**CALFED Quarterly Progress Report**

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

The Restoration task proceeded through the third quarter of 2003 by examining the relationship between restoration activities and susceptibility to invasion, particularly by the noxious plant *Lepidium latifolium* (California State List B). Lepidium infestation of the Cosumnes River Preserve (CRP) restored floodplain had been documented in 2002; each site was located, re-examined for density and area, and marked for future management. All data were entered into a MS Access database and cross-indexed with geographic data to establish a spatial-temporal relationship between observations. Vegetation ecologist Ingrid Hogle presented a poster at the California Invasive Plant Council annual meeting. The poster documented the efforts to track Lepidium on the CRP floodplain and analyze the spatial relationship with disturbance zones and possible anthropogenic vectors of transmission. This analysis includes environmental factors, such as elevation, slope, and canopy cover, with disturbance measures, such as distance to road or levee breach.

The relationship to restoration success centers on exploring the relationship between existing monitoring programs, inventories of existing restoration activities, and ongoing restoration experiments under the aegis of adaptive management. Adaptive management, particularly its application to restoration within the CALFED region, requires an experimental framework to incorporate results from localized activities and make inferences regionally. As such, vegetation ecologists under the direction of Professor Quinn have researched ongoing monitoring programs used by The Nature Conservancy, Audubon, Point Reyes Bird Observatory, National Park Service, United States Geological Survey, among many others. This background research will help identify the most appropriate and effective approach for monitoring restoration success at the Cosumnes River Preserve. By implementing monitoring strategies used by other organizations in the same and other regions, both spatial and ecological data can be shared and used for meta-analysis of riparian restoration efforts. The Restoration team visited riparian restoration sites in northern California and met with project managers to discuss restoration goals, planning and implementation methods, monitoring efforts, and analysis of restoration success. Sites visited include the multi-partner Cosumnes River Preserve, Audubon's Bobelaine Sanctuary, Sacramento Regional County Sanitation District Bufferlands, The Nature Conservancy's Sacramento River Project, and restoration projects implemented by Sacramento River Partners.

Lastly, task activities focused on the documentation and cataloging of digital photographs taken in the field of restoration sites, invasive plant species, and common plants of CRP. In cooperation with members of Task 5, photographs were documented with standardized metadata established by the National Biological Information Infrastructure. This will

allow CRG researchers and other interested parties, such as CRP docents and the general public, to search through and access digital photographs based on key concepts, such as site or species. The outcome of this exercise will include the development of a virtual herbarium that houses digital photographs of plant species found at CRP to help managers and volunteers identify each; this information is currently lacking and will be instrumental in further efforts to manage for at-risk species or monitor invasions by noxious ones.

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

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

Recent work by Graham Fogg's group includes a mixture of field and laboratory work and numerical analysis. Field work consisted of routine data collection from data loggers located at the field site near Highway 99 near Dillard Road. Laboratory work included two separate laboratory experiments to determine sediment particle size distribution and thermal properties. We also surveyed the land surface elevation over a square-mile section of the study reach.

Laboratory work included analysis of streambed sediment cores that were sampled continuously from the streambed surface to a depth of 30 feet. The continuous core was sub-sampled into seventeen six-inch long samples and two separate laboratory experiments were performed on these samples. The first experiment was performed to determine the sediment thermal properties and to assess the variability of these properties over the different sections of the core sample. This experiment was successful and the results were consistent with previously published measurements for similar sediment types. The results of this experiment demonstrate that thermal properties of the stream sediment at the Cosumnes River are highly variable at different locations in the streambed. The second experiment determined the sediment particle size distribution for each of the core samples analyzed in the previous laboratory experiment. Particle size analysis allowed us to categorize the streambed sediment into muds, silts and sands. Grouping of the streambed sediment allows us to parameterize the numerical model by representing the sediment thermal and hydraulic properties in the numerical model as being discretely heterogeneous. The correspondence between particle size distribution and thermal properties for each sample was vague.

Surveying data was processed and interpolated in order to develop a surface elevation map for the numerical model. Further simulations were carried out to analyze wetting and draining patterns within the streambed and how sediment water distribution was related to texture.

Lastly, a study of floodplain subsurface hydrology in the greater triangular floodplain area was initiated in cooperation with Professor Tim Horner of Sacramento State University. A total of 11 groundwater monitoring wells were installed, including 4 clusters (shallow and deep), and 2 single wells (30-40 ft deep). Core extracted from these

borings together with continuous monitoring of groundwater levels will provide vital information on water movement between the floodplain surface, stream and subsurface in this area.

***Subtask 2b: Evapotranspiration Analysis (K. T. Paw U, P.I., J. Kochendorfer, Graduate Student)***

The UC Davis biometeorology team led by Professor Paw U and graduate student J. Kochendorfer has installed the Deer Creek evapotranspiration tower and all of the accompanying micrometeorological sensors. They began recording energy balance evapotranspiration data at Deer Creek in late July. The research site will be maintained and data will continue to be recorded, aiding the hydrological modeling work performed by Professor G. Fogg's group.

The telescoping tower purchased for the eddy-covariance evapotranspiration measurements at the Accidental Forest site arrived in August, but was damaged by the shipping company. It was returned to the manufacturer, repaired, and then shipped back to Davis at the shipping company's expense. Delivery of the tower is expected by October 15. This delay interrupted the research planned for the summer, but the biometeorology team still plans on installing the tower before the winter rainy season begins.

The exact site for the tower was chosen using aerial maps provided by the Consumnes Research Group's data management project (Information Center For the Environment, Task 5). Site exploration was performed on the ground using GPS, and a meteorological survey of the area. The PRBO bird population study group (Task 4) and TNC accepted our choice of sites after discussions of the impact of the tower on the forest and its inhabitants.

Discussion has also been ongoing with W. Rainey, from the aquatic and terrestrial linkages group (Task 3), on how the Accidental Forest evapotranspiration tower can be used in the study of bats. We hope to use the evapotranspiration tower to simultaneously function as a mounting place for permanent and temporary bat sensors at varying heights. This group will also use our micrometeorological data to study foraging activity in relation to wind speed.

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

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

Since the last quarterly report we have continued to collect continuous data on bat activity from the bat detectors. We have also collected from the wetted floodplain habitats (main channel, triangular floodplain pond, lower floodplain pond, Wood Duck Slough) insect emergence samples on three occasions. Insect sample processing and data analysis is ongoing. We field-tested with great success a new design for sticky traps to be used as supplemental adult insect sampling on the floodplain. In the future, we will

place sticky traps at 3 locations (water, edge, vegetation) and 3 heights in each of the main floodplain habitats during the insect emergence sampling. Sticky traps allow us to compare which insect taxa are available in the habitat compared to which species are emerging. Additional future work will investigate the role of wind and forest edges on the distribution and availability of insects for aerial consumers, such as bat. This additional work is being completed by Denise Grab, as part of her UC-Berkeley undergraduate senior thesis.

Our goals for the upcoming quarter are to continue monitoring bat activity, collect insect data (emergence and sticky traps), and data analysis. Weather permitting, we hope to collect samples over a larger time series across a flood event to investigate the relationship between inundation and insect emergence.

***Subtask 3b (Grosholz) Flood Plain Primary and Secondary Production***

Our main activities have involved sorting and enumeration of floodplain and processing for stable isotope analyses. These samples included regular monitoring during the flood season ending in June, transects to measure nutrient and detritus subsidies from forest to floodplain, transects to measure distinct faunal changes from forest to floodplain, and mesocosm experiments. We have focused on several trophic levels in this work from periphyton and phytoplankton, zooplankton and aquatic invertebrates, to juvenile fishes and tadpoles. In concert with counting, enumeration and processing for stable isotope analyses, we are continuing to voucher and identify all new taxa encountered. We have also been processing samples associated with zooplankton feeding trials conducted this spring and those associated with monitoring of changes in phytoplankton abundance and composition. We also conducted some quality control tests and method comparisons for some of our measurement techniques, including chlorophyll measurements, primary productivity measurements using incubations with C-13, and microscopic phytoplankton enumeration.

**Task 4 - PRBO Bird Surveys (N. Nur)**

**Overview**

PRBO Conservation Science conducted intensive songbird monitoring and vegetation sampling during the month of July 2003 representing the end of breeding season monitoring at the Cosumnes River Preserve. From August to October PRBO staff entered and proofed data collected during the breeding season and finalized the GIS database of PRBO monitoring sites. PRBO staff also attended several Cosumnes Research Group meetings during the third quarter. Biologists Julian Wood, Jeanne Hammond and PRBO intern Andy Pfeffer conducted avian monitoring and vegetation sampling at the following six sites: Tall Forest, Orr Forest, Tall Forest West, Cottonwood Grove, Middle Breach and Triangle Plot (Table 1). A Total of 371 nests were found and monitored. Preliminary results show nest success to be very low this year. The proportion of successful song sparrow (*Melospiza melodia*) nests (nests that fledged at least one song sparrow young) on mature riparian plots was 6.9% in the Tall Forest and 8.3% in Orr Forest. Other ground and low shrub nesters on other sites had similar low nest success due in part to late spring floods. Preliminary results from 24-hour video

monitoring of nests for two song sparrow nests in the Tall Forest revealed female brown-headed cowbirds (*Molothrus ater*) to be nest predators on song sparrow young. Video data are being reviewed to identify additional predation events.

A total of 52 tree swallow (*Tachycineta bicolor*) nest boxes were monitored at two different sites. One set of boxes is located near the visitor's center and north along Franklin Blvd. and the other set of boxes is located in the floodplain. Nest boxes were added in August 2003 in preparation for the 2004 breeding season in a small restoration site (3.6 ha) surrounded by agriculture. This new site is located between the equipment pad and the Farm Center.

Table 1. PRBO study sites including point count transects, nest monitoring plots, and banding sites conducted spring/summer 2004.

| Method | | | | | |
|---|---|---|---|---|---|
| Point count | # Points | | | | |
| | | | | | |
| Tall Forest | 13 | | | | |
| Tall Forest West | 6 | | | | |
| Wendel's Road | 9 | | | | |
| Willow Slough | 15 | | | | |
| Wendel's Levee | 8 | | | | |
| Middle Breach | 3 | | | | |
| Triangle Plot | 5 | | | | |
| Accidental Forest | 2 | | | | |
| Green Field | 2 | | | | |
| | | | | | |
| Nest Monitoring | # Nests | | | | |
| | | | | | |
| Orr Forest | 65 | | | | |
| Tall Forest | 104 | | | | |
| Middle Breach | 32 | | | | |
| Triangle Plot | 38 | | | | |
| Tall Forest West | 65 | | | | |
| Accidental Forest | 67 | | | | |
| | | | | | |
| Mist Netting | Banded | Recaptures | Unbanded | Net hours | Birds/net hour |
| | | | | | |
| Wendel's Levee | 244 | 54 | 7 | 431.25 | 1.41 |
| Tall Forest | 129 | 47 | 2 | 349.5 | 1.96 |

## 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 from April 18 to June 20, 2003. Point count data were entered during the third 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 for each open cup nest found. Tree diversity and density were sampled in an 11 m radius. The percent canopy cover was also measured. In addition, 10 random points were sampled on each nest plot. We similarly measured vegetation at 25 point count stations between July 14 and August 6, 2003 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.

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

Data management for the Cosumnes Research Group continued through the third quarter of 2003 focusing on the development and implementation of an ESRI Internet Map Server (ArcIMS ) application. This ArcIMS application, based on the Watershed Center data server [http://watershed.ucdavis.edu/crg/mapindex.asp], allows users to customize maps of the project area. Through the addition and modification of ArcIMS base data, programmer analysts at the Information Center for the Environment under the direction of Professor Quinn have developed an innovative method for cataloging research activity spatially and providing these data through ArcIMS. This involved the standardization and documentation of place names and colloquial names given to important locales within the study area.

Data management activities included the continued support to CRG researchers through the development and generation of field maps, planning documents, and display posters. These and other documents of interest were also either updated or posted to the CRG website. Activities continued to help streamline data access and distribution mechanisms. Programmer analysts continued to research and develop methods for multiple data exchange formats to ease data transmission among CRG researchers and other interested parties.

In cooperation with researchers from Task 1 (Restoration), the development of a photographic image catalog was initiated. Not only will this catalog support a virtual herbarium to assist CRG, TNC, and the general public with the identification of plant species within the project area, the data are also cataloged using metadata standards within the overall framework of the National Biological Information Infrastructure (NBII). Thus, the virtual herbarium photographs, in addition to field level photographs of restoration activities, will be indexed and searchable on a national standard.

The image catalog uses Open Source software, including PHP, mySQL, Coppermine, and Image Magick, to provide a seamless mechanism to catalog digital photographs. Furthermore, the open source nature of the programming environment allows for critical modifications to enforce NBII metadata compliance. The approach allows for the

collection, display, and sharing of CRG digital photographs and provides integral data elements, which describe the "who, when, what, where, & how" of each photograph.

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

This quarter the Field Coordinator continued surveying in floodplain sampling and monitoring locations. He has also been preparing equipment on the floodplain for integration into the REMOTE program, which will provide real-time hydrologic and weather data. The ability to access this information remotely will allow scientists to better manage experiments, and will facilitate the prompt identification and repair of damaged or non-working hydrologic sensors. The Field Coordinator has been coordinating, with California State University Sacramento researchers and The Nature Conservancy, the installation of piezometers on the floodplain to monitor ground water levels. He collaborated with UCD hydrologists, PRBO and The Nature Conservancy to find solutions to problems of installing an evapotranspiration tower in the Accidental Forest. Other Field Coordinator tasks this quarter included: arranging for ATV maintenance and repair; retrieving temperature sensors on the floodplain and downloading the data; and providing water level and topographical data to various researchers to facilitate their work. Finally, he has been doing some preliminary work in preparation for reoccupying previously surveyed cross-sections and surveying changes in sand splay and channel topography.