FALL 2016

TechLine

INVASIVE PLANT NEWS

INNOVATIVE RESEARCH, SUCCESS STORIES, AND TIPS FOR INVASIVE PLANT MANAGERS

PRAIRIE & GRASSLANDS EDITION

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MEET THE TECHLINE TEAM

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EDITOR

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2016 PHOTO CONTEST

Send us your best shots of terrestrial INVASIVE PLANTS and terrestrial invasive plant MANAGEMENT IN ACTION for TechLine's 2nd annual photo contest and a chance to win a $200 prize.

WHEN TO ENTER: August 15 to October 14, 2016

WHAT TO ENTER: Your original photographs of terrestrial invasive plants or terrestrial invasive plant management in action.

WHY ENTER: You'll win a prize! The winner of each category will receive a gift card to Forestry Suppliers or REI ($200 value).

FIND DETAILS AT
http://techlinenews.com/photo-contest

Subscribe at http://techlinenews.com/subscribe/ to receive contest updates.

READER SURVEY

HOW ARE WE DOING? Help TechLine News editors give you the information you need to improve your weed management program! Your feedback is important to us and will help us improve upon sharing information that is accurate, timely, and relevant to you. **http://bit.ly/techlinesurvey**

Vastlan™ Specialty Herbicide Replaces Garlon® 3A

Vastlan™ is a herbicide developed by Dow AgroSciences for the control of woody plant species and annual and perennial broadleaf weeds on industrial vegetation management, aquatic, Conservation Reserve Program (CRP), range and permanent grass pastures sites and grasses grown for hay. Vastlan herbicide is formulated as a soluble liquid (SL) and contains 4 pounds acid equivalent per gallon (lbs ae/ gallon) of triclopyr choline. The choline formulation of triclopyr reduced the signal from "Danger" on Garlon® 3A to "Warning". This reduced toxicity and higher concentration sets Vastlan herbicide apart from its predecessor Garlon 3A. Grass tolerance and weed control spectrum of Vastlan herbicide is the same as Garlon 3A. Vastlan is registered for use in 47 states, excluding California, New York, and Florida.

APPLICATION RATE CONVERSION FOR GARLON® 3A TO VASTLAN™ SPECIALTY HERBICIDE

Garlon 3A has 3 lb acid equivalent per gallon (ae/gallon) and Vastlan has 4 lb ae/gallon.

GARLON® 3A (3 lb ae/gal)		VASTLAN™ (4 lb ae/gal)
2 pints/Acre	=	1.5 pints/Acre
3 pints/Acre	=	2.25 pints/Acre
4 pints/Acre	=	3 pints/Acre
6 pints/Acre	=	4.5 pints/Acre
8 pints/Acre (4 quarts)	=	6 pints/Acre (3 quarts)

LANDOWNER-HUNTER PARTNERSHIP SUPPORTS HABITAT CONSERVATION

Controlling Invasive Plants Enhances Diversity

By Celestine Duncan

CHRIS HITZEMAN

WETLANDS AND PRAIRIE GRASSLAND ARE RESTORED AND PRESERVED AS PART OF THE CONSERVATION RESERVE PROGRAM

AMID THE RESTORED PRAIRIE GRASSLAND IN CENTRAL SOUTH DAKOTA, A GROUP THAT INCLUDED LANDOWNERS, BIOLOGISTS, AND INVASIVE PLANT SPECIALISTS MET TO OBSERVE CONSERVATION AND HABITAT IMPROVEMENT PRACTICES. Chris Hitzeman, a farmer and owner of U-Guide South Dakota Pheasant Hunting, gathered the group to discuss the challenges and benefits of restoring wildlife habitat. This diverse collection of individuals shares an interest in expanding and improving habitat for wildlife in the prairie region.

"There are many agricultural producers that would like to do more for pheasants and other wildlife, but the farming and ranching business can be tough," explains Hitzeman. "Landowners understand there are challenges such as noxious weed invasion and potential loss of income when you convert cropland to permanent grass. There has to be financial incentives for them to take land out of agricultural production and plant the most critical wildlife habitat in South Dakota...food-cover plots for winter survival."

The majority of land owned by Hitzeman is in the Conservation Reserve Program (CRP) including riparian areas, trees, sloughs and permanent grass. He spent the past 13 years converting cropland to habitat for pheasants and other wildlife through CRP programs. His success forged a win-win partnership model between hunters and landowners that is strictly habitat-based.

Optimizing Habitat

"Our goal is to provide high quality, fair-chase opportunities to hunters by optimizing habitat for pheasants," explains Hitzeman. "This means maintaining high levels of plant diversity where birds can rear broods, and find cover and feed, especially during winter." Diverse habitat benefits not only pheasants but small and large mammals, insects, song birds, raptors and other prairie-dependent wildlife.

Hitzeman works closely with Pheasants Forever Farm Bill Biologists, Natural Resources Conservation Service, private industry, and others to develop the best seed mix, seeding strategy, and post-seeding management practices to meet his conservation goals. "There is no substitute for on-ground observation," says Hitzeman. "Spending time in the field and watching how the pheasants interact with various plantings at different times of the year is critical. We can adapt our management to more effectively meet the needs of pheasants and other wildlife."

When restoring prairie grassland, Hitzeman prefers to seed in early

Continued on page 4...

FARM BILL BIOLOGISTS

Pheasants Forever and Quail Forever Farm Bill Biologists are specialized consultants in conservation programs and habitat planning. The Pheasants Forever and Quail Forever mission is tied directly to federal conservation programs, such as the Conservation Reserve Program (CRP), with authority granted through the Federal Farm Bill. The purpose of Farm Bill Biologists is to assist landowners in designing, developing, and funding habitat improvements on private lands to meet their personal habitat and land use goals.

FIND A FARM BILL BIOLOGIST AT
http://bit.ly/farmbillbiologists


MIKE SCHULZ

CONSERVATION RESERVE PROGRAM LAND CP-25 ONE YEAR FOLLOWING A JUNE SPOT TREATMENT WITH MILESTONE® SPECIALTY HERBICIDE AT 5 FL OZ/A TO CONTROL CANADA THISTLE (RIGHT)

NEW CP-25 SEEDING IN A FIELD SHOWING THE FIRST MOWING IN JUNE TO REDUCE COMPETITION FROM VELVETLEAF AND OTHER ANNUAL WEEDS (BOTTOM, LEFT) AND THE SAME FIELD TWO GROWING SEASONS AFTER SEEDING SHOWING WELL-ESTABLISHED PRAIRIE FORBS AND GRASSES (BOTTOM, RIGHT).


CHRIS HITZEMAN


CHRIS HITZEMAN

... Continued from page 3

spring versus late fall to minimize seed loss to winter injury and rodents. Planting is followed by two mowing events the first growing season—one in mid June and the second in late July. Mowing at a height just above desirable seeded species reduces competition for light, nutrients and water from annual and perennial weeds. A flushing bar is mounted on the front of the tractor during field work to move wildlife out of the path of the mower.

During the second and subsequent growing season, noxious and invasive weeds are spot-treated with herbicide. Fire is also used to stimulate new vegetative growth and increase plant diversity, with individual fields burned once every five years in early spring. Thirty-foot borders around fields are seeded to alfalfa and serve as both a fire break and food plots for pheasant brood from June through August.

Hitzeman believes the recipe for success is providing a diversity of wildlife habitat. This includes warm and cool season grasses, a mix of forbs that bloom throughout the summer, wetlands, trees, food plots, and permanent cover and feed for winter.

Challenges

One of the challenges with CRP is that noxious weeds can invade new plantings. "Seeding success is often difficult to measure until three years post-seeding, and every year there are sites where Canada thistle and musk thistle need to be treated," explains Hitzeman. "One of our goals is to find a way to control noxious weeds while maintaining a diverse plant community for wildlife, and to share these successes with our neighbors. We tried mechanical clipping to control weeds on established CRP but the method didn't prove to be a viable control practice on perennial weeds like Canada thistle."

Hitzeman compared several different herbicide treatments on grasslands to control Canada and musk thistle including Transline® and Milestone® specialty herbicides applied alone or in combination with 2,4-D. He reported that the best treatment for controlling Canada thistle and maintaining plant diversity was Milestone at 5 fluid ounces per acre (fl oz/A) plus a non-ionic surfactant. "Milestone is the most selective herbicide to apply to clean up the thistle," says Hitzeman.

Thistle is also a problem in young shelterbelts. "Trees provide good cover for nesting birds especially if you plant grass between rows," says Hitzeman. "It can cost up to about $2,000 per acre to establish trees, so it's important to manage


CHRIS HITZEMAN


CHRIS HITZEMAN

WILD PHEASANT HARVEST FROM A CP-37 FIELD

noxious weeds and reduce competition for water and nutrients. After about five years the shelterbelt shouldn't require much maintenance."

Canada thistle growing within shelterbelts was treated with Transline® at 16 fl oz/A. Tree species included both deciduous trees (e.g. wild plum [*Prunus* sp.]) and conifers (e.g. Rocky Mountain juniper [*Juniperous scopulorum*]).

"The four-year-old deciduous trees showed good tolerance to Transline when spraying between rows," says Hitzeman. "There was no damage to juniper or other conifers, but some leaf curling was observed in deciduous trees that were one year old." No long-term damage to trees has been observed; however, it is important to understand the tolerance of individual tree species to various herbicides prior to treatment.

The noxious weed management plan for Hitzeman's property includes a tolerance level of about 20 percent Canada thistle cover within patches. Greater than 20 percent cover has a significant impact on desirable forbs. Fall application of Milestone® may be more selective on certain forbs and still provide good control of dense Canada thistle. Hitzeman suggests that inter-seeding Milestone-tolerant forbs may optimize plant diversity for wildlife habitat following herbicide treatment of dense Canada thistle infestations.

A WIN-WIN FOR CONSERVATION AND COMMERCE

Chris Hitzeman is a farmer and owner of U-Guide South Dakota Pheasant Hunting who forged a win-win partnership model between hunters and landowners in the common interest of improving and expanding wildlife habitat. The majority of land owned by Hitzeman is in the Conservation Reserve Program (CRP) including riparian areas, trees, sloughs and permanent grass.

CONSERVATION RESERVE PROGRAMS IMPLEMENTED BY HITZEMAN

1. CRP CP-5A: Field windbreak plantings.
2. CRP-CP12: Wildlife Food Plots.
3. CRP-CP21: Filter strips.
4. CRP-CP22: Riparian buffer.
5. CRP-CP25: Restoration of Rare and Declining Habitat Program.
6. CRP-CP27/28: Farmable Wetlands Program.
7. CRP-CP37: Duck Nesting Habitat (wetland restoration).

Sustainable Conservation

Conservation strategies that are habitat-based can help landowners diversify their income. Hitzeman explains, "Every year agricultural commodity prices change—one year, wheat may bring a high price, and a few years later it may be cattle. In our operation we get 40 percent of our revenue from CRP payments, 40 percent from hunting, and the remainder from cash rent on 100 acres of farmland. Optimizing habitat for wildlife and providing hunting opportunities on private land is a win-win situation for land conservation, hunters and landowners. By viewing sustainable conservation from a profitability standpoint it's possible to change landowner acceptance of programs, and more agricultural producers will devote more of their land to wildlife habitat. The land, water and wildlife ultimately benefit from these partnerships."

LEARN MORE

... about **trees tolerant to Milestone®** specialty herbicide at http://bit.ly/milestonewoodyplants.

... about **forbs tolerant to Milestone®** specialty herbicide that are recommended for seeding into sites infested with Canada thistle, musk thistle, and absinth wormwood at http://bit.ly/herbicidesprairie.

Integrative Management of Sericea Lespedeza in Prairie Restorations


JAMES MILLER, USDA FOREST SERVICE, BUGWOOD.ORG


CHRIS EVANS, UNIVERSITY OF ILLINOIS, BUGWOOD.ORG

EDITORS NOTE: *Data summarized in this article are from a thesis authored by Lindsay Shupert as partial fulfillment of a Master of Science degree at Southern Illinois University, Carbondale (May 2016). The entire thesis is available online at https://dx.doi.org/10.6084/9.figshare.3369952.v1*

Lindsay Shupert, a graduate student with Dr. David Gibson at Southern Illinois University conducted a research project on sericea lespedeza (*Lespedeza cuneata*) in the Crab Orchard National Wildlife Refuge. The refuge is located near Marion, Illinois between the Mississippi River and Ohio River, in Williamson County.

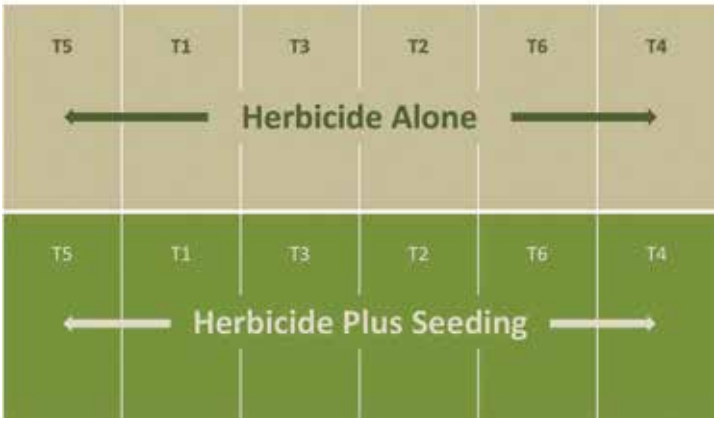
The goal of the study was to explore a comprehensive approach to reducing the abundance of sericea lespedeza. Primary objectives of the research were to: (1) Measure the level of sericea lespedeza control and forb tolerance to varying rates of Garlon® 4 Ultra specialty herbicide and PastureGard® HL herbicide applied in spring and summer; (2) compare effectiveness of summer-applied to spring-applied herbicide treatments; and (3) determine how supplemental seeding of native grasses and forbs enhance restoration success following herbicide treatment. The hypothesis was that the combination of herbicides and seeding would allow an increase in native plant diversity and reduce regrowth and reinvasion of sericea lespedeza.

Methods

Field studies were established at three sites within Crab Orchard Wildlife Refuge on infestations of sericea lespedeza. A split-plot design was used, where half of the summer herbicide-treated plot received a spring seeding of desirable prairie species, and the other half did not receive seeding (Figure 1).

Two herbicides at multiple rates were applied in August 2012 and two herbicides at one rate each were applied in May 2013 (Tables 1, 2). Herbicides included Garlon 4 Ultra* (triclopyr) and Pasturegard HL (triclopyr plus fluroxypyr), which have been shown to provide effective control in reducing sericea lespedeza. A native seed mix designed for Conservation Reserve Program lands (Table 3) was seeded in February 2013 to half of the August herbicide-treated plots. Plots were hand raked prior to seeding to remove litter and allow seed contact with the soil. The seed mix was distributed at an approximate density of 300 seeds per square meter. Plots receiving the May herbicide treatments were not seeded.

FIGURE 1. A SPLIT-PLOT DESIGN WAS USED, WHERE HALF OF THE SUMMER HERBICIDE-TREATED PLOT RECEIVED A SPRING SEEDING OF DESIRABLE PRAIRIE SPECIES, AND THE OTHER HALF DID NOT RECEIVE SEEDING. EACH "T" REPRESENTS A DIFFERENT HERBICIDE TREATMENT (T6= NON-TREATED CONTROL).



**Remedy Ultra rather than Garlon 4 Ultra should be applied on sites grazed by livestock.*

TABLE 1. HERBICIDES AND RATES THAT WERE APPLIED IN AUGUST (SUMMER) 2012.

Treatment	Herbicide	Active ingredient	Application Rate pints/A
1	Garlon® 4 Ultra	Triclopyr	1 (low rate)
2	Garlon 4 Ultra	Triclopyr	1.5 (high rate)
3	Pasturegard® HL	Triclopyr plus Fluroxypyr	1.1 (low rate)
4	Pasturegard HL	Triclopyr plus Fluroxypyr	1.5 (medium rate)
5	Pasturegard HL	Triclopyr plus Fluroxypyr	2.2 (high rate)
6	Non-treated (control)		0.0

TABLE 2. HERBICIDES AND RATES THAT WERE APPLIED IN MAY (SPRING) 2013.

Treatment	Herbicide	Active ingredient	Application Rate pints/A
A	Garlon® 4 Ultra	Triclopyr	1 (low rate)
B	Pasturegard® HL	Triclopyr plus Fluroxypyr	1.1 (low rate)

TABLE 3. LIST OF SPECIES INCLUDED IN SEEDING MIX

Scientific Name,	Common Name
Andropogon gerardii	big bluestem
Bouteloua curtipendula	sideoats grama
Schizachyrium scoparium	little bluestem
Sorghastrum nutans	Indian grass
Chamaecrista fasciculata	partridge pea
Dalea candidum	white prairie clover
Dalea purprea	purple prairie clover
Desmanthus llinoensis	Illinois bundleflower
Echinacea pallida	pale purple coneflower
Lespedeza capitata	round-headed bushclover
Penstemon digitalis	foxglove beardtongue
Ratibida pinnata	yellow coneflower
Rudbeckia hirta	black-eyed Susan
Veronicastrum virginicum	Culver's root

Vegetation was assessed prior to or immediately after herbicide application, and post-application in June and August 2013. Density of sericea lespedeza were measured using stem counts to quantify density, and a visual estimation of canopy cover according to the modified Daubenmire scale. Cover and richness of exotic and native plants on the August-treated herbicide plots were also measured. These steps allowed for comparison of the effectiveness of herbicides with and without reseeding, and applied in spring and in summer.

Analysis

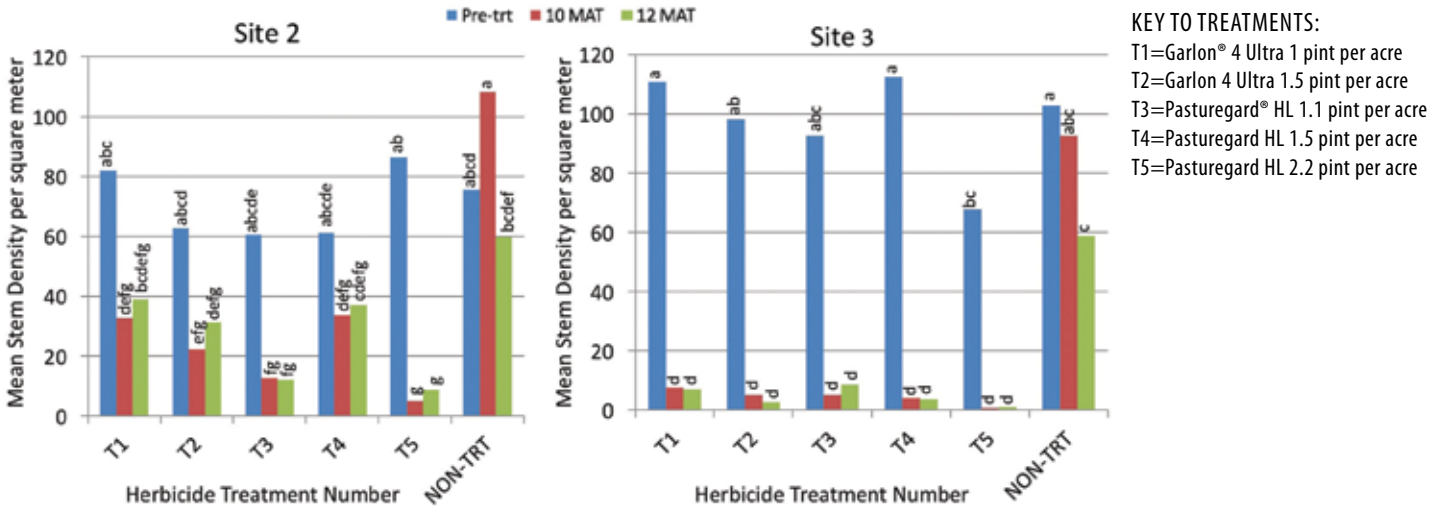
Mixed Model analysis by site was performed to test the effect of herbicide and seeding treatments on sericea lespedeza. The August herbicide-treated plots were also tested for effects on other plant groups. Statistical analysis was performed to assess community composition response to seeding and herbicide treatments.

Results

Herbicide treatments applied in August significantly reduced sericea lespedeza stem density (Figure 2) and cover compared to non-treated plots 10 months after application at all three locations. Evaluations taken 12 months after application showed Sites 1 and 3 responded similarly to herbicide treatments, which provided effective control of sericea lespedeza; however, only PastureGard HL at 2.2 pints/acre significantly reduced sericea stem density at Site 2 compared to non-treated plots. Site 2 had

Continued on page 8...

FIGURE 2. SERICEA LESPEDEZA MEAN STEM DENSITY PER SQUARE METER PRETREATMENT, 10 MONTHS (JUNE 2013) AND 12 MONTHS (AUGUST 2013) AFTER HERBICIDE TREATMENTS (MAT) WERE APPLIED. SITES 1 AND 3 WERE SIMILAR, SO ONLY SITE 3 IS COMPARED TO SITE 2 BELOW. BARS SHARING THE SAME LETTER DO NOT DIFFER STATISTICALLY FROM EACH OTHER ($P < 0.05$). KEY INDICATES THE HERBICIDE TREATMENT NUMBER USED.



KEY TO TREATMENTS:
T1=Garlon® 4 Ultra 1 pint per acre
T2=Garlon 4 Ultra 1.5 pint per acre
T3=Pasturegard® HL 1.1 pint per acre
T4=Pasturegard HL 1.5 pint per acre
T5=Pasturegard HL 2.2 pint per acre


DAVID GIBSON


STUDY SITE 2 SHOWING A TREATMENT BLOCK ABOUT THREE WEEKS POST HERBICIDE APPLICATION.

DAVID GIBSON


COURTESY OF LINDSAY SHUPERT

SOUTHERN ILLINOIS GRADUATE STUDENT LINDSAY SHUPERT GUIDES APPLICATOR SCOTT FLYNN, RESEARCH BIOLOGIST WITH DOW AGROSCIENCES, BY POINTING OUT CORNERS OF HER SERICEA LESPEDEZA RESEARCH PLOTS (LEFT).

LINDSAY SHUPERT (BOTTOM, LEFT).

... Continued from page 7

less intensive management than sites 1 and 3, soil compaction, and the lowest cover of native species, which may have affected herbicide efficacy and regeneration of sericea lespedeza. There was no significant difference in sericea lespedeza stem density or cover between various herbicide treatments except at Site 2. Supplemental seeding in the August herbicide-treated plots did not reduce the abundance of sericea lespedeza consistently across plots or sites.

Both Garlon 4 Ultra and PastureGard HL applied in May (spring) significantly reduced sericea cover three months following application similar to the August treatments. Comparisons between summer and spring treatments were difficult to assess since evaluation intervals were only four months for the spring application, and 10 to 12 months for the summer application.

Herbicide effects on native plant species were variable, and cover and richness of native plants was not correlated to herbicide treatment in the spring plots. Similarly, in the summer plots the richness of native plants fluctuated by sampling date, but was not correlated to herbicide treatment.

Conclusions

Good to excellent short-term control of sericea lespedeza was achieved in both the August (summer) and May (spring) herbicide treated plots. However, data from the herbicide treatments suggest that sericea lespedeza will regrow or reinvade on some sites and follow-up control will be necessary.

There was insufficient evidence to determine if supplemental seeding at the applied rate had an effect on restoration success following herbicide application, at least in the short term that this study was conducted. Data showed that supplemental seeding of native species did not significantly reduce regrowth of sericea lespedeza. This poor response of supplemental seedling may be due to the persistent soil seed bank created by sericea lespedeza, or ecological changes occurring in infested sites such as changes in fungal or bacterial communities or allelopathic tendencies of sericea lespedeza. These factors may allow sericea lespedeza to re-establish faster than the desirable seedlings can establish. In addition, the six-month time period that measurements were taken may have been too short for native seedling establishment or the ability of seedlings to compete with sericea lespedeza. Native species richness and cover were not consistently higher in seeded plots compared to non-seeded plots suggesting poor establishment of seed mix species.

Active ingredients for products mentioned in this article. Product (active ingredient):
Garlon 4 Ultra (triclopyr), PastureGard HL (triclopyr and fluroxypyr).

MANAGING SERICEA LESPEDEZA WITH SELECTIVE HERBICIDES

READ THE COMPLETE ARTICLE ONLINE AT http://bit.ly/sericeamanagement

Commitment

Successful management of sericea lespedeza requires a long-term commitment because of the tenacious nature of the plant and high longevity of seed viability in the soil seed bank. The management goal should be to control the plants and prevent seed production until the seed in the soil are no longer viable. Infested areas should be monitored each year and new plants controlled. Establishing and maintaining a thick cover of desirable grasses through proper grazing management helps discourage new plant establishment and site invasion.

Herbicide Application Timing

EARLY SUMMER

Begin treatment when sericea lespedeza is a minimum of 8 inches tall (May to June). Treatment may continue as long as plants are not stressed through the summer. Use the higher labeled rate when the plants are larger than 18 inches.

EARLY FALL

Treatment may continue through September when plants are actively growing. The higher labeled rate herbicides should be used late in the season due to the advanced growth stage of the plant.

Herbicides

PastureGard® HL (combination of triclopyr and fluroxypyr) at 0.75 to 1 pint per acre and Remedy® Ultra (triclopyr) at 1 to 1.5 pints per acre provides the most consistent control of sericea lespedeza across multiple application timings. The higher label rates tend to be more consistent than lower rates especially at August and September applications. Metsulfuron applied at later application timing provides good control of sericea lespedeza. Opensight® herbicide (a combination of metsulfuron and aminopyrlid) provides good late season control when applied at 3 to 3.3 oz of product per acre. The use of a non-ionic surfactant is recommended for all treatments.

Application

BROADCAST APPLICATION

Adequate coverage is a key component of control for sericea lespedeza. For best results, apply 3 or more gallons per acre total spray volume by air or 10 to 20 gallons per acre total spray volume by ground equipment. Use of a nonionic surfactant at 1 to 2 quarts per 100 gallons of spray solution is recommended for all sericea lespedeza treatments.

SPOT APPLICATION

Mix 3 pints PastureGard HL or 4 to 6 quarts Remedy Ultra per 100 gallons of water (0.5 fl oz PastureGard HL or 1.5 to 2 fl oz Remedy Ultra per gallon of water). Apply the spray uniformly and thoroughly wet the Sericea lespedeza foliage. Tank mixing of PastureGard HL with other herbicides is not required to control Sericea.

When using a backpack sprayer to treat small patches, adjust the spray tip to produce a higher volume spray, or install a flat spray tip such as a Teejet 2503 or 4004E. Backpack spraying is efficient for minor infestations and follow-up spot treatments. When treating by hand, be sure to spray all of the plants' growing tips, spraying to wet at least 80 percent of the foliage.

Fall rain and cooler temperatures provide good conditions for extending the herbicide application season. The following species and many others can be effectively controlled in the fall. Follow the links for control recommendations for each species.

SPOTTED & DIFFUSE KNAPWEED
http://bit.ly/spottedknapweed

CANADA THISTLE
http://bit.ly/canadathistle

LEAFY SPURGE
http://bit.ly/leafyspurge

BIENNIAL THISTLES
http://bit.ly/biennialthistle

CROWN VETCH
http://bit.ly/crownvetch

BIRDSFOOT TREFOIL
http://bit.ly/birdsfoottrefoil

SWEETCLOVER
http://bit.ly/sweetclover
(and see page 10)

TEASEL
http://bit.ly/teasel2014

WOODY PLANTS
Foliar herbicide application to woody plants can be made in fall until the first sign of color change in the leaves.
http://bit.ly/woodyplantcontrol

SOME SPECIES ARE NOT EFFECTIVELY CONTROLLED IN FALL. For example: Hawkweeds (*Hieracium* spp.), and annual weeds such as pigweeds (*Amaranthus* spp.), buffalobur (*Solanum rostratum*), and kochia (*Kochia scoparia*).


STEVE DEWEY, BUGWOOD.ORG


STEVE DEWEY, BUGWOOD.ORG


ROB ROUTLEDGE, BUGWOOD.ORG

Managing Sweetclover in Natural Areas

By Celestine Duncan

Yellow (*Melilotus officinalis*) and white (*M. alba*) sweetclover are herbaceous, non-native legumes that are widely distributed in the United States. A native to Europe, sweetclover was introduced to North America by the mid-1600s. Spread of the plant was likely facilitated by beekeepers and agriculturalists.

Sweetclover is considered both a beneficial plant and a problematic weed. Although cultivated for wildlife and livestock forage, soil stabilization, as a nitrogen-fixer, and as a bee plant, both white and yellow sweetclover are now classified in the United States as invasive in some midwestern states and Alaska. Sweetclover is known to degrade grasslands in prairie and natural areas by overtopping and shading native plants thereby reducing diversity. The success of prairie restorations is often hindered by sweetclover invasion (Figure 1). These clovers readily occupy open habitats and have successfully exploited many native prairies and open, mesic plant communities in the Midwest (U.S.).

BIOLOGY AND ECOLOGY

Yellow and white sweetclover are considered biennials and rarely annuals or short-lived perennials. Plants grow vegetatively the first year, developing a deep tap-root system. During the second growing season, sweetclover stems will grow up to 6 ½ feet in height with spreading branches. Flowering takes place from April through September. Small, yellow (or white), sweetly fragrant, pea-like flowers cluster along the end of each flowering stem and in leaf axils creating slender flower heads (Figure 2). Yellow sweetclover may bloom two to four weeks earlier than white sweetclover. Each flower produces one or two small seeds with hard seed coats. Although plants die after producing seed, long-term seed viability (81 years) allows infestations to persist for years until the soil seed bank is depleted.

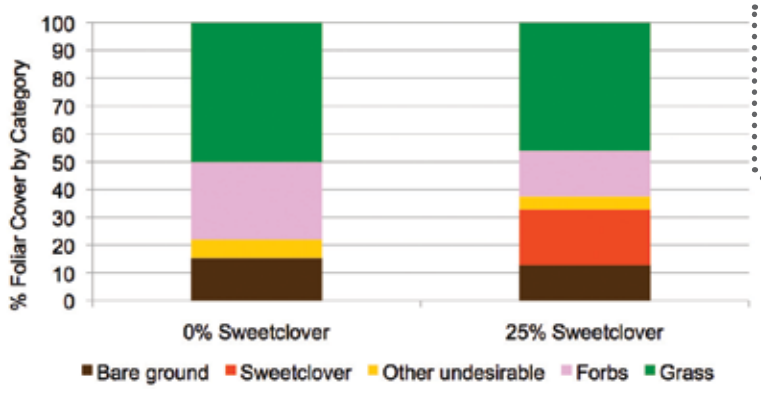


FIGURE 1. COMPARISON OF 0 AND 25 PERCENT SWEETCLOVER COVER ON THE PLANT COMMUNITY ONE YEAR AFTER BURNING AND INTER-SEEDING IN WESTERN MINNESOTA. SWEETCLOVER REDUCED ESTABLISHMENT OF SEEDED FORBS (% FORB COVER IN PINK).

MANAGEMENT

Herbicides, physical, cultural (grazing, fire and competition), and mechanical methods have been used for managing white and yellow sweetclover. An important consideration in controlling this species is long-term viability of seeds in soil; thus management practices that stop flowering are important for seed bank depletion. Although physical, cultural, and mechanical methods can provide some control of sweetclover, this article focuses on use of selective broadleaf herbicides.

Field trials were conducted in western Minnesota near Ortonville to study plant community response to various herbicide treatments in a prairie restoration. Pre- and post-treatment plant cover data were collected from 200 subplots within plots. In the plots where sweetclover was present, mean cover was about 25 percent prior to herbicide application. Results one year following application indicated that sweetclover cover declined to about 0.1 percent post-herbicide application with Milestone® specialty herbicide at 5 fluid ounces per acre (fl oz/A), equivalent to 99 percent control. On adjacent non-treated plots sweetclover cover increased to 36 percent during the same time period (Figure 3).

Studies conducted by Mark Renz with the University of Wisconsin produced similar results (http://techlinenews.com/s/sweetcloverrenz.pdf). Renz reports that either Milestone at 7 fl oz/A or Grazon® P+D herbicide at 32 fl oz/A provide the most effective sweetclover control the season of treatment and one year following treatment compared to other selective broadleaf herbicides.

Field trials conducted by Renz in Middleton, Wisconsin in 2012 indicate that Milestone at 5 fl oz/A and Transline® specialty herbicide at 1 pint/A applied in fall provide similar control of sweetclover the spring following treatment. Winterkill of sweetclover at Middleton may have influenced control (Renz unpublished data).

HERBICIDE APPLICATION TIMING

Sweetclover is capable of germinating throughout the growing season into fall. Herbicides applied in fall will control first year plants that haven't flowered. However, soil residual properties of the herbicide are important to prevent seedling germination the following spring and summer. Milestone, Tordon® 22K or Transline specialty herbicides applied in spring or early summer may control both bolting plants (second year growth) and seedlings that can germinate throughout the summer into fall. In prairie plantings, Milestone and Transline would provide more selective control of sweetclover than Tordon 22K. Design herbicide selection and application timing to meet management objectives for other desirable broadleaf species on the site and minimize non-target damage.

INTEGRATED MANAGEMENT

Sweetclover abundance can be reduced through integrated management strategies that are designed to encourage native vegetation and limit sweetclover growth and reproduction. Integrating late spring to early fall burns, seeding desirable species, mowing and herbicides will help reduce the competitive ability of sweetclover.

FIGURE 2. LEAVES ARE FULLY DIVIDED INTO THREE LEAFLETS, LIKE ALFALFA. LEAFLETS ARE EGG SHAPED TO OBLONG AND MOSTLY 0.4 TO 1 INCH (1–2.5 CM) LONG. THE MIDDLE LEAFLET HAS A SHORT STALK. LEAVES ARE ALTERNATE TO ONE ANOTHER ALONG THE STEM.

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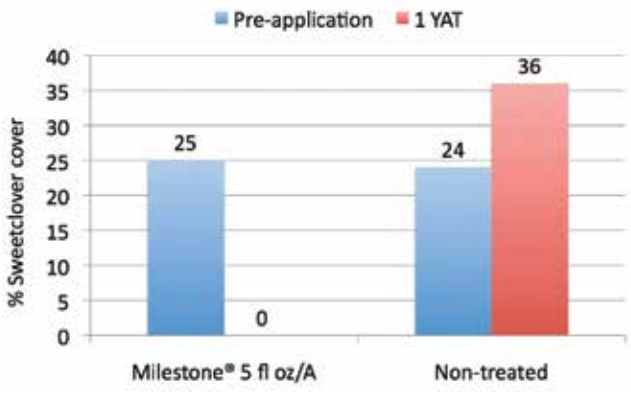
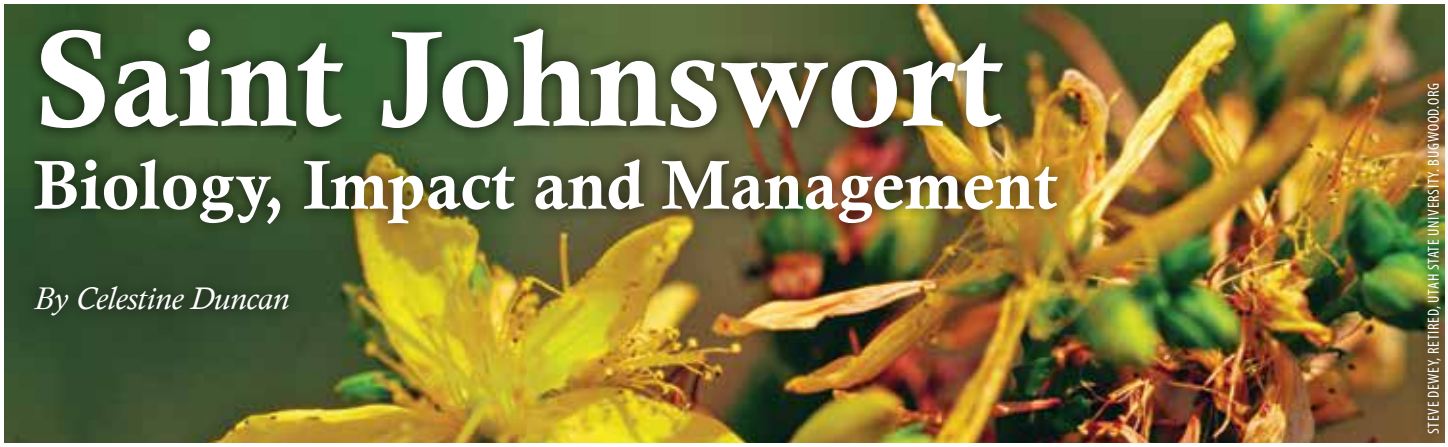


FIGURE 3. PERCENT SWEETCLOVER COVER (Y-AXIS) IN PRAIRIE RESTORATION PLOTS PRE-APPLICATION AND ONE YEAR POST-APPLICATION WITH MILESTONE® SPECIALTY HERBICIDE AT 5 FLUID OUNCES PER ACRE (FL OZ/A) COMPARED TO NON-TREATED CONTROL PLOTS IN WESTERN MINNESOTA.

Saint Johnswort
Biology, Impact and Management

By Celestine Duncan


STEVE DEWEY, RETIRED, UTAH STATE UNIVERSITY, BUGWOOD.ORG

Saint (St.) Johnswort (*Hypericum perforatum* L.), also known as Klamath weed or goatweed, was introduced to the United States as an ornamental and for medicinal purposes. The weed readily escapes cultivation, and has spread to infest natural areas, pastures and rangeland throughout most of the United States (Figure 1). St. Johnswort is listed as a noxious weed in eight western states (CA, CO, MT, OR, NV, SD, WA and WY) (USDA, NRCS 2016) and is on the noxious weed list for the North American Weed Free Forage Program (NAISMA 2016).

Impact

St. Johnswort contains the pigment hypericin, which causes photosensitization when ingested by grazing animals. Livestock will consume the weed when more desirable forage is scarce. Weakly pigmented parts of the grazing animal's body such as the mouth, nose, ears and udders become light sensitive. Sheep, cattle, horses and goats are susceptible, but goats are more resistant than other animals. Symptoms include blistering skin, hair loss, high body temperature, rapid pulse and respiration rates, salivation and diarrhea. Affected animals may die of dehydration or starvation because of swelling and soreness of the mouth following an episode of hypericism. St. Johnswort also forms monocultures, reducing native plant diversity and impacting wildlife habitat and livestock carrying capacity on rangeland and natural areas.

Identification

St. Johnswort is a taprooted perennial weed that reproduces from seed and lateral roots. Plants grow from one to five feet tall with numerous stems that are woody at the base. In autumn, infestations are easily visible because of the upright, rust-colored stems.

Leaves are opposite, sessile, entire, elliptic to oblong, and generally not more than one inch long. A diagnostic characteristic of St. Johnswort is the presence of tiny, transparent perforations on the leaves that are visible when the leaf is held up to a light source (Figure 2). A mature plant may produce up to 30 flowering stems annually.

Flowers are clustered in terminal cymes and each flower has five sepals and five petals (Figure 3). Petals are typically twice as long as sepals with black glands along the margins. The seed capsule bursts at maturity (Figure 4). A single plant can produce about 30,000 seeds that are easily transported by animals, wind, humans, and water. Seeds can remain dormant in soil for ten years.

Management

Early detection and treatment of newly invading plants, minimizing disturbance, and establishing desirable competitive vegetation will reduce the ability of St. Johnswort to establish and spread.

On small, isolated infestations, hand pulling or digging young plants may be effective. Repeated pulling or digging is necessary because lateral roots of older plants can give rise to new plants. Extracted plants should be removed from the area and burned to prevent vegetative regrowth and/or seed dissemination.

Mowing is ineffective as a management tool but may reduce spread of the plant if done before seeds form. Mowing may also negatively impact desirable vegetation that can compete with St. Johnswort. Burning may increase the density and vigor of St. Johnswort infestations.

HERBICIDE

Field trials conducted in Washington and Montana show that Milestone® specialty herbicide at 5 to 7 fluid ounces per acre (fl oz/A) provides excellent control (>95%) of St. Johnswort one year after treatment (Table 1). Applications should


EDDMAPS 2016

FIGURE 1. CURRENT DISTRIBUTION OF COMMON ST. JOHNSWORT IN THE UNITED STATES

TABLE 1. ST. JOHNSWORT CONTROL WITH VARIOUS HERBICIDES ONE YEAR AFTER TREATMENT (YAT) WITH SPRING APPLICATIONS IN THE WESTERN UNITED STATES.

Herbicide	Rate (product/A)	% control 1 YAT
Milestone® specialty herbicide	5 -7 fluid ounces	97 to 99
Milestone + metsulfuron	5 fluid ounces + 1 ounce	99
GrazonNext® HL herbicide	1.5 pints	98
2,4-D	1 qt	15

FIGURE 2. ST. JOHNSWORT LEAVES WITH TRANSPARENT PERFORATIONS.

FIGURE 3. FLOWERS ARE CLUSTERED IN TERMINAL CYMES AND EACH FLOWER HAS FIVE SEPALS AND FIVE PETALS. PETALS ARE TYPICALLY TWICE AS LONG AS SEPALS WITH BLACK GLANDS ALONG THE MARGINS.

FIGURE 4. THE SEED CAPSULE BURSTS AT MATURITY. A SINGLE PLANT CAN PRODUCE ABOUT 30,000 SEEDS THAT ARE EASILY TRANSPORTED BY ANIMALS, WIND, HUMANS, AND WATER. SEEDS CAN REMAIN DORMANT IN SOIL FOR TEN YEARS.

be made when the weed is actively growing in late spring, early summer, and in fall when basal regrowth occurs. Opensight® specialty herbicide at 2.5 to 3.3 ounces of product per acre provides similar control as Milestone. In Washington, late fall (November) application of Milestone at either 5 or 7 fl oz/A provided greater than 95 percent control 27 months following treatment (Figure 5). Neither metsulfuron (Escort) at 1 ounce of product per acre, nor 2,4-D provide acceptable control of St. Johnswort.

Control of large infestations should integrate herbicide application with biological control agents. Herbicides can be used on the perimeter of large infestations and on satellite patches, and biocontrol agents can be used in the core of the infestation. Efforts should be focused on management techniques that stop seed production and maintain a healthy plant community that reduces establishment of St. Johnswort.

BIOLOGICAL CONTROL

The flea beetle *Chrysolina quadrigemina* was introduced into California in 1945 to control St. Johnswort. The insect effectively reduced St. Johnswort to about one percent of its former acreage in that state. The flea beetle and three additional agents are currently impacting St. Johnswort: *Chrysolina hyperici*, a foliage feeding beetle; *Aplocera plagiata*, a foliage and flower feeding moth; *Agrilus hyperici*, a root-boring beetle. *Chrysolina hyperici* is better suited for wet sites than *C. quadrigemina*. The success and population stability of biological control agents depends on the fluctuations of St. Johnswort populations and site conditions including cold temperature.

Medicinal Properties

St. Johnswort has been promoted as a natural anti-depression compound and is sometimes used to treat other conditions that accompany depression such as anxiety, tiredness, loss of appetite and trouble sleeping. In some areas of the country, the plant is cultivated and harvested for use in multiple health products. St. Johnswort extracts can cause serious sensitivity to sunlight in humans. Products containing the plant will describe warnings to stay out of direct sunlight, and extracts may also have negative interaction with other drugs.

FIGURE 5. ST. JOHNSWORT CONTROL WITH MILESTONE® SPECIALTY HERBICIDE AT 7 FLUID OUNCES PER ACRE 27 MONTHS AFTER TREATMENT NOTE THE NONTREATED BUFFERS OF UNCONTROLLED ST. JOHNSWORT (FALL = BROWN STEMS).

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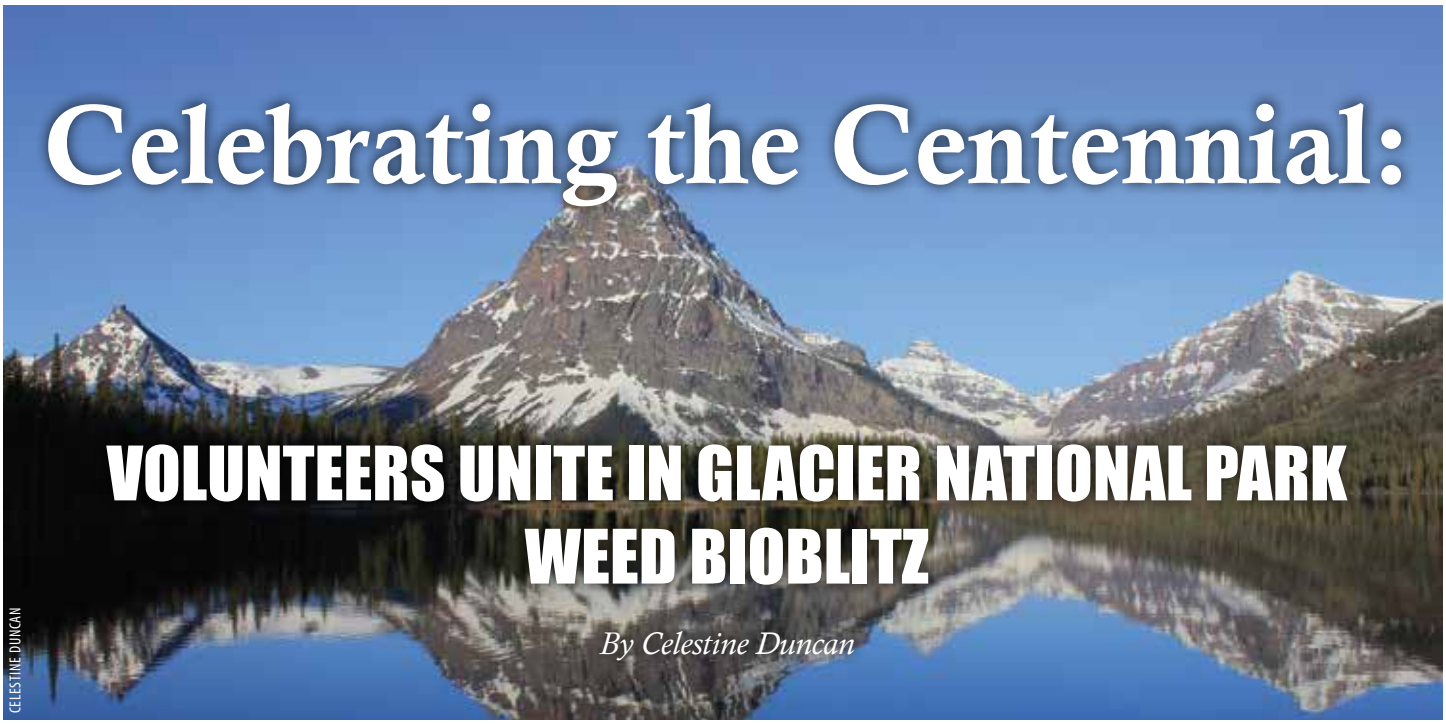
Celebrating the Centennial:



CELESTINE DUNCAN

VOLUNTEERS UNITE IN GLACIER NATIONAL PARK WEED BIOBLITZ

By Celestine Duncan

More than 90 volunteers gathered in July to be trained on noxious weed identification, monitoring and control in Glacier National Park as part of the Weed BioBlitz. Participants included volunteer youth and adults from Montana, Wyoming and Idaho. *See Box 1.*

The Weed BioBlitz is part of a larger effort coordinated by the National Park Service (NPS) to celebrate the NPS Centennial. "This is a great opportunity to learn more about the biodiversity of a park, and engage youth and adults in hands-on resource stewardship," says Terry Peterson, Citizen Science Coordinator for the Crown of the Continent Research Learning Center.

Glacier National Park hosts over 1,000 different species of plants including 126 non-native species, about 20 of which are noxious or invasive weeds. Although most invasive plants in the park are closely associated with disturbed areas such as recreational, roadside and construction sites, the 700 miles of backcountry trails also provide a corridor for invasive plants to spread into natural areas.

"Monitoring these backcountry trails is often difficult and time consuming, and we have limited field staff," explains Dawn LaFleur, restoration biologist and lead for the invasive plant management program in Glacier National Park. "Our goal is to keep noxious weeds out of backcountry areas, so it's important to find and control these plants as early as possible to minimize their impact on native vegetation and other natural resource values. With only four invasive plant managers on the summer work crew we need all the help we can get."

The Weed Blitz is a day-long event with volunteers attending an indoor training program on weed identification, impacts and monitoring presented by LaFleur. In the afternoon, volunteers separate into groups to search for and pull priority invasive plants in high public use areas.

"Our main objective in the afternoon is to get people familiar with five key target weeds, and hand pulling is a good way to do that," explains Tyler Jack, a group leader and member of the NPS Exotic Plant Management Team. Volunteers also pulled a lot of weeds, with a total of 48 bags containing about 630 pounds of weeds removed from high public use areas.

The training approach seems to be working! Mac McPherson, scout master with Troup 104 from Westmond, Idaho said that service projects are great for scouts, and hands-on is the best way for them to learn. "These scouts will always be able to identify oxeye daisy and the other weeds they are pulling during the BioBlitz."

BOX 1. PARTICIPANTS IN WEED BIOBLITZ

- AmeriCorps
- Montana Youth Conservation Corp
- Boy Scouts of America leaders and members
- Boys and Girls Club leaders and members
- Xanterra employees
- Citizen volunteers
- National Geographic representative
- Glacier National Park employees and volunteers

BOX 2. HISTORY OF GLACIER NATIONAL PARK

1895 Waterton Lakes National Park established.

MAY 11, 1910 Glacer National Park established.

1932 Established as Waterton-Glacier International Peace Park. Going- to- the-Sun Road completed.

1974 Established as an International Biosphere Reserve.

1995 Established as Waterton-Glacier International Peace Park World Heritage Site

CELESTINE DUNCAN


CELESTINE DUNCAN


MELISSA SLADEK

CLOCKWISE FROM TOP, LEFT:

DAWN LAFLEUR, RESTORATION BIOLOGIST IN GLACIER NATIONAL PARK AND TWO VOLUNTEER SCOUTS SHOW **HOW FAR LEAFY SPURGE ROOTS CAN SPREAD** AS PART OF THE BIOBLITZ TRAINING (TOP, LEFT).

TYLER JACK, MEMBER OF THE NPS EXOTIC PLANT MANAGEMENT TEAM PULLS OXEYE DAISY WITH A VOLUNTEER DURING THE WEED BIOBLITZ TRAINING (TOP, RIGHT).

MORE THAN 90 VOLUNTEERS GATHERED FOR THE WEED BIOBLITZ IN GLACIER NATIONAL PARK (BOTTOM, LEFT).

Once volunteers complete the training they can be part of the Invasive Plant Citizen Scientist Project in the park. "The citizen scientists find and report the location of high priority invasive plants in the backcountry," says LaFleur. "This way we can send crews directly to the site to control the weeds, saving us a lot of time and allowing us to expand what we can accomplish."

Species targeted by the program are spotted knapweed (*Centaurea stoebe*), oxeye daisy (*Leucanthemum vulgare*), houndstongue, (*Cynoglossum officinale*), St. Johnswort (*Hypericum perforatum*) and yellow toadflax (*Linaria vulgaris*). "These noxious weeds are well established in Glacier National Park high public use areas and are transported into backcountry areas by recreationists, wildlife, wind and water," explains LaFleur. There are also four new invaders on the high priority list for monitoring since they are recently established within the park or occur just outside park boundaries. *See Box 3.*

Each year more than two million visitors come to Glacier National Park from all over the world for the scenic mountain vistas, glaciers, and unique biodiversity. As visitation increases, the risk of introduction and spread of non-native species also escalates, making management a critical priority in the park.

Although the National Park Service recognizes the spread of invasive plants as a major factor contributing to ecosystem change and instability, funding for the program in Glacier National Park has declined over the last several years. According to LaFleur, adequate funding is always a struggle and managers at the national level needs to recognize and adequately fund invasive plant management programs.

"We try to be as efficient as we can and our volunteer program really helps, but there is no way we can adequately protect the park from invasive plants with only four employees spread over one million acres," LaFleur explains.

The volunteer Invasive Plant Citizen Science Program is one way that concerned public can help support Glacier National Park's invasive plant program. Strengthening these partnerships and increasing financial resources to control invasive plants is critical to protecting the unique biodiversity of Glacier National Park. For citizen scientists, the rewards are a sense of stewardship, a greater awareness of the park's resource issues, and an expanded insight in ecological research and management methods.

BOX 3. NEW INVADERS

THREATENING GLACIER NATIONAL PARK ARE A PRIORITY FOR CONTROL IN BOTH HIGH PUBLIC USE SITES AND BACKCOUNTRY AREAS

Orange hawkweed
(Hieracium aurantiacum/ Pilosella aurantiaca)

Meadow hawkweed complex
(*Hieracium caespitosum, H. praealturm, H. floridundum,* and *Pilosella caespitosa*)

Blueweed
(Echium vulgare)

Yellow starthistle
(*Centaurea solstitialis*)

MTWEED.ORG PHOTOS

BOX 4. CITIZEN SCIENCE PROGRAM

The Glacier National Park Citizen Science Program engages park visitors, students, and staff in collection of scientific information that would otherwise be unavailable to resource managers and researchers. Since 2005, the Citizen Science Program has invited members of the public to assist in biological research while recreating in the park. The program is coordinated by the Crown of the Continent Research Learning Center (CCRLC), based in Glacier National Park. For more information go to https://www.nps.gov/glac/learn/ccrlc.htm

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INVASIVE PLANT MANAGEMENT GUIDE
This guide provides information on selective herbicides as one tool for invasive plant management on rangeland, pastures, and natural areas. Information on herbicide use rates, herbicide selectivity on non-target plants, sprayer calibration, seeding guidelines, environmental considerations, and other useful tips are provided in this document. http://techlinenews.com/management-guide/

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