

Research Issues in Riparian Landscape Planning¹

Kerry J. Dawson² and Gregory E. Sutter³

Abstract--A Riparian reserve has been established on the UC Davis campus. The 80-acre Putah Creek Reserve offers the opportunity to research issues related to the typically-leveed floodways that increasingly flow through California's agricultural landscape. Explored is the integration of issues related to research, education, conservation, recreation and flood control.

INTRODUCTION

A Riparian Landscape Research Laboratory has recently been established on the campus of the University of California at Davis. The laboratory is a campus reserve located in the leveed floodway of Putah Creek, a major stream of the California central valley flowing from Lake Berryessa in the coast range to the Sacramento River's Yolo by-pass. The Putah Creek Campus Reserve is over four miles long, contains over 80 acres of University property, and has a flood control capacity of 80,000 CFS. With over 90% of California's native riparian landscape lost, this reserve offers the opportunity to research many planning issues related to the pressures placed upon the limited, typically leveed, riparian floodways that continue to flow through the state's agricultural landscape. A planning and research master plan is in the process of being completed on Putah Creek which outlines the role of the reserve for education, research, habitat preservation, recreation, and flood control. Of particular interest for recreation in the master plan is the continued quality of the area as a campus greenbelt. The master plan also encourages and expands educational activity. The major emphasis of the master plan and this paper, however, is the research program which is being established to study the integration of conservation versus development objectives.

HISTORICAL SETTING

Putah Creek originates within the eastern slopes of the California Coast Range. It drains a 576 square mile watershed in this chaparral

covered, sedimentary rock, mountainous area before beginning it's 30 mile-long meander across the flat central valley of California. The historical and natural terminus of the creek was a series of wetlands and seepage pits located just west of the Sacramento River (Figure 1). The historical flow pattern of Putah Creek was a torrential flow in the wet winter months with little or no flow in the late summer. It is highly unlikely that water even reached the UC Davis Campus in the dry season.⁴

Like most biotic systems in California, adjacent land uses have had a large impact on the structure of Putah Creek. The City of Davis (first known as Davisville) developed in the middle of the central valley around the railroads along what is now the University Arboretum. The city was periodically flooded by high flows from the creek and in 1872, the city decided to alleviate the problem by relocating the portion of the creek which flowed through the city to a new channel farther south. The relocation of the channel altered the slope of the drainage and caused incision to take place upstream of the new channel. The result of these activities left the reserve channel with steep banks and extensive riparian vegetation at the west end. In the 1940's, to further protect the surrounding agricultural areas from flooding, the U.S. Army Corp of Engineers added levees to the lower sections of the creek. This resulted in a broad, flat banked, manmade channel with leveed boundaries on the east end of the reserve (Figure 2).

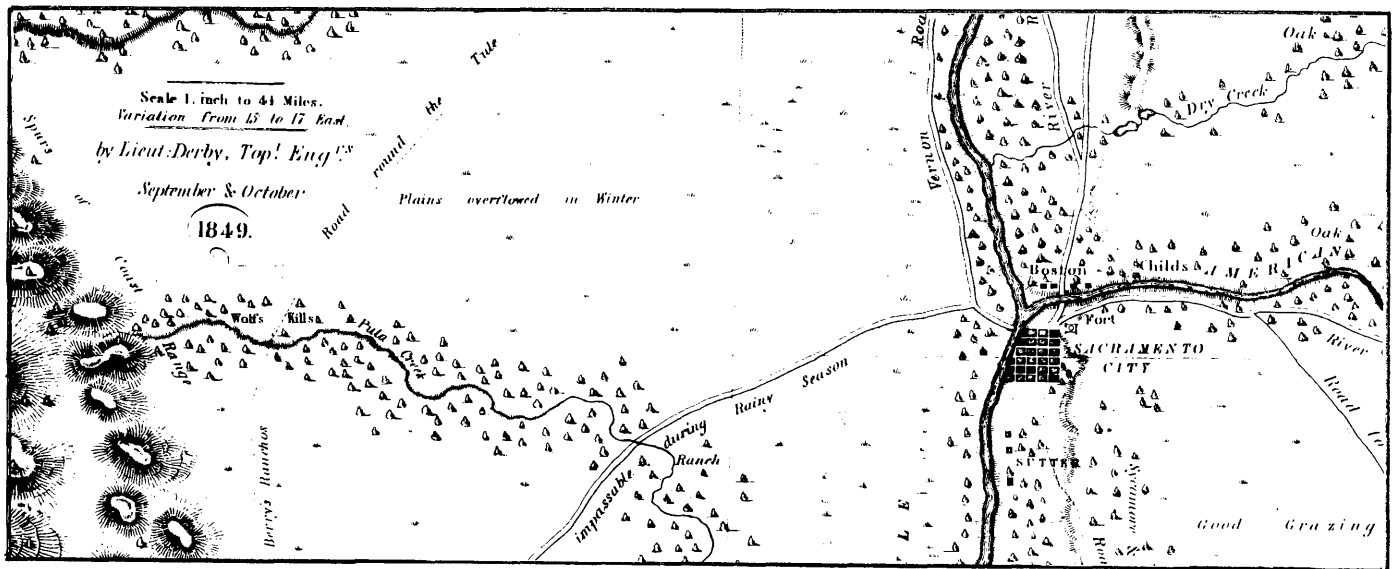
In the late 1950's the Bureau of Reclamation chose the steep coast range valley of Putah Creek for the site of its Solano Project reservoir. The completion of Monticello Dam in the early 1960's created Lake Berryessa. This project stored much of the winter runoff of Putah Creek for later release into irrigation canals. Downstream of the project near UC Davis, reserve peak flows have been

¹Paper presented at the first North American Conference "Riparian Ecosystems and Their Management; Reconciling Conflicting Uses," the University of Arizona, Tucson, Arizona, April 16-18, 1985.

²Associate Professor, Department of Environmental Design, University of California, Davis, California 95616.

³Graduate Student, Biological Ecology, University of California, Davis, California 95616.

⁴Garcia, Jose, 1923, "A Report on Putah Creek as a Source of Water Supply for the Irrigation Lands in the Sacramento Valley." M.S. Thesis, University of California, Berkeley, p. 11.



reduced from a maximum of 80,000 CFS to 40,000. In addition, year round flows now occur with summer flows legally maintained at a minimum of 5 CFS.

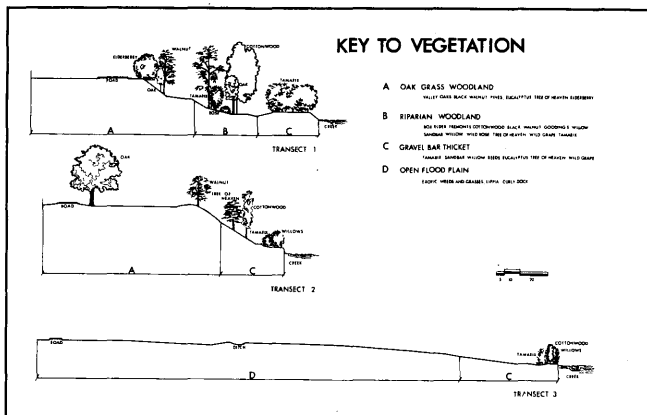
PRESNT CONDITIONS

Although the University of California owns the preserve, it is within a floodway managed by the State Department of Water Resources. It is this agency's responsibility to maintain the floodway capacity of the creek at adequate levels. Traditionally it is the practice of the flood control agencies to inspect the stream channels and remove debris and vegetative growth which they feel will restrict capacity of the floodway. With this objective in mind in 1949 the entire channel was cleared of vegetation from winters to the creeks terminus at the Yolo bypass. Additional clearing

activities have taken place since then along smaller sections of the creek on a five to seven year rotation.

Because the construction of Monticello Dam has substantially decreased the expected flood flows in the floodway, it has been agreed that certain vegetative growth will be allowed in the stream to compensate for this flood flow reduction. When vegetation removal is necessary in the preserve area, the State Department of Water Resources has agreed to work with the reserve management committee on the timing, type, and location of vegetation removed.

Despite the fact that the Putah Creek has been severely altered from it's pristine condition, it still represents an environmental corridor of significant importance to riparian dependents. Through the history of the central valley wildlife has been greatly reduced as agricultural development became more intensive. Remaining riparian systems like Putah Creek retain much of the riparian vegetation present in the valley and represent critical shelter and habitat for riparian dependents. Because only a small percentage of California's original riparian forest remains, remnant systems (even those degraded by man), are important to retain and reestablish. Three critical avian species which still find habitat in the Putah Creek Reserve include the Yellow Billed Cuckoo, Coccyzus americanus, the Inyo Brown Towhee, Pipilo fuscus, and the Swainson's Hawk, Buteo swainson.



PLANNING ISSUES

In 1984 the senior landscape architecture students of the University of California at Davis did an analysis of the new Putah Creek Reserve as part of their fall studio. The students began initial resource inventories, identified key

issues and prepared draft management plans for the reserve. The Putah Creek management committee is utilizing the student work as a basis for further analysis in their efforts to prepare a final management plan for the reserve. The committee has identified several key issues which must be addressed by the campus reserve master plan in order for the Putah Creek reserve to ultimately meet the goals affixed to it as a university reserve. These issues all revolve around the multiple use concept and the land use conflicts inherently involved with that concept. The issues can be grouped into five main categories: education, recreation, riparian habitat preservation, flood control, and research.

Currently, the reserve is underutilized educationally. The community occasionally utilizes the creek for dog training sessions, native basket weaving classes, and a day camp in the summer but the creek is seldom used for university instruction. A goal for the reserve is to create additional structured and unstructured educational opportunities through facility development and signage.

The reserve has been utilized for a widely diverse range of recreational activities. These activities include walking, jogging, picnicing, horse riding, swimming, boating, fishing, use of firearms, and off-road vehicle use (Figure 3). Although educational, recreational and other uses of the reserve can conflict, the management committee has generally been successful in addressing these issues by either eliminating undesirable uses or by locating uses so that conflicts are minimized.

The main hurdle which the preserve management committee is now facing is how to integrate the flood control objectives of the reserve with the riparian habitat preservation, educational and other goals of the reserve in one viable plan. The management committee reviewed the objectives



Figure 4--Despite the noise of busy interstate 80 the cottonwood trees west of the highway are used as a nesting sight by several pairs of the endangered Swainsons Hawk.

set up for these major functions. The following are examples of identified research questions which must be addressed and solutions found in order for the Putah Creek reserve to fully realize it's potential:

- What are the specific impacts of vegetation on the floodway capacity in the Putah Creek Reserve? i.e. exactly how much vegetation should be removed and at what locations?
- Do large tree specimens really pose a threat to levee and bridge facilities or do they overcome this negative aspect with positive aspects such as bank and soil stabilization.
- Is it possible to selectively remove vegetation and reduce the roughness coefficient to

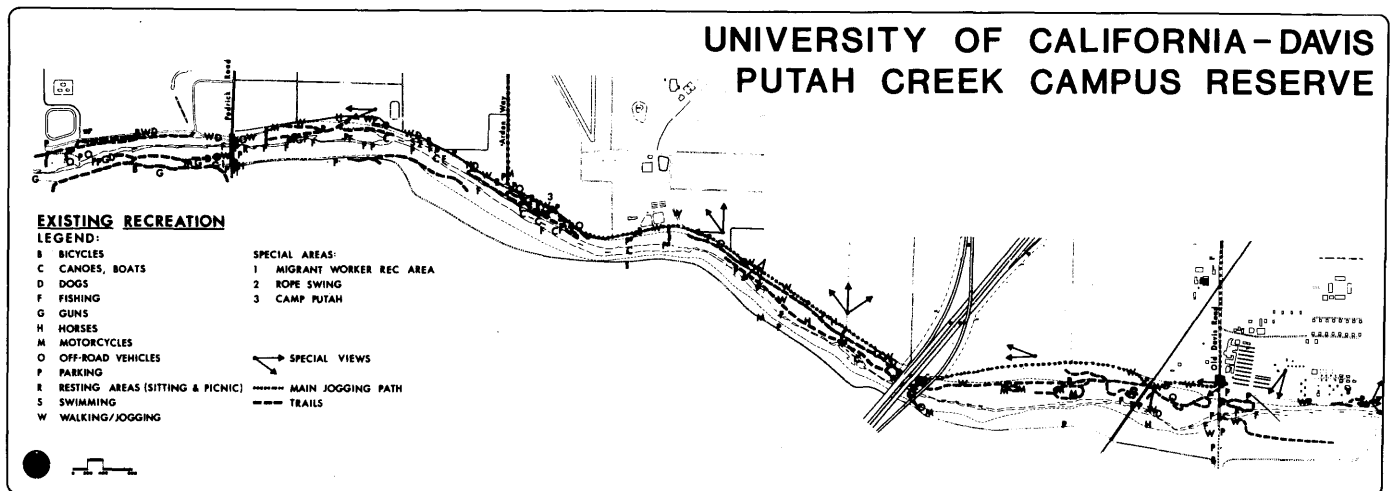


Figure 3--The Putah Creek Reserve is utilized for a wide variety of recreational uses. Because of the multiple use nature of the reserve, some of these uses will be accommodated in the master plan. Others may have to be eliminated due to conflicts with uses of higher priority.

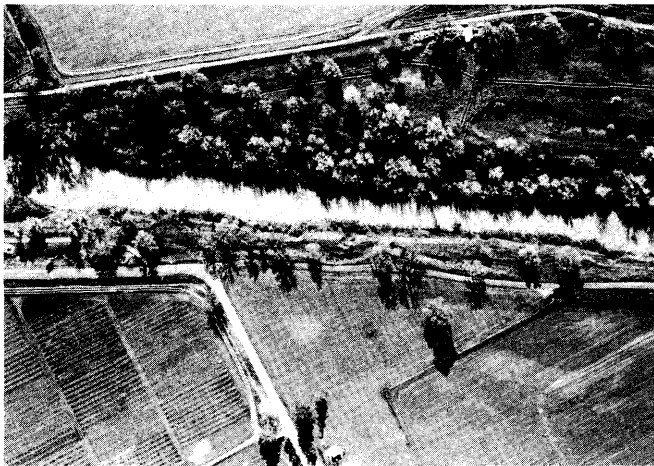


Figure 5--Agricultural land uses border Putah Creek on both the north and south. Yet within the levee roads significant riparian vegetation exists.

an adequate level while at the same time increasing diversity and habitat.

- What techniques exist for exotic plant species control and native species reestablishment?

- Where in the creek do fish spawn and what are the impacts of university gravel removal on these spawning sites.

ISSUES SURVEY

After defining the research subject areas which are specifically critical to the successful management of Putah Creek as a Riparian reserve within a floodway, it was decided that the opinions of other professional managers and scientists who are dealing with the same issue would be useful. Through a survey the research needs for the management of floodway riparian systems in the west could more clearly be identified and thus a priority of research in the Putah Creek reserve could be established which would more directly address the needs of managers throughout the state of California and western U.S.

The survey was sent to the participants and attendants at the 1977 and 1981 California Riparian Systems Conferences⁵ and the participants at the 1977 Symposium on the "Importance Preservation and Management of Riparian Habitat" held in Tucson Arizona.⁶

453 surveys were sent out and approximately 125 were returned. Each participant in the survey was asked to rank the following list of research issues according to their perception of the need for research in that area.

- A Effects of artificial hydrologic variation on the ecology of riparian systems.
- B Effects of channel structure and floodway design on the ecology of riparian systems.

- C Channel and levee management and maintenance issues.
- D Relationships of channel vegetation to flood flows.
- E Life histories of native terrestrial riparian flora and fauna.
- F Life histories of native aquatic riparian flora and fauna.
- G Life histories of native riparian invertebrates.
- H Relationship of water quality to cultural and ecological goals.
- I Studies in the biogeography of riparian areas and corridors.
- J Comparisons of natural riparian systems and "altered" riparian systems.
- K Impact of exotic flora and fauna on native riparian systems.
- L Techniques for exotic species control and management.
- M Techniques for native species reestablishment and management.
- N Habitat modeling for riparian landscape restoration.
- O Riparian/upland wildlife interaction.
- P Impacts of historic land use related to current riparian system structure.
- Q Impacts of timber and mining expansion on riparian systems.
- R Impacts of agricultural expansion on riparian systems.
- S Impacts of urban expansion on riparian systems.
- T Impacts of infrastructural expansion (utility easements, storm water outfalls, roadways, etc.) and riparian systems.
- U Recreation, open space, aesthetic values of riparian systems.
- V Archaeological, historical, and ethno-botanical values of riparian areas.
- W Legal aspects of riparian systems.
- X Economic values of riparian systems.

Figure 7 illustrates the results of the issues survey. Generally speaking the average response of the survey participants did not vary greatly among the different research issues. As one respondent comments "All of these are important issues. What we need the most is more research funds." The two issues of greatest concern to the participants were the effects of artificial hydrologic variation and the effects of channel structure and floodway design on the ecology of riparian systems. Techniques for exotic species control and native species reestablishment also ranked as high priority research issues.

CONCLUSIONS

With over 90% of the original riparian systems of California completely eliminated the remaining "altered" systems represent environmental corridors of significant value to conservation. Many of

⁵Sands, Anne; editor, 1977, "Riparian Forests in California Their Ecology and Conservation," proceedings of a symposium sponsored by the Institute of Ecology and the Davis Audubon Society, held May 14 at UC Davis.

⁶Warner, Richard E. and Kathleen M. Hendrix, editors 1984, "California Riparian Systems, Ecology, Conservation and Productive Management," Proceeding of the California Riparian Systems Conference held September 17-19, 1981 at UC Davis.

Johnson, R. Roy and Dale A. Jones, editors 1977, "Importance, Preservation and Management of Riparian Habitat," proceedings of a symposium, held July 9, 1977 at Tucson, Arizona.



Figure 6--800 C.Y. Of gravel are currently removed each year from the creek bed. Yet it is not known if this has a negative or positive impact on the fish spawning activities.

these altered systems have the potential to expand in value if an effort is made to actively restore them.

The key to the success of improving the habitat value of these systems is researching floodway management alternatives which use an integrated approach. These alternatives must

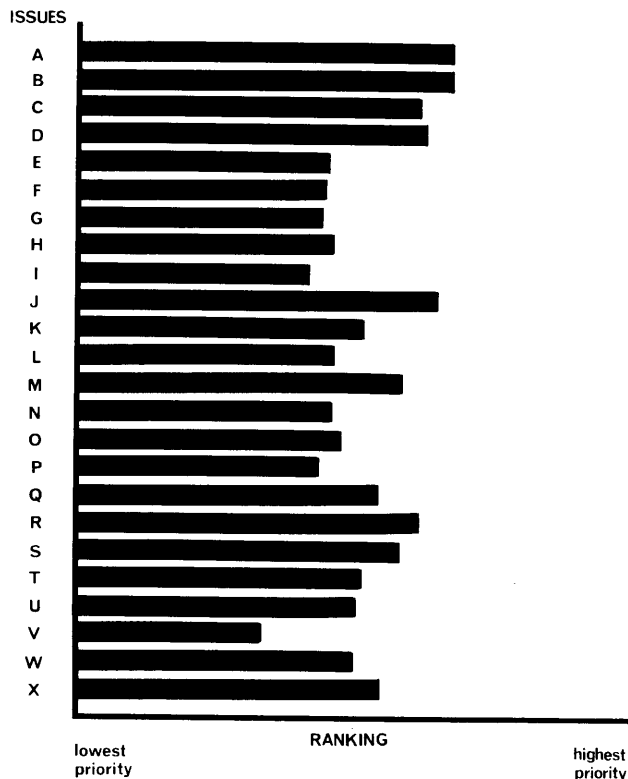


Figure 7--The bar chart illustrates the mean ranking of the research issues by the survey respondents. Overall there is very little variation in the responses to the different issues.

include cultural objectives such as flood protection but also can include objectives for conservation if intelligent planning occurs. This is the major goal that the Putah Creek Management Committee has for the University Reserve.

REFERENCES

- Carter, Lee W. and Gene L. Anderson. 1984. Riparian Vegetation on Flood Control Project Levees: Constraints and Opportunities. In Proceedings of the California Riparian Systems Conference, Richard E. Warner and Kathleen M. Hendrix editors, (University of California, Davis, September 17-19, 1981), pp. 548-550.
- Dawson, K. J. 1983. Recreational management for newly established natural areas. In Proceedings of the 48th North American Wildlife Conference, Kansas City. pp. 544-550.
- Dawson, Kerry J. 1984. Planting Design Inventory Techniques for Modeling the Restoration of Native Landscapes. In Proceeding of the California Riparian Systems Conference, Richard E. Warner and Kathleen M. Hendrix editors, (University of California, Davis, September 17-19, 1981), pp. 465-470.
- Hallberg, Donald L. and Gene R. Trapp. 1984. Gray Fox Temporal and Spacial Activity in a Riparian/Agricultural Zone in California's Central Valley. In Proceedings of the California Riparian Systems Conference, Richard E. Warner and Kathleen M. Hendrix editors, (University of California, Davis, September 17-19, 1981), pp. 920-928.
- Johnson, R. Roy and Dale A. Jones, editors. 1977. Proceedings of a Symposium: Importance, Preservation and Management of Riparian Habitat. (Tucson, Arizona, July 9, 1977), USDA Forest Service General Technical Report RM-43.
- Martin, Kenneth E. 1984. Recreation Planning as a tool to restore and Protect Riparian Systems. In Proceedings of the California Riparian Systems, Conference, Richard E. Warner and Kathleen M. Hendrix editors, (University of California, Davis, September 17-19, 1981), pp. 748-756.
- Sands, Anne, editor. 1977. Proceedings of a Symposium: Riparian Forests in California, Their Ecology and Conservation (University of California, Davis, May 14, 1977). Institute of Ecology, Publication #15.
- Schlorff, Ronald W. and Peter H. Bloom. 1984. Importance of Riparian Systems to Nesting Swainson's Hawks in the Central Valley of California. In Proceedings of the California Riparian Systems Conference. Richard E. Warner and Kathleen M. Hendrix, editors, (University of California, Davis, September 17-19, 1981), pp. 612-618.