Pest Management – Invasive Plant Control
Spotted Knapweed (*Centaurea maculosa*)

Conservation Practice Job Sheet ***MN-797***

Spotted Knapweed (Centaurea bierbersteinii)
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Spotted Knapweed
Spotted knapweed is native to Europe and Asia and was introduced to North America as a contaminant in alfalfa and possibly clover seed, and through discarded soil used as ship ballast, probably in the 1890's. It is now a serious problem in the rangelands of the Great Plains, and is reported to occur throughout Canada and in every state in the U.S. except Alaska, Georgia, Mississippi, Oklahoma and Texas. With a preference for dry, sandy soils, it is becoming a common weed of roadsides and pastures in Minnesota.

Habitat
Spotted knapweed is found at elevations up to and over 10,000 feet and in precipitation zones receiving from 8 to 80 inches of rain annually. It prefers well-drained, light-textured soils that receive summer rainfall, including open forests and prairie habitats. It is capable of invading well managed rangelands, but does not compete well with vigorously growing grass in moist areas.

Description
Spotted knapweed is a biennial or short-lived perennial. Its name is derived from the spots formed on the black margins of the flower bract tips. Spotted knapweed typically forms a basal rosette of leaves in its first year and flowers in sub-sequent years. It grows 2-4 feet tall with gray-green hairy foliage. The plant has a single, thistle-like pinkish purple flower that look similar to a Canada thistle flower and measures up to ¾ inch in diameter. It blooms from early July to early August. The slender, hairy stems grow in an erect and branched arrangement. Seeds are brownish in color, under ¼ inch in length, notched on one side of the base, and have a short tuft of bristles at the tip, enabling dispersal by wind, rodents, livestock or commercial hay. The stout taproot produces lateral shoots which form new rosettes near the parent plant.

Ecological Threat
Spotted knapweed infests a variety of natural and semi-natural habitats including fields, forests, prairies, meadows, pastures and rangelands. It makes and secretes chemicals into the soil that kill surrounding plants (allelopathy). In seasonally dry areas, spotted knapweed's taproot allows it to access water from deep in the soil, beyond the reach of more shallowly rooted species.

Plants generally live 3 to 7 years but can live up to nine years or longer. Plants regrow from buds on the root crown. Reproduction is by seed, and plants are capable of producing from 1,000 up to 20,000 seeds per plant per year. About 90% of the seeds are viable at the time of dispersal, and they can remain viable in the soil for 5 – 8 years. They germinate throughout the growing season. Knapweed tends to dominate sites at the expense of community diversity or forage production. It can also increase surface run-off and sedimentation. This plant is on the MDA **Secondary noxious weeds list** in Minnesota.

Control

The most cost effective management strategy for spotted knapweed is to prevent it from spreading to non-infested areas. The seeds can be easily hidden in hay and on vehicle undercarriages. Disbursement can be minimized by avoiding travel through infested areas; by cleaning footwear, clothing, vehicles and other items after traveling through infested areas; by not grazing livestock when ripe seeds are present; and by using weed free hay.

Mechanical or Manual Control:

The most effective control is early detection and removal of pioneering plants. Individual plants or small populations can be removed by digging or pulling, preferably prior to seed set. This is best done when the soil is moist. Because spotted knapweed can regrow from the base, the entire crown and taproot should be removed. Flowering plants can be bagged and removed from the site. Outlying plants should be controlled before main populations. Gloves should be worn because of the possibility of skin irritation.

Prescribed Burning

In some trials, knapweed has been reduced by hot prescribed burns. These can be followed by selective pulling and digging once the population has been decreased. Annual burns have reduced populations anywhere from five to ninety percent. Reductions seem to correlate to the intensity of the burn; burns that remove nearly all the duff are most effective. Burns must be done following a prescribed burn plan and NRCS practice standard 338, Prescribed Burning. Following a burn, reseed with native species.

Biological Control

A variety of natural enemies are used as biological control agents for large infestations of spotted knapweed. The goal of biological control is not to eradicate the weed, but to reduce the infestation to an acceptable level of control. In Minnesota the predominant biological control agents used include seedhead flies, seedhead weevils and root boring weevils. These three bioagents work in conjunction to control spotted knapweed. Seedhead flies are no longer actively collected and released in Minnesota because they are commonly recovered at infestations. Seedhead weevils and root boring weevils are collected from established sites and released at new sites. Many sites in Minnesota are considered controlled by biological control, using multiple bioagents in conjunction. However, this has proven a long term endeavor – control may take up to a decade for large sites. The Minnesota Department of Agriculture (MDA) is exploring methods to decrease the amount of time to achieve control. To start and maintain a spotted knapweed biological control program, consider the following steps:

1. Assess the site. If you have only a few plants, you should consider hand pulling or spraying the plants with an herbicide. Follow up over the next 3-4 years.
2. If you have more than a few plants, call your County Agricultural Inspector (CAI) or the MDA and explain that you are interested in using biocontrol. The CAIs have a well established network that coordinates with multiple agencies, including MDA, to ensure that bioagents are distributed where needed. There is no charge or cost to the landowner for the bioagents.
3. After bioagents are obtained, releasing them is simple. Take a photo of the site so you have an image to compare with several years following the bioagent release. Make a note of the release location or mark the spot with a stake, then open the container of insects and gently pour them onto the spotted knapweed plants. The insects will disperse on their own. Do not worry about touching the insects. They will not harm you.
4. It is unlikely that you will see immediate changes. It is important to monitor the site over the next few years to determine progress. The second summer after release, go back to the release site and look for bioagents. They can be difficult to find without a sweep net so don't be discouraged if you don't see any. In following years, you may begin to see a decrease in the amount of spotted knapweed. Again check for bioagents. If at this point you don't find any bioagents and see no decrease in the amount of spotted knapweed,

call your CAI or the MDA for advice. Augmenting the bioagent population may necessary in this case.

5. If you see spotted knapweed beginning to decrease, call your CAI or the MDA to report the progress. It is possible that your site has a collectible population of biocontrol agents. Bioagents can be collected and moved to a new location. Don't worry about depleting the bioagent population. Many will remain after the collection and will continue to eat away at the spotted knapweed.

Chemical Control

Control of spotted knapweed infestations using three chemical herbicides (2,4-D, clopyarlid, and picloram) has been reported but is problematic. Existing plants can be killed with 2,4-D but it needs to be reapplied yearly to control new plants germinating from seed.

Picloram is a more persistent herbicide and has controlled knapweed for three to five years when applied at 0.25 to o.5 lb/acre at any stage of plant growth. Picloram is a Restricted Use Pesticide in Minnesota, and may pose a risk of groundwater contamination where soils are permeable, particularly where the water table is shallow. It should not be used near water or on sandy soils with ground water ten feet or less below the surface.

Dicamba at 1-2 pounds (acid equivalent – see label) per acre also controls spotted knapweed, but may require annual follow-up treatment for a minimum of two years.

The selective herbicide clopyralid can be applied during bud growth in early June (48 oz per 100 gal of water) for best results. A mixture of 0.19 pounds of clopyralid per acre plus 2,4-D at 1 pound acid equivalent per acre is also an option; both herbicides provide good control of spotted knapweed with less soil residual than picloram or dicamba. Spotted knapweed that is still in the rosette stage can be controlled by applying a 2,4-D low volatile ester, oil soluble amine, or water soluble amine formulations at 2 pounds per acre. Annual spraying for several years may be required to deplete the seed bank.

Important Note

Mention of specific pesticide products in this document does not constitute an endorsement. These products are mentioned specifically in control literature used to create this document.

By law, herbicides may be applied only as per label instructions. Follow all label instructions when applying pesticides including "grazing and re-entry level restrictions" and application site restrictions (is the product labeled for "the application site" you are considering?).

Most of the products listed are not acutely toxic but have high potentials to move off-site via leaching or runoff under certain conditions. Off-site movement potential can be minimized by avoiding over-spraying or application to the point where products are reaching or dripping onto the ground.

Information and Recommendations compiled from:

Minnesota Department of Natural Resources web site:
http://www.dnr.state.mn.us/invasives/terrestrialplants/herbaceous/spottedknapweed.html

Minnesota Department of Agriculture web site:
http://www.mda.state.mn.us/weedcontrol/knapweed.htm
http://www.mda.state.mn.us/ipm/thicket/volume4no1/kwdatacollection.htm

Wisconsin Department of Natural Resources web site:
http://www.dnr.state.wi.us/invasives/fact/knapweed.htm
http://www.dnr.state.wi.us/org/caer/ce/eek/veg/plants/spottedknapweed.htm

National Park Service, Plant Conservation Alliance web site:
http://www.nps.gov/plants/alien/fact/cebi1.htm
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