

Contra Costa County
DECISION DOCUMENTATION for WEED MANAGEMENT: Artichoke Thistle

Date: 8/5/2014

Department: Agriculture

Location: Countywide

Situation: Artichoke thistle infestations throughout the County that threaten agricultural land, open space and wildlands.

What are the management goals for the weed?	Continued suppression of artichoke thistle in open space and rangeland in Contra Costa County. As properties become less infested, the Department adds new acreage that has not previously been treated.	
How often is the site monitored?	All historically treated artichoke thistle sites are monitored at least once a year. Currently the Department surveys over 220,000 acres (mostly private land, regional open space and parklands) each year. This monitoring includes the hundreds of acres that the Department has treated in past years. Previously treated sites are monitored because it can take in excess of 20 years to eradicate an infestation because of the residual seed bank longevity. This figure is far greater than many published estimates of 5 or more years; however, the Department's monitoring records and experience confirm the higher figure.	
Weeds have been identified as the following:	Weed: Artichoke thistle (<i>Cynara cardunculus</i>). It is a wild, non-native form of the cultivated globe artichoke. Family: Asteraceae Habitat: In general, open sites in grassland, pasture, chaparral, coastal sage scrub, riparian areas and abandoned agricultural fields. Often associated with areas impacted by historic or recent overgrazing. Grows best on deep clay soils. Does not tolerate heavy shade. Origin: Native to the Mediterranean region Photos: See page 5 Weedy characteristics: Highly invasive perennial that forms a deep fleshy taproot in the first year right after the cotyledon stage and before the rosette stage; roots can eventually reach 8 ft.; mature plants produce 100s of seeds that can remain viable for 15 to 20 years or more; formidable spines on the leaves and stems and on the bracts around the flowers impede the movement of livestock and make it impossible to hike through high densities of the plant; horses and cattle will not consume artichoke thistle and spines can cause injury to livestock; it has the potential to take thousands of acres of rangeland out of production through competition for space and soil moisture; dense colonies displace native vegetation and associated native animals, including endangered species, thus altering the natural environment of Contra Costa County. CDFA Rating: "B" (pest of known economic or environmental detriment and if present in California, is of limited distribution and is subject to action taken at the discretion of the County Agricultural Commissioner). This "B" rating actually reflects the fact that artichoke thistle has become too widespread and difficult to eradicate in many areas, and the authorities have opted for trying to prevent its spread and controlling it where feasible.	
Are populations high enough to require control? Explain	Yes. The Department's goal is widespread suppression, and therefore the tolerance level is low. In 1979, Contra Costa County was identified as one of the most heavily infested counties in the state. At that time, at least 100,000 acres of land were infested with artichoke thistle to one degree or another. Currently the Department estimates that only about 600 to 800 net acres are infested. Of that, 400 to 600 of those net acres have never been treated because of lack of resources at the Department.	
Is this a sensitive site?	Are any areas part of the court-ordered injunctions? (see: https://www.epa.gov/endangered-species/interim-use-limitations-eleven-threatened-or-endangered-species-san-francisco-bay)	Yes
	Are any of the sites known or potential habitat for any endangered or threatened species?	Yes

	Are any of the sites accessible to the public? The Department treats in East Bay Regional Parks.	Yes
	Are any of the sites near a drinking water reservoir?	No
	Are any of the sites near a creek or flood control channel?	Yes
	Are any of the sites near crops?	Yes
	Are any of the sites near desirable trees or landscaping?	Yes
	Are any of the sites on soil that is highly permeable, sandy, or gravelly?	No
	At any of the sites, is the ground water near the surface?	Yes
	Are any of the sites near well heads? Restrictions are 100 ft around well heads.	No
Which cultural controls were considered?	Mulching, weed barrier: Not effective; not practical on rangeland and open space. Planting Desirable Species: Artichoke thistle does favor disturbed, open sites, so preventing overgrazing and keeping grasslands and other areas healthy and with dense plant cover could help <i>reduce</i> the invasion of artichoke thistle but will not control existing populations. Also, the Department has no control over the land stewardship practices at the sites it surveys and treats for artichoke thistle. Burning: Burning can be used to remove the above ground portions of the plant once it dries in the late summer, but burning will not control the plant, which will sprout from the root the next season. Burning may cause seeds in the seedbank to sprout, which could provide an opportunity for control of young plants, but the Fire Marshal and the Air District would not allow burning in the County. Even if burning were allowed by regulatory authorities, it would require considerable resources in time, money, and expertise not available to the Department, and ranchers and other landowners would most likely object. CONCLUSIONS: None of these strategies is effective or practical.	
Which physical controls were considered?	Mowing by hand or by machine: This is neither effective nor practical on rangeland and open space. Digging by hand: Digging the plant out is a viable option where only a few plants are involved, especially if they are in the seedling stage. In the first year, the plant forms an extensive taproot and the majority of this root must be removed in order to prevent resprouting. This method is extremely time- and resource-consuming because established plants must be dug out to a depth of 14-18 inches. When clay soils harden in the summer, this is an almost impossible task. It was used without success by East Bay Regional Park crews at Briones Regional Park after two previous years of herbicide treatment in the park by the Department. They found that the crews were not thorough in finding the artichoke thistles or in digging them out sufficiently deep enough to kill the plant. The Department was again brought in to resume their treatment program after the failure. Discing or plowing: Discing or plowing populations in wildlands or grazing lands is impractical and not advised by weed researchers. Although it is theoretically possible to exhaust the carbohydrate reserves of the plant's tuberous roots, this would require many years of continued effort and several carefully timed passes each season because artichoke thistle can resprout repeatedly. Discing and plowing also disturbs the soil and opens areas up to reinfestation by this species or others. Discing when seed is present increases infestation size. Cutting flower stalks: This can stop seed production in small populations where timely treatment is not possible, but will not control existing plants. Grazing: Cattle, sheep and horses generally avoid artichoke thistle because of its spiny foliage. Goat grazing can reduce seed production but has not been shown to control the plant. CONCLUSIONS: Mowing is not used because it is neither effective nor practical. Grazing is not an effective control and the Department does not have control over the management of the properties it surveys and treats. Digging by hand is too time consuming and expensive for the large number of acres involved in treatment, but it can be used in some selected sites if there are a very few artichoke thistle plants, especially if they are immature and if the site is particularly sensitive. In some areas, staff cut flower stalks if they encounter them when they are about to produce seed.	
Which biological controls were considered?	Biological controls available: The artichoke fly (<i>Terellia fuscicornis</i>) was accidentally introduced into California but is not a California Department of Agriculture (CDFA) approved biological control agent. Preliminary studies suggest that some native thistles (<i>Cirsium</i> spp.) may be vulnerable to attack by the fly. The fly's impact on artichoke thistle populations is unknown. Larvae feed only on mature flowerheads, thus commercial artichokes	

	are not significantly affected since they are harvested while immature. This insect has not had any impact on artichoke thistle populations in Contra Costa County. CONCLUSIONS: No effective biological controls are available.
Which chemical controls were considered? For more information on pesticides listed here visit the National Pesticide Information Center (NPIC). This is a joint project of Oregon State University and the US EPA. http://npic.orst.edu/ You can communicate with an actual person at 800.858.7378 or npic@ace.orst.edu They are open from 8 am to 12 noon Pacific Time, Mon.-Fri.	During many years of research, experience, and experimentation, including consulting the literature, researchers, and colleagues about materials that are labeled for, and effective on, artichoke thistle, the Department has considered the herbicide options listed below. The Department continues to consult researchers and colleagues, as well as new literature, to identify new choices that may be more effective, more environmentally friendly, and of lesser human toxicity. Pesticides may potentially exhibit both acute and chronic toxicity. The Signal Words below refer to acute hazards. For information on chronic toxicity, contact NPIC (info on left). Herbicides and application methods are chosen that prevent or minimize the potential for drift and exposure to humans and wildlife. As with all weed control techniques, herbicides must be reapplied periodically to suppress weeds over the long term. Note that the Weed Science Society of America (WSSA) and the Herbicide Resistance Action Committee (HRAC) both create resistance group designations to help weed managers reduce the likelihood of creating resistant weeds. Possible herbicide choices: 2,4-D—The Department has not used this material for many years. It is only marginally effective, and there are safer and more effective alternatives. Aminocyclopyrachlor + chlorsulfuron—This combination is not labeled for grazing lands and may suppress or injure certain annual or perennial grasses. Though effective, there are more environmentally friendly materials available for use on artichoke thistle. Chlorsulfuron (Telar®): This material kills many broadleaf plants and has a long soil residual. Though effective, there are more environmentally friendly materials available for artichoke thistle control, Aminopyralid (Milestone®)—This is a selective broadleaf herbicide generally safe on grasses. It has soil residual activity that will kill emerging seedlings. Signal Word (indicates acute, or immediate, toxicity): CAUTION Rate: 5 to 7 oz. of product per acre. Timing: Pre and Post emergence in late winter or spring, ideally before bolting. Enjoined for endangered species? No Resistance management group: O(4) Clopyralid—Aminopyralid has a longer soil residual and higher activity on artichoke thistle than clopyralid so this material is not used by the department. Clopyralid + 2,4-D—The Department has not considered this combination as it is felt by the department that there are safer and more effective materials available. Dicamba type compounds (for example, Clarity®)—These are very effective on emerged plants. They are selective to broadleaf plants and do not harm desirable grasses. They do not have soil residual properties and therefore are not effective on seedlings that emerge after treatment. Signal Word (indicates acute, or immediate, toxicity): CAUTION Rate: 3 pints of product (Clarity®) per acre. Timing: Post emergence in late winter or spring, ideally before bolting but can be effective up to time of seed formation Enjoined for endangered species? No Resistance management group: O(4) Picloran—Was used in the past and was very effective but is currently not registered for use in California. Triclopyr Amine—Though effective the department feels that there are more environmentally friendly materials available. Also some of these products are labeled “Danger” because they have the potential to cause permanent eye damage if the concentrated material enters the eyes of the applicator. Triclopyr Ester—This formulation of triclopyr is effective, however it has a high potential to harm non target and desirable vegetation including trees and thus will not be used by the department. Triclopyr + 2,4-D—Though effective there are more environmentally friendly materials available Imazapyr—Though effective there are more environmentally friendly materials available. This herbicide kills all vegetation and leaves bare earth. This leaves open areas where artichoke thistle or other weed seeds could sprout. Glyphosate—Effective and has a good toxicology profile; however, rangeland grasses are extremely sensitive to glyphosate thus damaging desirable rangeland forage and leaving open areas where artichoke thistle or other weed seeds could sprout. Signal Word (indicates acute, or immediate, toxicity): CAUTION

	Rate: 2.4 to 3.2 quarts of product per acre. Timing: Post emergence in late winter or spring, ideally before bolting. Enjoined for endangered species? Yes, for California red legged frog Resistance management group: G(9) CONCLUSIONS: The department concluded that the least toxic and most efficacious materials are Milestone® (aminopyralid) and Clarity® (a dicamba type material). Often these materials are used together, though the Department is experimenting to determine the efficacy of aminopyralid-only treatments. Note: The Milestone®/Clarity® combination has been determined to be the safest and most effective treatment for both purple starthistle and artichoke thistle. This is fortunate as it saves much staff time in not having to change materials in areas where both of these species are found. Glyphosate is used in some sensitive areas such as where an artichoke thistle is in an orchard. It is also used on a property owned by the Town of Moraga and is sometimes used on artichoke thistle very late in the treatment season when plants are forming seed. Generally it is not the material of choice because it kills any desirable grass that is contacted by the material. Therefore, the general window of use is after the grasses dry out. This is a very short window of time in the very late spring. Glyphosate is a listed active ingredient in the California red-legged frog injunction. Use of glyphosate is restricted in specific, listed geographical areas, but there is a partial program exclusion for public agency run invasive species and noxious weed programs. Use around aquatic features in listed geographic areas in these programs is limited to hand held equipment, and herbicides cannot be applied within 15' of such features. Chlorsulfuron (Telar®) is not used by the Department on artichoke thistle.
Are adjuvants (drift retardants, surfactants, water conditioners, etc) used with any of the herbicides? If so, explain the choices.	Yes. Pro-tron®, a hydrolyzed vegetable oil adjuvant product, is added to the herbicide mix. Pro-tron® helps to break water tension and thus increase the efficacy of the herbicide on the plant surface. It also helps with plant and soil penetration and drift reduction. It is labeled as a "Caution" material, safest of the three label categories. Other surfactants are available; however, most are labeled "Warning" or "Danger" due to potential eye damage if the concentrate is splashed into the eyes of the applicator.
Which herbicide application methods are available for this chemical?	Methods available: Broadcast spray from helicopter, 200 gallon spray rig mounted on a 4WD truck; spot spray (directed spray) from backpack CONCLUSIONS: When the noxious weed program first began, helicopters were used to spray the extensive infestations of artichoke thistle. This has not been necessary for many years. The majority of plants are spot-treated by staff using backpack sprayers either as they hike or as they ride ATVs through infested areas. On properties that are new to the program and have heavy populations, staff generally use a 200 gallon spray rig mounted on a 4WD truck and pull hose to reach infestations. The spray is directed only to the infested areas of the property.
What factors were considered in choosing the pesticide application method?	The size of the noxious weed infestation and its location are the most important factors in considering the application method. The Department has limited resources and staff, and a limited window in the spring when treatment is most effective. The Department also considers safety to the applicator, to the environment, to non-target species and threatened and endangered species. It also considers the effectiveness of the method and the cost to the Department.
What weather concerns must be checked prior to application?	Wind is the primary concern. It can carry the herbicide off-site to non-target or sensitive areas. Mitigations such as using a very coarse spray and holding the backpack spray nozzle into the plant are used when wind is a concern. Materials used are rainfast in a relatively short time: one to two hours for Milestone® and Clarity® and about four hours for Roundup®. For Milestone®, rain anywhere from a few hours to a few weeks after treatment is desirable as it sets the material in the soil, which is needed to take advantage of the pre-emergent qualities of this product.
References	DiTomasso, Joseph M., et al. 2013. Weed control in Natural Areas in the Western United States. Univ. of CA WRIC. Bossard, Carla C., J.M. Randall, and M.C. Hoshovsky. 2000. Invasive Plants of California's Wildlands. U.C. Press, Berkeley. Cal IPC Artichoke thistle plant profile. http://www.cal-ipc.org/ip/management/plant_profiles/Cynara_cardunculus.php. Web page accessed 3/31/14.



Moraga Infestation



Rosettes



Wildcat Canyon, EBRPD



Wildcat Canyon, EBRPD