**CALFED Quarterly Progress Report**

**Program Manager**: Gillian Harris Phone 415-778-0999
**Project Manager**: Dr. James Quinn Phone 530-752-8027
**CALFED Project #**: ERP-01-NO1
**Period ending**: July 2003

## Task 1 - Restoration Success Criteria (J. Quinn)

The initial phases of the Restoration Success Criteria Task included data inventory and project conceptualization. The Second Quarter focused on broadening the scope of activities toward a robust project concept consisting of three primary facets: framework, monitoring, and tools.

The initial concept of establishing restoration success criteria required the development of a framework for analysis. This framework specifically includes vegetation inventory and monitoring components. These initial framework components are currently focused along existing and restored riparian forest sites at the Cosumnes River Preserve (CRP), but the framework itself is adaptive in nature and, thus, will likely be applied to other locations as is possible. The framework approach is based on a nested hierarchy, in which field level elements are successively folded into coarser spatial scales of analysis. This approach allows for rapid inventory and monitoring through the use of remote sensing technologies. Care has been taken to consult with a variety of local experts; these consultations have identified parameters that will have the greatest efficacy in defining restoration success. Professors Jim Quinn and Mark Schwartz are advising.

The second facet includes on the ground monitoring of pre-existing and new *Lepidium latifolium* (perennial pepperweed) populations on the "triangle floodplain" and Accidental Forest sites at the CRP. To date, we have re-surveyed over 100 *Lepidium sp*. populations; Dr. Kaylene Keller initially recorded these infestations as part of a previous UCD study.. We have initiated a comparison of *Lepidium sp*. stem counts from 2002 and 2003. We will assess the rate of spread of this invasive species on the floodplain by examining correlations and trends between the rate of spread and physical site characteristics, such as elevation and surrounding vegetation. Identifying mechanisms and characteristics of infestations of non-native invasive species is a key component of the CalFed adaptive management strategy for habitat restoration.

The third component of our activities includes the development and assembly of informational tools. These tools are intended to be used by members of the Cosumnes Research Group, volunteers with the Cosumnes River Preserve Habitat Restoration Team (HRT), and others to correctly identify and monitor changes in vegetation in riparian areas. With the cooperation of the UC Davis Herbarium and the Jepson Herbarium at UC Berkeley, we are in the process of assembling an herbarium collection specific to the CRP. This tool will also include a virtual herbarium, in

which digital photographs of the major plants (natives and non-natives) found in riparian areas of the preserve will be available in both electronic and hard copy form. The hard copies will be assembled to create a small field guide to help monitor restoration projects in the future.

**Task 2 – Groundwater - Vegetation Interactions (G. Fogg and K.T. Paw U)**

***Subtask 2a: Hydrologic Analysis (G. Fogg)***

Since the last quarterly report continuous data collection has been ongoing. A large flow event occurred April 14 and again on the 29th. These flow events were significant because the river flow went beyond the river banks and the hydrologic instrumentation recorded large increases in the amount of water exchange between the stream and subsurface. The stream banks, which are covered with riparian vegetation, had remained dry throughout the winter flow period; however, these areas became saturated due to the large flow events that occurred in April. These results support the hypothesis that flood events play an extremely important role in supplying water to the riparian vegetation along the Cosumnes River despite the relatively short duration and infrequent occurrence of these flood events. Additionally, sediments five to twenty feet directly below the streambed had remained relatively dry throughout the winter flow period and also became saturated due to the April flood events. This non-linear relationship between seepage and stream flow is one of the theoretical aspects of this research that will be explored further.

In addition to data collection and analysis that has been ongoing our group gave an oral presentation to several other scientists that are performing research on the Cosumnes River. This presentation was part of a meeting program that fosters collaboration and brainstorming among the many interdisciplinary scientists researching the ecology of the Cosumnes River.

***Subtask 2b: Evapotranspiration Analysis (K. T. Paw U)***

In the last three months Professor Paw U's team has further analyzed and obtained the equipment necessary for both the Deer Creek and the Accidental Forest sites. We ordered one 25-meter tower for the Accidental Forest, and received clearance to borrow a tower/trailer from another department for our research at Deer Creek. The borrowed tower was tested. Some work will be needed to repair the trailer electrical system, but the tower lifting system checked out well. We ordered and received all of the micrometeorological sensors needed for the two sites. The sensors have been checked out in a laboratory, and currently software is being developed to interface the sensors with dataloggers. We also designed two complete solar systems to provide power to our equipment at the different sites, and ordered and received all of the components for said solar systems.

Attempts to reach the land-owners for permission to mount equipment on the non-TNC land in the Deer Creek site have been futile. We will continue to try, but while waiting

we are planning to implement the plan, which involves estimating evapotranspiration as described in the last quarterly report, for the Deer Creek site. Beginning the week of July 7-11, we will erect the Deer Creek infra-red thermometry/energy balance tower with the accompanying sensors, data logger, and solar power. We hope have it operating by July 18.

The Accidental Forest sensors and solar power have all been delivered, but the tower we ordered will not arrive for four more weeks. We met an unforeseen delay in the UCD purchasing department that may prohibit us from raising the tower as soon as possible. We anticipate the Accidental Forest eddy-covariance tower will be operating by the end of August.

**Task 3 - Aquatic and Terrestrial Linkages (M. Power and T. Grosholz)**

***Subtask 3a: (M. Power, UC Berkeley)***: *Trophic Pathways in Floodplain and River Sites*

The continuing goals of this research are: to evaluate aquatic insect emergence through several flood cycles, to examine how floodplain habitat structure shapes aerial insect availability, and to investigate how aerial insectivore (bat) activity corresponds to those patterns. During April to June 2003, we permanently installed a total of 12 bat detector systems across the floodplain in our main sampling areas (Channel, Triangular Floodplain Pond, Lower Pond, Wood Duck Slough). These detectors are operational and will continually collect audio files throughout the remainder of the study. We sampled adult insect emergence once in both May and June. In May we expanded our regular sampling scheme to include 4 additional wetted sites (3 in open meadow, 1 in the Accidental Forest). By June, the water had retreated and we returned to sampling our regular permanent water sites (see Figure 1).

Currently we are processing both the emergence samples and the bat audio data. Overall, our initial observations from earlier in the year still holds with the insect community being dominated by adult flies (Diptera) with the lowest abundances in Wood Duck Slough compared to the other habitats. For the bat data, the gross pattern we observed in the March one day sample still holds, in that activity along the slough is higher than elsewhere in the sampling area. A provocative natural history observation is that 40 KHz *Myotis* are common and that May sequences appear to be *Myotis lucifugus*, a species essentially absent from museum collections from the Central Valley. Direct observation of flight style or capture would confirm this tentative bat species identification
We will continue sampling approximately every 3-4 weeks at the permanent water sites throughout the summer period.

**Figure 1. Drying ponds observed in 2nd Quarter of 2003.**

***Subtask 3b: Aquatic and Terrestrial Linkages (T. Grosholz):*** *Flood Plain Primary and Secondary Production*

We completed the spring sampling in June, although the heavy flooding in late April and May interrupted our usual schedule for that period. We conducted experiments addressing the movement of nutrients and detritus from the forest to the floodplain using naturally occurring carbon and nitrogen stable isotope signatures together with baseline data on C and N sources for the floodplain and forest prior to the spring flooding. We also expanded out transect sampling to document the small-scale spatial differentiation in fauna between the forest and the adjacent floodplain and to document the distribution and abundance of taxa that are either shared or not between the two habitats. We conducted mesocosm studies using either N-15 labeled periphyton, N-15 labeled phytoplankton or both outplanted in replicated 40 L. containers using ambient flora and fauna. The goal was to understand which organisms and trophic levels are primarily supported by periphyton vs. phytoplankton and the relative contributions of these two primary producers to the floodplain foodweb. Our samples not only included zooplankton and aquatic invertebrates, but also juveniles fishes and tadpoles. We also continued sampling to quantify periphyton and phytoplankton production and identifying changes in species assemblages of both periphyton and phytoplankton over time. We conducted another round of zooplankton feeding trials, in parallel with similar lab assays in previous years, using water from floodplain sites immediately after the beginning of the ponding phase; this phase typically initiates in May, after the late season floods.

**Task 4 - PRBO Bird Surveys**

***Overview***

PRBO Conservation Science continued intensive songbird monitoring during the second quarter of 2003. PRBO biologists, Julian Wood, Jeanne Hammond and PRBO interns Andy Pfeffer and Laura Pitsch conducted nest monitoring at the following six sites: Tall Forest, Orr Forest, Tall Forest West, Cottonwood Grove, Middle Breach and Triangle Plot. Data collected include clutch size, number of young fledged, Brown-headed Cowbird parasitism rate, predation rate, nest outcome and vegetation characteristics. Julian Wood conducted point count surveys at all nest monitoring sites as well as five additional sites all within the lower preserve. In addition, 52 Tree Swallow boxes were monitored and the young banded. Preliminary results show songbird nest success to be low this year primarily due to flooding early in the nesting period and high rates of predation.

*Study sites*

PRBO conducted songbird monitoring at six nest plots (Appendix 1). Four of these sites are restoration sites (see Appendix 2 for map of songbird nests on restoration sites). Tall Forest and Orr Forest are mature valley oak dominated riparian sites. The nests at these two sites are not included in Appendix 1. Point count surveys were conducted at 10 sites (Appendix 1).

Tree Swallows nesting in artificial nest boxes were monitored at the following three sites: 1) Floodplain – 28 boxes, 2) Franklin Road –18 boxes, and 3) Visitor Center – 4 boxes. The Floodplain boxes extend from the northeast corner of Tall Forest along the road towards Wendel's Road. The boxes along Franklin Rd. begin at the Desmond intersection and run south along the east side of the railroad tracks. The Visitor Center boxes are located along the nature trail northeast of the Visitor Center.

*Methods*

Variable circular plot point counts:
To measure species diversity, abundance and distribution throughout the preserve we used variable circular plot point counts in which the distance from the observer to each individual detected is estimated. Detections are estimated to within 10 m outward to 50 m. Two larger bands extend from 50 to 100 m and 100 to 200 m. The type of detection is recorded (i.e., song, call, and visual) and birds flying over the station are recorded separately. Any evidence of breeding is also recorded (e.g., material carry, food carry, and copulation). Point counts were conducted during the second quarter.

Constant effort mist netting:

Mist netting was conducted at two sites on the lower preserve; one site is located along Wendel's Levee, adjacent to Accidental Forest and the second site is east of Tall Forest (not conducted in 2001) in Wilson's Section. Mist netting commenced later in the season due to flooding (May 17 at Wendel's Levee site and June 9 at Tall Forest). Netting procedures conformed to guidelines described in Ralph et al (1993) and followed Institute for Bird Populations (IBP) protocol. In summary, 10 mist nets were operated once every ten days from 1 May – 8 August. Nets were operated from 15 minutes after local sunrise, checked every 20 to 45 minutes (depending on conditions) and were operated for five hours. Birds captured were removed from the net and processed near the capture site. Each bird captured (except hummingbirds and game birds) received a USFWS band for permanent identification and to allow estimates of survival from subsequent captures rates. All individuals of Song Sparrow were given a unique combination of three colorbands in addition to the USFWS band to facilitate identification in the field. Age, sex and other morphometric measurements were recorded as described by Pyle (1997) prior to releasing each bird.

Nest monitoring:
To calculate reproductive success and the factors that affect success, the nests of songbirds were located and monitored as described in Martin and Geupel (1993). Nests were located by observing revealing behaviors, flushing females from nests and searching in appropriate habitat. The nest contents are recorded every two to four days until fledging or failure can be determined. Any Brown-headed Cowbird activity is noted without manipulations by the observer. Nest success is calculated using the Mayfield method (Mayfield 1975), which takes into account the number of days a nest was observed thereby correcting for possible overestimation of nest success probability. This overestimation is caused by the greater likelihood of a nest found late in the nesting period succeeding compared with a nest found early in the nesting period.

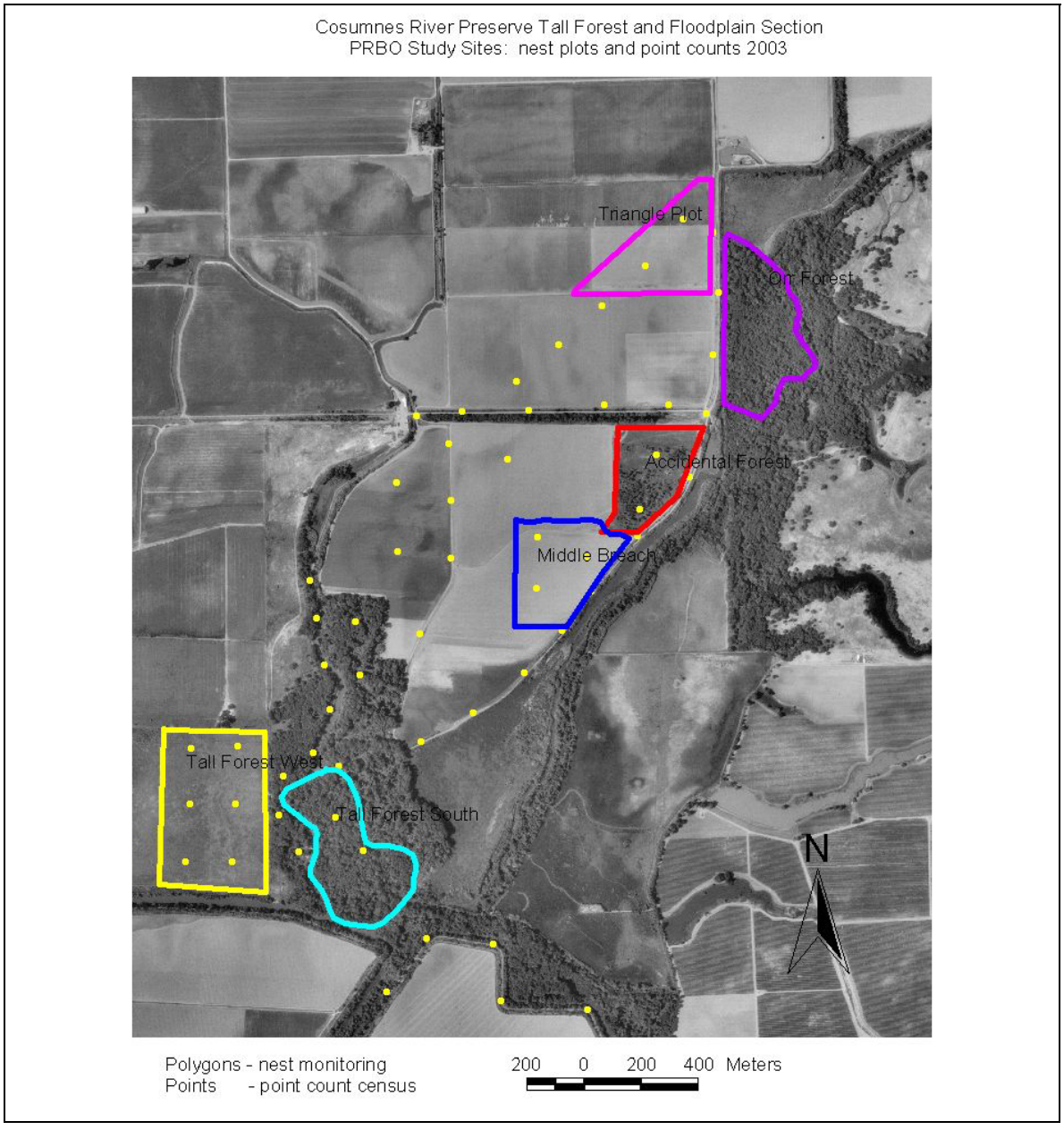
Spot mapping:
All nest plots plus Green Field site were spot mapped to determine the number and size of breeding songbird territories. Each nest plot was spot mapped at least twice per week by the same observer. Green Field, not a nest plot, was spot mapped three times during the breeding season.

Vegetation sampling:
Soon after a nesting attempt terminated we measured the vegetation associated with the nest within a 5 m radius following BBIRD protocol (Martin et al 1997). In summary, we identified the main nest substrate and measured shrub diversity and density and ground, forb, shrub, and tree cover and diversity. Tree diversity and density were sampled in an 11 m radius. The percent canopy cover was also measured. We similarly measured vegetation at point counts but used the relevé method as outlined in Ralph et al (1993). General habitat characteristics of the site were recorded within a 50 m radius of the point count station.

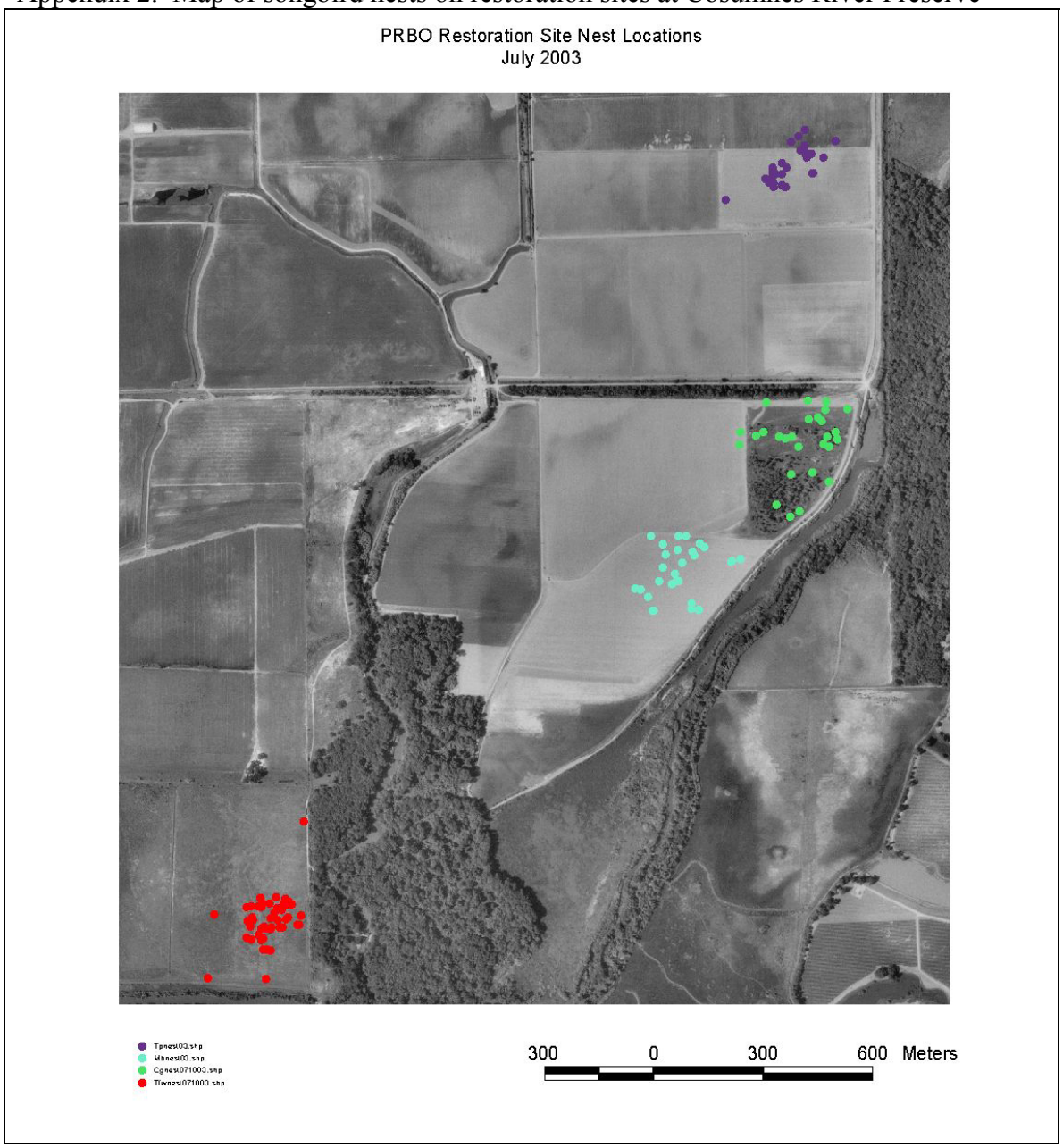
*Nest Predator Study*

To identify nest predators of Song Sparrow, PRBO placed video cameras on the nests of Song Sparrows at Tall Forest site. The cameras record activity at the nest 24 hours per day and use infrared light at night. The footage from depredated nests will be reviewed during the non-breeding season.

Appendix 1. Map of PRBO study sites including nest plot boundaries and point count stations at Cosumnes River Preserve.



Appendix 2. Map of songbird nests on restoration sites at Cosumnes River Preserve




**Task 5 - Data Management (J. Quinn)**

Data Management activities for the second quarter of 2003 focused on continuing information collection, organization, and storage. This data integration includes spatial and tabular data and report text, each adding to the existing library for intra and internet use. Each of the following elements were incorporated into this activity: integration of additional datasets into data library; integration of additional final reports into web

content; addition of regional clips to online and network data library for existing datasets; and data and process documentation and archiving

We are currently developing a detailed digital map of the Cosumnes River floodplain, and immediate vicinity, to document the highest concentration of research activity. This map will address the current lack of standardization of place names in this region, in that currently mapped place names are inconsistent and incomplete, and provide researchers, managers, and the general public a standardized, geo-referenced source of information. We are initiating this task by documenting all existing place names, ranging from federally recognized geographic names to local informal usage, particularly colloquial names used by CRG researchers (e.g., Accidental Forest). Once completed, this mapped data source will be available to display the names and locations of sites and areas of interest; these data will also be served from a multi-relational database functioning as a cross-walk among existing names.

Server and web-service tools were created and installed; these tools will be available to CRG participants for internal use. The programming language Perl was installed on the CRG server, this robust language allows web log report pages to be viewed via an Internet browser, easing administrative requirements. The service and report access will go online at the end of July, cataloging the first full month of web service following the server rebuild. A content assessment tool will also be available only to CRG researchers, and will indicate the data products have been obtained and catalogued, and a set of metadata elements describing their source, content, relevant dates and completeness. Additionally, ESRI ArcIMS (Version 4.0) software was installed on the Internet map server (http://watershed.ucdavis.edu/); this will allow server access to the data library server and Internet access to interactive mapping features. This upgrade will enable users to view and query spatial data from a web browser with and active Internet connection. We are currently developing applications for this service, which will be deployed in mid-August, and preparing spatial and raster datasets for their inclusion.

**Task 6 - Science Support (J. Mount)**

This quarter the Field Coordinator surveyed in the benchmarks on the floodplain to be used in future floodplain surveys. He also surveyed the changes in topography in the breeches and along the setback levee. During those periods when flooding was occurring, he measured discharge at the inlets and outlets of the floodplain. He continued installing and maintaining hydrological sensing equipment, and did targeted fish sampling to maintain a continuing database. The Field Coordinator also: assisted a researcher from the USGS in obtaining water samples for future mercury studies on the Cosumnes, attended a staff meeting at the Cosumnes Preserve to discuss what the university is studying at the Preserve and how these studies link to Preserve conservation objectives; collected invertebrates and used them to teach a group of elementary students about the life on the floodplain; and assisted Nature Conservancy staff with a magazine article and photographs for its national magazine featuring science in support of restoration.