

Field Guide for Managing Cheatgrass in the Southwest



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Cheatgrass (*Bromus tectorum* L.)

Grass family (Poaceae), Bromeae tribe

Cheatgrass is an invasive plant that is common throughout the southwestern United States. It is listed in New Mexico as a Class C noxious weed species, which allows management decisions to be determined at the local level based on feasibility of control and level of infestation.

This field guide serves as the U.S. Forest Service's recommendations for management of cheatgrass in forests, woodlands, rangelands, and deserts associated with its Southwestern Region. The Southwestern Region covers Arizona and New Mexico, which together have 11 national forests. The Region also administers 4 national grasslands located in northeastern New Mexico, western Oklahoma, and the Texas panhandle.

Description

Cheatgrass (synonyms: downy brome, drooping brome, June grass, bronco grass, early chess, military grass, thatch brome grass, Mormon oats) is an early emerging, introduced annual grass that is native to southern Europe, northern Africa, and southwestern Asia. As a seedling or young plant, cheatgrass is bright green with hairy blades and a dense, drooping seed head. Maturing foliage and seed heads are purplish in color that later change to brown and tan colors when dried out.

Growth Characteristics

- Annual or winter annual (biennial); shade intolerant; seed germinates mostly in late fall or early spring.
- Slender seed stalks grow erect or are decumbent at base; 4 to 30 inches tall.
- Forms tillers with 1 to 2 tillers or as many as 20 tillers per main root. Fibrous roots continue to grow during winter thereby supporting greater penetration of the soil profile by spring. Plant also sends out lateral roots to maximize access to soil moisture.
- Twisting leaf blades glabrous to hispid (covered with stiff or rough hairs); soft, short hairs on leaf sheaths.
- Slender, dense, 1-sided inflorescence with multiple drooping spikelets. Each spikelet has 5 to 8 florets.

- Reproduces only by seed. Each plant may produce between 25 and 5,000 seeds which typically mature by middle to late June; seeds are awned and readily attach to clothing and fur. Seed may remain dormant for 2 to 3 years in the soil, even at high temperatures.

Ecology

Impacts/Threats

Cheatgrass is an aggressive invader of sagebrush, pinyon-juniper, ponderosa pine, mountain brush, and other rangeland and forest communities. Its ability to rapidly grow and reproduce before most native grasses makes it especially troublesome on range, croplands, and pastures. Cheatgrass can alter the normal fire pattern in vegetated areas when its populations become dense and dominant. After wildfire, cheatgrass thrives and can out-compete native herbaceous and shrubby seedlings such as antelope bitterbrush. The presence of cheatgrass with its awned seed can diminish recreational opportunities, reduce available forage, degrade wildlife diversity and habitat, and decrease land values.

Site/Distribution

Cheatgrass grows in a variety of habitats and climate zones, generally preferring areas with 6 to 22 inches of precipitation. It grows in most soil types, although it prefers relatively coarse-textured soils, and tends to avoid areas with saline or compacted soil. It commonly invades disturbed areas such as recently burned areas, roadsides, overgrazed rangelands, cleared areas, railway and utility rights-of-way, cultivated fields, and vegetation management projects that involved soil disturbance. First identified in the northeastern U.S. in 1861, it is now found throughout all 50 States and is widely distributed across the western U.S.

Spread

The hairy, sharply awned seeds of cheatgrass are transported by various means including wind, water, birds, rodents, etc. They easily adhere to clothing, fleece, and animal fur. The seed is often a contaminant in grain, hay, and straw. Seed carried underneath vehicles and road

maintenance equipment is a major means of long distance transport.

Invasive Features

Cheatgrass germinates early, and its roots grow rapidly during winter which allows uptake of greater soil moisture for rapid spring growth, early maturation, and increased drought tolerance. Its potential for high population densities and serving as a fine-textured fuel increases the likelihood for fire ignition and spread. As a result, the greater frequency of fires occurring in cheatgrass-infested areas tends to favor overall cheatgrass dominance by removing reproduction of competing native plants.

Management

Choice of actions to take for cheatgrass control primarily depends on the management goals and objectives for the site. Control is particularly necessary when dense, competitive populations of cheatgrass block attainment of goals and objectives for land management. Because cheatgrass reproduces entirely from seed, management should focus on preventing seed production and depleting seed bank reserves. When implementing cheatgrass management, an adaptive approach should be followed that will allow adjustments to be made as necessary.

The following actions should be considered when planning a management approach for cheatgrass:

- Maintain healthy plant communities to prevent or limit cheatgrass infestations.
- Limit disturbance and revegetate quickly with desirable plants following a major disturbance.
- Detect, map, and eradicate new populations of cheatgrass as early as possible. Keep annual records of reported infestations.
- Combine mechanical, cultural, biological, and chemical methods for most effective control.
- Encourage use of spray washing stations to reduce seed spread when mechanized equipment is utilized inside or near an infestation.

Table 1 summarizes some management options for controlling cheatgrass under various situations. Further details on these management options are explained below. The selection of individual control method(s) for cheatgrass depends on the extent and density of infestation, current land use, and site conditions (accessibility, terrain, microclimate, other flora and fauna present, etc.). Other important considerations include treatment effectiveness, overall cost, and the number of years needed to achieve control. More than one control method may be needed for a particular site.

Physical Control

Physical methods to control cheatgrass should focus on removing plants to reduce seed overall production. Most methods require proper timing and may need to be repeated to reach an acceptable level of control. Seed reserves of desirable native species sufficient to repopulate a site following cheatgrass suppression or removal can increase effectiveness of control methods.

Manual Methods

Hand pulling, cutting, or digging – For small infestations of cheatgrass, hand pulling or hoeing before seeds are produced (approximately 1 week after flowering) will reduce seed but may not completely eliminate the infestation. Several consecutive years of hand removal may be required to reduce seed bank reserves. When pulling, extract as much of the root as possible.

Mechanical Methods

If using machinery to manage cheatgrass, the equipment should be cleaned after use to prevent movement of seed into un-infested areas.

Tillage – Disking or other mechanical control methods used alone may encourage further dominance, since disturbance coupled with a well-aerated seedbed favors cheatgrass establishment. When repeatedly done, disking or tillage operations may be effective if cheatgrass seed is buried at least 4 to 6 inches deep. The moldboard plow is an equipment option for this purpose, but the implement is less effective when used in rocky soils.

Table 1. Management options*

Site	Physical Control	Cultural Control	Biological Control	Chemical Control
Roadsides, fence lines, and non-crop areas	Mow or grade before seed production. Repeat every 2 to 3 weeks or until flowering is complete.	Use seed, mulch, and fill materials certified to be weed-free. Implement sanitary requirements for vehicle operations and reporting of infestations along roads. Avoid excessive disturbance. Consider reseeding with desirable native perennials after cheatgrass control.	If practical, late fall and early spring grazing with livestock will reduce seed production and decrease risk of wildfire; however, heavy grazing may promote infestation.	Use truck spraying equipment. Wash underneath vehicle afterward to prevent spread.
Rangeland, pasture, or riparian corridors	Use tillage with disc or plow to bury seed 4 to 6 inches deep after cheatgrass emerges in spring. Avoid excessive disturbance. Repeat if necessary. Consider prescribed burning in combination with herbicide or reseeding. However, burning pure stands may increase dominance.	Use seed and forage hay certified to be weed-free; use pellets for horses in backcountry areas. When moving livestock or vehicles through infested areas, inspect and remove seed from animals, clothing, and vehicles before entering un-infested areas. Avoid excessive disturbance. Consider reseeding with desirable native perennials after cheatgrass control.	Late fall and early spring grazing with livestock will reduce seed production and decrease risk of wildfire; however, heavy grazing may promote infestation.	Use ground broadcast sprayer on fairly level ground or use backpack sprayer for areas difficult to access. Wash underneath vehicle afterward to prevent spread. Broadcast spraying by aerial methods may be used on thicker stands if allowed.
Wilderness, other natural areas, and/or small infestations	Manual methods (such as hand pulling) to remove plants may be needed to protect other resources.	Use seed and forage hay certified to be weed-free; use pellets for horses in backcountry areas. When moving livestock through infested areas, inspect and remove seed from animals and clothing before entering un-infested areas. Post signs warning visitors to remove seed from clothing or animals before leaving infested areas. Avoid excessive disturbance. Consider reseeding with desirable native perennials after cheatgrass control.	Same as above.	Use backpack sprayer.

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

Mowing – Repeated mowing every 2 to 3 weeks during spring and summer may be as effective as an application of glyphosate. However, mowing for just a single time is not effective for preventing seed production since plants often rapidly regrow and still produce seed.

Prescribed Fire

Fire in cheatgrass stands often leads to a displacement of desirable native plants and an increase in cheatgrass

density and dominance. However, prescribed fire has been used with some success as an aid to cheatgrass control in certain areas with mixed shrub and grasses during late spring to early summer. Burning is usually more effective when used in combination with other control methods such as chemical control or reseeding with desirable native perennials (see “Integrated Control Methods” at the end of this section for more information).

Cultural Control

Seed and materials used for mulch, forage, or fill should be certified to be weed-free; pellets may be used for horses in backcountry areas. Travel through infested areas by vehicles, humans, and livestock should be discouraged. If not, a program to check and remove seeds from vehicles and livestock can be implemented. In cultivated fields, crop rotation can be used to reduce cheatgrass. Re-seeding with desirable native perennials may be necessary after cheatgrass control.

Biological Control

Grazing

Cheatgrass does not compete well with established perennial grasses; therefore, proper grazing management and practices that encourage perennial grasses will aid in cheatgrass suppression. Cheatgrass provides good quality forage for about 6 to 8 weeks early in the season, which is also the optimal time to graze. However, mature cheatgrass can have negative effects on livestock when consumed in late spring and summer due to the presence of the stiff awns on its seed.

To reduce cheatgrass stands, graze while the cheatgrass is green during the spring and again in the fall by using a high intensity, short duration approach. Proper timing and close management of livestock is required to minimize impact to non-target desirable plant species. Grazing newly emerged cheatgrass in the late summer or fall when it is less likely to regrow will reduce fuel levels during wildfire season. Although cheatgrass grazed in the spring may regenerate new culms and still produce seed, a reduction in seed production is possible if grazing is practiced twice per year for 2 consecutive years.

Classical Biological Control

There are no approved classical biocontrol agents for cheatgrass at this time, although a number of potential biocontrol agents are currently being researched, which includes a fungus, a mold, and several mites. A host-specific strain of the bacterium, *Pseudomonas fluorescens*, has been formulated as a biopesticide to control cheatgrass; however, its effectiveness against cheatgrass in the Southwest is unknown. Methods to

manipulate nutrients and soil microbes as a means for cheatgrass control are also being studied.

Chemical Control

Herbicides listed in table 2 will effectively control cheatgrass when properly applied; however, these herbicides may also impact non-target species as they are generally nonselective in nature. Aquatically approved formulations and surfactants should be used in or near water. Each herbicide product will have different requirements and restrictions. Thus, it is important to read the label carefully and follow all instructions and guidelines when mixing and applying chemical herbicides.

Herbicide Application

Herbicides approved for use on cheatgrass are usually best applied in fall or early winter before soils are frozen. An optimal period for fall application is between the first light frost and the first heavy frost after which all applications should be stopped. Herbicide treatments are less efficient in the spring once cheatgrass starts to enter its early leaf development stage. If a spring application is made, then plants should be sprayed when they are growing vigorously and are no more than 2 to 3 inches tall. Whenever any area is sprayed, non-target native plants ideally should be dormant and protect from any off-target drift or soil movement.

To control cheatgrass over broad areas, the application of a herbicide is generally required as part of any restoration strategy. Herbicide application will reduce cheatgrass while increasing available soil moisture for establishment of native plants. Fall application of herbicide usually has the greatest chance for successful seeding of rangeland and pastures. Since reseeding is often problematic, it may take several replanting efforts to establish desired plants. Chemical control can be more effective when used in combination with reseeding (see “Integrated Control Methods” at the end of this section for more information).

All herbicides listed in table 2 can be applied by broadcast or spot spray methods. Backpack or hand-held sprayers should be used for smaller, less dense infestations. For larger areas, it may be more practical to use an ATV or

Table 2. Herbicide recommendations

Common Chemical Name (active ingredient)	Product Example ¹	Broadcast Treatment (rate per acre)	Spot Treatment (spray solution) ²	Time of Application	Remarks
Indaziflam	Esplanade 200 SC	3.5-7 ounces	NA	Apply prior to weed seed germination	Pre-emergent herbicide. Labeled for non-crop areas but not for rangeland.
Imazapic	Plateau	2–12 ounces + 1 quart MSO (methylated seed oil)	0.25–1% + 1% MSO	Fall or spring	Amino acid inhibitor; residual. Broad spectrum weed control for roadsides and non-crop areas. Controls annual and perennial weeds with minimal effects on perennial grasses. May leach into groundwater. Not for use along waterbodies.
Imazapic + glyphosate	Journey	16–21 ounces + 1 quart MSO	1% + 1% MSO	Fall or spring	Broad spectrum weed control for roadsides, wildlife habitat, and non-crop areas.
Glyphosate	Roundup Pro, Rodeo, Accord, many others	0.5–1 pint	0.5–2%	Early spring, after cheatgrass emerges and before native perennial seedlings emerge. Has a narrow application window.	Nonselective amino acid inhibitor; will kill desirable vegetation, including native grasses, forbs, and woody species. Foliar application only; quickly de-activated in the soil.
Rimsulfuron	Matrix SG	3–4 ounces	3–4 ounces per 100 gallons of water	Apply in late fall on emerged seedlings for best results.	Labeled for roadsides and bare ground sites but not for rangeland. Pre-emergence or early post-emergence timing will control several grass and broadleaf species.
Sulfometuron methyl + chlorsulfuron	Landmark XP	1–1.5 ounces	1–1.5 ounces per 100 gallons of water	Warm, moist conditions following application accelerates herbicide activity.	Registered for use in non-crop situations only. Read product label carefully before applying. Care should be exercised when used in the vicinity of desired plants. Has a 12 month grazing restriction.

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 cheatgrass.

² Spray solution is the herbicide/water ratio in a spray mix that may be used for spot treatment with backpack or hand-held sprayers. The amount of product applied during an annual growing season must not exceed the maximum application rate per acre as specified by the product label – refer to the product label for the site type and application.

UTV sprayer or a conventional boom sprayer that is pulled or mounted to a truck or tractor. Any equipment used to spray herbicide should be calibrated.

Precautionary measures should be taken if non-target plants (including woody species) need to be protected.

Integrated Control Methods

To restore native plants in large areas dominated by cheatgrass infestations, the following combinations of control methods should be considered:

- **Broadcast spray–reseed–spot spray** – Use broadcast spraying to remove cheatgrass from the target area. If reseeding is needed, then use a range drill to plant desired native perennial species. To protect newly planted material or to allow native grasses to return naturally, a coordinated prescribed grazing plan should be implemented with cooperating livestock operators. Sprayed areas should be monitored and re-treated as necessary with spot spraying. This multi-year

program for cheatgrass control has been demonstrated to provide one of the best outcomes over the long term

- **Tillage–reseed** – Use spring tillage to interrupt cheatgrass growth. Follow up in the fall with repeat tillage and/or herbicide application to eliminate new seedlings. In late fall or early winter, consider reseedling with desirable perennial species.
- **Prescribed burn–reseed** – Perform a prescribed burn in early summer when cheatgrass seed is still in the inflorescence stage or during the fall to prepare the site for later seeding during the fall/winter/spring. Use a range drill to seed desirable native perennial species. Coordinate with prescribed grazing to trample seed into the ground through hoof- action and to protect newly planted material.

Management Strategies

Prioritizing areas for treatment with a combination of control methods will enhance long-term success for managing cheatgrass. Treatment priority should be assigned to small or sporadic infestations on otherwise healthy sites, which can be followed by treatment of larger infestations.

Before initiating any treatment, examine every proposed site closely to determine if native grasses will return naturally or if reseedling is necessary. If desirable native plants are common, they will often flourish once cheatgrass is removed, thereby allowing natural restoration. However, reseedling should particularly be considered if native plants are nearly absent.

Successive treatments of cheatgrass are usually needed to control seed germination and emerging seedlings. In most cases, 3 or more consecutive years of treatment will be necessary to deplete the seed bank. Since it is ordinarily useless to treat a cheatgrass-infested area only one time without retreatment, sufficient resources must be allocated for the area where control is attempted. After initial treatment, resources should also be available to respray or retreat the treated area successfully. Previously treated

areas should be monitored continuously and retreated when necessary to forestall cheatgrass recovery.

Adaptive Management

Cheatgrass is pervasive throughout the western United States and controlling it across broad areas is mostly impractical. Therefore, realistic goals and objectives should be established to manage cheatgrass infestations occurring extensively throughout a given landscape. To improve long-term success, consider using an adaptive management approach with the overall goal of restoring desirable plant communities. The stepwise process for adaptive management involves:

1. Assessment of the overall weed problem,
2. Establishing management goals and objectives,
3. Implementation of control strategies and measures,
4. Monitoring the effectiveness of management actions,
5. Evaluating actual outcomes in relation to expected results, and
6. Adjusting practices as necessary.

Steps of this process should be repeated in sequence as part of a continuous learning cycle that improves management planning and strategy by learning from the outcomes of previous management actions. In general, an adaptive management strategy is considered to be successful if:

1. Stakeholders are actively involved and remain committed to the process,
2. Monitoring and assessment are used to adjust and improve management decisions, and
3. Management goals and/or objectives for the resource are being achieved.

References and Further Information

- Carpenter, A.T. and T.A. Murray. 1999. Element Stewardship Abstract for *Bromus tectorum*. The Nature Conservancy. Arlington, VA. Available at <http://www.invasive.org/gist/esadocs/docmnts/bromtec.pdf> (accessed June 2010).
- Duncan, K, K. McDaniel, and M. Renz. 2005. Chemical Weed and Brush Control for New Mexico Rangelands. New Mexico State Univ. Las Cruces, NM. Available at http://aces.nmsu.edu/pubs/circulars/CR_597.pdf.
- Launchbaugh, K. 2008. Targeted Grazing. University of Idaho. Moscow, ID. Available at <http://www.cnr.uidaho.edu/rx-grazing/index.htm> (accessed June 2010)
- Menalled, F., J. Mangold, and E. Davis. 2008. Cheatgrass: Identification, Biology and Integrated Management. Montana State University Cooperative Extension 500-1008SA. Bozeman, MT. Available at <http://www.msuxextension.org/publications/AgandNaturalResources/MT200811AG.pdf> (accessed February 2010).
- North Dakota Department of Agriculture. 2010. Invasive Species Web-based Manual. Plant Industries. Bismarck ND. Available at <http://www.agdepartment.com/noxiousweeds/pdf/Cheatgrass.pdf> (accessed February 2010)
- Northam, E. and W. Meyer, et al. 2009. Non-Native Invasive Plants of Arizona. Conservation Districts and RC&D Areas of Arizona and the University of Arizona Cooperative Extension. Publication AZ1482. Available at <http://cals.arizona.edu/pubs/natresources/az1482.pdf> (accessed Feb. 2010)
- Pellant, M. 1996. Cheatgrass: The Invader that Won the West. BLM Idaho State Office. Boise, ID. Available at <http://www.icbemp.gov/science/pellant.pdf> (accessed June 2010).
- Renz, M. and F. Sholedice. 2006. Cheatgrass/*Bromus tectorum*. p. 58-59. In *Troublesome Weeds of New Mexico*. New Mexico State Univ. Las Cruces, NM. Available at <http://www.emnrd.state.nm.us/fd/Publications/documents/NMTroublesomeWeeds.pdf> (accessed February 2010).
- USDA. 2010. National Invasive Species Information Center. Available at <http://www.invasivespeciesinfo.gov/plants/downybrome.shtml> (accessed February 2010)
- USDA/NRCS. 2010. National Plant Database. Available at <http://www.plants.usda.gov> (accessed February 2010)
- Williams, B.K., R.C. Szaro, and C.D. Shapiro. 2009. Adaptive Management: The U.S. Department of the Interior Technical Guide. Adaptive Management Working Group, U.S. Department of the Interior, Washington, DC. URL: <https://www2.usgs.gov/sdc/doc/DOI%20Adaptive%20ManagementTechGuide.pdf>
- Young, J. 2006. Invasive Plants of California's Wildland. California Invasive Plant Council. Berkley, CA. Available at <http://www.cal-ipc.org> (accessed February 2010).
- Zouhar, K 2003. *Bromus tectorum*. In *Fire Effects Information System (Online)*. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available at <http://www.fs.fed.us/database/feis> (accessed February 2010)

Suggested Web Sites

DCNR Invasive Exotic Plant Tutorial for Natural Land Managers: http://www.dcnr.state.pa.us/Forestry/invasivetutorial/cheatgrass_M_C.htm

For information about calibrating spray equipment: NMSU Cooperative Extension Service Guide A-613, *Sprayer Calibration*. Available at http://aces.nmsu.edu/pubs/_a/A613

Herbicide labels available at <http://www.cdms.net/>

**For more information or
other field guides, contact:**

USDA Forest Service
Southwestern Region
Forest Health
333 Broadway Blvd., SE
Albuquerque, NM 87102

**Or visit the Southwestern Region's
website for invasive species:**

<http://www.fs.usda.gov/goto/r3/invasivespecies>



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