



# Klamath Network Invasive Species Early Detection Monitoring Protocol Annual Report for the 2013 Field Season

Natural Resource Data Series NPS/KLMN/NRDS—2014/660



**ON THE COVER**

Common mullein (*Verbascum thapsus*), one of the Klamath Network's prioritized invasive species, shown here at Lava Beds National Monument.

Photograph by: Sean B. Smith, Klamath Network Inventory and Monitoring Program

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Natural Resource Data Series NPS/KLMN/NRDS—2014/660

Sean B. Smith and Daniel Sarr  
Klamath Inventory and Monitoring Network  
1250 Siskiyou Blvd.  
Ashland, OR 97520

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## Contents

|                                                                       | Page |
|-----------------------------------------------------------------------|------|
| Figures.....                                                          | v    |
| Tables.....                                                           | v    |
| Appendices.....                                                       | vii  |
| Executive Summary .....                                               | ix   |
| Introduction.....                                                     | 1    |
| Methods.....                                                          | 1    |
| Field Preparation .....                                               | 1    |
| Site Selection.....                                                   | 1    |
| Species Selection.....                                                | 1    |
| Field Methods.....                                                    | 2    |
| Site Sampling.....                                                    | 2    |
| Data Collection.....                                                  | 3    |
| Results.....                                                          | 4    |
| Crew Productivity.....                                                | 4    |
| General Patterns of Invasive Species Distribution and Abundance ..... | 4    |
| Park-specific Patterns .....                                          | 4    |
| Discussion .....                                                      | 5    |
| Literature Cited .....                                                | 6    |



## Figures

|                                                                                                                              | Page |
|------------------------------------------------------------------------------------------------------------------------------|------|
| <b>Figure 1.</b> Schematic of segment sampling methodology for the Invasive Species Early Detection protocol.....            | 3    |
| <b>Figure A.1.</b> Locations of invasive plant species recorded in the 2013 Invasive Species Early Detection monitoring..... | A-2  |
| <b>Figure B.1.</b> Locations of invasive plant species recorded in the 2013 Invasive Species Early Detection monitoring..... | B-2  |
| <b>Figure C.1.</b> Locations of invasive plant species recorded in the 2013 Invasive Species Early Detection monitoring..... | C-2  |

## Tables

|                                                                                                                       | Page |
|-----------------------------------------------------------------------------------------------------------------------|------|
| <b>Table 1.</b> Invasive Species Early Detection plot measurements.....                                               | 3    |
| <b>Table 2.</b> Observed prioritized invasive species observed in the Klamath Parks, 2013. ....                       | 4    |
| <b>Table 3.</b> Percentage of segments with invasive species infestations by park in the Klamath Network in 2013..... | 4    |
| <b>Table A.1.</b> Summary of prioritized invasive species at Lava Beds National Monument. ....                        | A-1  |
| <b>Table B.1.</b> Summary of prioritized invasive species at Oregon Caves National Monument. ....                     | B-1  |
| <b>Table C.1.</b> Summary of prioritized invasive species at Whiskeytown National Recreation Area.....                | C-1  |



# Appendices

|                                                        | Page |
|--------------------------------------------------------|------|
| Appendix A: Lava Beds National Monument.....           | A-1  |
| Appendix B: Oregon Caves National Monument .....       | B-1  |
| Appendix C: Whiskeytown National Recreation Area ..... | C-1  |



## **Executive Summary**

The Klamath Inventory and Monitoring network implemented its Invasive Species Early Detection Protocol from May to June and then August and September 2013. This was the third season the protocol has been implemented. During the field season, crews visited three parks in the Klamath Network: Whiskeytown National Recreation Area, Lava Beds National Monument, and Oregon Caves National Monument. The crew monitored 42 road and trail segments, covering a total of 83 km. The sample effort fell short of our pre-season goals, due to difficulties in hiring field crews. We observed a total of 38 separate infestations of nine priority invasive species and collected site-specific data at 28 of these infestations.



# Introduction

In 2013, the Klamath Network Inventory and Monitoring (I&M) Network implemented its Invasive Species Early Detection Monitoring (ISED) Protocol (Odion et al. 2010) at three of the six Network parks: Lava Beds National Monument (LBE, or Lava Beds), Oregon Caves National Monument (ORCA, or Oregon Caves), and Whiskeytown National Recreation Area (WHIS, or Whiskeytown). We were not able to hire an Invasive Species Early Detection field crew, and that prevented us from implementing the protocol in the other three parks: Crater Lake National Park (CRLA, or Crater Lake), Lassen Volcanic National Park (LAVO, or Lassen), and Redwood National and State Parks (REDW, or Redwoods). Results of the 2013 season are described here in an abbreviated format, as we were not able to visit all parks and thus comparisons would be incomplete or misleading. These annual reports are intended to 1) quickly summarize the work completed in a given field season and 2) assist park managers with targeting their rapid invasive species response efforts.

## Methods

Full methodological details are available in Odion et al. (2010), but a brief summary is provided below.

### Field Preparation

#### *Site Selection*

For each park, all roads and trails were broken into 3 km target segments for sampling. Smaller terminal sections were also included. Busy roads posing a safety threat were eliminated from the sampling frame. We then selected a random spatially-balanced sample of segments for each park using the Generalized Random Tessellation Stratified (GRTS) technique (Stevens and Olsen 2004). We chose the number of segments to be visited at each park based on criteria explained in the Klamath Network ISED Protocol (Odion et al. 2010). We set the minimal sample size (segments visited) for WHIS and LBE at 25. ORCA, due to its small size, had a complete census of all road and trail segments performed: eleven total.

#### *Species Selection*

Klinger and Brooks (2008) conducted the invasive species prioritization to select species to monitor on a park-by-park basis. They used a combination of expert opinion and peer reviewed publications. First, lists of non-native species were split into two categories: invasive and non-invasive. Non-invasive species were judged to not be ecosystem transformers and were subsequently dropped from the prioritization process. The remaining invasive species were placed into one of three categories representing phases of the invasion process: 1) colonization, 2) establishment, or 3) spread/equilibrium. Species in the colonization phase were considered to be in areas adjacent to each park in the Klamath Network, or they recently colonized a small portion of the park. Species in the establishment phase had multiple, relatively small, localized populations within the boundaries of a park. Species in the spread/equilibrium phase were more widely distributed than those in the establishment phase. Some species in the spread/equilibrium phase were dropped from the list of species to be monitored because control of these species was considered infeasible; other species

were to be monitored only in the backcountry (as defined by each park). Before the beginning of the 2011 season, minor modifications occurred to the prioritization lists at CRLA, LABE, and WHIS based on park staff knowledge of emerging invasive species. No additional modifications were made before the 2013 season.

## **Field Methods**

### ***Site Sampling***

Members of the KLMN Vegetation Monitoring Crew and the Vegetation Mapping Crew performed the sampling at Lava Beds and Whiskeytown in the early summer. Oregon Caves monitoring occurred during the late summer, and was performed by Oregon Caves staff.

The field crew traversed each 3 km target segment, starting at the most accessible end. Locations and the size category of each infestation ( $<1 \text{ m}^2$ ,  $1\text{-}25 \text{ m}^2$ , or  $>25 \text{ m}^2$ ) were recorded. The 3 km segments were divided into 500 m subsegments. If the number of individual species infestations for each subsegment was more than four, or the entire subsegment was considered infested (for management purposes), up to three infestation plots per segment were sampled. Plots were circular, (radius = 5.6m; area =  $100 \text{ m}^2$ ), centered on the infestation, randomized and spatially balanced among infestations when these were numerous. Crews also randomly placed one circular  $100 \text{ m}^2$  plot within 6-14 m of the road or trail in each 500 m subsegment, without regard to location of infestations as shown in an example schematic (Figure 1). In each of these random plots, we sampled the vegetation, environmental variables, and abundance of invasive species (if present) (Table 1). Canopy cover was measured with a spherical densiometer.

To the degree feasible, parks were monitored at the time of maximum phenological expression for detecting priority invasive species. However, conditions were not always ideal for all species in all parks.

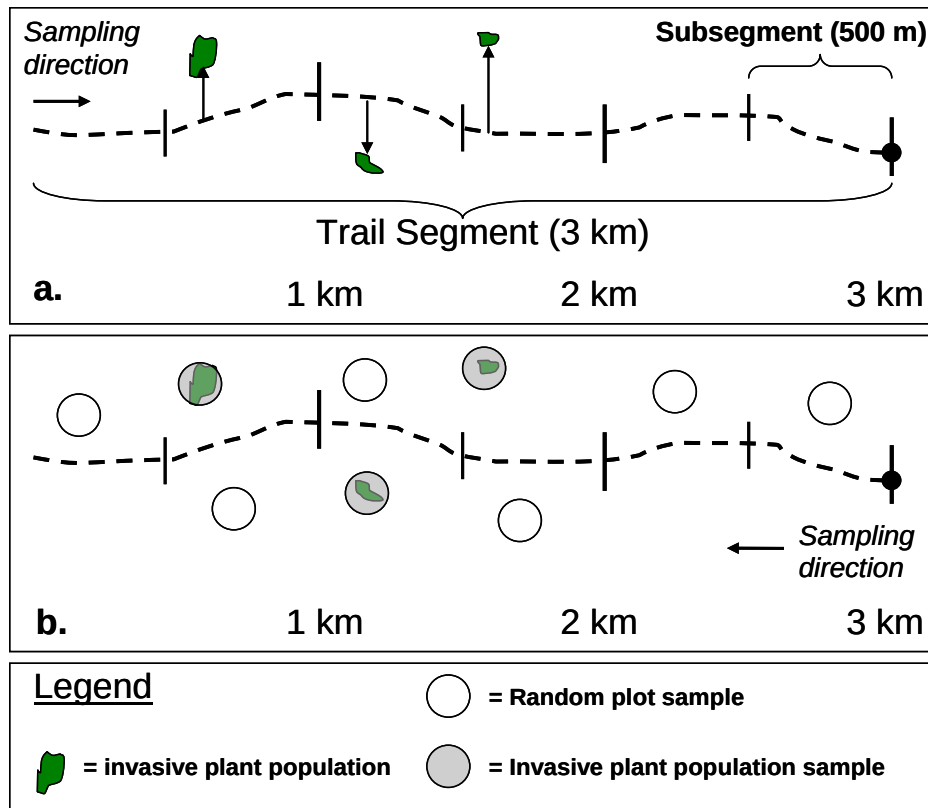


**Figure 1.** Schematic of segment sampling methodology for the Invasive Species Early Detection protocol.

**Table 1.** Invasive Species Early Detection plot measurements.

|                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                          |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>• GPS coordinates</li> <li>• Infestation size</li> <li>• Infestation % of plot</li> <li>• Infestation distance from road or trail</li> <li>• Slope</li> <li>• Aspect</li> <li>• Average canopy height</li> <li>• Percent cover (evergreen, deciduous, herb, shrub, woody debris, litter, bare ground, surface water, soil disturbance)</li> </ul> | <ul style="list-style-type: none"> <li>• Soil disturbance</li> <li>• Canopy cover (measured with a densiometer)</li> <li>• Phenology</li> <li>• Topography (macro and micro position)</li> <li>• Hydrology</li> <li>• Land use</li> <li>• Infestation species</li> </ul> |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

## Data Collection

We recorded all data electronically with a Trimble GeoXM handheld GPS. This was also the primary source of geographical (coordinate) data. In cases where the Trimble could not get satellite reception, we used a Garmin 76CSX or Garmin GPSmap 78s Global Positioning System for location coordinates. Data were also recorded at plots using paper datasheets when the Trimble was unable to record data.

# Results

## Crew Productivity

We monitored 42 road and trail segments for a total of 83 km. Roads accounted for 45% of surveyed segments while trails were 55%. We fell short of our monitoring goals as we were not able to hire a crew to specifically implement this protocol, as planned. We completed as many segments in as many parks as we could without sacrificing productivity in other KLMN monitoring protocols.

## General Patterns of Invasive Species Distribution and Abundance

We observed a total of 38 separate infestations of nine invasive species (Table 2) and collected site-specific data at 28 of these infestations. Three invasive species occurred in three of 220 random plots. Table 3 shows percentage of segments infested at each park.

**Table 2.** Observed prioritized invasive species observed in the Klamath Parks, 2013. Note: not all parks have the same species prioritized, see Appendices. Lava Beds National Monument (LBE), Oregon Caves National Monument (ORCA), and Whiskeytown National Recreation Area (WHIS).

| Species                                              | Park Frequency |
|------------------------------------------------------|----------------|
| Klamath weed ( <i>Hypericum perforatum</i> )         | 45.4 (ORCA)    |
| Scotch broom ( <i>Cytisus scoparius</i> )            | 21.4 (WHIS)    |
| yellow starthistle ( <i>Centaurea solstitialis</i> ) | 14.3 (WHIS)    |
| medusahead ( <i>Taeniatherum caput-medusae</i> )     | 11.7 (LBE)     |
| vernal sweetgrass ( <i>Anthoxanthum odoratum</i> )   | 7.1 (WHIS)     |
| totalote ( <i>Centaurea melitensis</i> )             | 7.1 (WHIS)     |
| Goat grass ( <i>Aegilops triuncialis</i> )           | 7.1 (WHIS)     |
| pinnate tansy mustard ( <i>Descurainia sophia</i> )  | 5.8 (LBE)      |

**Table 3.** Percentage of segments with invasive species infestations by park in the Klamath Network in 2013.

| Park Code | % of segments infested |
|-----------|------------------------|
| WHIS      | 43                     |
| LBE       | 18                     |
| ORCA      | 45                     |

## Park-specific Patterns

Appendices A-C provide more detailed information about park-specific survey dates, number and distances of segments completed, segments not completed, and species encountered along with locations and abundance maps.

## Discussion

Many factors combined (sequestration, hiring freeze, human resource delays, etc.) to prevent the Klamath Network from hiring an ISED-specific crew. Since the Vegetation Monitoring and Vegetation Mapping crews were not scheduled to start field work until mid-June, we were able to borrow a few days of their time to complete a modest number of ISED segments at Lava Beds and Whiskeytown. The ISED protocol was not implemented at Lassen, Crater Lake, or Redwoods. However, these three parks did receive some monetary funds from KLMN to direct towards Invasive species issues as they saw fit. At Oregon Caves, some of the seasonal park biotechnicians were able to implement the ISED protocol in full.

Due to the limited sampling we were able to accomplish in 2013, this report only describes location and abundance of targeted invasive species for a very limited proportion of the six KLMN parks. With such limited data we cannot provide inferences or comparisons between the parks.

## Literature Cited

- Klinger, R. C., and M. L. Brooks. 2008. Prioritization of non-native plants in the National Park Service Klamath Network using weighted criteria and measures of uncertainty. USGS Technical Report prepared for the National Park Service, Klamath Network. Western Ecological Research Center, US Geological Survey.
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# Appendix A: Lava Beds National Monument

## Fiscal Year 2013 Accomplishments

The Klamath I&M program implemented, for the third time, its Invasive Species Early Detection Protocol from May to September 2013. During the season, crews visited three parks in the Klamath Network, beginning the season in Whiskeytown, followed by Lava Beds, and concluding in Oregon Caves. The crews visited 42 road and trail segments for a total of 83 km. The overall sample effort fell below our original expectations.

## Park-specific Findings

Lava Beds was sampled between June 4 and June 7, the height of the flowering season for most invasive species, and 17 segments, or 37.6 km of combined roads and trails were surveyed. The Lava Beds effort recorded three of the 18 prioritized early detection invasive species across the park. The species, in descending order of abundance, included: medusa head (*Taeniatherum caput medusae*), goat's beard (*Tragopogon dubius*), and flix weed (*Descurainia sophia*). Table A.1 shows the percentage of segments infested by each species.

**Table A.1.** Summary of prioritized invasive species at Lava Beds National Monument. Note an \* indicates species only surveyed in wilderness areas.

| Species                           | Total # of infestations | # of segments infested | % of segments infested |
|-----------------------------------|-------------------------|------------------------|------------------------|
| <i>Descurainia sophia</i> *       | 4                       | 1                      | 5.8                    |
| <i>Tragopogon dubius</i> *        | 5                       | 1                      | 5.8                    |
| <i>Taeniatherum caput-medusae</i> | 2                       | 2                      | 11.7                   |

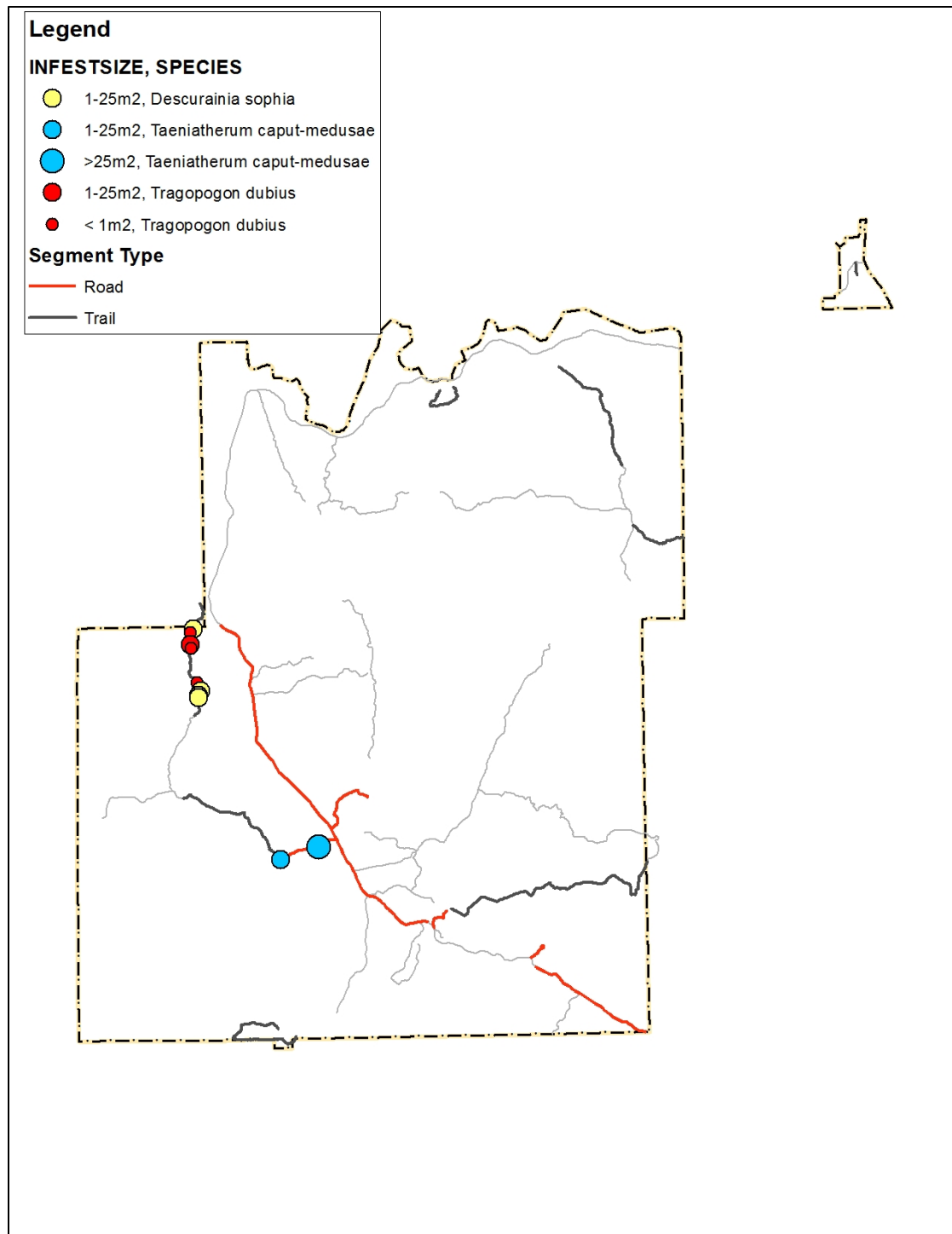


**Figure A.1.** Locations of invasive plant species recorded in the 2013 Invasive Species Early Detection monitoring. Note that not all road or trail segments are sampled each year, roads and trails in gray were not sampled for this fiscal year.

## Appendix B: Oregon Caves National Monument

### Fiscal Year 2013 Accomplishments

The Klamath I&M program implemented, for the third time, its Invasive Species Early Detection Protocol from May to September 2013. During the season crews visited three parks in the Klamath Network, beginning the season in Whiskeytown, followed by Lava Beds, and concluding in Oregon Caves. The crews visited 42 road and trail segments for a total of 83 km. The overall sample effort fell below our original expectations.

### Park-specific Findings

Oregon Caves was sampled between August 21 to September 4, to capture the peak flowering season for most invasive species, and 11 segments, or 11.9 km of combined roads and trails were surveyed. The Oregon Caves effort recorded one of the six prioritized early detection invasive species across the park: Klamath weed (*Hypericum perforatum*). Table B.1 shows the percentage of segments infested by each species.

**Table B.1.** Summary of prioritized invasive species at Oregon Caves National Monument.

| Species                     | Total # of infestations | # of segments infested | % of segments infested |
|-----------------------------|-------------------------|------------------------|------------------------|
| <i>Hypericum perforatum</i> | 8                       | 5                      | 45.4                   |

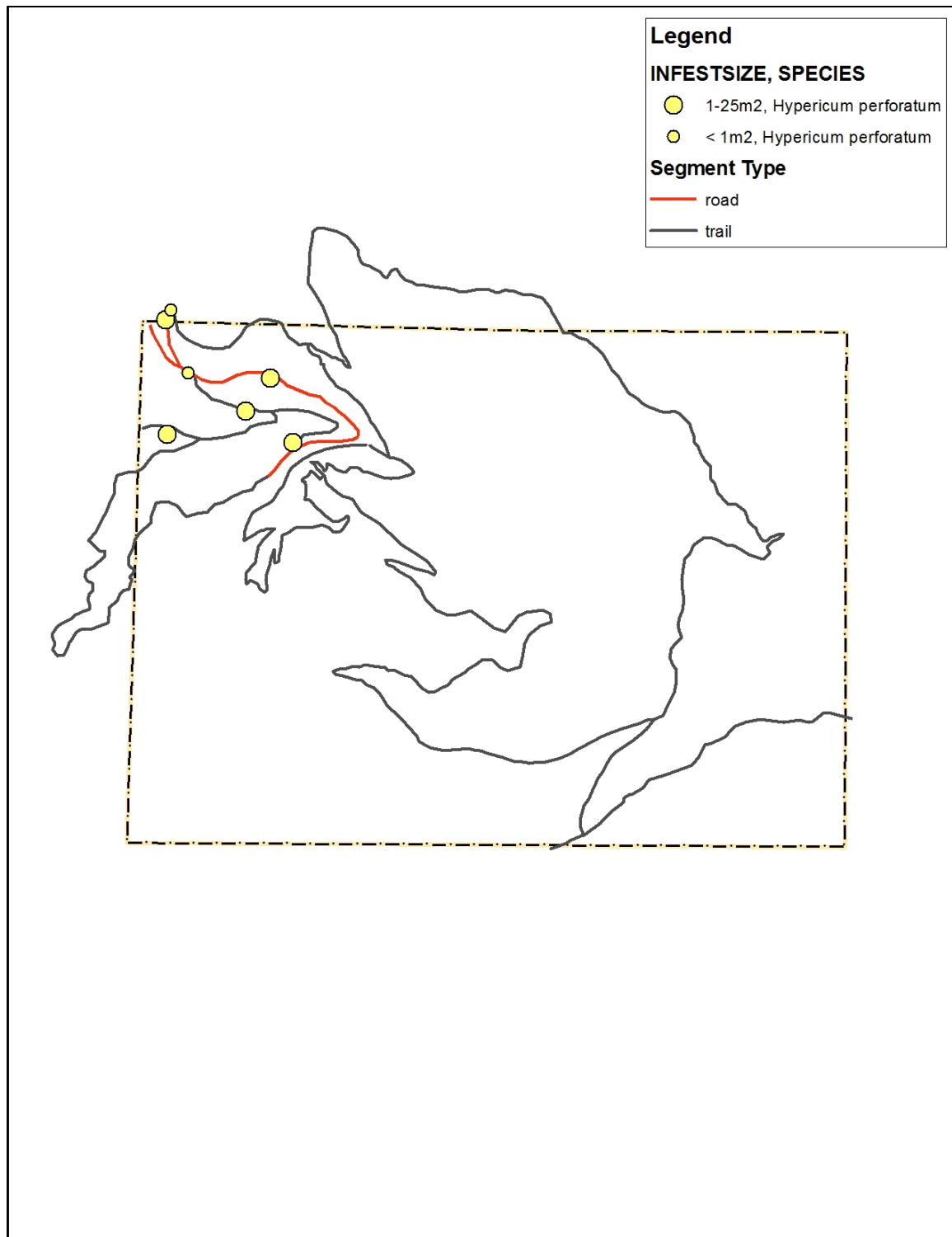


**Figure B.1.** Locations of invasive plant species recorded in the 2013 Invasive Species Early Detection monitoring. Note that not all road or trail segments are sampled each year, roads and trails in gray were not sampled for this fiscal year.

## Appendix C: Whiskeytown National Recreation Area

### Fiscal Year 2013 Accomplishments

The Klamath I&M program implemented, for the third time, its Invasive Species Early Detection Protocol from May to September 2011. During the season crews visited three parks in the Klamath Network, beginning the season in Whiskeytown, followed by Lava Beds, and concluding in Oregon Caves. The crew visited 42 road and trail segments for a total of 83 km. The overall sample effort fell below our original expectations.

### Park-specific Findings

Whiskeytown was sampled between May 28 and May 31, and 14 segments, or 33.8 km of combined roads and trails were surveyed. The Whiskeytown effort recorded five of the 34 prioritized early detection invasive species across the park. The species, in decreasing order of abundance, included: Scotch broom (*Cytisus scoparius*), star thistle (*Centaurea solstitialis*), vernal grass (*Anthoxanthum odoratum*), tocalote (*Centaurea melitensis*), and goat grass (*Aegilops triuncialis*). Table C.1 shows the percentage of segments infested by each species.

**Table C.1.** Summary of prioritized invasive species at Whiskeytown National Recreation Area.

| Species                         | Total # of infestations | # of segment infestations | % of segments infested |
|---------------------------------|-------------------------|---------------------------|------------------------|
| <i>Cytisus scoparius</i>        | 9                       | 3                         | 21.4                   |
| <i>Centaurea solstitialis</i> * | 7                       | 2                         | 14.3                   |
| <i>Anthoxanthum odoratum</i>    | 1                       | 1                         | 7.1                    |
| <i>Centaurea melitensis</i>     | 1                       | 1                         | 7.1                    |
| <i>Aegilops triuncialis</i>     | 1                       | 1                         | 7.1                    |

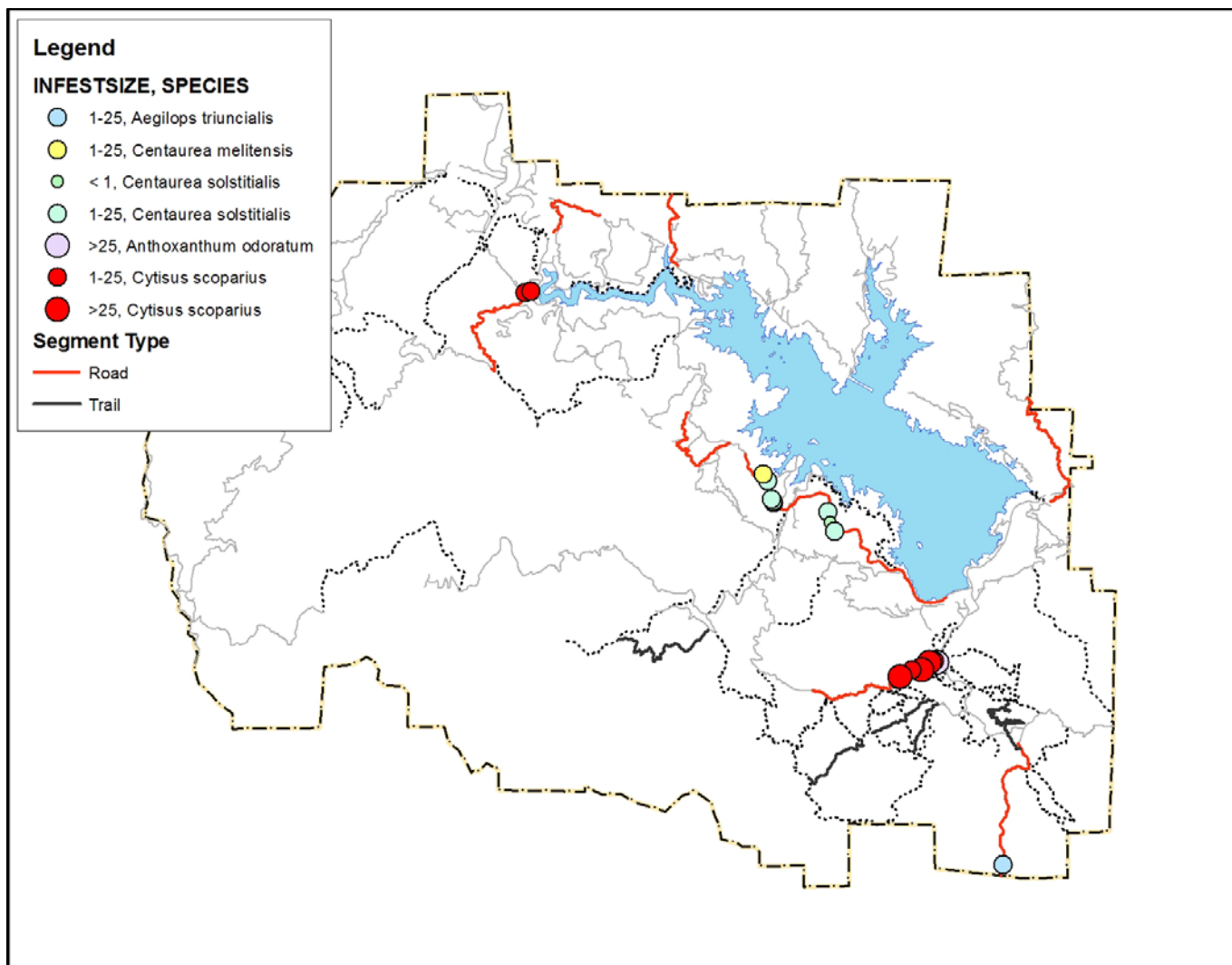


**Figure C.1.** Locations of invasive plant species recorded in the 2013 Invasive Species Early Detection monitoring. Note that not all road or trail segments are sampled each year, roads and trails in gray were not sampled for this fiscal year.

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**Natural Resource Stewardship and Science**  
1201 Oakridge Drive, Suite 150  
Fort Collins, CO 80525

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