

## SPOTTED KNAPWEED MANAGEMENT POSSIBLE WITH PLANNING, PERSISTENCE, AND INTEGRATED APPROACH

### Minnesota Department of Natural Resources protects resource values

**M**anaging invasive plants is a challenge under the best circumstances, but when coupled with high recreational use, miles of trails and diverse ecosystems, it becomes even more complex.

by Celestine Duncan, Editor

Chris Weir-Koetter, Strategic Program Manager for the Minnesota Department of Natural Resources (MNDNR) Northwest Region Parks and Trails credits careful planning, persistence, and integrating the most effective and selective methods for her success in managing spotted knapweed (*Centaurea stoebe*).

“Our agency is charged with conserving and managing Minnesota’s natural resources,” Weir-Koetter explains. “We have very diverse vegetation in Minnesota with four of North America’s biomes converging in the Northwest Region.” The Region encompasses 16 state parks, recreation areas and wayside areas containing over 70,000 acres. There are 200 miles of state trails and 700 miles of state water trails along with hundreds of public water access points. Ecological diversity combined with invasion pathways and recreational use means plenty of suitable habitat for a variety of nonnative plants.

Spotted knapweed is among the top ten invasive plants prioritized for management by the Northwest MNDNR. First observed in the Northwest Region in Clearwater County in 1997, the weed spread rapidly along road corridors, trails, and in sand and gravel materials used in construction and maintenance activities. Currently all counties within the North-



west Region are infested with spotted knapweed including ten state parks.

The management strategy for spotted knapweed on state parks and trails lands followed a simple plan according to Weir-Koetter. “First we needed to become knowledgeable about the weed, its impacts, prevention and control. We then developed a map and plan of attack working from pioneering weeds to centers of infestations. Lands with high resource values were prioritized for management. We also targeted entry points

and travel routes to prevent spread to non-infested sites. And finally we used the most effective and selective combination of prevention and containment techniques for controlling spotted knapweed.”

An integrated program to contain and control spotted knapweed was implemented in 1998. Methods included a combination of selective herbicides, mowing, biological control, hand pulling, and grazing. Different management strategies were customized for individual state parks based on the size and location

of weed infestations, operating budgets, and environmental constraints. A resource field crew trained for invasive plant management conducts most of the control efforts with support from parks and trails staff. Treated sites are monitored periodically to determine effectiveness of various management methods, and to locate and treat new infestations.

Selective herbicide treatments included dicamba applied at 32 fluid ounces per acre (fl oz/A), Milestone® at 5 to 7 fl oz/A, and Transline® at 10 to 16 fl oz/A. Herbicides were applied to spotted knapweed at the rosette to early bolt growth stage to remove plants and stop seed production. The higher herbicide rates were applied at later growth stages. Results of the herbicide treatments evaluated a year following application showed that dicamba gave less than 50% spotted knapweed control compared to Transline and Milestone with greater than 90% control. “Based on these results we adapted our program to use the most effective herbicide treatments,” explained Weir-Koetter.

On sites where common tansy (*Tanacetum vulgare*) and spotted knapweed are growing together, Opensight® at 2 to 3.3 ounces of product per acre is providing good control of both species. The combination of both herbicides on one granule makes it easier for applicators to mix spray solutions and broadens the weed control spectrum.

Although spotted knapweed seed remain viable in the soil for at least eight years, Weir-Koetter observed that growth of desirable vegetation increased following herbicide treatments and provided competition to germinating spotted knapweed. There are a few locations where desirable vegetation is not present prior to treatment. On these highly disturbed sites, the Northwest MNDNR Parks and Trails resource staff are restoring native and other desirable vegetation to help establish and promote a weed-resistant plant community.

In addition to herbicides, methods such as mowing, hand pulling, livestock grazing, and biological control were used. “We found that mowing, pulling and grazing didn’t fit our management goals and objectives on most



Mowing spotted knapweed plants does not prevent flower and seed production (above), and if not properly timed, mowing can actually spread seeds (right).



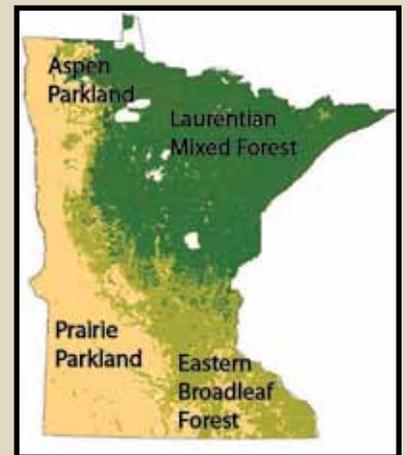
photos courtesy of C Weir-Koetter

of our sites,” explained Weir-Koetter. “Mowed plants can produce flowers and seed even with repeated mowing for more than 10 years. Because of the large number of sites and

acreage that needed treatment it was difficult to time all of our mowing operations prior to seed production, so mowing machines were actually spreading seed.”

## MINNESOTA BIOMES

A biome is a broad, regional type of ecosystem characterized by distinctive climate and soil conditions and a distinctive biological community adapted to those conditions. There are four biomes that converge in Minnesota and different non-native plants are problematic in each biome. Invasive plants including leafy spurge (*Euphorbia esula*), spotted knapweed, birdsfoot trefoil (*Lotus corniculatus*), crown vetch (*Coronilla varia*) and Canada thistle (*Cirsium arvense*) are problematic in the Prairie Parkland and Tallgrass, Aspen Parkland biomes. In the Eastern Broadleaf (deciduous) Forest, wild parsnip (*Pastinaca sativa*), European buckthorn (*Rhamnus cathartica*), garlic mustard (*Alliaria petiolata*), and tartarian honeysuckle (*Lonicera tatarica*) are the most invasive species. The Laurentian Mixed Forest Biome is the most resilient to invasion by non-native plants with infestations of common tansy and orange hawkweed (*Hieracium aurantiacum*).



[“MNDNR” continued on page 8]



Selective herbicide treatments were applied to spotted knapweed at the rosette to early bolt growth stage.



Goats used to graze spotted knapweed attracted public interest to the invasive plant problem.



The root-feeding weevil *Cyphocleonus achates* was released to help manage spotted knapweed populations at Glendalough State Park.

Persistent and careful hand pulling has been shown to control spotted knapweed if the entire crown portion of the plant is removed before the plant produces seed. Hand pulling spotted knapweed on MNDNR lands was effective on eliminating individual pioneer plants but had drawbacks when controlling larger infestations. Results of the MNDNR monitoring efforts showed that hand removal disturbed the ground and provided perfect conditions for spotted knapweed seeds to germinate. Pulling was also very labor intensive with high control costs. These observations were similar to hand removal projects evaluated in Montana that showed hand pulling well established infestations of spotted knapweed twice each year cost about \$14,000 per acre per year.

Cattle, sheep and goats are known to graze spotted knapweed at low to moderate levels. The Northwest Region MNDNR initiated a goat grazing project to control spotted knapweed infestations as part of their integrated efforts in Itasca State Park. "Our monitoring results showed that the goats had an impact on native vegetation and there was no decrease in spotted knapweed density two years after grazing," explained Weir-Koetter. "It was also expensive, our cost was \$2,069 for fencing and goats (with herder) plus about an equal amount of MNDNR labor to graze less than one acre for a year. However, the goat-grazing program likely reduced spotted knapweed seed production since goats consumed some flowers, and the animals were great for drawing public interest to the invasive plant problem."

Biological control can be an effective, long-term management tool for well-established infestations, but often requires many years before results are visible. At Glendalough State Park, the root-feeding weevil *Cyphocleonus achates* was released at multiple locations mainly along the edge of infested fields. The MNDNR is actively monitoring insect populations and is hopeful that biological control of spotted knapweed will play an important role in the management of spotted knapweed in northwestern Minnesota.

"Another important part of our invasive plant program is to insure that our management efforts weren't accelerating the problem," says Weir-Koetter. The Minnesota DNR developed guidelines for preventing spread of invasive plants within their own agency. This includes cleaning equipment to reduce spread, requiring weed-free materials (sand,

## OPENSIGHT® FOR MIXED STANDS

Noxious weeds often occur as a complex or mixed stand of various species that may include knapweeds (*Centaurea* sp.) or thistles (*Cirsium* and others), mixed with other weeds such as wild parsnip (*Pastinaca sativa*),

wild carrot (*Daucus carota*), poison hemlock (*Conium maculatum*), or common tansy (*Tanacetum vulgare*). Growth regulator herbicides such as Milestone® (aminopyralid) provide excellent control of knapweeds and thistle, but have less activity on weeds such as wild parsnip and common tansy. In contrast, metsulfuron methyl provides

excellent control of wild carrot and parsnip, common tansy, and poison hemlock but poor control of knapweeds and thistle. Opensight® herbicide combines both aminopyralid and metsulfuron-methyl on a dry pellet formulation. The combination of these two active herbicide ingredients broadens the weed control spectrum and

allows applicators to control noxious weed complexes with one application. The maximum label use rate for Opensight is 3.3 oz product/A, which contains 1.7 oz acid equivalent (ae) of aminopyralid (equal to 7 fl oz Milestone) and 0.36 oz active ingredient of metsulfuron methyl.

gravel), requiring contractors to enter a site with clean equipment, and inspecting and controlling weeds on stockpiled materials.

The Minnesota DNR realizes that successful management of spotted knapweed and other invasive plants is a long-term effort involving the combined use of all available control methods and improved land management practices in an integrated approach. Weir-Koetter's says, "Be tenacious in your control efforts, and as control is achieved, move from a project approach to a maintenance program but never walk away."



Chris Weir-Koetter, Strategic Program Manager for the Minnesota Department of Natural Resources Northwest Region Parks and Trails

## INTEGRATED WARFARE

poem by C.R. Weir-Koetter, 2005

*Do not despair  
My comrade in arms.  
For if we fall,  
Bloodied and spent,  
Before the Siege of Weeds.  
We fall as  
Warriors.  
And if we prevail,  
In a battle, or a war  
or after years of conflicted toil,  
We prevail still as  
Warriors.  
But if we do nothing,  
Discard the beetles and tanks,  
And grow fat and helpless,  
Complacent of the advance,  
We only despair.*

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