

**Contra Costa County**  
**DECISION DOCUMENTATION TREE for WEED MANAGEMENT: Perennial Pepperweed**

**Date:** 5/31/13

**Department:** Agriculture

**Location:** N/S Highway 4 and extending through the town of Rodeo

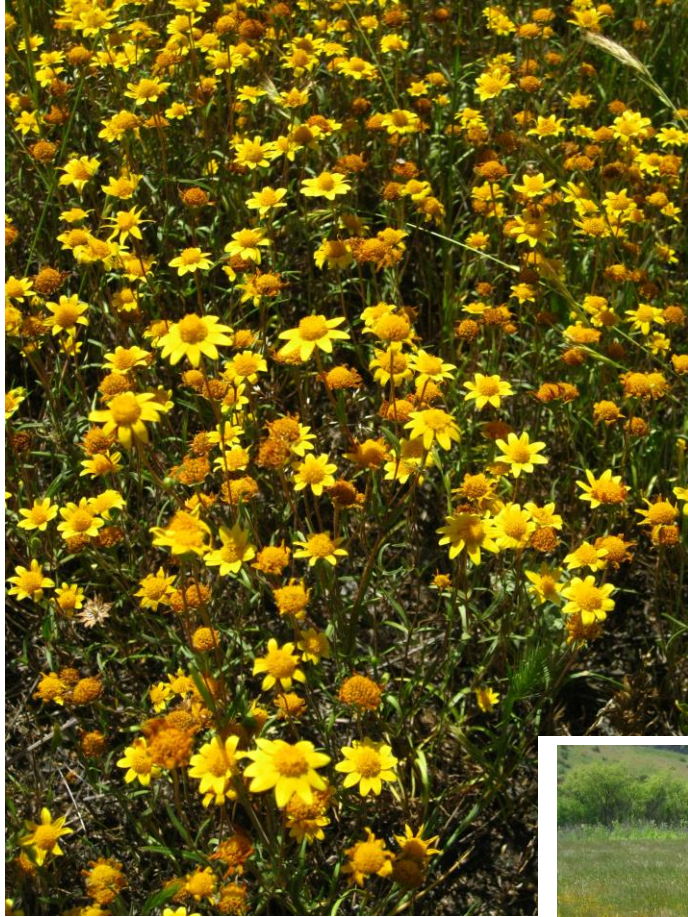
**Situation:** A perennial pepperweed (*Lepidium latifolium*) infestation is threatening the highly endangered Contra Costa goldfields (*Lasthenia conjugans*) at a remnant population site along Hwy 4 near the I-80 interchange. The infestation also threatens the riparian corridor, upland range and open areas nearby. Perennial pepperweed is a CDFA “B” rated noxious weed and is rated as highly invasive by Cal IPC.

<b>What are the management goals for the site or weed?</b>	To control and ultimately eradicate the sporadic perennial pepperweed infestation that has started in this area.	
<b>Was the site monitored and what was found?</b>	<p>Yes, and the following isolated infestations were found:</p> <ol style="list-style-type: none"> <li>1. in the immediate vicinity of the CC goldfields population</li> <li>2. east of the CC goldfields population on a Hwy 4 right-of-way across from Franklin Canyon Golf Course</li> <li>3. one area near Rodeo Creek in the populated area of the town of Rodeo</li> <li>4. in a Caltrans area near a pond at Willow Ave and Hwy 4</li> <li>5. between the eastbound and westbound lanes of Hwy 4 at and near the Oak Harbor Freight Co. office</li> </ol> <p>Later in 2013, 3 more patches were found in the vicinity of the above infestation.</p> <p>Note: The infestation on the Caltrans right-of-way across from Franklin Canyon Golf Course has been treated for the last 2 years by the Agriculture Department. The Oak Harbor Freight infestation was treated by the Department for the first time last year.</p>	
<b>Weeds have been identified as the following:</b>	<p><b>Weed:</b> Perennial pepperweed (<i>Lepidium latifolium</i>)</p> <p><b>Family:</b> Brassicaceae</p> <p><b>Habitat:</b> Many different areas and habitats, including wetlands, riparian areas, meadows, vernal pools, salt marshes, flood plains, sand dunes, roadsides, pasture land, irrigation ditches, ornamental plantings, and agronomic crops.</p> <p><b>Origin:</b> Native to Eurasia</p> <p><b>Weedy characteristics:</b> Prolific seeder; lab tests suggest that seeds germinate readily with fluctuating temperatures and adequate moisture; fortunately, seeds do not appear to remain viable in the soil for extended periods. It reproduces primarily vegetatively from roots and root fragments. Large root fragments can survive desiccation on the soil surface for extended periods, and fragments as small as ½ to 1 inch long and 2 to 8 mm in diameter can develop into new plants. Rhizomes extend to a depth of up to eight feet. Flooding, soil movement and human and animal activities disperse seeds and root fragments.</p>	
<b>Are populations high enough to require control?</b> <b>Explain</b>	<p>Yes, the goal is eradication in the Rodeo Creek watershed and therefore, the tolerance level is zero. It is important to eradicate the infestations in this area while they are still small and relatively easy to treat in order to protect the isolated population of the highly endangered Contra Costa goldfields. It is easiest to control infestations when they are new and of limited extent.</p> <p>Perennial pepperweed can rapidly form dense stands that displace desirable vegetation and wildlife. It spreads easily and once established it is persistent and difficult to control. The plant extracts salts from deep in the soil and when the plant dies, deposits the salts on the surface of the soil thus inhibiting the germination and growth of other species that are sensitive to salinity.</p>	
<b>Is this a sensitive site?</b>	<b>Does this include highly sensitive areas?</b>  These areas are in and near critical habitat for CC goldfields. Part of the area is within California red-legged frog listed geographic area. Within this area, and with the noxious weed program partial exemption, 2,4-D, glyphosate and imazapyr use is not allowed within 20' of a water feature.	Yes

	<p>Infestation is also near habitat for the Alameda whipsnake and California tiger salamander.</p>	
	<p><b>Are any areas part of the court-ordered injunctions?</b> (see: <a href="https://www.epa.gov/endangered-species/interim-use-limitations-eleven-threatened-or-endangered-species-san-francisco-bay">https://www.epa.gov/endangered-species/interim-use-limitations-eleven-threatened-or-endangered-species-san-francisco-bay</a>)</p> <p>The area is enjoined for a number of pesticides for the California red-legged frog and the Alameda whipsnake is south and east of the Franklin Canyon Golf Course and Hwy 4. (See also above.)</p>	No
	<p><b>Is this a known or potential habitat for any endangered or threatened species?</b></p> <p>See above.</p>	Yes
	<p><b>Is it on or near an area where people walk or children play?</b></p>	No
	<p><b>Is it near a drinking water reservoir?</b></p>	No
	<p><b>Is it near a creek or flood control channel?</b></p> <p>Near Rodeo Creek.</p>	Yes
	<p><b>Is it near crops?</b></p>	No
	<p><b>Is it near desirable trees or landscaping?</b></p> <p>There are trees along the creek, but no landscaping anywhere near.</p>	Yes
	<p><b>Is the soil highly permeable, sandy, or gravelly?</b></p>	Probably, along the creek.
	<p><b>Is the ground water near the surface?</b></p>	Unknown, but likely near the creek.
<b>Which cultural controls were considered?</b>	<p><b>Mulching, weed barrier:</b> Not effective; not practical in open fields or on creek banks</p> <p><b>Planting Desirable Species:</b> Establishing desirable vegetation in disturbed areas can suppress perennial pepperweed and slow reinvasion after control, but the County has no control over the areas in question.</p> <p><b>Burning:</b> Not effective at reducing stands, but it is helpful at removing accumulated thatch. Not practical in these areas and County has no control over infested sites.</p> <p><b>CONCLUSIONS: None of these strategies is effective and/or practical.</b></p>	
<b>Which physical/mechanical controls were considered?</b>	<p><b>Hand pulling:</b> Seedlings are easily controlled by hand, but seedlings are rarely encountered. Established plants cannot be controlled this way because shoots quickly resprout from vast root reserves. Hand pulling exacerbates the problem plus the area is too extensive for hand pulling.</p> <p><b>Mowing/tilling by machine:</b> Tilling typically increases the infestation by spreading root fragments. Mowing stimulates perennial pepperweed to resprout and produce new growth. Mowing can be helpful for removing thatch created by accumulated old stems. This can help prevent shading of desirable species. Combining mowing with herbicides has been shown to be effective. For best results, plants should be mown at the bolting or flower bud stage and herbicides applied to the resprouting shoots once they have reached the flower bud stage. Any mowing is difficult in wild land areas and depending on the time of year can cause a fire. There also exists increased hazard of mechanical and other injury to the operator.</p> <p><b>Grazing:</b> Cattle, sheep and goats will graze this weed, especially rosettes in early spring. When stands are dense, it becomes difficult for most animals to graze. Sheep and goats permanently maintained in a pasture suppress this weed's growth, but once animals are removed, plants quickly resprout. This technique could not be used near the Contra Costa goldfields. This technique could be used in some areas as a management tool; however, it is not compatible with the eradication goal of perennial pepperweed.</p> <p><b>CONCLUSIONS: None of these strategies is effective or practical for our purposes.</b></p>	
<b>Which biological controls were considered?</b>	<p><b>Biological controls available:</b> Biological controls are being evaluated for use in the U.S., but currently none are available. Finding biological control agents for perennial pepperweed is complicated by the fact that this weed is in the same family as broccoli, cabbage, cauliflower, and many other food plants. Researchers must take great care not to introduce a pest on food plants. Department staff have observed a powdery mildew and a native dodder that attack perennial pepperweed and appear to weaken the plants somewhat, though not to the extent that either would be an effective biocontrol agent.</p> <p><b>CONCLUSIONS: No effective biological controls are available.</b></p>	

<p><b>Which chemical controls were considered?</b></p> <p>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.</p> <p><a href="http://npic.orst.edu/">http://npic.orst.edu/</a></p> <p>You can communicate with an actual person at 800.858.7378 or <a href="mailto:npic@ace.orst.edu">npic@ace.orst.edu</a></p> <p>They are open from 8 am to 12 noon Pacific Time, Mon.-Fri.</p>	<p>During many years of research, experience, and experimentation, including consulting the literature, researchers, and colleagues about materials that are labeled for, and effective on, perennial pepperweed, 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.</p> <p><b>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).</b></p> <p><b>Herbicides and application methods are chosen that prevent or minimize the potential for drift and exposure to humans and wildlife.</b> As with all weed control techniques, herbicides must be reapplied periodically to suppress weeds over the long term.</p> <p><b>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.</b></p> <p><b>Possible herbicide choices:</b></p> <p><b>2,4-D</b>—We have not tried this and do not want to because there are safer and more effective alternatives.</p> <p><b>Glyphosate</b>—Will not kill seeds or inhibit germination the following season. It is not selective and therefore kills grasses and other plants. This opens the treated area to other weeds. Our trials have shown it to have limited effectiveness.</p> <p>Signal Word (indicates acute, or immediate, toxicity): CAUTION  Rate: 2 to 4 qt. product (Roundup ProMax)/acre; spot treatment: 2% product v/v  Timing: Postemergence from seedling to bloom; most effective at flower bud or flowering. It is sometimes used in conjunction with mowing or a mowing/wiping technique.  Enjoined for endangered species? Yes</p> <p><b>Imazapyr</b>—It is non-selective, has long soil residual activity, and leaves more bare ground than other treatments, even a year after application. Our trials have shown it to be very effective. However, we feel there is a more environmentally friendly treatment options (chlorsulfuron).</p> <p>Rate: 1 to 2 qt. product/acre  Timing: Postemergence from seedling to bloom; most effective from flower bud to flowering  Enjoined for endangered species? Yes</p> <p><b>Triclopyr</b>—Our trials have shown limited effectiveness. The product has a higher toxicity “Warning” label. It has a greater potential to cause offsite drift problems.</p> <p><b>Chlorsulfuron</b>—Has long soil residual activity and is generally safe on grasses. U.C Extension research in Southern California has shown Telar to be the most effective herbicide for perennial pepperweed. Our trials have shown it to be very effective as well. Telar has a “Caution” label.</p> <p>Signal Word (indicates acute, or immediate, toxicity): CAUTION  Rate: 1 to 2.6 oz. product/acre  Timing: Postemergence from seedling to flowering. Most effective at flower bud or flowering.  Enjoined for endangered species? No</p> <p><b>CONCLUSIONS: We feel that chlorsulfuron (Telar) is the safest effective material. It is also cost effective. It does not injure grasses and therefore allows us to maintain the competitive vegetation in the area and to prevent unsightly bare patches and browned-out areas around the treated weeds.</b></p> <p><b>Our ideal treatment time is from late May to early June when plants are beginning to flower, though Telar can be used effectively even into the fall. Perennial pepperweed plants are also easier to see when they are in flower.</b></p>
<p><b>Which herbicide application methods are available for this chemical?</b></p>	<p><b>Methods available:</b> Broadcast or spot spray (directed spray)</p> <p><b>CONCLUSIONS: We will use a directed spray to visible perennial pepperweed plants and the immediate vicinity. Chlorsulfuron that falls on the ground near the weeds will prevent perennial pepperweed seeds from germinating. Our work will mostly be done with a backpack sprayer, but depending on the density of the weed patches, we may need to use a hose pulled from a truck. We consider both of these methods spot treatments.</b></p>
<p><b>What factors were considered in choosing the herbicide application method?</b></p>	<p>The size of the noxious weed infestations and their location are the most important factors in considering the application method. We also consider safety to the applicator, the environment, and nontarget species; endangered species considerations; the effectiveness of the method; and the cost to the Department.</p>
<p><b>What weather concerns must be checked prior to application?</b></p>	<p>Wind is the primary concern. It can carry the herbicide off-site to non-target or sensitive areas. The Contra Costa goldfields are far enough away from the perennial pepper weed populations that the herbicide will not affect them under our normal treatment protocol. If any perennial pepperweed is found within the goldfield site or close enough to present a concern, the Department will consult with the Department of Fish and Wildlife.</p>

<b>References</b>	DiTomasso, Joseph M., et al. 2013. Weed control in Natural Areas in the Western United States Pest Notes. 2004. Perennial Pepperweed, Pub 74124. UC Statewide IPM Program, UC Davis Cal IPC Perennial pepperweed plant profile. <a href="http://www.cal-ipc.org/ip/management/plant_profiles/Lepidium_latifolium.php">http://www.cal-ipc.org/ip/management/plant_profiles/Lepidium_latifolium.php</a> . Web page accessed 5/15/13.



Closeup of Contra Costa Goldfields



Contra Costa Goldfields near Hwy 4 and I 80