CALFED Quarterly Progress Report

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Task 1 -- Restoration (J.Quinn)

We are continuing to analyze monitoring data from restoration and riparian forest areas. We are also processing and analyzing high spatial resolution imagery in reference to restoration spatial data. In preparation of a manuscript discussing patterns of riparian plant diversity in the CBDA region, Table 1 shows that successional gradients, created and maintained by dynamic ecosystem processes such as floods, are important in describing riparian plant biodiversity. The sand splay (SS) maintains the greatest number of riparian plant species (50); however, if you exclude exotic species, it has comparable numbers to the Accidental Forest (AF). What is not intuitive in these numbers, however, is that the Jaccard Similarity coefficient between SS and AF is only 0.30. The Mixed Riparian (MR) and Valley Oak (VO) forests consistently maintain the highest similarity, regardless of species pooling. These data reinforce the notion that heterogeneous habitat conditions, in the form of functional and structural diversity, are required to promote riparian biodiversity. River restoration efforts should target a suite of ecological processes to maintain, should embrace interannual variability, and should also seek habitat creating conditions along successional gradients.

Table 1. Cosumnes River Riparian Plant Taxa Similarity. Four levels of taxonomic grouping are tabulated across four sites (SS = Sand Splay; AF = Accidental Forest; MR = Mixed Riparian; VO = Valley Oak). Similarity coefficients follow Jaccard (1912); numbers of species are indicated parenthetically for each site by taxonomic grouping.

Taxa	SITE (spp)	SS	AF	MR	VO
All Spp	SS (50)	1.00			
All Spp	AF (38)	0.28	1.00		
All Spp	MR (23)	0.18	0.49	1.00	
All Spp	VO (30)	0.19	0.39	0.56	1.00
All Native	SS (21)	1.00			
All Native	AF (22)	0.30	1.00		
All Native	MR (15)	0.24	0.61	1.00	
All Native	VO (20)	0.21	0.45	0.67	1.00
Native Herb	SS (17)	1.00			
Native Herb	AF (13)	0.36	1.00		
Native Herb	MR (9)	0.30	0.57	1.00	
Native Herb	VO (13)	0.25	0.44	0.69	1.00
Native Woody	SS (4)	1.00			
Native Woody	AF (9)	0.18	1.00		
Native Woody	MR (6)	0.11	0.67	1.00	
Native Woody	VO (7)	0.10	0.45	0.63	1.00

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

Subtask 2a: Hydrologic Analysis (G. Fogg)

During this quarter we have been synthesizing data and results and writing about the surface-water/ground-water interactions at the Cosumnes River. Two major results of the work are that perched groundwater discharge to the river can maintain wetted conditions in the channel (either as ponds or flowing water) and saturated conditions in the riparian root zone. These results are significant because without regional groundwater contribution to the saturated regional surrounding a river (as is the case several miles of the Cosumnes River) conventional wisdom

would suggest that conditions would become completely dry when there is not runoff. Simulation modeling and field observations show that the channel and surrounding sediment can remain wet during much of the dry season in areas lacking contribution from regional groundwater. For example, sediment saturations beneath the river bank show continuous near-saturated conditions (figure 1). However, perched aquifers are likely limited in storage and simulation modeling suggests that phreatophytes become increasingly supply limited late in the dry season. Focused recharge of perched aquifers during the late summer or early fall could significantly enhance near-stream ecosystem functioning.

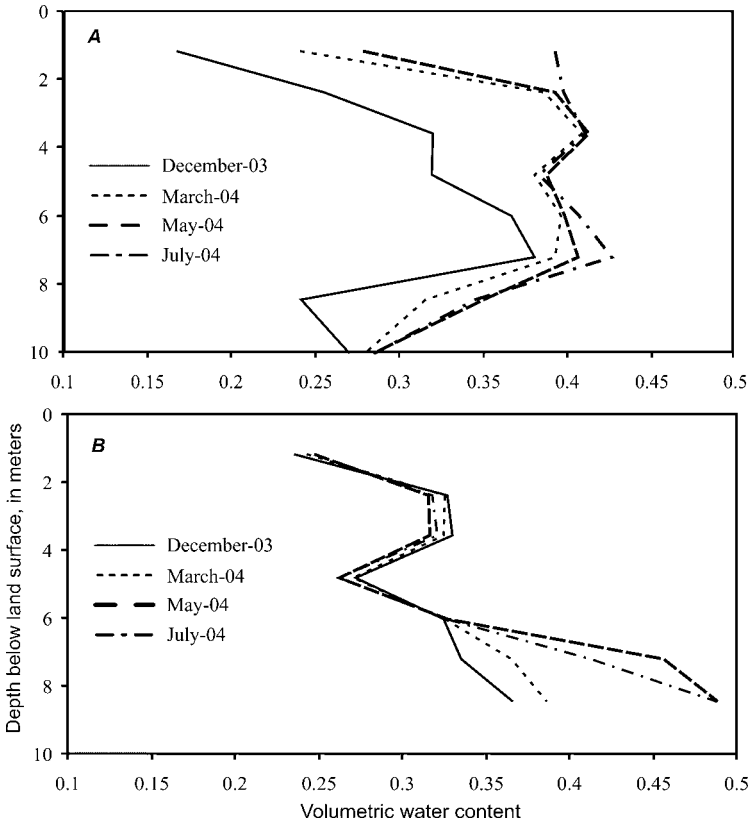

Figure 1: Sediment saturation (A) beneath the floodplain, and (B) beneath built levee. Regional groundwater levels range between 16-17 m below land surface in this area.

Subtask 2b: Evapotranspiration Analysis (P.I. K. T. Paw U & graduate student John Kochendorfer)

This past quarter we continued operation of the upstream (Deer Creek Costello) evapotranspiration tower. We began dismantling the downstream (Accidental Forest) tower in preparation for the conclusion of our Cosumnes research. Data analysis of water, carbon dioxide, and energy fluxes continues for both sites. We will be presenting some of our results from the downstream site at the Berkeley Atmospheric Sciences Center Symposium on October 14.

We also ran an intensive field study of edge effects on an agricultural field on the UC Davis campus. This work includes the measurement and analysis of turbulence data from 6 fast response 3D sonic anemometers, 4 fast response water vapor and CO_2 analyzers, 20 temperature and relative humidity sensors and numerous energy balance sensors. The field study is still continuing, and is scheduled to be complete between mid-October and early November. Preliminary analysis of our results suggests that the advection of temperature and water is significant within a homogenous canopy even at horizontal distances approaching 100 times the height of the canopy. This may have significant impact on the suitability of conventional micrometeorological techniques in riparian areas that are normally characterized by short fetches. We estimate that the project's accomplishments are approximately 90% towards achieving the project's final objectives. Labor costs may be incurred for additional personnel being recruited to assist with the conducting the last part of the experiments, and termination of the field experimental sites, and for the extensive data analysis needed to finish off the project.

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

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

Biweekly insect emergence sampling in the seasonally declining areas of surface water continued through the quarter. Bat acoustic activity monitors were also maintained at many of the stations used throughout the project, though microphone weathering, biofouling, and removal to permit maintenance excavation of waterways lead to data gaps at some sites. The evapotranspiration tower in the Accidental Forest was lowered, so the acoustic monitor previously using the tower to sample above canopy will run in a forest floor gap for the remainder of the study, as it did prior to tower installation. Cup anemometers added to several of the bat monitors are providing local wind speed data in both vegetatively sheltered (forest edge and interior gaps) and open sites for comparison with longer records available from both on-site and nearby off-site meteorological stations.

As in previous quarters, taxonomic identification and size measurements of invertebrates from emergence samples continued and the backlog of samples was substantially reduced. Data entry, validation and preparation of graphical displays for inspection were important activities preparatory to summarization for the final report. Similarly, analysis of acoustic station data examining activity by species and site continued, based on software 'filters' designed from bat species call characteristics. In the current state of software development, visual screening of a large sample of the categorized call sequence files is also employed to both insure that non-bat sound sources (*e.g.*, unknown ultrasonic insect signals) are not conflated with bat calls and to screen for uncommon bat species not reliably recognized automatically.

Subtask 3b: (Grosholz, UC Davis)

During the last quarter (July 1-Sept. 30), work on zooplankton and phytoplankton focused on quantification and biomass determination of winter and spring quarter samples. We have quantified biomass of all zooplankton samples collected during winter floods in coordination with water quality sampling during targeted phases of the hydrograph. We completing analysis and quantification of phytoplankton sampling, which included identification of all taxa and determination of edibility based on group affinity.

We also worked towards completion of the identification and quantification of benthic insect samples collected during the same hydrographic phases as the plankton sampling. We also secured outside taxonomic assistance with mayfly larvae and validated our reference collection. New field work included quantifying of the abundance and diversity of aquatic macrophytes such as *Ludwigia* and *Polypogon*. These species were among the dominants in a growing macrophyte community that is rapidly overgrowing the floodplain ponds. We quantified the canopy cover and biomass along shallow and deep transects in both upper and lower ponds as well as in grassland areas. We also investigated the taxonomic identity of *Ludwigia*, although no invasive *Ludwigia* was identified (only native *L. peploides*). We also continued to monitor periphyton abundance in pond areas as well.

Task 4 - Avian Studies component (N. Nur, G.R. Geupel, J Wood PRBO)

During this quarter, PRBO biologists and interns finished collection of data on bird abundance, distribution, diversity, productivity and survival. In 2005 we found, monitored and geo-

referenced over 365 nests of more than 27 species (Table 2). Point counts were conducted by staff biologists, two times, during the season at 118 locations. Vegetation assessments were conducted at all nests as well as at 150 randomly chosen non-use sites (30 within each nest searching area), and at all point counts. Mist netting was conducted at two sites, Wendell's Levee and Tall Forest (Wilson's Section), once late spring floods receded in late June. Approximately 50 active Tree Swallow (*Tachycineta bicolor*) nest boxes were monitored to determine nest success and nestling weight gain. Some adults and all nestlings were banded as part of a long-term attempt to measure fecundity and adult and juvenile survival and recruitment. All methods used are outlined in the second quarterly report 2003. All data collected were entered and proofed throughout the season.

Table 2. Number of nests found on all plots in 2005.

Common name	Scientific name	Total nests found
Pied-billed Grebe	*Podilymbus podiceps*	2
Mallard	*Anas platyrhynchos*	4
Virginia Rail	*Rallus limicola*	1
Common Moorhen	*Gallinula chloropus*	3
Mourning Dove	*Zenaida macroura*	9
Black-chinned Hummingbird	*Archilocus alexandri*	7
Allen's Hummingbird	*Selasphorus sasin*	1
Downy Woodpecker	*Picoides pubescens*	1
Nuttall's Woodpecker	*Picoides nuttallii*	1
Ash-throated Flycatcher	*Myiarchus cinerascens*	1
Western Wood-Pewee	*Contopus sordidulus*	10

Pacific-slope Flycatcher	*Empidonax difficilis*	2
Hutton's Vireo	*Vireo huttoni*	3
Tree Swallow	*Tachycineta bicolor*	82
Bushtit	*Psaltriparus minimus*	5
American Robin	*Turdus migratorius*	12
Wrentit	*Chamaea fasciata*	8
Common Yellowthroat	*Geothlypis trichas*	3
Bullock’s Oriole	*Icterus galbula bullockii*	2
Spotted Towhee	*Pipilo maculatus*	30
Song Sparrow	*Melospiza melodia*	125
Black-headed Grosbeak	*Pheucticus melanocephalus*	28
Blue Grosbeak	*Passerina caerulea*	1
House Finch	*Carpodacus mexicanus*	1
Red-winged Blackbird	*Agelaius phoeniceus*	11
Lesser Goldfinch	*Carduelis psaltria*	2
American Goldfinch	*Carduelis tristis*	11
		Total 365

Task 5 -- Data Management (J. Quinn)

This quarter’s activities centered upon supporting a move of Internet resources to a centralized server (http://baydelta.ucdavis.edu). Other activities included benchmarking data acquisition from Watershed Sciences LLC. A round of review was concluded on 6 Gigabytes of 18cm near-infrared imagery and 0.5m laser altimetry. Through combined funds of CRG2 (Mount) and Lepidium Control Experiment (Quinn), Watershed Sciences (Corvallis, OR) flew a combined sensor data collection mission. We acquired both LIDAR (light detection and ranging or laser

altimetry) and near-infrared digital aerial imagery for a large portion of the preserve (~I5 : Hwy 99). We have now received preliminary delivery products for these two data stores. The LIDAR appears to be final in form; however, WS is examining some return intensity anomalies and we'll have more information that soon. In the mean time, we have begun to assess the vertical accuracy of the LIDAR data. Their RTK control consisted of 352 ground based measurements (RMSE = 0.035m; max deviation = 0.127m). Our RTK control consisted of 17 monumented control points used in yearly floodplain surveys. We compared two data products (1m Bare Earth DEM and 0.5m Bare Earth DEM) to our RTK to assess an independent RMSE. Considering all 17 control points, our RMSE ranges from 0.112m for the 1m DEM to 0.126m for the 0.5m DEM. All points were within 26cm and 28cm, respectively. However, if Control Point 'O' is excluded from this comparison, the RMSE on both data products falls to within 0.09m (similar to WS 95% confidence level). Based on these comparisons, we feel that the LIDAR acquisition has a vertical accuracy of < 10cm.

Task 6 – Coordination/Science Support (J. Mount)

This quarter the field coordinator continued to collect and organize data to be used by the researchers on the project. Data was analyzed so that it could meet individual requests for various researchers. Surveying was completed to reoccupy transects from the beginning of the project to determine geomorphic change in the floodplain. The surveying was also used to help determine the accuracy of the LIDAR data that was acquired during the quarter.

Task 7 – Continued Floodplain Monitoring (J. Mount)

The results from this past flood seasons monitoring are being analyzed and submitted for publication. A manuscript entitled "Flood pulse driven trends in suspended algal biomass distribution across a restored floodplain: Priming the productivity pump" has been submitted to Freshwater Biology and is in review. The paper is the result of the winter quarters intensive spatial monitoring of water quality across the triangle floodplain. The results of the temporal monitoring are being analyzed and a manuscript will be submitted for publication by the end of the month. Some salient findings from the temporal monitoring include:

- The floodplain tends to act as a biogeochemical source (exporter of Chl-a, DOC, nutrients) during the initial and final stages of flooding.
- The floodplain acts as a sink for these same constituents during the peak stage of flooding.
- Because the fluxes moving in and out of the system are so much greater during the peak stage, the floodplain acts as an annual sink for these constituents and thus does not export these resources to the channel. We believe that this is due to the fact that residence time on the floodplain is much smaller than it would be on a natural floodplain (other studies corroborate this supposition). It follows that if floodplains are to be managed as food resource exporters then flood volume should be proportional to floodplain volume (ie residence time should be higher than what we find on the upper triangle).

These finds have implications which may be useful for future floodplain restoration in the Bay-Delta region.