CALFED Quarterly Progress Report

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Period ending: April 2005

Task 1 -- Restoration (J.Quinn)

This quarter's accomplishments include the addition and enhancement of geospatial information and vegetation monitoring data pertaining to restoration and weed control at the Cosumnes River Preserve. These new data protocols and development of database structures will be applicable to other sites and species.

From Task 5, we acquired and now maintain an image catalog of high resolution aerial imagery for the entire Preserve. We used this new high resolution imagery to digitize all roads, paved and unpaved, in and immediately around the Preserve. This new data layer will enable analyses of roads as potential factors influencing weed establishment and restoration success, as well as contributing to improved map production capabilities. We obtained raw vegetation and seedbank monitoring data from restoration and riparian forest areas of the Preserve taken by Dr. Mandy Tu from 1996-1998. Spatial reference information is being collected, and the organization of these data is being modified, to enhance their usefulness for integration with future analyses.

From Task 5, we implemented a template of standardized geographic environment settings specific to the region to improve geodatabase performance. From this template, we were able to analyze our data in ArcGIS editing tools to merge field-located *Lepidium latifolium* patches which are within the threshold of 3 meters of one another. (This threshold value is based on the rate of spread of *Lepidium latifolium*.) This protocol maintains and synthesizes important patch data such as cover, density and area.

We developed a protocol to track changes in patch size over time using spatial location rather than patch identification labels. This spatial method solves the problem of tracking patch merges and disappearances, as well as reducing the potential for data entry error. The results of these patch merging and tracking protocols are now being used to analyze data from three consecutive years of weed monitoring on a restored floodplain at the Preserve. We continued data acquisition towards the development of a "virtual herbarium" linking digital photos with plant species found at the Preserve. The results of this effort are now being used to compile a vegetation handbook for the Preserve's riparian and floodplain habitats. Volunteers will use this handbook to help UC scientists and Preserve managers assess and track restoration activities. This task is approximately 80% complete.

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

Subtask 2a: Hydrologic Analysis (G. Fogg)

During this period we have continued to refine the numerical model to simulate stream-aquifer interaction. We are finishing up the calibration procedure and are beginning to answer several scientific questions regarding the water budget within the 300 m reach being modeled. Beyond the general goal of doing a water budget including streamflow, seepage, groundwater flow and evapotranspiration, we are analyzing the effect of the heterogeneous sediment on the water budget. Specifically, we are analyzing how heterogeneous sediment controls the seepage and retention of water within the riparian rhizosphere. We are also analyzing how heterogeneous sediment controls root-water uptake. It is well known that the ability of plants to absorb water in their roots is controlled by the sediment hydraulic conductivity and water pressure. Consequently, the degree of heterogeneity and the distribution of fine and course sediment may exhibit control over the plants ability to uptake water. We are using the model to estimate the amount of water the plants can absorb at the Cosumnes for comparison to measured evapotranspiration rates. We are also varying the distribution and hydraulic conductivity of the different sediment types to evaluate the effect of heterogeneity on evapotranspiration.

With regards to the field activities, a very large flood inundated two more of our data loggers. As the roads dry up we will go out and try to salvage both the data and equipment that might have water damage. Sub-task 2a is about 85% finished.

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

This quarter we continued logging and processing micrometeorological data from our two field sites. This ongoing work includes visiting both preserve locations weekly; plotting all measured variables; calculating evapotranspiration from the data; devising new ways to prevent the vultures from roosting on the downstream tower; and removing and reinstalling equipment on the ground due to large flood events. This quarter we also raised the equipment below the tower to keep it above flood levels.

We estimated aboveground biomass and began analyzing the storage of energy (from one half hour to the next) within the downstream forest in preparation to contribute to a in-preparation manuscript on forest energy budgets.

Data analysis was performed in order to provide the hydrology group with screened and gap filled transpiration results from the eddy-covariance site (downstream). Our results were analyzed by looking at all covariance values with low correlation coefficients and removing spiking values of sensible heat and latent energy and also nighttime values of sensible heat an latent energy which were physically unreasonable.

Below are some of our results. This is a plot of hourly transpiration values from 2004 at the downstream site. Such results are now available continuously from March 2004 to the present:

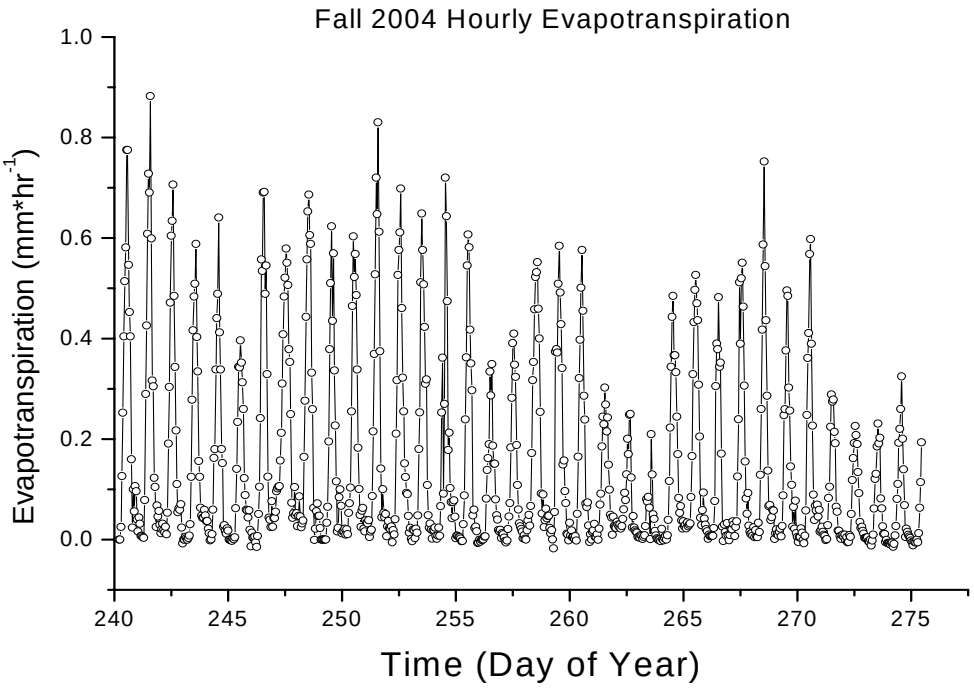


Figure 1.

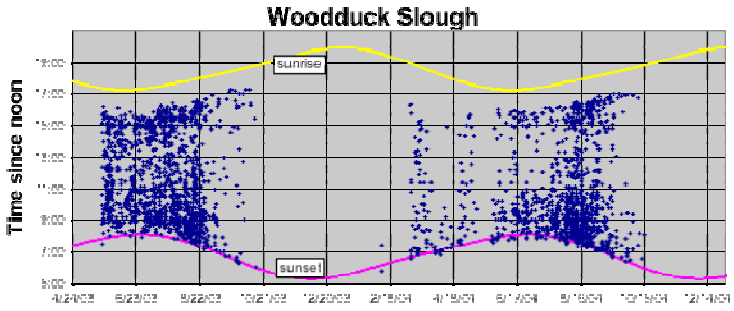
Budgetary and Logistic Situation

Substantial progress has been made in the past quarter; we estimate that the project's accomplishments are approximately 70% towards achieving the project's final objectives. We have purchased some equipment to help with analyzing data taken during 'advective' situations, typical of riparian regions. We plan to gather data for this summer 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 may be incurred for additional personnel being recruited to assist with both the field experiments and data analysis.

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

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

Field activities on the floodplain this quarter continued both insect emergence sampling and acoustic monitoring of bat foraging activity, as before. Student turnover required training in processing and taxonomic identification of emergence collections for different lab assistants, as well as familiarization with field collection methods. Both delays in component availability and, subsequently, high water delayed replacing the bat monitors at some stations, but a continuous record was maintained at several sites. Bat foraging activity early in the quarter was low. Analysis of acoustic data continued, indicating that individuals of seasonally migrating foliage roosting species were present earlier in the year than is generally thought (*i.e.*, well before leaf-out by deciduous trees and vines)(Figs 2a & 2b).



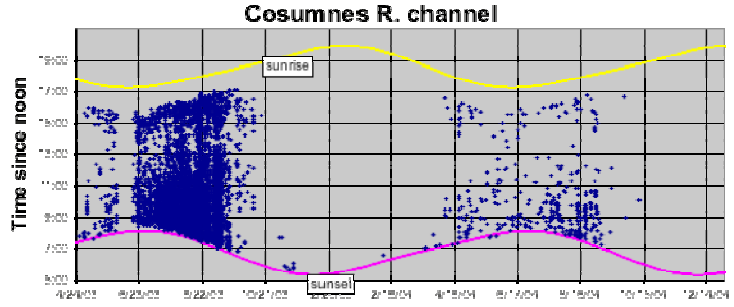


Figure 2a & 2b. Seasonal distribution of Western red bat (*Lasiurus blossevilli)* acoustic activity at two channel sites with permanent water. Each point is a 5 minute interval with activity. The seasonal duration of activity at the forested Slough site is less variable year to year.

Subtask 3b: (Grosholz, UC Davis)

We spent considerable time in the field this quarter. Our work focused on sampling the dynamics of plankton and benthic invertebrate populations as a function of specific points on the flood cycle. We collected samples for stable isotope and fatty acid analyses as well as our continual monitoring of changes in species identity and biomass. Sampling was conducted in concert with water quality monitoring and more recently fish abundance monitoring along an established network of sites that vary in residence time and vegetation structure. We also conducted field assays to investigate phytoplankton primary productivity, DOC production, and bacterial respiration in order to continue our assessment of aquatic ecosystem metabolism rates. We assessed the utility of several methods to achieve these measurements. A method involving the stable carbon 13 isotope yielded much more satisfactory results than the more standard method based on changes in dissolved oxygen. We also continued collection of field samples, including samples for chlorophyll, suspended sediment, and fatty acid analyses. Due to ongoing flooding, our 2005 fieldwork will likely continue well into the next quarter. In summary, the list of deliverables for this task in approximately 80% completed with the remaining 20% to be completed by the contract end date.

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

No data were collected in the field during the first quarter. Julian Wood PRBO staff Julian Wood, Nadav Nur, Geoff Geupel, Reneé Cormier, attended Cosumnes Research Group and other meetings. Prepared 9 years of point count data for analysis for final product. Data used include surveys from lower floodplain from 1995 to 2004. Julian Wood and other PRBO staff hired two interns and one experienced staff biologist to

collect bird monitoring data. PRBO hired Kirsten Lindquist to supervise field data collection on the Preserve. Kirsten will attend future CRG meetings and take an active role in data management, analysis and report preparation. Intern and seasonal staff biologist training week began on March 28th at Cosumnes River Preserve. This represents the beginning of the 2005 field season. Flooding has delayed the onset of breeding for many ground and low-nesting birds. Nest monitoring plots are currently being navigated by boat and chest waders. There are areas within the nest plots that are inaccessible and will remain so until the water levels decrease. Point count surveys are scheduled to begin April 15th and will be commenced regardless of water levels.

Task 5 -- Data Management (J. Quinn)

We have concentrated on three primary activities. We standardized the ArcGIS geospatial template to be used when collecting, collating, and managing all spatial data for the Research Group. For example, Task 1 benefited from this template in that their field data was easily incorporated into a single repository with little additional manipulation, allowing ready access to standard spatial analysis tools. We assisted other Tasks (e.g., Task 7) with interpreting and incorporating field data within a GIS; interpolating these data; and relating them to other spatial influences, such as distance from experimental breach. Lastly, we are focusing on creating a digital image catalog of high resolution aerial photographs. These aerial photographs are being segmented in eCognition, an object-oriented classification software package, to create delineated vegetation patches that can be used for further analysis. This task is approximately 85% complete.

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

With flooding taking place throughout much of the quarter, sensors have been maintained and data was downloaded from the water stage sensors and the temperature sensors. Flood discharge measurements were taken at all the breaches in the upper triangle in a continuing effort to calculate water flux through the restored floodplain. With high floodwaters, support was provided to researchers to help with access to and removal of equipment in danger of being flooded. Support was also provided in helping maintain the fish sampling on the floodplain.

Task 7 – Continued Floodplain Monitoring (J. Mount)

Intensive monitoring of water quality in the upper triangle has continued through the stormy months of Winter 2005. Autosamplers located at three of the four breaches have collected over 400 samples in the past three months. The resultant data will aid in creating 1) a high resolution temporal picture of water chemistry moving on and off the floodplain and 2) an accurate estimate of DOC, Chl-a, nutrient, and sediment yield from the floodplain. Approximately twice a week during the Winter in-situ florescence data were collected at over 200 points across the floodplain. The result is a high resolution map of suspended algal biomass distribution across the upper triangle. Preliminary results indicated that the algal biomass distribution is dependent on many factors including, flow, depth, temperature, and hydrogeomorphology. These factors change throughout a given storm and through the season as temperatures warm.

From these data we can now see that the floodplain does not only deliver algal biomass back into the channel during storms but also redistributes algal biomass to different areas within the floodplain itself. We believe that this may have important ramifications on productivity within different areas of the floodplain and area now compiling data sets with those studying invertebrates and fish. In the coming quarter we plan to finish the

algal biomass mapping and complete the calculations necessary to produce the chemical yield results.

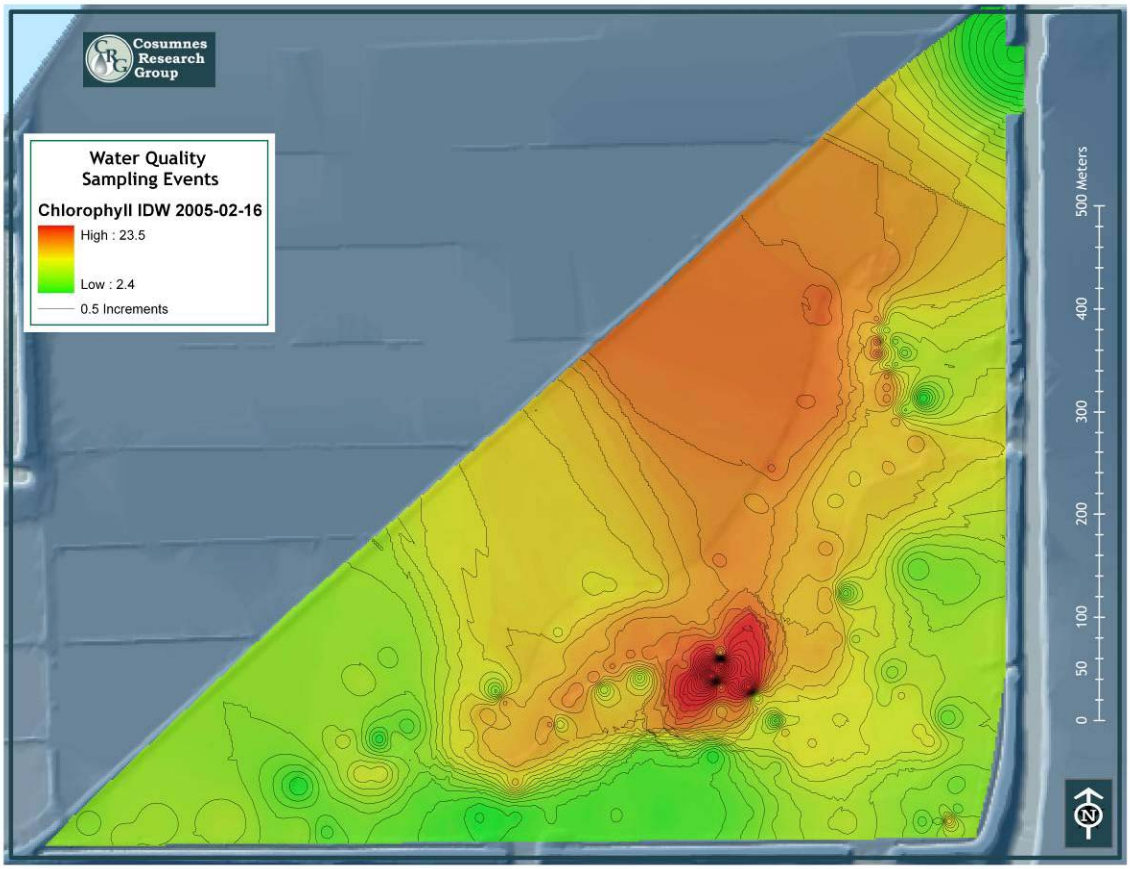


Figure 3. Distribution of Chl-a across the upper triangle overlain over a DEM. Note the highest Chl-a values are in the ponds. This is during a stagnant period 2 weeks after the floodplain disconnected from the river.

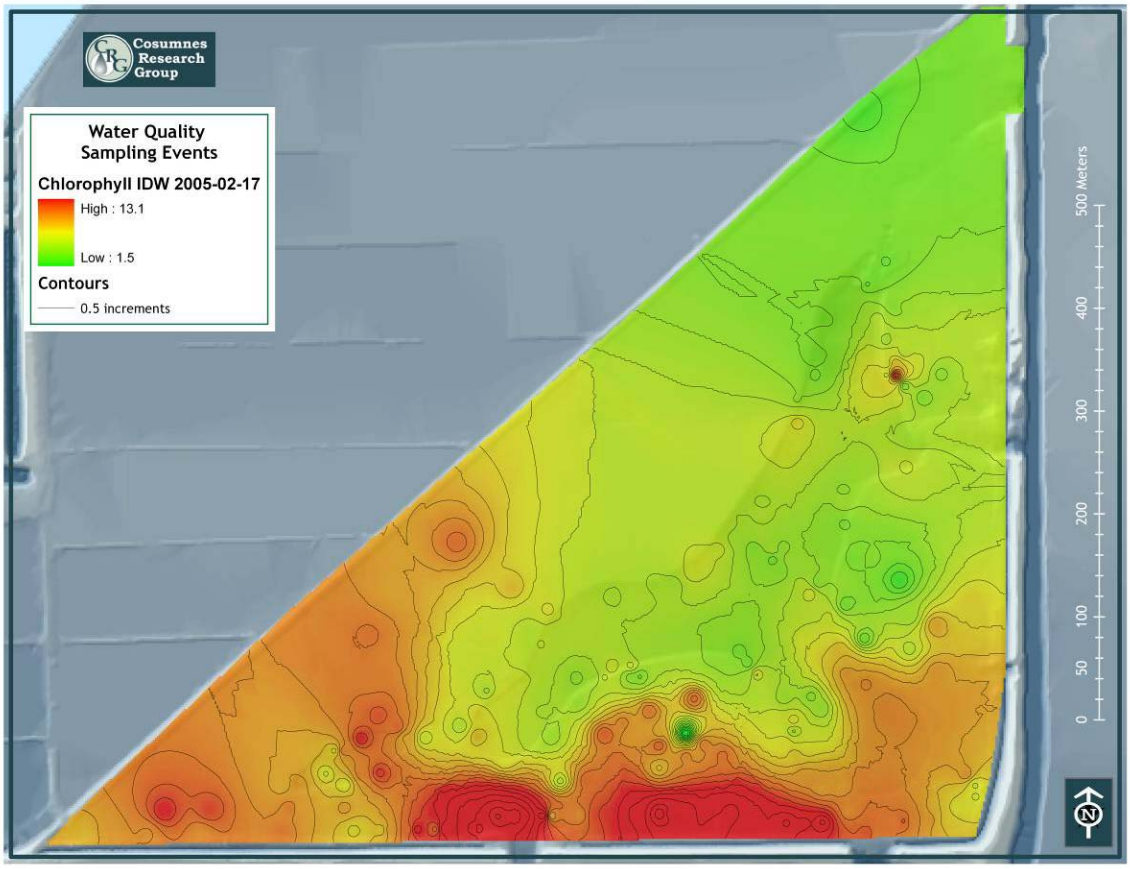


Figure 4. Distribution of Chl-a during the rising limb of a storm. The data was collected one day after the Figure 3 data. Note the transfer of algal biomass from the deep to shallow areas of the floodplain.