Contra Costa County
DECISION DOCUMENTATION for WEED MANAGEMENT: Purple Starthistle

Date: 8/6/2014

Department: Agriculture

Location: Countywide

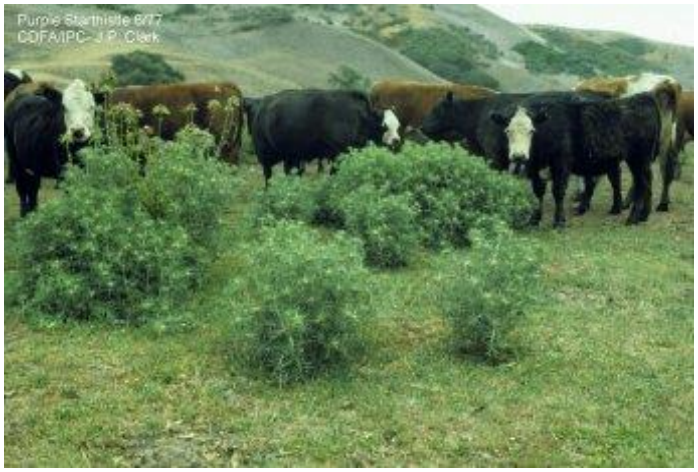
Situation: Purple starthistle (*Centaurea calcitrapa*) infestations throughout the County that threaten agricultural land, open space and wildlands.

What are the management goals for the weed?	Continued suppression of purple starthistle 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. In 2013 the Department surveyed 210 distinct properties that were previously infested with purple starthistle. Of these, 71 (over 30%) were free of purple starthistle and had been free of it for one or more years. This demonstrates the progress toward eradication that has been accomplished by the Department over the years of the program.
How often is the site monitored?	All historically treated purple starthistle 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. Approximately 30,000 acres of the total was previously infested with purple starthistle or is under current management. 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 15 years to eradicate an infestation due to the longevity of the residual seed bank. In addition, there is the chance of reinfestation. Fifteen years is far greater than many published estimates of 3 years; however, the Department's monitoring records and experience confirm the higher figure. The Department has found that it is important to monitor and treat missed plants a second time, usually in late May or June, as resources allow. This is especially so in areas of high suppression that are closer to eradication and are typically treated by back pack spot treatment. The second treatment is needed because it is very easy to miss some rosettes that later bolt and produce seed and because there can be late germinating seed.
Weeds have been identified as the following:	**Weed**: Purple starthistle (*Centaurea calcitrapa*) is an introduced invasive noxious weed. It is not known how it was introduced, though likely from contaminated seed imported from areas where it is native. It is a highly invasive, mostly a biennial (meaning it takes 2 years to mature) species but can also mature from seedling to mature plant in one season. It displaces annual grasses, desirable vegetation and wildlife and decreases the production value of agricultural land. It also has allelopathic properties (it produces chemicals that suppress the growth of other plants). Its formidable spines and high densities can be an impenetrable barrier to the movement of wildlife and livestock in open rangeland areas as well as to horses and hikers in parkland areas. Seed can remain viable in the soil for ten or more years. **Family**: Asteraceae **Habitat**: Open sites in grassland, pasture, riparian areas and abandoned agricultural fields. Often associated with areas impacted by historic or recent overgrazing. Grows best on deep fertile alluvial or clay soils. It has a long, sturdy tap root. It can form dense mounding stands if left unmanaged. It does not tolerate heavy shade. **Origin**: Native to the Mediterranean region of southern Europe and northern Africa **Photos**: See page 5 **Weedy characteristics**: Highly invasive biennial that forms a deep taproot that can reach 3-4 feet in length; mature plants produce 1000s of seeds that, in the experience of the Department, can remain viable for 10 or more years; formidable spines on the bracts around the flowers do not fall off the plants in autumn making any forage that grows in among the plants in the winter inaccessible to livestock; dense, spiny stands to 4 feet tall impede the movement of humans, livestock and wildlife; horses and cattle will not consume purple starthistle; and the spines can cause injury to livestock. Purple starthistle has the potential to take thousands of acres of rangeland out of production through competition for space and soil moisture, and 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 purple starthistle 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 eradication, and therefore the tolerance level is zero.	
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?	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:** Purple starthistle favors disturbed, open sites, so preventing overgrazing and keeping grasslands and other areas healthy and with dense plant cover could help *reduce* the invasion of purple starthistle but will not control existing populations. The Department has no control over the land stewardship practices at the sites it surveys and treats for purple starthistle. **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 of first year plants 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. If burning were allowed by regulatory authorities, it would require considerable resources in time, money, and expertise not available to the Department. Most of the infested areas within the county are infested in scattered patches or scattered plants so burning would result in removal of valuable range forage. **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. Rosettes are usually too low to be affected by mowing. **Digging by hand:** Chopping the plant off an inch or so below the surface will kill an individual purple starthistle plant. This is a viable option where only a few plants are involved and where the seedbank is small. **Discing or plowing:** Discing or plowing populations in wildlands or grazing lands is impractical and not advised by weed researchers. Discing and plowing also disturbs the soil and opens areas up to reinfestation by this species or others. It also results in wind erosion and erosion by water on sloped ground. Discing when seed is present increases infestation size and distribution. **Grazing:** Cattle, sheep and horses generally avoid purple starthistle because of its spiny florets. 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. Chopping 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 plants and a diminished or non-developed seed bank.**	

Which biological controls were considered?	**Biological controls available:** There is no biocontrol organism for purple starthistle.
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, purple starthistle, 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**: During many years of research, experience and experimentation, including consulting the literature, researchers and colleagues about materials that are labeled for purple starthistle, the Department has investigated the possible 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 or more environmentally friendly. **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. **Aminocyclopyrachor + 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 purple starthistle. **Chlorsulfuron (Telar®):** This material kills many broadleaf plants and has a long soil residual. Though effective, there are more environmentally friendly materials available for purple starthistle control. **Aminopyralid (Milestone®)**—This is a selective broadleaf herbicide generally safe on grasses. It has soil residual activity that will kill emerging seedlings. Rate: 5 to 7 oz. of product per acre. Timing: Pre and Post emergence in late winter or spring, ideally before bolting. This material is also effective on maturing plants into early flower stage. Enjoined for endangered species? No Hebicide Resistance management group: O(4) **Clopyralid**— This material is not used by the Department because aminopyralid has a longer desired soil residual and higher activity on plants that have bolted. **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 broadly very effective on emerged seedlings to matured 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. 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 Herbicide Resistance management group: O(4) **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.

	Glyphosate—Effective and has a good toxicology profile; however, rangeland grasses are extremely sensitive to this material. Glyphosate damages desirable rangeland forage and leaves open areas where other noxious or undesirable weed seeds could sprout. 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. Herbicide 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 when purple starthistle is found in an orchard. It is also used on a property owned by the Town of Moraga and is sometimes used on purple starthistle 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 the material contacts. Therefore, the general window of use is after grasses dry out. This is a very short window of time in the very late spring. Generally the Department feels that Milestone and Clarity have less impact on the environment in rangeland and pasture use areas. 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 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 purple starthistle.**
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 or spot treatment using a 200 gallon spray rig mounted on a 4WD truck; spot treatment (directed spray) from backpack **CONCLUSIONS: The majority of infested areas involve smaller patches or scattered plants. These are spot-treated by staff using backpack sprayers either as they hike or as they ride ATVs through infested areas. There are heavy populations on some properties that are new to the program where staff use a 200 gallon spray rig mounted on a 4WD truck with a boom sprayer or 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 to 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. DiTomasso, Joseph M., and Healy,Evelyn A.2007. Weeds of California and Other Western States. Univ. of CA 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.



Mature Plants

Rosettes