LMS/ULP/46716

2023 Monitoring Report, Dolores River Restoration on Lease Tract C-SR-13

May 2024

U.S. DEPARTMENT OF ENERGY | Legacy Management

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Abbreviations

CDA	Colorado Department of Agriculture
DA	disturbed area
DOE	U.S. Department of Energy
DRRP	Dolores River Restoration Partnership
IPM	integrated pest management
LM	Office of Legacy Management
LMS	Legacy Management Support
ULP	Uranium Leasing Program
USDA	U.S. Department of Agriculture

1.0 Background

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. Approximately 3.3 miles of the Dolores River riparian corridor are within U.S. Department of Energy (DOE) Uranium Leasing Program (ULP) Lease Tract C-SR-13 (Figure 1). DOE's Office of Legacy Management (LM) has supported DRRP's management goals in Lease Tract C-SR-13 by controlling weeds and restoring ecological communities since 2011. LM began annual ecological monitoring in 2012 to document changes in vegetation and guide weed control and restoration activities. LM formally joined the DRRP coalition in 2015 and renewed its memorandum of understanding in 2021 to continue the partnership through 2026 (DOE 2015; DRRP 2021). This report summarizes the most recent monitoring event, which was conducted from October 10–11, 2023.

Restoration activities in the riparian corridor on Lease Tract C-SR-13 are supported by the Ecosystem Management Team, one of nine Environmental Management System sustainability teams under the joint LM/Legacy Management Support (LMS) contractor *Environmental Management System/Energy Management System Description* (LM-Procedure-3-20-12.0, LMS/POL/S04346). They also support two LM goals, Goal 1: protect human health and the environment and Goal 4: sustainably manage and optimize the use of land and assets (DOE 2020).

The Dolores River riparian corridor is a transitional area between the Dolores River, with associated wetlands, and surrounding semiarid shrublands. It is important to conserve riparian corridors because they are the most productive habitats in the arid west and provide water, forage, and cover for a wide variety of species. Although they make up less than 2% of the land area in the arid west, their value is much greater than their relative size.

Historically, riparian corridors have been degraded by changes in hydrology resulting from upstream dams, water appropriations, and the introduction of invasive trees like tamarisk (*Tamarix ramosissima*), also known as saltcedar; Russian olive (*Elaeagnus angustifolia*); and Siberian elm (*Ulmus pumila*). These trees consume large amounts of water, but tamarisk is especially damaging because it can increase salt levels in soils, which curtails the growth of other more ecologically valuable native trees. Historically, ecosystems within riparian corridors have also been degraded by human activities, such as mining, infrastructure projects, and livestock grazing. Humans have introduced noxious and invasive species like Russian knapweed (*Acroptilon repens*), also known as hardheads; Canada thistle (*Cirsium arvense*); and musk thistle (*Carduus nutans*), also known as nodding plumeless thistle. Invasive species disrupt desirable native ecosystems and degrade habitat quality even when they do not consume large amounts of water.

A significant portion of Lease Tract C-SR-13 contains ecosystems dominated by stretchberry (*Forestiera pubescens*), also known as New Mexico privet, which is classified as globally imperiled by the Colorado Natural Heritage Program (CNHP 2022). This ecological community and its component species are tracked for conservation purposes (NatureServe 2022). The presence of this imperiled community makes conserving the Dolores River riparian corridor on Lease Tract C-SR-13 especially important.

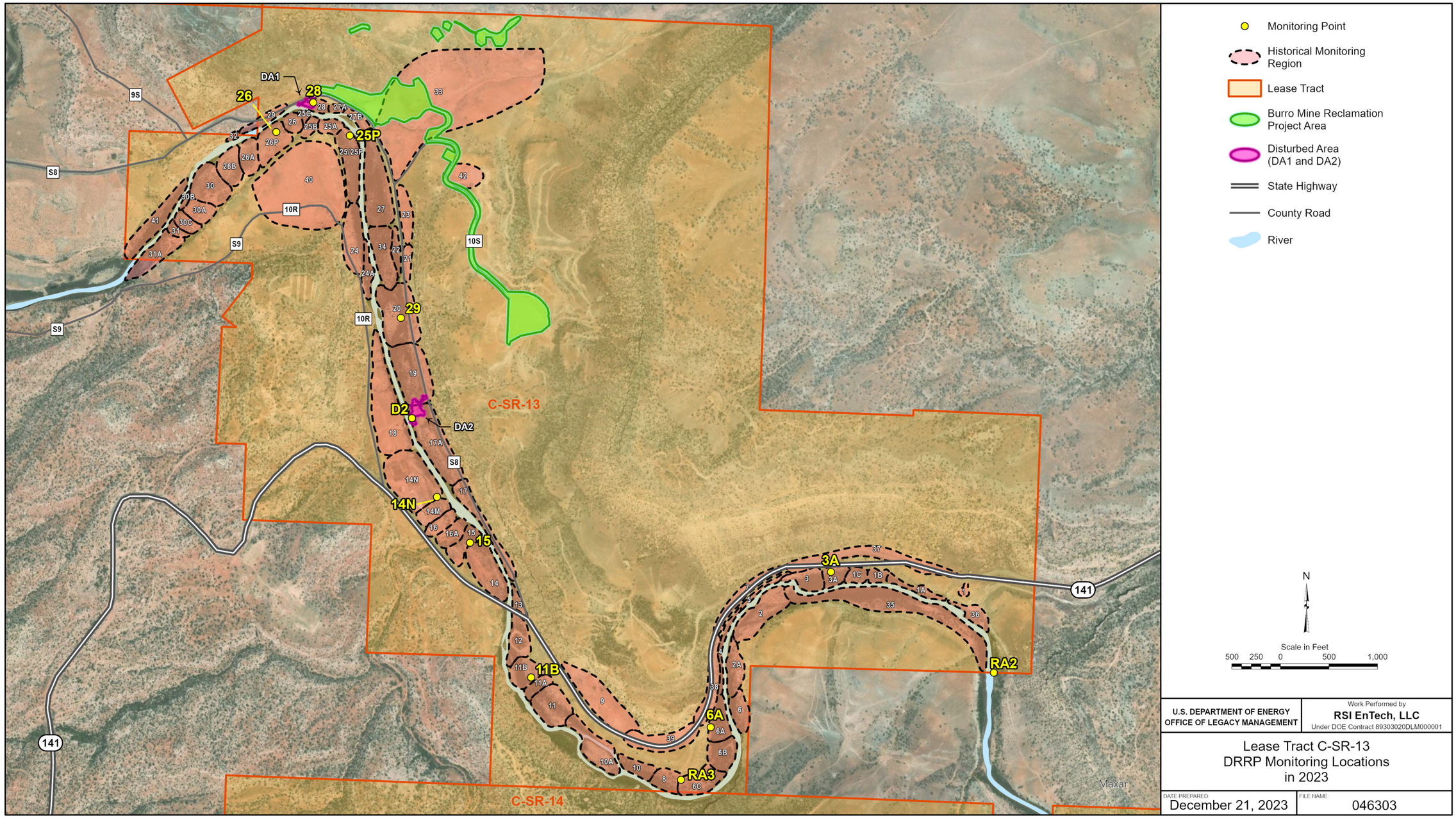


Figure 1. Lease Tract C-SR-13

1.1 Success Goals Met in 2022

LM developed six ecological success goals for the portion of the Dolores River riparian corridor on Lease Tract C-SR-13. Annual DRRP monitoring focused on comparing results to these goals until 2022, when all goals were met (DOE 2023). In 2023, DRRP monitoring began focusing on describing current conditions, including any that could threaten the continued success of the restoration efforts. Also in 2023, biological control agents that could benefit restoration at the site were investigated. As a result of this change in focus, success goals are no longer compared to monitoring results, but they are included in this section for reference.

Four goals were based on guidelines from the *Dolores River Riparian Action Plan (DR-RAP), Recommendations for Implementing Tamarisk Control & Restoration Efforts* (Tamarisk Coalition 2010) and the *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* (DRRP 2014). DOE developed two additional goals for ULP-related to revegetation success. The six goals in total are as follows:

1. Live tamarisk will be reduced to less than 5% relative cover within the riparian corridor
2. Invasive, nonnative plants other than tamarisk will be reduced to less than 15% relative cover within the riparian corridor
3. The remaining plant cover (i.e., greater than 80% relative cover) within the riparian corridor will be composed of desirable or native species
4. Total foliar cover within the riparian corridor will be greater than or equal to 30% (or less in particular areas where physical conditions hamper vegetation establishment)
5. Absolute cover of desirable species will be at least 75% of that in nearby reference areas
6. Noxious weeds will compose less than 1% of the relative cover

In 2022, annual monitoring results showed that all six goals have been met, and the area has been successfully restored. The detailed monitoring results from 2022 are provided in the 2022 monitoring report (DOE 2023).

1.2 Biological Controls

Biocontrol agents are host-specific insects, mites, or other pathogens like fungi that only control target plant species. The Colorado Department of Agriculture (CDA) receives new and approved biocontrol agents from the U.S. Department of Agriculture (USDA) Animal and Plant Health Inspection Service. A new biocontrol agent for Russian olive is being approved for release in the United States. Foreign scientists are developing biocontrol agents for cheatgrass (*Bromus tectorum*). Both Russian olive and cheatgrass are found on Lease Tract C-SR-13.

Biocontrol is part of a strategy called integrated pest management (IPM), an environmentally sensitive approach that relies on a combination of common-sense strategies to control invasive species. Biocontrol is utilized with other IPM methods, such as mechanical control. For example, mowing is recommended 2 to 4 weeks after releasing Canada thistle rust fungus, bindweed mites, or Russian knapweed gall flies. Biocontrol agents can also sometimes be used in combination for better success. As an example, the Russian knapweed gall midge and Russian knapweed stem gall wasp achieve more control in combination than each species individually (see Section 1.3.2).

The CDA Conservation Services Division Biological Control Program implements and distributes host-specific biocontrol agents. Also known as the Palisade Insectary, it has been operating since 1945 in Palisade, Colorado, and it currently offers 20 different biocontrol agents for use in Colorado. CDA is also a member of the DRRP.

1.3 Biocontrol Along the Dolores River

Biological controls are being considered for many LM sites, and Lease Tract C-SR-13 is a good candidate for several. Target plant species along the Dolores River corridor include invasive, nonnative plants such as Russian knapweed, spotted knapweed (*Centaurea stoebe*), diffuse knapweed (*Centaurea diffusa*), field bindweed (*Convolvulus arvensis*), musk thistle, puncturevine (*Tribulus terrestris*), Dalmatian toadflax (*Linaria dalmatica*), butter and eggs (also known as yellow toadflax) (*Linaria vulgaris*), hoary cress (*Lepidium draba*), leafy spurge (*Euphorbia esula*), Canada thistle, yellow star-thistle (*Centaurea solstitialis*), and tamarisk. Insect pests can also be target species, and these include the Oriental fruit moth (*Grapholita molesta*) and emerald ash borer beetle (*Agrilus planipennis*).

From October 10–11, 2023, LMS ecologists collaborated with CDA to evaluate the presence of host-specific biocontrol agents on nonnative and noxious weeds along the Dolores River riparian corridor within Lease Tract C-SR-13. This section provides background information on biological control agents and target species identified during that visit. Biocontrol agents could benefit DRRP efforts in a number of ways. Biocontrol is more cost-effective than chemical or mechanical control, and it can be more effective in areas that are challenging to access. Biocontrol agents can be released when chemical use is prohibited near water or when chemical use would damage native species like stretchberry. If chemical or mechanical methods fail to eradicate invasive plants, then biocontrol agents can be utilized to help naturally control infestations. Biocontrol agents can be released or established near infestation areas, and they will naturally spread.

1.3.1 Biocontrol Agents for Tamarisk

Tamarisk leaf beetles (*Diorhabda carinulata*) overwinter, or diapause, as adults in the duff under tamarisk trees then emerge in late spring to start feeding and begin reproduction. Hatched larvae have three growth stages, or instars, then they pupate in the duff and develop into adults (Figure 2). Both larvae and adults feed on the foliage, turning the leaves brown and dry. The Palisade Insectary implemented the introduction and monitoring of tamarisk leaf beetles along the Dolores River. They were first released in 2006 at two U.S. Bureau Land Management sites near Gateway and Bedrock, Colorado. In 2008, large numbers of tamarisk beetles moved along the Dolores River from Utah into Colorado. The beetles caused major defoliation events starting in 2008 at most areas along the Dolores River watershed (Figure 3). The tamarisk leaf beetles are now well established in western Colorado and continue to successfully suppress tamarisk. With biocontrol agents well established, the natural restoration of willows and cottonwoods along the Dolores River is occurring. Two other host-specific insects help control tamarisk naturally: tamarisk leaf weevils (*Coniatus splendidulus*) and green leafhoppers (*Opsius stactogalus*). Both were introduced with tamarisk in the late 1800s and are adventive species. CDA began monitoring leafhoppers in 2008 and discovered the weevils in Colorado in 2011. Neither species is offered as a biocontrol agent, but they are monitored; it is likely that both are contributing to tamarisk suppression along the Dolores River.

1.3.2 Biocontrol Agents for Russian Knapweed

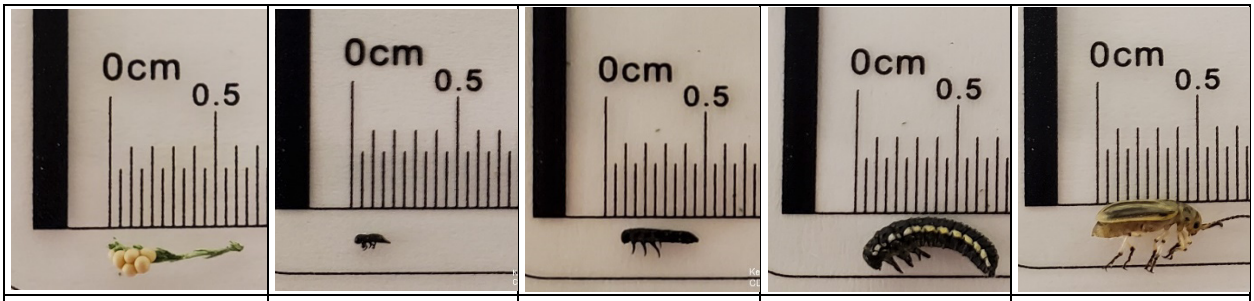
Russian knapweed is a Class B noxious weed in Colorado and has displaced native species throughout the Dolores River watershed. Two host-specific insects are available to help control this perennial weed: the Russian knapweed gall midge (*Jaapiella ivannikovi*) and the Russian knapweed stem gall wasp (*Aulacidea acroptilonica*). CDA first released the gall midges within the Dolores River watershed outside of Gateway, Colorado, in 2012. The stem gall wasps were first released in 2019, also outside of Gateway, and the agent was successfully established by 2020.

The gall midge (Figure 4), lays eggs on the growing tips of the leaves. Feeding larvae then stimulate gall formations, or abnormal growths, on the plant. Galls that form on the basal rosette stunt plant growth and decrease flowering, which inhibits pollination and reproduction. The gall midges need water to survive and are therefore best to release near a water system. The gall midges produce four to five generations each season and can successfully establish at grazed or mowed infestations. These characteristics make the Russian knapweed gall midge appropriate for natural control along Lease Tract C-SR-13.

Russian knapweed stem gall wasps lay eggs in the main and lateral stems of the plant. The adults need tender stems for egg laying; therefore, the optimal release window is spring to early summer. The larvae feed within the stems, which stimulates gall formation. The larvae tap into the water and sugar source of the stems, stunting plant growth, decreasing biomass, and reducing flower production (Figure 4). This biocontrol agent performs best near river or water systems, but it can establish at dry sites, unlike the gall midge. The stem gall wasp is also appropriate to naturally control Russian knapweed at Lease Tract C-SR-13.

The gall midges cohabitate with stem gall wasps in infestation areas and achieve control of Russian knapweed together. The gall midges, released in 2012, showed little evidence of galling until stem gall wasps were also introduced in 2019. Stem galls from the wasps stunt leaf formation and cause the growth of more tender leaves, which attract the gall midges. Greater Russian knapweed suppression is achieved with the wasps attacking the leaf and the midges feeding inside the stem compared to either biocontrol agent being used independently.

A third biocontrol agent found on Russian knapweed along the Dolores River is an adventitious rust fungus (*Puccinia acroptili*), which infects both the upper and lower leaf surfaces of the plant. The rust fungus spores are microscopic, but the brown pustules containing them can be seen on infected plants (Figure 5). The rust fungus causes leaf dieback and could reduce the plant's ability to photosynthesize, leading to a faster senescence process. The fungus can be found on midge or wasp galls at infestations near water systems. The biocontrol agent is not offered at the Palisade Insectary, but it is studied at monitoring sites.



Eggs, laid in clusters	First instar larva	Second instar	Third instar, has a distinct stripe	Adult female

Figure 2. Tamarisk Leaf Beetle Larval Stages and Adult Form (Photo Credit: CDA)

Note: The stand is 90% defoliated.

Figure 3. Defoliation of Tamarisk with Numerous Adult Beetles (Left) and Widespread Defoliationon a Tamarisk Stand (Right) (Photos Credit: CDA)

Figure 4. Left to Right: Russian Knapweed Gall Midge, Russian Knapweed Plant near Gateway with Midge Gall, Russian Knapweed Stem Gall Wasps, and Russian Knapweed Stem Gall the Size of a Fingerling Potato Outside of Gateway (Photo Credit: CDA)

Figure 5. Russian Knapweed Infected with Puccinia Acroptili *Fungus in Delta County, Colorado (Photo Credit: CDA)*

2.0 History of Restoration

Before 2011, LMS ecologists mapped large stands of noxious weeds (including noxious trees like tamarisk) along the Dolores River riparian corridor within ULP Lease Tract C-SR-13. The control of noxious weeds is mandated by federal, state, and local laws and regulations. Until 2011, tamarisk was abundant in the riparian corridor. Russian olive and Siberian elm had also become established. Russian knapweed was a major component of the understory plant cover. Also present were Canada thistle; musk thistle; saltlover (*Halogeton glomeratus*), also known as halogeton; and other noxious and invasive plants.

LM, the LMS contractor, subcontractors, and Gold Eagle Mining Inc. (the leaseholder for Lease Tract C-SR-13) performed weed control and restoration activities beginning in 2011. Invasive trees were mechanically removed with an excavator-mounted mulcher, and stumps were treated with herbicide. Herbicides were also applied to stands of understory weeds. Select areas were reseeded with native species. LM partnered with the Western Colorado Conservation Corps beginning in 2014 to conduct additional weed control on an annual basis. In 2017, LM began targeted habitat improvement projects that included treating stands of burningbush (*Bassia scoparia*) with herbicide and reseeding with native seed mixes containing pollinator-friendly species. LM collaborated with DRRP and the National Park Service in August 2020 to collect samples of common reed (*Phragmites australis*) for laboratory analysis to determine if it contains genetic material from benign native or introduced invasive subspecies. The specimens were later determined to be composed of both native and nonnative varieties (Utah State University 2020). A detailed list of restoration activities from 2011 to 2021 is provided in the 2021 monitoring report (DOE 2022).

To protect the Dolores River from potential sediment loads, LM relocated, stabilized, and armored portions of a waste rock pile associated with the Burro Mines Complex within Lease Tract C-SR-13. The mine complex was near but outside the riparian corridor of the Dolores River, and unconsolidated waste rock material was at the edge of a tributary that conveys stormwater runoff to the river. The reclamation project occurred between June and October 2021 and was unrelated to the DRRP. The footprint of the Burro Mines reclamation project is shown in Figure 1.

3.0 Monitoring Methods

Success criteria for revegetation were achieved in 2022 (DOE 2023), and the scope of monitoring changed for Lease Tract C-SR-13 in 2023. Monitoring methods include qualitative data collection, collection of plant species lists within numbered monitoring regions that were previously established at the site (Figure 1), noxious weed mapping, and photomonitoring. Ecologists began to implement biocontrol surveys (insect sweeps), and quantitative, point-intercept methods to measure vegetation cover and composition were eliminated. Weed control efforts have shifted from a maintenance-level approach to a monitoring-level approach.

Ecologists took photographs at select locations and established new photomonitoring location point 29 (shown in Figure 1). At each point, four photographs were recorded in each of the four cardinal directions (north, south, east, and west), plant species lists were collected, and ecologists noted any evidence of wildlife and host-specific biocontrol agents on target weed species. Ecologists also made observations about the surrounding ecology. Several representative photographs are included in this report, but all are retained as records in the project files.

A comprehensive list of plant and animal species observed during the 2023 field visit was compiled. It includes plants occurring near photomonitoring points, plants observed in the monitoring regions, and wildlife species observed within the entire riparian corridor. Scientific nomenclature and common names of the plants follow the USDA Natural Resources Conservation Service PLANTS Database (USDA 2023).

Biocontrol surveys were performed at monitoring points 14N, 26, and Disturbed Area 1 (DA1) (Figure 1). Insect sweeps were used to check for biocontrol agents on tamarisk. Insect sweeps were performed following the tamarisk beetle sweep survey protocol (Jamison et al. 2018). This protocol is used nationwide to monitor the spread of tamarisk leaf beetles in the United States. Twenty-five sweeps of tamarisk foliage into a bug net are performed at each monitoring or sweep point. Tree health evaluation is performed by visually estimating the percentage of deadwood versus green wood, the percentage of canopy foliage (green, brown, or yellow), and the percentage of flowers. Visual surveys were also performed to detect biocontrol agents on Russian knapweed. A visual estimation of infestation size and biocontrol abundance was performed at each of the three monitoring points.

4.0 Results and Discussion

The annual monitoring event found no evidence that any of the six success criteria had been compromised along Lease Tract C-SR-13 in 2023. Weed control is summarized in Section 4.1. Biocontrol assessment results from the 2023 monitoring event are summarized in Section 4.2. The results of qualitative methods (photomonitoring and species lists) and other observations are described in Sections 4.3 and 4.4.

4.1 Weed Control

Weed control along Lease Tract C-SR-13 has shifted from intensive management (i.e., mechanical removal and herbicide application) to a maintenance phase. Russian knapweed has been almost completely eradicated from the lease tract, and biocontrol agents have been found to be present on tamarisk, aiding in natural suppression. Remnant populations of Russian knapweed were observed at monitoring points 28, 29, 14N, and 11B. Each infestation was composed of six to 10 individual plants, and biocontrol agents were observed naturally suppressing the infestations at monitoring points 28 and 14N. Monitoring in 2023 found no infestations significant enough to require chemical or mechanical treatment, and annual monitoring of these points will continue.

4.2 Biocontrol Survey Results

Tamarisk trees were surveyed at monitoring points 26 and 14N (Figure 6). At monitoring point 26, one sweep point was taken on one small and one medium tree. No tamarisk leaf beetles were found in the sweep samples. One tamarisk weevil adult, two green leafhoppers, and other insects (flea beetles and earwigs) were observed in the sweep net. The trees had 0% to 1% flowers; the canopy foliage was mostly green with a low percentage of brown foliage, which indicates that feeding damage is most likely due to the weevils and leafhoppers. Neither tree had deadwood.

Figure 6. Feeding Damage Caused by Tamarisk Weevils and Green Leafhoppers Evidenced by the Brown and Senesced Foliage on the Tamarisk at Monitoring Point 26 (Left) and Monitoring Point 14N (Right)

At monitoring location 14N, a sweep point was taken on one small tree and one medium to large tree. One male tamarisk leaf beetle was found in the sweep net (Figure 7). The sweep sample also contained 12 tamarisk weevils, eight tamarisk leafhoppers, and other insects (ants, lacewings, spiders, flea beetles, true bugs, and parasitoids). Deadwood was higher on the medium to large tree than the small tree. The canopy foliage on the trees had a higher percentage of yellow feeding damage caused by green leafhoppers (Figure 7). There were few flowers on the trees. Zero percent brown foliage on the trees indicated that most tamarisk leaf beetles were overwintering for the season, or a low population of beetles was present in the area.

Figure 7. Sweep Net Survey Performed on Tamarisk Tree (Left) and Male Adult Tamarisk Leaf Beetle Collected During Sweep Sample at Monitoring Point 14N (Right)

Two of the three Russian knapweed agents were found at two monitoring points along the lease tract: rust fungus and midge galls. Russian knapweed rust fungus was found to be infecting most of the plants at point 14N. Some of the plants showed more advanced fungus damage than other newly infected plants. The advanced plants looked highly stressed, or senesced, by the fungus. The newly infected plants were still green and showing signs of early leaf dieback (Figure 8).

Note: The plants on the left are newly infected compared to the last plant on the right, which displays advanced damage with total dieback, and there is intermediate rust fungus damage on the plants in the center.

Figure 8. Rust Fungus Damage Progression from Left to Right

Disturbed soils are highly susceptible to invasive weed infestations. Areas void of vegetation at monitoring location DA1 make the area more susceptible to erosion. Russian knapweed gall midges were observed on a small infestation, composed of six to eight individuals, at DA1. Rosette galls were found on most of the plants. The galled plants were stunted in growth and had no flowers due to the biocontrol agent (Figure 9). Suppression has been achieved by natural control. Rilling was observed throughout the monitoring location, and native grasses and forbs, such as saltgrass (*Distichlis spicata*) and mountain pepperweed (*Lepidium montanum*), have begun to reestablish (Figure 10).

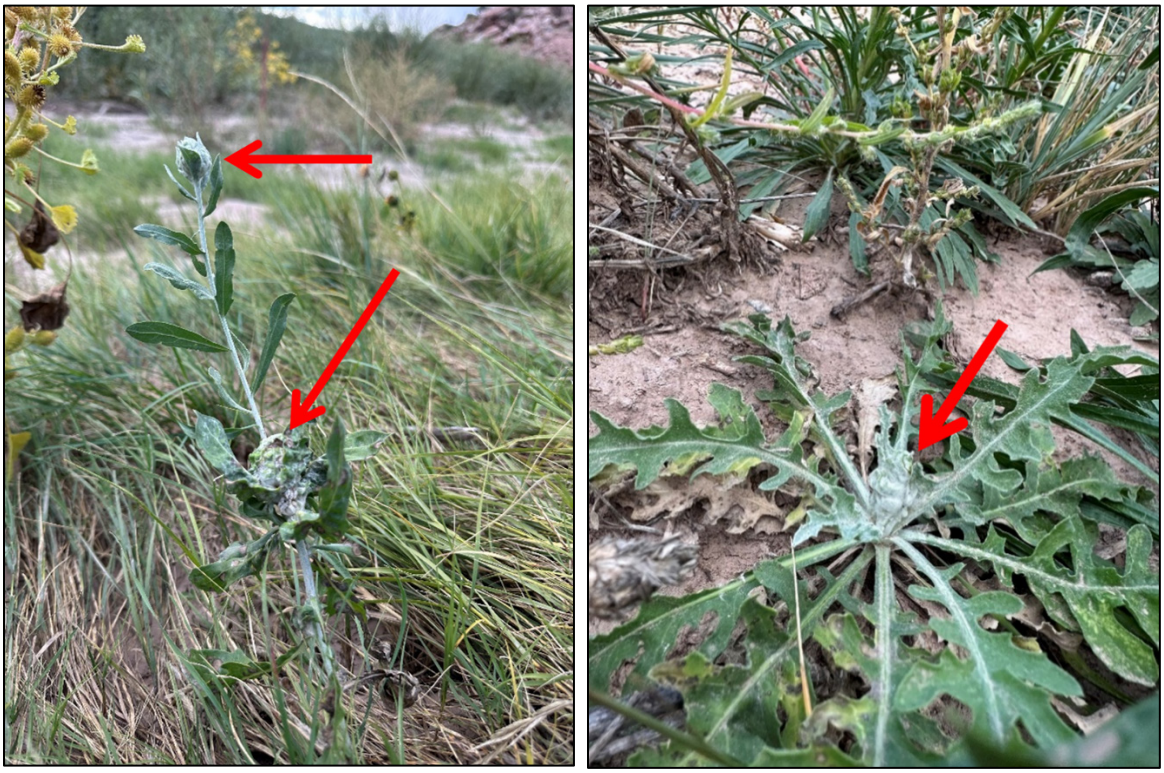


Figure 9. Russian Knapweed Midge Galls on Plants Preventing Flowering and Stunting Growth at Monitoring Point DA1

Figure 10. DA1 with Patches of Native Vegetation and Bare Ground

Russian knapweed and tamarisk are under control due to LM's management practices of using mechanical removal and chemical treatment, and only small infestations of up to 10 plants were observed. The plants most likely are remnants of past, larger populations that invaded the lease tracts from nearby infestations or were already present in the seed bank. Biocontrol agents do not know property borders and migrate over to naturally controlled infested areas. It can be inferred that biocontrol agents are present on nearby landowners' infestations because agents have not been released on Lease Tract C-SR-13. In areas where biocontrol agents are present, suppression of Russian knapweed has been achieved. Because the biocontrol agents are effectively controlling Russian knapweed, ecologists recommend that chemical or mechanical control is not currently necessary. The success of biocontrol agents will continue to be assessed during future monitoring.

4.3 Photomonitoring

Photographs taken at the same points over time suggest several trends. A significant reduction in the cover of noxious weeds, especially Russian knapweed, is evident, and native vegetation has become established in its place. Figure 11 shows the major reduction of Russian knapweed and the establishment of native vegetation, mainly saltgrass, over the last 10 years at monitoring point 14N. Russian knapweed was dominant in the understory at many points in 2012, but it has been reduced to a minor component through weed control efforts; less bare ground was visible in the understory in 2023 than in previous years.

Figure 11. Photomonitoring Point 14N in 2012 (Left), 2022 (Center), and 2023 (Right)

Figure 12 shows monitoring point 11B, an area where Russian knapweed has been successfully eliminated by herbicide treatment. In 2012, before the herbicide treatment, Russian knapweed was dominant throughout the understory and had formed a monoculture. This noxious weed has an allopathic root system, which sends toxins into the soil and prevents native vegetation from growing. After eradication, large patches of bare ground were present throughout the understory. Seasonal flooding events along the Dolores River watershed help to remove toxins, deposit nutrients into the soil, and aid in soil health recovery while reducing the impact from livestock grazing along the lease tract. Sand dropseed (*Sporobolus cryptandrus*) and other native grasses have begun to establish at the monitoring point and were more abundant in 2023 than in 2022.

Figure 12. Photomonitoring Point 11B Dominated by Russian Knapweed in 2012 (Left), Showing Large Amounts of Bare Ground After Knapweed Eradication in 2022 (Center), and Showing Native Grasses Beginning to Establish in the Understory in 2023 (Right)

Visual comparisons showed that photomonitoring point 25P had more bare ground in 2022 compared to 2023 (Figure 13). This area was also affected by seasonal flooding, which prevented livestock access and grazing for a portion of the growing season. Narrowleaf willow (*Salix exigua*), a desirable native tree, and other native plant species were beginning to establish at the monitoring location.

Figure 13. Photomonitoring Point 25P in 2022 (Left) and 2023 (Right), Showing the Natural Establishment of Narrowleaf Willow After Weed Eradication

4.4 Species Lists

Table 1 lists the dominant plant species observed in 2023. In addition to the species in Table 1, an abundance of plant species was observed in the riparian corridor in 2023. Species with high ecological value include those that were seeded in disturbed areas and species that potentially increase with habitat enhancements. Seeded species include Indian ricegrass (*Achnatherum hymenoides*), western wheatgrass (*Pascopyrum smithii*), blue grama (*Bouteloua gracilis*), and needle and thread (*Hesperostipa comata*). Examples of high-quality native species found in the riparian corridor that could increase with habitat enhancements are stretchberry, skunkbush sumac (*Rhus trilobata*), prairie sagewort (*Artemisia frigida*), Colorado four o'clock (*Mirabilis multiflora*), narrowleaf willow, and Fremont cottonwood (*Populus fremontii*). Invasive species found in trace amounts include tamarisk, Russian knapweed, cheatgrass, saltlover, and jointed goatgrass (*Aegilops cylindrica*).

Table 1. Dominant Plant Species Observed in the Riparian Corridor of Lease Tract C-SR-13 in 2023

Scientific Name	Common Name	Notes
Forestiera pubescens Nutt.	Stretchberry	Native desirable tree, dominant species in the stretchberry wet shrubland community
Distichlis spicata (L.) Greene	Saltgrass	Native perennial grass
Sporobolus cryptandrus (Torr.) A. Gray	Sand dropseed	Native perennial grass
Salix exigua Nutt.	Narrowleaf willow	Native desirable tree, dominant in wetter areas
Bassia scoparia (L.) A.J. Scott	Burningbush	Introduced, annual invasive weed (not noxious)
Sarcobatus vermiculatus (Hook.) Torr.	Greasewood	Native desirable shrub
Ericameria nauseosa (Pall. Ex Pursh) G.L. Nesom & Baird	Rubber rabbitbrush	Native desirable shrub
Acer negundo L.	Boxelder	Native desirable tree
Suaeda moquinii (Torr.) Greene	Mojave seablite	Native desirable shrub
Salsola tragus L.	Prickly Russian thistle	Introduced, annual invasive weed (not noxious)
Artemisia tridentata Nutt.	Big sagebrush	Native desirable shrub
Sporobolus airoides	Alkali sacaton	Native desirable grass
Populus angustifolia	Narrowleaf cottonwood	Native desirable tree

Observations of wildlife were also recorded during monitoring in 2023, including a sighting of a bullsnake (*Pituophis catenifer sayi*) and bear (*Ursus* spp.) tracks (Figure 14). Tracks, scat, or sightings of the following mammals were also observed: coyote (*Canis latrans*), mule deer (*Odocoileus hemionus*), and cottontail rabbit (*Sylvilagus* sp.). Multiple species of birds were seen or heard, including common ravens (*Corvus corax*), turkey vultures (*Cathartes aura*), and pinyon jays (*Gymnorhinus cyanocephalus*), a special-status species.

Figure 14. Evidence of Wildlife in the Riparian Corridor in 2023: Bullsnake (Left) and Bear (Right)

5.0 Recommendations

The following recommendations are made for future work at the lease tracts:

Weed control: Weed control efforts have reduced populations of noxious and invasive weeds to maintenance levels. Therefore, repeated, aggressive control measures are no longer cost-effective. It is recommended that the riparian corridor of Lease Tract C-SR-13 be divided into three segments and that weed control efforts be focused on one segment annually. The segments would rotate so that populations would be treated by spot spraying with herbicide or mechanical control methods or by releasing biocontrol agents on a regular basis to prevent weeds from reestablishing in any area. If biocontrol agents are observed to be effective in an area, additional control should not be needed.

Monitoring: To ensure that the success goals continue to be met, it is recommended that monitoring be performed every 3 years, with the next monitoring event scheduled for 2026. Because measuring tapes are difficult to lay down in dense riparian areas, and because quantitative methods have demonstrated that success goals have been met, ecologists plan to continue photomonitoring, collecting species lists, and performing biocontrol assessments without the need to collect quantitative data.

Habitat restoration: It might be appropriate to reallocate monitoring and maintenance resources and focus on habitat restoration projects, such as reseeding areas disturbed in 2021, enhancing or establishing stands of stretchberry, or enhancing specific habitat for special-status species, such as pinyon jays or monarch butterflies (*Danaus plexippus*). To support LM's beneficial reuse initiatives and current federal initiatives and guidance, future projects could emphasize pollinator habitat or enhance habitat for migratory birds.

Livestock grazing: Although properly managed grazing can be compatible with restoration goals, overgrazing can adversely affect restoration efforts. LM does not control livestock grazing on Lease Tract C-SR-13, but ecologists could meet with DRRP representatives, U.S. Bureau of Land Management biologists, and local landowners to discuss possible restrictions or alternative grazing strategies.

6.0 References

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