Hoary cress

Identification and Impacts

*Hoary cress* (*Cardaria draba*), commonly known as whitetop, is a creeping perennial that is a member of the mustard family and native to Europe. The stems, in the rosette stage, may grow up to 2 inches in height and produce grayish-green leaves that are lance shaped. The leaves are alternate and 3/4 to 4 inches long. The upper leaves have 2 lobes that clasp the stem. The plant has numerous small, white flowers with 4 petals on stalks radiating from a stem. Seed capsules are heart-shaped with two small, flat, reddish brown seeds. One plant can produce from 1,200 to 4,800 seeds. The plants emerge in early spring with stems emerging from the center of each rosette in late April. *Hoary cress* flowers from May to June and plants set seed by mid-summer.

Habitats for *Hoary Cress* include: fields, waste places, meadows, pastures, croplands and along roadsides. It is typically found on unshaded, generally open areas of disturbed ground. It generally does better with moderate amounts of precipitation and grows well on alkaline soils.

The key to effective control of *Hoary cress* is prevention. Preventing the encroachment of these weeds is the most cost-effective management. Preventing invasions by limiting seed dispersal, monitoring and using weed free hay, and quarantine animals that may have grazed in infested areas. Beyond prevention, the key is early detection when infestations are small, and aggressive management. Integrated Weed Management is required for proper control. Details on the back of this sheet can help to create a management plan compatible with your site ecology.

*Hoary cress* is designated as a “List B” species in the Colorado Noxious Weed Act. It is required to be either eradicated, contained, or suppressed depending on the local infestations. For more information visit [www.colorado.gov/ag/weeds](http://www.colorado.gov/ag/weeds) and click on the Noxious Weed Management Program. Or call the State Weed Coordinator at the Colorado Department of Agriculture, Conservation Services Division, 303-239-4100.

Photos © Kelly Uhing, Colorado Department of Agriculture; Mark Schwarzlander, University of Idaho. Above map: Crystal Andrews, Colorado Department of Agriculture.
CULTURAL
Prevent the establishment of new infestations by minimizing disturbance and seed dispersal, eliminating seed production and maintaining healthy native communities. Contact your local Natural Resources Conservation Service for seed mix recommendations. Planting competitive legumes, such as alfalfa, can reduce Hoary cress in crop rotations.

BIOLOGICAL
There is no biological control available for Hoary cress. Since biological control agents take years to research, develop and release, no releases are expected in the foreseeable future. For more information, contact the Palisade Insectary of the Colorado Department of Agriculture at 970-464-7916.

MECHANICAL
Mowing several times before the plants bolt stresses Hoary cress and forces the plant to use nutrient reserves stored in the root system. Combining mowing with herbicides will further enhance control of this weed. Mow repeatedly during the summer, then apply a herbicide in the fall.

HERBICIDES
NOTE: The following are recommendations for herbicides that can be applied to range and pasturelands. Rates are approximate and based on equipment with an output of 30 gal/acre. Please read label for exact rates. Always read, understand, and follow the label directions. The herbicide label is the LAW!

<table>
<thead>
<tr>
<th>HERBICIDE</th>
<th>RATE</th>
<th>APPLICATION TIMING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metsulfuron (Escort XP)</td>
<td>1 oz. product/acre 0.25 v/v non-ionic surfactant</td>
<td>Apply at the early bud growth stage; i.e. “broccoli” growth stage. (Early Spring to Early Summer)</td>
</tr>
<tr>
<td>Chlorsulfuron (Telar)</td>
<td>1 oz. product/acre 0.25 v/v non-ionic surfactant</td>
<td>Apply at the early bud growth stage; i.e. “broccoli” growth stage. (Early Spring to Early Summer)</td>
</tr>
<tr>
<td>Imazapic (Plateau)</td>
<td>12 fl. oz./acre + 2 pints/acre methylated seed oil or crop oil concentrate</td>
<td>Apply at late flower to post-flower growth stage. (Late Spring to Mid Summer)</td>
</tr>
</tbody>
</table>
Weed of the Week

Whitetop Cardaria draba (L.) Desv.

Synonyms: Lepidium draba L. and Lepidium draba L. ssp. draba L.

Common Names: whitetop, hoary cress, whiteweed, peppergrass, heart-podded hoarycress, hoary cardaria

Native Origin: Central Europe and Western Asia

Description: A stout, erect perennial in the mustard family (Brassicaceae) that can grow up to 2 feet tall. The plant is leafy below and branching above with grayish stems. The arrowhead shaped leaves are grayish-green in color, covered with fine hairs and feel soft to the touch. Basal leaves form a rosette in early spring, tend to be more slender but larger than stem leaves, and narrow into a short petiole. Upper leaves clasp the stem. Flower pedicels (stalks) diverge slightly from the stem and are white with four petals about 0.1 inches long, clumped at the top of the stem and flat-looking in appearance. The seedpods are heart shaped and contain one or two oval, reddish-brown seeds. The root system consist of deeply penetrating vertical and lateral roots with thick, corky bark, large food reserves, and numerous underground buds from which rhizomes and aboveground shoots arise. Reproduction occurs from seeds or from buds on underground rhizomes.

Habitat: It prefers soils with neutral to alkaline pH and disturbed sites, including excessively grazed areas. It can be found in a variety of non-shaded habitats such as fields, meadows, pastures, open grasslands, waste areas, roadsides, gardens, feed lots, watercourses, along irrigation ditches, and at the edge of riparian habitats.

Distribution: This species is reported from states shaded on Plants Database map. It is reported invasive in AZ, CA, CO, ID, OR, MT, WA, and WY. It is also a prohibited noxious weed in Michigan.

Ecological Impacts: The plants can spread rapidly. A single plant can eventually form a large colony, producing a dense monoculture that can crowd out native species. In the absence of a competitor, a single plant can spread over an area 12 feet in diameter in one year. Types of disturbance which promote colonization and spread include grazing, irrigation, and cultivation. The species also contains compounds of glucosinolates, which can be toxic to some animals.

Control and Management:
- Manual- pulling and grubbing should be done within 10 days of plant emergence and before flowering and seed set; till and repeat tilling to remove root systems; clean all equipment before moving from the infested site; flooding can be used because seeds lose viability after being in wet soil for one month; mowing can help control infestation by reducing seed production in existing plants but will not eradicate existing populations.
- Chemical- Successful control usually requires repeated applications with foliar herbicides. It can be effectively controlled using any of several readily available general use herbicides. Metsulfuron can be used on rosettes but it is ineffective after the plants start to bloom. 2,4-D is effective on mature plants. Chemicals provide the most control when applied at the rosette state or flowering stage when carbohydrates are moving from above to below ground and herbicides are more likely to be transported to the roots. Follow label and state requirements.


Produced by the USDA Forest Service, Forest Health Staff, Newtown Square, PA. Invasive Plants website: http://www.na.fs.fed.us/fhp/invasive_plants
Cover Photos

Top left: Chris Evans, Illinois Wildlife Action Plan, Bugwood.org
Top right: Steve Dewey, Utah State Universit, Bugwood.org
Lower right: Chris Evans, River to River CWMA, Bugwood.org

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**Whitetop** (*Cardaria draba* (L.) Desv., formerly known as *Lepidium draba*)

Mustard family (Brassicaceae)

Whitetop is listed as a noxious weed in Arizona and New Mexico. This field guide serves as the U.S. Forest Service’s recommendations for management of whitetop in forests, woodlands, and rangelands associated with its Southwestern Region. The Southwestern Region covers Arizona and New Mexico, which together have 11 national forests. The Region also includes four national grasslands located in northeastern New Mexico, western Oklahoma, and the Texas panhandle.

**Description**

Whitetop (synonyms: heart-podded hoary cress, whiteweed, peppergrass, hoary cardaria) is an introduced, creeping, broadleaved, perennial plant that grows up to 2 feet tall. It is similar in appearance to two closely related *Cardaria* species: *C. chalepensis* (lens-podded hoary cress) and *C. pubescens* (globe-podded hoary cress). These three exotics are members of the mustard family (Brassicaceae) and are often grouped together because they invade similar sites and are equally difficult to control. The primary distinguishing characteristic between these species is the type and shape of the fruit, which is an indehiscent (remaining closed at maturity) pod called a silicle. *C. draba* has heart-shaped pods that become flattened with prominent veins as they dry. *C. chalepensis* has oval or lens-shaped pods that do not become flattened and veins are not prominent. *C. pubescens* has globose, hairy purplish pods that remain inflated when dry.

**Growth Characteristics**

- **Leaves alternate; rosette leaves and basal leaves of mature plants taper to a petiole. When mature, lower leaves are long and slender; upper leaves are obovate with smooth to slightly toothed margins; arrowhead-like lobes of leaves clasp the stem; leaves covered with short, white hairs.**

- **Many white, 4-petalled flowers occur in a flat-topped inflorescence (corymb of racemes); flowers have 6 stamens; 1 pistil; sepals are green; petals are spoon shaped.**

- **Indehiscent fruits are heart-shaped, 2-chambered silicles with a distinct beak (a persistent style) on the end opposite the notch; one ovoid, reddish-brown seed per chamber.**

**Ecology**

**Impacts/threats**

Whitetop produces low quality forage, and dense infestations can crowd out desirable plants and reduce animal diversity. The foliage contains glucosinolates, which are toxic to cattle and decompose into allelopathic compounds that can impede germination and growth of desirable plants.

**Location**

Whitetop favors unshaded, disturbed areas with moderately moist, alkaline soils. It is widely distributed across the western U.S. and can be found along roadides or irrigation ditches, and in rangeland meadows, subirrigated pastures, and hay fields. Whitetop grows on a wide range of soil types, from those that are moderately saline to acidic soils with low moisture.

**Spread**

A single plant produces up to 4,800 seeds that are viable for up to 3 years in the soil. In warmer climates, whitetop may produce several seed crops during a growing season. Seed is dispersed by water, wind, and animals; seed may move great distances as a contaminant in other types of seed. New shoots are commonly grown from root fragments, which can be spread long distances as a contaminant in displaced soil,
hay bales used for erosion control, or alfalfa hay. Seed or root fragments may adhere to surfaces and undercarriages of vehicles and road maintenance equipment.

**Invasive Features**

Whitetop has a deep taproot and a creeping lateral root system. Extensive carbohydrate reserves are stored within the roots, which enable shoots to emerge early and grow rapidly in the spring. Root fragments less than 1-inch long may resprout to form new shoots. Because whitetop is adaptable to a wide range of habitats, invasions of whitetop often occur in sensitive areas, which can limit control options.

**Management**

Early detection and removal of new infestations soon after discovery is the most effective weed management strategy for whitetop control. Because of its extensive creeping rootstock, large populations are a challenge to eradicate if not an impossibility once established. Small or isolated infestations on otherwise healthy sites should be given high priority for treatment, followed by treatment of whitetop in corridors with a high likelihood for spread, such as waterways and irrigation structures. In areas where whitetop has become well established, containment should become a management priority. Containment can be achieved by managing the outside perimeter to prevent further spread. Whatever the approach, whitetop management will likely require several consecutive years of treatment with an integrated approach to reduce its impact to the plant community. The following actions should be considered when planning an overall management approach:

- Practice prevention and eradicate new populations of whitetop as early as possible.
- Periodically check areas where hay bales are used to control erosion or where soils have been imported for presence of whitetop.
- Use certified weed-free hay; use pellets to feed horses in back-country areas.
- Implement annual monitoring and a followup treatment plan for missed plants and seedlings.
- Combine mechanical, cultural, biological, and chemical methods for the most effective whitetop control.

Table 1 summarizes some management options for controlling whitetop under various situations. Choice of individual control method(s) for whitetop depends on many factors including the current land use and site condition; accessibility, terrain, and climate; density and degree of whitetop infestations; and nontarget flora and fauna present. Other considerations include treatment effectiveness, cost, and the number of years needed to achieve control. More than one control method may be needed for a particular site.

**Physical Control**

Although labor intensive and costly, physical methods that are consistently and repeatedly used can be effective at controlling whitetop. Effectiveness of physical methods is usually improved when combined with herbicide control.

**Manual Methods**

Hand removal – Hand digging or grubbing may be feasible for small, isolated populations or for plants located in sensitive areas such as riparian corridors. Ideally, the entire root system should be dug out before seed forms. Debris should be disposed of by burning piled plants or by bagging and then depositing the bags in a landfill.

**Mechanical Methods**

When using machinery to manage whitetop, equipment should be cleaned after use to prevent movement of seeds or root fragments into uninfested areas.
Table 1. Management options*

<table>
<thead>
<tr>
<th>Site</th>
<th>Physical Methods</th>
<th>Cultural Methods</th>
<th>Biological Methods</th>
<th>Chemical Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roadsides, fence lines, or noncrop areas</td>
<td>Mow at late bud to early flower stage; apply herbicide to resprouts.</td>
<td>Clean machinery following activity in infested areas.</td>
<td>Biological control agents are currently unavailable.</td>
<td>Spray at bud to early flower stage. For ground application, use truck-mounted or tractor-pulled spraying equipment. Wash under vehicle after application to prevent spread.</td>
</tr>
<tr>
<td></td>
<td>Remove small patches by hand pulling.</td>
<td>Train road crews and the public to identify and report infestations; map reported populations.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rangelands, pastures, or riparian corridors</td>
<td>For seedlings, use initial deep cultivation followed by repeat cultivation at a 4- to 5-inch depth every 5 to 10 days during the growth season; repeat for 2 to 4 consecutive years. Prescribed burning is NOT recommended.</td>
<td>Use certified weed-free seed and hay.</td>
<td>Prescribed grazing with sheep or goats may be considered in combination with other methods; slightly toxic to cattle. Closely manage grazing to prevent overuse of desirable species. Biological control agents are currently unavailable.</td>
<td>For extensive and dense infestations, use ground or aerial broadcast spraying. For sparse infestations, use backpack or hand-held sprayer.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Monitor areas where soil was imported or hay bales were used for erosion control.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reseed with competitive, desirable plants.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wilderness, other natural areas, and/or small infestations</td>
<td>Hand dig or grub small patches; remove as much of the root as possible; bag and dispose of debris appropriately.</td>
<td>Educate the public to identify and report infestations.</td>
<td>Same as above.</td>
<td>Use backpack or hand-held sprayers or use wick method for IPT.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>After passing through infested areas, inspect and remove any seed or root fragments from animals, clothing, and vehicles.</td>
<td></td>
<td>Broadcast spraying may be used on thicker stands, if allowed.</td>
</tr>
</tbody>
</table>

* Choice of a particular management option must be in compliance with existing regulations for land resource.

**Mowing** – By itself, mowing is not recommended as it can contribute to further spread and increased densities of whitetop. In agronomic lands or areas with level ground where mowing is practical, cutting the weed in combination with later well-timed herbicide applications will improve control effectiveness. Mow whitetop early in the growth season when it is at flower bud stage. Allow the shoots to resprout and then apply herbicide when plants again reach flower bud stage. Mowing causes the plant to produce larger leaves that are perpendicular to the ground which allows better access of herbicide into the lower third of leaves. An alternative is to spray plants in late summer/early fall and then mow in the spring. New shoots will likely be produced, and repeat spraying is usually necessary for further control.

**Tillage** – Cultivation is effective with seedlings and in areas where the population is not yet well established. Till plants below the depth of lateral and vertical roots, and plan to repeat cultivation shortly after new shoots emerge. This may require tillage that is needed every 10 to 15 days for 6 to 8 weeks during the growing season which may be followed by less frequent tillage. Speed of eradication depends upon timing and frequency of cultivation, and this practice usually has to be repeated for at least 2 consecutive years. Even infrequent cultivation before seed set can reduce whitetop infestation. Combining tillage with well-timed herbicide use can further improve effectiveness.

**Prescribed Fire**
Since 75 percent of whitetop’s total biomass is below ground, populations rebound rapidly following fire. Therefore, this practice is not recommended as a control method. Burning is an acceptable means to dispose of plant debris.
**Flooding**

When feasible, flooding an area with 6 to 8 inches of water for 2 months can be an effective control method.

**Cultural Control**

Prevention is key to controlling whitetop, and early detection and plant removal are critical for reducing its spread. Educating land managers, the local public, and others to identify nonnative noxious species is important so they can help report all suspected infestations. Weed screens for irrigation ditches should be considered as a means of preventing seed dispersal via waterways. Reseeding with desirable shrub and perennial grass species that are competitive with whitetop should be considered for areas not recovering naturally following suppression efforts.

**Biological Control**

**Grazing**

Although palatability is low, goats and sheep will graze whitetop from rosette until the early flowering stage. Whitetop reportedly is toxic to cattle if consumed in great enough quantity, but livestock generally make very little use of this weed.

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<table>
<thead>
<tr>
<th>Common Chemical Name (active ingredient)</th>
<th>Product Example¹</th>
<th>Product Example Rate per Acre (broadcast)</th>
<th>Backpack Sprayer Treatment Using Product Example²</th>
<th>Time of Application</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chlorsulfuron</td>
<td>TelarXP</td>
<td>1 ounce</td>
<td>1–2%</td>
<td>Bud to early bloom.</td>
<td>Selective; safe for labeled grasses; provides 1–2 years control. Not for use near waterbodies. Use 0.25% v/v NIS³. If area is mowed before herbicide applied, lower rate is effective.</td>
</tr>
<tr>
<td>Metsulfuron methyl</td>
<td>Escort, Ally</td>
<td>0.75–1 ounce</td>
<td>1%</td>
<td>Same as above.</td>
<td>Selective; safe for most perennial grasses. Not for use near irrigation water. Add 0.25% v/v NIS³. May apply in fall if part of plant is still green.</td>
</tr>
<tr>
<td>Chlorsulfuron + metsulfuron</td>
<td>Cimmaron Plus</td>
<td>1.25 ounces</td>
<td>1%</td>
<td>Same as above.</td>
<td>Broad spectrum; most broadleaved plants and certain grasses are susceptible; absorbed through foliage and roots; preemergent and postemergent activity. Add 1/16% – 1/18% v/v NIS³; a 1 to 2 inches of rainfall is required after application to move herbicide into root zone.</td>
</tr>
<tr>
<td>Aminopyralid + metsulfuron</td>
<td>Chaparral</td>
<td>2.5–3.33 ounces</td>
<td>1%</td>
<td>Spring (rosette to bolt) or fall (seedling to rosette).</td>
<td>Broad spectrum; most broadleaved plants (including legumes and woody plants) and certain grasses are susceptible. Not for use near surface water. Tank mix with 2,4-D for bolt to early flower stages. Add 0.25% v/v NIS³.</td>
</tr>
<tr>
<td>Glyphosate</td>
<td>Rodeo, RoundUp Pro, others</td>
<td>3 quarts</td>
<td>Rodeo: 0.75–2% + NIS3</td>
<td>Flower bud stage.</td>
<td>Nonselective. Rodeo is labeled for use in or near aquatic areas. If infestation is dense, mow and then apply glyphosate when regrowth reaches flower bud stage.</td>
</tr>
</tbody>
</table>

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[^1]: Common Chemical Name (active ingredient)
[^2]: Product Example
[^3]: Backpack Sprayer Treatment Using Product Example
[^4]: Time of Application
[^5]: Remarks
Table 2. Herbicide recommendations  (continued)

<table>
<thead>
<tr>
<th>Common Chemical Name (active ingredient)</th>
<th>Product Example¹</th>
<th>Product Example Rate per Acre (broadcast)</th>
<th>Backpack Sprayer Treatment Using Product Example²</th>
<th>Time of Application</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>2,4-D ester or amine⁴</td>
<td>several products available</td>
<td>2 quarts</td>
<td>1–5%</td>
<td>Before bud stage.</td>
<td>Selective; acceptable for use in/near aquatic areas. Apply annually for 2 years or more to control established stands. If infestation is dense, mow first and then spray regrowth.</td>
</tr>
<tr>
<td>Imazapyr</td>
<td>Arsenal, Habitat, others</td>
<td>2–3 pints</td>
<td>0.5–5%</td>
<td>Flower bud to flowering stage; apply to actively growing plant parts.</td>
<td>Nonselective; preemergent and postemergent; broad-spectrum control. Habitat is labeled for use near water. In addition to overspray, nontarget plants may be killed or injured by root transfer of imazapyr between intertwined root systems. Add 0.25% v/v NIS for postemergent use.</td>
</tr>
<tr>
<td>Imazapic</td>
<td>Plateau</td>
<td>12 fluid ounces</td>
<td>5%</td>
<td>Same as above.</td>
<td>Selective herbicide but may retard growth of some grasses. This herbicide is the preferred alternative to imazapyr if protection of desirable plants is needed.</td>
</tr>
</tbody>
</table>

¹ Trade names for products are provided for example purposes only, and other products with the same active ingredient(s) may be available. Individual product labels should be examined for specific information and appropriate use with whitetop.

² Herbicide/water ratio - As an example, a gallon of spray water with a 3 percent mixture is made by adding a sufficient volume of water to 4 ounces of liquid herbicide until a volume of 1 gallon is reached (4 oz ÷ 128 oz/gal = 0.03 or 3 percent).

³ NIS is an abbreviation for nonionic surfactant which is an additive commonly recommended by herbicide labels for postemergent foliar application of herbicides.

⁴ 2,4-D is a restricted use pesticide in New Mexico only. A certified applicator’s license is required for purchase and use.

Classical Biological Control

Biological control research is underway; however, there are currently no classical biological control agents approved by USDA for management of whitetop. The following species are being studied for whitetop control: *Ceutorhynchus cardariae* (a gall-forming weevil), *C. turbatus* (a seed-feeding weevil), *Melanobaris semistriata* (a root-mining weevil), and *Psylliodes wrasei* (a shoot-mining flea beetle).

Chemical Control

Whitetop grows in many different crop and rangeland situations, which complicates the choice for best chemical control. Herbicides commonly used to control mustards generally work well on whitetop; but these chemicals often control a wide range of other broadleaf plants as well, some of which may be desirable. For example, legumes such as alfalfa are sensitive to most herbicides that are effective with whitetop and could be lost if sprayed. All herbicides recommended in table 2 will effectively control whitetop when properly applied. Chlorsulfuron or metsulfuron methyl provide effective whitetop control in noncropland areas, but timing is important. Spraying should be done in early spring or preferably in the fall before winter dormancy. 2,4-D (ester or amine) can provide fair to good control or provide suppression when sprayed in early spring. Glyphosate, imazapic, or imazapyr formulations are acceptable for use in areas near water. Monitoring and followup applications at a minimum of several years are recommended to attain long-term control. Herbicide applications should be made during
the flower bud to early flowering stage when carbohydrate root reserves are lowest.

Each herbicide product will have different requirements and restrictions according to the label. Read and understand prior to any application. To prevent development of resistance in whitetop from repeated treatments, the label should be consulted for guidelines on rotating herbicide active ingredients. Consult the registrant if you have questions or need further detail.

Herbicides may be applied in several ways including backpack, ATV or UTV sprayers, or conventional boom sprayers that are pulled or attached to a tractor or truck. For sparse populations, one person or a small team can spray or wick whitetop in an area using the individual plant treatment (IPT) method. Spray plants directly by wetting the foliage and stems to the point of dripping while using an adjustable spray nozzle attached to a hand-held or backpack sprayer. To suppress whitetop in riparian areas while allowing desirable plant species to reestablish, wick individual plants with 100 percent solution of 2,4-D for several consecutive years. Where water is not present year-round, chlorsulfuron may be used as long as the herbicide has time to degrade in the soil before water returns.

## Control Strategies

Because each treatment situation is unique, the strategy adopted for whitetop control must involve careful planning and a long-term commitment to management actions. Combining methods, as outlined in this guide, should always be considered in a long-term approach to control whitetop. As an example, combining physical methods with chemical control can be an effective option.

Regardless of the strategy used, components of a successful whitetop control program should include repeated treatments, monitoring of treated areas, and measures taken to control missed plants, resprouts, and newly emerged seedlings. Monitoring should be conducted in early spring and late summer to find rosettes that form the leading edge of expanding infestations. To enhance long-term control, efforts should be made to encourage return of desirable plants such as shrubs and perennial grasses that will compete with whitetop for water, nutrients, and space.

## References and Further Information


**Suggested Web Sites**

CABI database:

http://www.cabi.org/?page=1017&pid=2257&site=170

For information on invasive species:

http://www.invasivespeciesinfo.gov/
http://www.invasive.org/weedus/index.html

For information about calibrating spray equipment:


Herbicide labels online:

http://www.cdms.net/LabelsMsds/LMDefault.aspx
The use of trade or firm names in this publication is for reader information and does not imply endorsement by the U.S. Department of Agriculture of any product or service. It does not contain recommendations for their use, nor does it imply that the uses discussed here have been registered. All uses of pesticides must be registered by appropriate State and/or Federal agencies before they can be recommended.

CAUTION: Pesticides can be injurious to humans, domestic animals, desirable plants, and fish or other wildlife—if they are not handled or applied properly. Use all pesticides selectively and carefully. Follow recommended practices for the disposal of surplus pesticides and pesticide containers.
Hoary Cress
Cardaria draba
2014 Quarterquad Survey
Distribution and Abundance in Colorado

30,044+ Infested Acres

Distribution Legend:
- 0 acres
- 1-10 acres
- 11-50 acres
- 51-300 acres
- 301-999 acres
- >1000 acres

Acreage estimates supplied by County Weed Supervisors and compiled by the Colorado Department of Agriculture.