

(criterion 4) (Holland 2000). The area within this unit encompasses the largest block of pristine, high-density vernal pool grasslands remaining in California (Vollmar 1999).

A majority of the vernal pool habitat in the Merced Unit is in Merced County, although the eastern edge of the unit overlaps into Mariposa County in the low-elevation foothills of the Sierra Nevada. The northern boundary parallels the Merced River, and Bear Creek serves as the southern border. The entire unit is located east of Highway 99. The majority of the land in this unit is privately owned and approximately 8 ac (3 ha) of lands within this unit are owned by the Federal government.

#### *Tuctoria greenei*

Greene's tuctoria occurrences are known from eight general areas of concentration from Shasta County to Madera County with an elevational variation of from near 30 m (100 ft) to near 1,067 m (3,500 ft). Conserving a broad distribution of Greene's tuctoria across its geographical and elevational distribution protects the natural environmental processes for the species and provides the best chance for retaining the species across the full extent of its range. The vernal pool types and soils associated with the eight areas of concentration of Greene's tuctoria differ greatly across the geographic range of the species; these differences lead to different species compositions and environmental conditions between Greene's tuctoria occurrences. Providing for a mosaic of habitat types both between and among vernal pool species occurrences is essential to the species conservation because it would include the full extent of the physical and environmental conditions for the species (Fugate 1992; Fugate 1998; Gonzales *et al.* 1996; Ikeda and Schlising 1990; Noss *et al.* 2002a; Platenkamp 1998; Zedler *et al.* 1979). The wide-ranging distribution of Greene's tuctoria reflects a diversity of vernal pool habitat types that provide habitat for the species. Vernal pool complexes that provide suitable habitat for this species include four different physiographic and edaphic settings—old high stream terrace, lower old stream terrace areas with soils having an iron-silica hardpan, sites with shallow soils underlain by cemented tuffaceous alluvium, and vernal pool complexes on claypan soils that are slightly acid to slightly alkaline. Not all areas of Greene's tuctoria have been identified as to the specific soil series or soil mapping units where they occur. The Butte County occurrences of Greene's tuctoria are associated with soils

underlain by tuffaceous alluvium, are considered to occur in Northern Basalt Flow and Northern Volcanic Mudflow type vernal pool complexes, and one occurrence is found on Tuscan soils. The Tehama County occurrences are associated with slightly to medium acid soils of the Tuscan and Anita soil series that are underlain by an iron-silica cemented hardpan occurring vernal pools and are the only area where vernal pools are associated with this type of landform. Many of these pools are a fraction of an acre and have a short inundation period and fewer number of shallower larger pool sizes well over an acre with a comparatively longer inundation period. A vernal pool's parent material greatly influences the pool's species composition and hydrologic functioning (Hanes and Stromberg 1998; Holland and Jain 1981; 1988). Soils beneath vernal pools are extremely variable and are not the same as soils mapped by soil surveys, but are usually undescribed hydric inclusions that vary by location (Holland and Dain 1990). The primary constituent elements of critical habitat for *Tuctoria greenei* are the habitat components that provide:

(i) Vernal pools, swales, and other ephemeral wetlands and depressions of appropriate sizes and depths and the adjacent upland margins of these depressions that sustain *Tuctoria greenei* germination, growth and reproduction, including but not limited to, Northern Claypan, Northern Hardpan, and Northern Basalt flow vernal pools that typically become inundated during winter rains, but are dry during the summer and do not necessarily fill with water every year; and

(ii) The associated watershed(s) and hydrologic features, including the pool basin, swales, and surrounding uplands (which may vary in extent depending on pool size and depth, soil type and depth, hardpan or claypan type and extent, topography, and climate) that contribute to the filling and drying of the vernal pool or ephemeral wetland, and that maintain suitable periods of pool inundation, water quality, and soil moisture for *Tuctoria greenei* germination, growth and reproduction, and dispersal, but not necessarily every year.

#### *Unit 1, Modoc Plateau Unit, Lassen and Shasta Counties (1,703 ac (689 ha))*

This unit contains a *Tuctoria greenei* occurrence within Northern Basalt Flow vernal pools (CNDDDB 2002). It is the only location where the species grows on this vernal pool type. The occurrence is located in an area described as a large vernal pool in an open flat in an

eastside pine forest. It is at a higher elevation, with lower average temperatures, than any other occurrence. Thus the unit is ecologically unique (criterion 2). It also represents the northern extent of the species' range, and is separated from occurrences to the south by over 68 mi (110 km) (criterion 1).

This unit occurs within the volcanic plateau of northeastern California. The unit is located in the area surrounding Murken Lake east of Hat Creek near Cinder Butte. Bidwell Road crosses through the southern boundary. The USFS owns approximately 1,530 ac (619 ha) of the unit. The remaining lands within this unit are privately owned.

#### *Unit 2, Vina Unit, Tehama and Butte Counties (25,102 ac (10,159 ha))*

This unit is essential to the conservation of *Tuctoria greenei* because it includes 60 percent of the remaining extant occurrences of the species (criterion 1) (CNDDDB 2002). The unit also represents one of only two areas throughout the species' range where *T. greenei* occurrences are not considered to be declining (CNDDDB 2002). The species occurs in vernal pool complexes within the unit found on Anita and Tuscan series soils.

This unit for *Tuctoria greenei* occupies the area south of Toomes Creek, and north of Pine Creek and the Cana Highway. State Route 99 bisects this unit and the western boundary generally parallels the Southern Pacific Railway line. The majority of the lands included within this unit are privately owned. Property ownership within this unit includes various types of protected lands (criterion 4), including CDFG (1 ac (0.4 ha)), CDFG administered lands (1 ac (0.4 ha)), TNC (5,738 ac (2,295 ha)), TNC easements (11,653 ac (4,661 ha)), and WRP easements and agreements (142 ac (57 ha)).

#### *Unit 6, Waterford Unit, Stanislaus and Tuolumne Counties (73,111 ac (29,588 ha))*

This unit supports occurrences of the species within the only vernal pools where *Tuctoria greenei* is known to occur on slightly alkaline soils of the Meikle and Paulsell series (criterion 2) (Holland 1998; USDA 2001; CNDDDB 2002). It is also important to the conservation of the geographic distribution of the species because it is one of only eight locations where the species remains extant (criterion 1). The Waterford Unit is bordered by the Stanislaus River to the north and the Tuolumne River to the south. The City of La Grange is located southeast of the unit. Stanislaus County Road J9 runs