



Crater Lake National Park

Steel Visitor Center Rehabilitation Revegetation Project

2022 Annual Report





ON THIS PAGE

The Steel Visitor Center at park headquarters undergoing significant construction in 2022.

Photo by Carrie Wyler.

ON THE COVER

Steel Visitor Center under construction during the 2022 field season; impacts to the landscape are apparent.

Photo by Carrie Wyler.

Steel Visitor Center Rehabilitation Revegetation Project

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

Crater Lake National Park's Steel Visitor Center is undergoing a major rehabilitation project that began in fall 2021. The Steel Visitor Center serves as the only year-round visitor information center for the park, houses the post office, the park library, and also provides office space supporting park operations. The Botany program has responsibility for revegetating disturbed natural areas after construction is completed. Revegetation efforts during the 2022 field season included site documentation and planning, collecting seed from 30 different native plant species, caring for 3,331 containerized plants, and seeding just under 400 pots for propagation. The project area was surveyed for invasive vegetation and 2,965 plants were found and treated. Revegetation work is planned to continue into the 2023 season by collecting seed, caring for propagated and salvaged plants, conducting active revegetation of the landscape post-construction (e.g., fencing, planting, and seeding), and continuing to survey for and control invasive plant species.

Acknowledgments

The Denver Service Center staff, especially Andrea Lind, assisted with planning and securing funding for revegetation efforts related to this project. Field and data entry assistance were provided by Eleanor Roeder, Kyle Bianchi, David Larkin, and Samantha Ulrich. Early and frequent communication with the Crater Lake National Park Facility Management Division, namely Kirsten Hardin, allowed revegetation and construction planning to occur in tandem. The U.S. Forest Service Dorena Genetic Resource Center aided with seed cleaning and providing plant materials for restoration.

Introduction

Crater Lake National Park's (CRLA) Steel Visitor Center (VC) located in Munson Valley's Historic District is one of the gateways to viewing Crater Lake and the only year-round center for visitors to gather park information. The Steel Visitor Center was originally built as a ranger dormitory in 1932, and decades of heavy snow loading have taken their toll on the building's integrity. The current rehabilitation project is tasked with: 1) correcting significant structural deficiencies in the stone walls, foundation, and second floor and roof wood framing; 2) providing seismic upgrades and increased load-bearing capacities; 3) replacing building systems; 4) replacing roofing; 5) ensuring the building is compliant with current building codes; and 6) enhancing the building's energy efficiency. In the process of reconstructing and rehabilitating the Steel VC, the landscape adjacent to the building is suffering damage and/or destruction by the need to replace foundations, stage and store materials, and maneuver construction vehicles and equipment around the work site. The CRLA Botany program has been tasked with revegetation work in association with this project.

The Steel VC is part of the Munson Valley Historic District, which was listed in the National Register of Historic Places in 1988. The Munson Valley Historic District is significant as it contains a designed landscape that is representative of "naturalistic" landscape design of the 1930s (Pavlik 2013). Between 1933-1934 over a thousand trees and several thousand shrubs were transplanted to the area as part of the "naturalization" program for the site. Large quantities of topsoil and peat were brought in from the south end of Munson Valley to amend the soils, and in some cases, to replace the pumice soil prior to planting. A specific suite of plants was placed around the building to soften the stone masonry and blend the building into the natural landscape (Pavlik 2013), some of which are still surviving and are termed "Foundation Plantings."

Construction activities for this project have created a large disturbance footprint in a culturally significant area subject to high visitor use (Figure 1). During construction, the Steel VC has been closed to the public requiring the establishment of a temporary visitor center sited in Mazama Village adjacent to the Camper Store (Figure 2). The establishment of the Temporary VC created ground disturbance requiring revegetation work. Additionally, a temporary post office was established at park headquarters that will need revegetation work upon its removal (Figure 3).

Due to the substantial impacts to soils and vegetation, the Crater Lake Botany program received funding to restore affected areas through revegetation and invasive vegetation management. The objectives of this work are:

1. Developing a revegetation plan and prescriptions for disturbed areas to be restored.
2. Surveying for and controlling nonnative, invasive plant species within the project area.
3. Salvaging, transplanting, and monitoring Foundation Plantings impacted by the project.
4. Collecting native seed and propagating plant materials for revegetation efforts.
5. Restoring affected areas through site preparation, planting, and seeding.
6. Monitoring restored areas for revegetation efficacy and augmenting restoration actions.

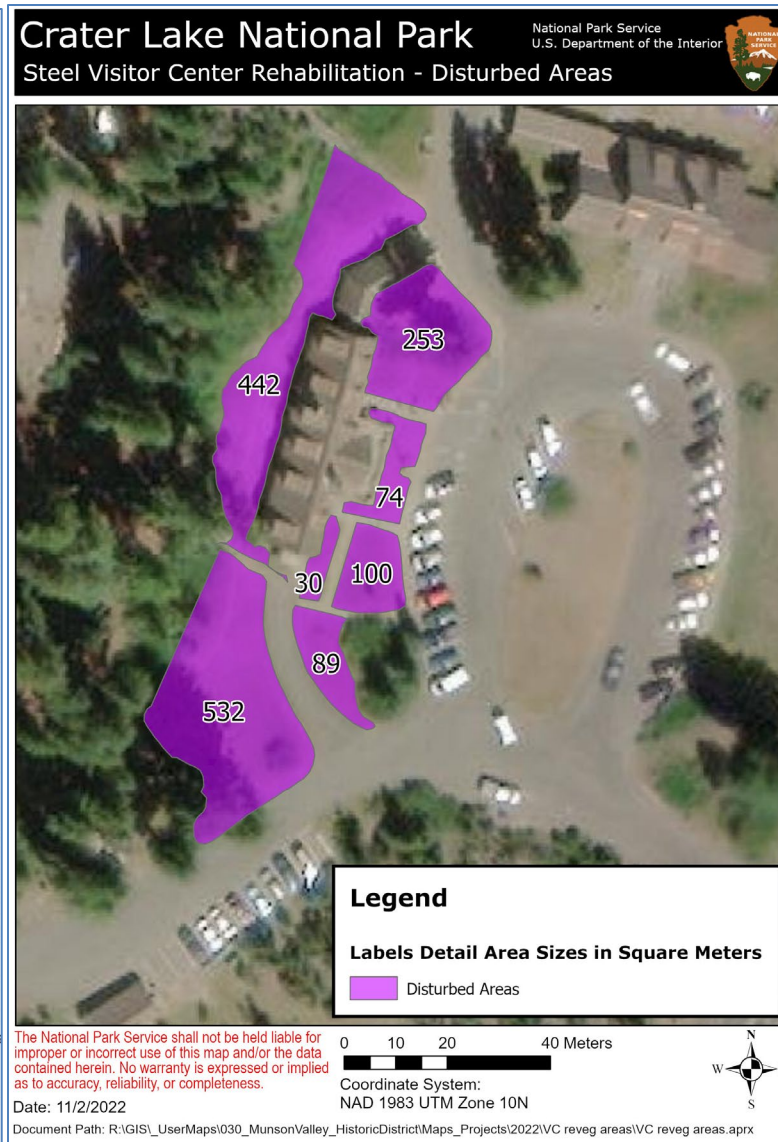


Figure 1. Location of the Steel Visitor Center within the park (left). Anticipated disturbance areas (highlighted in purple) at the Steel Visitor Center (right). Maps by Scott Heisler.

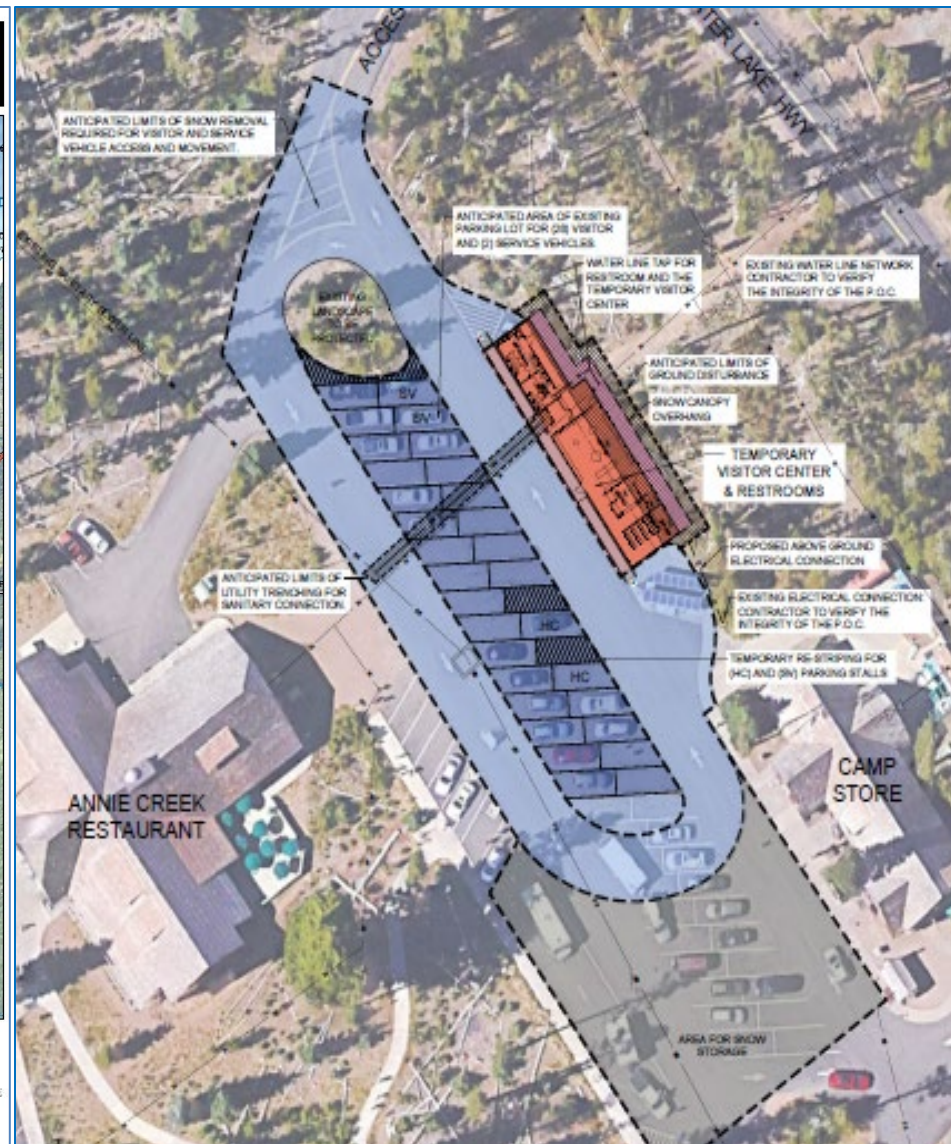


Figure 2. Location of the Temporary VC at Mazama Village (left). Map by Carrie Wyler. Drawing of the Temporary VC facilities (red and purple shading) near the Mazama Village Camper Store (right). Image provided by the Denver Service Center.

Construction work began during 2021. No ground disturbance occurred during the 2021 field season, but temporary fencing was installed, and work was initiated on the interior of the building. During the 2022 season a great deal of work was accomplished on the project and work will continue into 2023. A temporary mobile structure for the park's post office (Figure 3) was installed on the sidewalk and vegetation in the area across from the Steel VC (Figure 3) in the winter months of 2021 and 2022, which created minor ground disturbance when leveled and moved. During spring 2022 the temporary VC and restrooms were put in place at Mazama village (Figure 4). Underground cables and piping were installed to support work activities in the structure, and ground was levelled around the structure creating vegetation disturbance in multiple areas (Figure 4). In 2022, the Steel Visitor Center Rehabilitation Revegetation project supported five seasonal Biological Science Technicians (Plants), with the field season lasting from May 23rd to November 3rd.



Figure 3. Temporary mobile post office structure (left -photo by Carrie Wyler) location at the headquarters parking lot (green rectangle at right – image courtesy of Ausland Group construction company).

Restoration of disturbed areas around the Steel VC and Temporary VC will jumpstart natural succession of vegetation communities and protect the area from erosion and invasion by nonnative plant species. These restoration efforts will yield additional aesthetic benefits to park visitors by addressing newly created and existing disturbed ground throughout the project area.

The Botany program's 2022 work progress on the Steel VC Rehabilitation Revegetation project consists of two components: (1) revegetation and (2) invasive vegetation management. The revegetation component is further divided into three sections: (1) site prescriptions, (2) seed collection, and (3) plant material propagation and plant care.



Figure 4. Ground disturbance near the Temporary VC where underground cables and piping were installed (left). Temporary VC and restrooms located at Mazama Village (right). Photos by Carrie Wyler.

Methods

Revegetation

Site Prescriptions

Revegetation site prescriptions for the Steel VC Rehabilitation Revegetation project were developed in July 2020, prior to the commencement of construction activities. Due to uncertainties in the location and size of the temporary VC until after its placement, the site prescription and photo documentation (Figure 5) for this location was not completed until summer 2022. These prescriptions document the pre-disturbance site features and plant community composition unique to the area and serve to guide plant material needs and the evaluation of restoration efficacy. A revegetation plan was developed that details how many and which plants will be used to restore the project area (Wyler and Hooke 2022).



Figure 5. Before (left) and after (right) photos of the temporary VC site. Photos by Carrie Wyler.

Seed Collection

The two project areas (Steel VC and Temporary VC) and their surrounding quarter-mile radii are considered the seed zones for the project. These two seed zones serve as distinct areas where seeds and propagated plants can be sourced and moved while preserving site-specific biodiversity and genetic integrity. Species identified as occurring in the project areas, with an emphasis on Foundation Planting species, were targeted for seed collection. Priorities for bulk seed collection were based upon seed availability and the need for use in plant propagation. Table 1 lists all plant taxa subject to seed collection for the Steel VC revegetation effort. Seed collection was conducted during the 2019-2022 field seasons for the Steel VC. A list of plant taxa subject to seed collection for the temporary VC location can be found in Table 2. Target seed collection levels of 10-12 pounds per acre were set. As per the “Seed Collection in National Parks” manual (Taliga et al. 2015), seed is ideally collected from 30 - 100 individual plants per population, taking care not to collect more than 20% of seed from the total population unless the area is slated for removal due to construction, in which case as much seed as possible should be collected. Phenology of dominant plant species was recorded within both the project’s seed zones to monitor mature seed collection windows for both 2022 and future collection years.

Table 1. Seed collection plant taxa list for the Steel VC for 2019- 2022.

Scientific Name	Common Name
<i>Agoseris aurantiaca</i> var. <i>aurantiaca</i>	Orange agoseris
<i>Anaphalis margaritacea</i>	Pearly everlasting
<i>Bromus sitchensis</i> var. <i>carinatus</i>	California brome
<i>Calamagrostis rubescens</i>	Pinegrass
<i>Calyptidium umbellatum</i>	Pussypaws
<i>Carex pachycarpa</i>	Many-rib sedge
<i>Carex preslii</i>	Presl's sedge
<i>Carex spectabilis</i>	Showy sedge
<i>Carex stramineiformis</i>	Shasta sedge
<i>Chamaenerion angustifolium</i> ssp. <i>circumvagum</i>	Fireweed
<i>Cinna latifolia</i>	Slender woodreed
<i>Dicentra formosa</i> ssp. <i>formosa</i>	Pacific bleeding heart
<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>Erigeron glacialis</i> var. <i>glacialis</i>	Peregrine fleabane
<i>Eriocoma occidentalis</i>	Western needlegrass
<i>Eriogonum marifolium</i> var. <i>marifolium</i>	Marumleaf buckwheat
<i>Eucephalus ledophyllus</i>	Cascade aster
<i>Ligusticum grayi</i>	Gray's licorice-root

Scientific Name	Common Name
<i>Lupinus albicaulis</i> var. <i>shastensis</i>	Pine lupine
<i>Nothocalais alpestris</i>	Alpine lake false dandelion
<i>Penstemon rydbergii</i> var. <i>oreocharis</i>	Rydberg's penstemon
<i>Phacelia mutabilis</i>	Changeable phacelia
<i>Ribes cereum</i> var. <i>cereum</i>	Wax currant
<i>Ribes viscosissimum</i>	Sticky currant
<i>Senecio triangularis</i>	Arrowleaf groundsel
<i>Solidago elongata</i>	Narrow goldenrod
<i>Sorbus scopulina</i>	Greene's mountain ash
<i>Spiraea splendens</i>	Subalpine spiraea

Table 2. Seed collection plant taxa list for the temporary VC at Mazama village for 2020 and 2022.

Scientific Name	Common Name
<i>Achillea millefolium</i>	Common yarrow
<i>Agoseris aurantiaca</i> var. <i>aurantiaca</i>	Orange agoseris
<i>Anaphalis margaritacea</i>	Pearly everlasting
<i>Antennaria media</i>	Alpine pussytoes
<i>Bromus sitchensis</i> var. <i>carinatus</i>	California brome
<i>Calyptridium umbellatum</i>	Pussypaws
<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>Chamaenerion angustifolium</i> ssp. <i>circumvagum</i>	Fireweed
<i>Elymus elymoides</i> ssp. <i>elymoides</i>	Common squirreltail
<i>Elymus glaucus</i> ssp. <i>glaucus</i>	Blue wildrye
<i>Eriocoma occidentalis</i>	Western needlegrass
<i>Eucephalus ledophyllus</i>	Cascade aster
<i>Juncus parryi</i>	Parry's rush
<i>Lupinus albicaulis</i> var. <i>shastensis</i>	Pine lupine
<i>Lupinus lepidus</i> var. <i>lobbii</i>	Prostrate lupine
<i>Nothocalais alpestris</i>	Alpine lake false dandelion
<i>Phacelia mutabilis</i>	Changeable phacelia
<i>Xerophyllum tenax</i>	Bear-grass

When seeds were mature, they were collected, dried, and stored until cleaning. 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. Small, easy to clean collections were cleaned in house while the rest of collections were shipped to the USFS Dorena Genetic Resource Center (DGRC) for cleaning and storage.



Figure 6. Collected seed mix before cleaning (left). Seed drying and storage facility at park headquarters (right). Photos by Carrie Wyler.

Plant Material Propagation and Plant Care

Plant taxa chosen for propagation were selected based on past success with propagation at the park, Foundation Planting species status, and dominance of plant species in the disturbance footprint. Propagation of native plants from seed poses difficulties for the Botany program due to the lack of equipment and year-round facilities needed for cold stratification of seeds and early season plant care. To address these difficulties, plant propagation techniques utilize Crater Lake's abundant snowpack to cold stratify seeded pots, allowing the plant propagation schedule to align with the present Botany field season. More difficult to propagate species and plants propagated from cuttings are being produced by the DGRC in Cottage Grove, Oregon.

After the snow melted in 2022, plants that had been propagated in fall 2021 were assessed and inventoried and then placed in a shade house (40' x 20' x 10' - Figure 7). Pots without any green growth were discarded. The 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 8).



Figure 7. Containerized plants melting out in the spring (left). Shadehouse at the Ball Diamond nursery where plants are cared for until they can be planted at the Steel VC (right). Photos by Carrie Wyler.

During the 2022 season some Steel VC plants propagated in 2021 showed signs of rust infection and had to be disposed of as not to infect other plants. In the fall of 2022 plants were propagated to serve as replacement plants for the ones that were lost. The temporary VC was installed at Mazama Village in spring 2022 and created disturbance in the surrounding vegetation as expected. To restore these disturbed areas plants were propagated according to the revegetation prescriptions (Figure 8).



Figure 8. Plants with winter detritus before cleaning (left). Trimming and caring for containerized plants at the park’s nursery (middle). Seeding containers for propagation (right). Photos by Carrie Wyler.

Invasive Vegetation Management

In 2022, the project area was surveyed for nonnative, invasive plant species. Much of the area was inaccessible due to construction activities, which led to fewer nonnative plant detections and treatment than previous years. When invasive plants are encountered, data are recorded using ArcGIS Field Maps including scientific name, geographic coordinates, total number of plants

present, area occupied by invasive plants, and treatment applied to the population. Invasive plants were controlled via manual or chemical methods (Figure 9) as per the park’s Invasive Vegetation Management Plan (DOI NPS 2017). All plant parts capable of reproduction were bagged and disposed of in the trash compactor at park headquarters.



Figure 9. Controlling nonnative plants by manual means (left). Using herbicide to treat nonnative plants. Photos by Carrie Wyler.

Results

Revegetation

Site Prescriptions

Revegetation site prescriptions were developed for the anticipated disturbance footprints at the Steel VC and Temporary VC locations and can be found in the project’s revegetation plan (Wyler and Hooke 2022). An example of a site prescription can be found in Table 3. A complete list of plant taxa identified at each site can be found in Appendix B.

Table 3. Example of site prescription for the Steel VC project.

Seed Zone: Steel VC		Location ID: VC		Planned site	
Location: Steel VC					
Site Description: Area around main Steel VC and all surrounding vegetation; front, back, and sides					
Pre-Disturbance Site Information					
Plant Species		Common Name		(Front) Relative % Cover (Rear)	
<i>Calyptridium umbellatum</i>		Pussypaws		2%	0
<i>Carex</i> species, see attached list		Sedges		15%	20%
<i>Eucephalus ledophyllus</i>		Cascade aster		3%	5%
<i>Gayophytum diffusum</i> ssp. <i>parviflorum</i>		Nuttall's groundsmoke		5%	0
Grass species, see attached list		Grasses		15%	20%
<i>Penstemon rydbergii</i> var. <i>oreocharis</i>		Rydberg's penstemon		32%	5%
<i>Ribes viscosissimum</i>		Sticky currant		3%	0
<i>Salix commutata</i>		Undergreen willow		0	30%
<i>Solidago elongata</i>		Narrow goldenrod		2%	0
<i>Sorbus scopulina</i>		Greene's mountain ash		15%	0
Other				8%	20%
				Total Cover: 100%	
Associated species: See attached list for all present species					
UTM (Zone 10, NAD 83):		Beginning: N0570682 End: N0570689		Beginning: E4749688 End: E4749771	
Total Vegetative Cover: 75%				Elevation: 6,680 ft.	
Slope: none		Aspect: NA		Snowmelt out: Late May-early June	
Soil "hardness," presence of rocks: Very compacted in some areas					
General Soil description: Pumice, fine ash, gravely, sand					
Ameliorating microsite features: Existing vegetation, fine organic debris					
Wind exposure: low			Canopy cover (overall): low		
Area: projected: 1,520 ft ²					
Comments: Nonnative plants present: <i>Spergularia rubra</i> , red sandspurry, <i>Poa compressa</i> , Canada bluegrass, <i>Poa pratensis</i> , Kentucky bluegrass, <i>Rumex acetosella</i> , sheep sorrel, <i>Polygonum aviculare</i> ssp. <i>depressum</i> , common knotweed					
Estimate date for Site Restoration to begin: Fall 2023					
Recorder: CW, SH			Date: 7/14/20		

Seed Collection

Plant phenology was monitored from June 27 through October 20 during the 2022 field season. Snow-free dates at park headquarters were July 1 to October 22, 2022. Seed collection began in late

July and continued through mid-October. The peak seed collection for most plant species occurred from early August to late September (Tables 4 and 5). The 2022 growing season was notable for a late heavy snowfall in May and snow persisting until July 1st at park headquarters. This caused plant phenology to progress later than usual, resulting in a delayed seed collection period.

Table 4. Steel VC 2022 seed collection periods for key plant taxa indicated by gray shading.

Species	AUG (early)	AUG (mid)	AUG (late)	SEPT (early)	SEPT (mid)	SEPT (late)	OCT (early)	OCT (mid)	OCT (late)
<i>Bromus sitchensis</i> var. <i>carinatus</i>									
<i>Calyptridium umbellatum</i>									
<i>Carex</i> species									
<i>Elymus elymoides</i> ssp. <i>elymoides</i>									
<i>Elymus glaucus</i> ssp. <i>glaucus</i>									
<i>Eriocoma occidentalis</i>									
<i>Erigeron glacialis</i> var. <i>glacialis</i>									
<i>Eucephalus ledophyllus</i>									
<i>Lupinus albicaulis</i> var. <i>shastensis</i>									
<i>Penstemon rydbergii</i> var. <i>oreocharis</i>									
<i>Phacelia mutabilis</i>									
<i>Solidago elongata</i>									

Table 5. Temporary VC 2022 seed collection periods for key plant taxa indicated by gray shading.

Species	July (late)	AUG (early)	AUG (mid)	AUG (late)	SEPT (early)	SEPT (mid)	SEPT (late)	OCT (early)	OCT (mid)
<i>Achillea millefolium</i>									
<i>Anaphalis margaritacea</i>									
<i>Bromus sitchensis</i> var. <i>carinatus</i>									
<i>Calyptridium umbellatum</i>									

Species	July (late)	AUG (early)	AUG (mid)	AUG (late)	SEPT (early)	SEPT (mid)	SEPT (late)	OCT (early)	OCT (mid)
<i>Carex</i> species									
<i>Elymus elymoides</i> ssp. <i>elymoides</i>									
<i>Eriocoma occidentalis</i>									
<i>Lupinus albicaulis</i> var. <i>shastensis</i>									
<i>Lupinus lepidus</i> var. <i>lobbii</i>									
<i>Xerophyllum tenax</i>									

Grasses, composites, and sedges produced abundant seed that was easy to collect, and thus made up the bulk of the 2022 seed collection. Quantities of seed collected in 2019-2022 for both Steel VC and the temporary VC are listed in Table 6. Some seed collected during 2022 was sent to the DGRC to be cleaned and stored until needed. Seed collected as mixes and seed from certain easy-to-clean species were cleaned in-house by Botany staff.

Table 6. Seed collection quantities from 2019-2022.

Plant Species	Quantity (grams) collected Steel VC 2019	Quantity (grams) collected Steel VC 2020	Quantity (grams) collected 2020 Temporary VC	Quantity (grams) collected Steel VC 2021	Quantity (grams) collected Steel VC 2022	Quantity (grams) collected 2022 Temporary VC
Asteraceae species mix*	42.0	0	11.0	152.0	0	10.0
<i>Bromus sitchensis</i> var. <i>carinatus</i>	8.0	85.7	22.3	27.0	0	0
<i>Calyptidium umbellatum</i>	0	0	0	0	6.2	3.0
<i>Carex</i> species mix*	0	3.3	15.6	104.0	52.0	58.0
<i>Dicentra formosa</i> ssp. <i>formosa</i>	0	2.8	0	0	1.0	0
<i>Elymus elymoides</i> ssp. <i>elymoides</i>	0	10.6	25.0	15.0	24.6	0
<i>Elymus glaucus</i> ssp. <i>glaucus</i>	0	15.1	12.4	23.0	0	0
<i>Eriocoma occidentalis</i>	0	25.5	12.5	18.5	6.4	11.0
<i>Eucephalus ledophyllus</i>	0	4.2	0	*	14.3	0
Grass mix*	0	0	0	0	7.0	38.0
<i>Ligusticum grayi</i>	0	6.3	0	1.0	0	0

Plant Species	Quantity (grams) collected Steel VC 2019	Quantity (grams) collected Steel VC 2020	Quantity (grams) collected 2020 Temporary VC	Quantity (grams) collected Steel VC 2021	Quantity (grams) collected Steel VC 2022	Quantity (grams) collected 2022 Temporary VC
<i>Lonicera involucrata</i> var. <i>involucrata</i>	0	1.0	0	0	0	0
<i>Lupinus albicaulis</i> var. <i>shastensis</i>	0	20.0	0	*	0	0
<i>Lupinus</i> species mix*	0	0	2.5	24.0	0	0
<i>Penstemon rydbergii</i> var. <i>oreocharis</i>	175.0	11.1	0	240.9	395.6	0
<i>Phacelia mutabilis</i>	0	1.8	0	*	0	0
<i>Ribes cereum</i> var. <i>cereum</i>	0	1.0	0	1.0	0	0
<i>Solidago elongata</i>	18.0	71.6	0	280.6	0	0
<i>Sorbus scopulina</i>	0	Cuttings	0	11.0	0	0
<i>Spiraea splendens</i>	60.0	0.7	0	*	0	0
Riparian grass mix*	0	32.0	0	3.0	0	0
<i>Xerophyllum tenax</i>	0	0	0	0	0	13.0
Mix (rough cleaned) *	404.0	169.0	0	51.0	0	3.0
TOTAL	707.0	461.5	101.4	951.1	507.1	136.0

*Seeds were not collected by plant taxa but combined in a mix for ease of collection.

Quantities of surviving salvaged species (mostly Foundation Plantings) and newly divided plants can be found in Table 7; these will be transplanted back at the Steel VC in fall 2023.

Table 7. Quantities of plants salvaged from the Steel VC.

Salvage Location (Seed Zone)	Pot size	Quantities Salvaged Fall 2020	Quantities Salvaged Fall 2021	Quantities Remaining Fall 2022
East and South of the VC in sunny areas	1 gallon	57	35	86
East and South of the VC in sunny areas	3 gallons	11	0	9
East and South of the VC in sunny areas	8 gallons	1	0	1
West of the VC or shadier or wetter areas	1 gallon	133	5	144
West of the VC or shadier or wetter areas	3 gallons	15	2	17
West of the VC or shadier or wetter areas	5 gallons	2	0	2
West of the VC or shadier or wetter areas	flats of moss	3	0	3
Divided bleeding heart from sunny areas	jumbos	0	0	39
Divided bleeding heart from shady areas	jumbos	0	0	53
TOTAL		222	42	354

Plant Material Propagation and Plant Care

Nineteen plant taxa or mixes were targeted for plant propagation efforts from 2020-2022 (Table 8). Germination success was evaluated during the 2022 field season and plants were cared for over the 2022 season. A list of all plants that survived can be found in Table 9. In October of 2022, a total of 490 containers were seeded at CRLA and are presently in cold stratification under the snowpack at the Ball Diamond nursery (Figure 10).

Table 8. Number of plants propagated at CRLA and the DGRC for the Steel VC Rehabilitation project.

Location of Propagation	Scientific Name	# Fall 2020 Steel VC	# Fall 2021 Steel VC	# Fall 2022 Steel VC	# Fall 2022 Temporary VC
CRLA	Asteraceae species mix	0	0	0	98
CRLA	<i>Bromus sitchensis</i> var. <i>carinatus</i>	196	0	0	0
DGRC/CRLA	<i>Carex</i> species mix	784	196	0	98
DGRC	<i>Dicentra formosa</i> ssp. <i>formosa</i>	50	0	0	0
CRLA	<i>Elymus elymoides</i> ssp. <i>elymoides</i>	98	0	0	98
CRLA	<i>Elymus glaucus</i> ssp. <i>glaucus</i>	196	0	98	0
DGRC	<i>Ericameria greenei</i>	196	0	0	0
CRLA	<i>Eriocoma occidentalis</i>	490	98	0	0
DGRC	<i>Eucephalus ledophyllus</i>	294	0	0	0
CRLA	<i>Lonicera involucrata</i> var. <i>involucrata</i>	46	0	0	0
CRLA	<i>Penstemon rydbergii</i> var. <i>oreocharis</i>	490	0	0	0
CRLA	<i>Phacelia mutabilis</i>	98	0	0	0
CRLA	<i>Ribes</i> species	98	0	0	0
CRLA	Riparian grass mix	196	0	0	0
DGRC	<i>Salix commutata</i> *	20	0	0	0
CRLA	<i>Solidago elongata</i>	196	294	0	0
DGRC	<i>Sorbus scopulina</i> *	40	0	0	0
DGRC	<i>Spiraea splendens</i>	50	0	0	0
CRLA	<i>Xerophyllum tenax</i>	0	0	0	98
	TOTAL	3,558	588	98	392

*Propagation via cuttings instead of seed.

Table 9. Inventory of plants for the Steel VC Rehabilitation project as of October 2022.

Scientific Name	Number of Plants as of Fall 2022
<i>Eriocoma occidentalis</i>	503
<i>Bromus sitchensis</i> var. <i>carinatus</i>	169
<i>Carex</i> species mix	733
<i>Elymus elymoides</i> ssp. <i>elymoides</i> *	0
<i>Elymus glaucus</i> ssp. <i>glaucus</i>	188
<i>Ericameria greenei</i>	19
<i>Eucephalus ledophyllus</i>	19
<i>Lonicera involucrata</i> var. <i>involucrata</i>	25
<i>Penstemon rydbergii</i> var. <i>oreocharis</i>	335

Scientific Name	Number of Plants as of Fall 2022
<i>Phacelia mutabilis</i>	58
<i>Ribes</i> species	72
Riparian grass mix	154
<i>Salix commutata</i>	4
<i>Solidago elongata</i>	467
<i>Spiraea splendens</i>	96
Salvaged sunny side	134
Salvaged shady side	218
Salvaged moss flats	3
TOTAL	3,331

*Plants were all disposed of due to an infestation of rust.



Figure 10. Propagating plants from seed for the Steel VC Rehabilitation project (left). Grouped plants being overwintered at the Ball Diamond nursery (right). Photos by Carrie Wyler.

Invasive Vegetation Management

A total of 258 invasive plants were encountered and treated in the Steel VC project area during the 2022 season. At the temporary VC location at Mazama Village, 2,707 invasive plants were found and treated in 2022. Invasive plant populations around the Steel VC are displayed in Figure 11 and the temporary VC populations at Mazama Village are shown in Figure 12. Many of the invasive plants were challenging to treat because they were tightly admixed with native plants. Multiple treatments occurred throughout the season in order to treat invasive plants that were missed earlier.

A list of invasive plant taxa treated at the Steel VC can be found in Table 10, and invasive plant taxa treated at the temporary VC area at Mazama Village are displayed in Table 11. Most invasive plant populations decreased in size from 2020-2022 due to the effectiveness of using herbicide. However, red sand-spurrey had a large decrease in abundance from 2020 to 2022 most likely due to the inaccessibility of the project area due to construction closures.

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Steel Visitor Center - Invasive Vegetation Populations 2022



Legend

Label on point shows number of individual plants

- Agrostis gigantea
- Dysphania botrys
- Polygonum aviculare
- Rumex acetosella

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Date: 11/2/2022

Document Path: R:\GIS\UserMaps\030_MunsonValley_HistoricDistrict\Maps_Projects\2022\VC IVM 2022\VC IVM 2022.aprx

0 10 20 40 Meters



Coordinate System:
NAD 1983 UTM Zone 10N

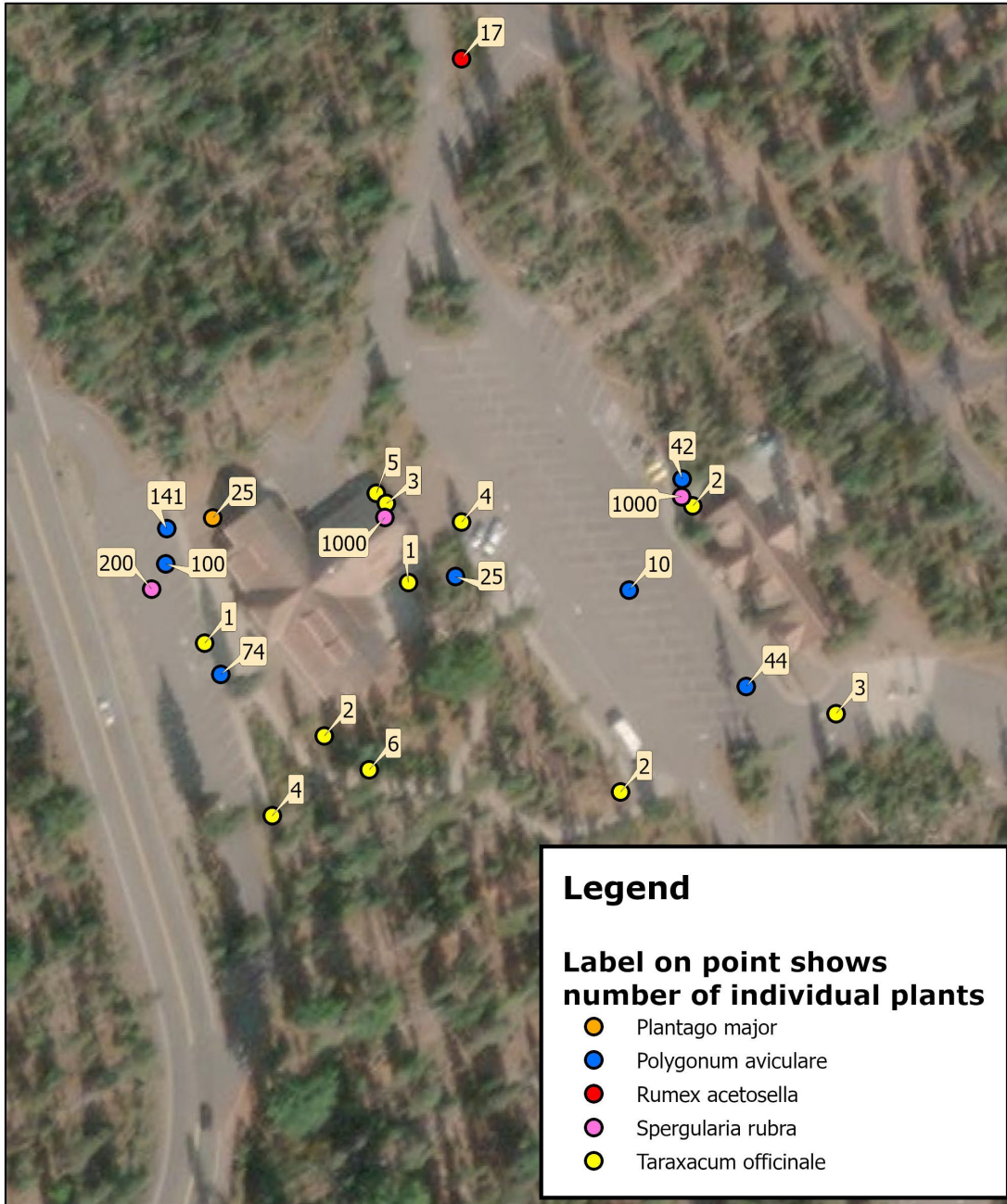


Figure 11. Current invasive plant populations at the Steel VC. Map by Scott Heisler.

Crater Lake National Park

Mazama Village - Invasive Vegetation Populations 2022

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Date: 11/2/2022

Document Path: R:\GIS\UserMaps\030_MunsonValley_HistoricDistrict\Maps_Projects\2022\VC IVM 2022\VC IVM 2022.aprx

0 10 20 40 Meters



Coordinate System:
NAD 1983 UTM Zone 10N



Figure 12. Current invasive plant populations at the temporary VC site at Mazama Village. Map by Scott Heisler.

Table 10. Abundance (number of individual plants) of treated invasive plants within the Steel VC project area for 2020-2022.

Invasive Plant Taxa	2020 Abundance	2021 Abundance	2022 Abundance
Annual bluegrass (<i>Poa annua</i>)	38	0	0
Bitter winter cress (<i>Barbarea vulgaris</i>)	35	12	0
Common dandelion (<i>Taraxacum officinale</i>)	4	42	0
Oval-leaf knotweed (<i>Polygonum aviculare</i> ssp. <i>depressum</i>)	133	79	6
Feather geranium (<i>Dysphania botrys</i>)	0	0	212
Red sorrel (<i>Rumex acetosella</i>)	388	62	42
Red sand-spurrey (<i>Spergularia rubra</i>)	6,076	40	0
Redtop (<i>Agrostis gigantea</i>)	0	0	4
Total	6,674	263	258

Table 11. Abundance (number of individual plants) of treated invasive plants within the temporary Mazama Village VC project area for 2020-2022.

Invasive Plant Species	2020 Abundance	2021 Abundance	2022 Abundance
Annual bluegrass (<i>Poa annua</i>)	0	500	0
Buckhorn plantain (<i>Plantago lanceolata</i>)	0	1	0
Common dandelion (<i>Taraxacum officinale</i>)	5	27	29
Oval-leaf knotweed (<i>Polygonum aviculare</i> ssp. <i>depressum</i>)	125	710	436
Common plantain (<i>Plantago major</i>)	0	1	25
Red sand-spurrey (<i>Spergularia rubra</i>)	0	2,400	2,200
Red sorrel (<i>Rumex acetosella</i>)	37	43	17
Total	167	3,682	2,707

Discussion

The 2022 season involved seed collection, plant care, and invasive plant surveys in accessible areas. As construction continues in 2023, revegetation work will focus on seed collection, care of propagated and salvaged plants, surveying for and controlling invasive plants, monitoring the area for unplanned disturbance, and conducting active restoration work (e.g., fencing, planting, seeding). As of fall 2022, the disturbance area is smaller than anticipated.

Recommendations and needs for Steel VC Rehabilitation Revegetation Project in the 2023 field season include:

- All salvaged plants and newly propagated plants will need to be assessed for status and health. Plants will need fertilization to assist with survival and growth. All containerized

plants should be checked for moss or liverwort growth, which should be removed if present to prevent disease.

- More seed will need to be collected in the surrounding areas when construction impacts become more apparent.
- The entire project areas need to be thoroughly surveyed for invasive plants at least three times throughout the field season.
- Any unanticipated newly disturbed areas need to be documented.
- The National Weather Service has an extremely useful weather database with daily, monthly, and yearly data summaries (<https://w2.weather.gov/climate/xmacis.php?wfo=mfr>) that should be used to help inform when to water newly planted seedlings and provides information for seed collection. It also facilitates year-to-year comparisons by providing data on annual snow loads and precipitation amounts.
- Landscaping islands and beds in the project area are particularly difficult areas to restore and maintain, as these areas are heavily trampled by visitors and employees (Figure 13). These areas will need to be assessed yearly for traffic patterns and trampling and filled in with plants as problem areas arise. Fencing will be needed to protect emerging and newly established vegetation. This has been found to be very successful at the park's Rim Village area which is also impacted by large number of visitors (Figure 14).



Figure 13. Large social trail created by park staff and visitors behind the Steel VC (left) and another one in front (right). Photos by Carrie Wyler.



Figure 14. Fencing in front of the Rim Village Café and Gifts building to protect revegetation sites in heavily trafficked areas. Photo by Carrie Wyler.

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Appendix A

Plant taxa listed on 1935 Planting Plan for Steel VC (list has been updated with confirmed/corrected plant taxa names).

Trees

Abies lasiocarpa var. *lasiocarpa*, subalpine fir
Abies magnifica x *Abies procera*, Shasta red fir
Tsuga mertensiana, mountain hemlock

Shrubs

Acer glabrum, dwarf maple
Amelanchier alnifolia, Saskatoon serviceberry
Ceanothus prostratus, Mahala mat
Holodiscus microphyllus var. *glabrescens*, bush ocean spray
Kalmia microphylla, alpine laurel
Lonicera conjugialis, purple-flower honeysuckle
Lonicera involucrata var. *involucrata*, black twinberry
Salix, willow
Sambucus racemosa var. *arborescens*, coast red elderberry
Spiraea splendens, subalpine spirea
Sorbus scopulina, Greene's mountain ash
Vaccinium scoparium, grouseberry
Rhamnus purshiana, cascara

Perennials

Phlox diffusa, spreading phlox
Dicentra formosa ssp. *formosa*, Pacific bleeding heart
Koenigia davisiae var. *davisiae*, Davis's knotweed
Lupinus albicaulis var. *shastensis*, Pine lupine

Additional Vegetation Transplanted 1930-1937

Aquilegia formosa, red columbine
Castilleja species, paintbrush
Erigeron glacialis var. *glacialis*, peregrine fleabane
Veratrum viride var. *eschscholzianum*, green false-hellebore
Juncus species, rushes
Lonicera conjugialis, purple-flower honeysuckle
Polemonium species, Jacob's-ladder
Valeriana sitchensis ssp. *sitchensis*, mountain heliotrope
Ribes erythrocarpum, Crater Lake current
Salix, willow
Carex species, sedges
Arctostaphylos nevadensis, pinemat manzanita

Appendix B

Plant taxa list for the Steel VC area.

Scientific Name	Common Name
<i>Acer glabrum</i>	Dwarf maple
<i>Agoseris aurantiaca</i> var. <i>aurantiaca</i>	Orange agoseris
<i>Agrostis gigantea</i> *	Redtop
<i>Amelanchier alnifolia</i>	Saskatoon serviceberry
<i>Anaphalis margaritacea</i>	Pearly everlasting
<i>Aquilegia formosa</i>	Red columbine
<i>Bromus sitchensis</i> var. <i>carinatus</i>	California brome
<i>Calamagrostis rubescens</i>	Pinegrass
<i>Calyptidium umbellatum</i>	Pussypaws
<i>Carex preslii</i>	Presl's sedge
<i>Carex spectabilis</i>	Showy sedge
<i>Carex stramineiformis</i>	Shasta sedge
<i>Chamaenerion angustifolium</i> ssp. <i>circumvagum</i>	Fireweed
<i>Cinna latifolia</i>	Slender woodreed
<i>Danthonia intermedia</i>	Timber oatgrass
<i>Dicentra formosa</i> ssp. <i>formosa</i>	Pacific bleeding heart
<i>Dicentra uniflora</i>	One flowered dicentra
<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 goldenweed
<i>Erigeron glacialis</i> var. <i>glacialis</i>	Peregrine fleabane
<i>Eriocoma occidentalis</i>	Western needlegrass
<i>Eriogonum marifolium</i> var. <i>marifolium</i>	Marumleaf buckwheat
<i>Erythranthe lewisii</i>	Great purple monkeyflower
<i>Eucephalus ledophyllus</i>	Cascade aster
<i>Gayophytum diffusum</i> ssp. <i>parviflorum</i>	Nuttall's groundsmoke
<i>Juncus drummondii</i>	Drummond's rush
<i>Ligusticum grayi</i>	Gray's licorice-root
<i>Lonicera involucrata</i> var. <i>involucrata</i>	Black twinberry
<i>Lupinus albicaulis</i> var. <i>shastensis</i>	Pine lupine
<i>Pectiantia breweri</i>	Brewer's mitrewort
<i>Nothocalais alpestris</i>	Alpine lake false dandelion
<i>Osmorhiza purpurea</i>	Purple sweet cicely
<i>Penstemon rydbergii</i> var. <i>oreocharis</i>	Rydberg's penstemon

Scientific Name	Common Name
<i>Phacelia mutabilis</i>	Changeable phacelia
<i>Phleum alpinum</i>	Alpine timothy
<i>Phlox diffusa</i>	Spreading phlox
<i>Poa compressa</i> *	Canada bluegrass
<i>Poa pratensis</i> *	Kentucky bluegrass
<i>Polygonum aviculare</i> ssp. <i>depressum</i> *	Oval-leaf knotweed
<i>Ribes cereum</i> var. <i>cereum</i>	Wax currant
<i>Ribes viscosissimum</i>	Sticky currant
<i>Rumex acetosella</i> *	Red sorrel
<i>Salix commutata</i>	Undergreen willow
<i>Sambucus racemosa</i> var. <i>arborescens</i>	Coast red elderberry
<i>Senecio triangularis</i>	Arrowleaf groundsel
<i>Solidago elongata</i>	Narrow goldenrod
<i>Sorbus scopulina</i>	Greene's mountain ash
<i>Spergularia rubra</i> *	Red sand-spurrey
<i>Spiraea splendens</i>	Subalpine spiraea
<i>Taraxacum officinale</i> *	Common dandelion
<i>Trifolium longipes</i> ssp. <i>hansenii</i>	Hansen's clover
<i>Turritis glabra</i>	Tower mustard
<i>Valeriana sitchensis</i> ssp. <i>sitchensis</i>	Mountain heliotrope
<i>Veratrum viride</i> var. <i>eschschozianum</i>	Green false-hellebore
<i>Viola glabella</i>	Pioneer violet

*Nonnative plant species

Plant taxa list for the temporary VC area at Mazama Village.

Scientific Name	Common Name
<i>Agoseris aurantiaca</i> var. <i>aurantiaca</i>	Orange agoseris
<i>Achillea millefolium</i>	Common yarrow
<i>Anaphalis margaritacea</i>	Pearly everlasting
<i>Antennaria media</i>	Alpine pussytoes
<i>Bromus sitchensis</i> var. <i>carinatus</i>	California brome
<i>Calyptidium umbellatum</i>	Pussypaws
<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>Chamaenerion angustifolium</i> ssp. <i>circumvagum</i>	Fireweed
<i>Elymus elymoides</i> ssp. <i>elymoides</i>	Common squirreltail

Scientific Name	Common Name
<i>Elymus glaucus</i> ssp. <i>glaucus</i>	Blue wildrye
<i>Eriocoma occidentalis</i>	Western needlegrass
<i>Eucephalus ledophyllus</i>	Cascade aster
<i>Juncus parryi</i>	Parry's rush
<i>Lupinus albicaulis</i> var. <i>shastensis</i>	Pine lupine
<i>Lupinus lepidus</i> var. <i>lobbii</i>	Prostrate lupine
<i>Nothocalais alpestris</i>	Alpine lake false dandelion
<i>Phacelia mutabilis</i>	Changeable phacelia
<i>Poa compressa</i> *	Canada bluegrass
<i>Poa pratensis</i> *	Kentucky bluegrass
<i>Polygonum aviculare</i> ssp. <i>depressum</i> *	Oval-leaf knotweed
<i>Rumex acetosella</i> *	Red sorrel
<i>Spergularia rubra</i> *	Red sand-spurrey
<i>Taraxacum officinale</i> *	Common dandelion
<i>Xerophyllum tenax</i>	Bear-grass
Conifer species	Conifers

*Nonnative plant species

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