

M e a d o w K n a p w e e d

Centaurea jacea x nigra

(synonyms: *Centaurea x moncktonii*,
Centaurea debeauxii subsp. *thuillieri*)

Asteraceae

Class B Noxious Weed Control Required

Legal Status in King County: Meadow knapweed is a Class B Noxious Weed (non-native species harmful to environmental and economic resources that landowners may be required to control based on distribution in the county and local priorities) according to Washington State Noxious Weed Law, RCW 17.10. In accordance with state law, the King County Noxious Weed Control Board requires property owners to control meadow knapweed on private and public lands throughout the county (control means to prevent all seed production and to prevent the dispersal of all propagative parts capable of forming new plants). In addition, state quarantine laws prohibit transporting, buying, selling, or distributing plants, plant parts or seeds of meadow knapweed.



Photo by Cindy Roche

BACKGROUND INFORMATION

Impacts and History

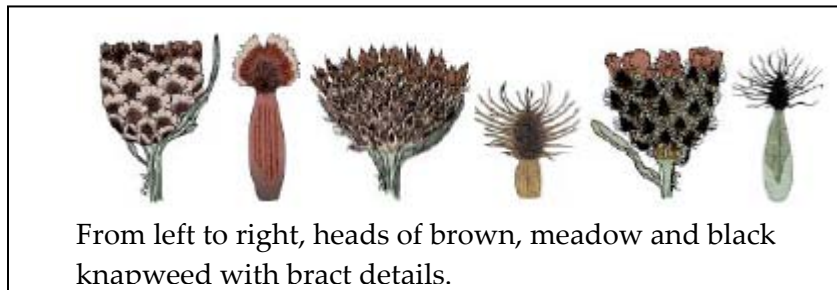
- Meadow knapweed is a fertile hybrid between black (*C. nigra*) and brown (*C. jacea*) knapweeds, European natives that have been grown as crop or garden plants.
- Brown knapweed was introduced into North America as a forage crop. Brown knapweed was grown as a hay or forage crop (known as bull clover) and as a pollen source for honeybees.
- Black knapweed, probably introduced in ship ballast or as an ornamental, spread as a weed, and was found in Pullman, Washington, in 1895, and near Portland in 1902.
- Meadow knapweed was first reported in the Pacific Northwest in Multnomah and Lane counties, Oregon, between 1910 and 1920, and was grown as a forage crop in Oregon as late as 1959.
- Meadow knapweed is leafier and more palatable than other knapweeds, but is low value forage and aggressively displaces other forage crops.
- Meadow knapweed invades native plant communities and it can disrupt wildlife habitat and wetlands by displacing native plant species.



- Large infestations are now found in western Washington in Clark, Whatcom, Pierce, and Thurston counties, and east of the Cascade Mountains in Kittitas, Klickitat, and Skamania counties. Localized infestations are also present in other counties including King County.

Description

- **Plant:** Meadow knapweed is a perennial that grows from a woody crown. Seedlings are tap rooted; mature plants develop a cluster of roots below the woody crown. The upright stems, mostly 20 to 40 inches (50-100cm) tall, are many-branched and tipped by a solitary flower head up to 1 inch wide.
- **Leaves:** Basal leaves are lance-shaped, up to 6 inches long, 1 1/2 inches wide, slightly pubescent, and may be pinnately cut or have wavy margins, occasionally lobed. Stem leaves usually don't have a petiole and are much smaller.
- **Flowers:** Rose-purple (occasionally white) flowers are borne in heads about the size of a nickel that are more rounded than other knapweeds. The light to dark brown bracts which surround the flower head bear a papery fringed margin. At flowering, the bracts reflect a metallic golden sheen. Flowering in western Washington is typically from mid-June to August but can continue into November and December.
- **Seeds:** Seeds are about 1/8 inch long, ivory-white to light brown, sometimes bearing a row of short hairs opposite the point of attachment.



Habitat

- Meadow knapweed invades moist sites, including pastures and moist meadows, river banks, streams, irrigation ditches, and openings in forested areas.
- Meadow knapweed can spread along heavily disturbed areas such as road ditches, agricultural field margins, railroad beds, pipelines, and recently installed utility lines. The plant will spread from these sites into pastures, meadows and other open habitats. Knapweed normally flourishes in full sun, but can tolerate some shade.

Reproduction and Spread

- Meadow knapweed reproduces mostly by seed. Root and root crowns can reestablish when fragmented and dispersed by cultivation or construction equipment.
- Meadow knapweed seeds are carried in rivers, streams, or irrigation water, in farm equipment and hay or by vehicles along roadsides. Wildlife and birds will also spread knapweed.

- Brown and black knapweeds are considered ornamentals and seeds are available in flower seed catalogs.

Local Distribution

Meadow knapweed is found in pastures and road rights-of-way in rural, eastern King county. It is also found in developed areas as a weed on unmanaged or vacant open spaces.

CONTROL INFORMATION

Integrated Pest Management

- The preferred approach for weed control is Integrated Pest Management (IPM). IPM involves selecting from a range of manual, mechanical, chemical, cultural and biological control methods to match the management requirements of a specific site. The goal is to maximize effective control and to minimize negative environmental, economic and social impacts.
- IPM means using an adaptive approach. Control methods should reflect the available time, funding, and labor of the participants, the land use goals, and the values of the community and landowners. Management will require dedication over a number of years, and allow for flexibility of methods used as appropriate to the current situation.

Planning Considerations

- Learn to identify the weed and survey the area for weeds.
- For larger infestations, the strategy will depend on the land use of the site. Set long term management goals and select the best control methods for the site conditions and regulatory compliance issues (**refer to the King County Noxious Weed Regulatory Guidelines**).
- Persistence is necessary. Plan to revisit the site to control plants that have survived initial control efforts.
- Control practices in critical areas should be selected to minimize soil disturbance or efforts should be taken to mitigate or reduce impacts of disturbance. Any disturbed areas need to be stabilized to control erosion and sediment deposition. Refer to the King County Surface Design Manual for further information about sediment and erosion control practices (call 206-296-6519 or go to <http://kingcounty.gov/wlr/Dss/Manual.htm> for more information). Minimizing disturbance also avoids creating more opportunities for germination of weed seeds.
- Generally work first in least infested areas, moving towards more heavily infested areas.
- Properly dispose of all parts of the plant (see Disposal Methods section below).
- Whenever possible, control should be done before plants are flowering to prevent seed production.

Early Detection and Prevention

- Prevention is the key to weed control. Watch for knapweed near known infestations.

- Knapweed is easiest to find once it flowers in **July**. Monitor roadsides, waste and disturbed areas, pastures, rangeland, and trails for new infestations.
- Small infestations and individual plants can be effectively hand-pulled or dug up. Uprooting one plant can prevent thousands of new seedlings.
- If there are more plants than you can remove manually, treat them with an appropriate herbicide.
- Prevent plants from spreading away from existing populations by washing tools and boots and clean vehicles and animals that have been in infested areas.
- Clean mowing equipment carefully before moving to un-infested areas.
- If animals are being moved from an infested pasture to an un-infested pasture, it is best to hold them for at least five days so that the seeds pass out of the animals' digestive system.
- Off-road vehicles create disturbances and carry weeds. Clean off-road equipment and avoid driving in infested areas.
- Communicate weed control needs and goals with neighbors and persons working in infested areas. Awareness will increase prevention.

Manual

- Established meadow knapweed plants have a large root that is hard to pull. Dig out plants and as much root as possible before they flower. Completely removing plants is easiest when the soil is loose or wet.
- Plants in flower may form viable seeds even after they are pulled, so carefully bag and dispose of all flowering plants.
- Cutting and bagging flower heads can buy time for more effective control.
- Return to the same location in the following spring and summer to remove plants coming up from seeds already in the soil or growing from root fragments and continue to monitor the area for several years.

Mechanical

- Roto-tilling or plowing will eliminate knapweed. Cultivating with a disk will control young plants and seedlings, but established plants can survive if the root or root fragments remain.
- Mowing will **not** control knapweed effectively. Plants are able to re-sprout and flower again in the same season when mowed. Plants that are regularly mowed will persist for years and can often flower and produce seed below the level of the mower.

Cultural

- In pastures, good grazing practices and management of grass and forage species will greatly improve control of knapweed. Seeding desirable species in any area will help prevent weed infestations.
- Minimize disturbance and revegetate disturbed areas to avoid creating opportunities for seed germination. Manage **for** the species desired on the site.

Chemical

- **Precautions:**
 - Herbicides should only be applied at the rates and for the site conditions and/or land usage specified on the label of the product being used. **Follow all label directions.**
 - For herbicide use in critical areas and their buffers, certain restrictions apply depending on the site and jurisdiction. In unincorporated King County, refer to the **King County Noxious Weed Regulatory Guidelines** for a summary of current restrictions and regulatory compliance issues. Elsewhere, check with the local jurisdiction.
 - For your personal safety, at a minimum wear gloves, long sleeves, long pants, closed toe shoes, and appropriate eye protection. Follow label directions for any additional personal protection equipment needed.
- Herbicides are usually the best method to control large or established infestations of knapweed in areas that cannot be tilled. For knapweed, it is most effective to apply selective broadleaf herbicides in the spring. Infested areas should not be mowed until after the herbicide has had a chance to work.
- Non-selective herbicides such as glyphosate (Roundup) can be used if damage to grass can be tolerated. However, re-seeding with grass after glyphosate treatments is recommended because this can help reduce knapweed re-invasion from the seed bank.
- The timing of an herbicide application is critical to success. Meadow knapweed should be sprayed with selective herbicides between the time when the rosettes of lower leaves are actively growing until the plant reaches the bud stage. Perennial plants such as meadow knapweed can also be treated after flowering when the plant begins to store food in the root. Fall applications after rains have initiated seed germination can also be effective if the plants are green and actively growing.
- Herbicides are most effective on actively growing plants with good soil moisture and warm, dry weather.
- Use a surfactant (spreader-sticker) to enhance herbicide effectiveness.
- Herbicides should be used as one tool in an integrated pest management approach. Cultural techniques such as fertilizing pastures or reseeded and establishing competing vegetation can minimize chemical use. Manual removal of survivors as follow-up can be effective.

Specific Herbicide Information

Selective Broadleaf Herbicides are very effective in controlling knapweed, especially in pastures and grassy areas. Most established grasses are not harmed by these selective herbicides and will compete with knapweed seedlings. However, selective herbicides can harm certain grasses, alfalfa, clover and other legumes. Soil type, water table depth and land use should be considered before using any herbicide. Selective herbicides such as clopyralid (Stinger) and aminopyralid (Milestone) are the most effective herbicides for meadow knapweed control, having soil residual activity that provides extended control of germination. However, these products must only be used in permanent pastures, rangeland or non-crop areas. Other selective herbicide combinations which are recommended for

meadow knapweed control are: clopyralid + 2,4-D (Curtail) or clopyralid + triclopyr (Redeem R&P).

Readily available selective herbicides effective in controlling knapweed include 2,4-D (many products), a combination treatment of dicamba and 2,4-D (e.g. Weedmaster or Weed-B-Gon) and a combination treatment of triclopyr and 2,4-D (e.g. Crossbow). If using 2,4-D or triclopyr (Garlon), re-treatment will be necessary to control late-germinating plants. 2,4-D is most effective when plants are bolting.

Glyphosate (Roundup) will effectively kill individual knapweed plants or plants where damage to non-target species can be tolerated. Glyphosate treatments should be made at or after bud stage. Treatment with glyphosate should be combined with effective re-vegetation of the site to prevent seedlings from re-infesting the area.

NOTE: Certain additional restrictions apply for products containing 2,4-D and Triclopyr BEE (e. g. Garlon 4, Crossbow). Refer to the King County Noxious Weed Regulatory Guidelines for more details.

The mention of a specific product brand name in this document is not, and should not be construed as an endorsement or as a recommendation for the use of that product. Chemical control options may differ for private, commercial and government agency users. **For questions about herbicide use, contact the King County Noxious Weed Control Program at 206-296-0290.**

Biological

- Biological control is the deliberate introduction of insects, mammals or other organisms which adversely affect the target weed species, reducing the population and reproductive ability of the weed. Biological control is generally most effective when used on large infestations or in areas where it is difficult to use other control techniques. In King County meadow knapweed infestations are small, and biological control agents are generally not suited to prevent small, pioneering infestations. Any biological control plan needs to incorporate another non-chemical control method if the goal is to prevent all seed production.
- Biological control can take many years to have a significant impact on an infestation. Population density and the number of flowering plants can be greatly reduced but eradication is not possible with biocontrol.
- Currently the only biocontrol agent that attacks meadow knapweed is the seed-feeding weevil, *Larinus obtusus*. Beetle populations build up quickly and appear to disperse well throughout the infestation, however, its effectiveness in reducing weed populations is still uncertain. With up to six larvae per seed-head, it appears that seed production may be dramatically reduced.

SUMMARY OF BEST MANAGEMENT PRACTICES

Small Infestations in Native and/or Desirable Vegetation

- Prevent plants from forming seed.
- Pull plants by hand if soil is wet; the plants may need to be dug up if large or in dry compacted soil.
- Replace any divots created when removing the plants to lessen the amount of disturbed soil.
- Apply appropriate herbicide to actively growing plants if hand removal is not practical.
- If using an herbicide in a grassy area, use a selective herbicide to avoid injury to the grass or re-seed after treatment if using a non-selective product such as glyphosate.
- Monitor site throughout growing season and remove any new plants.

Large Infestations/Monocultures in Grassy Areas

- Mowing will not control knapweed. Mowing can be used if the infestation is found later in the year to keep the plants from flowering until an approved control method can be used. Do not mow plants that have gone to seed and clean mower after cutting knapweed to avoid moving it off-site.
- Large infestations can be controlled with selective herbicides. (See the Chemical section of this BMP). Suppression of large infestations of knapweed with a selective herbicide will greatly increase grass production, which in turn increases the suppression of the knapweed.
- Promote healthy grassy areas by seeding and fertilizing. Use a mix of grass and clover species to improve resistance to weeds. Fertilize according to the soil needs.
- Pastures should be managed to promote grass and clover vigor. Avoid overgrazing and move animals when grass is still about 3 inches tall. Cross fencing allows regrowth of grasses, decreasing weeds and increasing forage. Avoid grazing when soil is very wet because holes can be opened up to new weed infestations. For more information on pasture management, contact the King Conservation District (<http://www.kingcd.org>).
- Monitor for knapweed on edges of pastures and in disturbed areas along roads, fences and watering and feeding areas. Remove isolated plants before they flower.
- Severely infested pastures should be reseeded.

Control in Riparian Areas

- Additional permits may be required for control of infestations in riparian areas. See the Noxious Weed Regulatory Guidelines for more information or contact your local jurisdiction.
- In some cases, the cleared area will need to be replanted with native or non-invasive vegetation and stabilized against erosion. See the King County Surface Water Design Manual for further information about sediment and erosion control practices (<http://www.kingcounty.gov/environment/waterandland/stormwater/documents/surface-water-design-manual> or call 206-296-6519).
- Focus on manual removal for small infestations if possible, and prevent seed production.

- Mowing can serve in the interim until more effective control measures can be utilized. However, mowers can spread seeds and should always be cleaned after use.
- For larger areas where herbicide use is warranted, spray using low pressure and large droplet size to reduce drift. If herbicide could potentially drift into the water or a wetland area, use only approved aquatic herbicides and surfactants after obtaining the necessary permits.
- Aminopyralid and amine formulations of 2,4-D and triclopyr can be used to the edge of water.
- If a non-selective herbicide is used, the area should be re-seeded to prevent reinvasion by weeds.
- Infested areas will need to incorporate a management plan lasting for several years to control plants germinating from the seed bank.

Control along Road Rights-of-Way

- Pull small infestations if possible, and prevent seed production.
- In most areas, spray with a selective broadleaf herbicide. Be sure to look for small rosettes and seedlings near the larger plants.
- Aminopyralid and amine formulations of 2,4-D and triclopyr can be used to the edge of water.
- Spot spraying with glyphosate is possible if weeds are in areas with no desirable grasses.
- Revegetate with desired species if necessary.
- If plants are about to flower, they can be mowed until a more effective control strategy can be used.

Disposal Methods

- Bag all flower heads. If the plants are in seed, carefully cut off the seed head and place in a bag without dispersing the seeds.
- Dispose of flower heads and plants in household garbage or take to a transfer station for disposal. Do not compost or put in yard waste.
- Never dump plant material as weeds may spread from yard waste piles.

References

- Pacific Northwest Weed Management Handbook. 2006. Oregon State University.
- Ochsmann, Jörg. 2005. The Knapweed pages. <http://www.centaurea.net>
- PNW0566. 2003. Washington State University.
- Wilson, L. M. and C. B. Randall. 2003. Biology and Biological Control of Knapweed. USDA-Forest Service FHTET-2001-07. 2nd Edition.

Internet References (unknown authors)

- <http://www.invasive.org/eastern/biocontrol/13Knapweed.html>
- http://www.co.whatcom.wa.us/publicworks/pdf/weeds/meadow_knapweed2.pdf