Management information: *Centaurea diffusa*

**Physical:**

If the infested area is relatively small, hand pulling before seed set may be an effective method of control. Burning has been shown to be an effective method of control with strong grass regrowth occurring on burned sites. A low-severity fire may only top-kill *C. diffusa*, but a severe fire will probably kill the plant. Dry soil conditions associated with burns may discourage re-infestation as moisture is the limiting factor for seed germination. Re-seeding desirable species may be necessary following burns to deter re-infestation.

**Chemical:**

Tordon (picloram) is the most widely recommended herbicide for treatment of *C. diffusa*. 2,4-D, dicamba, and glyphosate are also considered effective. Tank-mixes of picloram and dicamba (100g - 200g / 0.4 hectare + 50 - 100g / 0.4 hectares), picloram plus 2,4-D (85 g / 0.4 hectare + 450 g./ 0.4 hectare), and dicamba plus 2,4-D (225 g / 0.4 hectare + 450 g / 0.4 hectare) all control *C. diffusa*. In addition to picloram, products containing clopyralid have proven quite effective. A backpack sprayer or a wick is highly recommended in small areas to minimize damage to non-target plants. Herbicides should be applied before the mature plants set seed to maximize effectiveness.

**Biological:**

Certain species can act as vegetative suppressants to *C. diffusa*. Two species studied as suppressants are crested wheatgrass (*Agropyron cristatum*) and Russian wild-rye (*Elymus junceus*). Crested wheatgrass showed high rates of suppression while Russian wild-rye showed only moderate rates of suppression. Suppression was due to the lack of soil moisture available to the seedlings. Any suppresser species must grow early in the spring and withdraw moisture from the soil before seeds can germinate. However,
the effects of introducing one exotic plant to suppress another should be evaluated before it is used as a method of control. Additionally, since *C. diffusa* has the ability to travel and spread seeds over relatively long distances as a tumble weed, an effort should be made to analyze prevailing winds and infestations on neighboring lands to identify any populations that may pose a threat. *C. diffusa* does not respect boundaries and maintaining a high level of public awareness is important for successful control.

There is no single biological control agent that effectively controls the populations. The USDA Animal and Plant Health Inspection Service (APHIS) lists 12 biological control agents that are known to attack *C. diffusa* and nine have been established in the United States. Although many of these agents sharply reduce seed production or inhibit root and shoot growth, none of them has been shown to significantly reduce *C. diffusa* densities. The seed-production reducing agents *Urophora affinis* (banded gall fly), *Bangasternus fausti* (broad-nosed seed-head weevil), *Urophora quadrifasciata* (UV knapweed seed head fly), *Chaetorellia acrolophi* (knapweed peacock fly), *Larinus minutus* (lesser knapweed flower weevil) can reduce seed production by up to 95%.

Plant biomass/productivity reducing agents *Agapeta zoegana* (sulfur knapweed moth, yellow-winged knapweed root moth) often kill small plants and prevent many of the larger plants from flowering by larval feeding. *Sphenoptera jugoslavica* (bronze knapweed root-borer) feeds externally on the leaves of *C. diffusa* and its larvae deplete root carbohydrate reserves and stop rosette growth. *Pterolonche inspersa* (grey-winged root moth) larvae feed down the root and spin webs to cover the area where they are feeding. *Cyphocleonus achates* (knapweed root weevil) can cause considerable damage to the root systems by the older larval feeding. Two fungi that attack *C. diffusa* are being studied but are not yet cleared as biocontrol agents or for movement across state lines: *Puccinia jaceae* attacks the leaves, while *Sclerotinia sclerotiorium* attacks the root crowns.