Active and Passive Restoration of Fountain Thistle Habitat Following Jubatagrass Removal

Prepared by Don Thomas, Pest Control Specialist, San Francisco Public Utilities Commission

ABSTRACT

Fountain thistle (*Cirsium fontinale* var. *fontinale*) is a federally and state endangered plant species endemic to the San Francisco Peninsula, with the majority of its populations occurring within the Peninsula Watershed of the San Francisco Public Utilities Commission (SFPUC). One of the populations has been heavily invaded by jubatagrass (*Cortaderia jubata*). As the result of a 12-year-long control program, the SFPUC has removed almost all of the jubatagrass, and this has permitted fountain thistle to begin to reclaim the lost habitat. A monitoring program is being conducted to track the progress of re-colonization of the habitat by fountain thistle. Initial surveys revealed an average rate of expansion of the fountain thistle population of 1.7 ft. (0.5 m) between 2007 and 2008 and of 2.6 ft. (0.8 m) between 2008 and 2009, or an average rate of about 2.2 ft. (0.7 m) per year. At this relatively slow rate of spread, there is the risk of re-invasion of cleared habitat by invasive plants. Tall fescue (*Festuca arundinacea*) is rapidly increasing at the site and threatens to exclude fountain thistle from its potential habitat. Therefore a program of active restoration, involving the planting of California hairgrass (*Deschampsia cespitosa*), the most common native associate of fountain thistle in the Watershed, was begun in 2009 to supplement revegetation through passive recruitment and to provide a matrix of native plants that would resist further invasion. Survivorship of hairgrass will be followed to determine the effectiveness of this approach.

INTRODUCTION

The fountain thistle is a federally endangered species that grows only on the San Francisco Peninsula, with most of the plants growing within the Watershed of the San Francisco Public Utilities (SFPUC) (Figure1). It is restricted to a unique serpentine seep and wetland habitat. One of the populations had been largely displaced from its habitat by the invasion of jubatagrass (*Cortaderia jubata*). Invasion of the habitat by jubatagrass has been identified as one of the principal threats to fountain thistle by the U.S. Fish and Wildlife Service (U.S. Fish and Wildlife Service. 1998).

Over the past 12 years the SFPUC has progressively removed the jubatagrass, opening the habitat to fountain thistle re-colonization (Thomas and Ciardi 2008). The SFPUC is now attempting to restore the fountain thistle habitat. To accomplish this, it is pursuing two basic approaches to habitat restoration, passive restoration and active restoration. Passive restoration is the reliance mostly upon natural ecological successional processes, with minimal human interference, to direct the course of restoration. Active restoration employs human intervention to accelerate natural processes or to achieve a desired outcome.

PASSIVE RESTORATION

Following jubatagrass removal, the SFPUC followed the passive approach of employing natural succession and seedling recruitment to re-establish fountain thistle plants and the serpentine seep plant community. It was found that new fountain thistle plants were able to establish around the old dead bases of the jubatagrass (Figure2). An ongoing monitoring program is being conducted to study the progress of fountain thistle re-colonization. This involves measuring the distance to the edge of the population at intervals along a permanent transect (Figure 4). It was found that the margin of the population had expanded 1.7 ft. (0.5 m) between 2007 and 2008 and 2.6 ft. (0.8 m) between 2008 and 2009. The Garden Project, a non-profit organization involved in environmental education, assisted with the project and also with revegetation efforts (Figure 3).

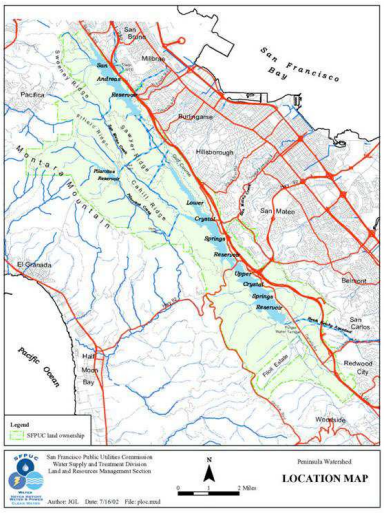

Figure 1. San Francisco Public Utilities Peninsula Watershed

Figure 2. Fountain thistle seedlings colonizing dead bases of jubatagrass

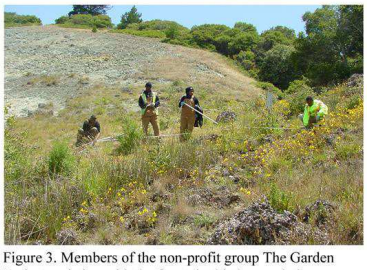

Figure 3. Members of the non-profit group The Garden Project assisting with the fountain thistle population survey

DISCUSSION

There has recently been a debate among practitioners about the relative merits of passive and active restoration, for example in management of parks (U.S. National Park Service 2005). Though it has traditionally been thought that it is better to rely upon natural processes, anthropic disturbances to the environment, such as the introduction of invasive species, have been so great that some human manipulation may be necessary.

Though fountain thistle is reclaiming its habitat through natural recruitment, this process is relatively slow. Fountain thistle is a k-selected species with relatively large achenes that are dispersed close to the parent plants (Powell 2007) Because of this, it is a poor colonizer. This has also been found for its conspecific relatives, the Mount Hamilton thistle (*C. fontinale* var. *campylon*) (Hillman 2007) and the Chorro Creek bog thistle (*C. fontinale* var. *obispoense*) (Chipping 1994). In contrast, the non-native congeneric bull thistle (*C. vulgare*) is an r-selected species and an aggressive colonizer. With rare and endangered k-selected species, such as fountain thistle, species recovery may be best achieved through a program that includes active restoration rather than one solely relying on passive restoration.

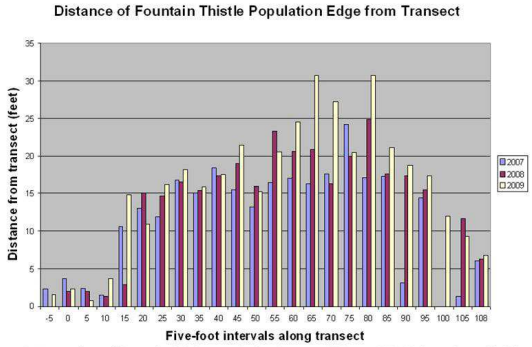

Figure 4. Expansion of fountain thistle population between 2007 and 2009 into cleared habitat, as indicated by distance to population edge from transect at 5-foot intervals along transect

Figure 6. Tall fescue invading fountain thistle habitat, with fountain thistle in background

Plant Species or Land Cover	Per Cent Cover
Dead remains of jubatagrass (Cortaderia jubata)	46.5
Seep monkeyflower (Mimulus guttatus)	16.4
Bare ground	15.5
Rabbit's foot grass (Polypogon monspeliensis)	12.6
Tall fescue (Festuca arundinacea)	2.4
Iris-leaved rush (Juncus xiphioides)	1.4
Sow thistle (Sonchus oleraceus)	1
Live jubatagrass (Cortaderia jubata)	1
Fountain thistle (Cirsium fontinale)	1

Figure 5. Cover values for fountain thistle habitat, determined by point intercept method, showing significant colonization by non-native plants

Figure 7. Hairgrass plug planted as part of the active restoration program

ACTIVE RESTORATION

Because the expansion of the fountain thistle population through passive recruitment is relatively slow, its habitat has been subject to re-invasion by jubatagrass and other non-native plants. To determine the extent of colonization by non-native invasive plants, compared with that by native plants, we conducted a survey for per cent plant cover in the cleared habitat, using the point intercept method and stratified random sampling. (Figure 5) While the greatest cover was found to be for a native plant, seep monkeyflower, the aggregate cover of non-native plants was found to be greater than that for native plants. One of these non-native plants, tall fescue, is increasing rapidly at the site and appears to be replacing jubatagrass as the most significant invasive plant (Figure 6).

Because of the threat of re-invasion by non-native plants, an active revegetation program was begun in 2009. This involves the planting of a native bunchgrass, hairgrass (*Deschampsia cespitosa*), the most common associate of fountain thistle in most of its habitat. Survivorship of hairgrass will be monitored to assess the effectiveness of this approach.

REFERENCES

Chipping, David. 1994. Chorro Creek bog thistle recovery project final report. Report submitted to California Department of Fish and Game. www.docstoc.com/docs/697479/Chorro-Creek-bog-thistle

Hillman, Janell. 2007. Constraints on population recruitment for a rare serpentine seep thistle. Master's thesis. San Francisco State University.

Powell, Kristin and Tiffany Knight. Washington University. 2007. Competitive abilities of rare, common, and invasive *Cirsium* species in different nutrient environments. Poster abstract. The ESA/SER Joint Meeting (August 5 – August 10, 2007). http://eco.confex.com/eco/2007/techprogram/P7995.htm

Thomas, Don and Guido Ciardi. 2008. Jubatagrass control and natural regeneration of *Cirsium fontinale* var. *fontinale* (fountain thistle). Proceedings of the 2008 California Invasive Plant Council Symposium. www.cal-ipc.org/symposia/archive/pdf/2008/Proceedings_2008.pdf

U.S. Fish and Wildlife Service. 1998. Recovery Plan for Serpentine Soil Species of the San Francisco Bay Area. http://ecos. fws.gov/docs/recovery_plans/1998/980930c.pdf

U.S. National Park Service. 2005. Passive vs. active restoration in national parks. Analysis and decision making for preserving genetic diversity. http://workflow.den.nps.gov/staging/8_Transportation/Resources/PassiveVsActiveRestoration2005.pdf