A Flora of the Sacramento National Wildlife Refuge
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THE COVER: The plant on the cover is vernal-pool saltbush, *Atriplex persistens*. This rare plant was described in 1993 from specimens collected at the Sacramento National Wildlife Refuge. Drawing by Robert Gamette.
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FIGURE 1. Location of the Sacramento National Wildlife Refuge in Northern California.
A FLORA OF THE SACRAMENTO NATIONAL WILDLIFE REFUGE

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The Sacramento National Wildlife Refuge (SNWR) is a parcel of 10,783 acres located on the west side of the Sacramento Valley between Willows and Maxwell (Figure 1). The refuge was established in 1937 and is the first in a series of land acquisitions that now make up the Sacramento National Wildlife Refuge Complex. Other units of the complex include Delevan NWR, Colusa NWR, Sutter NWR, Butte Sink NWR, and Sacramento River NWR. This flora is concerned only with the SNWR. The SNWR occupies all of the sections of land in the east half of T18N R3W, with the exception of the south halves of sections 34 and 36 (Figure 2). Most of the land lies in Glenn County, with the southern tip of the refuge extending into Colusa County. The land is an essentially flat plain, sloping from an elevation of slightly over 100 ft in the northwest corner to somewhat less than 70 ft in the southeast corner of the refuge. Natural drainage is provided by Logan Creek, which flows from the northwest to the southeast corners of the refuge, and Hunters Creek, which flows from west to east near the south boundary.

The refuge lies in the northwestern part of the Colusa Plains in an area of poorly drained Riz silt loam, Riz silty clay loam, and Willows clay, all of which are slightly to strongly saline/alkaline with a pH range of 8.5–9.7. The climate of the area is "Mediterranean, warm summer," which applies to all of the Sacramento Valley. Dry warm to hot summers are followed by a cool, wet winters. Rainfall averages eighteen inches per year, the rainy season usually running from October to April.

HISTORY

There is no record of any explorers or trappers crossing the northwest portion of the Colusa Plains before 1850. It was not until the start of construction of the westside railroad to Oregon in 1871 that settlement of the Colusa Plains north of the town of Colusa took place. Early travelers described the Colusa Plains as "a swamp," or "a vast, treeless prairie", or "worthless alkali" (Hall, 1975). In his history of Colusa County published in 1880, William S. Green described the land lying a little east and then south of Willows, which would include the SNWR, as poor land "so flat that the water does not run off it readily, and it is alkali." The term "gooselands" was widely applied to this area because of the large numbers of geese that wintered on these alkaline plains.

Norman D. Rideout bought the land now occupied by the refuge in 1877. He attempted to grow summer-fallow wheat, a successful crop on some parts of the Colusa Plains. Because of the poor soil, lack of summer water, and depredation by geese, Rideout’s ventures in wheat farming ended in failure. Cattle grazing on the Rideout Ranch also proved to be unsuccessful, at least in part due to competition by geese for forage.

Z.L. Spalding acquired the Rideout Ranch in 1900. The Spalding Ranch was more successful and became the largest agricultural operation in Glenn and Colusa counties between 1920 and 1935. Cattle, horses, mules, sheep, pigs, and turkeys were all pastured on the ranch at one time or another. After a series of artesian wells was developed, alfalfa was grown in the northwest portion of the ranch between 1910 and 1915. The first

1 Prepared under the volunteer program of the Sacramento National Wildlife Refuge Complex. I wish to thank Gary W. Kramer, Kim A. Forrest, Kim D. Hanson, John G. Mensik, Denise A. Dachner, and all of the other refuge personnel who made my work at the refuge an enjoyable and rewarding experience. Special thanks to my co-author, Joseph Silveira, who was responsible for arranging this project and to Robert Gamette for preparing the drawing of Atriplex persistens.

2 Historical information is primarily from Hall (1975).
FIGURE 2. The Sacramento National Wildlife Refuge in relation to certain topographic features.
rice was also grown during this time. With the development of a private irrigation system in 1916, rice culture became the dominant agricultural activity on the Spalding Ranch. However, irrigation water, which was responsible for the success of the ranch, also eventually led to the financial collapse of the operation. In 1919, landowners of the area established the Glenn-Colusa Irrigation District and a new drainage district, the 2047 Reclamation District. The cost of irrigation water from the former and annual assessments of the latter eventually produced the collapse of the Spalding agricultural enterprise.

Ownership of the Spalding Ranch was transferred to the federal government in January, 1937. Changes occurred rapidly on the new Sacramento Migratory Waterfowl Refuge (now the SNWR). Since the country was still in the grips of the Great Depression, manpower was readily available. Camp Sacramento, a unit of 150 men of the Civilian Conservation Corps, was established at Spalding Ranch headquarters on May 15, 1937. In a relatively short period of time, roads, water control structures, levees, dikes, and jetties were constructed; channels were cleared and cleaned; lakes and ponds were developed; and other projects involving dwellings, fencing, signs, and monuments were carried out. In 1938, 80 acres of rice and 115 acres of millet (Echinochloa crus-galli) were planted expressly for waterfowl with amazing success—over one-half million ducks consumed every seed and blade of vegetation in these fields during three consecutive nights in October! Farming for waterfowl continued for many years on the refuge. Wheat and barley were the primary crops grown in upland fields, and millet and rice become the dominant aquatic crops. Upland farming was largely phased out of the management program in the 1950’s, and the last rice was grown in 1988. However, certain tracts are still managed for millet, a weedy aquatic grass that readily volunteers and is highly attractive to waterfowl.

The Flora

The agricultural activities on the Rideout and Spalding ranches, followed by the extensive land leveling, impounding, farming, and other wildlife management activities on the SNWR, has resulted in major changes in the natural communities and native vegetation at the refuge. Hall (1975) could only speculate on the original nature of the northwestern Colusa Plains. The area would probably have been a low dry plain periodically inundated by major flooding of the Sacramento River and its feeder streams. Plant communities may have included Valley Grassland, Freshwater Marsh, and Alkali Sink. Four old photographs of goose hunting on the Spalding Ranch are reproduced in Hall’s thesis (1975). These pictures, taken about 1918, show a flat landscape without a single tree or shrub from the foreground to the distant horizon. Tufts of grasses and low herbs are scattered over mostly barren, probably alkaline soil. Today only small areas of up to several hundred square meters of vegetation resembling these original “gooselands” are scattered on the upland tracts of the refuge.

The refuge land is now divided into separate “tracts” and “pools,” most of which are subdivided into “cells” (Figures 2 and 3). Most of these units can be independently managed for water levels and food plants, resulting in seasonally-flooded marsh, watergrass (millet) impoundments, permanent ponds, and uplands (Mensik and O’Halloran, 1990). Riparian strips and borders occur along streams and waterways throughout the complex. Small stands of cottonwood-type riparian woodland occur in the northeast corner of Tract 31 and along the north border of Tract 37. The latter serves as an egret and heron rookery. Lower depressions in some of the upland units regularly develop into shallow vernal pools during the winter rainy season. Only the north portion of Tract G remains as an unplowed and relatively unmodified piece of the original Alkali Sink community that covered most of the refuge lands in presettlement times. Even here, drainage from surrounding fields and invasion of alien species has clouded the picture of the pristine vegetation.

One of the first botanists to collect on the northwestern Colusa Plains was Joseph Burtt-Davy, an English forester and taxonomist who served as an agrostologist (grass specialist) at The University of California from 1892 to 1902. In May 1898, he collected African pricklegrass (Crypsis vaginiflora = C. niliaca) near Norman, the first record of this grass in North America. On the same trip Burtt-Davy collected a grass, which he named Stapfia colusana (= Neostaphia colusana), “near Princeton...bordering rain pools on hard uncultivated alkali ‘goose-lands,’ beside the stage road to Norman.” Hall (1975) speculates that the type specimen of Colusa grass was collected near the Norman-Princeton Road in what is now Tract G of the refuge, but it was probably collected further to the east in habitat now obliterated by rice culture. Additional plants collected by Burtt-Davy in the Norman-Willows area include the spineless variety of bur-clover (Medicago polymorpha) and coyote-thistle (Eryngium vaseyi). Willis Lynn Jepson also collected in the Willows area (e.g., Trifolium albopurpureum var. olivaceum, Jepson 13,657). In his Manual of the Flowering Plants of California (1925), Jep
FIGURE 3. Plot map of the Sacramento National Wildlife Refuge.
Son lists *Atriplex fruticulosa* as occurring on the “goose lands” of Glenn Co.—whether this record is based upon his own collections or that of some other collector, e.g., Burtt-Davy, is not known.

The first attempt to survey the plants on the SNWR was conducted by Harry Anderson from June 1937 into May 1938. Mr. Anderson was a member of the newly-established “Camp Sacramento.” In the preface to a hand-written list of plants (SNWR files), Anderson remarks that “This being my first experience at plant collecting, my first plants were taken without roots; too few of a species were taken; certain plants molded. During the first part of the work, I had to walk half a day, often carrying the plants nearly the whole time. Such plants were almost invariably dried and withered when I returned and were useless.” However, a series of 110 numbered specimens, with accompanying notes on abundance and distribution, was eventually prepared. Unfortunately, Anderson’s collections have either been misplaced or destroyed and could not be examined for this study. In 1988, Anderson’s handwritten notes were transcribed and organized into a typewritten list entitled “Sacramento Refuge Herbarium” (SNWR files).

Since Anderson’s survey, additional collections have been made by Ross C. Hanson (1949–53), David B. Marshall (1951–1962 but mostly 1954), Eugene Kridler (1956 & 1960), Edward J. O’Neill (1961), S.R. Wilbur (1961–62), and Marguerite Hills (1982). These specimens, which are stored in the refuge herbarium, were examined and are incorporated into this study. Annotations indicate that Herbert L. Mason examined at least some, if not all, of the Marshall collections while he was preparing his *Flora of the Marshes of California*. Collections made at some of the other units of the Sacramento National Wildlife Refuge Complex and stored in the refuge herbarium are not been included in this study.

The survey forming the basis for this flora was conducted between April 23, 1993 and September 6, 1994 (30 visits). During this interval, 323 species, subspecies, and varieties of vascular plants were documented. An additional 14 species represented by vouchers in the SNWR herbarium have been studied and are included in the annotated plant list. Anderson’s collections from 1937–38 present a problem—twenty-five of the plants in his list have not been found during this study. Some of his plants are probably misidentified, but most were surely collected on the refuge. Our best judgment has been used in including or excluding these unvouched records in the annotated plant list. Thus the total flora since the establishment of the SNWR in 1937, as treated in the annotated plant list, includes 351 species and subspecific taxa in 207 genera distributed among 68 families (Table 1). No study of this type is ever complete—additional plants are still to be documented on the refuge!

**TABLE 1. Numerical analysis of the vascular flora of the Sacramento National Wildlife Refuge.**

<table>
<thead>
<tr>
<th>FAMILIES</th>
<th>GENERA</th>
<th>SPECIES</th>
<th>ADDITIONAL VARIETIES</th>
<th>TOTAL TAXA</th>
<th>NON-NATIVE</th>
<th>CNPS LISTED</th>
</tr>
</thead>
<tbody>
<tr>
<td>68</td>
<td>207</td>
<td>345</td>
<td>6</td>
<td>351</td>
<td>147 (42%)</td>
<td>13</td>
</tr>
</tbody>
</table>

Includes both varieties and subspecies.

Non-native species comprise 42 percent of the refuge flora. This number does not include certain plants that have been deliberately introduced on the refuge, e.g., Monterey cypress (*Cupressus macrocarpa*) and big saltbush (*Atriplex lentiformis*), which are native to other places in California. The large proportion of non-native plants is correlated to the highly disturbed nature of the refuge and is typical of similar areas in the northern Sacramento Valley. Forty-two percent of the plants at Harter’s Cherokee Ranch in central Butte County were also found to be aliens (Oswald, 1988), and 48 percent of the flora of The Butte Sink Unit of Gray Lodge Wildlife Area in Butte County consists of non-native species (Oswald, 1989). Of interest is the relatively short period of time in which alien plants can colonize a disturbed area. Anderson’s plant list indicates that at least 34 alien species (33% of the plants he collected) were already growing on the newly established refuge in 1937.

Thirteen of the refuge plants are listed in the *CNPS Inventory of Rare and Endangered Vascular Plants of California* (Skinner & Pavlik 1994). All except two of these are in List 1B, plants that are rare, threatened, or endangered in California and elsewhere (see Appendix I). The only significant populations of Ferris’ milk-vetch (*Astragalus tener var. ferrisiae*) remaining in California grow on SNWR in the northwest corner of Tract AB. Before being discovered on SNWR in 1994, only two populations of Heckard’s peppergrass (*Lepidium latipes var. heckardii*) were known from Yolo County. When Stutz and Chu described *Atriplex*
persilsens in 1993 (Madroño 40:209–213), the only viable populations were known from vernal pools on SNWR. Hoover’s spurge (Chamaesyce hooveri), hairy orcuttgrass (Orcultia pilosa) and Greene’s tuctoria (Tuctoria greenei) also grow in vernal pools on the refuge and illustrate the importance of preserving this rapidly disappearing habitat.

Nomenclature in the annotated plant list which follows is based upon The Jepson Manual (Hickman 1993). Some synonyms used in older floras or in refuge plant lists are also indicated in brackets. Author abbreviations follow Brummit and Powell (1992) and may deviate from those in The Jepson Manual. There are no accepted standards for common (English) plant names. When available, common names correspond to those in The Jepson Manual and in the 5th edition of the CNPS Inventory (Skinner and Pavlik 1994). The remaining common names are mostly those of Abrams (1923-60). Words describing the abundance of a species on the refuge such as rare, common, abundant, etc., are entirely subjective.

Voucher specimens of most of the plants found during this study have been prepared. These are deposited in the herbarium of California State University, Chico (CHSC), and a nearly complete duplicate set is in the herbarium of the Sacramento National Refuge Complex. In the annotated plant list, vouchers are indicated by collector(s) and collection number (e.g., Oswald & Silveira 6000). If a record is based on an observation without an accompanying voucher, the observer’s name is not italicized. Abbreviations are used to indicate the location of the collection: P = pool, T = tract, a superscripted number indicates the cell in a pool or tract. For example, “T16” and “PIA3” would be interpreted as “Cell 6 of Tract 1” and “Cell 3 of Pool IA,” respectively.

Keys have been modified from various sources and are simplified as much as possible. Some plants are included in the keys with the notation “at SNWR?”—these are plants that are not documented for SNWR but are known to grow in similar habitat in the northern Sacramento Valley.

**Principal References**


Cupressus arizonica Greene ssp. arizonica – Arizona Cypress. A gray-foliaged shrubby tree with bark peeling in small plates is planted in several locations at the headquarters complex (Oswald 5812). This tree is native to Arizona, northern and central Mexico, and northern Baja California. It is a rare native in the Cuyamaca Mtns. of southern California, but is widely planted in California as a windbreak.

Cupressus macrocarpa Gordon – Monterey Cypress. A shrubby tree with green foliage and fibrous bark grows on the margin of the woodlot in the northeast corner of Tract 31, where it was planted (Oswald 5810). Native to the coast of California, Monterey cypress is widely planted elsewhere.

Pinaceae – Pine Family

Pinus halepensis Mill. – Aleppine Pine. Several 2-needle pines, native to the Mediterranean region, have been planted at the headquarters complex (Oswald & Silveira 5801).

**Annotated Plant List**

**KEY TO THE MAJOR PLANT GROUPS**

1. Plants without seeds or flowers, reproducing by 1-celled spores borne in spongium
   - FERN ALLIES (page 1)

2. Plants with seeds produced in cones or by flowers
   - GYMNOSPERMS (page 1)

**AZOLLACEAE – MOSQUITO FERN FAMILY**

*Azolla filiculoides* Lam. – Large Mosquito Fern

Common and widespread small, floating plant in quiet waters of ponds and ditches, often forming a solid greenish-red mass (Anderson 11, Hanson 11-51). Plants reproduce vegetatively during most of the year.

**MARSILEACEAE – MARSILEA FAMILY**

*Marsilea vestita* Hook & Grev. ssp. vestita – Hairy Water-clover. Apparently uncommon plant of vernal pools, flooded depressions, and along drains and canals (Anderson 61, without a specific location; Hanson in 1951, without a specific location; Oswald 5362, T2 11). During the winter and early spring, it can be recognized by the floating clover-like leaves. It becomes terrestrial at dry-down, resembling *Oxalis* (to which it is referred in Anderson’s 1937–38 list). Sporocarps, which are needed to determine the species, are formed in the spring. [M. mcronea A. Braun]

**Pilularia americana** A. Braun – American Pillwort. Common but inconspicuous grass-like plant growing in vernal pools and seasonally flooded marshes (Oswald 5315, T2 3), becoming stranded on mud at dry-down. The plant can be readily identified once it is dug out of the mud by its basal, pea-like sporocarps.

**GYMNOSEPMRS**

1. Leaves scale-like, thickly covering the branches
   - Cupressus

2. Leaves needle-like, in bundles of 2–3
   - Pinus

**CUPRESSACEAE – CYPRESS FAMILY**

1. Foliage gray: outer leaf surface with a conspicuous gland, bark smooth, thin, peeling in thin strips or plates, cherry red
   - Cupressus arizonica

2. Foliage green, outer leaf surface without a conspicuous gland, bark fibrous, rich brown aging ash-gray
   - Cupressus macrocarpa

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1. Non-native plants are indicated by an italic, non-serif typeface (*Conium maculatum*); plants that appear in non-italic boldface (*Chamaesyce hooveri*) are listed in the 5th edition of the CNPS Inventory (Skinner and Pavlik, 1994).
21 Plants succulent, covered with puberulous, leaves cylindrical.............. Aizoaceae
20 Stamens fewer, not more than twice as many as the petals.
24 Petals more than 1, nearly or quite separate.
23 Plants mostly woody. 
26 Stamens attached below the ovary, small herbaceous plants with long tail-like spikes of petals................. Asclepiadaceae
24 Plants not woody. 
26 Stamens attached to a floral tube, refuge plants with woody, prickly stems.............. Rosaceae
24 Petals 1, of 1 or more carpels that are more or less united. 
27 Plants trailing or climbing by means of tendrils, leaves palmately veined
20 Leaves 3-foliate. ....... ................. .................... .......
21 Leaves simple.............. .................... ............. .............. .......... ............ ............. .......
27 Plants trailing or climbing by means of tendrils; leaves palmately veined
20 Leaves 3-foliate. ....... ................. .................... .......
21 Leaves simple.............. .................... ............. .............. .......... ............ ............. .......

**Aizoaceae – Fig-Marigold Family**

Mesembryanthemum nodiflorum L. – SLENDER-LEAVED ICEPLANT. Represented by a single waf growing in gravel on the edge of Parking Lot D on Norman Rd. at Logan Creek (Oswald 6215). This annual is a native of southern Africa. In California it is typically found on coastal bluffs and margins of saline wetlands from San Francisco Bay southwards. Spring.

**Amaranthaceae – Amaranth Family**

1. Inflorescence of compact solitary clusters.
2. Plant erect; sepals of the pistillate flowers about equal............. *Amaranthus albus*
3. Plant prostrate; sepals of pistillate flowers very unequal, 1 well developed, 1 much reduced or even lacking............... *Amaranthus californicus*
4. Inflorescence of terminal spikes.............. *Amaranthus retroflexus*

*Amaranthus albus* L. – TUMBLEWEED. Common and often locally abundant weedy annual along roads and on the dry beds of vernaly wet pools and depressions (Marshall in 1954; Oswald 3494, NW corner of T16E1). Late spring and summer.

*Amaranthus retroflexus* L. – RED-ROOTED AMARANTH. Uncommon weed around headquarters and on road beds in 1937 (Anderson 66). No plants were found during the 1993–94 survey. Native to tropical America. Late summer.

**Anacardiaceae – Sumac Family**

Toxicodendron diversilobum (Torr. & A.Gray) Greene – PACIFIC POISON-OAK. Known only from the woodlot in the northeast corner of Tract 31 south of Norman Rd. (Oswald in 1993). Spring. [Rhus diversiloba Torr. & A.Gray]

**Apiaceae – Carrot Family**

[Umbelliferae]

1. Inflorescence head-like, not umbellate; leaves spiny...................... *Eryngium*
2. Inflorescence a distinct umbel although the secondary umbels may be head-like; leaves not spiny
3. Fruit and fruit bearing pedicles or bristles.
4. Rays 1-12, involucrate none or of 1 linear bract.............. *Torilis*
5. Rays numerous; involucral bracts papillate (at SW/R?).............. *Daucus carota L.*
6. Ovary and fruit glabrous.
7. Fruit circular in cross section or flattened somewhat laterally; lateral ribs not conspicuously winged.
5 Flowers yellowish, stems not purple-dotted, herbage with a strong odor of anise: Anthriscus caucalis
6 Flowers white, stem purple-dotted, herbage with an unpleasant odor (CAUTION: DEADLY IF INGESTED) Conium
4 Fruit flattened dorsally, lateral ribs conspicuously winged: Lomatium

Along creeks and in vernaly wet, grassy depressions, commonly widespread and widespread European biennial along roads, ditches, and ponds (Oswald 6111, NW corner TAB³). The juice of the fresh leaves and green fruits contains highly toxic alkaloids. Spring.

Eryngium vaseyi J.M. Coul. & Rose – COYOTE-THISTLE. Common and widespread herbaceous perennial of vernal pools, marsh edges, and wet, grassy fields (Oswald 5404, TAB³; Oswald 5492, T13³). Late spring to early summer.

Foeniculum vulgare Mill. – FENNEL. Occasional to locally abundant herbaceous perennial along creeks and ponds (Oswald 5694, Logan Creek bordering PIA³; Oswald, S edge of T23; Oswald, along Hunters Creek). Native to southern Europe. Late spring and summer.

Lomatium caruiifolium (Hook. & Arn.) J.M. Coul. & Rose var. denticulatum Jeps. – ALKALI-PARSNIP. A few plants were reported as scattered along the west boundary in 1938 (Anderson 73). The plant is inconspicuous and, if it still survives, was overlooked during the 1993–94 survey. Early spring. [L. humile (J.M. Coul. & Rose) Hoover ex Mathias & Constance]

Torilis nodosa (L.) Gaertn. – KNOTTED HEDGE-PARSLEY. Common weedy annual in disturbed soil along ditches, roads, and leves (Oswald 5368, ditch along E side of TAB³). Spring.

Asclepiadaceae – MILKWEED FAMILY

Asclepias fascicularis Decne. – NARROW-LEAVED MILKWEED. Herbaceous perennial forming colonies along creeks and in vernaly wet, grassy depressions (Anderson 51, rare along Logan Creek E of headquarters; Oswald 5573, NE corner of T4¹). Summer. [A. mexicana Cav., misapplied]

Asclepias speciosa Torr. – SHOWY MILKWEED. Reported as rare in the NE¼ of the NE¼ of section 12 (in or near present-day Cell 1 of Tract E) in 1937 (Anderson 40). Attempts to relocate this species during the 1993–94 survey were unsuccessful. Summer.

Asteraceae – SUNFLOWER FAMILY

[Compositae]

1 Plants thistle-like; sap not milky.
2 Leaves not prickly on the margin.
3 Leaves white-mottled along veins.
4 Leaves not white-mottled.

Flowers blue or purple.
5 Flowers blue or purple.
6 Flowers blue; pappus of membranous scales, the akenes not beaked: Cirsium
7 Flowers yellow to creamy white.
8 Pappus of membranous scales that are gradually or abruptly narrowed above.
9 Akenes 3 mm long; scales 2 mm long or less: Micranthes elegans
10 Akenes 3.5 mm long.
11 Pappus scales linear-lanceolate, mostly smooth or lightly scabrous, tapering evenly into the awn: Microseris acuminata
12 Pappus scales lanceolate to acicular, scabrous or more often hairy, gradually or abruptly tipped by an awn: Microseris douglasii
13 Pappus of bristles.
14 Akenes at least in pairs with a slender beak.
15 Plants without a leafy stem, the flowering stems with small bracts only: Hypochoeris
16 Plants with a leafy stem.
17 Flowers yellow, surface of leaves coarse, barbed, usually pubulate-based bristles.
18 Flowers creamy to whitish, surface of leaves smooth, spines, if present restricted to the midribs and margins of the leaves.
19 Leaves linear-lanceolate or narrowly cut at the base, lanceolate lobes, the margins crenate or with distinctly-spurred small teeth, pappus spicelike, with short ascending branches: Lactuca saligna
20 Leaves oblong or elliptic in outline, the margins conspicuously spiny-tomentose; pappus open, with widely spreading branches: Lactuca serriola

Asclepias species

1 Leaves white-mottled along the veins: Stylism
2 Leaves not white-mottled: Conium

1 Plants not thistle-like, or if so, with milky sap.
2 Leaves not prickly on the margin.
3 Leaves highly dissected, herbage not glandular: Anthemis
4 Leaves entire, herbage coarsely-dock-glandular: Hemizonia congesta
5 Leaves yellow.
6 Leaves blue; pappus of membranous scales, the akenes not beaked: Cirsium
7 Flowers yellow to creamy white.
8 Pappus of membranous scales that are gradually or abruptly narrowed above.
9 Akenes 3 mm long; scales 2 mm long or less: Micranthes elegans
10 Akenes 3.5 mm long.
11 Pappus scales linear-lanceolate, mostly smooth or lightly scabrous, tapering evenly into the awn: Microseris acuminata
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20 Leaves oblong or elliptic in outline, the margins conspicuously spiny-tomentose; pappus open, with widely spreading branches: Lactuca serriola

1 At least some corollas tubular, marginal strap-shaped corollas, when present, 2-3-toothed, sap watery.
2 Rays absent or vestigial.
3 Pappus absent.
4 Pappus absent.
5 Male and female flowers in separate, distinctive heads, the male heads usually uppermost.
6 Phyllaries of male heads distinct; involucre of female heads becoming a stout spiny bar.
7 Leaves with conspicuous 3-forked spines in their foliage.
8 Leaves without spines in their foliage.
9 Phyllaries of male heads united; female heads not a stout bar but.... Androsia
10 Male and female flowers not in separate heads.
11 Flowers in 2 or more usually overlapping series.
12 Heads in a paniculate or spicate utriflorce. .. Artemisia
13 Heads solitary or in headless clusters.
14 Phyllaries or male heads distinct; involucres or female heads becoming a stout bur.
15 Flowers or male heads united; female heads not a stout bar but.... Androsia
16 Phyllaries mostly red-brown on inner surfaces of the involucres.
17 Disk flowers reddish to pinkish.
18 Phyllaries cream-colored; involucres or female heads not a stout bar but.... Androsia
19 Phyllaries cream-colored; involucres or female heads not a stout bar but.... Androsia
20 Phyllaries used to aed from the head at maturity; the sides of the akenes with 2 glandular lines that extend the length of the akenes.

Rays present:
25 Pappus of 1 downy-white barbed awn.
26 Pappus of all capitular bristles, rarely with additional outer scales.
27 Phyllaries completely scarious or transparent; herbage more or less white wooly.
28 Clusters of heads leafy-bracted; plants rarely as much as 3 dm high.
29 Clusters of heads not leafy-bracted; plants usually 2–10 dm high.
30 Clusters of leaves green, at least above.
31 Disk flowers red, of medium size.
32 Disk flowers reddish yellow.
33 Disk flowers white.
34 Disk flowers yellow.
35 Disk flowers white.
36 Disk flowers greyish.
37 Disk flowers greyish yellow.
38 Disk flowers yellow.
Achyrachaena mollis Schauer – BLOW-WIVES. Occasional to locally abundant annual in grassy places along roads and in upland fields (Anderson 94, abundant almost everywhere in 1938; Oswald in 1950, without a location; Oswald 5351, NE corner T4²). Spring.

Ambrosia psilostachya DC. – WESTERN RAGWEE. Common perennial forming spreading colonies along the edges of roads, ponds, and fields, especially in the southern part of the refuge (Anderson 10, SE corner Sect. 35 in 1937; Oswald & Silveira 5804, T44). Late summer and fall. [Includes var. californica (Ryd.) S.F.Blake]

Anthemis cotula L. – MAYWEED. Occasional to locally abundant weedy annual along roads, in parking lots, and in grassy fields (Wilbur in 1961; Oswald 5465, Parking Lot B, NW corner T32). Native to Europe. Late spring and early summer.

Artemisia douglasiana Besser – MUGWORT. Herbaceous perennial forming colonies across creeks and drainages (Oswald 5809, edge of Parking Lot C, NE corner T41). It is not common on the refuge. Late summer and fall.

Aster subulatus Michx. var. ligulatus Shinners – ANNUAL SALTMARSH ASTER. Common in dry to moist fields, marsh edges, and depressions (Marshall in 1954; Oswald 5940, Wetlands Hiking Trail in T11¹). Late summer and fall. [A. exilis Elliott]

Bidens frondosa L. – STICKTIGHT. Common annual on the edge of ditches and pools and on the banks of sloughs and other waterways (Wilbur in 1961; Oswald 5769, T4²). Late summer and fall.

Centaurea solstitialis L. – YELLOW STAR-THISTLE. This annual weed was already common over most of the area in 1937 (Anderson 52). It remains widespread, and locally abundant along roads, ditches, and in dry fields (Hanson in 1951). Native to Southern Europe. Spring into late autumn.

Chamomilla occidentalis (Greene) Ryd. – VALLEY PINEAPPLE-WEE. Widespread and locally abundant weedy annual in dry soil on levees, along roads, and in other disturbed places (Oswald 5366, levee road bordering TC¹). Not listed from the Sacramento Valley in The Jepson Manual. Spring. [Matricaria occidentalis Greene]

Chamomilla suaveolens (Pursh) Ryd. – COMMON PINEAPPLE-WEE. Apparently uncommon annual on the refuge and known only from a single waif in gravel of Parking Lot B at the northwest corner of Tract 32 (Oswald 5466). There is some question as to whether pineapple-weed is native to California (it is listed as an alien in The Jepson Manual). Spring. [Matricaria suaveolens (Pursh) Buch.; M. matricarioides (Less.) Porter]

Cichorium intybus L. – CHICORY. Perennial weed with attractive blue flowers that is found in localized infestations along some of the roads on the refuge (Oswald, near the woodlot S of the Checking Station; Oswald, N side of P1). Native to Europe. Summer.

Cirsium vulgare (Savi) Tenore – BULL THISTLE. Common annual weed in moist places along marshes and waterways (O'Neill in 1961). Summer and fall. [C. lanceolatum (L.) Scop.]

Conyza bonariensis (L.) Cronquist – SOUTH AMERICAN HORSEWEED. Uncommon annual weed in roadside gravel along Norman Rd. (Oswald & Ahart 5421). Native to South America. Late spring. [Erigeron linifolius Willd.]

Conyza canadensis (L.) Cronquist var. glabrata (A. Gray) Cronquist – CANADIAN HORSEWEED. Common annual of dry fields, margins of ponds, and roadsides (Anderson 38, sparse near the entrance gate in 1937; Oswald 5775, N edge of T2³; Marshall in 1962). Although weedy in habit, Cronquist (Vasc. Plants of the Pac. NW, 5:145. 1955) considers our western plants with nearly glabrous stems to be native. The eastern phase of the species with spreading stiff-hairy stems sometimes occurs in California as an introduction. Late summer and fall. [Varieties not recognized in The Jepson Manual.]

Conyza floribunda Humb., Bonpl., & Kunth – MANY-FLOWERED HORSEWEED. Common tall, weedy annual along trails, roads, and levees (Oswald 5887, Wetland Hiking Trail in T11¹). Native to S. America. Late summer and fall.

Cotula coronopifolia – COMMON BRASS-BUTTONS. Common and widespread weedy annual in
wet clay soils along ponds, in shallow ditches, and in other vernally wet places (Marshall in 1955, without a location; Oswald 5306, T2). Not listed from the Sacramento Valley in The Jepson Manual. Native to southern Africa. Spring.

_Euthamia occidentalis_ Nutt. – WESTERN GOLDFRAG. Locally common along creeks and in low fields (Oswald 5889, T44 on the N side of Hunters Creek). Late summer and fall. [Solidago occidentalis (Nutt.) Torr. & A. Gray]

_Gnaphalium californicum_ DC. – CALIFORNIA CUDWEED. Uncommon biennial along the branch of Logan Creek running through Refuge Headquarters (Oswald 5467, T11). Late spring.

_Gnaphalium luteo-album_ L. – WEEDY CUDWEED. Locally common annual in wet soil along ditches and ponds (Oswald 5468, ditch on the west edge of T11 near Refuge Headquarters; in TC near the Gravel Pit). Spring into fall.

_Gnaphalium palustre_ Nutt. – LOWLAND CUDWEED. Annual forb forming large localized populations in vernal pools, on the dry bed of marshes, and along the edge of flooded fields (Wilbur in 1961; Oswald 5304, T2). Spring.

_Gnaphalium stramineum_ Humb., Bonpl. & Kunth – COTTON-BATTING PLANT. Known only from an old collection (Wilbur in 1961) from the edge of a flooded millet (watergrass) field. [G. chilense Spreng.]

_Grindelia camporum_ Greene var. _camporum_ – GUM PLANT. Common and widespread perennial in dry fields, dry margins of vernal pools, and similar vernally wet but summer dry places (Anderson 53, over most of the area; Hanson 10-51 without a location; Oswald 4408, N side T18). Plants are often woody at the base, sometimes becoming well-developed shrubs. Summer into late fall.

_Helianthus annuus_ L. – COMMON SUNFLOWER. Uncommon in grassy fields bordering drying ponds (Oswald 5642, TD2). Summer. [Includes _H. jergeri_ (Heiser) Heiser; _H. lenticularis_ (Douglas) Cockerell; var. _macrocarpus_ (DC.) Cockerell]

_Hemizania congesta_ DC. ssp. _luzulifolia_ (DC.) – ALKALINE GOLDFIELDS. Inconspicuous annual in grassy fields, with the latter forming large patches of yellow on vernal pools and turning more shallow depressions and drainages into solid masses of yellow in late spring (Hanson in 1952; Marshall in 1954; Oswald 5298, NE corner T16). Spring. [Baeria chrysostoma Fisch. & C.A. Mey., including _H. grossii_ (DC.) Ferris]

_Lasthenia freemontii_ (Torr. ex A.Gray) Greene – FREMONT’S GOLDFIELDS. Common and widespread annual, forming bright yellow rings around vernal pools and turning more shallow depressions and drainages into solid masses of yellow in late spring (Hanson in 1953; Marshall in 1954; Oswald 5298, NE corner T16). Spring. [Baeria chrysostoma (Torr. & A.Gray) A.Gray]

_Lasthenia minor_ (DC.) Orndoff – WOOLLY GOLDFIELDS. Uncommon annual growing in moist roadside ditches (Oswald 6029, NE corner T11). Spring. [Baeria minor (DC.) Ferris]

_Lasthenia platycarpha_ (A.Gray) Greene – ALKALI GOLDFIELDS. Often growing with _Lasthenia californica_, the latter forming large patches of yellow on vernal pools and turning more shallow depressions and drainages into solid masses of yellow in late spring (Hanson in 1953; Marshall in 1954; Oswald 5298, NE corner T16). Spring. [Baeria platycarpha (A.Gray) A.Gray]

_Layia chrysanthemoides_ (DC.) A.Gray – SMOOTH TIDYTIPS. Apparently rare annual of grassy fields (Hanson in 1953; Oswald 6103, E side of P10). Spring. [Includes _H. grossii_ (DC.) Keck]

_Microseris acuminata_ Greene – SIERRA FOOTHILLS MICROSERIS. Inconspicuous annual in grassy fields (Oswald & Silveira 6025, NW corner of T7A). Early spring. [Microseris douglasii (DC.) Sch.Bip. ssp. _douglasii_ – DOUGLAS’ MICROSERIS. Scattered to locally abundant annual in grassy fields (Oswald 5986, S side of T18; Os-
Hills
TG). Early spring. Abundant woolly annual on the drying bottoms of shal-ndon's 1937 collections, spiny cocklebur is listed as a European weed reported as sparse from arow1d the present-day Cel 6 of Tract E) in 1937 5422, areas along roads in 1937; along the edge of seasonally flooded marshes, drainage depressions gion. Spring. Biennial or dikes and along roads and creeks.

Psilocarpus brevissimus Nutt. var. brevissimus – DWARF WOOLLYHEADS. Common and often locally abundant woolly annual on the drying bottoms of shallow vernal pools, seasonally flooded marshes, and drainage depressions (Oswald 5311, P11; Oswald 5364, NW corner TAB3). Spring.

Psilocarpus oregonus Nutt. – OREGON WOOLLYHEADS. Occasional annual forming large populations along the edge of seasonally flooded marshes, in shallow vernal pools, and along vernal wet drainages (Oswald 5336, TG). Spring.

Senecio vulgaris L. – OLD-MAN-OF-SPRING. Common weedy annual along roads and in other disturbed places (Anderson 74, common on the N part of the refuge in 1938; Oswald 5970, NW edge TG). Native to Eurasia. Early spring.

Silybum marianum (L.) Gaertn. – MILK-THISTLE. Common and widespread noxious annual or biennial weed along roads and on dikes bordering ponds and canals (Hanson in 1952). Native to the Mediterranean region. Spring.

Sonchus asper (L.) Hill – SPINY-LEAVED SOW-THISTLE. Common Eurasian annual weed along roads, edges of seasonally flooded marshes, and on high spots in other marshy places (Anderson 29, E of gravel pit and along roads in 1937; Wilbur in 1962; Oswald & Ahart 5422, ditch along Norman Rd.). Spring and summer.

Sonchus oleraceus L. – COMMON SOW-THISTLE. European weed reported as sparse from around the gravel pit and a pond in the NE¼ of section 13 (near present-day Cell 6 of Tract E) in 1937 (Anderson 41). Summer.

Tragopogon porrofolius L. – SALSIFY. Uncommon biennial on dikes and along roads and creeks (Oswald 6162, Norman Rd. near Logan Creek). Native to Europe. Spring.

Xanthium spinosum L. – SPINY COCKLEBUR. In Anderson's 1937 collections, spiny cocklebur is listed as a rare plant about old straw stacks and in other scattered areas (Anderson 27). No populations were found during the current study. Summer.

Xanthium strumarium L. – ROUGH COCKLEBUR. Widespread and locally abundant weedy annual along the edge and on dry beds of ponds and ditches (Oswald 5498, T18). Late spring and summer. [Includes vars. canadense (Mill.) Torr. & A.Gray and glabratum (DC.) Cronquist]

BIGNONIACEAE – BIGNONIA FAMILY

Campsis radicans Seem. – TRUMPET-CREEPER. Woody vine with large orange-red flowers planted at the headquarters complex (Oswald 6211). It decorates the old arch that early on marked the entrance to the refuge. Native to the eastern U.S. Summer.

BORAGINACEAE – BORAGE FAMILY


1 Flowers white (sometimes with colored veins or central areas or crests).
2 Flowers yellow (sometimes with colored veins or central areas or crests).
3 Flowers yellow (sometimes with colored veins or central areas or crests).
4 Flowers sessile and barely exserted in dense, one-sided, curved spikes, the older corollas with yellow- or purple-veined centers ............................................. Heliotropium
5 Flowers present near base of stem, the pedicels recurved in fruit .........................................................
6 Flowers sessile and barely exserted in dense, one-sided, curved spikes, the older corollas with yellow- or purple-veined centers ............................................. Heliotropium
7 Flowers usually not present near base of stem, the pedicels not stout. ..................................................
8 Flowers sessile and barely exserted in dense, one-sided, curved spikes, the older corollas with yellow- or purple-veined centers ............................................. Heliotropium
9 Flowers sessile and barely exserted in dense, one-sided, curved spikes, the older corollas with yellow- or purple-veined centers ............................................. Heliotropium
10 Flowers sessile and barely exserted in dense, one-sided, curved spikes, the older corollas with yellow- or purple-veined centers ............................................. Heliotropium

Amsinckia lycoperoides Lehnn. – BUGLOSS FIDDLE-NECK. Locally abundant annual in disturbed places at Refuge Headquarters, in grassy fields, and along levee roads (Marshall in 1954; Hanson in 1954; Oswald 5307, T22). Spring. [In older plant lists, usually referred to either A. douglasiiflora DC., A. douglasiiflora var. campes-tris (Greene) Jeps., or misidentified as A. intermedia Fisch. & C.A.Mey.]

Amsinckia menziesii (Lehnn.) A. Nelson & J.F. Macbr. var. intermedia (Fisch. & C.A.Mey.) F.R.Ganders – COMMON FIDDLENECK. Uncommon at the refuge and known only from along trails and roads near the headquarters complex (Oswald 6041, W boundary at the main entrance). Early spring. [A. intermedia Fisch. & C.A.Mey.]

Heliotropium curassavicum L. – WILD HELIOTROPE. Uncommon perennial forming localized populations on alkaline soil of vernal wet depressions in grassy fields, on the beds of vernal pools, and along roads (Anderson 49, rare at Grimes Lake (approximated by present-day Pool 2) in 1937; Oswald 5494, center of T18; Oswald 5950, TAB3). Late spring and summer. [Includes var. oculatum (A.Heller) I.M.Johnst.]

Plagiobothrys leptoclados (Greene) I.M.Johnst. – SMOOTH-STEMMED POPCORN-FLOWER. Occasional annual in vernal wet depressions and drainages in upland grasslands and on drying mud of shallowly flooded fields (Oswald 5330, TG; Oswald 5341, T282). It is super-ficially similar to the more common P. stipitatus var. micranthus, but it has a more prostrate habit and the nutlets are bristly-hairy. Spring.
Plagiobothrys scriptus (Greene) I.M. Johnst. – Scrib’s popcorn-flower. Inconspicuous annual on drier hummocks in grassy fields and in hard-packed soil of roads and parking areas (Oswald 5964, Parking Area D in NE corner P7; Oswald, T18). Early spring.

Plagiobothrys stipitatus (Greene) I.M. Johnst. var. stipitatus – LARGE-FLOWERED STIPITATE POPCORN-FLOWER. Common annual form forming white bands and patches in vernal pools and in vernally wet fields (Hanson in 1950, Marshall in 1954). This large-flowered variety often grows with the small-flowered var. micranthus. Anderson reports stipitate popcorn-flower as very common in all sections of the refuge in early 1938. Spring. [Allocarya stipitata Greene]

Plagiobothrys stipitatus var. micranthus (Piper) I.M. Johnst. – SMALL-FLOWERED STIPITATE POPCORN-FLOWER. A small-flowered variety of the previous plant and sometimes growing with it. It is usually found in shallow vernal pools or along the margins of deeper pools, forming bands or patches of white, but it is also found among grasses in vernally wet upland fields. Spring. [Allocarya stipitata var. micrantha J.F. Macbr.]

Brassicaceae – Mustard Family

Brassica nigra (L.) W.D.J. Koch – Black Mustard. Reported as an uncommon weed along boundaries of the refuge in 1938 (Anderson 79). It is now an abundant and widespread European annual, forming dense stands along dikes and ditches (Oswald 5962, W boundary at main entrance). Most months but especially in spring.

Capsella bursa-pastoris (L.) Medik. – Shepherd’s-Purse. Anderson found shepherd’s-purse to be common over most of the refuge in 1937 (Anderson 13). Today it seems to be a relatively uncommon annual in weedy places (anon. in 1952, on dike; D.B. Marshall in 1954; Oswald 6042, W boundary at the main entrance; Oswald, dike at NE corner of T31). Native to Eurasia. Spring.


Cardamine oligosperma Nutt. – Western bittercress. Inconspicuous annual in grassy fields (Oswald 6033, NW corner of T5; Oswald, NW corner TAB). Early spring.


Hirschfeldia incana (L.) Lagr.-Foss. – Mediterranean mustard. Occasional biennial to short-lived perennial along the edge of marshes and in dry fields (Oswald 5632, southwest corner of T5). Native to the Mediterranean area. Summer.

Lepidium dictyotum A.Gray var. dictyotum – Alkali pepper-grass. Locally abundant annual on moist alkaline flats and in grassy fields, often growing near L. dictyotum var. acutidens (Hanson in 1950; Marshall in 1954; Oswald 5994, NE side of P10; Oswald 6011, TAB; Oswald 6035, TG; Oswald 6028, W edge of T2). Late winter to early spring.

Lepidium dictyotum var. acutidens A.Gray – Sharp-toothed pepper-grass. Uncommon to locally abundant on vernally wet grassy flats and near shallow vernal pools and depressions in grassy fields (Oswald 5324, TG; Oswald 5993, NE side of P10), sometimes growing near L. dictyotum var. dictyotum. This is probably the pepper-grass referred to L. oxyacarpum and reported as very common over the entire refuge by Anderson in 1938. Early spring. [L. oxyacarpum Torr. & A.Gray var. acutidens (A.Gray) Jeps.]

Lepidium latifolium L. – Broad-leaved pepper-grass. Tall, weedy Eurasian perennial forming spreading colonies along ditches (north leg of Tour Route) and parking lots (Oswald 5463, Checking Station S of Norman Rd.). Spring.

Lepidium latipes Hook. var. latipes – Dwarf pepper-grass. Occasional to locally abundant prostrate annual on vernally wet grassy flats and near shallow vernal pools in grassy fields (Oswald 5323, TG; Oswald 5996, E side of P10). Early spring.

Lepidium latipes var. heckeri Rollins – Heckard’s dwarf pepper-grass. Uncommon on the refuge.
but sometimes locally abundant in alkaline soil of
vertically moist, grassy fields (Oswald 5985, Oswald & Silveira 6000, S side T18; Oswald 6031, W edge of T15; Oswald 6036, TG; Oswald, on N side of P4). Early spring. CNPS Inventory 1B.

Lepidium perfoliatum L. – CLASPING PEPPERGRASS. Common and sometimes locally abundant annual forbs along the edges of leevves and roads (Ridler in 1960; Oswald 5314, between TAB & P1). Native to Eurasia. Spring.

Sisymbrium orientale L. – ORIENTAL HEDGEMUSTARD. Occasional annual along roads and trails (Oswald 5452, T11, Wetlands Hiking Trail, Oswald 6090, Tour Route along N edge T16). Native to Europe. Spring and summer.

Tropidocarpum gracile Hook. – SLENDER TROPIDO­CARPUM. Reported as sparse along the west boundary near the railroad tracks in 1938 (Anderson 82). It was not found during the 1993–94 survey. Spring.

Callitrichaceae – WATER-STRAWBERRY FAMILY

Callitriche marginata Tott. – WINGED WATER­STRAWBERRY. Common in vernal pools and in flooded fields, the aquatic phase with floating rosettes of leaves. As the ponds dry down in late spring, the plant becomes terrestrial, forming green cushions on wet mud (Oswald 5316, TD). Winter and spring. [Includes C. longipedunculata Morong, the aquatic phase]

Campanulaceae – BELLFLOWER FAMILY

Campanula rapunculoides L. – STARWORT. Common in vernal pools and flooded spring. CNPS Inventory I B.

Campanula rapunculoides L. – STARWORT. Common and sometimes locally abundant in alkaline soil of grasslands, often growing with D. insignis (Oswald 6093, old rice fields on S side of T17; Oswald & Silveira 6110, SW side of TH). Spring.

Downingia bella Hoover – HOOVER’S DOWNINGIA. Annual forb, uncommon but sometimes locally abundant and covering the entire beds of smaller vernal pools and “hog wallows” (Oswald 6158, T11; Oswald 5325, TG; Oswald 6049, SW corner of TAB). It frequently grows with D. insignis. Spring.

Downingia insignis Greene – HARLEQUIN DOWN­INGIA. Common and widespread annual forbs in drying mud of vernal pools and vernally wet depressions, often forming blue rings around deeper pools or turning shallow pools into a solid mass of blue (Anderson 106 [as D. elegans(Lindl.) Tott., misapplied]), abundant in almost any wet place and low spot in 1938; Marshall in 1955, without a specific location; Oswald 5296, NE corner T16). Spring.

Downingia ornatissima Greene – FOLDED DOWN­INGIA. Uncommon at the refuge but sometimes locally abundant on drying mud of vernal pools and depressions in grasslands, often growing with D. insignis (Oswald 6093, old rice fields on S side of T17; Oswald & Silveira 6110, SW side of TH). Spring.

Samsam teach. Samsam – HONEY Suckle FAMILY

Sambucus mexicana C.Presl ex DC. – BLUE ELDERBERRY. Uncommon shrub along the edge of levee roads (Oswald, P1). Spring. [S. glauca Nutt.; S. velutina Dur. & Hilg.; S. cerulea Raf.]

Caryophyllaceae – PINK FAMILY

Cerastium glomeratum Thuill. – MOUSE-EARED CHICKWEED. Common annual forb in grassy fields, on levees, and in waste places (Oswald 5987, levee between T18 & P4). Spring. [C. viscosum L., misapplied]

Herniaria hirsuta L. ssp. hirsuta – HAIRY HERNI­ARIA. Occasional weed in roadside gravel along the Tour Route (Oswald 5455, near the viewing platform), probably introduced in the stream gravel hauled into the area. Native to southern Europe, northern Africa, and southwestern Asia. Spring.

Sagina decumbens (Elliot) Tott. & A.Gray ssp. occidentalis (S.Watson) G.E.Crow – WESTERN PEARL­WORT. Inconspicuous but locally abundant annual on grassy and gravelly flats (Oswald 5998, field W of checking station). Early spring.

Spergularia macrantha (Hornem.) Heyn. var. leucantha (Greene) B.L.Rob. – WHITE-FLOWERED SAND­SQUARE. Scattered to locally abundant herbaceous perennial in alkaline soils of grassy fields (Anderson 93, common E of Logan Creek; Hanson in 1950, without a location; Oswald 5321, TG; Oswald in NE corner of TAB). Spring.

Spergularia marina (L.) Griseb. – SALT-MARSH SANDSQUARE. Common and locally abundant in alkaline soils of vernally wet places in grassy fields, and on mud of drying vernal pools and drying ponds (Oswald 5312, P1). The plant has small but attractive pinkish flowers that open around mid-day on sunny days. A more robust form of this plant is locally common in gravel in the parking lot at the Checking Station (Oswald 5462). Spring. [Includes var. tenuis (Greene) R.Rossbach]

Spergularia rubra (L.) J.Presl & C.Presl – RUBY SANDSQUARE. Occasional weedy annual in parking lots and other disturbed places (Oswald 6160, parking area at viewing platform). Native to Europe. Spring.

Stellaria media (L.) Vill. – COMMON CHICKWEED. Uncommon annual weed of roadsides and disturbed places (Anderson 90, along a drain near headquarters in
1938; Oswald 5991, between T41 & T38'). Native to southwest Europe. Spring.

CERATOPHYLLACEAE – HORNWORT FAMILY

Ceratophyllum demersum L. – HORNWORT. Submersed aquatic represented by an old collection in the SNWR herbarium (Hanson in 1951), without a specific location. It was not found during the 1993–94 survey. Collected in Sept.

CHENOPODIACEAE – GOOSEFOOT FAMILY

1 Leaves not or scarcely flattened, either fleshy and sublinear or scaly or spiny.
2 Leaves scaly, the stems and branches fleshy.
3 Branches and flower clusters opposite. Salicornia
4 Branches and flower clusters alternate. Allennoloea
5 Leaves not scaly, either fleshy and nearly linear or spine-tipped. Salola
6 Leaves fleshy, not tipped with a spine.
7 Plant annual; calyx lobes unequal. Suaeda calceoliformis
8 Plant perennial; calyx lobes equal. Suaeda moquinii
9 Lower leaves lobed, foliaceous.
10 Flowers imperfect, the female enclosed in a pair of leaf-like bracts that encease in fruit.
11 Shrubby perennial; staminate and pistillate flowers in separate plants (nearly in the same plant).
12 Leaf blade oblong or narrowly ovalate, usually 2–4 mm wide; twigs slender, becoming spiny. Atriplex polyacarpa
13 Leaf blade ovate, usually 10–50 mm wide; stems not distinctly slender or spiny. Atriplex bienochlora
14 Herbageous annuals or non-shrubby perennials; plant with both staminate and pistillate flowers.
15 Leaves green on both surfaces, glabrous or sparsely scaly, triangular. Ceratophyllum demersum
16 Leaves white to gray, densely and finely scaly, especially below, not distinctly triangular. Atriplex fruticulosa
17 Leaves white to gray, densely and finely scaly, especially below, not distinctly triangular. Atriplex fruticulosa
18 Plants more or less glandular-pubescent or resinous-glandular, with a strong medicinal odor. Chenopodium ambrosioides
19 Plants more or less glandular-pubescent or resinous-glandular, with a strong medicinal odor. Chenopodium ambrosioides
20 Plants not or scarcely glandular-pubescent, without a medicinal odor. Chenopodium ambrosioides
21 Leaves shining on upper surface. Chenopodium murale
22 Leaves dull on upper surface. Chenopodium album

Allennoloea occidentalis (S.Watson) Kuntze – IODINE-BUSH. A single but large shrub grows on the northwest corner of Cell 3, Tract 23 on the south side of Norman Rd. (Oswald 5954), where it was probably planted long ago. Iodine-bush is native from eastern San Francisco Bay southward into the deserts of Southern California. Summer and fall.

Atriplex argentea Nutt. var. mohavensis M.E.Jones. – SILVERSCALE. Common and widespread annual of roadways, levees, dry beds of seasonally flooded pools, and grassy fields (Oswald 5773, T16; Oswald 5957, Wetlands Hiking Trail between T114 & 5). Late summer and fall.

Atriplex cordulata Jeps. – HEARTSCALE. Locally abundant in alkali soil of very wet flats, in hard dry soil of old rice fields which have reverted to upland, and along leves roads built up with alkali soil (Oswald 5461, N end of TG; Silveira & Oswald, E side of T21 & W side of T22; Oswald 5641, south corner of TC3; Oswald 5771, T16). CNPS Inventory List 1B. Late spring and summer.

Atriplex depressa Jeps. – BRITTLSECALE. Occasional locally common annual along the margins of perennial pools and in the adjacent very wet upland (Oswald 5778, NE4 of TAB3; Oswald & Silveira, W side P7A3). CNPS Inventory List 1B. Late summer and fall. [A. parishii S.Watson in part (Munz, Calif. Flora)]

Atriplex fruticulosa Jeps. – BALL-SALT BUSH. Common herbaceous perennial from a branching, woody caudex. It is found in very wet grassy fields, along the dry margins of perennial pools, and on roads (Oswald 5363 & 5370, NE corner TAB3; Oswald 5413, NW edge of TAB3; Oswald & Silveira, TH). Although Jepson (Flora Calif. 1:435. 1914) lists this plant as occurring on "alkali flats of the Great Valley from the 'gooselands' of Glenn County south to the San Joaquin," there have apparently been no recent collections from this area since The Jepson Manual lists it only as far north as the southern Sacramento Valley. Spring.

Atriplex heterosperma Bunge – VARIABLE-SEEDED SALT BUSH. Common annual in dry fields and along roads and levees (Oswald 5938, Wetlands Hiking Trail). Native to Eurasia. Late summer and fall.

Atriplex joaquinana A.Nelson – SAN JOAQUIN SPEARSCALE. Locally common annual in grassy fields, along leves roads, and near vernal pools (Marshall in 1954; Oswald 5412, N edge TAB3; Silveira, W edge of P104). CNPS Inventory List 1B. Although this plant was collected near Willows by Jepson (Flora Calif. 1:438. 1914), The Jepson Manual lists it as occurring only from the southern Sacramento Valley southward into the San Joaquin Valley and along the east slope of the Inner South Coast Ranges. Late spring. [A. spicata S.Watson; A. patula L. ssp. spicata (S.Watson) H.M.Hall & Clements]

Atriplex lentiformis (Torr.) S.Watson ssp. lentiformis – BIG SALT BUSH. Locally common shrub in dry upland (Oswald 5774, T21). Although big saltbush is not native this far north in the Great Valley, seedlings and young plants indicate that the plant can spread in the areas where it was planted long ago. Late summer and fall.

Atriplex persistens Stutz & G.L.Chu – VERNAL-POOL SALT BUSH. A small, annual Atriplex with the male flowers clustered at the branch tips is locally common in
alkaline soil on the dry beds of vernal pools at several locations on the refuge (Oswald & Silveira 5230, P1; Oswald 5640, TC; Oswald, TAB). Under favorable growing conditions, it sometimes forms large, green mats. Although this species and A. depressa are probably the Glenn County material referred to A. parishii in Munz, it has recently been recognized as new (Madroño 40:209. 1993). Although described too late to be included in the 5th edition of the CNPS Inventory, it qualifies as a List 1B plant. Summer and fall.

*Atriplex polycarpa* (Torr.) S. Watson – MANY-FRUITED SALTBUSH. A dioecious shrub native to the San Joaquin Valley and Southern California (Oswald & Silveira 5802, Oswald 5943, headquarters complex, T13). The plants show no indication of having spread in the area where they were planted. Late summer and fall.

*Atriplex rosea* L. – TUMBLING ORACLE. Uncommon annual in weedy upland fields (Oswald 5773, T16). Native to Eurasia. Late summer.

*Atriplex semibaccata* R. Br. – AUSTRALIAN SALT-BUSH. Common perennial forming low mounds along roads and levees (Marshall in 1954; Oswald 4028, SE corner P1A; Oswald 5944, SW corner T5). Native to Australia. Spring and summer.

*Atriplex triangularis* Willd. – SPEARSCALE. Common annual in dry ditches and along the edge of ponds (Marshall in 1954; Oswald 5939, Wetlands Hiking Trail). According to Anderson’s list, this plant (as *A. patula var. hastata*) was uncommon along the border of dirt roads and fence rows in 1937. There is some question as to Anderson’s identification since the roadside and fence-row habitats are more characteristic of the vegetatively similar *A. heterosperma*. Late summer and fall. [A. hastata L., misapplied; *A. patula* L. ssp. hastata (L.) H.M.Hall & Clem., misapplied]

*Bassia hyssopifolia* (Pallas) Kuntze – HYSSOP-LEAVED BASSIA. Common and widespread annual in alkaline soils along levee roads, on the dry margins of vernal pools, and in vernaly wet fields (Anderson 32, roads, borders of dry alkali spots; Anon. in 1951; Oswald 5410, NE quarter of TAB). Native to Eurasia. Late spring. [Echinopsion hyssopifolium (Pall.) Moq.]

*Chenopodium album* L. – LAMB’S-QUARTERS. Annual weed that is locally common along roads (Anderson 25 & 58, dry lake beds and roadways; Oswald 5491, near the beginning of the Tour Route). Probably native to Europe. Late spring and summer.

*Chenopodium ambrosioides* L. – MEXICAN-TEA. Annual native of tropical America that is found along the edge of marshes (Oswald 5937, Wetlands Hiking Trail; Oswald, E leg of the Tour Route). Summer and fall. [Includes vars. *anthelminticum* (L.) A. Gray and *vagans* (Standl.) J.T.Howell]

*Chenopodium murale* L. – NETTLE-LEAVED GOOSEFOOT. This European weed was found around old ranch buildings in 1937 (Anderson 37), a typical habitat for the species. It was not found during the 1993-94 survey. Summer.

*Salicornia subterminalis* Parish – PICKLEWEED. A single clump of this perennial of salt marshes and alkali flats was found along the west side of a summer-dry flat in Cell 2, Pool 11 (Oswald 5572). Summer.

*Salsola tragus* L. – RUSSIAN-THISTLE. Common weedy roadside annual in the North Valley but fairly uncommon at the refuge (Oswald 5695, edge of Norman Rd.; Oswald, Tour Route between the parking lot and Pole Line Rd.). Native to Eurasia. Summer into fall. [S. australis R. Br.; S. iberica Sennen & Pau; S. kali L. var. tenuifolia Tausch, all misapplied; the correct name may be *S. pestifera* A. Nelson (see Munz Suppl., p. 75)]]

*Suaeda calceoliformis* (Hook.) Moq. – HORNS SEA-BLITE. Common and locally abundant succulent annual on the margins of drying alkaline pools and on alkali scalds (Oswald 5329, TG; Oswald 5945, NW corner T5). Spring and summer. [S. depressa (Pursh) S.Watson var. erecta S.Watson; *S. depressa* var. depressa misapplied]

*Suaeda moquinii* (Torr.) Greene – BUSH SEEPWEED. Locally common subshrub in the southwest corner of Cell 3, Pool 7A (Oswald & Silveira 5643) and in the middle of the W side of the same pool (Silveira), the only known locations on the refuge. The plant has a foul odor. Spring and summer. [S. torreyana S.Watson including var. *amosissima* (Standl.) Munz; *S. fruticosa* (L.) Forssk., misapplied]

**CONVOLVULACEAE – MORNING-Glory Family**

1 Styles 2, distinct, flowers less than 1 cm long.......................... *Cressa*
2 Styles 1, flowers more than 1 cm long.................................. *Convolvulus*

*Convolvulus arvensis* L. – BINDWEED. Common weedy perennial vine of roadways and marsh edges (Anderson 50, W of headquarters and in section 22; Hanson in 1950, without a location; Oswald 5353, NE corner T41). Native to Europe. Late spring into fall.

*Cressa truxillensis* Kunth – ALKALI-WEED. Common and widespread herbaceous perennial in alkaline soils of verna­ly wet upland fields, on the drying beds of vernal pools and seasonally flooded marshes, and along roads (Anderson 20, common in dry alkali beds in 1937; Oswald 5405, TAB). At the refuge, alkaline-weed is commonly infected with a rust pathogen, causing the plants to develop enlarged, yellow-green leaves. Pustules are scattered on the lower epidermis of the leaves from which orange-colored spores are released. Late spring. [Includes var. *vallicola* (A. Heller) Munz; *C. cretica* L.]

**CRASSULACEAE – STONECROP Family**

1 Carpels (3)seeded, plants of moist to dry places.
2 Leaves and sepals blunt or gradually narrowed to a slender tip; flowers 3-5 merous .................................................. *Crassula cretacea*
3 Leaves and sepals obviously hair-tipped, the plant mossy looking; flowers 3-merous .......................................................... *Crassula torreyana*

1 Carpels 3 or more-seeded, plants of shallow water and wet places.
2 Seed surface wrinkled, dull .................................................. *Crassula aquatica*
3 Seed surface smooth, shiny (at SNWR?) ............................... *Crassula soleri* (Gay) F.M. Meyen
**Crassula argatica** (L.) Schonl. – Water Pigmyweed. Common but inconspicuous annual forb, often forming large populations in shallow water and later on drying mud of vernal pools and seasonally flooded marshes (Oswald 5344, NW corner T31). Spring. [Tillaea aquatica L.]

**Crassula connata** (Ruiz & Pav.) A. Berger – Pygmyweed. Inconspicuous annual forming localized populations along roads, in parking areas, and on dry, barren spots in grassy fields (Anderson 81, near the Gravel Pit in 1938); Oswald 5337, TG; Oswald 6091, road along N edge of T16). Spring. [Tillaea erecta Hook & Arn.]

**Crassula tillaea** Lest.-Garl. – Mossy Pigmyweed. Locally common annual on hard-packed soil of parking lots and roadways, and in dry openings in fields (Oswald 5993, parking lot in NE corner T41; Oswald 6092, road along N edge of T16). Often growing near the previous species. Native to the Mediterranean region. Spring. [Tillaea muscosa L.]

**Cuscutaceae – Dodder Family**

1 Corolla with obvious fringed, scale-like appendages attached to the tube below the stamens. Cuscuta salina

2 Corolla without fringed, scale-like appendages at the base of the filaments. Cuscuta californica

**Cuscuta californica** Hook. & Arn. var. californica – California Dodder. A common parasite of Hemizonia parryi (Oswald 5568, parking lot at the Checking Station S of Norman Rd.; Oswald 5772, T19). Summer.

**Cuscuta salina** Engelm. var. papillata Yunck. – Alkaline Dodder. Locally abundant parasite of Frankenia (Oswald 5496, NE T18; Oswald 5777, NE 1/4 T29). Summer.

**Dipsaceae – Teasel Family**

1 Bracts of head ending in a straight spine, the spines flexible even when dry. Dipsacus fullonum

2 Bracts of head ending in a recurved spine, the spines stiff. Dipsacus sativus

**Dipsacus fullonum** L. – Wild Teasel. Weedy perennial forming colonies along ponds and ditches (Wilbur in 1962, without a location; Oswald 5692, Tour Route near the viewing platform). Late spring and summer; some plants blooming again in the fall on new growth on old stems. [D. sylvestris Huds.]

**Dipsacus sativus** (L.) Honck. – Fuller’s Teasel. Weedy perennial forming colonies along ponds and ditches (Oswald 5457, E edge of P1A3). This is the species that was used to make the nap on woolen cloth. Late spring and summer. [D. fullonum L. & D. sylvestris Huds., misapplied]

**Elatinaceae – Waterfowl Family**

1 Plants glandular-pubescent; flower parts in 5’s; sepals pointed, with a thickened midrib; dry bottoms of vernal wet places. Elatine ambigua

2 Plants glabrous; flower parts in 2’s, 3’s, or 4’s; sepals blunt, without a midrib; aquatic or semiaquatic. Elatine californica

3 Flower parts in 3’s (or sepals reduced to 2); stamens 3 or varying from 1-6; seeds only slightly curved. Elatine missouriensis

3 Flowers sub(sessile) to distinctly pedicilled; fruit turning to one side at maturity; sepals equal in size. Elatine chilensis

**Euphorbiaceae – Spurge Family**

1 Plant silvery-hairy, flowers with a calyx, not borne within an involucre (cyathium). Euphorbia serpyllifolia

1 Plant green, flowers lacking a true calyx, borne within a cup-shaped involucre (cyathium) surrounding several reduced male flowers and a female flower with a 3-lobed peltate involucre. Euphorbia × loxandra

2 Ovary and capsule hairy ............................................................... Euphorbia serpyllifolia

2 Ovary and capsule glabrous .............................................................. Chamaesyce muscosa

3 Appendages of glands deeply parted into 3-5 scale-like structures 1 mm long; plants in and about dying vernal pools. Chamaesyce hooveri

3 Appendages entire to slightly lobed .......................................................... Chamaesyce serpyllifolia

**Chamaesyce hooveri** (Wheeler) Koutnik – Hoover’s Spurge. Discovered on the Sacramento Refugue by Joseph Silveira in 1992, Hoover’s spurge is locally common to abundant on summer-dry mud on the bottom of certain vernal pools (Silveira in 1992, P1; Silveira in 1992, TC2; Silveira in 1992 & Oswald 5951, TAB3; Oswald 5691, NE corner of T18). CNPS Inventory List 1B. Summer. [Euphorbia hooveri Wheeler]

**Chamaesyce maculata** (L.) Small – Spotted Spurge. Locally abundant annual weed on the edge of the Visitor’s Parking Area (Oswald 5942). [Euphorbia maculata L.; E. supina Raf.]

**Chamaesyce serpyllifolia** (Pers.) Small – Thyme-Leaved Spurge. Uncommon annual on the bank of Hunters Creek (Oswald & Silveira 5803, T44). Summer and fall. [Euphorbia serpyllifolia Pers.]

**Eremocarpus setigerus** (Hook.) Benth. – Turkey-Mullein. Reported as common on barren spots and along dirt roads in 1938 (Anderson 60). Today this common weedy native of roadsides in the North Valley is surprisingly uncommon at the refuge, being found only occasionally in dry fields (Wilbur in 1962; Oswald 5808, T44). Late spring and summer.

**Fabaceae – Legume Family**

[Leguminosae]

1 Leaves trifoliate or palmately compound.

2 Leaves palmately compound.

3 Flowers pinkish, keel ciliate on upper margins near the claws. Lupinus microcarpus
Lupinus micranthus Guss. misapplied

Medicago polymorpha L. – COMMON BUR-CLOVER. Common weedy annual forb along roads, dikes, and in grassy fields (Marshall in 1954; Oswald 6116, TAB). Some plants have essentially smooth fruits, a variant that is usually not taxonomically recognized (Marshall in 1954). Bur-clover is apparently much more common now than in 1937; Anderson (collection #11) lists it as sparse along the east boundary in Section 35. Spring. [M. polymorpha var. brevivinosa (Benth.) Heyn; M. hispida Gaertn., including var. confinis (W.D.J.Koch) Burnat]

Melilotus alba (L.) Medik. – WHITE SWEET-CLOVER. Eurasian native that is found along the edge of marshes, creeks, and roads (Oswald, Wetlands Hiking Trail). Summer.

Melilotus indica (L.) All. – INDIAN SWEET-CLOVER. Common and widespread annual forb along levee roads and ditches and in grassy fields (Anderson 12, gravel pit; Marshall in 1954; Oswald 6043, T5'). Spring.

Robinia pseudoacacia L. – BLACK LOCUST. Several small trees have volunteered along the creek at the headquarters complex. Native to the eastern US. Spring.

Trifolium albo purpureum Torr. & A. Gray var. albopurpureum – INDIAN CLOVER. Reported as common over most of the refuge in 1938 (Anderson 104). It was not found during the 1993–94 survey. Spring.

Trifolium bifidum A. Gray var. decipiens Greene – DECEPTIVE NOTCH-LEAVED CLOVER. Locally common annual in grassy pools and in pastures on the banks of seasonally flooded marshes (Oswald 5320 & 5338, TG; probably the clover (#100) referred to T. gracilentum by Anderson in 1938). Spring.

Trifolium ciliatum Benth. – FOOTHILL CLOVER. Reported as common over most of the refuge in 1938 (Anderson 105). It was not found during the 1993–94 survey. Spring. [T. ciliatum Nutt.]


Trifolium fucatum Lindl. – SOUR CLOVER. Apparently common over most of the refuge in 1938 (Anderson 102). Today it is an uncommon annual in adobe soil of grassy fields (Oswald 6040, NE corner of P7; Oswald 6101, NW corner of P7A). Spring.

Trifolium hirtum All. – ROSE CLOVER. Widespread naturalized annual in northern California but apparently uncommon at the refuge (Oswald, edge of the Visitor’s Parking Lot). Native to Eurasia. Spring.

Trifolium microcephalum Pursh – SMALL-HEADED CLOVER. Inconspicuous annual known only from moist soil along a verminally flooded swale on the northwest side of Cell 3, Tract AB (Oswald 6115). Spring.

Astragalus tener A. Gray var. ferrisiae Liston – FERRIS’ MILK-VETCH. A rare annual that is locally common along the grassy margins of several alkaline pools and drainages in the northwest quarter of Cell 3, Tract AB (Oswald 6005, 6113, 6114), the only known location on the refuge. CNPS Inventory List 1B. Spring.

Lotus corniculatus L. – BIRD’S-FOOT-TREFOIL. According to Anderson’s list, this plant was sparse in a wet area near the entrance in 1937. It is now a common, widespread, and locally abundant perennial forb in marshy and verminally wet places (Wilbur in 1961). Native to Eurasia. Spring into summer, some plants blooming again in early fall.

Lotus wrangelianus Fisch. & C.A.Mey. – WRANGLER LOTUS. Locally common in upland grassy fields (Oswald 5318, TG; Oswald 6045, T5'). Spring. [L. subpinmaus Lag., misapplied]

Lupinus microcarpus Sims var. microcarpus – PINK-FLOWERED LUPINE. Uncommon annual lupine forming colonies in wet clay soils in grassy fields (Silveira, TAB; Oswald, TG). Spring. [L. subvexatus C.P.Sm.; L. ruber A.Heller]

Lupinus polycarpus Greene – SMALL-FLOWERED LUPINE. Locally common annual lupine in wet clay soils of grassy places (Anderson 78, sparse in N half of refuge; Hanson in 1950; Oswald & Silveira 6026, NW corner of TAB). Spring. [L. micranthus Guss. misapplied. This lupine is included in L. bicolor Lindl. in The Jepson Manual, but it appears to be clearly distinct in our range.]
**Trifolium variegatum** Nutt. - WHITE-TIPPED CLOVER. An abundant annual reported to grow over most of the refuge in 1938 (Anderson 98). Today it is only occasionally found on the margins of vernal pools and other vernally wet depressions (Oswald, NE corner T16). Spring.

**Vicia benghalensis** L. - RED-FLOWERED VETCH. Uncommon annual along roadsides and in weedy fields (Oswald 5350, NE corner of T41). Native to Europe. Spring.

**Vicia sativa** L. ssp. *varia* (Host) Corb. - WINTER VETCH. Occasional to locally abundant annual along roads and ditches (Oswald 5352, NE corner of T41). Native to Europe. Spring. [V. villosa ssp. *varia* (Host) Corb. - Winter Vetch.]

**GERANIACEAE - GERANIUM FAMILY**

**Centaurium muehlenbergii** (Griseb.) W. Right ex Piper - JUNE CENTAURY. Attractive, locally abundant, and widespread annual in drying, grassy fields, along the edge of roads, and on the borders of marshes (Wilbur in 1961; Oswald 5361, SW corner T21). Late spring and early summer. [C. floribundum (Benth.) B.L. Rob.]

**GERANIACEAE - GERANIUM FAMILY**

**Frankenia salina** (Molina) I.M. Johnst. - ALKALI SEA-HEATH. Ubiquitous herbaceous perennial in alkali soils of upland fields, seasonally flooded marshes, and borders of vernal pools (Anderson 56, on all alkali spots and barren areas; Hanson 42-50, without a location; Marshall in 1954, without a location; Oswald 5406, TAB3). Late spring and summer. [F. grandifolia Cham. & Schltdl., including var. *campesiris* A.Gray]

**FRANKENIAEAE - FRANKENIA FAMILY**

**Hydrophyllaceae - Water-Leaf Family**

**Phacelia ciliata** Bentham. - GREAT VALLEY PHACEelia. Annual forb represented by a single collection in the SNWR herbarium (Hanson in 1952, without a location). It was also reported as a few scattered plants on the refuge in 1938 (Anderson 97). Spring.

**JUGLANDACEAE - WALNUT FAMILY**

**Juglans californica** S. Watson var. *hindsii* Jeps. - NORTHERN CALIFORNIA WALNUT. Small trees, many of nut-bearing age, are scattered along Hunters Creek in the south edge of the refuge. This area is included in List 1B of the CNPS Inventory, based on endangered native stands in Contra Costa, Napa, and Sacramento counties. It is widely planted along streets and highways in the North Valley and is used as a rootstock for English walnuts. It is now widely naturalized along creeks and rivers. [J. hindsii (Jeps.) Jeps. ex R.E.Smith]

**LAMIACEAE - MINT FAMILY**

**Lamium amplexicaule** L. - GIRAFFEHEAD. Weedy annual along roads and in other disturbed places (Oswald 5997, NE side of P10). Native to Eurasia. Early spring.

**Lycopus americanus** Muhl. ex W.P.C. Bart. - AMERICAN BUGLEWEED. Common herbaceous perennial along the edge of marshes and in other wet places (Anderson 9, W boundary drain); Hanson in 1951, without a location; Marshall in 1954, bank of Logan Creek; Oswald 5638, S edge of TAB3). Summer into fall.

**Marrubium vulgare** L. - WHITE HOREHOUND. Reported as only a few isolated plants on the refuge in
1937 (Anderson 71, Gravel Pit & drain along W boundary). It is now a common and widespread weedy perennial along roads, dikes, trails, and in other disturbed places (Oswald 6112, TAB3). Native to Europe. Spring.

Mentha arvensis L. — AMERICAN WILD MINT. Sparse herbaceous perennial reported from the Gravel Pit in 1937 (Anderson 55). It was not relocated during the 1993–94 survey. Late spring and summer.

Pogogyne zizyphoroides Benth. — SACRAMENTO POGOGYNE. Apparently rare on the refuge in 1937 (Anderson 58, near ditch W of headquarters). It is now a common and widespread annual forb on the margins of vernal pools and in other wet, grassy places (Oswald 5297, NE corner T10). Spring.

Stachys stricta Greene – SONOMA HEDGE-NETTLE. Uncommon herbaceous perennial in soil along streams and other wet places (Wilbur & O’Neill in 1961, edge of rice checks; Oswald 5806, edge of Hunters Creek). This plant has a strong, unpleasant odor. Late spring into summer. [Stachys ayugoides Benth. var. stricta (Greene) Jeps.]

LENTIBULARIACEAE – BLADDERWORT FAMILY


LIMNANTHACEAE – MEADOWFOAM FAMILY

Limnanthes douglasii B.R. ss. rosea (Hartw. ex Benth.) C.T. Mason – ROSY MEADOWFOAM. In 1938, rosy meadowfoam grew in small patches along the north and east boundaries of the refuge (Anderson 80). Today this herbaceous annual is known only from the margin of a small “hog wallow” in adobe soil in the southwest corner of Cell 3, Tract AB, where it is locally abundant (Oswald 6048). The veins in the petals seem to lack the reddish pigment seen in this subspecies on the east side of the valley, but the linear leaflets and prominently ridged nutlets correspond to the ss. rosea rather than the ss. nivea of the Inner North Coast Ranges to the west. Early spring.

LYTHRACEAE – LOOSESTRIFE FAMILY

1 Flower tube more or less cylindrical.

2 Plants perennial, usually well over 4 dm tall, petals over 4 mm long. .................................................... Lythrum adsurgens

3 Plants annual or rarely short-lived perennial, usually less than 4 dm tall, petals less than 4 mm long.

4 Flower-tube very slender in fruit, the ribs strongly scabrous. Lythrum virgatum

5 Flower-tube stout in fruit, the ribs smooth. Lythrum hyssopifolium

6 Flower tube short, bell-shaped to globular.

4 Leaves narrow at the base, clasping the stem, flowers mostly 1 in each axil (at SNWR?).

5 Leaves broad at the base, clasping the stem. .............................................................. Rotula ramosior (L.) Koehne

6 Leaves broad at the base, clasping the stem.

5 Inflorescences up to 5-flowered, usually with peduncles, the peduncle in 9 mm long, petals deep rose-purple, sometimes with a deeper purple spot on the base, 2 mm long and about as wide; anthers deep yellow; capsule equaling or exceeding the calyx lobes. .................. Ammannia coccinea

6 Inflorescences 1 to 5-flowered, sessile, petals pale lavender, sometimes with a deep rose banded spot or maroon, ca. 2.5 mm long and 3 mm wide; anthers pale yellow to yellow; capsule usually enclosed by or equaling the calyx lobes. .................................................... Ammannia robusta

Ammannia coccinea Rottb. – VALLEY REDSTEM. Common annual in shallow water and later on the drying margins of ponds (Hanson 5-51, in a rice field; Oswald 5563, T15). Late spring and summer. [A. auriculata Wild., misapplied]

Ammannia robusta Heer & Regel – GREAT REDSTEM. Locally abundant annual in shallow water and on the drying beds of marshes (Oswald 5890, T44). Summer and fall.

Lythrum californicum Torr. & A.Gray – CALIFORNIA LOOSESTRIFE. Rare or overlooked perennial along ditches, often growing among tules (Oswald 5890, T44). Summer and fall.

Lythrum hyssopifolium L. – HYSSOP LOOSESTRIFE. Common and widespread annual or biennial in drying marshes and on the borders and beds of seasonally flooded fields (Hills in 1982, Oswald 5414, NW corner TAB3). Native to Europe. Spring & summer. [Includes L. adsurgens Greene, the perennial form of the species.]

Lythrum triviale (Salz.) Spreng. – SLENDER-FRUITED LOOSESTRIFE. Common and widespread annual on the drying margins of vernal pools and seasonally flooded marshes (Oswald & Silveira 5403, TC2). Native to southern Europe. Spring & summer.

MALVACEAE – MALLOW FAMILY

1 Style branches terminating in head-like or truncate stigma.

2 Involutile absent below the calyx; petals up to 1 in or more tall; petals yellow or orange; carpels 2-9 seeded. .............................................................. Abutilon

3 Involutile of 1-several small bracts present below the calyx; low spreading plants; petals yellowish; carpels with a single seed. .............................................................. Malva

2 Involutile with 3 small bracts; flowers mostly in axils of regular stem leaves and much shorter than the leaves.

4 Small bracts at base of flower lanceolate to obovate. .................................................... Malva neglecta

5 Small bracts at base of flower linear.

6 Petals twice the length of the calyx (at SNWR?) ...

7 Petals slightly longer than the calyx

8 Petals scarcely longer than the calyx. .............................................................. Malva parviflora

9 Petals with 1 small bract or none, flowers in racemes or spikes. .................. Sidacea

Abutilon theophrasti Medik. – VELVETLEAF. This common weed of surrounding agricultural areas is known at the refuge only from a single waf growing at the vehicle-fueling station at the headquarters complex (Oswald & Silveira 5800). Native to southern Asia. Late summer.

Malva nicaensis All. – BULL MALLOW. Common annual to biennial weed along levees and roads (Marshall in 1956, without a location; Oswald 5354, SE corner Pool 10). Native to Eurasia. Spring.

Malva parviflora L. – LITTLE MALLOW. Common and locally abundant weedy annual on and along dike roads (Oswald, SE corner T10). Native to Eurasia. Spring.

Malvella leprosa (Ortega) Krapov. – ALKALI-MALLOW. Common and widespread perennial along roads, on alkaline flats, and in grassy fields (Anderson 54, on all alkali spots and barren areas; Hills in 1982, without a location; Oswald & Ahart 5424, along Nor-
man Rd.). Late spring & summer. [Sida hederacea (Douglas) Torr. & A.Gray]

*Sidalcea* diploscypha (Torr. & A.Gray) A.Gray – FRINGED CHECKER-MALLOW. Uncommon annual in grassy fields (Hanson in 1950, without a location; Marshall in 1955, without a location; Wilbur in 1961, without a location; Oswald & Silveira, P1A4 in 1993). Spring.

**Martyniaceae – Unicorn-Plant Family**


**Molluginaceae – Carpetweed Family**

1. Plant pubescent with branched hairs........................................................................... Glinus
2. Plant glabrous................................................................................................................ Mollugo

*Glinus lotoides* L. – GLINUS. Occasional European annual along the road at the viewing platform (Oswald 5453, southeast corner of P1A3), probably introduced in the stream gravel hauled into the area. Native to Europe. Spring.

*Mollugo verticillata* L. – INDIAN-CHICKWEED. Uncommon matted annual in roadside gravel (Oswald 5502, parking area at the viewing platform at the SE comer of the Tour Route). Native to tropical America. Late spring and summer.

**Moraceae – Mulberry Family**

1. Fruit an ake with a fleshy calyx, forming a succulent berry-like multiple fruit................................ Morus
2. Ake ones within a fleshy receptacle that matures into a bag-like fruit (fig)............................... Ficus

*Ficus carica* L. – FIG. A number of small trees grow along impoundments and creeks (Oswald 6161, Logan Creek just upstream from the NE comer of the Tour Route). Native to the Mediterranean area. Plants vegetative.

*Morus alba* L. – WHITE MULBERRY. A single tree noted at the rookery in the northeast comer of Tract 37 (Oswald in 1993). Vegetative in September.

**Myrtaceae – Myrtle Family**

*Eucalyptus camaldulensis* Delnх. – RIVER RED GUM. Tall tree planted at the Headquarters complex (Oswald 5961) and at several other places on the refuge (NE comer T41). Occasional seedlings volunteer. Native to Australia. Winter and early spring.

**Oleaceae – Olive Family**

1. Leaves pinnately compound, fruit a samara ...................................................................... Frammer
2. Leaves simple, fruit a drupe ................................................................................................. Olea

*Fraxinus latifolia* Benth. – OREGON ASH. Occasional small tree at scattered locations along Logan Creek (Oswald 5363, NE comer T211; Oswald, near the viewing platform). Spring.

*Olea europaea* L. – OLIVE. A few scattered volunteers have been seen on the refuge (Oswald, NE comer of T31; Oswald, N edge P5). A small grove has also been planted at the headquarters complex. Native to western Asia.

**Onagraceae – Evening-Primrose Family**

1. Petals 5, yellow; plants aquatic with floating leaves or becoming terrestrial at dry-down...... Ludwigia
2. Petals 4, pale to white; plants in dry to wet places but not aquatic............................. Ludwigia
3. Seeds lacking a terminal tuft of hairs (sect. *Brendesvallia*). ............................................ Epilobium
4. Capsule more or less cylindrical, lacking thick vascular ribs along the lines of dehiscence......................................................................................................................... Epilobium pygmaeum
5. Capsule conspicuously 4-sided with thick vascular ribs along the lines of dehiscence on the corners............................................................................................................. Epilobium clustiferum
6. Seeds in a single row in each cavity of ovary (sect. *E. parviflorum*).......................... Epilobium densiflorum (Land) P.Hoch & Raven
7. Seeds with a terminal tuft of hairs (sect. Epilobium).......................................................... Epilobium
8. Plants annual; stems with exfoliating epidermis, plants of places that become dry in summer................................................................................................. Epilobium ciliatum
9. Plants perennial; epiderms not exfoliating from the stems; plants of wet places ............. Epilobium ciliatum

*Epilobium brachycarpum* C.Presl – TALL ANNUAL WILLOWHERB. Locally abundant annual in dry soil along roads and levees (Oswald 5888, Pole Line Rd. along E side of T162). Late summer and fall. [E. parviflorum Nutt. ex Torr. & A.Gray, including vars. *laevicaule* (Ryd.) Munz & *tracyi* (Ryd.) Munz]

*Epilobium ciliatum* Raf. ssp. *ciliatum* – FRINGED WILLOWHERB. Occasional herbaceous perennial along streams and marshes (Wilbur in 1961, without a location; Oswald 5639, S edge of TAB3; Oswald, NE comer of T211). The plants on the refuge are the grayish, densely pubescent variant of the subspecies. Late spring and summer. [E. adenocaulon Hausskn., including vars. *holosericeum* (Trel.) Munz, *occidentale* Trel., & *parishii* (Trel.) Munz]


*Epilobium pygmaeum* (Speg.) P.Hoch & Raven – SMOOTH SPIKE-PRIMROSE. Widespread and locally abundant annual on the drying beds of vernal pools and seasonally flooded marshes (Oswald 5359, NE corner T16). Spring. [Boisduvalia clavelia (Nutt.) Walp., including var. *campestris* (Jeps.) Jeps.]

*Ludwigia peploides* (Humb., Bonpl. & Kunth) Raven – FLOATING PRIMROSE-WILLOW. Common emergent perennial with floating leaves, forming dense colonies in marshes, creeks, and ditches. It often becomes stranded on mud if the water level drops, where it continues to grow and flower (Anderson 57, in drains, ditches, and canals; Oswald 5633, SW corner of T55). Late spring into fall. [Jussiaea californica Jeps.; *J. repens* L. var. *peploides* (Humb., Bonpl., & Kunth) Griseb.]

**Oxalidaceae – Wood-sorrel Family**

*Oxalis corniculata* L. – CREEPING WOOD-SORREL. Common weed in the lawn at the Headquarters Building
(Oswald in 1994). Probably native to the Old World. Spring into fall.

PLANTAGINACEAE – PLANTAIN FAMILY

1 Leaves sharply and deeply toothed except in depauperate individuals; spikes nodding in bud
   
   Plantago coronopus

1 Leaves entire or minutely toothed; spikes erect in bud.
2 Leaves narrow, linear to almost threadlike, spring annuals.
3 Sepals glabrous, stamina 2
   
   Plantago elongata

2 Sepals long hairy, stamina 4
   
   Plantago erecta

2 Leaves broader, weedy perennial
   
   Plantago lanceolata

Plantago coronopus L. – CUT-LEAVED PLANTAIN. Common and widespread annual forb on dike roads, in moist clay soils in grassy fields, near vernal pools, and on alkali scalds (Oswald 5309, P11). Native to Europe. Spring.

Plantago elongata Pursh – ELONGATE PLANTAIN. Locally abundant on the drying beds of shallow vernal pools and in other vernally wet places (Oswald 5310, P11). Spring. [P. bigelovii A.Gray, including ssp. californica (Greene) Bassett]

Plantago erecta E.Morris – ERECT PLANTAIN. Uncommon annual forming localized colonies in grassy fields (Oswald 5989, SW corner of TAB3). Early spring. [P. hookeriana Fisch. & C.A.Mey. var. californica (Greene) Poe]

Plantago lanceolata L. – ENGLISH PLANTAIN. Occasional perennial weed of leveses and roadsides (Oswald & Ahart 5426, edge of Norman Rd.). Native to Europe. Spring & summer.

POLEMONIACEAE – PHLOX FAMILY

1 Flowers bicolor, the lobes pink or white, the throat and tube yellow; leaves opposite, palmately cleft
   
   Linanthus bicolor (Nutt.) Greene – BICOLORED LINANTHUS. Small but attractive annual in adobe soil of grassy fields, often forming large populations (Oswald 5988, SW corner of TAB3; Oswald, grassy flat on W side of P102). Spring.

2 Flowers white; leaves mostly alternate, palmately dissected
   
   Navarretia linanthus

Linanthus bicolor (Nutt.) Greene – BICOLORED LINANTHUS. Small but attractive annual in adobe soil of grassy fields, often forming large populations (Oswald 5988, SW corner of TAB3; Oswald, grassy flat on W side of P102). Spring.

Navarretia leucocephala Benth. ssp. leucocephala – WHITE-FLOWERED NAVARRETTA. Common and locally abundant along the edge of vernal pools, in seasonally flooded marshes at dry-down, and in vernal wet, grassy fields (Anderson 110, abundant over most of the refuge in 1938; Oswald 5343, NW corner T31). Spring.

POLYGONACEAE – BUCKWHEAT FAMILY

1 Calyx 5-parted (occasionally 6-parted), the segments similar.
2 Flowers in solitary fascicles
3 Plants prostrate to ascending, growing in disturbed places, perianth about 2.5 mm long, exserted from the stipule
   
   Polygonum amphibium

3 Plants erect, growing in marshy places; perianth about 1 mm long, more or less enclosed in the stipule
   
   Polygonum prolificum

2 Flowers in terminal dense to open spike-like racemes or fascicles
4 Racemes 1–2, terminal on the branches, stamens or styles exserted
   
   Polygonum hydropiperoides

4 Racemes several to numerous, terminal and axillary, stamens and styles included in the perianth or exserted.
5 Stipules entire or torn, not fringed with cilia or bristles; outer perianth membrane with the midvein divided at tip into 2 short recurved veins
   
   Polygonum lapathifolium

5 Stipules fringed with bristles; outer perianth membrane not as above.
6 Calyx dentate with glands; spikes slender, arching
   
   Polygonum amphibium

7 Glandular dots only on the inner perianth members

8 Calyx white, cilia shining
   
   Polygonum punctatum

8 Calyx greenish or with rose tips; cilia dull
   
   Polygonum hydropiperoides

Polygonum amphibium L. var. emersum Michx. – WATER SMARTWEED. Uncommon perennial forming colonies along the dry margins of seasonal marshes (Oswald, south leg of the Tour Route in P1A3). The identification is tentative since all plants have been vegetative to date (in both 1993 and 1994). [P. cotinum MuHl.]

Polygonum arenastrum Boreau – COMMON KNOTWEED. Common annual weed in dry soil of roads and paths, where it tends to have a prostrate growth form (Anderson 35, uncommon along drains and roads in 1937; Marshall in 1954, without a location; Oswald 5946, NW corner of T5). Native to Europe. The closely related P. aviculare L., to which some of our plants have been referred, is apparently not documented in California (The Jepson Manual, page 888). Spring and summer.

Polygonum hydropiperoides Michx. – SWAMP SMARTWEED. Common emergent perennial in quiet water of sloughs and ponds, often forming extensive colonies (Oswald 5569, Logan Creek along the E side of P102). Summer into fall.

Polygonum lapathifolium L. – WILLOW-WEED. Locally abundant annual in moist soil along marshes, creeks, and ditches (Anderson 46, common in wet places; Hanson in 1951, without a location; Oswald 5464, NE corner of T25). Late spring into fall. [Includes var. salicifolium Sibth.]

Polygonum persicaria L. – LADY’S-THUMB. Annual weed along the edge of marshes (Hanson 6-51, without a location; Oswald, Wetlands Hiking Trail). Native to Europe. Late spring into fall.

Polygonum prolificum (Small) B.L.Rob. – PROLIFIC KNOTWEED. Erect, much-branched knotweed in alkaline soil of marshy fields and ponds that dry during the summer (Oswald 5946, NW corner of T5). Native to eastern North America. Summer into fall.

Polygonum punctatum Elliot – DOTTED SMARTWEED. Annual or sometimes perennial plant forming localized colonies in shallow water or in wet mud along marshes and streams (Oswald 5779, edge of Logan Creek at the NE corner of the Tour Route; Oswald 5807, edge of Hunters Creek in T44). Summer into fall.
Rumex crispus L. – CURLY DOCK. Abundant and widespread herbaceous perennial in marshy and grassy fields (Marshall in 1954, without a location; Oswald 6212, NW corner of TAB3). According to Anderson’s list, this plant was already common along all of the drains, ditches, canals, lakes, and wet areas in 1937. Native to Eurasia. Spring.

Rumex dentatus L. – TOOTHED DOCK. Common and widespread annual forb on the edges of vernal pools, seasonally flooded marshes, and in other wet, marshy places (Oswald 5303.1, NE corner T16). Native to Eurasia. Spring. [R. dentatus ssp. klotzschianus (Meisn.) Rech.f.]

PORTULACACEAE – PURSLANE FAMILY
1 Calyx fused with the lower part of the ovary, its lobes coming off the summit of the capsule. Portulaca
1 Calyx free or ovoid free.

Calandrinia ciliata (Ruiz & Pav.) DC. – REDMAIDS. Represented by a collection in the SNWR herbarium (Hanson in 1950, without a specific location cited) but not relocated during this study. Although native to California, the plant tends to be weedy. Spring.

Montia fontana L. ssp. amporitana Sennen – WATER MONTIA. Locally abundant annual in various wet soil of uplands and depressions in grasslands (Oswald 5969, NW portion of TG). Early spring.

Portulaca oleracea L. – COMMON PURSLANE. Occasional to locally common weed in disturbed places (Wilbur in 1962, N of headquarters; Oswald, edge of Visitor’s Parking at the headquarters complex; Oswald, parking area at viewing platform at SE corner of Tour Route). Native to Europe. Summer.

RANUNCULACEAE – BUTTERCUP FAMILY
1 Flowers several on a leafy stem, with large purple petals and sepals. fruit a capsule. Delphinium
2 Flowers single or mostly so. Myosurus

Delphinium variegatum Torr. & A.Gray ssp. vari-egatum – ROYAL LARKSPUR. Represented by a collection from along Hwy. 99 near the entrance to the refuge (Kridler in 1956) but not relocated during this study. Spring.

Myosurus minimus L. – TINY MOUSETAIL. Inconspicuous and easily overlooked annual on the drying margins of vernal pools and in other vernal wet drainages and depressions (Oswald 5335, TG). Occasional plants have very short scapes and would key to the ssp. apus (Greene) G.R.Campb., a plant in List 3 of the CNPS Inventory. However, these plants always seem to grow in marginal habitats and are probably best interpreted as depauperate forms of the typical long-sca ped plant. Early spring. [Includes var. filliformis Greene & ssp. major (Greene) G.R.Campb.]

Myosurus sessilis S.Watson – SESSILE MOUSETAIL. Uncommon but locally abundant annual on drying silty mud of shallow, seasonally flooded marshes and muddy-bottomed vernal pools (Oswald 5340, T28). Spring. [M. minus L. var. sessiliflorus (Huth) G.R.Campb.]

ROSACEAE – ROSE FAMILY
1 Leaves simple. Pyracantha
2 Leaves pinnately compound.

Pyracantha koidzumii (Hayata) Rehder – PYRACAN tha. Known from a single shrub growing along the levee on the south side of Pool 2 (Silveira in 1995). The seeds of pyracantha, a standard horticultural shrub, are dispersed by a number of fruit-eating birds, and it is not uncommon to find waifs in suitable habitat in Northern California. Native to Formosa. Spring.

Rosa multiflora Thurb. ex Murr. – RAMBLER ROSE. Introduced in many of the wildlife areas in the North Valley where it persists and sometimes volunteers. It is locally abundant in the woodland in the north-eastern part of Stan 3 (Oswald 6097), forming patches of impenetrable brambles and sometimes climbing into trees. Native to Japan. Spring.

Rubus discolor Weihe & Nees – HIMALAYAN BLACKBERRY. Weedy perennial forming patches of impenetrable brambles along ditches and creeks and in other low places (Oswald, west boundary of refuge along the Wetlands Hiking Trail; Oswald, along Hunters Creek). Native to Eurasia. Spring flowering, the fruits ripening during the summer. [R. procerus Mueller]

RUBIACEAE – MADDER FAMILY
1 Leaves 5-8 in a whorl, fruit roundish, the carpels not curved outward on the inner face. Galium parisienne
2 Leaves 4-5 in a whorl, fruit much longer than broad, the carpels curved outward on the inner face. Galium murale


Galium murale (L.) All. – TINY BEDSTRAW. Inconspicuous but locally common annual weed in roadside gravel along Norman Rd. (Oswald & Ahart 5418). Native to Europe. Spring.

SALICACEAE – WILLOW FAMILY
1 Buds with numerous bud scales; scales of catkins cut into narrow lobes; stamens 6-60. Populus
2 Buds with a single bud scale; scales of catkins entire; stamens 1-10.

Salix gooddingii Benth. 4 Tree; leaves narrowly lanceolate, gray-green above and below, catkins scales yellow; stamens 3-9; catkins appearing with or after the leaves. Salix gooddingii
4 Shrub or small tree, leaves dark green above, paler below, catkins scales black, stamens 2; catkins appearing before the leaves (at SNWR?). Salix lasiandra Benth.
3 Leaves definitely pubescent beneath. 5 Leaves linear to lance-linear, 0.3-0.6 cm wide, tapering at both ends, grayish green on both surfaces; catkins yellow, catkins appearing with or after the leaves, the scales yellow. Salix exigua
5 Leaves lanceolate to oblanceolate or oblongate, mostly more than 1 cm wide; catkins appearing before the leaves, the scales black (at SNWR?). Salix lasiandra Benth. 2 Leaf blades distinctly toothed.
6 Leaves permanently pubescent beneath.
Populus fremontii S. Watson – FREMONT’S COTTONWOOD. A common tree on the refuge, although not as abundant as the black willow. Scattered trees grow along Logan Creek and other waterways, and it is common in the woodland in Tract 31 and at the rookery in Tract 37. Early spring.

Salix exigua Nutt. – NARROW-LEAVED WILLOW. Common small tree tending to form small thickets along creeks and in marshy places. It is easily recognized by its grayish leaves. Spring. [S. exigua var. stenophylla (Ryd.) C.K.Schneid.; S. hindsiana Benth., including var. leucodendroides (Rowlee) C.R.Ball & parishiana (Rowlee) C.R.Ball]

Salix gooddingii C.R.Ball – GOODDING’S BLACK WILLOW. This is the most common tree on the refuge, growing along Logan Creek and other waterways. It is also common in the woodland in Tract 31 and at the rookery in Tract 37. Spring. [S. nigra Marsh. var. vallicola Dudley; S. gooddingii var. variabilis Ball]

Salix laevigata Bebb – RED WILLOW. Occasional tree along streams, marshes, and in woodlots (Oswald, TC1; Oswald, Logan Creek along P62; Oswald, N edge of P1B; Oswald, rookery in the NE corner of T37). Early spring. [Includes var. araquipa (Jeps.) C.R.Ball]

Scrophulariaceae – Figwort Family

Antirrhinum sp. – SNAPDRAGON. An unidentified snapdragon with purplish-red flowers was collected in low, alkaline ground between the railroad and Hwy. 99W at the site of Norman (Oswald & Ahart 5427). Late spring.

Bacopa rotundifolia (Michx.) F.Wettst. – ROUND-LA ved WATER-HYSSOP. Locally common floating annual of marshy pools or becoming stranded on mud (Hanson in 1951, without a location; Oswald 5460, W side of Pole Rd. at the N end of T1S; Oswald 5500, S edge of T14S). Native to the central United States. Spring. [B. nobisiana Mason]

Castilleja attenuata (Gray) T.I.Chuang & Heckard – VALLEY-TASSELLS. Common annual forb in grassy fields (Anderson 103, a few around headquarters and along W boundary line in 1938; Oswald 6002, TAB3). Spring. [Orthocarpus attenuatus A.Gray]

Castilleja exserta (A.Heller) T.I.Chuang & Heckard var. exserta – PURPLE OWL-CLOVER. A few plants were reported west of the power line near headquarters in 1938 (Anderson 99). No plants were found during the 1993–94 survey. Spring.

Castilleja rubicundula (Jeps.) T.I.Chuang & Heckard var. rubicundula – CREAMSACS. Formerly very common on the refuge in early spring (Anderson 72 on 28 Feb. 1938), this attractive annual is now apparently completely extirpated. [Orthocarpus lithospermoides Benth. var. bicolor (A.Heller) Jeps.]

Cordylanthus palmatus (Ferris) J.F.Macbr. – PALMATE BIRD’S-BEAK. Three transplant populations of this rare bird’s-beak from a large natural population on the Delevan Refuge have been successfully established at the Sacramento Refuge in Cell 3 of Tract AB, Cell 2 of Tract C, and Cell 3 of Tract 8. CNPS Inventory List 1B. Late spring and summer.

Kickxia elatine (L.) Dumort. – SHARP-LEAVED FLUELLIN. Common along roads and in other disturbed places (Wilbur in 1961, road edges; Oswald 5503, parking area at viewing platform at SE corner of Tour Route). Native to Europe. Late spring and summer.

Mimulus guttatus Fisch. ex DC. – SEEP MONKEYFLOWER. Common and widespread in moist soil along vernal pools and drainages and on the edges of seasonally flooded marshes (Anderson 83, near Farmer Waite Lake, now approximated by P1A2; Oswald 5990, W side of P24S). This is a highly variable species in which many taxa have been named. The plants on the refuge are relatively small-flowered annually. Spring.

Triphysaria eriantha (Benth.) T.I.Chuang & Heckard var. eriantha – JOHNNYTUCK. Common annual forb in grassy places (Hanson in 1952, without a location, Oswald 5968, TG). Spring. [Orthocarpus bidwelliae A.Gray; O. erianthus Benth. var. erianthus]

Verbascum blattaria L. – MOTH MULLEIN. Herbaceous biennial that is common along the edge of the Visitor’s Parking area at Refuge Headquarters (Oswald 6157). Anderson (collection 21) lists this plant as rare along east boundary south of Norman Rd. in 1937. Native to Eurasia. Spring and summer.

Veronica anagallis-aquatica L. – BLUE WATER SPEEDWELL. Locally abundant herbaceous perennial in ditches, along the edge of seasonally-flooded fields, and in marshy places (Oswald 5305, T2); Oswald, ditch along W boundary bordering the Wetlands Hiking Trail; Oswald, edge of Logan Creek). Native to Europe. Spring.
Veronica peregrina \textit{L. ssp. xalapensis} (Humb., Bonpl., & Kunth) Pennell – PURSLANE SPEEDWELL. Common and widespread annual forb forming dense populations on the floor of drying vernal pools, along the edge of seasonally flooded marshes, and in other marshy places (Oswald 5542, T28; Oswald 6089, N edge T16). Spring.

**Solanaceae – Nightshade Family**

1. Corolla rotate, its tube short.
2. Calyx becoming large and papery and enclosing the fruit.
3. Corolla 10–20 mm wide; flowering calyx lobes acuminate: \textit{Physalis acutifolia}
4. Corolla 3–5 mm wide; flowering calyx lobes acute: \textit{Physalis angulata}
5. Calyx herbaceous, not enclosing the fruit.
6. Herbage densely scaly-serrulate, flowers violet or blue: \textit{Solanum elaeagnifolium}
7. Herbage glabrous; flowers white: \textit{Solanum americanum}

Nicotiana glauca Graham – TREE TOBACCO. Erect shrub or small tree represented by a collection in the SNWR herbarium from along Hunter’s Creek (O’Neill in 1961). This plant was not relocated during this study. Native to South America. Late summer.

**Physalis acutifolia** (Miers) Sandwith – SHARP-LEAVED GROUND-CHERRY. Known only from a single waif in the parking lot at the Checking Station south of Norman Rd. (Oswald 581). It is most easily separated from the next species by its larger flowers (10–20 mm wide). Late spring. ([P. wrightii A.Gray]

**Physalis lanterifolia** Nees – LANCE-LEAVED GROUND-CHERRY. Occasional weedy annual in localized populations on the dry bed of vernal wet pools and in disturbed places (Wilbur in 1961, in rice checks; Oswald 5690, NW corner of T11). The flowers are relatively small (3–5 mm wide). Native to South America. Summer. ([P. glauca A.Gray]

**Solanum americanum** Mill. – AMERICAN BLACK NIGHTSHADE. Occasional annual to subshrub along the edge of marshes (Oswald, Wetlands Hiking Trail in T11). Spring and summer. ([S. nodiflorum Jacq.

**Solanum elaeagnifolium** Cav. – WHITE HORSENETTLE. Uncommon weedy perennial forming localized populations on levee roads (Wilbur in 1961, without a specific location; Oswald 6411, S side of P11). Native of central U.S. and northern Mexico. Summer.

**Tamaricaceae – Tamarisk Family**

1. Flowers 4-merous: \textit{Tamarix parviflora}
2. Flowers 5-merous: \textit{Tamarix ramosissima}

**Tamarix parviflora** DC. – SMALL-FLOWERING TAMARISK. Weedy shrub planted at several locations on the refuge (O’Neill in 1961, T40; Oswald 5538, NE side T31). Native to southeastern Europe. Early spring.

**Tamarix ramosissima** Ledeb. – SALT-CEDAR. An attractive shrub planted at the headquarters complex (Oswald 6210). It blooms later in the spring than \textit{T. parviflora}, and the flowers are a deeper red color. Native to eastern Asia. Late spring.

**Urticaceae – Nettle Family**

**Urtica dioica** \textit{L. ssp. holosericea} (Nutt.) Thorn – STINGING NETTLE. Occasional perennial forming colonies along creeks (Oswald, Logan Creek bordering TH and P1B; Oswald, Hunters Creek in T44). Late spring and summer.

**Verbenaecae – Vervain Family**

1. Stems erect, clumped, often over 1 m tall; calyx 5-toothed, flowers in terminal spikes; nectaries \textit{Verbas}
2. Stems prostrate, creeping, forming a matted groundcover; calyx 2-toothed; flowers in short, usually axillary spikes or heads; nectaries 2.
3. Leaves including petals 1–3 cm long; peduncles 2–7.5 cm long \textit{Phyla nodiflora} var. \textit{nodiflora}
4. Leaves including petals 1–3 cm long; peduncles 1.5–3 cm long \textit{Phyla nodiflora} var. \textit{rosea}

**Phyla nodiflora** (L.) Greene var. \textit{nodiflora} – CREEPING LIPPIA. Locally abundant creeping perennial on the floor of the woodlot in the northeast corner of Tract 31 (Oswald 6410). Late spring and summer. ([Lippia nodiflora] (L.) Michx. var. \textit{reptans} (Humb., Bonpl., & Kunth) Kunze]

**Phyla nodiflora** (L.) Greene var. \textit{rosea} (D.Don) Munz – ROSY LIPPIA. Naturalized South American perennials forming mats in lawns, along roads, and on banks of ponds (Oswald 5571, S edge of P10). Late spring and summer. ([Lippia nodiflora] (L.) Michx. var. \textit{rosea} (D.Don) Munz]

**Verbena litoralis** Humb., Bonpl., & Kunth – SHORE VERVAIN. Scattered to common tall, clumped, herbaceous perennial along creeks and ditches (Oswald 5636, SW corner of T5; Oswald, Logan Creek; Oswald, Hunters Creek). Native to Central and South America. Late spring & summer. ([L. brasiiliensis Vell.]

**Vitaceae – Grape Family**

**Vitis californica** Bentham. – CALIFORNIA GRAPE. Uncommon woody vine climbing on trees along Logan Creek, bordering the east leg of the Tour Route. Late spring.

**Zygophyllaceae – Caltrop Family**

**Tribulus terrestris** L. – PUNCTURE-VINE. Occasional annual weed in roadside gravel and other disturbed places (O’Neill in 1961, S levee of P5; Oswald & Ahart 5523, along Norman Rd.). Late spring & summer.

**Monocot Flowering Plants**

**Key to Families**

1. Foliage of the palm type: \textit{Areaceae}
2. Foliage not of the palm type: \textit{Lamiales}
3. Plants larger, with stems, leaves, and usually well-developed roots: \textit{Lamiales}
4. Pattern wanting or reduced, its parts often bristles or scales, not petal-like in color or texture.
5. Flowers in the axils of chaffy or husk-like scales, those in spikes, spikes or heads: \textit{Poaceae}
6. Flowers not concealed in the axils of chaffy or husk-like scales: \textit{Cyperaceae}
7. Plants terrestrial or d aquatic, leaves and flowers well above the water.
Phoenix canariensis Chabaud – CANARY ISLAND DATE PALM. Occasional volunteer along streams (Oswald, NE end of T11). Several trees are also planted at Refuge Headquarters.

Washingtonia filifera (L. Lindem.) H.A. Wendel. – CALIFORNIA FAN PALM. Several seedlings were noted on the bank of the creek bordering the north side of T11. This native of the Sonoran Desert is commonly planted in the North Valley.

**ALISMATACEAE – WATER-PLANTAIN FAMILY**

1. **Akenes arranged in a ring on the receptacle; leaves never hasteate at the base**
   - *Akenes arranged in a ring on the receptacle; leaves never hasteate at the base*. **Damasonium californicum**

2. **Petals essentially entire; alamons rounded**
   - *Petals essentially entire; alamons rounded*. **Echinodorus berteroi**

3. **Leaves not hasteate; fruiting heads borne on the plant**
   - *Leaves not hasteate; fruiting heads borne on the plant*. **Sagittaria montevidensis**

4. **Lower node of inflorescence with only 2 flowers; these with both stamens and pistils**
   - *Lower node of inflorescence with only 2 flowers; these with both stamens and pistils*. **Carex praegracilis**

5. **Flowers in heads, racemes, or open clusters; each flower with both stamens and pistils**
   - *Flowers in heads, racemes, or open clusters; each flower with both stamens and pistils*. **Sagittaria longifolia**

6. **Flowers in spikes**
   - *Flowers in spikes*. **Potamogeton monostachyus**

7. **Flowers in clusters**
   - *Flowers in clusters*. **Alisma plantago-aquatica**

8. **Flowers in spikes**
   - *Flowers in spikes*. **Alisma japonicum**

9. **Lowest node of inflorescence with only 2 flowers; these with pistils only; pedicels ascending in fruit; plants perennial from stolons and tubers**
   - *Lowest node of inflorescence with only 2 flowers; these with pistils only; pedicels ascending in fruit; plants perennial from stolons and tubers*. **Sagittaria montevidensis**

10. **5 Basal leaf sheaths absorb water and associate the alamons; leaf blade attached below the terminal lobe**
    - *5 Basal leaf sheaths absorb water and associate the alamons; leaf blade attached below the terminal lobe*. **Sagittaria longifolia**

**Cyperaceae – SEDGE FAMILY**

1. **Flowers all sessile, alamons surrounded by a scale-like perigynium**
   - *Flowers all sessile, alamons surrounded by a scale-like perigynium*. **Carex bellidifolia**

2. **Scales of spikelet 1-ranked**
   - *Scales of spikelet 1-ranked*. **Carex juncea**

3. **Spikelets disarticulating above the basal pair of scales; scales persistent**
   - *Spikelets disarticulating above the basal pair of scales; scales persistent*. **Carex stricta**

4. **Axis of spikelet winged with a pair of inner transparent appendages at each node; plant annual**
   - *Axis of spikelet winged with a pair of inner transparent appendages at each node; plant annual*. **Carex echinorrhiza**

5. **Perennial with short rhizomes**
   - *Perennial with short rhizomes*. **Carex crispata**

6. **Annual with fibrous roots**
   - *Annual with fibrous roots*. **Carex benefica**

7. ** involucral leaves present; style-base deciduous; tuberoid none**
   - * involucral leaves present; style-base deciduous; tuberoid none*. **Carex elata**

8. **Spikeltes 1–12 in a capitate cluster; stems triangular, usually less than 1 m tall**
   - *Spikeltes 1–12 in a capitate cluster; stems triangular, usually less than 1 m tall*. **Scirpus maritimus**

9. **Flowers in heads, racemes, or open clusters; each flower with both stamens and pistils; bristles nearly as long as the alamons**
   - *Flowers in heads, racemes, or open clusters; each flower with both stamens and pistils; bristles nearly as long as the alamons*. **Scirpus maritimus**

**Arecaceae – PALM FAMILY**

1. **Leaves palmate**
   - *Leaves palmate*. **Washingtonia filifera**

2. **Leaves pinnate**
   - *Leaves pinnate*. **Phoenix canariensis**

**Cyperaceae – SEDGE FAMILY**

1. **Flowers all sessile, alamons surrounded by a scale-like perigynium**
   - *Flowers all sessile, alamons surrounded by a scale-like perigynium*. **Carex bellidifolia**

2. **Scales of spikelet 1-ranked**
   - *Scales of spikelet 1-ranked*. **Carex juncea**

3. **Spikelets disarticulating above the basal pair of scales; scales persistent**
   - *Spikelets disarticulating above the basal pair of scales; scales persistent*. **Carex stricta**

4. **Axis of spikelet winged with a pair of inner transparent appendages at each node; plant annual**
   - *Axis of spikelet winged with a pair of inner transparent appendages at each node; plant annual*. **Carex echinorrhiza**

5. **Perennial with short rhizomes**
   - *Perennial with short rhizomes*. **Carex crispata**

6. **Annual with fibrous roots**
   - *Annual with fibrous roots*. **Carex benefica**

7. ** involucral leaves present; style-base deciduous; tuberoid none**
   - * involucral leaves present; style-base deciduous; tuberoid none*. **Carex elata**

8. **Spikeltes 1–12 in a capitate cluster; stems triangular, usually less than 1 m tall**
   - *Spikeltes 1–12 in a capitate cluster; stems triangular, usually less than 1 m tall*. **Scirpus maritimus**

9. **Flowers in heads, racemes, or open clusters; each flower with both stamens and pistils; bristles nearly as long as the alamons**
   - *Flowers in heads, racemes, or open clusters; each flower with both stamens and pistils; bristles nearly as long as the alamons*. **Scirpus maritimus**

10. ** involucral leaves none; style-base persistent as a tuberoid**
    - * involucral leaves none; style-base persistent as a tuberoid*. **Carex elata**

11. **Leaves with elongated rays; alamons lenticular; style 3-branched**
    - *Leaves with elongated rays; alamons lenticular; style 3-branched*. **Scirpus maritimus**

12. **Annual with fibrous roots; stems slender, 10–50 cm tall**
    - *Annual with fibrous roots; stems slender, 10–50 cm tall*. **Elytrachne obtusa**

13. **Perennial with fibrous roots; stems 100–150 cm tall**
    - *Perennial with fibrous roots; stems 100–150 cm tall*. **Elytrachne macracantha**

14. **10 Leaves usually less than 5 mm wide**
    - *10 Leaves usually less than 5 mm wide*. **Scirpus maritimus**

15. **Scirpus maritimus**
    - *Scirpus maritimus*. **Elytrachne obtusa**

16. **Annual with fibrous roots; stems slender, 10–50 cm tall**
    - *Annual with fibrous roots; stems slender, 10–50 cm tall*. **Elytrachne obtusa**

17. **Perennial with fibrous roots; stems 100–150 cm tall**
    - *Perennial with fibrous roots; stems 100–150 cm tall*. **Elytrachne macracantha**

18. **10 Leaves usually less than 5 mm wide**
    - *10 Leaves usually less than 5 mm wide*. **Scirpus maritimus**

19. **Annual with fibrous roots; stems slender, 10–50 cm tall**
    - *Annual with fibrous roots; stems slender, 10–50 cm tall*. **Elytrachne obtusa**

20. **Perennial with fibrous roots; stems 100–150 cm tall**
    - *Perennial with fibrous roots; stems 100–150 cm tall*. **Elytrachne macracantha**

21. **10 Leaves usually less than 5 mm wide**
    - *10 Leaves usually less than 5 mm wide*. **Scirpus maritimus**

22. **Annual with fibrous roots; stems slender, 10–50 cm tall**
    - *Annual with fibrous roots; stems slender, 10–50 cm tall*. **Elytrachne obtusa**

23. **Perennial with fibrous roots; stems 100–150 cm tall**
    - *Perennial with fibrous roots; stems 100–150 cm tall*. **Elytrachne macracantha**

24. **9 Leaf sheaths free below; alamons lenticular; style 3-branched**
    - *9 Leaf sheaths free below; alamons lenticular; style 3-branched*. **Scirpus maritimus**

25. **Annual with fibrous roots; stems slender, 10–50 cm tall**
    - *Annual with fibrous roots; stems slender, 10–50 cm tall*. **Elytrachne obtusa**

26. **Perennial with fibrous roots; stems 100–150 cm tall**
    - *Perennial with fibrous roots; stems 100–150 cm tall*. **Elytrachne macracantha**

27. **9 Leaf sheaths free below; alamons lenticular; style 3-branched**
    - *9 Leaf sheaths free below; alamons lenticular; style 3-branched*. **Scirpus maritimus**

28. **Annual with fibrous roots; stems slender, 10–50 cm tall**
    - *Annual with fibrous roots; stems slender, 10–50 cm tall*. **Elytrachne obtusa**

29. **Perennial with fibrous roots; stems 100–150 cm tall**
    - *Perennial with fibrous roots; stems 100–150 cm tall*. **Elytrachne macracantha**

30. **9 Leaf sheaths free below; alamons lenticular; style 3-branched**
    - *9 Leaf sheaths free below; alamons lenticular; style 3-branched*. **Scirpus maritimus**

31. **Annual with fibrous roots; stems slender, 10–50 cm tall**
    - *Annual with fibrous roots; stems slender, 10–50 cm tall*. **Elytrachne obtusa**

32. **Perennial with fibrous roots; stems 100–150 cm tall**
    - *Perennial with fibrous roots; stems 100–150 cm tall*. **Elytrachne macracantha**
...Eichhornia crassipes (Mart.) Solms - PIGWEED. An annual with floating leaves, flowers, and fruits. This species is commonly found in freshwater environments.

Hydrocharitaceae - Water Family

[Includes Najadaceae of most western floras]

1 Leaf sheaths typically with ear-like appendages [at SNWR?]
   Najas guadalupensis Dele.

1 Leaf sheaths truncate or rounded, without ear-like appendages
   Najas guadalupensis

Najas guadalupensis (Spreng.) Magnus - Common Water-Nymph. Sometimes locally abundant submerged aquatic in shallow water of ponds (Marshall in 1954, without a specific location; Oswald 6404, S side of T111 beside Wetlands Hiking Trail). Summer into fall.

Juncaceae - Rush Family

1 Inflorescence seemingly lateral, the lowest bract cylindrical and exactly like a continuation of the stem.
2 Anthers shorter than to equal to length of filaments, plants densely tufted... Juncus effusus
3 Anthers much longer than filaments, plants forming spreading colonics from creeping rhizomes... Juncus balticus

Juncus effusus L. var. effusus - Common Toad Rush. Locally common in wet places but often locally abundant when found floating on the surface of ponds (Oswald 6104, SW corner of T39; Oswald, S edge of T121). Spring.

Juncus bufonius L. var. bufonius - Common Toad Rush. Locally common in wet areas and along roads and creeks (Oswald 5346, T38) and probably more widespread. Spring. [J. bufonius var. congestus (S.Watson) J.T.Howell]

Juncus bufonius var. congestus Wahl. - Congested Toad Rush. Locally abundant annual collected in a summer-dry marsh (Oswald 5566, T15). Spring.

Juncus triarius L. var. pacificus Fernald & Wiegand - Pacific Rush. Densely tufted perennial known only from a single colony growing in a weedy field bordering a tule marsh near the south end of Cell 2 of Tract C (Oswald 5948). Summer.

Lemnaceae - Duckweed Family

1 Fried with 2-4-nerved roots...
   Lemna minor

2 Fried with 1-4-nerved rotte... Lemna minor

3 Fried with prominent nodal and apical papules... Lemna acutifolia

4 Fried with a row of several papules along midline, the nodal and apical papules not distinct; many papules on upper surface... Lemna gibba

5 Fried with a row of several papules along midline, the midline papules not distinct; many papules on upper surface... Lemna minor

Lemna acutifolia Welw. - Summer Duckweed. Found on one occasion at the southeast corner of Cell 5 of Tract 1 (Oswald 5958) where it formed a dense colony. This duckweed can be identified by the prominent nodal and apical papules, which are visible in the field with the aid of a 10X lens. Collected in late October, the plants vegetative. [L. perpusilla Torr., misapplied]

Lemna gibba L. - Inflated Duckweed. Uncommon but often locally abundant when found floating on the surface of ponds (Oswald 5308, P1). The fronds are dull green and frequently streaked with red. The lower surface is usually noticeably inflated. Most months (plants vegetative).
Lemma minor L. – COMMON DUCKWEED. Locally common in shallow water among fules, especially in the fall of the year (Oswald, near the beginning of the Tour Route, T112). This species is very similar to L. turionifera and, in the absence of anthocyanin pigment and turions, the two species probably cannot be reliably separated. All plants vegetative.

Lemma minuta Humb., Bonpl. & Kunth – LEAST DUCKWEED. Locally abundant on the margins of flooded ponds and in ditches (Oswald 5953, SW corner TD3; Oswald, between Norman Rd. and T23). All collections vegetative. [L. minima Humb. ex Phil.; L. minuscula Herter]

Lemma turionifera Landolt – TURION DUCKWEED. Occasional but usually abundant when found in quiet water of ditches and along the edge of marshes (Oswald 5570, S edge of P102; Oswald, between Norman Rd. and T23). It is most reliably separated from L. minor by the development of reddish anthocyanin pigments on the lower surface. The plants also form starch-filled overwintering bodies (turions) during late fall and winter. All collections vegetative.

Spirodela polyrhiza (L.) Schleid. – COMMON DUCKMEAT. Apparently uncommon, at least during this survey in 1993-94. A few plants were found mixed in with a dense population of Lemma minuta on the edge of a recently flooded field (Oswald 5519, SW corner TD3). Plants vegetative.

LILIACEAE – LILY FAMILY

1 Flowers in scape-like umbel.
2 Perianth segments separate or nearly so.
3 Plants with a strong onion-like odor and taste
   Allium
4 Plants without an onion-like odor and taste
   Muilla
5 Perianth segments united into a definite basal tube; plants without an onion-like odor and taste
   Triteleia
7 Perianth segments separate.
8 Flowers not in scape-like umbel.
9 Green "foliage" consisting of needle-like branchlets borne in the axis of scale-like leaves; plant from rhizome with fleshy tubers
   A. paraguanaeflora
2 Spikelets usually upon distinct pedicels, borne in an open or spike-like raceme or panicle.
3 Spikelets sessile or nearly so.
4 Panicle of I-0 flowered; upper lemmas frequently empty; spikelet not falling entire in groups
   Lemna minor
5 Panicle of I-3 flowered
   Lemna minima
6 Flowers white; styles 3, distinct to the base
   Lemna minor
7 Flowers yellow; style 1, more or less lobed at the summit
   Lemna minima

Allium amplifolium Torr. – CLASPING ONION. Uncommon herbaceous perennial occurring in localized populations in adobe soil of grassy fields (Anderson 91, uncommon in 1938, Oswald 6046, SW corner of TAB3; Oswald 6099, NW corner of P7A4; Silveira, N edge T18). Spring.


Brodiaea coronaria (Salish) Engl. var. coronaria – HARVEST BRODIAEA. Perennial from a fleshy bulb, typically growing in adobe clay soils. At the refuge, it is known only from scattered colonies in upland grassland in the northwest corner of Tract G (Oswald 5322). Spring.


Muilla maritima (Torr.) S. Watson – MUILLA. Bulbous perennial in adobe soil of grassy fields, often growing with Zigadenus fremontii (Oswald 6039, TG; Oswald 6047, SW corner of TAB3; Oswald in 1994, W side of P7A5). Spring.

Triteleia laxa Bentham. – ITHURIEL’S-SPEAR. Perennial from a deep-seated bulb reported as abundant and found almost everywhere on the refuge in 1938 (Anderson 94). Today it is known only from a localized population in adobe soil of a grassy flat in southwest corner of Cell 4, Pool 7A (Oswald 6100). Spring. [Brodiaea laxa (Benth.) S. Watson]

Zigadenus fremontii (Torr.) Torr. ex S. Watson – FREMONT’S-DEATH-CAMAS. Apparently common in 1938 over most of the refuge where the soil was not too wet (Anderson 87). Today only scattered colonies grow in adobe clay of low spots in grassy fields and on the borders of marshy places (Marshall in 1954, entrance at RR; Oswald 5967, TG; Oswald, SW corner of TAB3). Early spring. [Includes vars. inezianus Jeps., minor (Hook. & Arn.) Jeps., and salsus Jeps.]

POACEAE – GRASS FAMILY

1 Spikelets with the glumes persistent, the spikelet axis pivoted above them, 1 to many-flowered; upper lemmas frequently empty; spikelet axis often prolonged beyond the upper lemma
2 Spikelets sessile or nearly so.
3 Spikes usually more than one; spikelets on one side of the axis, forming 1-sided spikes (Tribe Chlorideae).
4 Panicle of slender spikes arranged more or less in an elongate axis
5 Lemmas awned, spikelets 7-11 mm long
   Lepidium fasciculare
6 Lemmas awnless; spikelets 5-7 mm long
   Lepidium campestre
7 Panicle of slender spikes in an umbel-like arrangement
   Comus
8 Spike terminal, single; spikelets alternating on opposite sides of the axis (Tribe Hordeae).
9 Spikelets solitary at each node of the spike axis.
10 Spikelets 1-flowered, awns so low as to be not seen in the spike axis.
11 First glume absent; spike straight
   Panicum
12 First glume present; spike curved
   Parapholis
13 Spikelets 2-3 at each node of the spike axis.
14 Spikelets 4-5 at each node of the spike axis, the lateral pair pedicelled, usually reduced to awns.
15 Plants perennial
   Hordeum jubatum
16 Plants annual
   Hordeum murinum
17 Spikelets 3 at each node, 3 at each node of the spike axis, with ciliate margins
   Hordeum murinum var. glaucum
18 Anthers of lateral flowers more than 2 times longer than anthers of central flower
   Hordeum marisimum
19 Anthers of lateral flowers as long as central flower
   Hordeum marisimum var. glaucum
20 Glumes not ciliate.
21 Spike ovate to ovate-oblong, usually less than 1 cm long; awns and glumes strongly spreading at maturity
   Hordeum murinum
22 Spike linear-oblong, usually over 5 cm long; awns and glumes not spreading at maturity
   Hordeum depressum
23 Plants 2-3 at each node, 4 at each node of the spike axis
   Trianthium californicum (L.) Nevski
24 Spikelets 3 at each node of the spike axis, the lateral pair pedicelled, usually reduced to awns.
25 Plants perennial
   Hordeum jubatum
26 Plants annual
   Hordeum murinum
27 Spikelets 3 at each node of the spike axis, the lateral pair pedicelled, usually reduced to awns.
28 Plants perennial
   Hordeum jubatum
29 Plants annual
   Hordeum murinum
30 Spikelets 3 at each node of the spike axis, the lateral pair pedicelled, usually reduced to awns.
31 Plants perennial
   Hordeum jubatum
32 Plants annual
   Hordeum murinum
33 Spikelets 3 at each node of the spike axis, the lateral pair pedicelled, usually reduced to awns.
34 Plants perennial
   Hordeum jubatum
35 Plants annual
   Hordeum murinum
16 Spikelets without sterile lemmas below the fertile lemmas; palea 2-nerve.
17 (Tribe Agrostideae) .............. Agrostis

20 Palea short, compact, usually partly encased in the sheath.
21 Sheath margins hairy. ................. Cynosurus cristatus
22 Sheath margins glabrous. .............. Cynosurus echinatus
15 Spikelets 2 to many-haired.

22 Lemmas usually shorter than the empty glumes; the awn dorsal and usually bent
(Tribe Aveneae).

43 Spikelets not strongly flattened; glumes, or at least 1, usually developed.

43 Spikelets strongly flattened laterally; glumes reduced or wanting (Tribe
Aveneae).

47 Lemma and pa
cepa leathery or papery, very different in color and appearance from the

48 Glumes awnless; apex of palea usually enclosed by the lemma.

49 Sterile and fertile lemmas awnless or awn-tipped; primarily branches of
inflorescence 0-6 cm long; leaves usually purple-tinged. Echinochloa crus-galli
48 Glumes awnless; apex of palea usually enclosed by the lemma. 

51 Racemes slender, 
52 Racemes a pair at the summit of the stem. Paspalum dichotomum

52 Racemes several to many, forming a panicule. Paspalum dilatatum

50 Inflorescence diffuse, not 1-sided, spike-like racemes. Paspalum

45 Lemma and pal
ces thin, transparent, much more delicate in texture than the glumes.

46 Spikelets in pairs (Tribe Andropogoneae) . . . . . . . . . . . . . . . . . . . . . . . Sorgum

47 Spikelets not nodding; glumes less than 1 cm long.

53 Lemmas long-awned.

55 Lemmas awnless; glume lobes either absent or less than 0.6 mm long and not
ciliate-fingered. Polypogon monspeliensis

55 Lemmas long-awned. 

56 Mature panicked well-awned. Aelepecurus

56 Mature panicked usually at least partially enclosed in the enlarged leaf sheaths.

57 Sheath margins glabrous. Cynosurus echinatus

57 Sheath margins glabrous. Cynosurus cristatus

Agrostis avenacea J.G.Gmel. – PACIFIC BENT.
Common and widespread weedy grass along the edge of marshes and in
vernal wetland, grassy fields (Marshall in 1954, without a location; Oswald 5360, SW side T211). Late spring.

Aelepecurus saccatus Vasey – PACIFIC MEADOW-FOXTAIL. Common annual in vernal pools (Oswald 5326, TG). Spring.

Arundo donax L. – GIANT-REED. Tall, tufted, bamboo-like perennial along streams, ditches, and
marshy fields (Oswald 5956, Wetlands Hiking Trail). Native to Europe. Fall.

Avena barbata Brot. – BARBED OAT. Common and widespread annual along roads and in grassy fields.
Native to southern Europe. Spring.

Avena fatua L. – WILD OAT. Annual grass along roads and in grassy fields (Anderson 30, common along
large drains and on high ground; Hanson in 1950, without

Avena fatua L. – WILD OAT. Annual grass along roads and in grassy fields (Anderson 30, common along
large drains and on high ground; Hanson in 1950, without a location; Marshall in 1954, without a location). It
is less common than the previous oat, from which it can be

Bromus diandrus Roth – RIPGUT BROME. Coarse annual grass along roads, on dikes, in weedy fields, and
in other disturbed places (Hanson in 1950, without a location; Marshall in 1954, without a location). Native to
Europe. Spring. [Bromus rigidus Roth]

Bromus hordeaceus L. – SOFT CHES. Common and widespread grass in upland fields and along roads
and ditches (Anderson 34, on rice checks throughout the

Bromus hordeaceus L. – SOFT CHES. Common and widespread grass in upland fields and along roads
and ditches (Anderson 34, on rice checks throughout the

Bromus madritensis L. ssp. rubens (L.) Husn. – RED BROME. Common annual forming localized patches in
grassy fields and on the margins of vernal pools (Anderson 19, Logan Creek “NE of hog ranch buildings.”

29
Cortaderia selloana (Schult.) Asch. & Graebn. – uruguayan pampasgrass. Tall tufted perennial planted near the woodlot in Tract 31. A single clump, which would appear to be of natural origin, is located in T4. Native to eastern South America. Fall.

Cystisus schoenoides (L.) Lam. – swamp pricklegrass or swamp-timothy. Common and locally abundant European grass on the dry beds of marshes (Oswald 5409, TAB) and in roadside gravel. Late spring and summer. [Haleochloa schoenoides (L.) Host]

Cystisus vaginiflora (Forssk.) Opiz – african pricklegrass. The first North American collection of this Eurasian annual was made by Burtt-Davy at Norman in 1898. In 1937, Anderson lists it as being sparse in the southeast corner of section 25 (Anderson 28). Today it is a widespread and locally abundant weed on the dry beds of seasonally flooded marshes and in summer-dry ponds. Two forms occur on the refuge, sometimes growing side by side. One is very compact, forming small, round, brittle tufts less than 1 dm in diameter (Oswald 5497, NE¼ T18); the other has elongated internodes and forms loose spreading plants 2–3 dm in diameter. John R. Reeder of the University of Arizona has kindly examined a specimen of the latter type (Oswald 5634, SW corner of T5) and reports that it is within the range of variation for C. vaginiflora. Late spring and summer. [C. aculeata (L.) Aiton, misapplied; C. nilica (L.)]

Cynodon dactylon (L.) Pers. – Bermuda-grass. Reported as uncommon near headquarters and in section 15 in 1937 (Anderson 45). Today it is a common perennial forming dense matted colonies in dry marshes and along creek edges, ditches, and roads (Oswald & Ahart 5419, edge of Norman Rd.; Oswald, P1A). Native to Africa. Late spring and summer.

Deschampsia danthonioides (Trin.) Munro ex Benth. – annual hairgrass. Widespread and locally abundant annual on the margins and drying beds of shallow vernal pools and drainages (Marshall in 1954, without a location). Spring.

Digitaria sanguinalis (L.) Scop. – hairy crabgrass. Weed in roadside gravel, lawns, and other disturbed places, relatively uncommon at the refuge (O’Neill in 1961, without a location; Oswald & Ahart 5420, along Norman Rd.; Oswald, Visitor’s Parking Lot at the headquarters complex). Late spring into fall.

Distichlis spicata (L.) Greene – saltgrass. Widespread and locally abundant perennial in low, grassy fields and along marshes, especially in more alkaline places (Anderson 15, over most of the refuge; Hanson in 1951, without a location; Oswald & Ahart 5425, ditch along Norman Rd.). Spring. [Includes vars. divaricata (Beetle, nana) Beetle, stolonifera Beetle & stricta (Torr.) Beetle]

Echinochloa colona (L.) Link – jungle-rice. Reported as an uncommon grass in wet areas in 1937 (Anderson 70). It was not relocated during the 1993–94 survey. Native to Eurasia. Summer and fall.

Echinochloa crus-galli (L.) P.Beauv. – watergrass or millet. Common along the edge of marshes and in flooded fields, where it is managed for waterfowl (Anderson 42, common along all wet places; Hanson in 1951, without a location; Oswald 5637, NW corner of P1). Native to Eurasia and Africa. Summer.

Ellytrigia pontica (Podp.) Holub ssp. pontica – tall wheatgrass. Common tall bunchgrass along roads and in grassy fields (Oswald 5696, along Norman Rd.). It has been seeded in several of the upland tracts in the south part of the refuge. Native to Eurasia. Summer. [Agropyron elongatum (Host) P.Beauv., in part]

Festuca arundinacea Schreb. – tall fescue. Occasional tufted perennial along ditches and creeks (Oswald, Wetlands Hiking Trail in T11; Oswald, along Logan Creek bordering P1A). Native to Europe. Spring.

Hainardia cylindrica (Willd.) Greuter – barngrass. Uncommon but locally abundant European annual in grassy fields (Oswald 5411, N edge of TAB; Oswald & Ahart 5413, NE corner of TG). It is superficially similar to sicklegrass (Parapholis incurva), from which it differs in having a straight rather than curved inflorescence and spikelets with single rather than paired glumes. It is not recorded from the northern Sacramento Valley in the Jepson Manual. [Monterma cylindrica (Willd.) Coss. & Durand]

Hordeum depressum (Scribn. & J.G.Sm.) Rydb. – dwarf barley. Common and widespread annual in vernal wet, alkaline soils, often on the borders of vernal pools (Hanson in 1950, without a location; Oswald 5299, NE corner T16). Spring.

Hordeum jubatum L. – foxtail barley. Widespread and attractive grass in roadside ditches, on the edge of marshes, and along shallow drainages in grassy upland fields (Anderson 13, W of headquarters area; Hanson in 1950, without a location; Marshall in 1954, without a location; Oswald 5317, T17). Spring, sometimes heading out again in the fall.

Hordeum marinum Huds. ssp. gussoneanum (Parl.) Thell. – Mediterranean barley. Common annual along roads, along dry edges of vernal pools, in fields, and in waste places (Anderson 37, found on a few of the rice checks in 1937; Oswald 5301, NE corner T16). Native to Europe. Spring. [H. hystrix Roth; H. gussoneanum All.]

Hordeum murinum L. ssp. leporinum (Link) Arcang. – HARE BARLEY. Coarse annual on levees, along roads, and in other weedy places (Oswald 5966, Parking Area D in NE corner P7). Native to Europe. Spring. [H. leporinum Link]

Leersia oryzoides (L.) Sw. – RICE CUTGRASS. Common in wet soil or shallow water on the margins of marshes and streams, usually forming spreading colonies (Marshall in 1954, without a location; Oswald 5935, W edge of T13). Summer.

Leptochloa fascicularis (Lam.) A.Gray – BEARDED SPRANGLETOP. Common annual on the dry beds of marshes (Hanson 17-51, without a location; Oswald 5499, NE corner of T18). Late spring and summer. [Diplachne fascicularis (Lam.) P.Beauv.]

Leptochloa uninervia (C.Presl) Hitchc. & Chase – MEXICAN SPRANGLETOP. Common grass in drying marshes (Oswald 5407, TAB3). Although listed as an annual, at least some of the plants on the refuge have a distinctly perennial aspect. Late spring. [Diplachne uninervia (C.Presl) Parodi]

Lolium multiflorum Lam. – ANNUAL RYEGRASS. Common and widespread annual grass along roads, in both marshy and upland fields, and in waste places (Marshall, without any data). Native to Europe. Spring.

Orcuttia pilosa Hoover – Hairy Orcuttgrass. Rediscovered at the refuge by Joseph Silveira in 1993, this rare annual grows on the dry beds of vernal pools in populations varying from less than 50 plants to more than a thousand individuals (Silveira & Oswald in 1993, P1, Silveira & Oswald in 1993, TC2; Oswald 5403, TAB3; Silveira & Oswald in 1993, TAB3; Silveira & Oswald in 1993, T18). Anderson collected an Orcuttgrass, which he identified as O. californica, on the damp bed of Farmer Waite Lake (now approximated by Cell 3 of Pool 1A) in 1937. Since O. pilosa was not separated from O. californica until 1941, O. californica would have been the logical choice available to him in Jepson's Manual of the Flowering Plants of California (1925). Since O. californica as now defined is restricted to southern California, Anderson's grass can reliably be referred to O. pilosa. CNPS Inventory List 1B. Late spring.

Oryza sativa L. – CULTIVATED RICE. At one time grown on the refuge and represented by an old collection in the SNWR herbarium (Hanson in 1951). Summer.

Panicum capillare L. – WITCHGRASS. Annual grass found in the parking area at the viewing platform at the south-east corner of the Tour Route (Oswald 5693). Summer.

Parapholis incurva (L.) C.E.Hubb. – SICKLEGRASS. Locally abundant European annual on the edges of drying alkaline pools and in vernally wet grassy fields (Oswald 5313, P1). It is superficially similar to Hainardia cylindrica, from which it differs in having a curved inflorescence and spikelets with paired glumes. It is recorded only from salt marshes along the coast in The Jepson Manual, page 1278. Spring. [Pholiurus incurvus (L.) Schinz & Thell.]

Paspalum dilatatum Poir. – DALLISSGRASS. Common perennial along marshes and in other wet places (Anderson 22, in drains, canals, ditches, and streams; Oswald, Wetlands Hiking Trail). Native to South America. Spring & summer.

Paspalum distichum L. – KNOTGRASS. Common and locally abundant perennial in shallow water or later on the dry margins of marshes (Oswald, P1A3). Late spring and summer.

Phalaris aquatica L. – HARDING-GRAASS OR PERLA­GRASS. Tufted perennial scattered along roads and sometimes planted in fields (Oswald, NE side of T31). Native to Mediterranean Europe. Spring. [P. stenoptera Hack.; P. tuberosa L. var. stenoptera (Hack.) Hitchc.]

Phalaris lemmonii Vasey – Lemmon's Canary­GRASS. Uncommon annual in shallow vernal pools in upland grassy fields (Oswald 5332, TG). Spring.

Phalaris minor Retz. – LESSER CANARY-GRASS. Occasional weedy annual along canals, creeks, and levees (Oswald 6159, NW corner T16). Native to the Mediterranean area. Spring.

Phalaris paradoxa L. – MEDITERRANEAN CANARY­GRASS. Occasional weedy annual in grassy fields and along roads (Marshall in 1954, without a location; Oswald 5352, NE corner T41). Native to Mediterranean Europe. Spring.

Poa annua L. – ANNUAL BLUEGRASS. Locally common annual on levee roads and in parking lots, lawns, and other disturbed places (Oswald 5963, levee road on N side P7). The plants are often grazed by waterfowl. Native to Europe. Spring.

Polypogon maritimus Willd. – MEDITERRANEAN BEARDGRASS. Locally common annual in drying marshes and vernal pools (Hills in 1982, without a location; Oswald 5343, T36). Native to Mediterranean Europe and Africa. Spring.

Polypogon monspeliensis (L.) Desf. – ANNUAL BEARDGRASS. Locally abundant annual along the edges of vernal pools, in vernally wet drainages, and in ditches (Anderson 18, not common along Logan Creek and drains; Hanson in 1950, without a location). Native to southern and western Europe. Spring.

Puccinellia simplex Scribn. – LESSER ALKALI­GRASS. Locally abundant annual on the margins of drying alkaline pools and scalds (Oswald 5328, TG). Spring.

Setaria parviflora (Poir.) Kerguélen – PERENNIAL BRISTLEGRASS. Uncommon tufted perennial in roadside ditches along Norman Rd. (Oswald & Ahart 5416). Late Spring. [S. geniculata (Lam.) P.Beauv., misapplied; S. gracilis Kunth]

Setaria purpurea (Poir.) Roem. & Schult. – YELLOW BRISTLEGRASS. Annual grass represented by a collection
in the SNWR herbarium (O’Neill in 1961, Norman Rd. along West Canal seeps). Summer. [S. glauca (L.) P. Beauv.; S. lutescens (Weigel) F.T. Hubb.; Chaetochloa lutescens (Weigel) Stuntz]

Sorghum halepense (L.) Pers. – JOHNSONGRASS. Common perennial from stout rhizomes in moist to dry places along roads and creeks. Native to the Mediterranean. Late spring and summer.

Tuctoria greenei (Vasey) Reeder – GREENE’S TUCTORIA. A rare annual grass discovered by Joseph Silveira in 1994 (Silveira s.n.). About 55 plants were found on the dry bed of a vernal pool in Cell 1 of Pool 1. The related Orcuttia pilosa grows in the same pool. CNPS Inventory List 1B. Late spring.

Vulpia myuros (L.) C.C.Gmel. var. hirsuta Hack. – FOXTAILFESCUE. Common and locally abundant spring annual in fields, margins of vernal pools, and other grassy places (Oswald 6004, TAB). Native to Europe. Spring. [Festuca megalura Hack.]

Vulpia myuros (L.) C.C.Gmel. var. myuros – RATTAIL FESCUE. Common and locally abundant spring annual in fields, margins of vernal pools, and other grassy places (Marshall in 1954, without a location; Oswald 5302, NE corner T1). Native to Europe. Spring. [Festuca myuros L.]

Potamogetonaceae – PONDWEED FAMILY

1 Leaves all submerged and similar: 

Potamogeton pectinatus L. – SAGO PONDWEED. Locally abundant submersed perennial in quiet water of deeper ponds and in flowing water of ditches (Anderson 47, in Gravel Pit Lake; Hanson 9-51, without a location; Oswald 5367, gravel pit in TC1; Oswald 5493, ditch near the SW corner of the Tour Route. In the latter plants, the sheath extends past the blade 4–7 mm, forming a hyaline ligule). Spring & summer.

Potamogeton nodosus Poir. – LONG-LEAVED PONDWEED. Represented by an old collection in the SNWR herbarium (Hanson 9-51, without a location), the plants growing in both running and still water 4–5 ft deep. It is also reported from the canal along Hwy. 99 in 1937 (Anderson 63). Summer. [P. americanus Cham. & Schltdl.]

TYPHACEAE – CATTAIL FAMILY

Typha angustifolia L. – NARROW-LEAVED CATTAIL. Relatively uncommon cattail, forming colonies in marshes (Oswald, S edge of PIA3). Late spring.

Typha domingensis Pers. – SOUTHERN CATTAIL. This is the more common of the narrow-leaved cattails in marshy places on the refuge (e.g., between the visitor’s parking area and the headquarters complex). Late spring.

Typha latifolia L. – BROADLEAF CATTAIL. Widespread perennial forming large colonies in marshes, sloughs, and ditches. Late spring.

ZANNICHELLIACEAE – HORNED-PONDWEED FAMILY

Zannichellia palustris L. – HORNED-PONDWEED. Locally abundant submersed perennial in ditches and marshes (Marshall in 1955, without a location; Oswald 5469, west boundary of the refuge near the headquarters complex; Oswald 5574, T30). Spring and summer.
APPENDIX I. Plants growing on the Sacramento National Wildlife Refuge that are listed in the CNPS Inventory of Rare and Endangered Vascular Plants of California (Skinner & Pavlik, 1994).

Astragalus tener var. ferrisiae, List 1B.
Atriplex cordulata, List 1B
Atriplex depressa, List 1B.
Atriplex joaquiniana, List 1B.
Atriplex persistens, List 1B.
Chamaesyce hooveri, List 1B, PT
Cordylanthus palmatus, List 1B, CE, FE (transplant populations).
Eleocharis parvula, List 4.
Juglans californica var. hindsii, List 1B (our plants naturalized).
Lepidium latipes var. heckardii, List 1B.
Myosurus minimus ssp. apus, List 3 (identification uncertain; see discussion under M. minimus).
Orcuttia pilosa, List 1B, CE, PE.
Tuctoria greenei, List 1B, CR, PE.

CNPS LISTS

1B Rare, threatened, or endangered in California and elsewhere.
3 Plants about which we need more information—a review list.
4 Plants of limited distribution—a watch list.

STATE LISTS

CE State listed, endangered.
CR State-listed, rare.

FEDERAL LISTS

FE Federally listed, endangered.
PE Federally-proposed, endangered.
PT Federally-proposed, threatened.
APPENDIX II. Plot map showing the distribution of some of the rare plants on the Sacramento National Wildlife Refuge.
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