GRANTEE: **FRIENDS OF THE YAMPA**
PROJECT NAME: **YAMPA RIVER LEAFY SPURGE PROJECT**
ROUNDTABLE: **Yampa-White-Green**
[NTP Date: 19 November 2018]

General Project Status

- All Tasks described in the Yampa River Leafy Spurge Project (YRLSP) are presently on schedule and within budget (budget summary appears below).
- In-kind contributions are accruing, as anticipated, from all partners (in-kind contribution summary spreadsheet attached).
- A successful community outreach event was held in Craig on April 24, 2019. A follow-up event is scheduled for January 7, 2020 at the Maybell Elementary School. Moffat County Weed and Pest will provide dinner for attendees. YRLSP and the University of Wyoming team will provide updates on their work to local community members.
- This year, leafy spurge was mapped along approximately 60 miles of the Yampa River, from Hayden through Little Yampa Canyon. Maps are best viewed on our web site: https://www.yampariverleafyspurgeproject.com/maps.
- Field sites were selected for integrated management treatment research. Treatments were applied and data collected by University of Wyoming students and faculty.
- Half of the known historical biocontrol release sites (21 of 42) were visited for data collection in July, using a protocol developed in collaboration with Colorado Department of Agriculture.
- A successful youth engagement event occurred in July in collaboration with Boys and Girls Club and Routt and Moffat County CSU Extension.
- Detailed progress reports for each task are provided in the pages to follow.

YRLSP BUDGET—1-year Status Report—19 November 2019					
CONTRIBUTOR	AMOUNT Committed	% of TOTAL		AMOUNT Contributed or Invoiced To-Date	% of Total Project Commitment
CASH					
YWG Basin WSRF Request	$ 89,000	54%	54%	$ 24,593	28%
Moffat County	15,000	9%	26%	$ 15,000	100%
Routt County	15,000	9%		$ 7,500	50%
University of Wyoming	12,572	8%		$ 6,286	50%
IN-KIND					
YRLSP volunteers	20,000	12%	20%	$ 16,700	84%
Other Partners (BLM, NPS, TNC, CDA, CPW, Moffat County, Routt County, CSU Extension)	14,000	8%		$ 9,087	65%
TOTAL PROJECT COST	**$ 165,572**				

Status of Tasks Identified in the Statement of Work

Task #1 [$40,900 allocated from CWCB/YWG Basin account—21.5% invoiced—estimated percent completion for Task #1 = 20%]

Develop a watershed scale management framework for leafy spurge in the Yampa Valley through mapping and predictive modelling.

This task involves two distinct components:

1. Field mapping of leafy spurge in riparian habitat along the Yampa River—conducted by YRLSP volunteers.
2. Geospatial analysis, remote sensing and predictive modelling—conducted by the University of Wyoming.

Field Mapping Report

- YRLSP volunteer Peter Williams developed and maintains GIS products and systems to facilitate field mapping of leafy spurge, using electronic tablets.
- YRLSP volunteers John Husband and Ben Beall developed a landowner permission/access form and tracked down busy landowners to seek permission for field mapping of approximately 60 miles of the Yampa River from Hayden through Little Yampa Canyon in 2019. Landowners and/or managers granted permission for accessing land along the river for mapping and data sharing on approximately 80 percent of that 60-mile distance.
- Peter Williams and Ben Beall, with logistical assistance from additional volunteers, mapped leafy spurge along both banks (where permission allowed) of that same 60-mile reach. The maps resulting from this work are available on the YRLSP web site: https://www.yampariverleafyspurgeproject.com/maps.
- Leafy spurge mapping data were provided to the University of Wyoming for use in their spatial analysis and predictive modelling work.
- Plans for 2020 include seeking additional access permissions from landowners and continuing field mapping downstream from Little Yampa Canyon to Cross Mountain Canyon and from Cross Mountain Canyon to Dinosaur National Monument.

University of Wyoming Report

(Submitted by Chloe Mattilio and Dan Tekiela, PhD – University of Wyoming, Department of Plant Sciences – 11 November 2019)

Current Mapping Efforts and Extent of Leafy Spurge on the Yampa River

Leafy spurge populations have been mapped from Hayden, Colorado, to Lay, Colorado (shown in yellow in Figure 1 below). This data was collected in June and July of 2019 on mapping missions by Ben Beall and Peter Williams by raft. Populations range in size from 200 square feet to over 14 acres. In addition to location and size of populations, mapping data also included habitat information, amount of bare ground, descriptions of surrounding vegetation, and notes on leafy spurge abundance, canopy cover, and phenology. Though these fields are time consuming to collect, this data will be valuable for understanding both the ecology of leafy spurge

infestations and habitat factors that influence successful leafy spurge detection with remote sensing. Mapping efforts will continue next season, working to cover more of the study area (shown below in Figure 2).

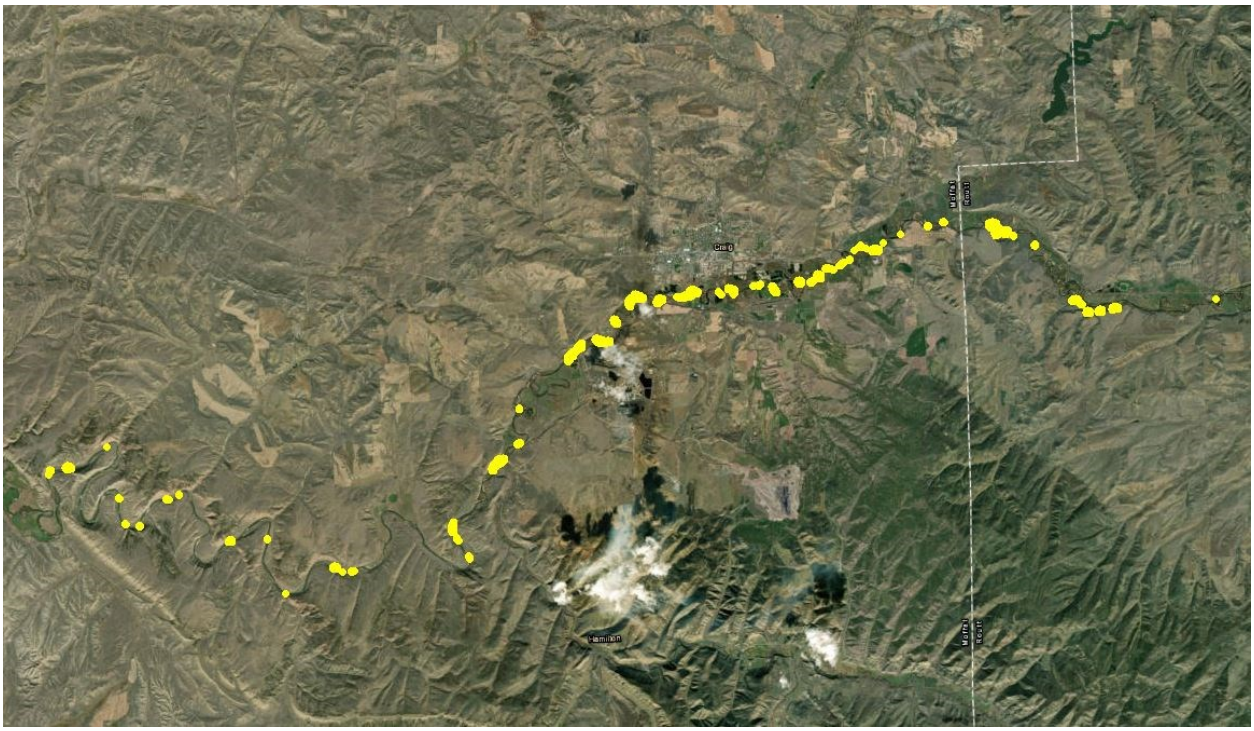


Figure 1. Current map of documented leafy spurge populations (yellow outlines) along the Yampa River.

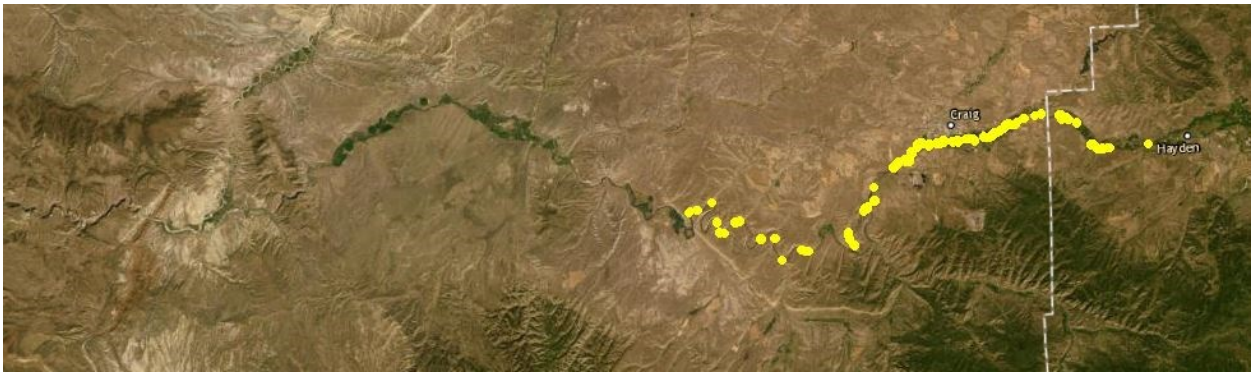


Figure 2. Map of the entire study area of this project, from Hayden, CO to Dinosaur National Monument, with mapped leafy spurge populations shown in yellow.

Remote Sensing Imagery Parameters for Leafy Spurge Detection

Based on data samples acquired from the 2019 leafy spurge bloom and growing season, literature on leafy spurge spectral properties, and project objectives, here are some required parameters of remote sensing imagery that can be used for this project:

1. Temporal Resolution

Based on 2019 imagery, peak bloom of leafy spurge appeared to be in early July, so scenes from this time frame would likely provide the best imagery classification of leafy spurge. Though leafy spurge emerges early and blooms through much of the summer, targeting plants when they are most spectrally separable from surrounding vegetation is ideal, so imagery should capture peak bloom of the bright yellow-green leafy spurge bracts.

2. Spatial Resolution

To classify small infestations of leafy spurge, high spatial resolution (small pixel size) imagery must be employed; otherwise small patches of spurge will go undetected. Since leafy spurge is a small, herbaceous perennial, pixel sizes between 1m x 1m and 5m x 5m will be used to maximize likelihood of accurately detecting and mapping even small patches of leafy spurge on the Yampa River. This is the logistic bottleneck that reduces imagery options, as this is very high spatial resolution data that can be expensive computationally and to purchase.

3. Spectral Resolution

Finally, to accurately map leafy spurge on the landscape, spectral resolution will have to strike a balance between being wide enough to separate leafy spurge from surrounding vegetation and being narrow enough to be available and easy to work with. Hyperspectral imagery, or imagery that is collected in many wavelengths of light, is useful for classifying vegetation down to individual species, but can be very time intensive to work with. With one specific target in the Yampa River, leafy spurge, fewer wavelengths of light, or bands, may be employed, providing those bands are able to identify leafy spurge. Most leafy spurge remote sensing projects have used multispectral imagery with red, green, blue (RGB), and near infrared bands, which is commonly used, easy to interpret, and widely available. Ideally, imagery will be composed of RGB and multiple near infrared bands for spectral profiling of leafy spurge.

<u>Descriptions of Leafy Spurge Reflectance with Free Orthoimagery</u>

Freely available multispectral aerial and satellite imagery from the 2019 Yampa River leafy spurge bloom was compiled in the fall of 2019 to describe reflectance of leafy spurge through the growing season. These imagery sets cover a wide range of spatial resolution, with pixel sizes between 1m x 1m and 30m x 30 m, and all consist of only visible, or RGB imagery. As previously mentioned, more spectral bands will be needed for accurate spurge mapping, but real color, RGB images are a good start for evaluating leafy spurge reflectance in imagery. Here are some examples of what 2019 mapped leafy spurge populations looked like in real color in these imagery sets:

National Agriculture Imagery Program (NAIP) RGB Imagery – 1m x 1m pixels, collected August 2019

NAIP imagery has the finest spatial resolution of datasets compared, and is closest to the spatial resolution that will be required for this project. But, unfortunately, this dataset was collected well past peak leafy spurge bloom, which renders this imagery ineffective for leafy spurge detection, but this NAIP imagery can still be used for image interpretation.

Figure 3. Mapped leafy spurge population (outlined in yellow), shown in late season NAIP imagery.

Sentinel RGB Imagery – 20m x 20m pixels, collected June and July 2019

This Sentinel satellite dataset provides an opportunity for catching leafy spurge at its peak bloom, albeit at a much too coarse spatial resolution for mapping small leafy spurge populations. But, this dataset does show some promise for separability of leafy spurge infestations, even in the visible spectral range (Figures 6 and 7).

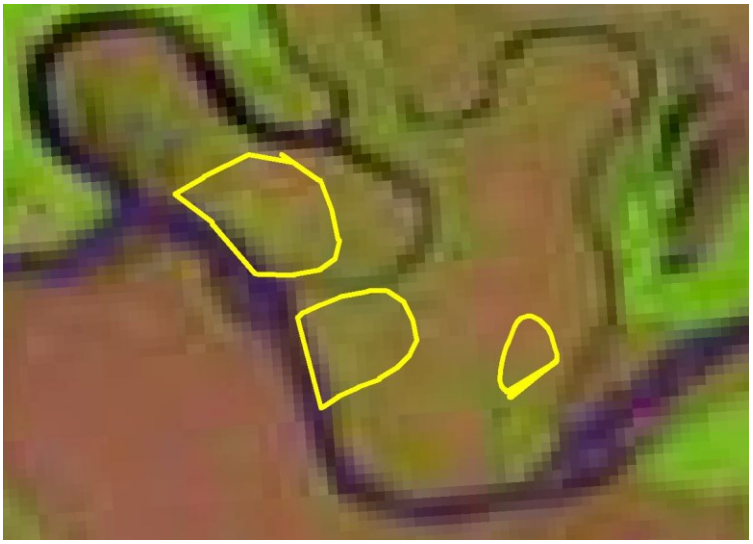


Figure 4. Mapped leafy spurge populations (outlined in yellow) shown with some light yellow green pixels in 6-24-2019 Sentinel imagery.

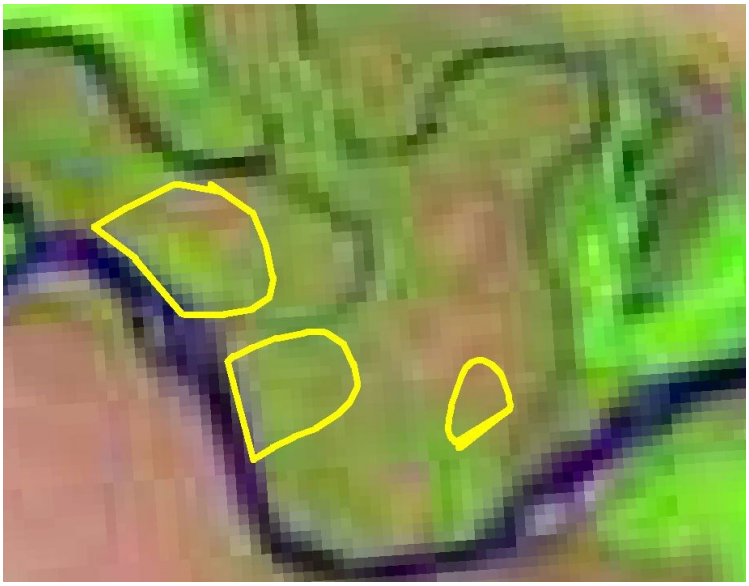
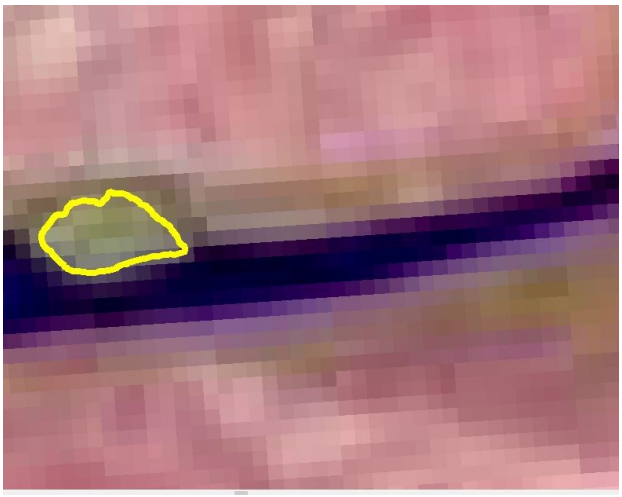
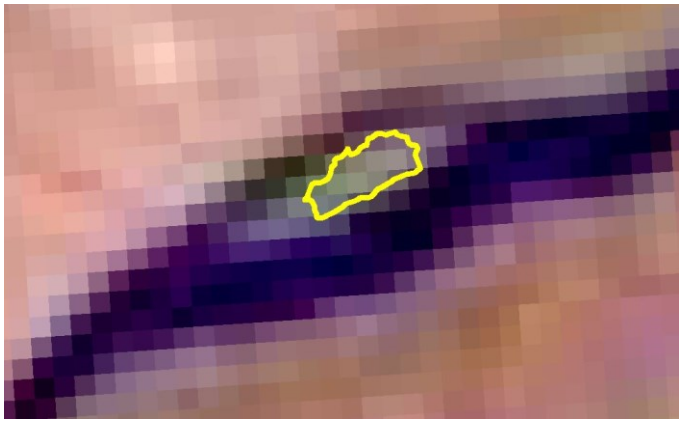


Figure 5. The same mapped leafy spurge populations (outlined in yellow) shown with some light yellow green pixels in 7-9-2019 Sentinel imagery. Notice visible reflectance differences of surrounding vegetation between the 6-24-2019 and 7-9-2019 imagery.





Figures 6 and 7. A mapped leafy spurge population (outlined in yellow) shown with some dusky green pixels in 7-9-2019 Sentinel imagery.

Landsat RGB Imagery – 30m x 30m pixels, collected July 2019

This Landsat satellite dataset again targets peak leafy spurge bloom, but at even coarser spatial resolution. Figure 8 below shows how mixed pixels decrease classification accuracy of small targets with large pixel sizes by sorting pixels into the class that takes up the majority of the cell.

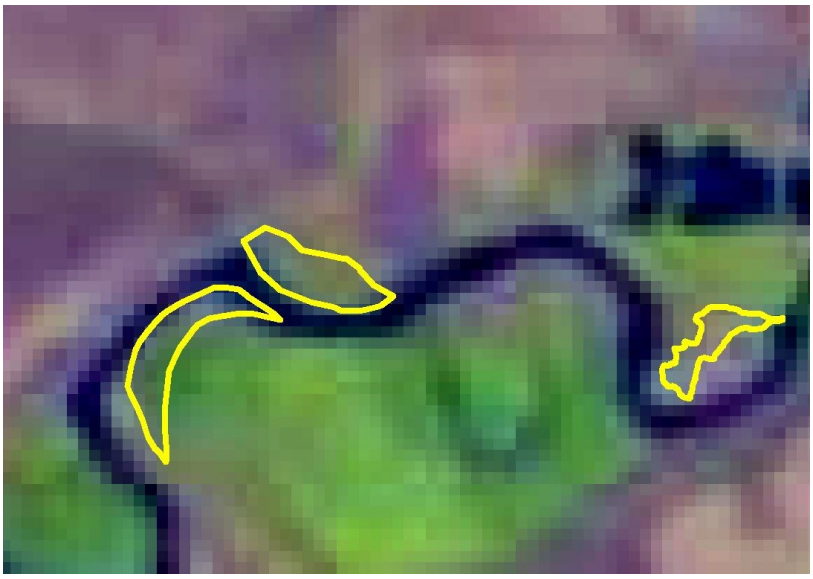


Figure 8. Mapped leafy spurge populations (outlined in yellow) on the banks of the Yampa River in Landsat imagery from 7-6-2019, with large pixel sizes resulting in pixels that are mixed, shown here with yellow leafy spurge population boundaries that extend into the river.

Additional Imagery Considerations

1. Potential Imagery Issues

One ever present concern with satellite based remote sensing projects is cloud cover. When clouds are in an area, not only is the area directly beneath the cloud obscured but based on the path of the satellite clouds may cast shadows, further obscuring the study area (See image below). Clouds coverage is difficult to predict and satellite paths are typically fixed, so measures must be taken to ensure that imagery of leafy spurge in peak bloom is fairly cloud free, to ensure accurate classification.

Figure 9. Clouds obscure a portion of the Yampa near Craig, CO. The top of the clouds appear as white, while the dark shadows they are casting follow the same trajectory, to the west of the clouds.

2. Challenges with Study Area

The study area for this project is long, but narrow, which causes logistic challenges for imagery acquisition. As our goal for this project is to map along the western flowing Yampa River, covering ground from Hayden, CO to the eastern border of Dinosaur National Park, we have a latitudinally narrow, but very wide longitudinally, study area. Additionally, most satellites orbit in a generally north-south direction, so we will likely need to acquire multiple satellite imagery scenes to cover our entire area of interest, with the Yampa only running through a small segment of each scene. This may add to the total numbers of scenes that must be acquired, and if imagery is being purchased, this will add to the overall cost of data acquisition.

Remote Sensing Imagery Acquisition Options

Imagery for leafy spurge mapping can be acquired by tasking or acquiring after collection, for free and at cost, and from multiple different private and public sources. Details, positives, and negatives of these two methods of imagery acquisition and different imagery sources are outlined below:

1. Tasking in Advance

   Satellites can be commissioned to acquire imagery in advance, or before the satellites have passed over the intended study area. This method is beneficial, because both users and producers communicate and ensure data acquisition occurs, timing of imagery acquisition can be controlled, and imagery products can be processed, compiled, and made available quickly. Unfortunately, two drawbacks to scheduling data collection ahead of time is that weather conditions may change, and clouds could obscure target area, and it can be very expensive to commission.

2. Post-Collection Purchasing

   Imagery scenes may be acquired after they are collected for free or at cost from geospatial clearinghouses and private companies. But, return intervals for satellites are different, depending on their orbital path, so complete coverage of a study area may not occur at ideal timing for an intended project. The biggest benefit of selecting imagery post-collection is being able to compare and evaluate different scenes to select the best imagery available. Most remote sensing resources turn these products around relatively quickly, so there is little lag time between reflectance data collection and distribution.

3. Data Sources

   With the imagery parameters needed for mapping leafy spurge on the Yampa River, we will likely be purchasing high spatial resolution multispectral satellite imagery. There are different options available through private companies like LandViewer and Harris Geospatial and I have gotten quotes for 2019 scenes from company representatives, which run between $1,000 and $6,000 for full coverage of the Yampa River study area. There are also opportunities for free imagery from agencies like NASA and the European Space Agency, and research proposals have been written and submitted to acquire imagery at no cost.

Data Compiled for Predictive Modelling of Leafy Spurge Invasion Risk

Training data for the predictive invasion risk model for this project comes from an extensive spatial dataset from Fremont County, WY. Locations of leafy spurge populations have been recorded for years by Fremont County Weed and Pest, resulting in a dataset of over 14,000 individual populations. In addition to spatial locations of leafy spurge populations in the Yampa River study area and the Fremont County training data, predictive data layers were acquired for

both locations. These layers include soil type, texture, and pH, climate temperature and precipitation annual and monthly means, population proximity to roads and developed areas, and location slope, elevation, and aspect. Fremont County spatial data and accompanying predictive layers will be used to identify environmental, abiotic, and landscape conditions that are correlated with leafy spurge presence and assumed absence, building a model which will be applied to the Yampa River to identify locations where leafy spurge invasion is likely.

Task #2 [$40,800 allocated from CWCB/YWG Basin account—30.2% invoiced—estimated percent completion for Task #2 = 30%]

Identify best integrated management practices for reducing leafy spurge seed production in riparian habitat in the Yampa Valley.

YRLSP received permission to access many private parcels for research purposes. The University of Wyoming team found suitable conditions on two private parcels, one Moffat County parcel, and one Colorado Trust Land parcel. We are grateful for the amount of community support received from landowners and public agencies.

University of Wyoming Report
(Submitted by Hannah Kuhns – Master's student – University of Wyoming, Department of Plant Sciences – 8 November 2019)

Grazing treatments were done during the last week of May 2019 and the second week of June 2019. Herbicide applications were made at the end of July 2019. Unfortunately, we lost one set of plots on the Shaffer property due to a miscommunication which resulted in the plots being hayed (Figure 1). There was discussion as to whether or not the plots were salvageable as a different type of "grazing" event; however, it was concluded that because the windrows had not been baled, it would not make sense to apply herbicide, and the whole site was scrapped. We moved forward with the four remaining plots from which data for the first season of treatments were successfully collected in the first two weeks of September 2019.

The data workup for the first year is still in its exploratory phase; thus, no statistical tests have been run but preliminary graphs have been made. When considering overall leafy spurge percent cover (Figure 2), the herbicide treatments seemed to have no affect on reducing the total cover of leafy spurge compared to the control. The grazing treatments, however, generally seemed to have lower leafy spurge percent cover, with a particularly noticable decrease in cover in the Grazing + Rinskor treatment. When considering each site individaully, both Wagner sites and the Fourmile site followed a similar pattern; however, the County parcel has noticabley lower leafy spurge percent cover in the grazing treatments (Figure 3). When plotted with the two other main species at the site, it seems as though Japanese brome may be coming in as a secondary invader, specifically in the grazed plots where the leafy spurge was knocked back early in the season. Further, the County parcel is the only site with Japanese brome, suggesting that it is one of the main drivers of the reduction in leafy spurge percent cover in the grazed plots at that site.

When looking at overall seed production, which has been quantified per meter squared based on stem counts, all treatments had higher seed counts than the control (Figure 4). Total seed production was quantified using three different parameters: burst, capsule, bract. Burst counts are representative of seeds released into the system. Capsule counts are representative of seeds that can still be added to the system which may or may not be viable. Bract counts are representative of the potential continued seed production throughout the season as well as an indicator of newer growth. In the grazed plots there are generally higher bract counts, suggesting that there has been some regrowth of the leafy spurge plants since the grazing treatment early in the season.

Future directions: All data will be collected again next summer to see second season effects. This is particularly important for the herbicide application treatments since they were applied in the fall. It makes sense that there is not much or any effect on percent cover or seed production this year but there may be an impact next year.

I am interested in the relationship between temperature and moisture and their combined effect, if any, on leafy spurge germination. A big part of the leafy spurge story in the Yampa River Valley is the 2011 flood, after which a substantial increase in populations were seen downstream. Beyond that, this year was very wet, but also quite cold into the late spring. I am curious to explore the relationship between temperature and moisture availability as it affects germination, especially given this season's weather. I am currently conducting a germination study across six temperatures (5 °C, 10 °C, 15 °C, 20 °C, 25 °C, and 30 °C) with different amounts of water availability (changing the bars of osmotic potential).

Figure 1. Windrows over hayed plots at Shaffer property

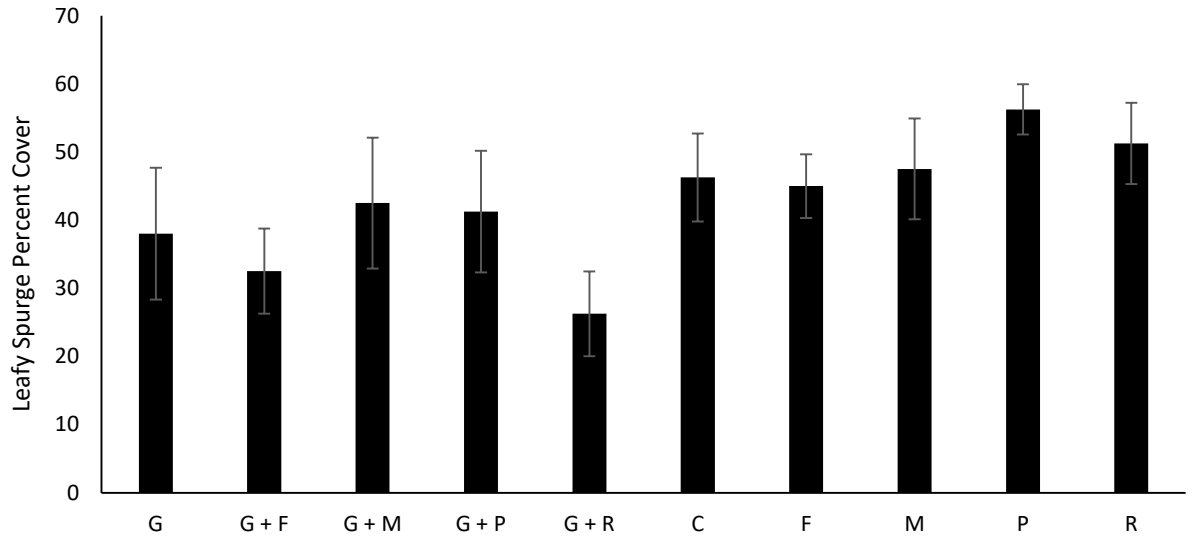


Figure 2. Leafy spurge percent cover for each treatment, averaged across four sites. Error bars represent standard error. G = grazed, G + F = grazed + Facet L, G + M = grazed + Milestone, G + P = grazed + Plateau, G + R = grazed + Rinskor, C = control, F = Facet L, M = Milestone, P = Plateau, R = Rinskor.

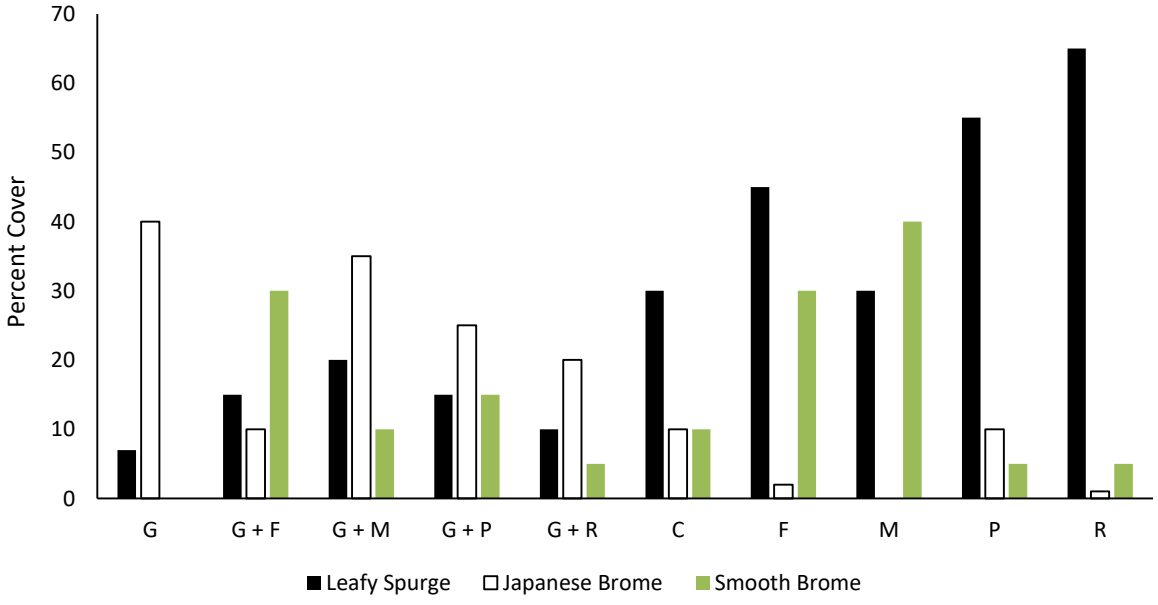


Figure 3. Percent cover of the three main species at the County parcel site for each treatment. G = grazed, G + F = grazed + Facet L, G + M = grazed + Milestone, G + P = grazed + Plateau, G + R = grazed + Rinskor, C = control, F = Facet L, M = Milestone, P = Plateau, R = Rinskor.

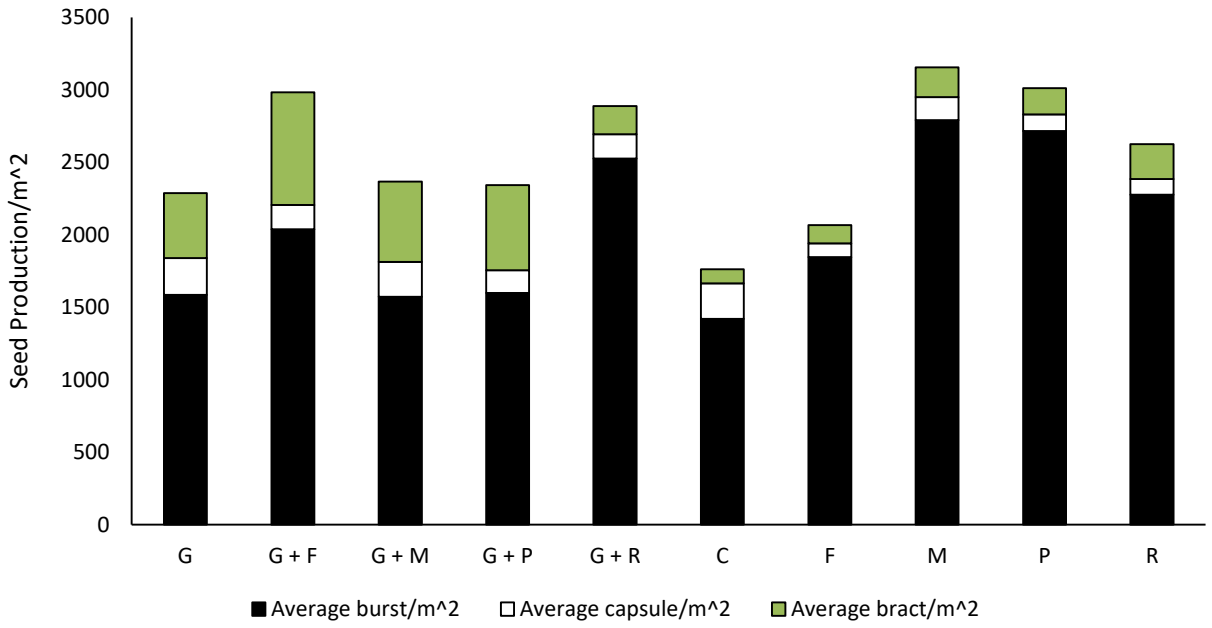


Figure 4. Total seed production per meter squared averaged across four sites, broken down by burst counts, capsule counts, and bract counts. G = grazed, G + F = grazed + Facet L, G + M = grazed + Milestone, G + P = grazed + Plateau, G + R = grazed + Rinskor, C = control, F = Facet L, M = Milestone, P = Plateau, R = Rinskor.

Task #3 [$ 3,000 allocated from CWCB/YWG Basin account—43.6% invoiced—estimated percent completion for Task #3 = 40%]

Education and Outreach—Engage youth in the Yampa River Leafy Spurge Project, using biological control as a means to encourage learning, participation and productive involvement.

Responsibility for completing Task #3 lies with YRLSP volunteers and partner agencies.

- CSU Extension—Moffat and Routt Counties
- Colorado Parks and Wildlife
- Colorado Department of Agriculture
- BLM—Little Snake Field Office

In July, 2019, the YRLSP sponsored a two-day kids' workshop on invasive weeds and biological control. Partner agencies contributed time and expertise to ensure the Boys and Girls Club kids had a quality educational and fun experience. Kids spent a half day of invasive weed orientation at Loudy Simpson Park in Craig. They were joined by Routt County Master Gardeners for a second day of leafy spurge biocontrol field science at the Highway 40 Rest Area between Hayden and Craig. The event wrapped up with a picnic lunch and good reviews from the young field scientists. More photos are available on the YRLSP web site: https://www.yampariverleafyspurgeproject.com/events.

The success of the 2019 youth engagement event has encouraged YRLSP partners plan and host a similar event in 2020.

YRLSP volunteer Peter Williams and Colorado Department of Agriculture (John Kaltenbach) worked together to develop an educational information sheet on leafy spurge biological control insects presently available for use in managing leafy spurge. This document is attached and is available for download from the YRLSP website:
https://www.yampariverleafyspurgeproject.com/resources

YRLSP volunteers collected information from a variety of sources to document historical releases of biological control insects in Moffat and Routt Counties. This effort yielded 44 records on 42 sites, dating back as far as 1989 (30 years). In July, 2019, YRLSP volunteer Tamara Naumann tracked down 23 records on 21 sites in the field, with help from Tyler Jacox (CPW), Chris Rhyne (BLM), John Husband (YRLSP), Jesse Schroeder (Moffat County), Hannah Kuhns (UW) and Todd Hagenbuch (CSU Extension). Each site was evaluated, using a field protocol developed with assistance from John Kaltenbach (CDA). Results are summarized below.

- 13 sites still had spurge *and* leafy spurge biocontrol beetles
- 6 sites had clearly been sprayed with herbicide and now support little or no leafy spurge—most of these are now occupied primarily by annual weeds
- 1 site was an older record with obviously incorrect coordinates, so its history could not be reliably assessed
- 1 site was inaccessible (island in a pond), so could not be assessed (although leafy spurge was visible on the island)

Site Name	Release Year	Spurge Density	Years Since Release
ROUTT COUNTY			
YRSWA 19	1991	Moderate	28
YRSWA 6	1994	Low	25
YRSTL 9	1997	Moderate	22
J Quarter ◯ 4	1998	Low	21
YRSWA 20	1999	Low	20
YRSTL 22	2008	Moderate	11
YRSWA 34	2016	Low	3
YRSWA 37	2016	Low	3
MOFFAT COUNTY			
BLM CR38 43	2016	High	3
FOURMILE 42 & 44	2016 & 2017	Moderate	3 & 2
PEROULIS N 33	2016	High	3
PEROULIS S 41	2016	Moderate	3
WAGNER	2016	High	3

These preliminary results were surprising because many people believed that local biological control efforts had failed. Although a sample size of 13 sites is small, it is notable that *ALL* of the

visited sites that still support leafy spurge also support small numbers of biological control insects. These results are encouraging.

As observers visited an increasing number of these sites during the field season, a possible pattern began to emerge with respect to the appearance of sites occupied by biological control insects. While it is not possible to know with certainty how each of the sites looked at the time of release (because no photos or quantitative data were recorded), standard procedure for biological control involves using this management tool in areas where large, dense weed populations are present. It is reasonable to assume that historical release sites supported large, dense leafy spurge populations in most, if not all cases. Currently, most of the sites support low or moderate spurge densities, especially on sites where biocontrol insects were released more than three years prior. A significant proportion of these sites present with stunted, non-flowering individual spurge plants distributed throughout a matrix of more desirable vegetation. Scattered small patches of dense, flowering leafy spurge also occur in many of these sites. The small sample size precludes definitive conclusions regarding efficacy of biocontrol in local riparian environments, but this pattern is consistent enough to suggest it may be beneficial to work toward enhancing local biological control efforts, including a more robust program of monitoring for efficacy.

All of the identified sites proximate to the mainstem Yampa River were visited in 2019. Plans for 2020 include visiting an additional dozen sites scattered around the area (pending access permission). Data will be collected using the protocol developed in collaboration with the Colorado Department of Agriculture. The contents of this protocol are reflected in the datasheet included here as a separate attachment. A companion digital version of the data sheet facilitates field data collection on tablets and subsequent data management.

It is notable that the leafy spurge mapping crew detected biocontrol insects in areas along the Yampa River that are significantly distant from known biocontrol release sites. This suggests that biocontrol agents have been present and active in the Yampa Valley for some time, possibly for nearly three decades. If biocontrol agents have been active in the Yampa Valley for +/-30 years, as it now appears, it is possible that the leafy spurge infestation has been thwarted to some degree over this same period of time.

The Colorado Department of Agriculture (John Kaltenbach) has made additional leafy spurge biological control insects available to the YRLSP, free of charge, in exchange for the data we are collecting on historical and current release sites. As a result, five new biocontrol releases occurred in 2019—four on the Yampa River SWA and one adjacent to the Hwy 40 Rest Area between Hayden and Craig. Data and photographs were collected at the time of release. YRLSP will work with interested partners and private landowners in the coming years to identify appropriate sites for release of additional biological control insects in the future. The overarching goal would be to provide a rapid and significant boost to the biocontrol insect population in the Yampa Valley. In the coming months, YRLSP partners will be discussing how best to inform and involve interested landowners in constructive pursuit of leafy spurge biological control projects.

IN-KIND MATCHING SUMMARY—YRLSP Partners

Yampa River Leafy Spurge Project—CWCB Water Supply Reserve Fund grant—Progress Report 11-19-2019

Partner In-kind Contributions—Second 6-Month Reporting Period—May 20, 2019 through November 19, 2019

PARTNER	DESCRIPTION	Human Resources			Services & Materials			percent of total commitment
		hours	hourly rate	TOTAL	unit	value	TOTAL	
TNC	(Geoff Blakeslee)							
	Lodging for UWYO graduate students and/or faculty at Carpenter Ranch, as needed, @ $50 per person per night				13	50	650	33%
	Staff time for planning, coordination, meetings, assigned tasks, etc.		45	-				
YRLSP	volunteers (Ben Beall, Tamara Naumann, Peter Williams, John Husband and . . .)							
	Meetings and coordination related to grant-specific activities	12	20	240				4%
	Field Mapping, GIS, data processing and map production	288	20	5,760				58%
	Labor for youth engagement/biocontrol project	124	20	2,480				62%
BLM	(Chris Rhyne)							
	Staff time for planning, coordination, implementation, etc.	23	65	1,495				75%
	Materials and supplies for grant-specific activities				1	30	30	12%
NPS	(Emily Spencer)							
	Staff time for planning, coordination, implementation, etc.		35	-				
	Materials and supplies for grant-specific activities						-	
CPW	(Tyler Jacox)							
	Staff time for planning, coordination, implementation, etc.	27	30	810				54%
CDA	(John Kaltenbach)							
	Staff time for planning, coordination, implementation, etc.	27	28	756				38%
	Materials and supplies for grant-specific activities						-	
ROUTT County	(Todd Hagenbuch—CSU Extension & Greg Brown—Routt County Weed Dept)							
	Staff time for planning, coordination, implementation, etc. (Hagenbuch)	10	35	350				63%
	Staff time for planning, coordination, implementation, etc. (Brown)	8	75	600				
MOFFAT County	(Jessica Counts—CSU Extension & Jesse Schroeder—Moffat County Weed & Pest Dept)							
	Staff time for planning, coordination, implementation, etc. (Counts)	19	45	855				93%
	Staff time for planning, coordination, implementation, etc. (Schroeder)	18	30	540				

Photo Identification Key for Leafy Spurge Biological Control

You found some insects in the plot. Are they what we are looking for?

IS IT A BEETLE?

Beetles have hardened front wings without veins, which meet in a straight line down the middle of the back. The membranous hindwings are hidden under the front wings until flight. They have mandibles (a pair of appendages that grasp in a horizontal plane) for mouth parts, but no cerci (a pair of forceps-like appendages) at the end of their abdomen. See the Beetle Parts illustration at the bottom of this page.

NOT A BEETLE? Go no further in this guide—we are only looking for beetles in this survey.

YOU HAVE A BEETLE—WHAT IS THE SIZE AND COLOR?

1–2mm, Tannish Beetle

Glyptina genus (native beetle)

These beetles may be found in our monitoring sweeps, and could be confused with the *Aphthona* genus we are looking for. Note the different color and smaller size than our target beetles.

10–12mm, Brown Beetle

Oberea erythrocephala
(leafy spurge stem boring beetle)

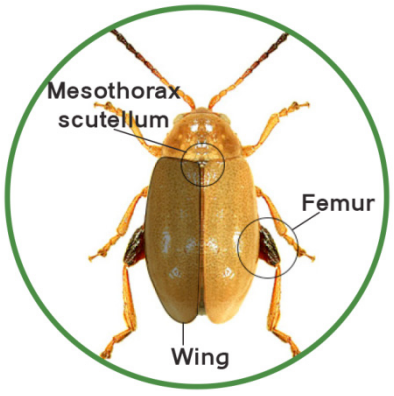
Target Species Adults have a reddish-orange head with black eyes, and a very slender body with grayish-black wings. The antennae extend more than half the length of the body.

CHARACTERISTICS COMMON TO ALL APHTHONA SPECIES

The rest of our target beetles are five separate species of the genus *Aphthona* (leafy spurge flea beetles). All will have these characteristics in common:

- Enlarged femurs (the top section of the rear leg)
- Antennae divided into eleven segments
- Females are larger than the males.

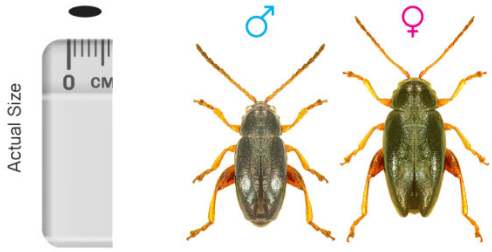
These details will be more visible if you place the beetle on a light-colored surface and use the magnifier found in the monitoring kit.



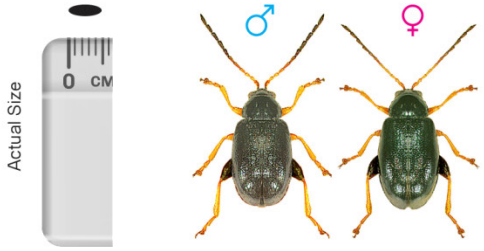
Beetle Parts

2.5–5mm, Black Beetle

The following two species can be virtually indistinguishable from each other in the field. Adults are typically 3–4mm in length and a shiny, metallic color. The legs are reddish-brown.

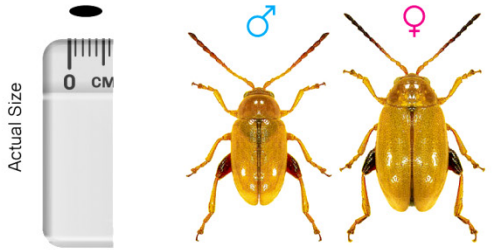


Aphthona lacertosa
Target Species

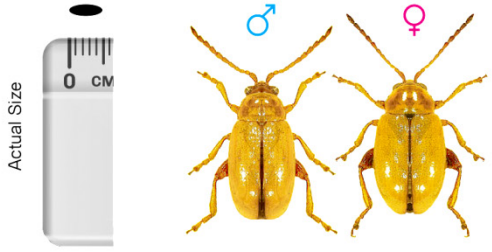


Aphthona czwalinae
Target Species

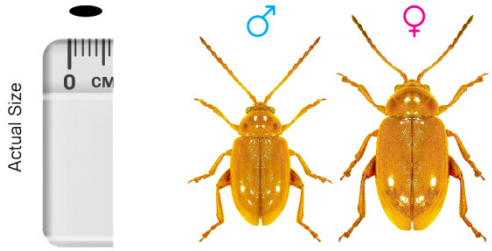
2.5–5mm, Brown to Tannish-Yellow Beetle



Aphthona nigriscutis
Target Species Yellow-rust, monochromatic with black mesothorax scutellum.



Aphthona cyparissiae
Target Species Reddish-yellow, monochromatic with mesothorax scutellum lightly darkened in posterior region. Not as dark as in *A. nigriscutis*, but darker than *A. flava*.



Aphthona flava
Target Species Slightly larger than the others. Rusty-red. Mesothorax scutellum is not darkened.

Aphthona images © Dr. Lech Borowiec, University of Wroclaw

These *Aphthona* are all native to Europe. The first releases in our area were probably made in 1991. All five species are now reported in Colorado, but you will most likely find either *A. lacertosa* (a black beetle), or *A. nigriscutis* and *A. flava* (both brown to tannish-yellow beetles). Definitive determination to species requires examining reproductive organs using a microscope.

COLORADO
Department of Agriculture
Conservation Services Division

Yampa River Leafy Spurge Project

YRLSP

2019 Biocontrol Data Sheet

Version 3-2019/05/31

SITE & REPORTER INFORMATION

Reporter:			Date:
			Time:
Reporter Affiliation:		Site Name:	
Is this a new biocontrol monitoring site? YES ☐ NO ☐			Default to YES in 2019, to capture envornmental data on legacy sites. If, NO, skip to LEAFY SPURGE COVER.
State:	Coordinates: Decimal lat/long or UTM (NAD 83, Zone 13)		Latitude:
			Longitude:
County:	Elevation: (ft.)		UTM E: __ __ __ __ __ __
			UTM N: __ __ __ __ __ __ __

OWNERSHIP

Ownership Type (Circle Type)	Private - Individual	Colorado-State Wildlife Area	Federal-BLM
	Private - Corporation or Organization	Colorado-State Park	Federal-Other
		Colorado-State Trust Lands	Other (specify)
Owner/Agency Contact (First and Last Name):			Phone:
Permission Required for Access ? YES ☐ NO ☐			If YES, verbal ? ☐ written ? ☐

HABITAT INFORMATION

Geomorphic Feature (circle type)	**Aspect**	**Soil Type** (circle type)	**Vegetation Type** (circle type)
active channel island	N	sandy loam	sparsely vegetated
active channel bar	NE	loam	riparian forest
river bank (edge of active channel)	E	silt loam	riparian herbaceous
seasonally inundated floodplain	SE	sandy clay loam	agricultural crop (includes grass hay)
irrigated agricultural field	S	clay loam	upland plant community
irrigation ditch bank	SW	silty clay loam	**Non-Soil Substrate Type**
upland	W	sandy clay	sand (<2mm)
other (specify)	NW	clay	gravel (2mm to 64 mm)
	flat (no aspect)	silty clay	cobble (>64mm)

BIOCONTROL RELEASE and/or MONITORING DATA

LEAFY SPURGE COVER: (circle one)	absent	trace (<1%)	low (1 to 5%)	moderate (5 -25 %)	high (25-100%)	
Weather Conditions: clear	partly cloudy	overcast	rain	other (specify)		
Wind: calm	light	moderate	strong		Air Temp. (°F):	

Initial Inspection for Biological Control Insects. Check all that were observed: None ☐

Aphthona—black flea beetles ☐ Aphthona—brown flea beetles ☐ Oberea—root borer beetles ☐

Sweep Monitoring for Biological Control Insects. Check all that were sampled: None ☐

Aphthona—black flea beetles ☐ Aphthona—brown flea beetles ☐ Oberea—root borer beetles ☐

Total Biological Control Insects counted in 20 sweeps:	Were Biological Control Insects released today? YES ☐ NO ☐	Include quantity and species of released insects in general comments.

General Comments:

YRLSP 2019 Biocontrol Data Sheet Instructions

Version 2-2019/03/16

SITE & REPORTER INFORMATION

Reporter: This is you—your first and last name.

Reporter Affiliation: e.g., YRLSP, CSU Extension, BLM, Moffat Co., Routt Co., CPW, etc.

Site Name: Each release site is assigned a unique site name. All future monitoring data collected at each site will be associated with that site name.

State: CO County: Moffat or Routt Elevation: Record this in feet.

Coordinates: Record the coordinates at the center of the monitoring plot/release site. These can be recorded in decimal lat/long or UTMs (NAD 83, Zone 13).

OWNERSHIP

Ownership Type: Circle the appropriate ownership category. If "other," include an explanation in the "General Comments" field.

Owner/Agency Contact: This is the best contact for access permission and/or local biocontrol site history.

Permission for access: This should be filled out before heading to the field. Necessary written permissions should be brought to the field.

HABITAT INFORMATION

Geomorphic Feature: Our primary interest is riparian settings—please circle the specific type. All upland sites are lumped as a single category. If "other," include an explanation in the "General Comments" field.

Soil Type: Consult supporting document describing how to estimate soil texture.

Non-soil substrate type: Active channel sites may have no descernable soil development. Use these categories to describe substrate particle size when no developed soil is present.

Vegetation Type: In general, "sparsely vegetated" pertains to active channel environments, including islands, channel margin bars and banks. Upland sites may be sparsely vegetated, but should be categorized as "upland plant community." It is permissible to circle more than one category, if the site is mixed.

BIOCONTROL RELEASE and/or MONITORING DATA

General Sampling Instructions

First, look over the release area to see if biocontrol insects are visually apparent. Record observations in the "Initial Inspection" field. Next, five sampling points will be swept along four lines in N, E, S and W direction from release point (20 sample points total). For each line, begin as close to the release point as possible. Using a 15-inch diameter sweep net, make four sweeps in front of you (back and forth twice). Each net sweep should proceed in a downward arc, so that the net moves vigorously through the vegetation as close to the ground as possible. Carefully examine the net and count the biocontrol insects present, then empty the net to release the counted insects. You may empty the insects into the white bucket to facilitate counting. Move ≈5 feet (2 paces) out and repeat above steps—a total of 5 times in each of the 4 cardinal directions.

Record swept insect numbers in the table below and then record the total number from all 20 sampling points.

	N	E	S	W
0 ft.				
5 ft.				
10 ft.				
15 ft.				
20 ft.				
TOTAL				

Photos Taken	
Direction	**File Number**
N	
E	
S	
W	

Add across the bottom (TOTAL) row to obtain the total for plot. _____