Minnesota Noxious Weed Risk Assessment

Developed by the Minnesota Noxious Weed Advisory Committee

Assessment information

Common name: Meadow knapweed

Scientific name: *Centaurea* x *moncktonii* C.E. Britton [*jacea* x *nigra*] (synonyms: *C. pratensis* Thuill., and *C. debauxii* subsp. *thuilleri*)

Family name: Asteraceae

Current reviewer name and organizational affiliation: Laura Van Riper, Minnesota Department of Natural Resources
Date of current review: June 22, 2022
Previous reviewer name and organizational affiliation: Monika Chandler, Minnesota Department of Agriculture
Date of previous review: September 12, 2012

Species description

Photos

Photo caption: Meadow knapweed flowers in Koochiching County, Minnesota, showing the variability in phenotypes with some plants having longer bracts than others. Photo credit: Minnesota Department of Agriculture.

Photo caption: Meadow knapweed infestation in St. Louis County, Minnesota. Photo credit: Minnesota Department of Agriculture.

Why the plant is being assessed

- Meadow knapweed was listed as a Prohibited Eradicate Noxious Weed in 2013. It is being reassessed in 2022 to update distribution information and determine if there is additional new information that would affect its regulatory status.
- From the Minnesota Department of Agriculture meadow knapweed webpage (2022):
    - Meadow knapweed is native to Europe and is likely a fertile hybrid between black (*C. nigra* L.) and brown (*C. jacea* L.) knapweeds. It may have been introduced to western North America for forage, but it is not palatable and has low nutritional value. Meadow knapweed escaped cultivation and is proliferating rapidly in the Pacific Northwest. Few meadow knapweed populations have been detected in Minnesota so it would be advantageous to control these populations before they have an opportunity to spread.
    - Meadow knapweed can outcompete other plants in pastures, hayfields, meadows, riparian areas, forest margins, and rights-of-way. This can result in reduced forage, wildlife habitat, and species diversity. A similar weed species, spotted knapweed, is abundant and can hybridize with meadow knapweed if the species co-exist. Concerns about a resulting vigorous hybrid add to the rationale for meadow knapweed eradication in Minnesota.

Identification, biology, and life cycle

From the Minnesota Department of Agriculture meadow knapweed webpage (2022):

- Identification
    - Meadow knapweed has multiple upright, reddish stems with vertical ridges that are 20-40” tall.

  - Single flowers, mostly pink/purple but occasionally white, are at the ends of branches and are approximately ¾” in diameter. Flowering occurs mid-summer until fall, followed by the production of white to light brown seeds with short plumes.
  - Leaves are lance-shaped and pubescent, occasionally with wavy margins or lobed. Basal leaves grow 4-9” long. Seedlings are tap-rooted and mature plants develop a cluster of roots below the crown.
  - Spotted knapweed (*C. stoebe* L. ssp. *micranthos*) is a similar species that is common in Minnesota. The two knapweed species are easily distinguished by the leaf shape and color. Spotted knapweed leaves are grey-green and are more deeply lobed.
- Biology and life cycle
  - Meadow knapweed is a perennial. Seed is the predominant means of reproduction although meadow knapweed can also be propagated by root crown fragments. Seed can be dispersed by wind, water, vehicles, and with hay.
  - Meadow knapweed prefers sunny and wet conditions such as wet meadows, hayfields, pastures, riparian areas, roadsides, and forest openings.

Monika Chandler (Minnesota Department of Agriculture) noted that meadow knapweed identification based upon visual characteristics is challenging and that there are specimens that may be meadow other knapweed species, or other hybrids or back crosses but identification is not clear (personal communication 2022).

Current distribution

According to USDA Plants (2022), meadow knapweed is reported in British Columbia, Ontario, Quebec, New York, Massachusetts, Connecticut, and North Carolina. According to EDDMapS (2022), meadow knapweed is reported in Washington, Oregon, California, Idaho, Montana, Colorado, Nebraska, Minnesota, Wisconsin, Michigan, and New York. EDDMapS (2022) has 435 reports of meadow knapweed in Minnesota. Within Minnesota, reports are mainly from northern Minnesota (Norman, Becker, Clearwater, Koochiching, St. Louis, Lake, and Pine counties) with one report in Dakota county.

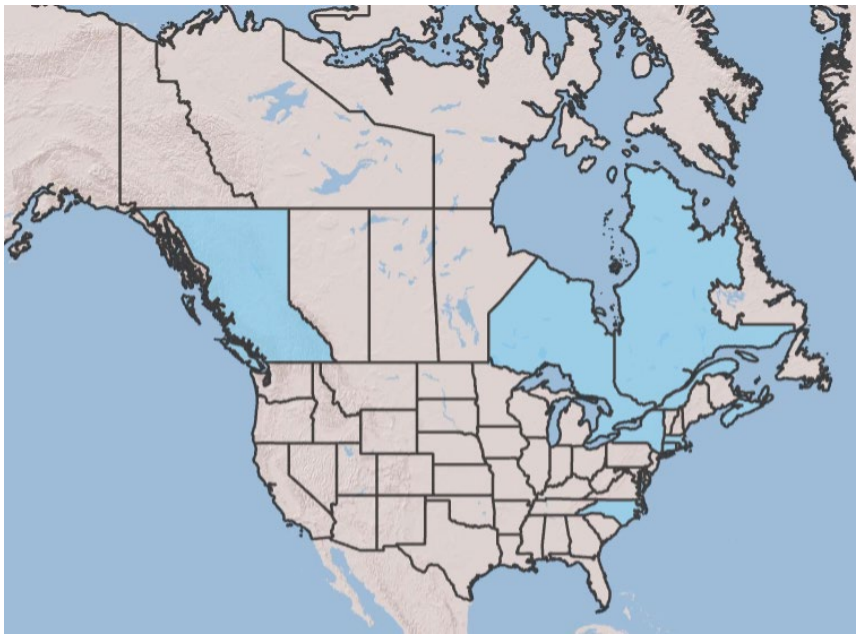

Figure caption: National level meadow knapweed map from USDA Plants. Meadow knapweed is reported in British Columbia, Ontario, Quebec, New York, Massachusetts, Connecticut, and North Carolina. Accessed January 18, 2022.

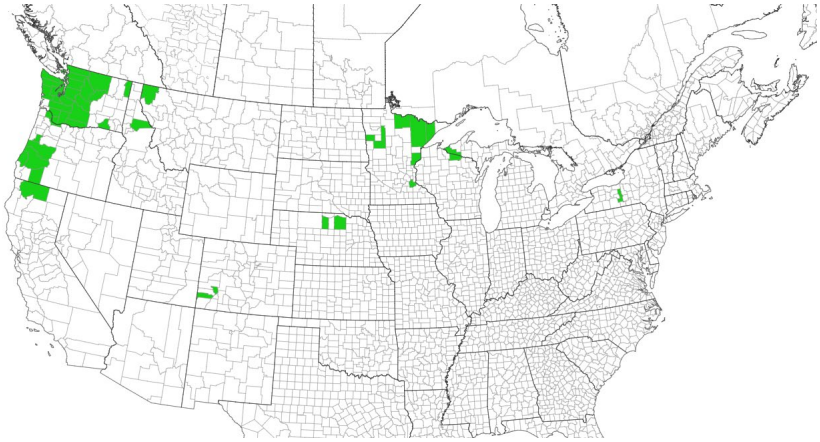

Figure caption: National level meadow knapweed map by county from EDDMapS. Meadow knapweed is reported in Washington, Oregon, California, Idaho, Montana, Colorado, Nebraska, Minnesota, Wisconsin, Michigan, and New York. Accessed January 18, 2022.

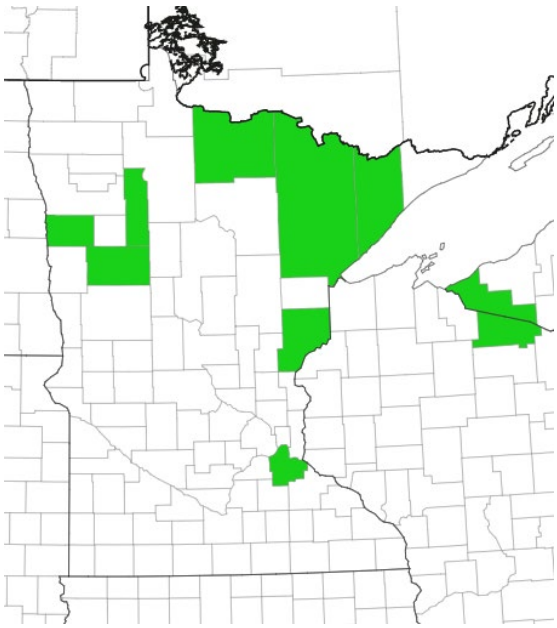

Figure caption: County level map of meadow knapweed in Minnesota from EDDMapS. Meadow knapweed reports are mainly from northern Minnesota (Norman, Becker, Clearwater, Koochiching, St. Louis, Lake, and Pine counties) with one report in Dakota county. Accessed January 18, 2022.

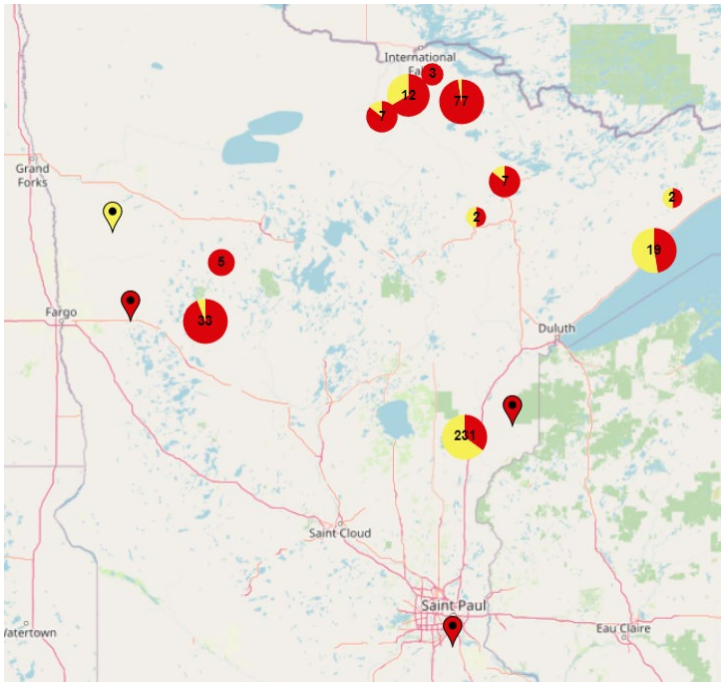

Figure caption: Point level map of meadow knapweed in Minnesota from EDDMapS. Red indicates a report of meadow knapweed that has not been marked as treated. Yellow indicates a meadow knapweed report that has been marked as treated. Accessed January 18, 2022.

Current regulation

Meadow knapweed has been regulated in Minnesota as a Prohibited Eradicate Noxious Weed since 2013. A 2022 search of National Plant Board records gave this list of five states in addition to Minnesota: California (noxious weed), Colorado (List A noxious weed), Idaho (Control), Oregon (B designated weed), and Washington (Class B noxious weed).

Four knapweed species are regulated in Minnesota. Meadow knapweed, diffuse knapweed (*Centaurea diffusa* L.), and brown knapweed (*Centaurea jacea* L.) are regulated as Prohibited Eradicate Noxious Weeds. Spotted knapweed (*Centaurea stoebe* L. ssp. *micranthos* (Gugler) Hayek) is regulated as a Prohibited Control Noxious Weed.

Risk assessment

Box 1:

Is the plant species or genotype non-native?

Answer: Yes.
Outcome: Go to Box 3.
Meadow knapweed and its parent species are not native to North America. Roché and Susanna (2010) explain that meadow knapweed (*Centaurea x moncktonii*) "is a frequent and fully fertile hybrid between *C. nigra* and *C. jacea*. *Centaurea nigra* is native to the British Isles, with hybrids being common when *C. jacea* was introduced from the European Continent." They also note that because "the F1 hybrid can back-cross with either parent and

with other F1 individuals, hybrid swarms normally completely replace the pure forms. Both the parent species and the hybrid are common in Eurasia, becoming rare to the East."

Records indicate that *C. nigra* (black knapweed) and *C. jacea* (brown knapweed) were introduced to North America in the 1800s, likely from ship ballast from Europe as well as for forage crops and ornamentals (Milbrath and Biazzo 2020). It is possible that meadow knapweed could have arrived in these ways as well. Based on distribution studies, it is likely that meadow knapweed was introduced, via ship ballast or intentional planting, directly to the Pacific Northwest in the early 1900s, as opposed to hybridizing from the parent species, as the parent species did not widely overlap in that area (Roché and Roché 1991). While some meadow knapweed may have been introduced in the Pacific Northwest as forage, its palatability was considered variable with some pastures left idle after meadow knapweed become dominant while other pastures had "closely cropped" meadow knapweed plants (Roché and Roché 1991).

Box 2:

Does the species pose significant human or livestock concerns or have the potential to significantly harm agricultural production?

Question 2A: Does the plant have toxic qualities that pose a significant risk to livestock, wildlife, or people?

Outcome: Decision tree does not direct to this question.

Question 2B: Does the plant cause significant financial losses associated with decreased yields, reduced quality, or increased production costs?

Outcome: Decision tree does not direct to this question.

Box 3:

Is the species, or a related species, documented as being a problem elsewhere?

Answer: Yes.
Outcome: Go to Box 6.
Meadow knapweed is regulated in California (noxious weed), Colorado (List A noxious weed), Idaho (Control), Oregon (B designated weed), and Washington (Class B noxious weed).

Box 4:

Are the species' life history and growth requirements understood?

Outcome: Decision tree does not direct to this question.

Box 5:

Gather and evaluate further information

Outcome: Decision tree does not direct to this question.

Box 6:

Does the species have the capacity to establish and survive in Minnesota?

Question 6A: Is the plant, or a close relative, currently established in Minnesota?

Answer: Yes.
Outcome: Go to Box 7.

Meadow knapweed has been documented in eight counties in Minnesota (EDDMapS 2022).

Question 6B: Has the plant become established in areas having a climate and growing conditions similar to those found in Minnesota?
Outcome: Decision tree does not direct to this question.

Question 6C: Has the plant become established in areas having a climate and growing conditions similar to those projected to be present in Minnesota under future climate projections?
Outcome: Decision tree does not direct to this question.

Box 7:

Does the species have the potential to reproduce and spread in Minnesota?

Question 7A: Are there cultivars of the plant that are known to differ in reproductive properties from the species?
Answer: No.
Outcome: Go to Question 7B.
No evidence was found for this.

Question 7B: Does the plant reproduce by asexual/vegetative means?
Answer: No. (If so, minimally)
Outcome: Go to Question 7D.
Reproduction is predominately by seed. There are conflicting reports on vegetative reproduction. Wilson and Randall (2005) does not include reference to asexual reproduction and only references seeds. A 2003 version of the Wilson and Randall document was cited in the 2012 meadow knapweed risk assessment as stating that there was reproduction from root crown fragments, but that document could no longer be accessed. A 2017 US Forest Service document (US Forest Service 2017) states that meadow knapweed can reproduce by seed and via root or crown fragments. No other references were found with that information. Informational webpages such as CABI (2022) only include references to seed reproduction. If plant parts are moved by human-mediated means it could spread the plants to new areas.

The 2015 version of the Wilson and Randall documents (Winston et al. 2015) states: “Unlike other knapweed species, meadow knapweed grows in moist sites, including irrigated pastures, meadows, river banks, streams, irrigation ditches, and forest openings. It spreads only by seeds, which can be dispersed by water, in hay, or on vehicles. Seeds can remain viable in the soil for many years. Germination occurs primarily in spring and autumn when soil moisture is sufficient.”

Question 7C: Are the asexual propagules - vegetative parts having the capacity to develop into new plants - effectively dispersed to new areas?
Outcome: Decision tree does not direct to this question.

Question 7D: Does the plant produce large amounts of viable, cold hardy seeds? For woody species, document the average age the species produces viable seed.
Answer: Yes.
Outcome: Go to Question 7G.

DiTomasso et al. (2021) found that "*C. × moncktonii* germinated under a broad range of temperature, light, seed stratification, and scarification treatments. However, the treatments had significant impacts on germination rates, which were maximized under warm temperatures and light following wet-cold stratification." DiTomasso et al. (2021) noted that they "evaluated the effects of temperature, light, seed stratification, scarification, and population on percent germination in four experiments over 2 yr. Percent germination ranged from 3% to 100% across treatment combinations".

In New York, Milbrath and Biazzo (2020) found that meadow knapweed averaged 1,521 or more seeds per plant for most years and that 36–94% of meadow knapweed seeds germinated. Meadow knapweed viable seed densities ranged from 947 viable seeds/m^2 to 5,826 viable seeds/m^2 among four study sites (Milbrath and Biazza 2020).

Question 7E: For species that produce low numbers of viable seeds, do they have a high level of seed/seedling vigor or remain viable for an extended period (seed bank)?

Outcome: Decision tree does not direct to this question.

Question 7F: Is the plant self-fertile?

Answer: No. ***This information is supplemental and is not part of the flow chart pathway for this risk assessment.***
Parent plant *C. jacea* is self-incompatible (Hardy et al. 2001). DiTomasso et al. (2021) note that meadow knapweed is self-incompatible like both of its parent plants.

Question 7G: Are sexual propagules – viable seeds – effectively dispersed to new areas? List and consider all vectors.

Answer: Yes.
Outcome: Go to Question 7I.
Seed can be dispersed by wind, water, vehicles, and with hay (Minnesota Department of Agriculture 2022). Roché and Roché (1991) specifically call out water and contaminated vehicles as dominant sources of spread in the northwestern United States.

Question 7H: Can the species hybridize with native species (or other introduced species) and produce viable seed and fertile offspring in the absence of human intervention?

Answer: Yes. ***This information is supplemental and is not part of the flow chart pathway for this risk assessment.***
The knapweeds (*Centaurea* species) are known to hybridize and backcross extensively (Blair and Haufbauer 2010, Lachmuth et al. 2019).

Question 7I: Do natural controls, species native to Minnesota, which have been documented to effectively prevent the spread of the species in question?

Answer: No.
Outcome: Go to Box 8 (no)
No information was found on species native to Minnesota that control meadow knapweed. There are biological control insects that have been introduced to the United States that feed on the seedheads of meadow knapweed and other knapweed species (Wilson and Randall 2005). Species include the fly *Urophora quadrifasciata*, the moth *Metzneria paucipunctella*, and the beetles *Larinus minutus*, *Larinus obtusus*, and

Bangasternus fausti (Wilson and Randall 2005). There are no introduced root boring biocontrol insects for meadow knapweed (Wilson and Randall 2005).

Some introduced biological control insects have been found in Minnesota. Appendix A has a photo of an introduced *Larinus* species on a meadow knapweed flower in Pine County, Minnesota. Monika Chandler from the Minnesota Department of Agriculture (personal communication 2022) has found that a *Larinus* species (probably *L. minutus*) flocks to meadow knapweed flowers but does not appear to control meadow knapweed plants alone. No one has surveyed for *Urophora quadrifasciata* on meadow knapweed in Minnesota, but this genus is unlikely to control meadow knapweed. *Metzneria paucipunctella* and *Bangasternus fausti* have not been documented to establish in Minnesota. She notes that without a root biocontrol agent, it is doubtful that the seedhead feeders on their own would be effective control.

Question 7J: Was the answer to Question 7A (Are there cultivars that differ in reproductive properties from the original species) "Yes"?

Answer:
Outcome: Decision tree does not direct to this question.

Box 8:

Does the species pose significant human or livestock concerns or have the potential to significantly harm agricultural production, native ecosystems, or managed landscapes?

Question 8A: Does the plant have toxic qualities, or other detrimental qualities, that pose a significant risk to livestock, wildlife, or people?

Answer: No.
Outcome: Go to Question 8B.
Meadow knapweed is not as palatable to cattle as other species so it can decrease forage production (Roché and Roché 1991) but it is not considered toxic. While knapweeds can be a skin irritant and people should wear gloves and cover their skin when working with them, knapweeds are not considered a serious human health threat. No specific information was found relating to meadow knapweed as a skin irritant.

Question 8B: Does, or could, the plant cause significant financial losses associated with decreased yields, reduced crop quality, or increased production costs?

Answer: Yes.
Outcome: Go to Box 9.
Meadow knapweed is not as palatable to cattle as other species so it can decrease forage production (Roché and Roché 1991). Knapweed species are widely managed across the United States to reduce their impacts to rangelands, pastures, and fields (Wilson and Randall 2005).

The various species of knapweeds can vary in their ideal habitats and hybridize with each other (Roché and Roché 1991). Roché and Susanna (2010) documented a new hybrid *Centaurea x kleinii* that was formed in North America with meadow knapweed and yellow star thistle (*C. solstitialis*) as the parent plants. Meadow knapweed and yellow starthistle do not overlap in their native ranges in Eurasia, but they were brought together in North America and produced a new hybrid. A concern of having multiple knapweed species widely distributed in Minnesota is that they may hybridize with each other and share traits that may either expand the conditions in which they are invasive or increase their competitiveness and densities.

Question 8C: Can the plant aggressively displace native species through competition (including allelopathic effects)?

Answer: Yes. ***This information is supplemental and is not part of the flow chart pathway for this risk assessment.***

At four sites in New York, meadow knapweed flowering stems ranged from 17 flowering stems/m^2 to 63 flowering stems/m^2 (Milbrath and Biazza 2020). Roché and Roché (1991) noted concerns about meadow knapweed's impact in native communities such as riparian areas and disturbed forests.

The CABI datasheet (2022) states that meadow knapweed "does not have significant impact on wider ecosystem processes, it can form very large stands, particularly in wet meadows, outcompeting some native flora."

Other knapweed species, such as spotted knapweed, have been found to have strong allelopathic effects (Ridenour and Callaway 2001), but no studies on meadow knapweed and allelopathy were found.

Question 8D: Can the plant hybridize with native species resulting in a modified gene pool and potentially negative impacts on native populations?

Answer: No. ***This information is supplemental and is not part of the flow chart pathway for this risk assessment.***

No information was found about meadow knapweed hybridizing with native species. The main concern is that it could hybridize with other invasive species.

Question 8E: Does the plant have the potential to change native ecosystems (adds a vegetative layer, affects ground or surface water levels, etc.)?

Answer: No. ***This information is supplemental and is not part of the flow chart pathway for this risk assessment.***

The CABI datasheet (2022) states that meadow knapweed "does not have significant impact on wider ecosystem processes, it can form very large stands, particularly in wet meadows, outcompeting some native flora."

Question 8F: Does the plant have the potential to introduce or harbor another pest or serve as an alternate host?

Answer: No. ***This information is supplemental and is not part of the flow chart pathway for this risk assessment.***

No information was found indicating that meadow knapweed harbors other pests or serves as an alternate host.

Box 9:

Does the species have clearly defined benefits that outweigh associated negative impacts?

Question 9A: Is the plant currently being used or produced and/or sold in Minnesota or native to Minnesota?

Answer: No.

Outcome: Go to Box 10.

Meadow knapweed is not native to Minnesota. Meadow knapweed was not being sold in Minnesota at the time of the original 2012 risk assessment. Meadow knapweed has been illegal to produce and sell in Minnesota since it was listed as Prohibited Eradicate Noxious Weed in 2013.

Question 9B: Is the plant an introduced species and can its spread be effectively and easily prevented or controlled, or its negative impacts minimized, through carefully designed and executed management practices?
Outcome: Decision tree does not direct to this question.

Question 9C: Is the plant native to Minnesota?
Outcome: Decision tree does not direct to this question.

Question 9D: Is a non-invasive, alternative plant material or cultivar commercially available that could serve the same purpose as the plant of concern?
Outcome: Decision tree does not direct to this question.

Question 9E: Does the plant benefit Minnesota to a greater extent than the negative impacts identified at Box #8?
Outcome: Decision tree does not direct to this question.

Box 10:

Should the species be regulated as Prohibited/Eradicate, Prohibited/Control, or Restricted Noxious Weed?

Question 10A: Is the plant currently established in Minnesota?
Answer: Yes.
Outcome: Go to Question 10D.
Meadow knapweed populations are reported in Minnesota in eight counties (Norman, Becker, Clearwater, Koochiching, St. Louis, Lake, Pine, and Dakota) as of January 2022 (EDDMapS 2022).

Question 10B: Would prohibiting this species in trade prevent the likelihood of introduction and/or establishment?
Outcome: Decision tree does not direct to this question.

Question 10C: Does this risk assessment support this species being a top priority for statewide eradication if found in the state?
Outcome: Decision tree does not direct to this question.

Question 10D: Does the plant pose a serious human health threat?
Answer: No.
Outcome: Go to Question 10F.
While knapweeds can be a skin irritant and people should wear gloves and cover their skin when working with them, knapweeds are not considered a serious human health threat.

Question 10E: Is the health threat posed by the plant serious enough, and is the plant distribution sufficiently small enough to be manageable, and are management tools available and effective enough to justify listing as Prohibited / Eradicate species?

Outcome: Decision tree does not direct to this question.

Question 10F: Is the plant known to cause significant ecological or economic harm and can the plant be reliably eradicated (entire plant) on a statewide basis using existing practices and available resources considering the distribution, reproductive biology and potential for spread?

- *For distribution, note if the distribution is well documented, the number and acreage of known infestations and how widespread they are in the state. Note if there are infestations in border areas.*
- *For reproductive biology, note if there are reproductive biology factor that make the plant easier to control and eradication more likely (for example, long pre-reproductive period, self-incompatible pollination, short-lived seed bank).*
- *For potential for spread and re-invasion of controlled areas, note its potential to spread beyond places where it is being controlled such as deliberate planting by people, wildlife vectors, re-infestation from border states, or other factors that facilitate spread.*
- *For known management tools, note what management tools are available, potential non-target impacts, and the reasonableness of state management or mandating that landowners throughout the state use the management tools to eradicate or control existing plants.*
- *For available resources, consider the capacity of state and local personnel and availability of funding to respond to new and existing infestations.*

Answer: No.
Outcome: Question 10G

Distribution: At the time meadow knapweed was first assessed in 2012, the only known meadow knapweed populations were in St. Louis and Koochiching Counties. In 2022, there were 435 reports of meadow knapweed spread across eight counties (EDDMapS 2022). The EDDMapS reports comprise 338 acres in Minnesota (EDDMapS.org query 7 February 2022). For comparison, there are 85,031 acres of spotted knapweed in Minnesota in EDDMapS (EDDMapS.org query 7 February 2022).

Reproductive biology: There are no reproductive factors that make the plant easier to control or eradicate. Due to the ability of knapweed species to hybridize, identification can be challenging.

Potential for spread and reinvasion: Re-invasion of eradicated areas is likely fairly small as it is not a plant that gets deliberately planted and doesn't have strong wildlife vectors. Wind/water or accidental movement with contaminated equipment or materials are likely main vectors of spread. The plant is fairly rare in bordering states.

Known management tools: Miller and Lucero (2014) found that: "In the summer following treatment, clopyralid alone or with 2,4-D, dicamba + 2,4-D, and triclopyr ester + 2,4-D ester provided 81 to 100% meadow knapweed control; the only other treatment providing similar control was glyphosate + ammonium sulfate applied at bolting and in autumn in the 2004 to 2005 trial." Additionally, they found that: "In the 2002 to 2003 trial, control when dicamba + 2,4-D was used exceeded 90%, except when meadow knapweed was mowed at rosette and sprayed at early flowering (78% control). Mowing twice the previous year had only a slight effect on meadow knapweed (10% control). Grass biomass exceeded meadow knapweed biomass in all herbicide-treated plots. In

the 2004 to 2005 trial, meadow knapweed control and grass biomass was maximized when plots were mowed at rosette and treated with dicamba + 2,4-D at early flowering or when treated twice with these herbicides; these were the only treatments where grass biomass exceeded meadow knapweed biomass."

The Minnesota Department of Transportation noxious weed guide (2020) lists these management methods for all the knapweed species regulated in Minnesota:

- Hand pulling or digging while time consuming can be an effective step when coupled with chemical treatments. Preferably, propagating plant parts should be disposed of onsite or when necessary contained (e.g., bagged) and removed to an approved facility. For more information on these disposal options, please read MDA's guide on removal and disposal.
- Repeated mowing or cutting can reduce seed production, but sites must be monitored and applications likely repeated or followed up with herbicide treatments.
- Prescribed fire can be used to encourage stands of native grasses that will compete with knapweeds. However, monitoring is needed to check for knapweed germination in bare soil soon after burns are completed.
- Herbicide foliar applications with formulations including aminopyralid, clopyralid, or picloram have proven effective in controlling knapweeds.

For eradication, hand removal and herbicides are the methods most targeted to killing plants as opposed to mowing or fire which are more seed suppression techniques. There are introduced biological control insects that feed on the seed heads of meadow knapweed and other knapweed species (Wilson and Randall 2005). Species include the fly *Urophora quadrifasciata*, the moth *Metzneria paucipunctella*, and the beetles *Larinus minutus*, *Larinus obtusus*, and *Bangasternus fausti* (Wilson and Randall 2005). Since all of the meadow knapweed biocontrol insects are seed feeders, they are unlikely to provide strong control on their own. Biocontrol is not an eradication tool, but it is a control tool.

Available resources: Resources for invasive plant management have been perennially low.

Overall, as agency staff and NWAC members have learned more about meadow knapweed identification, distribution, management, and impacts, it looks to be more appropriate to manage meadow knapweed in the same category as spotted knapweed – Prohibited Control.

Question 10G: Is the plant known to cause significant ecological or economic harm and can the plant be reliably <u>controlled</u> to limit spread on a statewide basis using existing practices and available resources? Would the economic impacts or other hardships incurred in implementing control measures be reasonable considering any ongoing or potential future increase of ecological or economic harm?

- *Also consider all bullet points listed under 10F when evaluating 10G*

Answer: Yes.
Outcome: LIST THE PLANT AS A PROHIBITED / CONTROL NOXIOUS WEED

Distribution: At the time meadow knapweed was first assessed in 2012, the only known meadow knapweed populations were in St. Louis and Koochiching Counties. In 2022, there were 435 reports of meadow knapweed spread across eight counties (EDDMapS 2022). The EDDMapS reports comprise 338 acres in Minnesota (EDDMapS.org query 7 February 2022). For comparison, there are 85,031 acres of spotted knapweed in Minnesota in EDDMapS (EDDMapS.org query 7 February 2022).

Reproductive biology: There are no reproductive factors that make the plant easier to control or eradicate. Due to the ability of knapweed species to hybridize, identification can be challenging.

Potential for spread and reinvasion: Re-invasion of eradicated areas is likely fairly small as it is not a plant that gets deliberately planted and doesn't have strong wildlife vectors. Wind/water or accidental movement with contaminated equipment or materials are likely main vectors of spread. The plant is fairly rare in bordering states.

Known management tools: See answer in 10F for details. Hand pulling, mowing, fire, and herbicides are all tools for controlling meadow knapweed. Biological control insects may also reduce seed spread.

Available resources: Resources for invasive plant management have been perennially low.

Overall, as agency staff and NWAC members have learned more about meadow knapweed identification, distribution, management, and impacts, it looks to be more appropriate to manage meadow knapweed in the same category as spotted knapweed – Prohibited Control.

Question 10H: Would prohibiting this species in trade have any significant or measurable impact to limit or reduce the existing populations or future spread of the species in Minnesota?
Answer:
Outcome: Decision tree does not direct to this question.

Question 10I: Are there any other measures that could be put in place as Special Regulations which could mitigate the impact of the species within Minnesota?
Answer:
Outcome: Decision tree does not direct to this question.

Box 11:

The species is being proposed to be designated as a Specially Regulated Plant. What are the specific regulations proposed?

Answer: Decision tree does not direct to this question.

Final outcomes of risk assessment (2022)

NWAC Listing Subcommittee

Outcome: Change designation from Prohibited Eradicate to Prohibited Control. (06/17/2022)
Comments: The Listing Subcommittee agreed on this outcome. The Listing Subcommittee recommends that brown knapweed (*Centaurea jacea* L.) should be reassessed the next time currently listed species are up for reassessment (2025). The Listing Subcommittee discussed two future research needs: 1- research on the varying levels of threat of different *Centaurea* species and 2 - research into whether invasive *Centaurea* species are hybridizing with ornamental *Centaurea* species.

NWAC Full Committee

Outcome: Change designation from Prohibited Eradicate to Prohibited Control. (12/13/2022)
Comments: The vote was 18 in favor and 0 against.

MDA Commissioner

Outcome: Change designation from Prohibited Eradicate to Prohibited Control.
Comments: No comments

Risk Assessment Current Summary (06-07-2022)

- Meadow knapweed is not as palatable to cattle as other species so it can decrease forage production (Roché and Roché 1991). Knapweed species are widely managed across the United States to reduce their impacts to rangelands, pastures, and fields (Wilson and Randall 2005).
- The various species of knapweeds can vary in their ideal habitats and hybridize with each other (Roché and Roché 1991). A concern of having multiple knapweed species widely distributed in Minnesota is that they may hybridize with each other and share traits that may either expand the conditions in which they are invasive or increase their competitiveness and densities.
- At the time meadow knapweed was first assessed in 2012, the only known meadow knapweed populations were in St. Louis and Koochiching Counties. In 2022, there were 435 reports of meadow knapweed spread across eight counties (EDDMapS 2022).
- There are effective management tools and strategies for meadow knapweed. These are generally the same herbicide, mowing, and fire options that are used with spotted knapweed.
- Meadow knapweed and other knapweed species and knapweed hybrids can be challenging to distinguish from one another.
- It is likely most appropriate at this time to move meadow knapweed from a Prohibited Eradicate Noxious Weed to a Prohibited Control Noxious Weed and treat it similarly to spotted knapweed.

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Appendix A – Biological Control Insect

Photo caption: An introduced biological control insect (*Larinus* species) on a meadow knapweed flower in Pine County, Minnesota. Photo credit: Minnesota Department of Agriculture