YAMPA RIVER LEAFY SPURGE PROJECT

TEN YEAR PLAN: A GUIDE TO MANAGING LEAFY SPURGE

June 2017, Gregory A. Brown, Routt County Weed Program

Leafy spurge, Euphorbia esula L. (EUES), in North America

Leafy spurge was first identified and collected in the United States at Newbury, Massachusetts in 1827. In 1933 leafy spurge distribution was mapped for North America and three centers of infestation were identified. The earliest infestation, dating to the late 1600's or early 1700's, is centered on the east coast and likely originated when ballast soil from the holds of sailing ships was spread at ports along the eastern shores. The second infestation occurred in the North Central States and South Central Canadian Provinces. The seed source for these infestations appears to be contaminated wheat seed brought in to Mennonite settlements in Manitoba, North Dakota and South Dakota with the contaminated seed supply sourced from Russia in the 1870's and 1880's. Some of these north central state infestations may also have an origin in contaminated smooth bromegrass seed, also imported from Russia in the same time period. The third center of infestation is centered in the northern Rocky Mountain States of the U.S. and has an initial infestation source as alfalfa seed imported from Russia in the 1890's.

Economic Impacts of leafy spurge infestations

Infestations of leafy spurge impact the economies of affected areas through the loss of productive rangeland and beef production and through the cost of treatments to control the weed. By 1993 these combined costs had amounted to over $130 million annually in the states of Montana, North Dakota and South Dakota. Since then, annual economic impacts have continued to increase. Studies have shown that a leafy spurge infestation of 40% cover will reduce cattle grazing by 90%. It has been reported that some ranchers in North Dakota and Montana have abandoned their ranches when the carrying capacity for cattle production was so reduced by leafy spurge and the cost of weed control so high that the economic viability of the ranching operations was destroyed.

Leafy spurge in Northwestern Colorado

There are a couple of stories related to the source of the initial leafy spurge infestation in the Yampa Valley. One story suggests that road construction equipment brought in to the area for highway construction on US 40 west of Hayden, Colorado may have been contaminated with leafy spurge seeds. Another suggested infestation source is hay equipment from Utah used for custom haying in hay meadows along the Yampa River west of Hayden. Both potential sources share a time period of around 1970, maybe a little earlier or a little later. The focus of our project and the core of the leafy spurge populations for both Routt County and Moffat County lies mostly along the Yampa River in the Riparian corridor and adjacent uplands, but significant outbreaks have occurred on upland sites throughout both counties. Localized occurrences of leafy spurge have been identified and treated from near Toponas, Colorado to the banks of the

Little Snake River right at the Wyoming border and from the border with Routt County on the east to far western regions of Moffat County.

Review of controls for leafy spurge

Well established treatment methods are available and effective for rangeland and right of way sites on upland (non-riparian) locations, but the proximity of water; as high ground water tables, streams, rivers, ponds and seasonally flooded ground precludes the use of the most effective herbicide treatments for leafy spurge. Various bio-control insects are also available to aid in the control of leafy spurge. As with all bio-controls the intended goal is a decrease in vigor for the targeted weeds rather than complete eradication. Along with insects, sheep and goat grazing can be used for leafy spurge control either with insects or as stand alone techniques. Continuous cultivation can be used to reduce seed development annually, but is relatively ineffective at providing permanent control of the roots and rhizomes which lie beneath the zone of cultivation.

HERBICIDES

Tordon, Tordon/2,4-D; 2,4-D: The long term standard herbicide control for leafy spurge has been picloram in the product Tordon, either alone or in combination with various 2,4-D products. These compounds are systemic in action and can be translocated to the roots and rhizomes, though annual incorporation of the herbicide is unlikely to reach all plant parts. A multi-year herbicide program is necessary to achieve control. Tordon is a restricted use herbicide and is prohibited for use near surface water or over a high water table. 2,4-D may be used near water and formulations are available that can be used in water, so 2,4-D may be a chemical which could be part of a herbicide strategy for leafy spurge within the riparian corridor. The appropriate timing for these herbicides is true flower growth or fall regrowth with rates of application of 2-4 quarts / acre for either herbicide.

Dicamba, as the products Banvel, Vanquish or Clarity, is a systemic herbicide effective on leafy spurge. The grazing restrictions (7-90 days) are more restrictive than 2,4-D and Tordon. Applied at 2 to 8 quarts / acre at true flower growth or fall regrowth. Great care must be taken when applying this herbicide near water or over high water tables. Careful assessment of sites within the riparian corridor may allow for the use of dicamba to treat leafy spurge while protecting surface and ground water.

Imazapic, the chemical in the product Plateau, can be applied in early to mid September at the rate of 8-12 ounces / acre with an MSO surfactant. Control rates of 90% after one year have been observed after imazapic treatment. The addition of urea to the solution will increase effectiveness. It is safe to use under most tree species, but care should be exercised around spruces. Even though it is considered to be a potential herbicide for use within the riparian corridor, great care should be exercised to avoid contamination of ground water especially on porous soils.

Quinclorac, the herbicide active ingredient in the products Paramount and Panoramic, can be applied to leafy spurge in the fall before frost at .5 lb./ acre with an MSO surfactant. It

should not be used on sites to be grazed or harvested for hay. At the current labeled rates quinclorac is considered a suppressant rather a control for leafy spurge.

Glyphosate, is the active ingredient in the products, Roundup, GlyStarPlus, Glyphosate Pro, Buccaneer, Makaze, Alecto and many others. Additionally there are products specifically formulated for use in or near water, such as Rodeo. Application at 1 quart / acre to actively growing plants after July 1 provides optimum control**. Because this chemical produces complete vegetation control at the recommended rate, care must be exercised to ensure no non-target vegetation will be sprayed.** This herbicide has no residual control and acts only on actively growing plants. Ammonium sulfate fertilizer can enhance the herbicide's effect.

Aminocyclopyrachlor, (AMCP) in the product Perspective, applied at the rate of 5-8 ounces / acre with an MSO surfactant is considered to be effective on leafy spurge, but less so than some other approved herbicides. The addition of 2,4-D improves the effectiveness. Application near desirable trees should be avoided, since this chemical is very mobile in the soil and transports into the root zone of trees readily.

Fosamine, in the product Krenite , which is generally considered a brush control agent may be used as a suppressant for leafy spurge. It is applied in a high volume spray (40 gallons / acre or more) at a rate of 1.5 to 6 gals / acre. The chemical is inconsistent in leafy spurge control, since mobility within the plant after absorption is low. Use of an MSO surfactant is recommended.

BIO-CONTROLS

Insects:

Several species of insects feed on leafy spurge. Bio-controls are not a reliable treatment for complete eradication, but can be very effective as part of an integrated weed management plan.

The genus Apthona contains several species that will feed on and diminish the vigor of leafy spurge. Apthona flava was the first flea beetle released in the U.S. for leafy spurge control and remains the most widespread and reliable. A. czwalinae and A. lacertosa were released next and A. lacertosa remains as a constituent in many flea beetle populations. A. nigriscutis and A. abdominalus have also been released as bio-control agents. Most available flea beetle releases now contain a mix of A. flava, A. lacertosa and A. nigriscutis. The adults of these beetles feed on the foliage during the summer where they lay their eggs. The larvae emerge from the eggs in 12-19 days and then bore into the stem, making their way to the roots where they continue to feed into the fall. The larvae over winter in the plant crowns and soil. They pupate and emerge as adults as the soil warms in the spring. Some releases of Apthona flava have resulted in a reduction of leafy spurge cover from 57% to 1% in four years. The adults of these species can be collected as adults in mid-summer for redistribution to other spurge infected sites. Adequate numbers should be released in single location to insure that an adequate population is present for reproduction to be successful.

Other insect species such as the long horn beetle or the red stem borer are available only in much smaller numbers and are considered to be too expensive as an efficient and cost effective bio-control tool.

Targeted grazing:

Sheep and goats can be an effective tool for the control of leafy spurge. Cattle range in North Dakota and Montana has been successfully restored by the careful management of grazing sheep. Either sheep or goats need diligent herding and management to be most effective at spurge control. But this can be a win-win situation, since studies from North Dakota show that bands of sheep experienced in the targeted grazing of leafy spurge have produced a rate of gain in the lambs which exceeds the rate of gain expected on conventional rangeland. One Idaho sheep rancher with long experience proclaimed to me that if he hasn't restored a leafy spurge infested range in 4-5 years he hasn't been doing his job. This is where the difficulty comes in. It is not simply a matter of turning sheep (or goats) on to affected range. A study conducted at CSU by George Beck and Larry Rittenhouse has shown that under stocking or overstocking can result in no improvement in the spurge infestation, but they were able to determine an optimum stocking rate and duration to have maximum impact on the leafy spurge population. The study indicated that 4-6 sheep / acre for 10-20 days exerted biological control of the leafy spurge while there was a corresponding increase in the smooth bromegrass and Kentucky bluegrass cover. Grazing for 30 days resulted in an increase in leafy spurge stem count and cover in subsequent years.

To use targeted grazing some additional management will be necessary. When it was tried several years ago in the riparian corridor west of Hayden, CO the mosquitoes drove the sheep and the herders out of the targeted range. To be effective in the future a mosquito control program will have to be implemented. And, even though there are more sheep present in northwestern Colorado than anywhere else in the state it will be necessary to work with a cooperator who can manage the sheep exactly as prescribed. The use of electric netting will be problematic due to the undergrowth and deadfall, so, close herding will probably be the only reasonable possibility. The addition of Apthona flea beetles to the targeted grazing results in the maximum possible bio-control impact.

USE OF VOLUNTEER RESOURCES:

Weed warrior activities:

Pulling leafy spurge at select locations in Dinosaur National Monument has been effective in reducing seedling populations on sand bars adjacent to and within the Yampa River channel and at overall seed numbers entering the river.

Master Gardener volunteers:

Interest has been shown to help manage the leafy spurge flea beetle nursery and to assist with monitoring and mapping county locations for leafy spurge.

IMPLEMENTATION OF YAMPA RIVER LEAFY SPURGE PROJECT

Year 1 (2016- 2017): General Management Area

A. Review existing mapping data for Routt County and Moffat County for current and past leafy spurge infestations.

B. Evaluate the possibility of using satellite imagery from appropriate dates to identify leafy spurge infestations.

   a. NRCS review imagery for possible infestations.

   b. Greg Brown, Routt County Weed Program and Christine Shook, Site visits to verify

   c. Inconsistent results: Some known infestation verified, others confirmed as yellow sweet clover.

   d. Concept considered at our level of funding and expertise for evaluating imagery.

C. Monitor both counties to identify existing leafy spurge populations in General Management Area as part of ongoing county weed program activities.

D. Treat all newly identified infestations in Routt County which lie outside the existing containment area west of Hayden.

   a. Routt County Weed Program provides oversight to direct the treatment of a 35-40 acre recently identified infestation, which lies at 40.25188N, 106.90500W.

   b. Monitor old treatment site at the intersection of Colorado Highway 131 and Colorado Highway 134.

      No EUES observed

E. Treat all known infestations with in county road right-of-ways.

   a. Routt County 76

   b. Routt County 129 along Wyoming border.

F. Monitor known infestations within containment area and encourage land owners to treat.

G. Continue to monitor and treat leafy spurge anywhere it is found in county road ROWs as part of ongoing Routt County Weed Program activities.

H. Provide outreach with promotional materials and educational opportunities in Routt and Moffat Counties in coordination with CSU / County Extension offices and Community Agriculture Alliance

Year 1 (2016-2017) Focus Area: Riparian Corridor

A. Colorado Parks and Wildlife continues to treat leafy spurge at fishing access site, south of US 40, west of Hayden.

B. Identify private lands within the focus area

C. Contact landowners to acquire permission to treat

   a. Identify specific sites for treatment

   b. Locate access gates and

   c. Specify treatment dates

   d. Treat with site appropriate chemicals

D. Release insects (mix of Apthona flea beetles) to establish leafy spurge flea beetle nurseries

   a. Routt

   b. Moffat

   c. Discuss with Routt County Master Gardener program the possibility of using volunteer hours to monitor and manage the nursery locations.

      i. Several Master Gardener's expressed interest in participating

      ii. Sites will be monitored in 2017 (late July-early August)

      iii. Anticipate the possibility for collection and release to new locations in 2018.

E. **Identify Sites in Routt County and Moffat County for contractors to treat Leafy spurge with site appropriate herbicides.** Funds available $20,000.

a. Moffat County site is Tepee Draw; Funds allocated, $9,500

i. 13.5 acres of difficult remote acreage selected for treatment with horse mounted spray equipment as supplied by Osborn Industries, LLC

ii. Acreage to be treated early season (May) 2017

iii. Chemicals chosen: Dicamba @12 oz / ac;

Quinclorac (Quinstar) @3.7 oz / ac

Difluenzopyr (Overdrive) @ 1.5 oz / ac

Activator 90 Surfactant

b. Routt County: Funds allocated, $9,500

i. Riparian / floodplain sites adjacent to Parks and Wildlife Access site south of US 40 Rest Area west of Hayden.

ii. Three participating landowners

iii. Herbicide solution

YEAR 2 (2017-2018): GENERAL MANAGEMENT AREA

A. Continue to manage leafy spurge under existing List B management plans throughout Routt and Moffat Counties as part of the Routt County Weed Program and the Moffat County Weed and Pest Program.

B. Continue to acquire mapping data, monitor known infestations and treat within the budgetary and time constraints of the county weed programs.

C. Notify landowners as necessary to inform them of the presence of leafy spurge and their responsibilities under the Colorado Weed Law.

D. In Routt County the Weed Program will continue to provide oversight and direction for treating the Iron Springs Ranch infestation and work with the County Commissioners to help coordinate funding to assist with treatments.

E. Consider possible sites for Apthona releases as insects are available.

F. Continue to monitor known infestations of leafy spurge within and outside of the county's containment area.

G. Provide outreach with promotional materials and educational opportunities in Routt and Moffat Counties in coordination with CSU / County Extension offices and Community Agriculture Alliance

H. Form a Financial Committee to: research long-term funding opportunities to support leafy spurge management; hire a Project Coordinator; and fully fund this integrated multi-year management plan.

YEAR 2 (2017-2018): FOCUS AREA: RIPARIAN CORRIDOR

A. Retreatment of areas treated with 2016 CDA funds is the priority for use of 2017 CDA funds.

   a. Moffat County

      i. Treat Tepee Draw as a follow fall treatment in 2017 or as an early treatment in 2018.

      ii. Visually evaluate the Tepee Draw location for effectiveness, future reference and planning.

      iii. Monitor 2016 insect releases.

   b. Routt County

      i. Treat sites initially treated in June 2017 or as a follow up fall treatment in 2017 or as an early treatment in 2018.

      ii. Visually evaluate treatment sites as a reference for effectiveness and for future planning.

      iii. Monitor 2016 insect release sites.

B. Work in conjunction with river users and organizations to refine riverside mapping as time, personnel and opportunity are available.

C. Continue to cooperate with Dinosaur National Monument, the BLM and Colorado Parks and Wildlife to encourage continued efforts for leafy spurge control on landscapes under their management.

D. Evaluate future funding opportunities, especially those associated with maintain or restoring the health of river systems.

YEAR 3 (2019) THROUGH YEAR 10 (2026): GENERAL MANAGEMENT AREA

A. Routt County Weed Program and Moffat County Weed Pest Program continue to manage Leafy spurge throughout the two county region according to their existing weed plans and in accordance with their funding and staffing levels.

B. Routt County Weed Program will continue to provide oversight and direction to continue control efforts at Iron Springs Ranch.

C. Acquisition of new mapping information as observations are made in normal program activities.

D. Volunteers will be sought to assist in monitoring and mapping activities

E. County weed programs will continue to provide outreach and educational materials and opportunities to area citizens.

F. Weed program supervisors will remain current on new herbicide possibilities for treating leafy spurge.

G. Weed program supervisors will remain aware of potential partners to collaborate on targeted grazing opportunities for the control of leafy spurge in both upland and riparian locations.

H. Weed program supervisors will continue to work with volunteers to monitor, collect and redistribute insects from the Apthona nurseries to appropriate new release sites.

I. Weed program supervisors will continue to acquire leafy spurge control insects as they are available and to the level that funding allows.

J. Weed program supervisors will continue to direct the release of leafy spurge insects into appropriate new sites.

YEAR 3 (2019) THROUGH YEAR 10 (2026): FOCUS AREA: RIPARIAN CORRIDOR

A. Routt County

   a. Monitor riparian sites treated in 2017 and 2018.

   b. If funds are available appropriate herbicide solutions will be considered and rotations made to guard against resistance.

   c. If funds are available the initial treatment sites will be retreated through at least 2020.

d. The treated sites will be evaluated for treatment effectiveness and decisions made for continued treatment or to apply any available funds to new treatment sites.

e. New treatment sites will only be considered if funding is available to support an effective (multi-year) treatment plan.

f. The established Apthona nurseries will be monitored, collections made, new release sites identified and insects released as part of Weed Program, CSU Extension and volunteer collaboration. This activity will depend on and require the collaboration of all three entities.

g. Mapping refinements will be made as funds and time are available or if volunteers can be enlisted.

B. Moffat County

a. Monitor Tepee Draw, treated in 2017 and 2018.

b. If funds are available appropriate herbicide solutions will be considered and rotations made to guard against resistance.

c. If funds are available the initial treatment sites will be retreated through at least 2020.

d. The treated sites will be evaluated for treatment effectiveness and decisions made for continued treatment or to apply any available funds to new treatment sites.

e. New treatment sites will only be considered if funding is available to support an effective (multi-year) treatment plan.

f. The established Apthona nurseries will be monitored, collections made, new release sites identified and insects released as part of Weed Program, CSU Extension and volunteer collaboration. This activity will depend on and require the collaboration of all three entities.

g. Mapping refinements will be made as funds and time are available or if volunteers can be enlisted.

C. Yampa River Leafy Spurge Project Committee

a. Will continue to assist Routt and Moffat Counties in their efforts to manage the leafy spurge infestations

b. Will assist the public land managers, BLM, Dinosaur National Monument, Colorado Parks and Wildlife, and the Colorado State Land Board, to prioritize the treatment and management of the leafy spurge infestations of public lands.

c. Will assist in the prioritization of leafy spurge treatment in the Focus Area, the riparian area of the Yampa River, in order to restrict the movement by seeds downriver into new areas, by evaluating the Yampa River downstream in 10 mile annual increments as resources are available.

d. Will collaborate with Routt and Moffat Counties and the public land managers in refining this 10-year Plan

e. Will continue to explore outside funding sources, acknowledging that Routt and Moffat Counties have limited funds, as the only way to funding a multi-year integrated leafy spurge management plan to decrease the impact of the 100-mile infestation on the Yampa River in Northwest Colorado.

If this plan can be implemented over the ten year period a substantial level of control may be achieved in the focus area. Much of the success will depend on the funding available and continued involvement of cooperating agencies. If funding levels are inadequate, virtually all control will depend on the successful population establishment and effectiveness of our insect allies.