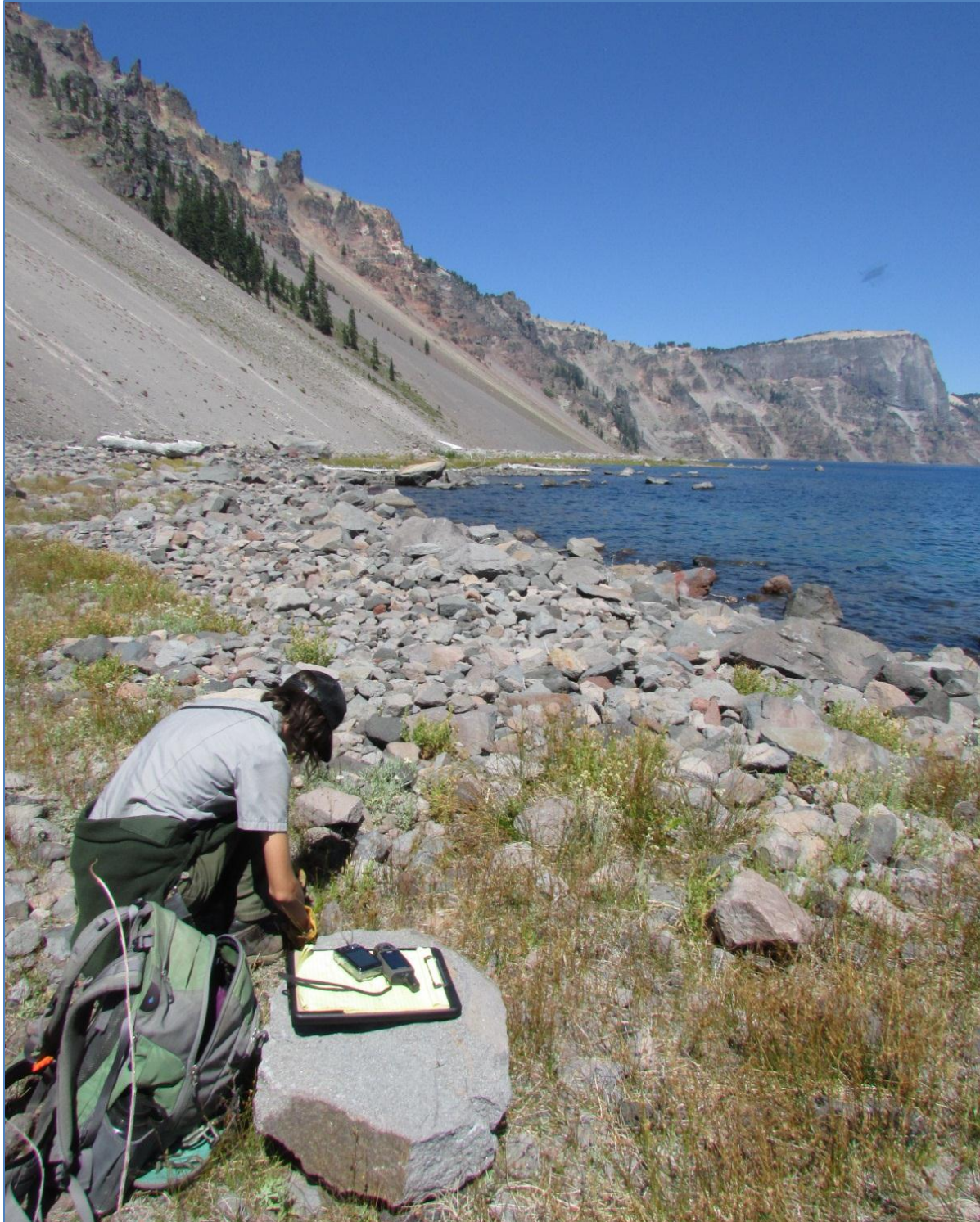




2014 Invasive Vegetation Management Annual Report





ON THIS PAGE

Removing invasive plants from the shoreline of Crater Lake.
Photograph by: Jen Beck

ON THE COVER

Removing invasive plants from the southwest portion of the Park.
Photograph by: Christine McCullough

2014 Invasive Vegetation Management Annual Report

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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

Work performed by the Crater Lake National Park Invasive Vegetation Management program during the 2014 season continued its focus on containing and reducing populations of invasive plant species within the Park. Steady progress made in 2014 and in previous years has helped stave off invasion of the Park's native plant communities by non-native plant species. Invasive plants were controlled parkwide using manual and limited chemical treatment methods. Over 80,000 invasive plants were controlled in 2014; five new weedy species were discovered within the Park for the first time. Several large projects and events occurring within the Park presented challenges to the Invasive Vegetation Management program in 2014 and will continue to need attention in the coming years; this includes the Rockfall Mitigation project, the Pavement Preservation project, the Rim Drive Rehabilitation project, and the Pumice Complex of wildfires. Recommendations are made for the 2015 Invasive Vegetation Management field season and beyond.

Acknowledgments

The 2014 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, and the Federal Highway Administration - Western Federal Lands Highway Division. Volunteer assistance with invasive vegetation control was received from the Friends of Crater Lake and the Youth Conservation Corps. Control of roadside St. John's wort was greatly assisted by the Oregon Department of Agriculture's Noxious Weed Control Program. Invasive plant observations reported by the Crater Lake National Park Roads crew and Interpretation staff, the Klamath Inventory and Monitoring Network Vegetation Monitoring and Vegetation Mapping crews, and the Southern Cascades Fire Effects Monitoring crew were greatly appreciated.

Introduction

The 2014 season marked the twelfth 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 2014 to have two devoted seasonal Biological Science Technicians; this was made possible through support by the NPS Natural Resource Cyclic Maintenance (NRCM) program, the Crater Lake Natural History Association (NHA), and the Crater Lake Fire Management 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. Special funding from the Crater Lake NHA made survey and treatment of invasive plants possible in these pristine and diverse areas. 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*) forests in the southern portion of the Park. Funding was received from the Crater Lake Fire Management program to survey for and control invasive plant species 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.

Over the past several years, the IVM program has been evolving to better protect the Park's native plant communities through expanded survey and control efforts, strengthened prevention techniques, and better data management and reporting systems. The Park is currently preparing an Invasive Vegetation Management Plan and Environmental Assessment that will 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.
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.

Activities that occurred within the Park in 2014 as they relate to invasive vegetation management include a Pavement Preservation project that applied a chip-seal treatment to major park roads (Highway 62, Munson Valley Road, North Entrance Road, Pinnacles Road, Cloudcap spur road, Park headquarters and housing roads). Since the Park does not have a local certified weed-free source for earthen materials, materials from a local gravel pit were used and a set of mitigations developed to lessen the probability of introducing contaminated materials into the Park. Several staging areas were used to stockpile gravel "chips" needed for this project, including the Ball Diamond, the junction of East Rim Drive and Pinnacles Road, North Junction Overlook, the Pumice Desert Overlook, Pole Bridge Creek Quarry, and South Yard. Intensive disturbance was made to portions of West and East Rim Drives as part of a Federal Highways Administration-sponsored Rockfall Mitigation project. In the process of mitigating safety hazards to road users by causing rocks to fall and rockslides to occur, much soil and vegetation were disturbed (Figure 1), including the



Figure 1. Disturbance to road shoulders and road cuts from the 2014 Rockfall Mitigation project. Photos by Kathryn Williams.

obliteration of the entire roadside vegetation communities in some areas. Areas affected include Wizard Island Overlook and the Watchman Cut on West Rim Drive; and Sun Grade, Anderson Point, and Dutton Cliffs on East Rim Drive. These two major projects involved large amounts of construction and contractor traffic with heavy equipment brought into the Park. Additionally, the

Park experienced 42 lightning-ignited fires in 2014, including the 25-fire Pumice Complex. Several hundred firefighting resources helped with managing the fires, with dozens of equipment such as engines, water tenders, helicopters, and fold-a-tanks brought into the Park.

The 2014 season marked the second consecutive summer the Park and region suffered through a drought. The Park received only 257" of snow (average is 523") during the 2013—2014 water year (October 1 – September 30), which is 49% of average. Snowmelt occurred over two weeks earlier than average; with the first snow-free date at Park headquarters achieved on June 3rd (average date is June 20th). Invasive vegetation survey and control work started in early May and continued into early October; the seasonal IVM crew was hired on from June 9 – September 25. A total of 80,132 invasive plants was treated during the 2014 season, including five new weedy species that had not been previously recorded within CRLA: rush skeletonweed (*Chondrilla juncea*), Jerusalem oak (*Dysphania botrys*), field pepperweed (*Lepidium campestre*), pineapple weed (*Matricaria discoidea*), and scentless mayweed (*Tripleurospermum inodorum*). These finds bring the number of non-native plant species documented within CRLA to 65.

Methods

Crater Lake National Park has assigned all of its 65 non-native 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 these 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 actions 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 species from the Park). Eradication of one or more invasive plant species has been attained in certain regions and sometimes the entire Park. Prior to the field season, IVM data are queried by region and maps 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 the best access to the site, if applicable), spatial data on which species are found in each region (displayed on

a map and also available digitally for import to a GPS unit), and abundance (number) and size of each invasive species population per spatial coordinate set.

Invasive vegetation survey consists of visually searching a region, typically on foot but sometimes via boat, automobile, or bicycle, for any 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 unsurveyed areas with no record of invasive plant species, surveys are concentrated on the most likely establishment points (close to moist habitats, open habitats, recently disturbed habitats). It is unlikely to find invasive species in thick, closed canopy forests at CRLA.

Presently, control of invasive 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 (Figure 2). For rhizomatous species, care is taken to extract as much of the root mass as possible during control operations. Rhizomatous individuals may also 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 (*Hypericum perforatum*). Through a Memorandum of Understanding (MOU) with the Oregon Department of Agriculture's



Figure 2. Left: The digging knife, the preferred tool of the IVM crew. Right: ODA staff prepare for a day of roadside St. John's wort treatment. Photos by Jen Beck.

(ODA) Noxious Weed Control program, roadside St. John's wort plants have been sprayed with Vista one day in late July by ODA personnel typically using ATV-mounted tank sprayers (Figure 2).

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 that plants occupy, and treatment applied to population. 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.

Any new-to-CRLA non-native plant species encountered are collected as voucher specimens for the Park's herbarium. Additionally, non-native plants encountered in previously undocumented locations are collected for the Park's herbarium. Extra specimens may be collected for use in the "working" herbarium maintained by the Park's Botany staff.

Results

Control efforts put forth by the 2014 IVM program are presented by general regions including roadsides, staging areas, developed areas, backcountry areas, and the lakeshore of Crater Lake. Data displayed on the following maps indicate the number of invasive plants found and treated during the 2014 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 Munson Valley Road also supporting considerable infestations. Highway 138 is also a problem area for invasive plant species. 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. Roadside invasive plant locations found in 2014 are displayed in Figure 3.

As previously mentioned, invasive plant survey and control work for West and East Rim Drives was funded in 2014 by the Federal Highways Administration's Rim Drive Rehabilitation project; this work is discussed further in the 2014 Rim Drive Rehabilitation Revegetation Annual Report. Notable findings from this effort include new infestations of St. John's wort along West and East Rim Drives; reduction in the amount of sheep sorrel (*Rumex acetosella*) in the vicinity of a rare Crater Lake rockcress (*Boechera horizontalis*) population along East Rim Drive; the discovery of a large sand spurry (*Spergularia rubra*) infestation threatening a Crater Lake rockcress population along West Rim Drive; and the discovery of a new common knotweed (*Polygonum aviculare* ssp. *depressum*) infestation in close proximity to rare plants along East Rim Drive.

Crater Lake National Park

2014 IVM - Park Roadsides

National Park Service
U.S. Department of the Interior

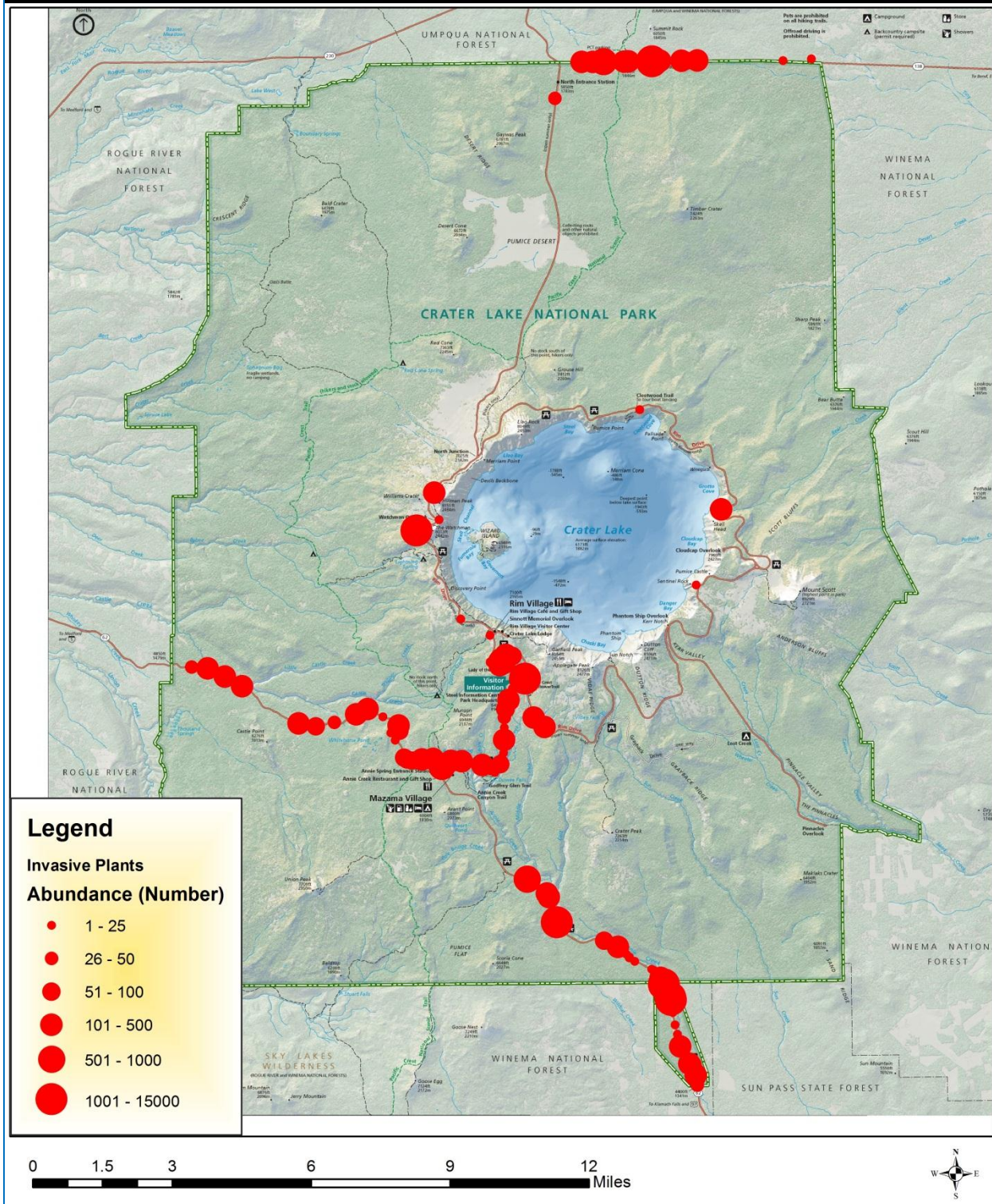


Figure 3. Invasive plants encountered along park roadsides in 2014. Map by Jen Beck.

Following trends detected in previous years, park-wide St. John's wort populations along roadsides continued to decline in 2014. The ODA Noxious Weed Control program once again assisted the Park with treating roadside St. John's wort with the herbicide fluroxypyr (Vista) on July 16. Surveys conducted ahead of this treatment identified 471 roadside St. John's wort plants in 2014; this is down 45% from the 861 plants detected in a similar survey in 2013. This treatment method has proven successful; a 95% reduction in roadside St. John's wort has been achieved since implementation in 2007 when 9,304 roadside St. John's wort plants were observed. Unfortunately, roadside St. John's wort emerges and blooms throughout the growing season, so a one-day treatment does not capture all St. John's wort plants growing along park roads in a single season. An additional 325 plants were encountered and pulled along park roads post-treatment, with flowering plants being detected as late as October.

New-to-the-Park species that were found this year along park roadsides include Jerusalem oak, rush skeletonweed, and field pepperweed. It is believed that Jerusalem oak was introduced into the Park through contaminated gravel by the Pavement Preservation project, as over 15,000 individuals were discovered to be growing right at and along the edges of newly treated roadways in several locations (Figure 4).

A spike in spotted knapweed (*Centaurea stoebe* ssp. *micranthos*) populations was encountered in 2014, with 102 plants found and controlled compared to 11 plants in 2013. To date, this invasive plant has been found only along park roadsides. Spotted knapweed had been declining within the Park over the past decade; manual control efforts had substantially reduced population sizes to the point where this plant was not even encountered within the Park in 2011. New infestations found along Highway 138 primarily contributed to the increase detected this year.

Another invasive plant found in greater numbers this year was cheat grass (*Bromus tectorum*), which had not been found within the Park since 2003. Bulbous bluegrass (*Poa bulbosa*), smooth brome (*Bromus inermis*), and sheep sorrel are other species that are expanding along park roadsides.

Staging Areas

Staging areas within the Park include large yards and old quarries that are currently closed to the public and used for staging of materials, vehicles, and equipment. South Yard, Pole Bridge Creek Quarry, the Ball Diamond, Anderson Quarry, and Roundtop Quarry are all areas that are actively



Figure 4. Jerusalem oak infestation that emerged immediately after the Pavement Preservation project. Photo by Christine McCullough.

used by the Park to support operations. As of 2014, the Ball Diamond and Roundtop Quarry are free of invasive plant species; although a velvet grass (*Holcus lanatus*) plant in seed was found attached to the undercarriage of heavy equipment staged at Roundtop Quarry for the Rockfall Mitigation project in July. Anderson Quarry, South Yard (Figure 5), and Pole Bridge Creek Quarry have established populations of invasive plants that are treated on an annual basis. Invasive plants encountered in 2014 at Park staging areas are displayed in Figure 6.

Due to regular and frequent visits by IVM personnel, invasive plants within the Park's staging areas are contained and efforts are underway to reduce infestation size. Since materials from these areas are often spread around the Park, locations of invasive plants are delineated with flagging and these locations shared with key staff in the Maintenance division to prevent the inadvertent dispersal of invasive plant seed. Frequently encountered invasive plants in park staging areas include yellow rocket (*Barbarea vulgaris*), St. John's wort, and woolly mullein (*Verbascum thapsus*).

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 (Figure 5), the North Junction parking area, the Pumice Desert Overlook, and the junction of East Rim Drive and Pinnacles Road.

The 2014 Pumice Complex of wildfires utilized the Annie Creek Sno-Park as a staging area and Incident Base Camp. Hundreds of firefighting personnel camped and concentrated in this area, which is immediately adjacent to the southern Park boundary. The upper Pole Bridge Creek Quarry was used to support air operations, with all water for air operations sourced from Pole Bridge Creek.

While not used as a staging area, the Watchman Flow on West Rim Drive is actively used by the Trails program for masonry materials. This area has been found to be free of invasive plant species.



Figure 5. Left: Woolly mullein growing on gravel pile at the South Yard. Photo by Jen Beck. Right: Gravel for the Pavement Preservation project stored at the Ball Diamond. Photo by Kathryn Williams.



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, and Rim Dorms); the Park's two campgrounds (Mazama Campground and Lost Creek Campground); Mazama Village (including the camper store, Annie Creek restaurant, and Mazama Cabins); Mazama Dorms; and the two sewage ponds (Mazama Dorms and Steel Circle). Invasive plants encountered within the Park's developed areas in 2014 are displayed in Figure 8.

These developed areas are surveyed at least twice per growing season (problem areas are visited more than twice, depending on the situation). The only site that has been free of invasive plants is the Steel Circle sewage ponds. These areas typically support a variety of invasive plants and need routine survey and treatment. The most problematic areas from an invasive plant perspective are Park headquarters and Rim Village.

Two new-to-CRLA weedy plants were found within developed areas in 2014: scentless mayweed and pineapple weed (Figure 7). While pineapple weed is listed as native by the Oregon Flora project, it has not been previously documented within the Park and is noted as being “weedy” in its native range (Flora of North America 2015). Scentless mayweed was encountered at Mazama Village close to the campground store.



Figure 7. Left: Pineapple weed, a new-to-CRLA species found within a landscaped area at Rim Village in 2014. Right: Ground disturbance after the Hazard Tree Removal project at Lost Creek Campground. Photos by Jen Beck.

A recent mountain pine beetle (*Dendroctonus ponderosae*) outbreak impacted both campgrounds, causing much mortality to overstory lodgepole pines (*Pinus contorta* var. *latifolia*). A Hazard Tree Removal project caused considerable ground disturbance in both campgrounds (especially Lost Creek Campground – Figure 7) while mitigating threats to camper safety. Additionally, several invasive grasses were detected within the Park headquarters area for the first time in 2014: bulbous bluegrass, smooth brome, and reed canarygrass (*Phalaris arundinacea*).

Crater Lake National Park

2014 IVM - Developed Areas

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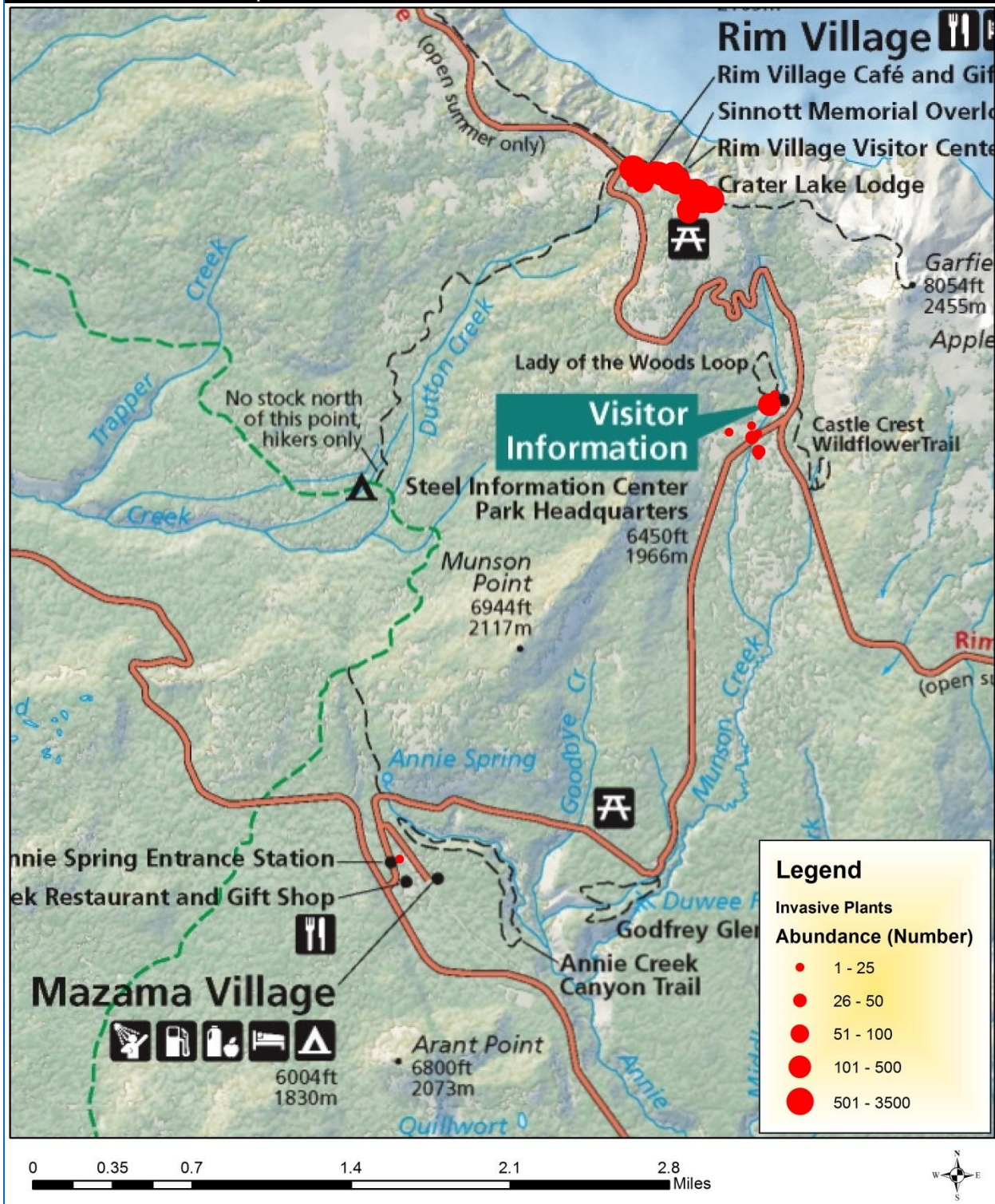


Figure 8. Locations of invasive plants encountered in developed areas throughout the Park. Map by Jen Beck.

Backcountry Areas

An increasing number of areas infested with invasive plants are being discovered within the Park's backcountry, with more areas being added on an annual basis. The backcountry IVM region includes the Red Blanket Canyon (area burned by the 2008 Middlefork fire of the Lonesome Complex); Spruce Lake; Cottonwood Meadows in the Panhandle; lower Castle Creek meadows; the area burned by the 2006 Bybee fire; lower Crater Creek; Poison Meadows; interior Panhandle sites (including the PH3 burn unit); the Cornerstone prescribed burn unit; north fork of Castle Creek; area burned by the 2008 Castle Fire; Sun Creek; Pothole Creek; and Thousand Springs. Additional invasive plant observations were submitted after the 2014 field season was over by the National Park Service Klamath Inventory and Monitoring Network (KLMN) crews; these included new invasive plant discoveries near Munson, Annie, Bybee, and National Creeks. These new locations will be surveyed during the 2015 field season by the IVM crew. Invasive plants encountered during 2014 in the Park's backcountry are displayed in Figure 10.

The more that meadows and forest openings within the Castle Creek watershed are surveyed, the more invasive plant infestations are found. In 2014, new well-established populations of Canada thistle (*Cirsium arvense*) and bull thistle (*Cirsium vulgare*) were found within this area. The scenic and diverse "Castle Creek Meadows" near the western Park boundary continues to be a problem area for invasive plant species. This area is heavily used by native ungulate species that cause substantial soil and vegetation disturbance, exacerbating the invasive plant problem.

The Red Blanket Canyon continues to be the most weed-infested natural area of the Park, containing Canada thistle, bull thistle (Figure 9), St. John's wort, wooly mullein, and many others. This area is steep, rugged, and remote; these factors contribute to a very challenging environment for invasive plant treatment and control.

Unfortunately, this is also one of the Park's most floristically diverse areas. The 2008 Middlefork fire of the Lonesome Complex affected this area; this fire burned 2,232 acres of the Park and was the largest wildfire in the Park's history. The fire, logging history on adjacent lands, remote and difficult terrain, and probably a lack of any pre-2009 invasive plant survey and control efforts contributed to the invasive plant issues present within this area today.



Figure 9. An understory of bull thistle in the Red Blanket Canyon. Photo by Jen Beck.

Other backcountry areas that will continue to need invasive plant survey and treatment include Poison Meadows, Spruce Lake, interior Panhandle sites, and the Panhandle's Cottonwood Meadows. Areas with very limited infestations that require regular survey and treatment to contain infestations include Crater Creek, Sun Creek, the Cornerstone prescribed burn unit, areas burned by the 2006 Bybee fire, Thousand Springs, and Pothole Creek.

Crater Lake National Park

2014 IVM - Backcountry Areas

National Park Service
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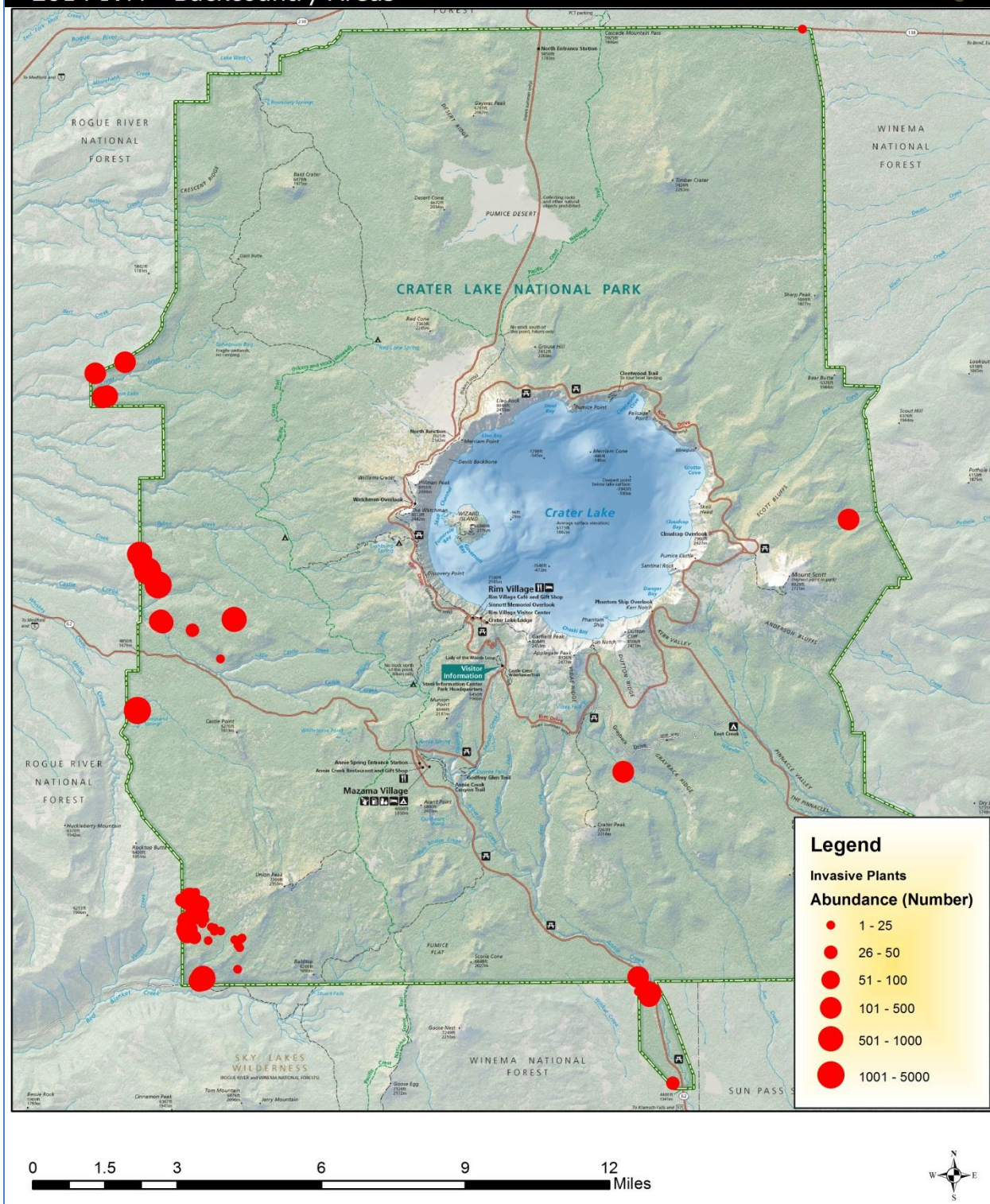


Figure 10. Locations of invasive plants encountered in backcountry areas throughout the Park. Map by Jen Beck.

Lakeshore

Invasive plants encountered along the lakeshore of Crater Lake in 2014 are displayed in Figure 12. 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. These three species are perennial and rhizomatous;

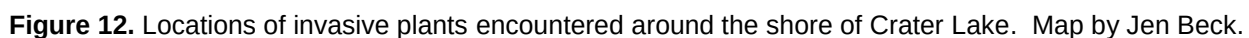


Figure 11. Arrows denote previously documented occurrences of St. John's wort; oval shows location of newly discovered plants. Photo by Jen Beck.

in sandy soils it has been possible to extract the entire root mass of some plants and reduction of population size has been achieved. At Black Sands Beach on Wizard Island, a population of 69 Canada thistle plants was meticulously removed from the sandy shore in 2011; no Canada thistle plants have been observed at this site from 2012-2014 but it will continue to need monitoring on an annual basis. In other areas, rocky substrates preclude the ability to effectively control invasive rhizomatous plants through manual treatment methods. In the Wineglass area, a population of St. John's wort was found extending up the caldera wall in 2009 at the site of an old fisherman's trail from the rim to the lakeshore. Plants in this area have been manually removed from 2011-2013 with some success; however, in 2014 an uphill extension to this population was discovered (Figure 11) in steep and unstable terrain.

Control of this new population will be challenging from logistical and safety perspectives. A persistent population of wooly mullein south of the Devil's Backbone continues to produce seedlings and requires annual treatment. All known Canada thistle locations are monitored (and treated, as needed) on an annual basis. Overall, the number of invasive plants found along the lakeshore was down to 233 plants in 2014 from its peak of 771 plants encountered in 2007. Annual IVM survey and control efforts will be needed along the lakeshore to help protect the diverse native plant communities inhabiting this special place.

2014 IVM - Lakeshore



Discussion

The work accomplished by the 2014 Invasive Vegetation Management program was greatly facilitated by the hard work of previous IVM crews. This season's efforts built upon years of previous treatments and were informed by documentation made by previous crews. Invasive Vegetation Management will be an ongoing annual activity for Crater Lake National Park, and it is recommended to secure a reliable source of funding to support an IVM crew leader (permanent subject-to-furlough position) and two seasonal IVM crew members. Without regular and recurring efforts to control invasive vegetation, twelve years of work will quickly be negated, and the Park will be faced with a larger and more costly invasive vegetation management problem that is far more difficult to control.

The Park is currently developing an Invasive Vegetation Management Plan and Environmental Assessment that, if approved, would greatly improve and enhance the Park's ability to protect native ecosystems through invasive vegetation control and management. As new-to-the-Park invasive species continue to be detected within Park boundaries, it is imperative that the IVM toolbox is expansive enough to allow for effective and appropriate treatment of invasive species that are already established within the Park and those that are recent arrivals.

The Pavement Preservation project of 2014 utilized several park staging areas and additional areas (junction of East Rim Drive and Pinnacles Road; North Junction parking area; Pumice Desert Overlook) to stockpile gravel and equipment used during project implementation. These areas will need to be surveyed several times per growing season for at least the next five years to detect any new invasive plant species that may have been introduced by contaminated materials and/or equipment.

The Park is about to embark on a multi-year Rim Drive Rehabilitation project that will impact park roads and staging areas, import earthen materials into the Park (e.g., base rock), involve hundreds of construction and contractor vehicles, and cause much ground disturbance. While the Federal Highways Administration is providing funding to the Park for revegetation and invasive plant treatment within project areas, all park roads being used by this project need to be watched for invasive plant species brought in by increased vehicle traffic. Additionally, the park roads affected by the 2014 Pavement Preservation project will need to be surveyed and monitored for invasive plant establishment.

Additional recommendations for IVM work in 2015 include the following:

- Early-season and multiple visits to all known cheat grass and bulbous bluegrass sites
- Early-season visits to Cottonwood Meadows, Pothole Creek, Thousand Springs, Sun Creek, and Bybee Creek sites
- Early-season and multiple visits to all known Jerusalem oak sites and vigilant surveys for this plant along park roads

- Early-season and multiple visits to spotted knapweed sites along Highways 62 and 138
- Focusing IVM work in the Red Blanket Canyon to the upper slopes/canyon rim and adjacent upland forests
- Multiple July visits to Poison Meadows to catch the yellow salsify (*Tragopogon dubuis*) in bloom
- Multiple visits to known Canada thistle sites starting in July
- Schedule ODA treatment for the week of July 20
- Schedule four days on the lakeshore during the weeks of August 3 and August 10; walk as much of the shore as possible
- Survey rock outcrop across the road from the Godfrey Glen parking lot in August for St. John's wort hiding away from the pavement edge
- Search for smooth brome along Highway 62, Munson Valley Road, and at Park headquarters
- 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 were based
- Thoroughly search housing areas (backyards, too) for invasive plants
- Thoroughly search all campground loops and facilities, especially areas disturbed by the Hazard Tree Removal project
- Survey fuel reduction areas on West Highway 62 that experienced pile burning treatments
- Survey thistle sites on the west side of the Park prior to August
- Survey areas burned by 2011 Oasis Fire and west side of Bald Crater Loop trail
- Survey areas burned by 2014 Pumice, Slope, Deer, and Dump fires (plus areas affected by access routes, spike camps, medevac sites, etc.) along with small fires along western boundary
- Check the Dyer's woad (*Isatis tinctoria*) site in front of the Annie Creek Restaurant, and the rush skeletonweed site on Lower Munson Valley Road multiple times per season

Literature Cited

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U.S. Department of the Interior



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