BASELINE ASSESSMENT

FOR

RIPARIAN RESTORATION

AT THE

1000-ACRE RANCH RESTORATION AREA

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SECTION ONE

1000-ACRE RANCH

RESTORATION PLANTING RECOMMENDATIONS

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Introduction

The 1000-acre Ranch tract is located approximately 2.75 miles south of Princeton in Colusa County on the west side of the Sacramento River at river mile 160 and is owned by The Nature Conservancy. The entire tract is 60 acres in area including land that is covered by flood control levees. The 1000-acre Ranch Restoration Area (hereafter "Restoration Area") comprises 50 acres of the tract inside the levees and is currently a plum orchard with no evident topography. East of the Restoration Area is mixed riparian forest and cottonwood riparian forest with large valley oaks along the edge of the Restoration Area. The southern portion of the Restoration Area is bounded by a narrow strip of herbaceous weeds and a dirt road with no evident native vegetation before the beginning of the Yerxa walnut orchard. The west and north are bounded by the levee with the Green Valley Corporation plum orchards on the far side with no evident native recruitment.

Field surveys of nearby remnant riparian vegetation, site soils and birds were conducted during May, June and July, 2005, at the Restoration Area. Information on special status animals and non-native mammals for the site was also compiled during that time.

Five natural plant communities were found to occur close to the Restoration Area: Great Valley mixed riparian forest, Great Valley cottonwood riparian forest, Great Valley willow scrub, elderberry savanna, and herbland (Holland 1986; Figure 1). With the exception of herbland, all of these communities in some form (i.e. may differ in nomenclature) are on the list of California Terrestrial Natural Communities recognized by The California Natural Diversity Database (CA DFG 2003). A detailed discussion of nearby remnant riparian vegetation is in Section Two.

The restoration planting recommendations are presented below with supporting vegetation and soil surveys in Sections Two and Three. The special status animal and non-native mammal information is in Section Four.

Adjacent Landcover

The 1000-acre Ranch tract is adjacent to three properties. To the east is the 69-acre Stegeman tract owned by the Wildlife Conservation Board and managed by California Department of Fish and Game as the northern parcel of the Stegeman Unit of their Sacramento River Wildlife Area. The Stegeman tract is comprised of remnant riparian vegetation (59 acres) and a fallow walnut orchard (10 acres) which is the Restoration Area. To the south is the 76-acre Yerxa property, with a young walnut orchard adjacent to the Restoration Area. More than half of the Yerxa property is remnant riparian vegetation, which occurs to the east of the orchard. An approximately 5 m wide strip of herbaceous weeds and a dirt road separates this property from the Restoration Area. To the west and north is 196 acres owned by Green Valley Corporation with a fruit drying facility and mature plum orchards. The levee separates the Restoration Area and this property by approximately 40 m.

Methods

The 50-acre Restoration Area was stratified into sections based on soils, topography and geomorphology. The sections were determined from aerial photographs and soil maps, and refined as needed upon site review. Potential plant communities were chosen for the Restoration Area utilizing the remnant riparian vegetation community descriptions and Restoration Area soil descriptions and estimated elevations (not shown), including the influence of historic channels and estimated flood frequency (Figures 1-4; Sections Two and Three). In the figures, the information on flood frequency comes from Department of Water Resources (DWR) 1997 data whereas the aerial photographs are from 1999. Thus on occasion the two do not coincide due to

changes in landform and river location between the two time periods. Furthermore the DWR estimated flood frequencies do not account for local topography and thus the estimated flood frequencies may not represent actual flooding patterns (CA DWR 2002, US ACOE 1997). Although only the flood frequencies are shown here, restoration recommendations take into account the topography data from the U.S. Army Corps of Engineers 1997 digital elevation model (DEM) with 2 foot contours. Since the error on these data is +/- 2 feet, only differences greater than 4 feet are considered real. The potential plant communities are based on Holland's riparian communities (1986). Since biodiversity enhancement is an important restoration goal, species composition of the Holland community is adjusted to reflect nearby remnant riparian plant communities and local differences in that plant community (Hubbell and Efseaff 1998).

Recommended frequencies for woody species are based on species frequency in the remnant riparian vegetation, visual dominance and biodiversity concerns (Tables 1 and 2; Peterson et al. 2003, Wood 2003). For communities where no nearby remnant vegetation data exist, data from other baseline assessments with that community were used (e.g. Hubbell et al. 1998, 1999a-d, 2003a-d) or estimates were made based on expected frequency of a species for that community. Remnant riparian woody species frequency was calculated in two ways to provide information on both species composition and distribution for recommended woody species. (1) Calculating remnant riparian woody species frequency across quadrants provides data on species composition and thus is referred to as <u>composition frequency</u> in this document. Within a remnant riparian community type composition frequency was calculated as: number of quadrants a species occurred in divided by total number of quadrants sampled times 100 (Table 4). Since remnant riparian vegetation composition frequencies for woody species are by one of three physiognomic classes, and recommended composition frequencies are for all woody species lumped together, then recommended composition frequencies will be 1/3 of those found in the remnant vegetation and then possibly adjusted as noted above (Table 1). For species that occurred in multiple physiognomic classes the composition frequency was totaled and then divided by three. (2) Calculating remnant riparian woody species frequency across sampling points provides data on species distribution within the community (e.g. is it clumped or ubiquitous) and thus is called <u>distribution frequency</u> in this document (Table 2). These data can be utilized in the details of the planting design. Within a remnant riparian community type distribution frequency was calculated as: number of points a species occurred at divided by total number of points sampled times 100 (Table 4). For recommendations of species that occurred in multiple physiognomic classes, distribution frequency was calculated across these physiognomic classes. Thus remnant vegetation distribution frequencies are more similar to recommendations.

The species composition and abundance recommendations for herbaceous species are predominantly based on local visual dominance in remnant riparian areas, ecologically-based substitutions of natives for those non-natives common in remnant areas, and biodiversity enhancement (Table 3; Peterson et al. 2003, Wood 2003). Recommendations for herbaceous species are not as precise as are those for woody species due to low occurrence of native herbs in remnant riparian vegetation as well as to the paucity of general information regarding composition and abundance of the herbaceous layer of riparian communities. Holl and Crone's (2004) study of herbaceous communities along a 150 km reach of the middle Sacramento River found no relationship between understory herbaceous communities and overstory dominance. Still, we were able to use Holl and Crone's data as a basis for some of the recommended herbaceous species. If there were data from both remnant riparian vegetation surveys and from Holl and Crone (2004) we used a mean of the two for the basis of our recommendations. Abundance of remnant riparian herbaceous species within a community type was calculated as mean percent cover: percent cover for a species summed over all points divided by the total

number of sampling points (Table 5). Direct seeded grass species are listed without abundances. Only abundance for recommended herbaceous species composition is included here due to the limited data for distribution frequency of remnant riparian herbaceous species (Table 3).

For communities with *Salix* species (cottonwood riparian forest, mixed riparian forest, willow scrub, mule fat scrub, buttonbush scrub) the total recommended herbaceous species coverage is less than 100 % because this value was calculated as 100% minus the sum of mean percent cover for all the *Salix* species in that community.

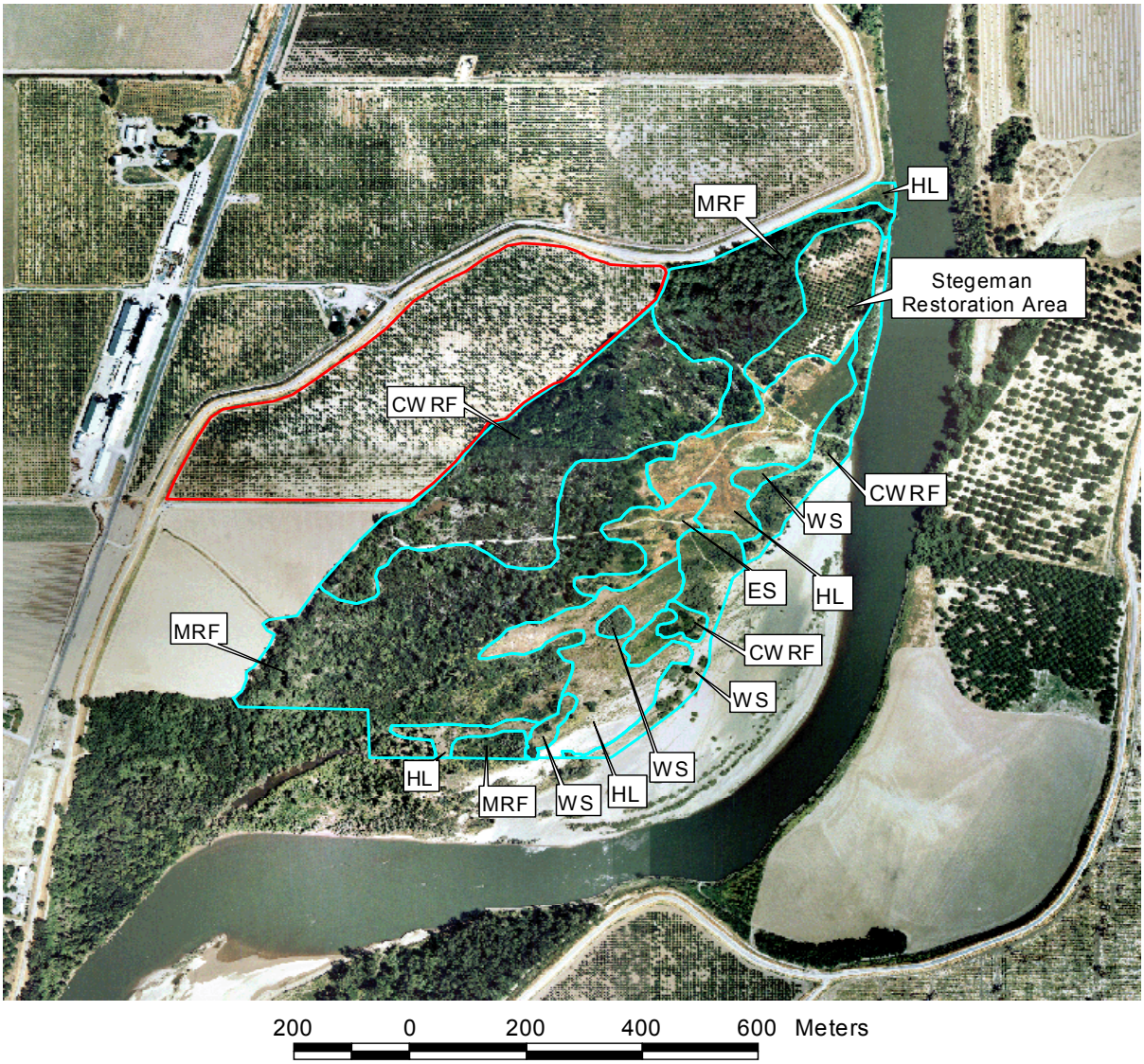
Restoration Type Recommendations

Active horticultural restoration is recommended for this Restoration Area. Direct loss of habitat is one of the primary reasons that many native species and communities of the Sacramento River ecosystem are in such critical conditions. To improve the situation more habitat must be created in the short term. While restoration by natural processes provides one means of creating new terrestrial habitats, the approach has its limitations. Natural process restoration only works in a timely manner on the lowest lying areas of the floodplain where appropriate hydrogeomorphologic conditions exist. Such conditions do not exist here. Sites where natural process restoration is appropriate are limited on the Sacramento River, where much of the habitat that needs to be restored to create large blocks of contiguous habitat is not subject to the erosional and depositional forces that foster natural recruitment events. Higher floodplain lands such as found in this Restoration Area will likely become infested with non-native invasive species (e.g., yellow-starthistle, Johnson grass, Bermuda grass) that will inhibit the colonization and proliferation of native vegetation if the orchard is simply allowed to go fallow. Even when these sites are artificially flooded coincident with the dispersal of native propagules, exotic species come to dominate, as was determined experimentally on the Sacramento River by Peterson (2002) in a collaborative study between U. S. Fish and Wildlife Service and The Nature Conservancy. Thus active restoration of this Restoration Area would be the most efficient method to create habitat relatively quickly. Mitigation measures for the archeological site should be incorporated into all restoration activities.

Restoration Planting Recommendations

Figure 4 depicts the potential plant communities with flood frequency and soil sampling locations. Composition and distribution frequencies for the recommended species within a potential plant community are in Tables 1-3. Communities are placed in arcuate bands as much as possible to simulate the natural vegetation pattern. An arcing band of mixed riparian forest is suggested for the finer-textured soils of the Restoration Area's western portion. Orchard growth appears more robust here in the 1999 aerial photo, further suggesting moister soils. Although the entire Restoration Area is in the modeled 5-year floodplain where valley oak riparian forest would be anticipated, the shallow depth to the water table and clayey soils of the western section make it more appropriate for mixed riparian forest. The band of mixed riparian forest starts in the northeast corner as an extension of the adjacent northern patch of mixed riparian forest and, should the lands to the south ever be restored, the arc could be continued to reconnect to the southern patch of mixed riparian forest. Valley oak riparian forest is suggested for the sandier, coarser-textured soils of the Restoration Area's eastern portion. There is greater depth to the water table here and orchard growth appears less robust in the 1999 aerial photo, further suggesting drier soils. Finally, the reduced flooding of the modeled 5-year floodplain is typical for valley oak riparian forest. Although this restored valley oak riparian forest will be adjacent to a large extant of remnant cottonwood riparian forest there are several large valley oaks along its western edge.

1000-acre Ranch Restoration Area: Remnant Riparian Plant Communities



1000-acre Ranch Restoration Area

Remnant vegetation communities
MRF= Mixed riparian forest
HL= Herbland
WS= Willow scrub
CWRF= Cottonwood riparian forest
ES= Elderberry savannah

N
W E
S

Department of Biological Sciences, CSU, Chico, 2005.
Sources: Department of Water Resources 1999 orthorectified aerial photo.

Figure 1. Remnant riparian plant communities nearby the 1000-acre Ranch and Stegeman Restoration Areas, Colusa County, California.

1000-acre Ranch Restoration Area: Estimated Flood Frequency, Soil Sampling Locations, and Historic River Channels

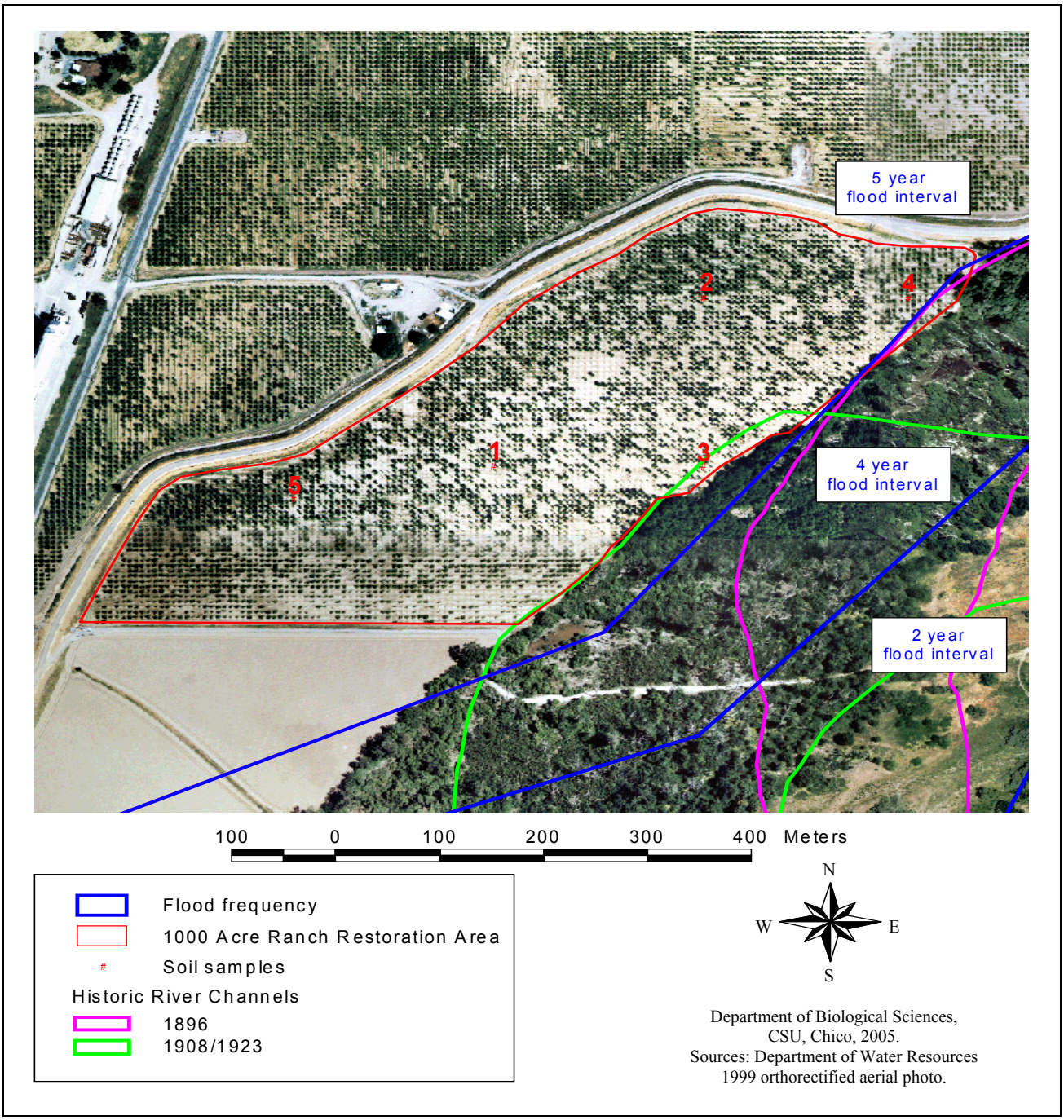


Figure 2. Estimated flood frequency, soil sampling locations, and historic river channels from 1896, 1908, and 1923 at the 1000-acre Ranch Restoration Area, Colusa County, California. The 1908 and 1923 river channel is the same for this stretch of the river. Flood frequencies are from Department of Water Resources 1997 data; air photos are from 1999.

1000-acre Ranch Restoration Area: Potential Plant Communities

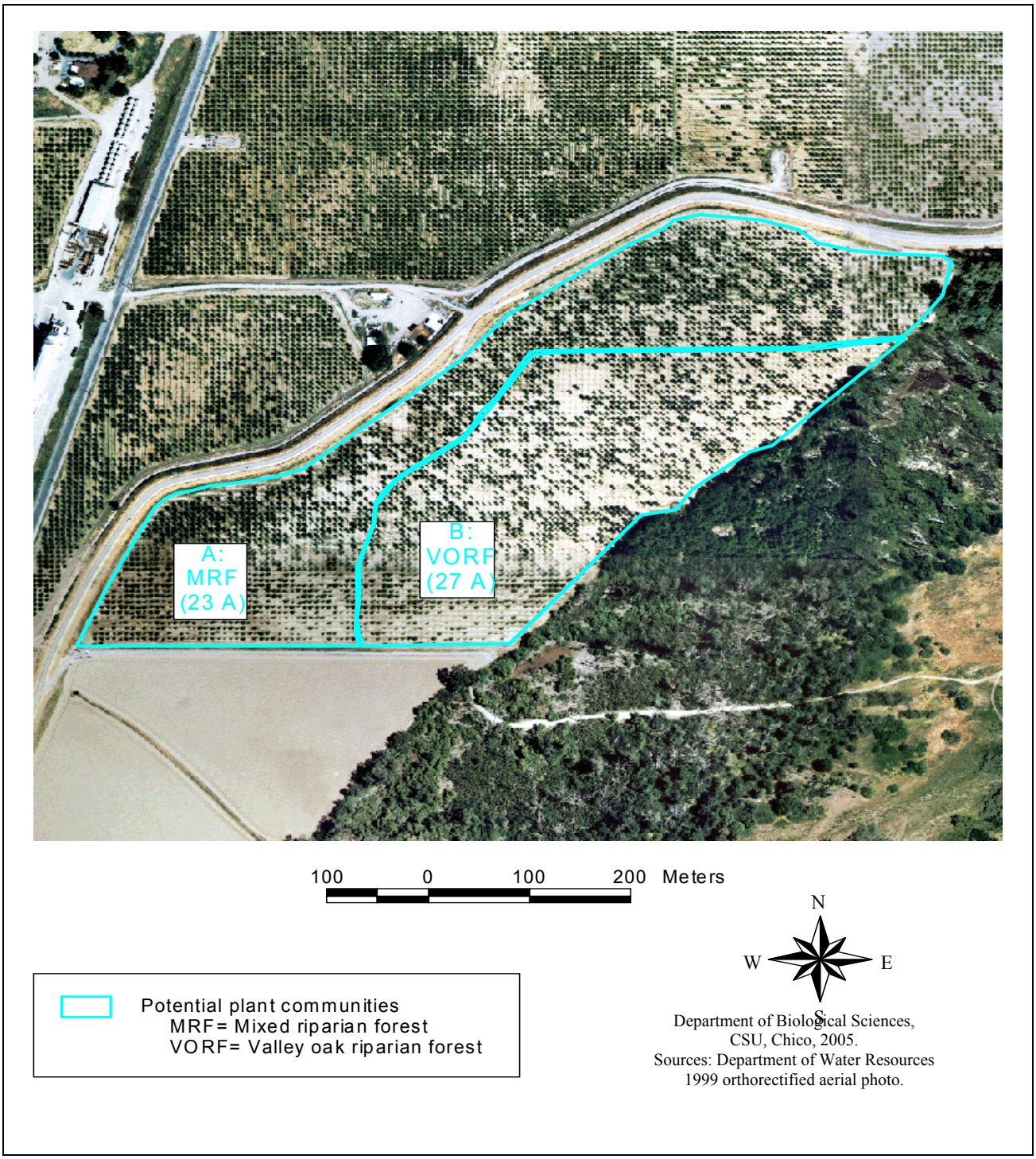


Figure 3. Potential plant communities for the 1000-acre Ranch Restoration Area, Colusa County, California.

1000-acre Ranch Restoration Area: Estimated Flood Frequency, Soil Sampling Locations, and Potential Plant Communities

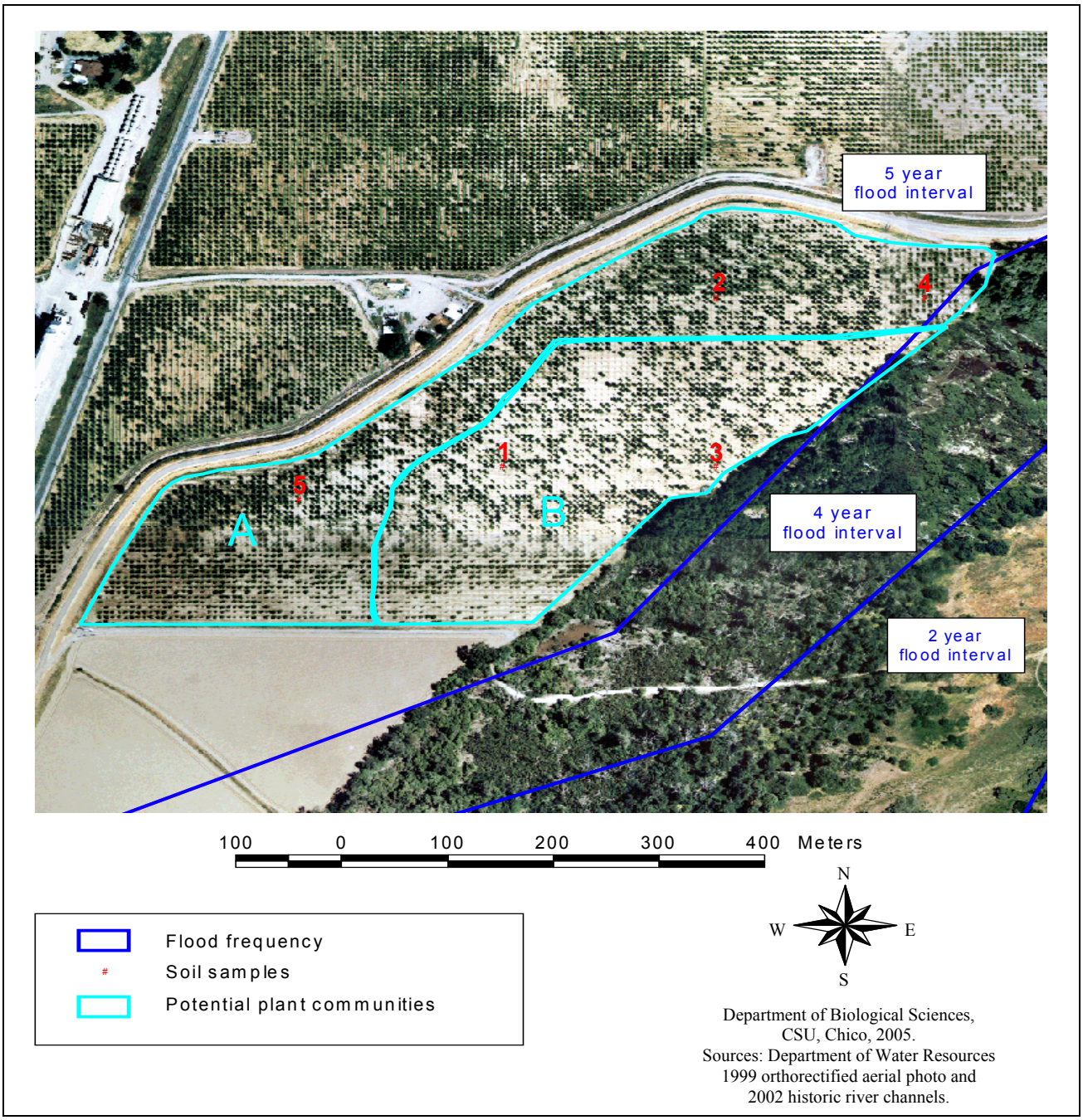


Figure 4. Estimated flood frequency, soil sampling locations, and potential plant communities at the 1000-acre Ranch Restoration Area, Colusa County, California. A is mixed riparian forest (23 acres) and B is valley oak riparian forest (27 acres). Flood frequencies are from Department of Water Resources 1997 data; air photos are from 1999.

Table 1. Composition frequency by community type for potential woody overstory restoration species for the 1000-acre Ranch Restoration Area, Colusa County, California. Remnant vegetation frequency is given by community type for those species recorded during quantitative sampling. Abbreviations are: VORF=Valley Oak Riparian Forest; MRF=Mixed Riparian Forest. A "+" indicates observed but not sampled for that community; a blank indicates not observed. An "H" indicates a species added since listed by Holland. B indicates a species added due to it being found at the Boeger tract VORF. Nomenclature follows The Jepson Manual (Hickman 1993).

		Composition Frequency (%)			
		Remnant Vegetation			
Common Name	**Scientific Name**	**1000-acre Ranch/Stegeman**	**Womble/Jensen**	**1000-acre Ranch Recommendations**	
Woody Species		**MRF (n=56)**	**VORF (n=8)**	**MRF**	**VORF**
box elder	*Acer negundo*	50	B	18	5
western sycamore	*Platanus racemosa*	2	B, H	4	10
Fremont cottonwood	*Populus fremontii*	14		6	
valley oak	*Quercus lobata*		75	3	30
narrow-leaved willow	*Salix exigua*	6		3	
Goodding's black willow	*Salix gooddingii*	H		3	
arroyo willow	*Salix lasiolepis*	23		9	
Oregon ash	*Fraxinus latifolia*	H	H	3	5
California button willow	*Cephalanthus occidentalis* var. *californicus*	H		3	
California rose	*Rosa californica*	5	B, H	4	8
California blackberry	*Rubus ursinus*	43	38	15	10
blue elderberry	*Sambucus mexicanus*				3
western poison oak	*Toxicodendron diversilobum*	14	101	6	14
red willow	*Salix laevigata*	H		3	
shining willow	*Salix lucida* ssp. *lasiandra*	H		3	
California pipevine	*Aristolochia californica*	9	+	4	1
virgin's bower	*Clematis ligusticifolia*	H	B, H	3	1
California man-root	*Marah fabaceus*	5	+	3	1
California wild grape	*Vitis californica*	23	50	9	12
greenbriar	*Smilax californica*		H		1
Total Coverage				100	100

Table 2. Distribution frequency by community type for potential woody overstory restoration species for the 1000-acre Ranch Restoration Area, Colusa County, California. Frequency is given by community type for those species recorded during quantitative sampling. Abbreviations are: VORF=Valley Oak Riparian Forest; MRF=Mixed Riparian Forest. A blank indicates not observed. An "*" indicates estimated frequency for species that were recommended but not sampled within a remnant community. Nomenclature follows *The Jepson Manual* (Hickman 1993).

Common Name	Scientific Name	1000-acre Ranch Recommendations	
		Distribution Frequency (%)	
Woody Species		**MRF**	**VORF**
box elder	*Acer negundo*	64	10*
western sycamore	*Platanus racemosa*	7	50*
Fremont cottonwood	*Populus fremontii*	43	
valley oak	*Quercus lobata*	10*	100
narrow-leaved willow	*Salix exigua*	7	
Goodding's black willow	*Salix gooddingii*	10*	
arroyo willow	*Salix lasiolepis*	29	
Oregon ash	*Fraxinus latifolia*	10*	10*
California button willow	*Cephalanthus occidentalis* var. *californicus*	10*	
California rose	*Rosa californica*	14	50*
California blackberry	*Rubus ursinus*	50	50
blue elderberry	*Sambucus mexicana*		10*
western poison oak	*Toxicodendron diversilobum*	21	100
red willow	*Salix laevigata*	10*	
shining willow	*Salix lucida* ssp. *lasiandra*	10*	
California pipevine	*Aristolochia californica*	14	10*
virgin's bower	*Clematis ligusticifolia*	10*	10*
California man-root	*Marah fabaceus*	7	10*
California wild grape	*Vitis californica*	29	100
greenbriar	*Smilax californica*		10*

Table 3. Mean percent cover by community type for potential herbaceous understory restoration species at the 1000-acre Ranch Restoration Area, Colusa County, California. Abbreviations are: VORF=Valley Oak Riparian Forest; MRF=Mixed Riparian Forest. Abundances in italics are from Holl and Crone (2004). A blank indicates not observed. An "E" indicates species to be planted on the edge. The "*" indicates that the source data are for this genus and one or more appropriate species were selected to represent the genus. A "DS" indicates that these species will be direct seeded and thus not planted as plugs. Note that the herbaceous component is less than 100 % in communities with *Salix* species (see Methods). Nomenclature follows *The Jepson Manual* (Hickman 1993).

		Mean Percent Cover			
		Remnant Vegetation			
Common Name	**Scientific Name**	**1000-acre Ranch/ Stegeman**	**Womble/Jensen**	**1000-acre Ranch Recommendations**	
Herbaceous Species		**MRF (n=14)**	**VORF (n=2)**	**MRF**	**VORF**
mugwort	*Artemisia douglasiana*	6.00		10	10
horseweed	*Conyza canadensis*	*0.05*		2	
fireweed	*Epilobium ciliatum*	*0.05*		2	
goose grass	*Galium aparine*	10.00	*10*	9	10
lotus	*Lotus purshianus*	*0.05*		2	
bugleweed	*Lycopus americanus*	*0.09*		2	
nettle	*Urtica dioica*	2.00		5	
western goldenrod	*Euthamia occidentalis*			11	
California goldenrod	*Solidago californica*			11	
hairy evening-primrose (E)	*Oenothera elata*			5	
Santa Barbara sedge	*Carex barbarae*	3.00*		11	50
clustered field sedge	*Carex praegracilis*	3.00*		8	30
blue wildrye	*Elymus glaucus* ssp. *glaucus*	1.00		DS	DS
creeping wildrye	*Leymus triticoides*		H	DS	DS
meadow barley	*Hordeum brachyantherum*			DS	DS
Total Coverage				79	100

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SECTION TWO

1000-ACRE RANCH

REMNANT RIPARIAN VEGETATION SURVEY

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Introduction

Remnant riparian vegetation surveys of nearby stands are used as a reference for potential vegetation communities and for determining planting recommendations in the Restoration Area. Vegetation surveys were conducted in May 2005.

East of the Restoration Area is mixed riparian forest and cottonwood riparian forest with large valley oaks along the edge of the Restoration Area. No significant native recruitment was evident along the southern, western or northern boundaries or within the Restoration Area. Existing remnant riparian vegetation surveyed occurs on land owned by the Wildlife Conservation Board and managed by California Department of Fish and Game as the Stegeman Unit of their Sacramento River Wildlife Area, and the Yerxa private property. Details of adjacent landcover can be found in Section One. The same remnant vegetation was sampled for both the 1000-acre Ranch and Stegeman Restoration Area Baseline Assessments.

Five natural communities were found to occur close to the Restoration Area: Great Valley mixed riparian forest, Great Valley cottonwood riparian forest, Great Valley willow scrub, elderberry savanna, and herbland (Figure 5). Qualitative community descriptions follow Holland (1986). With the exception of herbland, all of these communities in some form (i.e. nomenclature may differ) are on the list of California Terrestrial Natural Communities recognized by The California Natural Diversity Database (CA DFG 2003).

Methods

The vegetation survey maps community types and lists the most obvious plant species for nearby remnant riparian vegetation. Community typing here is qualitative and is based on visually dominant species, overall species list and frequency data rather than complete quantified sampling for community composition. Intergradations occur for most community types in the riparian vegetation. Listing of the visually common plant species was performed during point-quarter sampling and site reconnaissance. Nomenclature follows *The Jepson Manual* (Hickman 1993). If no common name is listed in *The Jepson Manual* then Oswald and Ahart's (1994) common name was used.

Vegetation sampling was conducted in the remnant riparian vegetation forming the eastern border of the Restoration Area (Figures 1 and 5). Point-quarter sampling was used to quantify frequency of woody species and abundance of herbaceous species (Barbour et al. 1999). Remnant vegetation was stratified into approximate community types using aerial photograph interpretation and GIS vegetation coverage (CA DWR 2002; not shown). Each community type was then sampled to provide enough data to confirm the community type, adjust boundaries, and describe species composition. The amount of sampling for each community is proportional to its area. In each community type within the remnant riparian vegetation at least four sampling points were established (if possible). Forty sampling points, each with four quadrants, were established along several transects running roughly perpendicular to the bands of vegetation. For frequency of woody species, each quadrant was sampled for three types of woody species: trees, shrubs and vines. For each type of woody species, the first species encountered within each quadrant of a sampling point was recorded. Since a number of riparian woody species occur as both trees and shrubs, physiognomic criteria were used (e.g. multiple stems for shrub and diameter at breast height greater than 8 cm for trees). Thus some woody species can be listed in two categories. For abundance of herbaceous species, the percent cover of the three most visually abundant species within a 3 m radius of each sampling point was recorded.

Within each remnant riparian community type and woody species category, frequency was calculated in two ways to provide information on both woody species composition and distribution. (1) Calculating woody species frequency across quadrants provides data on species composition and thus is referred to as <u>composition frequency</u> in this document. Within a

community type composition frequency was calculated as: number of quadrants a species occurred in divided by total number of quadrants sampled times 100 (Tables 4 and 6). These data are the basis for determining frequency of recommended species for restoration. (2) Calculating woody species frequency across sampling points provides data on species distribution within the community (e.g. is it clumped or ubiquitous) and thus is called distribution frequency in this document. These data can be utilized in the details of the planting design. Within a community type distribution frequency was calculated as: number of points a species occurred at divided by total number of points sampled times 100 (Tables 4 and 6). Abundance of herbaceous species within a community type was calculated as mean percent cover: percent cover for a species summed over all points divided by the total number of sampling points (Tables 5 and 7). Total percent herbaceous cover for a given point may sum to above or below 100% as a result of overlapping herb layers or patches of bare ground, respectively.

Species observed in the remnant riparian vegetation were divided into potential woody and herbaceous restoration species (Tables 4 and 5) and species not recommended for restoration (Tables 6 and 7). Composition and distribution frequency by community type are given for species that occurred at the sampling points. Species observed, but not quantitatively sampled, in a community type are noted by a "+" in the tables.

A search of the literature and the California Natural Diversity Database (CNDDB; CA DFG 2005) records was performed to determine potential and known occurrences of threatened and endangered plant species occurring within 1.0 mile of the Restoration Area. A separate CNDDB search was done by USGS quadrangles (7.5'series) to determine additional species with potential to occur on site. Four quadrangles were searched including Princeton, Butte City, Moulton Weir, and Sanborn Slough. An electronic copy of the CNDDB records is included on the Baseline Assessment CD.

River Channel History

The main channel of the Sacramento River scrolled across the remnant riparian vegetation area from at least 1896 through 1964 (CA DWR 2002; Figures 2, 10-12). By 1935 the main channel had moved to the eastern edge of the present day forests, making these forests between 75 and 100 years old (Figures 2, 10 and 11). The herbland, elderberry and willow scrub communities have developed since the channel migrated from this area in roughly 1964 making them as much as 41 years old (Figures 11 and 12). The point bar area to the east (open area with only a few tiny bands of vegetation) was the main channel from at least 1964 to at least 1976 (Figure 11). The small bands of vegetation toward the edge are the 1981 main channel's western edge (Figure 12). Thus most of the point bar developed sometime between 1976 and 1981, with the eastern edge developing between 1981 and 1999. Most of the point bar is therefore between 39 and 24 yrs old, with the eastern edge developing over the last 24 years.

Remnant Riparian Vegetation Community Descriptions

Qualitative community descriptions follow those of Holland (1986) with approximate acreage in parentheses. Remnant riparian plant communities are mapped in Figure 5. The remnant riparian habitat bordering the Restoration Area consists mainly of a large stand of cottonwood riparian forest (31 acres). This forest is composed primarily of widely spaced large Fremont cottonwood (*Populus fremontii*) interspersed with Goodding's black willow (*Salix gooddingii*) and a few western sycamore (*Platanus racemosa*), with an understory of young box elder (*Acer negundo*). A few valley oak (*Quercus lobata*) trees are interspersed along the border of the Restoration Area. There are patches of open areas occupied primarily by California blackberry (*Rubus ursinus*) and California wild grape (*Vitis californica*) and dense areas with

stands of medium-sized Fremont's cottonwood trees. Two large stands of mixed riparian forest (44 acres, 15 acres) occur closer to the river, adjacent to the cottonwood riparian forest. This forest community is relatively more dense with additional dominant species such as California black walnut (*Juglans californica*), willow *(Salix exigua*, *S. lasiolepis*), and pockets of pure edible fig (*Ficus carica*). Closer to the river, there are two large areas of herbland (11 acres, 12 acres) and another small area (2 acres) within the southern portion of the mixed riparian forest. The herbland is dominated by herbaceous species, primarily non-native forbs with patches of native mugwort (*Artemisia douglasiana*). Between the herbland and mixed riparian forest communities, there is a small elderberry savannah (4 acres) with blue elderberry (*Sambucus mexicana*) shrubs widely spaced among the herbaceous layer and a few solitary California black walnut and Fremont cottonwood trees. Along the river there are two stands of cottonwood riparian forest (7 acres, 1 acres) dominated by large Fremont cottonwood trees. Willow scrub patches occur along the river and intergrade with the surrounding herbland and cottonwood riparian forest communities. The willow scrub communities consist of dense patches of medium-sized narrow-leaved willow (*Salix exigua*) interspersed with pockets of herbaceous species, usually occurring closer to the edge of the community.

1000-acre Ranch Restoration Area: Remnant Riparian Vegetation Sampling Locations

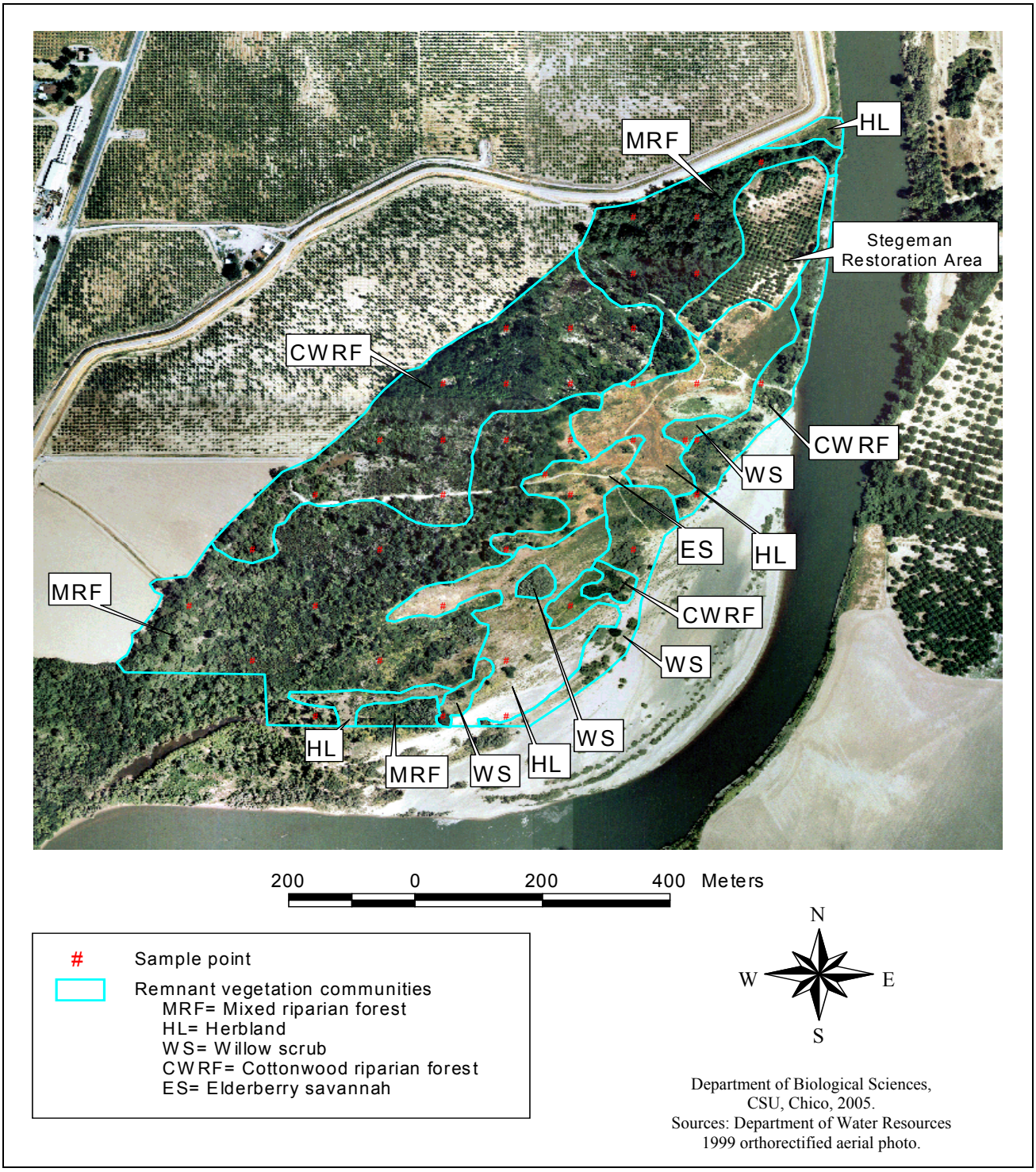

Figure 5. Remnant riparian plant communities and vegetation sampling locations within riparian plant communities close to the 1000-acre Ranch and Stegeman Restoration Areas, Colusa County, California.

Table 4. Composition and distribution frequencies by community type for potential native woody restoration species found in remnant riparian vegetation close to the 1000-acre Ranch Restoration Area, Colusa County, California. Frequency is given by community type for those species recorded during quantitative sampling. The sample size (n) for composition frequency represents the number of quadrants sampled. The sample size (n) for distribution frequency represents the number of points sampled. Abbreviations are: MRF=Mixed Riparian Forest; CWRF=Cottonwood Riparian Forest; ES=Elderberry Savannah; WS=Willow Scrub; HL=Herbland. A "+" indicates observed but not sampled for that community; a blank indicates not observed. Nomenclature follows *The Jepson Manual* (Hickman 1993).

Common Name	**Scientific Name**	**Family**	**Composition Frequency (%)**					**Distribution Frequency (%)**				
Trees			**MRF (n=56)**	**CWRF (n=56)**	**ES (n=16)**	**WS (n=16)**	**HL (n=16)**	**MRF (n=14)**	**CWRF (n=14)**	**ES (n=4)**	**WS (n=4)**	**HL (n=4)**
box elder	*Acer negundo*	Aceraceae	23	39				50	64			
western sycamore	*Platanus racemosa*	Platanaceae	2	2				7	7			
Fremont cottonwood	*Populus fremontii*	Salicaceae	14	46	6		6	43	79	25		25
valley oak	*Quercus lobata*	Fagaceae		+								
narrow-leaved willow	*Salix exigua*	Salicaceae	2	2		31		7	7		50	
Goodding's black willow	*Salix gooddingii*	Salicaceae		4					14			
arroyo willow	*Salix lasiolepis*	Salicaceae	9			6		14			25	
Shrubs												
box elder	*Acer negundo*	Aceraceae	27	46				50	71			
mule fat	*Baccharis salicifolia*	Asteraceae		5					14			
California button willow	*Cephalanthus occidentalis* var. *californicus*	Rubiaceae		4					14			
California rose	*Rosa californica*	Rosaceae	5					14				
narrow-leaved willow	*Salix exigua*	Salicaceae	4	14		75		7	21		100	
arroyo willow	*Salix lasiolepis*	Salicaceae	14	4		13	13	21	14		50	25
blue elderberry	*Sambucus mexicana*	Caprifoliaceae			69	6	6			100	25	25
western poison oak	*Toxicodendron diversilobum*	Anacardiaceae	5	2	6			14	7	25		

Table 4 continued.

Common Name	Scientific Name	Family	Composition Frequency (%)					Distribution Frequency (%)				
Vines			**MRF (n=56)**	**CWRF (n=56)**	**ES (n=16)**	**WS (n=16)**	**HL (n=16)**	**MRF (n=14)**	**CWRF (n=14)**	**ES (n=4)**	**WS (n=4)**	**HL (n=4)**
California pipevine	*Aristolochia californica*	Aristolochiaceae	9			6		14			25	
virgin's bower	*Clematis ligusticifolia*	Ranunculaceae			6					25		
California man-root	*Marah fabaceus*	Cucurbitaceae	5	4	31	44		7	7	50	50	
California blackberry	*Rubus ursinus*	Rosaceae	43	11	31			50	21	50		
western poison oak	*Toxicodendron diversilobum*	Anacardiaceae	9					14				
California wild grape	*Vitis californica*	Vitaceae	23	68				29	79			

Table 5. Mean percent cover and distribution frequency by community type of potential native herbaceous restoration species found in remnant riparian vegetation close to the 1000-acre Ranch Restoration Area, Colusa County, California. The sample size (n) for mean percent cover and for distribution frequency is the same and represents the number of points sampled. Abbreviations are: MRF=Mixed Riparian Forest; CWRF=Cottonwood Riparian Forest; ES=Elderberry Savannah; WS=Willow Scrub; HL=Herbland. A blank indicates not observed. Nomenclature follows *The Jepson Manua*l (Hickman 1993).

Common Name	**Scientific Name**	**Family**	**Mean Cover (%)**					**Distribution Frequency (%)**				
Herbs			**MRF (n=14)**	**CWRF (n=14)**	**ES (n=4)**	**WS (n=4)**	**HL (n=4)**	**MRF (n=14)**	**CWRF (n=14)**	**ES (n=4)**	**WS (n=4)**	**HL (n=4)**
Indian hemp	*Apocynum cannabinum* var. *glaberrimum*	Apocynaceae		1.00					7			
mugwort	*Artemisia douglasiana*	Asteraceae	6	8.00	50	23		7	14	75	75	
sedge	*Carex* sp.	Cyperaceae	3	0.36			1	21	7			25
blue wildrye	*Elymus glaucus* ssp. *glaucus*	Poaceae	1			3		7			25	
willow herb	*Epilobium* sp.	Onagraceae		1.00			3		7			25
goose grass	*Galium aparine*	Rubiaceae	10	2.00	4			50	14	25		
nettle	*Urtica dioica*	Urticaceae	2					21				

Table 6. Composition and distribution frequencies by community type for woody plant species not recommended, but found in remnant riparian vegetation close to the 1000-acre Ranch Restoration Area, Colusa County, California. Frequency is given by community type for those species recorded during quantitative sampling. The sample size (n) for composition frequency represents the number of quadrants sampled. The sample size (n) for distribution frequency represents the number of points sampled. Abbreviations are: MRF=Mixed Riparian Forest; CWRF=Cottonwood Riparian Forest; ES=Elderberry Savannah; WS=Willow Scrub; HL=Herbland. A "+" indicates observed but not sampled for that community; a blank indicates not observed. Nomenclature follows *The Jepson Manua*l (Hickman 1993).

Common Name	**Scientific Name**	**Family**	**Composition Frequency (%)**					**Distribution Frequency (%)**				
Trees			**MRF (n=56)**	**CWRF (n=56)**	**ES (n=16)**	**WS (n=16)**	**HL (n=16)**	**MRF (n=14)**	**CWRF (n=14)**	**ES (n=4)**	**WS (n=4)**	**HL (n=4)**
California black walnut	*Juglans californica*	Juglandaceae	38		31			71		75		
Mediterranean hackberry	*Celtis australis*	Ulmaceae		+								
Shrubs												
edible fig	*Ficus carica*	Moraceae	27	5				36	14			
California black walnut	*Juglans californica*	Juglandaceae	18	2				36	7			

Table 7. Mean percent cover and distribution frequency by community type for herbaceous plant species not recommended, but found in remnant riparian vegetation close to the 1000-acre Ranch Restoration Area, Colusa County, California. Frequency is given by community type for those species recorded during quantitative sampling. The sample size (n) for mean percent cover and for distribution frequency is the same and represents the number of points sampled. Abbreviations are: MRF=Mixed Riparian Forest; CWRF=Cottonwood Riparian Forest; ES=Elderberry Savannah; WS=Willow Scrub; HL=Herbland. A "+" indicates observed but not sampled for that community; a blank indicates not observed. Nomenclature follows *The Jepson Manua*l (Hickman 1993).

Common Name	**Scientific Name**	**Family**	**Mean Cover (%)**					**Distribution Frequency (%)**				
Herbs			**MRF (n=14)**	**CWRF (n=14)**	**ES (n=4)**	**WS (n=4)**	**HL (n=4)**	**MRF (n=14)**	**CWRF (n=14)**	**ES (n=4)**	**WS (n=4)**	**HL (n=4)**
bent grass	*Agrostis avenacea*	Poaceae				8	4				25	25
bur-chervil	*Anthriscus caucalis*	Apiaceae	1.00		25	16		7		75	50	
giant reed	*Arundo donax*	Poaceae				+						
ripgut grass	*Bromus diandrus*	Poaceae	4.00		20	15	16	7		25	25	25
black mustard	*Brassica nigra*	Brassicaceae	5.00	2	15			21	14	75		
soft chess	*Bromus hordeaceus*	Poaceae	1.00	1		13	26	7	7		25	50
yelllow star-thistle	*Centaurea solstitialis*	Asteraceae		4	16	10	8		14	25	25	25
red-stemmed filaree	*Erodium cicutarium*	Geraniaceae					7					50
grass	Grass sp.	Poaceae		2		9	1		7		50	25
Klamathweed	*Hypericum perforatum*	Hypericaceae			+		+					
smooth cat's-ear	*Hypochoeris glabra*	Asteraceae					1					25
Italian ryegrass	*Lolium multiflorum*	Poaceae		4			1		7			25
annual beard grass	*Polypogon monspeliensis*	Poaceae		4					7			
curly dock	*Rumex crispus*	Polygonaceae	0.21					7				

Special-status Plant Species

Information about known and potential occurrences of special-status plant species was obtained from the California Natural Diversity Database (CNDDB; CA DFG 2005). Based on the quadrangle search of the CNDDB, five species were initially identified to potentially occur within 1 mile of the Restoration Area. Based on distribution, elevation, and habitat requirements, one of these species was determined to be unlikely to occur. Of the four species with potential to occur, no known occurrences were found within 1.0 mile of the Restoration Area.

Table 8. Special-status plant species potentially occurring within 1.0 mile of the 1000-acre Ranch Restoration Area, Colusa County, California. FE=federally listed as endangered; FT=federally listed as threatened; CE=California state listed as endangered; CNPS=California Native Plant Society, 1B=rare, threatened or endangered in California and elsewhere, 2=rare in California but more common elsewhere, 3=need more information, 4=plants of limited distribution; a watch list. Habitat descriptions were adapted from CNPS (2004).

Scientific Name	Common Name	Habitat	Status	Potential to Occur
Astragalus tener var. *ferrisiae*	Ferris's milk-fetch	Meadows and seeps (vernally mesic), valley and foothill grassland (subalkaline flats); elevation 5-75 meters.	CNPS 1B	May occur. No known occurrences within 1 mile of the Restoration Area.
Atriplex depressa	brittlescale	Chenopod scrub, meadows and seeps, playas, valley and foothill grassland, vernal pools/alkaline, clay; elevation 1-320 meters.	CNPS 1B	May occur. No known occurrences within 1 mile of the Restoration Area.
Cordylanthus palmatus	palmate-bracted bird's-beak	Chenopod scrub, valley and foothill grassland (alkaline); elevation 5-155 meters.	FE, CE, CNPS 1B	May occur. No known occurrences within 1 mile of the Restoration Area. Known from only nine occurrences.
Hibiscus lasiocarpus	rose-mallow	Marshes and swamps (freshwater); elevation 0-120 meters.	CNPS 2	May occur. No known occurrences within 1 mile of the Restoration Area.
Neostapfia colusana	Colusa grass	Vernal pools (adobe); elevation 5-200 meters.	FT, CE, CNPS 1B	Unlikely to occur due to the lack of suitable habitat. No known occurrences within 1 mile of the Restoration Area.

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SECTION THREE

1000-ACRE RANCH

SOIL SURVEY

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Introduction

A survey of Restoration Area soils is used to document existing conditions for plant growth and thus guide the restoration planting recommendations. Information on soil texture and depth to water table gathered from auger holes across the Restoration Area is used to match specific locations with appropriate plant community types.

The 1000-acre Ranch tract is located approximately 2.75 miles south of Princeton in Colusa County. The Restoration Area, encompassing approximately 50 acres, lies inside the levees on the west side of the Sacramento River at river mile 160. Currently the Restoration Area is a plum orchard.

Methods

Soil data were gathered from augering 5 holes by hand across the existing orchard during May and June of 2005. These 5 holes were located on a grid at approximately 150-200 meter intervals across the orchard (Figures 2 and 9). Initially a grid with holes 200m apart was laid out on the Restoration Area, resulting in only 3 holes. Two additional holes were added to meet the minimum of 5 holes per/Restoration Area, or 1 hole/10 acres in order to give an accurate representation of soils across the Restoration Area. Textural analysis was done following the Natural Resource Conservation Service's (NRCS) texture-by-feel method at one-foot increments (Table 9; Schoeneberger et al. 2002). In addition, depth to refusal (gravel, water table or unconsolidated sand) was noted for each sample location along with any unique characteristics. Soil locations were classified into deep and shallow based on NRCS soil survey standards (Table 10; Schoeneberger et al. 2002).

Table 9. Natural Resource Conservation Service's soil texture classification.

Texture	% Sand
Silt	0-20
Silt loam	20-35
Sandy silt loam	35-50
Sandy loam	50-70
Loamy sand	70-85
Sand	85-100

Table 10. Natural Resource Conservation Service's soil depth classification.

Depth class	Depth (inches)
Very Shallow	0-10
Shallow	10-20
Moderately Deep	20-40
Deep	40-60
Very Deep	>60

Soils Description

The soils of the Restoration Area are dominated by clay loams, which mostly concur with the historic soil surveys of Colusa County from 1907, 1948 and 1967, but not with the current 1998 soil survey (Figures 6-9). In the historic surveys the soils are described as Sacramento silty clay loam and Sacramento silt loam (USDA 1907), Columbia loam and Sycamore loam (Harradine 1948), and Brentwood-Sycamore association with textures ranging from sandy loam to silty clay loam and Columbia association with fine sandy loam textures (USDA 1967). The 1998 soil survey differs from the historic surveys delineating the Restoration Area as Vina loam, except for the southwest corner which is delineated as Moonbend silt loam (Figure 9; USDA 1998). A typical profile of Vina loam describes loamy soils over sandy and silt loams, which differs from the clay loams found in the soil auger holes. The auger hole data taken in the Vina Loam contour is more similar to the Moonbend silt loam typical profile, although more fine-textured soils seem to occur at this site. Interestingly, the 1907 soil survey delineates the eastern portion of the Restoration Area as Sacramento silt loam similar to the Moonbend silt loam. Table 11 gives the auger hole data, and Table 12 lists comments (if any) for each hole. Surface textures across the site are relatively uniform, consisting of clay loam or sandy clay loam (Table 11). The clay loams overlay a homogeneous profile of finer textured soils in the north and a heterogeneous profile of mostly coarser textured soils in the south. This north-south pattern likely follows historic channel patterns at the site. Most of this Restoration Area has very deep soils with refusal from 7.5 to 13.5 feet.

The Restoration Area soils are typical of active floodplain soils where stratification from various flooding events is still quite evident but a uniform fining upward sequence (where coarser material is found at depth and finer textures make up the upper layers of the profile) has yet to occur. A uniform fining upward sequence is more typical of alluvial soils further from the active channel (Andrew Conlin Pers. Comm. 2003). The soil auger holes tend to fall into two groups: one that has a series of fining upward sequences (e.g. hole 1) and the other where coarser materials have been laid over finer materials (e.g. hole 4). The southern sample locations all have series of fining upward sequences representative of channel deposits and thus are likely occurring in an old river channel. Although there is no documentation of this in historic soil surveys (Harradine 1948, USDA 1907, 1967) or in the Sacramento River GIS (CA DWR 2002), from 1896-1923 the Sacramento River main channel did run along the eastern boundary of the Restoration Area (Figures 6-8, 10-12). In 1896 the main channel bounds the northeast edge then moves to the lower two-thirds of the eastern boundary by 1908 (Figure 10; CA DWR 2002). By 1935 the main channel has scrolled to the eastern edge of the present day remnant forest (Figure 11; CA DWR 2002). It is quite probable that either pre-1896 or between 1896 and 1923 the main channel meandered through the southern portion of the Restoration Area. The finer textures and homogeneity of the northern auger holes is indicative of slow moving flood waters.

The Restoration Area has very deep soils with the water table being reached between 7.5 and 13.5 feet at all 5 sample locations. The water table is deeper as one goes east across the Restoration Area towards the river. This was a particularly wet spring and early summer and thus the water table may be more elevated than in a typical year.

Four of the sampling locations had reduced oxygen features at depths ranging from 3 to 12 feet. Mottling, a reduced oxygen characteristic (redox feature), was encountered at 3 feet at sample 5, which had the highest water table at 7.5 feet and the most finely textured soils of the southern locations (Tables 11, 12, Figure 9). Redox features occurred between 7 and 12 feet at three other auger holes. Redox features represent soil horizons influenced by saturated conditions for extended periods of time throughout the year. These conditions would be expected in soils that are adjacent to present channels, overflow channels, or sloughs, or in the annual floodplain and in historic buried channels, which may then act as a channel for the underground flow of

water. The occurrence of redox features in the 3 southern auger holes is further evidence for the presence of a buried historic channel as discussed above. Gleying occurred in auger hole 3 at depths of 11 and 12 feet respectively. This reduced or "gleyed" layer is the extreme example of redox features where no oxygen is present in the soil resulting in the minerals remaining in a reduced form. Thus location 3 has periods of inundation longer than those just showing redox features (Table 12). The clay layer found to start at 4 feet in the northern samples indicates the northern portion of the Restoration Area will have increased water retention (Table 11, Figure 9).

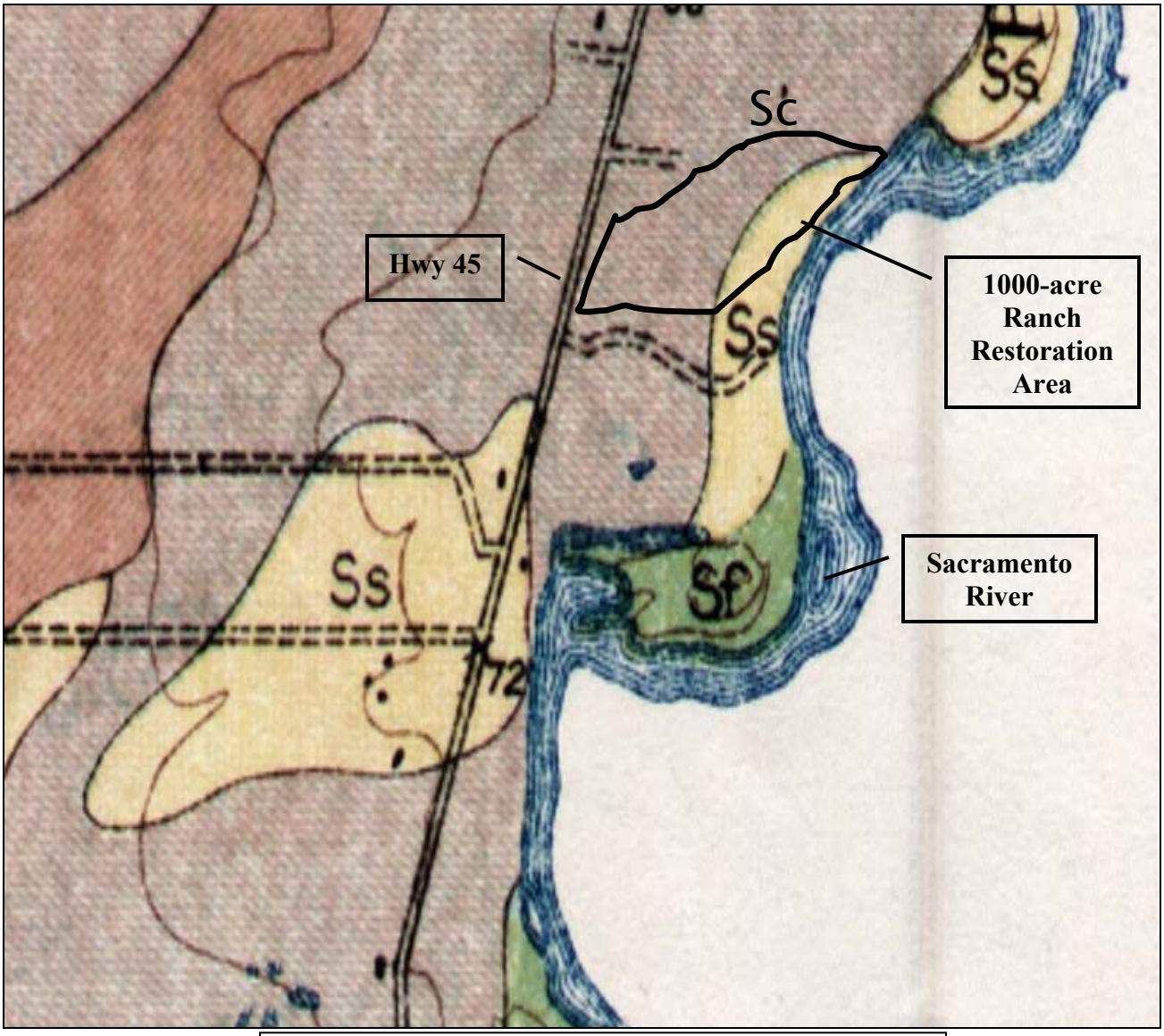
Table 11. Soil texture by depth across the 1000-acre Ranch Restoration Area, Colusa County, California.

Date Sampled	5/17/2005	6/2/2005	6/2/2005	6/2/2005	6/2/2005
Point	1	2	3	4	5
Surface	Sandy Clay Loam	Sandy Clay Loam	Clay Loam	Clay Loam	Clay Loam
1 ft	Sandy Clay Loam	Sandy Clay Loam	Clay Loam	Clay Loam	Clay Loam
2 ft	Sandy Loam	Sandy Clay Loam	Clay Loam	Clay Loam	Clay Loam
3 ft	Sandy Clay Loam	Clay Loam	Sandy Clay Loam	Clay Loam	Silty Clay Loam
4 ft	Clay Loam	Silty Clay	Sandy Clay Loam	Silty Clay	Clay
5 ft	Silty Clay Loam	Silty Clay	Sandy Loam	Silty Clay	Silty Clay
6 ft	Clay Loam	Silty Clay	Sandy Loam	Silty Clay	Silty Clay Loam
7 ft	Clay Loam	Silty Clay	Sandy Loam	Silty Clay	Silty Clay Loam
8 ft	Clay Loam	Silty Clay	Sandy Clay Loam	Silty Clay	
9 ft	Sandy Loam	Silty Clay	Sandy Clay Loam	Silty Clay	
10 ft	Sandy Clay Loam		Sandy Clay Loam	Silty Clay	
11 ft	Sandy Loam		Clay	Silty Clay	
12 ft	Sandy Loam		Silty Clay		
13 ft	Sandy Loam				
14 ft					
15 ft					
16 ft					
17 ft					
18 ft					
Total	13 ft 6 in	9 ft 6 in	12 ft 6 in	11 ft 6 in	7 ft 6 in
Refusal	Saturation	Saturation	Saturation	Saturation	Saturation

Table 12. Soil auger hole comments for the 1000-acre Ranch Restoration Area, Colusa County, California. Reduced oxygen conditions are noted as mottling. Extreme anaerobic conditions are noted as gleying or gleyed layers.

Hole #1- Dark mottling at 7 ft.
Hole #2- Mottling at 7 ft.
Hole #3- Mottling and gleying at 11 ft. Gleying at 12 ft.
Hole #4- No comments.
Hole #5- Mottling at 3 ft.

1000-acre Ranch Restoration Area: 1907 Soil Series

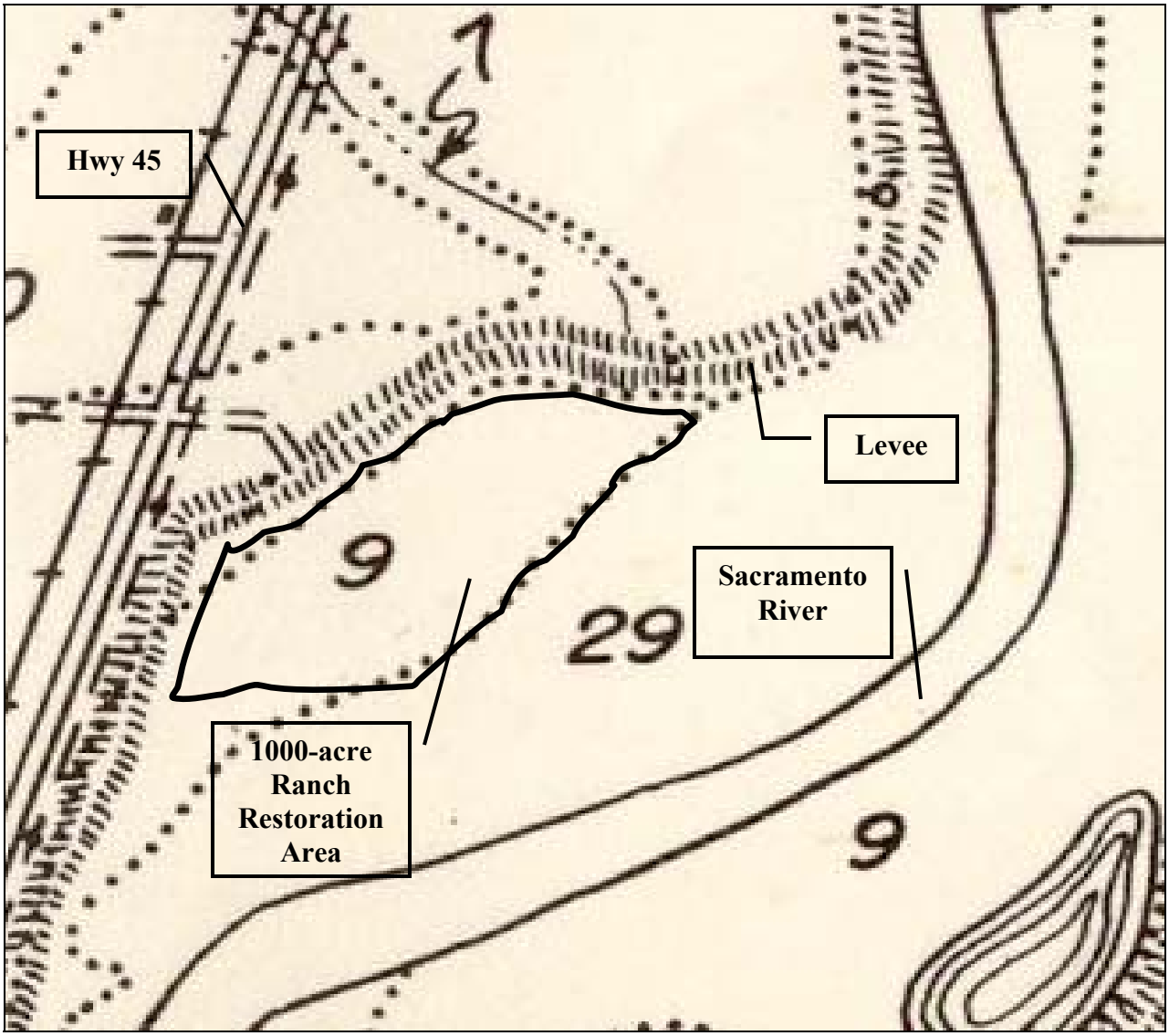


Soil Series Contours
Sc= Sacramento silty clay loam
Ss= Sacramento silt loam
Sf= Sacramento fine sandy loam

1 mile= approximately 4 inches

Figure 6. Approximate boundary and location of 1000-acre Ranch Restoration Area on the 1907 Soil Survey map, Colusa County, California (USDA Bureau of Soils).

1000-acre Ranch Restoration Area: 1948 Soil Series

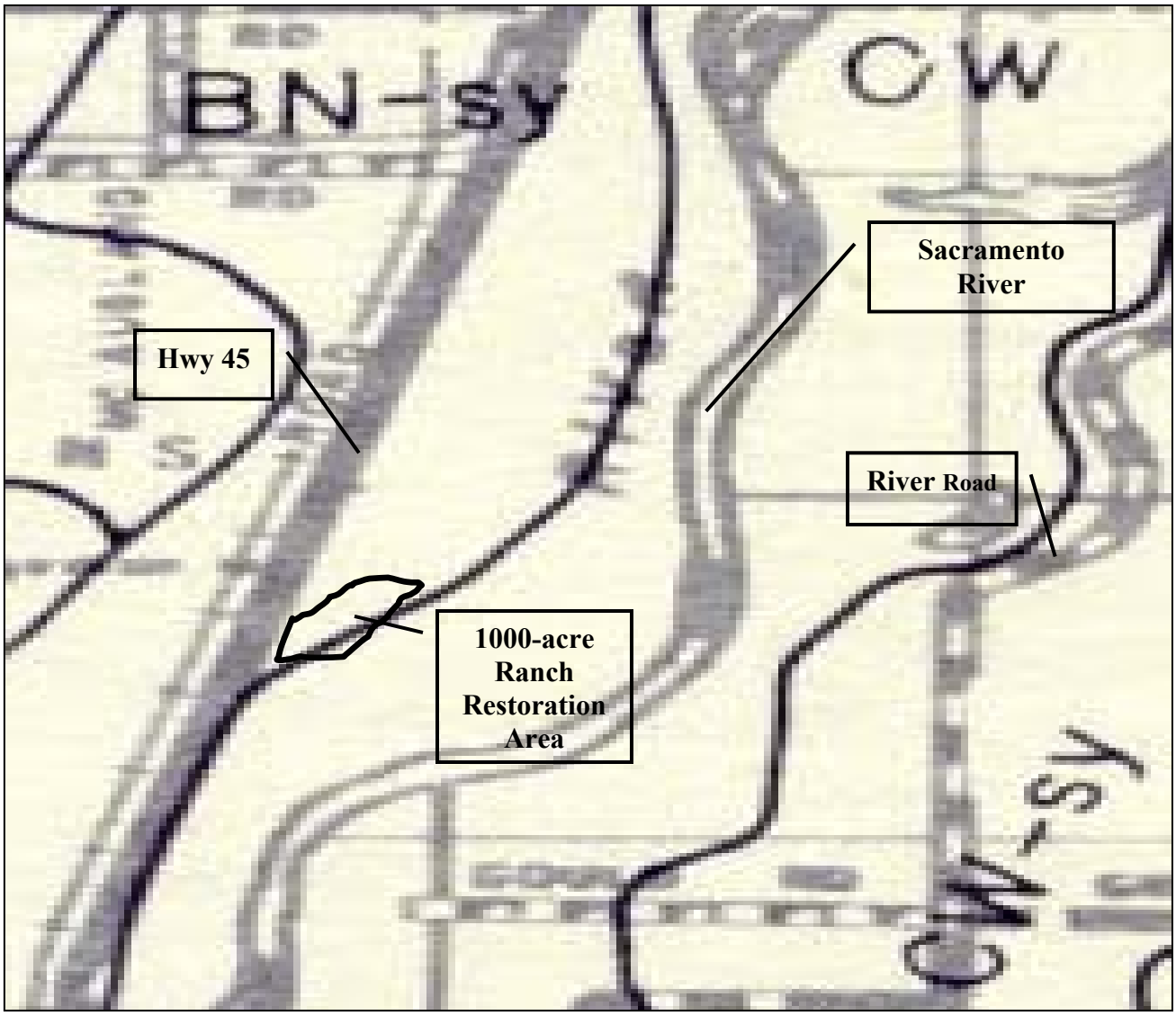


Soil Series Contours
7= Sycamore Loam, 0-2% slope, nearly level
9= Columbia Loam, 0-2% slope, gently undulating
29= Columbia soils undifferentiated, variable microrelief, 0-2% slope, gently undulating

1 mile= approximately 6 inches

Figure 7. Approximate boundary and location of 1000-acre Ranch Restoration Area on the 1948 Soil Survey map, Colusa County, California (Harradine 1948).

1000-acre Ranch Restoration Area: 1967 Soil Series



Soil Series Contours
CW= Columbia association
BN-sy= Brentwood-Sycamore association

1 mile= approximately 2 inches

Figure 8. Approximate boundary and location of 1000-acre Ranch Restoration Area on the 1967 Soil Survey map, Colusa County, California (USDA Soil Conservation Service).

1000-acre Ranch Restoration Area: 1998 Soil Series

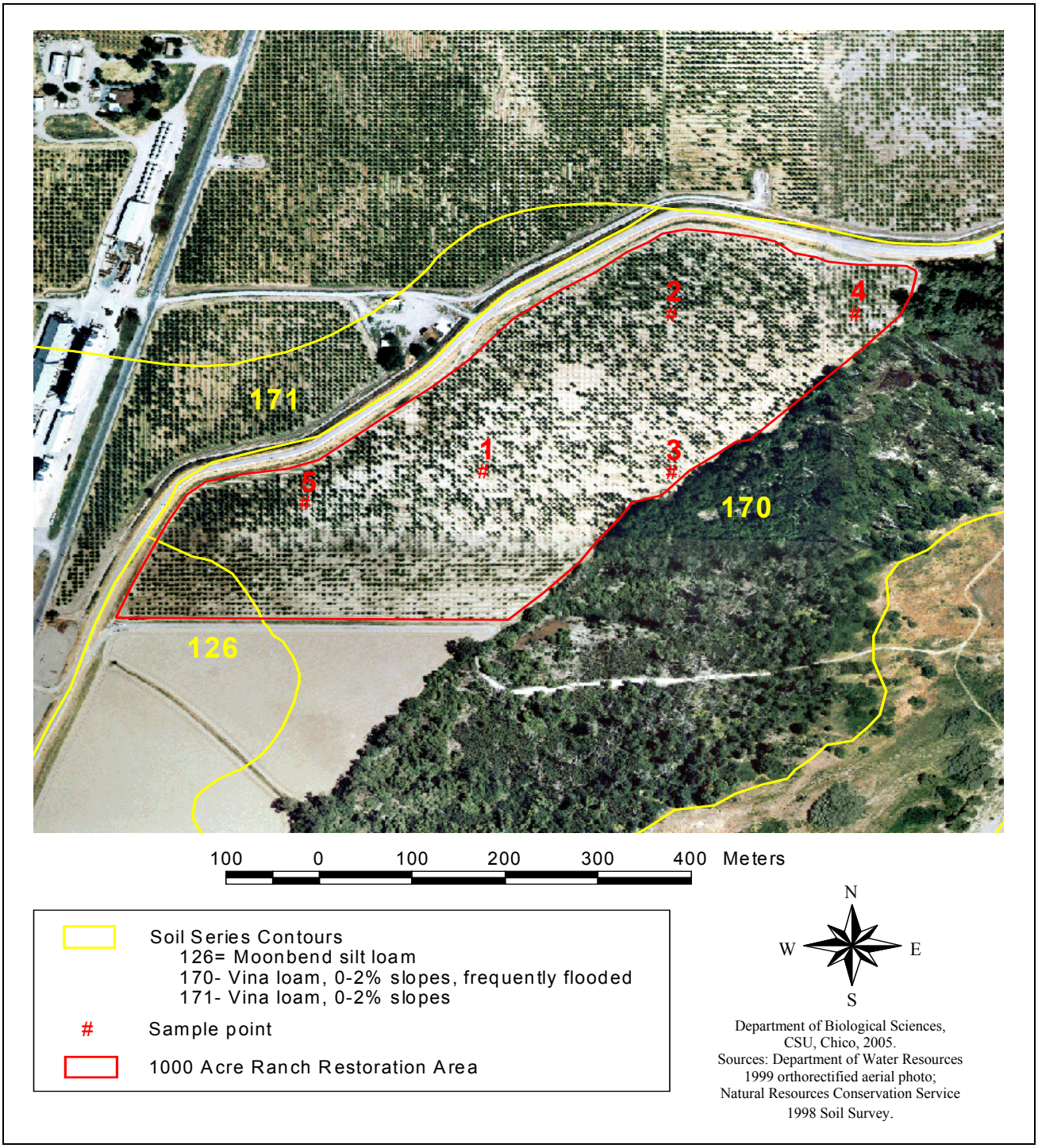


Figure 9. Soil series contours from the 1998 Colusa County Soil Survey and soil sampling locations at 1000-acre Ranch Restoration Area, Colusa County, California (USDA Natural Resources Conservation Service).

1000-acre Ranch Restoration Area: Historic River Channels 1896-1923

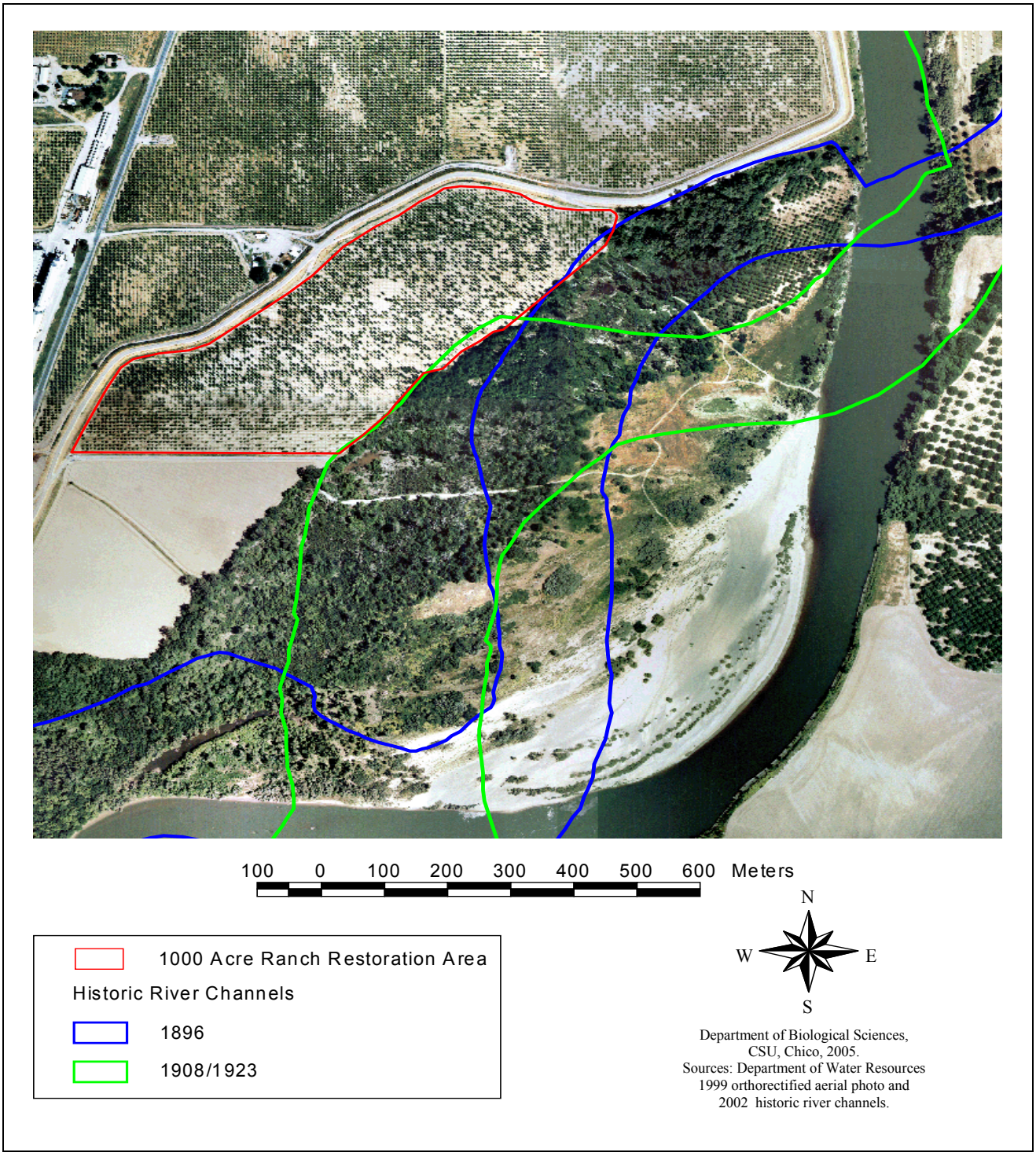


Figure 10. Historic river channels from 1896, 1908 and 1923 at 1000-acre Ranch Restoration Area, Colusa County, California. The 1908 and 1923 channel is the same for this stretch of the river.

1000-acre Ranch Restoration Area: Historic River Channels 1935-1976

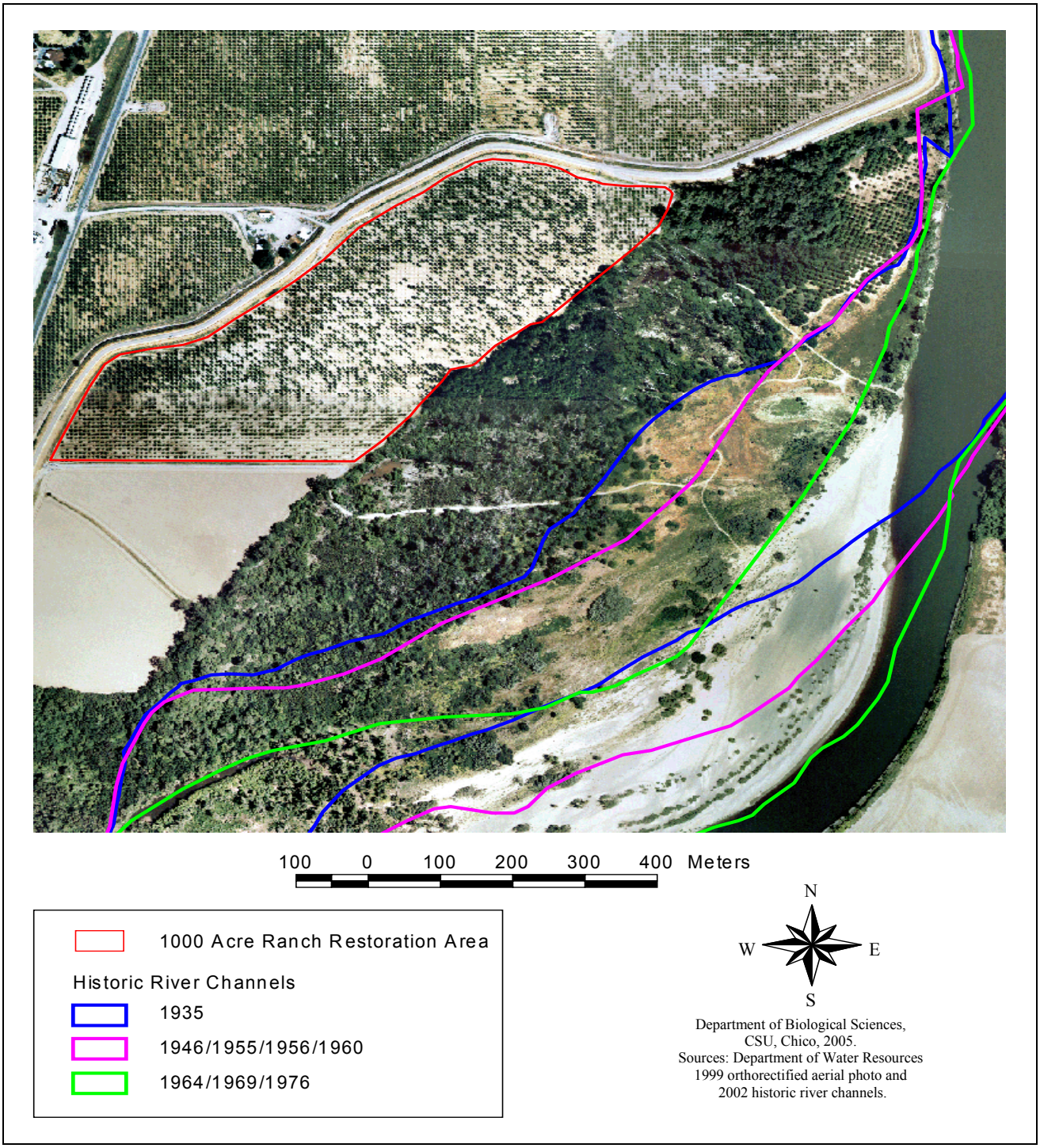


Figure 11. Historic river channels from 1935, 1960, and 1976 at 1000-acre Ranch Restoration Area, Colusa County, California. The 1960 channel is the same for this stretch of the river as 1946, 1955 and 1956. The 1976 channel is the same for this stretch of the river as 1964 and 1969.

1000-acre Ranch Restoration Area: Historic River Channels 1981-1997

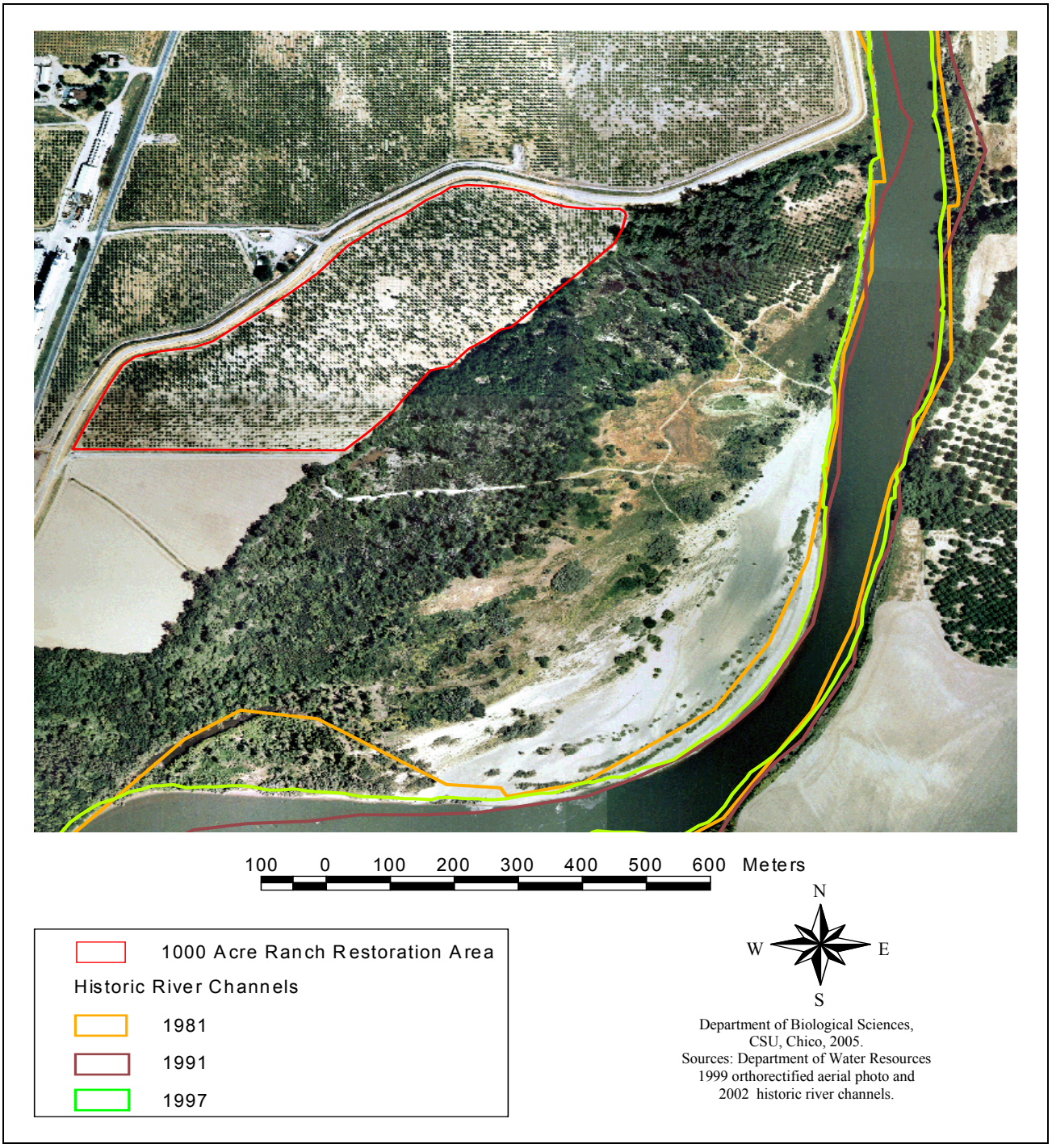


Figure 12. Historic river channels from 1981, 1991, and 1997 at 1000-acre Ranch Restoration Area, Colusa County, California.

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SECTION FOUR

SPECIAL STATUS ANIMAL SPECIES,

BIRD COUNTS, AND NON-NATIVE MAMMALS

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Introduction

Animals such as wildlife and birds will benefit from the increased habitat created through natural process or active restoration. Information on wildlife and bird species present or known to occur near the Restoration Area can be used to better judge the value of restoration actions at a particular site. Non-native mammal species are important due to their probable negative impact on native wildlife species. Non-native mammal species can prey upon, directly compete with, and significantly disturb native wildlife.

Methods

A July 2005 computer search for known occurrences of special status animal species (federal and state threatened and endangered species and species of special concern) occurring within 1.0 mile of the Restoration Area was conducted using the California Natural Diversity Database (CA DFG 2005). An assessment of potential non-native mammals and special status animal species occurring at or within 1.0 mile of the Restoration Area was performed in June and July 2005. This assessment was based on aerial photographs, field surveys of remnant riparian vegetation and associated nearby habitat, field experience of the authors and habitat characteristics of the species involved. During the bird point count survey (see below), any occurrences or signs of special status species or non-native mammals were noted. General habitat characteristics were gathered from vegetation surveys (Section Two). Information on species status was taken from California Wildlife Habitat Relations 8.0 (CA DFG 2002) and the California Natural Diversity Database (CA DFG 2005).

Bird species were surveyed on June 22, 2005, following an adaptation of the methods proposed by Ralph et al. (1993). Nine point count stations set approximately 200 m apart were established within remnant riparian habitat close to the 1000-acre Ranch tract (Figure 13). All birds observed (either seen or heard) within an eight-minute observation period were recorded. To reduce the possibility of individuals being recorded a second time at another station, only data on species encountered within 50 m of each station are presented here. To compute frequency of occurrence for a species, the total number of observations for that species was divided by the total number of observations for all species.

Special Status Animal Species

Table 13 lists California Natural Diversity Database special status species occurrences within 1.0 mile of the Restoration Area. More than one record indicates multiple sightings of a species in different years and/or locations. Table 14 is a list of special status wildlife species with potential or known to occur or reside within 1.0 mile of the Restoration Area.

Table 13. California Natural Diversity Database special status species occurrences occurring within 1.0 mile of the 1000-acre Ranch Restoration Area, Colusa County, California. FE/FT=federally endangered/federally threatened; FSC=Federal species of special concern; SE/ST=state endangered/state threatened; SSC=California species of special concern.

Common Name	Scientific Name	Status	# of known occurrences
Swainson's hawk	*Buteo swainsonii*	ST	1
Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	SE	3
Bank swallow	*Riparia riparia*	ST	4
Osprey	*Pandion haliaetus*	SSC	1

Table 14. Special status animal species with potential or known to occur or reside within 1.0 mile of the 1000-acre Ranch Restoration Area, Colusa County, California. FE/FT=federally endangered/federally threatened; FSC=Federal species of special concern; SE/ST=state endangered/state threatened; SSC=California species of special concern; SSC1=species that face immediate extirpation of their entire California population or their California breeding population if current trends continue (these species may qualify as state endangered or threatened, but are not yet listed); SSC =species on the decline in a large portion of their range in California, which require management to prevent their becoming SSC1; SSC3=species not in any present danger of extirpation and their populations within most of their range do not appear to be declining seriously, however, due to their small populations in California they are vulnerable to extirpation should a threat materialize; ?=not enough information.

Common Name	Scientific Name	Status	Breeding
Valley elderberry longhorn beetle	*Desmocerus californicus dimorphus*	FT	
Sacramento splittail	*Pogonichthys macrolepidoptus*	SSC1	potential
Steelhead – Central Valley ESU	*Oncorhynchus mykiss*	FT	potential
Chinook salmon (fall run)	*Oncorhynchus tsawytscha (fall run)*	SSC	potential
Chinook salmon (spring run)	*Oncorhynchus tsawytscha (spring)*	FT/ST	potential
Chinook salmon (winter run)	*Oncorhynchus tsawytscha (winter)*	FE/SE	probable
Hardhead	*Mylopharodon conocephalus*	SSC3	
Western spadefoot toad	*Spea hammondii*	SSC	potential
Western pond turtle	*Clemmys marmorata*	SSC	probable
Giant garter snake**	*Thamnophis gigas*	FT/ST	potential
American white pelican	*Pelecanus erythrorhynchos*	SSC	
Double-crested cormorant*	*Phalacrocorax auritus*	SSC2	potential
White-faced ibis	*Plegadis chihi*	SSC	
Osprey*	*Pandion haliaetus*	SSC2	known
Bald eagle	*Haliaeetus leucocephalus*	FT/SE	
Northern harrier	*Circus cyaneus*	SSC2	probable
Sharp-shinned hawk	*Accipiter striatus*	SSC3	
Cooper's hawk*	*Accipiter cooperii*	SSC3	probable
Swainson's hawk	*Buteo swainsoni*	ST	known
Ferruginous hawk	*Buteo regalis*	SSC	
Golden eagle	*Aquila chrysaetos*	SSC3	
Peregrine falcon	*Falco peregrinus*	SE	
Prairie falcon	*Falco mexicanus*	SSC3	
California gull	*Larus californicus*	SSC3	
Burrowing owl	*Athene cunicularia*	SSC2	potential
Short-eared owl	*Asio flammeus*	SSC2	potential
Long-eared owl	*Asio otus*	SSC	
Greater sandhill crane	*Grus canadensis tabida*	ST	
Long-billed curlew	*Numenius americanus*	SSC	
Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	FSC/SE	known
Willow flycatcher	*Empidonax traillii*	SE	?
Loggerhead shrike	*Lanius ludovicianus*	CSC	probable
Purple martin	*Progne subis*	SSC2	
Bank swallow	*Riparia riparia*	ST	known
Yellow warbler	*Dendroica petechia*	SSC2	potential
Yellow-breasted chat	*Icteria virens*	SSC2	probable
California horned lark**	*Eremophila alpestris actia*	SSC	potential
Tricolored blackbird	*Agelaius tricolor*	SSC	potential
Townsend's big-eared bat**	*Corynorhinus townsendii*	SSC2	?
Pallid bat**	*Antrozous pallidus*	SSC	?
Western mastiff bat	*Eumops perotis*	SSC2	?

***Species observed within 1.0 miles of the Restoration Area by the authors.**
**** Species not known or with low probability of occurrence within area of consideration.**

Threatened and Endangered Wildlife Species

Seven threatened or endangered wildlife species are of particular interest in the vicinity of the 1000-acre Ranch tract. Following is a brief discussion of their status and any observations noted during fieldwork.

1. Valley elderberry longhorn beetle (*Desmocerus californicus dimorphicus*)

Valley elderberry longhorn beetle (VELB) is a federally threatened species. Potential VELB habitat occurs throughout nearby remnant vegetation wherever blue elderberry (*Sambucus mexicana*) is present. This species is not recorded in the California Natural Diversity Database (CNDDB) as occurring within 1.0 mile of the Restoration Area and nearby remnant riparian habitat.

2. Steelhead (*Oncorhynchus mykiss*) – Central Valley Evolutionarily Significant Unit (ESU)

The Central Valley steelhead ESU is a federally threatened population. Steelhead is an anadromous fish species spawning in tributaries of the Sacramento River.

3. Chinook salmon (*Oncorhynchus tsawytscha*) – spring run

The spring run Chinook salmon is a federal and state threatened species. Spring run Chinook salmon are an anadromous species of fish that spawns in tributaries of the Sacramento River. Mill, Deer, and Butte Creek are the principle spawning grounds of this species.

4. Chinook salmon (*Oncorhynchus tsawytscha*) – winter run

Winter run Chinook salmon is a federal and state endangered species. Winter run Chinook salmon are known to spawn in cold gravels of the Sacramento River. This species is recorded as occurring throughout the lower Sacramento River below Keswick Dam.

5. Swainson's hawk *(Buteo swainsonii)*

Swainson's hawk is a state threatened species. Swainson's hawks have been observed foraging within 1.0 mile of the Restoration Area by the authors. This species is recorded in the CNDDB as nesting within 1.0 mile of the Restoration Area.

6. Bank Swallow (*Riparia riparia*)

Bank swallows are a state threatened species. This species is known to nest in colonies in undercut banks along the Sacramento River. This species is recorded in the CNDDB as nesting within 1.0 mile of the Restoration Area.

7. Western yellow-billed cuckoo (*Coccyzus americanus occidentalis*)

Western yellow-billed cuckoos are a state endangered species known to nest in riparian forests along the Sacramento River. This species is recorded in the CNDDB as nesting within 1.0 mile of the Restoration Area.

Non-native mammal species

Table 15 lists the non-native mammal species known to occur or potentially occurring within 1.0 mile of the Restoration Area, and an estimate (where possible) of abundance. Small mammal sampling is currently being conducted at the Restoration Area and within nearby remnant riparian habitat, but information on non-native mammals presented here is highly qualitative and should be taken as such.

Domestic dogs were not observed on or near the Restoration Area. Because of the proximity of residences, domestic dogs potentially occur on the Restoration Area periodically.

Feral cats have not been observed at the Restoration Area, but this species is expected to occur periodically due to the proximity of residences to the Restoration Area and the fact that feral cats have been observed repeatedly at other restoration areas. Feral cats can cause significant depredation on small vertebrates as well as serving as a potential vector for disease to other mammals (e.g. feline distemper, feline leukemia, feline immune deficiency disease, and toxoplasmosus; Coleman et. al. 1997).

House mice and roof rats are known to occur, and Norway rats have potential to occur within 1.0 mile of the Restoration Area. These animals are relatively widespread in lower elevations in California, especially in association with residences and agriculture (Whitaker 1991) and have been documented in riparian areas. Roof rats have been shown to be important nest predators in remnant riparian and riparian restoration sites at Cosumnes River Preserve (Whisson and Engilis Jr. 2005). According to Whisson, because of its arboreal habits, mixed riparian forests can provide an ideal habitat for this species (Whisson unpublished). Norway rats are also a widespread invasive mammal species with a high potential of occurrence, but lacking the arboreal tendencies of roof rats.

Nutria were not observed on or near the Restoration Area, but have a high probability of occurring in freshwater marsh within nearby riparian vegetation immediately east of the Restoration Area. Potential effects of nutria on native wildlife are not well documented. Tracks of Virginia opossum were observed on and around the Restoration Area. Domestic/feral dogs, feral cats, roof rats, Norway rats and Virginia opossum are all known predators of small mammals, birds, reptiles and amphibians. All non-native mammals listed above are likely to have a widespread occurrence within riparian habitat along the Sacramento River. Information is currently being gathered on the relative abundance of non-native rodent species, but more information on the presence/absence and relative abundance of other non-native mammals (such as feral cats) needs to be collected in order to determine the relative importance of these species.

Table 15. Non-native mammal species known or potentially occurring within 1.0 miles of the 1000-acre Ranch Restoration Area, Colusa County, California. Estimated abundances are based upon the experience of the authors and field observations at the Restoration Area and similar sites. A "common" indicates that the species was observed in abundance either during visual surveys or during small mammal trapping. An "unknown" indicates that either the species was never observed or that the site itself was not sampled.

Common Name	Scientific Name	Observed	Abundance
Domestic dog	*Canis domesticus*	No	Unknown
Feral Cat	*Felis catus*	No	Unknown
House Mouse	*Mus musculus*	Yes	Common
Roof Rat	*Rattus rattus*	Yes	Common
Norway Rat	*Rattus norvegicus*	No	Unknown
Nutria	*Myocastor coypu*	No	Unknown
Virginia Opossum	*Didelphus virginianis*	Sign (tracks)	Common

Bird Counts

Figure 13 shows sampling locations and Table 16 lists all bird species observed on the June 22, 2005 point counts. Figure 14 shows the frequency of occurrence for species observed more than once. Forty-two species were encountered during the survey, and species composition was fairly typical of riparian habitats along the Sacramento River. Black-headed grosbeak was the species most frequently observed (12.5%), followed by Bewick's wren (8.9%), spotted towhee (7.1%) and western wood-pewee (5.4%).

Table 16. Bird species observed within and adjacent to remnant riparian habitat of the 1000-acre Ranch Restoration Area, Colusa County, California (see Table 14 for definition of status).

Common name	Scientific Name	Status
American crow	*Corvus brachyrhynchos*	
American goldfinch	*Cardeulis tristas*	
American pelican	*Pelecanus erythrorhynchos*	SSC
American robin	*Turdus migratorius*	
Ash-throated flycatcher	*Myiarchus cinerascens*	
Bewick's wren	*Thryomanes bewickii*	
Black-headed grosbeak	*Pheucticus melanocephalus*	
Brewer's blackbird	*Euphagus cyanocephalus*	
Brown-headed cowbird	*Molothrus ater*	non-native
Bullock's oriole	*Icterus bullocki*	
Bushtit	*Psaltriparus minimus*	
California quail	*Calipepla californica*	
California towhee	*Pipilo crissalis*	
Common yellowthroat	*Geothlypis trichas*	
Downy woodpecker	*Picoides pubescens*	
European starling	*Sturnus vulgaris*	non-native
Great blue heron	*Ardea herodias*	
Great egret	*Ardea alba*	
Great-horned owl	*Bubo virginianus*	
House finch	*Carpodacus mexicanus*	
House wren	*Troglodytes aedon*	
Killdeer	*Charadrius vociferus*	
Lark sparrow	*Chondestes grammacus*	
Lazuli bunting	*Passerina amoena*	
Lesser goldfinch	*Cardeulis psaltria*	
Mourning dove	*Zenaida macroura*	
Northern flicker	*Colaptes auratus*	
Northern mockingbird	*Mimus polyglottos*	
Nuttall's woodpecker	*Picoides nuttallii*	
Oak titmouse	*Baeolophus inornatus*	
Red-tailed hawk	*Buteo jamaicensis*	
Rock dove	*Columba livia*	non-native
Spotted towhee	*Pipilo maculatus*	
Tree swallow	*Tachycineta bicolor*	
Turkey vulture	*Cathartes aura*	
Western bluebird	*Sialia mexicana*	
Western kingbird	*Tyrannus verticalis*	
Western scrub-jay	*Aphelocoma californica*	
Western wood-pewee	*Contopus sordidulus*	
White-breasted nuthatch	*Sitta carolinensus*	
Wood duck	*Aix sponsa*	
Yellow-billed magpie	*Pica nuttalli*	

1000-acre Ranch Restoration Area: Bird Survey Locations

100 0 100 200 300 400 Meters

N
W E
S

1000 Acre Ranch Restoration Area
Sample point

Department of Biological Sciences,
CSU, Chico, 2005.
Sources: Department of Water Resources
1999 orthorectified aerial photo.

Figure 13. Bird survey station locations in riparian habitat close to the 1000-acre Ranch Restoration Area, Colusa County, California.

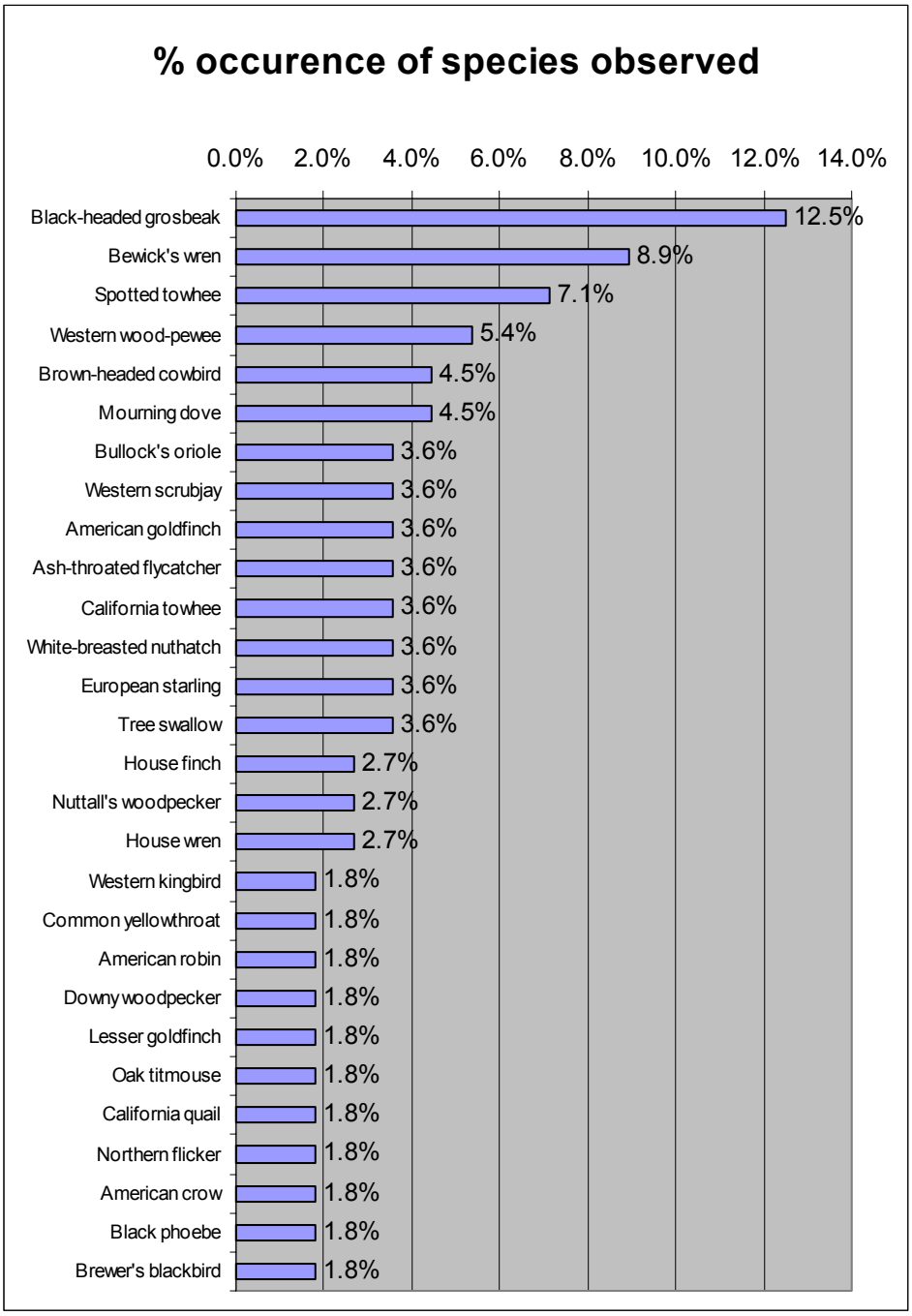

Figure 14. Frequency of bird species observed more than once within a 50 m radius of nine 8-minute observation stations within remnant riparian habitat close to the 1000-acre Ranch Restoration Area, Colusa County, CA. Species observed only once are excluded for clarity.

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