Prioritizing Riparian Restoration at the Watershed, Reach and Site Scales

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Issues

- Riparian communities provide multiple benefits to wildlife and fisheries. They also help stabilize streams, reduce non-point source pollution and have aesthetic appeal.
- Past and present land uses may have caused deleterious impacts to riparian communities
- Exotic plants have invaded and now dominate many riparian communities.
- Identifying “intact” and “degraded” riparian communities is the first step in developing plans and projects for restoration.

In this presentation, a procedure for classifying and evaluating riparian communities at the watershed, stream reach and site scales is described. The procedure was developed with funding from US EPA and has been applied to at least two California streams.

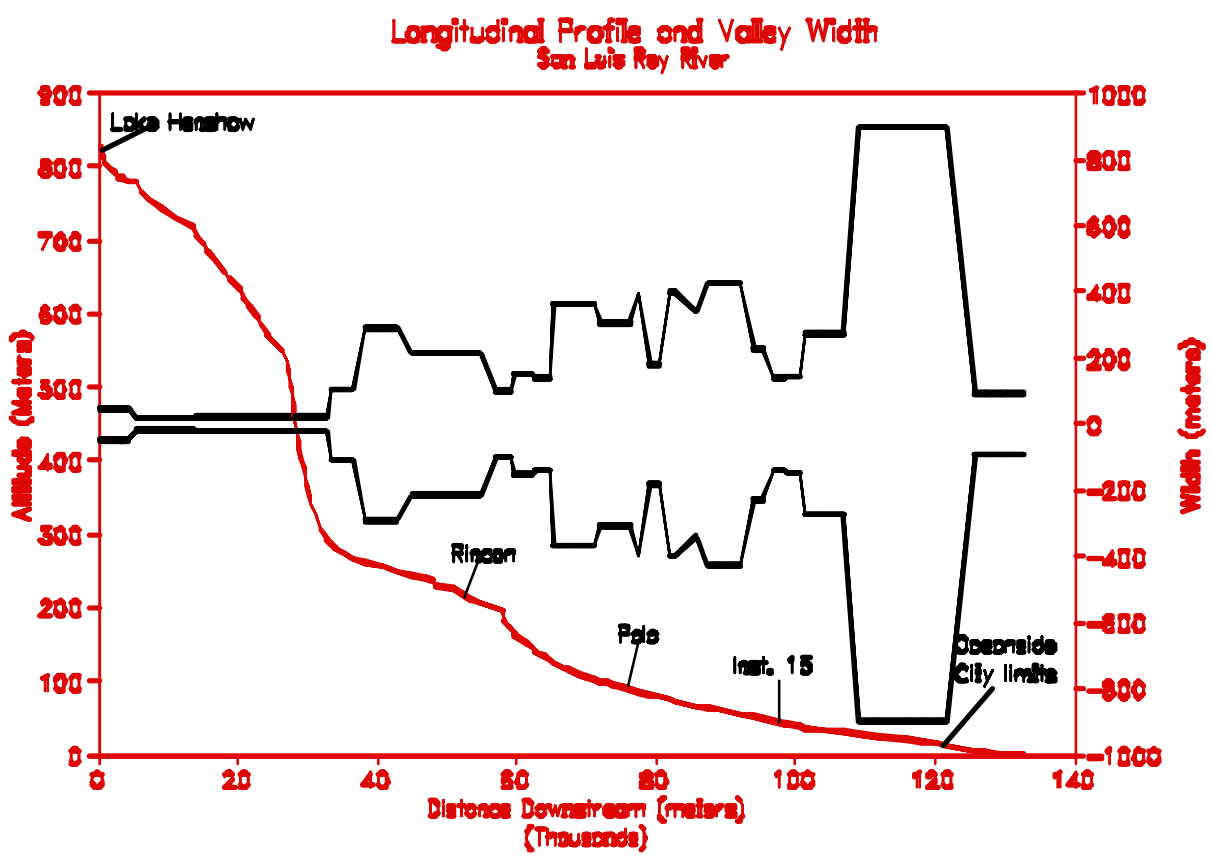
The Approach

- Classify stream reaches on the basis of geomorphology (stream profile and valley width).
- Map land cover in reaches.
- Determine if reaches are:
  - Fully occupied with native riparian cover.
  - Partly occupied with native riparian cover.
  - Developed or allocated to irreversible uses.

The Approach (cont.)

- On the basis of mapping, decide:
  - Which reaches qualify for protection (fully occupied by native riparian cover)
  - Which reaches should be surveyed in the field (reaches that have potential for restoration)
  - Which reaches are not feasibly restored (developed or otherwise unavailable)
- Develop field study plan to assess geomorphic (floodplain landforms) and vegetation conditions in survey reaches.
- Implement study plan, analyze data and evaluate results.
- Develop restoration plan and projects based on study findings.

Geomorphic Classification



- USGS quadrangles are used to create a longitudinal profile for the stream. The profile is then interpreted to define general “reach types” of similar gradient.
- Within the general reach types, further measurements of local channel slope and floodplain width are used to define shorter reaches of relatively uniform geomorphology.

Vegetation Mapping

- The boundaries of geomorphic reaches are transferred to aerial photographs.
- Land cover classes are chosen for interpretation:
  - Urban land cover versus vegetation.
  - Cultivated versus natural vegetation.
  - Canopy classes of natural vegetation (tree, shrub and herbaceous)
  - Permanent water and “barren” (undeveloped but no vegetation present) are separately mapped.
  - Conditions at the boundary between the upland and riparian/floodplain are also classified as urban, agriculture or natural vegetation (determines connectivity).

Reach Condition Evaluation

- Criteria for classifying reach-vegetation are developed:
  - Proportion of floodplain occupied by riparian trees and shrubs.
  - Degree of fragmentation (numbers and sizes of patches per reach, adjacency of irreversible land uses to riparian vegetation patches).
  - Proportion of floodplain occupied by urban and/or agricultural development.
  - Connectivity between floodplain and upland vegetation.
- Potential decision framework:
  - Protect: reaches >90 percent riparian vegetation in large patches with good connectivity to natural upland vegetation.
  - Infeasible to restore: reaches with high levels of irreversible uses and highly fragmented.
  - Further investigation needed: reaches with 60-90 percent riparian cover, limited fragmentation, <10 percent irreversible uses and good connectivity to uplands.

Field Study Plan

- For reaches to be further investigated, a study plan is prepared. The basic design entails laying out a grid of plots within the reaches.
- Rapid survey methods are used to collect data on vegetation composition and structure, floodplain landforms and surficial substrate (as an index to flood exposure). The objective is to collect data on as large a number of plots as possible so that computerized classification can be used to analyze the data.
- Three types of data are collected:
  - Measured plot data.
  - Classified plot data (agriculture, urban, water)
  - Estimated plot data (for inaccessible plots)

Analysis

- Cluster analysis is used to define vegetation types on the basis of dominant and associated species.
- Samples are stratified into landform/substrate classes. Vegetation samples within these classes are then subjected to a second cluster analysis to determine landform/substrate/vegetation associations.
- Outputs include an overall vegetation typing for the studied reaches, including the relative proportions of each vegetation type plus an array of vegetation types occurring on different landform/substrate classes.
- The occurrence of vegetation types on different landform/substrate classes is then interpreted to identify potential reference conditions.

Case Studies

- San Luis Rey River, San Diego County
  - Twenty-four reaches and about 10,000 acres of floodplain. Urban 20 percent, agriculture 10 percent, riparian vegetation 64 percent in 43 patches.
  - Nine reaches qualified for “protection” seven reaches were judged “infeasible for restoration” and eight reaches were evaluated in the field.
  - Over 3000 plots were sampled or classified, including 1275 where landform and vegetation data were collected.
  - Six communities were classified: mulefat, willow, oak savanna, cottonwood forest, herbaceous and scoured/barren.

San Luis Rey Case Study (cont.)

- Results:
  - Mulefat and willow communities were severely impacted by exotics, primarily *Arundo donax*.
  - Regeneration in oak savanna was adversely affected by grazing.
  - Cottonwood forest had been impacted by clearing for agriculture.
- GIS modeling was used to predict future vegetation conditions in restored reaches.
- Plot-level data were used to define reference communities for different landforms and look at trends in community composition e.g., degree to which exotics had replaced native species. Geo-referenced plot locations indicated where restoration should be done.

Second Case Study: Escondido Creek

- Initiated by San Elijo Lagoon Conservancy, with state funding.
- Riparian vegetation assessment was part of an overall action plan to acquire and protect key parcels, implement restoration and increase public awareness of environmental values in the watershed.
- Followed same procedures, as outlined previously, with assistance from UC. Reach classification criteria were:
  - Protect (through conservation easements, outright acquisition): >90 percent natural vegetation
  - Restore: 60-90 percent natural vegetation, <30 percent urban or agricultural
  - Monitor through project review: >30 percent urban or agricultural

Escondido Creek Reach-Level Results

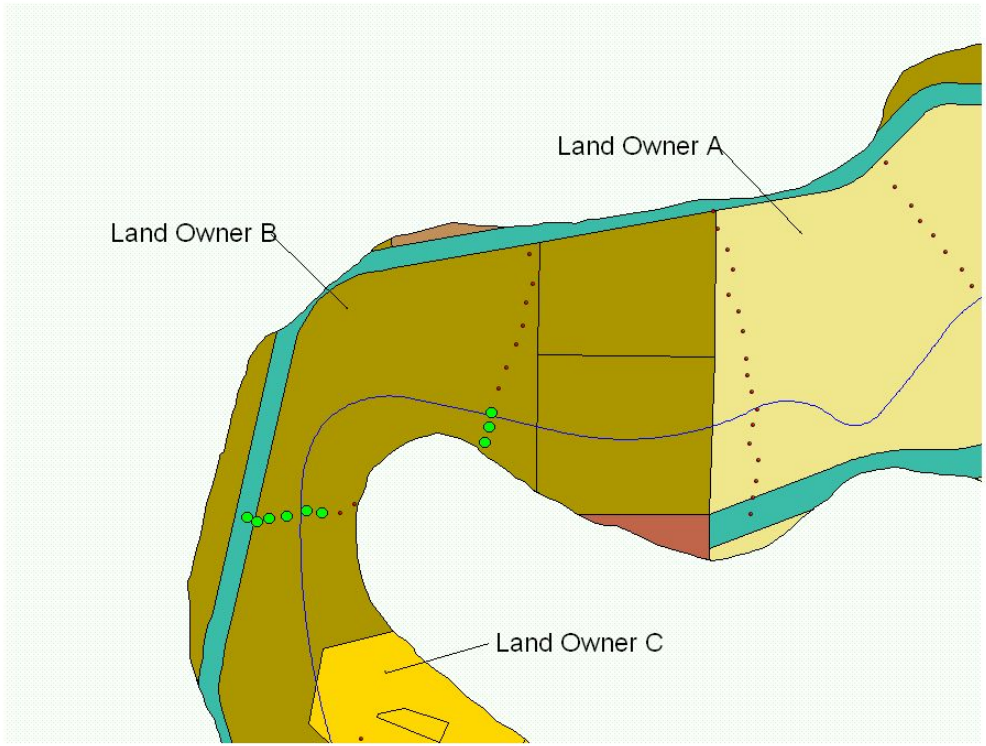
Reach Name	Area (acres)	Slope (%)	Natural Vegetation (%)	Urban and Cultivated (%)	Other LU (%)	Recommendation
Escondido Creek Main-stem						
Escondido Creek 10	46	3	90	1	9	Protect
Lake Wohlford	248	3	22	1	77	Protect
Dixon	175	8	50	40	10	Project Review
City of Escondido (and Reidy1)	1745	2	1	98	1	Unsuitable
Escondido Creek 5	112	2	58	37	5	Project Review
Escondido Creek 4	77	4	79	20	1	Restore
Escondido Creek 3	59	1	79	20	1	Restore
Escondido Creek 2	114	3	99	1	0	Protect
Escondido Creek 1	302	1	44	43	13	Project Review
San Elijo Lagoon	784	1	90	10	0	Protect
Tributaries						
Paradise CD	47	4	79	9	12	Restore
Paradise AB	35	5	39	56	5	Project Review
Jesmond Dene	53	2	80	20	0	Restore
Reidy 3	209	1	8	70	22	Project Review
Reidy 2	296	1	13	80	7	Project Review
Copper Creek 1	27	3	53	39	8	Project Review
Copper Creek 2	29	3	74	26	0	Project Review
La Orilla	110	1	23	75	2	Project Review

Escondido Creek Field Study Results

- Positioned transects at 160 m intervals along study reaches and surveyed plots every 12 m along each transect.
- Surveyed 325 transects and >1000 plots along 36 miles of stream with 870 acres of riparian woodland.
- Analysis indicated that few areas had intact, native riparian vegetation and numerous exotic species were present and abundant.

Escondido Creek Next Steps

- Plot data were used to identify locations for restoration projects such as eradication of *Arundo.*
- Funding was sought for these projects and they are being implemented.



Conclusions

- A watershed-level approach is advised to understand the status of riparian communities and protection or restoration needs.
- Quantitative studies can provide valuable data at all relevant scales from the watershed to the site.
- With some technical assistance and training, watershed groups can carry out the required study and in that way, become better informed about restoration needs.

For Further Information

- Harris, R.R., Hopkinson, P. McCaffrey, S. and Huntsinger, L. 1997. Use of geographical information systems versus manual techniques for map analysis in riparian restoration projects: a comparison. Journal of Soil and Water Conservation 52:140-145.

- Olson, C. and Harris, R.R. 1997. Applying a two-stage system to prioritize riparian restoration at the San Luis Rey River, San Diego County, California. Restoration Ecology 5(4S):43-55.

- Harris, R.R. and Olson, C. 1997. Two-stage system for prioritizing riparian restoration at the stream reach and community scales. Restoration Ecology 5(4S):34-42.

- Harris, R.R. 1999. Defining reference conditions for restoration of riparian plant communities: examples from California, USA. Environmental Management 24:55-63.

Thank You!