

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 *Navarretia myersii* ssp. *deminuta* are described below. *Navarretia myersii* ssp. *deminuta* is not known to have declined; the subspecies was unknown prior to 1992.

The single locality for *Navarretia myersii* ssp. *deminuta* was threatened by a subdivision (Day 1995, California Natural Diversity Data Base 2001), which was never developed. However, the parcel is zoned rural residential, and the landowner could build a residence, drain the wetland, or make other alterations without being required to obtain permits or conduct an environmental review (L. Esposito *in litt.* 2000). No imminent threats to the population have been noted but two more remote threats are possible. The single population makes *N. myersii* ssp. *deminuta* extremely susceptible to extinction by random events, including both natural and human-caused catastrophes.

e. Conservation Efforts

Navarretia myersii ssp. *deminuta* does not have any formal protection under Federal or State law. However, the California Native Plant Society (2001) considers *N. myersii* ssp. *deminuta* to be extremely rare and in danger of extinction, and thus has added it to List 1B. No conservation efforts have been reported other than denial of a development permit by Lake County officials (L. Esposito pers. comm. 1997).

10. PLAGIOBOTHRYUS HYSTRICULUS (BEARDED POPCORN FLOWER)

a. Description and Taxonomy

Taxonomy.—Piper (1920) first recognized bearded popcorn flower as a unique entity, assigning the name *Allocarya hystricula*. Jepson had collected the type specimen in 1892 from the Montezuma Hills, Solano County (Piper 1920). In his monograph on *Plagiobothrys*, Johnston (1923) considered *Allocarya hystricula* to be the same as *Plagiobothrys greenei* (Greene's popcorn flower). After several revisions to the name by various individuals, Johnston (1932 as cited in Abrams 1951) assigned the name by which bearded popcorn flower is known today, *Plagiobothrys hystriculus*. This taxon is in the borage family (Boraginaceae). Another common name for bearded popcorn flower is bearded allocarya (Smith *et al.* 1980).

Description and Identification.—*Plagiobothrys hystriculus* is an annual with erect or decumbent branched stems 10 to 45 centimeters (3.9 to 17.7 inches) long. The stem, leaves, and calyx are sparsely to densely covered with short, straight, appressed hairs. The narrow leaves are opposite near the base of the stem but alternate above. The leaves decrease in size up the stem, with the lower leaves 2 to 6 centimeters (0.8 to 2.4 inches) long. The flowers are widely spaced throughout the inflorescence. Each is supported by an individual stalk that is shorter than the flower, and many are subtended by bracts. The calyx consists of five sepals fused only at the base. When the flowers open, the calyx is 3 to 6 millimeters (0.12 to 0.24 inch) long, but the lobes increase in length as the flowers mature. The white corolla is tiny (1 to 2.5 millimeters [0.04 to 0.10 inch] wide) and has a tubular base with five lobes. Each flower produces four egg-shaped nutlets 1.5 to 2.5 millimeters (0.06 to 0.10 inch) long. The nutlets have narrow lengthwise and crosswise ridges that are covered with tubercles; each tubercle is broad at the base, blunt at the tip, and is about one-sixth the length of the nutlet. The tubercles and the nutlet surface in between are densely covered with tiny, barbed bristles (Piper 1920, Jepson 1925, Abrams 1951, Messick 1993). The chromosome number of *P. hystriculus* has not been reported.

Plagiobothrys hystriculus is difficult to distinguish from *P. acanthocarpus* (adobe popcorn flower), *P. greenii*, and *P. trachycarpus* (rough-fruited popcorn flower). Close inspection of the nutlets is necessary to identify the various species. Both *P. acanthocarpus* and *P. greenii* have long, pointed prickles instead of blunt tubercles. Furthermore, *P. acanthocarpus* has few bristles on the prickles or on the nutlet surface. *Plagiobothrys greenii* has longer nutlets than *P. hystriculus* and lacks crosswise ridges. *P. trachycarpus* rarely has tubercles on the nutlets but when present they lack bristles (Piper 1920, Abrams 1951, Messick 1993).

b. Historical and Current Distribution

Historical Distribution.—*Plagiobothrys hystriculus* was known historically from only two Solano County sites: the type locality and Elmira, where it was collected in 1883 (Piper 1920, Hoover 1937) (**Figure II-20**). The two reported occurrences of *P. hystriculus* would fall within the Solano-Colusa Vernal Pool Region, as defined by Keeler-Wolf *et al.* (1998).

Current Distribution.—This species has not been observed since 1892. Although classified as 1A (presumed extinct) by the California Native Plant Society, the California Natural Diversity Data Base (2005) still presumes the type locality to be extant. Various botanists have reported finding populations of *Plagiobothrys hystriculus*, but all recent reports have been determined to represent other species (Skinner and Pavlik 1994, Skinner *et al.* 1995).

c. Life History and Habitat

Reproduction and Demography.—The only information available on reproduction in *Plagiobothrys hystriculus* is that it flowers in April and May (Abrams 1951). Demographic data also are lacking.

Habitat and Community Associations.—The habitat of *Plagiobothrys hystriculus* is not well understood. The original collectors did not give detailed descriptions of the environment, and later botanists presented conflicting habitat descriptions. Jepson (1925:853), one of only two people who collected *P. hystriculus*, described the habitat as “low plains.” Hoover (1937:22) included *P. hystriculus* in his “Hog-wallow Endemism Area.” Abrams (1951:561) noted that the species grew on “grassy hillsides and plains.” More recent descriptions give the habitat as “grassland, probably vernal pools, wet sites” (Messick 1993:389) and as Northern Claypan Vernal Pools (Sawyer and Keeler-Wolf 1995). Microhabitats, soil types, and associated species are not known. Both collection sites are less than 50 meters (164 feet) in elevation (California Natural Diversity Data Base 2001).

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 *Plagiobothrys hystriculus* include the conversion of the area around Elmira to agriculture; no natural land remains (Holland 1984). The type locality for *Plagiobothrys hystriculus* was not specific enough to allow determination of its probable current status, based on known land uses. Threats to the survival of *P. hystriculus* cannot be assessed until any possible extant populations are located.

e. Conservation Efforts

Plagiobothrys hystriculus has no Federal or State status. The California Native Plant Society originally considered it to be rare (Powell 1974) but now includes it on List 1A, among those species presumed to be extinct (Skinner and Pavlik 1994). Various groups have looked for *P. hystriculus* in the course of surveying, but it has not been relocated. Thus, no other protection measures have been possible. *Plagiobothrys hystriculus* is included in this recovery plan to bring attention to the species and to encourage comprehensive surveys so that any potentially extant populations may be located.

Conservation Actions for Rediscovered Plants.—In the event of rediscovery, both immediate and long-term actions will be needed. Outlining these actions in a recovery plan increases the potential for participation by both State and Federal agencies and for funding to carry out needed actions. Three actions—status review, plant stabilization, and protection of plants and habitat—would be needed concurrently. First, a status review should be conducted immediately to assess if there are threats from current or planned activities such as grazing, fire, nonnative plant species, rodents, insects, habitat conversion, inbreeding depression, or others. The status review should include consideration of whether existing mechanisms for protection are adequate. The results of the status review would help determine if the plant warrants listing. Second, stabilizing the plants or populations of plants by alleviating threats to short-term survival would be essential. Such stabilization efforts may include controlling invasive nonnative or native vegetation, erosion, destructive rodents and/or insects, and providing insurance for the population by collecting and storing seed (if such collection would not further imperil the population’s survival). Third, securing and protecting the habitat and the existing plants would be essential. If the plant is rediscovered on public lands, it would be important to work with the land manager to develop a site-specific management plan that would include yearly monitoring measures to minimize any threats. If the plant is rediscovered on private lands, the willingness of the land owner to participate in recovery efforts would need to be assessed and encouraged. If the landowner (and land manager or lessee) were amenable, an agreement should be developed to formalize plant protection. This agreement could be temporary or long-term, depending on the willingness of the landowner and the needs of the species.

After short-term mechanisms for protection are in place, long-term management should begin. Different approaches should be evaluated. An implementation team, consisting of members with the expertise to determine appropriate measures and the means to implement such measures, would be of great benefit. Options include reintroduction to historical sites, propagation in greenhouses and/or botanical gardens, and seed collection and storage. Other necessary actions would include the alleviation of threats, securing sites, maintaining or enhancing abundance, developing and implementing a monitoring plan, conducting essential research (*e.g.*, demography, genetics, reproductive biology, and propagation techniques), reassessing status every 5 years to determine if Federal listing is warranted, and coordinating efforts with conservation and recovery actions for other species covered in this recovery plan or throughout the recovery plan area. Although actions are outlined here, they will not all necessarily be appropriate to the future situation, nor is the list complete.