



TechLine

Information About Invasive/Exotic Plant Management

Fall 2010

Partnerships key to funding integrated weed management effort



Bighorn Sheep and Elk Habitat Enhancement Project

By Celestine Duncan
TechLine coEditor

Photo by Cameron Rasor, USFS Pintler Ranger District

Stucky Ridge provides critical habitat for bighorn sheep.

Stucky Ridge, a series of grassy, wind-blown benches and timbered gulches located near Anaconda in southwestern Montana, provides critical winter range for elk, mule deer, and bighorn sheep, and is an important rutting and calving area for elk.

Most of the site was acquired in the late 1990s by the Beaverhead-Deerlodge National Forest. Additional privately owned acreage on the Ridge was purchased in 2008 through a partnership between the American Land Conservancy, Five Valley Land Trust, and Montana Fish, Wildlife and Parks. "The area is especially important to the bighorn sheep herd, which can be found on the site from fall through spring," says Cameron Rasor, Range Manage-

"We aren't just managing weeds, but we're improving critical wildlife habitat and protecting a valuable resource for future generations."

- Cameron Rasor

See "Habitat" on page 2

INSIDE TECHLINE

Effect of Milestone on Canada
thistle and native plant community
Page 4

Biocontrol Researcher Retires
Page 11

Fall application tips to control key
noxious weeds
Page 10

“Habitat” Continued from page 1

ment Specialist for the Pintler Ranger District. “Some of the other bighorn populations in Montana have been decimated by disease, so protection and habitat improvement on Stucky Ridge is important for sheep as well as the elk.”

One of the critical resource issues impacting Stucky Ridge was noxious weed infestation – primarily spotted knapweed (*Centaurea stoebe*) – that threatened big game habitat. A key partnership was formed between the Pintler Ranger District, Montana Fish, Wildlife and Parks, Deer Lodge County Weed District, and the Blue Eyed Nellie Working Group, which involves private landholders adjacent to Stucky Ridge. Private organizations also joined forces with the partners including the Rocky Mountain Elk Foundation, Montana Chapter of the Foundation for North American Wild Sheep, and the Anaconda Sportsmen’s Club. Partners agreed to cooperate on a five-year, large-scale habitat enhancement project for the area. “Our main objectives were to protect areas not infested by noxious weeds by treating established infestations in higher elevation areas of Stucky Ridge,” explains Rasor. “We also wanted to shift vegetation toward the potential natural community by increasing native bunchgrasses and forbs, and stop weed re-invasion of previously treated areas.”

Cost for the first year of the project in 2009 was calculated at \$100,000, more than half of the district’s annual weed budget. Because of the importance of the area and partners involved with the project, the Tri County Resource Advisory Committee (RAC) and Rocky Mountain Elk Foundation stepped up to provide \$45,000, with the remainder of funds provided by the Sikes Act (\$10,000), Region 1 Forest Service, and Beaverhead-Deerlodge National Forest. “We never would have been able to implement the project on this scale if it wasn’t for our partners,” explains Rasor.

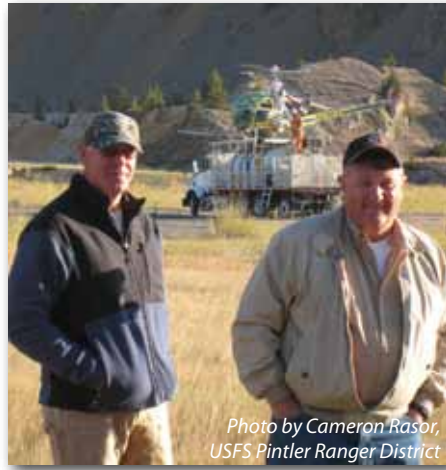


Photo by Cameron Rasor, USFS Pintler Ranger District

Rocky Mountain Elk Foundation employees Al Christophersen, Director of Habitat Stewardship Services, and Bob Schrenk, Habitat Stewardship Services Coordinator, supervising the aerial treatments on September 16, 2009.

*“We never would have been able to implement the project on this scale if it wasn’t for our partners.”
- Cameron Rasor*

Project Funding for 2009

Source	Amount (\$)
Sikes Act	10,000
Region 1 Forest Service Sikes Act Matching	10,000
Tri County Resource Advisory Council	30,000
Rocky Mountain Elk Foundation	5,000
Beaverhead-Deerlodge National Forest	35,228
TOTAL	100,228
Total Project Cost (5 Years)	316,550

“We aren’t just managing weeds, but we’re improving critical wildlife habitat and protecting a valuable resource for future generations.”

The project area was divided into three separate weed management units: 1) low elevation, fragile sites with dense populations of spotted knapweed and limited desirable native vegetation; 2) environmentally sensitive sites near aspen, conifers, and water; and 3) areas that were best suited to aerial herbicide application. The Forest Service implemented an integrated program that included release of biological control agents on spotted knapweed on low elevation sites. About 1,000 *Larinus* spp. (seed feeding insects) and 2,000 *Cyphocleonus achates* (root feeding insects) were released in 2009. “Our hope is that the insects will slowly remove the spotted knapweed allowing natural replacement of native vegetation,” explains Rasor. More releases are planned for 2010 with continued monitoring of insect populations to determine establishment.

Ground herbicide applications began in June 2009 with three different herbicide treatments including Milestone® at 7 fluid ounces per acre, 2,4-D at 1.5 quarts per acre, and Transline® at 2/3 pint per acre. Herbicide treatments were applied to 379 acres with a specialized off-road vehicle called the Land Tamer. The Land Tamer is equipped with two boom-buster ap-



Cameron Rasor, Range Management Specialist, USFS Pintler Ranger District



Photo by Cameron Rasor, USFS Pintler Ranger District



Photo by Cameron Rasor, USFS Pintler Ranger District

Spotted knapweed infestation on Stucky Ridge prior to treatment (left) and 9 months following a fall aerial application of Milestone at 6 fluid ounces per acre (right).

plication nozzles and a center single nozzle, which gives a treatment pattern of 55 feet and a total application volume of about 11 gallons per acre. “The Land Tamer allows us to accurately treat areas of rough terrain with a higher level of safety to our operators,” says Rasor. Results the year of treatment showed excellent spotted knapweed control with Milestone and Transline treatments, but poor results on sites treated with 2,4-D.

In September 2009 the Beaverhead-Deerlodge National Forest and Rocky Mountain Elk Foundation (RMEF) entered into a Stewardship Challenge Cost-Share Agreement for aerial herbicide application on 1,050 acres infested with spotted knapweed. With the help of the RMEF, a contract was issued to Heli-works Flight Services to apply Milestone at 6 fluid ounces per acre. “We reviewed results of our aerial treatments in July 2010 and had excellent control of spotted knapweed with the fall aerial treatments. The wildflowers, perennial grass, and sagebrush look great and healthy,” Rasor says.

Funding for the project was also used to construct a jackleg fence and install a closure gate to help keep unauthorized vehicles from entering the area. This should reduce movement of spotted knapweed to non-infested sites and limit disturbance caused by off-road vehicles. The final segment of the 2009 project included purchasing materials to re-develop a spring in 2010 to provide water for wildlife during summer months.

The importance of Stucky Ridge preservation and habitat enhancement was described

by James Weatherly, executive director of the Montana Chapter of the Foundation for North American Wild Sheep. “If Stucky Ridge weren’t conserved, another piece of land vital to bighorn sheep would be lost,” says Weatherly. “Saving this critical habitat helps keep our wildlife populations from further decline.”

The Beaverhead-Deerlodge National Forest is proud of the partnerships and accomplishments in 2009. Total cost of the habitat enhancement project to date is about \$72,000 to treat 1,429 acres of spotted knapweed, release 3,000 biological control agents, secure one road closure, and purchase material for a spring re-development. “We have money remaining from 2009, plus additional funding to put toward our future ground and aerial herbicide treatments and rehabilitation efforts. Our goal is to treat about 1,500 spotted knapweed acres each year through an integrated program, for a total of 5,094 acres over five years. Most importantly, the Forest wants to expand our partnerships and increase weed awareness with adjacent landowners and special interest groups,” says Rasor.



Photo by Cameron Rasor, USFS Pintler Ranger District

Land Tamer applying herbicide treatments.

The Land Tamer is a fully amphibious vehicle that can function as a boat, ATV, tractor or snow coach. The Pintler Ranger District purchased a Land Tamer in 2007 for treating noxious weeds. Equipped with a 100-gallon tank, an applicator can treat up to 9 acres before having to refill the tank. Additional information on the Land Tamer can be found online: <http://www.landtamer.com/>

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Editor's note: The following article was summarized from a research paper published in Weed Science Society of America Invasive Plant Science and Management. 3, April–June 2010. The entire article is available online at www.techlinenews.com <Click on the TechInfo>

By Travis L. Almquist
and Rodney G. Lym

Effect of Milestone® on Canada Thistle (*Cirsium arvense* L.) and the Native Plant Community in a Restored Tallgrass Prairie



Photo by Rod Lym, North Dakota State University

Native tallgrass prairies are diverse ecosystems that evolved with periodic disturbances such as fire and grazing pressure and are dominated by species that include big bluestem (*Andropogon gerardii* Vitman), Indiangrass [*Sorghastrum nutans* (L.) Nash], and switchgrass (*Panicum virgatum* L.). Currently, less than one percent of the original tallgrass prairie ecosystem

in North Dakota and Minnesota is left in native or restored condition. Fire suppression and removal of native nomadic grazers has increased invasion from woody plants, and the native and restored prairie that remains is threatened by continued human disturbance. Invasion by noxious weeds has become a major threat to the conservation of biodiversity and ecosystem sustainability in these remnant and restored prairies.

In 2006, North Dakota State University in cooperation with The Nature Conservancy established

a field study in restored tallgrass prairie within the Glacial Ridge Preserve in northwestern Minnesota. The objectives of the study were to evaluate Canada thistle control with Milestone® and measure effects on the plant community.

The study site was dominated by restored native perennial grasses such as big bluestem and Indiangrass. The site also contained many native forb species including purple prairie clover (*Dalea purpurea* Vent.), maximilian sunflower (*Helianthus maximiliani* Schrad.), Canada gold-

Table 1. Canada thistle density in response to Milestone® applications at the Glacial Ridge Preserve near Mentor, MN.

Treatment ^a - Rate	Before treatment	10 MAT ^b	22 MAT
Milestone - 7 fl oz/ac	15	0.1	1.3
Control	17	15.6	12
LSD (0.05)	NS	1.3	1.2

^a Milestone was applied on September 25, 2006, with a nonionic surfactant at 0.25% (v/v).

^b Abbreviation: MAT, months after treatment

enrod (*Solidago canadensis* L.), and white panicked aster (*Aster simplex* Willd.). Areas within the restoration had varying densities of Canada thistle infestation, but a majority of the restoration site was not invaded. Other weeds were also present in the restoration area such as absinth wormwood (*Artemisia absinthium* L.), perennial sowthistle (*Sonchus arvensis*), and field bindweed (*Convolvulus arvensis* L.).

Canada thistle-infested plots were paired with non-infested restored native sites. The restored native plant communities had a similar composition compared with the corresponding Canada thistle-infested plant communities, with the exception of Canada thistle presence, and were used to determine the effect of Milestone on native species. The changes in plant species composition (richness, evenness, and diversity) and cover in both Canada thistle-infested and native restored plant communities were determined after Milestone treatment.

Milestone was applied in the fall at 7 fluid ounces per acre (fl oz/A) to Canada thistle-infested sites when Canada thistle was at the rosette fall-regrowth stage, and

was also applied to corresponding native restored prairie plots. Canada thistle control was determined by counting stem density in July before treatment and 10 and 22 months after treatment (MAT). Plant community composition was evaluated by visually assessing the plant foliar cover. Bare ground, litter, and individual plant species cover were estimated in mid-July prior to herbicide treatment and 10 and 22 MAT.

Results of the study showed that Milestone at 7 fl oz/A applied in fall effectively reduced Canada thistle stem density more than 99% (16 stems per m² to 0.1 stems per m²) at 10 MAT (Table 1). Long-term control of Canada thistle was excellent with a 90% reduction in stem density at 22 MAT. Milestone® also removed or reduced several undesirable forb species from the restored prairie communities, such as absinth wormwood and perennial sowthistle.

Overall plant community composition in both the Canada thistle-infested and native plant communities was altered by Milestone. The major change was a decrease in the total number of high (desirable) and low seral (undesirable/weedy) forbs in the treated com-



Photo by Mary Halstvedt

Glacial Ridge Preserve is the largest prairie and wetland restoration project in U.S. history

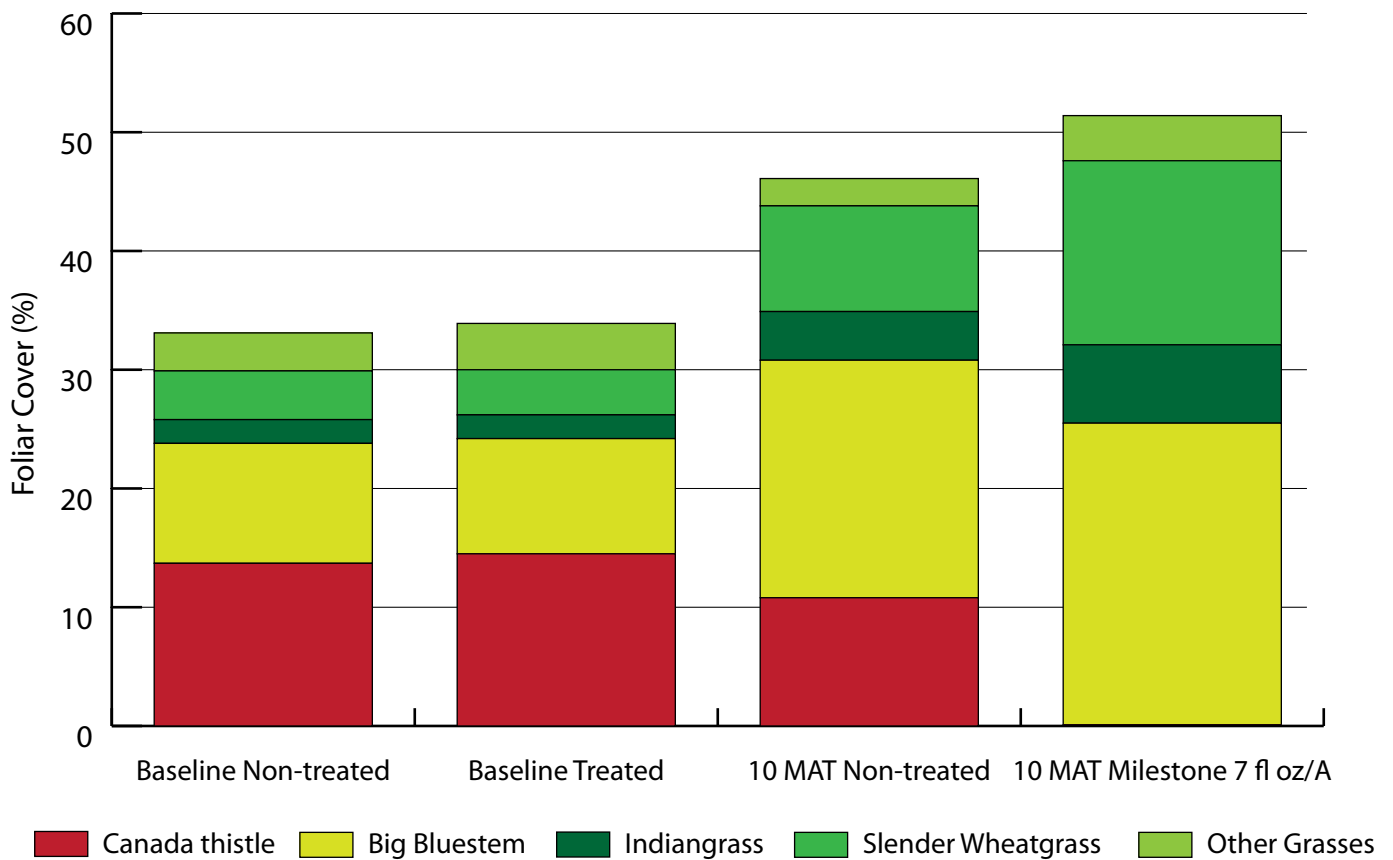
and is part of the 35,000-acre Glacial Ridge National Wildlife Refuge. Located in Polk County in northwestern Minnesota, the site hosts a diversity of plant species including the federally threatened western prairie fringed orchid (*Platanthera praeclara* Sheviak and Bowles). The land was purchased by The Nature Conservancy (TNC) in 2000, and is currently owned and managed by TNC and its federal partners including the Fish and Wildlife Service. The Glacial Ridge Project presents TNC and its partners with an unequalled opportunity to conserve and restore a unique landscape. Habitat fragmentation and invasion by exotic species such as Canada thistle (*Cirsium arvense* L.) are the most significant threats to the project area's native biodiversity. To date, TNC and its partners have restored 173 wetlands and seeded more than 11,000 acres of prairie. When the project is complete, more than 8,000 acres of wetlands and about 16,000 acres of tallgrass prairie will be restored.

“Prairie” continued on page 6



Research plot showing Canada thistle control with Milestone at 7 fluid ounces per acre (left) compared to non-treated plot (right).

Figure 1. Percent foliar cover of Canada thistle and high seral grasses found within Canada thistle–infested plant community sites before treatment (baseline) and 10 months after treatment (MAT) within the Glacial Ridge Preserve near Mentor, MN.



munities compared with non-treated communities. A number of high seral forbs were reduced or removed by Milestone, including maximilian sunflower and purple prairie clover. Foliar cover of high seral forbs in the native plant community was reduced from 12.2 to 7% at 22 MAT. However, most of the forbs that decreased 1 year after treatment recovered and were present by the second year following treatment. The cover of high seral grass species, such as big blue-stem, slender wheatgrass (*Elymus trachycaulus* [Link] Gould ex Shinnery), and Indiangrass increased 46% following Milestone application in both the Canada thistle-infested and native plant communities, with the greatest increase in Canada-thistle infested plots. The total foliar cover of high seral grasses in Canada thistle-infested communities nearly tripled, averaging 51.3% at 10 MAT compared with only 19% before treatment (Figure 1).

Species richness, evenness, and diversity were reduced after Milestone application in both Canada thistle-infested and native plant communities (Table 2). However, the benefits of Canada thistle control, removal of undesirable species, and the increase in native grass cover should lead to an overall improvement in the long-term stability and composition of the restored prairie plant community. This will likely outweigh the reduction of high seral forb species resulting from a Canada thistle control program at the Glacial Ridge Preserve.



Travis Almquist received his BS degree from Concordia College of Moorhead, MN where he also played football for four years. He received his MS degree with Dr. Rod Lym, Professor, Plant Sciences Department, North Dakota State Univ. in May 2008, and is currently working on his PhD with Dr. Richard Mack at Washington State Univ.

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Table 2. Plant species richness, evenness, and diversity in the Canada thistle-infested and native plant communities before treatment with Milestone® and 10 and 22 months after treatment (MAT) compared with non-treated paired plots at the Glacial Ridge Preserve.

Treatment ^a Rate	Evaluation Date (MAT)		
	0	10	22
Canada thistle sites			
	Richness (no. species subplot-1)^b		
Milestone 7 fl oz/ac	16.3 a	13.4 a	15.0 a
Nontreated —	16.5 a	18.5 b	17.4 b
Native sites			
Milestone 7 fl oz/ac	14.8 z	10.0 y	12.4 a
Nontreated —	14.1 z	14.6 y	15.2 b
Canada thistle sites			
	Evenness (E^c)		
Milestone 7 fl oz/ac	0.977 a	0.908 a	0.902 a
Nontreated —	0.976 a	0.942 b	0.93 b
Native sites			
Milestone 7 fl oz/ac	0.976 a	0.873 y	0.877 a
Nontreated —	0.974 a	0.903 z	0.904 b
Canada thistle sites			
	Diversity (H^c)		
Milestone 7 fl oz/ac	2.68 a	2.34 a	2.41 a
Nontreated —	2.7 a	2.73 b	2.64 b
Native sites			
Milestone 7 fl oz/ac	2.55 z	1.92 y	2.18 a
Nontreated —	2.52 z	2.39 z	2.41 b

^a Surfactant Activator 901 at 0.25% (v/v) was applied with Milestone.

^b Values within sites with same letters in columns are not significantly different (P, 0.05).

^c Abbreviations: E^c Evenness (Shannon–Wiener diversity value divided by the natural log of number of species in the plot); H^c Shannon–Wiener diversity.





Native Forb and Shrub Tolerance to Milestone® Herbicide

Mary B. Halstvedt* and Daniel C. Cummings, Dow AgroSciences LLC., Billings, MT and Perry, OK; Travis Almquist, Luke Samuel, Rodney G Lym, North Dakota State University, Fargo; K. George Beck, Colorado State University, Ft. Collins; Roger L. Becker, University of Minnesota, St. Paul; Celestine A. Duncan, Weed Management Services, Helena, MT; Peter M. Rice, University of Montana, Missoula.

Milestone® (aminopyralid) is a broadleaf herbicide that has reduced risk to the environment compared with other commercially available herbicides, making it a desirable alternative for invasive weed control on rangeland and wildland sites. Effect of Milestone on desirable native forbs and shrubs is a consideration for land managers when making decisions about controlling invasive plants . . .

Editor's note:

A full report with tables describing 10 research locations and listing individual species response is available at www.techlinenews.com
<Click on the TechInfo>

Experiments were established at ten locations in four states to determine long-term response of native forbs and shrubs to Milestone applied in early summer or fall, and to develop a tolerance/susceptibility ranking for native plants. Studies were established within diverse native plant communities in western Montana; Boulder, Colorado; Theodore Roosevelt National Park (TRNP), North Dakota; Glacial Ridge Preserve and restored prairies in Minnesota.

Field experiments were designed as randomized complete block with two to five replications and initiated from 2004 to 2007. Milestone at 5 to 7 fluid ounces per acre was applied broadcast by ground or aerial application equipment. Treatments were made in September or October at six locations, June at two locations, and June and September comparisons at two Minnesota sites.

Data collection across sites varied from either canopy cover or plant counts along a permanent transect, or plant density within each plot.

First year post-application vegetation sampling was conducted in June and July the summer after treatment at all locations. Second year sampling was completed at eight study sites. There were a total of 118 native forbs across sites, with 20 species occurring at more than one location. Individual rankings of tolerance to Milestone (see **Table**) were established for 98 native forb species and 19 shrubs. Evaluations were based on individual species reduction in canopy cover or density compared to non-treated controls or baseline data.

Of the 98 forb species categorized, 28, 17, 25, and 28 were ranked susceptible, moderately susceptible, moderately tolerant, and tolerant, respectively (**Figure 1**).

Data were collected on 68 species approximately 2 years after treatment. Many forbs recovered by the second year following Milestone application with only 14 of 68 native forbs ranked either moderately susceptible or susceptible. Sunflower, yarrow, and lobelia were very susceptible to Milestone® while lupine, golden Alexander and wild bergamot were very tolerant (**Figure 2**).

There were 29 plant families represented, with the greatest number of species (35%) in the Asteraceae family.

Shrubs were more tolerant than forbs to Milestone. There were 19 shrub species, and 74% were ranked either moderately tolerant or tolerant. Shrubs in the Rosaceae Family were generally the most susceptible to Milestone.

Table. Four categories for ranking tolerance of forbs and shrubs to Milestone herbicide.

Category	Symptoms	Injury Level
Tolerant	Minimal symptoms <15% injury - may have slight cupping of leaves	<15%
Moderately tolerant	Symptoms include cupping/yellowing and can inhibit flowering, with recovery the first growing season after application	15-50% stand reduction
Moderately susceptible	Injury could be significant the first year and may reduce stand	50-75% stand reduction
Susceptible	Severe injury the season of application and stand reduction the year after treatment with possible death of established plants. Some plants may regenerate from seed bank	>75% stand reduction



Photos by Dave Powell, USFS, www.bugwood.org

Pictured left to right, Nuttall's violet (*Viola nuttallii*), horsemint (*Monarda fistula*), and blanket flower (*Gaillardia aristata*) were found to be tolerant to Milestone herbicide two years after treatment.

Conclusions:

- Most native forb species and shrubs were moderately tolerant to tolerant, or recovered following treatment with Milestone herbicide.
- Historical data¹ suggests that by the third or fourth year post-application there would be little difference in non-target forb tolerance with only a few very sensitive forbs being adversely impacted in the long term.
- Land managers can use these data as a guideline to evaluate risk to native plant communities when using Milestone for invasive species management.
- Milestone® Herbicide (aminopyralid) can be used to manage invasive plants in mixed plant communities and facilitate recovery of desirable forbs and shrubs.

¹ Rice, P. M., J. C. Toney, D. J. Bedunah, and C. E. Carlson. 1997. Plant community diversity and growth form responses to herbicide applications for control of *Centaurea maculosa*. *J. Appl. Ecol.* 34:1397-1412.

Figure 1. Results of all forb species combined 1 year following treatment.

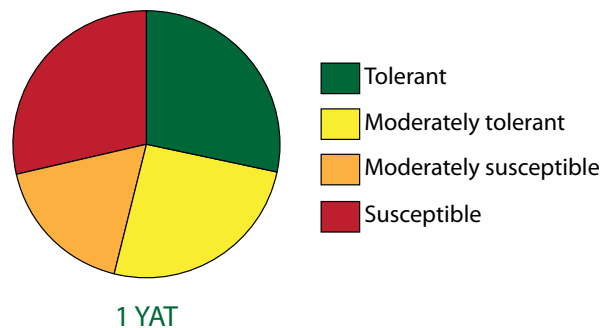
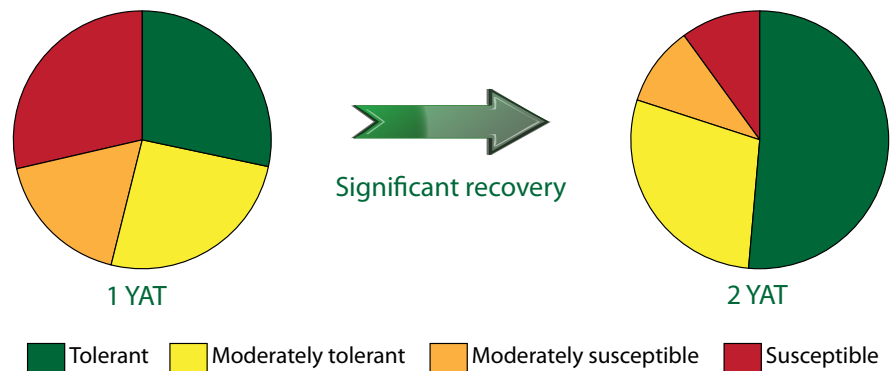


Figure 2: Results of 68 forb species with both 1 and 2 YAT data showing increase in species tolerance by the second year following treatment.



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Fall Application of Milestone® to Control Key Invasive Weeds

Fall is an excellent time to control invasive weeds with Milestone. Late summer and fall rains in many areas of the Central Plains and the West in 2010 will provide land managers with a good opportunity to extend their application season.

Russian Knapweed



Milestone at 5 or 7 fluid ounces per acre (oz/A) is highly effective for controlling Russian knapweed. Unlike

other herbicides, applications of Milestone can be made on Russian knapweed through late summer and until after the foliage has died back (leaves are brown and dead!) in fall. Milestone is taken up by the foliage, through the root crown or from the soil into this noxious weed. Milestone® will provide residual control of plants that try to re-grow and emerge after the initial application.

Spotted and Diffuse Knapweed



The application window for treating spotted and diffuse knapweed with Milestone is wider than many herbicide

options. Milestone at 5 or 7 fl oz/A applied to spotted knapweed in fall gave excellent control (>95%) of both established plants and seedlings up to 2 years after treatment in Montana and was similar to the standard treatment of Tordon® 22K at 1 pint/A. Applications can be made up to late October or early November before soil freezes.

Canada Thistle



Field research has shown that fall applications are extremely effective with Milestone at

labeled rates of 5 to 7 fl oz/A. Tank mixing with another herbicide is not necessary; Milestone alone will control Canada thistle. University of Nebraska research reports Canada thistle is actually more susceptible to herbicides when applied in the fall following a frost. Applications can be made in the fall as long as there is live Canada thistle foliage. Even though Canada thistle leaves will begin to senesce, generally there is still excellent efficacy up to late October as long as there is some green foliage.

Biennial Thistles



Fall application of Milestone® at 3 to 5 fl oz/A provides excellent control of biennial thistle

(e.g. musk, bull, and plumeless thistle). Fall herbicide treatments may be applied to rosettes over a longer period in the fall than in the spring. An additional advantage is that fall treatments reduce the potential of injury from spray drift to foliage of nearby desirable plants since sensitive crops have been harvested or desirable plants are dormant.

Tamarisk (salt cedar) and Russian Olive



Fall is an excellent time to maintain grass understory and control re-sprouting on tamarisk and Russian olive with

a tank-mix of Milestone herbicide with Garlon® 4 Ultra or Remedy® Ultra specialty herbicides. You should

wait least 6 months after cutting to allow time for the plants to regrow and develop adequate leaf area for more herbicide uptake with a foliar application. Apply Milestone at 7 fluid ounces per acre plus Garlon® 4 Ultra or Remedy® Ultra at 3 quarts per acre with a non-ionic surfactant at 0.25% v/v or 1 quart/acre of methylated seed oil (MSO). This treatment allows grasses to flourish and will also control broadleaf weeds such as Canada thistle, musk thistle, Russian knapweed, and many others that may invade the area after cutting. Tamarisk and Russian olive control may not be complete with just a single application so the site should be monitored in subsequent years and re-sprouts treated for complete control.

Other Species



Fall application of Milestone at 5 to 7 fl oz/A also provides excellent control of absinth wormwood, oxeye daisy, and

several other invasive plants as indicated on the label.

View Milestone Herbicide label at www.techlinenews.com

<Click on Product Information>



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Photos by Steve Dewey, Utah State University (retired)

Biological Control Researcher Announces Retirement

Jim Story, biological control of weeds research scientist for Montana State University (MSU) announced his retirement the end of June, 2010. Jim started his career in 1974 as an entomology graduate student at Montana State University. He began working for MSU in 1976 and transferred to the MSU-Western Agricultural Research Center at Corvallis, Montana in 1979. Jim is recognized nationally and internationally for his research on the biology and behavior, establishment, augmentation, population dynamics, and efficacy of introduced insects for control of invasive plants. He was responsible for some of the first work on interactions of spot-

ted knapweed biological control agents with herbicides and other weed management tools, and is a supporter of integrating biological agents with other control methods. His career highlight includes establishing a complex on insects on spotted knapweed that lead to a reduction in spotted knapweed densities in western Montana. Story plans to stay active in invasive plant issues and continue serving on the Montana Noxious Weed Advisory Council. We wish Jim the best in retirement and thank him for his years of service and dedication to managing invasive plants.



Jim Story, biological control research scientist for Montana State University



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GLOBAL INVASIVE SPECIES DATABASE

Take a look at the Global Invasive Species Database (GISD) to find information about invasive alien species. The GISD focuses on species that threaten native biodiversity and covers all taxonomic groups from micro-organisms to animals and plants in all ecosystems. Database content is contributed and reviewed

by experts from around the world, and is continually updated.

Input species name, location, habitat, and organism type to find information related to species ecology, distribution, management, and impacts. Lists of references, relevant links, and contacts are also available.

The database is located at:

<http://interface.creative.auckland.ac.nz/database/welcome/>

******* Bonus! *******

Look at the top of the page to find a link to the 100 World's Worst Invasive Alien Species booklet from the Foundation D'Entreprise.

Need More Information?

email techlinenews@gmail.com

The goal of *TechLine*TM newsletter is to share new, innovative and proven invasive exotic vegetation management research and successes between federal, state, county, private, and conservation organization weed managers. *TechLine* is published and distributed free of charge to both public and private land managers

and interested publics in the United States and Canada.

The complete texts of abridged versions of articles in *TechLine* are available in their entirety on request. Comments, suggestions, and articles are welcome and should be emailed to techlinenews@gmail.com.

TechLine is sponsored by Dow

AgroSciences, LLC in hopes of providing an objective communication tool for on-the-ground vegetation managers who face common management challenges so they may share the successes of their programs, techniques, and methods and learn from one another.