



Invasive Vegetation Management

2015 Annual Report





ON THIS PAGE

St. John's wort (*Hypericum perforatum*) growing along a roadside in Crater Lake National Park.
Photograph by C. McCullough.

ON THE COVER

Canada thistle (*Cirsium arvense*) colonizing a recently burned forest in Crater Lake National Park.
Photograph by C. McCullough.

Invasive Vegetation Management

2015 Annual Report

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Abstract

Work performed by the Crater Lake National Park Invasive Vegetation Management program during the 2015 season continued its focus on detecting, containing, and reducing populations of invasive plant species within the Park. Steady progress made in 2015 and in previous years has helped stave off invasion of the Park's native plant communities by non-native plant species. In 2015, invasive plants were controlled Parkwide using manual treatment methods. Approximately 159,500 invasive plants were controlled in 2015; twelve new weedy species were encountered within the Park for the first time. Large construction projects and natural events occurring within the Park this season presented challenges to the Invasive Vegetation Management program and will continue to need attention in the coming years; this includes the Rim Drive Rehabilitation project and the National Creek Complex of wildfires. Recommendations are made for the 2016 Invasive Vegetation Management field season and beyond.

Acknowledgments

The 2015 Invasive Vegetation Management seasonal crew at Crater Lake National Park was made possible through support provided by the National Park Service Natural Resource Cyclic Maintenance program, the Crater Lake Natural History Association, the Crater Lake Fire Management Program, DOI/NPS Burned Area Rehabilitation, and the Federal Highways Administration – Western Federal Lands Highway Division. Invasive plant observations reported by other Crater Lake National Park employees, especially the Bull Trout and Roads staffs, were greatly appreciated and very helpful in preventing the spread of invasive plants. Sean Mohren and Chris Wayne assisted with the development of the Invasive Vegetation Management geodatabase and Access database, and with the transition to using Trimble Juno units for data collection.

Introduction

The 2015 season marked the thirteenth year of recurring management of non-native, invasive plant species within Crater Lake National Park (CRLA). Invasive species are widely recognized as being one of the largest threats to natural areas; as such, the National Park Service (NPS) has been charged with preventing the establishment of non-native, invasive plant species and controlling infestations of invasive plants where they have become established (USDI NPS 2006). Responding quickly to new invasions and controlling existing infestations of invasive plants are important functions of CRLA's Invasive Vegetation Management (IVM) program.

The IVM program was fortunate in 2015 to have four devoted seasonal Biological Science Technicians, which was the largest crew in the IVM program's history. This was made possible through support from the NPS Natural Resource Cyclic Maintenance (NRCM) program, the Crater Lake Natural History Association (NHA), Federal Highways – Western Federal Lands Highway Division (WFLHD), the Crater Lake Fire Management program, and the Department of Interior (DOI) NPS Burned Area Rehabilitation (BAR) program. The NRCM provides funding for cyclic treatment of invasive plant species along roads and trails and around facilities such as visitor centers, campgrounds, and scenic overlooks. The majority of CRLA's invasive plants are found within these “front-country” areas; however, an increasing number of invasive plant populations are being discovered in the Park's backcountry, including remote stretches of wilderness. Funding from the Crater Lake NHA enabled survey and treatment of invasive plants possible in these pristine and diverse areas (Figure 1). The Federal Highways WFLHD program provided funding for invasive plant survey and control along roads affected by the 2014 Pavement Preservation project. The Pavement Preservation project applied a chip-seal treatment to most Park roads (Highway 62,



Figure 1. A new infestation of Canada thistle encountered in 2015 near National Creek. Photo by J. Beck.

Munson Valley Road, headquarters/housing service roads, Pinnacles Road, Cloudcap Spur Road, and North Entrance Road) and utilized numerous staging areas (Pumice Desert Overlook, South Yard, Ball Diamond, junction of East Rim Drive and Pinnacles Road, Pole Bridge Creek Quarry, and the junction of North Entrance Road with West Rim Drive). Unfortunately, a contaminated (e.g., not weed-free) gravel source was used during project implementation, so funds were provided to the Park for follow-up treatment and effectiveness monitoring. The Park is planning for implementation of the West Panhandle Forest Restoration project, which will utilize silvicultural treatments to restore forest structure, composition, and function in ponderosa pine (*Pinus ponderosa*) dominated forests in the southern portion of the Park. Funding was received from the CRLA Fire Management program to survey for and control

invasive plants within the project area. This is intended to help lessen project impacts upon the Park's native plant communities that are the focus of restoration efforts. Funding was also received from the DOI NPS BAR program to survey for and control invasive plants within the areas impacted by the 2014 Pumice Complex of wildfires. The Pumice Complex included 40 lightning-ignited wildfires that were aggressively suppressed; the largest of which was the 25-acre Pumice fire. Over 300 firefighters were brought in to manage the fires and suppression costs exceeded \$2,000,000. In addition to burned areas, other impacted areas such as base camp, spike camps, helispots, social trails, etc. were subject to invasive plant survey and treatment efforts.

The IVM program continues to evolve and to improve techniques for protecting the Park's native plant communities through expanded survey and control efforts, strengthened prevention techniques, and better data management and reporting systems. The large 2015 IVM field crew enabled a substantial increase in invasive plant survey and treatment efforts. A new IVM geodatabase and Access database were created in 2015, and the IVM crew switched from recording data on paper data sheets to using Trimble Juno handheld computers with GPS receivers for data collection (Figure 2). The Park is currently preparing an Invasive Vegetation Management Plan Environmental Assessment with hopes to greatly expand and enhance prevention, control, and management options Park-wide.

The goals of the IVM program are:

1. *Prevention*: prevent the introduction and spread of invasive plant species within Crater Lake National Park.
2. *Early Detection and Rapid Response*: survey for new invasive plant infestations to allow for swift treatment and control.
3. *Effective Control*: control invasive plant species within the Park through eradication, containment, and reduction of invasive plant population densities and abundance. Utilize an adaptive management framework based on the best available science and current knowledge to determine the most effective and appropriate treatment options for proactively controlling invasive plant species.
4. *Monitoring and Data Management*: monitor treatment efficacy, and use results of monitoring to inform management. Manage invasive vegetation data to enable regular reporting of results and progress.



Figure 2. IVM crew members collecting field data on a Trimble Juno unit. Photo by C. McCullough.

5. *Outreach and Education*: educate and inform the Park's visitors, employees, and partners on the Park's Invasive Vegetation Management program and involve them in prevention, control, and monitoring efforts.
6. *Collaboration*: communicate regularly with Park partners, including other federal, state, and county entities, and collaborate on invasive vegetation management and control.

Major activities that occurred within the Park in 2015 with repercussions for invasive vegetation management include the Rim Drive Rehabilitation project, a multi-year effort that commenced this spring and caused substantial ground disturbance to areas of East Rim Drive and Roundtop Quarry (Figure 3). This major road construction project involved large amounts of construction and contractor traffic with much heavy equipment brought into the Park. Another significant event was the Crescent fire of the National Creek Complex of wildfires, which was the largest fire in the Park's recorded history affecting 14,639 acres within the Park. The National Creek Complex burned nearly 21,000 acres, including neighboring lands on the Rogue River Siskiyou and Umpqua National Forests. Throughout the course of the incident, thousands of fire management personnel were brought in to assist with control. The National Creek Complex will require extensive post-fire invasive plant survey and control, due to many existing invasive plant populations on neighboring USFS lands, and heavy-handed (e.g., dozer lines) control techniques employed near the Park boundary. Fire suppression impacts within the Park that will require follow-up invasive plant survey and potential treatment include almost 15 miles of handline; over a mile of mechanical treatment employed along the North Entrance Road (Figure 3); multiple sites utilized as spike camps and helispots; and two areas affected by 0.7 mile-long applications of fire retardant.



Figure 3. Major slope and soil disturbance at Roundtop Quarry from the Rim Drive Rehabilitation project (left); aftermath of mechanical treatment along the Park's North Entrance Road during the National Creek Complex (right). Photos by J. Beck.

Invasive plant species are affected by annual fluctuations in precipitation and temperature, as these factors influence growing season length among other things. An increase in growing season length

may benefit invasive plant species, as these species often have short life cycles and high rates of fecundity (Bradley et al. 2010). The 2015 season marked the third consecutive summer the Park and region suffered through a drought. The Park received only 197” of snowfall at Park headquarters (average is 524”) during the 2014 –2015 water year (October 1 – September 30), which is 38% of average. However, the total amount of precipitation (melted) received at Park headquarters was closer to average at 61” (average is 67”), which is 91% of average. The warm 2014 –2015 winter contributed to more precipitation falling as rain vs. snow at Park headquarters. Snowmelt occurred over a month earlier than average; with the first snow-free date at Park headquarters reached on May 11th (average date is June 20th). These factors may have facilitated an increase in invasive plant species encountered in 2015.

Invasive vegetation survey and control work occurred from April 20 – September 29, 2015. A total of 159,495 invasive plants were treated during the 2015 season, including 12 new non-native species that had not been previously recorded within CRLA: common burdock (*Arctium minus*), ripgut brome (*Bromus diandrus*), soft chess (*Bromus hordeaceus*), African filaree (*Erodium cicutarium*), ivy bindweed (*Fallopia convolvulus*), broadleaf cottonrose (*Filago pyramidata* var. *pyramidata*), purple anther field pepperweed (*Lepidium heterophyllum* – Figure 4), stinking pepperweed (*Lepidium ruderale*), birdsfoot trefoil (*Lotus corniculatus*), Russian thistle (*Salsola kali* ssp. *pontica*), pubescent wheatgrass (*Thinopyrum intermedium*), and wheat (*Triticum aestivum*). All of these were found along Park roadsides. These finds bring the number of non-native plant species documented within CRLA to 76. Additionally, five non-native species that had been previously recorded within the Park (though not for some time) and that had never been encountered by the IVM program (2003—2014) made an appearance this year: field mustard (*Brassica rapa*), shepherd’s purse (*Capsella bursa-pastoris*), quackgrass (*Elymus repens*), perennial ryegrass (*Lolium perenne*), and red clover (*Trifolium pratense*). These were also found exclusively along Park roadsides.



Figure 4. Purple anther field pepperweed, a new-to-CRLA weed discovered in the Pumice Desert in 2015. Photo by C. McCullough.

Methods

Crater Lake National Park has assigned all of its 76 non-native plant species a management priority of Low, Medium, High, or Watch. All high priority species are actively targeted for control efforts; medium priority species are targeted as time and resources allow. Low priority species are usually

not targeted for management, either because populations of those species are not aggressively spreading or populations are beyond control. Watch species are those that have been documented within the Park, but have not been observed in some time (> 10 years) and are believed to be eradicated from within Park boundaries. If any watch species are found within the Park, they will receive a management priority of high. These priorities may change depending upon situation and location. For example, a low priority species may be controlled if found in a pristine wilderness environment and its control is feasible. A high priority species may not be treated in a specific region where its population is beyond control. Low priority species may be controlled concurrently at sites where high priority species are being treated.

The Park has been divided into IVM Regions where survey and control efforts are targeted. Each region is a “problem area” where invasive plants are known to be concentrated or have recently been detected. The control strategy for each region varies depending upon which species it contains. General control strategies for invasive plant species are *containment* – preventing new infestations and spread; *reduction* – reducing the size and extent of existing infestations; and *eradication* – extirpating the invasive plant species from the Park). Prior to the field season, IVM data are queried by region and maps of invasive plant species distribution created. Packets are made for the IVM crew containing the following information per region: maps of the region in relation to the Park, including directions on best access to the site (if applicable); spatial data on which species are found in each region provided on maps and also digitally for import to a GPS unit; and abundance (number) and

size of each invasive plant population per spatial coordinate set.



Figure 5. Surveying roadsides for invasive plants.
Photo by C. McCullough.

Invasive vegetation survey consists of visually searching a region, typically on foot (Figure 5) but sometimes via boat, automobile, or bicycle, for invasive plant species. The IVM crew navigates to known invasive plant locations with a GPS unit and searches a broad grid around that coordinate point using transects (width determined by terrain and vegetation structure). In previously un-surveyed areas with no record of invasive plant species, surveys are concentrated on the most likely establishment points such as open habitats, areas with moist soils or close to water, and recently disturbed habitats. It is unlikely to find invasive plant species in dense, closed canopy forests at CRLA.

Presently, control of invasive plant species at CRLA is largely limited to manual methods. Most invasive plants are pulled or severed from the root below the ground surface using a digging knife.

During the 2015 field season, the addition of other tools including cultivator mattocks, pitchforks, and long-handled spades aided with ergonomics and crew safety. For rhizomatous species, care is taken to extract as much of the root mass as possible during control operations (Figure 6).

Rhizomatous individuals may be solarized with plastic sheeting or covered with weed cloth if populations are dense enough to not negatively impact native plant species co-located at the treatment site. In 2007, CRLA received permission via a Categorical Exclusion to apply the herbicide fluroxypyr (trade name Vista) to roadside St. John's wort. Through a Memorandum of Understanding with the Oregon Department of Agriculture's (ODA) Noxious Weed Control Program, roadside St. John's wort plants have been sprayed with Vista one day in late July by ODA personnel using ATV-mounted tank sprayers. In 2015, ODA did not provide this service to the Park for the first time since 2007 largely due to their increased workload and CRLA's decline in roadside St. John's wort population numbers.

Once an invasive plant population is discovered, data are recorded including scientific name, UTM coordinates (Zone 10, NAD83 datum), total number of plants present, area (m²) that plants occupy, and treatment applied to population. Data are input into a Trimble Juno field computer and GPS receiver using ArcPad software. The transition to the Juno units in 2015 eliminated a lot of the chances for error in the data collecting process. All plant parts capable of reproduction are bagged, removed from the site, and disposed of in the trash compactor at Park headquarters where they are hauled (in a closed truck) to the Dry Creek Landfill in White City, Oregon for burial. Vegetative parts incapable of reproduction are left to desiccate on site unless they present logistical or aesthetic problems for Park visitors, employees, and partners.

When possible, any new-to-CRLA non-native plant species encountered are collected as voucher specimens for the Park's herbarium. Often only one or two individuals are discovered and are destroyed during the plant identification process, so vouchers are missing in these cases. Non-native plants encountered in previously undocumented locations within the Park are also collected for the Park's herbarium.



Figure 6. Below-ground mass associated with Canada thistle, including slender root segments that easily break off and remain in the soil. Photo by C. McCullough.

Results

Control efforts put forth by the 2015 IVM program are presented by general regions including roadsides, staging areas, developed areas, backcountry areas, and the shore of Crater Lake. Data displayed on the following maps indicate the number of invasive plants found and treated during the 2015 season.

Park Roadsides

Roads within the Park include Highway 62, Munson Valley Road, West and East Rim Drives, Pinnacles Road, Grayback Road (closed to public motor vehicle traffic), North Entrance Road, and Highway 138. Of these, only Pinnacles Road and Grayback Road have been found to be free of invasive plant species. Highway 62 contains the largest and most abundant infestations of invasive plant species (especially South Highway 62 closest to the south entrance), with Highway 138 and Munson Valley Road also supporting considerable infestations. West and East Rim Drives contain localized infestations of invasive plant species; portions of these roads have been found to be weed-free. North Entrance Road is sparsely colonized by invasive plants; very few infestations have been found along this road and most have been associated with the North Entrance Station infrastructure and the junction with Highway 138. Roadside invasive plant locations encountered in 2015 are displayed in Figure 8.

Invasive plant survey and control work for West and East Rim Drives continued to be funded in 2015 by the Federal Highway Administration's Rim Drive Rehabilitation project; this work is discussed further in the 2015 Rim Drive Rehabilitation Revegetation annual report. Notable findings from this effort include finding cheat grass (*Bromus tectorum*) for the first time along East Rim Drive; and documenting quackgrass along West Rim Drive, which had not been seen in the Park for some time (Zika 2003). Steady progress was made toward controlling persistent invasive plant populations at Rim Village, which is the area that receives the highest level of visitor use.

A significant increase in cheat grass was encountered this year along south Highway 62 and Highway 138. Unfortunately, cheat grass was also found in the Park's backcountry for the first time this year in the Red Blanket Canyon area. Another notable invasive plant finding was the discovery of two non-native species (field pepperweed and field bindweed – *Convolvulus arvensis* – Figure 7). These two non-native species were found in the



Figure 7. Field bindweed found in the Pumice Desert. Photo by C. McCullough.

Crater Lake National Park

2015 IVM - Park Roadsides

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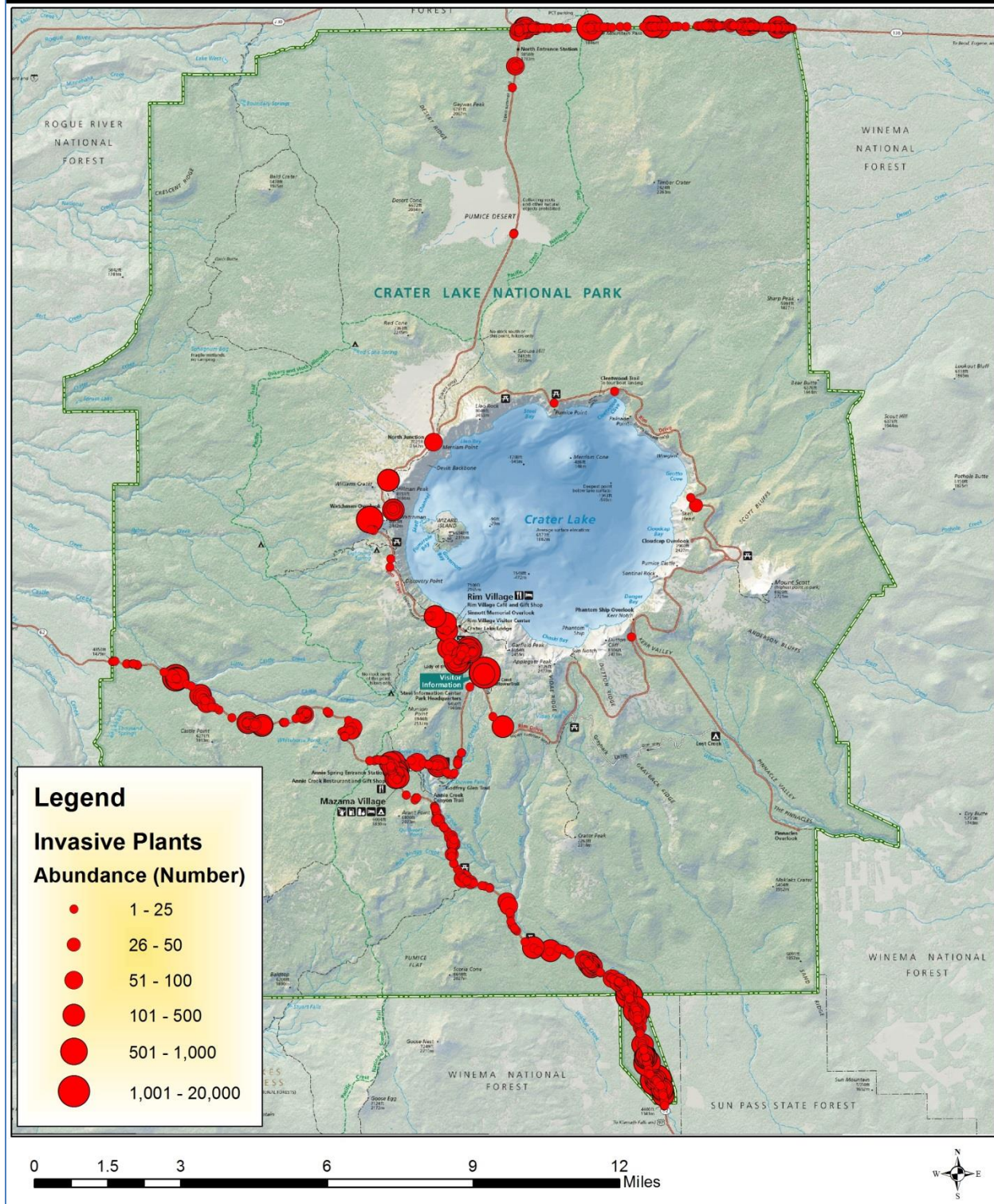


Figure 8. Invasive plants encountered along Park roadsides in 2015. Map by J. Beck.

Pumice Desert in an area that had been used to stockpile gravel “chips” for the 2014 Pavement Preservation project. The Pumice Desert has been designated as one of the Park’s Research Natural Areas, with the justification that it represents a unique opportunity to study floristic succession in a harsh, volcanic environment (Van der Schaff 1993). The Pumice Desert has been the focus of long-term study; in over 50 years of observation only 14 vascular plant species have been recorded in the area (Horn 1968, Horn 2003). The fact that two non-native species were observed in the exact location where gravel was stockpiled for a road project is troubling and precautionary, and a reminder that we are transforming Park landscapes with our continued infrastructure “improvements.”

Spotted knapweed (Figure 9) continued to increase its numbers along Park roadsides; 517 plants were controlled in 2015 compared with 102 plants in 2014 and 11 plants in 2013. Spotted knapweed populations are confined to Highway 138 and south Highway 62.



Figure 9. Left: Spotted knapweed found along Highway 138. Right: Jerusalem oak (red arrows) persists along Munson Valley Road. Photos by C. McCullough.

Two populations of Jerusalem oak (*Dysphania botrys* – Figure 9) believed to be introduced after implementation of the 2014 Pavement Preservation project maintained their population sizes from last season. No known seed has been released from these sites, and it is hoped that the seed bank will be exhausted with annual control efforts. An increase in St. John’s wort was encountered this season, especially along the southernmost extent of Highway 62. Control of the rhizomatous grass smooth brome (*Bromus inermis*) continued to be problematic this year along the southern portion of Munson

Valley Road. This grass closely resembles some native species of *Bromus*, so care was taken to properly identify smooth brome.

Roadside maintenance of vegetation occurred in 2015 along the North Entrance and Munson Valley Roads. The work conducted by the Roads crew employed light-on-land methods (e.g., hand-thinning) but these areas will need to be monitored next season since some ground disturbance did occur. Clearing of roadside ditches occurred along upper Munson Valley Road from Park headquarters to Rim Village with resulting ground disturbance. This area will need to be watched in the 2016 season. Additionally, culvert maintenance occurred at Vidae Falls at both ends of the long culvert that diverts Vidae Creek under East Rim Drive; these sites should be inspected in 2016 for invasive plant establishment. Areas under the Goodbye and Annie Creek bridges along lower Munson Valley Road should also be inspected for invasive plant establishment in 2016, since recent renovation work caused ground disturbance at these sites.

The west side of the North Entrance Road from the Park boundary to the North Entrance station was affected by mechanical removing of lodgepole pines (*Pinus contorta* var. *latifolia*) using a “buzz-bar” (Figure 10) brought in from Redwood National Park. This site will need to be monitored for invasive plant establishment. The entire west side of the North Entrance Road was used as a fire control line for the National Creek Complex; burnout operations affected areas from the Park boundary to the northern edge of the Pumice Desert (Figure 10). While Minimum Impact Tactics were used in fire management activities along the North Entrance Road, including minimal mop-up efforts, many snags were felled prior to the burnout and high concentrations of fire personnel were present within this area. This area will need survey efforts in 2016.



Figure 10. Left: Buzz-bar creating a fuelbreak along the North Entrance Road; Right: Burnout operations along the North Entrance Road north of the Pumice Desert. Photos by J. Beck.

Staging Areas

The Park's staging areas include large yards and old quarries that are closed to the public and used for staging of materials, vehicles, and equipment. These include South Yard, Pole Bridge Creek Quarry, the Ball Diamond, Anderson Quarry, and Roundtop Quarry. Invasive plants encountered in 2015 at Park staging areas are displayed in Figure 12.

The South Yard has persistent populations of woolly mullein (*Verbascum thapsus*), St. John's wort, and sweet clover (*Melilotus* sp.). Pole Bridge Creek quarry experienced an increase in yellow rocket (*Barbarea vulgaris*) this year, but a decrease in St. John's wort. Anderson Quarry had a sharp decrease in invasive plants this year, with only a small number of yellow rocket plants found. There have been no invasive plants found at the Ball Diamond or Roundtop Quarry; however, one velvet grass plant in seed was found attached to the undercarriage of equipment staged at Roundtop Quarry in 2014. Roundtop Quarry experienced massive ground disturbance in 2015 from the Rim Drive Rehabilitation project (Figure 11); this area will need to be surveyed for invasive plant establishment and subjected to intense revegetation and restoration efforts.



Figure 11. Substantial ground disturbance at Roundtop Quarry. Photos by J. Beck.

The 2014 Pavement Preservation project utilized several park staging areas and additional areas to stockpile gravel and equipment used during project implementation. Affected areas include: South Yard, Pole Bridge Creek Quarry, Roundtop Quarry, the Ball Diamond, the North Junction parking area, the Pumice Desert Overlook, and the junction of East Rim Drive and Pinnacles Road. These sites continue to need monitoring for invasive plant establishment and spread.

The 2015 National Creek Complex of wildfires also used the Pumice Desert Overlook as a staging area. The upper Pole Bridge Creek Quarry continued to be used as a helispot, with Pole Bridge Creek sourced for water to support fire management operations (although not for the National Creek Complex). These sites should be monitored for invasive plant establishment. While not used as a staging area, the Watchman Flow on West Rim Drive is actively used by the Trails program for

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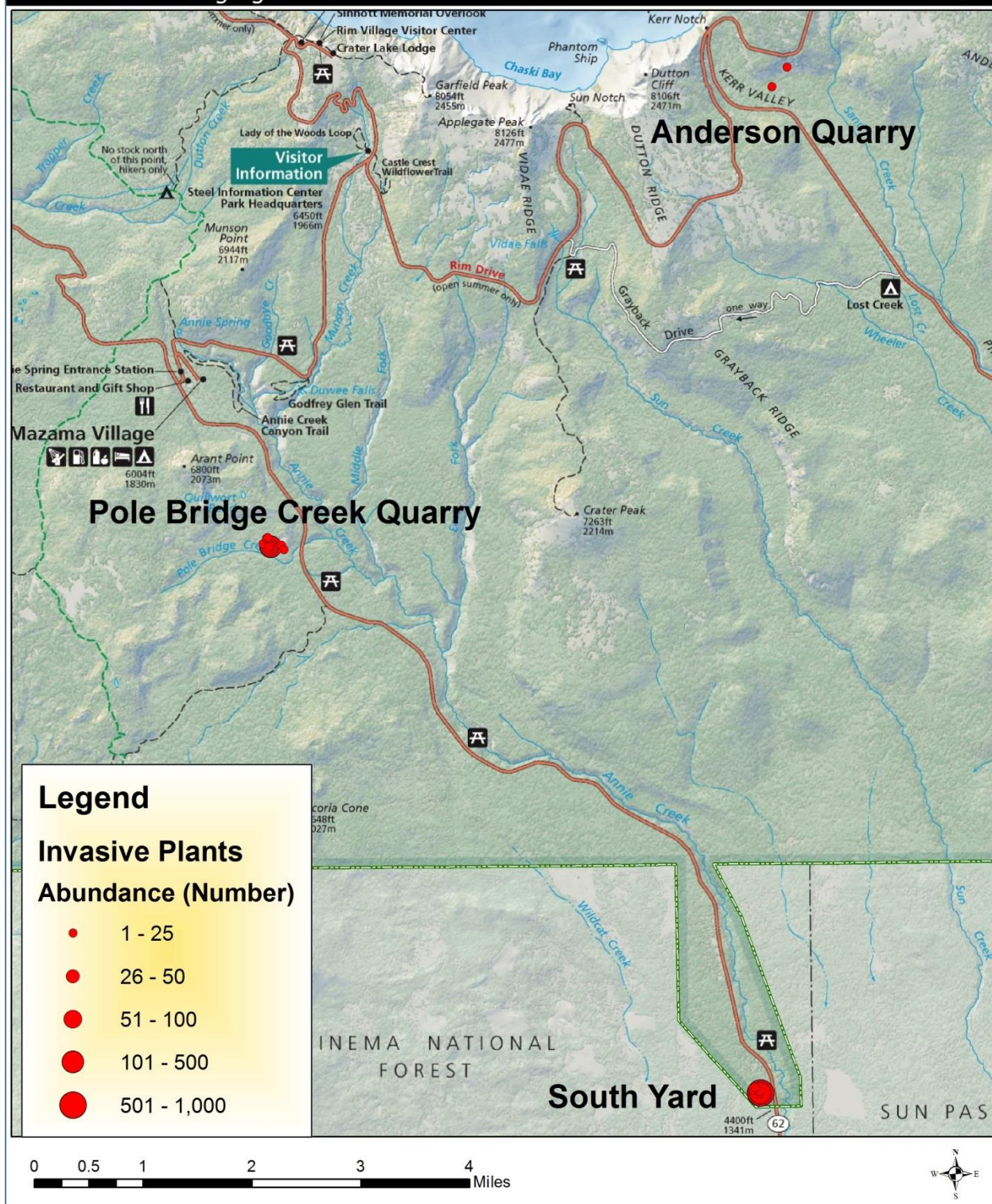


Figure 12. Locations of invasive plants encountered at staging areas throughout the Park. Map by J. Beck.

masonry materials. This area has been found to be free of invasive plant species, but is monitored each year for new invasive plant establishment.

Regular and recurring survey and control of invasive plants within Park staging areas helps keep established invasive plant populations contained. Marking the boundaries of invasive plant populations (including a buffer zone to include areas of seed dispersal) with pin flags and noxious weed flagging, and communicating these locations to Park Maintenance staff help prevent the spread of contaminated earthen materials around the Park.

Developed Areas

The Park's developed areas include Park headquarters (visitor center, administrative buildings, parking areas, Sleepy Hollow housing loop, Steel Circle housing loop, the Stone Houses, and the Science and Learning Center); Rim Village (including the Crater Lake Lodge, Picnic Hill, promenade, and Rim Dorms); the Park's two campgrounds (Mazama Campground – including the Xanterra employee loop, and Lost Creek Campground); Mazama Village (including the camper store, Annie Creek Restaurant, and Mazama Cabins); Mazama Dorms; and two sewage lagoons (Mazama Dorms and Steel Circle). Invasive plants encountered within the Park's developed areas in 2014 are displayed in Figure 14.

These developed areas are surveyed at least twice per growing season. Problem areas are visited more frequently, depending on the situation. The Steel Circle sewage lagoons are free of invasive plants, but all other developed areas support a wide variety of non-native plants. The most heavily infested areas are Park headquarters and Rim Village.

The Rim Village parking lot was recently repaved; this area will need to be watched in 2016 for invasive plant establishment. The Mazama Campground (all loops and access roads) was repaved in 2014; this area should also be monitored for invasive plant establishment. All roads around park Headquarters were also affected by the 2014 Pavement Preservation project and “chip seal” treatment, so future invasive plant surveys should keep that in mind. Additionally, a new fiber-optic cable was installed at Park headquarters in 2015 (Figure 13), which created localized ground disturbance. A trench was dug and refilled from the Steel Visitor Center to the forest behind Rat Hall. This area will need follow-up invasive plant surveys into the future.

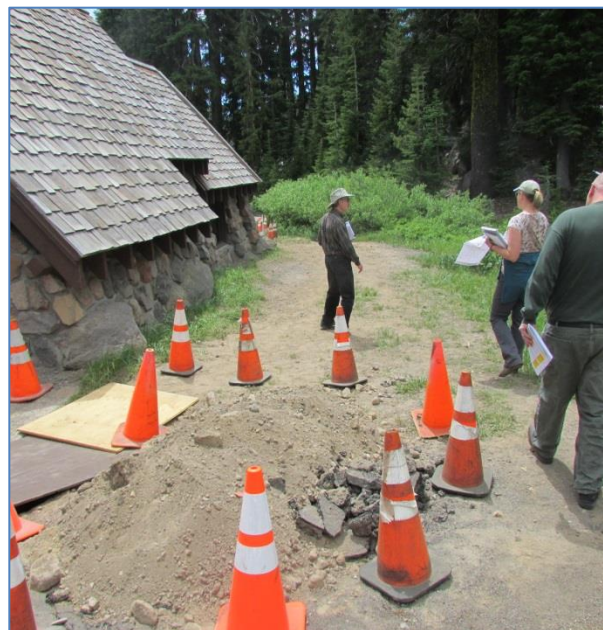
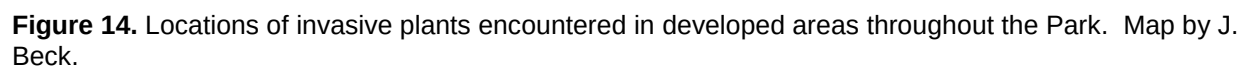


Figure 13. Ground disturbance from installation of a new fiber-optic cable at Park headquarters. Photo by J. Beck.



Backcountry Areas

The Park's backcountry areas include areas burned by wildfire (Red Blanket Canyon, 2006 Bybee Fire, 2008 Castle Fire); Spruce Lake; Panhandle sites (Cottonwood Meadows, Interior); prescribed burn units (PH3, Upper Panhandle, Cornerstone); riparian areas (Annie Creek, Bybee Creek, Castle Creek, Crater Creek, Pothole Creek, Sand Creek, Sun Creek); and meadow systems (Castle Creek meadows, Poison Meadows). Backcountry areas that were not surveyed during the 2015 season include the 2006 Bybee Fire, Munson Creek, National Creek, and Thousand Springs. The National Creek region was generally inaccessible during the 2015 season due to wildfire closures. Invasive plants encountered in backcountry areas during the 2015 season are displayed in Figure 16.

Many new invasive plant infestations were discovered in 2015 along the Annie Creek Canyon. Access to and within this area can be problematic due to steep slopes, cliffs of pumice and ash, and narrow creek beds. The level of invasion found in this area is not surprising due to rugged terrain hindering invasive plant survey efforts, the proximity to the south Highway 62 corridor, and the high level of ungulate use in this area leading to ground disturbance and mineral soil exposure. The Upper Panhandle burn unit was another new area surveyed in 2015, with many invasive plants found within recently burned areas (Figure 15). Many new populations of bull thistle (*Cirsium vulgare*) were found along Crater Creek near the Park boundary; this is troubling since the diverse Sphagnum Bog Research Natural Area lies just upstream. The Red Blanket Canyon continued to present a formidable challenge to the IVM crew in many respects. Dense snag patches, steep slopes, poor access, and large invasive plant populations continue to slow invasive plant control efforts in this area. Four distinct populations of cheat grass were found in remote sites within the Red Blanket Canyon in 2015, marking the first time this ecosystem-altering species has been found within the Park's recommended wilderness.



Figure 15. Left: Understory of wood groundsel (*Senecio sylvaticus*) and bull thistle in the Upper Panhandle Burn Unit. Photo by J. Beck. Right: Cheat grass in the Red Blanket Canyon. Photo by C. McCullough.

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2015 IVM - Backcountry Areas

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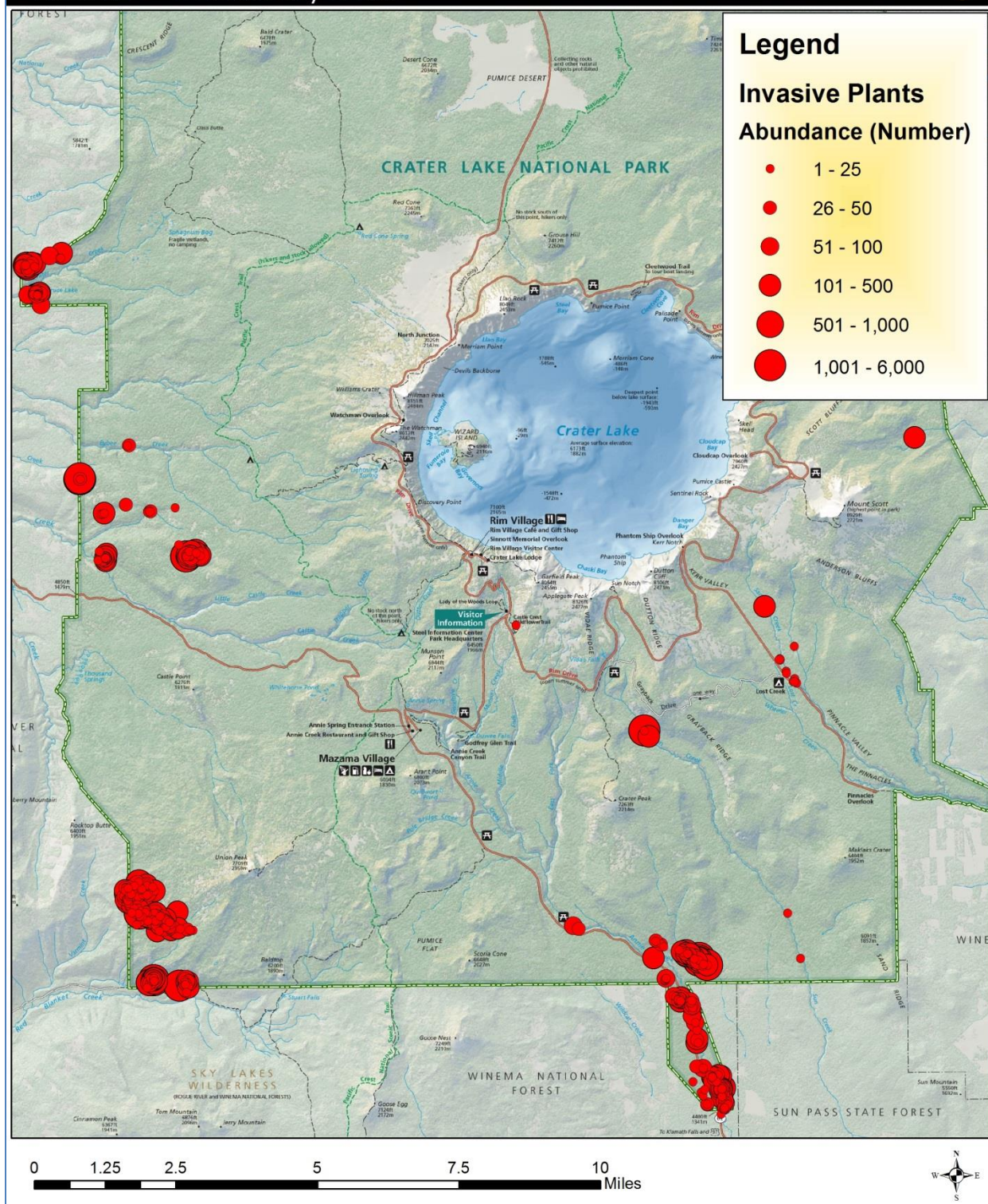


Figure 16. Locations of invasive plants found within backcountry areas in 2015. Map by J. Beck.

Area affected by the National Creek Complex of wildfires will be high on the priority list for IVM survey and control efforts in 2016. Survey efforts will focus on areas directly impacted by fire suppression actions such as firelines, spike camps, retardant drops, and helispots. Additionally, survey efforts will target areas that burned with high severity, along with floristically diverse and important areas including Boundary Springs and the wetland containing the southernmost extent of devil's club (*Oplopanax horridum*) in this species' range (Figure 17).



Figure 17. Left: The post-fire head spring area at Boundary Springs, the origin of the Wild and Scenic Rogue River. Photo by D. Hering. Right: Devil's club population affected by the National Creek Complex. Photo by B. Mumblo.

Lakeshore

The shore of Crater Lake contains several invasive plant species; the most difficult to control are Canada thistle, St. John's wort, and sheep sorrel (*Rumex acetosella*). These three species are perennial and rhizomatous; in sandy soils it has been possible to extract the entire root mass of some plants, and a reduction in population size has been achieved. In other areas with rocky or harder substrates, manual treatment methods have been less effective especially since plants can sprout from tiny root fragments left behind in the soil. Invasive plants encountered along the lakeshore are displayed in Figure 18.

Invasive plant survey and control efforts occurred during only a three-day window due to scheduling conflicts with the Park's Lake crew. This resulted in missing invasive plant survey and control efforts along the stretch of lakeshore from Skell Head clockwise to Discovery Point. This area will be a high priority for survey during 2016. A slight increase in Canada thistle and St. John's wort was observed in 2015 compared to 2014. Otherwise, invasive plant populations seemed to be generally contained due to annual control efforts.

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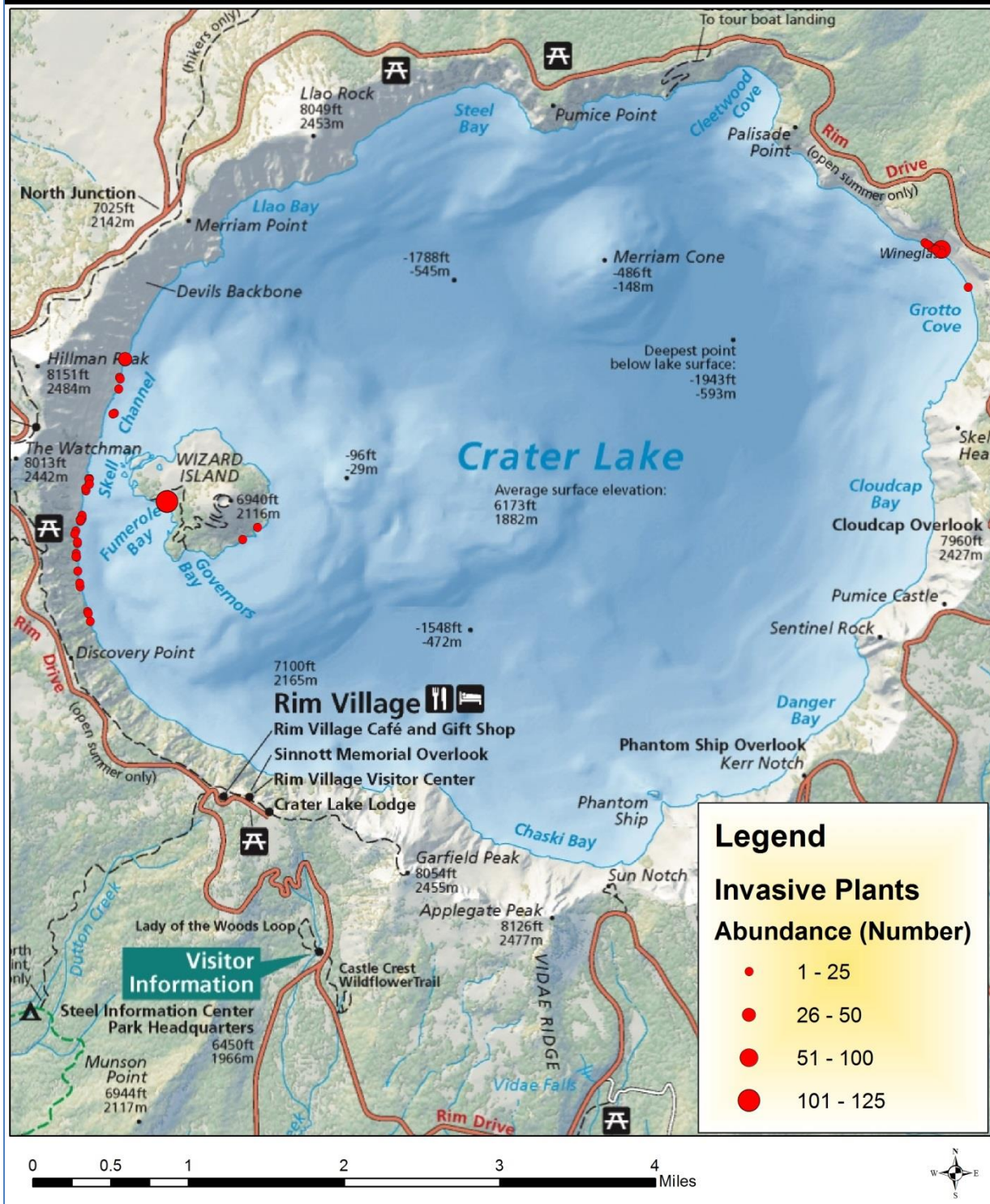


Figure 18. Locations of invasive plants found around the lakeshore in 2015. Map by J. Beck.

Discussion

The 2015 Invasive Vegetation Management program was very effective at meeting program goals due to the larger size of the field crew and the use of improved tools and techniques. Work accomplished in the 2015 season built upon the hard work of previous field crews, including past survey and control efforts and good documentation. Invasive Vegetation Management will be an ongoing activity for Crater Lake National Park, and reliable funding is needed to ensure that the momentum maintained over many years of annual work is not lost. Without regular and recurring funding, progress made in controlling invasive plants over the past 13 years could be quickly lost and the Park could be faced with a larger and more costly invasive plant problem that is far more difficult to control.

The Park has prepared a new Invasive Vegetation Management Plan (IVMP) and Environmental Assessment that is currently being reviewed through the process of abiding with laws and policies such as the National Environmental Policy Act of 1970. It is hoped that the new IVMP can be implemented soon to greatly improve and enhance the Park's ability to protect native ecosystems through invasive vegetation control and management.

Areas that continue to need to be watched for invasive plant establishment include areas impacted by the 2014 Pavement Preservation project (aforementioned roadsides plus staging areas), and areas impacted by the 2014 Rockfall Mitigation project including the Watchman cut and Wizard Island Overlook stretches on West Rim Drive; and Sun Grade, Dutton Cliffs, and Anderson Point stretches along East Rim Drive. The 2014 Pumice Complex of wildfires still requires post-fire invasive plant survey and possible treatment, and year two BAR funds have been secured for this purpose.

Additional recommendations for IVM work in 2016 include:

- Early-season and multiple visits to all invasive grass sites
- Early-season visits to Cottonwood Meadows, Pothole Creek, Thousand Springs, Sun Creek, and lower Bybee Creek
- Continue surveying Park roadsides for new Jerusalem oak infestations, as well as treating known populations
- Multiple visits to known Canada thistle sites starting in July
- Survey for new smooth brome infestations along Park roadsides
- Focus IVM work in the Red Blanket Canyon to the upper canyon slopes and rim
- Continue to survey along Park creeks especially along the western boundary
- Multiple visits to the Panhandle and Upper Panhandle burn unit
- Monthly visits to Spruce Lake

- Multiple July visits to Poison Meadows to catch yellow salsify (*Tragopogon dubius*)
- Thoroughly search developed areas (e.g., around buildings, in backyards, around utility boxes) for invasive plants
- Survey areas impacted by roadside vegetation management during 2015 (North Entrance Road, Munson Valley Road, Vidae Falls culverts)
- Survey areas impacted by infrastructure improvements during 2014-2015 (headquarters fiber-optic line, PCT group campsite, Mazama Campground paving, Mazama sewage lagoon access road, Century Link cable trench along Munson Valley Road, Annie Creek Restaurant, Mazama Cabins)
- Continue to refine and improve data collection using Trimble Juno units
- Ensure IVM crew is trained on new geodatabase and Access database and that weekly downloads and backups occur during field season
- Collect voucher specimens for new-to-CRLA invasive plants
- Ensure IVM crew is trained on processing unknown plant specimens
- Schedule four days to survey the Lakeshore early in the season with the Lake staff: target the weeks of August 3 and August 10. Walk as much of the lakeshore as possible.
- Survey rock outcrop across from the Godfrey Glen parking lot in August for St. John's wort hidden from pavement edge
- Survey Pole Bridge Creek for invasive plants above and below drafting point for Fire Management operations, and also the upper Pole Bridge Creek Quarry where air operations are based
- Thoroughly search areas disturbed by the 2014 Hazard Tree Removal project (Mazama Campground, Mazama Village, Lost Creek Campground, Park headquarters)
- Survey fuel reduction areas on west Highway 62 and around Park headquarters that experienced pile burning treatments
- Survey areas burned by the 2014 Pumice, Slope, Deer, and Dump fires, plus areas affected by access routes, spike camps, medevac sites, etc.
- Check the Dyer's woad (*Isatis tinctoria*) site in front of the Annie Creek Restaurant, and the rush skeletonweed (*Chondrila juncea*) site on Lower Munson Valley Road
- Utilize the National Creek Complex Burned Area Rehabilitation map to guide survey and control efforts in this area

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