slender woodreed	5	
<i>Erythranthe lewisii</i>	Great purple monkeyflower	20	
<i>Lupinus latifolius</i> var. <i>latifolius</i>	Broad-leaved lupine	5	
<i>Maianthemum racemosum</i> ssp. <i>amplexicaule</i>	Large false Solomon’s Seal	2	
<i>Ribes lacustre</i>	Swamp currant	2	
<i>Senecio triangularis</i>	Arrowleaf groundsel	2	
<i>Dicentra formosa</i> ssp. <i>formosa</i>	Pacific bleeding heart	3	
<i>Arnica cordifolia</i>	Heart-leaved arnica	2	
<i>Castilleja suksdorfii</i>	Suksdorf’s paintbrush	5	
Other		7	
	Total Cover:	100%	
Associated species: mosses, ferns, <i>Erigeron glacialis</i> var. <i>glacialis</i> , <i>Aquilegia formosa</i> , <i>Alnus alnobetula</i> ssp. <i>sinuata</i> , <i>Agoseris</i> sp., <i>Osmorhiza berteroi</i> , <i>Boechera</i> sp., <i>Dodecatheon alpinum</i> , <i>Chamaenerion angustifolium</i> ssp. <i>circumvagum</i>			
UTM (Zone 10, NAD 83):	Beginning: N577639 End: E4751158 LOWER	Beginning: N577634 End: E4751174 UPPER	
Total Vegetative Cover: 30%		Elevation: 6,537’ Lower 6,549’ Upper	
Slope: High	Aspect: SE	Snowmelt out:	
Soil “hardness,” presence of rocks: Wet, medium compact, rocky			
General Soil description: Sand, gravelly, rocky			
Ameliorating microsite features: Existing vegetation, boulders, groundwater/nearby water, plant detritus			
Wind exposure: Low	Canopy cover (overall): Low		
Area: 581 ft²			
Comments: Area has a lot of trampling and soil compaction from visitors wanting to get up to falls and to river for pictures.			
Recorder:	CW/ER	Date: 7/2022	

Seed Collection

Plant materials for this project were collected by park staff during the 2022 field season and will continue to be collected through 2023 (Figure 8). Seed cleaning, processing, and storage is handled by the park's Botany staff.



Figure 8. Seed collection along the Plaikni Falls Trail. Photos by Carrie Wyler.

Plant phenology was monitored during the field season through biweekly visits to collection sites, and then later in the season concurrently with seed collection. In 2022 seed collection for the project commenced in early August and continued into late October. The peak seed collection for the bulk of plant species in most of the seed zones occurred from mid-August to mid-September (Table 4).

Table 4. 2022 seed collection periods for priority collection species indicated by gray shading.

Species	AUG (early)	AUG (mid)	AUG (late)	SEPT (early)	SEPT (mid)	SEPT (late)	OCT (early)	OCT (mid)	OCT (late)
<i>Anaphalis margaritacea</i>									
<i>Arnica longifolia</i>									
<i>Cinna latifolia</i>									
Carex Mix									
<i>Elymus glaucus</i> ssp. <i>glaucus</i>									
<i>Eucephalus ledophyllus</i>									
<i>Erythranthe lewisii</i>									
<i>Phacelia mutabilis</i>									
<i>Ribes erythrocarpum</i>									
<i>Ribes lacustre</i>									
<i>Senecio triangularis</i>									

Botany staff collected seed from species on the project's species collection list; quantities are listed in Table 5.

Table 5. Seed collection quantities and dispersal amounts for 2022.

Scientific Name	Common Name	Amount collected 2022 (grams)	Amount Dispersed 2022 (grams)
<i>Anaphalis margaritacea</i>	Pearly everlasting	16	12
<i>Carex</i> spp.	Carex Mix	9	0
<i>Chamaenerion angustifolium</i> ssp. <i>circumvagum</i>	Fireweed	11	11
<i>Drymocallis glandulosa</i> var. <i>reflexa</i>	Montana sticky cinquefoil	20	16
<i>Elymus glaucus</i> ssp. <i>glaucus</i>	Blue wildrye	1	0
Forb Mix 1: <i>Castilleja suksdorfii</i> , <i>Osmorhiza berteroi</i> , <i>Hackelia micrantha</i> , <i>Dicentra formosa</i> ssp. <i>formosa</i> , <i>Erigeron glacialis</i> var. <i>glacialis</i> , <i>Aquilegia formosa</i>	Suksdorf's paintbrush, mountain sweet cicely, blue stickseed, Pacific bleeding heart, peregrine fleabane, red columbine	8	0
Forb Mix 2: <i>Anaphalis margaritacea</i> , <i>Arnica longifolia</i> , <i>Senecio triangularis</i> , <i>Eucephalus ledophyllus</i> , <i>Hieracium</i> spp.	Pearly everlasting, longleaf arnica, arrowleaf groundsel, Cascade aster, hawkweed spp.	51	3
Grass Mix: <i>Elymus elymoides</i> ssp. <i>elymoides</i> , <i>Bromus sitchensis</i> var. <i>carinatus</i> , <i>Elymus glaucus</i> ssp. <i>glaucus</i> , <i>Cinna latifolia</i>	Common squirreltail, California brome, blue wildrye, slender woodreed	44	0
<i>Erythranthe lewisii</i>	Great purple monkeyflower	8	1
<i>Lupinus latifolius</i> var. <i>latifolius</i>	Broad-leaved lupine	6	3
<i>Phacelia mutabilis</i>	Changeable phacelia	24	12
<i>Ribes erythrocarpum</i>	Crater Lake currant	4	0
<i>Ribes lacustre</i>	Swamp currant	4	0
	TOTAL	206	58

Native Plant Nursery Work

Plant propagation for 2022 included containers of grasses, sedges, shrubs, and forbs (Table 6 and Figure 9). After snowmelt in 2022 (Figure 9), overwintered plants were assessed and inventoried. Plants without any green growth or with rotted roots were discarded. Plants with detritus, moss, liverwort, or volunteer plants were cleaned (Figure 9). Detailed reports of daily nursery activities are on file in the Botany office in the Nursery Activities binder.

Table 6. Propagation and germination numbers for 2022.

Scientific Name	Common Name	# of pots seeded for propagation	# of plants germinated in spring 2022
<i>Anaphalis margaritacea</i>	Pearly everlasting	98	96
<i>Arnica longifolia</i>	Longleaf arnica	196	182
Carex mix	Carex mix	98	96
<i>Elymus glaucus</i> ssp. <i>glaucus</i>	Blue wildrye	98	65
Grass Mix: <i>Elymus elymoides</i> ssp. <i>elymoides</i> , <i>Bromus sitchensis</i> var. <i>carinatus</i> , <i>Elymus glaucus</i> ssp. <i>glaucus</i> , <i>Cinna latifolia</i>	Common squirreltail, California brome, blue wildrye, slender woodreed	98	87
<i>Erythranthe lewisii</i>	Great purple monkeyflower	98	70 (172)*
<i>Ribes erythrocarpum</i>	Crater Lake currant	98	91
<i>Ribes lacustre</i>	Swamp currant	98	56
	TOTAL	882	743 (845)**

*70 plants germinated but were divided to end up with 172 plants.

**Total number of plants available after germination and total number after plant division.



Figure 9. Covering seeded pots with vermiculite for propagation (left). Overwintered plants emerging from the snow (middle). Cleaning and trimming plants at the Park's nursery (right). Photos by Carrie Wyler.

Planting and Seeding

Seeding and planting work began in fall 2022 in areas PF1, PF2, PF3, PF4. A total of 461 plants were planted and 58 grams of seed dispersed over all sites (Table 7). Following the 2022 planting, park staff seeded and raked seed in at each restoration site and ensured that plantings were properly watered and prepared for the winter season.

Table 7. Outplanting and seed dispersal numbers for 2022.

Scientific Name	Common Name	# Of Plants Outplanted in 2022	Amount of Seed Dispersed 2022 (grams)
<i>Anaphalis margaritacea</i>	Pearly everlasting	63	12
<i>Arnica longifolia</i>	Longleaf arnica	92	0
<i>Carex mix</i>	Carex mix	47	0
<i>Chamaenerion angustifolium</i> ssp. <i>circumvagum</i>	Fireweed	0	11
<i>Drymocallis glandulosa</i> var. <i>reflexa</i>	Montana sticky cinquefoil	0	0
<i>Elymus glaucus</i> ssp. <i>glaucus</i>	Blue wildrye	60	0
Forb Mix 2: <i>Anaphalis margaritacea</i> , <i>Arnica longifolia</i> , <i>Senecio triangularis</i> , <i>Eucephalus ledophyllus</i> , <i>Hieracium</i> spp.	Pearly everlasting, longleaf arnica, arrowleaf groundsel, Cascade aster, hawkweed spp.	0	3
Grass Mix: <i>Elymus elymoides</i> ssp. <i>elymoides</i> , <i>Bromus sitchensis</i> var. <i>carinatus</i> , <i>Elymus glaucus</i> ssp. <i>glaucus</i> , <i>Cinna latifolia</i>	Common squirreltail, California brome, blue wildrye, slender woodreed	74	0
<i>Erythranthe lewisii</i>	Great purple monkeyflower	87	1
<i>Lupinus latifolius</i> var. <i>latifolius</i>	Broad-leaved lupine	0	3
<i>Phacelia mutabilis</i>	Changeable phacelia	0	12
<i>Ribes erythrocarpum</i>	Crater Lake currant	24	0
<i>Ribes lacustre</i>	Swamp currant	14	0
TOTAL		461	58

Despite a successful planting season in 2022, additional plants remain for future revegetation efforts. These will be used during the 2023 planting season along with any seed collected. Plants are being held over the 2022-23 winter at the Ball Diamond nursery to fill in gaps at restoration sites as needed during 2023. When ambient temperature dropped below freezing the containers were consolidated and mulch was stacked around the bases of herbaceous plants to prevent root freezing (Figure 10). These plants will need further care in the summer of 2023 including watering, fertilization, and transplanting into larger containers.



Figure 10. Distributing mulch around the edges of pots to insulate against frigid winter temperatures (left). Consolidated plants prior to overwintering (right). Photos by Carrie Wyler.

Social Trail Obliteration and Fencing

Areas disturbed by social trails were restored by re-shaping and scarifying compacted soils. All areas of visitor trespass were restored via light woody debris placement and obstruction of paths. Temporary fencing measures were put into place to encourage visitors to remain along the designated trail and to deter further destruction of native vegetation communities.

In spring of 2022 fence post receiver sleeves were installed alongside trail edges. With in-ground receivers in place, powder coated posts were inserted and chain strung through all receivers (Figure 11). In the fall posts and chain were removed and winter caps placed on top of receivers. This process will be repeated in the spring of 2023.



Figure 11. Installation of fence post receivers (left). Installation of fence posts, chain, and signage along the trail edge (right). Photos by Carrie Wyler.

Invasive Vegetation Management

The Rehabilitate Plaikni Falls Trail Landscape project area contains no known invasive plant species, but some invasive plants could be introduced through visitor use. The project area was surveyed for invasive plants in the spring and summer of 2022 and no infestations were found. The project area will continue to be surveyed in coming years to ensure that the area remains free of invasive vegetation.

Discussion

During the 2022 season revegetation work was completed for the first year of the project. Fencing was installed, maintained, and removed before snowfall. Recent plantings were monitored for proper planting and watering.

The Plaikni Falls Trail terminates at the falls and provides limited seating, shade, or areas for visitors to disperse which leads to trampling and disturbance. The terminus of the trail is located in a riparian area containing a highly diverse and sensitive assemblage of vegetation types growing around the falls. This riparian vegetation assemblage is a limited and linear feature surrounded by a forested vegetation community with a depauperate understory. Sources of plant materials for restoration are restricted to the Sand Creek riparian zone, which makes it difficult to collect large quantities of seed without impacting local plant communities. Limited seed quantities makes it difficult to restore trampled areas when plant materials cannot be obtained in needed quantities. Additionally, the trail areas suffering the highest disturbance have very rocky soils which made it difficult to install fencing, signage, and plants, which are essential for successful restoration. The damaged sites were located at the end of a mile-long trail, which meant staff had to haul all needed items into the site, which also made restoration more difficult. The Plaikni Falls trail terminus will need annual fencing, signage, and monitoring to protect this area.

All of these factors should be considered in the future when considering potential sites for new trail construction. With higher numbers of visitors recreating in parks each year the probability for vegetation disturbance is increasing. Therefore, the sustainability of the landscape supporting new trails should be carefully assessed so that visitor use will not negatively impact sensitive park resources.

Recommendations and needs for the Rehabilitate Plaikni Falls Trail Landscape project work in the 2023 field season include:

1. Fencing and signage will need to be installed as soon as possible in the spring after snowmelt.
2. All plants that overwintered in 2022-2023 need to be assessed for status and health. Root-bound plants will need to be transplanted into larger containers or divided as soon as practical after the snow melts. Plants will need fertilization to assist with survival and growth. Care should be taken to not expose newly transplanted plants to water, light, or temperature shock. All containerized plants should be checked for moss, liverwort growth, and weeds and they should be removed if present.
3. The entire project area needs to be thoroughly surveyed for invasive plants at least twice throughout the 2023 field season.
4. Restoration prescriptions will need to be updated and documented for changes in revegetation status.
5. Sites will need to be surveyed to determine whether desired foot traffic continues with new fencing measures taken and fencing will need to be regularly monitored for maintenance needs.
6. Revegetation sites will need to be monitored, and barren or failed areas will need to be addressed with more planting and seeding.

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