RIPARIAN RESTORATION PLANNING IN SOUTHERN CALIFORNIA -- WHAT'S MISSING?

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ABSTRACT: Riparian habitat restoration/revegetation projects in southern California are typically designed to mitigate development impacts. Environmental documentation (EA/EIR/EIS) outlines the general nature of required mitigation and a revegetation plan is usually submitted during regulatory processing. Review of several approved projects reveals that inadequate information is available to allow accurate prediction of potential restoration success. Common shortcomings include a lack of clear, detailed, site specific restoration goals (which is also reflected in inappropriate monitoring programs) and inadequate consideration of the restoration site's physical environment, particularly site hydrology. Planting descriptions, while more adequate, rarely consider pre-disturbance flora, unique local riparian floral elements versus "generic" riparian elements, or duplication of natural species mosaics. Other topics requiring more detailed treatment include: historic site conditions; future water availability and quality (including recharge enhancement and use of treated wastewater) sources of plant material, including on-site salvage and genetic stock for localized species; adjacent habitat relationships and provision of effective buffers; maintenance of wildlife corridors; meaningful monitoring, and long-term habitat management plans. This information should be available for public and agency review prior to permit approvals. Improving the uncertain success of local riparian restoration projects to date, will require more stringent, better integrated, and more vigorously enforced local, state and federal regulatory guidelines.

INTRODUCTION

In the dry Mediterranean climate of southern California, dominated by grasslands and scrub, riparian vegetation often appears as a striking green belt along watercourses and around lakes. Fertile alluvial soils and abundant water supply enhance biological productivity and support a unique riparian flora and fauna (Sands 1980; Warner and Hendrix 1981; Holland 1986).

Riparian habitats are scarce in southern California. Air-photo interpretation indicates that in 1977, of the more than 2.7 million acres of San Diego County (California's southernmost county) only 13,000 acres were riparian woodland. Further, a preliminary comparison of San Diego County imagery between 1972-1974 and 1986 suggests that only one third of the riparian habitat present in the early 1970s survived into 1986 (Holland 1987, Jones and Stokes 1987). A similar pattern is noted in adjacent counties. Kaufman (1987), citing increased pressure for development along the foothills inland from the coast, believes riparian ecosystems are now, "...the scarcest and most threatened natural habitats represented in southern California."

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Since riparian habitats typically qualify as both biologically sensitive areas and wetlands (Cowardin *et al.* 1979), they receive protection under several federal[2] and State of California[3] statutes. Increasing habitat scarcity has also resulted in the listing of the least Bell's vireo (*Vireo bellii pusillus*), a riparian habitat-restricted migrant songbird, as both a federal and state endangered species (RECON 1988). Despite this protective legislation, regional development pressures continue to threaten riparian habitats (National Wildlife Federation 1987).

Although few studies have been done, it appears obvious that regional interest in riparian habitat restoration largely reflects mitigation requirements imposed by regulatory agencies during development project permit processing (see, for example, USFWS 1981). The fact that mitigation requirements "drive" restoration has some significant consequences. The present regulatory process ties habitat restoration closely to construction project implementation, despite their very different goals and time frames. Since mitigation proponents are not always altruistic horticulturalists, restoration outcome is often dependant on follow-through (or the lack of it) from public interest groups or regulatory agencies.

Negotiation of mitigation requirements is generally a two-phase process. First, state or federally mandated documentation (state Environmental Impact Report or federal Environmental Impact Statement) describing probable environmental impacts of the proposed project is prepared. Since all project impacts must be described, coverage is typically broad and sometimes rather superficial. Conceptual mitigation measures to offset project impacts may be described (e.g., wetlands or riparian Mitigation Concept Plan), but details required for implementation are not included. This documentation is usually adequate for the project to receive local city/county approval, with the provision that appropriate regulatory permits must be obtained prior to actual development. Project proponents often resist more detailed mitigation and habitat restoration studies until after local project approval and some regulatory processes cannot be initiated prior to receipt of local approval. (The 404 federal process must follow the EIS, but can proceed without EIS approval; the State 1600 stream alteration agreement process cannot be initiated until the EIR is certified.)

The second phase of establishing mitigation requirements occurs when the applicant negotiates with state and federal regulatory agencies (California Department of Fish and Game, U.S. Fish and Wildlife Service, and U.S. Army Corps of Engineers, for example) for appropriate project permits. While substantive discussion of the goals, data base, and methodology for proposed riparian habitat enhancement or restoration may occur during these negotiations, the only resulting public documents are likely to be a revegetation plan (principally the numbers and types of plants to be used and how to plant them) and any special provisions of the applicants' regulatory permits.

We have reviewed numerous local riparian restoration plans that received regulatory approval and where possible have reviewed the environmental documentation that preceded

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[2]National Environmental Policy Act (NEPA); Fish and Wildlife Coordination Act; Section 404 of the Clean Water Act (discharge of dredge or fill material); Section 10 of the River and Harbors Act (structures or work in navigable waters); see also Davis 1978.

[3]California Environmental Quality Act (CEQA); Wetlands Resources Policy; Section 1600 of the Fish and Game Code (streambed modification permits).

them. In most cases the information presented is superficial, inadequately referenced, and insufficient to objectively determine the probable future success or failure of the riparian enhancement or restoration proposed. There are no generally accepted or widely circulated guidelines for the contents of an adequate riparian habitat enhancement or restoration plan; therefore, the remainder of this paper outlines the types of information considered critical to preparation of an adequate riparian restoration plan for a location in southern California. Ideally, this information would be made available for public review prior to agency approval of the restoration plan and related project permits.

An adequate data base, specifically focused on riparian-related issues and describing conditions at the proposed development/restoration site, should first be developed (Table 1). This data base is used to assess specific impacts from proposed development to existing and proposed riparian sites. Significant data gaps must be identified and filled, as appropriate. Together, the project-site data base and impact analysis are used to develop a riparian restoration plan concept, which will subsequently be studied in much greater detail. The contents proposed for the detailed restoration plan are outlined in Table 2. The types of data to be examined and issues addressed under each of the headings set out in Tables 1 and 2 are briefly described in subsequent paragraphs.

Table 1. Riparian Restoration Planning in Southern California: Pre-restoration Data Base Contents.

PHASE I: PRE-RESTORATION DATA BASE
EXISTING CONDITIONS AT RESTORATION SITE
Topography and drainage patterns
Surface hydrology (flooding history)
Groundwater hydrology (watertable depth and seasonality)
Water quality issues
Soils issues (suitability, disturbance, salinity, toxins)
Vegetation
Existing species distribution patterns
Species data from least disturbed comparable local examples
Relationships to adjacent habitats
Wildlife resources (insects, vertebrates)
Human use patterns
IMPACT OF PROPOSED PROJECT
Changes to physical environment (topography and hydrology)
Vegetation losses (areas and vegetation types)
Impact on wildlife resources
SIGNIFICANT DATA GAPS
RESTORATION PLAN OVERVIEW - THE CONCEPT

PRE-RESTORATION DATABASE

The two principal goals of this effort are: (1) to provide as complete a description as possible of existing on-site riparian habitats, including species composition, vegetation structure, and underlying physical environmental variables; and (2) to document existing riparian functions and values to wildlife, so that significant development-related losses can be replaced within the proposed habitat restoration design.

Existing Conditions at Restoration Site

The single most important variable -- site hydrology -- is usually the least well documented. What are the sources of surface and subsurface water that enter or leave the site? What are the magnitude and frequency of flooding? How do watertable depths vary across the site and what seasonal fluctuations do they exhibit? Is present or future water quality (salinity, dissolved nutrients, toxins, etc.) a concern?

What are the characteristics of soils in existing or potential riparian areas? Have they been disturbed by past activities or are toxins present? Will proposed construction disrupt natural soil profiles and textural sequences or alter soil water-holding or drainage characteristics?

Extensive vegetation data must be collected: not only the range of riparian species present -- trees, shrubs, herbs, grasses, annuals/perennials, natives/introductions -- but also their densities and relative abundances. Vegetation stratification, species mosaics, age distributions and relationships with adjacent habitats should all be noted so that restoration activities can mimic these natural patterns. If on-site riparian areas are severely degraded, useful supplementary data can be collected from historical aerial photographs (many coastal southern California sites were photographed as far back as 1928) and from comparable nearby, but less disturbed, riparian habitats.

The need for wildlife data, describing occurrence and uses by insect populations, birds and other vertebrate groups, has already been noted. Wildlife uses by both year-round residents and seasonal visitors must be documented. The habitat's role (day or night) as a dispersal corridor, connecting adjacent riparian areas or other habitat types, must also be determined. Existing human use patterns within present or proposed areas of riparian habitat, an important factor in determining realistic wildlife values, must also be recorded.

Impact of Proposed Project

This portion of the data base documents potential effects of proposed development on existing riparian areas and on other portions of the study site set aside for riparian enhancement and restoration. What changes will occur to the physical environment -- drainage patterns, surface and subsurface hydrology, soils? How will the riparian vegetation be affected? What locations, acreages, and vegetation types will be lost and how will these losses affect riparian habitat-related or other local wildlife?

Significant Data Gaps

If significant data gaps are discovered during pre-restoration data collection, they must be clearly identified, and appropriate steps should be taken to obtain the missing data. The

absence of key data, such as site hydrology, could compromise meaningful restoration planning.

Restoration Plan Concept

The data sets described above should be collected as part of the environmental documentation process (EIR/EIS)[4]. When the riparian documentation is assembled and development-related riparian impacts determined, then a workable conceptual plan to mitigate riparian losses can be developed. This conceptual plan would be included in the EIR/EIS as presently required. During subsequent regulatory processing, however, the presently required "revegetation plan" would be replaced by a much more complete and more thoroughly documented "riparian habitat restoration plan". The contents proposed for such a plan (Table 2) are described in the following section.

RESTORATION PLAN CONTENTS

A complete riparian habitat restoration plan should include five separate information categories: (1) a clear statement of specific restoration goals; (2) an adequate analysis of physical variables of the site to confirm appropriate hydrological and soils conditions to support permanent riparian restoration; (3) a more detailed revegetation plan than is presently customary; (4) a monitoring program that tracks restoration success and also provides an enforceable mechanism to correct any problems or inadequacies[5]; and (5) a clear identification of long-term management responsibilities for the restored riparian habitat.

Specific Restoration Goals

A clear statement of specific restoration goals is extremely important for it not only focuses restoration design, but also provides the basis for future monitoring and objective determination of the project's ultimate success. Alternative restoration goals might include returning the site to documented historical or pre-disturbance conditions; increasing total riparian habitat acreage; restoring the "entire community," or increasing riparian species diversity and productivity; enhancing/creating habitat for a particular species, such as the endangered least Bell's vireo; or protecting local genetic stock.

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[4]Local agency planning staff indicate reluctance to request more detailed data from development sponsors unless it has been specifically requested by state or federal regulatory agencies. More comprehensive regulatory guidance on restoration plan data needs, particularly early in the process, could thus promote more adequate restoration planning.

[5]Effective January 1, 1989, the Cortese Bill (California Assembly Bill (AB) 3180 - Mitigation Finding and Monitoring Requirements) provides a mechanism to help assure that mitigation measures required to reduce significant adverse environmental impacts are implemented in a timely manner in accordance with the terms of project approval. These monitoring requirements, to be adopted by state and local agencies for projects subject to CEQA, are similar to those imposed by NEPA federal regulations (California EIR Monitor. 1989. 14:4, pp. 1-4).

Establishment of restoration goals is usually an iterative process, during which restoration site opportunities and constraints are balanced against regulatory agency requirements and the preferences of applicants, landowners and restoration specialists. The task would be more straightforward, and perhaps more farsighted, if a regional plan for riparian habitat protection and enhancement were adopted, much like the currently proposed, but species-specific, least Bell's vireo comprehensive species management plan (RECON 1988).

Restoration Site Physical Variables

Since most riparian areas are also wetland habitats (Cowardin *et al.* 1979), site hydrology is central to potential restoration success. Current, detailed topographic maps and grading plans of proposed riparian areas are essential to understanding local topographic features and site drainage patterns. An approximate water budget, including both surface and subsurface flows, should be prepared for the site to confirm availability, seasonality, location, and depth of water supplies. Evapotranspiration needs of proposed riparian vegetation (both during and following establishment) must be considered in the budget and potential impacts on downstream water needs identified. Additional considerations include the security of future water supplies (e.g., potential competing uses), the potential for increasing local stream and water table recharge, future use of reclaimed wastewater, and present and future water quality issues including pesticide and fertilizer use in adjacent areas (Rottier *et al.* 1988).

Soils issues include suitability of present soil types; maintenance of natural soil profiles; sediment textures, drainage and salinity characteristics; and the potential for flow-related soil erosion and sedimentation. The preservation, stockpiling, and reuse of existing riparian topsoils -- to use seedbank and soil-microorganism resources -- should be considered. Potential soil amendment programs employed during site planting should also be explained and justified.

Revegetation Plan

The revegetation plan is typically the most complete element of recently prepared riparian restoration programs. Even so, more detailed consideration of several topics would be useful (Burkhart 1988). Is the proposed species list merely "generic riparian," or does it take into account local species occurrence patterns and any unique features of the site's flora? How will natural species patchiness; vegetation stratification patterns, and uniformly aged stands of trees be incorporated into the planting plan? How will transitions to adjacent habitats be handled (e.g., linked habitat corridors, maintenance of edge habitat, buffer zones, use of plantings to restrict public access)? What types of plant materials will be needed, where will they be obtained, and what lead times will be necessary? What about alternate supplies if the preferred plan doesn't work?

Will any riparian vegetation presently on-site be salvaged, and if so, how and when (e.g., mature or young trees and shrubs, cuttings, seeds, unusual specimen plants)? Will planting be phased and during what times of year will it be accomplished? Will special irrigation, maintenance, or fertilizing programs be needed; and what are they, when, and for how long would they be used?

Table 2. Riparian Restoration Planning in Southern California: Proposed Restoration Plan Contents.

PHASE II: CONTENTS OF THE RESTORATION PLAN

SPECIFIC RESTORATION GOALS

RESTORATION SITE PHYSICAL VARIABLES
- Topography and drainage patterns
- Approximate water budget for site (surface/subsurface)
- Water quality issues
- Soils issues

REVEGETATION PLAN
- Develop species list
- Plan to mimic natural stratification, species mosaic, age structure
  - (Instant maturity versus successional planting)
- Plan relationships to adjacent habitats
- Identify types, sources, lead times for plant material acquisition
- Determine phasing and timing of plantings
- Determine irrigation requirements

MONITORING PROGRAM
- Construction/Implementation monitoring
  - Define standards for mitigation success
  - Standardize data collection procedures
- Scientifically based monitoring
  - Appropriate physical environment
  - Successful revegetation (species cover, density, plant height)
  - Use by wildlife (insects, vertebrates)

IDENTIFICATION OF MANAGEMENT RESPONSIBILITIES
- Agency oversight responsibilities/enforcement
- Regional habitat management plan
- Short-term habitat maintenance, replacement
- Long-term habitat maintenance
- Legal obligations (deed restrictions, easements)
- Financial responsibilities (performance bonds, maintenance district)

Monitoring Program

Two basically different forms of project monitoring should be included as part of a riparian habitat restoration plan. Construction/implementation monitoring is already generally required by a project's lead regulatory agency but presently lacks standardized methodology and goals. This form of monitoring basically confirms that the specifications of the proposed restoration plan, such as grading requirements, site plantings, and irrigation were in fact carried out as

stated. Such monitoring may continue for at least 5 years and typically includes criteria for replacement of unsuccessful plantings.

There is a critical need for additional, scientifically-based monitoring that addresses other issues. How closely does the physical environment established at the restoration site parallel that in natural riparian settings? Monitoring watertable fluctuations, for example, could yield valuable insights for future restoration design. How successfully does the restoration planting program mimic natural vegetation patterns? Indeed, what models are available for undisturbed riparian habitats? Why might some plantings fail while others succeed? Is succession proceeding in the modified habitat as it does in natural riparian areas? The whole issue and desirability of planting for "instant maturity", versus slower, but more natural species succession, needs to be addressed. How can invasive weedy species best be controlled? To what extent are the processes and functions of natural riparian habitats also occurring at the restoration site? When, and to what extent, has a riparian biota moved into the restored habitat and how does this compare with past use?

Another topic that deserves discussion under the proposed monitoring program concerns definition of the successful completion of the restoration program. At what point will the restoration's stated goals be accomplished and the new habitat be considered "on its own"?

Identification of Management Responsibilities

A series of issues that relate to the long-term management and maintenance of potential riparian habitat restoration projects exist that do not appear to be adequately addressed under present planning or regulatory guidelines. Once a restoration is "completed," what happens to it? Which agencies have what types of oversight responsibilities? How can individual restoration projects be integrated to meet broader goals of possible regional habitat management plans? Should restored riparian areas be subject to long-term habitat maintenance -- deliberate stream clearing, for example, which could imitate the impacts of the catastrophic flooding that occurs on natural, undammed streams. Final questions to be addressed include who has long-term legal obligations regarding the restoration site and who carries financial and management responsibilities to meet future habitat needs.

CONCLUSION

Future Riparian Habitat Restoration Plans must contain substantially more types of data, and more detailed data than are presently required by local lead agencies and the state and federal permitting agencies. This will increase future restoration success, but perhaps equally important, it will also greatly expand the data base available for riparian habitat restoration planning. Since different restoration plans have different data needs, the scope of data collection and analysis should generally reflect the size and potential difficulty of the proposed restoration plan. This remains a judgment call and is probably best based on the confidence level with which the restoration project's outcome can be predicted.

The review of selected local riparian restoration plans strongly suggests that the uncertain success of such projects to date reflects inadequate understanding of existing and necessary site conditions, superficial restoration planning, and insufficient monitoring and follow-up by project proponents and regulatory staff. Many of the shortcomings seen in present requirements for

riparian restorations in southern California closely parallel concerns expressed by Kunz et al. (1988) following their assessment of wetland mitigation practices in the State of Washington.

Riparian habitats in southern California and elsewhere are a precious but diminishing national resource. Habitat protection must be accompanied by active restoration of degraded riparian areas and creation of new riparian habitat to replace historic losses. The success of such a plan will require better understanding of how riparian habitats function; substantially more detailed restoration planning; and most importantly, more stringent, better integrated, and more vigorously enforced local, state and federal regulatory guidelines -- preferably with greater opportunity for public input and review.

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