



Rehabilitate Rim Trail Landscape Project

2022 Annual Report





ON THIS PAGE

Hauling water into restoration planting sites along the Rim Trail.
Photo by Carrie Wyler.

ON THE COVER

Planting in an area denuded by visitor trampling along the Rim Trail corridor.
Photo by Carrie Wyler.

Rehabilitate Rim Trail Landscape Project

2022 Annual Report

Carolyn S. Wyler, Scott E. Heisler, and Jennifer S. Hooke

National Park Service
Crater Lake National Park
P.O. Box 7
Crater Lake, Oregon 97604

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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.

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Abstract

In 2019 and 2022, the Botany program at Crater Lake National Park received funds to repair landscapes damaged by visitor use immediately adjacent to the park's Rim Trail. This project was planned to complement cyclical trail maintenance efforts, with the intent of restoring areas of trampled vegetation and compacted soils created by the numerous social trails and visitor expanded and created viewpoints along the length of the trail. Damaged areas identified within the project's boundaries total over an acre. Work conducted in 2022 by the Botany program focused on disturbed area assessment, revegetation (native seed collection, seed cleaning, and plant care), and social trail obliteration. Accomplishments included development of a restoration framework; collection and processing of 242 grams of native seed from three distinct seed collection zones; care of 2,805 containerized native plants; outplanting of 2,495 plants; dispersal of 13,393 grams of seed; and social trail obliteration at 69 sites totaling approximately 0.7 acres.

Acknowledgments

This project was supported by the National Park Service Recreation Fee program. The U.S. Forest Service Dorena Genetic Resource Center staff assisted with seed cleaning and plant propagation. Eleanor Roeder, Samantha Ulrich, Kyle Bianchi, David Larkin, Hamilton Hasty, Casey Allen, Brian Pitt, Javonn Simms, and the Northwest Youth Corps helped with seed collection, plant care, planting, seeding, watering, and social trail obliteration.

Introduction

Crater Lake National Park's (CRLA) Rim Trail provides visitors a unique opportunity to experience Crater Lake as a primitive landscape. Beginning at CRLA's historic Rim Village, the trail traverses 7.6 miles along the western edge of the caldera rim to the trail's northern terminus at North Junction (Figure 1). Along the way, visitors are immersed in a landscape of old growth forest, subalpine meadows, rugged peaks, and windswept cliffs. Frequent breaks in the forest open to views of the caldera's steep inner walls and the sweeping expanse of Crater Lake. The Rim Trail provides an immersive experience in nature's beauty befitting a national park, placed within a context which lends perspective to the scale of the landscape and forces that shape it.

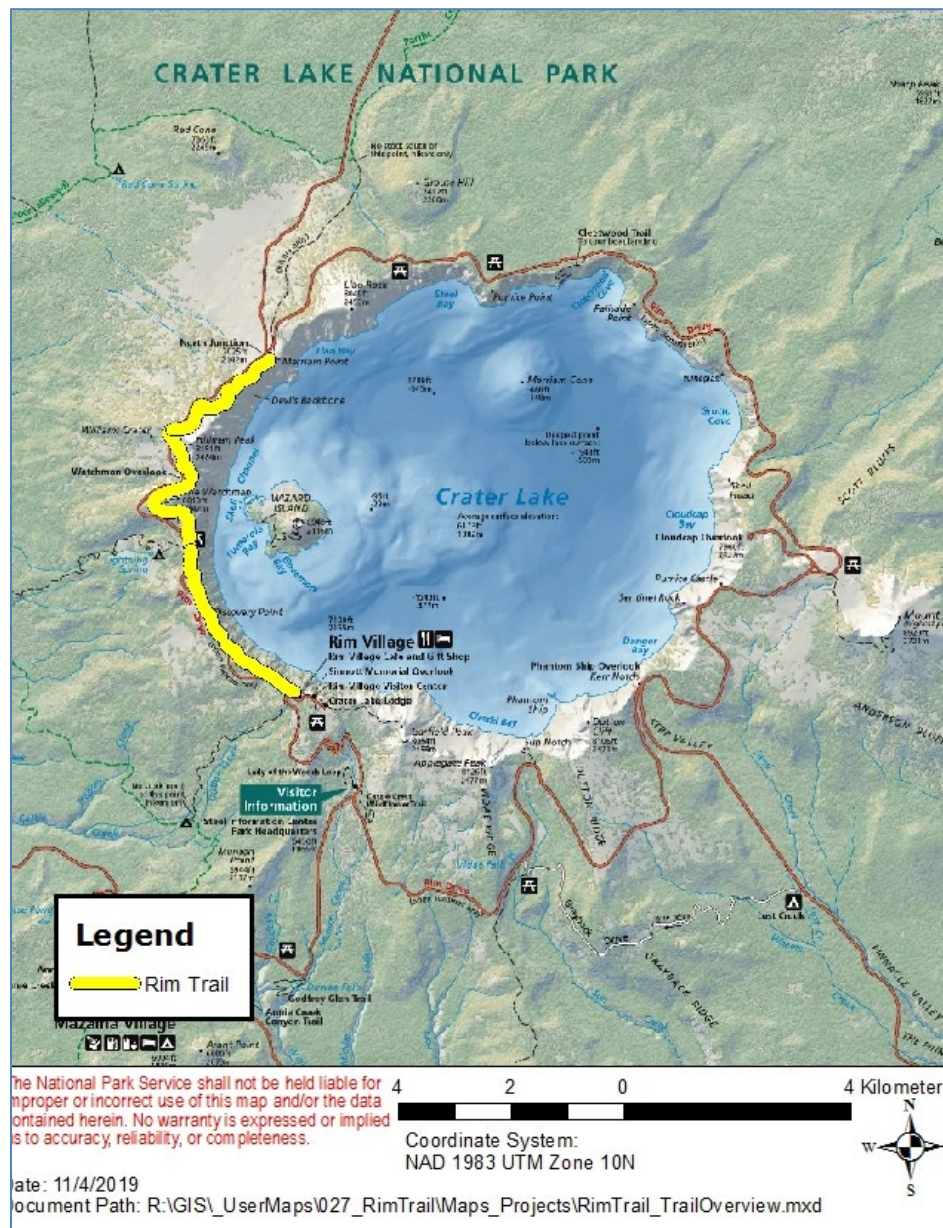


Figure 1. Yellow highlighted area is the 7.6 mile long Rim Trail. Map by Scott Heisler.

The Rim Trail originated as a short 1.5-mile segment constructed in 1932 connecting Rim Village and Discovery Point, called the Discovery Point Trail (Mark 2013). Decades passed before the Discovery Point Trail was extended north along the caldera rim to North Junction. New trail construction was minimized by aligning as much of the new trail as possible with the old Rim Road. The completion of this project occurred in 1994, and the new trail was called the “PCT Alternate” route as it provided an option for Pacific Crest Trail (PCT) hikers to experience views of Crater Lake before joining back up with the PCT at North Junction (Mark 2013). The name “Rim Trail” came to encompass the entire 7.6 mile stretch from Rim Village to North Junction around 2000 (Mark, personal communication).

The Rim Trail is one of the most popular trails at CRLA. Decades of intense use by visitors, with CRLA now frequently setting new records for annual visitation, have combined with a lack of maintenance to render large areas of the trail in a heavily degraded condition. Extensive social trails; broad, barren trampled areas; and diverted sections of tread have proliferated along the trail, with especially high levels of degradation in areas surrounding established access points such as pullouts and picnic areas along West Rim Drive. In addition to detracting from the aesthetics of the trail, this damage compromises visitor safety by decreasing the stability of the trail and directing traffic into hazardous areas along the cliffs of the caldera wall (Figure 2). All areas within the caldera are off-limits to visitors due to hazardous conditions, with the exception of the designated Cleetwood Cove Trail.



Figure 2. Social trails that lead from the Rim Trail into the Crater Lake caldera, which is closed to the public due to safety concerns. Photos by Carrie Wyler.

In 2019 and 2022, CRLA’s Botany program received funds to repair damaged landscapes immediately adjacent to the Rim Trail. This project was designed to complement cyclical maintenance efforts performed by the CRLA’s Trail program. Coupling revegetation work with trail maintenance while improving visitor access and safety is an effective strategy to restore the landscape for the enjoyment of visitors for generations to come. Unfortunately, priorities for the

Trails program shifted and the two crews were not able to work together as closely as planned. In 2022, the Botany program restored areas that were not dependent on prior maintenance by the Trails crew and focused on visitor use-disturbed areas adjacent to the trail corridor.

The goals of this revegetation project are to repair barren sites (Figure 3) and areas impacted by social trails through decompacting and amending soils; increasing vegetation cover and abundance; and discouraging additional disturbances in these areas through education and obstruction. The funds received for this project supported salary and supplies for seasonal Biological Science Technicians (Plants) to achieve the following tasks:

- Assist with developing a revegetation plan for seed collection, site repair, broadcast seeding, and planting.
- Collect and process native seeds and plant materials from adjacent wildlands.
- Help propagate native herbaceous and shrubby plants for restoration plantings.
- Prepare seed mixes for broadcast seeding and actively restore area through planting and seeding.
- Obliterate social trails and restore barren and denuded areas. Rehabilitate disturbed soils through adding native organic materials such as park-sourced compost and woody debris.
- Install signs and natural barriers to keep visitors on designated trail and overlook areas.
- Monitor efficacy of restoration efforts and augment seeding/planting as needed to restore barren areas.

Efforts during the 2022 field season focused on three distinct components of the project: project area assessment; revegetation (native seed collection and processing, plant propagation and care, planting, and seed dispersal), and social trail obliteration. These components will be discussed separately in the following sections.

Methods

Disturbed Area Assessment

A formal assessment and mapping of revegetation sites within the project area was conducted in early summer 2022 (Figure 3). This assessment identified and characterized problem areas, photo documented sites (Figure 3), gathered area measurements, and refined a plant taxa list to guide seed collection efforts. A master list of revegetation sites can be found in Appendix A.



Figure 3. Collecting data on trampled areas along the Rim Trail (top). Excessively wide section of the Rim Trail (bottom left), and trampled area inside the caldera rim (bottom right). Photos by Carrie Wyler.

Revegetation

Seed Collection and Processing

Due to the proximity in location, the seed collection zones previously developed for the adjacent Rim Drive Rehabilitation Revegetation project (Figure 4) were used for the Rim Trail project. Within these zones, seed was collected from within a half mile of the trail. Species collection lists were developed by surveying plant communities along the trail and assessing the Botany program's success with the use of individual species in previous revegetation efforts (Table 1). Phenology of collection species within the seed collection area was recorded during the 2022 field season. Plant materials were supplemented with previously collected seed that was remaining from the Rim Drive Rehabilitation Revegetation (RDRR) project while being consistent with seed zones.



Figure 4. Rim Trail sections and seed zones. Map by Scott Heisler.

Table 1. Plant taxa List for the Rehabilitate Rim Trail Landscape project.

Scientific Name	Common Name
<i>Bromus sitchensis</i> var. <i>carinatus</i>	California brome
<i>Calyptidium umbellatum</i>	Pussypaws
<i>Carex breweri</i>	Brewer's sedge
<i>Carex halliana</i>	Hall's sedge
<i>Carex inops</i> ssp. <i>inops</i>	Long-rhizome sedge
<i>Carex pachycarpa</i>	Many-rib sedge
<i>Elymus elymoides</i> ssp. <i>elymoides</i>	Common squirreltail
<i>Elymus glaucus</i> ssp. <i>glaucus</i>	Blue wildrye
<i>Ericameria greenei</i>	Greene's goldenbush
<i>Eriocoma occidentalis</i>	Western needlegrass
<i>Eriogonum marifolium</i> var. <i>marifolium</i>	Marumleaf buckwheat
<i>Eriogonum pyrolifolium</i> var. <i>coryphaeum</i>	Hairy Shasta buckwheat
<i>Eucephalus ledophyllus</i>	Cascade aster
<i>Koenigia davisiae</i> var. <i>davisiae</i>	Davis' knotweed
<i>Lupinus albicaulis</i> var. <i>shastensis</i>	Pine lupine
<i>Lupinus lepidus</i> var. <i>lobbii</i>	Prostrate lupine
<i>Phacelia hastata</i> var. <i>compacta</i>	Compact phacelia
<i>Phlox diffusa</i>	Spreading phlox
<i>Pinus albicaulis</i>	Whitebark pine
<i>Polygonum shastense</i>	Shasta knotweed
<i>Ribes erythrocarpum</i>	Crater Lake currant

Seed was collected according to the Botany program's established Seed Collection Protocols (Beck et al. 2017). This seed was then dried and cleaned according to the Botany program's Seed Cleaning and Short-Term Storage Protocol (on file on the Botany server).

When seeds were mature, they were collected, dried, and stored until shipment or cleaning. Large quantities of seed were shipped to the USFS Dorena Genetic Resource Center (DGRC) for cleaning, while smaller quantities were cleaned in house. A single bag was used to collect all the seed from an individual species if the species was to be used for propagation purposes (Figure 6) otherwise species were combined into seed mixes for ease of collection. Collection bags were labelled with 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 6). 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 seed zone and plant species (Figure 5).



Figure 5. Collected seed before cleaning (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.

Propagation and Plant Care

Anticipating the need for established containerized plants for use by this project and the slow growth of native plants in the high elevation conditions at CRLA, an advance round of plant propagation was conducted in fall 2018, and two more rounds were conducted in 2020 and 2021 to account for plant mortality. A method of plant propagation previously established by the Botany program was utilized to address staffing and equipment limitations (Heisler et al. 2019). This method uses the reliable snowpack at CRLA for cold stratification of pre-seeded pots. Selection of plant species and quantities for this effort were based upon the program's familiarity with the project area and experience gained from the Rim Drive Rehabilitation Revegetation project.

After the snow melted each season, plants that had been propagated the previous fall were assessed and inventoried and then placed in a shade house (40' x 20' x 10' - Figure 6). Pots without any green growth were discarded. Remaining plants were fertilized with Osmocote 14-14-14 slow-release fertilizer. 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. Descriptions of fertilization procedures can be found in Botany program files in the "Nursery Activities" binder. Plants with detritus, moss, liverwort, or volunteer plants were cleaned throughout the season.



Figure 6. Potted plants melting out from winter snowpack (left). Shadehouse at the Ball Diamond nursery (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. At restoration sites, holes 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, 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 to ensure 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 compost were then placed in the center of the rings around plants (Figure 8). After mulching the plants were watered from water that was hiked into the site (Figure 8). Planting rates are figured at 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 fill in the remaining area through seed rain.

A site-specific seed mix combined with compost (Figure 7) was prepared and hand-broadcast over planted areas and raked into the soil after planting was completed. Common target rates of seed application in revegetation projects are 60 to 90 live seeds per square foot. Each restoration area received a custom seed mix appropriate to its revegetation prescription. After hand broadcasting, seed were 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 7. Outplanted plant with berm and mulch (left). Carrying planting drill and water jugs via frame pack into restoration planting sites (middle). Prepared seed mixed with compost (right). Photos by Carrie Wyler.

Social Trail Obliteration

Based upon an assessment of candidate revegetation sites, 68 sites along heavily impacted stretches of the Rim Trail were selected for social trail obliteration and rehabilitation: 49 in the South seed zone, 12 in the Central seed zone, and 7 in the North seed zone. These sites will be monitored to assess the effectiveness of methods and barriers used in order to guide future efforts. The sites selected were presumed to not need intensive trail work as a corrective measure, and consisted of braided trails, heavily impacted designated viewpoints, and egregious visitor-created viewpoints.

Soil decompaction and tread removal were conducted by hand using a McLeod or pick mattock tool (Figure 8). Following decompaction, planting was completed (Figure 9), duff sourced from adjacent areas was added, and broadcast seeding and raking of collected native seed mixes was conducted to disguise the obliterated path, amend the barren soils, and jumpstart revegetation efforts. Access to the social trails was then obstructed by the addition of large, coarse woody debris and rocks (Figure 8).



Figure 8. Decompacting soil on a social trail with a McLeod (left). Planting a disturbed area on the Rim Trail (middle). Obstructing a restoration site with woody debris (right). Photos by Carrie Wyler.

Results

Disturbed Area Assessment

The assessment of disturbed areas identified 75 disturbed sites and 69 sites that could realistically be restored without help from the Trails program. The combined area totaled 0.7 acres. A georeferenced photo database documenting pre-restoration conditions of revegetation sites was created (located on the Botany server), along with accurately mapped boundaries of the sites for each zone (Figures 9-11).

Crater Lake National Park

Rim Trail Rehabilitation and Revegetation - North Seed Zone

National Park Service
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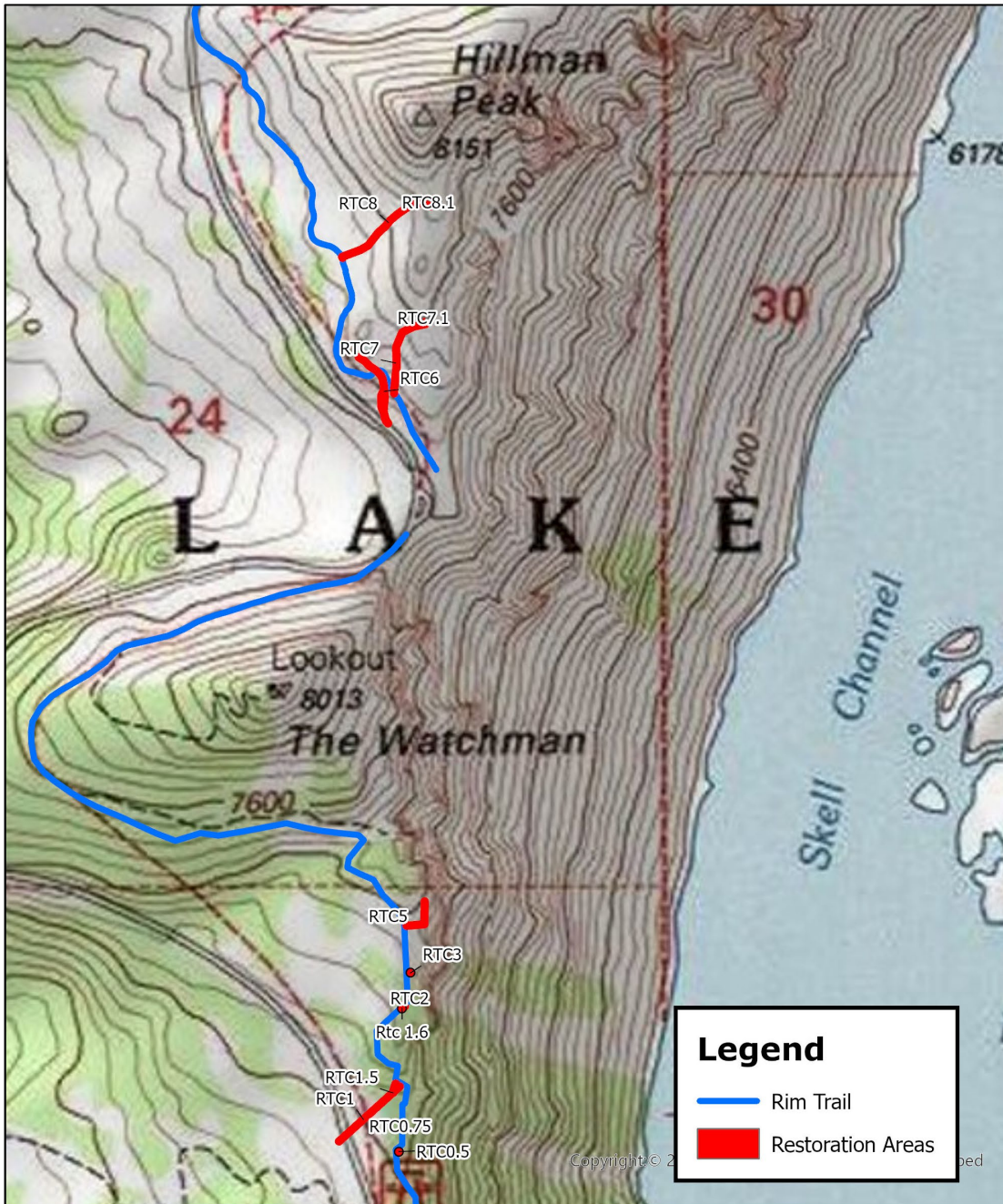


Figure 9. Restoration sites for the North section of the Rim Trail. Map by Scott Heisler.

Crater Lake National Park

Rim Trail Rehabilitation and Revegetation - Central Seed Zone

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Figure 10. Restoration sites for the Central section of the Rim Trail. Map by Scott Heisler.

Crater Lake National Park

Rim Trail Rehabilitation and Revegetation - South Seed Zone

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NAD 1983 UTM Zone 10N



Figure 11. Restoration sites for the South section of the Rim Trail. Map by Scott Heisler.

Revegetation

Seed Collection and Processing

Plant phenology was monitored during the field season through biweekly visits to collection zones, and then later in the season concurrently with seed collection. In 2022, seed collection for the Rim Trail project commenced in mid-August and continued into mid-October. The peak seed collection for the bulk of plant species in most of the seed zones occurred from late August to late September (Table 2). A total of 12,734 g of rough-cleaned native seed was collected during the 2019-2022 field seasons. A list of plant species collected from, and seed collection totals per zone are detailed in Table 3. The seed was dried and cleaned at the park and was stored in the Botany program's seed cooler. This was available for broadcast seeding and plant propagation. To supplement seed quantities, remaining seed from the completed RDRR project was used in seed mixes for each seed zone.

Table 2. 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>Calyptidium umbellatum</i>									
<i>Carex inops</i>									
<i>Carex pachycarpa</i>									
<i>Elymus glaucus</i> ssp. <i>glaucus</i>									
<i>Ericameria greenei</i>									
<i>Eriocoma occidentalis</i>									
<i>Eriogonum marifolium</i> var. <i>marifolium</i>									
<i>Eriogonum pyrolifolium</i> var. <i>coryphaeum</i>									
<i>Koenigia davisiae</i> var. <i>davisiae</i>									
<i>Lupinus lepidus</i> var. <i>lobbii</i>									
<i>Phacelia hastata</i> var. <i>compacta</i>									

Table 3. Seed collection plant taxa for the Rehabilitate Rim Trail Landscape project.

Seed Collection by Zone	2019			2020			2022		
	Amount Collected (g) by Seed Zone			Amount Collected (g) by Seed Zone			Amount Collected (g) by Seed Zone		
Plant Taxa	South	Central	North	South	Central	North	South	Central	North
<i>Bromus sitchensis</i> var. <i>carinatus</i>	770	15	0	72	0	12	0	0	0
<i>Calyptridium umbellatum</i>	1	x	6	4	x	0	0	x	3
<i>Carex breweri</i>	x	26	100	x	0	7	x	0	0
<i>Carex halliana</i>	208	200	x	0	0	x	0	0	x
<i>Carex pachycarpa</i>	1,145	31	0	0	0	0	0	0	15
<i>Elymus elymoides</i> ssp. <i>elymoides</i>	2,677	1,569	2,000	0	0	0	0	0	31
<i>Elymus glaucus</i> ssp. <i>glaucus</i>	47	x	34	44	x	52	0	x	0
<i>Ericameria greenei</i>	288	x	0	0	x	1	0	x	0
<i>Eriocoma occidentalis</i>	1,712	x	151	5	x	25	0	x	35
<i>Eriogonum marifolium</i> var. <i>marifolium</i>	175	154	484	0	0	0	0	0	35
<i>Eriogonum pyrolifolium</i> var. <i>coryphaeum</i>	x	32	15	x	0	1	x	0	0
<i>Eucephalus ledophyllus</i>	23	x	x	0	x	x	0	x	x
<i>Koenigia davisiae</i> var. <i>davisiae</i>	8	x	10	1	x	56	0	x	0
<i>Lupinus albicaulis</i> var. <i>shastensis</i>	82	x	x	40	x	x	0	x	x
<i>Lupinus lepidus</i> var. <i>lobbii</i>	x	1	124	x	0	2	x	0	29
<i>Phacelia hastata</i> var. <i>compacta</i>	23	x	0	0	x	0	0	x	83
<i>Phlox diffusa</i>	7	2	7	41	0	2	0	0	0
<i>Polygonum shastense</i>	x	1	x	x	0	x	x	0	x
Mix	x	x	0	x	x	0	x	x	11
Total Amounts Collected by Zone	7,166	2,031	2,931	207	0	158	x	x	242
	South	Central	North						
Total Collected (g) All Years	7,373	2,031	5,362						

x = plant species not collected in seed zone

Propagation and Plant Care

After the snow melted in 2022, plants that had been propagated in previous years were assessed and inventoried (Figure 12). Pots without any green growth were discarded. Plants with detritus, moss,

liverwort, or volunteer plants were cleaned throughout the season. Detailed reports of daily nursery activities are on file in the Botany office in the Nursery Activities binder.

Starting in 2019, 3,213 living containerized plants were propagated and survived until the 2022 field season (Table 4). Some plants died over the years while others experienced modest growth during the following growing seasons at the Ball Diamond nursery (Figure 12).



Figure 12. Overwintered plants emerging from the snow (left). Cleaning and trimming plants at the park's nursery (right). Photos by Carrie Wyler.

Table 4. List of plants propagated for the Rehabilitate Rim Trail Landscape Project from 2019-2022.

Seed Collection Zone	Scientific Name	2019 Plant Inventory #s	2020 Plant Inventory #s	2021 Plant Inventory #s	2022 Plant Inventory #s
South Rim Trail	<i>Bromus sitchensis</i> var. <i>carinatus</i>	488	554	484	456
	<i>Elymus glaucus</i> ssp. <i>glaucus</i>	0	98	98	98
	<i>Ericameria greenei</i>	611	370	217	172
	<i>Eriocoma occidentalis</i>	392	684	596	585
	<i>Eucephalus ledophyllus</i>	294	83	44	4
	<i>Holodiscus microphyllus</i> var. <i>glabrescens</i>	20	20	20	20
	<i>Koenigia davisiae</i> var. <i>davisiae</i>	0	61	11	11
	<i>Phlox diffusa</i>	196	185	171	171
	<i>Ribes erythrocarpum</i>	0	162	145	127

Seed Collection Zone	Scientific Name	2019 Plant Inventory #s	2020 Plant Inventory #s	2021 Plant Inventory #s	2022 Plant Inventory #s
	<i>Pinus albicaulis</i>	0	0	200	150
	Total	2,001	2,217	1,986	1,794
Central Rim Trail	<i>Koenigia davisiae</i> var. <i>davisiae</i>	0	48	48	42
	<i>Phlox diffusa</i>	51	16	16	6
	<i>Pinus albicaulis</i>	0	0	100	50
	Total	51	64	164	98
North Rim Trail	<i>Carex breweri</i>	203	193	193	159
	<i>Koenigia davisiae</i> var. <i>davisiae</i>	124	196	196	196
	<i>Lupinus lepidus</i> var. <i>lobbii</i>	0	6	3	2
	<i>Phlox diffusa</i>	52	98	98	88
	<i>Ribes erythrocarpum</i>	0	278	173	168
	<i>Pinus albicaulis</i>	0	0	400	300
	Total	378	771	1,063	913
Total		2,430	3,052	3,213	2,805

Planting and Seeding

Revegetation work over the fall of 2022 consisted of soil decompaction, planting, and seeding in all three seed zones. A total of 2,495 plants were planted and 13,293 grams of seed dispersed over all sites (Table 5).

Table 5. Number of Plantings and seed dispersal amounts for 2022 in each area of disturbance.

Seed Collection Zone	Scientific Name	Number Of Plantings	Quantity of seed dispersed (grams)
South Rim Trail	<i>Bromus sitchensis</i> var. <i>carinatus</i>	399	71.0
	<i>Calyptidium umbellatum</i>	0	4.0
	<i>Carex halliana</i>	0	1386.0
	<i>Carex inops</i> ssp. <i>inops</i>	0	0.3
	<i>Carex pachycarpa</i>	0	658.4
	<i>Elymus elymoides</i> ssp. <i>elymoides</i>	0	1137.0
	<i>Elymus glaucus</i> ssp. <i>glaucus</i>	98	44.0
	<i>Ericameria greenei</i>	149	251.5
	<i>Eriocoma occidentalis</i>	497	632.4
	<i>Eriogonum marifolium</i> var. <i>marifolium</i>	0	575.0
	<i>Eucephalus ledophyllus</i>	4	0
	<i>Holodiscus microphyllus</i> var. <i>glabrescens</i>	20	420.1

Seed Collection Zone	Scientific Name	Number Of Plantings	Quantity of seed dispersed (grams)
	<i>Koenigia davisiae</i> var. <i>davisiae</i>	11	7.6
	<i>Lupinus albicaulis</i> var. <i>shastensis</i>	X	918.7
	<i>Phlox diffusa</i>	118	7.0
	<i>Ribes erythrocarpum</i>	127	0
	<i>Pinus albicaulis</i>	127	0
	Total	1,550	6,113.2
	<i>Carex halliana</i>	X	800.0
Central Rim Trail	<i>Elymus elymoides</i> ssp. <i>elymoides</i>	X	1,259.0
	<i>Elymus elymoides</i> ssp. <i>elymoides</i> *	X	2,000.0
	<i>Ericameria greenei</i>	X	0.3
	<i>Eriocoma occidentalis</i>	X	64.0
	<i>Koenigia davisiae</i> var. <i>davisiae</i>	42	0
	<i>Phlox diffusa</i>	6	0
	<i>Pinus albicaulis</i>	40	0
	Total	88	4,123.3
	<i>Calyptidium umbellatum</i>	X	11.0
	<i>Carex breweri</i>	155	0
North Rim Trail	<i>Carex pachycarpa</i>	X	15.0
	<i>Elymus elymoides</i> ssp. <i>elymoides</i> *	X	2,597.0
	<i>Eriocoma occidentalis</i>	X	35.0
	<i>Eriogonum marifolium</i> var. <i>marifolium</i>	X	376.0
	<i>Koenigia davisiae</i> var. <i>davisiae</i>	196	0
	<i>Lupinus lepidus</i> var. <i>lobbii</i>	2	29.0
	<i>Phacelia hastata</i> var. <i>compacta</i>	X	83.0
	<i>Phlox diffusa</i>	85	0
	<i>Ribes erythrocarpum</i>	168	0
	<i>Pinus albicaulis</i>	251	0
	Mix	X	11.0
	Total	857	3,157.0
Total		2,495	13,393.4

*Seed from Meeker increase fields

Following the 2022 planting (Figure 13), seed was dispersed and raked in at each restoration site, plantings were properly watered, and access to restored sites was blocked with large woody debris.

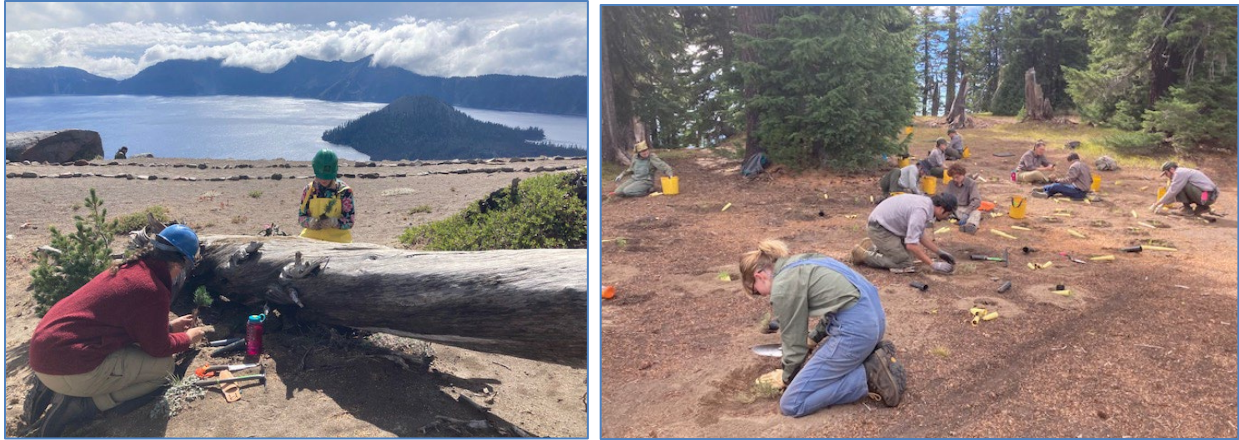


Figure 13. Planting native plants along the Rim Trail in the North seed zone (left). Planting a large, disturbed area along the Rim Trail in the South seed zone (right). Photos by Carrie Wyler.

Social Trail Obliteration

Social trail obliteration was conducted at 69 revegetation sites, encompassing approximately 0.7 acres of area in total (Figure 14). Figure 15 demonstrates before and after pictures of two obliterated social trail sites.



Figure 14. Placing locally available woody debris to block access to visitor-created trails and trampled areas (left); decompacting large heavily trampled areas ahead of planting. Photos by Carrie Wyler.



Figure 15. Before (left) and after (right) results of social trail obliteration work at two revegetation sites. Photos by Carrie Wyler.

Discussion

The density of severely impacted areas along the Rim Trail strongly correlates to the number of nearby developed access points, and likely corresponds to increased levels of casual visitation for purposes other than hiking (seeking views of the lake, picnicking, photography, etc.). To address visitors not interested in following an established trail, more formalized barriers and guidance may be needed to restrict access to natural areas proximal to the trail corridor. Careful consideration should

be given to development and implementation of trail traffic control measures, as to not significantly impact the viewshed or redirect traffic into undisturbed locations. Monitoring the 2022 social trail obliteration sites will hopefully provide some guidance on the efficacy of passive, native material use methods of obstructing access in these high-use areas.

In the summer of 2022, the Trails crew and volunteers delineated a section of the northern portion of the Rim Trail with rocks (Figure 16) in open pumice areas. This delineation seemed to be effective in keeping visitors on the designated trail in these expansive open areas. If time and resources allow more sections of the trail would benefit from this type of rock delineation.



Figure 16. Example of an area on the Northern section of the Rim Trail that uses rocks to delineate the trail for a clear path. Photo by Eleanor Roeder.

The Rim Trail is situated in a location of the park (close by Rim Village and West Rim Drive) that is readily accessible in late spring and early summer, a time when large areas of the park have limited access due to the prior winter's lingering snowpack. This results in high levels of traffic on the trail at a time when snowmelt is variable and the snowpack obscures portions of the trail. Visitors attempting to follow the trail during this confusing period of lingering snowpack are prone to creating unintentional social trails. These social trails often continue to be followed after the snow melts and the vegetation is in a particularly vulnerable stage as it is emerging from winter dormancy.

To address this source of social trail creation, temporary trail signage should be installed, and confusing trail segments should be flagged or marked. If ground-based signs are used, locations would need to be selected that wouldn't require frequent re-setting as the snowpack melts.

Additional funding will be sought to continue revegetation work on this project in future years. Consultation and coordination with the Trails program will be an essential part of ensuring this collaborative rehabilitation project is successful. Recommendations for future work include:

- The entire project area needs to be thoroughly surveyed for invasive plants at least twice throughout the 2023 field season.
- The area will need to be monitored in 2023 for restoration progress and determine if further planting is needed.
- Fencing (North Junction area) and signage will need to be installed in the spring of 2023 as soon as snowmelt allows.

Literature Cited

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- Mark, Steven R. 2013. Crater Lake National Park Trails. Chapter 19 in Administrative History of Crater Lake National Park. U.S. Department of the Interior, National Park Service, Crater Lake National Park, Crater Lake, Oregon.
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Appendix A

Rim Trail Revegetation Project Master Revegetation List

Zone	Site ID	Type of Area	Impact Category	Area (ft ²)	Actions taken	Rehabilitated?
North	RTN 1	Social Trail	Moderate	318	Documented	No
	RTN 2	Social Trail	Moderate	347	Documented, STO, Seeded	Yes
	RTN 3	Social Combo	Moderate	500	Documented, STO, Planted, Seeded	Yes
	RTN 4	Social Combo	Moderate	144	Documented, STO, Seeded	Yes
	RTN 5	Social Combo	Severe	1888	Documented, STO, Planted, Seeded	Yes
	RTN 6	Trampled Area	Severe	3498	Documented, STO, Shrunk Viewpoint, Planted, Seeded	Yes
	RTN 7	Social Trail	Moderate	321	Documented, STO, Seeded	Yes
	RTN 8	Social Trail	Moderate	132	Documented, STO, Seeded	Yes
	RTN 9- North Junction	Trampled Area	Severe	987	Documented, STO, Shrunk Viewpoint, Planted, Seeded, Temporary fencing	Yes
Central	RTC 0.5	Trampled Area	Moderate	**	Document, STO	Yes
	RTC 0.75	Trampled Area	Moderate	107	Documented, STO, Seeded	Yes
	RTC 1	Social Trail	Moderate	926	Documented, STO, Seeded	Yes
	RTC 1.5	Social Trail	Moderate	118	Documented, STO, Seeded	Yes
	RTC 1.6	Social Viewpoint	Moderate	**	Documented, STO, Seeded	Yes
	RTC 1.7	Social Combo	Moderate	42	Documented, STO, Seeded	Yes
	RTC 2	Social Combo	Severe	386	Documented, STO, Seeded	Yes
	RTC 3	Social Viewpoint	Light	**	Documented, STO, Seeded	Yes
	RTC 5	Social Combo	Moderate	230	Documented, STO, Seeded	Yes
	RTC 6	Social Combo	Moderate	1600	Documented, STO, Seeded, Planted	Yes
	RTC 7	Social Combo	Severe	1968	Documented, STO, Seeded	Yes
	RTC 7.1	Social Viewpoint	Moderate	981	Documented	No
	RTC 8	Social Combo	Severe	3678	Documented, STO, Seeded	Yes
	RTC 8.1	Social Viewpoint	Moderate	968	Documented	No
South	RTS 0.5	Social Viewpoint	Severe	**	Documented, STO, Seeded	yes
	RTS.75	Social Combo	Severe	198	Documented, STO, Seeded	yes
	RTS 1	Social Trail	Moderate	255	Documented	No
	RTS2	Social Viewpoint	Light	**	Documented, STO, Seeded	yes
	RTS 2.1	Social Combo	Light	40	Documented, STO, Seeded	yes
	RTS 2.3	Social Combo	Severe	441	Documented, STO, Planted, Seeded	yes
	RTS 3	Social Combo	Severe	645	Documented, STO, Seeded	yes
	RTS 4	Social Combo	Light	61	Documented, STO, Seeded	yes

Zone	Site ID	Type of Area	Impact Category	Area (ft²)	Actions taken	Rehabilitated?
South	RTS 5	Social Combo	Moderate	66	Documented, STO, Seeded	yes
	RTS 5.1	Trampled Area	Light	131	Documented, STO, Seeded	yes
	RTS 5.2	Social Viewpoint	Severe	424	Documented, STO, Seeded	yes
	RTS 6	Social Viewpoint	Light	**	Documented, STO, Seeded	yes
	RTS 7	Social Combo	Light	76	Documented, STO, Seeded	yes
	RTS 8	Social Combo	Light	40	Documented, STO, Seeded	yes
	RTS 8.1	Social Viewpoint	Moderate	320	Documented, STO, Seeded	yes
	RTS 8.2	Social Combo	Severe	56	Documented, STO, Seeded	yes
	RTS 9	Social Combo	Light	52	Documented, STO, Seeded	yes
	RTS 10	Social Trail	Severe	96	Documented, STO, Seeded	yes
	RTS 11	Social Combo	Severe	70	Documented, STO, Seeded	yes
	RTS 12	Social Trail	Light	50	Documented, STO, Seeded	yes
	RTS 12.5	Social Combo	Moderate	93	Documented, STO, Planted, Seeded	yes
	RTS 12.75	Trampled Area	Severe	2264	Documented, STO, Planted, Seeded	yes
	RTS 13	Trampled Area	Severe	661	Documented, STO, Seeded	yes
	RTS 14	Social Trail	Light	78	Documented, STO, Seeded	yes
	RTS 14.1	Social Trail	Light	72	Documented, STO, Seeded	yes
	RTS 15	Social Combo	Moderate	192	Documented, STO, Seeded	yes
	RTS 16	Social Trail	Moderate	484	Documented, STO, Seeded	yes
	RTS 17	Social Combo	Severe	84	Documented, STO, Seeded	yes
	RTS 18	Social Trail	Light	107	Documented, STO, Seeded	yes
	RTS 19	Social Trail	Severe	171	Documented, STO, Seeded	yes
	RTS 20	Social Trail	Moderate	71	Documented, STO, Planted, Seeded (has been restored in the past and re-trampled)	yes
	RTS 21	Social Trail	Moderate	196	Documented, STO, Planted, Seeded (has been restored in the past and re-trampled)	yes
	RTS 22	Social Viewpoint	Severe	301	Documented, STO, Seeded (has been restored in the past and re-trampled)	yes
	RTS 23	Social Trail	Moderate	228	Documented, STO, Planted, Seeded (has been restored in the past and re-trampled)	yes
	RTS 24	Social Trail	Severe	178	Documented, STO, Planted, Seeded (has been restored in the past and re-trampled)	yes
	RTS 24.1	Social Combo	Severe	79	Documented, STO, Seeded	yes
	RTS 25	Social Trail	Moderate	70	Documented, STO, Seeded	yes

Zone	Site ID	Type of Area	Impact Category	Area (ft²)	Actions taken	Rehabilitated?
South	RTS 25.1	Trampled Area	Moderate	98	Documented, STO, Seeded	yes
	RTS 26	Social Trail	Moderate	31	Documented, STO, Seeded	yes
	RTS 26.1	Social Trail	Light	18	Documented, STO, Seeded	yes
	RTS 27	Social Trail	Moderate	88	Documented, STO, Seeded	yes
	RTS 28	Social Trail	Light	128	Documented, STO, Seeded	yes
	RTS 29	Social Trail	Light	132	Documented, STO, Seeded	yes
	RTS 31	Social Viewpoint	Severe	124	Documented	No
	RTS 32	Social Viewpoint	Severe	70	Documented	No
	RTS 32.1	Trampled Area	Moderate	**	Documented, STO, Seeded	yes
	RTS 33	Social Combo	Severe	732	Documented, STO, Seeded (has been restored in the past and re-trampled)	yes
	RTS 34	Social Trail	Moderate	670	Documented, STO, Seeded (has been restored in the past and re-trampled)	yes
	RTS 34.1	Social Trail	Light	61	Documented, STO, Seeded (has been restored in the past and re-trampled)	yes
	RTS 35	Social Combo	Moderate	140	Documented, STO, Seeded (has been restored in the past and re-trampled)	yes
	RTS 36	Social Trail	Light	79	Documented, STO, Seeded	yes
	RTS 37	Social Viewpoint	Moderate	176	Documented, STO, Seeded	yes
All	Total number of disturbed sites		75		Total area of disturbed sites	29,904
All	Total number of sites restored		69		Total area of sites restored	27,188

STO = Social Trail Obliteration

**= No data available

The Department of the Interior protects and manages the nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

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U.S. Department of the Interior



[Crater Lake National Park](#)

P.O. Box 7
Crater Lake, OR 97604