

# **Chapter 4. Recommended Future Studies**

## **Biological Restoration Opportunities Analysis**

This study and the accompanying study of physical processes provide baseline data for planning riparian restoration along the 149-mile reach of the mainstem San Joaquin River from Friant Dam to the Merced River. The emphasis of the analysis of historical riparian habitat conditions presented in this report was on accumulating historical data and quantifying changes in the acreages of riparian habitat and adjacent land uses. Analysis of the nature of the changes in habitat and land uses revealed several important factors that have affected riparian habitat. Although it was beyond the scope of this study, a detailed analysis of the spatial distribution of the effects of these factors over time would provide a biological basis for specific habitat restoration opportunities.

Any analysis of specific restoration opportunities should make use of the historical GIS data and aerial photographs used in this study and the results of the physical processes study. Areas where particular riparian habitat types have increased or decreased could be identified and correlated to specific factors, such as land use conversions, decreased floodflows, and increased summer base flows. Individual habitat patches (polygons) of interest should be tracked over time using spatial analysis with ARC/INFO GIS software. Quantitative statistical relationships could be developed between the specific factors affecting riparian habitat and the riparian vegetation at certain locations. For example, the vegetation dynamics prior to land use conversion at locations that have been converted from riparian habitats to agricultural fields or pasture can be used to predict the effects of setting back levees in those areas to allow natural colonization and succession of riparian vegetation to occur. In addition, riparian development in areas with channel encroachment under various hydrologic conditions can be used to estimate vegetation succession rates and predict riparian encroachment rates, which may lead to recommendations concerning riparian management tools.

The result of an analysis of restoration opportunities should be a map of a quantitative index of restoration potential within the study area for a given set of restoration actions and recommended actions for different areas with high biological opportunity. The set of desirable restoration actions can be defined by the SJRRHRP prior to analysis to limit the analysis to feasible and practicable solutions. The analysis of restoration opportunities would provide a scientifically defensible reason for the siting of specific restoration projects.

## Restoration Constraints Analysis

Providing habitat for communities of plants and wildlife is only one of the functions of the San Joaquin River. For example, the river supplies irrigation water to agricultural and urban interests, conveys and attenuates flood flows, and provides gravel to mining interests. All interests should be considered in planning restoration activities, particularly those that compete with, or would benefit from, habitat restoration. It is recommended that an analysis of the constraints on spatial restoration be conducted to develop a map showing levels of constraints (i.e., no constraints or a low, medium, or high level of constraints) on riparian restoration in various areas along the river. Such a map should be used to help locate restoration projects in areas where restoration would be feasible.

Primary data that should be compiled in a GIS database include property ownership (e.g., private, state, or federal), any land use designations or zoning from general and specific plans, and proposed projects. Any ongoing vegetation management and channel maintenance practices should be considered. River reaches subject to particular hydrologic management rules and policies or flood control design flows should also be mapped. Coordination with local, state, and federal agencies would be required to obtain the most up-to-date planning data. These data should then be synthesized into a quantitative scale of riparian restoration constraints.

The riparian restoration constraints analysis would result in a map that, in combination with the biological restoration opportunities map, would provide a restoration feasibility map. This map would identify areas with high opportunity and low constraints where restoration projects would be most cost effective. It would also show areas with low constraints and low biological opportunity where restoration might be feasible but would afford limited benefits for the cost. Areas with high constraints would also be identified; restoration in these areas would either be infeasible or would require modification of current policies or planned development, which may be undesirable because of a high political cost.

## Analysis of an Additional Historical Data Source

Data from a valuable historical source, the 1914-1915 “California Debris Commission Maps” (U.S. Army Corps of Engineers 1917), were discovered in the course of this study. These maps show vegetation between Herndon and the confluence of the San Joaquin River with the Merced River at a scale of 1:4,800. An analysis of the data in these maps would provide a valuable addition to the data presented in this report.

The 1914-1915 maps are valuable because they are the earliest detailed vegetation maps available for the study area. The maps show the extent of riparian vegetation 23 years before the earliest aerial photos available for this study were taken.

The vegetation changed substantially during this 23-year period. In addition, the occurrence of vegetation patches can be correlated with the extensive elevational data shown on the maps, including soundings and detailed cross sections. The data from these maps could, therefore, provide important insights into the natural elevational distribution and hydrological relationships of riparian vegetation type to river stage in the study area.

The vegetation data from the 1914-1915 maps could be digitized and rectified to the 1920s topographic maps and then quantitatively compared to the 1937 riparian habitat and land use data. However, prior to this step, the vegetation data on the 1914-1915 maps should be compared to the 1937 photographs to assess the completeness of the maps. If the 1914-1915 data are found to be sufficiently reliable, the 1914-1915 condition could be compared with the 1937 condition to arrive at an understanding of the vegetation dynamics and spatial distribution prior to dam construction and much of the land reclamation close to the river. The 1914-1915 data would also provide a better understanding of “natural” riparian conditions than was possible with the soil data analyzed in this report.