CALFED Quarterly Progress Report

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Subtask 1: Restoration (J. Quinn)

We continue to identify, map and analyze the population dynamics of invasive perennial pepperweed (*Lepidium latifolium*) infestations within riparian restoration areas at the Cosumnes River Preserve. This information is being used to construct hypotheses on the causal factors of infestation dynamics, to inform eradication efforts, and to evaluate the success of restoration efforts to date. We have recently improved our pepperweed data management system to include more streamlined GPS protocols and a more parsimonious database structure for maintaining field records. We have also upgraded our GIS layers to a geodatabase within ArcGIS 8.3, which allows for a contained structure of records which enables more accessible distribution of spatial data among researchers and Preserve staff. We continue to expand our herbarium collection and photographic "virtual herbarium" of riparian vegetation at the Cosumnes River Preserve. Preserve volunteers are assisting in this effort, learning to identify plants in the process. These efforts are helping to train volunteers for vegetation monitoring efforts at the Preserve in the future. Our group submitted an abstract to the CALFED Science Symposium that details our pepperweed tracking efforts.

Dr. Joshua Viers convened a roundtable panel to discuss communication of science to the public. Experiences from the Cosumnes River, and CALFED Bay-Delta region, were used as examples to explore how to better articulate scientific understanding of floods, inherent ecological linkages, and its environmental benefits. Several prominent scientists attended, including Professors Jeff Mount and Peter Moyle, as well as former chief editor of Conservation Biology Reed Noss. In addition to floods, the group discussed the role of wildland fire as both an ecological necessity and a popular pariah, as juxtaposed with roads, where they are viewed as ecological disasters and public goods. We feel that this forum will help craft useful language in regards to communicating the role of restoration in the Bay-Delta in terms accessible and intelligible to the general public. These issues also form the basis for adaptive management in that the crux is the establishment of a defined set of goals and objectives through sound scientific principles *and* communicating these goals and objectives to resource managers, scientists, and stakeholders. Dr. Viers has submitted an abstract to

the CALFED Science Symposium which will include these facets as they relate to restoration success in the Cosumnes River watershed.

Subtask 2a: Hydrologic Analysis (G. Fogg)

Summer field activities are being planned and will include more hydrologic instrumentation and reconnaissance at various sites along the river between the Folsom South Canal and Twin Cities Road. Temperature probes and peizometers are being installed at various locations along the channel to monitor the location of the stream terminus before, during and after the first flow event in Fall 2004 and to monitor shallow groundwater levels beneath the channel.

Hydrologic data collected as part of the reach scale investigation has provided insight into the local hydraulic behavior over a 200-m section of the river. This data suggests that groundwater perches beneath the channel, flows laterally, and provides water for riparian vegetation. The build up of perched groundwater beneath the channel decreases the vertical hydraulic gradient and less water is able to infiltrate into the subsurface. We measured upward hydraulic gradients below the river after high flows subsided during the spring of 2002, indicating that water was flowing from perched groundwater into the channel. A better understanding of surface/ground-water interaction gained from the reach-scale investigation is guiding field activities this summer.

This study continues to analyze the effects of perched groundwater on surface/ground-water interaction at the Cosumnes River. This work indicates that perched groundwater may alter the conditions typically found beneath disconnected rivers. If perched groundwater is a common occurrence along many reaches of the river then present conceptual models of surface/ground-water interaction at the Cosumnes may need to be altered accordingly. Information gained from studying the Cosumnes may help in managing other rivers in the Central Valley if groundwater levels continue to decline.

The analysis of data collected from the reach scale investigation continues as does the development of a numerical model of this site. Sediment permeability values are being optimized within the numerical model using an automated parameter estimation code. Temperature, sediment water content, and perched groundwater level data are being used as observation data for parameter estimation. Once the model development phase is completed then various simulations will be conducted to develop a water balance of the study reach.

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

At the Deer Creek Costello site, upstream from Highway 99, we installed a new infrared thermometer to measure the surface temperature of the ecosystem.

This additional sensor gives us some redundancy if the other surface temperature sensor fails, and also allows us to verify data from the original sensor. The UC Davis Biometeorological group also installed a water spraying system at this site (at almost no cost to the project) through which we can wet the surface of the vegetation adjacent to the tower, and improve our estimates of the aerodynamic resistance as a function of wind speed. Using the estimated aerodynamic resistance, we can calculate evapotranspiration (ET) from the remaining micrometeorological variables recorded (Figure 1).

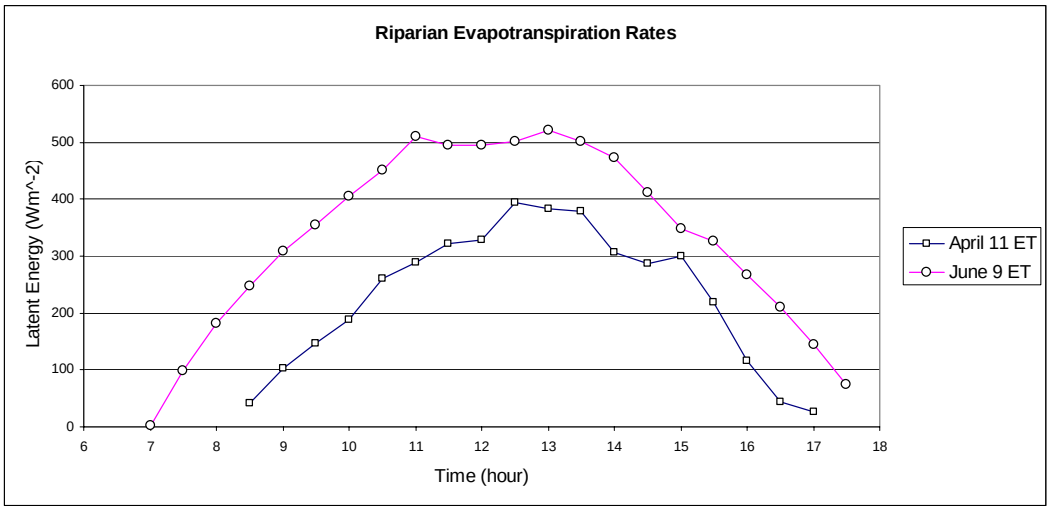

Figure 1. Latent energy (LE) lost by the ecosystem to the atmosphere via evapotranspiration on two sunny days.

At the Accidental Forest site the eddy-covariance (EC) tower sensors ran continuously this past quarter. We developed and debugged the program used to analyze the EC 10 Hz data. EC data analysis shows that the turbulent ecosystem-atmosphere exchange appears reasonably captured by the instruments on our tower. Water and carbon dioxide anomalies are very well correlated with vertical wind speed.

We are also in the process of creating a thorough quality control routine that UC Davis Biometeorology field assistants will perform during the weekly site visits. This will include semi-automated raw data processing and plotting executed at the site immediately after downloading the data, and will help minimize the amount of down time incurred if any component of either evapotranspiration towers fails.

Substantial progress has been made in the past quarter; we estimate that the project's accomplishments are approximately 45% towards achieving the project's final objectives. Continued enhancements to the instrumentation are expected in the near future, which should entail equipment expenditures. We plan to gather data for the next year at both of our sites, and perhaps beyond

until the end of the project, with concentration on analyzing the data by the end of this calendar year. Labor costs for additional personnel being recruited to assist with both the field experiments and data analysis, and travel expenditures to a conference in August 2004, will be incurred.

Subtask 3a: (M. Power, UC Berkeley)

This quarter we again continued periodic sampling aerial insects with overnight deployments of aquatic emergence traps while continuously sampling bat acoustic activity with solar or storage battery powered monitors at the series of stations on the Cosumnes floodplain and adjacent channels. Denise Grab, an undergraduate student completed a report analyzing a portion (February and March samples) of the insect sticky trap samples collected in the previous quarter at four sites (simultaneously with emergence trap sampling). Cylindrical sticky traps were exposed on poles for 24 hr at two heights (immediately above the water, soil, or surface vegetation and at 0.9m). Across sites, both insect biomass and abundance (number of individuals) were highest at the minimum height. Abundance was significantly higher over water than at terrestrial sites 5m and 30m away. Both abundance and biomass were greater in March than February. There were significant differences among sites in abundance, but not biomass, with the permanent water sites (Wood Duck Slough and the river channel at the Corps Breach) lower than the Accidental forest and Triangular pond margins. Correlation of sticky trap (including both aquatic and terrestrial insects) and aquatic emergence trap collections were low, consistent with the expectation that aquatic production and the 'standing crop' of flying insects at a point are not necessarily closely coupled. In Berkeley, laboratory work also continued on identifying other emergence trap samples.

Review of bat acoustic data showed large increases in activity during the episode of unseasonably warm weather in late March (an event which also led to unusually early tree leaf-out). This activity peak was largest at the Forested Wood Duck Slough site and included several species, notably the migratory hoary bat (*Lasiurus cinereus*). Numbers of detections per night for this species greater than any previously observed in this study occurred on several nights in late March-early April, suggesting passage of pulses of northward migrants. No evidence of similar pulses of Spring migrant red bats (*Lasiurus blossevillii*) were detected. Late last summer the acoustic monitor on the river channel at the Corps Breach detected similar activity spikes consistent with southward migrant pulses. Unfortunately, this monitor was inactive through part of March 2004 because of a previously unknown hardware/firmware interaction (now repaired).

Initial results from the bat acoustic monitor at the top of the 21m floodplain observation tower of the Evapotranspiration Analysis shows substantial levels of nightly activity and similar temporal pattern to a monitor at the ground level

edge of the Accidental Forest. The bat assemblage foraging at the forest canopy 'edge' observed so far is largely limited to larger open air foraging species. Significant project time was, as previously, devoted to various aspects of operating the acoustic monitoring systems, such as field downloading, dealing with tree falls and 'bio-fouling' (e.g., European wasp nests constructed in the ultrasound microphones), other hardware maintenance, data processing and archiving as prelude to analyses.

Subtask 3b: (Grosholz, UC Davis)

This quarter, Anke Mueller-Solger and Su-Fei Kuok completed field sampling for the 2004 floodplain sampling season and a series of organic matter bioavailability assays. Analysis of samples collected this quarter is in progress. Anke Mueller-Solger presented results from the bioavailability assays at the June 2004 ASLO summer meeting in Savannah, Georgia. Briefly, the bioavailability assays showed that concentrations and bioavailability of DOC and POC in the Cosumnes River floodplain are similar and often greater than in Delta habitats. Similar to results from comparable experiments conducted in Delta habitats, bioavailable DOC in the Cosumnes floodplain is associated with detritus and bioavailable POC is associated with phytoplankton. However, somewhat differently from Delta results, phytoplankton-detritus appears to be more readily available for microbial consumption than fresh phytoplankton. In addition we also found large differences in total and bioavailable POC and DOC concentrations between forested and open floodplain areas, areas with different residence times, and during different flood stages (flood versus drain). We also conducted mesocosm experiments to determine the fate of water column nitrogen and the timing of uptake. We experimentally augmented experimental mesocosms with either N-15 labeled nitrate, labeled nitrate with added phosphate or controls with neither added. Nitrate levels fell quickly to background by day five. We are still analyzing samples of zooplankton, phytoplankton, periphyton, macrophytes and insects to determine the fate of water column nitrogen through the food web. We also still analyzing samples from the intensive flood associated sampling conducted in February and March on the residence time transect. We have analyzed all the water quality samples and are continuing to work through samples of zooplankton and insects. We are also beginning to analyze phytoplankton samples to document changes in palatable species.

Subtask 4: PRBO (N. Nur)

PRBO began collecting songbird data in the field on March 22, 2004. One PRBO biologist and three interns searched for and monitored the nests of songbirds at six study sites on the lower preserve. The study sites are the same as 2003. Five-minute variable circular plot point counts were conducted from May through June in the same locations as 2003 with the addition of a transect in Orr Forest.

Mist netting for passerines was also conducted in the same locations as previous years. Unlike 2003, mist netting began on time (May 1) due to the lack of floodwater on the site. The tree swallow (*Tachycineta bicolor*) study continued in 2004. A total of 53 boxes were monitored at the visitor center, in the lower floodplain and near rice fields north of the equipment pad. This is the first year the boxes in the small restoration site north of the equipment pad were monitored. Tree swallow boxes were monitored from nest building through laying, incubation, and nestling stages until nest fate was determined. Behavioral observations were conducted for one hour in the morning on each box at day 8 to 10 of the nestling stage. The number and time of visits by either parent were recorded. Nestlings were weighed prior to and 24 hours after each behavioral observation to determine nestling weight gain. When made available, fecal samples were collected from tree swallows and song sparrow individuals (*Melospiza melodia*) during nestling banding. Video surveillance of song sparrow and spotted towhee (*Pipilo maculatus*) nests occurred in Orr Forest. This breeding season, three black rats (*Rattus rattus*) and one brown-headed cowbird (*Molothrus ater*) were confirmed as nest predators on song sparrow and spotted towhee nests. Nadav Nur and Julian Wood attended a birds and bats working group meeting to discuss the synthesis of terrestrial components, how this might best be achieved and what potential products might be produced.

Subtask 5: Data Management (J. Quinn)

A critical aspect of a collaborative restoration research is communicating the spatial relationships between restoration efforts and ecosystem results. As such, our data management strategy employs Open Source (OS) software, to minimize costs and improve portability/accessibility. We are continuing in our server cut-over to Linux, which supports a variety of other OS code (e.g., PHP, MySQL, Coppermine, ImageMagick and Mapserver). We feel that this operating system will better support the data management needs of the Cosumnes Research Group through information sharing. Our modifications to OS permit the collection and storage of image metadata, consistent with standards of the National Biological Information Infrastructure (NBII), and extend the Dublin Core metadata framework. Our quarterly activities, thus, have focused principally on system administration, implementation and testing of OS media, and fulfilling routine group data requests.

Subtask 6: Coordination (J. Mount)

This quarter the Field Coordinator compiled and organized the hydrological and thermal data that was collected throughout the previous flood season. The information was provided to the Group's researchers, to provide a basis for analyzing and correlating data collected in various field projects. The Field Coordinator also conducted detailed surveying of cross sections on the floodplain

to determine changes in topography. The installation of a radio tower for the REMOTE project was approved to relay the real-time sensor data from the floodplain. Two of the hydrologic sensors were moved to locations better able to sample the changes in water stage on the floodplain. Additional sensors were ordered to make a more complete data set on the lower floodplain. Continuing monitoring of the groundwater was conducted on a monthly basis.

Subtask 7: Monitoring (J. Mount)

This task is not yet implemented.