BASELINE ASSESSMENT

FOR

RIPARIAN RESTORATION

AT THE

WOMBLE RESTORATION AREA

Prepared by:

Jean G. Hubbell, M.S.
Catherine Little
Katie C. Price
John W. Hunt, M.S.
Dr. David M. Wood
Department of Biological Sciences
California State University, Chico

July 2006

Prepared for:

The Nature Conservancy
Sacramento River Project, Chico, California

TABLE OF CONTENTS

	Page
SECTION 1: RESTORATION PLANTING RECOMMENDATIONS	2
Introduction	3
Adjacent Landcover	3
Methods	4
Restoration Type Recommendations	6
Restoration Planting Recommendations	6
References	15
SECTION 2: REMNANT RIPARIAN VEGETATION SURVEY	16
Introduction	17
Methods	17
River Channel History	18
Remnant Riparian Vegetation Community Descriptions	19
Special-status Plant Species	26
References	27
SECTION 3: SOIL SURVEY	28
Introduction	29
Methods	29
Soils Description	30
References	42
SECTION 4: SPECIAL STATUS ANIMAL SPECIES, BIRD COUNTS, AND NON-NATIVE MAMMALS	43
Introduction	44
Methods	44
Special Status Animal Species	44
Threatened and Endangered Wildlife Species	46
Non-native Mammal Species	47
Bird Counts	48
References	52

SECTION ONE

WOMBLE

RESTORATION PLANTING RECOMMENDATIONS

Prepared by:

Jean G. Hubbell, M.S.
Catherine Little
Katie C. Price
Dr. David M. Wood
Department of Biological Sciences
California State University, Chico

Introduction

The Womble tract is located about one mile south of Princeton, in Glenn and Colusa Counties on the east side of the Sacramento River at river mile 162 and is owned by the Wildlife Conservation Board and managed by the California Department of Fish and Game as part of their Sacramento River Wildlife Area. The entire tract is 307 acres in area including land that is covered by flood control levees. The Womble Restoration Area (hereafter "Restoration Area") comprises 58 acres of the tract inside the levees and currently consists of annual row crops and a single small patch of riparian vegetation. The remainder of the tract to the south consists of riparian habitat and an oxbow lake.

Mixed riparian forest and willow scrub within the Womble tract and annual row crops on the adjacent property form the Restoration Area's northern boundary (Figures 1 and 5). East of the Restoration Area are annual row crops separated by a levee. The southern border of the Restoration Area is mixed riparian forest which wraps around and bounds the southwest corner. This vegetation is also within the Womble tract and extends southward into the adjacent property. A small patch of willow scrub occurs along the southern border as well. The remainder of the western border is annual row crops on adjacent property. Within the Restoration Area there is one small patch (0.8 acres) of remnant riparian vegetation in the southeastern corner that is dominated by arroyo willow (*Salix lasiolepis*), box elder (*Acer negundo*), and California wild grape (*Vitis californica*).

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.

Vegetation sampling was done in the eight natural plant communities to the north and south of the Restoration Area, three of which are adjacent to the Restoration Area. The adjacent natural communities are: Great Valley mixed riparian forest, Great Valley valley oak riparian forest, Great Valley willow scrub. The five natural communities nearby the Restoration Area occur to the south: buttonbush scrub, Great Valley cottonwood riparian forest, elderberry blackberry scrub, valley wildrye grassland/valley oak woodland, and herbland (Figure 1). 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). Seven of these plant communities (excluding herbland) together comprise the estimated 244 acres of native riparian vegetation within the Womble tract. 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, bird counts and non-native mammal information is in Section Four.

Adjacent Landcover

The Womble tract is adjacent to seven properties. Three properties are adjacent to the eastern boundary of the Restoration Area. Starting in the north is the Drumheller Dryers LLC property with 40+ acres of annual row crops which borders the Restoration Area for 209 m. In the middle is the Joseph David Luftuska Trust property with 514 acres of row crops, which borders the Restoration Area for the next 93 m. The remaining eastern boundary of the Restoration Area (393 m) is with the Roberts property consisting of 45 acres of annual row crops. The northern one-fourth of the Roberts property along with the other two properties adjacent to the eastern boundary are approximately 40 m from the Restoration Area separated by the levee and River Road. The southern three-fourths of the Roberts property is adjacent to the

oxbow lake and remnant riparian vegetation on the Womble tract and is separated from the tract by the levee and River Road. To the south on the east side is the Propfe property consisting of 23 acres of remnant riparian forest and separated by 853 m of remnant riparian vegetation from the Restoration Area. To the south on the west side is TNC's Jensen Property which is separated from the Restoration Area by 698 m of remnant riparian vegetation. To the west is the Sacramento River. To the northwest is the Zumwalt & Associates property, consisting of 100+ acres of annual row crops adjacent to the Restoration Area. An approximately 5 m wide strip of herbaceous weeds separates this property from the Restoration Area. To the north is the Ferraro property consisting of 75+ acres of annual row crops and separated from the Restoration Area by 3 patches of riparian forest totaling about 650 m long and 40-120 m wide.

Methods

The 58-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 most of the aerial photographs are from 1999 and a few are from 2005 as noted in the figure captions. Thus on occasion the floor frequency and the photo 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 ACE 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 composition frequency 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 distribution frequency 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 information regarding composition and abundance of the natural 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, blackberry 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.

For blackberry scrub, the woody species composition and abundance recommendations were based on the elderberry blackberry scrub (EBBS) found in the remnant riparian, the California blackberry (*Rubus ursinus*) dominated shrub layer of the northern middle patch of mixed riparian forest adjacent to the Restoration Area (MRF BBS), and the blackberry scrub (BBS) found in the remnant riparian for the Boeger site. Thus there are three columns in Table 1 remnant vegetation to represent these three sources of data (two from Womble/Jensen and one from Boeger): EBBS, MRF BBS and BBS. Since the EBBS is mixed with species adapted for much drier soils (e.g. elderberry; Hubbell 1997), other sources for BBS were needed. Thus the 3 points taken in the northern middle patch of mixed riparian forest adjacent to the Restoration Area were analyzed separately since California blackberry dominated the shrub layer. This mixed riparian forest patch is adjacent to the section to be restored as BBS and is at a similar elevation (US ACE 1997). The blackberry scrub from Boeger was utilized because it was the only data from a pure blackberry scrub appropriate for the Womble Restoration Area. Although no native herbs were sampled in any of the three aforementioned data sources, *Carex* species have been seen growing with California blackberry in other sites (D.M. Wood and R. Luster, personal communication June 2006) thus two *Carex* species were recommended for the herbaceous component.

Restoration Type Recommendations

Active horticultural restoration is recommended to derive the greatest habitat benefit 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 condition. 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. Sites where natural process restoration is appropriate are limited on the Sacramento River, as most areas are not subject to the erosional and depositional forces that foster natural recruitment events.

Active restoration is recommended even though the Restoration Area is mainly in the estimated 1-2 year floodplain and has generally similar elevations (US ACE 1997) as the adjacent remnant riparian vegetation. The northern patches of existing mixed riparian forest, particularly the central patch, required over 50 years to reach their current size (patches were significantly smaller in the 1952 aerial photo (1968 Glenn County soil survey) than in the 1999 aerial photo). This suggests that any natural process restoration that might occur will be too slow to develop into quality habitat in a timely manner. In addition, the higher elevation of the western two thirds of the Restoration Area will probably not flood to the degree required for natural process restoration to be successful. Higher floodplain lands such as found in Sections A and B (Figure 3) 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 desirable native vegetation for the foreseeable future. Previous research along the Sacramento River has shown that even when sites are artificially flooded coincident with the dispersal of native propagules, exotic species will come to dominate (Peterson 2002). Thus active restoration of this Restoration Area would be the most efficient method to create natural habitat relatively quickly.

Restoration Planting Recommendations

The potential plant communities are shown in Figure 3, whereas Figure 4 depicts the potential plant communities with estimated 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.

Mixed riparian forest is recommended for section A to connect the existing mixed riparian forest north and south of the Restoration Area. This section is predominantly at a higher elevation (73-82 feet), has loamier soils and greater depth to the water table and is mainly within the estimated 2-4-year floodplain, typical characteristics of mixed riparian forest. Section A has an elevation of 82 feet sloping down to 73 feet going away from the river (west to east) with the southern edges sloping down to 72 feet. Mixed riparian forest generally occurs in the 1-4 year floodplains from 70 to 74 feet and 64 to 82 feet in the sampled remnant riparian vegetation to the north and south of the Restoration Area, respectively (US ACE 1997). The loamy soils range from coarse to fine textures (sandy to clay loam) and water table depth ranges from 15 to 7 feet, generally following the topography of the land. The deeper water table is found at the higher elevations in the west. Thus it is recommended that the planting design distribute those species more tolerant of drier/coarser soils (e.g. valley oak, *Quercus lobata*, and blue elderberry, *Sambucus mexicana*) into the northern two-thirds of section A with species more tolerant of wetter soils (e.g. box elder, *Acer negundo*, and California blackberry, *Rubus ursinus*) into the lower one-third of section A.

Rose/*Baccharis* scrub (Keeler-Wolf and Vaghti 2000), co-dominated by California rose, *Rosa californica,* and coyote brush, *Baccharis pilularis*, is recommended for section B due to the mapping of a gravel pit in this section by the 1968 Glenn County Soil Survey on a 1952 aerial photo. Based on the past gravel pit and the poor cover as shown by the aerial photo, soils here have the potential to be coarser-textured and thus drier. Although the nearby soils range from clay to loam, soil sample 3 (which appears to be on the western edge of the feature) is one of the sandier samples. The section is somewhat larger than the mapped gravel pit to allow for the approximate location of the pit. There is a very slight mound at the 74 foot contour with a "summit" of 76 feet (shown on the digital elevation maps; US ACE 1997) that was used to further guide the section location. This section does lie within the 4-year floodplain.

Willow scrub (*Salix* spp.) and blackberry scrub are recommended for sections C and D due to their occurrence in the historic oxbow lake, lower elevation (68-72 feet; US ACE 1997), the high water table, the finer-textured clay soils, habitat diversity, and because the elevation matches that of the remnant communities. Although this area has supported some tree growth in the past, as seen in the 1952 aerial photo for the 1968 Glenn County Soil Survey (Figure 9), water ponds here annually and thus scrub communities are recommended. The annual ponding of water due to lower elevation, the historic oxbow lake, clay soils and thus high water table (3.5-6.2 feet) offsets the occurrence of these sections in the 4-year floodplain. The poor crop growth as shown by the 1999 aerial photo further supports scrub communities for these sections. These two communities would provide structural diversity for the site and thus more different types of habitat. Willow scrub is recommended for section C to extend the existing patch in the Restoration Area. Section C is suggested to lie between the 70-72 foot contours north of the existing willow scrub and then widen to the 68-72 foot contours to the south, to match the elevation of the willow scrub patch section C will encompass and the willow scrubs sampled adjacent to the Restoration Area. Section D comprises the majority of the eastern boundary where the 1926 oxbow lake was. This is a plain at approximately 70 feet which coincides with the elevation of the sampled elderberry blackberry scrub (EBBS in Table 1) and the California blackberry dominated shrub layer of the northern patch of mixed riparian forest (MRF BBS in Table 1). Hence, section D also will extend the California blackberry shrub layer found beneath the mixed riparian forest to the north.

Also, willow scrub is recommended for section E to extend the patch at the edge of the sampled riparian vegetation due to section E's lower elevation (68-72 feet), high water table (5.5 feet), occurrence in the approximate 2-year floodplain, and sandier soils. Section E is at an elevation of 68 feet adjacent to the remnant riparian vegetation and then slopes up to the north and northeast to 72 feet. This matches the sampled remnant willow scrubs adjacent to the Restoration Area which occur from 66 to 74 feet and lie within the approximate 2-year floodplain. Similar to sections C and D, poor crop growth as shown in the 1999 aerial photo guided the delineation of this section. However in this case the poor growth is more likely due to coarse soils and thus drier conditions once summer drawdown has occurred. This is supported by the coarser-textured soils found in soil sample 5 in section E versus the wet clay soils of sections C and D. These two different soil types with the same plant community demonstrate the plasticity of the willow scrub with its ability to grow in soils that are very wet year round or for only part of the year. The key is their ability to grow quickly enough to tap into the water table.

Womble Restoration Area:
Remnant Riparian Plant Communities

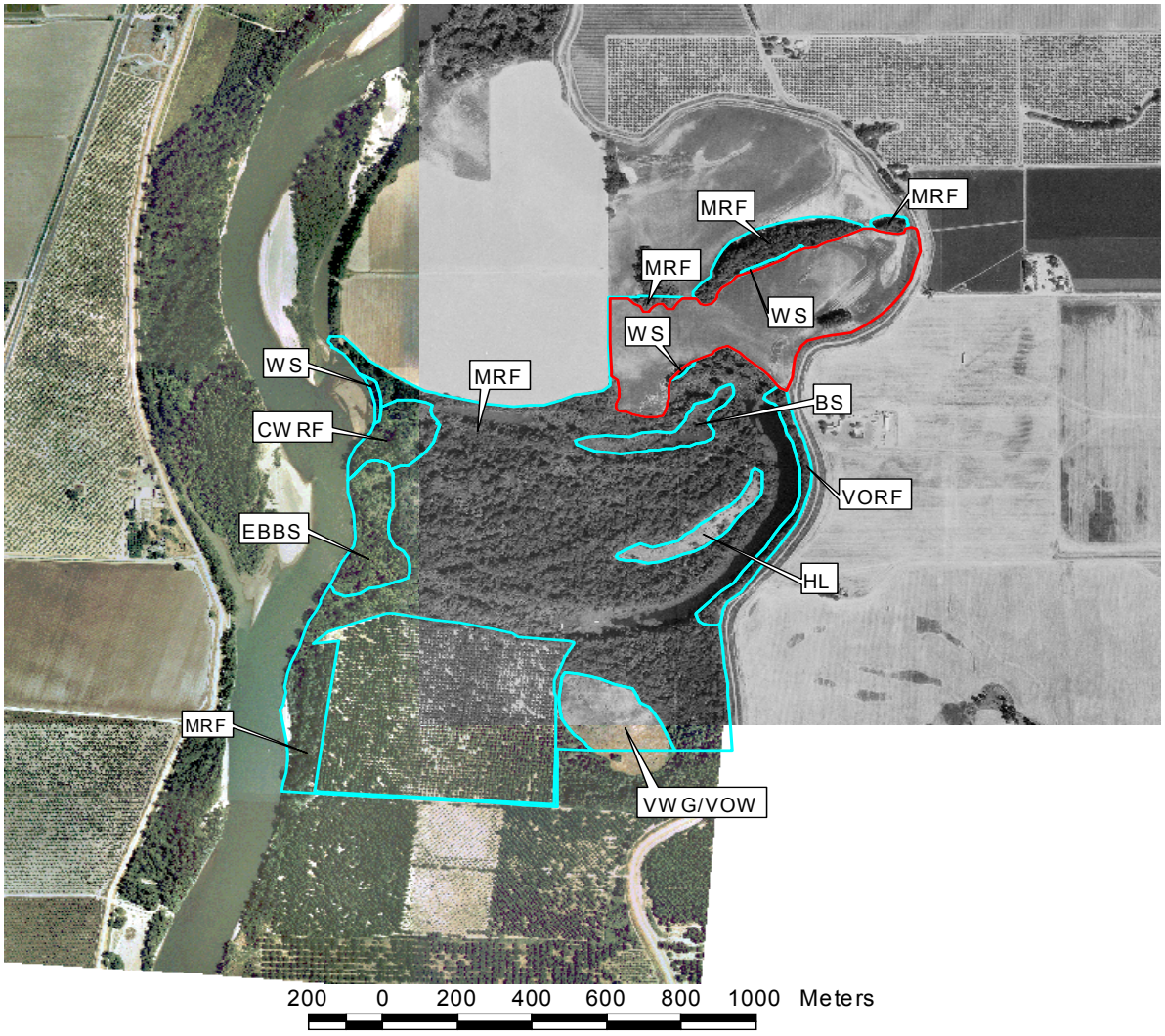


Figure 1. Remnant riparian plant communities nearby the Womble Restoration Area, Glenn and Colusa Counties, California.

Womble Restoration Area: Estimated Flood Frequency, Soil Sampling Locations, and Historic River Channels

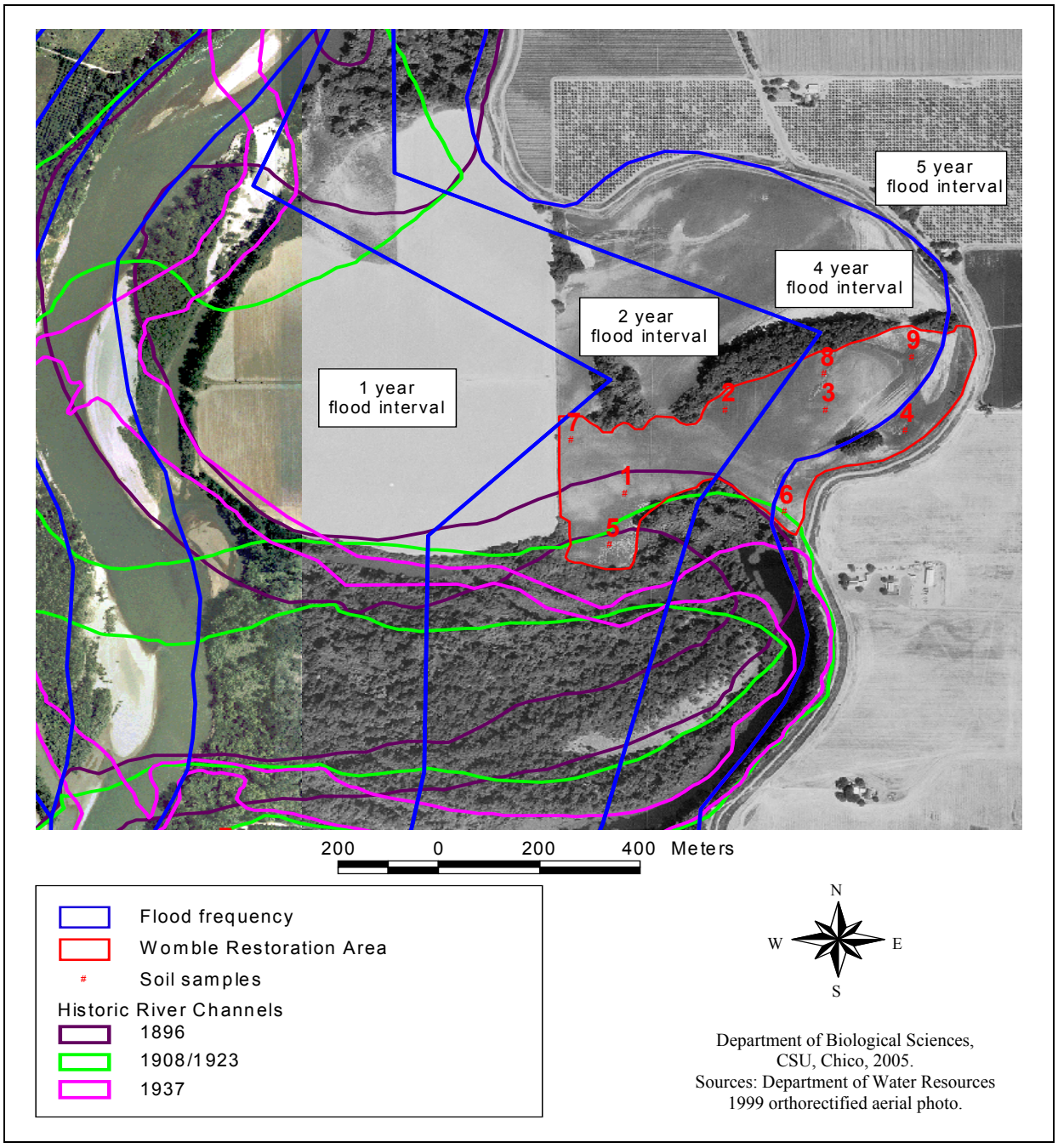


Figure 2. Estimated flood frequency, soil sampling locations, and historic river channels from 1896, 1908, 1923 and 1937 at the Womble Restoration Area, Glenn and Colusa Counties, California. The 1923 river channel is the same as the 1908 river channel for this stretch of the river.

Womble Restoration Area:
Potential Plant Communities

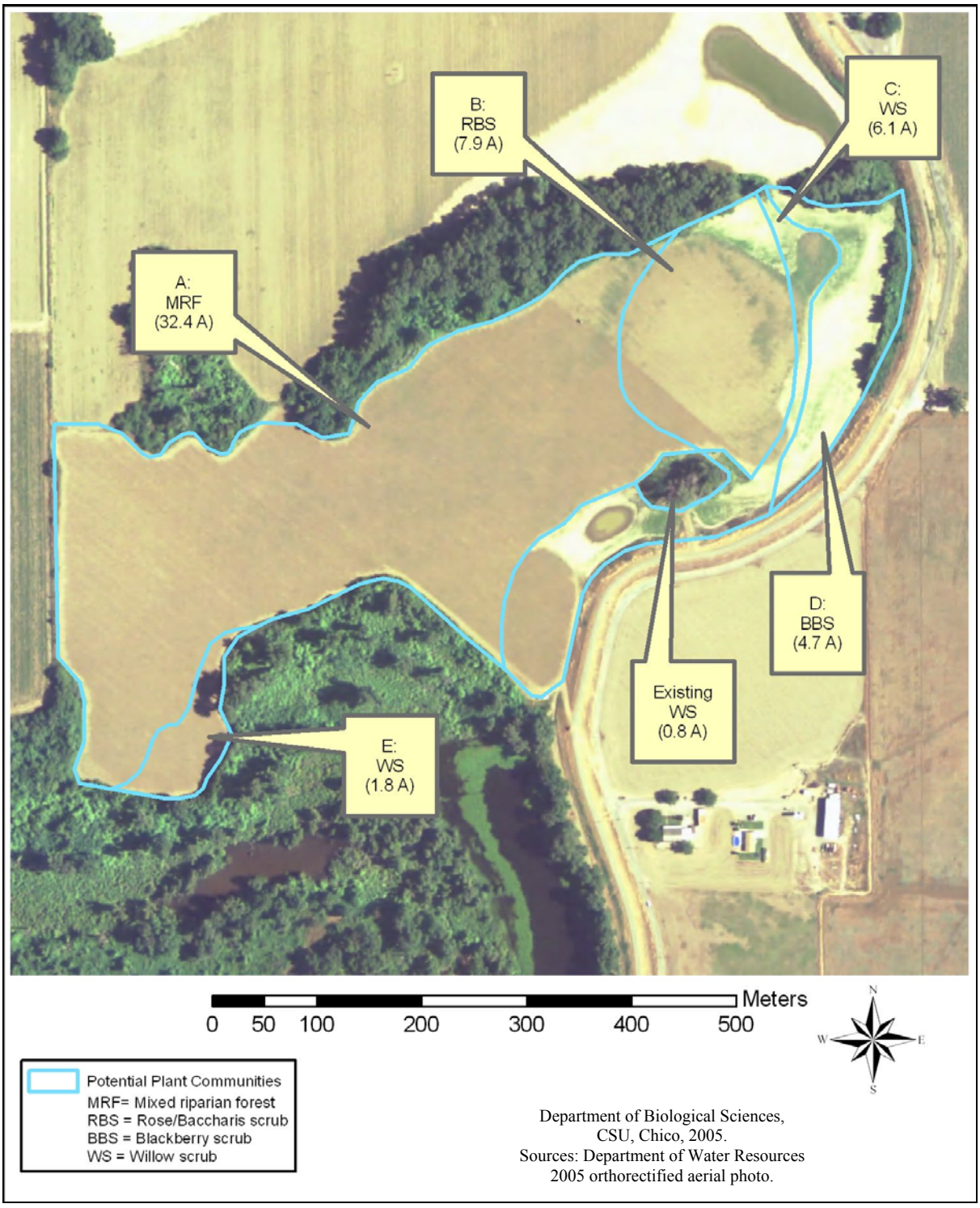


Figure 3. Potential plant communities for the Womble Restoration Area, Glenn and Colusa Counties, California.

Womble Restoration Area: Estimated Flood Frequency, Soil Sampling Locations and Potential Plant Communities

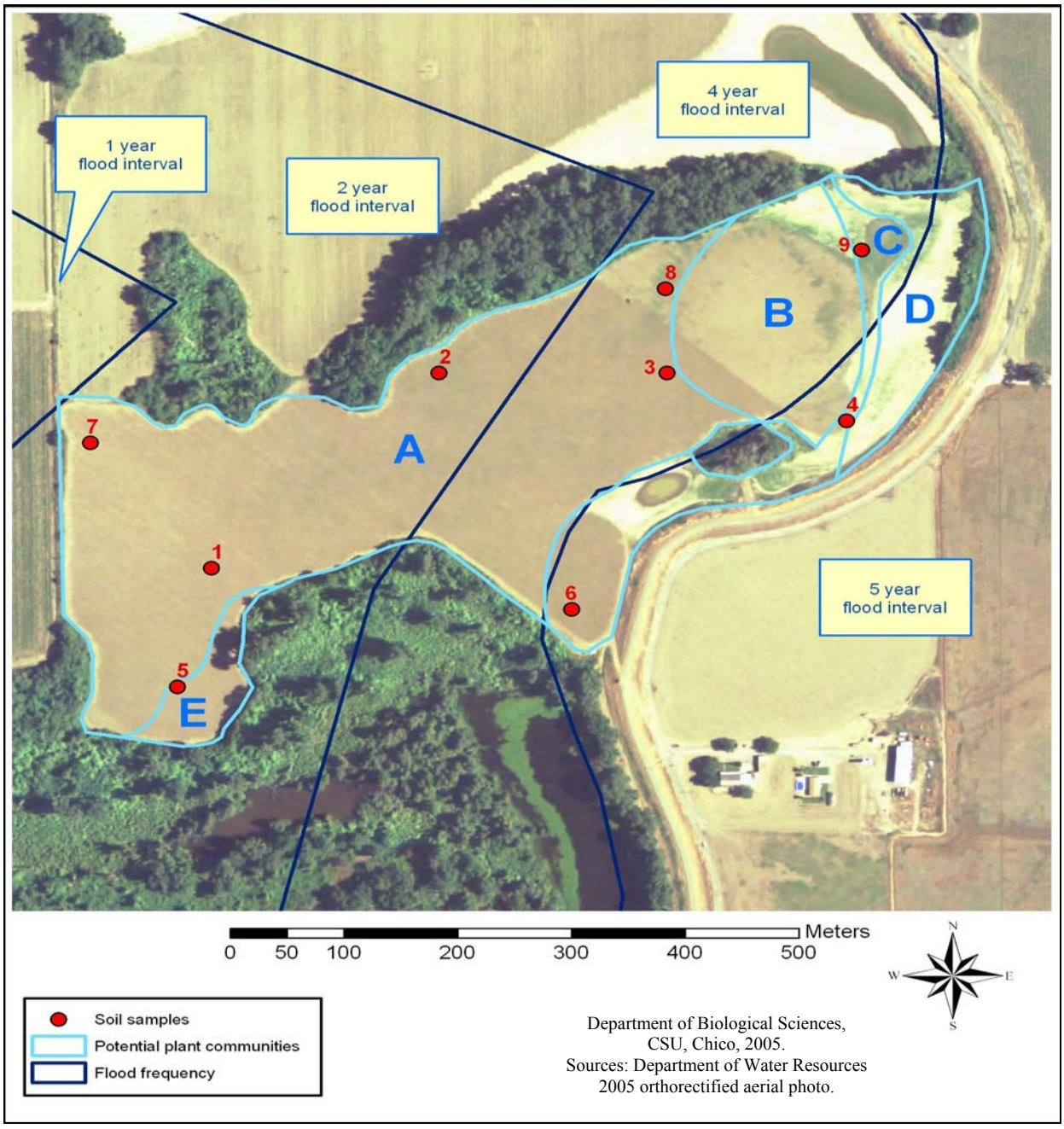


Figure 4. Estimated flood frequency, soil sampling locations, and potential plant communities at the Womble Restoration Area, Glenn and Colusa Counties, California. A is mixed riparian forest (32.4 acres); B is rose/*Baccharis* scrub (7.9 acres); C and E are willow scrub (6.1 and 1.8 acres, respectively); D is blackberry scrub (4.7 acres). Flood frequencies are from Department of Water Resources 1997 data; air photo is from 2005. See text for discussion of discrepancy.

Table 1. Composition frequency by community type for potential woody overstory restoration species for the Womble Restoration Area, Glenn and Colusa Counties, California. Remnant vegetation frequency is given by community type for those species recorded during quantitative sampling. Abbreviations are: MRF=Mixed Riparian Forest; WS=Willow Scrub; EBBS=Elderberry Blackberry Scrub; MRF BBS=Mixed Riparian Forest Blackberry Scrub (see Methods); BBS=Blackberry Scrub; RBS=Rose/*Baccharis* Scrub. A "+" indicates observed but not sampled for that community; a blank indicates not observed. An "H" indicates a species added since listed by Holland. Nomenclature follows *The Jepson Manual* (Hickman 1993).

Common Name	Scientific Name	Composition Frequency (%)								
		Remnant Vegetation					Womble Recommendations			
		Womble/Jensen				Boeger				
Woody species		MRF (n=84)	WS (n=8)	EBBS (n=12)	MRF BBS (n=12)	BBS (n=8)	MRF	RBS	WS	BBS
box elder	*Acer negundo*	60	13	92	67	25	22		9	20
western sycamore	*Platanus racemosa*	+					4			
Fremont cottonwood	*Populus fremontii*	20	H	8			9		5	3
valley oak	*Quercus lobata*	7					5			
narrow-leaved willow	*Salix exigua*		88						35	
Goodding's black willow	*Salix gooddingii*	7				13	5		10	
arroyo willow	*Salix lasiolepis*	12	+		8		6		10	3
Oregon ash	*Fraxinus latifolia*	H					4			
coyote brush	*Baccharis pilularis*							30		
California button willow	*Cephalanthus occidentalis* var. *californicus*	5			8		3			6
California rose	*Rosa californica*	5	H				3	30	5	
California blackberry	*Rubus ursinus*	43		25	58	75	17	20		60
blue elderberry	*Sambucus mexicana*	4		33			2	5		
western poison oak	*Toxicodendron diversilobum*	8			8		3			3
red willow	*Salix laevigata*	H					2		10	
shining willow	*Salix lucida* ssp. *lasiandra*	H	H				2		10	
California pipevine	*Aristolochia californica*	4					2	15		
virgin's bower	*Clematis ligusticifolia*	6		8			3			
California man-root	*Marah fabaceus*			17						
California wild grape	*Vitis californica*	23	H		42	25	8		5	6
Total Coverage							100	100	100	100

Table 2. Distribution frequency by community type for potential woody overstory restoration species for the Womble Restoration Area, Glenn and Colusa Counties, California. Frequency is given by community type for those species recorded during quantitative sampling. Abbreviations are: MRF=Mixed Riparian Forest; WS=Willow Scrub; BBS=Blackberry Scrub; RBS=Rose/*Baccharis* Scrub. 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	Womble Recommendations			
		Distribution Frequency (%)			
Woody Species		MRF	RBS	WS	BBS
box elder	*Acer negundo*	86		50	72
western sycamore	*Platanus racemosa*	10*			
Fremont cottonwood	*Populus fremontii*	52		10*	33
valley oak	*Quercus lobata*	19			
narrow-leaved willow	*Salix exigua*			100	
Goodding's black willow	*Salix gooddingii*	29		10*	
arroyo willow	*Salix lasiolepis*	24		10*	33
Oregon ash	*Fraxinus latifolia*	10*			
coyote brush	*Baccharis pilularis*		75*		
California button willow	*Cephalanthus occidentalis* var. *californicus*	10			33
California rose	*Rosa californica*	5	75*	10*	
California blackberry	*Rubus ursinus*	67	50*		78
blue elderberry	*Sambucus mexicana*	14	10*		
western poison oak	*Toxicodendron diversilobum*	19			33
red willow	*Salix laevigata*	10*		10*	
shining willow	*Salix lucida* ssp. *lasiandra*	10*		10*	
California pipevine	*Aristolochia californica*	10	50*		
virgin's bower	*Clematis ligusticifolia*	14			
California wild grape	*Vitis californica*	62		10*	75

Table 3. Mean percent cover by community type for potential herbaceous understory restoration species at the Womble Restoration Area, Glenn and Colusa Counties, California. Abbreviations are: MRF=Mixed Riparian Forest; WS=Willow Scrub; EBBS=Elderberry Blackberry Scrub; MRF BBS=Mixed Riparian Forest Blackberry Scrub (see Methods); BBS=Blackberry Scrub; RBS=Rose/*Baccharis* Scrub. Abundances in italics are from Holl and Crone (2004). A blank indicates not observed. "E" indicates species to be planted on the edge. "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).

Common Name	Scientific Name	Mean Percent Cover					
		Remnant Vegetation Womble/Jensen		Womble Recommendations			
Herbaceous Species		**MRF (n=21)**	**WS (n=2)**	**MRF**	**RBS**	**WS**	**BBS**
mugwort	*Artemisia douglasiana*	1.00	3	20		22	
horseweed	*Conyza canadensis*	*0.05*		3		3	
fireweed	*Epilobium ciliatum*	*0.05*		3			
goose grass	*Galium aparine*	8.00	15	8		6	
lotus	*Lotus purshianus*	*0.05*		3			
bugleweed	*Lycopus americanus*	*0.09*		3			
nettle	*Urtica dioica*	*1.76*	1	5		5	
western goldenrod	*Euthamia occidentalis*			10	50	3	
California goldenrod	*Solidago californica*			10	50	3	
hairy evening-primrose (E)	*Oenothera elata*			5		3	
Santa Barbara sedge	*Carex barbarae*	*1.56*		10			50
clustered field sedge	*Carex praegracilis*			5			47
blue wildrye	*Elymus glaucus* ssp. *glaucus*	*3.49*	*4*	DS	DS	DS	
creeping wildrye	*Leymus triticoides*			DS	DS	DS	
meadow barley	*Hordeum brachyantherum*			DS		DS	
purple needlegrass	*Nassella pulchra*				DS		
Total Coverage				85	100	45	97

References

California Department of Fish and Game. 2003. California Natural Diversity Database, List of California Terrestrial Natural Communities. Wildlife and Habitat Data Analysis Branch, Sacramento CA. Retrieved from: http://www.dfg.ca.gov/whdab/pdfs/natcomlist.pdf.

California, Department of Water Resources. 2002. GIS of the middle Sacramento River, California. Northern District, Red Bluff, California.

Hickman, J., Ed. 1993. The Jepson Manual: Higher Plants of California. University of California Press, Berkeley, California.

Holl, K. D. and E. L. Crone. 2004. Applicability of landscape and island biogeography theory to restoration of riparian understorey plants. Journal of Applied Ecology 41:922-933.

Holland, R. F. 1986. Preliminary Descriptions of the Terrestrial Natural Communities of California. California Department of Fish and Game, Non-game Heritage Program, Sacramento, California.

Hubbell, J. G. 1997. Competitive effects of intercropping alfalfa with valley oak and blue elderberry seedlings. Master's thesis. California State University-Chico, Chico, California.

Hubbell, J.G. and D.S. Efseaff. 1998. Vegetation Assessment of Five 1998/1999 Sacramento River Project Restoration Sites for The Nature Conservancy. Unpublished report to The Nature Conservancy.

Hubbell, J.G., D.L. Brown, J. Rotnem, J. Schwenkler, G. Magda, C. Wilder, and S. Ellberg. 1999a. Kaiser 1999 Site Assessment for The Nature Conservancy. Unpublished report to The Nature Conservancy.

----------. 1999b. River Vista 1999 Site Assessment for The Nature Conservancy. Unpublished report to The Nature Conservancy.

Hubbell, J.G., D.L. Brown, J. Rotnem, J. Schwenkler, G. Magda, and C. Wilder. 1999c. Ryan 1999 Site Assessment for The Nature Conservancy. Unpublished report to The Nature Conservancy.

----------. 1999d. Stone 1999 Site Assessment for The Nature Conservancy. Unpublished report to The Nature Conservancy.

Hubbell, J.G., J.W. Hunt, M. Quinn, and D.M. Wood. 2003a. Site Assessment for Riparian Restoration at the RX Ranch Unit. Unpublished report to The Nature Conservancy.

----------. 2003b. Site Assessment for Riparian Restoration at the Deadman's Reach Unit of U.S. Fish and Wildlife Service's Sacramento River National Wildlife Refuge. Unpublished report to The Nature Conservancy.

----------. 2003c. Site Assessment for 2003 Restoration at the Haleakala Unit of U.S. Fish and Wildlife Service's Sacramento River National Wildlife Refuge. Unpublished report to The Nature Conservancy.

----------. 2003d. Site Assessment for Riparian Restoration at the Sunset Ranch Unit. Unpublished report to The Nature Conservancy.

Keeler-Wolf, T. and M. Vaghti. 2000. Vegetation Mapping of Suisun Marsh, Solano County, California. California Department of Fish and Game, Wildlife and Habitat Data Analysis Branch.

National Agriculture Imagery Program. 2004. Orthorectified aerial photos of Glenn and Colusa Counties, California.

The Nature Conservancy. 2005. Draft Colusa Subreach Background Report. Northern Central Valley Office, Chico, California.

Peterson, D.R. 2002. The development of an alternative restoration strategy for Sacramento River riparian forests. Master's Thesis, California State University, Chico.

Peterson D.R., G.H. Golet, R. Luster, M. Roberts, and D. Jukkola. 2003. Modeling plant community types as a function of physical site characteristics. Report to CALFED. Available at: http://www.sacramentoriverportal.org.

U.S. Army Corps of Engineers. 1997. Digital elevation model. Received from The Nature Conservancy.

Wood, D.M. 2003. An analysis of vegetation on restoration sites. Report to The Nature Conservancy. Available at: http://www.sacramentoriverportal.org.

SECTION TWO

WOMBLE

REMNANT RIPARIAN VEGETATION SURVEY

Catherine Little
Jean G. Hubbell, M.S.
Gay Ann Silman
Katie C. Price
Dr. David M. Wood

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.

Mixed riparian forest and willow scrub within the Womble tract, and annual row crops on the adjacent property, form the Restoration Area's northern boundary (Figure 5). East of the Restoration Area are annual row crops separated by a levee. The southern border of the Restoration Area is mixed riparian forest which wraps around and bounds the southwest corner. This vegetation is also within the Womble tract and extends southward into the adjacent property. A small patch of willow scrub occurs along the southern border as well. The remainder of the western border is annual row crops on adjacent property.

Remnant riparian vegetation surveyed occurs on land owned by the Wildlife Conservation Board and managed by California Department of Fish and Game as part of their Sacramento River Wildlife Area (Womble tract) and on The Nature Conservancy's (TNC) Jensen tract. This remnant riparian vegetation bounds the Restoration Area to the north and south (Figure 5) and extends south and southwest to TNC's Jensen tract. The remnant riparian vegetation on TNC's Jensen tract lies between the Sacramento River and the Jensen Restoration Area. Details of adjacent landcover can be found in Section One. The same remnant riparian vegetation was surveyed for both the Womble and Jensen Restoration Area Baseline Assessments.

Eight natural communities were found to occur nearby the Womble Restoration Area: buttonbush scrub, Great Valley cottonwood riparian forest, elderberry blackberry scrub, valley wildrye grassland/valley oak woodland, Great Valley mixed riparian forest, Great Valley valley oak riparian forest, Great Valley willow scrub, 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). Seven of these plant communities (excluding herbland) together comprise the estimated 244 acres of native riparian vegetation within the Womble tract.

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 during May and June 2005 in the remnant riparian vegetation located along the northern and southern borders of the Restoration Area, extending south and southwest to the Jensen tract and west of the Jensen Restoration Area (Figure 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 two sampling points were established (if possible). Thirty-

five sampling points, each with four quadrants, were established along several transects running roughly perpendicular to the bands of vegetation. The dense vegetation at this site resulted in a few points being sampled very close together. 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 composition frequency 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: 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 majority of the remnant vegetation area from at least 1896 through 1946 (DWR 2002, Figures 11-13). By 1946 the main channel had moved to the western edge of the present day forests, making these forests between 59 to >109 years old. It appears the main channel did not occupy the remnant forests north of the Restoration Area or west and east of the Jensen Restoration Area since before 1896 (Figure 11). Therefore, these forests are potentially over 109 years old. However the northern patches of existing mixed riparian forest adjacent to the Restoration Area, particularly the central patch,

were significantly smaller in the 1952 aerial photo (1968 Glenn County soil survey) than in the 1999 aerial photo. Thus a portion of these stands developed over the last 50 years.

Remnant Riparian Vegetation Community Descriptions

Qualitative community descriptions follow those of Holland (1986) with approximate acreage in parentheses. Remnant riparian plant communities sampled are mapped in Figure 5. The remnant riparian vegetation that borders the Restoration Area to the north consists of three patches of mixed riparian forest (10, 1, and 1 acres) primarily dominated by Fremont cottonwood (*Populus fremontii*) covered in California wild grape (*Vitis californica*) vines. There is a tree subcanopy of California black walnut (*Juglans californica*) and edible fig (*Ficus carica*) with an understory dominated by California blackberry (*Rubus ursinus*). The western patch of the three also has blue elderberry (*Sambucus mexicanus*) shrubs lining the forest edge. There is a narrow corridor of willow scrub (<1 acre) between the Restoration Area and the mixed riparian forest that is composed predominantly of arroyo willow (*Salix lasiolepis*) in the eastern half and narrow-leaved willow (*Salix exigua*) in the western half. The other two patches of willow scrub are dominated by narrow-leaved willow. These small patches (<1 acre and 1 acre) are located in the remnant riparian vegetation between the Womble and Jensen Restoration Areas: one along the southern edge of the Restoration Area and the other one along the Sacramento River.

The majority of the remnant riparian vegetation between the Womble and Jensen Restoration Areas consists of a mixed riparian forest (215 acres) almost surrounded by remnant oxbow and slough areas. The forest is a mosaic dominated by Fremont cottonwood and Goodding's black willow trees in some sections, and valley oak (*Quercus lobata*) and western sycamore (*Platanus racemosa*) in other sections, with an underlying subcanopy of trees in both. The subcanopy consists of a mix of box elder (*Acer negundo*), California black walnut, edible fig, and arroyo willow, with an abundance of Himalayan blackberry (*Rubus discolor*) occurring under the trees. There is a buttonbush scrub (6 acres) community in one of the seasonal slough areas composed of California button willow (*Cephalanthus occidentalis* var. *californicus*) with scattered California blackberry and California wild grape. This area was completely flooded during the initial survey but limited access for sampling occurred later as floodwaters receded. Closer to the river, there is a small stand of cottonwood riparian forest (8 acres) visually dominated by Fremont cottonwood. South of the cottonwood riparian forest, adjacent to the river, there is an elderberry blackberry scrub community (12 acres) composed primarily of large blue elderberry, sometimes single stemmed, and tall, dense Himalayan blackberry. Along the northwest border of the Jensen Restoration Area there is a large patch of giant reed (*Arundo donax*).

East of the Jensen Restoration Area there is an abandoned field that has been colonized by native grasses such as blue wildrye (*Elymus glaucus* ssp. *glaucus*), by coyote brush (*Baccharis pilularis*) shrubs, by young valley oak trees, and by some non-native forbs. In between the levee and the larger oxbow area there is a stand of valley oak riparian forest (7 acres) dominated by large valley oak trees, western poison oak (*Toxicodendron diversilobum*), and native vines. On the other side of the oxbow, within the mixed riparian forest, there is an herbland community (6 acres) that was not sampled due to access issues**.**

Womble Restoration Area:
Remnant Riparian Vegetation Sampling Locations

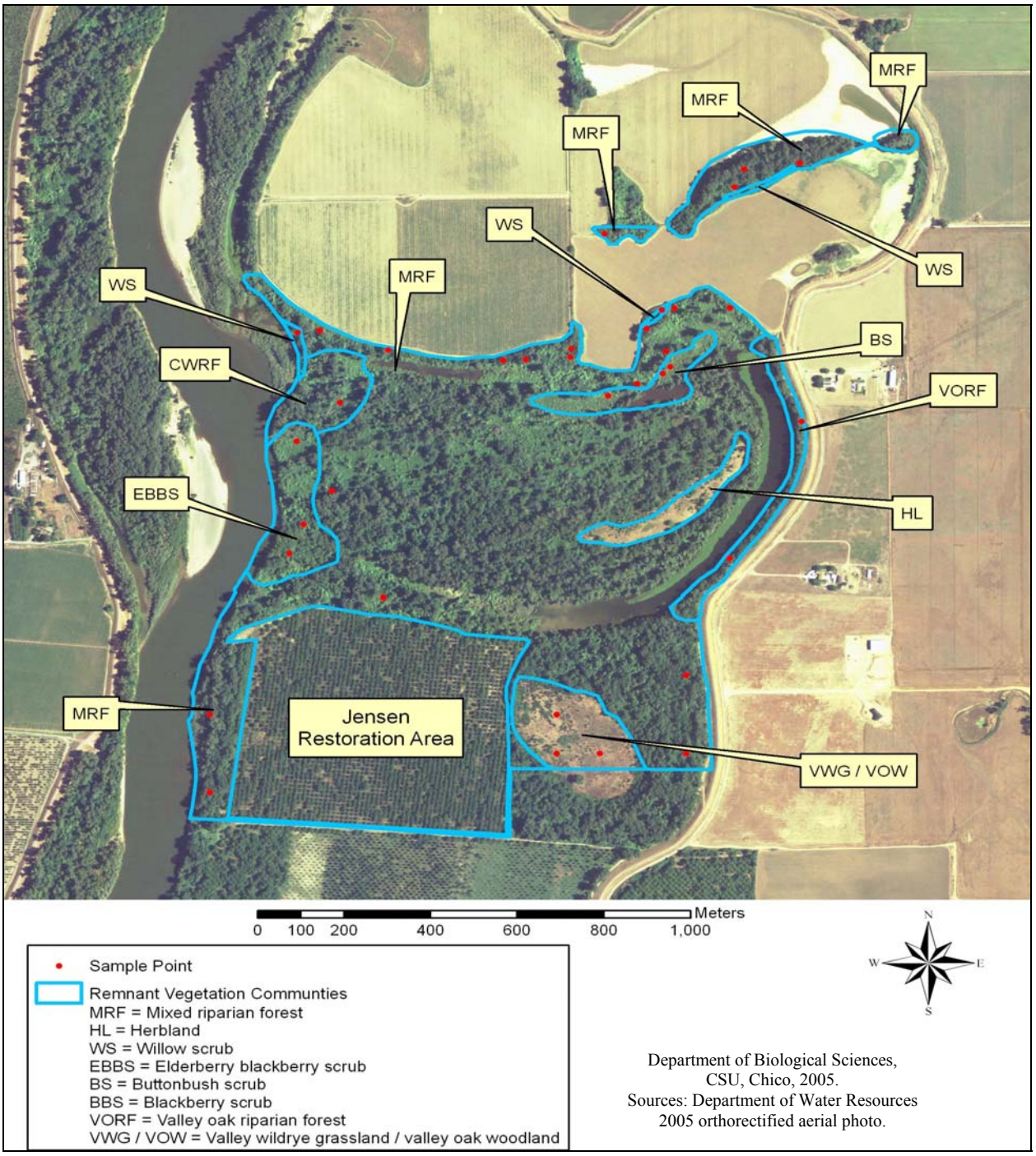


Figure 5. Remnant riparian plant communities and vegetation sampling locations within riparian plant communities close to the Womble Restoration Area, Glenn and Colusa Counties, California.

Table 4. Composition and distribution frequencies by community type for potential native woody restoration species found in remnant riparian vegetation close to the Womble Restoration Area, Glenn and Colusa Counties, California. Frequency is given by community type for those species recorded during quantitative sampling. The sample size (in parentheses) for composition frequency represents the number of quadrants sampled. The sample size (in parentheses) for distribution frequency represents the number of points sampled. Abbreviations are: BS=Buttonbush Scrub; CWRF=Cottonwood Riparian Forest; EBBS=Elderberry Blackberry Scrub; VWG/VOW=Valley Wildrye Grassland/Valley Oak Woodland; MRF=Mixed Riparian Forest; VORF=Valley Oak Riparian Forest**;** WS=Willow Scrub. 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**	**Composition Frequency (%)**							**Distribution Frequency (%)**						
Trees		**BS (12)**	**CWRF (4)**	**EBBS (12)**	**VWG/ VOW (12)**	**MRF (84)**	**VORF (8)**	**WS (8)**	**BS (3)**	**CWRF (1)**	**EBBS (3)**	**VWG/ VOW (3)**	**MRF (21)**	**VORF (2)**	**WS (2)**
box elder	*Acer negundo*			42		20					67		57		
western sycamore	*Platanus racemosa*					+									
Fremont cottonwood	*Populus fremontii*		75	8		20				100	33		52		
valley oak	*Quercus lobata*				50	7	75					100	19	100	
Goodding's black willow	*Salix gooddingii*					7							29		
arroyo willow	*Salix lasiolepis*		+			5							14		
blue elderberry	*Sambucus mexicanus*			33							67				
Shrubs															
box elder	*Acer negundo*		100	50		40		13		100	67		76		50
coyote brush	*Baccharis pilularis*				92		+					100			
California button willow	*Cephalanthus occidentalis* var. *californicus*	92				5			100				10		
California rose	*Rosa californica*					5							5		
narrow-leaved willow	*Salix exigua*							88							100
arroyo willow	*Salix lasiolepis*					7		+					19		
blue elderberry	*Sambucus mexicanus*					4							14		

Table 4 continued.

Common Name	Scientific Name	Composition Frequency (%)							Distribution Frequency (%)						
Shrubs		**BS (12)**	**CWRF (4)**	**EBBS (12)**	**VWG/ VOW (12)**	**MRF (84)**	**VORF (8)**	**WS (8)**	**BS (3)**	**CWRF (1)**	**EBBS (3)**	**VWG/ VOW (3)**	**MRF (21)**	**VORF (2)**	**WS (2)**
Western poison oak	*Toxicodendron diversilobum*					7	88						19	100	
Vines															
California pipevine	*Aristolochia californica*					4	+						10		
virgin's bower	*Clematis ligusticifolia*			8		6					33		14		
California man-root	*Marah fabaceus*			17			+				67				
California blackberry	*Rubus ursinus*	42	25	25		43	38		100	100	33		67	50	
western poison oak	*Toxicodendron diversilobum*					1	13						5	50	
California wild grape	*Vitis californica*	58	75			23	50		100	100			62	100	

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 Womble Restoration Area, Glenn and Colusa Counties, California. The sample size (in parentheses) for mean percent cover and for distribution frequency is the same and represents the number of points sampled. Abbreviations are: BS=Buttonbush Scrub; CWRF=Cottonwood Riparian Forest; EBBS=Elderberry Blackberry Scrub; VWG/VOW=Valley Wildrye Grassland/Valley Oak Woodland; MRF=Mixed Riparian Forest; VORF=Valley Oak Riparian Forest**;** WS=Willow Scrub. A blank indicates not observed. Nomenclature follows *The Jepson Manua*l (Hickman 1993).

Common Name	**Scientific Name**	**Mean Cover (%)**							**Distribution Frequency (%)**						
Herbs		**BS (3)**	**CWRF (1)**	**EBBS (3)**	**VWG/ VOW (3)**	**MRF (21)**	**VORF (2)**	**WS (2)**	**BS (3)**	**CWRF (1)**	**EBBS (3)**	**VWG/ VOW (3)**	**MRF (21)**	**VORF (2)**	**WS (2)**
mugwort	*Artemisia douglasiana*					1		3					5		50
blue wildrye	*Elymus glaucus* ssp. *glaucus*				33							67			
goose grass	*Galium aparine*		5		1	8		15		100		33	19		50
nettle	*Urtica dioica*							1							50

Table 6. Composition and distribution frequencies by community type for woody plant species not recommended, but found in remnant riparian vegetation close to the Womble Restoration Area, Glenn and Colusa Counties, California. Frequency is given by community type for those species recorded during quantitative sampling. The sample size (in parentheses) for composition frequency represents the number of quadrants sampled. The sample size (in parentheses) for distribution frequency represents the number of points sampled. Abbreviations are: BS=Buttonbush Scrub; CWRF=Cottonwood Riparian Forest; EBBS=Elderberry Blackberry Scrub; VWG/VOW=Valley Wildrye Grassland/Valley Oak Woodland; MRF=Mixed Riparian Forest; VORF=Valley Oak Riparian Forest**;** WS=Willow Scrub. 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**	**Composition Frequency (%)**							**Distribution Frequency (%)**						
Trees		**BS (12)**	**CWRF (4)**	**EBBS (12)**	**VWG/ VOW (12)**	**MRF (84)**	**VORF (8)**	**WS (8)**	**BS (3)**	**CWRF (1)**	**EBBS (3)**	**VWG/ VOW (3)**	**MRF (21)**	**VORF (2)**	**WS (2)**
tree of heaven	*Ailanthus altissima*						+								
edible fig	*Ficus carica*		+			2							10		
California black walnut	*Juglans californica*		25	17		33	25			100	33		81	100	
white mulberry	*Morus alba*					4							14		
black locust	*Robinia pseudoacacia*					+									
Shrubs															
edible fig	*Ficus carica*		+	17		5					33		19		
California black walnut	*Juglans californica*			33		24	13				33		48	50	
white mulberry	*Morus alba*	8				2			33				10		
Vines															
Himalayan blackberry	*Rubus discolor*			50	8	24	+				67	33	38		

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 Womble Restoration Area, Glenn and Colusa Counties, California. Frequency is given by community type for those species recorded during quantitative sampling. The sample size (in parentheses) for mean percent cover and for distribution frequency is the same and represents the number of points sampled. Abbreviations are: BS=Buttonbush Scrub; CWRF=Cottonwood Riparian Forest; EBBS=Elderberry Blackberry Scrub; VWG/VOW=Valley Wildrye Grassland/Valley Oak Woodland; MRF=Mixed Riparian Forest; VORF=Valley Oak Riparian Forest**;** WS=Willow Scrub. 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**	**Mean Cover (%)**							**Distribution Frequency (%)**						
Herbs		**BS (3)**	**CWRF (1)**	**EBBS (3)**	**VWG/ VOW (3)**	**MRF (21)**	**VORF (2)**	**WS (2)**	**BS (3)**	**CWRF (1)**	**EBBS (3)**	**VWG/ VOW (3)**	**MRF (21)**	**VORF (2)**	**WS (2)**
bur-chervil	*Anthriscus caucalis*					1							5		
giant reed	*Arundo donax*					+									
wild oat	*Avena fatua*						8							50	
ripgut grass	*Bromus diandrus*				2	3	13					33	10	50	
black mustard	*Brassica nigra*					2		5					5		50
soft chess	*Bromus hordeaceus*				20							33			
yelllow star-thistle	*Centaurea solstitialis*				17							33			
bull thistle	*Cirsium vulgare*				1							33			
grass	Grass sp.							1							50
jointed charlock	*Raphanus raphanistrum*				15							67			
cocklebur	*Xanthium strumarium*	+													

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 mile of the Womble Restoration Area, Glenn and Colusa Counties, 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.

References

Barbour, M.G., J.H. Burk, W.D. Pitts, F.S. Gilliam and M.W. Schwartz. 1999. Terrestrial Plant Ecology 3rd Edition. Addison Wesley Longman, Menlo Park, CA.

California Department of Fish and Game. 2003. California Natural Diversity Database. List of California Terrestrial Natural Communities. Wildlife and Habitat Data Analysis Branch, Sacramento, CA. Retrieved from: http://www.dfg.ca.gov/whdab/pdfs/natcomlist.pdf

California Department of Fish and Game. 2005. California Natural Diversity Database. RareFind 3. Updated May 27, 2005. Wildlife and Habitat Data Analysis Branch, Sacramento, CA.

California Department of Water Resources. 2002. GIS of the middle Sacramento River, California. Northern District, Red Bluff, California.

California Native Plant Society (CNPS). 2004. Inventory of Rare and Endangered Vascular Plants of California (sixth edition). Rare Plant Scientific Advisory Committee, David P. Tibor, Convening Editor. California Native Plant Society. Sacramento, CA.

Hickman, J.C. 1993. The Jepson Manual. University of California Press, Berkeley, California.

Holland, R.F. 1986. Preliminary descriptions of the terrestrial natural communities of California. California Department of Fish and Game, Sacramento, California.

Oswald, V. and L. Ahart. 1994. Manual of the Vascular Plants of Butte County, California. CNPS Press, Sacramento, California.

The Nature Conservancy. 2005. Draft Colusa Subreach Background Report. Northern Central Valley Office, Chico, California.

SECTION THREE

WOMBLE

SOIL SURVEY

Jean G. Hubbell, M.S.
Catherine Little
Katie C. Price
Dr. David M. Wood

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 Womble tract is located about one mile south of Princeton, in Glenn and Colusa Counties at river mile 162 and is owned by the Wildlife Conservation Board and managed by the California Department of Fish and Game as part of their Sacramento River Wildlife Area. The Restoration Area is approximately 58 acres of the Womble tract inside the levees on the east side of the Sacramento River. Currently the Restoration Area consists of annual row crops.

Methods

Soil data were gathered from augering 9 holes by hand across the Restoration Area during May and June 2005. These 9 holes were located on a grid at approximately 100-300 meter intervals (Figures 2 and 4). Initially a grid with holes 200m apart was laid out on the Restoration Area, resulting in 4 holes. Five 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 Restoration Area is generally dominated by clay loam soils, with clay dominated soils in the east and loam/sandy loam dominated soils in the center. This generally differs from the historic soil surveys of Oroville Area (1926), Colusa County (1948 and 1967), Glenn County (1968) and the current 1998 soil survey of Colusa County (Figures 6-10). In general the historic soil surveys map the Restoration Area as a type of Columbia loam. The 1926 Oroville Area historic soil survey, which included small portions of Glenn and Colusa Counties, delineates the Restoration Area mainly as Columbia loam. In the 1948 and 1967 Colusa County historic surveys for the lower half of the Restoration Area, the soils are described as Columbia soils undifferentiated and Columbia loam (USDA 1948), and Columbia association with fine sandy loam textures (USDA 1967). The 1968 Glenn County historic soil survey for the upper half of the Restoration Area, described it as Columbia silt loam with varying slopes, Zamora silty clay loam and gravel pits (USDA 1968). The 1998 Colusa County soil survey for the lower half describes the soils as Vina loam (USDA 1998). The auger hole soil textures are generally finer textured clay loam or clay and occasionally coarser textured than the soils described in the surveys above. The soil auger data are most similar to the Zamora silty clay loam. Table 11 gives the auger hole data and Table 12 lists comments (if any) for each hole. Surface textures across the site are primarily clay loams with a trend of courser to finer textured soil going from the southwest/west to northeast/east (Table 11). Thus there is sandy loam in the southwest, then sandy clay loam and clay loam in the middle and finally clay in the northeast. The subsoil pattern has a band of coarser textured soils running east-west through the center (holes 1 and 3) of the Restoration Area with finer textured clay loam soils to the north and south (holes 7, 2, 8, 5 and 6) and clay soils in the east (holes 9 and 4). The clay loam soils are relatively heterogeneous throughout the profile, with clay loams alternating with finer and coarser-textured layers. The clay and loam/sandy loam dominated soils have less heterogeneous profiles than the clay loam soils. Most of the Restoration Area has very deep soils with refusal from 5.5 to 15 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 three groups: one where there is a series of fining upward sequences (e.g. hole 7) or a single fining upward sequence but other layers above, below or both (e.g. hole 5); one that has a uniform fining upward sequence (hole 3) and one with no fining upward sequence (hole 9). The sample locations in the western half of the Restoration Area and one in the eastern half (hole 8) all have profiles indicative of channel deposits reflecting the historic scrolling of the Sacramento River across the Restoration Area (Table 11; Figures 6, 11-13; DWR 2002, USDA 1926). From at least 1896 until at least 1923 the main channel of the Sacramento River ran across the southwestern corner of the Restoration Area. This meander in the channel is known as Boggs Bend. Sometime between 1923 and 1926 a new main channel had formed to the west through a channel avulsion making Boggs Bend a side channel that flowed along the edge of the Restoration Area's southwestern corner. By 1935 Boggs Bend had shrunk such that it flowed south of the Restoration Area and by 1946 Boggs Bend no longer carried regular flow. Thus the southern sample points 1, 5 and 6 were all within the historic main channel. The northern sample points 7 and 2 were likely part of a meander scroll previous to 1896. Sample points 1, 7 and 2 all have series of fining upward sequences representative of channel deposits however the southern sample points (5 and 6) and one eastern sample point (8) all have a single fining upward sequence but other layers above, below or both. The depth of these 3 holes, ranging from 5-7

feet, may be limiting the ability to see the multiple sequences typical of channel deposits. It was a very wet spring and early summer 2005, with the area along the northeastern boundary of the Restoration Area under water during May sampling. Thus a high water table was likely present even in the end of June. The historic channel data confirms that at least samples 5 and 6 were indeed in the main channel as discussed above. The eastern two sampling points with clay soils have little to no fining upward sequence, which is explained by their occurrence in an historic oxbow lake as shown on the 1926 Oroville Area Soil Survey map (Figure 6). The oxbow lake is no longer evident in the 1952 aerial photo used for the 1968 Glenn County Soil Survey (Figure 9). Also, this explains the annual ponding of water in this portion of the Restoration Area.

The Restoration Area has deep to very deep soils with refusal at the water table at all sampling locations. The water table was reached between 3.5 and 8.5 feet during May sampling of points 1-5 and between 5 and 15 feet during June sampling of points 6-9. In May the water table was higher in the northern and southern portions of the Restoration Area with a lower water table running through the central portion of the Restoration Area. This follows the soil textures found in these areas with the coarsest soils being found in the central band of the Restoration Area (points 1 and 3). It is important to note, as stated above, that the section along the eastern boundary of the Restoration Area (i.e. the location of the 1926 oxbow lake) was under water during May. In June the water table continued to be higher in the south, where sampling was done in the historic channel. This makes sense as historic channels often act as underground conduits of water. The water table tended to get higher as one goes from west to east across the Restoration Area. This pattern reflects the approximate 10 foot drop in elevation from west to east (US ACE 1997) and reflects the slightly coarser soil textures found in the western portion of the Restoration Area. The higher water table to the south is only partly explained by the approximate 10 foot decrease in elevation along that direction (US ACE 1997). A particularly wet spring and early summer occurred in 2005 and thus the water table may have been more elevated than in a typical year.

Four of the sampling locations had reduced oxygen characteristics (redox features) at depths ranging from 2 to 6 feet (Table 12). 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 2 northern auger holes (2 and 8) is further evidence for these being in a buried pre-1896 channel as discussed above.

The 1968 Glenn County Soil Survey (Figure 9) denotes a gravel pit in the eastern portion of the Restoration Area. This designation could mean anything from disturbed land due to former gravel mining to an active gravel pit. Although no sampling was done within this feature the area on the 1999 aerial photo appears to have reduced vegetative growth. Point 3, which appears to be on the western edge of the feature, is one of the sandier samples.

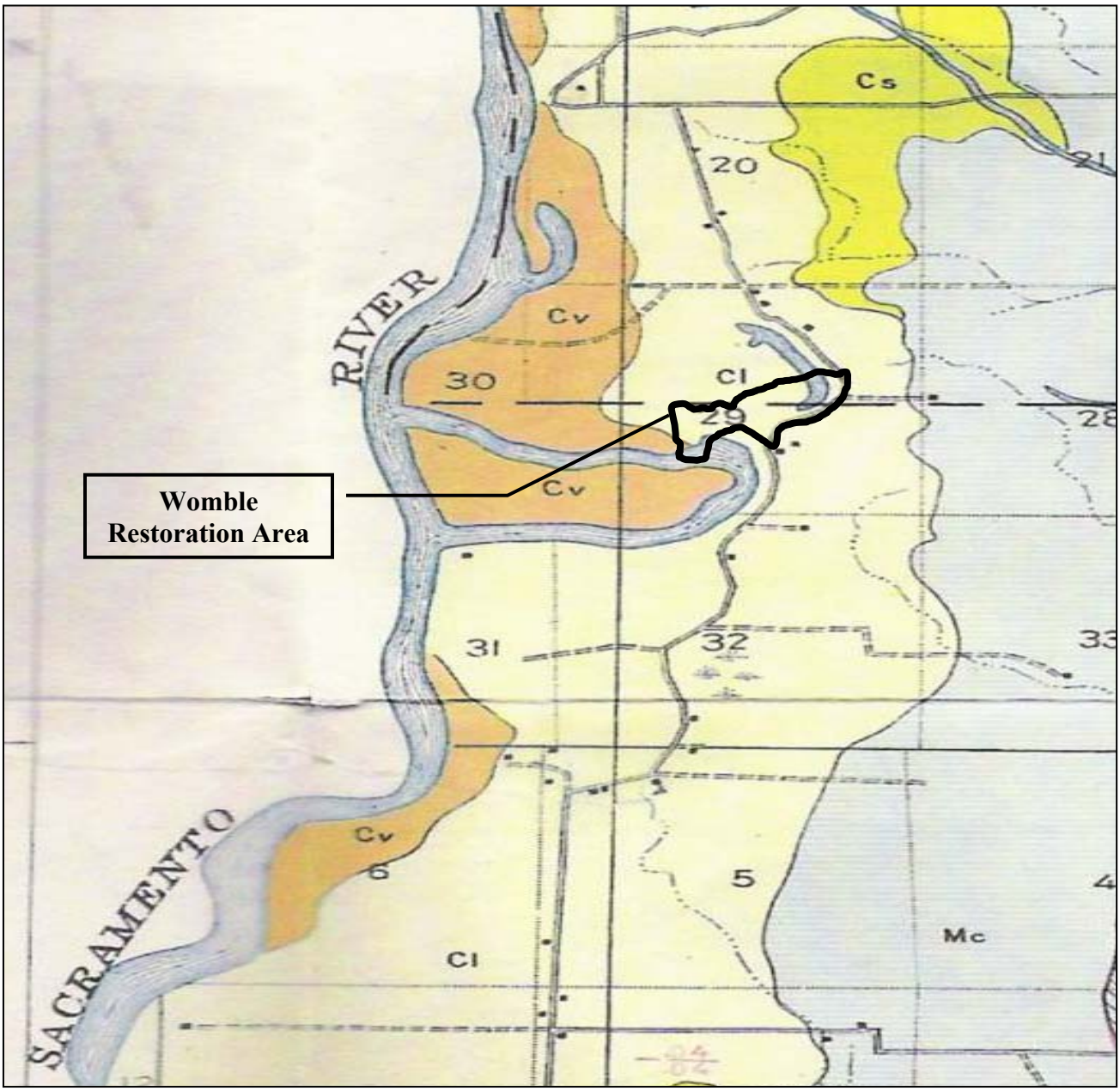
Table 11. Soil texture by depth across the Womble Restoration Area, Glenn and Colusa Counties, California.

Date Sampled	5/31/05	5/31/05	5/31/05	5/31/05	5/31/05	6/21/05	6/21/05	6/21/05	6/21/05
Point	1	2	3	4	5	6	7	8	9
Surface	Sandy Clay Loam	Clay Loam	Clay Loam	Clay	Sandy Loam	Clay Loam	Sandy Clay Loam	Clay Loam	Clay Loam
1 ft	Sandy Clay Loam	Clay Loam	Clay Loam	Silty Clay	Sandy Loam	Clay Loam	Clay Loam	Clay	Clay
2 ft	Sandy Loam	Silty Clay Loam	Loam	Clay	Clay Loam	Clay Loam	Clay Loam	Clay Loam	Silty Clay
3 ft	Loamy Sand	Silty Clay Loam	Loam	Silty Clay	Sandy Loam	Silty Clay Loam	Clay	Clay Loam	Clay
4 ft	Sandy Loam	Clay Loam	Loam		Clay Loam	Clay	Clay	Clay Loam	Clay
5 ft	Loamy Sand	Clay Loam	Loam		Clay Loam		Clay Loam	Clay	Clay
6 ft	Loamy Sand	Silty Clay Loam	Sandy Loam				Loam	Clay	
7 ft	Sandy Loam	Clay Loam	Sandy Loam				Clay Loam		
8 ft	Sandy Loam		Sandy Loam				Loam		
9 ft							Loam		
10 ft							Clay Loam		
11 ft							Clay Loam		
12 ft							Sandy Clay Loam		
13 ft							Sandy Clay Loam		
14 ft							Sandy Loam		
15 ft									
16 ft									
17 ft									
18 ft									
Total	8 ft 6 in	7 ft 6 in	8 ft 6 in	3 ft 6 in	5 ft 6 in	5 ft	15 ft	7 ft	6 ft 2 in
Refusal	Saturation	Saturation	Saturation	Saturation	Saturation	Saturation	Saturation	Saturation	Saturation

Table 12. Soil auger hole comments for the Womble Restoration Area, Glenn and Colusa Counties, California. Reduced oxygen conditions are noted as mottling. Extreme anaerobic conditions are noted as gleying or gleyed layers.

Hole #1- No comments.
Hole #2- Mottling at 5 and 6 ft.
Hole #3- Slightly sandy between 2 and 5 ft.
Hole #4- No comments.
Hole #5- Mottling at 2 ft. Gleying and mottling at 5 ft.
Hole #6- No comments.
Hole # 7- No comments.
Hole #8- Charcoal and mottling at 2 ft.
Hole #9- Red and black mottling at 2 and 3 ft. Red and black mottling and gleying at 4 and 5 ft.

Womble Restoration Area:
1926 Soil Series

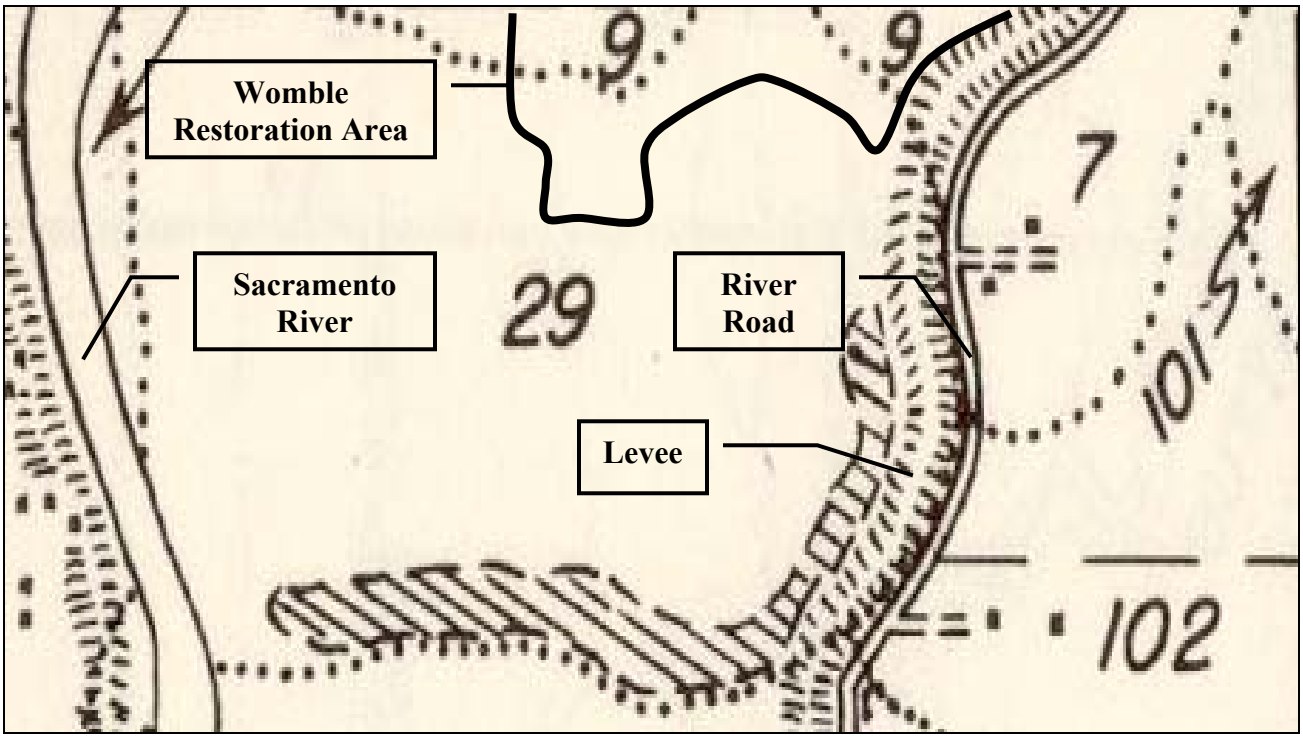


Cl= Columbia loam
Cv= Columbia very fine sandy loam

1 mile= approximately 2 inches

Figure 6. Approximate boundary and location of Womble Restoration Area on the 1926 Soil Survey map, Oroville Area, California (USDA Bureau of Soils), Glenn and Colusa Counties, California.

Womble Restoration Area:
1948 Soil Series

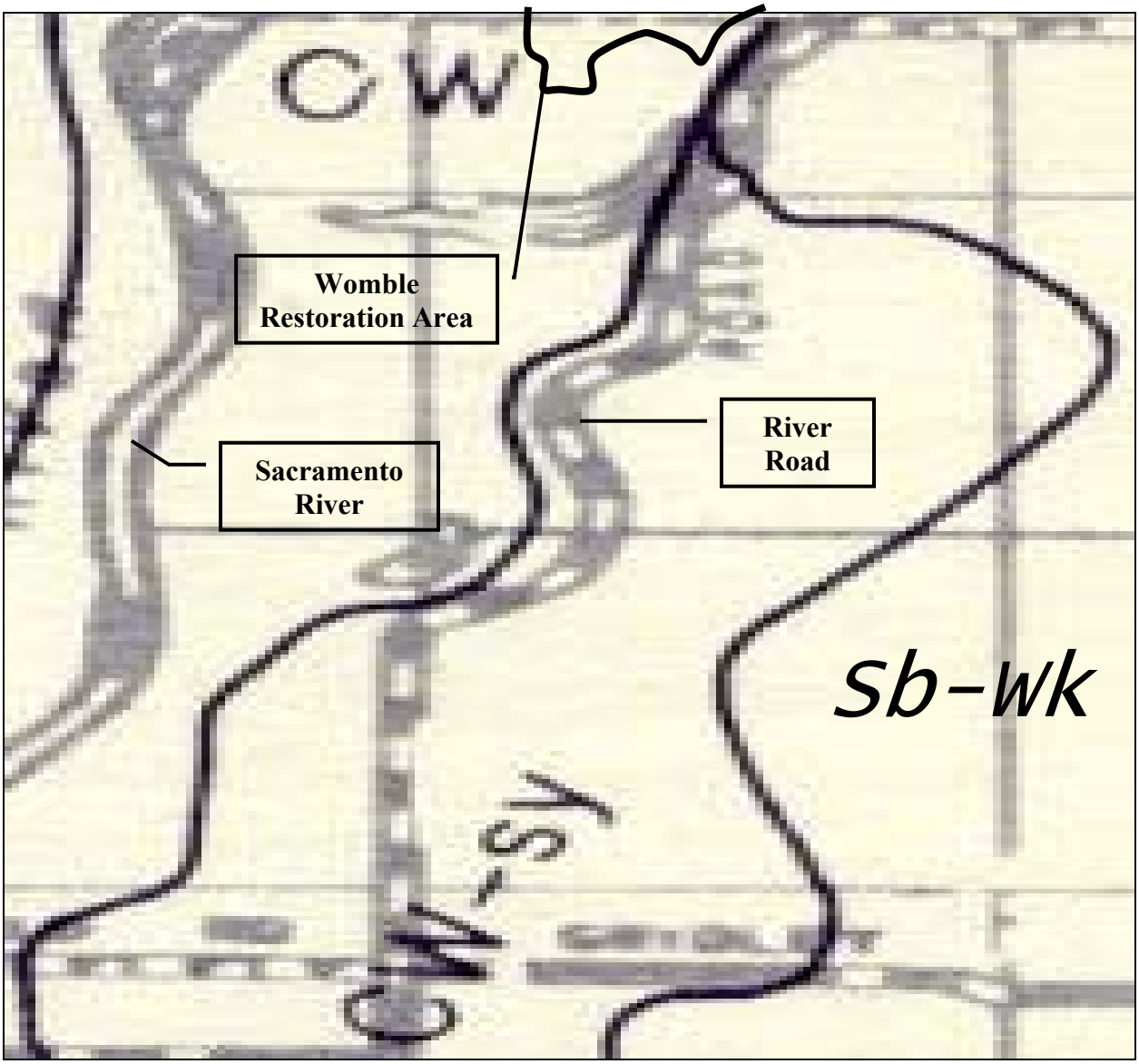


Soil Series Contours
7= Sycamore loam
9=Columbia loam, gently undulating
29= Columbia soils undifferentiated, variable microrelief, 0-2% slope, gently undulating

Scale: 1 mile= approximately 4 ¾ inches

Figure 7. Approximate boundary and location of the lower half of the Womble Restoration Area on the 1948 Soil Survey map, Colusa County, California (Harradine 1948).

Womble Restoration Area:
1967 Soil Series

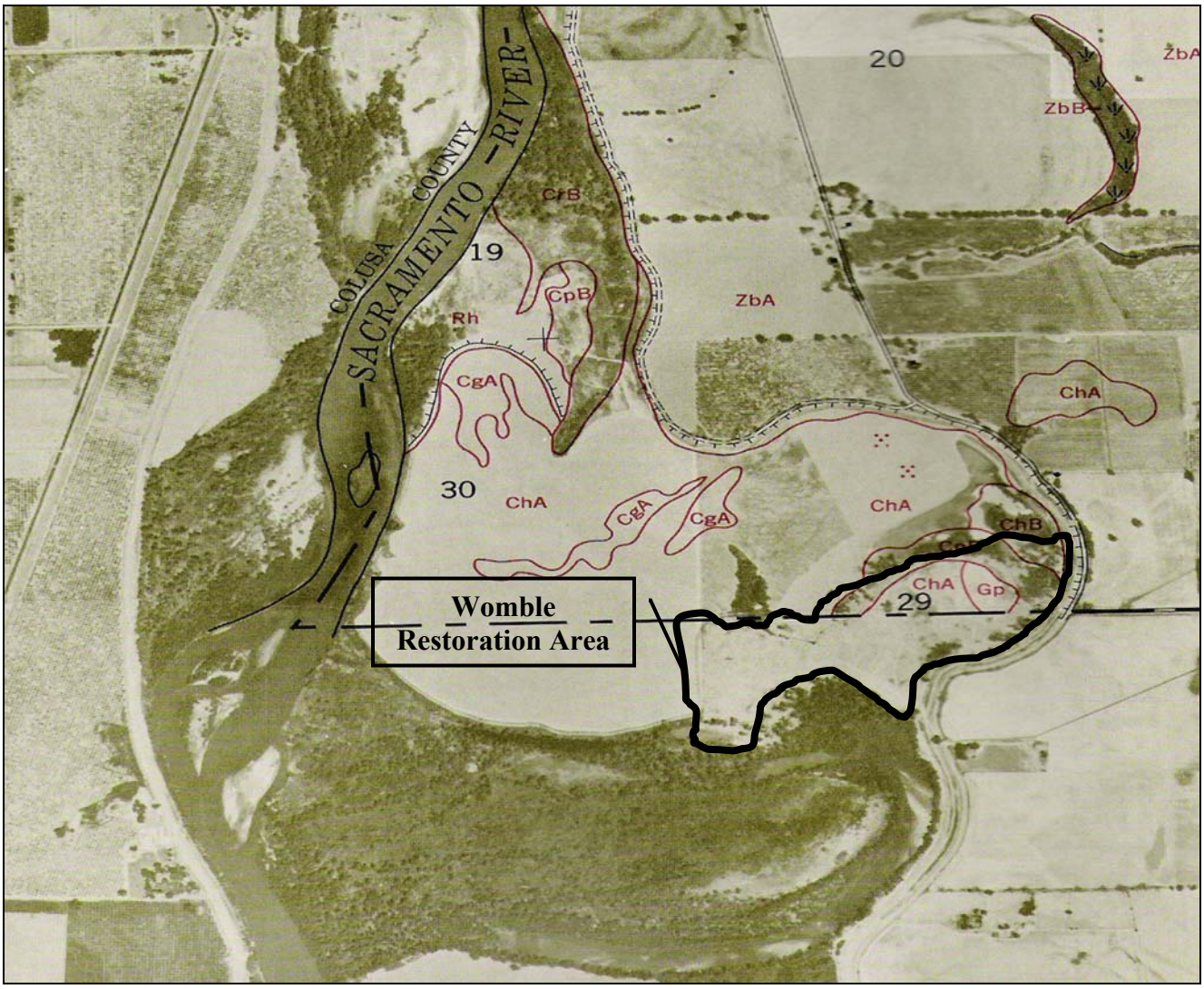


Soil Series Contours
- CW= Columbia association
- CW-sy= Columbia-Sycamore association
- Sb-Wk= Sacramento-Willows association

1 mile= approximately 3 1/8 inches

Figure 8. Approximate boundary and location of the lower half of the Womble Restoration Area on the 1967 Soil Survey map, Colusa County, California (USDA Soil Conservation Service).

Womble Restoration Area:
1968 Soil Series



Soil Series Contours
- ChA= Columbia silt loam, 0-2% slopes
- ChB= Columbia silt loam, 2-8% slopes
- Gp= Gravel pit
- CpB= Columbia silt loam, water table, 1-8% slopes
- ZbA= Zamora silty clay loam, 0-2% Slopes

1 mile= approximately 4 ¼ inches

Figure 9. Approximate boundary and location of Womble Restoration Area with soil series contours from the 1968 Glenn County Soil Survey overlain on 1952 aerial photo, Glenn and Colusa Counties, California (USDA Soil Conservation Service and Forest Service).

Womble Restoration Area:
1968 & 1998 Soil Series

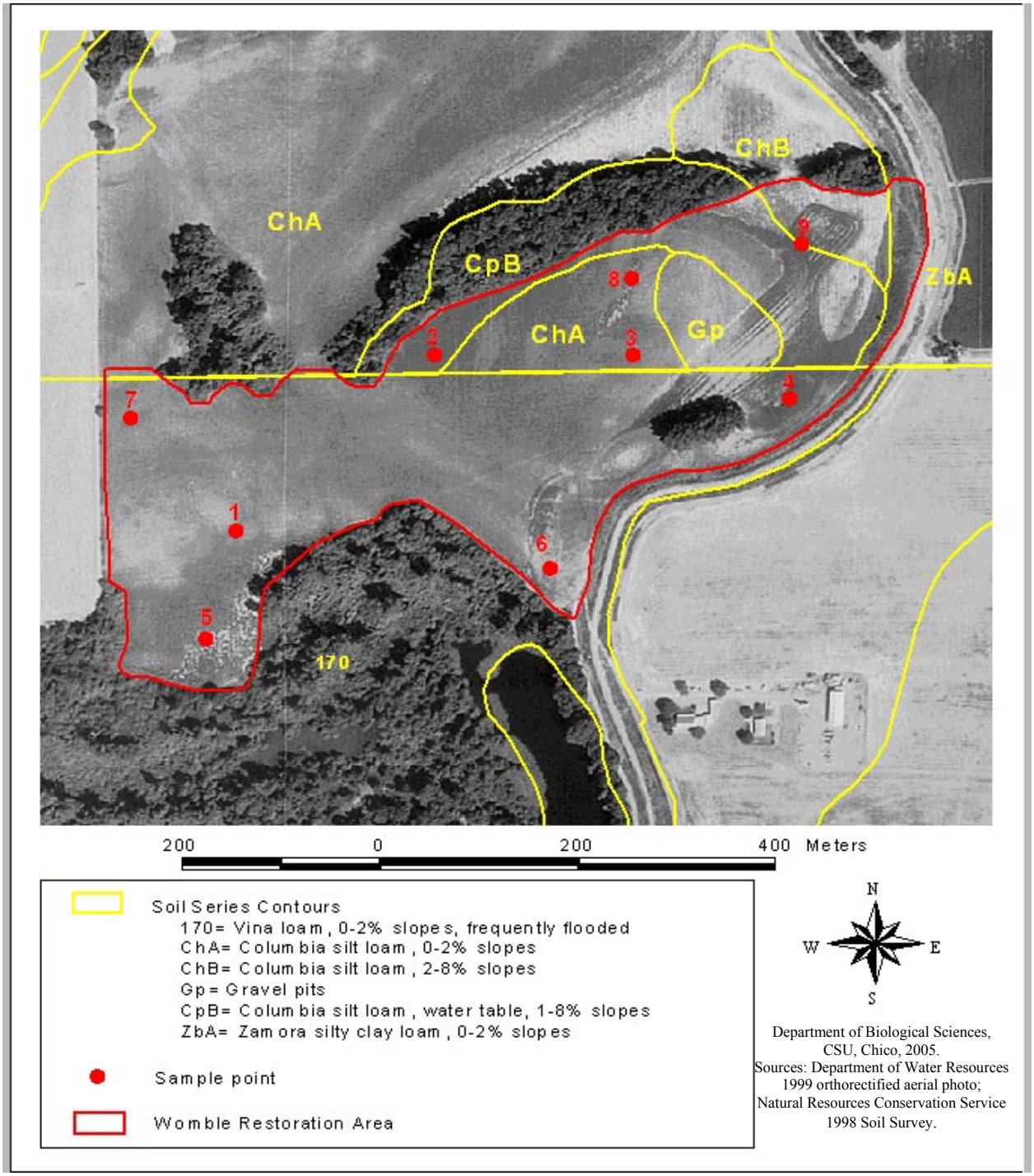


Figure 10. Soil series contours from the 1968 Glenn County Soil Survey and 1998 Colusa County Soil Survey overlain on a 1999 aerial photo of Womble Restoration Area, Glenn and Colusa Counties, California (USDA Soil Conservation Service and Forest Service for 1968 and Natural Resources Conservation Service for 1998).

Womble Restoration Area:
Historic River Channels 1896-1923

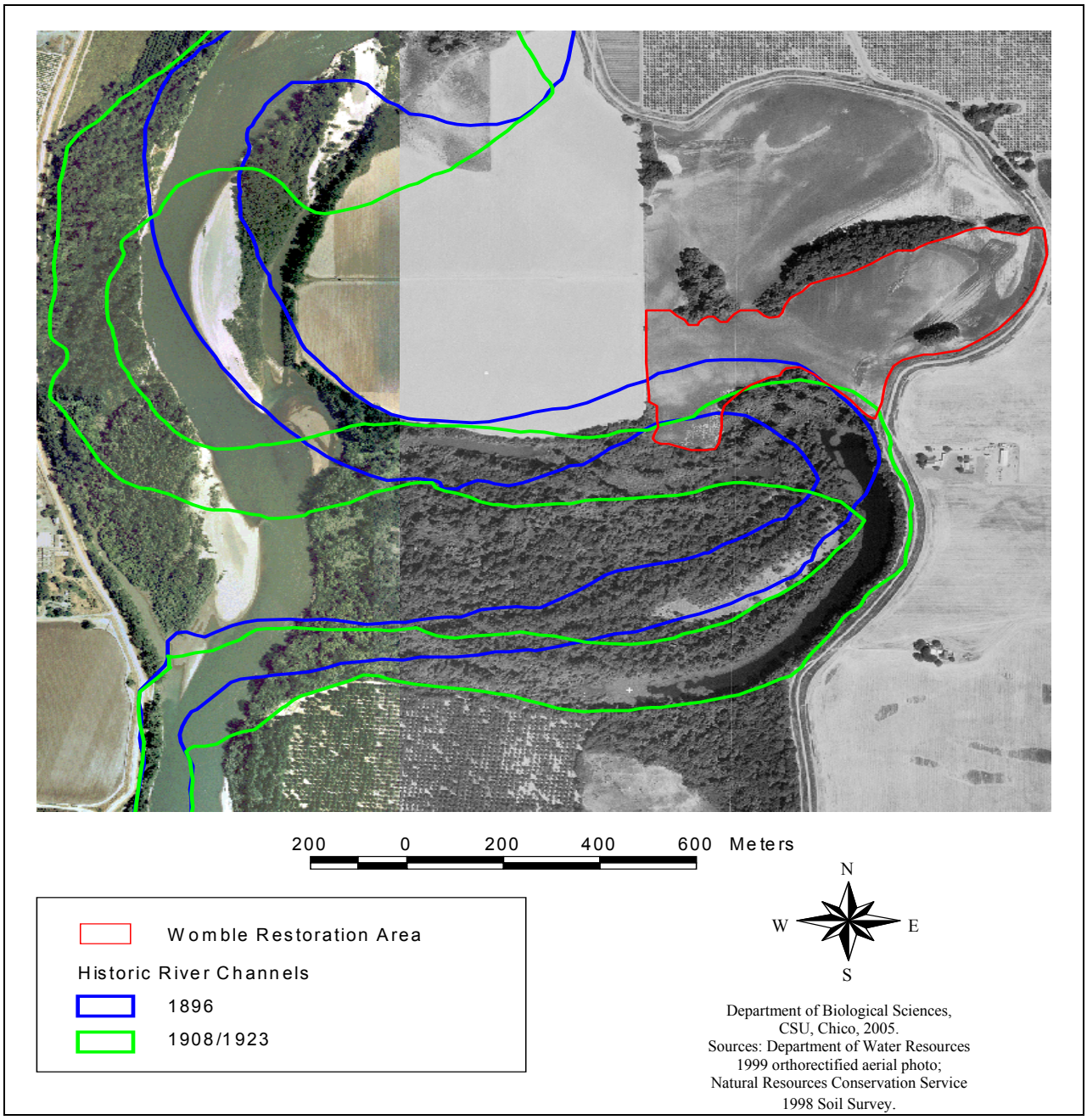


Figure 11. Historic river channels from 1896, 1908 and 1923 at Womble Restoration Area, Glenn and Colusa Counties, California. The 1908 and 1923 channel is the same for this stretch of the river.

Womble Restoration Area:
Historic River Channels 1935-1960

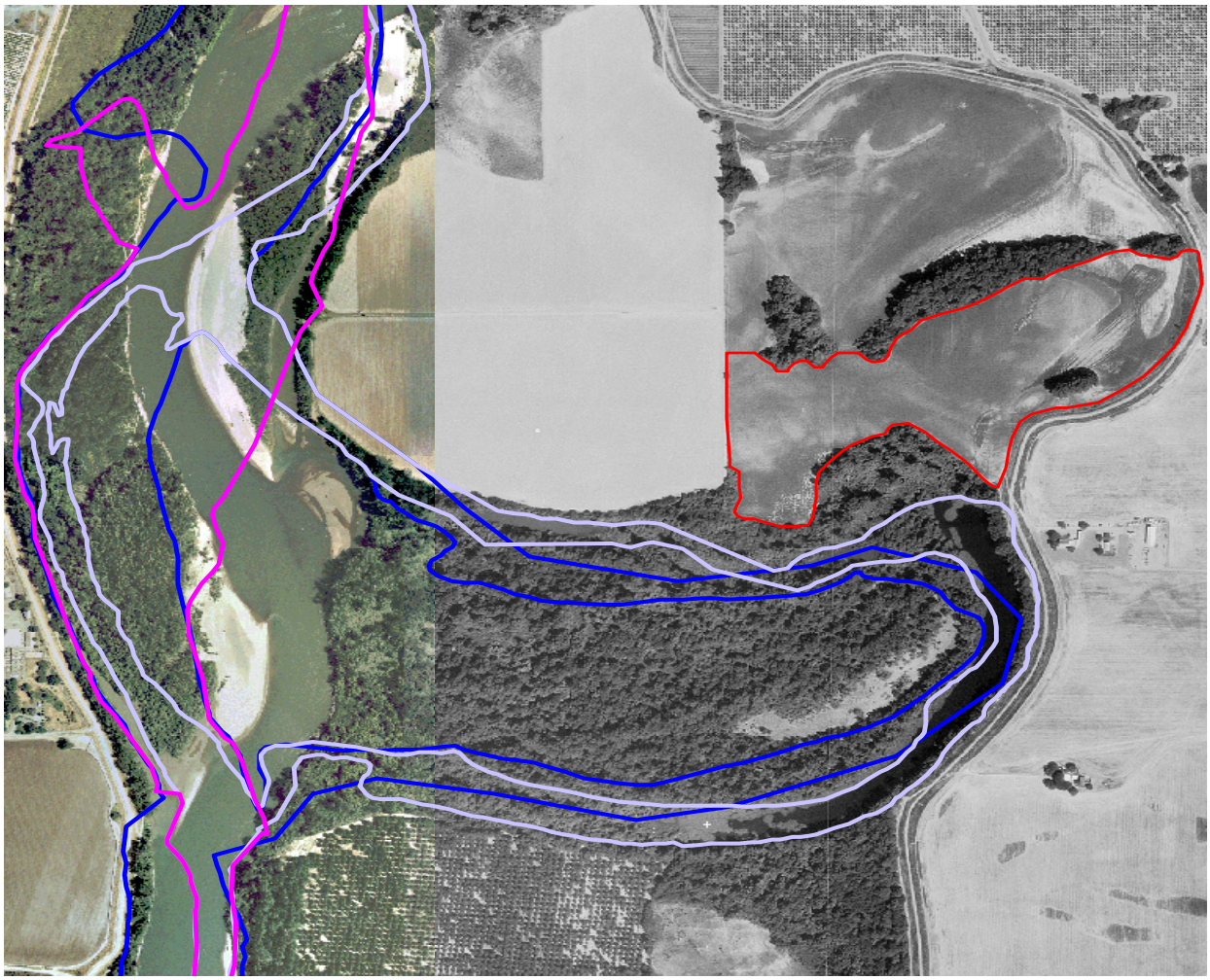


Figure 12. Historic river channels from 1935, 1937, and 1960 at Womble Restoration Area, Glenn and Colusa Counties, California. The 1960 channel is the same for this stretch of the river as 1946, 1955 and 1956.

Womble Restoration Area:
Historic River Channels 1964-1991

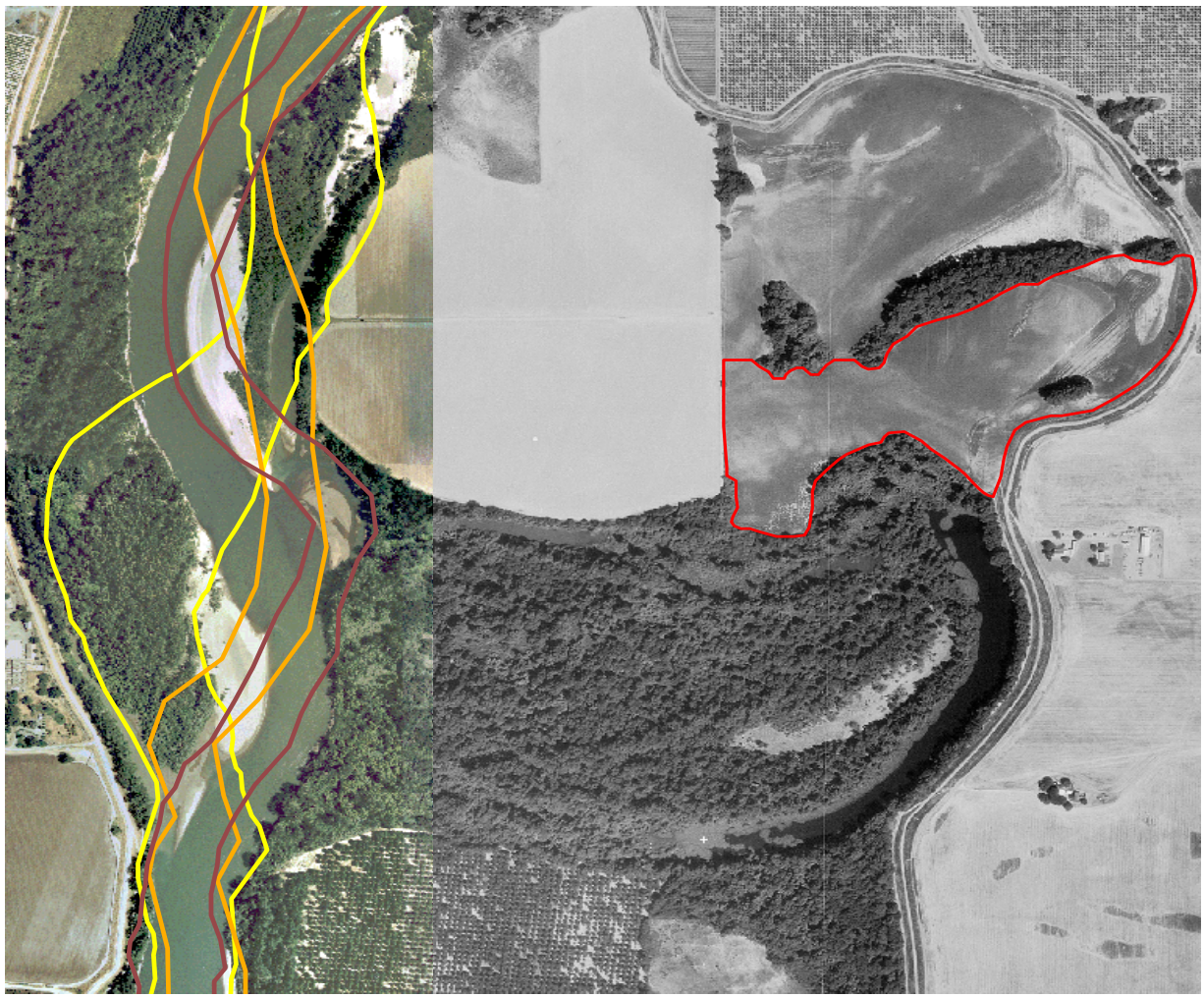


Figure 13. Historic river channels from 1976, 1981, and 1991 at Womble Restoration Area, Glenn and Colusa Counties, California. The 1976 channel is the same for this stretch of the river as 1964 and 1969.

Acknowledgements

Thanks to our field assistants Gay Ann Silman, Aggie Morrow, Mark Lynch, Stacee Henderson, and Jason Glick for augering holes and data entry.

References

California Department of Water Resources. 2002. GIS of the middle Sacramento River, California. Northern District, Red Bluff, California.

Harradine, F. F. 1948. Soils of Colusa County, California. University of California Berkeley, College of Agriculture, Agricultural Experiment Station, Division of Soils. Berkeley, California.

Schoeneberger, P.J., D.A. Wysocki, E.C. Benham and W.D. Broderson, (editors). 2002. Field book for describing and sampling soils, Version 2.0. Natural Resources Conservation Service, National Soil Survey Center, Lincoln, NE.

The Nature Conservancy. 2005. Draft Colusa Subreach Background Report. Northern Central Valley Office, Chico, California.

U.S. Army Corps of Engineers. 1997. Digital elevation model. Received from The Nature Conservancy.

U.S. Department of Agriculture, Bureau of Chemistry and Soils. 1926. Soil Survey of the Oroville Area, California.

U.S. Department of Agriculture, Soil Conservation Service. 1967. Report and general soil map, Colusa County, California.

U.S. Department of Agriculture, Soil Conservation Service and Forest Service. 1968. Soil Survey of Glenn County, California.

U.S. Department of Agriculture, Natural Resources Conservation Service. 1998. Soil Survey of Colusa County, California.

SECTION FOUR

WOMBLE

SPECIAL STATUS ANIMAL SPECIES,

BIRD COUNTS, AND NON-NATIVE MAMMALS

John W. Hunt, M.S.
David Koenig
Dr. David M. Wood

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 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 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 July 2-3, 2005, following an adaptation of the methods proposed by Ralph et al. (1993). Eleven point count stations set approximately 200 m apart were established in remnant riparian habitat at the Womble tract (Figure 14). 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 Womble Restoration Area, Glenn and Colusa Counties, 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	2
Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	SE	3
Bank swallow	*Riparia riparia*	ST	3
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 Womble Restoration Area, Glenn and Colusa Counties, 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	probable
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	probable
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

Table 14 continued.

Common Name	Scientific Name	Status	Breeding
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 Womble 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 recorded in the California Natural Diversity Database (CNDDB) as occurring within 1.0 mile of the Womble 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 is 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 is 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. This species is recorded in the CNDDB as occurring within 1.0 mile of the Womble Restoration Area and adjacent remnant riparian habitat.

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 occurring within 1.0 mile of the Womble 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 occurring within 1.0 mile of the Womble 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. Due to the lack of available field data, 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 were not 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, roof rats, and Norway rats all 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 (unpublished), because of its arboreal habits, mixed riparian forests can provide an ideal habitat for roof rats. Norway rats are also a widespread invasive mammal species with a high potential of occurrence, but they lack the arboreal tendencies of roof rats.

Nutria were not observed on or near 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 below 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 Womble Restoration Area, Glenn and Colusa Counties, 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*	No	Unknown
Roof Rat	*Rattus rattus*	No	Unknown
Norway Rat	*Rattus norvegicus*	No	Unknown
Nutria	*Myocastor coypu*	No	Unknown
Virginia Opossum	*Didelphus virginianis*	Sign (tracks)	Unknown

Bird Counts

Figure 14 shows sampling locations and Table 16 lists all bird species observed on the July 2-3, 2005 point counts. Figure 15 shows the frequency of occurrence for species observed more than once. Forty-three species were encountered during the survey. Species composition was fairly typical of riparian habitats along the Sacramento River. Black-headed grosbeak was the species most frequently observed (8.6%) followed by spotted towhee (7.5%), Bewick's wren (6.7%) and Nuttall's woodpecker (6.3%).

Table 16. Bird species observed within and adjacent to remnant riparian habitat nearby the Womble Restoration Area, Glenn and Colusa Counties, 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*	nonnative
Bullock's oriole	*Icterus bullocki*	
Bushtit	*Psaltriparus minimus*	
California quail	*Calipepla californica*	
California towhee	*Pipilo crissalis*	
Cliff swallow	*Petrochelidon pyrrhonota*	
Common yellowthroat	*Geothlypis trichas*	
Downy woodpecker	*Picoides pubescens*	
European starling	*Sturnus vulgaris*	nonnative
Great blue heron	*Ardea herodias*	
Great egret	*Ardea alba*	
House finch	*Carpodacus mexicanus*	
House wren	*Troglodytes aedon*	
Killdeer	*Charadrius vociferus*	
Lark sparrow	*Chondestes grammacus*	
Lesser goldfinch	*Cardeulis psaltria*	
Mallard	*Anas platyrhynchos*	
Mourning dove	*Zenaida macroura*	
Northern flicker	*Colaptes auratus*	
Nuttall's woodpecker	*Picoides nutalli*	
Oak titmouse	*Baeolophus inornatus*	
Pied-billed grebe	*Podilymbus podiceps*	
Red-tailed hawk	*Buteo jamaicensis*	
Spotted towhee	*Pipilo maculatus*	
Swainson's hawk	*Buteo swainsonii*	ST
Tree swallow	*Tachycineta bicolor*	
Turkey vulture	*Cathartes aura*	
Western bluebird	*Sialia mexicana*	
Western kingbird	*Tyrannus verticalis*	
Western scrubjay	*Aphelocoma californica*	

Table 16 continued.

Common name	Scientific Name	Status
Western wood-pewee	*Contopus sordidulus*	
White-breasted nuthatch	*Sitta carolinensus*	
Wild turkey	*Meleagris gallopavo*	nonnative
Wood duck	*Aix sponsa*	
Yellow-billed magpie	*Pica nuttalli*	

Womble Restoration Area:
Bird Survey Locations

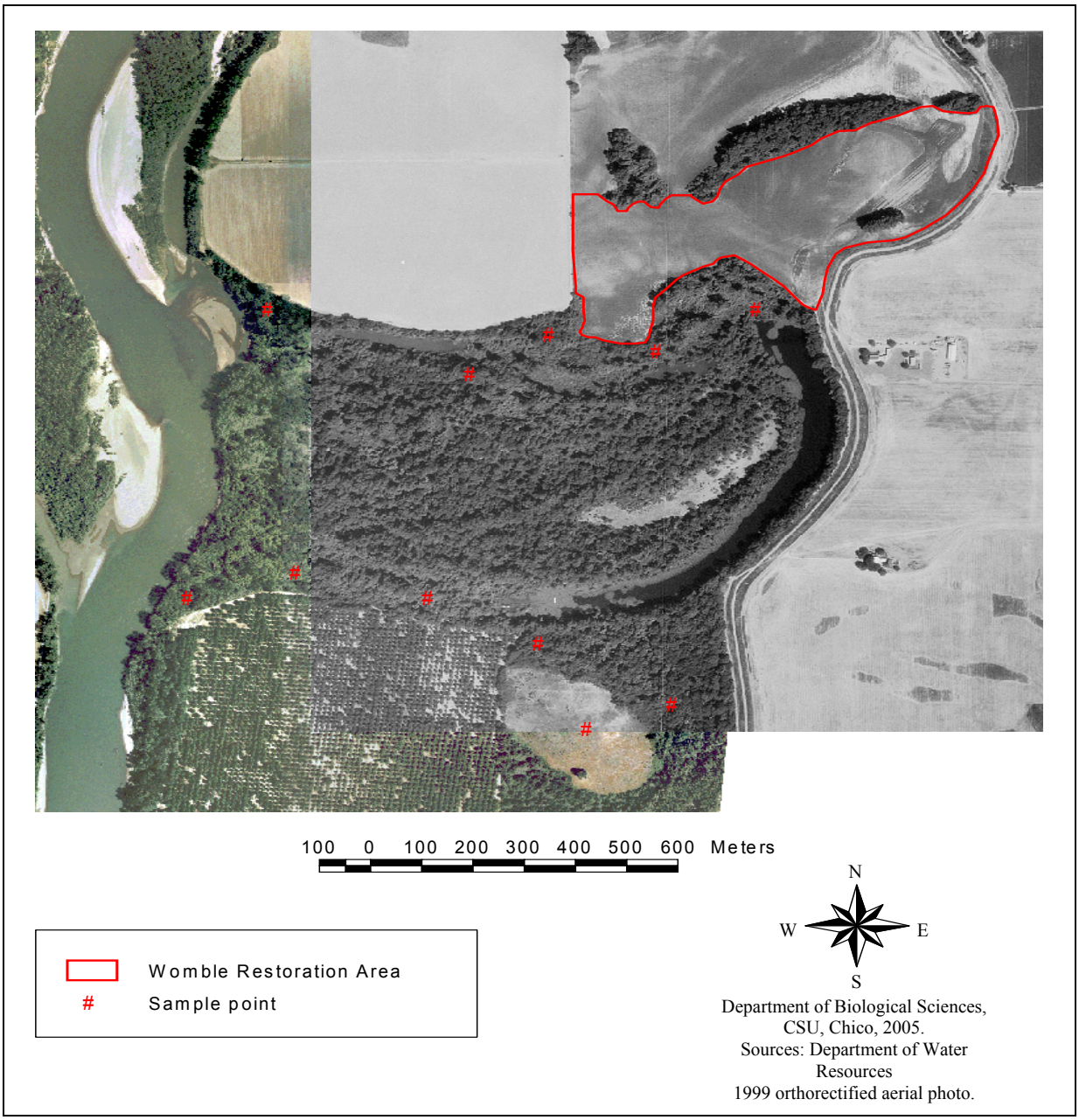


Figure 14. Bird survey station locations in riparian habitat adjacent to the Womble Restoration Area, Glenn and Colusa Counties, California.

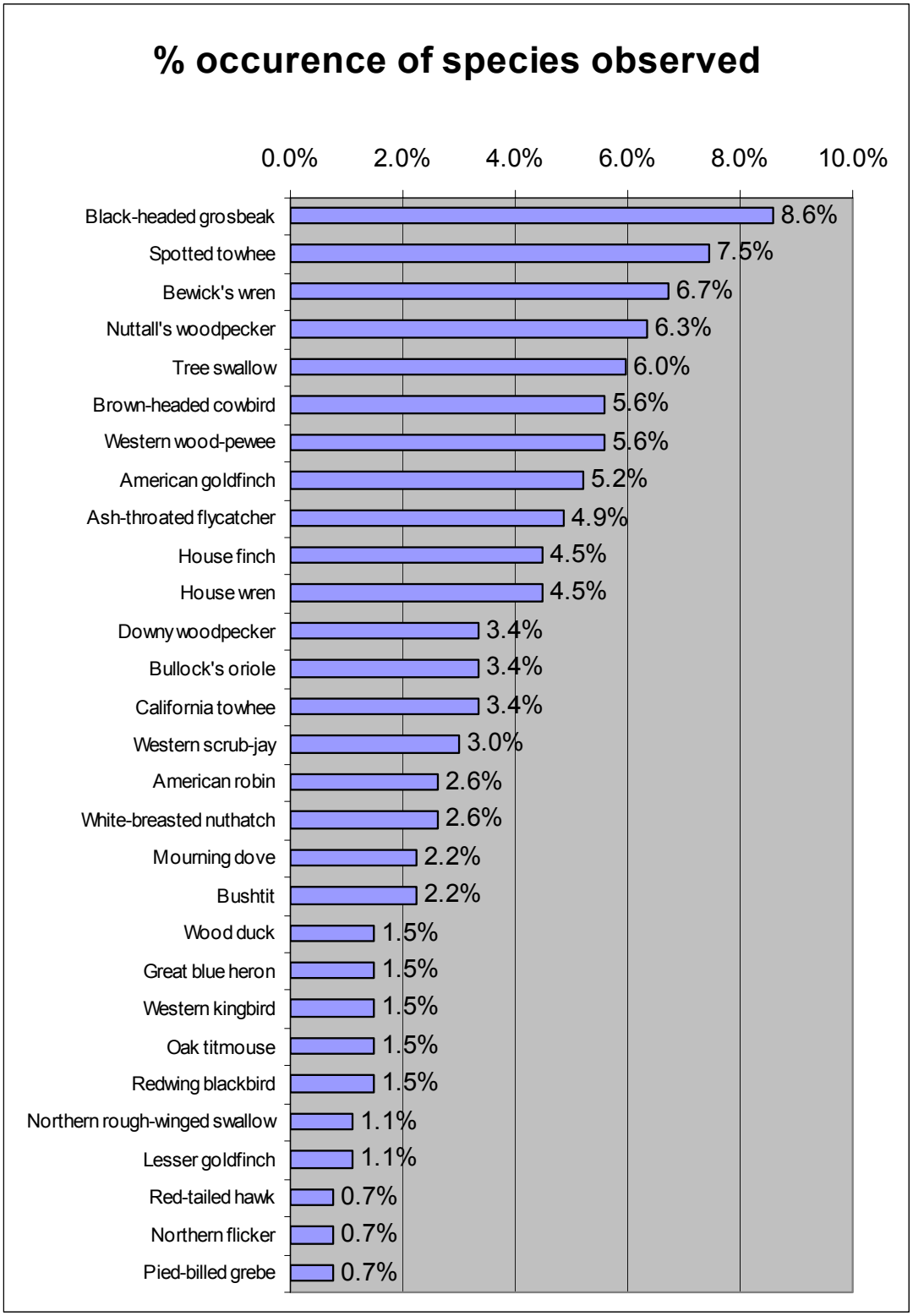


Figure 15. Frequency of bird species observed more than once within a 50 m radius of ten 8-minute observation stations within remnant riparian habitat adjacent to the Womble Restoration Area, Glenn and Colusa Counties, California. Species observed only once are excluded for clarity.

References

Burt, W. H., and R. P. Grossenheider. 1976. A Field Guide to Mammals. Houghton Mifflin Co., Boston, MA.

California Department of Fish and Game. 2002. California Wildlife Habitat Relationships Systems 8.0. Wildlife and Habitat Data Analysis Branch, Sacramento, CA.

California Department of Fish and Game. 2005. California Natural Diversity Database. RareFind 3. Updated May 27, 2005. Wildlife and Habitat Data Analysis Branch, Sacramento, CA.

California Department of Fish and Game. 2005. California's Plants and Animals. Wildlife and Habitat Data Analysis Branch, Sacramento, CA. Retrieved from: http://www.dfg.ca.gov/hcpb/species/species.shtml.

California, Department of Water Resources. 2002. GIS of the middle Sacramento River, California. Northern District, Red Bluff, California.

Coleman, J.S., S.A. Temple, and S.R. Craven. 1997. Facts on cats and wildlife: a conservation dilemma. University of Wisconsin Extension, Madison, WI.

Ehrlich, P. R., D.S. Dobkin and D. Wheye. 1988. The Birder's Handbook. Simon and Schuster, Inc., New York, NY.

Ingles, L.G. 1965. Mammals of the Pacific States. Stanford University Press, Stanford, CA.

Moyle, P. 1976. Inland Fishes of California. University of California Press, Berkeley, CA.

National Geographic. 1999. Field Guide to the Birds of North America. National Geographic Society, Washington, D.C.

Ralph, C. J., G.R. Geupel, P. Pyle, T.E. Martin, and D.F. DeSante. 1993. Handbook of field methods for monitoring landbirds. Gen. Tech. Rep. PSW-GTR-144. Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture, Albany, CA.

Small, S. S., J. DeStaebler, G.R. Geupel, and A. King. 1999. Landbird response to riparian restoration on the Sacramento River system: preliminary results of the 1997 and 1998 field season. Submitted to The Nature Conservancy and U.S. Fish and Wildlife Service, October 1999, by Point Reyes Bird Observatory, Stinson Beach, CA.

Stebbins, R.C. 1985. A Field guide to Western Amphibians and Reptiles. Peterson Field Guide Series. Houghton Mifflin Company, Boston, MA.

Whitaker Jr., J.O. 1991. The Audubon Society Field Guide to North American Mammals. Alfred A. Knopf, Inc., New York, NY.

Whisson, D. and A. Engilis Jr.. 2005. Predation of songbirds in California riparian areas (ongoing research). Retrieved from**:**
http://wfcb.ucdavis.edu/www/Faculty/desley/research.htm
Department of Wildlife, Fish, and Conservation Biology, University of California, Davis, CA.