Prairie & Grasslands Edition

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IN THIS ISSUE

NEW ONLINE

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ABOUT TECHLINE

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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TechLine
INVASIVE PLANT NEWS

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

PHEASANTS FOREVER
Conserving Wildlife through Habitat Protection and Restoration

BY CELESTINE DUNCAN

MATT MORLOCK

PRAIRIE WILDFLOWER DISPLAY on Conservation Reserve Program lands in Clark County, South Dakota.

PHEASANTS FOREVER IS CELEBRATING 30 YEARS AS A LEADER in conservation of pheasants, quail and other upland wildlife through habitat improvements, public awareness and education, and land management policies and programs. Since its inception in 1982, Pheasants Forever wildlife habitat projects have benefited more than 8.5 million acres across the United States.

"Conservation and protection of soil and water resources through Pheasants Forever programs has had a significant impact on upland wildlife," explains Matt Holland, Wildlife Biologist and Director of Grant Development for Pheasants Forever. "Wildlife is dependent on habitat, and when habitat is restored and protected the benefits to soil, water, wildlife and human quality of life are also enhanced."

The Pheasants Forever mission is tied directly to a strong framework of federal conservation programs, such as the Conservation Reserve Program (CRP), with authority granted through the Federal Farm Bill. A unique partnership between Pheasants Forever, state, and federal agencies supports Farm Bill Biologists within priority pheasant habitat areas.

LEARN MORE

Pheasants Forever

WHEN IT ALL BEGAN

Concerned about loss of wildlife habitat, avid pheasant hunters and conservationists formed Pheasants Forever in 1982. Since then, the organization has grown steadily and expanded its wildlife habitat conservation mission across much of the United States and Canada. Today, Pheasants Forever and its quail conservation division, Quail Forever, is the nation's largest nonprofit organization dedicated to upland habitat conservation. Pheasants Forever and Quail Forever have more than 135,000 members and 720 local chapters across the United States and Canada. Members include hunters, non-hunters, farmers, ranchers, landowners, conservation enthusiasts and wildlife officials who want to make a difference for wildlife by creating habitat, restoring wetlands and protecting prairies. At the heart of Pheasants Forever is the unique grassroots system of fundraising and project development that allows members to determine how locally raised conservation funds will be spent–the only national conservation organization that operates through this grassroots structure.

To find a Pheasants Forever chapter near you or for more information call 1-877-773-2070 or go to: http://www.pheasantsforever.org

ACCOMPLISHMENTS

- Over 8.5 million acres impacted.
- More than 1,346 land acquisitions, representing 169,507 acres open to public hunting and other outdoor recreation opportunities.
- Exceeded 460,944 wildlife habitat projects.
- 250,000 youth mentored through outdoor initiatives.

Habitat Forever, LLC

(a subsidiary of Pheasants Forever)

EXAMPLES OF SERVICES PROVIDED

- Native grass and forb planting
- Cool season grass planting
- Native prairie restorations
- Fully trained fire crews and equipment for prescribed burning
- CRP and mid-contract management
- Grassland rejuvenation by disking and interseeding
- Wetland restoration
- Mowing
- Food plot planting
- Specialty spraying
- Tree planting
- Brush clearing
- Wildlife management plans
- Competitive prices for native grass, forb seed and food plot mixes

"Our job is to assist landowners in designing, developing, and funding habitat improvements on private lands," explains Matt Morlock, a Farm Bill Biologist in Brookings, South Dakota. "The majority of our work is directly related to reseeding, restoration, and maintenance, including invasive plant control on private lands enrolled in CRP or Wetland Reserve Programs (WRP). The most common invasive plants infesting our habitat projects include Canada thistle (*Cirsium arvense*), biennial wormwood (*Artemisia biennis*), musk thistle (*Carduus nutans*), leafy spurge (*Euphorbia esula*) and grasses such as smooth brome (*Bromus inermis*) and Kentucky bluegrass (*Poa pratensis*)."

HABITAT FOREVER

HABITAT FOREVER, LLC IS A SUBSIDIARY OF PHEASANTS FOREVER and provides specialists for hire to land owners and managers interested in restoring or maintaining existing habitat. Habitat specialist Dennis Pederson from Montevideo, Minnesota explains that the Pheasants Forever and Habitat Forever networks provide expertise on creating and maintaining quality wildlife habitat.

"In the last 12 years, our team has seeded about 13,000 acres and burned about 30,000 acres to improve wildlife habitat within a 13-county area in west central Minnesota. The bulk of our work is providing advice and recommendations on prairie restoration projects, seeding desirable native grasses and forbs, conducting prescribed burns, and selling native wildflower and grass seed," says Pederson.

Habitat specialists also network with universities and private industry on invasive plant management projects. Pederson is currently collaborating with Dr. Roger Becker (University of Minnesota) and Dow AgroSciences on a study to determine the best management practices for using Milestone® and Transline® herbicides in prairie restoration.

"As part of our collaboration we help the university and industry partners find sites to conduct field research. This partnership gives us the opportunity to observe first-hand the effectiveness of herbicide treatments on target and non-target plants—information that helps us do a better job on our restoration projects and invasive plant control," Pederson explains.

SCENES FROM THE FIELD. **Dennis Pederson** is a Habitat Forever specialist (top left). • Collaborative **research site** at Rath, Minnesota to determine best management practices for Milestone and Transline herbicide treatments in prairie restoration (top right). • Prairie restoration often includes use of **prescribed fire** to enhance seeding success, or to maintain a more diverse plant community for wildlife (bottom left). • **Restored wetlands** (bottom right).

"WILDLIFE IS DEPENDENT ON HABITAT, AND WHEN HABITAT IS RESTORED AND PROTECTED THE BENEFITS TO SOIL, WATER, WILDLIFE AND HUMAN QUALITY OF LIFE ARE ALSO ENHANCED."

MATT HOLLAND, WILDLIFE BIOLOGIST AND DIRECTOR OF GRANT DEVELOPMENT FOR PHEASANTS FOREVER

Canada thistle is a perennial noxious weed that is widespread in Pederson's management area. "Either Milestone at 7 fluid ounces per acre (fl oz/A) or Transline at 10 to 12 fl oz/A provides excellent Canada thistle control," says Pederson. Although these are broadleaf herbicides, Pederson has a strategy to protect wildflowers from herbicide injury.

"On Canada thistle infested sites where wildflowers are present and established for at least two growing seasons, our field work suggests that it's best to delay herbicide treatment until fall following a light frost. We've found that a temperature of 28 degrees F will cause many wildflowers to become dormant, but Canada thistle will remain viable for a longer period of time. This application timing provides excellent control of Canada thistle and minimizes injury to some desirable wildflowers," says Pederson.

BEFORE AND AFTER. A 140-acre wetland restoration project before (left) and two years after (right) restoration in Renville County, Minnesota.

TABLE 1. A SAMPLE PRAIRIE SEED MIX FOR MESIC SITES THAT IS TOLERANT TO MILESTONE AND TRANSLINE. Species were compiled by Dennis Pederson (based on the work of Dow AgroSciences, the Minnesota DNR, Feders Native Prairie Seed Company and many others) for Conservation Reserve Program projects using the CP25 practice. Cost of this seed mix through Habitat Forever, LLC in Minnesota is $176/acre in the spring of 2013.

	Allowed % of Mix	Seeded % of Mix	Lbs/Acre Seeded	Seeds/sq ft (1 lb)	Mix Seeds/sq ft	Cool/Warm	Variety
Big bluestem	0-50	27.4%	2.31	3.8	8.8	Warm	MN Native
Indiangrass	0-50	14.4%	1.15	4.0	4.6	Warm	MN Native
Little bluestem	0-30	7.1%	0.38	6.0	2.3	Warm	Itasca or MN Native
Sideoats grama	0-30	15.4%	1.12	4.4	4.9	Warm	Pierre or MN Native
Blue grama	0-20	2.7%	0.05	17.5	0.9	Warm	MN Native
Switchgrass	0-5	4.8%	0.17	9.0	1.5	Warm	Forestburg
Rough dropseed		8.2%	0.15	17.4	2.6	Warm	MN Native
Green needlegrass	0-10	10.0%	0.80	4.0	3.2	Cool	Lodorm
Slender wheatgrass	0-10	10.1%	0.87	3.7	3.2	Cool	Revenue
TOTAL		**100.0%**	**7.00**		**32.0**		

	Allowed % of Mix	Seeded % of Mix	Oz/Acre Seeded	Seeds/sq ft (1 oz)	Mix Seeds/sq ft	PLS LBS	Scientific Name
Anise hyssop	20	7.5%	0.50	2.07	1.035	0.031	*Agastache foeniculum*
Black-eyed Susan[1]	20	14.5%	0.95	2.11	2.0045	0.059	*Rudbeckia hirta*
Blue vervain	20	10.8%	0.70	2.13	1.491	0.044	*Verbena hastata*
Canada milk vetch	20	8.5%	3.00	0.39	1.17	0.188	*Astragalus canadensis*
Golden Alexanders	20	3.1%	1.70	0.25	0.425	0.106	*Zizia aurea*
Hoary vervain	20	7.9%	1.70	0.64	1.088	0.106	*Verbena stricta*
Leadplant	20	1.3%	0.50	0.37	0.185	0.031	*Amorpha canescens*
New England aster	20	1.7%	0.15	1.52	0.228	0.009	*Aster novae-angliae*
Ox-eye sunflower	20	4.3%	4.20	0.14	0.588	0.263	*Heliopsis helianthoides*
Prairie cinquefoil[1]	20	15.4%	0.40	5.30	2.12	0.025	*Potentilla arguta*
Prairie onion	20	0.5%	0.30	0.25	0.1	0.019	*Allium stellatum*
Showy goldenrod	20	5.5%	0.35	2.18	0.763	0.022	*Solidago speciosa*
Smooth blue aster	20	5.9%	0.65	1.26	0.819	0.041	*Aster laevis*
Stiff goldenrod	20	2.7%	0.40	0.94	0.376	0.025	*Solidago rigida*
Wild bergamot	20	2.9%	0.25	1.61	0.4025	0.016	*Monarda fistulosa*
Yarrow[1]	20	7.5%	0.25	4.13	1.0325	0.016	*Achillea millefolium*
TOTAL		**100.0%**	**16.00**		**13.8**		

Total Seeds/SqFt=45.8 | Cool Season Grass %=20.0 | Grass % of Mix=69.88 | Forb % of Mix=30.12

[1]Recognized as not tolerant.

Seed Mix Name: CP25 Mesic Mix, designed to comply with the Natural Resource Conservation Service (NRCS) standard for Conservation Practice (CP) 25 – and mesic moisture conditions.

Seed mix meets 643 standard requirements of the Minnesota NRCS: 7 lbs pure live seed (PLS) grass/acre; 16 oz PLS forbs/acre; No more than 20% of the grass portion of a mix, by count of seeds/ ft2 can be cool season grasses; No single forb can comprise more than 20% of the total forb seed count; No more than 70% of the total seed count in the mix can be comprised of grass – conversely, 30% or more has to be forbs

Data from field studies suggest that some wildflowers are sensitive to fall herbicide application. It is important for land managers to understand what wildflowers are present prior to fall herbicide treatments to minimize damage to desirable plants.

Pederson utilized data from the University of Minnesota and Dow AgroSciences to develop a seeding mix for south central Minnesota that was tolerant to applications of Milestone and Transline (Table 1). This mix may be a useful guide for reseeding or restoring sites infested with Canada thistle or other perennial broadleaf weeds that have been treated or are proposed for herbicide treatment.

BRINGING IT ALL TOGETHER:

See page 6 for Dennis Pederson's tips for managing Canada thistle, and seeding recommendations for Canada thistle infested sites.

THE FUTURE OF WILDLIFE HABITAT CONSERVATION

PHEASANTS FOREVER IS PROUD OF THE WORK THEY HAVE ACCOMPLISHED, but recognize the challenge of keeping conservation and habitat protection relevant on a landscape scale. "The increasing need to produce more food, fiber and places to live, pose future challenges for protecting wildlife habitat," says Holland. "As an organization we will continue to expand on new and innovative ideas for wildlife conservation, and advocate for a long term vision of sustainable agriculture that protects and conserves wildlife habitat. Our mission is to continue to keep soil, water, and habitat conservation on the ground to sustain our way of life in this country."

Midwest Invasive Plant Network

Joining Forces to Combat Invasive Plants in the Midwest

INVASIVE PLANTS POSE ONE OF THE GREATEST THREATS TO BIODIVERSITY IN THE MIDWEST, taking over natural areas and crowding out native species. The Midwest Invasive Plant Network (MIPN) was organized in 2002 to bring attention to the invasive plant problem and pool resources and knowledge of those working to reduce the threat from invasive plants.

Kate Howe, coordinator for MIPN explains, "Our goal is to improve prevention, early detection and rapid response, control and management, education, and research on invasive plants in the Midwest." The Network provides leadership for cooperative efforts, helps facilitate information exchange, and coordinates regional efforts with a broad network of partners across the region.

Currently MIPN has a listserv and website to improve communication about invasive plants and related issues in the Midwest, a database of educational materials to improve access to information, data standards for invasive plant mapping and inventory, and a compilation of information on invasive plant research conducted in the Midwest. The Network also publishes regional educational materials on invasive plants, engages in discussions with the horticultural industry to encourage voluntary reduction in the sale of invasive species, and develops training workshops on the creation of Cooperative Weed Management Areas.

The Nature Conservancy, U.S. Forest Service and the Wisconsin Department of Natural Resources (DNR) played a major role in the establishment of this network, which is now hosted by Purdue University. Other partners and groups that contribute in-kind services or funding include the U.S. Fish and Wildlife Service, National Park Service, DNRs in Iowa, Illinois, and Minnesota, The Stewardship Network, Federal Highway Administration, Chicago Botanic Garden, Gaylord and Dorothy Donnelley Foundation, University of Wisconsin-Madison, and a number of other federal, state, local and private groups. The Network is guided by a Board of Directors.

TO LEARN MORE ABOUT MIPN or to become involved with the organization, contact Kate Howe howek@purdue.edu or view MIPN's Strategic Plan.

MIPN.org
Midwest Invasive Plant Network

Bringing It All Together

Practical Tips for Effectively Managing Canada Thistle in Natural Areas

BY DENNIS PEDERSON

- **MOWING OR FIRE ALONE WILL NOT CONTROL CANADA THISTLE; USE FIRE AND/OR MOWING IN CONJUNCTION WITH HERBICIDES.** Spring fire and spring mowing reduce vegetative cover allowing better herbicide coverage on thistle. Fire and mowing also add an additional stress to Canada thistle. It is important to delay herbicide application until all Canada thistle have emerged following fire. Wait at least two weeks after mowing to apply herbicides.
- **CONTROL THE ROOT SYSTEM.** About 95 percent of thistle biomass is underground, so the root system has to be killed to effectively control Canada thistle.
- **USE THE MOST EFFECTIVE HERBICIDES AT LABELED RATES.** Milestone® at 5 to 7 fl oz/A or Transline® at 10 to 12 fluid ounces per acre (fl oz/A) translocate into the root system giving the best control. Milestone is more effective on Canada thistle and less costly than Transline, but Transline can be more selective and can be used to control thistle in areas where there is desirable woody vegetation. Milestone and Transline can be applied in either spring or fall; however, Milestone is more effective in the fall.
- **SPRING/EARLY SUMMER HERBICIDE APPLICATIONS** should be made when thistle is fully emerged, and when the largest plants are at early bud growth stage. Mowing or fire prior to application will allow for more consistent Canada thistle growth, but be sure plants are at rosette to bolt growth stage prior to herbicide application.
- **FALL APPLIED HERBICIDES.** Thistle can tolerate about 25 F so applications can be made from September until early- to mid-October as long as green growth remains on thistle.
- **USE BROADCAST HERBICIDE APPLICATIONS.** Unless thistle patches are completely defined and well documented, spot spraying is usually self-defeating and a false economy. To ensure the greatest chance for thorough and complete application, the whole field should be treated.
- **CONTROL INFESTATIONS ON FIELD EDGES.** If field edges, ditch banks, wetland edges and fence lines are not treated along with the main grassland body, thistle colonies will maintain a foothold in those locations and reestablish quickly.

Forb/Wildflower Seeding Recommendations for Canada Thistle Infested Sites in Prairies

J.B. Bright with the US Fish and Wildlife Service (USFWS) described a successful restoration as "A diverse plant community that will include different levels of canopy cover and structural diversity to serve a wider array of birds, pollinator insects and other wildlife" (http://bit.ly/partnersforfws). To help land managers meet their restoration goals, cooperative field trials between Dow AgroSciences, USFWS, Dennis Pederson, and University of Minnesota were conducted at multiples sites in the Midwest. Results from these trials show that Milestone® is the most effective herbicide for controlling Canada thistle. The herbicide should be applied at 5 to 7 fl oz/A in either late spring after all Canada thistle plants have emerged (some may be at the bud stage), and in fall (http://bit.ly/canadathistle). A list of wildflower options for a seeding mix that is tolerant to Milestone herbicide, and includes diverse structural diversity (height) and flowering times for pollinators was also developed from these field trials (Table 2).

CATEGORIES FOR RANKING TOLERANCE OF FORBS AND SHRUBS TO MILESTONE HERBICIDE

Code	Description
	Observed Tolerant. Field observations reported to Dow AgroSciences that indicate the forb is tolerant.
	Tolerant. Minimal symptoms–may exhibit slight injury and cupping of leaves. <15% stand reduction.
	Moderately Tolerant. Cupping/yellowing and possible inhibited flowering, with recovery the first growing season after application. 15 to 50% stand reduction.
	Moderately Susceptible. Significant injury the first year and possible stand reduction. 51 to 75% stand reduction.
	Susceptible. Severe injury the season of application and stand reduction the year after treatment with possible death of established plants. Some plants may regenerate from seed bank. >75% stand reduction.

For a complete list of forbs tolerant to Milestone herbicide, see section 5 of **"Invasive Plant Management with Milestone® and Other Herbicides–A Guide for Natural Area Managers"** **http://bit.ly/milestoneguide**

TABLE 2. DESIRABLE FORBS THAT CAN BE CONSIDERED IN A PRAIRIE RESTORATION PLANTING THAT ARE TOLERANT TO MILESTONE HERBICIDE, based on data collected in field trials conducted from 2007 through 2012. Forb tolerance based on application timing is noted in the table.

Common Name *Scientific Name*	**Tolerance Category 1 year after treatment**	**Flw color**	**Height ft**	**Flowering Time** Apr	May	Jun	Jul	Aug	Sep	**Cost**
Blanket flower *Gaillardia aristata*	Moderately Tolerant	Red/yellow	1 to 2			X	X			Inexpensive
Blue vervain *Verbena hastata*	Tolerant	Blue	5				X	X	X	Moderate
Butterfly milkweed *Asclepias tuberosa*	Observed Tolerant	Orange	2 to 3			X	X	X		Expensive
Button (or rougth) blazingstar *Liatris aspera*	Observed Tolerant	Purple/pink	3 to 5					X	X	Expensive
Common milkweed *Asclepias syriaca*	Tolerant	Lavender	2 to 4			X	X	X		Moderate
Cup plant *Silphium perfoliatum*	Moderately Tolerant	Yellow	3 to 10				X	X	X	Moderate
Golden Alexanders *Zizia aurea*	Tolerant	Yellow	3	X	X	X				Moderate
Heart-leaved alexanders *Zizia aptera*	Tolerant	Yellow	2	X	X					Moderate
Heath aster *Aster ericoides*	Moderately Tolerant	White	2					X	X	Expensive
Hoary vervain *Verbena stricta*	Tolerant	Blue	2			X	X	X	X	Moderate
Large flowered penstemon *Penstemon gradiflorus*	Observed Tolerant	Lavender	2 to 4		X	X				Moderate
Leadplant *Amorpha canascens*	Observed Tolerant	Purple	2 to 3			X	X			Moderate
Lupine *Lupinus perennis*	Tolerant	Blue	1 to 2		X	X				Expensive
Meadow blazingstar *Liatris ligulistylis*	Observed Tolerant	Purple/pink	3 to 5					X	X	Expensive
New England Aster *Aster novae-angliae*	Observed Tolerant	Purple/pink/blue	3 to 6					X	X	Moderate
Ox Eye Sunflower *Heliopsis helianthoides*	Moderately Tolerant	Yellow	3 to 6			X	X	X	X	Inexpensive
Prairie blazingstar *Liatris aspera*	Moderately Tolerant	Purple	3				X	X	X	Expensive
Prairie onion *Allium stellatum*	Tolerant	Purple	1				X	X		Moderate
Purple meadow-rue *Thalictrum dasycarpum*	Moderately Tolerant	White	6			X	X			Inexpensive
Purple prairie clover *Dalea purpurea*	Susceptible Fall Tolerant Summer	Purple/yellow	1 to 2 2 to 2				X	X		Inexpensive
Round-headed bush clover *Lespedeza capitata*	Moderately Susceptible	White	3 to 5					X	X	Moderate
Showy tickfoil *Desmodium canadense*	Moderately Susceptible	Purple	5				X	X		Moderate
Smooth Blue aster *Aster laevis*	Moderately Tolerant	Blue	4					X	X	Moderate
Stiff goldenrod *Solidago rigida*	Moderatley Tolerant Summer Susceptible Fall	Yellow	3 4					X	X	Moderate
Stiff sunflower *Helianthus pauciflorus*	Moderatley Tolerant Summer Moderately Susceptible Fall	Yellow	5 5				X	X	X	Expensive
White prairie aster *Aster ericoides*	Moderately Susceptible Summer Moderately Tolerant Fall	White	2 3					X	X	Expensive
Swamp milkweed *Asclepias incarnata*	Observed Tolerant	Red/pink	3 to 5			X	X			Moderate
White wild indigo *Baptisia alba*	Moderately Tolerant	White	4			X	X			Moderate
Wild bergamot *Monarda fistulosa*	Tolerant	Purple	4				X	X	X	Moderate

Restoring Wisconsin's PINE BARREN LANDSCAPE

Reducing Risk of Non-native Plant Invasion During Restoration

OPEN HABITAT RESTORED. The 1,000-acre Moquah Barrens after a recent prescribed fire to remove encroaching trees and restore open habitat. This portion of the project area is designated a weed free zone.

BY CELESTINE DUNCAN // **PHOTOS BY** MATT BUSHMAN

THE PINE BARREN ECOSYSTEM WAS ONCE WIDESPREAD THROUGHOUT THE LANDSCAPE OF NORTHWESTERN WISCONSIN. TODAY, ONLY ABOUT ONE PERCENT OF THE ORIGINAL 2.3 MILLION ACRES OF THIS RARE ECOSYSTEM REMAINS.

"The mosaic of forests and open prairies characterizing the barrens supports habitat for plants and wildlife, some of which are now considered rare in Wisconsin because of habitat loss and fragmentation, changes in land use, and fire suppression," explains Matt Bushman, District Botanist for the Washburn Ranger District of the Chequamegon-Nicolet National Forest. Bushman is helping facilitate the Northwest Sands Pine Barren Restoration Project that encompasses about 23,000 acres in northwest Wisconsin.

The creation and maintenance of the pine barrens landscape on the Washburn Ranger District has been ongoing since the 1960s. Although about 7,000 acres were in some phase of restoration prior to 2009, the Northwest Sands project greatly expanded the Forest Service mission of reestablishing the barrens ecosystem.

"The project includes a number of different on-the-ground actions including timber harvest, mechanical site treatment, and prescribed burning," explains Bushman. "Historically, fire was the major natural disturbance in the pine barrens ecosystem and our management techniques try to mimic these natural disturbance processes."

Disturbance caused by timber harvest, building temporary roads, burning, and mechanical site treatment are common throughout much of the Northwest Sands project area. These actions can increase the risk of spreading invasive plants to non-infested sites. Removing the tree canopy during restoration activities also increases light availability and provides more suitable habitat for invasive plants that grow best in full sun.

"We recognized that this restoration project would increase the risk for spread and establishment of non-native plants so we conducted pre-treatment surveys and developed a strategy to mitigate the impacts," explains Bushman.

The survey showed about 45 acres infested with spotted knapweed (*Centaurea stoebe*), bull thistle (*Cirsium vulgare*), leafy spurge (*Euphorbia esula*) and several other non-native plants within the project area (Table 1).

Bushman explains, "Spotted knapweed is our most widespread weed and it thrives in full sun conditions and on disturbed sites. We knew it was important to treat existing infestations, and find and control newly established spotted knapweed to meet our restoration goals. If spotted knapweed and other non-native plants became well established in the pine barrens habitat that was being restored, they could outcompete native vegetation and alter fire behavior."

PREVENTION AND CONTROL

TO MINIMIZE THE HIGH RISK OF INTRODUCTION and spread of weeds, guidelines and design features such as location of log landings, clean sources of gravel for road fill, and language in contracts regarding equipment cleaning were implemented. Also, herbicide treatments on invasive plants were conducted within the project area prior to, during and following logging and mechanical treatment. Local weed control efforts by the Northwood's Cooperative Weed Management Area and Forest-wide weed treatment also reduced the size and scope of infestations within and adjacent to the project area, reducing the potential for movement into the site.

"We initially sprayed spotted knapweed in the Northwest Sands project area with Round-up*. After the first year of treatment, we switched to Transline® at 2/3 pint per acre based on recommendations from other applicators and on-the-ground observations. Although Transline gave good selective control of spotted knapweed, we currently apply Milestone® at 5 to 7 fluid ounces per acre (fl oz/A) because of the sandy soils and more consistent spotted knapweed control," explains Bushman.

Woody invasive plants in forested sites include Siberian pea shrub (*Caragana arborescens*) and autumn olive (*Elaeagnus umbellata*), which were planted in the project area 20 to 40

TABLE 1. NON-NATIVE INVASIVE PLANT SPECIES AND ACREAGE INFESTED within the Northwest Sands Project Area.

Species	Acres of infestation
Spotted knapweed – *Centaurea stoebe*	41.9
Brown knapweed – *Centaurea jacea*	0.50
Leafy spurge – *Euphorbia esula*	0.86
Siberian pea shrub – *Caragana arborescens*	0.42
Exotic honeysuckles – *Lonicera* spp.	0.10
Bull thistle – *Cirsium vulgare*	0.04
Reed canary grass – *Phalaris arundinacea*	0.04
Autumn olive – *Elaeagnus umbellata*	0.59
Total	45.1

*1,719 of 2 million acres of Chequamegon-Nicolet National Forest lands, and 293 of 202,535 acres of Washburn Ranger District are infested with invasive plants.

BROWN KNAPWEED (*Centaurea jacea*) is a perennial plant that grows 1 to 3 feet tall and invades dry fields, roadsides and meadows. Basal leaves are oblanceolate to elliptic and 2 to 10 inches long. Leaves become smaller and more linear as they move up the stem. The flower heads are found at the tips of branches and have dark brown fringed bracts. Flowering occurs from June to October, when rose to purple colored flowers appear in 1 to 1.25 inch wide, solitary heads. The plant reproduces from seeds and from the woody root crown. Brown knapweed is native to Europe, and is an aggressive invader, preferring moister, cooler conditions than other knapweed species. It can tolerate partial shade.

SCENES FROM THE FIELD. A mowing operation (top left) removed a young aspen (*Populus tremuloides*) stand and retained jack pine (*Pinus banksiana*). Removing the tree canopy increases risk of invasion from plants like spotted knapweed that grow best in full sun. • Pictured top right, a **typical forest two-track road** in the Northwest Sands project area with patchy occurrence of spotted knapweed. • **Timber harvest creates the pine barrens structure**, and prescribed fire will help to promote a fire-adapted understory plant community. A red pine (*Pinus resinosa*) stand pre-harvest in 2009 (bottom left) with 120 trees per acre compared to post-harvest (bottom right) with about 50 trees per acre.

years ago to provide food for wildlife. Forest Service weed crews have been controlling these plants by cutting and uprooting. "Both woody plants are a high priority for treatment since infestations are small and eradication is still possible," explains Bushman.

The biggest challenge for project managers is locating and treating newly established infestations of spotted knapweed and other invasive plants. Inventorying the Northwest Sands project area in addition to the entire Washburn District is a difficult challenge, and land managers are constantly finding new populations of non-native invasive plants. Fortunately, most infestations in the area are along roadways where they are visible and relatively easy to control.

The Northwest Sands restoration project is a high priority for managing invasive plants within the Chequamegon-Nicolet Forest. "Portions of the project area are designated weed-free zones, most infestations are easily accessible, and there are few infested acres so we can protect a large landscape from weed invasion at a relatively low cost," says Bushman.

Most of the Chequamegon-Nicolet National Forest has dense tree canopy cover and is not as susceptible to invasion by spotted knapweed and leafy spurge. By focusing treatments within grasslands and other open habitats the Forest Service is able to utilize slim resources more effectively.

LONG-TERM COMMITMENT

THE WASHBURN RANGER DISTRICT IS COMMITTED to restoring the vegetation structure and composition of a functioning pine barrens ecosystem in northwest Wisconsin. Management actions such as timber harvest, fire, and mechanical treatment are shifting the plant community toward the barrens landscape. However, long-term use of prescribed fire and diligent control of invasive plants will be necessary to maintain the ecosystem.

"Ideally, the different components of the pine barrens ecosystem (pine savanna, open barrens) would shift around the landscape over time due to tree mortality or recruitment in response to fire," explains Bushman. "We realize it may take decades, but we are making progress in restoring the ecosystem and preserving the habitat it provides to native plants and wildlife."

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Active ingredients for herbicide products mentioned in this article: Milestone (aminopyralid), Transline (clopyralid), Round-up (glyphosate).

Herbicide Selectivity in Invasive Plant Management

Choosing the right herbicide to fit your vegetation management objectives is an important decision. Herbicides are classified in a number of ways based on how they are used and their selectivity on different plant families.

NONSELECTIVE HERBICIDES are not selective about the plants they control. Glyphosate (Roundup*, Accord® XRT II, Rodeo®, and other trade names) is a non-selective herbicide that will cause significant injury to both broadleaf and grass plants. Often undesirable weedy plants will re-establish in bare ground created by nonselective herbicide treatments.

SELECTIVE HERBICIDES are those formulated to control specific plant families. Milestone® and Transline® are selective herbicides that control invasive broadleaf plants, allowing grasses and some desirable broadleaf plants to thrive. Applying selective herbicides to target plants reduces the potential for erosion by maintaining vegetative cover and minimizes damage to desirable non-target plants.

NONSELECTIVE HERBICIDE (glyphosate) applied to Scotch broom (*Cytisus scoparius*) resulted in injury to desirable grasses (left) shown 45 days following application. Removal of grass competition by glyphosate allowed for invasion of oxeye daisy (*Leucanthemum vulgare*), another invasive plant, 416 days after application (right).

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Proper Application Timing

Maximizes Invasive Plant Control with Milestone® Herbicide


DAN TENAGLIA, BUGWOOD.ORG

BIRDSFOOT TREFOIL
(Lotus corniculatus)

Birdsfoot trefoil is a perennial broadleaf plant that reproduces by seeds, and spreads laterally by stolons and rhizomes. Milestone® at 5 to 7 fluid ounces per acre (fl oz/A) applied in either June or fall provides good control of the plant and is more effective than Transline® at 1 pint per acre. The lower rate of Milestone (5 fl oz/A) is more effective when applied in fall compared to June. Additional information: http://bit.ly/birdsfoottrefoil

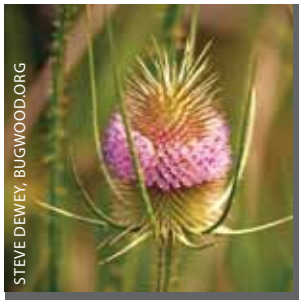
BIENNIAL THISTLES

BULL THISTLE (*Cirsium vulgare*)
MUSK THISTLE *(Carduus nutans)*
PLUMELESS THISTLE *(Carduus acanthoides)*


BRITT SLATTERY, BUGWOOD.ORG

Milestone® at 3 to 5 fl oz/A can be applied in spring and early summer from rosette to early flower growth stage. Use the 5 fluid ounce rate at the late bolt to early flower growth stage.

Additional Information: http://bit.ly/biennialthistle


STEVE DEWEY, BUGWOOD.ORG

TEASEL
(Dipsacus sylvestris)

The most cost effective treatment for teasel is the use of selective foliar applied herbicides. Milestone at 4 to 7 fl oz/A provides good to excellent control of teasel. Milestone herbicide should be applied in the spring and early summer to rosettes or bolting plants to stop seed production. The higher application rate of 5 or 7 fl oz/A is recommended for plants at the bolting growth stage.

Additional information: http://bit.ly/teasel2012

SPOTTED KNAPWEED
(Centaurea stoebe)


DOW AGROSCIENCES

Milestone at 5 to 7 fl oz product per acre may be applied any time during the growing season when plants are actively growing. Applications made during the late bud to bloom stage will not stop seed production the year of treatment.

Additional Information: http://bit.ly/spottedknapweed


CHRIS EVANS, BUGWOOD.ORG

CROWN VETCH
(Securigera varia [Coronilla varia])

Crown vetch is a deciduous, perennial forb that reproduces and spreads by both rhizomes and seed. Large infestations of crown vetch are best controlled with an integrated management approach. Milestone at 5 to 7 fl oz/A should be applied to crown vetch at the vegetative growth stage prior to bloom. The higher rate of 7 fl oz/A is recommended at later growth stages. Removal of top growth by pulling, mowing or burning followed by an herbicide application to regrowth may improve control. Follow-up herbicide application may be necessary to control seedlings emerging from the soil seed bank or older plants that survive treatment.

Additional information: http://bit.ly/crownvetch

WOODY PLANT CONTROL IN PRAIRIES


STEVE DEWEY, BUGWOOD.ORG

Managing invasive plants such as Siberian elm (*Ulmus pumila*), buckthorn (*Rhamnus cathartica*), honeysuckle (*Lonicera* spp.), locust (*Robinia* spp.), and other woody species is often difficult. Herbicide treatments alone or in combination with fire and mechanical methods, such as cutting and shredding, can provide cost effective removal of woody vegetation. Use of herbicides minimizes site disturbance compared to mechanical methods, and can be applied on a variety of sites often throughout the year.

For detailed information regarding foliar, basal, and cut surface herbicide applications on woody plants go to http://bit.ly/woodyplantcontrol

Active ingredients for herbicide products mentioned in this article: Milestone (aminopyralid).

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Lessons from the Islands: Online Exclusives

From the tropical rainforests of the East Maui Watershed to Eastern Island at Midway Atoll National Wildlife Refuge, three articles from the Pacific Islands tell stories of innovative strategies to control incipient invasive plant populations, successful restoration of nesting seabird habitat through invasive plant control, and studies to improve individual plant herbicide application techniques.

Read online about how the National Park Service, US Fish and Wildlife Service, and University of Hawai'i Cooperative Extension Service Invasive Weed Management Program are using innovative approaches to address unique challenges of tropical ecosystems.

Protecting Paradise Through Partnerships– Surveillance, Detection, and a New Application Technology Benefit Miconia Control Effort

http://bit.ly/miconia

CELESTINE DUNCAN

Successful Habitat Restoration at Eastern Island, Midway Atoll National Wildlife Refuge

http://bit.ly/easternisland

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COURTESY OF JAMES LEARY

Herbicide Incision Point Injection for Woody Plant Control Saves Time and Resources

http://bit.ly/pointinjection

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