



CALFED Progress Report
California Sea Grant College Program

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TypeQuestionnaire_2B Interim Questionnaire

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Project Information

ProjectNo_2C R/SF-25 StartDate_3a 3/1/08 EndDate_3b 12/19/08
ProjectTitle_4 Modeling Physical Drivers and Age Structure of Cottonwood Forest Habitat: An Integrated Systems Approach....

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Additional Research Mentors and Community Mentors

Additional Research Mentors_8

Form with 5 horizontal lines for entering research mentor information.

Additional Community Mentors_9

Form with 5 horizontal lines for entering community mentor information.

Project Objectives: Please type your responses, and answer the questions in a style appropriate for laymen.

ProjectObjectives_10

The ultimate goal of this project is to improve the long-term prospects for restoring and protecting one of the signature species of the Central Valley's riparian ecosystem—the Fremont cottonwood. Toward this end, we will use an integrated systems approach, combining a model of the physical processes driving river channel migration and cottonwood habitat creation with a model of cottonwood population dynamics. Our models will focus on a 100-mile stretch of the Sacramento River from Red Bluff to Colusa. The Nature Conservancy, resource agencies and other stakeholders view this area as a prime site for conservation and restoration because the river still migrates naturally and is not confined by levees. Our models will be used to generate predictions of how cottonwood forests will fare in the future under various physical states, including different climate scenarios, flow regimes and floodplain sedimentation rates. The results will be useful in identifying highvalue habitat and planning corridor-wide conservation efforts.

Summary of progress in meeting each of these goals and objectives

ProgressSummary_11

In the first year of the study (2008) we developed a demographic model of Fremont cottonwood recruitment and survival and integrated this model with a physical-based model of river channel migration that simulates suitable cottonwood habitat patch creation. The model development process included: 1) synthesizing existing empirical data on Fremont cottonwood growth, survival, and reproduction for populations on the Sacramento River; 2) developing a mechanism-based model framework to quantify the relationships among the parameters that drive cottonwood population dynamics (e.g. stage-discharge relationships, sediment accretion rates, root growth rate, etc.); 3) adapting an existing channel meander migration model to predict the location and size of newly created suitable habitat patches resulting from high flow events based on the actual regulated flow record from the Sacramento River; 4) coding the population model in MATLAB to integrate the physical and demographic models to predict patch occupancy, age structure, germination frequency and first-year survival frequency on a 175-year time scale.

Preliminary results of this study were reported in five presentations made at three conferences, including the biennial CALFED Science Conference in

PROJECT MODIFICATIONS: Please explain any substantial modifications in research plans, including new directions pursued. Describe major problems encountered, especially problems with experimental protocols and how they were resolved. Describe any ancillary research topics developed.

Modifications_12

This CALFED fellowship was initially awarded to Alex Fremier in collaboration with John Stella in March 2008. Dr. Fremier accepted a faculty position at the University of Idaho in September 2008 and the post-doctoral position at SUNY-ESF was then filled by Dr. Elizabeth Harper. This transition did not lead to substantial modifications in research plans. Research plans were modified, however, in response to the California state budget crisis, which resulted in the cessation of payment for work done after December 19, 2008. This resulted in an altered project timeframe as follows:
Year 1: 3/1/08-12/08 = 10 months
(Stop work 1/09-6/09)
Year 2: 7/09-3/10 = 10 months.
Dr. Harper was no longer paid by CALFED for the months of Jan-June 2008 and as a result, took a part-time instructor position at Paul Smith College (NY) to help cover costs. Nevertheless the project team continued work on the numerical modeling, sensitivity analysis, and manuscript preparation during the grant hiatus.

BENEFITS AND APPLICATIONS: Suggest the relevance of these new findings to management. Describe any accomplishment, that is significant effects your project has had on resource management or user group behavior. CALFED is looking for "management cue" (see <http://science.calwater.ca.gov/pdf/soemgmtcues.pdf>).

BenefitsApplic_13

Our development of a mechanism-based model of Fremont cottonwood population dynamics is informative to CALFED's efforts to restore the Bay-Delta ecosystem. Fremont cottonwood provide food, nesting habitat and cover for many species, including the golden eagle, Swainson's hawk and ladder-backed woodpeckers among others. In the Bay-Delta ecosystem Fremont cottonwood populations have declined due to floodplain conversion and widespread flow regulation, which influence the physical and biotic drivers of demography. Our model synthesizes the current understanding of the relationships between these biotic and abiotic drivers, including the effects of the timing and magnitude of river flows on cottonwood recruitment and survival. This model builds on earlier conceptual models and provides a tool for identifying and quantifying important thresholds. Future work will include a sensitivity analysis, incorporation of new data into the model and model validation. After these steps have been taken, the model can be used to assess the effects of climate change and alternative resource management.

strategies on Fremont cottonwood populations in the Bay-Delta ecosystem.

PUBLICATIONS: List any publications, presentations, or posters that have resulted from this funded research. Give as many details as possible, including status of paper (e.g., in review; in press), journal name, conference location and date of presentation. Please note (as outlined in the conditions of the award) that each fellow is required to submit an abstract for an oral or poster presentation at each State of the Estuary conference and CALFED Science Conference during the duration of the fellowship.

Publications_14

PSutbellilcaa, tlio.Cn,s J_1J4. Battles, J.R. McBride, B.K. Orr. 2008. Riparian seedling mortality in semi-arid ecosystems and applications to river restoration. Oral presentation at the 5th Biennial CALFED Science Conference (Global Perspectives and Regional Results: Science and Management in the Bay-Delta System), 22-24 October, 2008, Sacramento, California.

M.K. Hayden, J.C. Stella, J.J. Battles, S. Dufour, and H. Piégay. 2008. Riparian forest patterns in abandoned channels on the middle Sacramento River: an alternative recruitment pathway for pioneer riparian vegetation in gravel-bed meandering rivers. Oral presentation at the 5th Biennial CALFED Science Conference (Global Perspectives and Regional Results: Science and Management in the Bay-Delta System), 22-24 October, 2008, Sacramento, California.

Fremier, A.K., J. H. Viers, J.C. Stella. 2008. Floodplain Heterogeneity Drives Riparian Vegetation Composition and Structure Through Channel Meander Migration and Channel Abandonment. EOS Transactions of the American Geophysical Union, Fall 2008 Meeting Supplement, Abstract H33B-1007, (Fall 2008 AGU meeting, San Francisco, CA, December 15-19).

Stella, J.C., M.K. Hayden, J.J. Battles, H. Piégay, S. Dufour, and A.K. Fremier. 2008. A Conceptual Model of Riparian Forest Response to Channel Abandonment on Meandering Rivers. EOS Transactions of the American Geophysical Union, Fall 2008 Meeting Supplement, Abstract H31H-07 (Fall 2008 AGU meeting, San Francisco, CA, December 15-19).

Dufour S., H. Piégay, M.K. Hayden, J.C. Stella, and J.J. Battles. 2008. Impacts de la dynamique sédimentaire sur la végétation terrestre en plaine alluviale, variabilité spatiale et interactions d'échelles (Impacts of sediment dynamics on terrestrial vegetation of alluvial plains, spatial variability and scaling). Séminaire "Interactions végétation et contraintes physiques" (Vegetation Interactions and Physical Constraints Workshop), 28-29 January 2008, Grenoble, France.

