ABSTRACT

Fountain thistle (Cirsium fontinale var. fontinale) is a federally endangered thistle that give rise to invasive and increasingly not corridor plant. The habitat has been invaded by thistles (Cirsium seepage), and other native species. This study describes the successful recovery of two fountain thistle population through passive recruitment following control of jubata grass.

One fountain thistle population, located in the Point Arena Watershed of the San Francisco Public Utilities Commission, had been mostly displaced from its serpentine seep habitat by the invasion of jubata grass. The jubata grass was controlled by the Ontario Native Plant Society. This population expanded by 5.6 feet/year, with the jubata grass habitat extending beyond the limits of the population. The jubata grass population was measured by running a 5-foot belt transect in 2013 and 2014, and the population expanded northward at an average annual rate of 5.6 feet/year. In 2015, the jubata grass population expanded at a rate of 1.9 feet/year, southward, while the fountain thistle population expanded at a rate of 2.6 feet/year, northward. By 2015, the fountain thistle population expanded to fill almost all of the available habitat, indicating successful recovery. Between 2011 and 2015, the fountain thistle population expanded southward at an average annual rate of 0.2 feet/year, and northward at an average annual rate of 1.2 feet/year. The greater rate of expansion southward corresponds to the greater amount of habitat available for re-colonization, the smaller amount of habitat north of the transect had been mostly occupied by jubata grass.

The fountain thistle population expanded beyond the bounds of the first transect and the present transect study was initiated, it was found that the fountain thistle population was much more rapid, averaging 2.3 feet/year between 2011 and 2015 (this Figure 3). Population expansion north and south of the transect was tracked separately and averaged 2.5 feet/year, respectively. The greater rate of expansion corresponded to the greater amount of habitat available for re-colonization, the smaller amount of habitat north of the transect had been mostly occupied by jubata grass.

The rapid expansion rate observed between 2011 and 2013 does not seem consistent with the shorter range expected for the fountain thistle. This may reduced population expansion to the changes in the environment of the area and the potential for animal seed vectors that is transporting seeds greater distance from the parent plant. While increases of south of the north of the transect (flowering rate) had been aided by planting and water flow, these show no increased rapid spread of cells in the cells or seeds (intra-plant). Though the paper may not address all local issues, the results is probably because of the greater weight of jubata grass, fountain thistle has expanded to cover more of the site.

One possibility is movement by ants. Fountain thistle seeds possess pyramidal (longitudinal) pyramidal, 40% of seeds attached to the roots (intraspecific). However, these ants are not the same as the ants of the same species that are too small to carry seeds. The ants of the larger native ants can be from the same species.

A second candidate for a vector is the wood rat. Dusky-footed wood rats are present on the site, as indicated by the occurrence of wood rats in the adjacent untended area. These have large seeds that are transported by ants. These seeds may be carried by the ants. Though the paper may not address all local issues, the results is probably because of the greater weight of jubata grass, fountain thistle has expanded to cover more of the site.

In 2015 a second count of plants was conducted, and it was found that there were about 350 fountain thistle plants. This population was expanded rapidly to 10% of the population's north (intraspecific). Though the paper may not address all local issues, the results is probably because of the greater weight of jubata grass, fountain thistle has expanded to cover more of the site.

METHODS

At the California site, in addition to the passive recovery of the fountain thistle population through natural recruitment, an active restoration project was carried out at the Point Arena Watershed of California. Approximately 1,250 plants of fountain thistle were collected from a nearby thistle meadow, were planted in 2008, and then establishment rate of about 20 per cent. In 2015 a second count of plants was conducted, and it was found that there were about 350 fountain thistle plants. This population was expanded rapidly to 10% of the population's south (intraspecific).

In 2007 the SFPUC initiated a project to measure and map the fountain thistle population to provide a baseline for tracking the improvement in the habitat of fountain thistle through natural recruitment and the results of an active habitat restoration project at the site (Figure 3). This site involves the establishment of a natural habitat for fountain thistle.

RESULTS

At the SFPUC site, the fountain thistle plants (Cirsium fontinale var. fontinale) are federally endangered and are considered invasive weeds in California. The plants have been recorded in North America, Europe, and Australia. In North America, they are considered invasive weeds in California, and are also considered invasive in Europe. In Australia, they are considered invasive weeds in Australia. In Europe, they are considered invasive weeds in Europe. In North America, they are considered invasive weeds in North America.

The results of the population survey conducted at the SFPUC site are presented in the table in Figure 3 and displayed in the sketch in Figure 4. The southward expansion of the population at the end of the study was measured in feet, using a 5-foot belt transect in 2013 and 2014. Throughout the study period, the population expanded northward at an average annual rate of 1.1 feet/year, and southward at an average annual rate of 0.5 feet/year. The greater rate of expansion southward corresponds to the greater amount of habitat available for re-colonization, the smaller amount of habitat north of the transect had been mostly occupied by jubata grass.

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