

Appendix B2

Survey of Eastern Merced County (Vollmar Consulting)



**To:** Vicki Cambell (USFWS), Marc Hoshovsky (CDFG), Jeff Single (CDFG), and other interested parties

**From:** John Vollmar, Vollmar Consulting (on behalf of Merced County)

**Re:** Proposed Study Design for Conducting Rare Plant Surveys during Spring/Summer 2001 on Ranchlands in Eastern Merced County, California.

**Date:** March 29, 2001

This is a proposed study design for conducting surveys for listed and other rare vascular plant species during the spring and summer of 2001, on approximately 47,000 acres of ranchlands in eastern Merced County, California. The purpose of these surveys is to develop broad regional information on the occurrence, distribution, and ecology of rare plant species known to occur or with potential to occur in the region. Information from the surveys will be used to support regional conservation planning by the County of Merced and provide baseline information for conservation easements that may be established by landowners. The surveys will be conducted by Vollmar Consulting and associated subcontractors working on behalf Merced County.

We understand and emphasize that, since the surveys will only a portion of the total study area, the survey information cannot be used to conclude absence of any special-status plant species within the study area. Nor will the information be comprehensive enough to conduct impact assessments under CEQA, NEPA, or other environmental regulations in any portion of the study area. In addition, any distributional patterns that may be inferred through analysis of survey data will be thoroughly reviewed and accepted by CDFG and USFWS prior to being used for any landscape level conservation planning as part of a regional conservation plan.

The survey protocols were developed in consultation with recognized experts on the natural communities and rare plants of vernal pool landscapes in general and those in Eastern Merced County including Dr. Tom Griggs (botany), Dr. Robert Holland (landscape ecology), and Dr. Robert Schlising (botany). Other knowledgeable scientists who contributed to, or commented on the survey design included Bill Davilla, John Dittes, Matt Gause, Dr. Dean Taylor, John Vollmar, and Carol Witham.

## **Survey Area**

The current study area for the proposed regional conservation plan covers approximately 375,000 acres and includes that portion of Merced County that lies east of Highway 99. Predominant land uses within this area are ranching (concentrated on the alluvial terraces in the eastern portion of the study area) and farming (concentrated on the basin rim and lower alluvial terraces in the western portion of the study area). The ranching areas support annual grasslands with large blocks of vernal pools and pool complexes, and associated mima mound topography.

The farming areas support a variety of annual and perennial crops. Most native habitat has been eliminated through crop conversion, however, there are isolated parcels and remnant creek channels that support native plant communities.

There are several small- to medium-sized creeks that traverse the study area, generally trending west-southwest including, from north to south, Dry Creek, Fahrens Creek, Black Rascal Creek, Bear Creek, Owens Creek, Miles Creek, Duck Slough, and Dutchman Creek, as well as several smaller named and unnamed tributaries. The Merced River traverses the north-central portion of the study area and the Chowchilla River forms the southern boundary of the study area. All of these creeks and rivers ultimately flow into the San Joaquin River.

Within the larger study area, surveys are proposed in areas where we have legal access, including public lands and right-of-ways, and private lands where permission to enter has been granted by landowners. All the private lands to which we have access are operated as large cattle ranches. These are located in the eastern portion of the study area. Total area of these private lands is approximately 47,000 acres. These lands cover most of the high-density vernal pool areas mapped by Dr. Robert Holland for the California Department of Fish and Game in the mid 1980s. These access lands also happen to be arranged in roughly four east-west corridors that are distributed fairly evenly from north to south along the length of the study area. In general, these corridors extend across the vernal pool grassland habitat and encompass seven of the eight geologic formations that occur in the region.

For the present study, surveys for listed and rare vascular plant species will be conducted only on the private ranchlands to which we have access with limited additional surveys on localized sites that may provide potential habitat for Merced monardella (*Monardella leucocephala*). At present, access in the farmland portion of the study area is limited to public roadways and a few public lands (mostly parks) that have little potential to support target species.

## **Survey Team**

Mr. Roy Buck, Mr. Glenn Clifton, Mr. John Dittes, Mr. Matt Gause, Ms. Josephine Guardino, Mr. John Hale, Ms. Joan Reynolds, Mr. Gary Schoolcraft, and Mr. John Vollmar will serve as lead botanists on the field surveys. All of these individuals are highly qualified botanists, most of whom have extensive experience with vernal pool and valley annual grassland systems. Dr. Dean Taylor will also conduct targeted rare plant surveys for a few selected species.

## **Survey Design**

### *Target Species*

Table 1 is a list of the target rare plant species known to occur or with high potential to occur within the study area. Most of these species are associated with specific geologic formations.

**Table 1. Special-status plant species known to occur or with high potential to occur in the eastern Merced County study area.**

SCIENTIFIC NAME <sup>1</sup>	COMMON NAME <sup>1</sup>	STATUS <sup>2</sup>	HABITAT
Listed Species			
<i>Castilleja campestris</i> ssp. <i>succulenta</i>	Succulent Owl's-clover	FT/CE/CNPS 1B	vernal pools (acidic soils)
<i>Chamaecyse hooveri</i>	Hoover's Spurge	FT/CNPS 1B	large vernal pools
<i>Eryngium racemosum</i>	Delta Button-Celery	FSC/CE/CNPS 1B	riparian scrub, flooded river terraces
<i>Gratiola heterosepala</i>	Bogg's Lake Hedge-hyssop	CE/CNPS 1B	vernal pools
<i>Neostapfia colusana</i>	Colusa Grass	FT/CE/CNPS 1B	larger vernal pools, seasonal stock ponds
<i>Orcuttia inaequalis</i>	San Joaquin Valley Orcutt Grass	FT/CE/CNPS 1B	large vernal pools
<i>Orcuttia pilosa</i>	Hairy Orcutt Grass	FE/CE/CNPS 1B	large vernal pools
<i>Pseudobahia bahiifolia</i>	Hartweg's Golden Sunburst	FE/CE/CNPS 1B	north slope mima mounds w/ acidic soils
<i>Tuctoria greenei</i>	Greene's Tuctoria	FE/CR/CNPS 1B	large vernal pools
Other Special Status Species			
<i>Agrostis hendersonii</i>	Henderson's Bent Grass	FSC/CNPS 3	thin soils in mesic mesic grasslands
<i>Calycadenia hooveri</i>	Hoover's Calycadenia	FSC/CNPS 1B	Ione/Valley Springs rock outcrops
<i>Clarkia rostrata</i>	Beaked Clarkia	FSC/CNPS 1B	steep, north-facing grassland slopes
<i>Downingia pusilla</i>	Dwarf Downingia	CNPS 2	vernal pools
<i>Eryngium spinosepalum</i>	Spiny-Sepaled Button-celery	FSC/CNPS 1B	vernal pools
<i>Legenere limosa</i>	Legenere	FSC/CNPS 1B	deeper vernal pools
<i>Monardella leucocephala</i>	Merced Monardella	FSC/CNPS 1A	remnant sand dunes (Delhi sand soil series)
<i>Navarretia myersii</i>	Pincushion Navarretia	CNPS 1B	vernal pools (acidic soils)
<i>Navarretia nigelliformis</i> spp. <i>radians</i>	Shining Navarretia	CNPS 1B	seasonally-saturated clay flats (oft Mehrten)
<i>Phacelia ciliata</i> var. <i>opaca</i>	Merced Phacelia	FSC/CNPS 1B	weathered adobe soils
<i>Sagittaria sanfordii</i>	Sanford's Arrowhead	FSC/CNPS 1B	freshwater marsh in sloughs, ponds, ditches

1. Scientific and common names from CNDDDB (1999)

2. FE = Federally Listed Endangered Species; FT = Federally Listed Threatened Species; FC = Federal Candidate for Listing; FSC = Federal Species of Concern; CE = State Listed Endangered Species; CDFG SSC = California Department of Fish and Game Species of Special Concern; CDFG FP = Species Fully Protected under the CA Fish and Game Code. California Native Plant Society (CNPS) Lists: List 1A = species presumed to be extinct; List 1B = species considered rare, threatened, or endangered in California and elsewhere; List 2: species rare or threatened in California but more common elsewhere; List 3: species about which more information is needed to make a determination regarding rarity; List 4 = watch list, species uncommon but not currently threatened or endangered.

Within these formations, the species are generally associated with specific unique microhabitats such as vernal pools, sandstone or volcanic tuff rock outcrops, north slope mima mounds on acidic soils, weathered clay soils, etc.

While the species in Table 1 will serve as the target species for the surveys, the surveys will identify all plant species encountered including any other rare plant or possibly undescribed species that may be present in the survey area. As examples, two additional rare plant species that have been identified as potentially occurring in the survey area are Madera linanthus (*Linanthus serrulatus*) and Ahart's paronychia (*Paronychia ahartii*).

### *Selection of Survey Sites*

Surveys will be conducted on 12 private ranches covering a total of approximately 47,000 acres. No surveys are proposed for the Smith Trust lands as they have been intensively surveyed over the past two years. For the purposes of this study, each ranch will be considered a distinct sampling area since each ranch is operated under a unique grazing regime that may influence the presence and distribution of the target species. Additional surveys for Merced monardella will be conducted on a few targeted areas located outside the 12 private ranches.

The survey effort will be stratified by geologic formation. There are a total of seven major geologic formations in the study area as summarized in Table 2. Laguna and Mehrten are the predominant formations in the study area, probably comprising at least 80% of the total survey area. In addition, these formations support most of the high-density vernal pool habitat in the survey area. The upland areas within these formations consist of fairly homogeneous annual grasslands with very limited areas of unique microhabitats (such as adobe soils and thin soils) known to support rare plant species. The other five formations (Mariposa, Ione, Valley Springs, Turlock Lake, and Riverbank) are comparatively rare, probably comprising less 20% of the total survey area, and generally do not support extensive areas of high-density vernal pools. The upland areas within Valley Springs and Ione have unique microhabitats (rock outcrops and certain mima mound formations) known to support rare plant species. The upland areas within Riverbank and Turlock Lake consist of fairly homogeneous annual grasslands that do not typically support rare plants.

Based on these conditions within the formations and budget/time constraints for conducting the surveys, our survey design proposes to conduct representative random stratified surveys within selected portions of the Laguna and Mehrten formations and complete surveys of the Mariposa, Ione, Valley Springs, Turlock Lake, and Riverbank formations.

The random stratified surveys within Laguna and Mehrten formations will be focused on those areas determined to support high-density vernal pools. We will develop digitized maps showing the distribution of the geologic formations overlaid with topography (digital elevation model [DEM]). In general, high-density pool complexes occur on low-gradient surfaces (generally less than 2% slope). The maps will be compared with existing aerial photographs (infrared photos from Chico State) to delineate areas with high-density vernal pools. A grid will then be placed over the delineated area and random points will be selected using a random number generator to select x and y coordinates. Points will be placed where the random coordinates intersect. Grid

**Table 2. Summary of age, parent material, and origin of the geologic formations of central East Merced County. (Data Sources: Amundson pers. comm, Arkley 1962, Hill 1976, Kelsey pers. comm.)**

<b>Geologic Formation</b>	<b>Epoch</b>	<b>Age</b>	<b>Parent Material</b>	<b>Origin</b>
Mariposa	Jurassic	130my	greenstone and slate	seafloor prior to the uplift of the Sierra range; greenstone is derived from metamorphosed basic, igneous intrusive (non-volcanic) rock, slate is derived from metamorphosed seafloor mud
Ione	Eocene	45-60my	quartz sandstone and kaolinitic clays	consolidated sands and clays deposited along the shores and lagoons of an inland sea that formerly occupied the Central Valley
Valley Springs	Oligocene/ Miocene	24-33my	rhyolytic tuff	deposited as ash fall and ash flow from rhyolytic (acidic, explosive) Sierran volcanic eruptions
Mehrten	Miocene/ Pliocene	4-24my	andesitic tuff and mudflow	volcanic mudflows (lahars) and ashfall/ashflow tuff deposits from andestic (less acidic/less explosive) volcanic eruptions high in the Sierra Nevada which covered the region
Laguna	Pliocene	3-12my	alluvial gravels from mixed sources including andesite and granite	mixed alluvial deposits thought to be associated with the last major uplift of the Sierra range; these high terrace gravels often overlay and are interbedded with Mehrten Formation
Turlock Lake	Pleistocene (Kansan)	1my	weakly indurated granitic sandstone	consolidated granitic alluvium washed down from glaciated and weathered granite in the high Sierra
Riverbank	Pleistocene (Illinoian)	0.1my	granitic alluvium	granitic alluvium washed down from glaciated and weathered granite in the high Sierra

lines will be spaced 1,000 feet to insure appropriate spacing of random points to avoid duplication of survey efforts. In the field, surveys will be conducted in a circular area within a standardized radius (500-1,000 feet) around each random point. The center point of each plot will be located using a professional GPS unit with sub-meter accuracy. Navigation within the boundaries of the plot will also be accomplished using the GPS unit. Each plot will be completely surveyed for the presence of rare plant species. The survey efforts will focus on vernal pool and vernal swale habitats and any areas unique microhabitats identified in the upland areas.

As a target, we propose to survey a combined area of 15%-30% of the delineated high-density vernal pool habitat within Laguna and Mehrten formations. Total area surveyed will depend on available budget, field staff, and time to complete the surveys. This spring is so far exceptionally dry and warm which significantly shortens ideal window for conducting these surveys. As an exception to the random stratified surveys with the Laguna formation, we will conduct complete surveys of the vernal pool habitat along the top of the China Hat ridge (China Hat member of the Laguna Formation). The soils on top of the ridge are extremely old (3-5 million years), weathered, and very acidic providing a very unique microhabitat. This may be an ideal site to find additional occurrences of Myers navarretia (*Navarretia myersii*) which is presently known from only three sites in the state all of which are on acidic Laguna or Valley Springs soils, as well as succulent owl's-clover (*Castilleja campestris* ssp. *succulentus*) and perhaps previously undescribed species.

For the complete surveys of Mariposa, Ione, Valley Springs, Turlock Lake, and Riverbank formations, we will utilize digitized geologic maps to identify the locations of each formation on each ranch. The survey effort will focus on vernal pools and swales, vernal- mesic grasslands, rock outcrops, certain types of mima mound complexes in Valley Springs formation (known to support Hartweg's golden sunburst [*Pseudobahia bahiifolia*]), and any other unique microhabitats identified within these formations.

### *Field Data Collection*

All plants encountered in the field will be identified to species. Separate lists will be maintained for each geologic formation. The locations of all rare plant occurrences within each random plot and complete survey area will be recorded using the GPS unit. Additional data will be collected as follows:

For rare plants occurring in vernal pools, comprehensive ecological data will be collected for the first pool encountered within each plot that supports a particular rare plant species as well as the three closest pools that also support that species (assuming it occurs in at least four pools). This approach will provide data on the range of pool types that support the species. Data to be collected will include:

- pool shape and area
- maximum potential ponding depth of pool
- distribution of rare plant within pool basin
- estimated population size (stratified by growth stage)

- floristic inventory/abundance in ½ meter square quad placed within rare plant population boundary
- six-inch soil core from within rare plant population boundary

The same data will be collected for a maximum of two ‘control’ pools in the immediate vicinity that are within the range of area and depth of the rare plant pools but do not support the rare species.

For each survey plot or complete survey area, a maximum of four pools (plus two control pools) will be comprehensively sampled for a particular rare plant species. The locations of other occurrences of the species within the plot will be recorded using the GPS unit but no additional data will be collected.

In general, a maximum of 8-12 pools per ranch (depending on size) and 50 pools throughout the entire survey area will be comprehensively sampled for each vernal pool rare plant species encountered (control pools will be extra). This will insure a sufficient sample size (‘N’) for habitat analyses while working within budget and time constraints for data collection. For species locally restricted to only one or a few ranches, more pools will be sampled per ranch to achieve a sample size of 50 pools.

For populations of rare plant species associated with upland habitats (non-vernal pools or vernal swale species), the following data will be gathered:

- population location and boundary
- estimated population size (stratified by growth stage)
- floristic inventory/abundance in ½ meter square quad placed within boundary of the rare plant population
- slope/aspect
- six-inch soil core from within rare plant population boundary
- notes on microhabitat

It is assumed that these data will be collected for all occurrences of upland rare plant species except for soil cores which will be collected in a maximum of 20 sites.

Data will also be collected on the occurrence and distribution of noxious weeds in the survey plots. The boundaries of populations will be recorded using GPS and population size estimated. A list of target noxious weeds will be developed prior to beginning surveys.

### *Voucher Specimens*

A minimum of ten voucher specimens of all rare plant species encountered in the survey area will be collected and archived with a University herbarium (U.C. Berkeley or U.C. Davis). No more than 5% of a population will be collected at any given site.

## **Data Analysis**

The survey design has been developed such that it will provide a high detection rate of rare plant occurrences within the survey area while also collecting the data in a manner that is useful for landscape-level analysis of rare plant distribution and habitat preferences. Some of the landscape-level information we expect the survey design and field data to provide are discussed below.

- 1) Data from the complete surveys of Mariposa, Ione, Valley Springs, Turlock Lake and Riverbank formations will be used to determine which rare plants tend to be associated with these formations versus those which are more typically restricted to Laguna and Mehrten formations.
- 2) Data from the random stratified surveys conducted within Laguna and Mehrten formations (versus targeted, non-random surveys), should be useful (depending on results of statistical analyses) for determining the general occurrence or pool occupancy rates of different rare plant species found on these formations and therefore the relative values of the formations from a regional conservation perspective in terms of rare plants. This type of analysis could not be conducted if the surveys were not random.
- 3) Ecological data collected within rare plant populations (and in adjacent control sites) will be used to characterize the microhabitats that support various rare plant species and will be useful for targeting future surveys for these rare plants
- 4) Data on the occurrence and distribution of weeds can be used to determine regional patterns in weed occurrence due to such factors as land use, grazing regimes, and proximity to weed transport corridors (such as roads and railways).

## **Timing of Surveys**

Three rounds of surveys will be conducted during the spring and summer of 2001. Each round will take approximately two weeks to complete and will be accomplished by six to eight botanists. The first round will be initiated on April 3 and will focus on Hartweg's golden sunburst, Merced phacelia, and early spring vernal pool species. The second round will be initiated around April 25 and will focus on mid-spring vernal pool and upland species. The third round will be conducted in June and will focus on late season vernal pool rare grasses (Orcuttieae tribe) and Hoover's calycadenia (*Calycadenia hooveri*).

## **Reporting**

A final report summarizing the methods and results of the surveys will be prepared within 90 days of completion of field surveys.

## **Bibliography**

Amundson, R. pers. comm. 2001. Dr. Amundson is an associate professor in geology and pedology at University of California, Berkley.

Arkley, J. R. 1962. Soils of East Merced County. Soil Scientist, California Agricultural Experiment Station. United States Department of Agriculture Soil Conservation Service. Issued July 1962 -Reissued March 1991

Kelsey, J. pers. comm. 2001. Mr. Kelsey operates a large cattle ranch in the vicinity Merced Falls, Merced County, California. He has conducted extensive mining studies on his ranch and has a strong knowledge of the local geology.