

Dalmatian Toadflax

Linaria dalmatica ssp. *dalmatica*
Family: Scrophulariaceae

**Class B Noxious Weed
Control Required**

Legal Status in King County: Legal Status in King County:

Dalmatian toadflax 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 Dalmatian toadflax 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, Washington quarantine laws prohibit transporting, buying, selling, or distributing plants, plant parts or seeds of Dalmatian toadflax.



BACKGROUND INFORMATION

Impacts and History

- Dalmatian toadflax is an herbaceous perennial plant introduced from the Mediterranean region into the western United States around 1874. Because of its showy snapdragon flowers, it has been cultivated widely as an ornamental.
- Toadflax invades disturbed plant communities including roadsides, rangeland, forest clearings and industrial areas, often displacing native and desirable species.
- Dalmatian toadflax is found in at least 22 US states and seven Canadian provinces, but it is most widely distributed in the western US and Canada.
- The primary economic impact of toadflax lies in reduced livestock production.
- Dalmatian toadflax can form a monoculture that severely reduces forage, productivity, biodiversity and wildlife habitat.



Description

- Dalmatian toadflax has narrow, upright herbaceous floral stems from a stocky, woody base that grow up to 3 feet. Flowers are bright yellow snapdragon-like blooms, often with an orange throat. The plant will often also have short prostrate leafy stems.
- The leaves are alternate, broad, with a thick, waxy cuticle and a bluish cast. Each leaf is heart-shaped and wraps the stem.
- The root system is perennial and spreading. Individual plants can live 3-5 years.



Habitat

- Habitat for Dalmatian toadflax includes disturbed open sites, fields, pastures, rangeland, roadsides, cropland and forest clearings.
- Dalmatian toadflax competes well on soils with low organic content and excessively drained soils, but can also be a problem on high quality soils.
- Infestations can begin in small disturbed sites, and then spread to rangeland or wildlife habitats that are in excellent condition. Dalmatian toadflax is a highly aggressive plant that can genetically adapt to varied environmental conditions and herbicide controls.

Reproduction and Spread

- A single plant produces up to 500,000 seeds, most of which fall within 18 inches of the parent plant. Seeds can remain viable for at least 10 years. Seeds are very small and easily dispersed by animals, water, machinery, and mud and soil.
- Seeds can germinate in the spring or fall and can produce prostrate rosettes that survive through the winter. Seedlings are usually not competitive in low moisture conditions. In spring floral stalks are produced.
- Adventitious buds form on perennial roots, forming a large plant with many flowering stalks. Roots may extend 4 to 10 feet deep and up to 10 feet from the parent plant. Vegetative shoots from roots are typically the first to emerge in the spring, before other desirable plant species, and can grow with little water. Spread of established plants can be rapid, and is usually vegetative; however, new populations of Dalmatian toadflax are typically established by seeds.
- Dried floral stalks retaining seed can remain on the plant for up to two years. These stalks can break off and blow across a landscape and disperse seeds.

Local Distribution

- Most Dalmatian toadflax in King County is found on highway and railroad rights of way and vacant or open industrial areas.

CONTROL INFORMATION

Integrated Pest Management

- The preferred approach for any weed control is Integrated Pest Management (IPM). IPM involves selecting from a range of possible control methods to match the management requirements of each specific site. The goal is to maximize effective control and to minimize negative environmental, economic and social impacts.
- When possible use a multifaceted and adaptive approach. Select control methods which reflect the land use goals of the community and landowners, the biology of the weed, and the available time, funding, and labor of the participants. Management will require dedication over a number of years, and should allow for flexibility in method as appropriate.

Planning Considerations

- Survey area for weeds, set priorities and select best control method(s) for the site conditions and regulatory compliance issues (**refer to the King County Noxious Weed Regulatory Guidelines**).
- 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 weeds.
- If the infestation is large, generally begin work 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

- Controlling established Dalmatian toadflax can be expensive and difficult, prevention is the best option. Identify and remove colonizing plants.

Manual Control

- Grubbing out toadflax is effective on small infestations and newly established plants that have not developed an extensive root system. Care should be taken to get as much of the root out as possible. The thin, spreading rhizomes will break easily. Remove all visible plants before seeds develop (if plants have seeds, place bag over stems and then cut them to reduce dispersal of seeds). Ongoing monitoring and repeated plant removal during the growing season is essential.
- Cutting flower stalks to prevent seeding will temporarily prevent spread but plants will continue to re-sprout throughout the growing season.

Mechanical Control

- In cultivated areas, toadflax should not be a problem. Regular tillage will control toadflax.
- Mowing is not effective except to diminish seed production. Mowing when toadflax is in seed is likely to spread the infestation further because mowers can carry seeds to uninfested areas.

Chemical Control

- **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.**
 - The addition of a suitable surfactant is usually necessary for good herbicide effectiveness. The only time surfactant should not be used is when drift into aquatic areas is possible, unless using an approved aquatic surfactant and herbicide, or when additional damage to grasses is unacceptable when applying a broadleaf selective herbicide (surfactants may increase grass susceptibility in some cases). Look for surfactant products with at least 70% active ingredient. Read the surfactant label, and add to spray mixture accordingly.
 - When using foliar applied herbicides, wet all foliage thoroughly, but avoid excessive run-off.
 - Soil active herbicides should be sprayed over the immediate area around the plant, covering rhizome and seed disbursal areas.
 - 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.

Specific Herbicide Information

Chemical control of toadflax can be difficult. The waxy leaves make a good oil-based or silicon surfactant necessary. The cuticle may be thickest during the summer months, so applications should be made in spring or fall. This is a perennial plant and application to established plants should begin at early flowering stage. Fall applications are very effective as long as the plant is active. Care needs to be taken not to damage off-target species and potential competitors such as brushy species and tree seedlings when using the higher rates of herbicides necessary for controlling toadflax.

Toadflax is controlled by higher rates of the selective broadleaf herbicide Chlorsulfuron (Telar). This herbicide has soil residual activity that will prolong control. Care should be

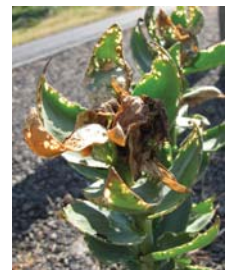
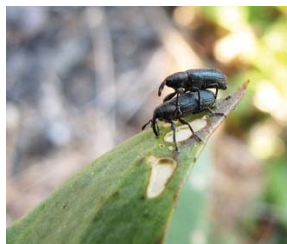
taken to avoid use in areas with shallow water tables, sandy soils or where soil movement is possible. Imazapic (Plateau) has been effective in rangeland situations. Small infestations of toadflax can also be controlled with the non-selective herbicide glyphosate (Roundup or Aquamaster). These chemicals should be used carefully to avoid off-target damage. Read the labels carefully. Proper application will reduce herbicide use.

HERBICIDE	RATE	APPLICATION METHOD AND TIMING
Chlorsulfuron (Telar)	2-3 oz./acre	Apply at flower stage in spring and/or in the fall. Add non-ionic surfactant
Glyphosate (Round-up, Aquamaster, etc.)	2% solution or 3-4 qts/acre	Apply at flower stage in spring and/or in the fall. Add non-ionic surfactant @ 0.5 to 1%.
Glyphosate (Round-up, Aquamaster, etc.)	33% solution	Apply directly to leaves and stem of flowering plants using wiper or wick method.
Imazapic (Plateau)	12 oz.	Apply when 25 percent of plant is necrotic, usually after a hard frost. Use methylated seed oil surfactant

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 Control

Biocontrol agents are available to use against toadflax. Their effectiveness has not been fully evaluated, but in the long term these insects can help reduce the invasiveness of toadflax. The stem-mining weevil *Mecinus janthinus* has been particularly effective in Washington, Oregon, and Idaho. For control of small problem areas other methods should be used.



Mecinus janthinus
damage on toadflax

Species name	Type	Order: Family	Notes
<i>Brachyterolus pulicarius</i>	flower-feeding beetle	Coleoptera: Nitidulidae	More effective on yellow toadflax (<i>Linaria vulgaris</i>)
<i>Gymnetron antirrhini</i>	fruit-feeding weevil	Coleoptera: Curculionidae	More effective on yellow toadflax (<i>Linaria vulgaris</i>)
<i>Mecinus janthinus</i>	stem-mining weevil	Coleoptera: Curculionidae	The most effective agent for Washington State

SUMMARY OF BEST MANAGEMENT PRACTICES

Small Infestations in Native and/or Desirable Vegetation

- Hand grub or treat with glyphosate.

Large Infestations/Monocultures

- In crop areas, cultivate or use chemical control and then replant with desired species. Be persistent, and root out survivors.
- In non-crop areas, use selective chemical application and manage for desired species. Fertilizing desired species during control usually helps.

Control in Riparian Areas

- Toadflax can thrive on sandy riverbanks. Hand grubbing can be very effective in sandy soils, as the roots and rhizomes can be more easily removed. Glyphosate (Aquamaster) can be used in these 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, a 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.
- 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.

Control along Road Rights-of-Way

- Dig up small infestations if possible.
- Spray infested areas with a systemic herbicide (see Chemical Section above for recommendations), taking care not to spray beneficial vegetation.
- In grassy areas, use a selective broadleaf herbicide such as chlorsulfuron; if controlled with a non-selective herbicide, such as glyphosate, re-seed after control is completed.

Disposal Methods

- Bag and dispose of cut flower heads and seeding stems in the garbage or take to a land fill. Non-flowering stems can be left on site but stems with roots should also be bagged and discarded as garbage. Do not put toadflax in yard waste bins or compost piles.

References

- Lejeunesse, S. 1999. Dalmatian and yellow toadflax. In: R. L. Sheley, and J. K. Petroff (eds). Biology and Management of Noxious Rangeland Weeds, Oregon State University Press, Corvallis, OR.
- Montana State University. 2000. Dalmatian and Yellow Toadflax; Weeds of Pasture and Rangeland. MSU Extension Services, Bozeman, MT.
- Ogden, J.A. and Renz, M.J. 2005. Dalmatian Toadflax (*Linaria genistifolia* ssp. *Dalmatica*). New Mexico State University Weed-Factsheet
- Beck, K.G. Biology and Management of the Toadflaxes. 2008. Colorado State University Extension
- Carpenter, A.T. and Murray, T.A. 1998. Element Stewardship Abstract for *Linaria genistifolia* (L.) P. Miller ssp. *dalmatica* (L.) Maire & Petitmengin (Synonym: *Linaria dalmatica* (L.) P. Miller) and *Linaria vulgaris* P. Miller. The Nature Conservancy, 1815 North Lynn Street, Arlington, Virginia