Santa Cruz tarplant

Holocarpha macradenia

State:	Endangered	1979
Federal:	Threatened	2000

General Habitat:

Santa Cruz tarplant is known from grasslands and prairies on coastal terraces below 400 feet in elevation. Historically, it occurred from Monterey County north to Marin County. It typically grows on deep loam and sandy loam soils with a subsurface clay component, which hold moisture longer into the growing season compared to the surrounding sandy soils. Currently known Santa Cruz tarplant populations are frequently associated with non-native grasses such as wild oat, barley, rattlesnake grass, vulpia, and bromes. Native associates include rushes, California oatgrass, and other tarplants. At some locations, the plant is found with other rare species, including the state-endangered San Francisco popcorn flower (*Plagiobothrys diffusus*) and the federally-endangered Ohlone tiger beetle (*Cicindela ohlone*).

Description:

Santa Cruz tarplant is an aromatic, glandular annual herb in the sunflower family (Asteraceae), growing four to 20 inches tall. Small plants may produce a single yellow daisy-like flower head on a single stem, while larger plants have a rigid main stem and lateral branches that grow to the height of the main stem and produce many flowers. The leaves are linear and larger at the base of the plant (up to five inches), getting smaller as they go up the stem. Santa Cruz tarplant produces numerous (40 to 90) central disk flowers, many more than any related species.

Status:

Santa Cruz tarplant, as its name implies, is coated with a sticky, resinous material that helps to retard water loss during the heat of the day and may also help to repel potential predators. Santa Cruz tarplant was once found in most San Francisco Bay Area counties and south to Monterey County. The distribution of Santa Cruz tarplant has been severely reduced due to the destruction and alteration of

coastal prairie habitat, primarily due to urban development and land management practices that favor competing invasive, non-native species. All natural populations in the counties surrounding the Bay have been extirpated. The last remaining native population in this area, known as the Pinole Vista population, consisting of 10,000 plants, was eliminated in 1993 by commercial development. Santa Cruz tarplant is currently known from approximately 13 native and 8 experimentally seeded populations in Contra Costa, Monterey, and Santa Cruz Counties. Seven native occurrences are located near the cities of Santa Cruz and Soquel, and six are located near Watsonville. Some of the native populations may represent separate, fragmented patches of what historically was a single, larger population. The eight experimentally seeded populations are located at Wildcat Canyon Regional Park in Richmond, Contra Costa County. Very recently, three additional population introductions have been attempted in Santa Cruz and Monterey counties, in conjunction with research on the effects of different grazing regimes on native coastal prairie vegetation. However, it not yet known whether these populations will persist.

In 1982, seed salvaged from a development site in Pinole was introduced to 22 sites in Wildcat Canyon Regional Park and onto East Bay Municipal Utilities District (EBMUD) lands. These introduction sites have been monitored fairly regularly for the past 17 years by EBRPD, EBMUD, CNPS volunteers, and DFG staff. Although a number of populations did well for a few years, only eight have persisted, and only one has consistently supported large numbers of individuals. In 2002, this population supported almost 30,000 plants, the largest it has been since the initial seeding. Artichoke thistle, a noxious weed, has been a problem at Wildcat, and began encroaching on several of the Santa Cruz tarplant sites. EBRPD has been implementing an artichoke thistle control program.

Most recent surveys at the thirteen natural populations found 10,000+ plants at three of the populations, 1001-10,000 plants at four populations, and 1000 or fewer plants at four populations. Two populations had no standing plants. The number and location of standing plants in a population can vary greatly from year to year due to a number of factors, including rainfall, temperature, soil conditions, disturbance factors, and the extent and nature of the seed bank. For example, at the Graham Hill population near Santa Cruz, 12,000 plants were found in 1994, and only 550 in 2001. At the Apple Hill population near Watsonville, zero plants were found in 1999; 4,049 in 2000; and 1,330 in 2002. Each population is comprised of not only the standing plants each year, but a persistent soil seed bank which can be very large and often covers an area much greater than the visible population of standing plants. Research has found that Santa Cruz tarplant's seed bank is made up primarily of ray achenes, which lay dormant in the soil as a "genetic storehouse" until the appropriate environmental or disturbance cues stimulate their germination. The seed bank is very important to the species' year-to-year and long-term survival, and the extent of seed bank reserves is variable from population to population.

Management activities can affect the health of the populations and influence the balance between the number of plants and the extent of seed bank reserves. In many areas the disturbance factors with which coastal California grassland vegetation evolved, including large mammal disturbances, Native American burning practices for the past 10,000 years, and cattle grazing for about the past 250 years, have been removed. This has lead to an increase in live vegetation, an increase in litter, and a reduction of soil disturbance. As a result, the abundance of non-native species has increased, and the species richness and abundance of native species has decreased. This trend has led to the decline of many native species, including Santa Cruz tarplant. Active management is required to reverse the trend. Several studies on Santa Cruz tarplant's demography, life history, and potential management techniques have recently been conducted by researchers at UC Berkeley and UC Santa Cruz, partially funded

through a USFWS Section 6 Grant.

Burning, mowing, grazing and scraping habitat have been utilized to mimic the natural disturbance regimes with the hope of enhancing populations at several sites, with variable results. Results indicate that management activities that result in the removal of thatch cover and expose areas of bare ground are most effective. Recent research on using grazing as a tool to manage grasslands found that response to disturbance varied from site to site, and a matrix of different disturbance regimes must be created to maintain native grassland species.

At the Arana Gulch population, four patches of Santa Cruz tarplant, comprising over 100,000 plants, were extant until the cessation of grazing in 1989. The population declined and then disappeared. A series of mowing, scraping, and burning experiments were implemented. Results found that scraping was more effective than mowing or burning. Scraping resulted in an increase in bare ground in spring, allowing plants to germinate and take root without being crowded out by competitors. The richness of native species was higher in scraped areas than in burned areas. However, the potential negative effects of repeated scraping are not known.

An arson fire at the Arana Gulch population in 1996 yielded the highest density of Santa Cruz tarplant in years. Following this fire, and its apparent benefit to Santa Cruz tarplant, two prescribed burns were conducted: one in 1998 and one in 2001. Both were not effective; no seedlings were observed after the burn, but tests of the soil found viable achenes. The prescribed burns were likely not as hot as the accidental fire, and were not adequate to remove thatch layers. Further research using hotter fires would be necessary before fire could be recommended as a restoration technique for this species.

At the Watsonville Airport site, Santa Cruz tarplant habitat adjacent to runways has been continuously mowed, disced, and grazed to maintain visibility for airport operations. This has increased the germination and therefore the density of the plants; however, the vigor of individual plants appears to be in decline and the reproductive output is lower. Increasing the number of standing individuals may also deplete seed bank reserves. Therefore, the goals of appropriate management should include not only increasing the number of standing individuals in small populations, but also maintaining the appropriate balance between standing individuals and seed bank reserves.

Santa Cruz tarplant, like other closely related tarplants, is self-incompatible, meaning that individuals will not produce viable seeds without cross pollinating with other individuals. Gene flow from individual to individual and from population to population increases the likelihood of viability through the maintenance of genetic diversity; therefore gene flow is important for the long-term survival of self-incompatible species. When populations are small and isolated, gene flow can become a problem. A student at Brown University looked at the correlation between population size and plant performance for Santa Cruz tarplant. Her results showed that small populations of Santa Cruz tarplant produce fewer seed heads, fewer seeds, and a larger number of dormant seeds. She concluded that negative environmental pressures such as pollen and resource limitations, invasion of non-native plants, and lack of disturbance forces were likely powerful enough to cause extirpation of small populations, and recommended intensive and proactive management, and possibly ex-situ cultivation, to rehabilitate small populations.

Where habitat is still intact, management favorable to the species can reverse decline of this species

and allow seeds in the dormant seed bank of the species to germinate and grow. The ability to provide appropriate management for the remaining occurrences of Santa Cruz tarplant will be pivotal in the recovery of the species.

The USFWS designated 2902 acres of critical habitat for the species in Contra Costa, Santa Cruz, and Monterey counties on October 16, 2002.