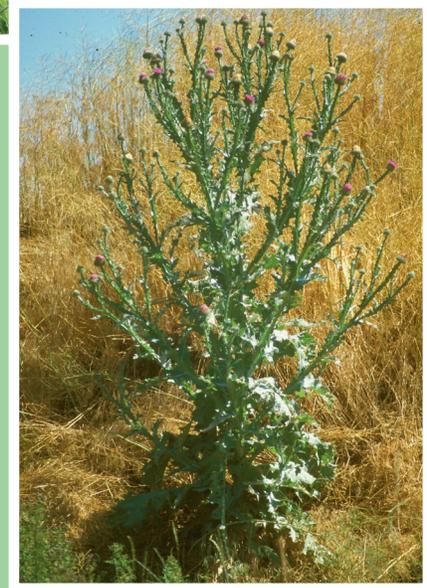


Field Guide for Managing Annual and Biennial Invasive Thistles in the Southwest



Cover Photos

Top left: Bull thistle plant, Steve Dewey, Utah State University, Bugwood.org

Top right: Plumeless thistle, Todd Pfeiffer, Klamath Country Weed Control, Bugwood.org

Bottom left: Musk thistle, Ricky Layson, Ricky Layson Photography, Bugwood.org

Bottom right: Scotch thistle plant, Steve Dewey, Utah State University, Bugwood.org

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Bull thistle (*Cirsium vulgare* (Savi) Tenore)

Musk thistle (*Carduus nutans* L.)

Plumeless thistle (*Carduus acanthoides* L.)

Scotch thistle (*Onopordum acanthium* L.)

Sunflower family (Asteraceae)

Bull, musk, plumeless, and Scotch thistles are annual and biennial nonnative plants in the sunflower family that are considered invasive. Plumeless and Scotch thistles are listed as noxious weeds in both Arizona and New Mexico. Musk thistle and bull thistle have been listed as noxious weeds only in New Mexico.

This field guide serves as the U.S. Forest Service's recommendations for management of annual and biennial invasive thistles 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

All thistles addressed in this guide are annual to biennial in growth form. They reproduce solely by seed and are prolific seed producers. The seed remains viable in the soil for many years. At maturity, these spiny weeds have basal rosettes, purplish disk flowers, and flowering stems that are highly branched. Distinguishing features by which individual species can be identified include plant size, appearance of phyllaries (involucral bracts), and the hairiness and shape of the leaves. Growth characteristics useful for identifying these thistles are given in table 1.

Ecology

Impacts/threats

Thistles are highly competitive and persistent plants. Given suitable conditions, these weeds rapidly invade rangeland, pastures, abandoned fields, roadsides, and disturbed sites. A high density of thistles reduces availability of quality forage and the diversity of flora and fauna species. Additionally, most thistles have taproots that do not stabilize the soil as well as the fibrous roots of native grass species; therefore,

high densities of thistles can contribute to soil erosion and stream sedimentation.

Location

Thistles establish readily on disturbed or neglected sites, especially along roadsides, railways, ditchbanks, and waste areas. Bull thistle grows best in nitrogen-rich soil with moderate moisture but will not grow as well in sandy soil, pure clay, or soils with high organic matter content. Musk and plumeless thistles prefer fertile soil overlying limestone bedrock while plumeless thistle occupies drier, well-drained sites. Scotch thistle prefers sites in dry climates with fertile soils and high moisture content.

Spread

Thistle seed is easily dispersed by wind, water, birds, and other animals. Seed can be carried long distances by adhering to surfaces and undercarriages of road vehicles and road maintenance equipment. Thistles may also be introduced to new areas via seed in hay that is not certified to be weed free.

Invasive Features

Excessive grazing favors thistle growth over grasses since livestock do not prefer to graze these weeds. In spring, thistles develop a large rosette base that shades the soil and reduces competition from other emerging plants. Additionally, some thistles have allelopathic properties that slow or prevent growth of desirable plant species, thereby allowing these thistles to thrive.

Management

Since all thistle species addressed in this guide are prolific seed producers, high priority for thistle management should be directed toward preventing establishment and eliminating new plants as soon as they are found. Small infestations occurring within otherwise healthy sites should

Table 1. Growth characteristics

Species	Life Span	Growth and Root Habit	Vegetative Appearance	Flower and Phyllary ¹	Seed
Bull thistle	Biennial or annual	Rosette up to 3 feet in diameter. Several primary roots each with many laterals.	Bushy appearance. Leathery, deeply lobed, green leaves; prickly hairs on upper side; underside wooly; yellowish pointed spines. Hairy stems with dark purple veins; broad, prickly wings line stem.	Purple disk flower. Phyllary urn-shaped; spiny.	Glossy light brown to pale yellow or white seed with narrow, dark brown stripes; 0.1 to 0.15 inch long.
Musk thistle	Biennial or winter annual	Rosette up to 2 feet or more in diameter. Single, fleshy taproot 15 to 16 inches long.	Waxy, pale green silver-margined leaves with yellow spine tips. Multibranched stems; stem wings do not extend completely up stem.	Showy purplish-red disk flowers that “nod” at a 90 degree angle. Phyllary with broad, overlapping, brown bracts; resembles a pine cone.	Straw-colored glossy seed with stripes, plume-like bristles, and a light apical rim; 0.15 to 0.2 inch long.
Plumeless thistle	Biennial or winter annual	Rosettes up to 2 feet or more in diameter. Stout, fleshy taproot.	Plant looks like a candelabrum. Deeply lobed leaves with white margins and 1 to 3 very stiff spines; hairy underside. Flower stems branched with spiny wings.	Red to purple disk flowers (smaller than musk thistle). Very narrow phyllary bracts with short, sharp spines.	Small, grey to light brown seed with slight curvature and distinct light apical collar; 0.07 to 0.11 inch long.
Scotch thistle	Biennial or short-lived perennial	Rosette up to 6 feet in diameter. Stout, fleshy taproot up to 12 inches or more.	Large, grey-green, coarsely lobed, spiny-edged leaves with wooly hairs. Stems have prominent spiny wings.	Purple disk flowers on globe-shaped heads with many spiny phyllaries in overlapping rows.	Mottled brown to blackish seed with wavy ridges and pinkish to red pappus bristles that fuse into a ring at the base; 0.16 to 0.2 inch long.

¹ A phyllary is an involucre bract subtending (located below) the flower head of a composite plant.

be given special consideration for control treatment. Larger infestations should be managed using an integrated management strategy. Regardless of the approach for treatment, do not anticipate that thistles will be effectively controlled in a single year or by using only one control method. Complete control will likely require several years of monitoring with repeated treatment. Strategies to contain and reduce thistle populations require long-term planning and integrated management. The following actions should be considered when planning a management approach:

- Maintain healthy plant communities to prevent or limit thistle infestations. This may involve using improved grazing management strategies to prevent overgrazing.
- Check hay and straw for presence of weed seed before using them in thistle-free areas. Certified weed-free hay and pellets should be fed to horses used in back-country areas.

- Limit disturbance and/or promptly revegetate disturbed areas with desirable perennial forage species, especially perennial grasses.
- Detect, report, record, and eradicate new populations of thistle as early as possible.
- Map known infestations. Keep annual records of reported infestations.
- Combine mechanical, cultural, biological, and chemical methods for most effective thistle control.
- Implement monitoring and a followup treatment plan for missed plants and seedlings.

Table 2 summarizes management options for controlling thistles under various situations. Choice of individual method(s) for thistle control depends on the degree and density of the 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 period of time needed to achieve control. More than one control method may be needed for a particular site.

Special Considerations

There are at least 20 species of native thistles in the genus *Cirsium* in Arizona and New Mexico. These native thistles are noninvasive and are important constituents of their ecological communities. Since native thistles can be confused with nonnative thistles, accurate identification of thistle species should be an important first step in managing invasive, nonnative thistles.

The Sacramento Mountain range in southern New Mexico serves as habitat for the endangered Sacramento Mountains thistle (*Cirsium vinaceum*) which is protected under the Endangered Species Act of 1973. Portions of the mountain range within Otero County are also inhabited by local populations of Wright's marsh thistle (*C. wrightii*) which is a New Mexico listed endangered species and a Federal candidate for listing. Wright's marsh thistle is also found

in Eddy, Chaves, Guadalupe, and Socorro Counties in New Mexico. Both thistle species occur in wetland habitats such as spring, seeps, and marshy edges of streams and ponds. To avoid harm to these species, information should be obtained from the U.S. Fish and Wildlife Service at (505) 346-2525 before implementing treatment of thistle in these types of habitats associated with the Sacramento Mountains and the aforementioned counties.

Physical Control

Physical methods can be used to control thistles by reducing seed production and preventing germination through the destruction of individual thistle plants and any maturing seed heads. Methods that sever or eliminate the entire top of a thistle or its root system usually have to be repeated and must be timed properly to be most effective.

Manual Methods

Hand pulling, hoeing, grubbing, or cutting may be done any time of year; but these methods are most effective if done before development of flower heads occurs. Thistle plants should be severed 2 to 4 inches below the soil surface to prevent resprouting from the root crown. For isolated thistles or small infestations, seed heads of individual plants may be clipped and placed in bags for disposal. This method can prevent further seed dispersal or seedling establishment from disturbance while also allowing treated plants to be more easily relocated next year.

Proper disposal of debris is essential in preventing spread. If flowers or seed are not present, plants may be pulled and left onsite. If flowers or seed are present, debris should be bagged and removed from the site for safe disposal or else piled and burned onsite.

Mechanical Methods

Properly timed and repeated tillage with a plow or disc can provide effective control; however, ill-timed or nonrecurring tillage may favor further invasion. In areas with high densities of viable thistle seed, tillage may actually

Table 2. Management options*

Site	Physical Methods	Cultural Methods	Biological Methods	Chemical Methods
Roadsides	Repeat mowing very close to surface throughout the growth season (preferably in the bolt to early bud growth stage before seed matures and disperses). Consider mowing as part of a combined approach.	Educate road crews to identify and report infestations along roads; implement requirements for vehicle operations in infested areas.	Use biological control agents (gall-forming fruit flies, flies, beetles, or weevils) if release does not threaten rare or endangered native thistles (see table 3). Agents for thistle control may be used only if thistle infestations are large enough to sustain control agent populations. Effectiveness of agents may be limited due to possible disturbances in agent life cycles from roadside operations.	Apply herbicides in spring or fall at rosette stage. When using truck or tractor spraying equipment, wash thoroughly afterward to prevent seed spread.
Rangelands	For smaller infestations, hand pull; otherwise, cut plants 2 to 4 inches below the surface with a hoe, grubbing tool, or spade. Cut prior to flowering. For larger infestations, use well-timed mowing to reduce seed production (bolt to flower bud stage). Although prescribed burning is not recommended, individual plant treatment with a blow torch or similar device may be an option in localized situations.	Use certified weed-free hay. After passing through infested areas, inspect and remove any seed from animals, clothing, and vehicles before entering treated or uninfested areas. Use certified seed to reseed.	Use a prescribed grazing strategy to target young thistles. Closely manage grazing to prevent overuse. Use biological control agents (gall-forming fruit flies, flies, beetles, or weevils) if release does not threaten rare or endangered native thistles. Agents for thistle control may be used only if thistle infestations are large enough to sustain control agent populations.	Use individual plant treatment with a backpack sprayer on sparse populations. For extensive and dense infestations, use ground or aerial broadcast spraying.
Wilderness and other natural areas	Same as above.	Use certified weed-free hay. After passing through infested areas, inspect and remove any seed from animals and clothing before entering treated or uninfested areas. Post signs warning visitors to inspect for seeds and remove them from animals, clothing, and vehicles when leaving an infested area.	Same as above.	Same as above.

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

increase establishment of thistle seedlings in succeeding seasons through disturbance of the soil surface. If tillage is used, thistle plants should be cultivated shortly after they emerge but before they reach a height of 3 inches. Shallow cultivation in hot, dry weather greatly stresses plants. Tillage will not eradicate seeds; therefore, tillage may be more effective as a component in a combined control strategy. See the “Control Strategies” section for more information.

Mowing reduces plant height of thistles but may not entirely eliminate flowering and seed production. Some vegetation management experts do not recommend mowing at all since plants often produce side branches that have more flowers, even with repeated mowing and proper timing. However, mowing may be useful as part of a combined strategy (see the “Control Strategies” section for more information). If mowing is used, cut soon after plants begin to bolt but before flowering; repeat mowing about every 21 days during active growth. For sites where plants have begun to flower, consider walking through the infested area before mowing and either pull plants or cut stems that have open flowers. Flower heads should be bagged and disposed offsite to prevent seed dispersal.

Prescribed Fire

Broadcast burning can eliminate existing plants, but this activity is likely to favor invasive thistles in future years. Thus, prescribed burning is not ordinarily recommended for thistle management. However, individual plant treatment (IPT) by using a blowtorch or flamethrower has been used with some success on thistles in California.

Cultural Control

If invasive thistles are not currently present, steps should be taken toward preventing their introduction. Early detection and plant removal are critical for preventing establishment of thistle. Land managers, the local public, and road crews should be educated on how to identify invasive thistle species so they can help report suspected infestations.

Biological Control

Grazing

Livestock generally avoid entering dense stands of mature thistle; but they will graze young, immature thistles. Prescribed grazing, therefore, can be part of an effective control strategy if an intensive, short-term, grazing approach is used. Cattle, sheep, and goats can be used to graze bull thistle rosettes. Musk thistle is readily grazed by sheep and goats from rosette to bolting stage and by cattle before the bud stage is reached. Scotch thistle is grazed by goats and cattle in the seedling to vegetative stages. Use of grazing in combination with herbicide can increase effectiveness of both of these control methods. See the “Control Strategies” section at the end of this field guide for more information about combined approaches.

Classical Biological Control

Numerous classical biological control agents have been introduced throughout the United States for control of thistles, including those listed in table 3. Biological control methods for invasive thistles primarily involve using insect larvae to impact the root, stem, leaf, or flower. Control with biological agents may be most suitable for remote, otherwise inaccessible pastures and rangeland sites where mowing, cultivating, or treating with herbicide is impractical. Biological control agents for thistle control may be used only if thistle infestations are large enough to sustain control agent populations. Some agents have been found to be less effective when their life cycle is disturbed, either by the presence of livestock or by management actions involving the thistle. Treatments such as cutting or spraying may not allow the biological control agent to complete its life cycle. As a result, the needs of the biological control agent (if present) should be considered before other treatment methods are implemented. For further information on biological control of annual and biennial thistles, see Winston et al. (2008) in the “References and Further Information” section of this field guide.

Table 3. Classical biological control agents

Species	Type of Agent	Plant Impacted/ Site of Attack	Impact on Host	Use/Considerations for Release
<i>Urophora stylata</i>	gall-forming fly	Bull thistle; seed.	Adult lays eggs in the closed flower buds. Each larva forms its own gall tissue and the gall forms around the immature seed. Mature larvae reside in the flower head through winter. Pupation is in May, and adults emerge in June.	Species is well established in the western U.S. with 60 to 90 percent of bull thistle seed heads infested in some areas.
<i>Rhinocyllus conicus</i>	beetle/weevil	Musk thistle; seed head and upper stems.	The larvae burrow into the seed head. Since musk thistle reproduces entirely by seed, <i>R. conicus</i> can disrupt seed production.	Seems to establish best on sites heavily infested with musk thistle where life cycle will not be disturbed and cattle are absent. This particular weevil species should not be released as a biological control agent since it can feed on native thistles including the endangered Sacramento Mountains thistle.
<i>Trichosirocalus horridus</i>	beetle/weevil	All thistles addressed in this guide; rosette shoot tip.	Larvae burrow down petiole into the growth point. Heavy feeding by mature larvae results in death of rosette. As larval infestation increases, stressed thistle becomes more susceptible to competition from perennial grasses.	Released in Oklahoma and Texas; recently appeared in the Sacramento Mountains of New Mexico. This particular weevil species should not be released as a biological control agent since it can feed on native thistles including the endangered Sacramento Mountains thistle.

An important consideration for release of a biological control agent is whether the agent will impact native thistles, especially rare or endangered species. For example, recent expansion of seed head weevil (*Rhinocyllus conicus*) from early release sites has enabled the weevil to attack the endangered Sacramento Mountains thistle in southern New Mexico. The rosette weevil (*Trichosirocalus horridus*) has also recently arrived in the Sacramento Mountains, and its presence could impact the Sacramento Mountains thistle along with local populations of the Wright’s marsh thistle which is a New Mexico listed endangered species and a Federal candidate for listing. To help prevent such impacts, these particular weevil species should not be released as biological control agents. Land managers should contact the New Mexico Ecological Services Field Office of the U.S. Fish & Wildlife Service at (505) 346-2525 before releasing

any biological control agents within the Sacramento Mountains or Eddy, Chaves, Guadalupe, and Socorro Counties in New Mexico that can impact these endangered thistles.

Agents used for biological control in southwestern states should be adaptable to arid environments and local conditions. Public, tribal, and private land managers may obtain biological control agents for release directly from local offices of the USDA Animal and Plant Health Inspection Service (APHIS) when the agents are available. Other sources for biocontrol agents include private companies or locally developed insectaries. A permit must be obtained from APHIS before biological control agents can be transported across state boundaries. Regulations and permit applications (PPQ 526 permit forms) pertaining to interstate shipment of biological control agents can be

found at <http://www.aphis.usda.gov/ppq/permits/>. Although biological control agents may be collected and released within a given state without a permit from APHIS, the state's Department of Agriculture or Agricultural Extension Service should be consulted for any regulations relating to movement of these agents inside the state.

Chemical Control

Thistles are best controlled with a postemergent broadleaf herbicide that is foliar applied. The most commonly used herbicides include dicamba, clopyralid, or picloram either alone or in combination with 2,4-D. Two relatively new herbicides—aminopyralid and aminocyclopyrachlor—are

labeled for thistle control and are also effective. Cost, availability, and effectiveness are important in the choice of product to use. Herbicides listed in table 4 are effective in reducing invasive thistles while allowing perennial native grasses to compete. These herbicides can impact other desirable broadleaf and woody species; therefore, caution should be taken if nontarget species need protection. Label instructions and guidelines for mixing, application, and grazing restrictions following treatment should always be followed.

For thistles covered in this guide (bull, musk, plumeless, and Scotch), the best time for application is usually during the fall when new plants have emerged and are actively

Table 4. Herbicide recommendations

Common Chemical Name (active ingredient)	Product Example ¹	Product Example Rate per Acre (broadcast)	Backpack Sprayer Treatment Using Product Example ²	Time of Application	Remarks
Aminopyralid	Milestone	bull, musk, and plumeless thistles: 3–5 fluid ounces Scotch thistle: 5 to 7 fluid ounces	3–5%	Lower rate for rosette; higher rate at bolting. Fall or spring.	Labeled for use on wildlife management areas and other natural areas. May be applied up to water's edge. No grazing restrictions.
Aminopyralid + 2,4-D ³	GrazonNext	bull, musk, and plumeless thistles: 1.5–2 pints Scotch thistle: 2–2.6 pints	3–5%	Full leaf through flowering. If using in combination, wait 9 to 12 months to spray after last mowing.	Most perennial grasses are tolerant of this herbicide, as long as they are established.
Aminocyclopyrachlor + chlorsulfuron	Perspective	3–8 ounces	Consult label for spot applications.	Apply to actively growing plants. Lower rate for rosette in fall; higher rate at bolting in spring.	Selective herbicide used on noncrop sites; may cause temporary injury to some grass species.
Aminocyclopyrachlor + metsulfuron methyl	Streamline	4.75–9.5 ounces	Same as above.	Same as above.	Same as above.
Clopyralid	Stinger Reclaim	0.33–1.3 pints	1–3%	During active growth at rosette stage.	Established perennial grasses are tolerant.

Table 4. Herbicide recommendations (continued)

Common Chemical Name (active ingredient)	Product Example ¹	Product Example Rate per Acre (broadcast)	Backpack Sprayer Treatment Using Product Example ²	Time of Application	Remarks
Clopyralid + 2,4-D ³	Curtail	1–2 quarts	1–3%	Rosette in spring or fall.	Same as above.
Clopyralid + triclopyr	Redeem	1.5–2 pints	1–3%	Same as above.	Same as above.
Imazapic	Plateau	8–12 ounces	3–5%	Same as above.	May cause slight damage to cool season grasses.
Metsulfuron + 2,4-D ³ + dicamba	Cimarron Max	Rate II to III	Consult label	Same as above.	Established perennial grasses are tolerant.
Picloram ⁴	Tordon 22K	0.5–2 pints	1–3%	Any growth stage; however, application is most effective in the fall when plants are in rosette stage.	May pose a risk to groundwater in permeable soils or in areas where the water table is near surface.
Picloram ⁴ + 2,4-D ³	Grazon P+D	bull thistle: 1–2 pints other thistles: 2–4 pints	1–2%	Lower rate for rosette stage in spring or fall; higher rate for bolt to bud growth stage.	Established perennial grasses are tolerant.
Dicamba + diflufenzopyr	Overdrive	4–6 ounces	1–3%	Rosette in spring or fall.	Use higher rate for older or denser stands.
Dicamba + 2,4-D ³	Weedmaster (premixed)	1.5–2 pints	1–2%	During active growth; lower rate for rosette in fall; higher rate in spring (not advisable to spray during bolt).	Same as above.

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 thistle.

² Herbicide/water ratio - As an example, a 3 percent spray mixture is made by adding a sufficient volume of water to 4 ounces of liquid herbicide until a volume of 1 gallon is reached ($4 \text{ oz} \div 128 \text{ oz/gal} = 0.03$ or 3 percent). For dry formulations, particulates should be added to sufficient water as specified by the label until the required concentration or volume of spray water is reached.

³ 2,4-D is a restricted use pesticide in New Mexico only. A certified applicator's license is required for purchase and use.

⁴ Restricted use pesticide - A certified applicator's license is required for purchase and use.

growing during the seedling to rosette stage. Spraying in spring through the summer is also effective, but higher rates of application may be necessary. Consult label directions carefully. Herbicides may be applied by backpack sprayer, ATV or UTV sprayers, or a conventional boom sprayer that is pulled or attached to a tractor or truck. For individual plant treatment (IPT), wet the foliage and stem thoroughly with a single nozzle, hand-held sprayer.

Control Strategies

To meet the overall goal of restoring a native plant community, control methods discussed in this guide may be used in various combinations to reduce competition from a thistle population. Initial treatment should attempt to eliminate live thistle plants and disrupt seed production as much as possible. Treated areas should always be monitored closely and, if necessary, retreated for further thistle control.

The following strategies should be considered for management of annual and biennial thistles:

- **General control strategy for thistles** – Since annual and biennial thistles germinate nearly year-round, a range of plant sizes may be present at any one site. If thistle seedlings and young rosettes are mostly present in fall or early spring, consider applying a herbicide as the initial control treatment. Mowing or using a controlled, short term, intensive grazing approach may be a better option on an infested area if starting treatment in late spring or summer. When mowing, cut weeds very close to surface during the early bud stage before flowers begin to color or mature. Mowing will need to be repeated during the summer growing season. Herbicide spraying in the fall should be considered as a followup treatment after mowing. Monitor for return of perennial native vegetation and reseed with desirable perennial forage species if necessary, especially perennial grasses. Repeat for multiple years.

- **Strategy for small infestations of thistle** – Use hand pulling, grubbing, hoeing, cutting (stems or seed heads), or spot spraying to treat individual plants. Destroy debris via fire or mulching (or bag and remove plants and/or seed heads). If treated site is disturbed, reseed with desirable perennial grasses. Periodically monitor for emerged plants and spot treat or hand remove.

Regardless of the strategy used, the key to successful long-term thistle control is to continuously monitor treated sites and re-treat these areas when necessary. Failure to perform followup management may result in recolonization and a return of the population to pretreatment levels.

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Suggested Web Sites

2,4-D Safe Handling Guide:

<http://www.cdms.net/LDat/ld02B005.pdf>

Dow AgroSciences labels:

Clarity: <http://www.cdms.net/LDat/ld797002.pdf>

Curtil: <http://www.cdms.net/LDat/ld02B005.pdf>

Grazon P + D: <http://www.cdms.net/LDat/ld0B1014.pdf>

GrazonNext: <http://www.cdms.net/LDat/ld8C6002.pdf>

Milestone: <http://www.cdms.net/LDat/ld77N006.pdf>

Reclaim: <http://www.cdms.net/LDat/ld1KP006.pdf>

Redeem: <http://www.cdms.net/LDat/ld4KE004.pdf>

Stinger: <http://www.cdms.net/LDat/ld02P012.pdf>

Tordon22K: <http://www.cdms.net/LDat/ld0AJ013.pdf>

Duncan, K, K. McDaniel, and M. Renz. 2005. Chemical Weed and Brush Control for New Mexico Rangelands. New Mexico State University College of Agriculture and Home Economics and Cooperative Extension Service. Las Cruces, NM. 14 pp.

http://aces.nmsu.edu/pubs/_circulars/CR_597.pdf

Encycloweedia Datasheets by California Department of Food and Agriculture:

<http://www.cdfa.ca.gov/phpps/ipc/weedinfo/spinythistle-key.htm> <http://www.cdfa.ca.gov/phpps/ipc/weedinfo/onopordum.htm>

Herbicide labels available at:

<http://www.cdms.net/LabelsMsds/LMDefault.aspx>

NuFarm Agricultural Products labels:

Weedmaster: <http://www.cdms.net/LDat/ld8QL000.pdf>

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

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

Or visit:

<http://www.fs.usda.gov/main/r3/forest-grasslandhealth/invasivespecies>

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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.