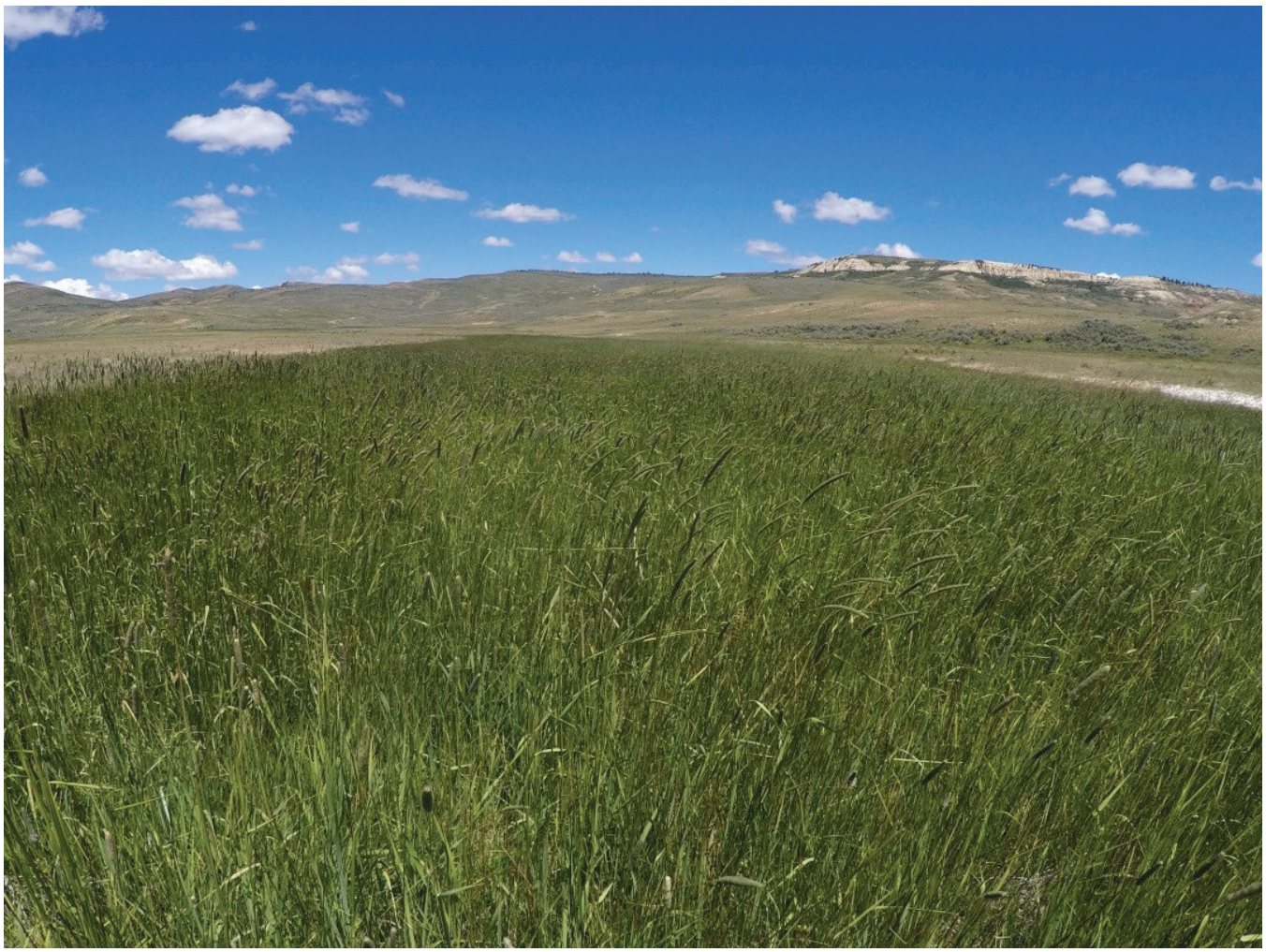
National Park Service
U.S. Department of the Interior

Natural Resource Stewardship and Science

Invasive Exotic Plant Monitoring at Fossil Butte National Monument

2018 Field Season

Natural Resource Report NPS/NCPN/NRR—2019/1920



ON THE COVER

A field of creeping foxtail (*Alopecurus arundinaceus*) in Fossil Butte National Monument. (NPS/Luke Gommermann)

Invasive Exotic Plant Monitoring at Fossil Butte National Monument

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Natural Resource Report NPS/NCPN/NRR—2019/1920

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Fort Collins, Colorado

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Executive Summary

Invasive exotic plant (IEP) species are one of the biggest threats to natural ecosystem integrity and biodiversity, and controlling them 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. This report represents work completed during the 2018 field season at Fossil Butte National Monument (NM). From June 28 to July 1, 2018, we found a total of 16 different IEP species during monitoring. Eleven priority species were recorded in 947 patches along 66.8 kilometers (41.5 mi) of 27 monitoring routes. Of these 947 total patches, 674 (71.2%) were larger than 40 m^2. However, 668 (70.5%) of all patches were classified as "very low" on the patch management index scale, indicating a wide, sparse distribution of IEPs. The highest densities of IEP patches were detected in several drainages: East Red Hill (39.8 patches/km), South Millet Canyon (19.5/km), West Fork Chicken Creek (16.2/km), Millet Canyon (15.6/km), Chicken Creek (15.6/km), Fossil Butte East (15.2/km), Smallpox Creek (15.2/km), and along the main park road (22.1/km). The Fossil Butte NW and Wasatch Saddle drainages were the only two routes free of priority IEPs in 2018. Cheatgrass (*Bromus tectorum*), creeping foxtail (*Alopecurus arundinaceus*), and Japanese brome (*Bromus japonicus*) were the most widespread species; each has been increasing across all years they have been monitored (since 2014 for cheatgrass, 2009 for creeping foxtail, and 2016 for Japanese brome). Conversely, flixweed (*Descurainia sophia*) has decreased every monitoring year since 2014. Several other IEP species have remained in similar densities or declined slightly over recent monitoring years. Control efforts by park staff are likely helping to prevent some IEP increases in the park and are summarized in this report. The network will return to Fossil Butte NM for a seventh round of monitoring in 2020.

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L. Gommermann and K. Fahey conducted field work. A. Wight was extremely helpful in generating routes, quadrats, and other GIS information. A. Aase assisted with reviewing the park target invasive plant list, arranging site logistics, and sharing data on control efforts. L. Gommermann, R. Weissinger, and A. Aase improved this report with their thoughtful reviews. Data management was provided by H. Thomas. M. Schrade assisted with logistical and administrative details.

1 Introduction

Invasive exotic species fragment native ecosystems, displace native plants and animals, and alter ecosystem function. Invasive species are among the top threats to biodiversity after species overexploitation and habitat loss (agricultural and urban development) (Maxwell et al. 2016), 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. 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 escapes and seeds transported on shoes 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 units is beyond the fiscal capabilities of the network and parks, the NCPN focuses 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 it 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:

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

This report summarizes the 2018 field season and sixth complete monitoring rotation at Fossil Butte National Monument (NM).

2 Methods

We followed the invasive plant monitoring protocol developed by the NCPN (Perkins et al. 2016). The protocol emphasizes 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 capture the greatest amount of information (i.e., benefit) with the least amount of time and effort (i.e., cost).

After park and NCPN staff reviewed the list of target invasive plants (see Section 2.1), we established a series of co-located monitoring routes and quadrats along all roads, major drainages, and trails in the park. The quadrats, which are sampled in a quantitative manner, are used to make inference to the percent cover of IEPs located along the park's invasive pathways (i.e., the monitoring routes) and allow us to estimate trends in IEP percent cover over time. The monitoring routes, which are not quantitatively sampled, are used to increase the spatial coverage of mapping performed, with the goal of maximizing our opportunities for detecting IEPs in the park.

All roads, trails, and riparian areas were surveyed previously with monitoring routes and quadrats in 2008–2009, 2010, 2012, 2014, and 2016 (Perkins 2010, 2011, 2013, 2015, 2017). During the first rotation, the park was monitored over two years.

2.1 Developing a park target invasive exotic plant list

The original list of target IEPs was developed by reviewing past park literature and state and county weed lists, and consulting with park staff and county weed managers. Our priority IEP list includes existing IEPs and potential IEPs of high management concern. Because these methods were designed to be rapid, field crews were trained to develop a focused search image on the target plants, instead of looking for every possible invasive plant species. Eradicating these target species, or containing them within a park, is possible.

The list of priority species is reviewed before each field season. Prior to the start of monitoring in 2018, NCPN and park staff reviewed the list of high-priority target IEPs (Table 2-1) that was initially developed in 2008 and then reviewed before each year of sampling. No new species were added to the list in 2018.

Table 2-1. Priority invasive exotic plant list, Fossil Butte National Monument, 2008–2018.

Scientific name	Common name
Alopecurus arundinaceus	creeping foxtail
Arctium minus	burdock
Bassia scoparia	summer cypress
Bromus japonicus[a]	Japanese brome
Bromus tectorum[b]	cheatgrass
Cardaria sp.	whitetop
Carduus nutans	musk thistle
Centaurea diffusa	diffuse knapweed
Centaurea maculosa	spotted knapweed
Centaurea repens	Russian knapweed
Cirsium arvense	Canada thistle
Cirsium vulgare	bull thistle
Convolvulus arvensis	field bindweed
Cynoglossum officinale	common houndstongue
Descurainia sophia[c]	flixweed
Elymus repens	quackgrass
Hyoscyamus niger	black henbane
Isatis tinctoria	Dyer's woad
Lepidium latifolium	perennial pepperweed
Linaria dalmatica	Dalmatian toadflax
Melilotus officinalis	yellow sweetclover
Sonchus arvensis	perennial sowthistle
Tamarix sp.	tamarisk
Verbascum thapsus	woolly mullein

[a]Added to priority list in 2016, referred to in Perkins (2015) as Japanese chess.
[b]Added to priority list in 2014.
[c]Added to priority list in 2012.

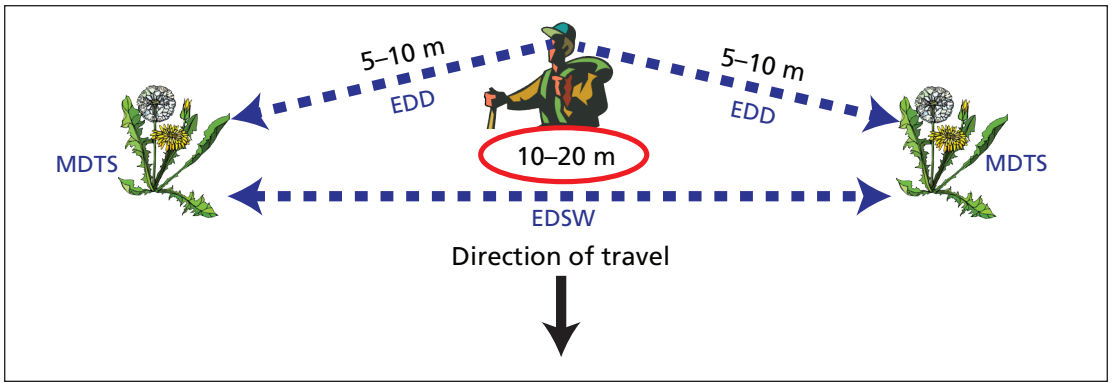


Figure 2-1. The maximum Effective Detection Distance (EDD) at Fossil Butte National Monument ranged from 5 to 10 meters in 2018, making the Effective Detection Swath Width (EDSW) 10–20 meters.

2.2 Monitoring routes

2.2.1 Minimum detection target size

The minimum detection target size (MDTS) represents the patch size that was large enough to detect 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. The NCPN has established an MDTS of 40 m^2 (0.01 acres, or approximately 20 × 20 ft) for all IEPs. Use of the MDTS is necessary because field technicians are not expected to find every single plant of every targeted weed species during route surveys. Although searching for single mature plants of some species, such as tamarisk (*Tamarix* sp.), 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 unless the observer is very close to the patch.

2.2.2 Effective detection distance

The effective detection distance (EDD) is the maximum distance from which a searcher can consistently detect (i.e., see and recognize) the MDTS of the least-visible targeted species with at least 90% detection efficiency (Figure 2-1). Crew members are trained by walking away from fake plants of a targeted size and determining the maximum distance from which they could 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 Fossil Butte NM was between 5 and 10 meters in 2018, depending on surrounding vegetation.

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 weeds for one EDD on either side of the search route. The EDSW ranged from 10 to 20 meters at Fossil Butte NM in 2018.

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 infestations, or 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 meters, based on the assumption that most plants or groups of plants separated by less than 50 meters are typically considered to be one patch during planning and implementation of weed-control operations. If a patch is continuous for more than 50 meters, then cover estimates

are made every 50 meters to aid in developing an effective management strategy for the entire patch.

2.2.5 Data collection methods

For the main park road, we walked one EDD out from one side of the road and then returned to the starting point by walking back one EDD from the road on the other side. For secondary roads, single-track trails, and drainages, we walked the center of the trail or drainage in only one direction (Figure 2-2). While walking, we searched for IEPs by visually scanning (side-to-side) all of the land within the borders of the swath. However, if the terrain was uneven or steep, and the observer had to glance frequently at the ground to ensure safe foot placement, then searchers stopped approximately every 10–20 meters (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 GPS units with at least five-meter accuracy. Only species designated as priority were consistently recorded on monitoring routes.

When a priority IEP was discovered, we recorded the following information: (1) monitoring route, (2) sequential number of the invasion per monitoring route, (3) patch size class (see below), (4) whether the plant was pulled, and (5) cover class (see below). If several species 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. Invasions more than 50 meters apart were considered separate patches and recorded with a separate point.

Patch size class was estimated as follows:

1. 1–3 plants (used for isolated single plants or very small patches (≤2 × 2 m),
2. Four 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 cover class by estimating the amount, or "percentage," of ground covered by the vertical projection of plant matter in the infestation patch 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. Percent 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, distance to road, wetland, stream), the growth stage of exotic trees (i.e., sapling, pole, mature), evidence of prior treatment, and evidence of disturbances (e.g., recent fire, flood, small mammal disturbance).

2.3 Monitoring transects

Beginning in 2010, we established transects with three vegetation quadrats every 500 meters along monitoring routes. From 2010 to 2014, if no IEPs were detected for four consecutive transects (12 quadrats), then transects were established every 1,000 meters. If invasive plants were found in categories greater than 1 for cover class or patch size class, then we went back to establishing transects every 500 meters. In 2016 and 2018, transects were always completed every 500 meters.

2.3.1 Quadrat establishment

From 2010 to 2018, we centered vegetation quadrats at 0.5, 5, and 10 meters away from the edge of a road on the same side as the route that was being walked and on alternating sides for riparian areas, small roads, or trails. We placed a 1-m^2 sampling frame to sample vegetation cover and soil-surface features 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.

Quadrat-sampling methods differed slightly from 2008 to 2009–2012. In 2008, we used three 1-m^2 vegetation quadrats, placed in a circular macroplot (Perkins and Weissinger 2009). In 2009, quadrats were placed at 3, 8, and 13 meters away from the monitoring route. In 2008, all invasive species detected were recorded in monitoring quadrats. From 2009 to 2018, only priority species and cheatgrass were recorded in quadrats.

2.3.2 Data collection methods

In the monitoring quadrats, we recorded all priority IEP species and cheatgrass observed. 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, 100%. We also recorded percent cover 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) using the same classes.

2.4 Analyses

We calculated the mean number of patches per kilometer for monitoring routes. Percent cover estimates for monitoring routes or groups of monitoring routes were generated from the monitoring transect data. We calculated the mean and standard error of percent cover by species for monitoring quadrats. Due to differences in observers' knowledge, only priority species were used when comparing results from year to year.

We developed a patch management index (PMI) to quantify both the extent and the density of a patch into a single value that helps identify the scale of the problem. Park managers will be able to use this tool to help prioritize IEP treatment. PMI was determined using the following formula:

Patch size class (1–5) × Cover class (1–5) = Patch management index (1–25)

We then grouped PMI into five classes:

1. Very low (1–5)
2. Low (6–10)
3. Moderate (11–15)
4. High (16–20)
5. Very high (21–25)

Patches identified as very low or low PMI will generally be easier to control or remove than patches with a high or very high PMI. In many cases, directing resources toward controlling patches with very low or low PMI can be a highly effective management strategy; the goal of early detection is to allow managers to eliminate patches before they can grow into bigger problems. Other times, a species with many inventoried patches that are mostly very low or low in PMI may or may not be easier to treat (and possibly eradicate) than a different species that has a few inventoried patches that are high or very high in PMI. Therefore, park managers should consider PMI within the context of information on species and patch numbers.

3 Results

3.1 Monitoring routes

3.1.1 2018 results

In 2018, we recorded a total of 16 IEP species during monitoring at Fossil Butte National Monument (Table 3-1). Eleven priority species were detected in 947 patches along 66.8 kilometers (41.5 mi) of 27 monitoring routes (Figures 3-1, 3-2, 3-3, 3-4; Tables 3-1, 3-2; Appendix A). Of the 947 priority patches, 674 (71.2%) were larger than 40 m^2 (Table 3-3). However, 668 (70.5%) of all patches were "very low" in PMI (Table 3-3).

The highest densities of IEP patches were detected in several drainages:

- East Red Hill (39.8 patches/km),
- South Millet Canyon (19.5 patches/km),
- West Fork Chicken Creek (16.2 patches/km),
- Millet Canyon (15.6 patches/km),
- Chicken Creek (15.6 patches/km),
- Fossil Butte East (15.2 patches/km),
- Smallpox Creek (15.2 patches/km),

and along the main park road (22.1 patches/km). Other roads and several other drainages had much lower patch densities (see Table 3-2). The Fossil Butte NW and Wasatch Saddle drainages were the only routes with no priority IEPs detected in 2018 (see Table 3-2).

Cheatgrass (*Bromus tectorum*), creeping foxtail (*Alopecurus arundinaceus*), and Japanese brome (*Bromus japonicus*) were by far the most widespread species, representing 85.5% of all priority patches detected (see Table 3-3). These were the only three species with patches that were medium or higher in PMI (see Table 3-3). The next-most widespread species was flixweed (*Descurainia sophia*), with 55 total patches detected.

Several non-priority IEPs were seen in the park during monitoring in 2018 but were not mapped (or were only partially mapped, in the case of yellow salsify) (see Table 3-1). Crested wheatgrass (*Agropyron cristatum*) was seen across the park, especially along the main park road and historic quarry trails, where it was observed in trace-to-moderate cover. Prickly lettuce (*Lactuca serriola*) was widespread but sparse along

Table 3-1. Invasive exotic plants detected at Fossil Butte National Monument, June 28–July 1, 2018.

Scientific name	Common name	Method detected		Park priority?
		Route	Transect	
Alopecurus arundinaceus	creeping foxtail	✓	✓	Yes
Bromus japonicus	Japanese brome	✓	✓	Yes
Bromus tectorum	cheatgrass	✓	✓	Yes
Cardaria sp.	whitetop	✓	–	Yes
Carduus nutans	musk thistle	✓	–	Yes
Cirsium arvense	Canada thistle	✓	–	Yes
Convolvulus arvensis	field bindweed	✓	–	Yes
Descurainia sophia	flixweed	✓	✓	Yes
Elymus repens	quackgrass	✓	–	Yes
Hyoscyamus niger	black henbane	✓	–	Yes
Melilotus officinalis	yellow sweetclover	✓	–	Yes
Agropyron cristatum	crested wheatgrass	✓	–	No
*Lactuca serriola**	prickly lettuce	✓	–	No
Poa bulbosa	bulbous bluegrass	✓	–	No
*Thlapsi arvense**	field pennycress	✓	–	No
Tragopogon dubius	yellow salsify	✓	–	No

*Species not mapped.

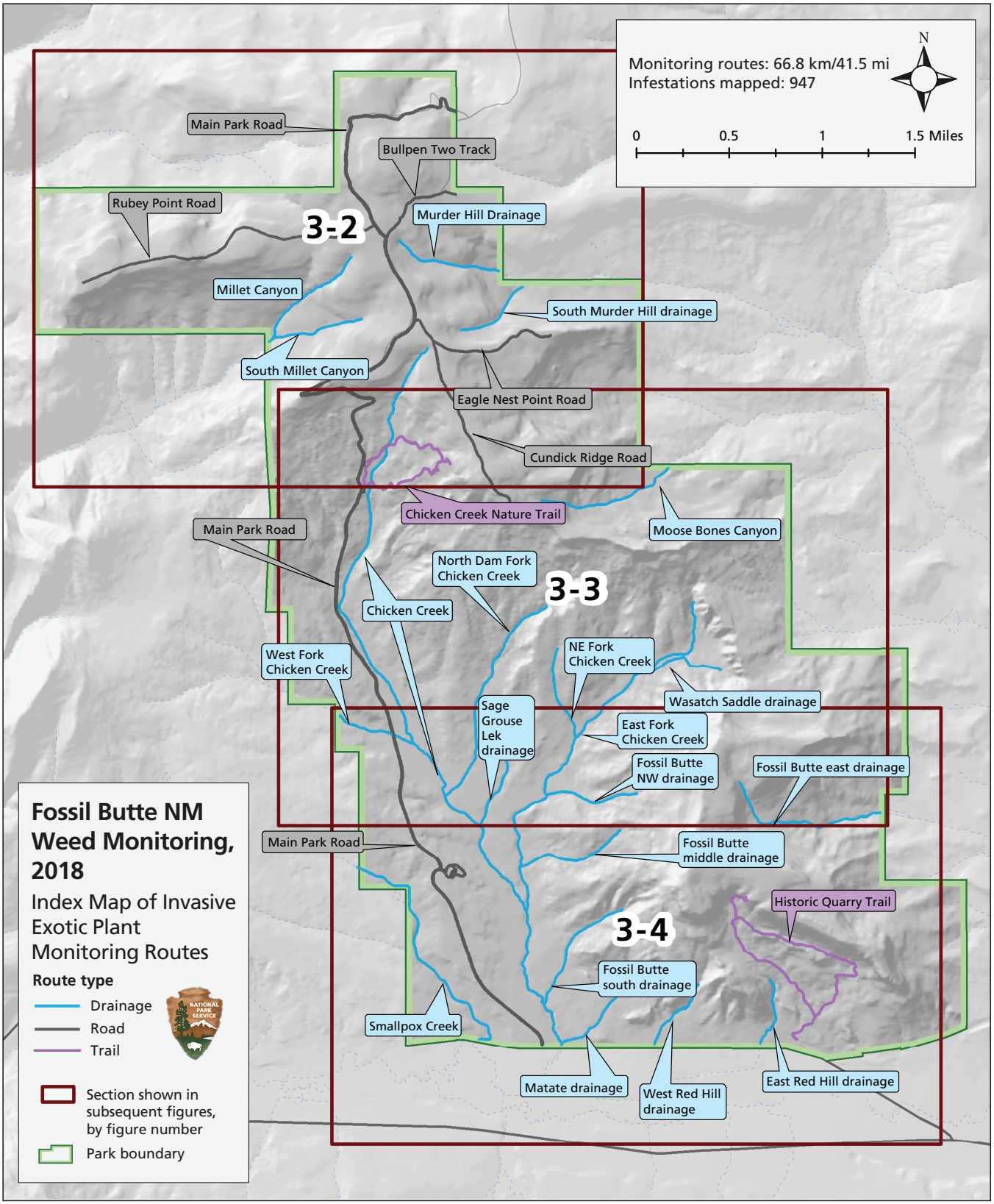


Figure 3-1. Invasive exotic plant monitoring routes, Fossil Butte National Monument, June 28–July 1, 2018.

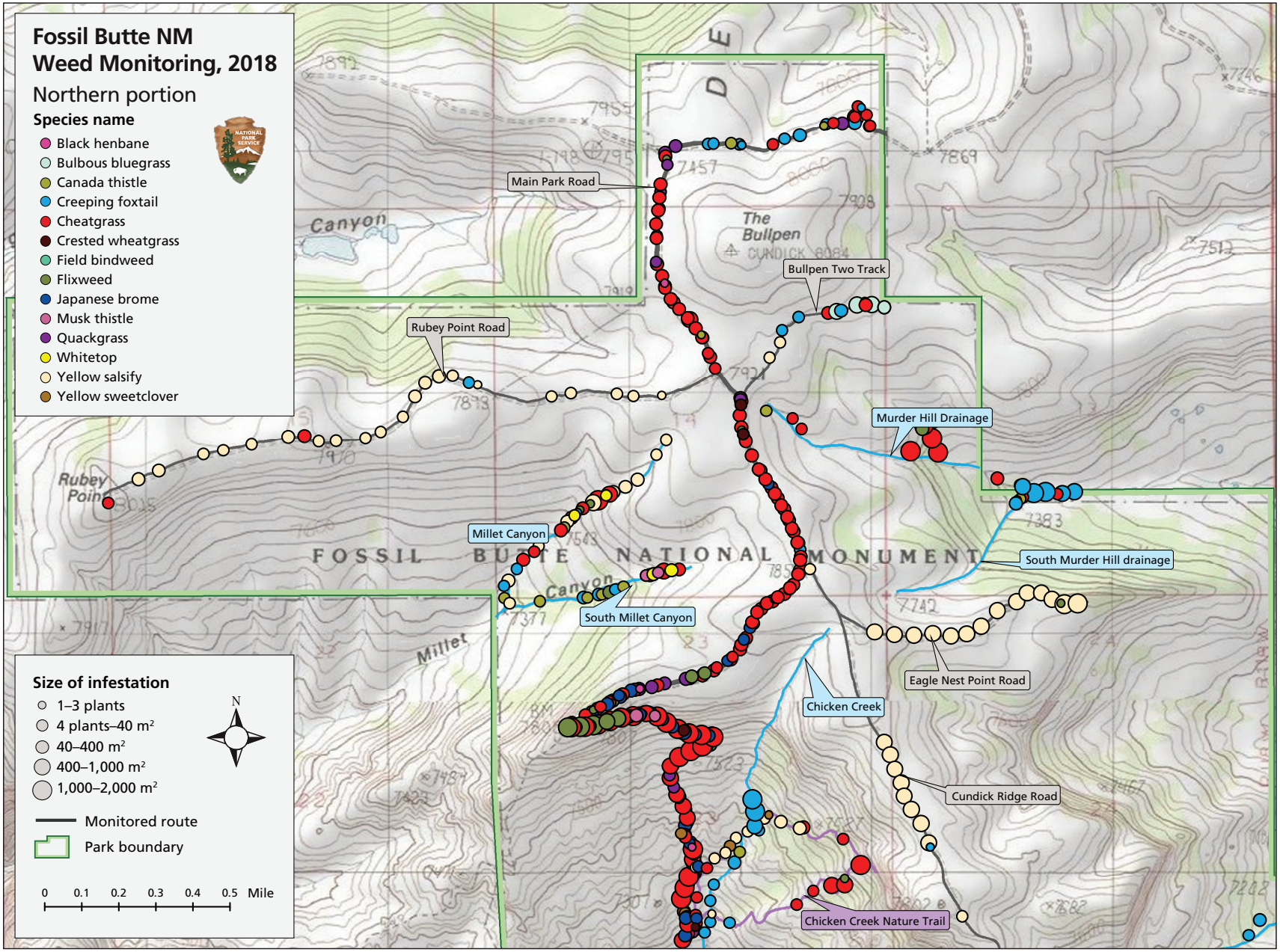


Figure 3-2. Invasive exotic plant patches detected along monitoring routes in the northern section of Fossil Butte National Monument, June 28–July 1, 2018.

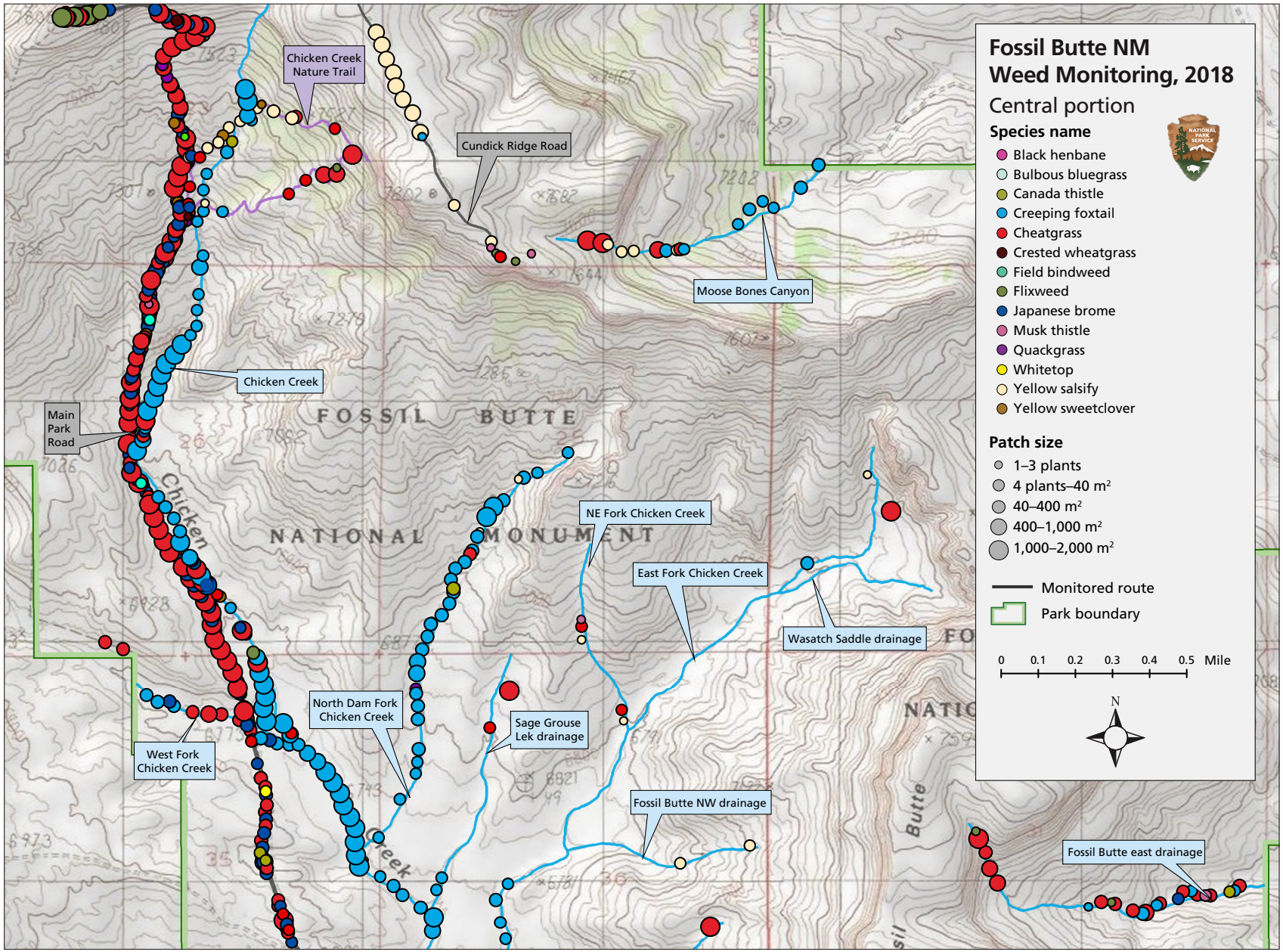


Figure 3-3. Invasive exotic plant patches detected along monitoring routes in the central section of Fossil Butte National Monument, June 28–July 1, 2018.

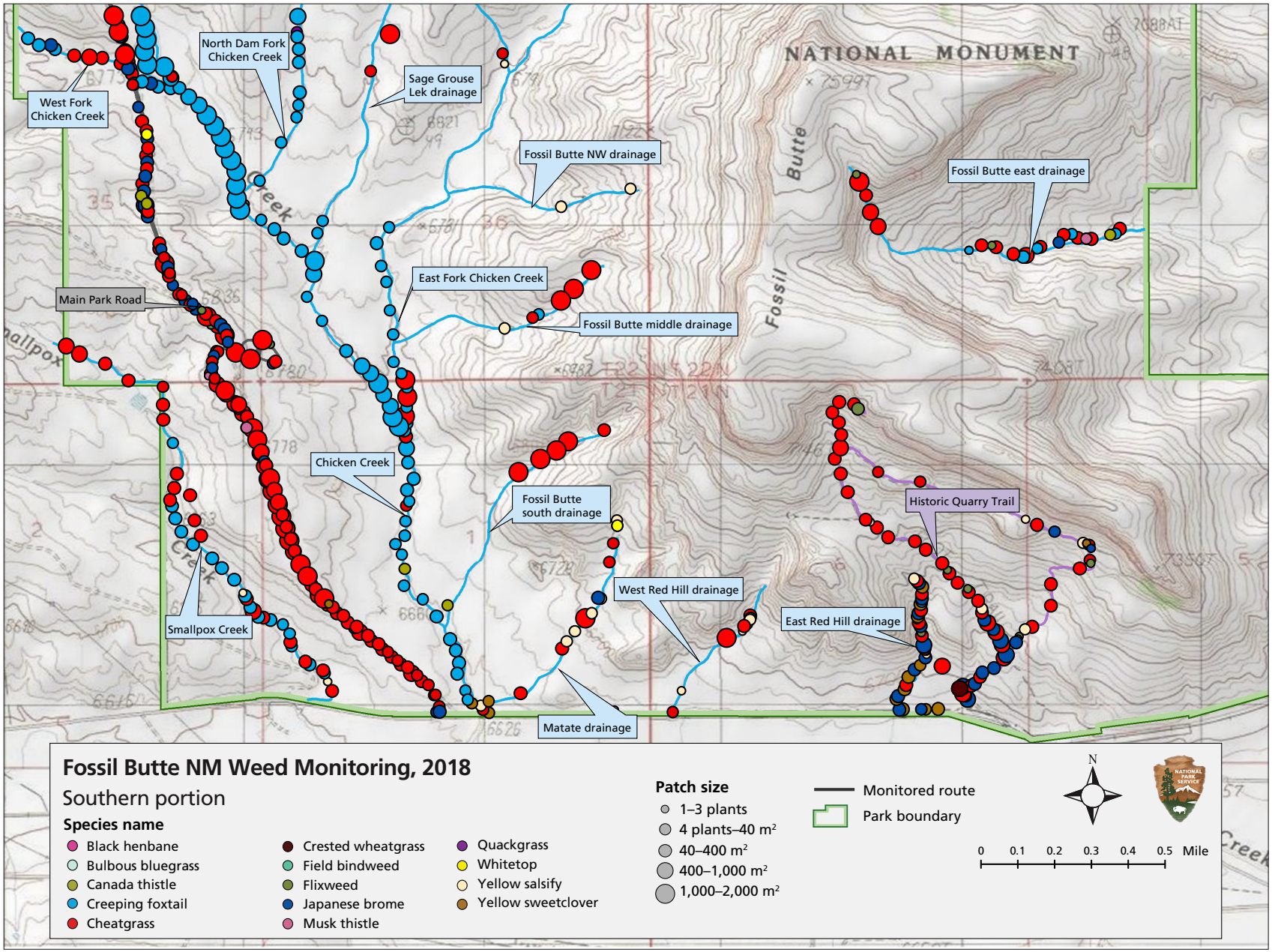


Figure 3-4. Invasive exotic plant patches detected along monitoring routes in the southern section of Fossil Butte National Monument, June 28–July 1, 2018.

Table 3-2. Number of priority IEP patches per route, and number per kilometer by route type, Fossil Butte National Monument, June 28–July 1, 2018.

Route	Route type	Length (km)	Total patches	Patches/km
Chicken Creek	Riparian	7.198	112	15.6
East Fork Chicken Creek	Riparian	3.619	15	4.1
East Red Hill Drainage	Riparian	0.653	26	39.8
Fossil Butte East Drainage	Riparian	1.514	23	15.2
Fossil Butte Middle Drainage	Riparian	1.015	5	4.9
Fossil Butte NW Drainage	Riparian	0.838	0	0.0
Fossil Butte S. Drainage	Riparian	1.166	6	5.1
Matate Drainage	Riparian	0.999	9	9.0
Millet Canyon	Riparian	1.090	17	15.6
Moose Bones Canyon	Riparian	1.248	12	9.6
Murder Hill Drainage	Riparian	0.967	5	5.2
NE Fork Chicken Creek	Riparian	0.841	3	3.6
N. Dam Fork Chicken Creek	Riparian	2.037	30	14.7
Sage Grouse Lek Drainage	Riparian	1.192	4	3.4
Smallpox Creek	Riparian	2.236	34	15.2
South Millet Canyon	Riparian	0.821	16	19.5
S. Murder Hill Drainage	Riparian	0.717	4	5.6
Wasatch Saddle Drainage	Riparian	0.727	0	0.0
West Fork Chicken Creek	Riparian	0.740	12	16.2
West Red Hill Drainage	Riparian	0.700	6	8.6
All Riparian		*30.316*	*339*	*11.2*
Bullpen Two Track	Road	0.829	6	7.2
Cundick Ridge Road	Road	1.972	4	2.0
Eagle Nest Point Road	Road	1.131	1	0.9
Main Park Road	Road	23.542	520	22.1
Rubey Point Road	Road	2.739	4	1.5
Chicken Creek Nature Trail	Trail	2.390	17	7.1
Historic Quarry Trail	Trail	3.902	56	14.4
All Roads/Trails		*36.505*	*608*	*16.7*
Total		66.821	947	(avg) 14.2

Table 3-3. Number of priority IEP patches detected along monitoring routes by patch size class and patch management index, Fossil Butte National Monument, June 28–July 1, 2018.

Scientific name	Common name	Total patches	Patch size class[a]					Patch management index[b]				
			1	2	3	4	5	Very low	Low	Medium	High	Very high
Alopecurus arundinaceus	creeping foxtail	199	5	76	68	17	33	102	79	17	1	0
Bromus japonicus	Japanese brome	158	1	37	103	16	1	124	33	1	0	0
Bromus tectorum	cheatgrass	453	0	54	256	51	92	333	117	3	0	0
Cardaria sp.	whitetop	6	0	4	2	0	0	5	1	0	0	0
Carduus nutans	musk thistle	12	6	5	1	0	0	11	1	0	0	0
Cirsium arvense	Canada thistle	18	2	15	1	0	0	15	3	0	0	0
Convolvulus arvensis	field bindweed	2	0	2	0	0	0	1	1	0	0	0
Descurainia sophia	flixweed	55	2	35	13	2	3	55	0	0	0	0
Elymus repens	quackgrass	20	0	11	9	0	0	3	17	0	0	0
Hyoscyamus niger	black henbane	3	3	0	0	0	0	3	0	0	0	0
Melilotus officinalis	yellow sweetclover	21	3	12	6	0	0	16	5	0	0	0
Totals		947	22	251	459	86	129	668	257	21	1	0

[a]Patch size classes: 1 = 1–3 plants (≤2 × 2 m), 2 = 4 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), 5 = 1,000–2,000 m^2 (0.25–0.5 acre).

[b]PMI classes: Very low (1–5), Low (6–10), Medium (11–15), High (16–20), Very high (21–25). PMI = Patch size class (1–5) × Patch percent cover (1–5).

the northern section of the main park road. Bulbous bluegrass (*Poa bulbosa*) was widespread in trace-to-moderate cover along the main park road and Bullpen two-track road. Field pennycress (*Thlapsi arvense*) was widespread across the park, particularly along the main park road north of the switchbacks. The crew saw park staff pulling yellow salsify (*Tragopogon dubius*) along the main park road on the second day of monitoring. After this, the crew began mapping this species (see Figures 3-2, 3-3, 3-4) based on its management potential.

3.1.2 Priority patches over time

3.1.2.1 Priority species over time

Only priority species were examined when comparing years and areas, as these were the only species recorded consistently by all observers. Monitoring years 2008–2009 represented one complete cycle of all monitoring routes.

Three priority IEP grass species have increased notably in patch density over time. The number of patches per kilometer of creeping foxtail (*Alopecurus arundinaceus)* has risen across all monitoring years (from 0.40 patches/km in 2008–2009 to 3.05 patches/km in 2018) (Table 3-4, Figure 3-5). Creeping foxtail has been on the IEP priority list since 2008, but was not recorded in 2008. It is suspected that observers had difficulty identifying this plant, due either to a control effort that removed seed heads and/or insufficient field training on this species. This species was recorded reliably across the park in 2009. Therefore, the numbers presented for the 2008–2009 sampling period may underrepresent this species. Cheatgrass (*Bromus tectorum*) has increased in patches per kilometer since it was added to the IEP priority list in 2014 (from 3.01 patches/km in 2014 to 6.96 patches/km in 2018) (Table 3-4, Figure 3-5). Japanese brome (*Bromus japonicus*) increased from 1.37 patches/kilometer in 2016 (when it was added to IEP priority list) to 2.39 patches/kilometer in 2018.

Quackgrass (*Elymus repens*), Canada thistle (*Cirsium arvense*), and yellow sweetclover (*Melilotus officinalis*) did not change dramatically between 2016 and 2018, and remain at lower densities than in earlier monitoring years (Table 3-4, see Figures 3-5, 3-6). Musk thistle (*Carduus nutans*) and flixweed (*Descurainia sophia*) decreased in patches per kilometer from 2014 to 2018 (Table 3-4, Figure 3-6).

3.1.2.2 Areas over time

To examine IEP species across time in different areas of Fossil Butte NM, we combined routes into five areas:

- Northern drainages: Murder Hill, South Murder Hill, Millet Canyon, South Millet Canyon, and Moose Bones Canyon
- Southern drainages: Smallpox, Matate, West Red Hill, East Red Hill, Fossil Butte East, Fossil Butte NW, Fossil Butte Middle, Wasatch Saddle, Sage Grouse Lek, NE Fork of Chicken Creek, East Fork of Chicken Creek, West Fork of Chicken Creek, North Dam Fork of Chicken Creek, and Chicken Creek
- Main Park Road: main park road
- Other Roads: Eagle Nest Point, Rubey Point, Bullpen Two Track, and Cundick Ridge
- Trails: Chicken Creek and Historic Quarry trails

Patch density of all IEP priority species was compared across the five areas over time, excluding cheatgrass (*Bromus tectorum*), Japanese brome (*Bromus japonicus*) and flixweed (*Descurainia sophia*), which were added to the list after early monitoring years. Southern drainages saw increases in overall IEP species patch densities across all monitoring years, from 2.87 patches/kilometer in 2008–2009 to 7.11 patches/kilometer in 2018 (Table 3-5, Figure 3-7). This was driven mostly by an increase in creeping foxtail (*Alopecurus arundinaceus*). Conversely, the main park road has seen a decrease in overall IEP patch densities of consistently monitored species, from 8.85 patches/kilometer in 2008–2009 to 2.51 patches/kilometer in 2018. This was due mostly to declines in patch densities of Canada thistle (*Cirsium arvense*), quackgrass (*Elymus repens*), black henbane (*Hyoscyamus niger*), and yellow sweetclover (*Melilotus officinalis*).

Cheatgrass increased throughout most of the park, particularly on the main park road (from 5.92 patches/km in 2014 to 12.83 patches/km in 2018), trails (from 2.38 patches/km in 2014 to 7.31 patches/km in 2018), and southern drainages (from 1.21 patches/km in 2014 to 3.14 patches/km in 2018) (Table 3-5). Japanese brome increased throughout the park, but remains absent from the Other Roads and Northern Drainages areas. Throughout all monitoring years, black henbane has only been found on the main park road. Whitetop (*Cardaria* sp.) was found in the northern drainages for the first time during NCPN monitoring in 2018 (4 total patches). It should be noted that one or more of these patches might have been little-pod false flax (*Camelina microcarpa*), which is also an exotic species. The crew plans to investigate this during the next visit.

3.2 Monitoring transects

A total of 125 transects were sampled in 2018 (Figure 3-8, Appendix B). In 2018, four IEP priority species were detected in transects: cheatgrass (*Bromus tectorum*), creeping foxtail (*Alopecurus arundinaceus)*, Japanese brome (*Bromus japonicus*), and flixweed (*Descurainia sophia*) (Tables 3-1, 3-6). Cheatgrass was the most commonly detected species, found in 34 total transects. Japanese brome was next-most common, detected in 14 transects. A total of 44 transects had at least one IEP species present. The average cover of IEP species across all transects in the park was 0.72%. Transects along the main park road accounted for the majority of IEP occurrences, with 30 of 46 transects containing at least one IEP priority species. In the southern drainages, 10 of 47 transects had at least one IEP species. No IEP species were detected in northern-drainage transects.

Only IEP priority species and cheatgrass have been reliably recorded in transects across all study years. Estimated percent covers of cheatgrass along the main park road have fluctuated at below 1% (range 0.1%–0.9%) across all monitoring years (Table 3-6). From 2008–2009 to 2018, the percentage of transects containing cheatgrass has risen from 2.9% to 27.2% park-wide. Since 2016, the percentage of transects containing Japanese brome increased from 4.2% to 11.2% (Table 3-6). Since 2014, flixweed has remained very low in overall percent cover, declining from 0.04% in 2014 to 0.01% in 2018.

Table 3-4. Total IEP patches per kilometer and PMI class of patches detected, Fossil Butte National Monument, 2008–2018.

Scientific name	Common name	Year[a]	Total patches (per km)[b]	Patch management index[c]				
				Very low	Low	Medium	High	Very high
Alopecurus arundinaceus	creeping foxtail	2008–2009	24 (0.40)	11	9	3	1	0
		2010	63 (0.96)	49	11	3	0	0
		2012	58 (0.88)	47	10	1	0	0
		2014	123 (1.86)	81	35	3	4	0
		2016	188 (2.82)	113	57	8	9	1
		2018	204 (3.05)	102	82	19	1	0
Bromus japonicus[d]	Japanese brome	2008–2009	–	–	–	–	–	–
		2010	–	–	–	–	–	–
		2012	–	–	–	–	–	–
		2014	–	–	–	–	–	–
		2016	91 (1.37)	66	25	0	0	0
		2018	160 (2.39)	126	33	1	0	0
Bromus tectorum[e]	cheatgrass	2008–2009	–	–	–	–	–	–
		2010	–	–	–	–	–	–
		2012	–	–	–	–	–	–
		2014	199 (3.01)	134	54	8	3	0
		2016	337 (5.06)	173	153	10	1	0
		2018	465 (6.96)	334	126	5	0	0
Cardaria sp.	whitetop	2008–2009	2 (0.03)	1	1	0	0	0
		2010	1 (0.02)	0	1	0	0	0
		2012	0	0	0	0	0	0
		2014	1 (0.02)	1	0	0	0	0
		2016	7 (0.11)	5	1	1	0	0
		2018	6 (0.09)	5	1	0	0	0
Carduus nutans	musk thistle	2008–2009	28 (0.46)	23	5	0	0	0
		2010	37 (0.57)	28	9	0	0	0
		2012	19 (0.29)	16	3	0	0	0
		2014	30 (0.45)	29	1	0	0	0
		2016	17 (0.26)	15	1	1	0	0
		2018	14 (0.21)	13	1	0	0	0
Centaurea maculosa	spotted knapweed	2008–2009	0	0	0	0	0	0
		2010	1 (0.02)	1	0	0	0	0
		2012	4 (0.06)	4	0	0	0	0
		2014	6 (0.09)	6	0	0	0	0
		2016	1 (0.02)	1	0	0	0	0
		2018	0	0	0	0	0	0

Table 3-4. Total patches per kilometer and PMI class of patches of IEP species detected, Fossil Butte National Monument, 2008–2018, cont.

Scientific name	Common name	Year[a]	Total patches (per km)[b]	Patch management index[c]				
				Very low	Low	Medium	High	Very high
Cirsium arvense	Canada thistle	2008–2009	68 (1.13)	40	22	3	3	0
		2010	54 (0.83)	15	34	5	0	0
		2012	9 (0.14)	5	3	1	0	0
		2014	19 (0.29)	16	3	0	0	0
		2016	27 (0.41)	15	11	1	0	0
		2018	19 (0.28)	16	3	0	0	0
Cirsium vulgare	bull thistle	2008–2009	7 (0.12)	6	1	0	0	0
		2010	9 (0.14)	7	2	0	0	0
		2012	6 (0.09)	5	1	0	0	0
		2014	0	0	0	0	0	0
		2016	4 (0.06)	3	1	0	0	0
		2018	0	0	0	0	0	0
Convolvulus arvensis	field bindweed	2008–2009	5 (0.06)	2	3	0	0	0
		2010	1 (0.02)	0	1	0	0	0
		2012	0	0	0	0	0	0
		2014	2 (0.03)	2	0	0	0	0
		2016	2 (0.03)	2	0	0	0	0
		2018	2 (0.03)	1	1	0	0	0
Descurainia sophia[f]	flixweed	2008–2009	–	–	–	–	–	–
		2010	–	–	–	–	–	–
		2012	3 (0.50)	3	0	0	0	0
		2014	165 (2.50)	126	35	4	0	0
		2016	81 (1.22)	67	14	0	0	0
		2018	57 (0.85)	56	1	0	0	0
Elymus repens	quackgrass	2008–2009	53 (0.88)	20	30	2	1	0
		2010	95 (1.45)	19	48	8	20	0
		2012	23 (0.35)	16	6	1	0	0
		2014	5 (0.08)	3	2	0	0	0
		2016	31 (0.47)	5	26	0	0	0
		2018	20 (0.30)	3	17	0	0	0
Hyoscyamus niger	black henbane	2008–2009	19 (0.31)	18	1	0	0	0
		2010	5 (0.02)	4	1	0	0	0
		2012	4 (0.06)	4	0	0	0	0
		2014	4 (0.06)	3	1	0	0	0
		2016	10 (0.15)	10	0	0	0	0
		2018	3 (0.04)	3	0	0	0	0

Table 3-4. Total patches per kilometer and PMI class of patches of IEP species detected, Fossil Butte National Monument, 2008–2018, cont.

Scientific name	Common name	Year[a]	Total patches (per km)[b]	Patch management index[c]				
				Very low	Low	Medium	High	Very high
Isatis tinctoria	Dyer's woad	2008–2009	2 (0.02)	2	0	0	0	0
		2010	0	0	0	0	0	0
		2012	0	0	0	0	0	0
		2014	0	0	0	0	0	0
		2016	0	0	0	0	0	0
		2018	0	0	0	0	0	0
Melilotus officinalis	yellow sweetclover	2008–2009	54 (0.89)	43	9	2	0	0
		2010	54 (0.83)	38	16	0	0	0
		2012	0	0	0	0	0	0
		2014	20 (0.30)	19	1	0	0	0
		2016	23 (0.35)	23	0	0	0	0
		2018	25 (0.37)	20	5	0	0	0

[a]Dates surveyed: July 14–15, 2008 and August 6–8, 2009; July 24–28, 2010; August 2–5, 2012; July 19–22, 2014; June 30–July 4, 2016; June 28–July 1, 2018.

[b]Distances surveyed: 2008–2009: 60.44 km, 2010: 65.35 km, 2012: 65.87 km, 2014: 66.03 km, 2016: 66.56 km, 2018: 66.82 km.

[c]PMI classes: Very low (1–5), Low (6–10), Medium (11–15), High (16–20), Very high (21–25). PMI = Patch size class (1–5) × Patch percent cover (1–5).

[d]Added to priority list in 2016.

[e]Added to priority list in 2014.

[f]Added to priority list in 2012.

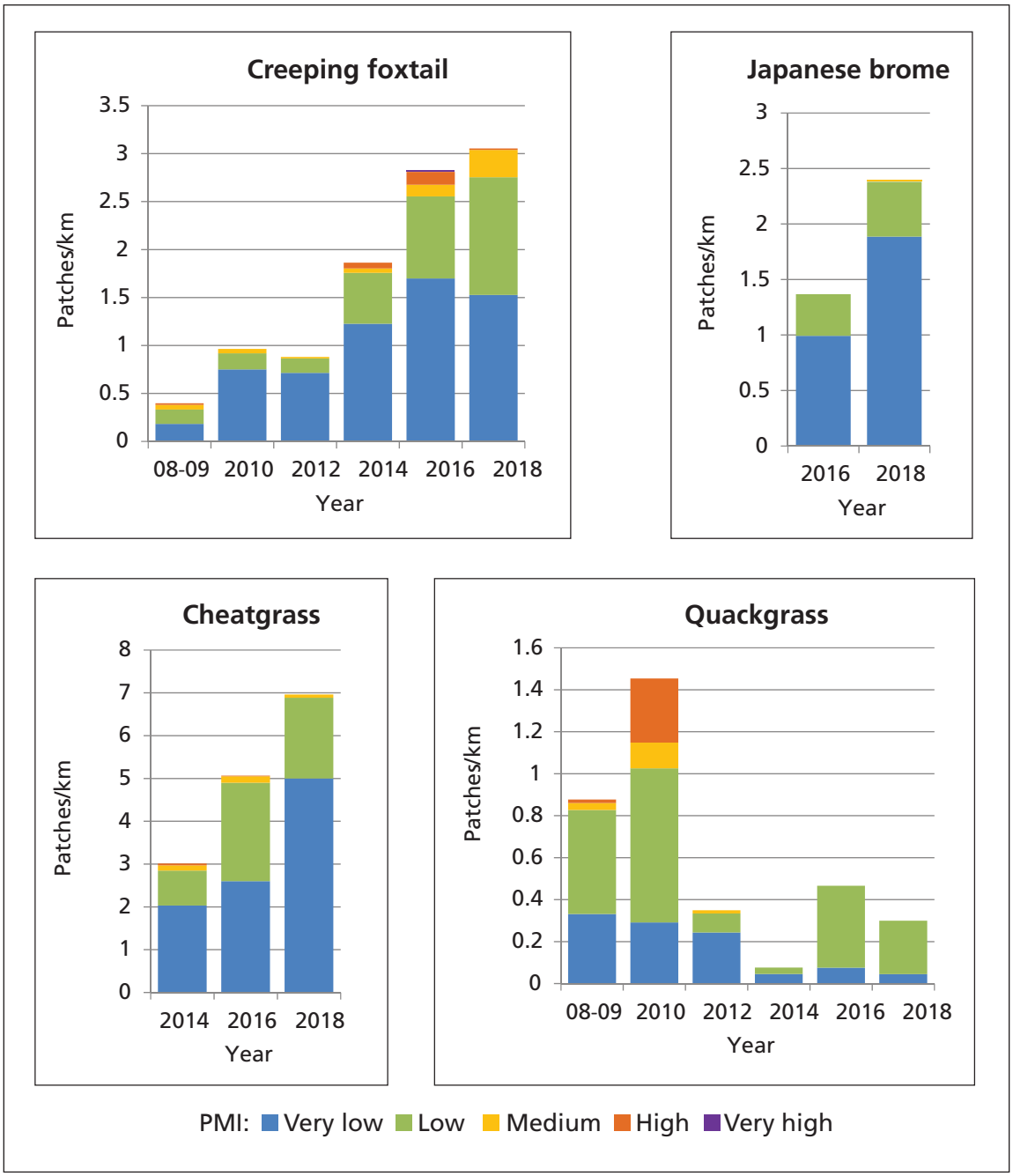


Figure 3-5. Total patches per kilometer and patch management index (PMI) of the four most common IEP grass species in Fossil Butte National Monument, 2008–2018. Cheatgrass was added to the IEP priority list in 2014, and Japanese brome was added in 2014.

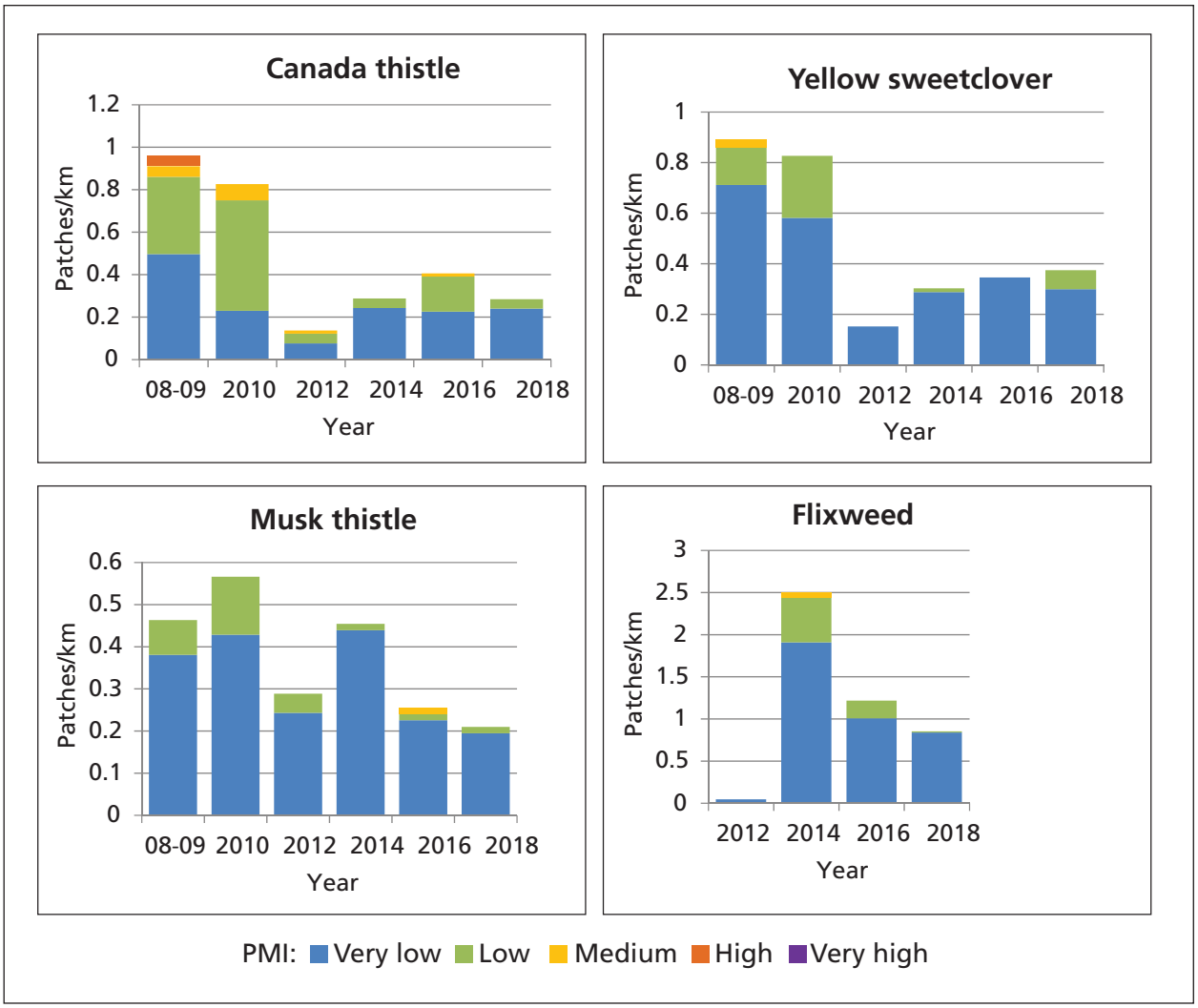


Figure 3-6. Total patches per kilometer and patch management index (PMI) of four common IEP species in Fossil Butte National Monument, 2008–2018. Flixweed was added to the IEP priority list in 2012.

Table 3-5. Total patches per kilometer of priority IEPs monitored in all years, detected parkwide, in northern drainages, southern drainages, main park road, other roads, and trails, Fossil Butte National Monument, 2008–2018.

Scientific name	Common name	Year	Total patches (per kilometer)					
			Parkwide	Northern drainages[a]	Southern drainages[b]	Main park road	Other roads[c]	Trails[d]
Alopecurus arundinaceus	creeping foxtail	2008–2009	24 (0.40)	2 (0.41)	22 (0.87)	0	0	0
		2010	63 (0.96)	8 (1.75)	43 (1.70)	6 (0.27)	2 (0.29)	4 (0.66)
		2012	58 (0.88)	1 (0.23)	55 (2.18)	2 (0.08)	0	0
		2014	123 (1.86)	15 (3.07)	95 (3.72)	9 (0.38)	3 (0.45)	1 (0.18)
		2016	186 (2.79)	14 (2.89)	149 (5.92)	16 (0.68)	5 (0.75)	2 (0.32)
		2018	199 (2.98)	15 (3.10)	160 (6.28)	17 (0.72)	5 (0.75)	2 (0.32)
Bromus japonicus[e]	Japanese brome	2008–2009	–	–	–	–	–	–
		2010	–	–	–	–	–	–
		2012	–	–	–	–	–	–
		2014	–	–	–	–	–	–
		2016	91 (1.37)	0	8 (0.32)	77 (3.27)	0	6 (0.95)
		2018	158 (2.38)	0	18 (0.71)	126 (5.35)	0	14 (2.23)
Bromus tectorum[f]	cheatgrass	2008–2009	–	–	–	–	–	–
		2010	–	–	–	–	–	–
		2012	–	–	–	–	–	–
		2014	199 (3.01)	13 (2.66)	31 (1.21)	139 (5.92)	3 (0.45)	13 (2.38)
		2016	333 (5.00)	11 (2.27)	51 (2.02)	234 (9.94)	7 (1.05)	30 (4.77)
		2018	453 (6.78)	19 (3.92)	80 (3.14)	302 (12.83)	6 (0.90)	46 (7.31)
Cardaria sp.	whitetop	2008–2009	2 (0.03)	0	0	2 (0.11)	0	0
		2010	1 (0.02)	0	1 (0.04)	0	0	0
		2012	0	0	0	0	0	0
		2014	1 (0.02)	0	0	1 (0.04)	0	0
		2016	7 (0.11)	0	3 (0.12)	4 (0.17)	0	0
		2018	6 (0.09)	4 (0.83)	1 (0.04)	1 (0.04)	0	0

Table 3-5. Total patches per kilometer of priority IEPs monitored in all years, detected parkwide, in northern drainages, southern drainages, main park road, other roads, and trails, Fossil Butte National Monument, 2008–2018, cont.

Scientific name	Common name	Year	Total patches (per kilometer)					
			Parkwide	Northern drainages[a]	Southern drainages[b]	Main park road	Other roads[c]	Trails[d]
Carduus nutans	musk thistle	2008–2009	27 (0.45)	8 (1.65)	12 (0.47)	7 (0.39)	0	0
		2010	37 (0.57)	7 (1.53)	16 (0.63)	13 (0.58)	1 (0.14)	0
		2012	18 (0.27)	5 (1.15)	10 (0.40)	2 (0.08)	0	1 (0.17)
		2014	30 (0.45)	9 (1.84)	11 (0.43)	9 (0.38)	1 (0.15)	0
		2016	16 (0.24)	4 (0.83)	5 (0.20)	6 (0.25)	0	1 (0.16)
		2018	12 (0.18)	2 (0.41)	3 (0.12)	6 (0.25)	1 (0.15)	0
Centaurea maculosa	spotted knapweed	2008–2009	0	0	0	0	0	0
		2010	1 (0.02)	0	1 (0.04)	0	0	0
		2012	4 (0.06)	0	0	4 (0.17)	0	0
		2014	6 (0.09)	0	0	6 (0.26)	0	0
		2016	1 (0.02)	0	0	1 (0.04)	0	0
		2018	0	0	0	0	0	0
Cirsium arvense	Canada thistle	2008–2009	67 (1.11)	10 (2.07)	25 (0.98)	32 (1.78)	0	0
		2010	53 (0.81)	13 (2.85)	21 (0.83)	12 (0.53)	3 (0.43)	4 (0.66)
		2012	9 (0.14)	5 (1.15)	1 (0.04)	2 (0.08)	0	1 (0.17)
		2014	19 (0.29)	6 (1.23)	11 (0.43)	2 (0.09)	0	0
		2016	27 (0.41)	9 (1.86)	5 (0.20)	13 (0.55)	0	0
		2018	18 (0.27)	8 (1.65)	5 (0.20)	5 (0.21)	0	0
Cirsium vulgare	bull thistle	2008–2009	6 (0.10)	1 (0.21)	3 (0.12)	1 (0.06)	0	1 (0.18)
		2010	9 (0.14)	4 (0.88)	3 (0.12)	1 (0.04)	0	1 (0.17)
		2012	6 (0.09)	1 (0.23)	2 (0.08)	3 (0.13)	0	0
		2014	0	0	0	0	0	0
		2016	4 (0.06)	0	3 (0.12)	1 (0.04)	0	0
		2018	0	0	0	0	0	0

Table 3-5. Total patches per kilometer of priority IEPs monitored in all years, detected parkwide, in northern drainages, southern drainages, main park road, other roads, and trails, Fossil Butte National Monument, 2008–2018, cont.

Scientific name	Common name	Year	Total patches (per kilometer)					
			Parkwide	Northern drainages[a]	Southern drainages[b]	Main park road	Other roads[c]	Trails[d]
Convolvulus arvensis	field bindweed	2008–2009	4 (0.07)	0	0	4 (0.22)	0	0
		2010	1 (0.02)	0	0	1 (0.04)	0	0
		2012	0	0	0	0	0	0
		2014	2 (0.03)	0	0	2 (0.09)	0	0
		2016	2 (0.03)	0	0	2 (0.08)	0	0
		2018	2 (0.03)	0	0	2 (0.08)	0	0
Descurainia sophia[g]	flixweed	2008–2009	–	–	–	–	–	–
		2010	–	–	–	–	–	–
		2012	3 (0.05)	0	1 (0.04)	2 (0.08)	0	0
		2014	164 (2.48)	6 (1.23)	64 (2.51)	75 (3.19)	9 (1.35)	10 (1.83)
		2016	80 (1.20)	3 (0.62)	23 (0.91)	43 (1.83)	0	11 (1.75)
		2018	55 (0.82)	6 (1.24)	6 (0.24)	33 (1.40)	3 (0.45)	7 (1.11)
Elymus repens	quackgrass	2008–2009	53 (0.88)	0	3 (0.12)	49 (2.73)	1 (0.15)	0
		2010	95 (1.45)	13 (2.85)	0	69 (3.06)	8 (1.15)	5 (0.83)
		2012	23 (0.35)	0	2 (0.08)	21 (0.89)	0	0
		2014	5 (0.35)	1 (0.20)	0	4 (0.17)	0	0
		2016	31 (0.47)	0	2 (0.08)	25 (1.06)	0	4 (0.64)
		2018	20 (0.30)	0	1 (0.04)	19 (0.81)	0	0
Hyoscyamus niger	black henbane	2008–2009	19 (0.31)	1 (0.21)	2 (0.08)	16 (0.89)	0	0
		2010	5 (0.08)	1 (0.22)	2 (0.08)	2 (0.09)	0	0
		2012	4 (0.06)	0	0	4 (0.17)	0	0
		2014	4 (0.06)	0	0	4 (0.17)	0	0
		2016	10 (0.15)	0	0	10 (0.42)	0	0
		2018	3 (0.04)	0	0	3 (0.13)	0	0

Table 3-5. Total patches per kilometer of priority IEPs monitored in all years, detected parkwide, in northern drainages, southern drainages, main park road, other roads, and trails, Fossil Butte National Monument, 2008–2018, cont.

Scientific name	Common name	Year	Total patches (per kilometer)					
			Parkwide	Northern drainages[a]	Southern drainages[b]	Main park road	Other roads[c]	Trails[d]
Melilotus officinalis	yellow sweetclover	2008–2009	54 (0.89)	0	6 (0.24)	48 (2.67)	0	0
	yellow sweetclover	2010	54 (0.83)	0	18 (0.71)	35 (1.55)	0	1 (0.17)
	yellow sweetclover	2012	10 (0.15)	0	3 (0.12)	6 (0.25)	0	1 (0.17)
	yellow sweetclover	2014	20 (0.30)	0	5 (0.20)	15 (0.64)	0	0
	yellow sweetclover	2016	23 (0.35)	0	8 (0.32)	14 (0.59)	0	1 (0.16)
	yellow sweetclover	2018	21 (0.31)	0	11 (0.43)	6 (0.25)	0	4 (0.64)
All IEP species[h]		2008–2009	256 (4.24)	22 (4.54)	73 (2.87)	159 (8.85)	1 (0.15)	1 (0.18)
		2010	319 (4.88)	46 (10.08)	105 (4.16)	139 (6.17)	14 (2.01)	15 (2.49)
		2012	132 (2.00)	12 (2.77)	73 (2.89)	44 (1.87)	0	3 (0.50)
		2014	210 (3.18)	31 (6.35)	122 (4.78)	52 (2.21)	4 (0.60)	1 (0.18)
		2016	307 (4.61)	27 (5.58)	175 (6.95)	92 (3.91)	5 (0.75)	8 (1.27)
		2018	281 (4.21)	29 (5.99)	181 (7.11)	59 (2.51)	6 (0.90)	6 (0.95)

[a]Northern drainages: Millet Canyon, Murder Hill, South Millet Canyon, South Murder Hill, and Moose Bones.

[b]Southern drainages: all Chicken Creek tributaries, Small Pox Creek, Matate, Sage Grouse Lek, Wasatch Saddle, Red Hill, and Fossil Butte.

[c]Other Roads: Rubey Point, Bullpen 2-Track, Eagle Nest, and Cundick Ridge.

[d]Trails: Chicken Creek Nature Trail, Historic Quarry Trail.

[e]Added to priority list in 2016.

[f]Added to priority list in 2014.

[g]Added to priority list in 2012.

[h]Does not include cheatgrass, flixweed, or Japanese brome because these species were added to the IEP priority list after the early monitoring years.

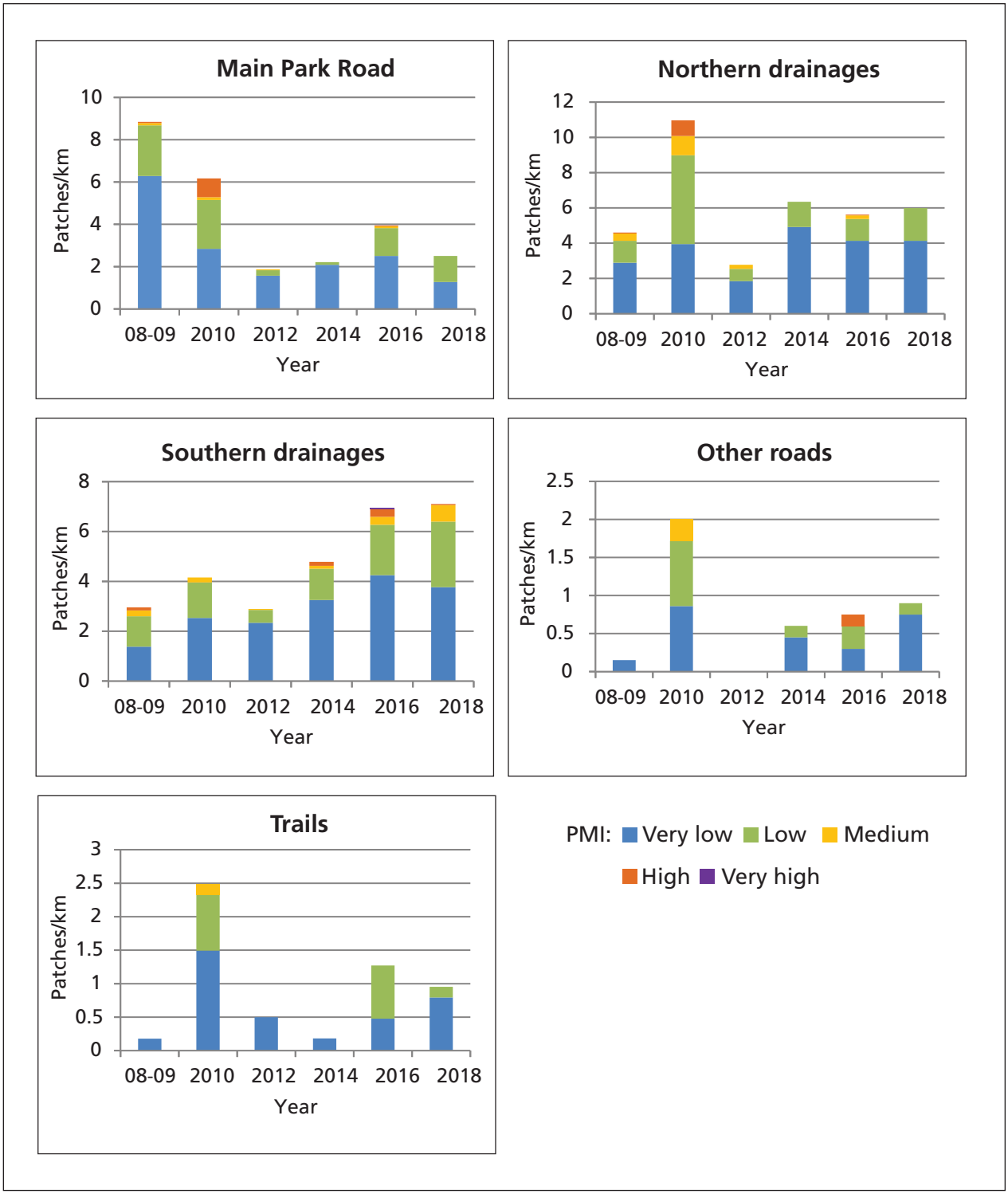


Figure 3-7. Total number of patches per kilometer and patch management index of all IEP species detected parkwide, in northern drainages, southern drainages, main park road, other roads, and trails in Fossil Butte National Monument, 2008–2018. (Does not include cheatgrass, Japanese brome, or flixweed, as these species were not searched for in early monitoring years.)

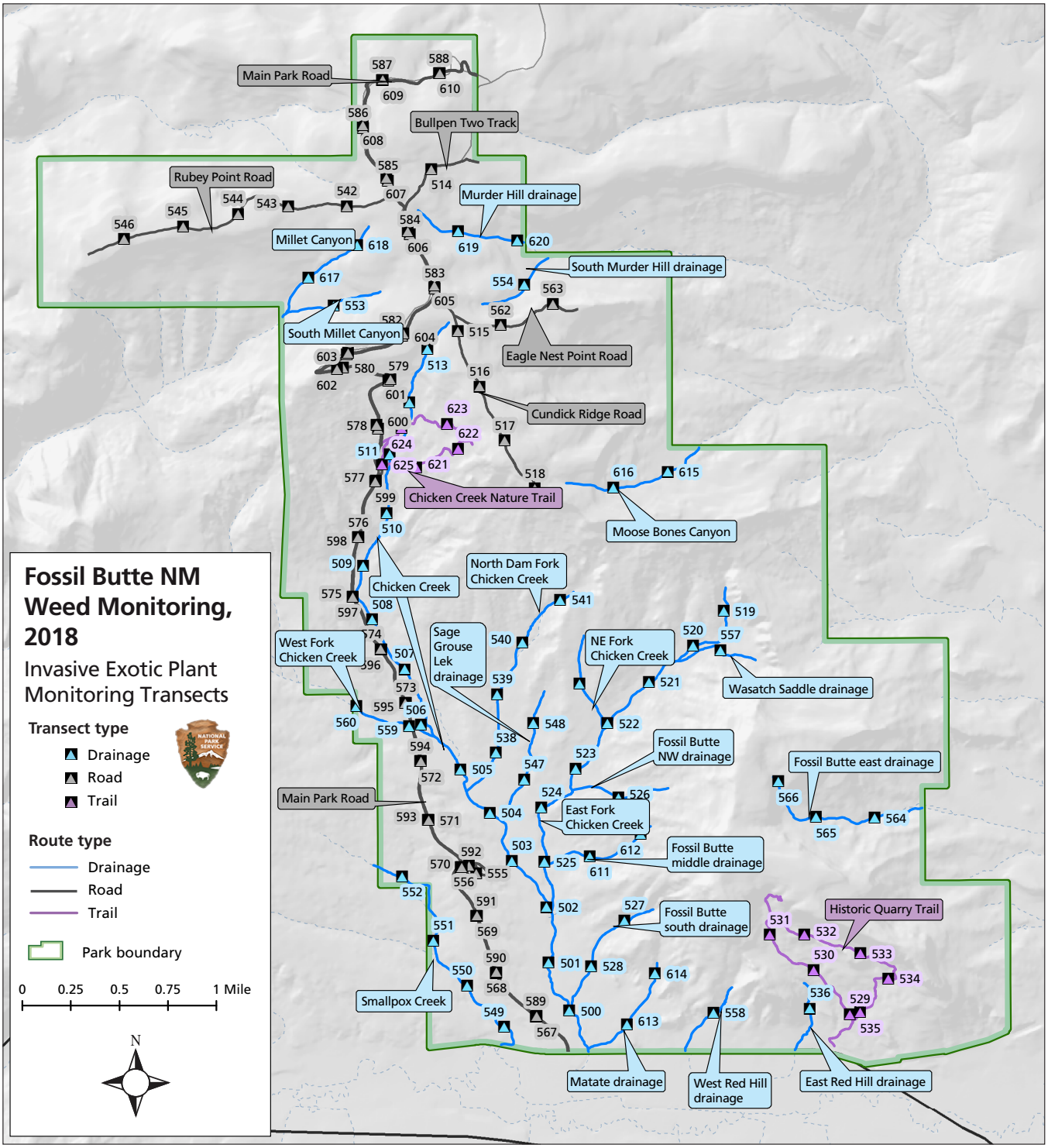


Figure 3-8. Invasive plant monitoring transects, Fossil Butte National Monument, June 28–July 1, 2018.

Table 3-6. Detections and mean percent cover of four common IEP species in transects in monitoring areas, Fossil Butte National Monument, 2008–2018.

Area	Year(s)	Cheatgrass		Creeping foxtail[a]		Flixweed[b]		Japanese brome[c]	
		Detected/ total	% cover (SE)	Detected/ total	% cover (SE)	Detected/ total	% cover (SE)	Detected/ total	% cover (SE)
Parkwide	2008–2009[d]	3/102	0.08 (0.05)	0/102	0	–	–	–	–
	2010	9/96	0.09 (0.04)	1/96	0.24 (0.24)	–	–	–	–
	2012	3/100	0.29 (0.27)	2/100	0.03 (0.02)	0/100	0	–	–
	2014	12/122	0.37 (0.19)	1/122	0.04 (0.02)	8/122	0.04 (0.01)	–	–
	2016	27/142	0.08 (0.02)	8/142	0.16 (0.13)	3/142	0.02 (0.01)	6/142	0.02 (0.01)
	2018	34/125	0.11 (0.03)	7/125	0.54 (0.29)	5/125	0.01 (0.01)	14/125	0.06 (0.03)
Northern drainages[e]	2008–2009[d]	0/12	0	0/12	0	–	–	–	–
	2010	0/10	0	0/10	0	–	–	–	–
	2012	0/8	0	0/8	0	0/8	0	–	–
	2014	0/8	0	0/8	0	0/8	0	–	–
	2016	0/11	0	0/11	0	0/11	0	0/11	0
	2018	0/8	0	0/8	0	0/8	0	0/8	0
Southern drainages[f]	2008–2009[d]	–	–	–	–	–	–	–	–
	2010	0/48	0	1/48	0.49 (0.49)	–	–	–	–
	2012	1/43	0.62 (0.62)	2/43	0.06 (0.04)	0/43	0	–	–
	2014	2/47	0.05 (0.04)	1/47	0.11 (0.02)	4/47	0.04 (0.02)	–	–
	2016	2/59	0.01 (0.004)	8/59	0.39 (0.31)	0/59	0	2/59	0.03 (0.02)
	2018	3/47	0.01 (0.01)	7/47	1.44 (0.75)	1/47	0.01 (0.01)	1/47	0.01 (0.01)
Main park road[g]	2008–2009[d]	2/20	0.33 (0.23)	0/20	0	–	–	–	–
	2010	9/23	0.36 (0.17)	0/23	0	–	–	–	–
	2012	2/30	0.06 (0.06)	0/30	0	0/30	0	–	–
	2014	10/45	0.94 (0.51)	0/45	0	3/45	0.05 (0.03)	–	–
	2016	22/46	0.18 (0.05)	0/46	0	1/46	0.04 (0.004)	3/46	0.01 (0.01)
	2018	27/46	0.22 (0.05)	0/46	0	3/46	0.02 (0.01)	12/46	0.07 (0.15)

Table 3-6. Detections and mean percent cover of four common IEP species in transects in monitoring areas, Fossil Butte National Monument, 2008–2018, cont.

Area	Year(s)	Cheatgrass		Creeping foxtail[a]		Flixweed[b]		Japanese brome[c]	
		Detected/ total	% cover (SE)	Detected/ total	% cover (SE)	Detected/ total	% cover (SE)	Detected/ total	% cover (SE)
Other roads[g,h]	2008–2009[d]	0/6	0	0/6	0	–	–	–	–
	2010	0/12	0	0/12	0	–	–	–	–
	2012	0/10	0	0/10	0	0/10	0	–	–
	2014	0/12	0	0/12	0	1/12	0.03 (0.03)	–	–
	2016	0/15	0	0/15	0	0/15		0/15	0
	2018	1/12	0.01 (0.01)	0/12	0	0/12	0	0/12	0
Trails[i]	2008–2009[d]	1/12	0.08 (0.08)	0/12	0	–	–	–	–
	2010	0/10	0	0/10	0	–	–	–	–
	2012	0/10	0	0/10	0	0/10	0	–	–
	2014	0/10	0	0/10	0	0/10	0	–	–
	2016	3/12	0.22 (0.18)	0/12	0	2/12	0.04 (0.03)	1/12	0.01 (0.01)
	2018	3/12	0.21 (0.17)	0/12	0	1/12	0.01 (0.01)	1/12	0.03 (0.03)

[a]Not identified in 2008.

[b]Added to priority list in 2012.

[c]Added to priority list in 2016.

[d]In 2008 and 2009, transect methods differed slightly in placement of 1 m^2 quadrats from all subsequent years.

[e]Northern drainages: Millet Canyon, Murder Hill, South Millet Canyon, South Murder Hill, and Moose Bones.

[f]Southern drainages: all Chicken Creek tributaries, Small Pox Creek, Matate, Sage Grouse Lek, Wasatch Saddle, Red Hill, and Fossil Butte.

[g]The density of transects along the main park road and other roads was lower in early monitoring years than in recent years.

[h]Other Roads: Rubey Point, Bullpen 2-Track, Eagle Nest, and Cundick Ridge.

[i]Trails: Chicken Creek Nature Trail, Historic Quarry Trail.

4 Discussion

4.1 Control efforts by park staff, 2017–2018

Fossil Butte National Monument staff treated 12 IEP species in 2017–2018, 11 of which were priority species (Table 4-1). In both years, work focused on roadsides, the Historic Quarry area, Millet Canyon, Chicken Creek Nature Trial, Murder Hill, and around the park visitor center and maintenance buildings (including an area affected by burying a cable line in 2018). Declines in some treated species along the main park road (particularly Canada thistle, black henbane, flixweed, and yellow sweetclover) are likely due to these treatments (see Table 3-6). There were not substantial changes in targeted species along the other routes where treatment occurred from 2016 to 2018, but treatments may be preventing increases in these species along these routes. Along the Historic Quarry Trail, yellow sweetclover was detected for the first time in 2018, but there was a decline in flixweed from 2016 to 2018.

In 2017, a total of 14,445 IEPs were pulled, 2.38 acres of IEPs were sprayed with herbicide, and 88.5 thirty-three-gallon bags of mowed cheatgrass were removed. In 2018, a total of 7,984 IEPs were pulled, 0.73 acres of IEPs were sprayed with herbicide, and 41 thirty-three-gallon bags of mowed cheatgrass were removed. A portion of these efforts occurred after the NCPN IEP monitoring trip.

4.2 Possibilities for management control

The NCPN will continue to work with Fossil Butte NM staff and area weed experts to review and update the list of priority species each year. Based on current control efforts, yellow salsify could be considered for addition to the park's IEP priority list.

Presence and absence data for most priority species should be reliable for the areas searched. However, absence data for other species are suspect, as they are not consistently recorded from year to year.

Despite control efforts, patch density of cheatgrass continued to increase throughout much of the park between 2014 and 2018. The overall percent cover of cheatgrass across the park has remained below 1% and fluctuated in recent years, while the percent of transects with cheatgrass has steadily increased over all monitoring years. This suggests that cheatgrass is becoming more widespread but is often sparse in distribution. However, park managers should be congratulated for even being able to consider controlling cheatgrass, as its levels at

Table 4-1. Amounts of IEPs removed by species, Fossil Butte National Monument, 2017–2018.

Scientific name	Common name	Method	2017	2018
Bromus tectorum	cheatgrass	mowed	88.5 bags (33-gal)	41 bags (33-gal)
Cardaria sp.	whitetop	sprayed	0.88 acres	0.13 acres
Carduus nutans	musk thistle	pulled	386 plants	1,760 plants
Centaurea maculosa	spotted knapweed	pulled	28 plants	477 plants
Cirsium arvense	Canada thistle	sprayed	1.5 acres	0.41 acres
Cirsium vulgare	bull thistle	pulled	26 plants	0 plants
Convolvulus arvensis	field bindweed	sprayed	0 plants	0.06 acres
Descurainia sophia	flixweed	pulled	5,705 plants	1,217 plants
Hyoscyamus niger	black henbane	pulled	135 plants	969 plants
Melilotus officinalis	yellow sweetclover	pulled, sprayed	4,209 plants	1,283 plants, 0.13 acres
*Tragopon dubius**	yellow salsify	pulled	3,884 plants	2,274 plants
Verbascum thapsus	common mullein	pulled	72 plants	4 plants

*Not on the IEP priority list

many parks are too high for control efforts to be effective. Japanese brome also increased throughout the park from 2016 to 2018. Creeping foxtail continues to increase throughout the park, especially throughout the southern drainages, where it has been the driving cause for the overall increase in IEP patch density along these routes. However, it should be noted that field crews have had difficulty identifying this species, particularly in previous monitoring years. More confident identification of creeping foxtail in recent years could be at least partially responsible for the recent apparent increases in the prevalence of this species. Apparent declines in quackgrass across monitoring years may also be due, at least in part, to the difficulty in distinguishing this species from native *Elymus* species and their hybrids.

In 2012, we saw the lowest IEP patch densities parkwide for most IEP species out of all years monitored. Park staff believe the efforts of a seasonal biotechnician may have contributed to the large decrease in IEP patches seen from 2010 to 2012 (A. Aase, pers. comm.). The year 2012 was also notably dry. Most IEP species increased from 2012 to 2014, but several species have since remained relatively constant or declined slightly, including Canada thistle, yellow sweetclover, and musk thistle. Control efforts are likely slowing the spread of these species. Substantial declines in flixweed throughout much of the park since 2014 attest to the effectiveness of control efforts. Though recorded in 2016, no infestations of bull thistle or spotted knapweed were found in 2018. Overall, patch densities of consistently recorded species (i.e., not including cheatgrass, Japanese brome, or flixweed) along the main park road have declined in recent monitoring years, likely due to control efforts. If control efforts cease, several priority IEP species will likely increase over time.

The patch management index was originally intended to elucidate changes in IEP populations over time, but it can also be used to inform treatment decisions. In 2018, the vast majority of patches in Fossil Butte NM were classified as very low or low, indicating that most patches are small in area, sparse in cover, or both (Table 3-5, Figure 3-1). Patches with very low or low PMI should not be interpreted as insignificant. On the contrary, these patches may be some of the most important areas to treat, especially for isolated and/or uncommon species, such as black henbane. Prioritizing treatment of small-scale patches can effectively prevent future spread and make eradication possible. The large number of patches with very low and low PMI indicates that widespread species, such as cheatgrass, creeping foxtail, and Japanese brome, are sparsely scattered across a broad landscape. Controlling these populations will mean travel across broad areas. When determining treatment priorities, managers should consider species traits (e.g., how likely and quickly plants may spread) and environmental conditions (precipitation and temperature), and combine this information with patch numbers and PMI values.

Areas away from riparian areas and the main park road continued to have fewer IEPs. In 2018, the Wasatch Saddle drainage and the Fossil Butte NW drainage were free of priority weed species. Efforts should be made to eliminate patches in nearby drainages and trails to prevent increasing infestations in this area. Additionally, in the central area of the park, the East and NE forks of Chicken Creek and the Sage Grouse Lek drainage had low patch densities in 2018. The Murder Hill drainage and nearby Cundick Ridge and Eagle Nest Point roads also had low patch densities. These areas should be priority locations for future control efforts.

It should be noted that estimates of percent cover in this report (see Section 3.2) 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. Data from monitoring routes are meant to provide information for control efforts. Unlike the monitoring transects and associated quadrats, the routes are not designed to make statistical comparisons between years and areas. However, large changes in patches are likely to represent biological realities.

4.3 Future monitoring efforts

IEPs at Fossil Butte NM will generally be monitored biennially, at the same time of year. Consistency in timing of monitoring should ensure consistency in detection probabilities and cover estimates of most species. For many species, sampling at any time from June to August is not expected to drastically alter the chances of detecting invasive species larger than the minimum detection target size. A complete seventh rotation of monitoring routes will be completed in 2020. Long-term trend reporting will focus on trends in species distributions and percent cover of individual species, and changes in IEP percent cover of priority species by monitoring route. Extra-area surveys will also be considered for inventories at the park's request.

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Appendices

Appendix A. Exotic plant patches detected on monitoring routes at Fossil Butte NM, June 28–July 1, 2018.

Plot_ID	Species	Master_Common_Name	Pulled	N_Coord	E_Coord	Cover_Class	Size_Class
Bullpen Two Track	Alopecurus arundinaceus	Creeping foxtail	0	4637455.21	518577.863	3	2
Bullpen Two Track	Alopecurus arundinaceus	Creeping foxtail	0	4637510.736	518646.008	1	2
Bullpen Two Track	Alopecurus arundinaceus	Creeping foxtail	0	4637536.53	518822.543	1	3
Bullpen Two Track	Bromus tectorum	Cheatgrass	0	4637526.544	518768.243	1	3
Bullpen Two Track	Bromus tectorum	Cheatgrass	0	4637559.415	518923.701	3	3
Bullpen Two Track	Descurainia sophia	Flixweed	0	4637574.091	518921.548	1	2
Bullpen Two Track	Poa bulbosa	Bulbous bluegrass	0	4637532.293	518804.741	2	4
Bullpen Two Track	Poa bulbosa	Bulbous bluegrass	0	4637550.692	519002.104	2	3
Bullpen Two Track	Poa bulbosa	Bulbous bluegrass	0	4637562.527	518950.721	3	4
Bullpen Two Track	Poa bulbosa	Bulbous bluegrass	0	4637560.896	518888.119	3	4
Bullpen Two Track	Tragopogon dubius	Yellow salsify	0	4637342.571	518526.815	1	2
Bullpen Two Track	Tragopogon dubius	Yellow salsify	0	4637405.43	518569.407	1	2
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4634222.943	518074.13	2	5
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4634168.739	518048.384	3	5
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4630429.385	519830.408	2	3
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4631679.932	519371.914	2	3
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4631400.694	519567.335	2	5
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4630378.24	519842.668	2	3
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4630569.344	519749.093	2	3
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4631099.321	519627.197	2	3
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4634956.476	518256.839	1	2
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4631145.392	519654.356	2	3
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4631052.805	519635.913	2	2
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4632522.777	518865.841	3	5
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4631585.527	519474.396	1	4
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4634444.279	518191.705	3	5
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4634099.783	518037.38	1	3
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4634653.42	518261.518	1	2
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4632929.625	518532.52	2	5
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4632572.925	518850.884	3	5
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4631346.129	519615.46	2	3

Appendix A. Exotic plant patches detected on monitoring routes at Fossil Butte NM, June 28–July 1, 2018, cont.

Plot_ID	Species	Master_Common_Name	Pulled	N_Coord	E_Coord	Cover_Class	Size_Class
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4634001.881	518003.316	2	5
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4631543.546	519507.362	2	5
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4634999.848	518280.616	2	2
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4634401.242	518160.49	3	5
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4631214.232	519631.567	2	3
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4634815.23	518279.549	1	2
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4630968.611	519619.427	1	2
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4635089.385	518280.747	2	2
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4631274.136	519625.25	2	4
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4633718.32	518158.484	3	3
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4632875.054	518543.503	3	5
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4635460.378	518466.143	2	5
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4632226.05	519018.757	2	2
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4635400.623	518465.311	2	4
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4633234.233	518457.694	3	2
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4634047.534	518028.139	2	4
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4632369.257	518913.385	2	5
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4633808.067	518092.646	1	3
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4633027.923	518533.542	1	5
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4630908.01	519616.336	1	2
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4635156.303	518295.814	2	2
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4632977.952	518539.929	2	5
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4631494.59	519529.39	2	4
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4632314.293	518917.301	2	5
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4630261.05	519870.545	2	2
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4634765.938	518266.944	3	4
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4633345.382	518394.632	2	2
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4631904.836	519209.01	2	2
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4633076.937	518515.946	2	5
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4632096.331	519186.434	2	3
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4635247.098	518380.513	2	3
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4630642.188	519692.642	2	2
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4630476.134	519806.354	1	3

Appendix A. Exotic plant patches detected on monitoring routes at Fossil Butte NM, June 28–July 1, 2018, cont.

Plot_ID	Species	Master_Common_Name	Pulled	N_Coord	E_Coord	Cover_Class	Size_Class
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4630829.456	519605.377	2	2
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4633141.082	518503.848	3	4
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4633480.393	518269.204	3	5
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4630699.13	519613.746	2	2
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4631363.583	519592.045	3	5
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4631447.811	519556.392	2	4
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4634522.644	518253.118	1	2
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4632266.452	518930.328	2	5
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4632473.966	518891.855	3	5
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4632865.141	518614.935	2	5
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4633766.63	518122.185	2	3
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4630223.361	519879.942	2	2
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4632776.028	518678.087	3	3
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4632619.384	518822.342	3	5
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4632187.311	519073.902	2	3
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4634587.778	518254.294	1	2
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4634482.389	518227.532	2	2
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4633620.127	518184.585	3	5
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4632428.286	518914.453	3	5
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4632055.182	519241.932	2	5
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4630331.708	519837.265	2	3
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4630871.761	519577.722	1	2
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4631616.607	519438.676	1	4
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4632818.194	518642.456	2	4
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4634319.342	518105.444	2	5
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4633440.211	518302.501	2	2
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4635509.511	518455.612	3	5
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4631803.174	519272.953	2	2
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4633665.718	518183.826	3	3
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4633556.64	518223.078	3	4
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4632662.396	518791.37	2	5
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4632739.106	518715.609	2	4
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4632705.391	518758.097	3	4

Appendix A. Exotic plant patches detected on monitoring routes at Fossil Butte NM, June 28–July 1, 2018, cont.

Plot_ID	Species	Master_Common_Name	Pulled	N_Coord	E_Coord	Cover_Class	Size_Class
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4634363.813	518124.062	2	5
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4631999.594	519236.871	2	4
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4634268.922	518090.704	2	5
Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4632148.786	519111.897	2	3
Chicken Creek	Bromus japonicus	Japanese chess	0	4631357.425	519608.306	2	2
Chicken Creek	Bromus japonicus	Japanese chess	0	4633534.493	518243.381	2	3
Chicken Creek	Bromus japonicus	Japanese chess	0	4634080.742	518033.066	2	2
Chicken Creek	Bromus japonicus	Japanese chess	0	4633263.554	518436.358	3	2
Chicken Creek	Bromus japonicus	Japanese chess	0	4633442.47	518294.775	2	5
Chicken Creek	Bromus tectorum	Cheatgrass	0	4633118.634	518506.645	2	5
Chicken Creek	Bromus tectorum	Cheatgrass	0	4633507.222	518251.391	2	5
Chicken Creek	Bromus tectorum	Cheatgrass	0	4632822.222	518647.277	3	2
Chicken Creek	Bromus tectorum	Cheatgrass	0	4631349.032	519597.015	3	3
Chicken Creek	Bromus tectorum	Cheatgrass	0	4633544.452	518231.264	2	3
Chicken Creek	Bromus tectorum	Cheatgrass	0	4634126.756	518038.86	1	5
Chicken Creek	Bromus tectorum	Cheatgrass	0	4634062.696	518029.742	2	3
Chicken Creek	Bromus tectorum	Cheatgrass	0	4631322.204	519621.259	3	3
Chicken Creek	Bromus tectorum	Cheatgrass	0	4633251.339	518442.704	2	5
Chicken Creek	Bromus tectorum	Cheatgrass	0	4633401.332	518338.701	3	2
Chicken Creek	Bromus tectorum	Cheatgrass	0	4633454.601	518279.072	2	5
Chicken Creek	Bromus tectorum	Cheatgrass	0	4631031.938	519623.929	3	2
Chicken Creek	Cirsium arvense	Canada thistle	0	4630768.757	519616.852	3	2
Chicken Creek	Cirsium arvense	Canada thistle	0	4635291.647	518401.933	2	2
Chicken Creek	Descurainia sophia	Flixweed	0	4632292.375	518949.935	1	2
Chicken Creek	Descurainia sophia	Flixweed	0	4633160.397	518488.983	1	3
Chicken Creek	Melilotus officinalis	Yellow sweet-clover	0	4633392.283	518351.883	3	2
Chicken Creek	Melilotus officinalis	Yellow sweet-clover	0	4630207.115	519896.092	2	2
Chicken Creek	Tragopogon dubius	Yellow salsify	1	4635034.417	518286.852	5	1
Chicken Creek Nature Trail	Alopecurus arundinaceus	Creeping foxtail	0	4634997.922	518359.89	2	2
Chicken Creek Nature Trail	Alopecurus arundinaceus	Creeping foxtail	0	4635380.929	518482.095	3	2
Chicken Creek Nature Trail	Bromus japonicus	Japanese chess	0	4635231.197	518230.777	2	2
Chicken Creek Nature Trail	Bromus japonicus	Japanese chess	0	4635015.063	518222.031	2	2
Chicken Creek Nature Trail	Bromus tectorum	Cheatgrass	0	4635236.442	518903.082	1	5

Appendix A. Exotic plant patches detected on monitoring routes at Fossil Butte NM, June 28–July 1, 2018, cont.

Plot_ID	Species	Master_Common_Name	Pulled	N_Coord	E_Coord	Cover_Class	Size_Class
Chicken Creek Nature Trail	Bromus tectorum	Cheatgrass	0	4635072.907	518637.455	3	2
Chicken Creek Nature Trail	Bromus tectorum	Cheatgrass	0	4635153.008	518782.795	2	4
Chicken Creek Nature Trail	Bromus tectorum	Cheatgrass	0	4635155.425	518836.754	1	4
Chicken Creek Nature Trail	Bromus tectorum	Cheatgrass	0	4635030.089	518218.455	1	2
Chicken Creek Nature Trail	Bromus tectorum	Cheatgrass	0	4635102.86	518223.486	2	2
Chicken Creek Nature Trail	Bromus tectorum	Cheatgrass	0	4635344.345	518830.252	3	2
Chicken Creek Nature Trail	Bromus tectorum	Cheatgrass	0	4635224.081	518266.423	2	2
Chicken Creek Nature Trail	Bromus tectorum	Cheatgrass	0	4635393.282	518667.387	1	3
Chicken Creek Nature Trail	Bromus tectorum	Cheatgrass	0	4635130.448	518707.816	3	2
Chicken Creek Nature Trail	Descurainia sophia	Flixweed	0	4635182.157	518837.31	1	2
Chicken Creek Nature Trail	Melilotus officinalis	Yellow sweet-clover	0	4635445.916	518523.457	5	1
Chicken Creek Nature Trail	Melilotus officinalis	Yellow sweet-clover	0	4635315.849	518361.713	2	2
Chicken Creek Nature Trail	Tragopogon dubius	Yellow salsify	0	4635375.792	518436.302	1	2
Chicken Creek Nature Trail	Tragopogon dubius	Yellow salsify	0	4635263.395	518298.223	1	2
Chicken Creek Nature Trail	Tragopogon dubius	Yellow salsify	0	4635350.448	518388.16	2	2
Chicken Creek Nature Trail	Tragopogon dubius	Yellow salsify	0	4635429.67	518503.777	1	2
Chicken Creek Nature Trail	Tragopogon dubius	Yellow salsify	0	4635287.95	518344.413	2	2
Chicken Creek Nature Trail	Tragopogon dubius	Yellow salsify	0	4635389.715	518650.527	1	3
Chicken Creek Nature Trail	Tragopogon dubius	Yellow salsify	0	4635416.802	518573.591	1	3
Cundick Ridge Road	Alopecurus arundinaceus	Creeping foxtail	0	4635311	519192.985	3	1
Cundick Ridge Road	Bromus tectorum	Cheatgrass	0	4634810.475	519518.926	2	2
Cundick Ridge Road	Carduus nutans	Musk thistle	1	4634847.237	519480.206	5	1
Cundick Ridge Road	Descurainia sophia	Flixweed	0	4634824.533	519501.306	2	2
Cundick Ridge Road	Tragopogon dubius	Yellow salsify	0	4635467.743	519113.548	1	4
Cundick Ridge Road	Tragopogon dubius	Yellow salsify	0	4635633.703	519045.4	1	4
Cundick Ridge Road	Tragopogon dubius	Yellow salsify	0	4636463.122	518692.676	1	2
Cundick Ridge Road	Tragopogon dubius	Yellow salsify	0	4635745.661	519002.398	1	4
Cundick Ridge Road	Tragopogon dubius	Yellow salsify	0	4634874.532	519482.084	1	2
Cundick Ridge Road	Tragopogon dubius	Yellow salsify	0	4635577.792	519072.151	1	4
Cundick Ridge Road	Tragopogon dubius	Yellow salsify	0	4635694.415	519025.665	1	4
Cundick Ridge Road	Tragopogon dubius	Yellow salsify	0	4635025.158	519326.096	1	2
Cundick Ridge Road	Tragopogon dubius	Yellow salsify	0	4635523.287	519084.631	1	4
Cundick Ridge Road	Tragopogon dubius	Yellow salsify	0	4635410.016	519154.247	1	4

Appendix A. Exotic plant patches detected on monitoring routes at Fossil Butte NM, June 28–July 1, 2018, cont.

Plot_ID	Species	Master_Common_Name	Pulled	N_Coord	E_Coord	Cover_Class	Size_Class
Cundick Ridge Road	Tragopogon dubius	Yellow salsify	0	4635328.463	519185.908	1	4
Eagle Nest Point Road	Descurainia sophia	Flixweed	0	4636322.408	519733.618	1	1
Eagle Nest Point Road	Tragopogon dubius	Yellow salsify	0	4636186.772	519277.841	1	4
Eagle Nest Point Road	Tragopogon dubius	Yellow salsify	0	4636194.936	519343.652	1	4
Eagle Nest Point Road	Tragopogon dubius	Yellow salsify	0	4636190.301	519124.824	1	4
Eagle Nest Point Road	Tragopogon dubius	Yellow salsify	0	4636330.348	519550.516	1	4
Eagle Nest Point Road	Tragopogon dubius	Yellow salsify	0	4636196.706	519202.443	1	4
Eagle Nest Point Road	Tragopogon dubius	Yellow salsify	0	4636322.128	519804.682	2	5
Eagle Nest Point Road	Tragopogon dubius	Yellow salsify	0	4636365.013	519653.289	1	4
Eagle Nest Point Road	Tragopogon dubius	Yellow salsify	0	4636292.258	519470.292	1	4
Eagle Nest Point Road	Tragopogon dubius	Yellow salsify	0	4636191.522	519043.694	1	4
Eagle Nest Point Road	Tragopogon dubius	Yellow salsify	0	4636319.117	519749.443	2	5
Eagle Nest Point Road	Tragopogon dubius	Yellow salsify	0	4636339.835	519697.5	1	4
Eagle Nest Point Road	Tragopogon dubius	Yellow salsify	0	4636365.258	519593.332	1	4
Eagle Nest Point Road	Tragopogon dubius	Yellow salsify	0	4636203.151	518961.498	1	4
Eagle Nest Point Road	Tragopogon dubius	Yellow salsify	0	4636228.116	519402.248	1	4
East Fork Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4631583.317	519603.744	2	2
East Fork Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4631966.585	519541.391	1	2
East Fork Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4632195.739	519551.596	1	2
East Fork Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4631443.893	519625.112	2	2
East Fork Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4633533.38	520799.07	2	3
East Fork Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4631633.287	519569.279	1	2
East Fork Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4632033.284	519519.036	1	2
East Fork Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4631847.893	519555.2	1	2
East Fork Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4631527.628	519627.108	2	2
East Fork Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4631375.951	519626.611	2	2
East Fork Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4631747.108	519568.59	1	2
East Fork Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4632129.337	519501.059	1	3
East Fork Chicken Creek	Bromus tectorum	Cheatgrass	0	4631406.217	519619.276	1	5
East Fork Chicken Creek	Bromus tectorum	Cheatgrass	0	4631486.529	519627.892	1	5
East Fork Chicken Creek	Bromus tectorum	Cheatgrass	0	4631558.747	519620.526	1	5
East Fork Chicken Creek	Tragopogon dubius	Yellow salsify	1	4633901.189	521050.206	5	1
East Fork Chicken Creek	Tragopogon dubius	Yellow salsify	0	4632281.231	520270.391	1	2

Appendix A. Exotic plant patches detected on monitoring routes at Fossil Butte NM, June 28–July 1, 2018, cont.

Plot_ID	Species	Master_Common_Name	Pulled	N_Coord	E_Coord	Cover_Class	Size_Class
East Fork Chicken Creek	Tragopogon dubius	Yellow salsify	0	4632355.843	520560.375	1	2
East Red Hill drainage	Alopecurus arundinaceus	Creeping foxtail	0	4630632.925	521773.978	2	2
East Red Hill drainage	Bromus japonicus	Japanese chess	0	4630531.766	521769.8	3	3
East Red Hill drainage	Bromus japonicus	Japanese chess	0	4630348.467	521744.5	1	3
East Red Hill drainage	Bromus japonicus	Japanese chess	0	4630398.052	521790.247	2	3
East Red Hill drainage	Bromus japonicus	Japanese chess	0	4630451.332	521784.49	3	4
East Red Hill drainage	Bromus japonicus	Japanese chess	0	4630708.501	521762.154	1	3
East Red Hill drainage	Bromus japonicus	Japanese chess	0	4630238.684	521675.446	1	3
East Red Hill drainage	Bromus japonicus	Japanese chess	0	4630584.322	521761.749	2	3
East Red Hill drainage	Bromus japonicus	Japanese chess	0	4630646.737	521775.17	1	3
East Red Hill drainage	Bromus tectorum	Cheatgrass	0	4630490.113	521774.89	1	3
East Red Hill drainage	Bromus tectorum	Cheatgrass	0	4630437.54	521786.167	1	3
East Red Hill drainage	Bromus tectorum	Cheatgrass	0	4630285.858	521708.642	2	3
East Red Hill drainage	Bromus tectorum	Cheatgrass	0	4630598.206	521770.282	1	3
East Red Hill drainage	Bromus tectorum	Cheatgrass	0	4630664.568	521776.155	1	3
East Red Hill drainage	Bromus tectorum	Cheatgrass	0	4630719.305	521755.061	1	3
East Red Hill drainage	Bromus tectorum	Cheatgrass	0	4630544.51	521762.086	2	3
East Red Hill drainage	Carduus nutans	Musk thistle	1	4630426.262	521793.041	5	1
East Red Hill drainage	Descurainia sophia	Flixweed	0	4630502.224	521771.729	1	2
East Red Hill drainage	Descurainia sophia	Flixweed	0	4630555.343	521756.842	1	2
East Red Hill drainage	Melilotus officinalis	Yellow sweet-clover	0	4630226.7	521668.667	1	3
East Red Hill drainage	Melilotus officinalis	Yellow sweet-clover	0	4630318.136	521719.763	1	3
East Red Hill drainage	Melilotus officinalis	Yellow sweet-clover	0	4630367.217	521767.923	1	2
East Red Hill drainage	Melilotus officinalis	Yellow sweet-clover	0	4630570.369	521757.738	1	3
East Red Hill drainage	Melilotus officinalis	Yellow sweet-clover	0	4630621.289	521769.711	1	3
East Red Hill drainage	Melilotus officinalis	Yellow sweet-clover	0	4630695.1	521776.465	2	3
East Red Hill drainage	Melilotus officinalis	Yellow sweet-clover	0	4630265.554	521702.522	2	3
East Red Hill drainage	Tragopogon dubius	Yellow salsify	1	4630411.771	521795.303	5	1
East Red Hill drainage	Tragopogon dubius	Yellow salsify	1	4630728.088	521742.484	1	2
Fossil Butte east drainage	Alopecurus arundinaceus	Creeping foxtail	0	4632167.513	522581.763	3	2
Fossil Butte east drainage	Alopecurus arundinaceus	Creeping foxtail	0	4632098.659	521971.926	5	1
Fossil Butte east drainage	Alopecurus arundinaceus	Creeping foxtail	0	4632071.027	522197.875	1	3
Fossil Butte east drainage	Alopecurus arundinaceus	Creeping foxtail	0	4632165.538	522401.555	2	2

Appendix A. Exotic plant patches detected on monitoring routes at Fossil Butte NM, June 28–July 1, 2018, cont.

Plot_ID	Species	Master_Common_Name	Pulled	N_Coord	E_Coord	Cover_Class	Size_Class
Fossil Butte east drainage	Alopecurus arundinaceus	Creeping foxtail	0	4632105.773	522256.857	2	2
Fossil Butte east drainage	Bromus japonicus	Japanese chess	0	4632132.908	522346.207	3	2
Fossil Butte east drainage	Bromus tectorum	Cheatgrass	0	4632198.739	521593.471	2	4
Fossil Butte east drainage	Bromus tectorum	Cheatgrass	0	4632188.017	522601.733	2	3
Fossil Butte east drainage	Bromus tectorum	Cheatgrass	0	4632111.775	522083.981	2	3
Fossil Butte east drainage	Bromus tectorum	Cheatgrass	0	4632119.615	522025.114	2	3
Fossil Butte east drainage	Bromus tectorum	Cheatgrass	0	4632083.874	522157.178	1	3
Fossil Butte east drainage	Bromus tectorum	Cheatgrass	0	4632113.255	522270.925	1	3
Fossil Butte east drainage	Bromus tectorum	Cheatgrass	0	4632076.956	522210.219	1	4
Fossil Butte east drainage	Bromus tectorum	Cheatgrass	0	4632384.49	521513.805	1	5
Fossil Butte east drainage	Bromus tectorum	Cheatgrass	0	4632146.658	522481.471	1	3
Fossil Butte east drainage	Bromus tectorum	Cheatgrass	0	4632258.204	521561.332	1	4
Fossil Butte east drainage	Bromus tectorum	Cheatgrass	0	4632327.204	521542.07	1	3
Fossil Butte east drainage	Bromus tectorum	Cheatgrass	0	4632150.433	522425.605	2	3
Fossil Butte east drainage	Bromus tectorum	Cheatgrass	0	4632163.298	522366.938	1	3
Fossil Butte east drainage	Carduus nutans	Musk thistle	0	4632146.437	522460.92	1	2
Fossil Butte east drainage	Cirsium arvense	Canada thistle	0	4632162.23	522561.319	2	2
Fossil Butte east drainage	Descurainia sophia	Flixweed	0	4632415.136	521502.896	1	2
Fossil Butte east drainage	Descurainia sophia	Flixweed	0	4632119.225	522067.446	2	2
Fossil Butte middle drainage	Alopecurus arundinaceus	Creeping foxtail	0	4631831.777	520176.23	2	2
Fossil Butte middle drainage	Bromus tectorum	Cheatgrass	0	4631889.768	520268.358	2	5
Fossil Butte middle drainage	Bromus tectorum	Cheatgrass	0	4631938.45	520322.663	2	5
Fossil Butte middle drainage	Bromus tectorum	Cheatgrass	0	4631819.018	520151.199	3	2
Fossil Butte middle drainage	Bromus tectorum	Cheatgrass	0	4632015.469	520395.997	3	5
Fossil Butte middle drainage	Tragopogon dubius	Yellow salsify	0	4631773.045	520034.544	1	2
Fossil Butte south drainage	Bromus tectorum	Cheatgrass	0	4631228.681	520182.445	1	5
Fossil Butte south drainage	Bromus tectorum	Cheatgrass	0	4631301.624	520299.392	2	5
Fossil Butte south drainage	Bromus tectorum	Cheatgrass	0	4631264.067	520250.353	2	5
Fossil Butte south drainage	Bromus tectorum	Cheatgrass	0	4631173.104	520092.209	1	5
Fossil Butte south drainage	Bromus tectorum	Cheatgrass	0	4631347.183	520449.587	2	3
Fossil Butte south drainage	Cirsium arvense	Canada thistle	0	4630616.477	519797.13	2	2
Historic Quarry Trail	Agropyron cristatum	crested wheatgrass	0	4630269.677	521933.193	3	4
Historic Quarry Trail	Bromus japonicus	Japanese chess	0	4630469.731	522104.657	2	4

Appendix A. Exotic plant patches detected on monitoring routes at Fossil Butte NM, June 28–July 1, 2018, cont.

Plot_ID	Species	Master_Common_Name	Pulled	N_Coord	E_Coord	Cover_Class	Size_Class
Historic Quarry Trail	Bromus japonicus	Japanese chess	0	4630337.503	522028.403	1	3
Historic Quarry Trail	Bromus japonicus	Japanese chess	0	4630290.842	521995.07	1	3
Historic Quarry Trail	Bromus japonicus	Japanese chess	0	4630462.187	522167.88	1	3
Historic Quarry Trail	Bromus japonicus	Japanese chess	0	4630555.125	522036.521	1	3
Historic Quarry Trail	Bromus japonicus	Japanese chess	0	4630410.373	522126.408	2	4
Historic Quarry Trail	Bromus japonicus	Japanese chess	0	4630854.885	522479.934	2	1
Historic Quarry Trail	Bromus japonicus	Japanese chess	0	4630516.969	522075.428	2	3
Historic Quarry Trail	Bromus japonicus	Japanese chess	0	4630355.571	522076.644	1	3
Historic Quarry Trail	Bromus japonicus	Japanese chess	0	4630278.31	521944.924	2	4
Historic Quarry Trail	Bromus japonicus	Japanese chess	0	4630226.047	521965.966	2	4
Historic Quarry Trail	Bromus japonicus	Japanese chess	0	4630924.791	522328.49	1	2
Historic Quarry Trail	Bromus tectorum	Cheatgrass	0	4630770.679	522433.138	1	3
Historic Quarry Trail	Bromus tectorum	Cheatgrass	0	4630952.646	522255.736	1	3
Historic Quarry Trail	Bromus tectorum	Cheatgrass	0	4630454.169	522110.263	1	4
Historic Quarry Trail	Bromus tectorum	Cheatgrass	0	4631456.837	521492.242	2	3
Historic Quarry Trail	Bromus tectorum	Cheatgrass	0	4631088.453	521465.953	1	3
Historic Quarry Trail	Bromus tectorum	Cheatgrass	0	4630543.552	522049.055	1	4
Historic Quarry Trail	Bromus tectorum	Cheatgrass	0	4630849.227	521791.228	1	3
Historic Quarry Trail	Bromus tectorum	Cheatgrass	0	4630672.527	521971.513	1	3
Historic Quarry Trail	Bromus tectorum	Cheatgrass	0	4631379.707	521428.395	2	3
Historic Quarry Trail	Bromus tectorum	Cheatgrass	0	4630973.82	521541.876	1	3
Historic Quarry Trail	Bromus tectorum	Cheatgrass	0	4630902.249	521635.551	1	3
Historic Quarry Trail	Bromus tectorum	Cheatgrass	0	4630318.512	522018.028	1	3
Historic Quarry Trail	Bromus tectorum	Cheatgrass	0	4630398.058	522117.707	2	4
Historic Quarry Trail	Bromus tectorum	Cheatgrass	0	4630635.849	522009.838	3	3
Historic Quarry Trail	Bromus tectorum	Cheatgrass	0	4631465.192	521429.111	1	3
Historic Quarry Trail	Bromus tectorum	Cheatgrass	0	4630505.259	522083.913	1	4
Historic Quarry Trail	Bromus tectorum	Cheatgrass	0	4630588.262	522027.001	1	3
Historic Quarry Trail	Bromus tectorum	Cheatgrass	0	4631173	521593.62	1	2
Historic Quarry Trail	Bromus tectorum	Cheatgrass	0	4630248.724	521944.892	3	4
Historic Quarry Trail	Bromus tectorum	Cheatgrass	0	4631133.286	521767.977	1	2
Historic Quarry Trail	Bromus tectorum	Cheatgrass	0	4630942.16	521588.838	1	3
Historic Quarry Trail	Bromus tectorum	Cheatgrass	0	4631422.013	521402.101	2	3

Appendix A. Exotic plant patches detected on monitoring routes at Fossil Butte NM, June 28–July 1, 2018, cont.

Plot_ID	Species	Master_Common_Name	Pulled	N_Coord	E_Coord	Cover_Class	Size_Class
Historic Quarry Trail	Bromus tectorum	Cheatgrass	0	4630282.717	521981.33	1	3
Historic Quarry Trail	Bromus tectorum	Cheatgrass	0	4630527.659	522234.866	1	3
Historic Quarry Trail	Bromus tectorum	Cheatgrass	0	4630706.417	522314.694	3	3
Historic Quarry Trail	Bromus tectorum	Cheatgrass	0	4631227.878	521411.397	2	3
Historic Quarry Trail	Bromus tectorum	Cheatgrass	0	4630805.571	522476.31	1	2
Historic Quarry Trail	Bromus tectorum	Cheatgrass	0	4630614.654	522313.877	1	3
Historic Quarry Trail	Bromus tectorum	Cheatgrass	0	4630869.369	522472.52	1	2
Historic Quarry Trail	Bromus tectorum	Cheatgrass	0	4630793.385	521859.584	1	3
Historic Quarry Trail	Bromus tectorum	Cheatgrass	0	4631167.383	521436.506	1	3
Historic Quarry Trail	Bromus tectorum	Cheatgrass	0	4630751.873	521890.456	1	3
Historic Quarry Trail	Bromus tectorum	Cheatgrass	0	4630883.221	521745.811	1	3
Historic Quarry Trail	Bromus tectorum	Cheatgrass	0	4631274.486	521436.339	1	4
Historic Quarry Trail	Bromus tectorum	Cheatgrass	0	4631329.32	521439.723	1	3
Historic Quarry Trail	Bromus tectorum	Cheatgrass	0	4630711.039	521924.468	2	3
Historic Quarry Trail	Descurainia sophia	Flixweed	0	4630763.588	521882.093	1	2
Historic Quarry Trail	Descurainia sophia	Flixweed	0	4630793.937	522479.799	1	2
Historic Quarry Trail	Descurainia sophia	Flixweed	0	4630486.871	522181.354	1	2
Historic Quarry Trail	Descurainia sophia	Flixweed	0	4630685.806	521965.88	1	2
Historic Quarry Trail	Descurainia sophia	Flixweed	0	4630490.579	522089.913	1	2
Historic Quarry Trail	Descurainia sophia	Flixweed	0	4631436.984	521509.044	1	3
Historic Quarry Trail	Melilotus officinalis	Yellow sweet-clover	0	4630238.604	521957.574	1	2
Historic Quarry Trail	Melilotus officinalis	Yellow sweet-clover	0	4630876.361	522463.536	5	1
Historic Quarry Trail	Tragopogon dubius	Yellow salsify	1	4630308.071	522011.075	5	1
Historic Quarry Trail	Tragopogon dubius	Yellow salsify	1	4630976.745	522208.063	5	1
Historic Quarry Trail	Tragopogon dubius	Yellow salsify	1	4630603.203	522026.12	1	2
Historic Quarry Trail	Tragopogon dubius	Yellow salsify	1	4630477.11	522176.089	5	1
Historic Quarry Trail	Tragopogon dubius	Yellow salsify	1	4630516.163	522205.37	1	2
Historic Quarry Trail	Tragopogon dubius	Yellow salsify	1	4630877.042	522448.429	1	2
Historic Quarry Trail	Tragopogon dubius	Yellow salsify	1	4630964.127	521560.701	5	1
Main Park Road	Agropyron cristatum	crested wheatgrass	0	4637023.625	518416.646	2	2
Main Park Road	Agropyron cristatum	crested wheatgrass	0	4634979.149	518217.611	4	1
Main Park Road	Agropyron cristatum	crested wheatgrass	0	4637146	518406.482	2	2
Main Park Road	Agropyron cristatum	crested wheatgrass	0	4635795.21	518169.96	3	2

Appendix A. Exotic plant patches detected on monitoring routes at Fossil Butte NM, June 28–July 1, 2018, cont.

Plot_ID	Species	Master_Common_Name	Pulled	N_Coord	E_Coord	Cover_Class	Size_Class
Main Park Road	Alopecurus arundinaceus	Creeping foxtail	0	4638230.363	518293.485	3	2
Main Park Road	Alopecurus arundinaceus	Creeping foxtail	0	4638313.626	518879.052	2	3
Main Park Road	Alopecurus arundinaceus	Creeping foxtail	0	4632922.627	518453.682	2	4
Main Park Road	Alopecurus arundinaceus	Creeping foxtail	0	4638223.372	518410.624	3	1
Main Park Road	Alopecurus arundinaceus	Creeping foxtail	0	4637960.232	518068.491	1	2
Main Park Road	Alopecurus arundinaceus	Creeping foxtail	0	4637847.02	518059.55	2	2
Main Park Road	Alopecurus arundinaceus	Creeping foxtail	0	4638308.595	518760.303	2	2
Main Park Road	Alopecurus arundinaceus	Creeping foxtail	0	4638378.89	518906.343	5	1
Main Park Road	Alopecurus arundinaceus	Creeping foxtail	0	4635830.832	517840.527	3	2
Main Park Road	Alopecurus arundinaceus	Creeping foxtail	0	4638248.435	518587.707	2	2
Main Park Road	Alopecurus arundinaceus	Creeping foxtail	0	4636544.058	518652.898	3	2
Main Park Road	Alopecurus arundinaceus	Creeping foxtail	0	4638227.451	518270.856	2	2
Main Park Road	Alopecurus arundinaceus	Creeping foxtail	0	4637422.215	518250.974	3	2
Main Park Road	Alopecurus arundinaceus	Creeping foxtail	0	4638225.734	518401.068	2	2
Main Park Road	Alopecurus arundinaceus	Creeping foxtail	0	4635813.348	517717.19	3	2
Main Park Road	Alopecurus arundinaceus	Creeping foxtail	0	4638264.171	518650.452	1	3
Main Park Road	Alopecurus arundinaceus	Creeping foxtail	0	4638301.22	518938.75	3	2
Main Park Road	Bromus japonicus	Japanese chess	0	4632346.42	518529.22	1	3
Main Park Road	Bromus japonicus	Japanese chess	0	4634945.798	518175.971	2	3
Main Park Road	Bromus japonicus	Japanese chess	0	4634806.237	518107.233	1	3
Main Park Road	Bromus japonicus	Japanese chess	0	4633881.747	518001.259	1	2
Main Park Road	Bromus japonicus	Japanese chess	0	4635778.73	518216.618	2	3
Main Park Road	Bromus japonicus	Japanese chess	0	4635326.216	518194.5	1	2
Main Park Road	Bromus japonicus	Japanese chess	0	4634849.218	518134.421	2	2
Main Park Road	Bromus japonicus	Japanese chess	0	4632696.769	518505.518	1	2
Main Park Road	Bromus japonicus	Japanese chess	0	4633350.8	518304.733	1	3
Main Park Road	Bromus japonicus	Japanese chess	0	4635751.7	518293.5	1	2
Main Park Road	Bromus japonicus	Japanese chess	0	4633293.727	518317.176	1	3
Main Park Road	Bromus japonicus	Japanese chess	0	4636172.413	518420.049	1	2
Main Park Road	Bromus japonicus	Japanese chess	0	4635860.204	517988.486	2	3
Main Park Road	Bromus japonicus	Japanese chess	0	4632985.949	518430.252	1	2
Main Park Road	Bromus japonicus	Japanese chess	0	4633395.133	518273.05	1	3
Main Park Road	Bromus japonicus	Japanese chess	0	4634570.728	518052.497	1	3

Appendix A. Exotic plant patches detected on monitoring routes at Fossil Butte NM, June 28–July 1, 2018, cont.

Plot_ID	Species	Master_Common_Name	Pulled	N_Coord	E_Coord	Cover_Class	Size_Class
Main Park Road	Bromus japonicus	Japanese chess	0	4633494.401	518213.564	1	4
Main Park Road	Bromus japonicus	Japanese chess	0	4635773.777	518274.214	2	3
Main Park Road	Bromus japonicus	Japanese chess	0	4634245.123	517977.278	2	3
Main Park Road	Bromus japonicus	Japanese chess	0	4635015.979	518179.069	2	3
Main Park Road	Bromus japonicus	Japanese chess	0	4635840.533	518079.885	1	3
Main Park Road	Bromus japonicus	Japanese chess	0	4635241.361	518204.579	1	2
Main Park Road	Bromus japonicus	Japanese chess	0	4632287.506	518537.687	1	4
Main Park Road	Bromus japonicus	Japanese chess	0	4635789.371	518167.285	2	4
Main Park Road	Bromus japonicus	Japanese chess	0	4634673.623	518053.056	1	3
Main Park Road	Bromus japonicus	Japanese chess	0	4631887.654	518701.918	2	3
Main Park Road	Bromus japonicus	Japanese chess	0	4634428.637	518013.922	1	3
Main Park Road	Bromus japonicus	Japanese chess	0	4632026.704	518628.816	2	3
Main Park Road	Bromus japonicus	Japanese chess	0	4634193.476	517973.598	1	2
Main Park Road	Bromus japonicus	Japanese chess	0	4635861.619	518038.567	1	3
Main Park Road	Bromus japonicus	Japanese chess	0	4631952.834	518649.553	2	2
Main Park Road	Bromus japonicus	Japanese chess	0	4630242.11	519739.635	1	2
Main Park Road	Bromus japonicus	Japanese chess	0	4631853.931	518744.515	2	3
Main Park Road	Bromus japonicus	Japanese chess	0	4634792.833	518106.274	1	4
Main Park Road	Bromus japonicus	Japanese chess	0	4632103.033	518601.742	1	2
Main Park Road	Bromus japonicus	Japanese chess	0	4633827.158	518043.978	1	3
Main Park Road	Bromus japonicus	Japanese chess	0	4635819.151	517768.566	1	3
Main Park Road	Bromus japonicus	Japanese chess	0	4635811.498	517705.572	1	3
Main Park Road	Bromus japonicus	Japanese chess	0	4635961.212	517952.782	1	3
Main Park Road	Bromus japonicus	Japanese chess	0	4635277.473	518214.649	1	3
Main Park Road	Bromus japonicus	Japanese chess	0	4635853.693	517931.939	1	3
Main Park Road	Bromus japonicus	Japanese chess	0	4633670.599	518101.61	1	3
Main Park Road	Bromus japonicus	Japanese chess	0	4631659.049	518821.726	1	2
Main Park Road	Bromus japonicus	Japanese chess	0	4633172.506	518360.66	1	3
Main Park Road	Bromus japonicus	Japanese chess	0	4631717.424	518879.445	1	2
Main Park Road	Bromus japonicus	Japanese chess	0	4633543.663	518185.007	2	3
Main Park Road	Bromus japonicus	Japanese chess	0	4630523.013	519406.474	2	2
Main Park Road	Bromus japonicus	Japanese chess	0	4633625.85	518124.017	1	3
Main Park Road	Bromus japonicus	Japanese chess	0	4635864.807	517986.321	1	3

Appendix A. Exotic plant patches detected on monitoring routes at Fossil Butte NM, June 28–July 1, 2018, cont.

Plot_ID	Species	Master_Common_Name	Pulled	N_Coord	E_Coord	Cover_Class	Size_Class
Main Park Road	Bromus japonicus	Japanese chess	0	4631768.661	518864.222	2	3
Main Park Road	Bromus japonicus	Japanese chess	0	4635828.338	517823.633	1	3
Main Park Road	Bromus japonicus	Japanese chess	0	4635851.479	517935.541	1	3
Main Park Road	Bromus japonicus	Japanese chess	0	4632017.044	518625.394	1	3
Main Park Road	Bromus japonicus	Japanese chess	0	4635839.839	517878.455	1	3
Main Park Road	Bromus japonicus	Japanese chess	0	4635871.148	517789.056	1	3
Main Park Road	Bromus japonicus	Japanese chess	0	4633449.109	518246.45	2	3
Main Park Road	Bromus japonicus	Japanese chess	0	4634579.541	518062.566	1	3
Main Park Road	Bromus japonicus	Japanese chess	0	4633265.454	518327.916	1	3
Main Park Road	Bromus japonicus	Japanese chess	0	4636222.06	518444.768	1	2
Main Park Road	Bromus japonicus	Japanese chess	0	4635808.804	517723.315	1	3
Main Park Road	Bromus japonicus	Japanese chess	0	4633061.307	518408.617	1	2
Main Park Road	Bromus japonicus	Japanese chess	0	4630174.484	519762.935	2	3
Main Park Road	Bromus japonicus	Japanese chess	0	4631217.947	519031.994	2	2
Main Park Road	Bromus japonicus	Japanese chess	0	4635329.507	518197.507	1	3
Main Park Road	Bromus japonicus	Japanese chess	0	4635401.325	518175.646	1	3
Main Park Road	Bromus japonicus	Japanese chess	0	4633403.881	518275.793	1	3
Main Park Road	Bromus japonicus	Japanese chess	0	4634093.238	517976.518	1	3
Main Park Road	Bromus japonicus	Japanese chess	0	4631628.216	519066.415	2	2
Main Park Road	Bromus japonicus	Japanese chess	0	4635021.377	518184.176	1	3
Main Park Road	Bromus japonicus	Japanese chess	0	4635092.633	518165.386	1	3
Main Park Road	Bromus japonicus	Japanese chess	0	4635904.243	517854.245	1	3
Main Park Road	Bromus japonicus	Japanese chess	0	4632856.153	518463.052	1	3
Main Park Road	Bromus japonicus	Japanese chess	0	4633931.061	517973.302	1	2
Main Park Road	Bromus japonicus	Japanese chess	0	4634012.052	517965.755	1	2
Main Park Road	Bromus japonicus	Japanese chess	0	4633215.711	518336.395	1	3
Main Park Road	Bromus japonicus	Japanese chess	0	4632240.438	518545.376	1	3
Main Park Road	Bromus japonicus	Japanese chess	0	4635829.054	517840.355	2	3
Main Park Road	Bromus japonicus	Japanese chess	0	4631875.545	518732.111	1	2
Main Park Road	Bromus japonicus	Japanese chess	0	4633494.224	518218.6	2	4
Main Park Road	Bromus japonicus	Japanese chess	0	4631607.597	518812.902	1	2
Main Park Road	Bromus japonicus	Japanese chess	0	4633363.755	518307.746	1	3
Main Park Road	Bromus japonicus	Japanese chess	0	4634633.066	518061.323	1	3

Appendix A. Exotic plant patches detected on monitoring routes at Fossil Butte NM, June 28–July 1, 2018, cont.

Plot_ID	Species	Master_Common_Name	Pulled	N_Coord	E_Coord	Cover_Class	Size_Class
Main Park Road	Bromus japonicus	Japanese chess	0	4634968.971	518216.077	1	3
Main Park Road	Bromus japonicus	Japanese chess	0	4634741.94	518080.897	1	4
Main Park Road	Bromus japonicus	Japanese chess	0	4635840.781	517885.744	1	3
Main Park Road	Bromus japonicus	Japanese chess	0	4632464.844	518543.762	1	3
Main Park Road	Bromus japonicus	Japanese chess	0	4635939.443	517902.368	1	2
Main Park Road	Bromus japonicus	Japanese chess	0	4634933.454	518177.722	1	3
Main Park Road	Bromus japonicus	Japanese chess	0	4632858.356	518471.244	2	3
Main Park Road	Bromus japonicus	Japanese chess	0	4633583.206	518153.494	1	3
Main Park Road	Bromus japonicus	Japanese chess	0	4633728.089	518081.702	1	3
Main Park Road	Bromus japonicus	Japanese chess	0	4634686.514	518064.209	1	3
Main Park Road	Bromus japonicus	Japanese chess	0	4634301.951	517989.769	1	3
Main Park Road	Bromus japonicus	Japanese chess	0	4633444.79	518242.866	1	4
Main Park Road	Bromus japonicus	Japanese chess	0	4634040.249	517974.542	3	3
Main Park Road	Bromus japonicus	Japanese chess	0	4633777.813	518063.493	1	3
Main Park Road	Bromus japonicus	Japanese chess	0	4634520.143	518049.707	1	3
Main Park Road	Bromus japonicus	Japanese chess	0	4636084.578	518352.252	1	2
Main Park Road	Bromus japonicus	Japanese chess	0	4633986.682	517972.205	2	3
Main Park Road	Bromus japonicus	Japanese chess	0	4633317.66	518324.259	1	3
Main Park Road	Bromus japonicus	Japanese chess	0	4635812.237	518122.663	1	3
Main Park Road	Bromus japonicus	Japanese chess	0	4634249.1	517985.941	1	3
Main Park Road	Bromus japonicus	Japanese chess	0	4634352.752	517998.987	1	3
Main Park Road	Bromus japonicus	Japanese chess	0	4634144.169	517980.117	1	3
Main Park Road	Bromus japonicus	Japanese chess	0	4634409.893	518015.697	1	3
Main Park Road	Bromus japonicus	Japanese chess	0	4633115.227	518394.024	1	3
Main Park Road	Bromus japonicus	Japanese chess	0	4632795.362	518488.111	1	3
Main Park Road	Bromus japonicus	Japanese chess	0	4633927.705	517981.691	1	3
Main Park Road	Bromus japonicus	Japanese chess	0	4635813.734	517779.461	1	3
Main Park Road	Bromus japonicus	Japanese chess	0	4636815.566	518521.301	2	2
Main Park Road	Bromus japonicus	Japanese chess	0	4634894.384	518158.015	1	2
Main Park Road	Bromus japonicus	Japanese chess	0	4632406.612	518534.652	1	3
Main Park Road	Bromus japonicus	Japanese chess	0	4632564.464	518543.7	1	3
Main Park Road	Bromus japonicus	Japanese chess	0	4634463.527	518032.096	1	3
Main Park Road	Bromus japonicus	Japanese chess	0	4635148.061	518185.171	1	3

Appendix A. Exotic plant patches detected on monitoring routes at Fossil Butte NM, June 28–July 1, 2018, cont.

Plot_ID	Species	Master_Common_Name	Pulled	N_Coord	E_Coord	Cover_Class	Size_Class
Main Park Road	Bromus japonicus	Japanese chess	0	4635281.493	518210.588	2	2
Main Park Road	Bromus japonicus	Japanese chess	0	4635196.214	518208.72	1	3
Main Park Road	Bromus japonicus	Japanese chess	0	4631787.931	518848.713	2	3
Main Park Road	Bromus japonicus	Japanese chess	0	4633875.67	518013.703	1	3
Main Park Road	Bromus japonicus	Japanese chess	0	4635934.063	517906.523	1	3
Main Park Road	Bromus japonicus	Japanese chess	0	4634310.22	517981.132	1	3
Main Park Road	Bromus japonicus	Japanese chess	0	4630172.837	519749.902	2	2
Main Park Road	Bromus japonicus	Japanese chess	0	4634837.415	518135.395	1	4
Main Park Road	Bromus japonicus	Japanese chess	0	4634196.53	517982.479	1	4
Main Park Road	Bromus japonicus	Japanese chess	0	4634883.31	518160.773	1	4
Main Park Road	Bromus japonicus	Japanese chess	0	4632287.101	518529.687	1	4
Main Park Road	Bromus tectorum	Cheatgrass	0	4634425.459	518020.93	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4633171.141	518353.104	1	5
Main Park Road	Bromus tectorum	Cheatgrass	0	4635312.343	518209.202	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4633854.685	518027.754	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4635594.439	518121.363	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4635775.884	518287.901	1	4
Main Park Road	Bromus tectorum	Cheatgrass	0	4631251.858	519014.127	1	4
Main Park Road	Bromus tectorum	Cheatgrass	0	4634897.235	518164.542	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4631256.682	519018.669	1	4
Main Park Road	Bromus tectorum	Cheatgrass	0	4633078.806	518402.412	1	5
Main Park Road	Bromus tectorum	Cheatgrass	0	4635868.087	518027.388	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4635792.157	518182.262	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4631673.467	518911.642	2	5
Main Park Road	Bromus tectorum	Cheatgrass	0	4634995.003	518212.603	1	4
Main Park Road	Bromus tectorum	Cheatgrass	0	4636239.265	518456.357	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4635102.207	518169.249	1	4
Main Park Road	Bromus tectorum	Cheatgrass	0	4630528.09	519416.767	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4631583.712	518808.931	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4633951.522	517974.923	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4631992.017	518634.225	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4635944.307	517916.298	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4635159.468	518188.676	1	3

Appendix A. Exotic plant patches detected on monitoring routes at Fossil Butte NM, June 28–July 1, 2018, cont.

Plot_ID	Species	Master_Common_Name	Pulled	N_Coord	E_Coord	Cover_Class	Size_Class
Main Park Road	Bromus tectorum	Cheatgrass	0	4635825.399	517808.076	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4635884.166	517813.989	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4634260.424	517986.181	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4634850.951	518144.016	1	4
Main Park Road	Bromus tectorum	Cheatgrass	0	4632321.57	518522.707	2	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4635726.049	518263.422	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4630370.782	519600.799	2	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4635826.975	517707.326	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4635846.727	518077.8	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4634653.535	518061.583	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4630608.206	519317.504	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4630994.794	519107.013	2	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4634159.14	517979.805	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4634314.582	517991.176	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4635783.592	518234.152	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4630685.7	519245.563	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4635468.406	518177.166	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4635708.075	518212.776	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4634003.62	517972.693	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4631513.577	518867.411	1	5
Main Park Road	Bromus tectorum	Cheatgrass	0	4630358.987	519629.627	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4634757.347	518087.842	1	4
Main Park Road	Bromus tectorum	Cheatgrass	0	4634475.255	518035.36	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4636935.663	518452.25	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4636460.655	518652.27	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4637342.85	518280.8	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4635981.567	518060.167	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4630585.061	519333.942	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4631453.888	518925.054	1	4
Main Park Road	Bromus tectorum	Cheatgrass	0	4635834.953	517860.271	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4636331.555	518538.406	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4631835.299	518786.903	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4634951.812	518188.24	1	3

Appendix A. Exotic plant patches detected on monitoring routes at Fossil Butte NM, June 28–July 1, 2018, cont.

Plot_ID	Species	Master_Common_Name	Pulled	N_Coord	E_Coord	Cover_Class	Size_Class
Main Park Road	Bromus tectorum	Cheatgrass	0	4636089.392	518365.222	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4636802.469	518534.231	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4630646.133	519279.992	2	5
Main Park Road	Bromus tectorum	Cheatgrass	0	4635044.04	518171.319	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4636285.939	518475.029	2	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4631094.302	519066.077	1	5
Main Park Road	Bromus tectorum	Cheatgrass	0	4632884.682	518464.292	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4635847.772	517909.86	1	5
Main Park Road	Bromus tectorum	Cheatgrass	0	4637729.651	518058.963	2	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4634646.464	518040.979	3	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4634219.115	517974.364	2	5
Main Park Road	Bromus tectorum	Cheatgrass	0	4634054.651	517974.598	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4635354.012	518176.621	2	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4635599.355	518114.918	2	4
Main Park Road	Bromus tectorum	Cheatgrass	0	4638348.179	518926.77	1	2
Main Park Road	Bromus tectorum	Cheatgrass	0	4634872.49	518148.142	1	5
Main Park Road	Bromus tectorum	Cheatgrass	0	4631912.346	518687.734	1	2
Main Park Road	Bromus tectorum	Cheatgrass	0	4634553.299	518052.128	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4635432.846	518184.716	2	4
Main Park Road	Bromus tectorum	Cheatgrass	0	4635529.089	518141.608	1	4
Main Park Road	Bromus tectorum	Cheatgrass	0	4634785.795	518092.617	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4633155.818	518370.892	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4633708.454	518088.634	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4633349.894	518315.466	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4635481.088	518167.216	2	4
Main Park Road	Bromus tectorum	Cheatgrass	0	4635302.85	518207.831	1	5
Main Park Road	Bromus tectorum	Cheatgrass	0	4634992.582	518187.266	2	4
Main Park Road	Bromus tectorum	Cheatgrass	0	4635646.557	518114.86	1	4
Main Park Road	Bromus tectorum	Cheatgrass	0	4634338.756	517988.394	2	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4634459.272	518021.701	1	4
Main Park Road	Bromus tectorum	Cheatgrass	0	4634713.17	518062.156	2	5
Main Park Road	Bromus tectorum	Cheatgrass	0	4634925.218	518164.456	1	4
Main Park Road	Bromus tectorum	Cheatgrass	0	4635187.832	518190.076	1	5

Appendix A. Exotic plant patches detected on monitoring routes at Fossil Butte NM, June 28–July 1, 2018, cont.

Plot_ID	Species	Master_Common_Name	Pulled	N_Coord	E_Coord	Cover_Class	Size_Class
Main Park Road	Bromus tectorum	Cheatgrass	0	4635827.795	518098.577	1	5
Main Park Road	Bromus tectorum	Cheatgrass	0	4635854.922	517960.338	1	5
Main Park Road	Bromus tectorum	Cheatgrass	0	4636150.088	518407.789	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4634385.459	518002.138	1	4
Main Park Road	Bromus tectorum	Cheatgrass	0	4634603.001	518055.917	1	5
Main Park Road	Bromus tectorum	Cheatgrass	0	4635142.825	518174.483	2	5
Main Park Road	Bromus tectorum	Cheatgrass	0	4637463.086	518219.293	2	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4636680.636	518599.026	2	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4638339.733	518879.114	2	2
Main Park Road	Bromus tectorum	Cheatgrass	0	4638302.32	518941.874	1	2
Main Park Road	Bromus tectorum	Cheatgrass	0	4634285.157	517979.404	1	5
Main Park Road	Bromus tectorum	Cheatgrass	0	4634706.107	518068.677	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4633807.78	518052.513	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4633516.588	518196.538	1	5
Main Park Road	Bromus tectorum	Cheatgrass	0	4635205.484	518215.767	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4635096.852	518158.781	2	5
Main Park Road	Bromus tectorum	Cheatgrass	0	4635893.139	517824.443	1	2
Main Park Road	Bromus tectorum	Cheatgrass	0	4635776.048	518243.923	2	5
Main Park Road	Bromus tectorum	Cheatgrass	0	4635783.855	518192.321	2	5
Main Park Road	Bromus tectorum	Cheatgrass	0	4635810.127	517759.532	1	5
Main Park Road	Bromus tectorum	Cheatgrass	0	4633299.736	518325.311	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4634532.925	518053.183	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4633199.718	518344.264	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4630434.726	519522.326	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4635858	517763.659	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4635912.014	517863.094	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4635861.833	517971.777	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4635362.634	518174.711	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4635256.445	518213.198	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4635260.241	518206.125	1	4
Main Park Road	Bromus tectorum	Cheatgrass	0	4635851.903	518060.56	1	5
Main Park Road	Bromus tectorum	Cheatgrass	0	4630572.636	519360.757	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4636099.343	518372.943	1	2

Appendix A. Exotic plant patches detected on monitoring routes at Fossil Butte NM, June 28–July 1, 2018, cont.

Plot_ID	Species	Master_Common_Name	Pulled	N_Coord	E_Coord	Cover_Class	Size_Class
Main Park Road	Bromus tectorum	Cheatgrass	0	4632989.017	518435.183	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4636243.136	518452.923	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4634106.479	517977.862	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4635820.464	517812.663	1	5
Main Park Road	Bromus tectorum	Cheatgrass	0	4635683.804	518150.595	1	5
Main Park Road	Bromus tectorum	Cheatgrass	0	4635730.046	518246.456	1	5
Main Park Road	Bromus tectorum	Cheatgrass	0	4635800.273	518144.482	2	5
Main Park Road	Bromus tectorum	Cheatgrass	0	4635817.505	517756.665	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4634828.502	518120.766	1	5
Main Park Road	Bromus tectorum	Cheatgrass	0	4633103.97	518398.413	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4634364.197	518002.641	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4634605.231	518062.724	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4634806.102	518115.534	1	5
Main Park Road	Bromus tectorum	Cheatgrass	0	4635865.152	518013.378	1	4
Main Park Road	Bromus tectorum	Cheatgrass	0	4633759.128	518069.934	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4636055.962	518307.272	2	2
Main Park Road	Bromus tectorum	Cheatgrass	0	4632127.619	518593.345	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4636571.407	518645.3	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4632438.68	518540.821	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4631822.282	518789.841	1	5
Main Park Road	Bromus tectorum	Cheatgrass	0	4633576.851	518140.099	1	5
Main Park Road	Bromus tectorum	Cheatgrass	0	4632494.829	518538.809	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4633866.526	518010.966	1	5
Main Park Road	Bromus tectorum	Cheatgrass	0	4633672.406	518094.327	1	5
Main Park Road	Bromus tectorum	Cheatgrass	0	4632260.288	518546.161	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4636728.243	518574.556	2	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4632598.693	518539.393	3	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4630244.232	519747.02	1	2
Main Park Road	Bromus tectorum	Cheatgrass	0	4631786.861	518837.607	1	4
Main Park Road	Bromus tectorum	Cheatgrass	0	4632002.56	518637.652	1	2
Main Park Road	Bromus tectorum	Cheatgrass	0	4636323.326	518514.614	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4633124.943	518379.588	1	5
Main Park Road	Bromus tectorum	Cheatgrass	0	4636346.887	518560.095	1	3

Appendix A. Exotic plant patches detected on monitoring routes at Fossil Butte NM, June 28–July 1, 2018, cont.

Plot_ID	Species	Master_Common_Name	Pulled	N_Coord	E_Coord	Cover_Class	Size_Class
Main Park Road	Bromus tectorum	Cheatgrass	0	4633276.532	518317.133	2	5
Main Park Road	Bromus tectorum	Cheatgrass	0	4636442.651	518644.183	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4637584.055	518116.545	2	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4638060.509	518073.468	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4637836.4	518057.273	2	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4636575.625	518640.675	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4636515.005	518656.118	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4630468.861	519477.773	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4630793.199	519172.375	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4630402.111	519561.659	2	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4631036.766	519086.351	1	5
Main Park Road	Bromus tectorum	Cheatgrass	0	4633039.712	518422.337	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4631678.561	518830.526	1	2
Main Park Road	Bromus tectorum	Cheatgrass	0	4635711.036	518198.591	2	5
Main Park Road	Bromus tectorum	Cheatgrass	0	4636360.89	518585.608	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4637504.828	518186.69	2	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4634029.519	517966.47	1	5
Main Park Road	Bromus tectorum	Cheatgrass	0	4638314.37	518789.636	2	2
Main Park Road	Bromus tectorum	Cheatgrass	0	4632044.009	518615.711	1	5
Main Park Road	Bromus tectorum	Cheatgrass	0	4636024.609	518248.47	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4637358.968	518270.869	1	2
Main Park Road	Bromus tectorum	Cheatgrass	0	4636995.624	518427.366	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4636132.451	518402.855	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4636386.031	518611.069	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4630841.204	519153.438	1	4
Main Park Road	Bromus tectorum	Cheatgrass	0	4636178.936	518429.132	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4633721.89	518073.85	1	5
Main Park Road	Bromus tectorum	Cheatgrass	0	4633417.408	518257.84	2	5
Main Park Road	Bromus tectorum	Cheatgrass	0	4637052.882	518408.233	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4636633.72	518618.099	2	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4630285.701	519716.092	1	2
Main Park Road	Bromus tectorum	Cheatgrass	0	4630738.477	519210.913	1	5
Main Park Road	Bromus tectorum	Cheatgrass	0	4631804.447	518828.636	2	3

Appendix A. Exotic plant patches detected on monitoring routes at Fossil Butte NM, June 28–July 1, 2018, cont.

Plot_ID	Species	Master_Common_Name	Pulled	N_Coord	E_Coord	Cover_Class	Size_Class
Main Park Road	Bromus tectorum	Cheatgrass	0	4631742.445	518874.709	2	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4631676.483	518838.396	1	2
Main Park Road	Bromus tectorum	Cheatgrass	0	4635806.583	517705.457	1	5
Main Park Road	Bromus tectorum	Cheatgrass	0	4631404.169	518958.291	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4631202.063	519037.655	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4631563.855	518825.003	1	2
Main Park Road	Bromus tectorum	Cheatgrass	0	4636776.935	518547.327	2	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4630845.691	519158.097	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4630490.187	519462.796	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4638227.037	518539.621	2	2
Main Park Road	Bromus tectorum	Cheatgrass	0	4637894.33	518055.819	2	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4630895.411	519141.253	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4637680.002	518079.597	2	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4630422.267	519547.151	1	2
Main Park Road	Bromus tectorum	Cheatgrass	0	4631634.117	518813.603	1	2
Main Park Road	Bromus tectorum	Cheatgrass	0	4637541.956	518151.019	2	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4630387.898	519587.92	1	2
Main Park Road	Bromus tectorum	Cheatgrass	0	4631355.353	518983.582	1	5
Main Park Road	Bromus tectorum	Cheatgrass	0	4638004.742	518068.788	2	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4632637.386	518520.991	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4634210.242	517983.409	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4631743.373	518866.625	1	5
Main Park Road	Bromus tectorum	Cheatgrass	0	4634118.024	517969.825	1	5
Main Park Road	Bromus tectorum	Cheatgrass	0	4633011.212	518423.467	2	5
Main Park Road	Bromus tectorum	Cheatgrass	0	4633625.064	518116.672	1	5
Main Park Road	Bromus tectorum	Cheatgrass	0	4631634.779	519078.784	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4633910.012	517980.391	1	5
Main Park Road	Bromus tectorum	Cheatgrass	0	4636873.046	518486.874	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4632524.526	518546.147	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4631048.539	519090.139	1	4
Main Park Road	Bromus tectorum	Cheatgrass	0	4633777.905	518056.417	1	5
Main Park Road	Bromus tectorum	Cheatgrass	0	4630326.664	519668.296	1	2
Main Park Road	Bromus tectorum	Cheatgrass	0	4632914.924	518449.578	1	5

Appendix A. Exotic plant patches detected on monitoring routes at Fossil Butte NM, June 28–July 1, 2018, cont.

Plot_ID	Species	Master_Common_Name	Pulled	N_Coord	E_Coord	Cover_Class	Size_Class
Main Park Road	Bromus tectorum	Cheatgrass	0	4633374.133	518289.637	2	5
Main Park Road	Bromus tectorum	Cheatgrass	0	4635834.979	517862.778	1	5
Main Park Road	Bromus tectorum	Cheatgrass	0	4632789.877	518481.24	3	2
Main Park Road	Bromus tectorum	Cheatgrass	0	4635769.223	518291.239	2	5
Main Park Road	Bromus tectorum	Cheatgrass	0	4634169.044	517972.686	1	5
Main Park Road	Bromus tectorum	Cheatgrass	0	4631724.27	519023.035	1	5
Main Park Road	Bromus tectorum	Cheatgrass	0	4630194.812	519761.036	1	2
Main Park Road	Bromus tectorum	Cheatgrass	0	4630945.465	519124.017	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4632069.265	518613.404	1	2
Main Park Road	Bromus tectorum	Cheatgrass	0	4631915.052	518675.071	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4630333.443	519646.714	1	4
Main Park Road	Bromus tectorum	Cheatgrass	0	4633391.449	518286.166	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4633432.961	518256.983	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4633213.305	518328.686	2	5
Main Park Road	Bromus tectorum	Cheatgrass	0	4631871.577	518722.621	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4636500.308	518652.505	2	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4636878.4	518480.454	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4630748.366	519197.39	2	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4630703.437	519226.455	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4631197.668	519031.437	1	4
Main Park Road	Bromus tectorum	Cheatgrass	0	4633480.956	518226.882	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4630937.461	519118.941	2	5
Main Park Road	Bromus tectorum	Cheatgrass	0	4633531.368	518194.461	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4633659.09	518106.335	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4638383.97	518892.25	1	2
Main Park Road	Bromus tectorum	Cheatgrass	0	4630987.543	519102.804	2	5
Main Park Road	Bromus tectorum	Cheatgrass	0	4630887.354	519134.572	1	5
Main Park Road	Bromus tectorum	Cheatgrass	0	4637423.791	518246.516	2	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4635415.695	518184.895	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4630505.214	519429.325	2	4
Main Park Road	Bromus tectorum	Cheatgrass	0	4630545.744	519379.242	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4631312.442	518990.414	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4633902.581	517993.682	1	3

Appendix A. Exotic plant patches detected on monitoring routes at Fossil Butte NM, June 28–July 1, 2018, cont.

Plot_ID	Species	Master_Common_Name	Pulled	N_Coord	E_Coord	Cover_Class	Size_Class
Main Park Road	Bromus tectorum	Cheatgrass	0	4633571.096	518163.09	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4631498.8	518872.962	1	4
Main Park Road	Bromus tectorum	Cheatgrass	0	4631143.724	519048.592	1	5
Main Park Road	Bromus tectorum	Cheatgrass	0	4631645.169	518973.357	2	5
Main Park Road	Bromus tectorum	Cheatgrass	0	4633613.024	518132.485	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4631374.727	518967.22	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4632104.353	518593.567	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4631460.056	518908.314	1	4
Main Park Road	Bromus tectorum	Cheatgrass	0	4631538.425	518833.859	1	4
Main Park Road	Bromus tectorum	Cheatgrass	0	4632376.69	518521.725	2	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4633325.616	518313.479	2	5
Main Park Road	Bromus tectorum	Cheatgrass	0	4630618.208	519295.751	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4630299.562	519687.738	2	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4632934.187	518450.234	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4635683.701	518163.39	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4631418.32	518940.412	1	4
Main Park Road	Bromus tectorum	Cheatgrass	0	4632833.622	518478.2	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4630659.097	519256.647	2	4
Main Park Road	Bromus tectorum	Cheatgrass	0	4631147.006	519056.083	1	5
Main Park Road	Bromus tectorum	Cheatgrass	0	4636837.137	518509.087	2	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4635651.904	518123.498	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4630789.074	519182.204	2	5
Main Park Road	Bromus tectorum	Cheatgrass	0	4636398.673	518624.969	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4635820.308	518122.402	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4633248.514	518330.034	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4630455.163	519507.761	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4635850.793	517918.249	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4636666.595	518607.683	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4635964.768	517966.864	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4637630.123	518093.002	2	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4637950.907	518064.566	2	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4637103.357	518402.105	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4632258.828	518539.371	1	2

Appendix A. Exotic plant patches detected on monitoring routes at Fossil Butte NM, June 28–July 1, 2018, cont.

Plot_ID	Species	Master_Common_Name	Pulled	N_Coord	E_Coord	Cover_Class	Size_Class
Main Park Road	Bromus tectorum	Cheatgrass	0	4637637.758	518092.911	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4638177.064	518094.769	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4633469.374	518226.518	2	5
Main Park Road	Bromus tectorum	Cheatgrass	0	4635519.099	518153.423	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4637160.312	518407.866	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4636619.347	518626.379	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4638338.777	518882.539	1	4
Main Park Road	Bromus tectorum	Cheatgrass	0	4631306.84	519002.281	2	5
Main Park Road	Bromus tectorum	Cheatgrass	0	4636758.928	518560.589	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4636042.957	518294.544	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4636013.482	518196.87	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4631097.803	519072.968	1	4
Main Park Road	Bromus tectorum	Cheatgrass	0	4637499.559	518195.023	1	4
Main Park Road	Bromus tectorum	Cheatgrass	0	4637571.022	518127.667	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4636298.682	518490.542	1	3
Main Park Road	Bromus tectorum	Cheatgrass	0	4636713.451	518585.883	1	3
Main Park Road	Cardaria sp.	whitetop	0	4632581.097	518542.008	2	2
Main Park Road	Carduus nutans	Musk thistle	0	4634613.235	518054.676	5	1
Main Park Road	Carduus nutans	Musk thistle	0	4635856.359	518050.896	2	2
Main Park Road	Carduus nutans	Musk thistle	0	4635858.148	517974.221	3	3
Main Park Road	Carduus nutans	Musk thistle	0	4631574.793	518799.319	5	1
Main Park Road	Carduus nutans	Musk thistle	0	4631144.466	519041.532	5	1
Main Park Road	Carduus nutans	Musk thistle	0	4631359.917	518956.826	2	2
Main Park Road	Cirsium arvense	Canada thistle	0	4632293.282	518542.142	2	2
Main Park Road	Cirsium arvense	Canada thistle	0	4632325.439	518517.188	2	2
Main Park Road	Cirsium arvense	Canada thistle	0	4638302.417	518750.583	4	1
Main Park Road	Cirsium arvense	Canada thistle	0	4638230.744	518365.933	3	2
Main Park Road	Cirsium arvense	Canada thistle	0	4637435.497	518242.962	4	1
Main Park Road	Convolvulus arvensis	Field bindweed	0	4633865.151	518021.356	2	2
Main Park Road	Convolvulus arvensis	Field bindweed	0	4634547.153	518057.615	3	2
Main Park Road	Descurainia sophia	Flixweed	0	4635863.658	518000.646	2	2
Main Park Road	Descurainia sophia	Flixweed	0	4631848.159	518769.002	5	1
Main Park Road	Descurainia sophia	Flixweed	0	4635853.495	517947.729	1	3

Appendix A. Exotic plant patches detected on monitoring routes at Fossil Butte NM, June 28–July 1, 2018, cont.

Plot_ID	Species	Master_Common_Name	Pulled	N_Coord	E_Coord	Cover_Class	Size_Class
Main Park Road	Descurainia sophia	Flixweed	0	4635869.656	518007.469	1	3
Main Park Road	Descurainia sophia	Flixweed	0	4636339.237	518546.234	1	2
Main Park Road	Descurainia sophia	Flixweed	0	4635733.958	518280.506	1	3
Main Park Road	Descurainia sophia	Flixweed	0	4635934.301	517890.811	2	2
Main Park Road	Descurainia sophia	Flixweed	0	4635822.661	518108.049	2	2
Main Park Road	Descurainia sophia	Flixweed	0	4636317.74	518502.445	1	2
Main Park Road	Descurainia sophia	Flixweed	0	4635844.7	517897.779	1	4
Main Park Road	Descurainia sophia	Flixweed	0	4635919.2	517875.05	1	3
Main Park Road	Descurainia sophia	Flixweed	0	4637041.423	518410.665	1	2
Main Park Road	Descurainia sophia	Flixweed	0	4635813.205	518134.963	1	2
Main Park Road	Descurainia sophia	Flixweed	0	4638165.595	518098.825	1	2
Main Park Road	Descurainia sophia	Flixweed	0	4634293.838	517973.547	1	2
Main Park Road	Descurainia sophia	Flixweed	0	4635859.765	517957.466	1	3
Main Park Road	Descurainia sophia	Flixweed	0	4635810.285	517740.322	1	5
Main Park Road	Descurainia sophia	Flixweed	0	4635880.001	517796.108	2	2
Main Park Road	Descurainia sophia	Flixweed	0	4635807.944	517690.949	1	5
Main Park Road	Descurainia sophia	Flixweed	0	4635877.8	517802.849	1	2
Main Park Road	Descurainia sophia	Flixweed	0	4636031.349	518256.823	1	3
Main Park Road	Descurainia sophia	Flixweed	0	4635847.162	517905.494	1	3
Main Park Road	Descurainia sophia	Flixweed	0	4635817.028	517796.384	1	5
Main Park Road	Descurainia sophia	Flixweed	0	4635864.46	518027.607	1	2
Main Park Road	Descurainia sophia	Flixweed	0	4635791.612	518153.703	1	2
Main Park Road	Descurainia sophia	Flixweed	0	4635831.408	517851.378	1	4
Main Park Road	Descurainia sophia	Flixweed	0	4636019.931	518202.764	1	3
Main Park Road	Descurainia sophia	Flixweed	0	4635715.039	518231.945	1	3
Main Park Road	Descurainia sophia	Flixweed	0	4631785.679	518808.964	2	2
Main Park Road	Descurainia sophia	Flixweed	0	4636376.709	518601.87	1	2
Main Park Road	Descurainia sophia	Flixweed	0	4631706.548	519055.953	1	2
Main Park Road	Descurainia sophia	Flixweed	0	4635480.468	518170.972	1	2
Main Park Road	Descurainia sophia	Flixweed	0	4635783.089	518259.43	1	2
Main Park Road	Elymus repens	Quackgrass	0	4637169.217	518405.026	2	2
Main Park Road	Elymus repens	Quackgrass	0	4631355.623	518967.973	3	2
Main Park Road	Elymus repens	Quackgrass	0	4636010.177	518178.578	3	3

Appendix A. Exotic plant patches detected on monitoring routes at Fossil Butte NM, June 28–July 1, 2018, cont.

Plot_ID	Species	Master_Common_Name	Pulled	N_Coord	E_Coord	Cover_Class	Size_Class
Main Park Road	Elymus repens	Quackgrass	0	4634959.859	518205.12	2	3
Main Park Road	Elymus repens	Quackgrass	0	4638028.372	518073.438	3	2
Main Park Road	Elymus repens	Quackgrass	0	4638190.866	518092.738	3	3
Main Park Road	Elymus repens	Quackgrass	0	4631437.022	518922.893	3	2
Main Park Road	Elymus repens	Quackgrass	0	4638141.154	518102.881	3	2
Main Park Road	Elymus repens	Quackgrass	0	4637009.392	518423.231	3	2
Main Park Road	Elymus repens	Quackgrass	0	4635974.952	518037.771	2	3
Main Park Road	Elymus repens	Quackgrass	0	4635989.626	518090.704	2	3
Main Park Road	Elymus repens	Quackgrass	0	4635966.803	517984.036	2	3
Main Park Road	Elymus repens	Quackgrass	0	4637173.459	518405.039	2	3
Main Park Road	Elymus repens	Quackgrass	0	4638311.636	518827.802	1	3
Main Park Road	Elymus repens	Quackgrass	0	4637738.221	518056.428	2	2
Main Park Road	Elymus repens	Quackgrass	0	4635515.283	518149.349	3	2
Main Park Road	Elymus repens	Quackgrass	0	4635610.487	518111.118	3	2
Main Park Road	Elymus repens	Quackgrass	0	4638218.823	518136.102	3	3
Main Park Road	Elymus repens	Quackgrass	0	4635560.523	518129.016	3	2
Main Park Road	Hyoscyamus niger	Black henbane	1	4635969.236	517987.912	5	1
Main Park Road	Hyoscyamus niger	Black henbane	1	4637651.303	518091.407	5	1
Main Park Road	Hyoscyamus niger	Black henbane	1	4635311.021	518204.445	5	1
Main Park Road	Melilotus officinalis	Yellow sweet-clover	0	4630623.591	519300.726	5	1
Main Park Road	Melilotus officinalis	Yellow sweet-clover	0	4634558.553	518060.108	2	2
Main Park Road	Melilotus officinalis	Yellow sweet-clover	0	4635367.801	518159.803	2	2
Main Park Road	Melilotus officinalis	Yellow sweet-clover	0	4634487.444	518040.5	3	2
Main Park Road	Melilotus officinalis	Yellow sweet-clover	0	4635037.712	518174.95	2	2
Main Park Road	Melilotus officinalis	Yellow sweet-clover	0	4634397.846	518012.162	3	2
Main Park Road	Tragopogon dubius	Yellow salsify	0	4635226.7	518220.337	1	2
Matate drainage	Bromus japonicus	Japanese chess	0	4630650.065	520423.4	2	3
Matate drainage	Bromus tectorum	Cheatgrass	0	4630797.806	520470.326	3	2
Matate drainage	Bromus tectorum	Cheatgrass	0	4630437.337	520272.714	3	3
Matate drainage	Bromus tectorum	Cheatgrass	0	4630250.716	520100.264	1	3
Matate drainage	Bromus tectorum	Cheatgrass	0	4630563.216	520371.122	1	5
Matate drainage	Bromus tectorum	Cheatgrass	0	4630875.172	520486.352	3	2
Matate drainage	Bromus tectorum	Cheatgrass	0	4630182.242	519943.791	2	2

Appendix A. Exotic plant patches detected on monitoring routes at Fossil Butte NM, June 28–July 1, 2018, cont.

Plot_ID	Species	Master_Common_Name	Pulled	N_Coord	E_Coord	Cover_Class	Size_Class
Matate drainage	Cardaria sp.	whitetop	0	4630950.362	520504.953	3	2
Matate drainage	Melilotus officinalis	Yellow sweet-clover	0	4630217.216	519968.181	2	2
Matate drainage	Tragopogon dubius	Yellow salsify	0	4630198.362	519935.663	1	2
Matate drainage	Tragopogon dubius	Yellow salsify	0	4630646.058	520435.418	1	2
Matate drainage	Tragopogon dubius	Yellow salsify	0	4630509.129	520327.166	1	2
Matate drainage	Tragopogon dubius	Yellow salsify	0	4630970.658	520502.52	1	2
Matate drainage	Tragopogon dubius	Yellow salsify	0	4630584.488	520397.973	1	2
Matate drainage	Tragopogon dubius	Yellow salsify	0	4630467.085	520292.128	1	2
Millet Canyon	Alopecurus arundinaceus	Creeping foxtail	0	4636465.407	517479.366	1	2
Millet Canyon	Alopecurus arundinaceus	Creeping foxtail	0	4636394.787	517425.021	2	2
Millet Canyon	Alopecurus arundinaceus	Creeping foxtail	0	4636698.671	517730.659	4	1
Millet Canyon	Bromus tectorum	Cheatgrass	0	4636625.107	517661.41	1	3
Millet Canyon	Bromus tectorum	Cheatgrass	0	4636503.274	517505.172	2	3
Millet Canyon	Bromus tectorum	Cheatgrass	0	4636774.159	517861.97	2	4
Millet Canyon	Bromus tectorum	Cheatgrass	0	4636536.584	517550.288	1	2
Millet Canyon	Bromus tectorum	Cheatgrass	0	4636677.45	517704.755	1	3
Millet Canyon	Bromus tectorum	Cheatgrass	0	4636716.851	517751.38	1	3
Millet Canyon	Bromus tectorum	Cheatgrass	0	4636750.737	517815.513	1	5
Millet Canyon	Cardaria sp.	whitetop	0	4636769.351	517849.073	2	2
Millet Canyon	Cardaria sp.	whitetop	0	4636686.765	517718.097	1	2
Millet Canyon	Cirsium arvense	Canada thistle	0	4636637.025	517675.615	2	2
Millet Canyon	Cirsium arvense	Canada thistle	0	4636344.747	517427.649	1	2
Millet Canyon	Descurainia sophia	Flixweed	0	4636735.964	517781.866	1	2
Millet Canyon	Descurainia sophia	Flixweed	0	4636709.754	517739.51	1	2
Millet Canyon	Descurainia sophia	Flixweed	0	4636761.035	517835.02	2	2
Millet Canyon	Tragopogon dubius	Yellow salsify	0	4636835.265	517977.55	1	3
Millet Canyon	Tragopogon dubius	Yellow salsify	0	4636804.532	517928.318	1	3
Millet Canyon	Tragopogon dubius	Yellow salsify	0	4636940.047	518057.17	1	2
Millet Canyon	Tragopogon dubius	Yellow salsify	0	4636416.751	517442.392	1	3
Millet Canyon	Tragopogon dubius	Yellow salsify	0	4636558.567	517569.722	1	2
Millet Canyon	Tragopogon dubius	Yellow salsify	0	4637000.283	518098.705	1	2
Millet Canyon	Tragopogon dubius	Yellow salsify	0	4636740.6	517796.383	1	4
Millet Canyon	Tragopogon dubius	Yellow salsify	0	4636783.66	517878.858	1	3

Appendix A. Exotic plant patches detected on monitoring routes at Fossil Butte NM, June 28–July 1, 2018, cont.

Plot_ID	Species	Master_Common_Name	Pulled	N_Coord	E_Coord	Cover_Class	Size_Class
Millet Canyon	Tragopogon dubius	Yellow salsify	0	4636660.778	517688.02	1	3
Moose Bones Canyon	Alopecurus arundinaceus	Creeping foxtail	0	4635007.893	520558.497	2	3
Moose Bones Canyon	Alopecurus arundinaceus	Creeping foxtail	0	4635013.466	520659.648	1	2
Moose Bones Canyon	Alopecurus arundinaceus	Creeping foxtail	0	4634836.158	520211.993	3	3
Moose Bones Canyon	Alopecurus arundinaceus	Creeping foxtail	0	4634945.907	520512.012	3	2
Moose Bones Canyon	Alopecurus arundinaceus	Creeping foxtail	0	4634840.766	520284.82	3	2
Moose Bones Canyon	Alopecurus arundinaceus	Creeping foxtail	0	4635193.017	520847.588	1	3
Moose Bones Canyon	Alopecurus arundinaceus	Creeping foxtail	0	4635098.268	520772.296	2	3
Moose Bones Canyon	Alopecurus arundinaceus	Creeping foxtail	0	4635042.393	520614.097	2	2
Moose Bones Canyon	Bromus tectorum	Cheatgrass	0	4634841.763	520269.679	2	3
Moose Bones Canyon	Bromus tectorum	Cheatgrass	0	4634839.734	520175.598	3	4
Moose Bones Canyon	Bromus tectorum	Cheatgrass	0	4634867.793	519946.437	1	5
Moose Bones Canyon	Bromus tectorum	Cheatgrass	0	4634877.024	519881.792	2	5
Moose Bones Canyon	Tragopogon dubius	Yellow salsify	0	4634831.9	520025.404	1	2
Moose Bones Canyon	Tragopogon dubius	Yellow salsify	0	4634837.509	520255.992	1	2
Moose Bones Canyon	Tragopogon dubius	Yellow salsify	0	4634834.466	520075.87	1	2
Moose Bones Canyon	Tragopogon dubius	Yellow salsify	0	4634861.501	519968.402	1	2
Murder Hill drainage	Bromus tectorum	Cheatgrass	0	4636948.753	519225.296	2	5
Murder Hill drainage	Bromus tectorum	Cheatgrass	0	4637090.284	518621.59	1	2
Murder Hill drainage	Bromus tectorum	Cheatgrass	0	4636954.227	519110.891	2	5
Murder Hill drainage	Bromus tectorum	Cheatgrass	0	4637046.402	518658.432	2	2
Murder Hill drainage	Cirsium arvense	Canada thistle	0	4637121.084	518511.33	2	2
NE Fork Chicken Creek	Bromus tectorum	Cheatgrass	0	4632920.323	520025.946	2	2
NE Fork Chicken Creek	Bromus tectorum	Cheatgrass	0	4633269.887	519858.597	3	2
NE Fork Chicken Creek	Carduus nutans	Musk thistle	1	4633298.827	519856.599	5	1
NE Fork Chicken Creek	Tragopogon dubius	Yellow salsify	1	4633213.419	519857.442	5	1
NE Fork Chicken Creek	Tragopogon dubius	Yellow salsify	1	4632875.569	520034.804	5	1
North Dam Fork Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4633412.857	519322.884	3	3
North Dam Fork Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4632937.394	519175.458	1	3
North Dam Fork Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4633172.989	519192.788	1	3
North Dam Fork Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4633226.995	519216.504	1	3
North Dam Fork Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4633511.099	519331.848	3	3
North Dam Fork Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4633909.959	519674.162	2	2

Appendix A. Exotic plant patches detected on monitoring routes at Fossil Butte NM, June 28–July 1, 2018, cont.

Plot_ID	Species	Master_Common_Name	Pulled	N_Coord	E_Coord	Cover_Class	Size_Class
North Dam Fork Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4632549.171	519100.453	1	2
North Dam Fork Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4633584.513	519403.695	3	3
North Dam Fork Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4633074.257	519170.859	1	4
North Dam Fork Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4633316.569	519275.048	1	3
North Dam Fork Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4633890.265	519616.29	2	3
North Dam Fork Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4633278.16	519229.224	2	3
North Dam Fork Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4632989.604	519168.268	1	3
North Dam Fork Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4633994.319	519801.265	3	2
North Dam Fork Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4633767.998	519491.133	2	5
North Dam Fork Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4632703.878	519173.922	2	2
North Dam Fork Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4633538.462	519370.326	2	3
North Dam Fork Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4633121.81	519173.652	1	4
North Dam Fork Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4632757.767	519178.329	1	3
North Dam Fork Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4632882.034	519175.355	2	3
North Dam Fork Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4632655.024	519166.416	2	2
North Dam Fork Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4633725.653	519461.86	4	5
North Dam Fork Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4633644.029	519422.557	2	3
North Dam Fork Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4633365.039	519308.078	3	3
North Dam Fork Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4633464.472	519313.705	3	3
North Dam Fork Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4633795.592	519533.583	2	3
North Dam Fork Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4632389.657	519012.345	3	2
North Dam Fork Chicken Creek	Bromus tectorum	Cheatgrass	0	4633570.707	519393.852	2	3
North Dam Fork Chicken Creek	Cirsium arvense	Canada thistle	0	4633426.879	519324.015	2	3
North Dam Fork Chicken Creek	Elymus repens	Quackgrass	0	4633009.016	519168.005	4	2
North Dam Fork Chicken Creek	Tragopogon dubius	Yellow salsify	1	4633290.344	519232.256	5	1
North Dam Fork Chicken Creek	Tragopogon dubius	Yellow salsify	1	4633663.66	519433.227	5	1
North Dam Fork Chicken Creek	Tragopogon dubius	Yellow salsify	1	4633882.903	519595.632	5	1
Not on route	Alopecurus arundinaceus	Creeping foxtail	0	4636779.866	519620.566	2	5
Not on route	Alopecurus arundinaceus	Creeping foxtail	0	4636786.046	519789.39	3	4
Not on route	Alopecurus arundinaceus	Creeping foxtail	0	4636777.779	519739.795	2	4
Not on route	Alopecurus arundinaceus	Creeping foxtail	0	4636783.776	519669.449	2	5
Not on route	Alopecurus arundinaceus	Creeping foxtail	0	4636806.17	519576.619	3	4
Not on route	Bromus japonicus	Japanese chess	0	4630181.62	521681.503	1	3

Appendix A. Exotic plant patches detected on monitoring routes at Fossil Butte NM, June 28–July 1, 2018, cont.

Plot_ID	Species	Master_Common_Name	Pulled	N_Coord	E_Coord	Cover_Class	Size_Class
Not on route	Bromus japonicus	Japanese chess	0	4630183.276	521772.412	1	2
Not on route	Bromus tectorum	Cheatgrass	0	4630362.523	521859.738	3	4
Not on route	Bromus tectorum	Cheatgrass	0	4631075.645	518720.921	3	3
Not on route	Bromus tectorum	Cheatgrass	0	4633203.263	517872.366	2	3
Not on route	Bromus tectorum	Cheatgrass	0	4633174.911	517946.596	1	3
Not on route	Bromus tectorum	Cheatgrass	0	4630970.476	518741.201	2	3
Not on route	Bromus tectorum	Cheatgrass	0	4637086.075	519199.415	2	5
Not on route	Bromus tectorum	Cheatgrass	0	4633749.811	521147.775	3	5
Not on route	Bromus tectorum	Cheatgrass	0	4630907.356	518766.218	3	3
Not on route	Bromus tectorum	Cheatgrass	0	4637007.97	519198.384	2	5
Not on route	Bromus tectorum	Cheatgrass	0	4637062.898	519166.816	2	5
Not on route	Bromus tectorum	Cheatgrass	0	4636776.309	519720.187	3	2
Not on route	Bromus tectorum	Cheatgrass	0	4636840.45	519470.482	2	3
Not on route	Carduus nutans	Musk thistle	0	4630180.138	520491.273	5	1
Not on route	Carduus nutans	Musk thistle	1	4634822.8	519649.056	5	1
Not on route	Cirsium arvense	Canada thistle	0	4636812.528	519564.788	2	2
Not on route	Descurainia sophia	Flixweed	0	4634791.295	519583.215	1	2
Not on route	Descurainia sophia	Flixweed	0	4637045.316	519158.137	2	3
Not on route	Melilotus officinalis	Yellow sweet-clover	0	4630168.869	519969.602	2	2
Not on route	Melilotus officinalis	Yellow sweet-clover	0	4630184.911	521842.799	1	3
Not on route	Melilotus officinalis	Yellow sweet-clover	0	4630183.03	521696.288	1	3
Not on route	Melilotus officinalis	Yellow sweet-clover	0	4630184.359	521791.075	1	2
Ruby Point Road	Alopecurus arundinaceus	Creeping foxtail	0	4637237.916	517279.987	1	2
Ruby Point Road	Bromus tectorum	Cheatgrass	0	4637015.916	516597.626	1	3
Ruby Point Road	Bromus tectorum	Cheatgrass	0	4636738.318	515783.347	3	2
Ruby Point Road	Bromus tectorum	Cheatgrass	0	4637296.657	518300.869	2	2
Ruby Point Road	Tragopogon dubius	Yellow salsify	1	4637181.164	517961.53	1	2
Ruby Point Road	Tragopogon dubius	Yellow salsify	1	4637185.121	518079.272	5	1
Ruby Point Road	Tragopogon dubius	Yellow salsify	0	4636838.178	515909.407	1	3
Ruby Point Road	Tragopogon dubius	Yellow salsify	1	4637192.137	517892.983	1	2
Ruby Point Road	Tragopogon dubius	Yellow salsify	1	4637180.922	517621.789	1	2
Ruby Point Road	Tragopogon dubius	Yellow salsify	0	4637179.442	517057.058	1	3
Ruby Point Road	Tragopogon dubius	Yellow salsify	1	4637193.98	517702.348	1	2

Appendix A. Exotic plant patches detected on monitoring routes at Fossil Butte NM, June 28–July 1, 2018, cont.

Plot_ID	Species	Master_Common_Name	Pulled	N_Coord	E_Coord	Cover_Class	Size_Class
Ruby Point Road	Tragopogon dubius	Yellow salsify	0	4637033.623	516914.7	1	2
Ruby Point Road	Tragopogon dubius	Yellow salsify	0	4637236.189	517098.589	1	3
Ruby Point Road	Tragopogon dubius	Yellow salsify	1	4637229.484	517314.819	4	1
Ruby Point Road	Tragopogon dubius	Yellow salsify	0	4637264.987	517154.776	1	3
Ruby Point Road	Tragopogon dubius	Yellow salsify	0	4637012.025	516531.53	1	3
Ruby Point Road	Tragopogon dubius	Yellow salsify	1	4637266.696	517211.312	1	2
Ruby Point Road	Tragopogon dubius	Yellow salsify	0	4636942.708	516178.899	1	2
Ruby Point Road	Tragopogon dubius	Yellow salsify	0	4636872.315	515994.504	1	3
Ruby Point Road	Tragopogon dubius	Yellow salsify	0	4636957.414	516261.756	1	2
Ruby Point Road	Tragopogon dubius	Yellow salsify	0	4637096.321	517005.861	1	2
Ruby Point Road	Tragopogon dubius	Yellow salsify	0	4636982.69	516378.972	1	2
Ruby Point Road	Tragopogon dubius	Yellow salsify	0	4636996.345	516657.065	1	2
Ruby Point Road	Tragopogon dubius	Yellow salsify	0	4637006.451	516851.641	1	2
Ruby Point Road	Tragopogon dubius	Yellow salsify	0	4636996.811	516727.556	1	2
Sage Grouse Lek drainage	Alopecurus arundinaceus	Creeping foxtail	0	4632171.74	519253.633	1	2
Sage Grouse Lek drainage	Alopecurus arundinaceus	Creeping foxtail	0	4632220.865	519273.949	2	2
Sage Grouse Lek drainage	Bromus tectorum	Cheatgrass	0	4632846.738	519474.659	2	2
Sage Grouse Lek drainage	Bromus tectorum	Cheatgrass	0	4632999.965	519555.897	2	5
Smallpox Creek	Alopecurus arundinaceus	Creeping foxtail	0	4630980.048	518659.774	1	3
Smallpox Creek	Alopecurus arundinaceus	Creeping foxtail	0	4630608.585	518973.211	2	3
Smallpox Creek	Alopecurus arundinaceus	Creeping foxtail	0	4630498.183	519136.689	1	2
Smallpox Creek	Alopecurus arundinaceus	Creeping foxtail	0	4630724.021	518904.75	1	3
Smallpox Creek	Alopecurus arundinaceus	Creeping foxtail	0	4630923.768	518685.266	1	3
Smallpox Creek	Alopecurus arundinaceus	Creeping foxtail	0	4630538.587	519109.012	1	2
Smallpox Creek	Alopecurus arundinaceus	Creeping foxtail	0	4630445.658	519145.271	1	2
Smallpox Creek	Alopecurus arundinaceus	Creeping foxtail	0	4630772.254	518853.157	1	3
Smallpox Creek	Alopecurus arundinaceus	Creeping foxtail	0	4631031.014	518646.131	1	3
Smallpox Creek	Alopecurus arundinaceus	Creeping foxtail	0	4630569.02	519005.292	1	3
Smallpox Creek	Alopecurus arundinaceus	Creeping foxtail	0	4630870.302	518734.743	1	3
Smallpox Creek	Alopecurus arundinaceus	Creeping foxtail	0	4630555.329	519056.841	1	3
Smallpox Creek	Alopecurus arundinaceus	Creeping foxtail	0	4630333.459	519282.397	1	2
Smallpox Creek	Alopecurus arundinaceus	Creeping foxtail	0	4630655.39	518950.388	1	3
Smallpox Creek	Alopecurus arundinaceus	Creeping foxtail	0	4631293.918	518649.282	1	2

Appendix A. Exotic plant patches detected on monitoring routes at Fossil Butte NM, June 28–July 1, 2018, cont.

Plot_ID	Species	Master_Common_Name	Pulled	N_Coord	E_Coord	Cover_Class	Size_Class
Smallpox Creek	Alopecurus arundinaceus	Creeping foxtail	0	4630370.033	519220.922	1	3
Smallpox Creek	Alopecurus arundinaceus	Creeping foxtail	0	4630812.534	518813.766	1	3
Smallpox Creek	Bromus tectorum	Cheatgrass	0	4631529.661	518608.141	1	2
Smallpox Creek	Bromus tectorum	Cheatgrass	0	4630345.683	519276.454	2	3
Smallpox Creek	Bromus tectorum	Cheatgrass	0	4631166.18	518666.197	2	3
Smallpox Creek	Bromus tectorum	Cheatgrass	0	4631106.619	518653.951	1	3
Smallpox Creek	Bromus tectorum	Cheatgrass	0	4630565.194	519028.805	2	3
Smallpox Creek	Bromus tectorum	Cheatgrass	0	4630645.322	518957.875	1	3
Smallpox Creek	Bromus tectorum	Cheatgrass	0	4631390.796	518609.194	2	3
Smallpox Creek	Bromus tectorum	Cheatgrass	0	4631625.979	518366.339	1	3
Smallpox Creek	Bromus tectorum	Cheatgrass	0	4631699.427	518204.396	1	4
Smallpox Creek	Bromus tectorum	Cheatgrass	0	4631666.55	518259.99	1	4
Smallpox Creek	Bromus tectorum	Cheatgrass	0	4630592.246	518985.191	1	4
Smallpox Creek	Bromus tectorum	Cheatgrass	0	4631455.128	518607.695	1	3
Smallpox Creek	Bromus tectorum	Cheatgrass	0	4631555.005	518464.693	1	3
Smallpox Creek	Bromus tectorum	Cheatgrass	0	4630381.967	519202.369	1	3
Smallpox Creek	Bromus tectorum	Cheatgrass	0	4630259.524	519314.449	1	3
Smallpox Creek	Bromus tectorum	Cheatgrass	0	4631057.257	518637.793	1	3
Smallpox Creek	Bromus tectorum	Cheatgrass	0	4630463.349	519140.536	1	3
Smallpox Creek	Tragopogon dubius	Yellow salsify	1	4630299.244	519294.796	5	1
Smallpox Creek	Tragopogon dubius	Yellow salsify	1	4630668.217	518942.458	5	1
South Millet Canyon	Alopecurus arundinaceus	Creeping foxtail	0	4636379.873	517885.608	3	2
South Millet Canyon	Alopecurus arundinaceus	Creeping foxtail	0	4636345.04	517755.83	3	3
South Millet Canyon	Alopecurus arundinaceus	Creeping foxtail	0	4636358.593	517818.264	2	3
South Millet Canyon	Bromus tectorum	Cheatgrass	0	4636439.487	518030.196	1	3
South Millet Canyon	Bromus tectorum	Cheatgrass	0	4636455.456	518088.629	1	4
South Millet Canyon	Bromus tectorum	Cheatgrass	0	4636461.69	518152.079	1	3
South Millet Canyon	Cardaria sp.	whitetop	0	4636442.758	518044.286	1	3
South Millet Canyon	Cardaria sp.	whitetop	0	4636458.605	518118.564	1	3
South Millet Canyon	Carduus nutans	Musk thistle	0	4636437.98	518014.452	1	2
South Millet Canyon	Carduus nutans	Musk thistle	0	4636449.348	518063.376	1	2
South Millet Canyon	Cirsium arvense	Canada thistle	0	4636330.659	517574.64	2	2
South Millet Canyon	Cirsium arvense	Canada thistle	0	4636391.277	517920.359	2	2

Appendix A. Exotic plant patches detected on monitoring routes at Fossil Butte NM, June 28–July 1, 2018, cont.

Plot_ID	Species	Master_Common_Name	Pulled	N_Coord	E_Coord	Cover_Class	Size_Class
South Millet Canyon	Cirsium arvense	Canada thistle	0	4636359.236	517831.764	1	2
South Millet Canyon	Cirsium arvense	Canada thistle	0	4636345.878	517771.041	1	2
South Millet Canyon	Descurainia sophia	Flixweed	0	4636452.159	518073.945	1	3
South Millet Canyon	Descurainia sophia	Flixweed	0	4636368.601	517862.448	1	3
South Millet Canyon	Tragopogon dubius	Yellow salsify	0	4636323.614	517447.378	1	2
South Murder Hill drainage	Alopecurus arundinaceus	Creeping foxtail	0	4636737.646	519547.042	2	3
South Murder Hill drainage	Bromus tectorum	Cheatgrass	0	4636762.165	519577.376	3	2
South Murder Hill drainage	Cirsium arvense	Canada thistle	0	4636754.612	519565.459	2	2
South Murder Hill drainage	Descurainia sophia	Flixweed	0	4636751.294	519551.714	1	2
West Fork Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4632774.787	518639.516	1	3
West Fork Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4632781.107	518589.215	1	3
West Fork Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4632802.967	518519.824	1	3
West Fork Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4632954.913	518089.744	1	3
West Fork Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4632937.021	518157.982	1	3
West Fork Chicken Creek	Alopecurus arundinaceus	Creeping foxtail	0	4632982.956	518044.594	1	3
West Fork Chicken Creek	Bromus japonicus	Japanese chess	0	4632795.699	518558.246	1	3
West Fork Chicken Creek	Bromus japonicus	Japanese chess	0	4632956.069	518140.322	1	3
West Fork Chicken Creek	Bromus tectorum	Cheatgrass	0	4632911.841	518237.105	1	3
West Fork Chicken Creek	Bromus tectorum	Cheatgrass	0	4632902.392	518356.073	1	3
West Fork Chicken Creek	Bromus tectorum	Cheatgrass	0	4632904.866	518303.007	1	4
West Fork Chicken Creek	Bromus tectorum	Cheatgrass	0	4632877.719	518430.871	1	3
West Red Hill drainage	Bromus japonicus	Japanese chess	0	4630565.797	521060.773	2	2
West Red Hill drainage	Bromus tectorum	Cheatgrass	0	4630172.137	520735.304	2	2
West Red Hill drainage	Bromus tectorum	Cheatgrass	0	4630481.703	520960.991	1	5
West Red Hill drainage	Bromus tectorum	Cheatgrass	0	4630575.754	521059.987	1	3
West Red Hill drainage	Bromus tectorum	Cheatgrass	0	4630532.06	521033.847	1	3
West Red Hill drainage	Melilotus officinalis	Yellow sweet-clover	0	4630540.362	521045.096	2	2
West Red Hill drainage	Tragopogon dubius	Yellow salsify	0	4630486.667	520972.913	1	2
West Red Hill drainage	Tragopogon dubius	Yellow salsify	1	4630509.477	521027.034	5	1
West Red Hill drainage	Tragopogon dubius	Yellow salsify	1	4630261.574	520770.643	5	1
West Red Hill drainage	Tragopogon dubius	Yellow salsify	0	4630556.702	521057.267	1	2

Appendix B. Detected exotic plant cover in transects at Fossil Butte NM, June 28–July 1, 2018.

Route	Transect	E_Coord	N_Coord	Species	Master_Common_Name	Alive?	AverageCover
Chicken Creek	502	519584.303	4631365.733	Alopecurus arundinaceus	Creeping foxtail	Y	6.667
Chicken Creek	504	519112.932	4632147.967	Alopecurus arundinaceus	Creeping foxtail	Y	0.167
Chicken Creek	505	518869.867	4632506.695	Alopecurus arundinaceus	Creeping foxtail	Y	23.333
Chicken Creek	506	518542.531	4632874.598	Alopecurus arundinaceus	Creeping foxtail	Y	0.333
Chicken Creek	509	518062.395	4634195.732	Alopecurus arundinaceus	Creeping foxtail	Y	23.333
Chicken Creek Nature Trail	622	518852.324	4635168.643	Bromus tectorum	Cheatgrass	Y	0.167
Chicken Creek Nature Trail	625	518216.716	4635037.398	Bromus tectorum	Cheatgrass	Y	0.333
East Red Hill drainage	536	521771.07	4630522.573	Bromus japonicus	Japanese chess	Y	0.5
East Red Hill drainage	536	521771.07	4630522.573	Bromus tectorum	Cheatgrass	Y	0.167
Fossil Butte east drainage	566	521509.465	4632405.242	Descurainia sophia	Flixweed	Y	0.333
Historic Quarry Trail	529	522101.552	4630475.559	Bromus japonicus	Japanese chess	Y	0.333
Historic Quarry Trail	529	522101.552	4630475.559	Bromus tectorum	Cheatgrass	Y	2
Historic Quarry Trail	529	522101.552	4630475.559	Descurainia sophia	Flixweed	Y	0.167
Main Park Road	556	518939.436	4631708.348	Bromus tectorum	Cheatgrass	Y	0.167
Main Park Road	567	519500.81	4630459.664	Bromus tectorum	Cheatgrass	Y	0.167
Main Park Road	568	519168.467	4630822.709	Bromus tectorum	Cheatgrass	Y	0.167
Main Park Road	569	519007.253	4631294.944	Bromus tectorum	Cheatgrass	Y	0.5
Main Park Road	570	518880.399	4631696.788	Bromus tectorum	Cheatgrass	Y	0.167
Main Park Road	571	518606.305	4632088.634	Bromus tectorum	Cheatgrass	Y	0.167
Main Park Road	574	518212.796	4633504.886	Bromus japonicus	Japanese chess	Y	1.667
Main Park Road	574	518212.796	4633504.886	Bromus tectorum	Cheatgrass	Y	0.333
Main Park Road	575	517977.041	4633941.28	Bromus japonicus	Japanese chess	Y	0.167
Main Park Road	575	517977.041	4633941.28	Bromus tectorum	Cheatgrass	Y	0.333
Main Park Road	576	518023.804	4634434.39	Bromus tectorum	Cheatgrass	Y	0.167
Main Park Road	577	518168.072	4634905.025	Bromus japonicus	Japanese chess	Y	0.667
Main Park Road	577	518168.072	4634905.025	Bromus tectorum	Cheatgrass	Y	0.167
Main Park Road	578	518187.297	4635338.956	Bromus japonicus	Japanese chess	Y	0.167
Main Park Road	578	518187.297	4635338.956	Bromus tectorum	Cheatgrass	Y	0.167
Main Park Road	579	518271.895	4635730.677	Bromus tectorum	Cheatgrass	Y	1.333
Main Park Road	579	518271.895	4635730.677	Descurainia sophia	Flixweed	Y	0.167
Main Park Road	580	517893.052	4635843.264	Bromus japonicus	Japanese chess	Y	2.667
Main Park Road	580	517893.052	4635843.264	Bromus tectorum	Cheatgrass	Y	1.333
Main Park Road	580	517893.052	4635843.264	Descurainia sophia	Flixweed	Y	0.333

Appendix B. Detected exotic plant cover in transects at Fossil Butte NM, June 28–July 1, 2018, cont.

Route	Transect	E_Coord	N_Coord	Species	Master_Common_Name	Alive?	AverageCover
Main Park Road	583	518655.97	4636501.429	Bromus tectorum	Cheatgrass	Y	0.167
Main Park Road	584	518447.431	4636948.811	Bromus tectorum	Cheatgrass	Y	0.333
Main Park Road	590	519163.62	4630818.724	Bromus tectorum	Cheatgrass	Y	0.333
Main Park Road	591	519001.191	4631290.571	Bromus tectorum	Cheatgrass	Y	0.333
Main Park Road	595	518409.612	4633056.027	Bromus japonicus	Japanese chess	Y	0.167
Main Park Road	596	518207.621	4633503.991	Bromus japonicus	Japanese chess	Y	0.333
Main Park Road	596	518207.621	4633503.991	Bromus tectorum	Cheatgrass	Y	0.333
Main Park Road	597	517975.384	4633940.878	Bromus tectorum	Cheatgrass	Y	0.167
Main Park Road	598	518017.223	4634433.374	Bromus japonicus	Japanese chess	Y	0.167
Main Park Road	599	518159.61	4634897.93	Bromus japonicus	Japanese chess	Y	0.167
Main Park Road	599	518159.61	4634897.93	Bromus tectorum	Cheatgrass	Y	1.167
Main Park Road	600	518170.701	4635368.868	Bromus tectorum	Cheatgrass	Y	0.333
Main Park Road	601	518287.588	4635746.067	Bromus japonicus	Japanese chess	Y	0.167
Main Park Road	601	518287.588	4635746.067	Bromus tectorum	Cheatgrass	Y	0.167
Main Park Road	602	517845.164	4635831.271	Bromus japonicus	Japanese chess	Y	0.5
Main Park Road	602	517845.164	4635831.271	Bromus tectorum	Cheatgrass	Y	0.667
Main Park Road	602	517845.164	4635831.271	Descurainia sophia	Flixweed	Y	0.5
Main Park Road	604	518395.342	4636127.143	Bromus tectorum	Cheatgrass	Y	0.333
Main Park Road	605	518651.134	4636526.549	Bromus tectorum	Cheatgrass	Y	0.333
Main Park Road	607	518251.841	4637417.209	Bromus tectorum	Cheatgrass	Y	0.167
Main Park Road	609	518224.403	4638230.831	Bromus japonicus	Japanese chess	Y	0.167
Main Park Road	610	518697.812	4638286.578	Bromus tectorum	Cheatgrass	Y	0.333
Matate drainage	614	520484.01	4630812.754	Bromus tectorum	Cheatgrass	Y	0.167
North Dam Fork Chicken Creek	539	519175.316	4633130.919	Alopecurus arundinaceus	Creeping foxtail	Y	0.333
North Dam Fork Chicken Creek	540	519385.248	4633560.029	Alopecurus arundinaceus	Creeping foxtail	Y	13.333
North Dam Fork Chicken Creek	540	519385.248	4633560.029	Bromus tectorum	Cheatgrass	Y	0.167
Rubey Point Road	545	516566.106	4637014.36	Bromus tectorum	Cheatgrass	Y	0.167

The Department of the Interior protects and manages the nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

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National Park Service
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