National Park Service
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Natural Resource Stewardship and Science

Invasive Exotic Plant Monitoring at Curecanti National Recreation Area

Field Season 2014

Natural Resource Report NPS/NCPN/NRR—2015/982



ON THE COVER

Woolly mullein (*Verbascum thapsus*) in flower. Photo by Patrick J. Alexander.

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Prepared by
Dustin W. Perkins
Northern Colorado Plateau Network
National Park Service
P.O. Box 848
Moab, UT 84532

Editing and Design
Alice Wondrak Biel
Northern Colorado Plateau Network
National Park Service
P.O. Box 848
Moab, UT 84532

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Abstract

Invasive exotic plant (IEP) species are a significant threat to natural ecosystem integrity and biodiversity, and controlling IEPs is a high priority for the National Park Service. The Northern Colorado Plateau Network (NCPN) selected the early detection of IEPs as one of 11 monitoring protocols to be implemented as part of its long-term monitoring program. In conjunction with park staff, NCPN staff created target lists of priority IEPs for early detection. During surveys conducted from July 2 to September 3, 2014, observers detected 23 priority IEP species on monitoring routes and 10 priority IEP species in transects along 164.5 kilometers (102.2 miles) at Curecanti National Recreation Area (NRA). Canada thistle (*Breea arvensis*), woolly mullein (*Verbascum thapsus*), Russian thistle (*Salsola* spp.), and reed canarygrass (*Phalaroides arundinacea*) were the most widespread species. The routes with the highest densities of invasive plant patches were along the Gunnison River in the Cooper/Neversink area (20.9 patches/km), the Elk Creek area (18.6/km), and the Blue Mesa routes 1, 3, 5, and 7 (12.2–28.1/km). Relatively few patches were found along some areas surrounding Blue Mesa Reservoir Route 4 (0.00/km) and Route 6 (1.0/km), and the Pine Creek Trail (1.4/km). IEPs were found on 29% and 88% of transects around Blue Mesa and the Cooper/Neversink extra area, respectively, with an average of 0.37 and 1.24 IEP species detected per plot. Percent cover of reed canarygrass (16.3%) and Canada thistle (2.0%) in the Cooper/Neversink area was the highest of any invasive plant on any route. While there were twelve invasive species recorded in transects around Blue Mesa, the percent cover of all invasive species combined was less than 1%. This report only covers patches detected in 2014. We will complete a more detailed report comparing IEP patches found in 2014 and 2015 for all of Curecanti NRA and Black Canyon of the Gunnison National Park after the 2015 field season, when the full rotation of monitoring routes is complete.

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1 Introduction

Invasive exotic species fragment native ecosystems, displace native plants and animals, and alter ecosystem function. Invasive species are second only to habitat loss as threats to global biodiversity (Scott and Wilcove 1998) and represent one of the most serious threats to natural ecosystem integrity (NRC 2002). Biological invasions are occurring at accelerated rates in nearly every major ecosystem (Mooney and Hobbs 2000). Exotic plants negatively affect park resources and visitor enjoyment by altering landscapes and fire regimes, reducing native plant communities and animal habitat, and increasing trail maintenance needs (Loope 1992). Recognizing these challenges, Northern Colorado Plateau Network (NCPN) parks identified invasive exotic plants (IEPs) as a high-priority vital sign for long-term monitoring (O'Dell et al. 2005).

IEPs are a subset of exotic plants "whose introduction does or is likely to cause economic or environmental harm or harm to human health" (Executive Order 13112). With the aim of facilitating strategic control approaches, this monitoring program detects early invasions, identifies existing invasions, and, to the extent possible, tracks changes in the abundance and distribution of target IEPs in parks along key invasive pathways.

Invasive exotic plants can spread into national parks via a number of different pathway types. Predictable IEP pathways include roads, trails, and riparian corridors. Long-distance dispersal through cargo containers and air freight are examples of sudden pathways. Anthropogenic pathways include horticultural escapees, livestock grazing and trailing, and seeds transported on apparel and in restoration seed mixes. For the National Park Service (NPS), the consequences of these plant invasions present a significant challenge to the agency's ability to maintain natural resources "unimpaired for the enjoyment of future generations."

Because regular, comprehensive monitoring of the distribution and abundance of all exotic plant species within NCPN park units is beyond the fiscal capabilities of the network and parks, the NCPN is focusing on the most likely areas where a broad range of invasive exotic plants may occur: riparian corridors, roads, trails, areas of high visitor impact (e.g., campgrounds), and park boundaries. This approach is cost-effective for finding many new invasions in areas where they are most likely to occur, but may miss exotic plants dispersed to the interior areas of large parks by wind and/or animals.

Specific objectives of NCPN invasive exotic plant monitoring are:

1. To detect incipient populations and new introductions of invasive plant species before they become established in areas of management significance and invasion pathways; and
2. To determine status and trends of selected invasive plant populations of management significance.

This report summarizes the 2014 field season at Curecanti National Recreation Area (NRA).

2 Methods

We followed the invasive exotic plant monitoring protocol developed by the NCPN (Perkins et al. 2013). The protocol emphasizes the quick collection of IEP location and abundance data in order to maximize the amount of area searched, thus increasing our chances of finding a higher percentage of both new invasions and established IEPs. By focusing on roads, trails, and waterways, which are major vectors for invasive plants, we will capture the greatest amount of information (i.e., benefit) with the least amount of time and effort (i.e., cost).

2.1 Developing a park target invasive exotic plant list

Prior to beginning monitoring in 2014, NCPN and Curecanti NRA staff reviewed the park's list of high-priority target IEPs (Table 2-1), initially created in 2010. The original list was developed by reviewing past park literature and state and county weed lists, and consulting with park staff and county weed managers. Our high-priority target IEP list includes existing IEPs and potential IEPs of high management concern. Because these methods are designed to be rapid, field crews are trained to develop a focused search image on the target plants, instead of looking for every possible invasive plant species. The likelihood of eradicating these target species, or containing them within a park, is generally high. The list of priority species is reviewed before each field season, with a few minor changes from year to year.

2.2 Monitoring routes

2.2.1 Minimum detection target size

The minimum detection target size (MDTS) represents the patch size that is large enough to be detected with a high level of confidence (typically at least 90% of the total number of patches of that size and larger in the monitoring area) under actual field conditions, but small enough that any missed patches smaller than the MDTS could still feasibly be eradicated if not found until the next scheduled monitoring visit. We established an MDTS of 40 m^2 (0.01 acres, or approximately 20 × 20 ft) for all IEPs. Use of the MDTS was necessary because field technicians are not expected to find every single plant of every targeted IEP species during route surveys. Although searching for single mature plants of some species, such as Russian olive (*Elaeagnus angustifolia*) and tamarisk (*Tamarix* spp.), is possible due to their large size, single plants of other species, such as field bindweed (*Convolvulus arvensis*), are nearly impossible to detect in most field conditions.

Table 2-1. Priority invasive exotic plant list, Curecanti National Recreation Area, 2010–2014.

Scientific name	Common name
Acosta diffusa	diffuse knapweed
Acosta maculosa	spotted knapweed
Acroptilon repens	Russian knapweed
Arctium minus	burdock
Artemisia absinthium	absinth wormwood
Bassia sieversiana	kochia
Breea arvensis	Canada thistle
Cardaria draba	hoary cress
Cardaria latifolia	perennial pepperweed
Carduus nutans	musk thistle
Cirsium vulgare	bull thistle
Clematis orientalis[1]	Chinese clematis
Convolvulus arvensis[1]	field bindweed
Cynoglossum officinale	common houndstongue
Elaeagnus angustifolia	Russian olive
Hesperis matronalis	Dame's rocket
Hyoscyamus niger	black henbane
Iva xanthifolia	marsh elder
Leucanthemum vulgare	ox-eye daisy
Linaria genistifolia	Dalmatian toadflax
Linaria vulgaris	yellow toadflax
Matricaria perforata	scentless chamomile
Onopordum acanthium	Scotch thistle
Phalaris arundinacea	reed canarygrass
Potentilla recta[2]	sulfur cinquefoil
Rubus armeniacus[2]	Himalayan blackberry
Rumex crispus[1]	curly dock
Salsola australis	Russian thistle
Tamarix spp.	tamarisk
Tithymalus esula	leafy spurge
Ulmus pumila	Siberian elm
Verbascum thapsus	woolly mullein

[1]2010 only
[2]2011–2014

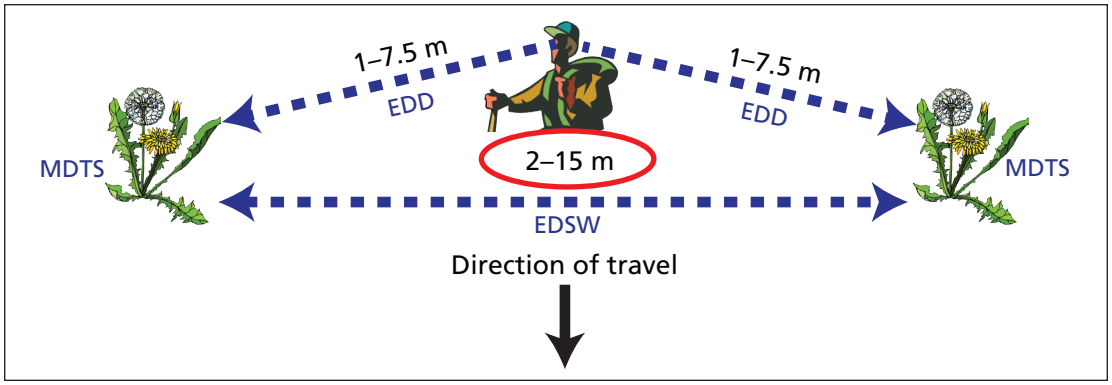


Figure 2-1. The maximum Effective Detection Distance (EDD) at Curecanti National Recreation Area ranged from 1 to 7.5 meters, making the Effective Detection Swath Width (EDSW) 2–15 meters.

2.2.2 Effective detection distance

The effective detection distance (EDD) is the maximum distance from which a searcher could consistently detect (i.e., see and recognize) the MDTS of the least-visible targeted species with at least 90% detection efficiency (Figure 2-1). Using fake plants of a targeted size, crew members are trained by walking away and determining the maximum distance from which they can consistently see and recognize the patch with complete confidence. The size of the EDD is then estimated in the field by crew members. The distance is measured either by pacing or using a laser rangefinder. The EDD for Curecanti NRA in 2014 was 1–7.5 m.

2.2.3 Effective detection swath width

Effective detection swath width (EDSW) is defined as the maximum width of a linear search swath (band transect) in which a walking observer is confident of visually detecting 90% of all target species of the MDTS (Figure 2-1). The effective detection swath width (EDSW) is equal to two times the EDD, because the surveyor is able to effectively detect IEPs for one EDD on either side of his/her search route. The EDSW was 2–15 m at Curecanti NRA in 2014.

2.2.4 Patch separation resolution

We define patch separation resolution (PSR) as the minimum distance between plants that must be considered members of separate patches. Individuals or clusters of a target species separated by the PSR distance or more are recorded as separate patches. We consider plants separated by less than the PSR to be a single patch. The PSR is set at 50 m, based on the assumption that most plants or groups of plants separated by less than 50 m are typically considered to be one patch during planning and implementation of weed control operations. If a patch is continuous for more than 50 m, then cover estimates are made every 50 m to aid in developing an effective management strategy for the entire patch.

2.2.5 Between feature position

Between feature positions allow electronic tracking of a user's route. A GPS unit is set to automatically generate these positions at a distance equal to the EDSW. Each time a surveyor walks the equivalent of one EDSW, the GPS unit creates a point.

2.2.6 Data collection methods

The observers walked down the center of the trail/route (Figure 2-2), searching for IEPs by visually scanning (side-to-side) all the land within the borders of the swath. If the terrain was uneven or steep, and the observers had to glance frequently at the ground to ensure safe foot placement, then searchers stopped approximately every 2–15 m (the length of one EDSW) and visually scanned the area in all directions. As monitoring routes were traversed, locations of all target species were documented, using global positioning system (GPS) units with at least five-meter accuracy.

Only IEPs that were designated as priority were consistently recorded during monitoring routes. Survey crew members were given the latitude to record additional IEP species if they were noteworthy. When a priority IEP was discovered, we recorded the following

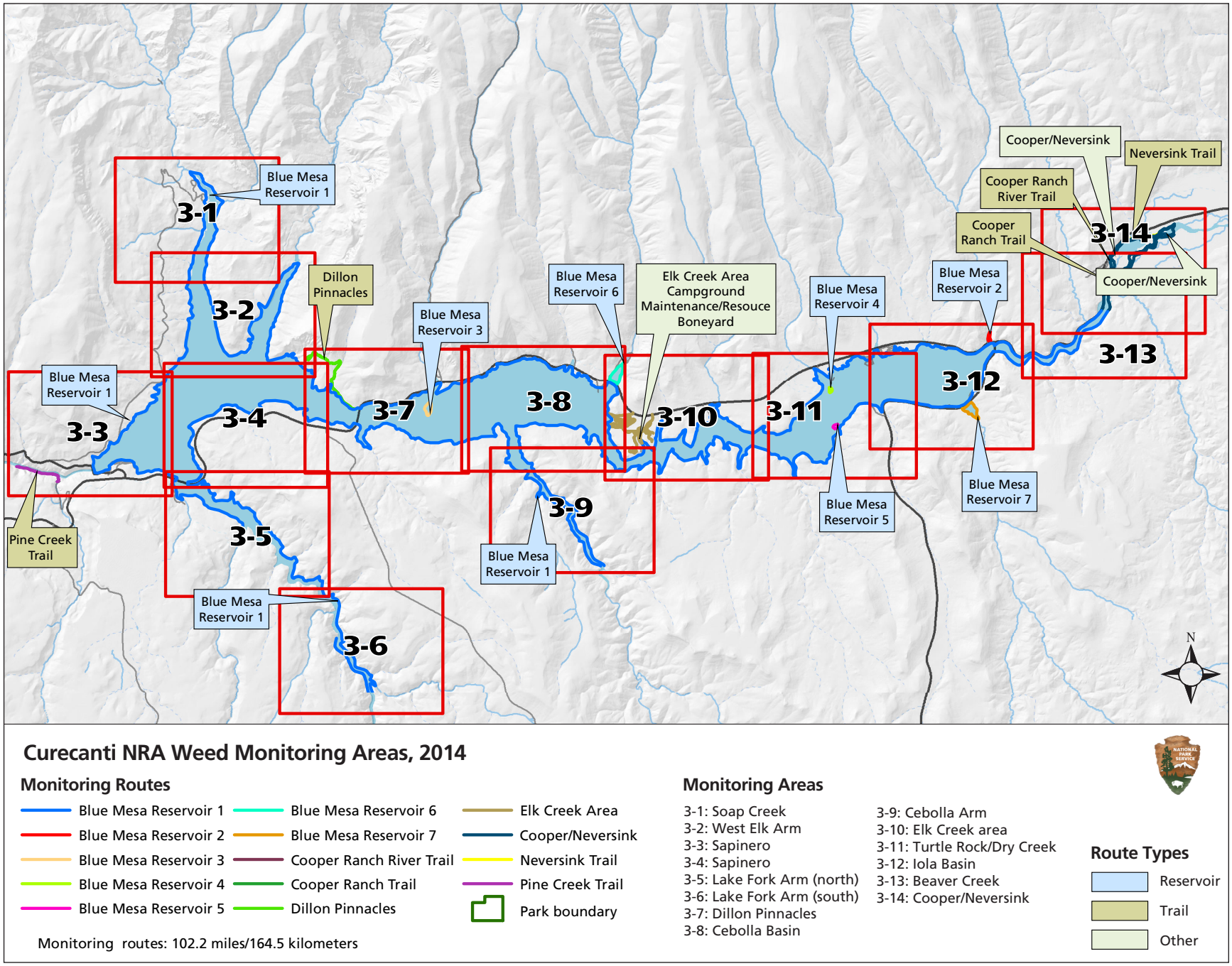


Figure 2-2. Overview of IEP monitoring routes surveyed, with subareas labeled by figure number, Curecanti National Recreation Area, July 2–September 3, 2014.

information: (1) the monitoring route, (2) the sequential number of the invasion per monitoring route, (3) patch size class (see below), (4) whether the plant was pulled by the observer, and (5) canopy cover class (see below). If several IEPs were present with similar distributions at a single point, then we recorded a point for each individual species and assigned it its own sequential identification number. Patch size class was estimated as follows:

1. 1–a few plants (used for isolated single plants or very small patches (≤ 2 × 2 m),
2. few plants–40 m^2 (48 yd^2),
3. 40–400 m^2 (48–478 yd^2),
4. 400–1,000 m^2 (0.1–0.25 acre), and
5. 1,000–2,000 m^2 (0.25–0.5 acre).

We recorded canopy cover class by estimating the amount, or "percentage," of ground covered by the vertical projection of plant matter as visualized from a bird's-eye view of the vegetation (Elzinga et al. 1998). This estimate included both the living and dead standing material of the vegetation of a single plant species. Canopy cover of a patch was recorded using the following classes:

1. Trace (<1%)
2. Low (1–5%)
3. Moderate (6–25%)
4. High (26–50%)
5. Majority (51–100%).

We recorded the following ancillary information with every patch: descriptive notes (e.g., hillside), the growth stage of exotic trees (e.g., sapling, pole, mature), evidence of prior treatment, and evidence of disturbances (e.g., recent fire, flood, small mammal disturbance).

2.3 Monitoring transects

2.3.1 Quadrat establishment

We established one transect with three vegetation quadrats every 500 m along monitoring routes. We centered vegetation quadrats at 0.5, 5, and 10 m away from the edge of a road on the same side as the route being walked and on alternating sides for riparian areas, small roads, or trails. A 1-m^2 sampling frame, used to sample vegetation cover and soil surface features, was placed on the right side of the transect line as the technician walked the monitoring route. In some cases, we leveled the sampling frame by propping up quadrat corners.

2.3.2 Data collection methods

In the monitoring quadrats, all priority IEP species, as well as cheatgrass (*Bromus tectorum*) and yellow sweetclover (*Melilotus officinalis*), were recorded in transects. For each quadrat, we recorded percent cover of each IEP using the following classes: <1, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 20, 30, 40, 50, 60, 70, 80, 90, or 100%. We also recorded percent cover, to the nearest 10%, of dominant soil surface features (i.e., dead wood, dung, fungus, lichen, litter/duff, live root/bole, mineral soil/sediment, moss, biological soil crust, road, rock, standing water/flooded, stream, or trash/junk).

2.4 Analyses

We calculated the mean number of patches per 100 m for monitoring routes. Mean percent cover and standard error estimates were generated from the monitoring transect data for each monitoring route. Due to differences in observers' knowledge, only priority species should be used when comparing results from year to year.

3 Results

3.1 Target invasive exotic plant list

In 2014, field crews searched monitoring routes for 29 species identified as high-priority at Curecanti NRA (see Table 2-1). Observers were trained to recognize priority species but given the freedom to map additional species; therefore, presence and absence data for priority species are reliable for the areas searched, but absence data for other species are suspect. We recorded a total of 25 IEP species along 164.5 kilometers (102.2 miles) of monitoring routes and transects in 2014 (Table 3-1, see Figure 2-2).

3.2 Monitoring routes

We surveyed most of the monitoring routes at Curecanti NRA in 2014. A total of 2,291 patches of 23 different priority species were detected along the monitoring routes (Tables 3-2, 3-3; Figures 3-1 through 3-14; Electronic Appendix A). Canada thistle (*Breea arvensis*), woolly mullein (*Verbascum thapsus*), Russian thistle (*Salsola* spp.), and reed canarygrass (*Phalaroides arundinacea*) were the most widespread species (Table 3-2). Routes with the highest density of invasive plant patches were the Cooper/Neversink riparian area (20.9 patches/km), Elk Creek area (18.6/km), and Blue Mesa Routes 1, 3, 5, and 7 (12.2–28.1 km). (Table 3-3). Relatively few patches were found along Blue Mesa routes 4 (0.00/km) and 6 (1.0/km), and the Pine Creek Trail (1.4/km).

3.3 Monitoring transects

A total of 12 species were detected in 286 transects in 2014 (Table 3-4; Electronic Ap-

Table 3-1. Invasive exotic plants detected at Curecanti National Recreation Area, July 2–September 3, 2014.

Scientific name	Common name	Method detected		Park priority?
		Routes	Transects	
Acosta diffusa	diffuse knapweed	X		Yes
Acosta maculosa	spotted knapweed	X		Yes
Arctium minus	burdock	X		Yes
Artemisia absinthium	absinth wormwood	X		Yes
Bassia sieversiana	summer-cypress	X	X	Yes
Breea arvensis	Canada thistle	X	X	Yes
Cardaria latifolia	perennial pepperweed	X	X	Yes
Cardaria sp.	whitetop	X		Yes
Carduus nutans	musk thistle	X	X	Yes
Cirsium vulgare	bull thistle	X	X	Yes
Iva xanthifolia	marsh elder	X		Yes
Elaeagnus angustifolia	Russian olive	X		Yes
Leucanthemum vulgare	ox-eye daisy	X		Yes
Linaria vulgaris	butter-and-eggs	X	X	Yes
Matricaria perforata	scentless chamomile	X	X	Yes
Phalaroides arundinacea	reed canarygrass	X	X	Yes
Potentilla recta	sulfur cinquefoil	X		Yes
Rubus armeniacus	blackberry	X		Yes
Salsola sp.	Russian thistle	X	X	Yes
Tamarix spp.	tamarisk	X		Yes
Tithymalus esula	leafy spurge	X		Yes
Ulmus pumila	Siberian elm	X		Yes
Verbascum thapsus	wooly mullein	X	X	Yes
Bromus tectorum	cheatgrass		X	No
Melilotus officinale	yellow sweetclover		X	No

pendix B). IEPs were found on 29% and 88% of transects around Blue Mesa and the Cooper/Neversink area, respectively, with an average of 0.37 and 1.24 IEP species detected per plot. Percent cover of reed canarygrass (16.3%) and Canada thistle (2.0%) in the Cooper/Neversink area were the highest of any area. While there were 12 invasive species recorded in transects around Blue Mesa, the percent cover of all invasive species combined was less than 1%. The Elk Creek area and Pine Creek Trail had no invasive plants detected in transects, while the Dillon Pinnacles Trail only had Canada thistle detected in one transect.

Table 3-2. Number of IEP patches and patches/km by route type, Curecanti National Recreation Area, July 2–September 3, 2014.

Route	Length (km)	Area (ha)	# patches	Patches/km
Reservoir				
Blue Mesa 1	131,978.9	229.1	1,722	13.1
Blue Mesa 2	587.0	0.9	2	3.4
Blue Mesa 3	853.6	0.9	24	28.1
Blue Mesa 4	365.6	0.2	0	0.0
Blue Mesa 5	407.8	0.4	5	12.3
Blue Mesa 6	1,475.5	2.9	3	1.0
Blue Mesa 7	1,391.1	2.8	17	12.2
Reservoir total	*137,059.5*	*237.2*	*1,773*	*12.9*
Riparian				
Cooper/Neversink	12,847.4	7.0	310	7.4
Road				
Elk Creek Access	606.5	0.6	30	49.5
Elk Creek Boneyard	1,170.9	1.2	7	6.0
Elk Creek Campground	3,609.6	4.0	68	18.8
Elk Creek Main	1,235.2	1.8	28	22.7
Elk Creek Maintenance	1,656.4	1.8	21	12.7
Road total	*8,278.6*	*9.4*	*154*	*18.6*
Trail				
Cooper Ranch River	262.4	0.3	2	7.6
Cooper Ranch	309.6	0.3	5	16.1
Dillon Pinnacles	3,125.8	5.0	19	6.1
Elk Creek to Old HW 50	266.3	0.3	4	15.0
Neversink	910.7	0.7	19	20.9
Pine Creek	1,383.8	1.7	2	1.4
Trail total	*6,258.5*	*8.2*	*51*	*8.1*
Incidental Observation Ponderosa CG	42.0	0.1	3	71.4

Table 3-3. Species observed and patch size class detected along monitoring routes, Curecanti National Recreation Area, July 2–September 3, 2014.

Scientific name	Common name	Total patches	Patch size class				
			1	2	3	4	5
Acosta diffusa	diffuse knapweed	1	0	1	0	0	0
Acosta maculosa	spotted knapweed	1	1	0	0	0	0
Arctium minus	burdock	1	1	0	0	0	0
Artemisia absinthium	absinth wormwood	12	6	5	1	0	0
Bassia sieversiana	kochia	97	4	16	40	16	21
Breea arvensis	Canada thistle	628	29	243	201	139	16
Cardaria latifolia	perennial pepperweed	64	1	12	10	28	13
Cardaria spp.	whitetop	2	0	2	0	0	0
Carduus nutans	musk thistle	281	52	98	73	50	8
Cirsium vulgare	bull thistle	55	26	21	7	1	0
Elaeagnus angustifolia	Russian olive	1	1	0	0	0	0
Iva xanthifolia	marsh elder	1	1	0	0	0	0
Leucanthemum vulgare	ox-eye daisy	21	6	7	4	4	0
Linaria vulgaris	yellow toadflax	12	4	6	2	0	0
Matricaria perforata	scentless chamomile	101	16	21	16	25	23
Phalaris arundinacea	reed canarygrass	255	7	33	102	89	24
Potentilla recta	sulfur cinquefoil	2	1	0	1	0	0
Rubus armeniacus	Himalayan blackberry	2	1	1	0	0	0
Salsola sp.	thistle	279	14	82	104	68	11
Tamarix spp.	saltcedar	4	4	0	0	0	0
Tithymalus esula	leafy spurge	1	1	0	0	0	0
Ulmus pumila	Siberian elm	1	0	1	0	0	0
Verbascum thapsus	woolly mullein	469	43	103	140	166	17
Priority species		**2,291**	**218**	**653**	**701**	**586**	**133**

Table 3-4. Number of monitoring transects where exotic plant species were detected, mean percent cover, and standard error, by area, Curecanti National Recreation Area, July 2–September 3, 2014.

		Blue Mesa		Cooper/Neversink	
Scientific name	**Common name**	**Detected (of 249)**	**Percent cover (SE)**	**Detected (of 25)**	**Percent cover (SE)**
Bromus tectorum^	cheatgrass	16	0.02 (0.01)	0	0.00 (0.00)
Bassia sieversiana	kochia	2	<0.01 (<0.01)	0	0.00 (0.00)
Breea arvensis	Canada thistle	17	0.08 (0.03)	9	1.96 (1.07)
Cardaria latifolia	perennial pepperweed	8	0.12 (0.08)	0	0.00 (0.00)
Carduus nutans	musk thistle	7	0.02 (0.01)	0	0.00 (0.00)
Cirsium vulgare	bull thistle	1	<0.01 (0.01)	0	0.00 (0.00)
Linaria vulgaris	yellow toadflax	1	<0.01 (<0.01)	0	0.00 (0.00)
Matricaria perforata	scentless chamomile	8	0.19 (0.11)	0	0.00 (0.00)
Melilotus officinale^	yellow sweetclover	9	0.04 (0.03)	0	0.00 (0.00)
Phalaris arundinacea	reed canarygrass	4	0.06 (0.04)	23	16.33 (4.50)
Salsola sp.	thistle	6	0.04 (0.02)	0	0.00 (0.00)
Verbascum thapsus	woolly mullein	14	0.06 (0.02)	0	0.00 (0.00)
All invasive species		**73**	**0.63 (0.15)**	**22**	**18.29 (4.38)**

^Not on priority list, but a species that is consistently looked for and recorded, if present, in all transects.

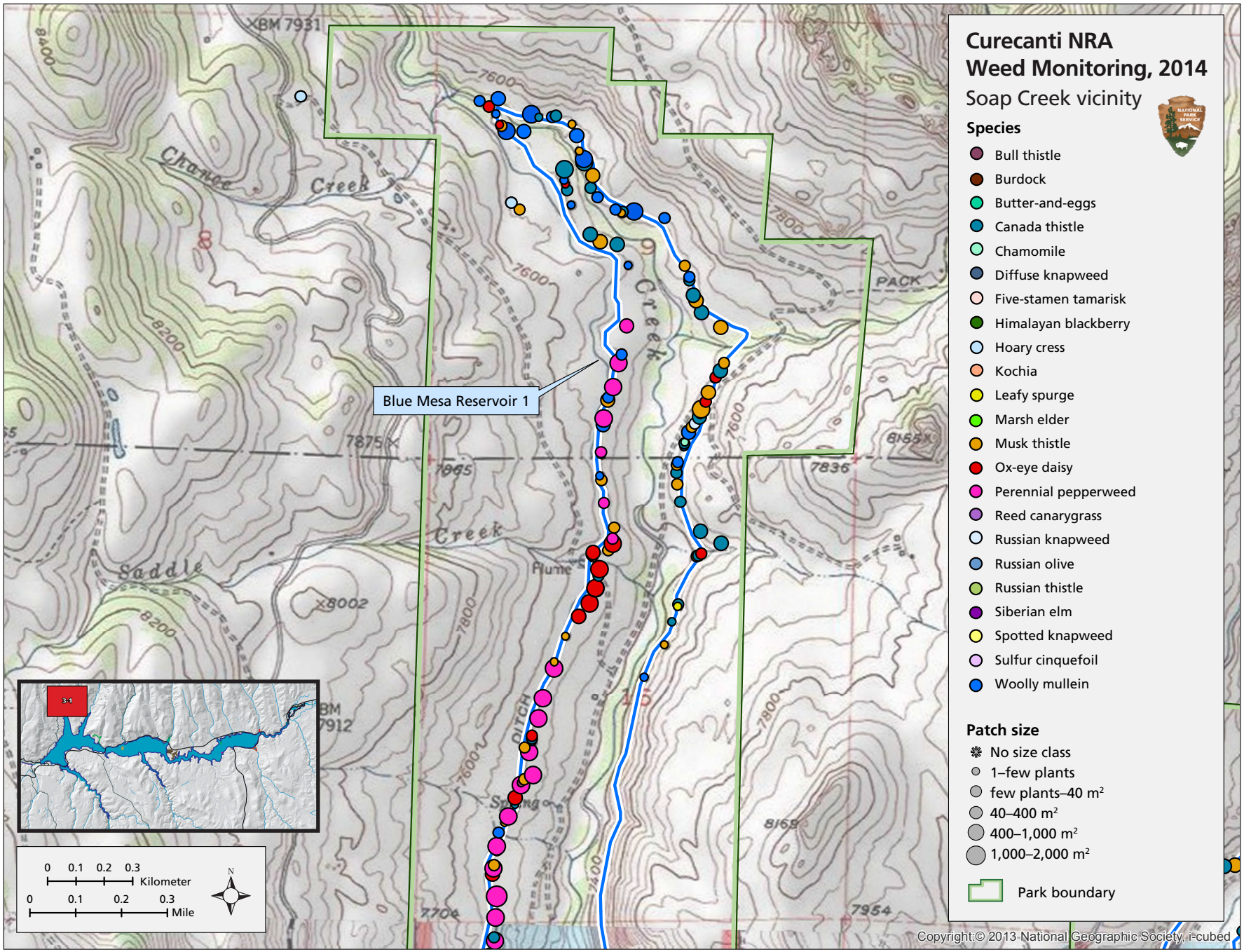


Figure 3-1. Invasive plants detected on monitoring routes and quadrats in the vicinity of Soap Creek, Curecanti National Recreation Area, July 2–September 3, 2014.

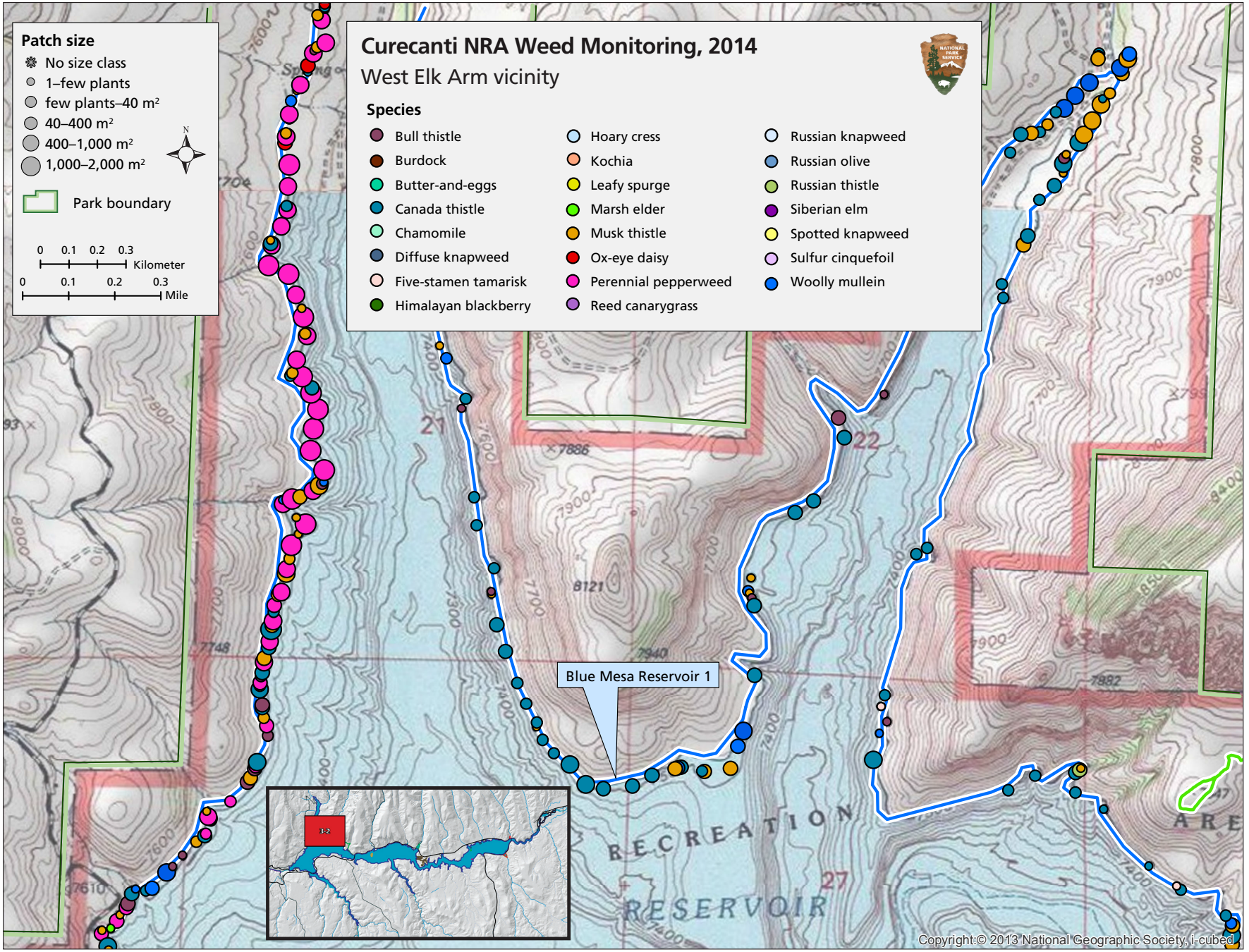


Figure 3-2. Invasive plants detected on monitoring routes and quadrats in the vicinity of West Elk Arm, Curecanti National Recreation Area, July 2–September 3, 2014.

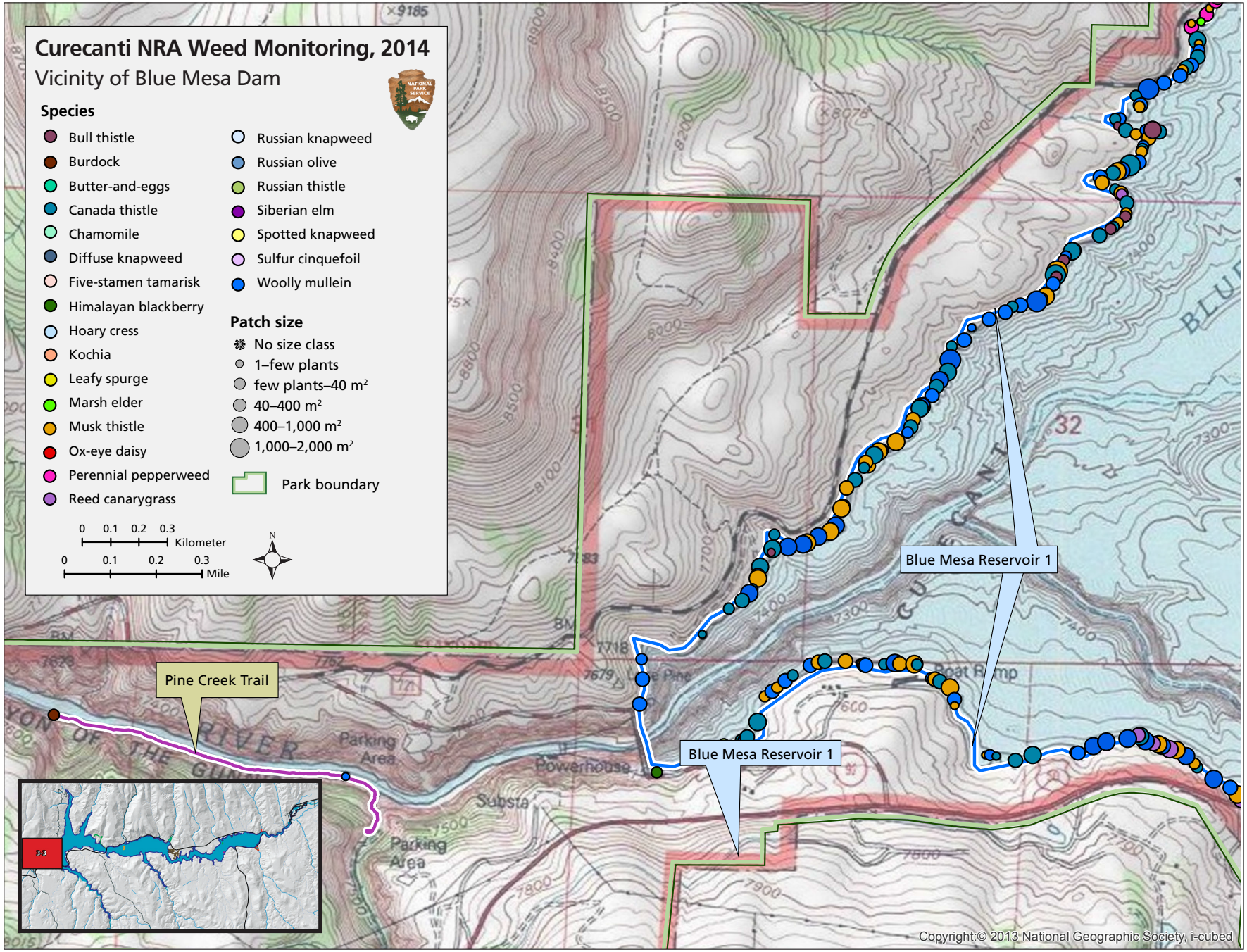


Figure 3-3. Invasive plants detected on monitoring routes and quadrats in the vicinity of Blue Mesa Dam, Curecanti National Recreation Area, July 2–September 3, 2014.

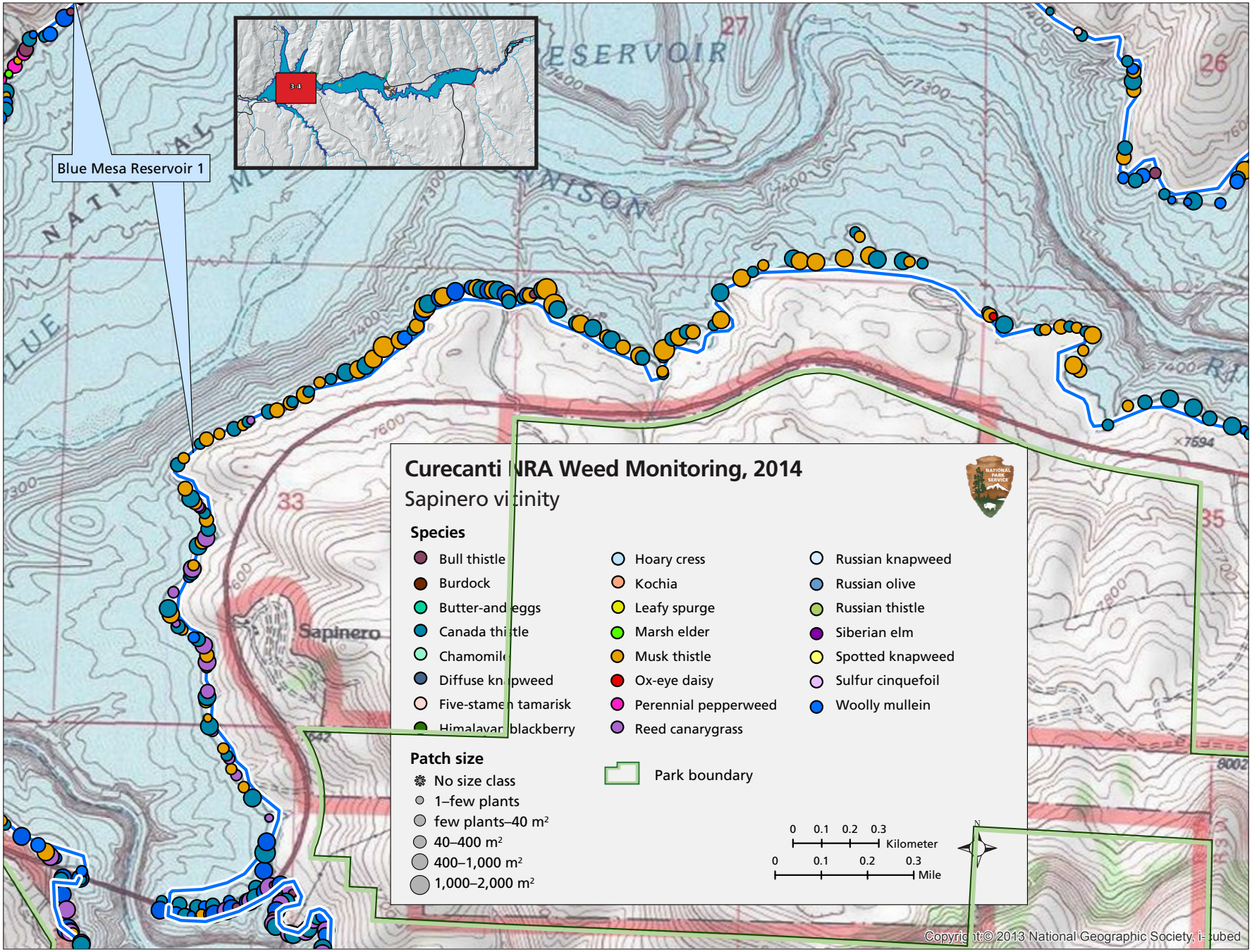


Figure 3-4. Invasive plants detected on monitoring routes and quadrats in the vicinity of Sapinero, Curecanti National Recreation Area, July 2–September 3, 2014.

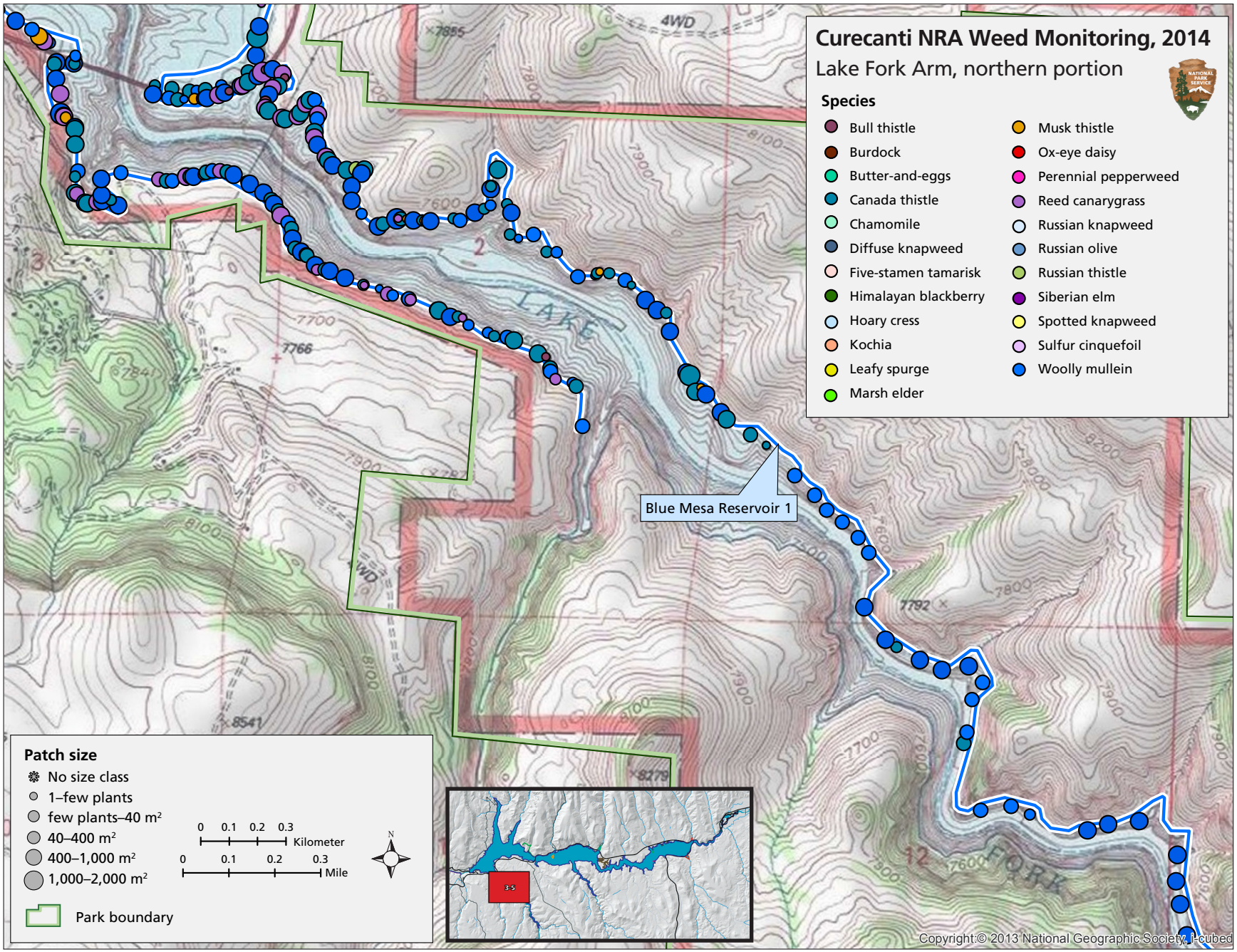


Figure 3-5. Invasive plants detected on monitoring routes and quadrats in the northern portion of Lake Fork Arm, Curecanti National Recreation Area, July 2–September 3, 2014.

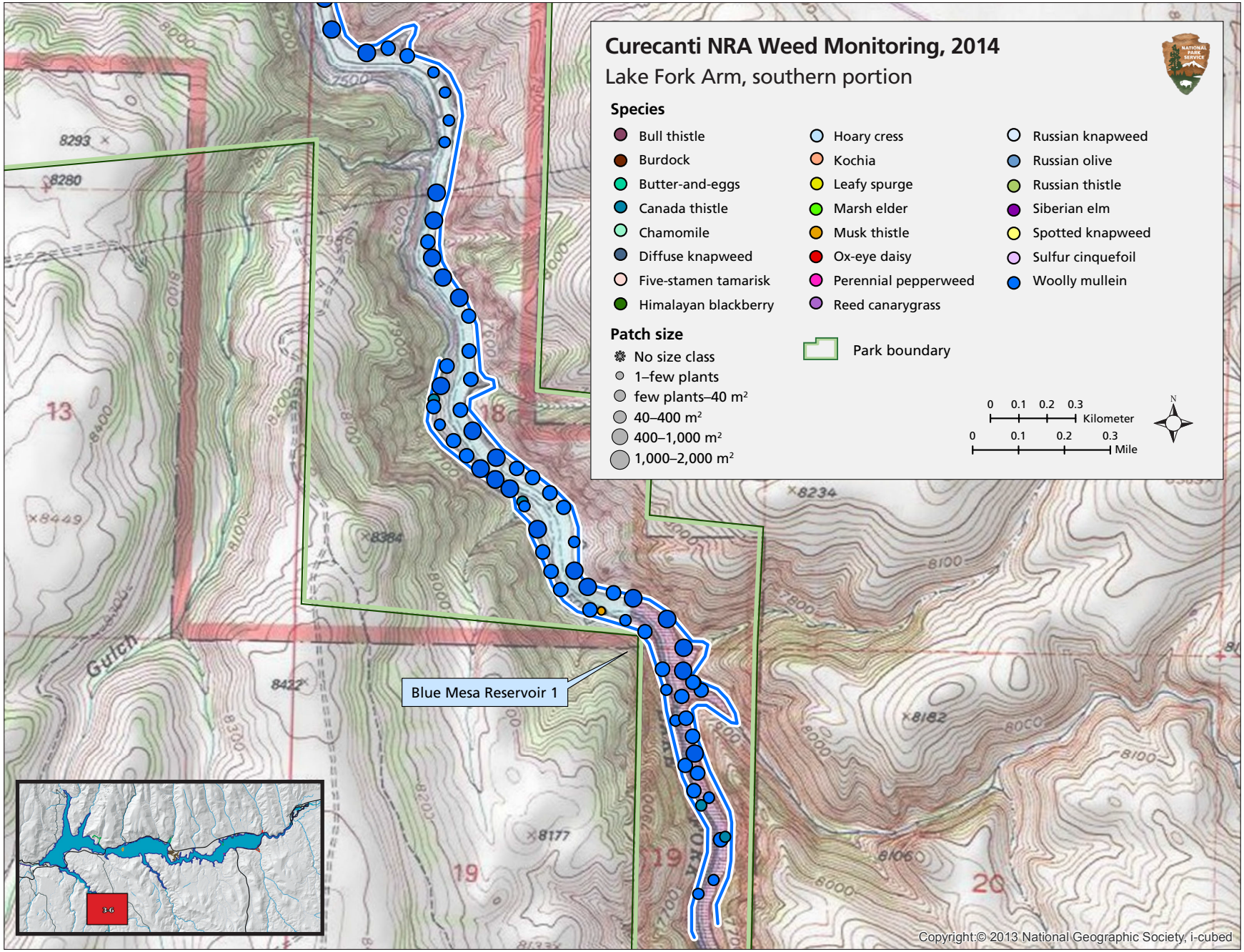


Figure 3-6. Invasive plants detected on monitoring routes and quadrats in the southern portion of Lake Fork Arm, Curecanti National Recreation Area, July 2–September 3, 2014.

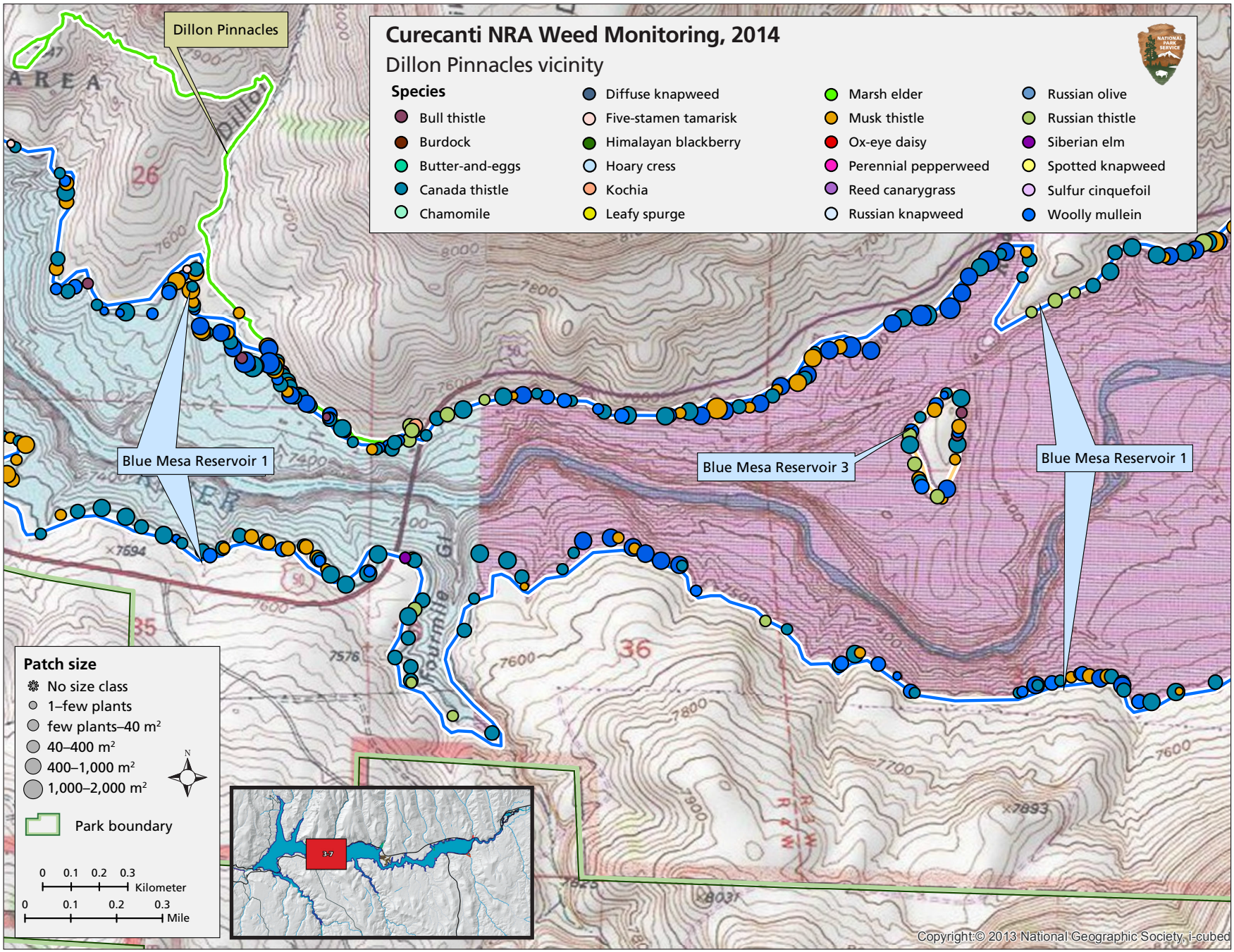


Figure 3-7. Invasive plants detected on monitoring routes and quadrats in the vicinity of Dillon Pinnacles, Curecanti National Recreation Area, July 2–September 3, 2014.

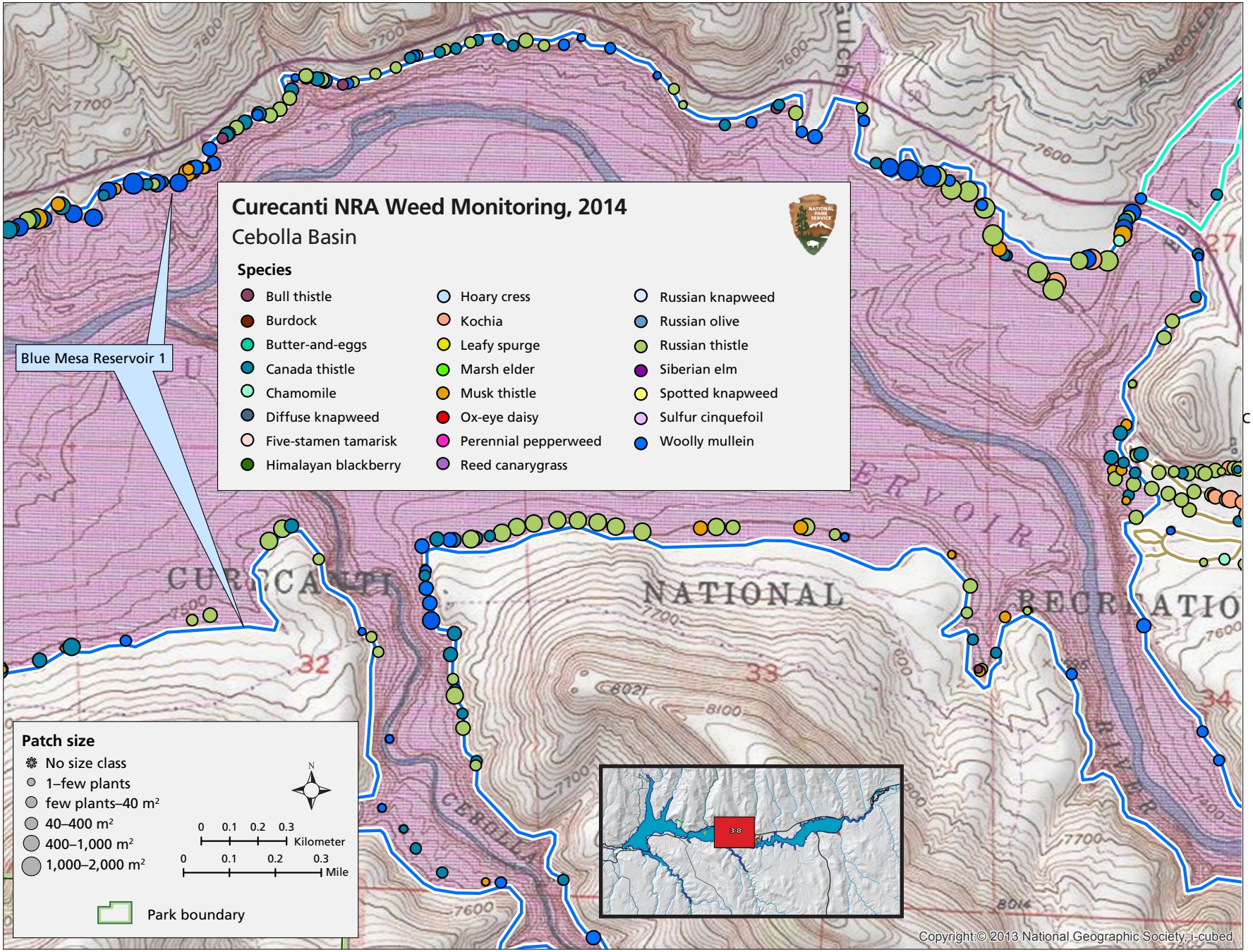


Figure 3-8. Invasive plants detected on monitoring routes and quadrats in Cebolla Basin, Curecanti National Recreation Area, July 2–September 3, 2014.

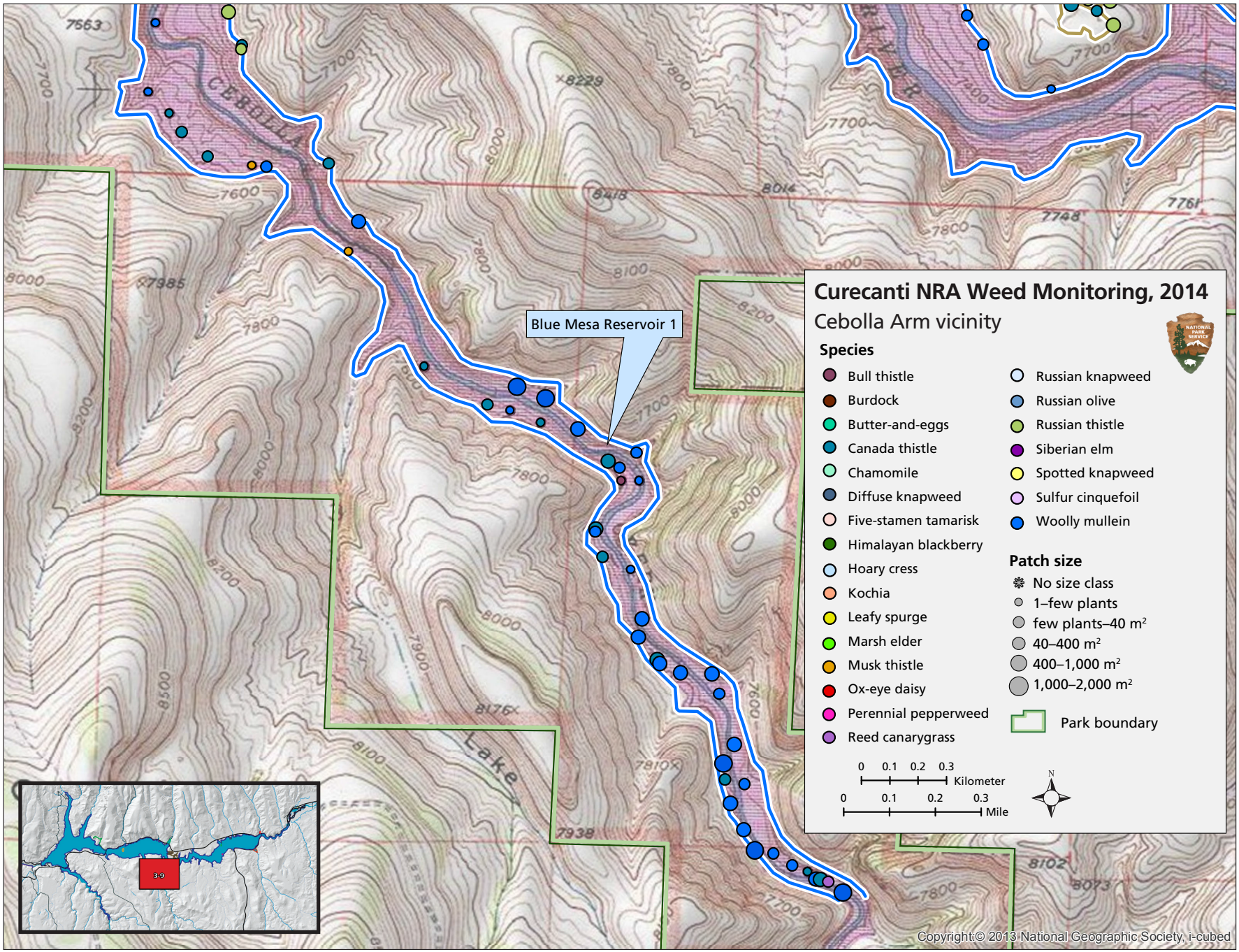


Figure 3-9. Invasive plants detected on monitoring routes and quadrats in the vicinity of Cebolla Arm, Curecanti National Recreation Area, July 2–September 3, 2014.

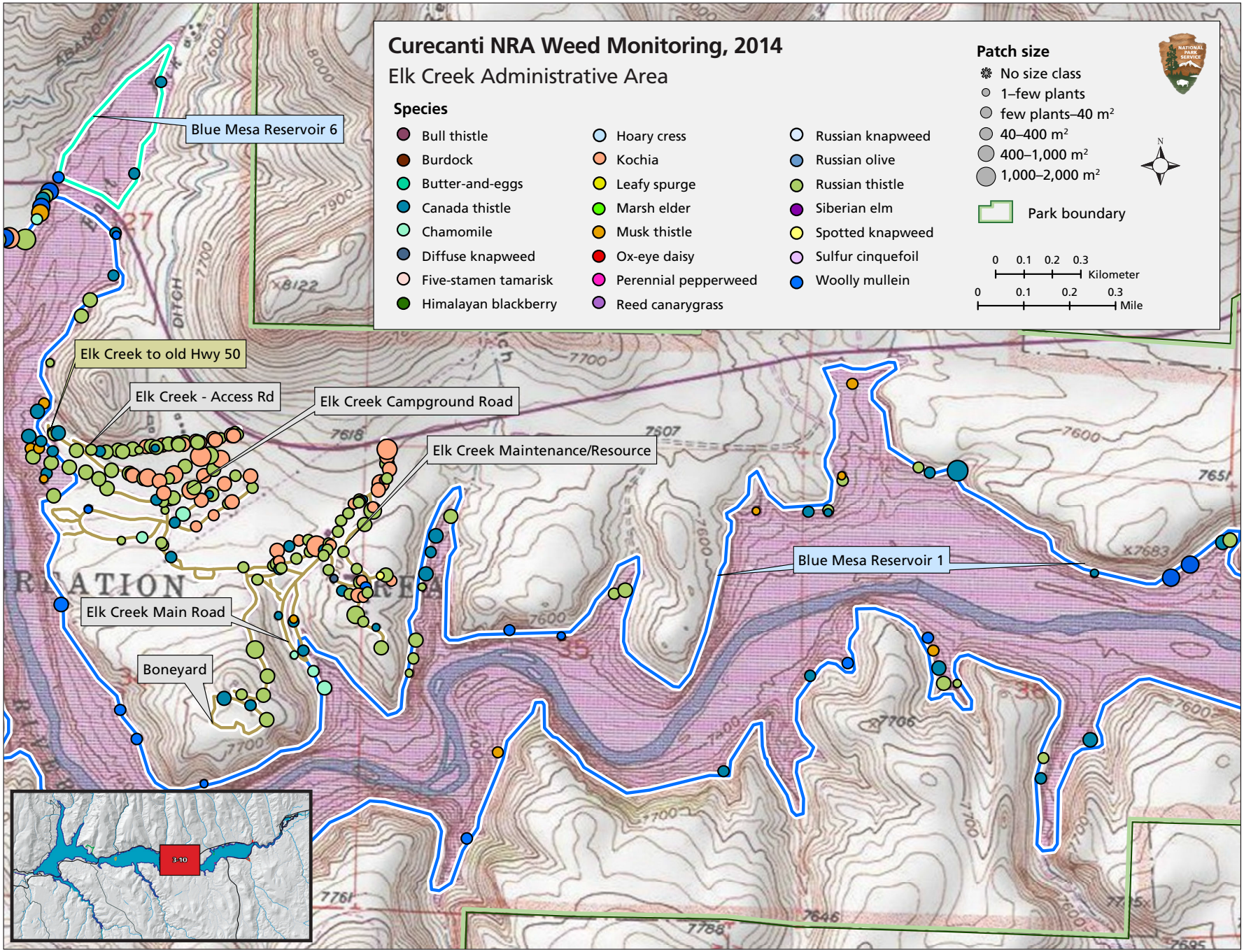


Figure 3-10. Invasive plants detected on monitoring routes and quadrats in the Elk Creek administrative area, Curecanti National Recreation Area, July 2–September 3, 2014.

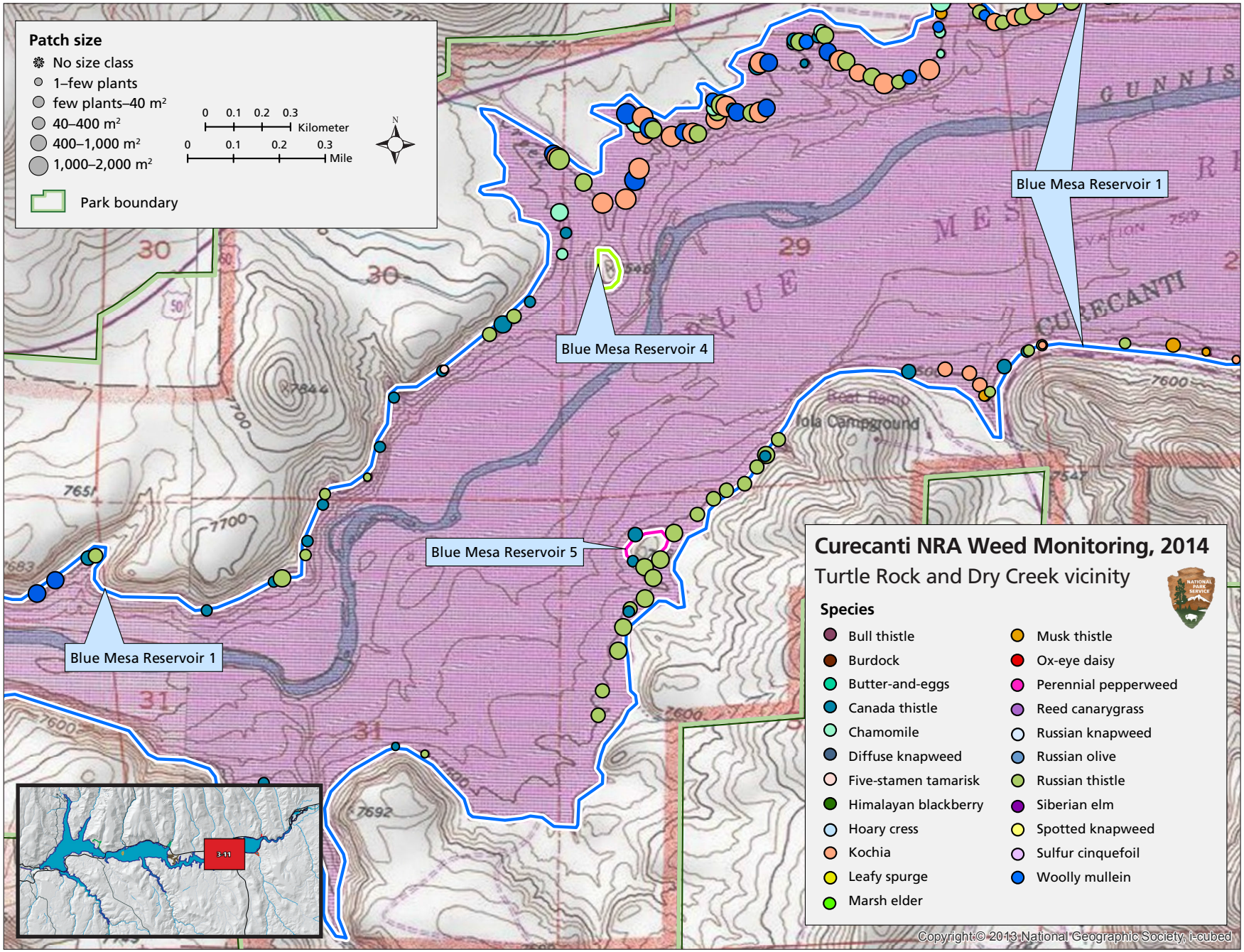


Figure 3-11. Invasive plants detected on monitoring routes and quadrats in the vicinity of Turtle Rock and Dry Creek, Curecanti National Recreation Area, July 2–September 3, 2014.

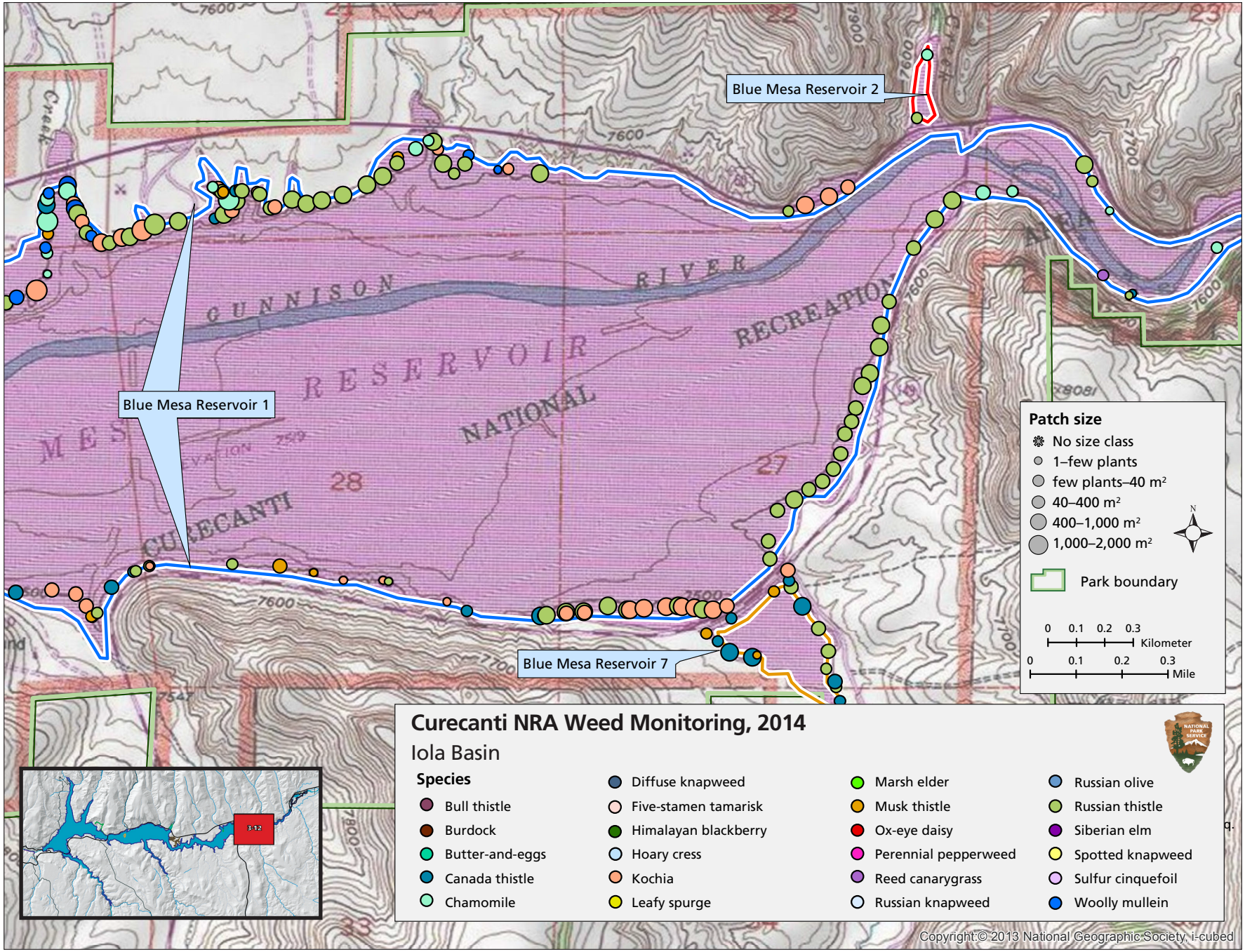


Figure 3-12. Invasive plants detected on monitoring routes and quadrats in Iola Basin, Curecanti National Recreation Area, July 2–September 3, 2014.

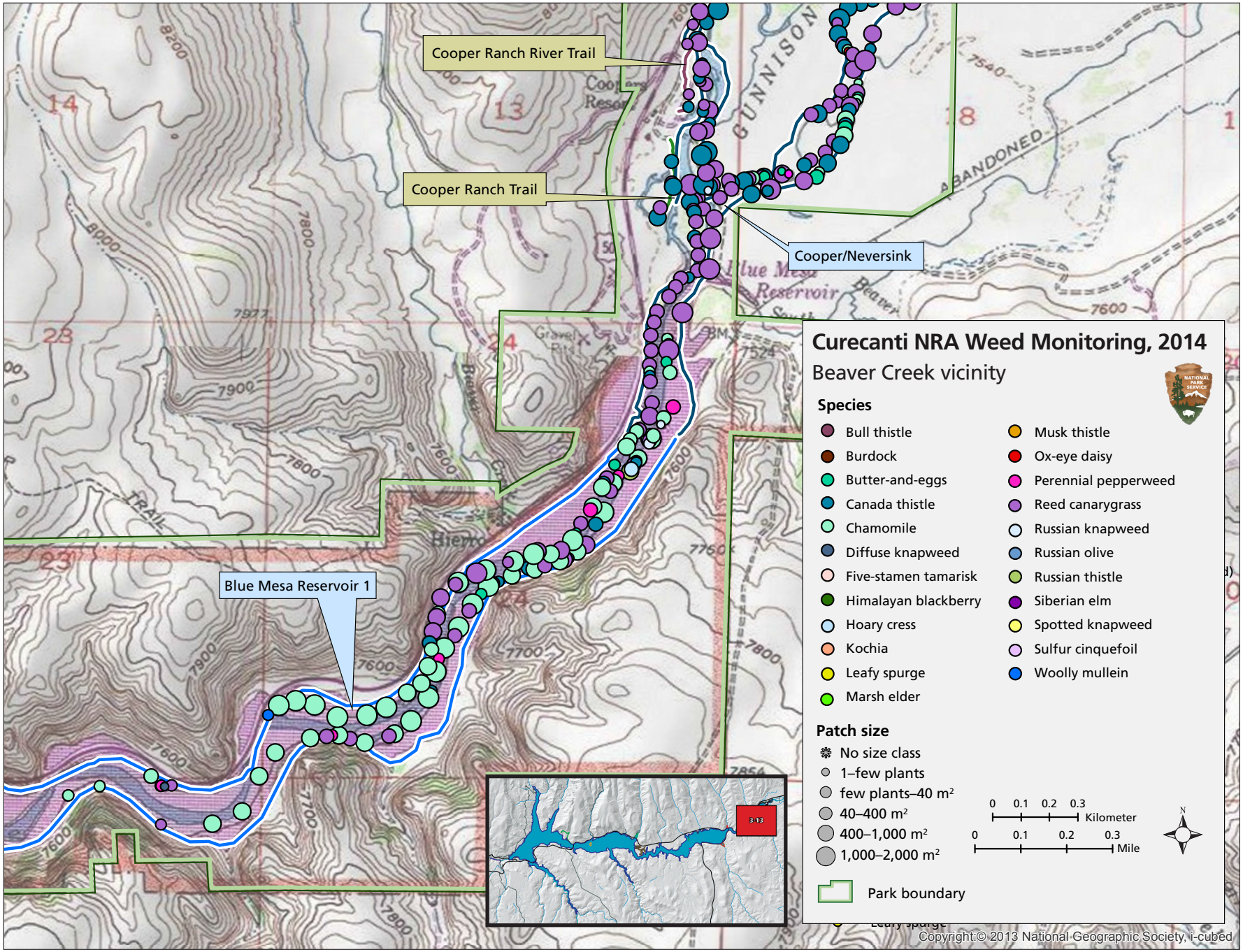


Figure 3-13. Invasive plants detected on monitoring routes and quadrats in the vicinity of Beaver Creek, Curecanti National Recreation Area, July 2–September 3, 2014.

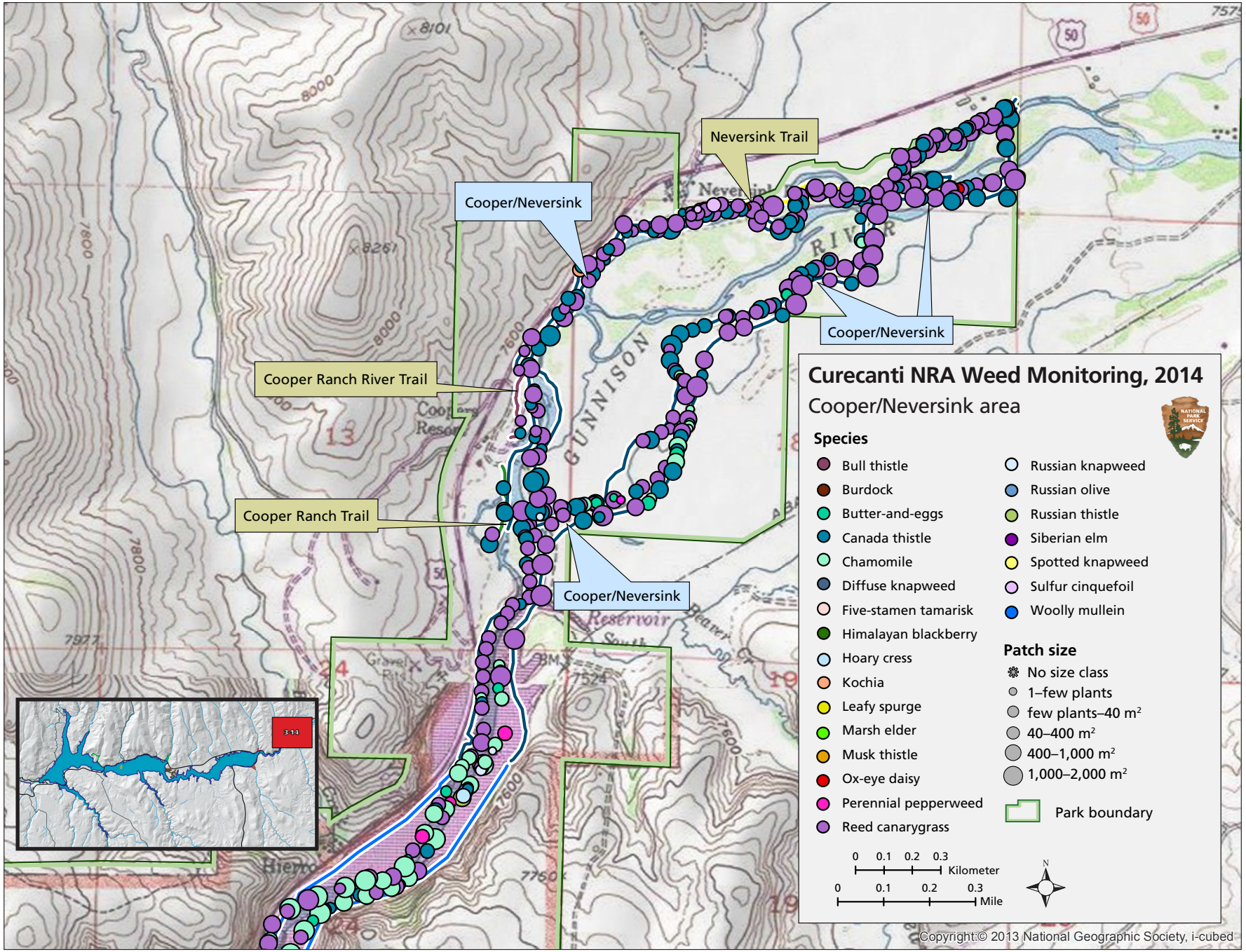


Figure 3-14. Invasive plants detected on monitoring routes and quadrats in the Cooper/Neversink area, Curecanti National Recreation Area, July 2–September 3, 2014.

4 Discussion

4.1 Priority IEP list

The NCPN will continue to work with park staff and area IEP experts to review and update the list of priority species each year. Presence and absence data for most priority species, and presence data for other species, should be reliable for the area surveyed; however, absence data for non-priority species are suspect, because not all observers recorded all of these species in all years. We did not add any new species to the priority list in 2014, but yellow sweetclover was added to the list of species to record in transects. The park has suggested that cheatgrass be added to the priority list for 2015.

4.2 Possibilities for management control

In 2014, priority IEPs were most widespread along the shores of Blue Mesa Reservoir and the Elk Creek management area. Canada thistle, woolly mullein, Russian thistle, and reed canarygrass were the most common IEPs. All of these species, except for reed canarygrass, can be controlled with sufficient resources. Reed canarygrass was widespread along the Cooper/Neversink area.

It should be noted that estimates of percent cover in this report (see Table 3-4) are limited to the routes surveyed. Actual percent cover of IEPs across the entire park cannot be inferred with these methods. Because we have chosen to monitor along areas most likely to be invaded by a broad suite of IEPs, it is plausible that the percent cover for most IEP species is lower in the interior of the park than along the monitoring routes.

4.3 Future monitoring efforts

IEPs at Curecanti NRA will generally be monitored at the same time of year, every other year. Consistency in timing of monitoring should ensure consistency in detection probabilities and cover estimates of most species. For many species, sampling any time from May through September is not expected to drastically alter the chances of detecting invasive species larger than the MDTS. The NCPN will monitor invasive plants for two years out of three and then take one year off. In 2015, the network will return to complete the second re-visit at Curecanti NRA and the third re-visit at Black Canyon of the Gunnison National Park. A more complete report comparing invasive patches found in 2014–2015 to earlier surveys (Edvarchuk et al. 2012; Perkins 2012, 2013) will be completed in the winter of 2015–2016, after the monitoring rotation is completed.

Depending on the route, a crew member can search 6–10 km per day. Survey times vary and are often at the lower end of the range at Black Canyon of the Gunnison National Park, where many routes follow trails and drainages with only one way in and out. We will work with park staff to ensure that areas of highest priority are covered in 2015.

Long-term trend reporting will focus on trends in species distributions, trends in percent cover of individual species, and changes in IEP percent cover of priority species and cheatgrass by monitoring route. Extra-area surveys will also be considered for inventories at the park's request.

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Appendix A. Exotic plant patches detected on monitoring routes at Curecanti NRA, July 2–September 3, 2014.

See electronic appendices.

Appendix B. Exotic plant transect data detected at Curecanti NRA, July 2–September 3, 2014.

See electronic appendices.

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