



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-14 StartDate_3a January 1, 2006 EndDate_3b June 2011
 ProjectTitle_4 Restoring non-equilibrium riparian communities in disturbance-altered ecosystems: implications for river management and climate change

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Additional Research Mentors and Community Mentors

Additional Research Mentors_8

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Additional Community Mentors_9

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

ProjectObjectives_10

In the Central Valley of California, Fremont cottonwood (*Populus fremontii*) dominates the near-channel ecosystems. These forests provide a myriad of ecosystem services that benefit aquatic and terrestrial natural resources and human society; however, throughout the western U.S. and across Europe, water regulation, channel confinement, and land conversion have significantly altered the amount and distribution of cottonwood-dominated riparian vegetation, as well as the physical processes that drive forest regeneration rates and age structure. The ecological and hydrological functions of Valley riparian zones are directly tied to the population dynamics of this species. The goal of this research is to assess the health and dynamics of remnant riparian forest stands dominated by Fremont cottonwood throughout the Central Valley. The fundamental scientific and management challenge is to understand how to restore this disturbance-dependent community in a severely disturbance-altered ecosystem. The specific objectives are to (1) assess the current pattern of stand structure and spatial distribution of cottonwoods at the site- and landscape-scale relative to hydrogeomorphic and biological variables, and (2) to assess the health of remnant stands and understand the drivers of stand regeneration under various recruitment pathways, and (3) to integrate this information with management/restoration and climate change considerations.

Summary of progress in meeting each of these goals and objectives

ProgressSummary_11

In 2010, research was focused on objective (2), and included completing a manuscript of our conceptual model of pioneer riparian forest dynamics in abandoned channels, and implementing the first year of an experiment to more explicitly test the various parameters of our model. The cottonwood (*Populus*) and willow (*Salix*) trees that line river corridors in semi-arid regions provide essential ecosystem services. Yet these pioneer species have experienced significant declines in North America due to land conversion and the effects of dams. If aging forests are not replaced, the long-term persistence of these species is threatened. The most well understood regeneration pathway, which occurs on point bars in river bends, has been severely limited by river regulation. Successful management and conservation of these forests thus depends on understanding the variety of methods and locations where these species persist. Abandoned channels, often referred to as oxbow lakes, are a common feature in many meandering rivers. While their importance as refugia for mobile organisms like fish has long been recognized, we suggest that they also provide an alternate avenue for persistence of pioneer trees. We set out to test our conceptual model that links sedimentation and vegetation dynamics within abandoned channels. This model, based on observational field studies, suggests that conditions change through time from a period where physical factors dominate forest dynamics, to conditions driven more by biotic interactions, particularly competition for light and water. We tested our model with a controlled community competition study along a realistic environmental gradient. The key factors potentially constraining establishment of tree seedlings in these refugia include water availability and competition for resources (primarily light and water). We designed and built a mesocosm facility that accommodates 100 plant communities grown in 25cm diameter X 125cm deep "rhizopods" (growth tubes connected to a central water control reservoir) under a variety of environmental resource gradients (e.g., soil, water, light). The facility has instrumentation to monitor soil moisture, air temperature and humidity, and to monitor and control water table depth. In our first year of experiments, we focused on the influence of substrate texture on water availability, and on a gradient of interspecific competition, and examined the effect of these treatments on Fremont cottonwood seedling growth and survival. We also continued collaboration with our colleagues at SUNY ESF in constructing a population dynamics model for cottonwood (addressing Objective 3), and contributed to the manuscript lead by our French colleagues examining understory species diversity patterns in abandoned channel floodplains (related to Objective 1).

COOPERATING ORGANIZATIONS: List those agencies and/or persons who provided financial, technical or other assistance to your project since inception. Describe the nature of their collaboration.

CoopOrganiz_15

Department of Environmental Science, Policy and Management, UC Berkeley – Laboratory space, library and administrative resources. UC Center for Forestry – field experiment research space. Dept. of Earth and Planetary Science, UC Berkeley and Richmond Field Station – workshop facilities and equipment. Rohit Salve, Lawrence Berkeley National Labs – technical assistance with soil moisture probes. Nature Conservancy & Dept. of Water Resources – scientific expertise and local knowledge of the middle Sacramento River, existing data sharing, field and logistical support. CA Dept. of Fish & Game, US Fish & Wildlife Service – site access & research permits. (continued in Additions)

AWARDS: List any special awards or honors that you, or mentor or members of the research team, have received during the duration of this project.

Awards_16

Outstanding Graduate Student Instructor, UC Berkeley (Maya Hayden)
NSF Doctoral Dissertation Improvement Grant (Maya Hayden, John Battles)

KEYWORDS: List keywords that will be useful in indexing your project.

Keywords_17

Riparian vegetation, Fremont cottonwood, river floodplain, abandoned channel, oxbow, ecogeomorphology, dendroecology

PATENTS: List any patents associated with your project.

Patents_18

NA

Additions: Additional information can be added here. Please begin the text with the number of the question you are adding to.

Additions_19

Hervé Piégay, National Center for Scientific Research (CNRS), France; Simon Dufour, Université Rennes 2, France; Alex Fremier, University of Idaho; Matt Kondolf, UC Berkeley – collaborators working in abandoned channels of the middle Sacramento River.