

# 2020 Monitoring Report, Dolores River Restoration on Lease Tract C-SR-13

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U.S. DEPARTMENT OF  
**ENERGY**

Legacy  
Management

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## Abbreviations

BLM	U.S. Bureau of Land Management
DOE	U.S. Department of Energy
DRRP	Dolores River Restoration Partnership
LM	Office of Legacy Management
LMS	Legacy Management Support

## Definitions

**absolute cover:** The area comprising ground cover, bare ground, and total foliar cover. The sum of ground cover, bare ground, and total foliar equals 100%.

**basal cover:** The percent of land surface covered by plant bases. Large basal gaps are important indicators of potential erosion, weed invasion, and wildlife habitat. Basal cover is measured in absolute cover but is reported in the total foliar cover values. Basal cover values are used for yearly comparisons.

**biological crust:** Microorganisms (e.g., algae, cyanobacteria) and nonvascular plants (e.g., mosses and lichens) that grow on or just below the soil surface. Biological crusts are important in stabilizing soil surfaces. Biological crust is measured in absolute cover but is reported in the total foliar cover values.

**desirable species:** Native and introduced plant species that are not invasive. Desirable species are measured in absolute cover and relative cover (see Sections 3.0 and 5.6 herein).

**ground cover:** The percentage of material, other than bare ground, covering the land surface. It may include live and standing dead vegetation, plant litter, biological crust, cobble, gravel, stones, and bedrock. Ground cover is measured in percent absolute cover.

**introduced species:** Plant species that are not native to a particular geographical region. In this report, species native to areas other than the western United States are considered to be introduced.

**invasive species:** Plant species generally considered to be weeds in a region. Species that are considered to be invasive in this report are highlighted in Appendix A.

**line-point intercept:** A rapid, accurate method for quantifying vegetation and ground cover data that includes measurements of plant abundance, plant composition, plant height, basal cover, bare ground, rock, and plant litter.

**native species:** Plant species that are endemic to a particular geographic region. In this report, species endemic to the western United States are considered to be native.

**noxious weed:** An invasive species that is listed by a federal, state, or local entity and targeted for monitoring or control. In Colorado, noxious weeds are categorized as “List A,” “List B,” “List C,” or “Watch List” species.

**photomonitoring:** An ecological monitoring technique that establishes fixed points from which similar photographs may be taken at regular intervals.

**relative cover:** The percent of individual species or groups of species (e.g., desirable, invasive, and noxious species) that contribute to the total foliar cover. The sum of the relative cover of all species or groups of species is 100%.

**species richness:** The total number of species present.

**standing dead vegetation:** Dead leaves and stems that are brown, tan, or gray in color and considered to be previous years’ growth. Standing dead vegetation is measured in absolute cover but is reported in the total foliar cover values. Standing dead cover values are used for yearly comparisons.

**total foliar cover:** The area of ground surface within a sample area obscured at any height by the current year’s growth of leaves and stems of all plant species. Current year’s growth is identified as green material and live woody stems. The area of ground surface covered by biological crust (see definition) is also included in total foliar cover.

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## 1.0 Background

Invasive plants can displace native plant communities, degrade wildlife habitat and forage, hinder recreational opportunities, and increase risks associated with wildfire. The Dolores River Restoration Partnership (DRRP) is a coalition of public and private organizations working to restore the riparian corridor of the Dolores River in western Colorado and eastern Utah. Since 2011, the U.S. Department of Energy (DOE) Office of Legacy Management (LM) has supported DRRP’s ecological and management goals by conducting weed control, restoration, and monitoring activities along the Dolores River.

Approximately 3.3 miles of the Dolores River riparian corridor is on DOE’s C-SR-13 uranium lease tract. Within the corridor are intact populations of stretchberry (also known as New Mexico privet), which form a community that is considered globally imperiled and identified as a potential conservation area (CNHP 2000<sup>1</sup>). Restoration activities on the lease tract began in late summer 2011 (DOE 2012), and annual monitoring began in summer 2012<sup>2</sup> to assess the success of restoration efforts over time. Results from the August 2020 monitoring—the ninth year of monitoring—are summarized in this report. Scientific nomenclature and common names of the plants identified on the lease tract follow the U.S. Department of Agriculture Natural Resources Conservation Service PLANTS Database (USDA 2020) and are listed in Table A-1 in Appendix A.

## 2.0 History of Restoration

Prior to 2011, large stands of invasive plants were present along the Dolores River corridor on the C-SR-13 lease tract. Saltcedar (also known as tamarisk) was the dominant invasive shrub/tree in the overstory, and Russian olive and Siberian elm were minor components. In the understory, hardheads (also known as Russian knapweed) were major components of the plant cover, and smaller populations of Canada thistle, nodding plumeless thistle (also known as musk thistle), saltlover (also known as halogeton), and other noxious and invasive species were present.

Beginning in 2011, LM has been involved in the following DRRP activities:

- August 29–September 8, 2011: Gold Eagle Mining Inc. (leaseholder for C-SR-13) cut invasive trees with a track hoe-mounted mulcher head and treated them with herbicide. Large stands of hardheads were also treated with herbicide, and most areas with disturbed soils were seeded with a native plant seed mix (DOE 2012).
- July 24–25, 2012: Legacy Management Support (LMS) ecologists performed data collection for *2012 Monitoring Report, Dolores River Restoration Project on Lease Tract C-SR-13* (DOE 2013).
- September and October 2012: Gold Eagle Mining Inc. applied foliar herbicide to resprouted saltcedar, small infestations of saltlover and Canada thistle, and approximately 25 acres of hardheads. Mature saltcedar trees were also cut and treated with herbicide (DOE 2012).

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<sup>1</sup> “Globally imperiled” and “potential conservation area” are not considered legal designations but are descriptors given to the Dolores River corridor by the Colorado Natural Heritage Program to guide management decisions concerning these communities (CNHP 2000).

<sup>2</sup> Monitoring began in 2012, but those data are not used in this report because of data quality issues.

- August 13–15, 2013: LMS ecologists performed data collection for *2013 Monitoring Report, Dolores River Restoration Project on Lease Tract C-SR-13* (DOE 2015a).
- November 2013: Hedges Spraying LLC treated approximately 23 acres of hardheads and smaller infestations of Canada thistle, saltlover, and resprouted saltcedar. Several mature saltcedar trees were also cut and treated with herbicide.
- August 12–14, 2014: LMS ecologists performed data collection for *2014 Monitoring Report, Dolores River Restoration Project on Lease Tract C-SR-13* (DOE 2015b).
- October 20–November 12, 2014: The Southwest Conservation Corps treated approximately 12 acres of hardheads, Canada thistle, nodding plumeless thistle, and saltcedar with herbicide.
- April 4, 2015: LM signed the DRRP Memorandum of Understanding and officially became a member of the partnership (DOE 2015c).
- August 16–18, 2015: LMS ecologists performed data collection for *2015 Monitoring Report, Dolores River Restoration Project on Lease Tract C-SR-13* (DOE 2016).
- October 20–November 11, 2015: The Southwest Conservation Corps and LMS staff treated approximately 3 acres of hardheads, Canada thistle, nodding plumeless thistle, and saltcedar with herbicide.
- August 15–17, 2016: LMS ecologists performed data collection for *2016 Monitoring Report, Dolores River Restoration Project on Lease Tract C-SR-13* (DOE 2018a).
- October 24–27, 2016: The Southwest Conservation Corps and LMS staff treated approximately 2.3 acres of hardheads, Canada thistle, nodding plumeless thistle, and saltcedar with herbicide.
- May 3–4, 2017: LMS staff applied herbicide to approximately 1.1 acres of the invasive weed burningbush (also known as kochia) within monitoring regions 12, 14, 16, 16A, and 31A (Figure 1) to remove high-density infestations of this weed and provide an open soil surface for reseeding in fall 2017.
- August 21–24, 2017: LMS ecologists performed data collection for *2017 Monitoring Report, Dolores River Restoration Project on Lease Tract C-SR-13* (DOE 2018b).
- October 30–November 3, 2017: Hedges Spraying LLC and LMS staff treated approximately 21 acres of hardheads and smaller infestations of Canada thistle and saltcedar with herbicide. LMS staff broadcast-seeded approximately 4 acres of relatively barren ground within monitoring regions 12, 14, 16, 16A, and 31A that had formerly been infested with burningbush and hardheads. The seed mix, which includes many pollinator-friendly species, was sown to facilitate native plant succession and deter invasive weeds from reestablishing.
- August 12–15, 2018: LMS ecologists performed data collection for *2018 Monitoring Report, Dolores River Restoration Project on Lease Tract C-SR-13* (DOE 2020a). LMS ecologists identified and characterized six reference areas. The established reference areas are shown in green in Figure 1 and are listed in Table A-1 (Appendix A). The selected reference areas are representative of minimally disturbed areas that illustrate intact hydrologic processes, geomorphic setting, and vegetation dynamics of the Dolores River corridor. Data collected from the reference sites are used as a comparison to assess the effectiveness of ongoing restoration efforts (Section 5.6).



- October 9–13, 2018: The Southwest Conservation Corps and LMS staff treated approximately 6 acres of burningbush, hardheads, Canada thistle, nodding plumeless thistle, and saltcedar with herbicide.
- November 28–29, 2018: LMS staff broadcast-seeded approximately 4 acres of relatively barren ground within monitoring regions 14, 15, 16, 16A, and 25/25p that had formerly been infested with burningbush and hardheads. The seed mix was the same as that planted in fall 2017.
- August 3–6, 2019: LMS ecologists performed data collection for *2019 Monitoring Report, Dolores River Restoration Project on Lease Tract C-SR-13* (DOE 2020b).
- September 30–October 2, 2019; October 21–23, 2019: LMS staff treated about 2.1 acres of Canada thistle, hardheads, and saltcedar with herbicide.
- June 2–4, 2020: LMS staff treated 6.4 acres of burningbush with herbicide.
- August 3–6, 2020: LMS ecologists performed data collection for *2020 Monitoring Report, Dolores River Restoration Project on Lease Tract C-SR-13*. LMS ecologists collected common reed specimens (see Figure 1) and submitted them for laboratory analysis. This work was conducted in collaboration with DRRP and the National Park Service to investigate the distribution of native, introduced, and hybrid subspecies across western Colorado and eastern Utah. The introduced subspecies exhibits invasive characteristics and is listed on the Colorado noxious weed Watch List<sup>3</sup>. Results should be available for discussion in the 2021 report.
- October 6–8, 2020; October 20–22, 2020; November 11–12, 2020: LMS staff treated 4.7 acres of Canada thistle and hardheads with herbicide.
- January 5, 2021: LM renewed the DRRP Memorandum of Understanding to continue the partnership for another 5 years (DOE 2021).

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<sup>3</sup> Species that have been determined by the state to pose a potential threat to agricultural productivity and environmental values. The Watch List is intended to serve advisory and educational purposes only. Its purpose is to encourage the identification and reporting of these species to the Department of Agriculture to assist the Department in determining which species should be designated as noxious weeds (Colorado Department of Agriculture 2019).

### 3.0 Success Goals

In its Dolores River Riparian Action Plan (Tamarisk Coalition 2010), DRRP established a monitoring program and defined ecological success goals for the Dolores River project area. The plan was later modified (DRRP 2014) to include the following objectives related to the partnership's ecological goals:

- Relative cover of live saltcedar will be reduced to less than 5% within the riparian corridor
- Relative cover of invasive, nonnative plants other than saltcedar will be reduced to less than 15% within the riparian corridor
- The remaining plant cover within the riparian corridor will be composed of desirable or native species (i.e., greater than 80% relative cover)
- Total foliar cover within the riparian corridor will be greater than or equal to 30% (or less in particular areas where vegetation is deemed adequate for the circumstances)

In addition to the DRRP goals, LM established two additional success goals for the C-SR-13 lease tract. These goals follow criteria previously used on Uranium Leasing Program lease tracts and are commonly used in uranium mine reclamation (DOE 2012). The LM success goals are as follows:

- Absolute cover of desirable species is at least 75% of that in nearby reference areas
- Noxious weeds compose less than 1% of the relative cover

LM compares annual monitoring results to DRRP and LM success goals and assesses changes in species richness and the cover of desirable species over time to potentially detect improvements in riparian habitat. LM will consider the area successfully restored when all six goals are met. Once goals are achieved, monitoring should take place biannually or triennially to ensure they continue to be met. Comparisons of monitoring results to DRRP and LM success goals are summarized in Section 5.6.

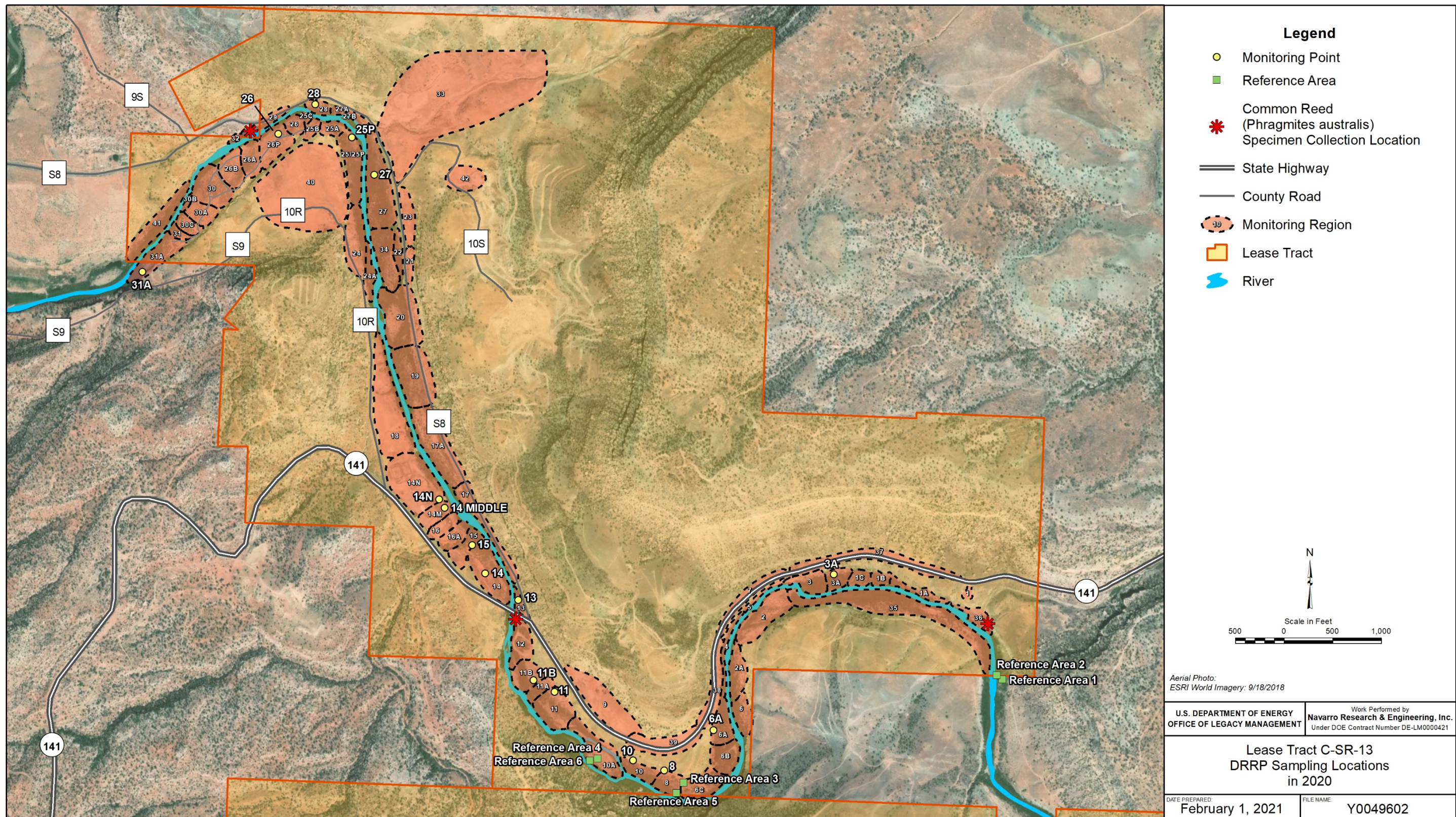


Figure 1. Lease Tract C-SR-13 DRRP Monitoring Points, Photo Points, Monitoring Regions, and Reference Areas in 2020

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## **4.0 Monitoring Methods**

Ecologists use three primary data collection methods—vegetation and ground cover measurements, noxious weed mapping, and photomonitoring—to monitor restoration efforts on the lease tract. Methods established when monitoring began in 2012 later evolved to include the collection of additional statistics and more encompassing information. In 2011, ecologists identified known weed infestations within the riparian corridor of lease tract C-SR-13 on a project map. In 2012, established monitoring points were created at those coordinates with a portable GPS unit. Vegetative and ground cover data were collected, and photographs were taken at each point from 2012 through 2020. The 16 established monitoring points are shown in yellow in Figure 1 and listed in Table A-1 (Appendix A). To gather additional information, ecologists later expanded the riparian corridor into numbered monitoring regions to identify broader areas to collect opportunistic data and note areas of concern (Figure 1). The three primary data collection methods are described in the following sections.

### **4.1 Vegetation and Ground Cover**

In August 2020, LMS ecologists conducted line-point intercept methods to collect vegetative and ground cover data at each monitoring point. The sampling points were located with a GPS unit, and a 25-meter tape measure was used to establish a transect at a preestablished, random azimuth. Data were collected every 0.5 meter along the transects, resulting in 50 data points at each transect (Herrick et al. 2017). Species observed adjacent to the monitoring transect were also recorded. Results were summarized and compared to DRRP’s success goals, LM’s success goals, reference area data, and previous years’ data.

### **4.2 Noxious Weed Mapping**

During 2020 monitoring, the approximate size, location, and species of noxious weed infestations were mapped in the field, primarily with a GPS unit. Relevant data are summarized in this report. However, because noxious weeds are no longer a dominant component of the vegetation at lease tract C-SR-13, detailed maps of noxious weed infestations are managed by weed control teams and are no longer included in this report.

### **4.3 Photomonitoring**

Photographs were taken at the established monitoring points to visually track changes in vegetation at specific points over time. The selected locations are representative of river corridor areas containing current or historical weed infestations. Although only a subset of photographs is included in this report, all photographs are maintained as records in the project files.

## 5.0 Results

Ecologists conducted monitoring between August 3 and 6, 2020. Results are summarized below. A detailed species list and line-point intercept data are provided in Appendix A.

### 5.1 Ground Cover

Average total foliar cover at the 16 monitoring points (not including reference areas) decreased from 59% in 2019 to 35% in 2020, which is the lowest since monitoring began. The decrease in foliar cover could have been due to the extended drought this area has experienced during the last several years (United States Drought Monitoring 2020). Ecologists also observed evidence of heavy livestock grazing (i.e., closely grazed vegetation, low herbaceous vegetation height, and cattle manure) in some areas of the lease tract, which may have contributed to the decrease in foliar cover as well. Although managed grazing (i.e., managing proper carrying capacities and seasonal rotations) can be compatible with the restoration goals, overgrazing could cause setbacks. LM has no control over grazing on the C-SR-13 lease tract as the land surface is owned by private entities or, in some areas, managed by the U.S. Bureau of Land Management (BLM).

### 5.2 Vegetation Composition and Species Richness

In August 2020, the most abundant woody species were rubber rabbitbrush and stretchberry, having average relative covers of 10% and 7%, respectively. Secondary woody species included fourwing saltbush, narrowleaf willow, yellow rabbitbrush, Wyoming big sagebrush, boxelder, greasewood, and skunkbush sumac. All of these are desirable native species.

The most abundant grass was saltgrass, which had an average relative cover of 5%. Secondary grasses were alkali sacaton, sand dropseed, and James' galleta, all of which are desirable native species. Notable amounts of introduced, undesirable grasses—primarily common reed and cheatgrass (both accounting for 2% average relative cover)—were also present.

The most abundant forb was the undesirable, introduced burningbush (9% average relative cover). Also present were desirable native forbs such as mountain pepperweed and Rocky Mountain beeplant. The most abundant noxious forb species was hardheads, which had a 2% average relative cover.

The average relative foliar cover of undesirable species (noxious and non-noxious weeds) was 17% across the site, a decrease from 22% recorded in 2019. The most abundant undesirable species were burningbush, cheatgrass, common reed, and hardheads in 2020. A summary of foliar cover for all years of monitoring is in Table 1.

Ecologists have continually identified new species within the lease tract (Photo 1). Some species have populated through seedings efforts (i.e. Rocky Mountain beeplant). Additionally, ecologists have begun to document more observed species within the monitoring regions to better understand the entire floral community. In 2020, 105 plant species were identified at the monitoring locations, and the mean species richness was 27, which is the highest since monitoring began.



*Photo 1. Newly Documented Species, Native Shrub, Silverleaf Buffaloberry (Shepherdia argentea)*

### **5.3 Reference Areas**

Ecologists performed the line-point intercept method to collect vegetative and ground cover data at six reference areas during 2020 monitoring. The selected reference areas are representative of minimally disturbed areas that illustrate intact hydrologic processes, geomorphic setting, and vegetation dynamics of the Dolores River corridor within the lease tract. Data collected from the reference areas are used as a comparison to assess the effectiveness of ongoing restoration efforts.

Results indicate that total foliar cover also decreased in the reference areas from 70% in 2019 to 58% in 2020, likely due to the same reasons for the decrease in cover at the 16 monitoring points. Undesirable species (noxious and non-noxious weeds combined) were found in small amounts (1% average relative cover). Dominant woody species were narrowleaf willow, stretchberry, rubber rabbitbrush, and skunkbush sumac, all desirable native species. Dominant herbaceous species (grasses and forbs) were alkali sacaton, Wyoming Indian paintbrush, and hoary tansyaster, also desirable native species. Table 1 compares reference area averages with monitoring point averages. The complete dataset from the reference areas is in Appendix A.

Table 1. Summary of Vegetation Monitoring Data at Lease Tract C-SR-13, 2013–2020

Year	Monitoring Point																Mean
	3A	6A	8	10	11	11B	13	14	14M	14N	15	25P	26P	27	28	31a	
<b>Total foliar cover (%)</b>																	
2013	73	68	25	50	48	63	73	28	-	-	13	33	53	23	28	-	44
2014	55	50	15	50	40	45	75	75	55	-	30	25	25	25	-	-	43
2015	55	70	35	20	35	50	35	55	70	60	20	35	40	25	35	-	43
2016	35	45	20	20	55	30	50	45	40	40	45	25	40	50	50	-	39
2017	75	80	30	75	60	55	60	70	80	90	80	65	65	80	85	-	70
2018	52	60	36	66	34	34	44	31	58	40	72	56	24	44	42	26	45
2019	54	64	44	70	42	46	82	44	54	48	80	64	50	52	62	82	59
2020	32	48	34	50	12	30	42	26	42	38	58	40	42	34	28	4	35
<b>2020 REFERENCE AREAS</b>																	58
<b>Relative cover of noxious weeds (primarily hardheads and saltcedar) (%)</b>																	
2013	25	0	6	32	6	77	2	10	-	-	26	17	42	12	4	-	20
2014	33	6	0	0	9	3	3	0	0	-	12	0	-	30	23	-	9
2015	4	0	0	0	3	3	3	6	0	0	4	0	2	0	3	-	2
2016	0	0	0	0	8	4	0	2	0	0	0	2	2	10	0	-	2
2017	1	0	1	1	11	18	26	25	16	21	24	0	10	6	5	-	11
2018	3	1	0	0	0	44	0	0	2	5	10	5	3	2	20	51	9
2019	0	0	0	2	0	20	0	0	0	0	2	0	0	0	3	0	2
2020	0	0	0	0	0	10	0	5	0	5	0	0	5	0	0	0	2
<b>2020 REFERENCE AREAS</b>																	0
<b>Relative cover of invasive species (noxious and non-noxious weeds) (%)</b>																	
2013	28	53	22	32	8	82	31	86	-	-	37	17	42	12	4	-	35
2014	33	9	0	0	13	6	80	76	0	-	98	0	-	39	30	-	30
2015	8	55	3	0	3	26	50	55	0	0	96	0	2	14	45	-	24
2016	11	13	0	0	8	4	52	93	0	2	100	7	2	31	24	-	23
2017	9	1	1	1	21	27	55	36	24	29	53	23	35	13	37	-	24
2018	3	2	0	0	4	48	2	16	2	5	40	6	6	4	20	51	13
2019	8	10	0	18	8	32	50	27	0	0	52	6	18	7	14	75	20
2020	10	6	0	12	0	10	25	25	0	10	30	0	26	13	7	100	17
<b>2020 REFERENCE AREAS</b>																	1
<b>Relative cover of desirable species (native and introduced) (%)</b>																	
2013	72	47	78	68	92	18	69	14	-	-	63	83	58	88	96	-	65
2014	67	91	100	100	87	94	20	24	100	-	2	100	-	61	70	-	70
2015	89	45	97	100	97	74	50	45	100	100	4	100	98	86	55	-	76
2016	89	87	100	100	92	96	48	17	100	98	0	93	98	69	76	-	78
2017	91	99	99	99	79	73	45	64	76	71	47	77	65	87	63	-	76
2018	97	98	100	100	96	52	98	83	98	95	61	94	94	96	80	49	86
2019	92	90	100	82	92	68	50	73	100	100	48	94	82	93	86	25	80
2020	90	94	100	88	100	90	75	70	100	85	70	100	69	87	93	0	83
<b>2020 REFERENCE AREAS</b>																	93



Table 1. Summary of Vegetation Monitoring Data at Lease Tract C-SR-13, 2013–2020 (continued)

Year	Monitoring Point																Mean
	3A	6A	8	10	11	11B	13	14	14M	14N	15	25P	26P	27	28	31a	
<b>Species richness</b>																	
2013	14	12	10	10	9	10	10	6	-	-	5	-	11	4	6	-	9
2014	11	11	10	5	10	8	6	5	5	-	5	6	4	8	-	-	7
2015	18	17	8	8	11	7	8	7	6	3	4	7	4	6	11	-	8
2016	9	7	6	9	11	6	5	4	5	4	5	6	4	5	6	-	6
2017	24	10	11	13	12	17	12	22	19	15	16	18	26	14	22	-	17
2018	12	15	12	17	15	17	12	5	10	6	18	31	15	10	17	15	14
2019	23	23	23	23	13	22	16	19	18	16	13	25	29	14	19	9	20
2020	29	31	18	31	26	24	23	31	23	23	29	42	31	26	26	20	27
<b>2020 REFERENCE AREAS</b>																	24

**Note:**

A dash indicates that no data were collected for this point during the monitoring event.

## 5.4 Noxious Weed Mapping Results

The locations of noxious weed infestations were mapped during monitoring. Infestations of hardheads, jointed goatgrass, saltlover, Canada thistle, saltcedar, and nodding plumeless thistle were mapped. Detailed weed maps were provided to weed control specialists and are maintained as records in the project files. Weed control efforts have significantly reduced noxious weed populations. Although large monocultural stands have been reduced, scattered noxious weeds are present throughout the river corridor. LMS staff treated approximately 6.4 acres of burningbush with herbicide in spring 2020 and 4.7 acres of hardheads, Canada thistle, nodding plumeless thistle, and young saltcedar in early fall 2020.

## 5.5 Photomonitoring Results

Photomonitoring results from selected locations in 2020 and corresponding photos from previous years are included below. Of the 22 total photo points, 7 are included in this report, located at reference area 3 and monitoring points 3A, 6A, 11B, 14N, 25P, and 27. Photomonitoring data suggest the following trends:

- A visible and significant reduction can be seen in the cover of noxious weeds at all photomonitoring locations
- In many areas, native vegetation growth is evident in areas previously dominated by hardheads or saltcedar
- Visual observations of decreased foliar cover, effects of drought, and evidence of heavy livestock grazing was photographed

**Reference Area 3, View to the Southwest**



*Photo 2a. 2019—Understory Dominated by Native Grass, Alkali Sacaton*



*Photo 2b. 2020—Visible Decrease in Foliar Cover Likely from Continued Drought and Livestock Grazing; Average Total Foliar Cover at the Reference Areas Decreased from 70% in 2019 to 58% in 2020*

***Monitoring Point 3A, View to the East***



*Photo 3a. 2012—Understory Dominated by Hardheads*



*Photo 3b. 2020—Hardheads Have Been Nearly Eliminated*

***Photo Point 6A, View to the North-Northeast***



*Photo 4a. 2012—Understory of Hardheads Surrounding Observer*



*Photo 4b. 2020—Reduction of Hardheads; Native Fourwing Saltbush in Foreground*

***Photo Point 11B, View to the Northwest***



*Photo 5a. 2012—Plants in Foreground Are Hardheads*



*Photo 5b. 2020—Reduction of Hardheads; Native Rubber Rabbitbrush in Foreground*

**Photo Point 14N, View to the North**



*Photo 6a. 2012—Flowering Plants in Foreground Are Hardheads*



*Photo 6b. 2020—A Few Hardheads are Present, but Native Inland Saltgrass Is the Dominant Ground Cover; Visible Decrease in Foliar Cover and Closely Grazed Vegetation*

**Photo Point 25P, View to the South**



*Photo 7a. 2012—Saltcedar (Shrub with Orange Flagging), Not Yet Treated*



*Photo 7b. 2020—Same Saltcedar After Treatment (Now Woody Debris on the Ground) and Recruitment of Several Native Species*

## 5.6 Comparison of 2020 Results to Success Goals

Table 2 shows a comparison of 2020 results at the 16 monitoring points to the four DRRP success goals and two LM goals. Green-shaded cells indicate areas where goals have been met. Three of the six goals were met in 2020; however, results indicate conditions are near the success criteria for all goals.

The mean relative cover of invasive species (17%), desirable vegetation compared to the reference areas (53%), and relative cover of noxious species (2%) did not meet success criteria in 2020. Since 2012, the mean cover of noxious species at the 16 monitoring points has declined considerably (saltcedar: 2012—15%, 2020—<1%; hardheads: 2012—20%, 2020—2%); however, scattered populations remain throughout the lease tract. Jointed goatgrass, first identified during the 2019 monitoring, was still present in 2020 but did not appear to be as prevalent. The mean relative cover of invasive species (noxious and non-noxious weeds) decreased slightly from 22% in 2019 to 17% in 2020.

The relative cover of desirable species meets the DRRP success criteria (>80%) at 10 of the 16 monitoring points. When compared to the reference areas, the relative cover of desirable species meets LM success criteria at 2 of the 16 monitoring points. Noxious species other than saltcedar remain at most of the monitoring points but do not make up a significant portion of the foliar cover. With continued vegetation management, it is expected that goals will be met in the next several years.

Table 2. Comparison of 2020 Data at Established Monitoring Points to Success Goals

Goal	3A	6A	8	10	11	11B	13	14	14M	14N	15	25P	26P	27	28	31a	Mean
<b>DRRP Goals</b>																	
Relative cover of saltcedar <5%	0	0	0	0	0	0	obs	0	0	obs	0	0	obs	0	0	obs	<1
Relative cover of invasive species <15%	10	6	0	12	0	10	25	25	0	10	30	0	26	13	7	100	17
Relative cover of desirable (native and introduced) species >80%	90	94	100	88	100	90	75	75	100	90	70	100	74	87	93	0	83
Total foliar cover >30%	32	48	34	50	12	30	50	26	42	38	58	40	42	34	28	4	35
<b>LM Goals</b>																	
Absolute cover of desirable species is at least 75% of that in nearby reference areas	62	79	59	77	21	47	38	34	74	60	71	70	54	52	46	0	53
Relative cover of noxious species <1%	obs	0	0	0	obs	10	0	5	obs	5	obs	0	5	0	obs	0	2

**Notes:**

Green-shaded cells indicate areas where goals have been met.

**Abbreviation:**

obs = plants observed at the monitoring point but accounted for <1% of the foliar cover



## 6.0 Recommendations

Monitoring in 2020 showed progress toward restoration goals in some areas along the 3.3 miles of the Dolores River corridor through DOE lease tract C-SR-13. Weed control efforts (herbicide treatments and mechanical removal) are decreasing invasive and noxious species; however, some areas still contain notable populations. Other areas show increases in native species through reseeding efforts and passive recruitment.

The following recommendations are provided based on 2020 monitoring results:

- Although the foliar cover of invasive and noxious species has significantly decreased, scattered populations remain present throughout the lease tract. Ecologists recommend that LM continue to monitor and spot-spray weed infestations to improve ongoing restoration efforts and to comply with state and local noxious weed regulations as described in the *Procedure for Handling Herbicides at Western Legacy Management Sites* (LMS/PRO/S12853). To maximize effectiveness, noxious weed control activities should be scheduled for the appropriate season, depending on the targeted species. Herbicide spraying for noxious biennial thistles, burningbush, and saltlover should take place in spring before plants flower and produce seed. Tamarisk cutting and spraying should take place in late summer or fall when plants are taking up nutrients. Herbicide treatments for hardheads and Canada thistle should take place in June during bud stage or in fall as the plants go dormant.
- Ecologists observed evidence of heavy livestock grazing on the lease tract in 2020. Although managed grazing can be compatible with LM restoration goals, overgrazing can cause setbacks. Additionally, ecologists believe that the continuing drought in the Slick Rock area may be adversely affecting plant cover. Total foliar cover decreased from 59% in 2019 to 35% in 2020, the latter of which is the lowest amount since monitoring began in 2013. If heavy grazing appears to continue in 2021, it is recommended that ecologists meet with DRRP representatives, BLM, and local landowners to discuss this issue.
- LMS ecologists collected common reed specimens for submission of laboratory analysis in August 2020. This work was conducted in collaboration with DRRP and the National Park Service to investigate the distribution of native, introduced, and hybrid subspecies across western Colorado and eastern Utah. The introduced subspecies exhibits invasive characteristics and is listed on the Colorado noxious weed Watch List. Results should be available for discussion in the 2021 report.
- Investigate potential revegetation efforts, such as seeding or transplanting, at monitoring points with low foliar cover (monitoring points 3A, 4, 11, 11B, 27, 28, and 31A).

## 7.0 References

Colorado Department of Agriculture, 2019. *Noxious Weed Species*, <https://www.colorado.gov/pacific/agconservation/noxious-weed-species>, accessed September 7, 2020.

CNHP (Colorado Natural Heritage Program), 2000. *A Natural Heritage Assessment San Miguel and Western Montrose Counties, Colorado*, [https://cnhp.colostate.edu/wp-content/uploads/download/documents/2000/San\\_Miguel\\_and\\_Western\\_Montrose.pdf](https://cnhp.colostate.edu/wp-content/uploads/download/documents/2000/San_Miguel_and_Western_Montrose.pdf), March.

DOE (U.S. Department of Energy), 2012. *Summary of U.S. Department of Energy's 2011 Dolores River Restoration Work on Uranium Lease Tract C-SR-13, near Slick Rock, Colorado*, LMS/ULP/Y00343, Office of Legacy Management, February.

DOE (U.S. Department of Energy), 2013. *2012 Monitoring Report, Dolores River Restoration Project on Lease Tract C-SR-13*, LMS/ULP/Y00361, Office of Legacy Management, May.

DOE (U.S. Department of Energy), 2015a. *2013 Monitoring Report, Dolores River Restoration Project on Lease Tract C-SR-13*, LMS/ULP/Y00371, Office of Legacy Management, January.

DOE (U.S. Department of Energy), 2015b. *2014 Monitoring Report, Dolores River Restoration Project on Lease Tract C-SR-13*, LMS/ULP/Y00372, Office of Legacy Management, February.

DOE (U.S. Department of Energy), 2015c. Dolores River Restoration Partnership Memorandum of Understanding, memorandum by Deputy Director of Field Operations David Schafer, December 23.

DOE (U.S. Department of Energy), 2016. *2015 Monitoring Report, Dolores River Restoration Project on Lease Tract C-SR-13*, LMS/ULP/Y00396, Office of Legacy Management, September.

DOE (U.S. Department of Energy), 2018a. *2016 Monitoring Report, Dolores River Restoration Project on Lease Tract C-SR-13*, LMS/ULP/Y00407, Office of Legacy Management, May.

DOE (U.S. Department of Energy), 2018b. *2017 Monitoring Report, Dolores River Restoration Project on Lease Tract C-SR-13*, LMS/ULP/Y00410, Office of Legacy Management, May.

DOE (U.S. Department of Energy), 2020a. *2018 Monitoring Report, Dolores River Restoration Project on Lease Tract C-SR-13*, LMS/ULP/Y00417, Office of Legacy Management, July.

DOE (U.S. Department of Energy), 2020b. *2019 Monitoring Report, Dolores River Restoration Project on Lease Tract C-SR-13*, LMS/ULP/Y00495, Office of Legacy Management, November.

DOE (U.S. Department of Energy), 2021. Dolores River Restoration Partnership Memorandum of Understanding, memorandum by Deputy Director of Field Operations David Schafer, January 5.

DRRP (Dolores River Restoration Partnership), 2014. *Dolores River Restoration Partnership Transition Plan 2015-2019, Protecting Our Shared Investments in Riparian Restoration Through Monitoring and Maintenance, Appendix A: Updated DRRP Goals & Metrics*, [https://www.drrpartnership.org/pdf/DRRP\\_Transition\\_Plan\\_05\\_23\\_2014.pdf](https://www.drrpartnership.org/pdf/DRRP_Transition_Plan_05_23_2014.pdf), May 23.

Herrick, E.H., J.W. Van Zee, S.E. McCord, E.M. Courtright, J.W. Karl, and L.M. Burkett, 2017. "Monitoring Manual for Grassland, Shrubland, and Savanna Ecosystems Volume I: Core Methods," 2nd edition, U.S. Department of Agriculture, ARS Jornada Experimental Range, Las Cruces, New Mexico, April 4.

*Procedure for Handling Herbicides at Western Legacy Management Sites*, LMS/PRO/S12853, continually updated, prepared by Navarro Research and Engineering, Inc., for the U.S. Department of Energy Office of Legacy Management.

Tamarisk Coalition, 2010. *Dolores River Riparian Action Plan (DR-RAP), Recommendations for Implementing Tamarisk Control & Restoration Efforts*, March, [http://ocs.fortlewis.edu/drrp/pdf/2010\\_Dolores\\_River\\_Riparian\\_Action\\_Plan.pdf](http://ocs.fortlewis.edu/drrp/pdf/2010_Dolores_River_Riparian_Action_Plan.pdf), accessed June 9, 2017.

United States Drought Monitor, 2020. “Map Archive,” Colorado, August 3, 2019, <https://droughtmonitor.unl.edu/Maps/MapArchive.aspx>, accessed September 7, 2020.

USDA (U.S. Department of Agriculture), 2020. “PLANTS Database,” Natural Resources Conservation Service, <https://plants.usda.gov>, accessed September 7, 2020.

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## **Appendix A**

**Complete Dataset for 2020 Dolores River Restoration Monitoring,  
Lease Tract C-SR-13**

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Table A-1. Complete Dataset for 2020 Dolores River Restoration Monitoring, Lease Tract C-SR-13

Reference Area or Monitoring Point	REF	REF	REF	REF	REF	REF	REF	3A	6A	8	10	11	11B	13	14	14 Middle	14N	5a	25p	26	27	28	31a	MEAN			
	1	2	3	4	5	6	Mean																				
	Absolute Cover (%)																										
<b>Total foliar cover</b>	46	66	52	34	64	88	58	32	48	34	50	12	30	42	26	42	38	58	40	42	34	28	4	35			
<b>Bare ground</b>	18	24	28	44	24	8	24	28	28	26	16	46	44	28	38	28	36	12	38	38	6	22	16	28			
<b>Rock</b>	0	0	0	0	0	0	0	0	0	20	4	18	10	0	0	0	0	0	0	0	0	8	0	4			
<b>Herbaceous litter</b>	10	10	12	14	6	4	9	12	8	12	10	20	12	20	30	28	24	14	16	18	2	10	62	19			
<b>Woody litter</b>	18	0	2	0	6	0	4	10	16	4	8	0	4	10	6	2	2	16	6	2	58	30	18	12			
<b>Basal</b>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	1			
<b>Lichen</b>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
<b>Standing dead</b>	8	0	6	8	0	0	4	18	0	4	12	4	0	0	0	0	0	0	0	0	0	2	0	3			
Scientific Name	Common Name (USDA)		Relative Cover (%)																								
<i>Acer negundo</i>	Boxelder		0	0	0	0	0	0	obs	0	0	0	0	0	obs	obs	0	0	49	obs	0	0	0	0	3		
<i>Achnatherum hymenoides</i>	Indian ricegrass		0	0	0	11	0	0	2	0	obs	0	obs	obs	0	obs	0	0	obs	0	obs	0	0	<1			
<i>Acroptilon repens</i>	Hardhead (Russian knapweed)		obs	0	0	obs	0	2	0	obs	0	0	0	obs	10	0	6	obs	5	obs	obs	5	0	obs	2		
<i>Aegilops cylindrica</i>	Jointed goatgrass		0	0	0	0	0	0	0	0	0	obs	0	obs	obs	0	0	0	0	0	0	0	0	<1			
<i>Agrostis stolonifera</i>	Creeping bentgrass		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	obs	0	0	<1			
<i>Alyssum desertorum</i>	Desert madwort		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*			
<i>Amaranthus blitoides</i>	Mat amaranth		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*			
<i>Amaranthus retroflexus</i>	Redroot amaranth		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*			
<i>Ambrosia artemisiifolia</i>	Annual ragweed		0	0	0	0	0	0	0	obs	0	0	0	0	0	0	0	0	0	0	16	obs	0	1			
<i>Apocynum cannabinum</i>	Indianhemp		0	obs	0	0	0	2	2	0	0	0	0	0	obs	0	0	0	0	obs	0	0	0	<1			
<i>Aristida purpurea</i>	Purple threeawn		0	0	0	obs	0	0	0	obs	obs	6	0	29	obs	0	0	0	0	obs	0	0	0	2			
<i>Artemisia dracunculus</i>	Tarragon		0	0	0	obs	0	0	0	0	0	0	obs	obs		0	0	0	obs	obs	0	0	<1				
<i>Artemisia frigida</i>	Prairie sagewort		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*			
<i>Artemisia nova</i>	Black sagebrush		0	0	0	obs	0	0	<1	obs	0	obs	obs	obs	0	0	0	0	0	0	0	0	0	<1			
<i>Artemisia tridentata</i> ssp. <i>wyomingensis</i>	Wyoming big sagebrush		5	obs	9	obs	2	0	3	5	21	obs	9	obs	15	0	obs	obs	0	obs	obs	0	obs	3			
<i>Artemisia tridentata</i> ssp. <i>tridentata</i>	Basin big sagebrush		0	0	0	0	0	0	0	0	0	0	0	0	0	obs	0	0	0	obs	0	0	0	<1			
<i>Asclepias cryptoceras</i>	Pallid milkweed		0	0	0	0	0	0	0	0	0	obs	0	0	0	0	0	0	0	0	0	0	0	<1			
<i>Asclepias speciosa</i>	Showy milkweed		0	0	0	obs	0	obs	0	0	0	0	0	0	0	0	0	0	obs	0	0	0	0	<1			
<i>Asparagus officinalis</i>	Garden asparagus		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	obs	0	obs	0	0	<1			
<i>Astragalus bisulcatus</i>	Twogrooved milkvetch		obs	obs	0	0	0	0	0	0	obs	0	obs	0	0	0	0	0	0	0	obs	0	0	<1			
<i>Astragalus mollissimus</i>	Wooly locoweed		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*			
<i>Astragalus</i> sp.	Milkvetch		0	0	0	0	0	0	0	0	0	0	0	0	obs	0	0	0	0	0	0	0	0	<1			
<i>Atriplex canescens</i>	Fourwing saltbush		3	0	0	0	0	0	19	18	11	3	obs	0	7	17	obs	obs	obs	0	obs	0	7	obs	5		
<i>Atriplex confertifolia</i>	Shadscale saltbush		0	0	0	0	0	0	obs	0	0	0	0	0	obs	0	0	0	0	obs	0	0	0	<1			
<i>Atriplex gardneri</i>	Gardner's saltbush		0	0	0	0	0	0	0	0	0	obs	0	0	0	0	0	0	0	0	0	0	0	<1			
<i>Bassia scoparia</i>	Burningbush		0	0	obs	0	0	0	0	6	0	0	obs	obs	4	11	obs	5	14	0	0	13	0	100	9		
<i>Bouteloua curtipendula</i>	Sideoats grama		0	0	0	0	0	0	obs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	<1			
<i>Bouteloua gracilis</i>	Blue grama		0	0	0	0	0	0	0	6	0	obs	0	0	0	0	0	0	obs	0	0	0	0	<1			
<i>Bromus inermis</i>	Smooth brome		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*			
<i>Bromus tectorum</i>	Cheatgrass		obs	obs	0	0	obs	0	0	10	obs	0	12	0	obs	obs	obs	obs	obs	8	obs	obs	obs	7	obs	2	
<i>Calamagrostis canadensis</i>	Bluejoint		0	16	0	0	0	3	3	0	0	0	0	0	0	0	0	0	26	obs	0	0	0	2			
<i>Calochortus nuttallii</i>	Sego lily		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*			
<i>Carduus nutans</i>	Nodding plumeless thistle		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	obs	<1		
<i>Castilleja linariifolia</i>	Wyoming Indian paintbrush		8	11	obs	obs	20	obs	7	0	0	0	0	0	0	obs	obs	obs	obs	obs	0	obs	obs	<1			
<i>Chamaesyce maculata</i>	Spotted sandmat		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	<1			

Table A-1. Complete Dataset for 2020 Dolores River Restoration Monitoring, Lease Tract C-SR-13 (continued)

Reference Area or Monitoring Point		REF 1	REF 2	REF 3	REF 4	REF 5	REF 6	REF Mean	3A	6A	8	10	11	11B	13	14	14 Middle	14N	5a	25p	26	27	28	31a	MEAN
		Absolute Cover (%)																							
<i>Chenopodium album</i>	Lambsquarters	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Chrysothamnus viscidiflorus</i>	Yellow rabbitbrush	obs	5	0	obs	2	0	1	0	6	0	6	0	0	11	obs	obs	0	obs	0	0	25	27	obs	5
<i>Cirsium arvense</i>	Canada thistle	0	0	0	0	0	0	0	0	0	0	obs	0	0	0	0	0	0	0	0	0	obs	0	0	<1
<i>Cirsium undulatum</i>	Wavyleaf thistle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*
<i>Cirsium vulgare</i>	Bull thistle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*
<i>Clematis ligusticifolia</i>	Western white clematis	0	0	0	0	0	obs	<1	0	0	0	0	0	0	0	0	0	0	0	0	0	obs	0	0	<1
<i>Cleome serrulata</i>	Rocky Mountain beeplant	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	obs	obs	0	0	0	0	0	1
<i>Comandra umbellata</i>	Bastard toadflax	0	0	0	obs	0	0	<1	0	0	0	0	0	0	0	0	0	0	0	obs	0	0	0	0	<1
<i>Convolvulus arvensis</i>	Field bindweed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*
<i>Conyza canadensis</i>	Canadian horseweed	0	0	0	0	0	obs	<1	0	0	0	obs	0	0	0	0	0	obs	0	0	obs	0	0	0	<1
<i>Coreopsis sp.</i>	Tickseed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*
<i>Cornus sericea</i>	Redosier dogwood	0	0	0	0	0	obs	<1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Descurainia pinnata</i>	Western tansymustard	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*
<i>Distichlis spicata</i>	Saltgrass	obs	obs	3	0	0	0	1	0	obs	0	15	0	0	21	obs	95	90	obs	obs	0	obs	33	0	16
<i>Echinocereus coccineus</i>	Scarlet hedgehog cactus	0	0	obs	0	0	0	<1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Echinochloa crus-galli</i>	Barnyardgrass	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	obs	0	<1
<i>Elymus canadensis</i>	Canada wildrye	0	0	0	0	0	3	1	0	0	0	0	0	0	0	0	0	0	0	obs	0	0	obs	0	<1
<i>Elymus elymoides</i>	Squirreltail	0	0	obs	obs	0	0	<1	obs	0	obs	0	0	0	0	0	obs	0	0	0	0	0	0	0	<1
<i>Elymus repens</i>	Quackgrass	0	0	0	0	0	0	0	0	0	0	0	0	0	14	0	0	0	0	0	0	0	0	0	1
<i>Elymus trachycaulus</i>	Slender wheatgrass	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	obs	0	<1
<i>Ephedra torreyana</i>	Torrey's jointfir	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*
<i>Equisetum hyemale</i>	Scouring horsetail	obs	2	0	obs	0	0	<1	0	obs	0	0	0	0	0	0	0	0	obs	obs	obs	obs	0	0	<1
<i>Eremopyrum triticeum</i>	Annual wheatgrass	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*
<i>Ericameria nauseosa</i>	Rubber rabbitbrush	3	0	13	17	obs	0	5	48	3	0	6	43	25	0	28	5	obs	11	obs	obs	obs	0	obs	10
<i>Erigeron sp.</i>	Fleabane	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*
<i>Eriogonum ovalifolium</i>	Cushion buckwheat	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*
<i>Erodium cicutarium</i>	Redstem stork's bill	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*
<i>Forestiera pubescens</i>	Stretchberry	27	18	obs	obs	16	3	11	5	21	0	9	obs	20	obs	obs	obs	obs	0	obs	obs	50	obs	obs	7
<i>Fraxinus anomala</i>	Singleleaf ash	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*
<i>Gaillardia pinnatifida</i>	Red dome blanketflower	0	0	0	obs	0	0	<1	obs	obs	obs	0	0	obs	0	0	0	0	0	0	0	0	0	0	<1
<i>Glycyrrhiza lepidota</i>	American licorice	obs	7	obs	obs	2	3	2	0	0	0	obs	0	0	0	obs	obs	obs	obs	obs	obs	0	0	0	<1
<i>Grindelia squarrosa</i>	Curlycup gumweed	0	0	0	0	0	0	0	0	obs	obs	0	0	0	obs	obs	obs	obs	obs	obs	obs	obs	obs	0	<1
<i>Gutierrezia sarothrae</i>	Broom snakeweed	obs	0	0	obs	0	0	0	obs	obs	0	3	14	obs	0	obs	0	0	0	0	0	0	0	0	1
<i>Halogeton glomeratus</i>	Saltlover	obs	0	0	0	0	0	<1	0	obs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	<1
<i>Helianthus annuus</i>	Common sunflower	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*
<i>Hesperostipa comata</i>	Needle and thread	0	0	0	obs	0	0	0	0	0	0	0	0	0	0	obs	0	0	0	0	0	0	0	0	<1
<i>Hesperostipa neomexicana</i>	New Mexico feathergrass	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*
<i>Heterotheca villosa</i>	Hairy false goldenaster	0	0	0	17	0	0	3	0	0	0	0	obs	obs	0	0	0	0	0	obs	0	0	0	0	<1
<i>Hymenopappus filifolius</i>	Fineleaf hymenopappus	0	0	0	obs	0	0	<1	obs	0	0	obs	obs	obs	0	0	0	0	0	0	obs	0	0	0	<1
<i>Ipomopsis aggregata</i>	Scarlet gilia	0	obs	obs	0	4	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Juncus articus</i>	Mountain rush	0	2	0	0	0	obs	<1	0	obs	0	0	0	0	0	0	obs	0	obs	obs	0	obs	0	0	<1
<i>Juniperus osteosperma</i>	Utah juniper	3	0	0	0	obs	0	<1	obs	0	0	obs	obs	obs	0	0	0	0	0	0	0	0	0	0	<1
<i>Krascheninnikovia lanata</i>	Winterfat	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	obs
<i>Lappula occidentalis</i>	Flatspine stickseed	0	0	0	0	0	0	0	0	obs	obs	obs	obs	0	0	0	0	0	0	0	0	0	0	0	<1
<i>Lepidium montanum</i>	Mountain pepperweed	0	0	0	0	obs	0	0	obs	9	0	3	0	obs	4	11	obs	obs	5	obs	0	obs	obs	0	2



Table A-1. Complete Dataset for 2020 Dolores River Restoration Monitoring, Lease Tract C-SR-13 (continued)

Reference Area or Monitoring Point		REF 1	REF 2	REF 3	REF 4	REF 5	REF 6	REF Mean	3A	6A	8	10	11	11B	13	14	14 Middle	14N	5a	25p	26	27	28	31a	MEAN	
		Absolute Cover (%)																								
<i>Lepidium perfoliatum</i>	Clasping pepperweed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*
<i>Leymus cinereus</i>	Basin wildrye	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	obs	0	<1
<i>Linum rigidum</i>	Stiffstem flax	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*
<i>Lomatium</i> sp.	Desertparsley	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*
<i>Lygodesmia juncea</i>	Rush skeletonplant	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*
<i>Machaeranthera canescens</i>	Hoary tansyaster	obs	obs	0	17	obs	16	5	0	0	0	0	0	0	0	0	0	0	obs	obs	0	0	obs	0	<1	
<i>Medicago sativa</i>	Alfalfa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	obs	obs	obs	0	obs	<1	
<i>Melilotus officinalis</i>	Sweetclover	0	obs	0	obs	0	obs	0	0	0	0	0	obs	obs	0	0	0	0	0	4	obs	obs	obs	0	<1	
<i>Mentzelia rusbyi</i>	Rusby's blazingstar	0	0	0	0	0	0	0	obs	0	obs	0	0	0	0	0	0	0	0	0	0	0	0	0	<1	
<i>Mirabilis linearis</i>	Narrowleaf four o'clock	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*	
<i>Mirabilis multiflora</i>	Colorado four o'clock	0	0	0	0	0	0	0	obs	obs	obs	0	0	0	0	0	0	0	0	0	0	0	0	0	<1	
<i>Oenothera longissima</i>	Longstem evening primrose	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	<1	
<i>Opuntia polyacantha</i>	Plains pricklypear	obs	obs	6	obs	obs	0	1	obs	obs	0	obs	obs	obs	0	obs	obs	0	0	0	0	0	obs	0	<1	
<i>Panicum capillare</i>	Witchgrass	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*	
<i>Pascopyrum smithii</i>	Western wheatgrass	0	9	0	0	0	5	2	0	0	0	0	0	0	obs	0	0	0	obs	obs	0	0	0	0	<1	
<i>Penstemon palmeri</i>	Palmer's penstemon	0	0	0	0	0	0	0	0	0	0	0	obs	obs	0	obs	0	0	0	0	0	0	0	0	<1	
<i>Phalaris arundinacea</i>	Reed canarygrass	0	2	0	0	0	obs	0	0	0	0	0	0	0	0	0	obs	0	0	0	0	0	0	0	<1	
<i>Phlox hoodii</i>	Spiny phlox	0	0	0	0	0	0	0	0	0	obs	0	0	0	0	0	0	0	0	0	0	0	0	0	<1	
<i>Phlox longifolia</i>	Longleaf phlox	0	0	0	0	0	0	0	0	0	obs	0	0	0	0	0	0	0	0	0	0	0	0	0	<1	
<i>Phragmites australis</i>	Common reed	0	2	0	0	obs	0	0	0	0	0	0	0	0	7	11	0	0	8	obs	obs	obs	obs	0	2	
<i>Pinus edulis</i>	Twoneedle pinyon	0	0	0	0	obs	0	<1	obs	0	0	obs	0	0	0	0	0	0	0	0	0	0	0	0	<1	
<i>Plantago patagonica</i>	Wooly plantain	0	0	obs	0	0	0	0	obs	0	6	0	0	0	0	0	0	0	0	obs	obs	0	obs	0	<1	
<i>Pleuraphis jamesii</i>	James' galleta	0	0	22	0	0	0	4	obs	obs	44	obs	obs	0	0	0	0	0	0	0	0	0	0	0	2	
<i>Poa palustris</i>	Fowl bluegrass	0	obs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	obs	obs	0	0	obs	obs	<1	
<i>Polygonum aviculare</i>	Prostrate knotweed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*	
<i>Polypogon monspeliensis</i>	Annual rabbitsfoot grass	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*	
<i>Populus angustifolia</i>	Narrowleaf cottonwood	0	0	0	0	0	0	0	0	0	0	0	0	0	obs	0	0	0	0	obs	obs	0	obs	0	<1	
<i>Populus fremontii</i>	Fremont cottonwood	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	obs	0	0	0	0	<1	
<i>Portulaca oleracea</i>	Little hogweed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*	
<i>Psathyrostachys juncea</i>	Russian wildrye	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*	
<i>Quercus gambelii</i>	Gambel oak	0	0	obs	0	0	0	0	0	obs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	<1	
<i>Rhus trilobata</i>	Skunkbush sumac	obs	obs	obs	obs	18	0	3	0	0	6	24	obs	obs	obs	obs	obs	obs	obs	obs	obs	0	6	0	2	
<i>Ribes inerme</i>	Whitestem gooseberry	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*	
<i>Rosa woodsii</i>	Woods' rose	0	obs	0	0	0	obs	0	0	9	0	0	0	0	0	obs	0	obs	0	obs	obs	0	0	0	1	
<i>Rumex crispus</i>	Curly dock	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*	
<i>Salix amygdaloides</i>	Peachleaf willow	0	0	0	0	0	obs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
<i>Salix exigua</i>	Narrowleaf willow	0	25	0	17	14	62	20	0	3	0	0	0	obs	obs	obs	obs	obs	5	56	obs	obs	13	obs	5	
<i>Salsola tragus</i>	Prickly Russian thistle	0	0	obs	obs	0	0	0	0	obs	obs	obs	obs	0	0	obs	obs	obs	obs	obs	5	0	0	obs	<1	
<i>Sarcobatus vermiculatus</i>	Greasewood	14	0	obs	0	0	0	2	0	obs	0	3	obs	5	7	obs	obs	obs	0	obs	obs	6	13	obs	2	
<i>Schizachyrium scoparium</i>	Little bluestem	0	0	0	obs	0	0	<1	0	0	0	0	0	0	0	0	0	0	0	obs	0	0	0	<1		
<i>Schoenoplectus tabernaemontani</i>	Softstem bulrush	0	0	0	0	0	obs	<1	0	0	0	0	0	0	0	0	obs	obs	0	0	0	0	0	<1		
<i>Senecio flaccidus</i>	Threadleaf ragwort	0	0	0	6	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
<i>Shepherdia argentea</i>	Silverleaf buffaloberry	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	obs	obs	obs	0	0	0	0	<1		
<i>Sisymbrium altissimum</i>	Tall tumbled mustard	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*	
<i>Solanum triflorum</i>	Cutleaf nightshade	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*	

Table A-1. Complete Dataset for 2020 Dolores River Restoration Monitoring, Lease Tract C-SR-13 (continued)

Reference Area or Monitoring Point		REF 1	REF 2	REF 3	REF 4	REF 5	REF 6	REF Mean	3A	6A	8	10	11	11B	13	14	14 Middle	14N	5a	25p	26	27	28	31a	MEAN	
		Absolute Cover (%)																								
<i>Solidago</i> sp.	Goldenrod	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*
<i>Sorghastrum nutans</i>	Indiangrass	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*
<i>Spartina gracilis</i>	Alkali cordgrass	0	obs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Sphaeralcea coccinea</i>	Scarlet globemallow	0	0	0	obs	0	0	0	obs	obs	0	obs	obs	obs	0	0	0	0	0	0	obs	0	0	0	<1	
<i>Sporobolus airoides</i>	Alkali sacaton	35	obs	47	0	2	obs	14	5	obs	0	9	0	0	7	0	0	obs	obs	obs	37	obs	obs	0	4	
<i>Sporobolus contractus</i>	Spike dropseed	0	0	0	0	0	obs	0	0	0	0	0	0	25	0	6	0	0	0	15	0	0	0	0	3	
<i>Sporobolus cryptandrus</i>	Sand dropseed	0	obs	0	17	12	0	5	5	obs	22	obs	14	0	0	0	obs	obs	obs	0	37	obs	obs	obs	5	
<i>Stanleya pinnata</i>	Destert princesplume	obs	0	0	obs	0	0	0	5	3	0	0	0	0	0	0	obs	obs	0	obs	0	0	0	0	<1	
<i>Suaeda moquinii</i>	Mojave seablite	obs	0	0	0	0	0	0	0	0	0	0	0	0	18	0	0	0	0	0	0	obs	0	obs	1	
<i>Symphyotrichum frondosum</i>	Short-rayed alkali aster	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*	
<i>Tamarix ramosissima</i>	Saltcedar (tamarisk)	0	0	0	0	0	obs	0	0	0	0	obs	0	0	obs	0	0	obs	0	0	obs	obs	0	obs	<1	
<i>Tetradymia canescens</i>	Spineless horsebrush	0	0	0	0	0	0	0	obs	0	0	obs	obs	0	0	0	0	0	0	0	0	0	0	0	<1	
<i>Thelypodium integrifolium</i>	Entireleaved thelypody	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*	
<i>Toxicodendron rydbergii</i>	Western poison ivy	0	obs	0	0	6	0	1	0	0	0	0	0	0	obs	obs	0	0	0	0	0	0	0	0	<1	
<i>Tragopogon dubius</i>	Yellow salsify	0	0	0	0	0	0	0	0	0	0	obs	0	0	0	0	0	0	0	0	0	0	0	0	<1	
<i>Tribulus terrestris</i>	Puncturevine	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*	
<i>Ulmus pumila</i>	Siberian elm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	obs	0	0	0	0	0	0	0	0	<1	
<i>Verbascum thapsus</i>	Common mullein	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*	
<i>Vulpia octoflora</i>	Sixweeks fescue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	0	0	0	0	0	0	0	0	1	
<i>Xanthium strumarium</i>	Rough cocklebur	0	0	0	0	0	obs	0	0	0	0	0	0	0	0	0	0	0	0	obs	obs	0	obs	0	<1	
<i>Yucca baccata</i>	Banna yucca	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*	
<b>Species richness</b>		23	27	17	30	19	25	24	29	31	18	31	26	24	23	31	23	23	29	42	31	26	26	20	27	
<b>Herbaceous height (cm)</b>		22	59	17	26	33	59	36	15	25	31	22	15	14	26	47	15	14	37	27	29	29	19	17	19	
<b>Woody height (cm)</b>		53	141	68	165	123	195	124	153	113	73	87	50	141	73	96	0	0	793	94	0	124	109	0	119	
<b>Slope (%)</b>		1	1	3	0	3	1	2	2	3	10	7	2	1	7	2	2	0	1	0	0	4	3	0	3	
<b>Azimuth (0-360)</b>		2	340	204	262	122	130	-	59	70	288	194	140	288	134	84	158	315	272	138	239	19	103	44	-	

**Notes:**

- Orange highlight indicates State of Colorado List B noxious weeds.
- Blue highlight indicates State of Colorado List C noxious weeds.
- Purple highlight indicates State of Colorado noxious Watch List species.
- Green highlight indicates undesirable, invasive species not listed by the State of Colorado.
- \* Indicates species observed in previous years but not during the 2020 monitoring.

**Abbreviations:**

- cm = centimeters
- obs = observed
- USDA = U.S. Department of Agriculture