Protecting the Rivers of the California Delta

2012 FIELD REPORT

Background Information

Lead PI: John Williams

Project scientists: Zack Steel (zacksteel@gmail.com) holds a M.Sc. in Ecology from UC Davis and was our lead field technician for similar research in Chile. He has returned to California, and has assisted with vegetation sampling and bird identification.

Report completed by: John Williams, Mehrey Vaghti

Period Covered by this report: 2012

Date report completed: 2013-01-05 14:21:34

Research site: Heritage Oak Winery was added to our Cosumnes River Preserve site to include a working vineyard. For 2013, we will expand the geographic scope of our research to include parts of Sonoma County and the Russian River watershed. More details available.

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Protected area status: The Russian River has few formal protected areas, but is the focus of several state and federal attempts to improve water quality and quantity for anadromous salmon.

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Sustainable Planet

Dear Earthwatch Volunteer,

On behalf of Pacific Agroecology and our colleagues at The Nature Conservancy and the University of California, Davis, I want to thank you for your participation in our research project “The Riparian Zone: Protecting California’s Rivers.”

With your help, we were able to collect data from several of our long-term research sites on the Mokelumne and Cosumnes Rivers. These data will significantly advance our research in ecosystem services, as well as help land managers with long term monitoring objectives.

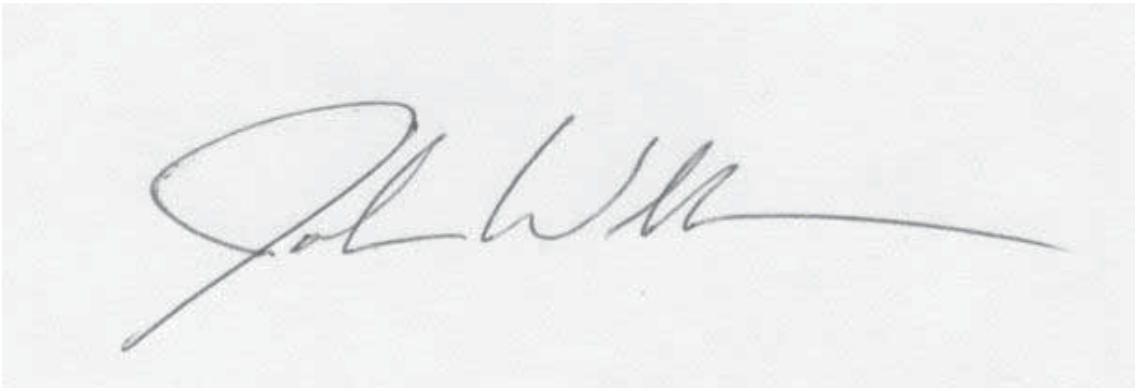
In addition to sampling new areas and habitat types, we collected new temporal data for the spring, summer and fall of 2012. It is only by returning to our sites at multiple times during the year and over multiple years that we begin to get an accurate picture of the trends and normal fluctuations in bird and butterfly diversity and abundance, which we use as indicator species to infer habitat quality and function, and how those data relate to plant diversity and different habitat types in these watersheds.

With the additional data on wider variety of habitats, as well as more plots within habitats, we can now begin to distinguish normal variation within a habitat for variables like biomass and bird diversity from differences between habitats, like how does a wetland differ from a floodplain. From the mature oak stands of the Shaw and Tall Forests and the horticultural (planted) restoration sites at Heritage Oak Vineyards and the Cosumnes River Preserve to the Cougar Wetlands and the process-based restoration sites of the Accidental and Intentional forests along the Cosumnes River, these expeditions collected data that will be used to characterize the plant diversity, vegetation biomass and the associated butterfly and avifauna diversity for a continuum of diverse and dynamic ecosystems.

In turn, the data collected will allow us to determine how these habitat types, as well as the two distinct approaches to restoration, compare in terms of the biodiversity they support and the ecosystem services they provide.

As you reflect back on 2012, we hope you have fond memories of your participation in our research project. We also hope those memories are accompanied by a degree of satisfaction you gained, both from learning more about the biological diversity and habitat dynamics of riparian ecosystems, and from your contribution to a greater scientific understanding of the biodiversity and ecosystem dynamics that will be used to improve agricultural management and conservation of the Sacramento-San Joaquin Delta and the Central Valley's natural riparian resources.

With gratitude and best wishes,



John N. Williams, Ph.D. Chief Scientist & Managing Partner Pacific Agroecology LLC

SECTION ONE: Scientific research achievements

Top highlight from the past season

The data collected as a result of this project are allowing us to confirm and expand upon earlier research by Williams et al. (2011) that quantified the ecosystem services, particularly carbon storage, that accrue as a result of maintain patches of natural habitat in vineyard landscapes. The findings in this research support the conclusions of the earlier study, namely, that forest lands store significantly greater quantities of aboveground carbon. The current research goes beyond the initial study, however, by demonstrating that agricultural systems that maintain moderate amounts of natural habitat, such as riparian corridors, support significant levels of biological diversity as measured by three very different taxonomic indicators: birds, butterflies and woody vegetation.

Reporting against research objectives

Thanks in large part to the participation of the four groups of Earthwatch volunteers who helped us collect field data, we completed a woody biomass and diversity inventory of the Heritage Oak Vineyard and nearly completed one for the Cosumnes River Preserve (CRP). The Earthwatch expeditions also contributed substantially to our collection of baseline data on butterfly and bird diversity across a variety of habitat types within the two locales.

The woody biomass and diversity data collection was conducted using a square plot sampling design to characterize physical structure and record woody plant diversity in young, middle-aged, and mature forest stands in both horticultural and process-based restoration areas. The data collected from these plots also complements the existing plots monitored by The Nature Conservancy—a network that now includes additional plots in the Cougar Wetlands, Tall Forest, Tall Forest West, Accidental Forest, Intentional Forest, Shaw Forest, Visitor Center, McCormack-Williamson Tract, and Castello Tract stands of the CRP, as well as in the floodplain, Mokelumne riparian corridor and in forest patches on the Heritage Oak property.

The CRP plot network has allowed us to relate aboveground carbon storage to the major vegetation types found within the CRP. Table 1 shows a comparison of the different vegetation types and the per-hectare amount of carbon estimated in aboveground woody biomass; data from Heritage Oak is included for comparison. These data suggest that naturally regenerating stands, such as the Populus fremontii – Salix gooddingii (cottonwood

– willow) vegetation sampled in the Accidental and Intentional Forests, stores more carbon per hectare than horticulturally restored stands, even of harder woods such as Quercus lobata (Valley oak). Mature Populus fremontii (cottonwood) stands exhibited the greatest average carbon storage per hectacre; these stands were characterized by moderate stem densities and relatively tall trees. By comparison, regenerating P. fremontii stands had twice the stem density but approximately half the stored carbon for equally tall trees reflecting this species ability for rapid growth given the ideal conditions of the Accidental and Intentional Forests. Mature Quercus lobata (Valley oak) stands exhibited lower than expected average carbon storage despite the largest average diameter trunks. Further investigation of temporal or spatial variability within these 27 plots may elucidate additional significant driving factors. These data also suggest that stand age and site conditions are important variable in total carbon storage.The Heritage Oak vegetation surveys also show relatively high amounts of carbon stored in a variety of natural habitats, especially when compared to vine tracts (Figure 1).

The companion data for the carbon storage by landuse/habitat type results are the biodiversity data that make the connection between ecosystem services, such as carbon storage, and ecosystem health, as defined here by proxy, using a simplified set of taxonomic diversity indicators. Table 2 shows how carbon storage relates to habitat type, number of woody species present, and bird and butterfly diversity. While there is no expectation that tree diversity will correlate directly to carbon storage (a monoculture of giant sequoias would store more carbon than just about any mix of 100+ tree species that one could assemble), Table 2 demonstrates that many different habitat types can store significant amounts of carbon. It is this variety of habitat that gives the CRP much of its conservation value, while simultaneously providing important ecosystem service like carbon storage.

We are also using the data collected to compare habitat type and woody species diversity to butterfly and bird species richness. Although we still need additional sampling for birds and butterflies to get a more complete estimate of the resident and migrant diversity for these sites, as well as for gauging daily, seasonal, and annual fluctuations for these taxa, the data we have collected so far is already giving us an improved understanding of habitat preferences, relative abundance and timing. The butterfly data is particularly helpful in this regard because many of the butterfly species are associated with specific plant species that serve as either host plants for their larvae or as nectar (food) sources for the adults (Table 3a).Thus, even if we do not record a given plant species, the presence of a particular species of butterfly, especially if recorded repeatedly, is indicative of one or more of host plants or nectar sources. Over multiple years, increases or declines in these butterfly

numbers will give us clues as to the integrity of the ecosystems with which they are associated. By relating both species presence and abundance to data collection sites, the butterfly data also allow us to differentiate between habitat types in ways that go beyond our own vegetation metrics (Table 3b). That is, comparing forest sites by woody species and basal area, we note differences among the Accidental/Intentional, Shaw and Tall & Horticultural forests. However, we wouldn't necessarily be able to predict that butterfly species and individuals appear to prefer these forests in this order. Such cross-taxon comparisons allow us to test our own preconceptions and develop new hypotheses about how different taxa use the range of habitats available to them.

Like the butterfly data, the estimates of bird diversity and abundance are incomplete and will require repeated field surveys at different times of the year and over multiple years to get a more accurate assessment of which species are using which habitat types at which times of the year and with what frequency. Nevertheless, the data collected to date again offer insight into avian diversity, abundance and habitat use. Table 4 presents species richness and abundance by site. As might be expected, some generalist species, such as the Lesser Goldfinch and Scrub Jay are found in most habitats, while other specialist species, such as the Acorn Woodpecker and Marsh Wren, are limited to their characteristic habitats, such as oak forests and wetlands, respectively. Overall, we see that the two most diverse habitats of the CRP are the mature oak stands of the Shaw Forest, and the Cougar Wetlands, which is a matrix of forest patches, tule wetlands, and adjoining riparian forest and grasslands. By contrast, the recovering forests of the Accidental and Intentional Forests, while lower in species diversity than the more mature forests, are nevertheless providing habitat to a number of bird species that are frequently found either in forests or along forest edges and riparian habitat, such as the Spotted Towhee, Bewick's Wren, and Common Yellowthroat. We should also make some caveats to put the results in context. First, for most of the CRP sites, the data reflect a single day of observations. Thus, it highly likely that some species were missed in each habitat, just as others may have been accidentals that day. Second, the relative species richness of the two vineyard sites, Vino Farms and Heritage Oak Vineyards, are somewhat misleading. The Vino Farms site is on the edge of both a wetland and a forest remnant, thus it offers viewing access to bird species typical of both habitats. The site is also open, and thus offers unobstructed viewing of flying birds in ways that forest habitats do not. The diversity of the Heritage Oak site is also somewhat misleading when compared to the CRP sites because a) there were three days of observations, compared to one for each of the CRP sites, and b) it is actually a collection of different habitats, including vineyard, riparian forest, floodplain forest, woodland, and grassland. Thus, for these reasons, it is not directly comparable to the more homogenous habitat types such as the Shaw or

Tall/Horticultural forests. Despite these caveats, however, the relative abundance and diversity of these two working landscapes do suggest that when grape production is conducted within a matrix that includes natural habitat, considerable numbers of birds from many species will either use the agricultural land for foraging and/or nesting, or will spill over into these lands as part of their effective daily range.

Additional Material: See appendices.

SECTION TWO: Impacts

Partnerships

We continue to work closely with The Nature Conservancy to assure access to the Cosumnes River Preserve and that our efforts fit within the research objectives established by the Cosumnes Research Group through the Center for Watershed Sciences, at the University of California, Davis. We have also established good working relationships with two private landowners (Heritage Oak Vineyard and Winery, and Vino Farms (one California's largest producers of winegrapes). As we begin to establish other reference sites in the Delta and the Russian River, we will be keen to balance both NGO and private involvement. We have communicated with California-Trout regarding their work in the Russian River on working with surrounding landowners to improve riparian habitat, and this group will likely become a formal partner as we continue our research.

Contributions to conventions, agendas, policies, management plans

- **National or regional**

The Cosumnes River Preserve is the only major undammed river on the western slope of the Sierra Nevada. As such, it provides unique habitat for a wide variety of aquatic and terrestrial plant and animal species that are dependent on the natural hydrologic fluctuations of riverine habitat. Our research is contributing to an improved understanding of how a range of plant and animal taxa are using the different habitat types within this landscape, as well as within the agricultural landscape that both adjoins and surrounds the Reserve.

- **Local**

Our research is providing direct measurements of woody plant, butterfly and bird diversity at the alpha, or local, spatial scale. These data can be directly compared to estimates of such diversity at other sites, and can contribute to estimates of larger scale beta or gamma

diversity estimates that amalgamate the diversity found at different local sites that contribute to larger landscape patterns of species richness. For species that are either threatened or of special concern, our data is providing spatially and temporally explicit records of their presence. Given the restoration nature of the Cosumnes River Preserve, these records may be used to evaluate and document the use of such restored landscapes by native species.

Developing Environmental Leaders

The Earthwatch volunteers who have participated in our research program range from young and enthusiastic individuals who are in the formative stages of choosing their careers—late high school to early college—to environmentally conscious individuals in early-, mid-, and late-career stages, as well as retirees, who are dedicated to raising their own awareness as well as that of their families and communities about how land and water use affect the integrity of the natural landscapes that remain within the fabric of agriculture in California's Central Valley, Delta, and elsewhere. The volunteers who have participated in our research have repeatedly stressed that they did not realize the extent to which natural habitat can be incorporated into agricultural landscapes, and how much native species will use that habitat when it is there. As such, we are optimistic that these motivated individuals will share their experience with others, and promote these concepts as they continue with their own careers and personal pursuits.

Actions or activities that enhance natural and/or social capital

Our research is providing direct quantification of ecosystem services in the form of both carbon storage and biodiversity within the context of working and protected landscapes. Our scientific findings can be used as both baseline and ongoing monitoring efforts to demonstrate habitat use, change, and response to a variety of vectors, including agriculture, restoration and climate change.

Conservation of Taxa

While our research does not involve specific conservation actions, it focuses on how key habitats found in the agricultural land matrix are home to native woody plant species and are used by the suites butterfly and bird species identified in Tables 1-4.

Conservation of Habitats

Again, while our research does not involve specific conservation actions, it focuses on how the key habitats identified in Table 1 contribute to ecosystem services, thereby providing explicit justification for their conservation based on these (among other) criteria.

Ecosystem Services

We are documenting and quantifying ecosystem services, including long-term carbon stored in woody biomass and biological diversity as measured by woody plant, butterfly and bird species richness.

Dissemination of research results

Scientific peer-reviewed publications

Our past research on ecosystem services and biodiversity conservation in working landscapes has been published as follows:

Viers, J.H., Williams, J.N., Nicholas, K.A., Barbosa, O., Kotzé, I., Spence, L., Webb, L.B., Merenlender, A., & M. Reynolds. In Press. Pairing wine with nature. Conservation Letters.
Williams, J.N., Hollander,A.D., O'Geen, A.T., Thrupp, L.A., Hanifin, R., Steenwerth, K., McGourty, G. & L.E. Jackson. 2011. Assessment of carbon in woody plants and soil across a vineyard-woodland landscape. Carbon Balance & Management 6(11):1-14.

We anticipate that the current research reported on here will be published in similar journals that report on conservation, agriculture and/or the quantification of ecosystem services.

SECTION THREE: Anything else

Acknowledgements

We acknowledge the dedication and hard work of the Earthwatch volunteers and their trainers. We would also like to thank Earthwatch and Michael L. Johnson LLC for their project administration, as well as Jesse Roseman (TNC) and Sara Sweet (TNC) at the Cosumnes River Preserver for their continued coordination.

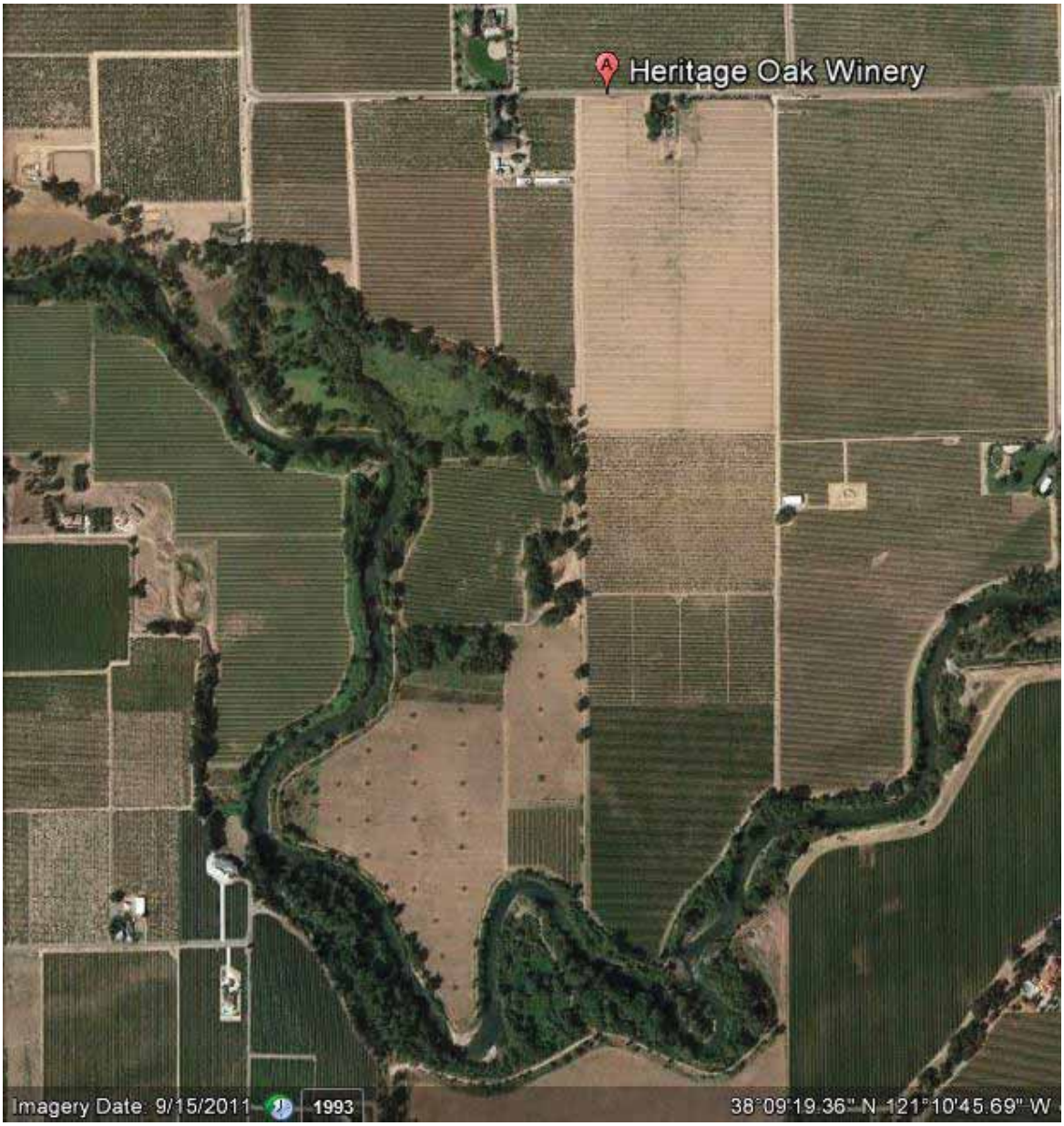
Sampling Habitats in the Cosumnes River Preserve - West


CRP04
accidental forest
CRP53
CRP52
CRP11
CRP10
CRP60
West of accidental forest
intentional forest
CRP56
CRP59
CRP51
CRP67
CRP06
CRP61
mac world hort
CRP77
CRP03
cougar wetlands
CRP75
CRP08
CRP07
Tall forest
CRP33
CRP34
CRP73
CRP72
West of Tall forest W
CRP40
Tall forest W
CRP71
CRP35
CRP36
CRP29

Sampling Habitats in the Cosumnes River Preserve – Shaw Forest Area

Sampling Habitats in the Cosumnes River Preserve – Visitor Center and Delta Islands

Heritage Oak Winery & Vineyard and the Mokelumne River.

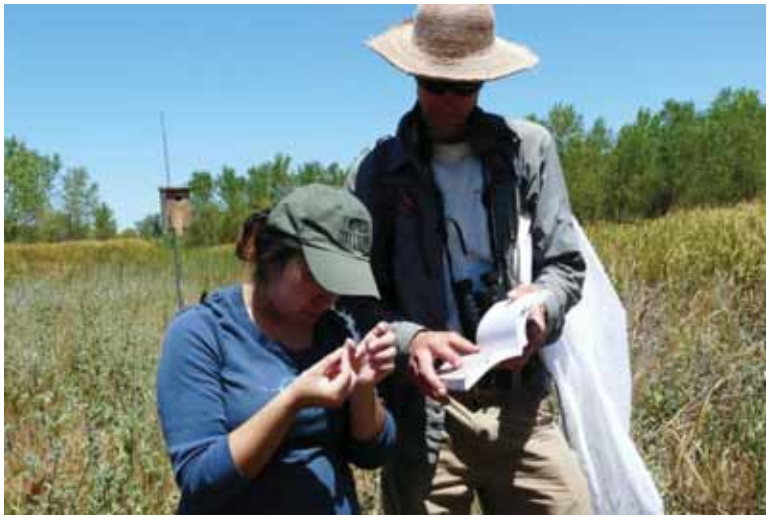


Earthwatch Youth Volunteers From Los Angeles Wrap Up A Day in the Field (photo by M. Vaghti)

Earthwatch Volunteer Measures Grape Vines for Carbon Storage Analysis at Vino Farms

Earthwatch Volunteers Enter the Tall Forest at Cosumnes River Preserve (Photo by C. Welihinda)

Earthwatch Volunteers Measure Tree Heights and Diameters for Carbon Storage Analysis (photo by M. Vaghti)



Butterfly Identification, Cosumnes River Preserve (photo J. Pomposelli)

Butterfly diversity monitoring (photo J. Williams)

Butterfly ID, Cosumnes River Preserve (photo J. Pomposelli)

Bird Diversity Monitoring (photo J. Pomposelli)

Measuring Carbon in woody biomass, Cosumnes River Preserve (photo J. Pomposelli)

Bird counting, Cosumnes River Preserve (photo J. Pomposelli)

Riparian Zone Expedition Team, July 2012 (photo J. Pomposelli)

The happy botanist, Cosumnes River Preserve (photo J. Pomposelli)

Eastern-tailed Blue butterfly, Cosumnes River Preserve (photo J. Pomposelli)

Data recording is fun, Cosumnes River Preserve (photo J. Pomposelli)

Introduction to vegetation monitoring, Cosumnes River Preserve (photo J. Pomposelli)

Measuring oak biomass, Cosumnes River Preserve (photo J. Pomposelli)

Measuring vegetation structure with a range-finder, Cosumnes River Preserve (photo J. Pomposelli)

Using aerial photos to select sampling locations (photo J. Pomposelli)

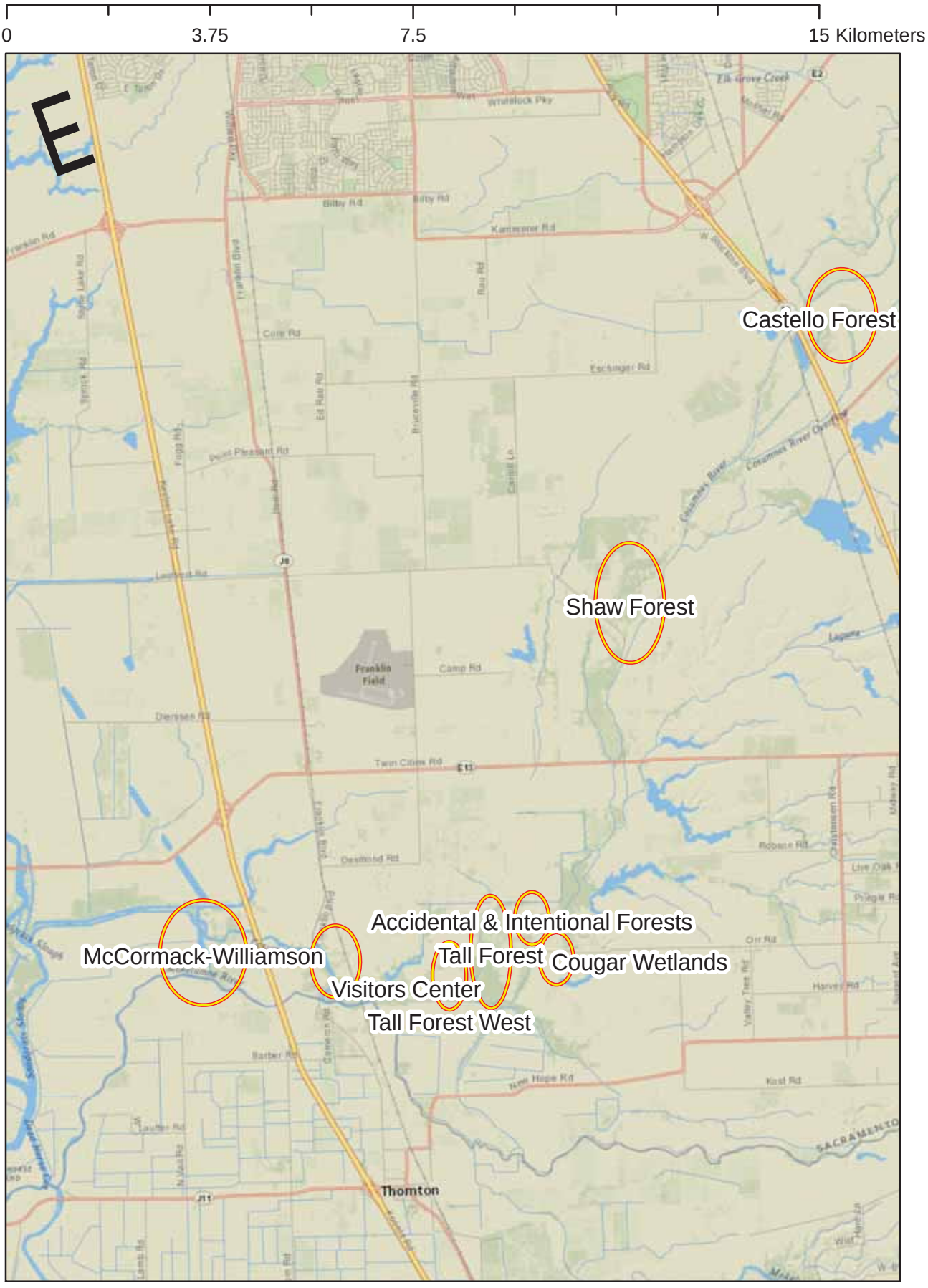

0
3.75
7.5
15 Kilometers
E
Castello Forest
Shaw Forest
Accidental & Intentional Forests
McCormack-Williamson
Tall Forest
Cougar Wetlands
Visitors Center
Tall Forest West
Thornton
Franklin Field
Camp Rd
Twin Cities Rd
Desmond Rd
Dierssen Rd
Lambert Rd
Bilby Rd
Kammerer Rd
Cole Rd
Exchanger Rd
Point Pleasant Rd
Cosumnes River Preserve
General Location of 2012 Activities

Figure 1 - Allocation of Total Carbon Storage (Mg) at Heritage Oaks Winery

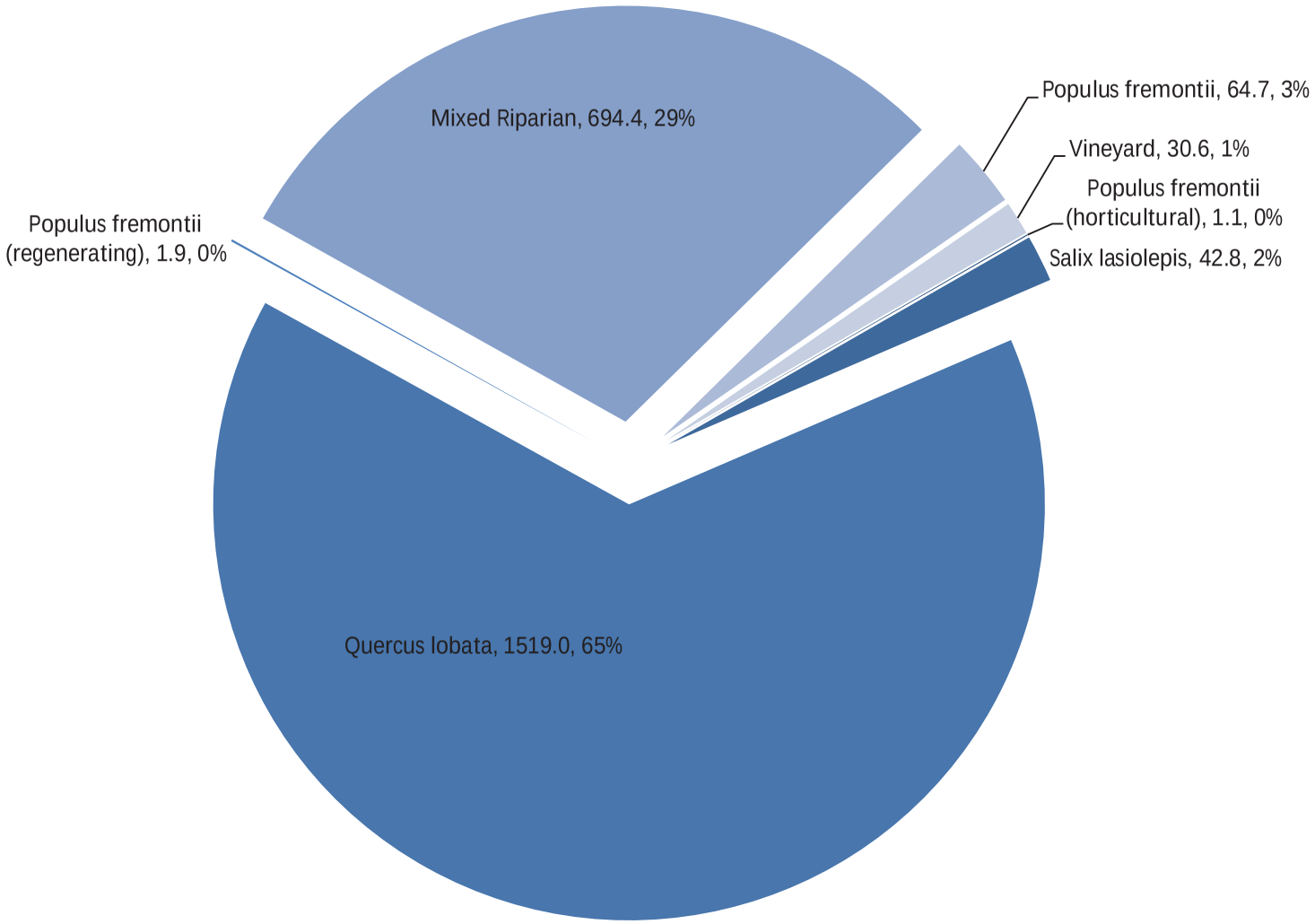


Table 1 - Basal Area and Carbon by Vegetation Type for the Cosumnes River Preserve

Vegetation Type	# of Plots	Avg # Stems/plot	Avg # Stems/ha	Mean Ht (m)	Mean DBH (cm)	Avg Basal Area (cm^2/ha)	Avg Carbon Storage (Mg/ha)
Fraxinus latifolia	3	25.67	641.67	7.78	21.60	413974.34	11.17
Mixed Riparian	4	30.25	756.25	9.32	24.67	485997.12	13.47
Platanus racemosa - Quercus lobata	1	20.00	500.00	7.32	29.14	456855.90	17.23
Populus fremontii	12	30.08	752.08	11.56	27.83	518689.81	19.44
P. fremontii - Salix gooddingii (*regenerating*)	5	66.40	1660.00	10.64	15.58	506782.76	8.24
Quercus lobata	27	13.81	345.37	12.29	39.72	378314.15	9.44
Quercus lobata - Fraxinus latifolia	7	28.86	721.43	9.16	21.71	357818.74	10.58
Quercus lobata (*horticultural*)	6	21.33	533.33	8.44	17.53	154352.60	5.32
Salix gooddingii	4	34.75	868.75	11.00	20.53	420410.29	7.91
Salix lasiolepis	1	59.00	1475.00	7.77	11.26	168989.61	2.10

Table 2 - Carbon Storage and Species Diversity by Location

Location	Mean Carbon Storage (Mg/ha)	Species Diversity		
		Woody Plants	Pollinators	Birds
Accidental & Intentional Forest	10.60	6	12	11
Tall Forest West (horticultural)	7.73	5	7	15
Tall Forest	19.32	6	5	11
Cougar Wetlands	8.00	5	5	19
Maccormik-Williamson Delta Islands	6.67	9	5	18
Shaw Forest	7.66	6	6	18
Vino Farm - Vineyards	0.17	n/a	4	22
Heritage Oak - Vineyards	0.25	n/a	4	32
Heritage Oak - Riparian Forests	8.55	5	4	32

Table 3a. Butterfly diversity, abundance and plant preference (Shapiro 2012) as measured at Heritage Oak Winery, Cosumnes River Preserve, and Vino Farms in 2012 in California's Central Valley, 2012.

Common Name	Scientific Name	Sitings	Abund	Associated Plant Genera*
Buckeye	Junonia coenia	3	6	H=Plantago, Kickxia, lippia (Phyla); N=lippia, heliotrope, Aesculus, Chrysothamnus, Baccharis
Cabbage White	Pieris rapae	7	51	H=Brassicaceae; N=Epilobium, many others
Common Checkered Skipper	Pyrgus communis	2	2	H=Malvaceae: Malva, Malvella, Sidalcea; N=Lotus, Mentha, Lavandula
Eastern Tailed Blue	Cupido comyntas	5	8	H=Fabaceae: Vicia, Lathyrus, Acmispon, Lotus, Melilotus, Trifolium; N=lippia, heliotrope, clover
Field Skipper	Atalopedes campestris	2	3	H=Cynodon, Paspalum; N=goldenrod, verbena, Chrysothamnus, Bacchris, alfalfa, thistles, dogbane.
Fiery Skipper	Hylephila phyleus	2	7	H=Cynodon (Bermuda grass), Distichlis; N=lantana, verbena, zinnia, buddleja, marigolds
Lorquin's Admiral	Limenitis lorquini	4	15	H=Salix (only glabrous, i.e. not fuzzy-leaved); N=Aesculus, Eriodictyon, buttonbush
Monarch	Danaus plexippus	1	1	H=Asclepias; N=Asclepias, many species of large flowered plants
Mourning Cloak	Nymphalis antiopa	1	1	H=Salix, Celtis, Ulmus; N=fruit, dung, mud, rabbitbrush (Chrysothamnus)
Mylitta Crescent	Phyciodes mylitta	5	14	H=Circium, Carduus, Silybum; N=Cirsium, Eriodictyon, heliotrope
Orange Sulphur	Colias eurytheme	3	5	H=alfalfa, vetches, clovers, lupines
Pale Swallowtail	Papilio eurymedon	1	1	H=Rhamnus, Ceonothus, Alnus, Melilotus; N=vetch, Eriodictyon, Dicholostema, Aesculus, lilies.
Propertius Duskywing	Erynnis propertius	1	1	H=Quercus; N=Verbena, Eriodictyon, Aesculus, vetch, dogbanes, brodiaeas, wild onion
Purplish Copper	Lycaena helloides	3	12	H=Polygonum, Rumex; N=lippia, heliotrope, asters, Baccharis
Sad Duskywing	Erynnis tristis	3	4	H=Quercus; N=Verbena, Eriodictyon, Aesculus, Buddleja
Tiger Swallowtail	Papilio rutulus	3	14	H=Platanus, Fraxinus , Prunus, Salix, Liquidambar; N=Eriodictyon, Aesculus, Aesclepia
Total		**47**	**145**	

Table 3b. Butterfly diversity and abundance by habitat type in the Cosumnes River Preserve, Vino Farms Vineyards and Heritage Oak Winery and Vineyard.

Species - Common Name	Acc/Int Forest	Beacon Hort For.	Tall Forest	Shaw Forest	Cougar Wetlands	Mac-Will Delta Isl.	Vino Farms	Heritage Wine
Buckeye	1		4				1	
Cabbage White	10	10	2	20	2	6	2	1
Common Checkered Skipper				1			1	
E. Tailed Blue	3	1						4
Field Skipper		2			4	1		
Fiery Skipper	4		3		2			
Lorquin's Admiral	7	1		5		2		
Monarch	1							
Mourning Cloak			1					
Mylitta Crescent	2	2	7	2	2			1
Orange Sulphur	1							4
Pale Swallowtail						1		
Propertius Duskywing	1							
Purplish Copper	5	6			2		1	
Sad Duskywing	1	2		1				
Tiger Swallowtail	5			5		4		
Total	**41**	**24**	**17**	**34**	**12**	**14**	**5**	**10**

Table 4. Bird Diversity and Abundance by sampling site in the Cosumnes River Preserve, Vino Farms Vineyards, and the Heritage Oak Winery & Vineyard.

Species - Common Name	Acc/Int Forest	Beacon Hort For.	Tall Forest	Shaw Forest	Cougar Wetlands	Mac-Will. Delta Isl.	Vino Farms	Heritage Wine	Total
Species Count	11	15	11	18	19	18	22	32	61
American Crow				3				5	8
American Kestrel							1		1
American Pippet							1		1
Anna's Hummingbird								2	2
Ash-throated Flycatcher		1		5		2			8
Belted Kingfisher						1		1	2
Black-headed Grosbeak		1							1
Brown-headed Cowbird						1			1
Bushtit	4								4
California Quail				2					2
Canada Goose							1		1
Common Yellowthroat	1				1				2
Dark-eyed Junco							1		1
Duck, Anas sp.								2	2
Dunlin					10				10
Egret, Great		3		2	1				6
Egret, Snowy					1				1
Hawk, Cooper's					1				1
Hawk, Red-shouldered			2	1	1		1	2	7
Hawk, Red-tailed			4	3			1	5	13
Hawk, Swainson's				3					3
Heron, Great Blue	1	1			1	1			4
Heron, Green-backed						1			1
House Finch	1	1		25		6	3	9	45
Killdeer					4				4

Species - Common Name	Acc/Int Forest	Beacon Hort For.	Tall Forest	Shaw Forest	Cougar Wetlands	Mac-Will. Delta Isl.	Vino Farms	Heritage Wine	Total
Lesser Goldfinch	5	3		6		3	2	1	20
Lesser Yellowlegs					6				6
Mourning Dove	2	8		5		1	1	2	19
Northern Flicker			1		3		4	5	13
Oak Titmouse			1					1	2
Phoebe, Black				1	2	2	2	4	11
Phoebe, Say's							1		1
Red-winged Blackbird					20	6			26
Robin	1	1				3	8	6	19
Ruby-crowned Kinglet			2		1			3	6
Sand Hill Crane							10	10	20
Scrub jay		1	1	1	3	5	1	5	17
Sparrow, Golden-crowned					2			7	9
Sparrow, Song		1			2	4			7
Sparrow, White-crowned					7		5	4	16
Starling								2	2
Swallow sp.								4	4
Swallow, Bank								9	9
Swallow, Barn						5			5
Swallow, Northern Rough-winged	1						5		6
Swallow, Tree		3	10	1			4	5	23
Towhee, Brown				2					2
Towhee, Spotted	1	1	2	3		3		8	18
Turkey Vulture	4	1	1	7		1	10	11	35
Warbler, Orange-crowned								1	1
Warbler, Yellow-rumped							2	4	6
Western Bluebird							10	5	15
Western Meadow Lark							2		2
White-breasted Nuthutch			2	1	1			1	5

Species - Common Name	Acc/Int Forest	Beacon Hort For.	Tall Forest	Shaw Forest	Cougar Wetlands	Mac-Will. Delta Isl.	Vino Farms	Heritage Wine	Total
White-fronted Goose					4				4
Woodpecker, Acorn								2	2
Woodpecker, Downy								1	1
Woodpecker, Nuttall's		1		1		1		7	10
Wren, Bewick's	1		3						4
Wren, Marsh		1				2			3
Yellow-billed Magpie								4	4
Grand Total	**22**	**28**	**29**	**72**	**71**	**48**	**76**	**138**	**484**