

DALMATIAN TOADFLAX
Linaria genistifolia spp. *dalmatica* (L.)
(*Linaria dalmatica*)

Life History/Identification:

Dalmatian toadflax is an introduced perennial weed closely related to yellow toadflax, *L. vulgaris* Mill. This plant reproduces both by seed and vegetative root buds. One plant can produce up to **one-half million seeds** as well as have lateral roots up to 10 feet from the parent plant. The two methods of reproduction give this plant a competitive advantage under a wide range of environmental conditions. Often stands of Dalmatian toadflax will disappear for several years, only to re-establish through the seed bank or possibly vegetative root buds.

Dalmatian toadflax seedlings are poor competitors for soil moisture and often have difficulty becoming established. However, seeds that do become established quickly send up a robust stem 1-3 feet tall. The leaves are broad, alternate, and the bases tend to wrap around the stem. Leaves are waxy, smooth margined and have a whitish or bluish cast.

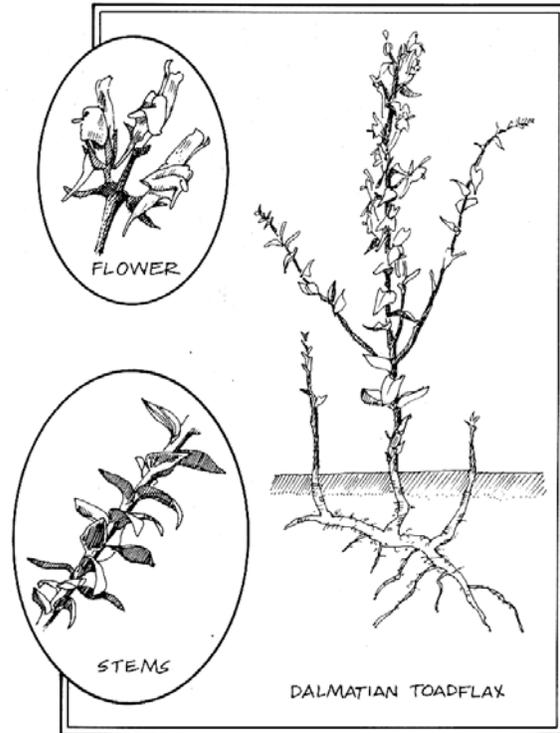
Flower buds begin forming in June with flowering beginning late in June. The Dalmatian toadflax flower is bright **yellow** with an orange nectar guide and a long spur. Flowering continues until late September when pollinators, like bumblebees and halictid bees, are no longer abundant. Seed dispersal can begin as early as July when the seed capsules dry and break open releasing 90% of the seed at the base of the plant. The tiny angular seeds are about 1/16 inch in diameter, they have irregular wings to aid wind dispersal and oily seed coats to enhance water and granivore dispersal.

Origin & Impacts:

Native to the Mediterranean region, Dalmatian toadflax was introduced to the United States as an ornamental before 1672. This plant is classified as a weed in Europe, Russia, New Zealand and North America, where it is considered a serious noxious weed in Arizona, Colorado, Montana, and New Mexico. Dalmatian toadflax poses a serious threat to native plants and grasses and therefore the animals that depend on them. The weed forms dense stands eliminating native species by out-competing them for water. This reduces forage production, thereby reducing the carrying capacity of the land. Consumption of this weed by livestock is not known to cause any disorders, however if the plant is browsed the animals will spread viable seed on fur and in droppings. The Dalmatian toadflax root system has the ability to increase over 400% in one year. If not controlled this would further decrease biodiversity and grazing habitat for native wildlife and livestock species.

Northern Arizona Localities:

Throughout the Ponderosa pine forest surrounding Flagstaff dense stands are seen on roadsides, empty lots, and frequently used trails in the surrounding forest. Outlying populations have been identified at Ash Fork, Bill Williams Mountain, Kendrick Park, Prescott, Highway 17, Walnut Canyon and Sunset Crater. Dalmatian toadflax is a **restricted noxious weed in Arizona**. Arizona Administrative Code **R3-4-244 & R3-4-245** revised July 1999 established three categories of noxious weeds in our state: regulate, restricted and prohibited.



Control:

An **integrated** combination of methods will be needed to control such an aggressive and adaptable noxious weed. Extensive **mapping** and consistent **monitoring** following **re-vegetation** are necessary to determine which control methods will be most effective.

Cultural Control: **Prevention** is the most effective and least expensive method of control. Maintenance of a vigorous, competitive plant community will prevent toadflax seedling establishment. Cleaning tires, boots and hooves when leaving infested areas will prevent the creation of new infestations. Purchase only certified weed-free hay, and don't allow livestock to graze infested areas in spring and summer. Overgrazing gives toadflax another advantage over native plants. Re-vegetation of any disturbed sites with vigorous, hardy native grass and perennial mixes will also prevent establishment of new toadflax seedlings.

Mechanical Control: **Hand pulling** or grubbing is effective for small infestations. Pull before flowers have bloomed, and repeat for at least five years till the root reserves are depleted. Remember that seeds may stay dormant in the soil for ten to fifteen years. **Cultivation**, where feasible, will control Dalmatian toadflax within two years. Tilling must be done five or six times a year, one week apart, starting in June. If cultivation is not carried out at this rigorous schedule it will only exacerbate the problem. **Mowing** is not recommended, as plants produce side branches with more flowers. **Burning** is not usually effective either, as soil temperatures are not sufficient to kill root buds or buried seed. Dalmatian toadflax is usually able to out-compete natives after a burn since they maintain large root reserves.

Chemical Control: *(Noted here are chemical control techniques that have been used in other areas. Always check with weed specialists or chemical suppliers before treatment to ensure correct dosage and application. Mention of these products does not imply endorsement by the USDA Forest Service, Northern Arizona Weed Council or The Nature Conservancy.)*

Mixed results have been observed for the effectiveness of herbicides on toadflax control. In most cases picloram has achieved some degree of control (30-98%), however it seems to depend on soil type, moisture, and time of application. Promising results have also been seen with the use of dicamba and picloram 2,4-D. Even when treatment was successful permanent long-term control was not achieved unless re-treatments occurred for 3-5 years.

Biological Control: *(No exotic species should be introduced into an ecosystem without extensive research into the long-term effects. Mention of the species below does not imply appropriateness for use in Northern Arizona.):* Two introduced insect species have been important in the control of Dalmatian toadflax in North America. An ovary feeding beetle, *Brachyterolus pulicarius* (L.), was accidentally introduced to North America and feeds on buds, flowers, and seed capsules. The defoliating moth, *Calophasia lunula* Huffnagel, has been tested for host specificity and intentionally released against Dalmatian toadflax in WA, OR, ID, MO, WY, and CO. This moth can consume up to 20% of the leaves from a plant. Most of these biological control agents attack the flower head with the goal of reducing seed production and plant spread, while root feeders reduce rosette survivorship. Insects alone will not eliminate an infestation, however they will enhance control and reduce the rate of expansion of large existing infestations. Biological control is most appropriate in populations large enough to be beyond control by any other means. Contact the Flagstaff agricultural extension agent (774-1868) & APHIS/NBCI (www.aphis.usda.gov/nbc) for availability, status, and information before attempting a biological control program in your area.

Integrated Control: Mechanical control combined with herbicide treatment can be more effective than mechanical treatment alone. Herbicide treatment followed by seeding with competitive grasses has been successful in many parts of the western U.S. The use of herbicides in combination with insect control is successful on large populations. One example of this technique would be to release the insects near the center of the infestation, and then spray the edges to reduce or prevent the spread of the infestation.

No single control method, nor any one-year treatment program will ever achieve effective control of an area infested with Dalmatian toadflax. The fast growth, extensive root system and high reproductive

capacity of this plant requires long-term cooperative integrated management programs and planning to contain and reduce Dalmatian toadflax populations in Northern Arizona.

SAN FRANCISCO PEAKS WEED MANAGEMENT AREA
SPECIES ACTION PLAN #4
DALMATIAN TOADFLAX
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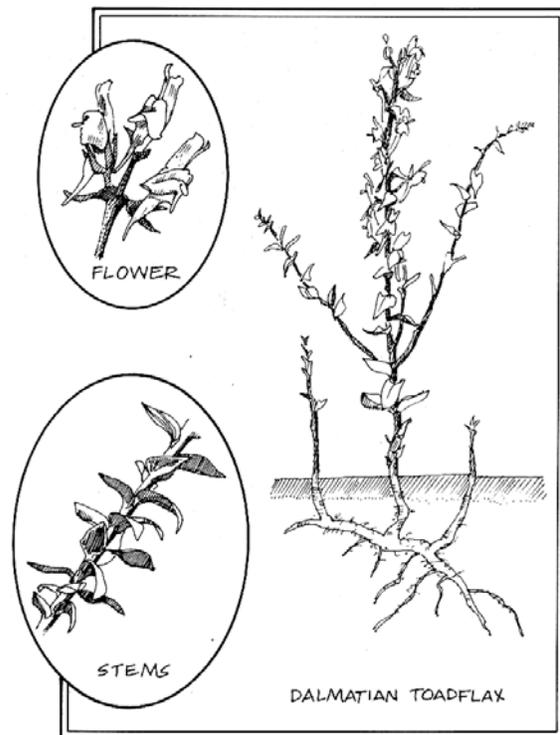
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Impact:

Dalmatian toadflax poses a **serious threat** to native plants and grasses and therefore the animals that depend on them. The weed forms dense stands eliminating



native species by easily out-competing them for water. This reduces forage production, thereby reducing the carrying capacity of the land. Consumption of this weed by livestock is not known to cause any disorders, however if the plant is browsed the animals will spread viable seed on fur and in droppings. The Dalmatian toadflax root system has the ability to increase over 400% in one year and is already common throughout most of California and the Northern Rockies. If not controlled this would further decrease biodiversity and grazing habitat for native wildlife and livestock species.

Flagstaff Localities:

Native to the Mediterranean region, Dalmatian toadflax was introduced to the United States as an ornamental before 1672. This plant is classified as a weed in Europe, Russia, New Zealand and North America, where it is considered a serious noxious weed in Arizona, Colorado, Montana, and New Mexico. Throughout Flagstaff and over 200,000 acres of Coconino National Forest dense stands are seen on roadsides, empty lots, frequently used trails and campgrounds. Outlying populations have been identified at Fern Mountain, A-1 Mountain, Highway 17, Walnut Canyon and Sunset Crater.

Dalmatian toadflax is a **restricted noxious weed in Arizona**. Arizona Administrative Code **R3-4-244 & R3-4-245** revised July 1999 established three categories of noxious weeds in our state:

Regulated – Are well-established widespread weeds like field bindweed and burclover, which should be controlled but are not likely to be quarantined. **Restricted** – Are species invading various areas throughout the state like Russian, diffuse and spotted knapweed, yellow starthistle, and camelthorn. The Department of Agriculture is supposed to quarantine any product or land infested with these plants, and notify the owner of the restrictions and required treatments. If nothing is done to remove or destroy the noxious weed the state can complete the required actions and put a lien on the property for the cost.

Prohibited - Are those weeds Arizona wishes to prevent from entering the State, it includes most of the restricted noxious weeds as well as many of those that aren't in the state according to our present knowledge like purple starthistle and squarrose knapweed. The quarantine is very similar to above, but it refuses entry into the state unless treatment is undertaken.

If any other population of Dalmatian toadflax is found in the Flagstaff area or all of N. Arizona, please contact us for help creating a management plan:

Laura P. Moser, coordinator

Tel: 520-527-3423

Fax: 520-527-3620

Email:

lmoser@fs.fed.us

San Francisco Peaks Weed Mngt. Area

2323 Greenlaw Lane

Flagstaff, AZ 86004

Control:

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2. Mechanical Control:

Hand pulling or grubbing is effective for small infestations. Pull before flowers have bloomed, and repeat for at least five years till the root reserves are depleted. Remember that seeds may stay dormant in the soil for ten to fifteen years. **Cultivation**, where feasible, control Dalmatian toadflax within two years. Tilling must be done five six times a year, one week apart, starting in June. If cultivation is not carried out at this rigorous schedule will only exacerbate the problem.



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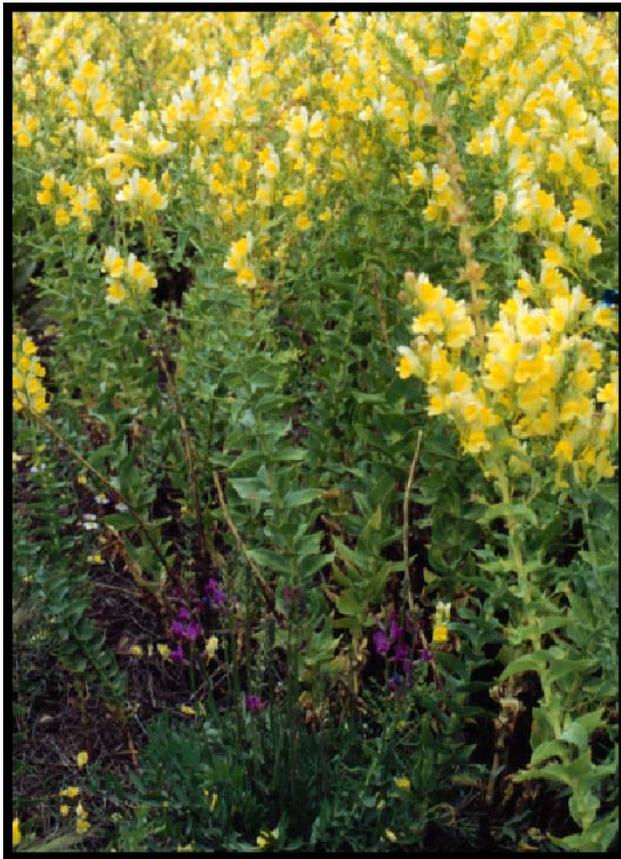
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References:

Arizona Noxious Weed List in Arizona Administrative Code **R3-4-244 & R3-4-245**, July 1999

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