

aspect of the recovery plan, which was to survey suitable habitats for *T. mucronata*; their efforts led to the discovery of the two populations that were unknown at the time of listing (California Natural Diversity Data Base 2003).

B. State-Listed Plant Species and Other Plant Species of Concern

1. *ASTRAGALUS TENER* VAR. *FERRISIAE* (FERRIS' MILK-VETCH)

a. Description and Taxonomy

Taxonomy.—Milk-vetches are members of the pea family (Fabaceae). Ferris' milk-vetch was recognized and named as a distinct variety (*Astragalus tener* var. *ferrisiae*) only recently (Liston 1990b). However, Ferris had collected the type specimen in 1926, "3 miles west of Colusa," in Colusa County (Liston 1990b:100). Specimens now attributed to Ferris' milk-vetch formerly had been included under Jepson's milk-vetch (*Astragalus rattanii* var. *jepsonianus*), a serpentine endemic plant (Barneby 1964 as cited in Liston 1990b). According to Liston (1990b), further confusion about the taxonomy was generated when Abrams (1944) mistakenly provided a drawing of Ferris' milk-vetch labeled as Clara Hunt's milk-vetch (*Astragalus clarianus*). There is some speculation that Ferris' milk-vetch is an ecomorph of alkali milk vetch, *Astragalus tener* var. *tener*, a somewhat more common species of concern found in vernal pool habitats (C. Witham pers. comm. 2003). An alternative common name for *Astragalus tener* var. *ferrisiae* is Sacramento Valley milk-vetch.

Description and Identification.—The flower structure of *Astragalus* and related genera is complex. Although the calyx is unremarkable, the corolla consists of five petals that differ in size, shape, and sometimes in color. The outermost petal, which is called the banner, often curves upward away from the other petals. Just inside the banner is a pair of petals that are very narrow at the base; these separate but similar petals are known as the wings. The innermost pair of petals is called the keel because the two petals are fused to form a flattened structure resembling a boat. The pistil and stamens are hidden inside the keel. Although each flower has ten stamens, only one is separate; the filaments of the other nine are fused together (Smith 1977).

Astragalus tener var. *ferrisiae* is a delicate annual with one or more stems up to 26 centimeters (10.2 inches) long. The pinnately compound leaves have 7 to 15 wedge-shaped leaflets. The dense inflorescences arise from the leaf axils and contain 3 to 12 pinkish-purple flowers each. In *A. tener* var. *ferrisiae*, the banner ranges from 7.8 to 9.6 millimeters (0.31 to 0.38 inch) in length and has a white spot in the center. The keel is shorter than the wings, which are 5.8 to 7.1 millimeters (0.23 to 0.28 inch) long. Fruits of *A. tener* var. *ferrisiae* are

crescent-shaped, papery pods with narrow, stalk-like bases. The pods are 2.7 to 5 centimeters (1.1 to 2.0 inches) long, about 2 millimeters (0.08 inch) wide, and have a groove running the length of the underside. The stalk-like base is at least 3 millimeters (0.12 inch) long. At maturity, the fruit stalks are deflexed at an angle of about 45 degrees. Each pod contains between 10 and 16 smooth seeds divided between two chambers (Liston 1990*b*, A. Liston *in litt.* 1993, Spellenberg 1993). The diploid chromosome number of *A. tener* var. *ferrisiae* is not known.

The other varieties of *Astragalus tener* have shorter, straighter fruits than *A. tener* var. *ferrisiae*, and their fruits do not have long, stalk-like bases (Liston 1990*b*, A. Liston *in litt.* 1993, Spellenberg 1993). All other *Astragalus* species that overlap in range have erect fruit stalks and rough seeds (Liston 1992). *Astragalus rattanii* var. *jepsonianus* is further distinguished from *A. tener* var. *ferrisiae* by its fruit shape and flower color (purple keel, white wings, and a white banner tipped with purple). Although *A. clarianus* has a pod similar in shape to that of *A. tener* var. *ferrisiae*, the former is shorter. Moreover, the flowers of *A. clarianus* differ in that the keel is longer than the wings and the banner is whitish with a purple tip (Liston 1990*b*, Liston 1992, Spellenberg 1993).

b. Historical and Current Distribution

Historical Distribution.—A total of 18 historical occurrences of *Astragalus tener* var. *ferrisiae* are reported by the California Natural Diversity Data Base (2005) (**Figure II-21**). Seven historical localities in the Solano-Colusa Vernal Pool Region included College City, Colusa, and Mountain House in Colusa County; Dunnigan and Saxon in Yolo County; Olcott Lake in Solano County; and the Sacramento National Wildlife Refuge in Glenn County. Four occurrences have been discovered in the Northeastern Sacramento Valley Vernal Pool Region (T. Keeler-Wolf *in litt.* 2000, J. Silveira *in litt.* 2000) since 1989. Three were on the Llano Seco Unit of the Sacramento River National Wildlife Refuge and one was in the Gray Lodge Waterfowl Management Area, all in Butte County (California Natural Diversity Data Base 2005). Seven other historical localities were outside of the vernal pool regions designated by Keeler-Wolf *et al.* (1998) or were not described in sufficient detail to determine the region. These sites include Biggs, Nord, Oroville Road, Sacramento River, and Upper Butte Basin Wildlife Management Area in Butte County; Yuba City in Sutter County; and an unidentified “causeway” location.

Current Distribution.— Although the California Natural Diversity Data Base (2005) lists nine occurrences as “presumed extant,” despite repeated visits only two have been confirmed extant since 1996. The extant occurrences are at Saxon Station in Yolo County, in the Solano-Colusa Vernal Pool Region, and at the Gray Lodge Waterfowl Management Area in Butte County, managed by the

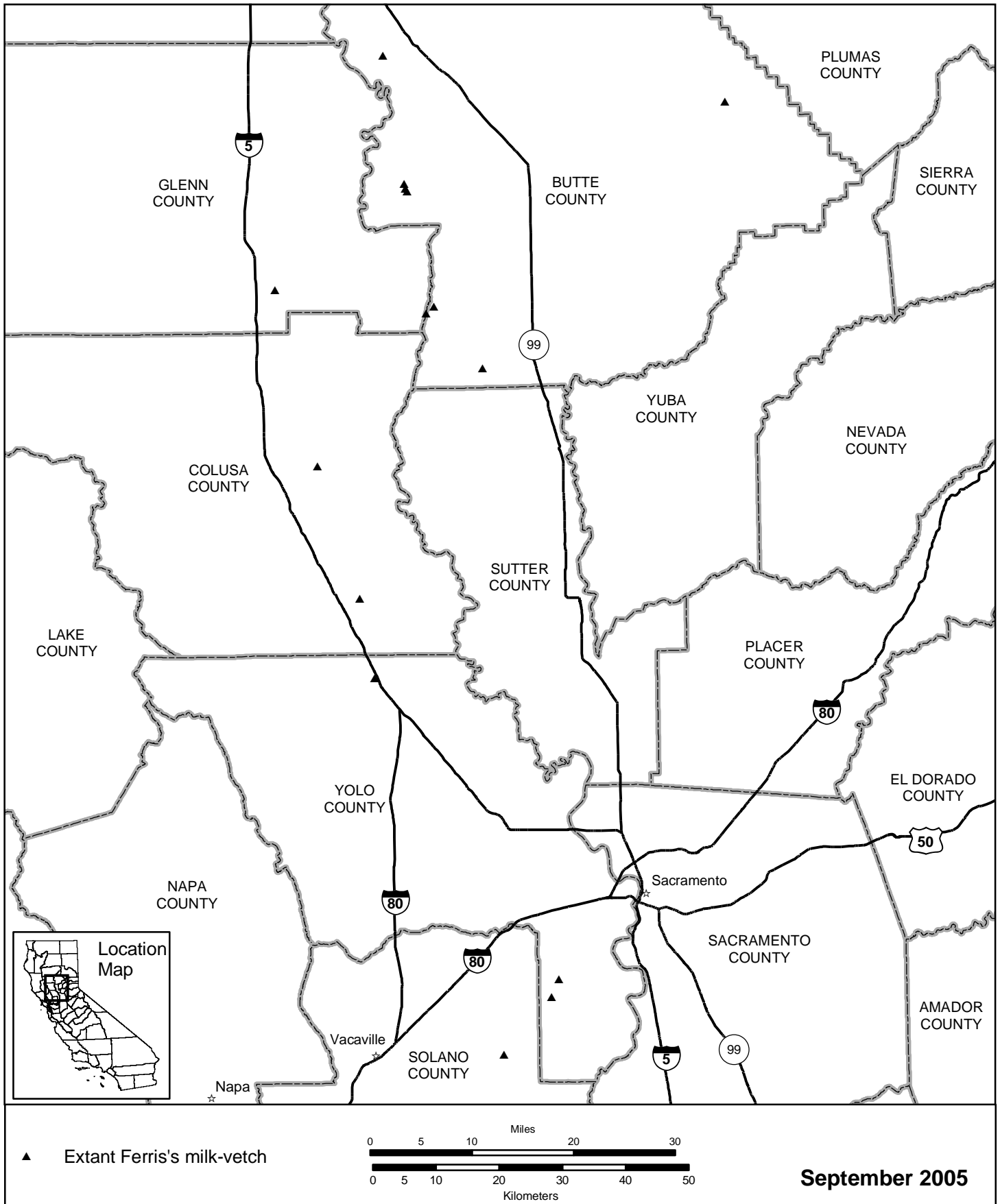


Figure II-21. Distribution of *Astragalus tener* var. *ferrisiae* (Ferris's milk-vetch).

California Department of Fish and Game. Morphology of the plants seems to vary depending on associated vegetation, casting doubt on the validity of this taxon (C. Witham pers. comm. 2003).

c. Life History and Habitat

Reproduction and Demography.—The life history of *Astragalus tener* var. *ferrisiae* has not been studied. Most of the information on reproductive biology and genetics in the species was gathered from *A. tener* var. *tener* and another variety of the same species, *A. tener* var. *titi* (coastal dunes milk-vetch) because the researcher (Liston 1992) was unaware of any extant populations of *A. tener* var. *ferrisiae*. Many of his observations apply to the species *A. tener* as a whole, and other information provided in the *A. tener* var. *tener* species account may also apply to *A. tener* var. *ferrisiae*.

Astragalus tener var. *ferrisiae* is an annual, but the conditions necessary for seed germination are unknown. It flowers in April and May (Skinner and Pavlik 1994). The pollinators are not known for certain. Liston (1992) predicted that butterflies would pollinate all varieties of *A. tener*, even though most other species of *Astragalus* are pollinated by bees. His rationale was that the flower structure, in which the wings are pressed tightly together with the keel shorter than the wings, would not allow bees to reach the nectar glands with their mouthparts. Butterflies are known to visit other *Astragalus* species with similar flower morphology (Liston 1990a cited in Liston 1992). Little is known about seed dispersal in *A. tener*, except that the pod does not split until it drops from the plant (Liston 1992). Liston (1992) speculated that this species would form a soil seed bank because seeds of related species undergo dormancy (Liston 1990a cited in Liston 1992).

The demography of *Astragalus tener* var. *ferrisiae* has not been monitored. Among occurrences for which the population size has been estimated, 2 numbered 200 and 400 plants when they were discovered, and 2 others numbered 10 or fewer. If the populations of *A. tener* var. *ferrisiae* follow a pattern similar to that of *A. tener* var. *tener*, plants may reappear in future years at sites where they have been absent for a number of years.

Habitat and Community Associations.—Since it was first discovered, *Astragalus tener* var. *ferrisiae* has been found in a variety of habitats including vernal meadows, “tule land” (presumably a marsh), borders of drainages, and fallow rice fields. The factors common to collection sites were that they were alkaline, moist in the springtime, and level (Liston 1992, Skinner and Pavlik 1994, California Natural Diversity Data Base 2001). This taxon does not occur in vernal pools *per se* and therefore is not referenced by vernal pool type in

A Manual of California Vegetation (Sawyer and Keeler-Wolf 1995). *Astragalus tener* var. *ferrisiae* grows on clay soils (California Natural Diversity Data Base 2001 and unprocessed data, J. Silveira *in litt.* 2000). Collection localities were at elevations ranging from 6 to 46 meters (20 to 150 feet). Plant species associated with *A. tener* var. *ferrisiae* have rarely been reported. It was growing with *Sidalcea hirsuta* (hairy checker-mallow), *Scirpus mucronatus* (bog bulrush), *Eleocharis obtusa* (blunt spikerush), and *Phalaris lemmonii* (Lemmon's canary grass) near Biggs and among "weedy grasses and forbs" at Upper Butte Basin Wildlife Management Area (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 *Astragalus tener* var. *ferrisiae* are described below.

Much of the suitable habitat in the historical range of *Astragalus tener* var. *ferrisiae* has been converted to agriculture (Skinner and Pavlik 1994). The reasons why this variety no longer occurs at Olcott Lake, which is in a nature preserve, are unknown.

Permanent flooding is a potential threat to *Astragalus tener* var. *ferrisiae* at wildlife management areas if waterfowl production is given priority (California Natural Diversity Data Base 2001). Competition from unspecified upland plants is a problem at the Upper Butte Basin Wildlife Management Area (C. Rocco *in litt.* 1993) and probably at all sites in the Sacramento Valley (J. Silveira *in litt.* 2000). Small population size is a concern for all of the extant occurrences, which ranged in size from 10 to 400 individuals during the 1990s; growing plants have been absent from all but 1 population over the past several years (C. Witham pers. comm. 2003). An additional threat is a decline in pollinators. Pollinating insects may breed in areas outside of *A. tener* var. *ferrisiae* habitat and thus may be subject to different threats than the plants. However, until the specific pollinators of *A. tener* var. *ferrisiae* have been identified, the robustness of their populations cannot be assessed.

e. Conservation Efforts

Astragalus tener var. *ferrisiae* has no Federal or State protection. The California Native Plant Society includes this variety on List 1B, giving it the highest endangerment rating possible (Skinner and Pavlik 1994). Dr. Vernon Oswald discovered several populations during the past decade while exploring Butte and

Glenn Counties (California Natural Diversity Data Base 2001 and unprocessed data). Five occurrences are afforded some protection by virtue of their location on public land, but no particular conservation efforts have been undertaken in those areas.

2. *ASTRAGALUS TENER* VAR. *TENER* (ALKALI MILK-VETCH)

a. Description and Taxonomy

Taxonomy.—Alkali milk-vetch is in the pea family Fabaceae. Gray (1864) named *Astragalus tener*, commonly known as alkali milk-vetch. He gave the type locality only as “California ... from near Monterey or San Francisco” (Gray 1864:206). No varieties were named until Barneby (1950) reduced *Astragalus titi*, commonly known as coastal dunes milk-vetch, from a full species to the variety *Astragalus tener* var. *titi*. In so doing, the combination *Astragalus tener* var. *tener* was created automatically to represent Gray’s original material (*i.e.*, alkali milk-vetch), according to accepted rules of botanical nomenclature. Another common name by which this variety is known is slender rattle-weed (Abrams 1944).

Description and Identification.—*Astragalus tener* var. *tener* (Figure II-22) is similar in most respects to *A. tener* var. *ferrisiae*. However, the two taxa differ in leaflet shape and fruit morphology. *Astragalus tener* var. *tener* leaflets vary, even on the same plant, from narrow and pointed to wedge-shaped with blunt or notched tips. In *A. tener* var. *tener*, the pod is only 1 to 2.5 centimeters (0.4 to 1.0 inch) long and straight or only slightly curved. The base of the pod is typically rounded; if stalk-like, the base is much less than 3 millimeters (0.12 inch) long. Also, the fruits are deflexed all the way to the stem of the inflorescence. *Astragalus tener* var. *tener* pods contain between 8 and 14 seeds (Gray 1864, Liston 1990*b*, A. Liston *in litt.* 1993, Spellenberg 1993). The plants have a diploid chromosome number of 22 (Liston 1992).

The variable leaflets and shorter, straighter pods, which are more strongly deflexed, distinguish *Astragalus tener* var. *tener* from *A. tener* var. *ferrisiae* (Liston 1990*b*, A. Liston *in litt.* 1993, Spellenberg 1993). *Astragalus tener* var. *titi* has a shorter banner (5.2 to 6 millimeters [0.20 to 0.24 inch] long) and only 5 to 11 seeds per pod (Spellenberg 1993). This species can be distinguished from all other species of *Astragalus* that occur in the same areas by its deflexed fruit stalks and smooth seeds (Liston 1992). Additional identifying features were given in the *A. tener* var. *ferrisiae* account presented earlier in this document.