

<b>NAME OF SPECIES:</b> <i>Linaria dalmatica</i> (L.) Mill.	
<b>Synonyms:</b> <i>Linaria genistifolia</i> ssp. <i>dalmatica</i> (L.) Maire & Petim.; <i>Antirrhinum dalmaticum</i> L.	
<b>Common Name:</b> Dalmation toadflax, Balkan toadflax, broadleaf toadflax	<b>Cultivars?</b> YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>
<b>A. CURRENT STATUS AND DISTRIBUTION</b>	
I. In Wisconsin?	1. YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>
	2. <u>Abundance:</u> Low (4)
	3. <u>Geographic Range:</u> Samples have been collected from Dane, Green, Sauk, Juneau, Bayfield, Sawyer, Ashland, and Vilas counties (2). The majority of samples at the UW Herbarium come from Bayfield county (8 samples) with 3 from Dane, 2 from Juneau and 1 each from the other counties listed.
	4. <u>Habitat Invaded:</u> Disturbed Areas <input checked="" type="checkbox"/> Undisturbed Areas <input checked="" type="checkbox"/>  Notes: Disturbance promotes toadflax invasion and may be necessary for establishment to occur. However once established, toadflaxes readily spread into adjacent non-disturbed areas (6). Dalmatian toadflax is typically found along disturbed sites, roadsides, clear cuts, railroad right-of-ways, fences, croplands, pastures, and rangelands.
	5. <u>Historical Status and Rate of Spread in Wisconsin:</u> Introduced - locally established, blooms Jun.-Oct (1).
	6. <u>Proportion of potential range occupied:</u> Low (4)
II. Invasive in Similar Climate Zones	1. YES <input checked="" type="checkbox"/> NO <input type="checkbox"/> <u>Where (include trends):</u> AR, AZ, CA, CO, CT, ID, IL, IN, KS, MA, ME, MI, MN, MT, ND, NE, NH, NJ, NM, NV, NY, OH, OK, OR, PA, RI, SD, UT, VT, WA, WI, WY, and CAN (2). Most common in the western U.S. (8).
III. Invasive in Which Habitat Types	1. Upland <input checked="" type="checkbox"/> Wetland <input type="checkbox"/> Dune <input type="checkbox"/> Prairie <input checked="" type="checkbox"/> Aquatic <input type="checkbox"/> Forest <input type="checkbox"/> Grassland <input checked="" type="checkbox"/> Bog <input type="checkbox"/> Fen <input type="checkbox"/> Swamp <input type="checkbox"/> Marsh <input type="checkbox"/> Lake <input type="checkbox"/> Stream <input type="checkbox"/> Other: Commonly found along roadsides, fences, range lands, croplands, clear cuts, and pastures. Disturbed or cultivated ground is a prime candidate for colonization (8).
IV. Habitat Affected	1. <u>Soil types favored or tolerated:</u> It prefers dry sites with coarse, well-drained soils (3). Dalmatian toadflax is adapted to grow in a wide variety of soil types and moisture conditions. It can be found in open, sunny places on well-drained, coarse-textured soils with pH between 6.5 and 8.5 (source 5).
	2. <u>Conservation significance of threatened habitats:</u>
V. Native Range and Habitat	1. <u>List countries and native habitat types:</u> Dalmatian toadflax is native to southeastern Europe and southwestern Asia (5). It generally grows in sunny places, from sea level up to 2,800 meters (8).
VI. Legal Classification	1. <u>Listed by government entities?</u> Listed noxious by AZ, CA, CO, ID, MT, ND, NM, NV, OR, SD, WA, WY (5).

	2. <u>Illegal to sell?</u> YES <input checked="" type="checkbox"/> NO <input type="checkbox"/> Notes:
<b>B. ESTABLISHMENT POTENTIAL AND LIFE HISTORY TRAITS</b>	
I. Life History	<p>1. <u>Type of plant:</u> Annual <input type="checkbox"/> Biennial <input type="checkbox"/> Monocarpic Perennial <input type="checkbox"/> Herbaceous Perennial <input checked="" type="checkbox"/> Vine <input type="checkbox"/> Shrub <input type="checkbox"/> Tree <input type="checkbox"/></p> <p>2. <u>Time to Maturity:</u> Most seeds germinate in spring, but some can germinate in fall. Seeds are small and germinate if they are not buried deeper than 6 mm in the soil (5). Individual plants live up to five years with an average lifespan of 3.8 years – lifespan is dependent on environmental conditions (8).</p> <p>3. <u>Length of Seed Viability:</u> Seeds can remain dormant in soil for up to 10 years (5).</p> <p>4. <u>Methods of Reproduction:</u> Asexual <input checked="" type="checkbox"/> Sexual <input checked="" type="checkbox"/> <u>Notes:</u> Reproduces sexually by seeds and vegetatively from buds on the roots. New infestations usually originate from seeds. Each plant can produce up to 500,000 seeds annually. New plants can be produced when vegetative buds sprout from the lateral roots that are found in the upper 5 to 30 ½ cm of soil. Plants can regenerate from root fragments as short as ½ inch.</p> <p>5. <u>Hybridization potential:</u> Dalmatian toadflax may form hybrids. (5)</p>
II. Climate	<p>1. <u>Climate restrictions:</u> Prefers southwest facing slopes (5). A northern limit of 55 – 66 degrees latitude (8).</p> <p>2. <u>Effects of potential climate change:</u></p>
III. Dispersal Potential	<p>1. <u>Pathways - Please check all that apply:</u></p> <p><u>Unintentional:</u> Bird <input type="checkbox"/> Animal <input checked="" type="checkbox"/> Vehicles/Human <input checked="" type="checkbox"/> Wind <input checked="" type="checkbox"/> Water <input type="checkbox"/> Other:</p> <p><u>Intentional:</u> Ornamental <input checked="" type="checkbox"/> Forage/Erosion control <input type="checkbox"/> Medicine/Food: Other:</p> <p>2. <u>Distinguishing characteristics that aid in its survival and/or inhibit its control:</u> Each plant can produce up to 500,000 seeds annually (5). Can adapt growth to fit a range of habitats, and have a tolerance for low temperatures and coarse soils. The large, deep, root systems exploit water effectively (8).</p>
IV. Ability to go Undetected	1. HIGH <input type="checkbox"/> MEDIUM <input checked="" type="checkbox"/> LOW <input type="checkbox"/>
<b>C. DAMAGE POTENTIAL</b>	
I. Competitive Ability	<p>1. <u>Presence of Natural Enemies:</u></p> <p>2. <u>Competition with native species:</u> Dalmatian toadflax is capable of forming colonies through adventitious buds from creeping root systems. It can rapidly colonize disturbed or cultivated ground to out-compete desirable native plant species and decreases plant species diversity. It can significantly reduce crop yields and stress native communities. It can compete to reduce the abundance of</p>

	<p>grasses and other forbs. In a study, toadflax-free plots produced 2.5 times more grass than plots where toadflax was present (3).</p> <p>Rate of Spread:          -changes in relative dominance over time:          -change in acreage over time: Most Dalmatian toadflax infestations are in western states. In these areas, Dalmatian toadflax has increased at a rate of 8-29% per year depending on the site (7).          HIGH(1-3 yrs) <input type="checkbox"/> MEDIUM (4-6 yrs) <input checked="" type="checkbox"/> LOW (7-10 yrs) <input type="checkbox"/>          Notes:</p>
II. Environmental Effects	<p>1. <u>Alteration of ecosystem/community composition?</u>          YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>          Notes: Impact on community composition, structure, and interactions: Dalmatian toadflax can outcompete and displace native plant species. Grazing animals find this plant unpalatable. Bumble bees and halictid bees are the most important pollinators for Dalmatian toadflax Dalmatian toadflax may form hybrids (5).</p> <p>2. <u>Alteration of ecosystem/community structure?</u>          YES <input checked="" type="checkbox"/> NO <input type="checkbox"/> (5)          Notes: Form colonies through adventitious buds from creeping root systems. These colonies push out native grasses and other perennials, thereby altering the species composition of natural communities ( 8).</p> <p>3. <u>Alteration of ecosystem/community functions and processes?</u>          YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>          Notes: Impact on ecosystem processes: Infestations of Dalmatian toadflax can lead to the establishment and dominance of other invasive species in a community (5).</p> <p>4. <u>Allelopathic properties?</u> YES <input type="checkbox"/> NO <input checked="" type="checkbox"/>          Notes:</p>
<b>D. SOCIO-ECONOMIC EFFECTS</b>	
I. Positive aspects of the species to the economy/society:	Notes: Ornamental
II. Potential Socio-Economic Effects of Requiring Controls:	Positive: Since not well established/widespread, control is feasible without impacting a large amount of people/industries. Negative: Nursery industries would need to liquidate/destroy stock.
III. Direct and indirect Socio-Economic Effects of Plant :	Notes: Dalmatian toadflax contains an iridoid glycoside, a quinoline alkaloid, and a peganine so it is toxic to some livestock such as cattle. However, cattle avoid Dalmatian toadflax and there are no confirmed reports of livestock poisoning.(5)
IV. Increased Costs to Sectors Caused by the Plant:	Notes:
V. Effects on human health:	Notes:
VI. Potential socio-economic effects of restricting use:	Positive: Would limit vectors of introduction by restricting sales, transfer of plants. Negative: Nursery industries would need to liquidate/destroy stock.
<b>E. CONTROL AND PREVENTION</b>	
I. Costs of Prevention (please be	Notes: Clean agricultural equipment, construction equipment, etc

as specific as possible):	(high pressure washer, etc.) to prevent moving root fragments to new sites.
II. Responsiveness to prevention efforts:	Notes:
III. Effective Control tactics:	<p>Mechanical <input checked="" type="checkbox"/> Biological <input checked="" type="checkbox"/> Chemical <input checked="" type="checkbox"/></p> <p>Times and uses: Keys to successful control include prevention of seed production, depleting rootreserves, and killing seedlings before vegetative reproduction begins. Manual- hand-pulling, mowing, and tillage can be effective in preventing seed production and starving toadflax roots, thereby controlling infestations under certain conditions only if done repeatedly and/or in combination with other control methods. Chemical- effective herbicides for Dalmatian toadflax include chlorsulfuron, dicamba, picloram and imazapic. It may be necessary to retreat infestations every 3 to 4 years. Follow label and state requirements. Triclopyr and glyphosate do not effectively control this plant. Biological- flower feeding beetles (<i>Brachypterolus pulicarius</i> and <i>Gymnetron antirrhini</i>) reduce seed production in toadflax (3).</p> <p>Additional control info:  Dalmatian toadflax can be controlled by hand pulling or applying herbicides. Five insect species have been approved by the USDA for release as biological control agents. Because seeds can remain dormant for up to ten years and plants can regenerate from root fragments, control measures must be repeated every year for at least ten years to completely remove a stand (5).  Any management program should be conducted during the month of June. This is when root carbohydrate reserves are at their lowest, which makes it more difficult fro the root system to recover. Follow-up work in late June-early July is recommended to locate and remove any late-flowering plants (8).</p>
IV. Costs of Control:	Notes: Depends on integrated approach used, but includes cost of herbicide, labor for control and monitoring/follow-up, mowing, cost of seed/plants to revegetate the site.
V. Cost of prevention or control vs. Cost of allowing invasion to occur:	Notes: Since it is not established in Wisconsin, it is better to prevent the invasion from happening given the circumstances in western U.S.
VI. Non-Target Effects of Control:	Notes:
VII. Efficacy of monitoring:	Notes: Monitoring should be conducted in early June when plants have formed buds and are beginning to flower (8).
VIII. Legal and landowner issues:	Notes:
<b>F. HYBRIDS AND CULTIVARS</b>	
I. Known hybrids?	Name of hybrid:
YES <input type="checkbox"/> NO <input checked="" type="checkbox"/>	Names of hybrid cultivars:
II. Species cultivars	Names of cultivars and any information about the invasive behaviors of each:

	<p>Notes: Subordinate taxa:  <i>Linaria dalmatica</i> (L.) Mill. subsp. <i>dalmatica</i>; syn: <i>Linaria genistifolia</i> (L.) Mill. subsp. <i>dalmatica</i>; <i>Linaria jattae</i> Palanza</p> <p><i>Linaria dalmatica</i> ssp. <i>macedonica</i>  <i>Linaria genistifolia</i> (L.) Mill., sensu Salamun (1951),</p>

**G. REFERENCES USED:**

- UW Herbarium
- WI DNR
- TNC
- Native Plant Conservation Alliance
- IPANE
- USDA Plants

Number	Reference
1	Wisconsin Botanical Information System. Wisconsin State Herbarium. Wisflora- Vascular Plant Species. < <a href="http://www.botany.wisc.edu/cgi-bin/detail.cgi?SpCode=LINDAL&amp;Genus=Linaria&amp;Family=Scrophulariaceae&amp;Species=dalmatica&amp;Common=Dalmatian%20toadflax&amp;photo=.%2Fphotos%2FLINDAL_EJJ2.jpg&amp;thumbmaps=.%2Fthumbmap%2FLINDAL.gif&amp;hand=H">http://www.botany.wisc.edu/cgi-bin/detail.cgi?SpCode=LINDAL&amp;Genus=Linaria&amp;Family=Scrophulariaceae&amp;Species=dalmatica&amp;Common=Dalmatian%20toadflax&amp;photo=.%2Fphotos%2FLINDAL_EJJ2.jpg&amp;thumbmaps=.%2Fthumbmap%2FLINDAL.gif&amp;hand=H</a> >
2	Wisconsin Botanical Information System. Wisconsin State Herbarium. Wisflora- Vascular Plant Species. Specimen Location Map. <a href="http://www.botany.wisc.edu/herb/wwwbotanydev/herbarium/wisflora/dots/LINDAL.gif">http://www.botany.wisc.edu/herb/wwwbotanydev/herbarium/wisflora/dots/LINDAL.gif</a>
3	USDA Forest System. Northern Area. < <a href="http://na.fs.fed.us/fhp/invasive_plants/weeds/dalmatian-toadflax.pdf">http://na.fs.fed.us/fhp/invasive_plants/weeds/dalmatian-toadflax.pdf</a> >
4	United States Department of Agriculture. Natural Resources Conservation System. Plants Database, < <a href="http://plants.usda.gov/java/profile?symbol=LIDA">http://plants.usda.gov/java/profile?symbol=LIDA</a> >
5	Alaska Natural Heritage Program. University of Alaska Anchorage. < <a href="http://aknhp.uaa.alaska.edu/services/AKNHP.cfc?method=downloadDocumentByUsdaCode&amp;documentType=species_bio&amp;usdaCode=LIDA">http://aknhp.uaa.alaska.edu/services/AKNHP.cfc?method=downloadDocumentByUsdaCode&amp;documentType=species_bio&amp;usdaCode=LIDA</a> >
6	Colorado State University Extension. < <a href="http://www.ext.colostate.edu/pubs/natres/03114.html">http://www.ext.colostate.edu/pubs/natres/03114.html</a> >
7	Minnesota Department of Agriculture. <a href="http://www.mda.state.mn.us/plants/badplants/toadflax.aspx">http://www.mda.state.mn.us/plants/badplants/toadflax.aspx</a>
8	Carpenter, A., and T. Murray, J.M. Randall (ed). 2000. <i>Linaria</i> spp. The Nature Conservancy – Element Stewardship Abstract. < <a href="http://wiki.bugwood.org/Linaria_spp">http://wiki.bugwood.org/Linaria_spp</a> >

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