TechLine
INVASIVE PLANT NEWS

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

Western Range & Wildlands Edition

FALL 2015

Partnership Protects Greater Sage-grouse Habitat from Invasive Plants Page 08

GARY KRAMER, US FISH AND WILDLIFE SERVICE

ABOUT TECHLINE

Invasive Plant News aims to provide an objective communication tool for on-the-ground natural resource managers who face common management challenges so they may share the successes of their programs and learn from one another.

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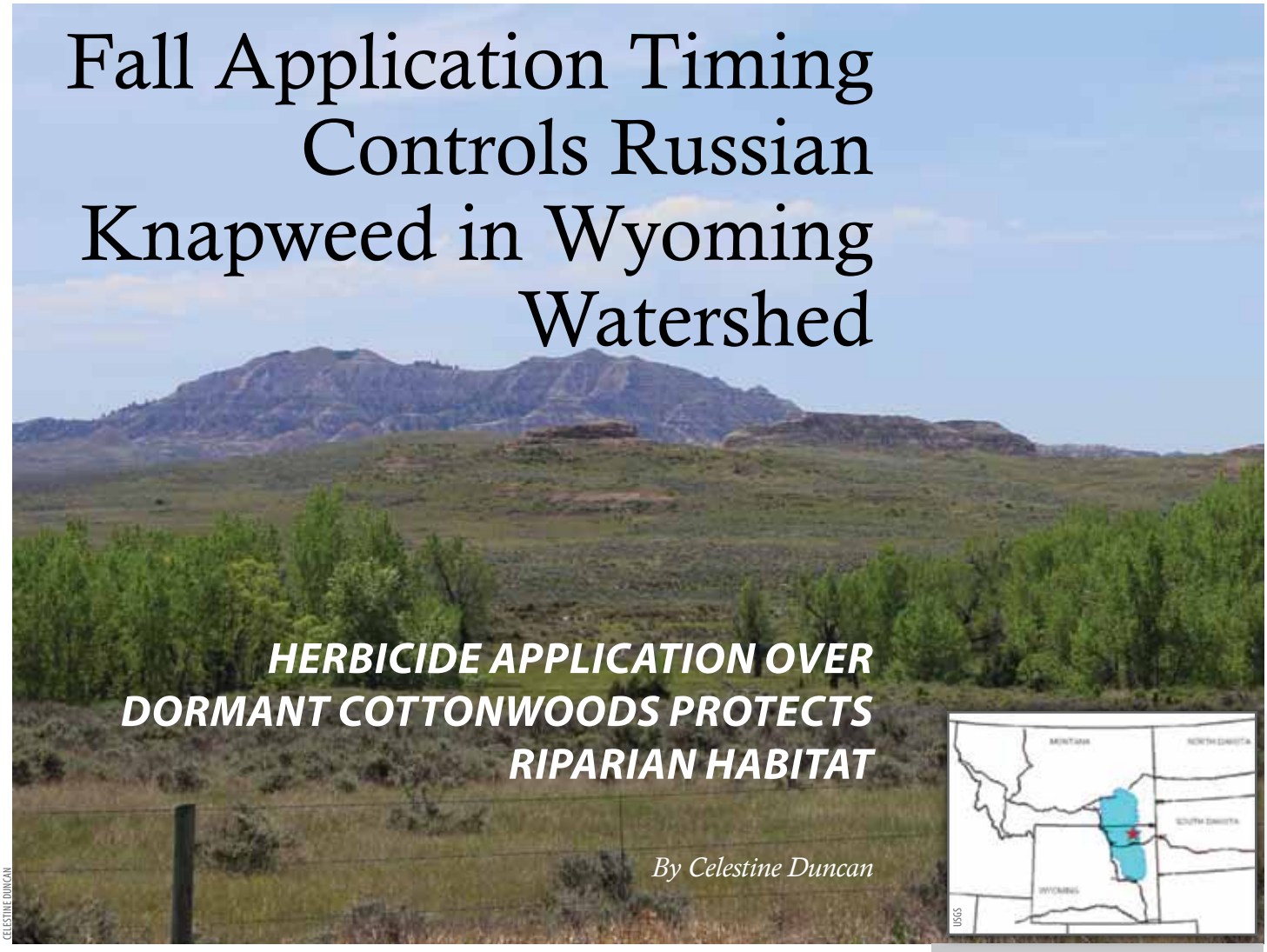
Fall Application Timing Controls Russian Knapweed in Wyoming Watershed



CELESTINE DUNCAN

HERBICIDE APPLICATION OVER DORMANT COTTONWOODS PROTECTS RIPARIAN HABITAT

By Celestine Duncan

USGS

LOCATION OF PROJECT AREA (star) in the Powder River Basin.

THE LITTLE POWDER RIVER AND COTTONWOOD CREEK ARE IMPORTANT TRIBUTARIES IN THE POWDER RIVER BASIN OF NORTHEASTERN WYOMING. Together they drain more than 1,200 square miles before flowing into the Powder River, and ultimately the Yellowstone River in southeastern Montana.

Russian knapweed (*Acroptilon repens*) is well established in both drainages, and there is growing concern among area ranchers and the weed and pest district about rapid spread of the weed.

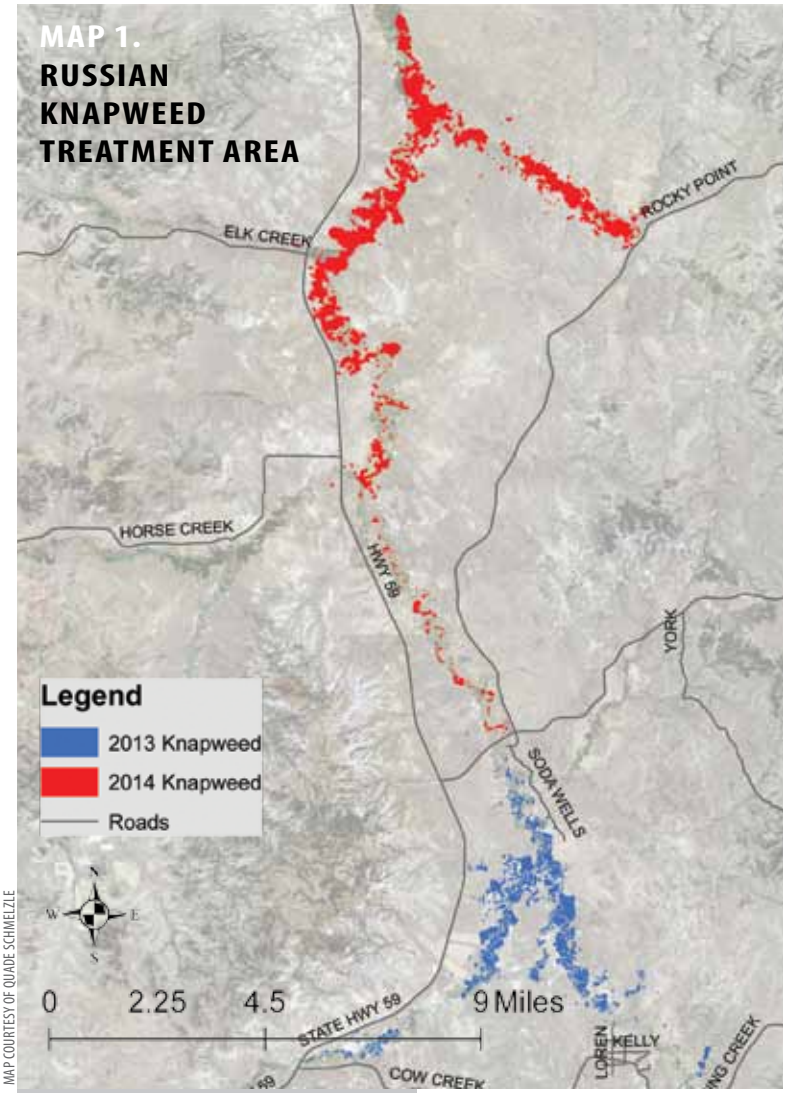
"In the summer of 2010 we were working with landowners in the watershed to control a grasshopper outbreak," explains Quade Schmelzle, supervisor of Campbell County Weed and Pest District. "The effectiveness of the grasshopper program helped solidify the credibility of the weed and pest district and generated interest in initiating a control program on Russian knapweed."

Since the majority of concerned landowners were in the upper reaches of the drainage, the weed and pest district initially focused efforts in that area. "Our goal was to start the control program on the uppermost infestations and then gain support from downstream producers," says Schmelzle.

The first step was to inventory the area to determine the size of the infestation and develop a management strategy. Each

BOX 1.

THE POWDER RIVER BASIN is a 20,000 square mile area occupying most of the northeast quadrant in the state of Wyoming. The basin is bound by the Black Hills to the east, the Big Horn Mountains to the west, and the Laramie Range and Hartville Uplift to the south. The area historically provided perfect habitat for North American bison and other large mammals, and was a valued hunting ground for American Indians, especially the Lakota Sioux. The basin is mainly sagebrush grassland underlain by extensive coal deposits. Coal and oil development along with ranching are the economic backbone of the basin.



MAP 1. RUSSIAN KNAPWEED TREATMENT AREA

MAP COURTESY OF QUADE SCHMELZLE

QUADE SCHMELZLE

QUADE SCHMELZLE

KLINKENBORG AERIAL SPRAYING AND SEEDING INC. applied herbicide with a turbine Bell helicopter. Total output with the Simplex spray system was 4 gallons per acre. Applications were made just over treetops to ensure herbicide was distributed below the canopy, above.

RUSSIAN KNAPWEED IS ESTABLISHED in meadows and under cottonwood trees within the project area, left.

JOHN RANDALL, THE NATURE CONSERVANCY

BOX 2. RUSSIAN KNAPWEED

Russian knapweed is a deep-rooted, herbaceous perennial that spreads by seed and vegetative root buds. The plant is characterized by its extensive root system and persistence. Russian knapweed is common throughout the western United States, infesting about 1.2 million acres of rangeland, cropland, pastures, and disturbed sites.

summer for three years a four-person crew recorded the location of Russian knapweed infestations within the 50-mile area. Location waypoints were buffered by 100 feet to account for smaller plants that may have been missed during the survey. By the end of 2014, crews had documented about 5,000 acres of Russian knapweed within the project area (Map 1).

Cottonwood trees are scattered throughout the treatment area and Russian knapweed grows in grass meadows and under the canopy of many of the trees. Schmelzle explains, "We didn't want to damage the cottonwoods but we needed to control the knapweed. In 2012 we brought in specialists with Dow AgroSciences and Van Diest Supply to help with recommendations. They suggested a fall aerial application of Milestone® specialty herbicide at 7 fluid ounces per acre (fl oz/A) when cottonwood trees were dormant."

The project area was divided into three phases, beginning at the top of the watershed and working downstream. The first phase of the project began in the fall of 2013 when 1,600 infested acres were treated.

Results nine months after treatment were excellent with about 90 percent control of Russian knapweed and no damage to cottonwood trees. "The success we had with the first phase of the project increased landowner participation downstream to nearly 100 percent," says

Continued on page 4 > > >

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COTTONWOOD TREES GROWING IN THE PROJECT AREA, above. There was no visible injury to trees 18 months following a fall aerial application of Milestone® specialty herbicide at 7 fl oz/A over dormant trees.

CELESTINE DUNCAN

QUADE SCHMELZLE, right, Campbell County Weed and Pest District supervisor stands in an area treated with Milestone® specialty herbicide at 7 fl oz/A. Russian knapweed control was estimated at 90 to 95 percent at this location 18 months after treatment.

< < < Continued from page 3

Schmelzle. In 2014 an additional 2,600 acres were treated with similar results, and about 2,340 acres are scheduled for treatment in fall of 2015.

Although Campbell County Weed and Pest District paid the entire cost of the application plus 80 percent of the herbicide cost, landowners are responsible for follow-up maintenance. "We have signed agreements with all 17 cooperators in the project area since continued maintenance is critical to the long-term success of this project," says Schmelzle.

The strength of the project is based on accurate inventories, careful planning, and trust between landowners and the weed and pest district. "The best of intentions and high aspirations aren't enough if you lack cooperation and a good working relationship with the landowners. It is very important to be organized, patient, and sure that everyone agrees on project goals and objectives. It's a time consuming process to get everything in place, but the extra effort pays off," concludes Schmelzle.

Partnerships Expand Invasive Plant Management in Dakota Prairie Grasslands

Story and Photos By Celestine Duncan

THE RUGGED LANDSCAPE OF THE DAKOTA PRAIRIE NATIONAL GRASSLAND STRETCHES OVER 1.2 MILLION ACRES in two states, encompassing a mix of state, federal and private ownership. These grasslands support a diversity of uses including livestock grazing, wildlife habitat, paleontological and archeological digs, oil and gas production, and recreation.

Chad Prosser, Range and Weeds Program Manager for Dakota Prairie Grasslands explains that Canada thistle (*Cirsium arvense* L.), leafy spurge (*Euphorbia esula*), absinth wormwood (*Artemisia absinthium*), black henbane (*Hyoscyamus niger* L.), and houndstongue (*Cynoglossum officinale*) are priority noxious weeds in the grasslands. Infestations are managed on a watershed scale through partnerships that cross ownership boundaries.

More than half of the 22,000 acres treated in 2014 were on leafy spurge in the Sheyenne Grasslands in eastern North Dakota. Biological control of leafy spurge has been effective on some sites. "The flea beetle (*Aphthona* spp.) populations cycle, and when their numbers are down we use herbicide applications to contain and control the weed," says Prosser.

Rocky mountain juniper (*Juniperus scopulorum*) and creeping juniper (*J. horizontalis*) are native plants that have been increasing on the grasslands the last 50 years.

"The mixed prairie grassland evolved with fire and grazing, but fire has been mostly removed from the equation," says Jack Dahl, botanist with the Medora Ranger District. "This allowed the junipers to increase exponentially, especially on north facing slopes, on sites that should be dominated by grasses and forbs. Encroachment of junipers may be one of the biggest natural resource challenges we face in the grasslands without the use of prescribed fire."

OIL AND GAS DEVELOPMENT AND INVASIVE PLANTS

Bakken Oil Field activity has increased disturbance and the risk of introducing new weeds to the Little Missouri River Grassland. Billings County Weed Control Board works with the oil companies and their private contractors to train employees and manage weeds on roadsides, drill pads and pipelines.

Katie Clyde, Supervisor for the Billings County Weed Control Board explains that the weed district conducts a pre-inspection survey prior to any pipeline construction and monitors roadsides for newly invading weeds. If weeds are present the oil company has to control the infestation and continue monitoring and control measures.

Black henbane and absinth wormwood are big problems on disturbed areas, especially roadsides. Milestone® specialty herbicide at 5 to 7 fluid ounces per acre is used to control both these weeds along with Canada thistle.

KATIE CLYDE
Billings County Weed Control Board Supervisor

CHAD PROSSER
Range & Weeds Program Manager for Dakota Prairie Grasslands

MOVING FORWARD

Partners agree that the most important asset to the invasive plant program is the ability to work together toward a common goal.

"You have to have a team approach—not only within an agency but also with outside partners. Sometimes you hit a bump in the road, but you have to keep moving forward as a team," says Dahl.

Prosser agrees, "Partnerships allow us to have more eyes looking for invasive plants and that local on-ground knowledge is instrumental in the success of any management effort. Our weed crews and those of our partners are doing a great job, and we are extremely appreciative of the work they do."

EXCERPTED FROM PRAIRIE & GRASSLANDS EDITION OF TECHLINE INVASIVE PLANT NEWS, FALL 2015.
READ FULL ARTICLE ONLINE >> http://techlinenews.com/articles/2015/dakotaprairie

Early Detection and Control Stops Purple Starthistle Spread in Idaho

By Celestine Duncan

PURPLE STARTHISTLE (*CENTAUREA CALCITRAPA*) IS ESTABLISHED IN AT LEAST 14 STATES IN THE U.S., BUT RECENTLY EXPANDED ITS RANGE TO TWIN FALLS COUNTY, IDAHO. A quick response from the land owner, field inspector, county weed coordinator, and Idaho State Department of Agriculture is stopping the weed in its tracks.

Kali Van Leeuwen-Sherrill, Twin Falls County Weed Coordinator is the lead for the eradication effort. "In June 2014 a private field inspector contacted our office and reported purple starthistle in a pasture near Castleford," explains Kali. "The weed had spread from a few plants found by the landowner in 2013 to infest over 20 acres in 2014—it's a very aggressive plant."

The county developed a strategy that included surveying all properties within several miles of the known infestation, including neighboring fields, roadsides, and federal land. "We didn't find purple starthistle in any other fields, pastures, or rangeland," says Kali. "However, we did find five plants along the roadside near the infestation and believe that the weed was introduced by a vehicle and spread from the roadside into the field."

Idaho State Department of Agriculture declared an emergency listing of both purple starthistle and closely related Iberian star thistle (*Centaurea iberica*) in June 2014. The noxious weed designation gave the county weed district authority to control the weed until the state legislature moves to make the designation law.

The infested pasture was treated with Milestone® specialty herbicide at 6 fluid ounces per acre (fl oz/A) in June 2014. County weed district field crews monitored the pasture through the summer of 2014. In August

PURPLE STARTHISTLE FLOWER, plant (inset above), and rosette (inset right).

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

of that year, Twin Falls County had a record rainfall of more than four inches in three days. By September, many new purple starthistle rosettes established. A second application of Milestone was made at the same rate in fall 2014.

Field and roadside surveys were conducted in spring and summer of 2015. To date, there are no purple starthistle rosettes or seedlings that have been found within or outside of the treated infestation.

"We plan to continue to monitor the roadside and 60-acre pasture for at least five more years," explains Kali "Keeping Idaho free of invasive plants like purple starthistle requires a long term commitment from everyone to find and eradicate newly invading weeds."

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PURPLE STARTHISTLE

USUALLY GROWS AS A BIENNIAL, BUT CAN BE AN ANNUAL OR PERENNIAL. Seedlings emerge and form rosettes during the first growing season and usually send up a flowering stalk in the second growing season. Older rosettes often develop a ring of stout spines at the center before bolting. Mature plants are one to four feet high, densely branched, and have numerous flower heads with straw-colored, stout, spine-tipped bracts under the purple flowers. The stems and leaves are covered with fine hairs.

The species name "calcitrapa" is derived from the word caltrop, a weapon with protruding spikes that was thrown on the ground in ancient times to obstruct the movement of cavalry horses.

Purple starthistle is native to the Mediterranean region of southern Europe and northern Africa. It was first reported in California in 1886 and has recently become established as a rangeland and pasture pest as far north as Washington and south to Arizona and New Mexico. Purple starthistle reproduces only by seeds that are spread long distances in hay, straw, and on vehicles and other equipment.

Purple starthistle is similar to Iberian starthistle (*Centaurea iberica*). The most distinguishing feature between the two weeds is that Iberian starthistle seeds have a plume of flattened bristles, about half as long as the seed, at one end. Both starthistles have adapted to diverse climatic and soil conditions. The sharp spines cause domestic and wild animals to avoid foraging the plant and restrict recreational access on infested sites.

USDA PLANTS DATABASE, HTTP://PLANTS.USDA.GOV/.

STATES SHOWN IN GREEN indicate distribution of purple starthistle in the United States prior to identification in Idaho (star).

What happens to herbicides after they are applied? This two-part series discusses environmental factors and herbicide properties that influence the fate of several herbicides used on range, pasture and natural areas. http:// bit.ly/ herbicidesintheenvironment

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Explore the "Articles>Herbicide Information" tab to learn more about reading and understanding herbicide labels, herbicide formulations, factors affecting herbicide performance, the influence of adjuvants, and more. http:// techlinenews.com/herbicides

Now is a great time to capture photographs of invasive plants and weed managers in action!

Start shooting now and submit your favorite photo of an invasive plant and/or photos of weed management in action as part of our Invasive Plant Photo Contest. The top photograph will receive a $100 value prize along with your photo published on the cover of TechLine Invasive Plant News.

WHEN TO ENTER: August 14, 2015 to October 15, 2015

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

WHY TO ENTER: You'll win a prize! The overall winner will receive a gift card to Forestry Suppliers or REI ($100 value).

VISIT http://techlinenews.com/photo-contest for contest rules and details on how to submit your entry.

GARY KRAMER, US FISH AND WILDLIFE SERVICE

Partnership Protects Greater Sage-Grouse Habitat from Invasive Plants

By Wes Smalling and Celestine Duncan

FREMONT COUNTY WEED AND PEST CONTROL DISTRICT AND THE U.S. BUREAU OF LAND MANAGEMENT (BLM) TEAMED UP WITH THE WYOMING GAME AND FISH DEPARTMENT and others to keep invasive plants out of greater sage-grouse (*Centrocercus urophasianus*) habitat.

The South Hudson-Government Draw Leafy Spurge Mapping and Treatment Project encompasses nearly 215,000 acres in the heart of sage-grouse country east of Lander, Wyoming and south of the small community of Hudson. About 85 percent of the area consists of lands controlled by the BLM.

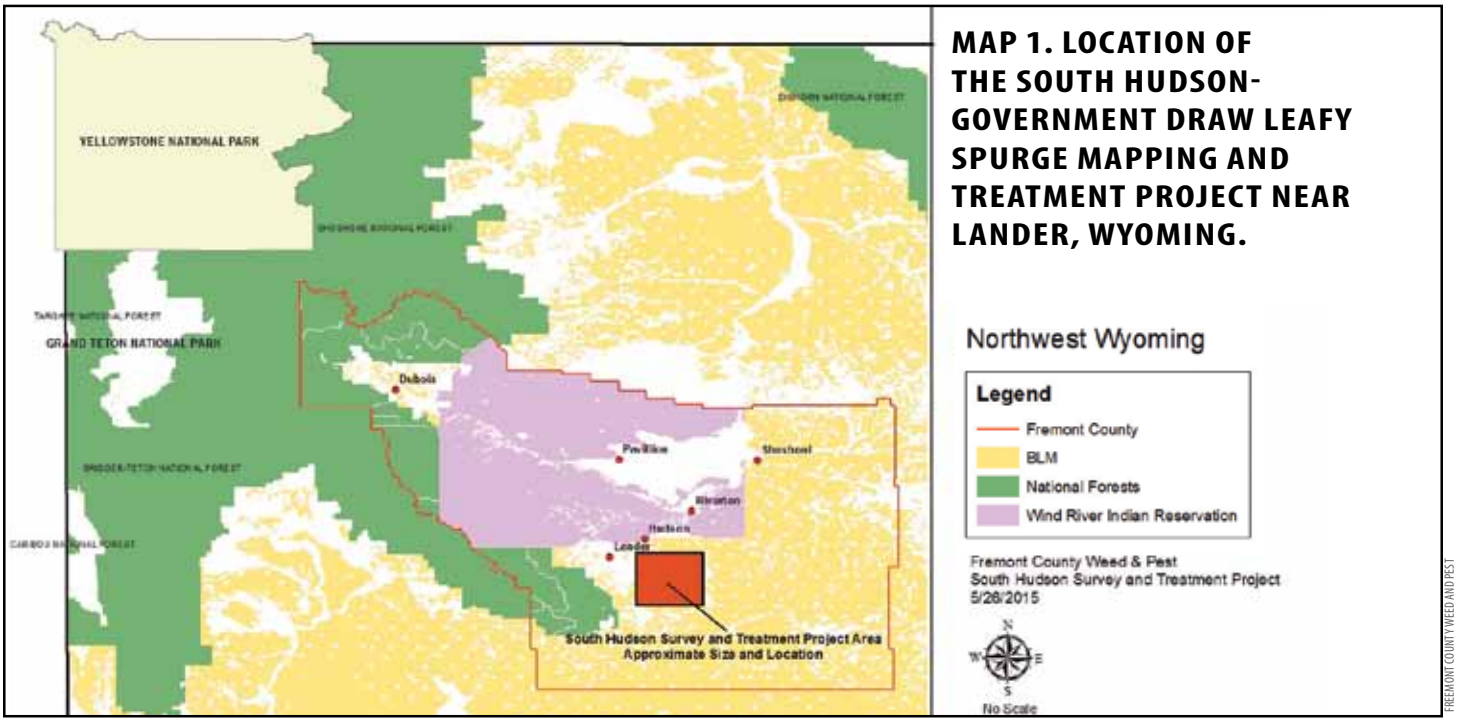
Leafy spurge (*Euphorbia esula*) is a state-designated noxious weed infesting a significant amount of the project area, much of which is within the Greater South Pass sage-grouse core management area. According to the local sage-grouse conservation plan (http://bit.ly/1JhuMIR), the sagebrush grasslands and open spaces of the area are "recognized as one of the highest density sage-grouse areas in the state of Wyoming, and represent one of the strongholds for breeding populations of sage-grouse in western North America."

Preventing the introduction and proliferation of invasive plants is an important objective of the local working group's sage-grouse conservation plan. The plan lists vegetation management, particularly invasive plants, as one of the factors impacting sage-grouse populations. If left untreated, non-native invasive plants

BOX 1. PROJECT PARTNERS

ESTIMATED COST FOR A THREE-YEAR PROJECT IS $150,000.
The WRSR Sage-Grouse Working Group provided a grant to the South Hudson-Government Draw Leafy Spurge Mapping and Treatment Project. Funding was from the Wyoming Sage-Grouse Conservation Fund via the Wyoming Game and Fish Commission, and Wyoming Game and Fish Department. The local working group is one of eight established throughout Wyoming for the purpose of conserving sage-grouse. Each working group is comprised of representatives of local interests such as agriculture, conservation and industry, and federal, state, local and tribal governments.

PARTNERS INCLUDE
Freemont County Weed and Pest Control District
U.S. Bureau of Land Management (BLM)
Wind River/Sweetwater River (WRSR) Sage-Grouse Working Group
Wyoming Department of Transportation
Wyoming State Lands
PopoAgie Conservation District
Participating private landowners



MAP 1. LOCATION OF THE SOUTH HUDSON-GOVERNMENT DRAW LEAFY SPURGE MAPPING AND TREATMENT PROJECT NEAR LANDER, WYOMING.

such as leafy spurge can dominate a landscape and create a monoculture consisting of a single dominant species. Controlling leafy spurge and other newly invading non-native plants allows a greater diversity of native vegetation to flourish, which benefits greater sage-grouse and other wildlife.

Kimberly Johnson, assistant supervisor for Fremont County Weed and Pest District, and Susan Oberlie, wildlife biologist for BLM Lander Field Office, kickstarted the ambitious project in the summer of 2014. "Managing leafy spurge in this area has been a priority for us because it encompasses a significant livestock grazing allotment as well as pristine sage-grouse habitat," explains Johnson.

The first step in the project included GPS-mapping of invasive plants. Approximately 58,000 acres were mapped in 2014, and an additional 150,000 acres are scheduled to be surveyed for leafy spurge and other noxious weeds in 2015 and 2016.

"Gathering GPS data to create a noxious weed inventory is important for developing a treatment plan that will be effective and economically viable, especially for such a large area," said Johnson, head of the Fremont County Weed and Pest's GIS program. The survey includes not only leafy spurge but also newly invading species like Dalmatian toadflax (*Linaria dalmatica*) and Scotch thistle (*Onopordum acanthium*) that are part of the county's early detection, response program.

Herbicide treatments were initiated on leafy spurge in June 2015 to stop spread and control invasive plant infestations. Tordon® 22K herbicide at 1 pint per acre plus Overdrive at 4 ounces per acre will be applied to leafy spurge on upland sites near roads and trails.

"We plan to include ForeFront® HL [GrazonNext HL] at 2 pints per acre (pt/A) plus Overdrive at 4 ounces product per acre and evaluate this mix versus the Weedmaster applications along ephemeral drainages and watering areas," explains Aaron Foster, Fremont County Weed and Pest supervisor. "We are waiting for approval to apply ForeFront and Milestone on BLM lands." In addition to leafy spurge, rapid response crews mapped and treated newly invading noxious weeds such as Scotch thistle and Dalmatian toadflax, along with musk thistle (*Carduus nutans*) and saltcedar (*Tamarix* spp.).

[1]Milestone® specialty herbicide
[2]ForeFront® HL [GrazonNext HL] specialty herbicide

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BOX 2.
INVASIVE ANNUAL GRASSES AND PERENNIAL FORBS PLAY A CRITICAL ROLE

in greater sage-grouse (*Centrocercus urophasianus*) conservation, both in their effect on wildfire cycles and the direct impact they have on habitat quality. A recent report compiled by the Western Association of Fish and Wildlife Agencies discusses impacts of invasive plants such as cheatgrass/downy brome (*Bromus tectorum*), Russian knapweed (*Acroptilon repens*), and other perennial weeds on sagebrush habitat.

REPORT: http://bit.ly/1JhtZHV

WES SMALLING.

LEAFY SPURGE INFESTS SAGEBRUSH GRASSLANDS within the project area impacting greater sage-grouse habitat.

"It's a huge area and some of the leafy spurge infestations are quite severe," said Foster. "To treat the entire infestation with herbicides would not be economical or sustainable, so we plan to use an integrated approach beginning with treatments in places where we surveyed in 2014."

Small infestations will be targeted for eradication, while larger infestations will be contained by treating the outside edges of patches with herbicides. Biological control insects, including flea beetles (*Aphthona* sp.), have been released on large infestations in previous years and will continue to play a role in treatment efforts.

Fremont County Weed and Pest also plans to develop outreach programs for livestock producers and recreational users in an effort to reduce the spread of noxious weeds by people and their livestock. The region is popular for recreational pursuits, such as off-highway vehicle use, horseback riding and target shooting, and also has several state and BLM grazing allotments.

After the three-year project is completed, Fremont County Weed and Pest and the BLM will continue to monitor for invasive plants and will consider additional invasive plant treatments as needed. The county currently shares control costs on private lands within the project area.

"Keeping our open spaces free of invasive plants requires a long term commitment from everyone involved," Foster said. "We all have a stake in the future of Wyoming's sage-grouse and in keeping our native wildlife habitat intact."

BOX 3. GREATER SAGE-GROUSE

The greater sage-grouse (*Centrocercus urophasianus*) is the largest grouse in North America and is totally dependent on sagebrush-dominated habitat for survival. Its range currently covers 165 million acres across 11 states in the western United States, a loss of 56 percent from the species historic habitat. At one time, the greater sage-grouse population likely numbered in the millions, but is estimated to have dwindled to 200,000 to 500,000 individuals range-wide. Much of the decline is due to loss of sagebrush habitat from invasive non-native plants, increased intensity and frequency of wildfires from cheatgrass (*Bromus tectorum*) invasion, and land-management practices that increase difficulty of restoring large blocks of sagebrush.

Map below shows current range of the greater sage-grouse in the western United States (orange shading) and location of project area (red star).

US FISH AND WILDLIFE SERVICE

RELATED ARTICLE

MANAGEMENT OF LEAFY SPURGE WITH HERBICIDE

http://bit.ly/leafyspurge

Ask THE Experts

Are Fall Herbicide Applications Effective on Perennial Invasive Plants?

EACH YEAR TECHLINE RECEIVES QUESTIONS FROM READERS ABOUT TREATING BROADLEAF PERENNIAL WEEDS IN THE FALL—including whether it is an effective application timing, what weeds are most susceptible to fall herbicide treatments and WHY? We interviewed seven weed scientists who work in natural areas about their research results and thoughts regarding fall application timing for perennial invasive plant control.

Weed Scientists Interviewed for "Ask the Experts"

ROGER BECKER, PhD
Extension Agronomist,
Univ. of Minnesota.

JOE DITOMASO, PhD
Extension Specialist,
Univ. of California at Davis.

STEPHEN ENLOE, PhD
Associate Professor,
Univ. of Florida.

RODNEY LYM, PhD
Associate Dept. Head and Professor, North Dakota State Univ.

SCOTT NISSEN, PhD
Professor and Extension Specialist, Colorado State Univ.

TIMOTHY PRATHER, PhD
Professor,
Univ. of Idaho.

MARK RENZ, PhD
Associate Professor and Extension Weed Specialist, Univ. of Wisconsin-Madison.

Do you agree or disagree that fall is a good time to apply herbicides for perennial invasive plant control?

BECKER, DITOMASO, ENLOE, LYM, NISSEN, PRATHER, RENZ: Fall applications can often provide equal or better weed control compared to spring or summer herbicide applications; however, success or failure will depend on: 1) the target weed species, 2) herbicide being applied, 3) growing conditions, and 4) soil residual properties of the herbicide.

ENLOE: "It is important to define fall application timing. In the Southeast, early fall applications are often from two to six weeks prior to a frost when plants are still green and photosynthesizing. Herbicide application made immediately prior to or following a light frost on many cold-sensitive herbaceous plants may not be effective. This is different in the West where fall application timing is effective on many perennial plants following a light frost (26 to 30° F)."

DITOMASO: "For most perennial plants, particularly woody species, fall is an effective time for control. We found that for some species and herbicides (e.g. perennial pepperweed [*Lepidium latifolium*] treated with chlorsulfuron) both spring and fall applications give the same level of control."

LYM: "You cannot make a general yes or no statement. For instance, glyphosate will not control leafy spurge (*Euphorbia esula*) when applied in June or July in our region (north central U.S.), but will give about 9 to 12 months of control when applied in September. Milestone[1] provides best control of Canada thistle (*Cirsium arvense*) at bud stage, but can work on rosettes in the fall. Absinth wormwood (*Artemisia absinthium*) is best controlled with either Milestone or Transline[2] in spring (May), or in fall if you mow ahead of time."

PRATHER: "Idaho has a number of perennial weeds where fall application timing is effective, such as rush skeletonweed (*Chondrilla juncea*) with Milestone; however, fall herbicide treatments do not provide optimum control of hawkweeds (*Hieracium* spp)."

RENZ: "Research has shown that applications following the first light frost of the season (temperature drops below 32° F, but leaf tissue is not damaged) will provide a significant

Continued on page 12 > > >

[1]Milestone® specialty herbicide
[2]Transline® specialty herbicide

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increase in control with several perennials. A hard frost with temperatures in the mid- to lower 20s (° F) may cause injury to some herbaceous perennials reducing control. Frost damage can take a day or more to show visually on plants. To assess potential damage to plants the morning after a suspected frost, gently squeeze the leaf with your thumb and forefinger, and release. If you see your fingerprint, this indicates the epidermis has separated and the plants likely have suffered frost damage to the point where we would not recommend spraying that fall."

In your opinion, why does fall application timing work or not work?

DITOMASO AND ENLOE: Data are available on movement of total non-structural carbohydrates that demonstrates carbohydrate movement to roots in early to late fall, and depletion of reserves in early spring. The hypothesis is that systemic phloem-mobile herbicides[3] should move with carbohydrates and effectively control the root system of perennial plants. The question is…when are carbohydrates moving to important growing points? In herbaceous plants there is likely some variability, but in woody plants movement of carbohydrates in fall is more predictable.

BECKER AND RENZ: Deposition of the herbicide close to plant crowns and root system appears to be important. Research suggests that the distance between the source (above ground leaves) and sink (crown buds and root) is a major factor in movement of photosynthates and presumably systemic herbicides. Buds on lateral roots or rhizomes are also very active metabolically in fall building up carbohydrate reserves to over-winter. In the upper Midwest, fall herbicide applications on herbaceous perennials (e.g. Canada thistle) that have been mowed and have fall regrowth are very effective. In unmanaged systems such as pastures or prairies that have not been mowed or grazed heavily, much of the plant material may be the shoots that originally emerged last spring with minimal new regrowth. As long as the lower portions of these original stems and leaves have green tissue, fall applications can be effective.

NISSEN: "Residual activity of the herbicide in soil is very important[4]. Root and/or root bud herbicide absorption from soil is a significant factor in fall and early winter, especially for weeds like Canada thistle and Russian knapweed. In Colorado, studies have shown that soil-residual herbicides (for example, Milestone) are absorbed by Canada thistle and Russian knapweed roots and/or root buds even when no top growth is present. In areas with high soil organic matter content (>3%), herbicide absorption by roots may be reduced. Although results from the upper Midwest indicate that above-ground green growth must be present to achieve good control, this is not the case in Colorado. Higher soil organic matter present in the upper Midwest may bind herbicides reducing root and bud uptake from soil in the fall."

PRATHER: "With fall applications you may get enhanced herbicide translocation in perennial weeds because of slower metabolic processes that detoxify the herbicide. Microbial degradation of soil-active herbicides would also be slower in fall allowing for a longer period of time for root uptake of the herbicide."

BECKER, LYM AND RENZ discuss how dry conditions in late summer and fall can reduce effectiveness of fall herbicide applications.

BECKER: "In Minnesota and Iowa, the exception to better, more consistent control with fall applications has been in drought cycles where spring moisture was adequate, but by fall, the target weeds were severely moisture stressed and did not appear to translocate herbicides effectively. Rainfall totals and distribution start to transition rapidly moving from western Iowa and Minnesota into Nebraska and the Dakotas, increasing the likelihood of fall moisture stress and reduced control with fall vs. spring/early summer applications. The take home message – in the upper Midwest, assess the stress level of target weeds in the fall following abnormally dry periods. If plants are showing obvious moisture stress, you might be better off leaving a foliar herbicide in the jug."

LYM: "This is not an easy question to answer. Herbicide efficacy in fall can be influenced by plant growth stage (e.g. Canada thistle mature stems vs rosettes), soil moisture, and canopy cover. If conditions are dry in fall, herbicide application may be ineffective."

RENZ: "It appears that soil active herbicides such as Milestone may improve perennial weed control in fall. Even a small percentage of the herbicide absorbed by roots in the fall, winter and early spring can improve perennial weed control. Moisture may also influence control. If summers are very dry and regrowth is limited (e.g. Canada thistle rosettes), then control may go from good to poor. A major reason for weed control failure in fall is no fall moisture."

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http://techlinenews.com/games-and-surveys/fallappresults

[3] Systemic herbicides are those that are absorbed by the roots or foliage and translocated (moved) throughout the plant. This includes herbicides Milestone®, Transline®, Tordon® 22K, Garlon® 4 Ultra, glyphosate, and many more.

[4] The length of time an herbicide remains active in soil is called soil persistence, or soil residual life. Herbicides such as Milestone, Tordon 22K and Transline have soil residual properties that allow for root and or bud absorption (uptake). Garlon 4 Ultra is not readily absorbed by roots.

Which perennial invasive plants are good targets for fall herbicide application?

Following is a summary of some invasive plants that can be controlled with fall applications (listed by scientists in this interview). Herbicide options and rates are available at http://techlinenews.com/management-guide and in other online references.

WEED SPECIES	COMMENTS
Most large-statured perennial weeds that rely strongly on asexual spread by roots	In the Midwest, the presence of basal regrowth is important to success of fall applications.
Absinth wormwood (*Artemisia absinthium*)	Spring or Fall regrowth following mowing in mid-summer.
Canada thistle (*Cirsium arvense*)	Bud stage and fall.
Dalmatian toadflax (*Linaria dalmatica*)	Flower or fall.
Dandelion (*Taraxacum officinalis*)	Fall (best) or spring.
Field bindweed (*Convolvulus arvensis*)	Flower or fall.
Hemp dogbane (*Apocynum cannabinum*)	Flower or fall.
Russian knapweed (*Acroptilon repens*)	Bud stage to late fall.
Knapweeds-taprooted (*Centaurea* spp.)	Rosette to fall.
Kudzu (*Pueraria montana*)	Late June to October.
Leafy spurge (*Euphorbia esula*)	True flower (best) or fall.
Perennial pepperweed (*Lepidium latifolium*)	Fall basal regrowth.
Purple loosestrife (*Lythrum salicaria*)	Bloom or fall.
Rush skeletonweed (*Chondrilla juncea*)	Spring (rosette to early bolt) or fall.
Smooth brome (*Bromus inermis*) and Reed canarygrass (*Phalaris arundinacea*)	Fall in Wisconsin Iowa, Minnesota, and Illinois.

RESEARCH ON HERBICIDE APPLICATION TIMING

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By Corey V. Ransom & Heather E. Olsen;

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Mapping invasive plants using a helmet based video system

PHOTO COURTESY COREY RANSOM, UTAH STATE UNIVERSITY

Infested acreage and the time required to estimate it were compared for two inventory methods: a traditional method of mapping on foot with handheld GPS units versus an experimental method of recording video of infestations while riding a mountain bike. Helmet-mounted cameras were placed facing forward and focused approximately 70 degrees apart to give wide perspective to the right and left of the rider.

INTRODUCTION

Conducting invasive plant inventories is a critical component of an integrated approach to invasive plant management. Inventory data often provides the information necessary to evaluate the extent of weed invasion allowing land managers to prioritize management efforts; however, this data is often expensive to collect. Aerial approaches to invasive plant mapping can be more efficient for highly visible species, but are limited to plants visible from the air. Recent advances in video technology allow collection of high definition video with compact, relatively inexpensive cameras.

OBJECTIVES

Research was conducted at Utah State University to compare a traditional ground-based approach to invasive plant mapping, to one using helmet mounted video cameras. The two ground-based inventory methods were compared for: 1) total estimated infested acreage, and 2) time required to conduct the inventories.

METHODS

The first inventory method involved mappers on foot inputting infestation data into a handheld GPS (traditional method). The second approach utilized a person riding a mountain bike wearing two helmet mounted video cameras (GoPro Hero2, GoPro Inc.) and later using the video to generate inventory polygons on a desktop computer in the office. A GPS or smart phone was used to collect tracklog data to accompany the video footage.

The helmet-mounted cameras were placed facing forward and focused approximately 70 degrees apart to give wide perspective to the right and left of the rider. Five trails were mapped using both approaches in mid May 2014 while the target plant was in full bloom. Dyer's woad (*Isatis tinctoria* L.) was selected as the target since its bright yellow flowers are easily distinguishable from surrounding green vegetation. The videos from both cameras were blended into a single video (Premiere CS6, Adobe) and then imported along with the corresponding tracklog into software (VIRB Edit,

NOTE:

This information was presented at the Western Society of Weed Science meeting March 9-12, 2015, Portland, OR.

Garmin Ltd.) that allows the video and the tracklog to play simultaneously. Using a second computer monitor, infestation shapes were drawn onto a GIS map (ArcPad 10, ESRI) as they were observed in the video and the location was identified on the corresponding map. The time spent mapping on the computer was recorded and was added to the time required to ride each trail section to determine total time required for mapping. Time required to stitch videos together or to sync tracklogs with the video was not included in calculations as the process could likely be automated in the future. Comparison of the two mapping methods included total time, total number of points, polygons, and lines, as well as total infested acres.

RESULTS

Time efficiency as well as estimates of total infested acreage varied widely between the two techniques.

TIME SAVINGS WITH VIDEO APPROACH

Time savings using the helmet mounted video approach ranged from 17 to 25% for a very steep trail and a small parcel respectively; and 60 to 73% for trails that were relatively flat to mostly downhill.

INFESTATION ESTIMATES WITH VIDEO APPROACH

The video mapping approach had lower estimates (70 to 83%) than the on-foot approach for two of the trails, but infestation estimate was almost 35% higher for another trail. Unfortunately there was no way to determine which method is more accurate since there was no actual infestation measurement for comparison. Future studies will need to include such a comparison. In some instances, both mapping methods identified small patches or single plants in the exact same location. While infestation polygons differed in size, in most cases the location of plants and patches were similar between the methods. Many discrepancies were due to the method each mapper selected to represent any given infestation (individual patches vs. large polygons or line features).

CONCLUSIONS

The video approach did allow fairly clear differentiation between dyer's woad and other yellow-flowered species in bloom. Newer video cameras offer even higher resolutions and video frame capture rates that could increase the ease of identifying specific species. Approaches to stabilize the camera during data collection are currently being investigated and have potential to improve video clarity. This research shows that helmet mounted video cameras can be used to map easily detected weed patches, with potential time savings compared to mapping on foot.

READ ABSTRACT > http://bit.ly/helmetvideomapping

CELESTINE DUNCAN

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.

RUSSIAN KNAPWEED
http://bit.ly/russianknapweed

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

ABSINTH WORMWOOD
http://bit.ly/absinth

BLACKBERRY
http://bit.ly/blackberrycontrol

YELLOW STARTHISTLE
http://bit.ly/yellowstarthistle

RUSH SKELETONWEED
http://bit.ly/rushskeletonweed

COMMON TANSY
http:/bit.ly/commontansy

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*).

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