

Natural Diversity Data Base 2003). The Sacramento National Wildlife Refuge populations have been monitored annually since 1992 (J. Silveira *in litt.* 2000). One additional occurrence of *C. hooveri* in Merced County is on private land (the Bert Crane Ranch) that is protected from development by a conservation easement (J. Silveira *in litt.* 2000).

We funded a status survey for *Chamaesyce hooveri* and other vernal pool plants in 1986 and 1987 (Stone *et al.* 1988), resulting in 10 new occurrences. We and the California Department of Fish and Game jointly funded an ecological study of the Vina Plains Preserve pools, which was conducted by faculty from California State University, Chico (Alexander and Schlising 1997). Independent surveys conducted by Joseph Silveira led to discovery of the Merced and Glenn county occurrences (J. Silveira *in litt.* 2000). Private landowners also have contributed to conservation of this species. One pool in Tehama County was fenced by the property owner in the late 1980s, to exclude livestock (Stone *et al.* 1988).

3. *ERYNGIUM CONSTANCEI* (LOCH LOMOND BUTTON-CELERY)

a. Description and Taxonomy

Taxonomy.—Loch Lomond button-celery, specifically known as *Eryngium constancei* (Sheikh 1983), is a member of the carrot family (Apiaceae). This species was only recently described and therefore has no history of name changes. The common name was derived from the type locality, Loch Lomond, which is in Lake County (Sheikh 1983). Other common names for this species are Loch Lomond coyote-thistle (Skinner and Pavlik 1994) and Constance's coyote-thistle (Smith *et al.* 1980).

Description and Identification.—Certain features are common to species of the genus *Eryngium*. Unlike most vernal pool plants, *Eryngium* species are biennial or perennial, with an overwintering rootstock. The plant parts are often spiny, hence the word “thistle” in the common names. The earliest leaves produced from the rootstock each year are long and tubular with crosswise partitions. Leaves produced later in the growing season typically have a narrow petiole and a broader blade, which is usually lobed. *Eryngium* plants also have leaves at both the base of the plant and on the stem; stem leaves are typically opposite, but the upper leaves may be alternate. The tiny flowers are clustered into spiny heads. Individual fruits are small, dry, often scaly, and composed of two one-seeded, indehiscent units which separate at maturity and function as seeds.

Eryngium constancei has slender, loosely branched stems 20 to 30 centimeters (7.9 to 11.8 inches) tall, which may be decumbent or upright. The entire plant is covered with downy hairs. The mature leaves are 11 to 16 centimeters (4.3 to 6.3 inches) long, with the petiole accounting for most of the length. The leaf blade is lance-shaped and may have a smooth, sharply toothed, or lobed margin. The bracts are narrow, spiny-margined, and shorter than the leaves. In this species, the rounded flower heads are only 3 to 5 millimeters (0.12 to 0.20 inch) in diameter; however, the stems supporting the flower heads may be as much as 8 centimeters (3.1 inches) long. Each flower head contains only five to seven tiny flowers. The petals are approximately 1 millimeter (0.04 inch) long and are white or tinged with purple. Fruits of this species are egg-shaped and approximately 2 millimeters (0.08 inch) long. The diploid chromosome number of *E. constancei* is 32 (Sheikh 1983, Constance 1993).

The downy hairs and sparsely-flowered heads of *Eryngium constancei* distinguish it from other *Eryngium* species. All other species in the genus are hairless and have more than 10 flowers per head (Sheikh 1983, Constance 1993).

b. Historical and Current Distribution

Historical Distribution.—For over 5 decades, this species was known only from Loch Lomond, where it was first collected in 1941 (Sheikh 1983). *Eryngium constancei* has always been restricted to the Lake-Napa Vernal Pool Region (Keeler-Wolf *et al.* 1998) (**Figure II-5**).

Current Distribution.—Three additional populations of *Eryngium constancei* were discovered during the late 1990s, bringing the total number of populations to four. Three of the *E. constancei* populations are in Lake County and the other is in Sonoma County; all are in the Lake-Napa Vernal Pool Region (Keeler-Wolf *et al.* 1998). In Lake County, the species grows at Loch Lomond, Dry Lake (California Natural Diversity Data Base 2003), and in an unnamed pool near Cobb (A. Howald *in litt.* 1995, J. Diaz-Haworth pers. comm. 2001). The Sonoma County occurrence is composed of two pools on Diamond Mountain (California Natural Diversity Data Base 2003).

The Sonoma County plants differ slightly from the description above in that the heads have more flowers and some individuals have stout stems, but their identity was verified by species expert Dr. Lincoln Constance (Hrusa and Buckmann 2000). The site near Cobb is not yet listed as an occurrence in the California Natural Diversity Data Base (2003), but Dr. Constance has confirmed the identity of the specimens (A. Howald *in litt.* 1995). Based on an analysis of soils, slope,

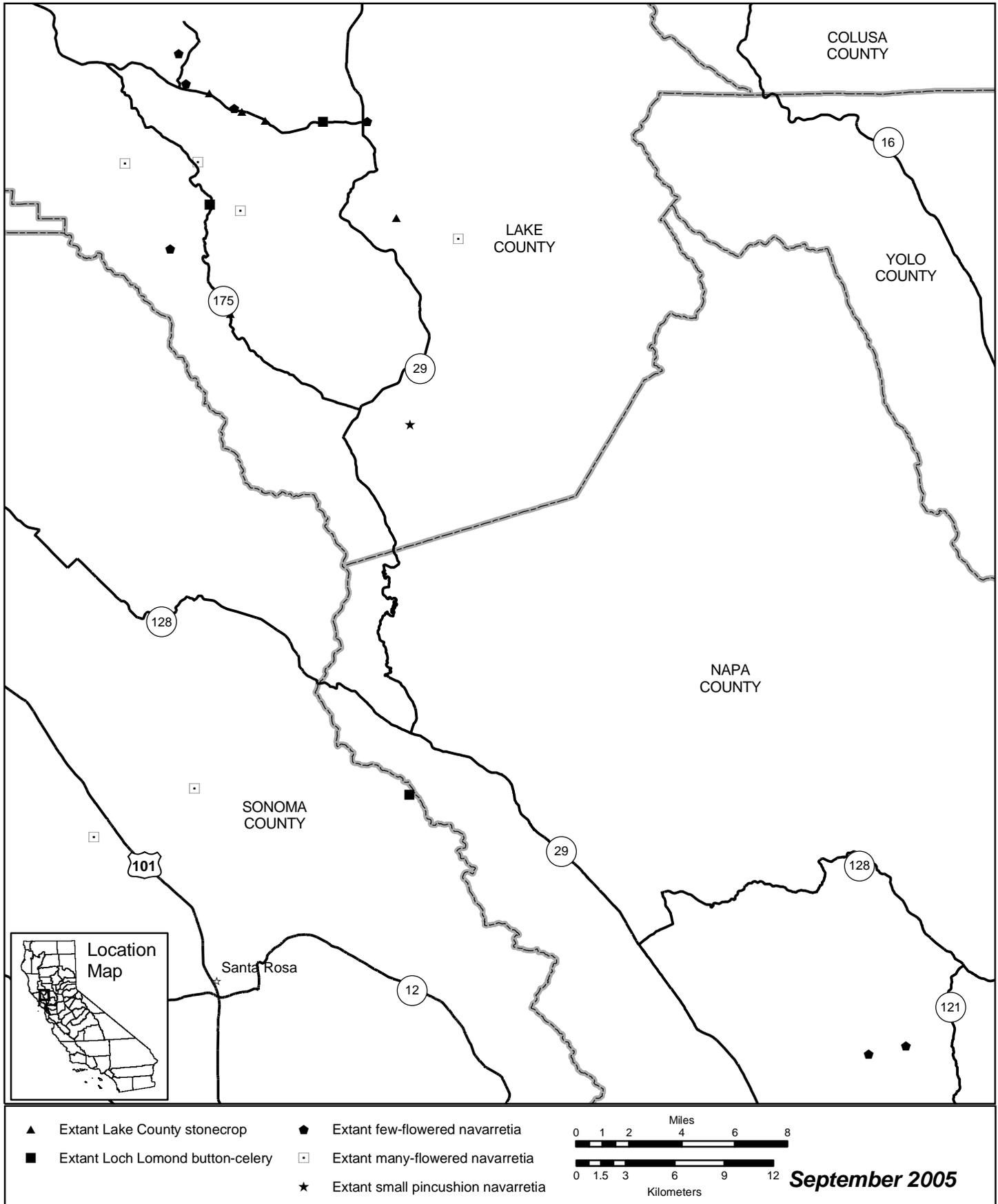


Figure II-5. Distribution of *Parvisedum leiocarpum* (Lake County stonecrop), *Eryngium constancei* (Loch Lomond button-celery), *Navarretia leucocephala* ssp. *pauciflora* (few-flowered navarretia), *Navarretia leucocephala* ssp. *plieantha* (many-flowered navarretia), and *Navarretia myersii* ssp. *deminuta* (pincushion navarretia).

elevation, and climate, only a very limited area in Lake and Napa Counties is considered to be suitable habitat for *Eryngium constancei* (Holland 2003).

c. Life History and Habitat

Reproduction and Demography.—*Eryngium constancei* flowers after the water evaporates from the pools, typically between June and August (California Department of Fish and Game 1985, 1994). Little else is known about the reproductive ecology or demography of this species. However, its life history may be quite similar to that of *E. vaseyi* (Vasey's coyote-thistle): producing a tuft of tubular leaves underwater from the perennial rootstock or from a newly-germinated seed in the late winter or early spring; developing broad terrestrial leaves later in the spring as the water evaporates; flowering in the summer; and developing fruits in July or August (Jepson 1922).

The demography of *Eryngium constancei* has not been studied. However, population size would not be expected to vary substantially among years because it is a perennial. The Dry Lake and Sonoma County populations numbered in the tens of thousands in both 1996 and 1997. However, in 1996, the Loch Lomond population was at least two orders of magnitude larger than in 1997 (California Natural Diversity Data Base 2003). The size of the fourth population has not been reported. Germination dates and conditions for *E. constancei* have not been determined, nor have pollinators or seed dispersal agents been identified.

Habitat and Community Associations.—Habitat information is available only for the three occurrences catalogued by the California Natural Diversity Data Base (2005). Loch Lomond is a small, intermittent lake with a surface area of about 3 hectares (7 acres) at maximum inundation (U.S. Fish and Wildlife Service 1985b). This wetland is classified as a Northern Volcanic Ashflow Vernal Pool (Sawyer and Keeler-Wolf 1995, California Natural Diversity Data Base 2003) and is on Collayomi-Aiken-Whispering complex soils. The lake is at an elevation of 853 meters (2,800 feet). The surrounding area is mountainous and supports a mixed forest dominated by *Pinus ponderosa* (ponderosa pine), *Quercus kelloggii* (black oak), *Pseudotsuga menziesii* (Douglas fir), and understory of *Arctostaphylos* spp. (manzanita) and *Ceanothus* spp. (California lilac) (California Department of Fish and Game 1994, K. Aasen *in litt.* 1995, California Natural Diversity Data Base 2003). *Eryngium constancei* occurred throughout the lakebed in 1994, but grew most densely towards the center, where it was one of the most abundant species. Other plants that were abundant in Loch Lomond that year included *Perideridia gairdneri* ssp. *gairdneri* (Gairdner's yampah), *Cuscuta howelliana* (Boggs Lake dodder), *Mentha pulegium* (pennyroyal), *Plagiobothrys stipitatus* (stalked popcornflower), *Plagiobothrys tener* (slender popcorn flower),

and a species of *navarretia* (California Department of Fish and Game 1994) that has been identified as an intergrade between *Navarretia leucocephala* ssp. *plieantha* and *N. leucocephala* ssp. *pauciflora* (A. Day *in litt.* 1997). *Eryngium aristulatum* (Jepson's button-celery), a close relative of *E. constancei*, also co-occurred in the lakebed (California Department of Fish and Game 1994).

On Diamond Mountain, the pools where *Eryngium constancei* grows are shallow and spring-fed (California Natural Diversity Data Base 2003); they are classified as Northern Basalt Flow Vernal Pools (Sawyer and Keeler-Wolf 1995, California Natural Diversity Data Base 2003). The surface area of the occupied pools and the soil type have not yet been determined. The surrounding plant community consists of *Quercus garryana* (Oregon oak), *Q. lobata* (valley oak), and *Pseudotsuga menziesii* (Hrusa and Buckmann 2000). The elevation of the site has been variously reported as 628 meters (2,060 feet) (California Natural Diversity Data Base 2003) or 685 meters (2,247 feet) (Hrusa and Buckmann 2000). *Eryngium constancei* was dominant in both pools in 1996 (B. Hunter *in litt.* 1996). Associated plant species that year included *Pogogyne douglasii* (Douglas' pogogyne), *Perideridia kelloggii* (Kellogg's yampah), *Perideridia howellii* (Howell's yampah), *Eleocharis* spp. (spikerush), *Madia elegans* ssp. *densifolia* (leafy common madia), and *Clarkia purpurea* (winecup clarkia) (California Natural Diversity Data Base 2003).

Less information is known about the Cobb and Dry Lake occurrences. The surface area of the Cobb pool is approximately 2 hectares (5 acres) (J. Diaz-Haworth pers. comm. 2001), but its elevation and soil type are not known. The endangered plant *Navarretia leucocephala* ssp. *pauciflora* is the only associate that has been reported at the Cobb pool (A. Howald *in litt.* 1995). The Dry Lake pool is at an elevation of 463 meters (1,520 feet) and is surrounded by *Quercus douglasii* (blue oak) woodland. In 1997, *Eryngium constancei* was the dominant species and was associated with unidentified rushes (*Juncus* spp.; California Natural Diversity Data Base 2003). Soils underlying Dry Lake are in the Sobrante-Guenoc-Hambright complex.

d. Reasons for Decline and Threats to Survival

Most species addressed in this recovery plan are threatened by similar factors because they occupy the same vernal pool ecosystems. These general threats, faced by all the covered species, are discussed in greater detail in the Introduction section of this recovery plan. Additional, specific threats to *Eryngium constancei* are described below.

Specific threats to two of the four populations are that at least one of the occupied pools at Diamond Mountain may be converted to a vineyard, and the owner of

Dry Lake has proposed excavating the pool for a reservoir (California Natural Diversity Data Base 2003). Changes in hydrology threaten three of the four occurrences. In addition, runoff from adjacent roads and swimming pools creates excess water flow, whereas drainage ditches, culverts, and diversion of a natural spring are reducing the flow of water to *Eryngium constancei* habitat (Hrusa and Buckmann 2000, California Natural Diversity Data Base 2005).

Larger-scale hydrological alterations, including commercial development and timber harvesting, are also occurring in all the watersheds where *Eryngium constancei* grows, thus posing added hydrological threats (U.S. Fish and Wildlife Service 1985b, 1986, 1993b; California Department of Fish and Game 1994; K. Aasen *in litt.* 1995; B. Hunter *in litt.* 1996; California Natural Diversity Data Base 2005).

The extremely restricted distribution of *Eryngium constancei* is an additional threat to this species. Although the individual populations of *E. constancei* are sufficiently large that intrinsic problems such as genetic drift are not a concern, other random events could cause the species to go extinct. Catastrophic weather events, climate change, or other unforeseen circumstances potentially could eliminate all of the populations, due the very limited distribution of this plant.

A more subtle threat that could cause decline of *Eryngium constancei* populations would be a lack of pollinators, if they are necessary for seed-set. Pollinating insects may require habitat outside of the vernal pools, which could be lost if it is not identified and targeted for protection. However, neither the importance nor status of pollinators have been identified at this time.

e. Conservation Efforts

In 1985, we declared *Eryngium constancei* to be endangered under emergency listing provisions of the Endangered Species Act (U.S. Fish and Wildlife Service 1985b). Following this emergency listing, we published a final rule on December 23, 1986 determining *E. constancei* to be an endangered species (U.S. Fish and Wildlife Service 1986). However, due to conservation efforts directed at Loch Lomond (see below), we later proposed to downlist the species to threatened status (U.S. Fish and Wildlife Service 1993); action on this proposal is still pending.

The California Fish and Game Commission listed *Eryngium constancei* as endangered in 1987 (California Department of Fish and Game 1991). The California Native Plant Society has considered the plant rare and endangered since 1980 (Smith *et al.* 1980). *Eryngium constancei* currently is on the

California Native Plant Society's List 1B, with the highest endangerment rating possible (California Native Plant Society 2001).

California's Wildlife Conservation Board and Public Works Board acquired Loch Lomond and a small adjacent buffer in 1988 to prevent its conversion to a recreational lake. The site is now known as the Loch Lomond Vernal Pool Ecological Reserve. In 1989, the California Department of Fish and Game, with financial assistance from us, fenced the perimeter of the lake to exclude off-road vehicles and other detrimental recreational use (U.S. Fish and Wildlife Service 1993, California Department of Fish and Game 1994). In 1994, the California Department of Fish and Game prepared a management plan for the reserve and obtained a baseline population estimate for *Eryngium constancei*. Periodic monitoring of the population and interpretive displays about the species are planned (California Department of Fish and Game 1994).

A local citizen with an interest in conservation bought the Cobb parcel where *Eryngium constancei* grows. She intends to protect the vernal pool and its associated species (J. Diaz-Haworth pers. comm. 2001, B. Flynn pers. comm. 2001). The California Department of Fish and Game has reviewed timber harvest plans and other land uses for areas adjacent to any of the populations and has provided recommendations on how to avoid impacts to *E. constancei* (e.g., K. Aasen *in litt.* 1995, B. Hunter *in litt.* 1996, A. Buckmann *in litt.* 1998). In addition, their biologists conducted surveys for this species (U.S. Fish and Wildlife Service 1985b), and the agency is investigating ways to protect the Diamond Mountain occurrence (Hrusa and Buckmann 2000).

4. *LASTHENIA CONJUGENS* (CONTRA COSTA GOLDFIELDS)

a. Description and Taxonomy

Taxonomy.—Greene (1888) first described Contra Costa goldfields, naming this species *Lasthenia conjugens*. The type locality is Antioch, in Contra Costa County (Greene 1888). Hall (1914) later lumped Contra Costa goldfields with the common species Fremont's goldfields, which at that time was called *Baeria fremontii*. Ferris (1958) proposed the name *Baeria fremontii* var. *conjugens* to recognize the distinctiveness of Contra Costa goldfields. Finally, Ornduff (1966) restored Greene's original name and rank, returning this species to the genus *Lasthenia*. The two closest relatives of *Lasthenia conjugens* are *L. burkei* (Burke's goldfields) and *L. fremontii* (Fremont's goldfields).