ecosystem
MANAGEMENT AND RESTORATION

Technology News from the Ecosystem Management and Restoration Research Program January 2003

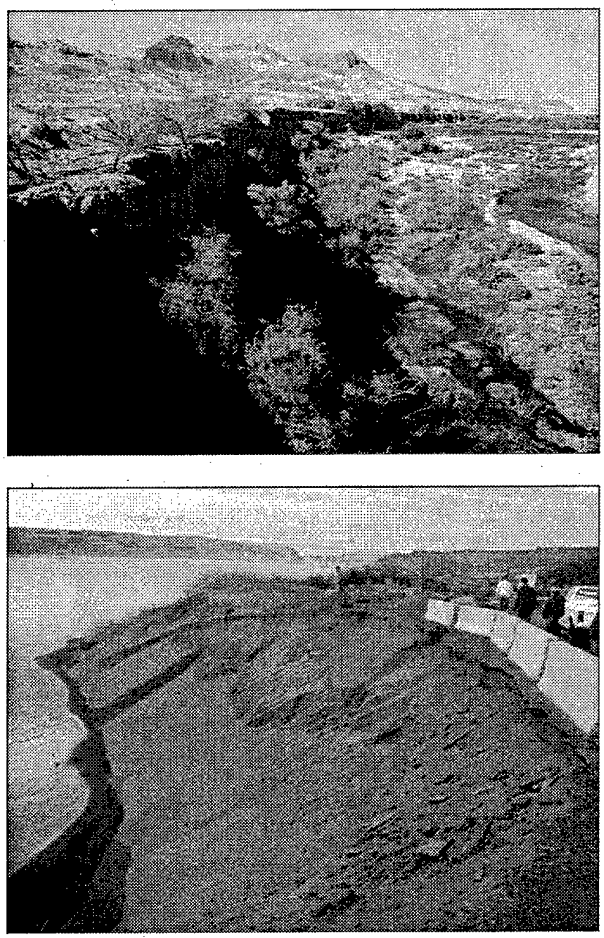
Riparian restoration and management needs in the arid and semi-arid western United States

by Richard A. Fischer

Introduction

The restoration and management of riparian zones has become a very popular and widespread practice in recent years (Briggs 1996). There has been a dramatic increase in the tools and techniques available to assist the restoration and management of these ecosystems (National Research Council 2002). As agencies, organizations, and private landowners with land management capabilities learn of the multitude of functions and values that riparian zones provide, and the relative ease of restoring some of these functions using the proper techniques, this interest will continue to grow.

Most riparian restoration efforts have been focused within temperate regions of the country. However, the restoration of riparian ecosystems in the arid and semi-arid western United States, where the loss of functional riparian zones has approached 99 percent in some areas (Briggs 1996), has recently become a focal issue for many agencies and organizations, including the Corps of Engineers (Corps). This is especially true for the Corps following the recent release of the seven Environmental Operating Principles that stress, among other goals, that the Corps should provide for the maintenance of healthy, diverse, and sustainable ecosystems, as well as consideration for environmental consequences of all programs and actions.

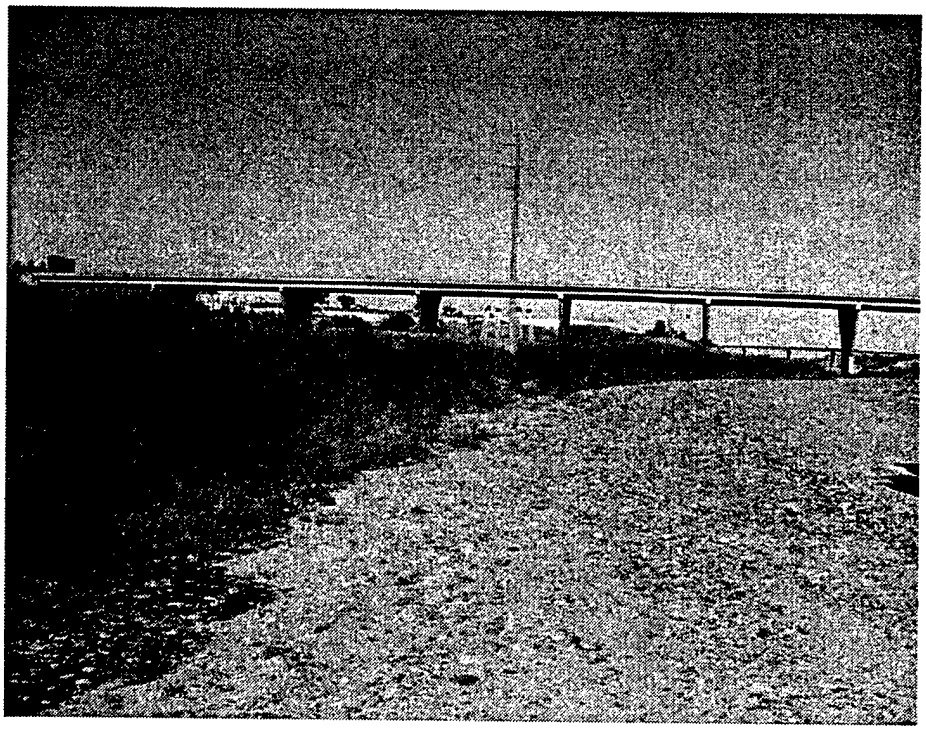


Restoration of arid (Las Vegas Wash [upper]) and semi-arid (Snake River [lower]) riparian areas will require knowledge and technology for stabilizing streambanks, removing exotic species, and successfully establishing native trees, shrubs, and herbaceous plants where groundwater is often the limiting factor in plant establishment

Background

Corps personnel are regularly faced with planning or managing projects aimed at restoring or enhancing degraded riparian habitats to provide more of their former functions and values. However, most recommendations from riparian investigations result mainly from forested regions of the United States, especially from the eastern, southern, and central regions of the country. Several Corps Districts in the western United States recently have initiated projects aimed at reestablishing riparian plant communities where these ecosystems have historically been degraded. These include semi-arid areas in the Fort Worth and Walla Walla Districts, to extremely arid desert riparian areas in the Los Angeles District, with projects ranging in size from small-scale streambank restorations to large-scale riparian ecosystem restoration projects along lengthy river reaches. Many of these efforts involve other Federal and state agencies, and include mitigation for wetlands loss or are ecosystem restoration projects of the Corps Continuing Authorities Program (CAP) (e.g., Section 1135 and 206 projects under the Water Resources Development Act of 1986). Some of the largest restoration projects in the West are "General Investigation" (GI) studies being implemented by the Corps in conjunction with a local cost-share partner. Local governments, primarily through CAP and GI projects, have found riparian ecosystem restoration an attractive option for improving water quality, enhancing wildlife habitat, and providing recreational opportunities. Local governments, organizations, and agencies frequently rely on Corps personnel for technical guidance in restoring these systems.

The increase in arid and semi-arid riparian restoration efforts has resulted in a need for better tools, techniques, and technical information to



Riparian restoration efforts by the Los Angeles District along the Salt River in Phoenix are some of the best examples of riparian ecosystem restoration in the arid West

improve restoration, management, and monitoring of these systems. While several worthwhile reference documents are available to provide insight on general riparian restoration and management topics, concise state-of-the-science information to help Corps personnel make sound decisions in these most challenging environments is lacking.

The Corps' Ecosystem Management and Restoration Research Program (EMRRP) was established in 1997 to provide state-of-the-science techniques and information for prediction and analysis of environmental impacts of Corps projects and activities, and for research to improve the success of environmental restoration projects that will benefit the Corps and the Nation as a whole. Previous efforts within the EMRRP have addressed recommended designs for riparian corridors and buffer strips for water quality and wildlife (Fischer and Fischenich 2000). A research project recently initiated within the EMRRP, and described in this information bulletin, is attempting to address some of the issues and develop technical guidelines associated with riparian restoration and management in the arid and semi-arid western United States.

Project Objectives and Proposed Research

This EMRRP research project will focus on restoring functions and values to arid and semi-arid western riparian ecosystems, emphasizing 1) site evaluation and selection, 2) plant species selection, 3) available planting techniques, spacing, and architecture, and 4) techniques for developing long-term monitoring protocols.

The first phase of the effort will involve an extensive review of the literature and the synthesis of information from previous restoration efforts in the western United States. Districts currently involved in arid and semi-arid riparian restoration efforts will also be surveyed to determine the level of effort (i.e., types of restoration efforts, site characteristics, species used, planting techniques), relative success/failure of ongoing efforts, information needs, and monitoring activities. Subsequent efforts will focus on identifying the most promising plant species and planting techniques, and establishing demonstration sites and monitoring programs at ongoing projects (within the western Corps Districts) to test their effectiveness under controlled conditions.

Site Evaluation and Selection

Degree of degradation, visibility, or presence of certain wildlife species in need of improved habitat often dictate the selection of a riparian area for restoration (Stromberg 2000). However, decisions on where to focus restoration and management funds and efforts are not always straightforward. In some situations, there may be several candidate sites for restoration that need to be assessed and prioritized. Briggs (1995) pointed out the importance of identifying several factors prior to making decisions about selection of sites for restoration, including causes of site decline, the current ecological condition of the site, and the potential of the site for meeting project objectives. Site evaluation and selection will be summarized in a technical note with supporting information from the District and project input.

Plant Species Selection

Selecting plant species that will adapt to the site and meet ecological site characteristics (e.g., ability to reach the water table) is extremely important. The selection of plants for restoring the structure and the integrity of these systems are also important considerations (Stromberg 2000). The USDA Natural Resources Conservation Service maintains a useful Web site (*http://plants.usda.gov*) to assist in plant species selection during restoration efforts. This site and other information sources

will be used to recommend native plants, including trees, shrubs, and herbaceous species, that are suitable for riparian restoration efforts. Species will be identified and described relative to their suitability for region, climate, and growing conditions.

Planting Techniques

Establishing riparian vegetation in arid western environments can be extremely challenging due to infertile soils, very low rainfall, flashy hydrologic patterns that often scour soils holding planted vegetation, and very prolific non-native plant species that tend to dominate the plant community. Riparian restoration efforts in these regions of the country are frequently unsuccessful where irrigation is not possible, is cost-prohibitive, or where the water table occurs below the root zone of newly established vegetation. Lack of irrigation or lowered water tables can preclude adequate soil moisture for riparian plants to become established, or to survive after initially becoming established. Several products that may enhance plant survival are available on the commercial market. One product of interest to riparian restoration in arid regions is super-absorbent water retention polymers. These polymers are designed to absorb soil water up to 400 times their own weight, hold the water near the root zone, and release it back to plant roots over an extended period of time.

Although this technique appears useful for improving the long-term survival of riparian plantings, the success and effectiveness of these products in large-scale plantings (where irrigation and intense cultural practices are impractical) has not been extensively studied in large-scale controlled experiments. The influence of soil-absorbent polymers on riparian plant survival will be investigated in replicated experiments at selected sites in the western United States.

Monitoring Protocols

All restoration projects should be monitored to ensure that objectives are being met. A monitoring protocol should be developed as part of the planning process for a project, and implemented at the appropriate time. Long-term monitoring protocols, including the selection of appropriate metrics that can be used to evaluate the success/failure of restoration efforts, will be summarized.

Summary

Guidelines established under the current research effort will provide state-of-the-science information, enabling Districts to better develop and plan riparian restoration projects in arid and semi-arid environments of the western United States, where this type of effort has had very mixed results. It will provide working demonstrations of some successful restoration efforts/techniques currently in use and will provide District personnel with information and techniques necessary to develop more economical and effective restoration efforts. Results of literature reviews, District surveys, and field efforts will be developed into technical notes (TNs) as part of the ongoing Stream Restoration TNs previously developed under the EMRRP. Results of this effort will also likely identify where future investigations will be necessary to provide additional guidelines on restoration and management of these ecosystems. The intended audience for this research includes all Corps personnel involved in planning and construction of riparian ecosystem restoration and enhancement projects, as well as other Federal, state, local, and private agencies and organizations.

Points of Contact

For additional information, contact Dr. Richard A. Fischer (601-634-3983, *Richard.A.Fischer@erdc.usace.army.mil*), or the Program Manager of the Ecosystem Management and Restoration Research Program, Glenn Rhett (601-634-3717), *Glenn.G.Rhett@erdc.usace.army.mil*).

References

Allen, E. B. (1995). "Restoration ecology: Limits and possibilities in arid and semi-arid lands." *Proceedings: Wild land scrub and arid land restoration symposium.* B. A. Roundy, A. D. McArthur, J.S. Haley, and D. K. Mann, compilers. U.S. Forest Service General Tech. Rept. INT-GTR-315.

Briggs, M. K. (1995). "Evaluating degraded riparian ecosystems to determine the potential effectiveness of revegetation." *Proceedings: Wild land scrub and arid land restoration symposium.* B. A. Roundy, A. D. McArthur, J.S. Haley, and D. K. Mann, compilers. U.S. Forest Service General Tech. Rept. INT-GTR-315.

Briggs, M. K. (1996). *Riparian ecosystem recovery in arid lands: Strategies and references.* The University of Arizona Press, Tucson.

Fischer, R. A., and Fischenich, J. C. (2000). "Design recommendations for corridors and vegetated buffer strips," *EMRRP Technical Notes Collection* (EMRRP-SR-24), U.S. Army Engineer Research and Development Center, Vicksburg, MS.

National Research Council. (2002). "Riparian areas: Functions and strategies for management. Committee on riparian zone functioning and strategies for management," Water Science and Technology Board, National Research Council, Washington, DC.

Stromberg, J. (2000). "Restoration of riparian vegetation in the arid southwest: Challenges and opportunities," *Arizona Riparian Council Newsletter,* 13:1-7.

About the Author

Richard A. (Rich) Fischer is a research wildlife biologist in the Environmental Laboratory at the U.S. Army Engineer Research and Development Center. He received a B.S. degree in biology from Oglethorpe University, an M.S. in wildlife science from Auburn University, and a Ph.D. in wildlife and range sciences from the University of Idaho. He is presently conducting research on restoration and management of riparian areas, and ecology and management of neotropical migrant birds on military lands.

EMRRP Technical Notes, 2001-2002

EMRRP Technical Notes are available on the web at *http://www.wes.army.mil/el/emrrp/tnotes.html.* If you would like to be notified when new EMRRP publications are posted, you may subscribe to our listserver (*http://www.wes.army.mil/el/listserv.html*). Each notification will include appropriate unsubscribe information.

EMRRP-EM-02	Simulating Movement of Highly Mobile Aquatic Biota: Foundation for Population Modeling in an Ecosystem Context, January 2002
EMRRP-EM-03	Small Floodplain Pools as Habitat for Fishes and Amphibians: Methods for Evaluation, May 2002
EMRRP-SI-19	Sensitive Western Riparian Songbirds Potentially Impacted by USACE Reservoir Operations, April 2001
EMRRP-SI-20	The Importance of Corps of Engineers Lands to Migrating and Breeding Birds, July 2001
EMRRP-SI-21	Management of Bottomland Hardwood Forests for Nongame Bird Communities on Corps of Engineers Projects, September 2001
EMRRP-SI-22	Riparian Habitat Management for Reptiles and Amphibians on Corps of Engineers Projects, September 2001
EMRRP-SI-23	Hedgerow and Fencerow Management on Corps of Engineers Projects, November 2001
EMRRP-SI-24	Eastern Cave and Crevice Dwelling Bats Potentially Impacted by USACE Reservoir Operations, September 2002
EMRRP-SI-25	Cave and Crevice Dwelling Bats on USACE Projects: Gray Bat (*Myotis grisescens*), May 2002
EMRRP-SI-27	Cave and Crevice Dwelling Bats on USACE Projects: TownsendÆs Big Eared Bat (*Corynorhinus townsendii*), May 2002
EMRRP-SI-28	Black capped Vireo and Golden cheeked Warbler Populations Potentially Impacted by USACE Reservoir Operations, July 2002
EMRRP-SI-29	Riparian Habitat Management for Mammals on Corps of Engineers Projects, July 2002
EMRRP-SR-23	Brush Mattresses for Streambank Erosion Control, May 2001
EMRRP-SR-25	Riparian Terminology: Confusion and Clarification, January 2001
EMRRP-SR-26	Determining Optimal Degree of Soil Compaction for Balancing Mechanical Stability and Plant Growth Capacity, May 2001
EMRRP-SR-28	Units and Conversions for Stream Restoration Projects, May 2001
EMRRP-SR-29	Stability Thresholds for Stream Restoration Materials, May 2001
EMRRP-SR-31	Live and Inert Fascine Streambank Erosion Control, May 2001
EMRRP-SR-32	Impacts of Stabilization Measures, May 2001
EMRRP-SR-33	Plant Material Selection and Acquisition, May 2001
EMRRP-SR-34	An Assessment of Watershed Planning in Corps of Engineers Civil Works Projects, August 2002
EMRRP-SR-36	Techniques for Measuring Substrate Embeddedness, September 2002

Workshop Restoration of Riparian Zones for Water Quality and Ecological Functions

The U.S. Army Engineer Research and Development Center (ERDC), Environmental Laboratory, announces the availability of a free workshop to Corps of Engineers employees. The 2½-day workshop is tentatively scheduled for late August or early September (location to be determined), and will include a variety of technical presentations by ERDC engineers and scientists on riparian restoration and management, centering on the prevention and control of non-point source pollution using riparian buffer strips along streams, rivers, lakes, and wetlands. We will also address methods and techniques that provide a broad range of physical and ecological functions, including flood storage capacity, habitat and movement corridors, and aesthetics. This workshop will provide a more in-depth analysis and presentation of the problems and potential solutions available for the assessment, design, and implementation of buffer strips that may be lacking in other courses.

If you are interested in attending the course, please send your request for attendance to the course coordinator, Dr. Richard Fischer (*fischer@wes.army.mil*). Further details regarding location, hotel, meeting room, etc., will be provided once we have a list of attendees.

This workshop is made possible by funds from the Water Operations Technical Support Program (*http://www.wes.army.mil/el/wots/wots.html*).

Related Research Published by ERDC — 2001-2002

Guidelines for Developing Regional Guidebooks

Clairain, E. J. (2002). "Hydrogeomorphic Approach to Assessing Wetland Functions: Guidelines for Developing Regional Guidebooks; Chapter 1, Introduction and Overview of the Hydrogeomorphic Approach," ERDC/EL TR-02-3, U.S. Army Engineer Research and Development Center, Vicksburg, MS.

Smith, R. D. (2001). "Hydrogeomorphic Approach to Assessing Wetland Functions: Guidelines for Developing Regional Guidebooks - Chapter 3, Developing a Reference Wetland System," ERDC/EL TR-01-29, U.S. Army Engineer Research and Development Center, Vicksburg, MS.

Smith, R. D. and Wakeley, J. S. (2001). "Hydrogeomorphic Approach to Assessing Wetland Functions: Guidelines for Developing Regional Guidebooks - Chapter 4, Developing Assessment Models," ERDC/EL TR-01-30, U.S. Army Engineer Research and Development Center, Vicksburg, MS.

Wakeley, J. S. and Smith, R. D. (2001). "Hydrogeomorphic Approach to Assessing Wetland Functions: Guidelines for Developing Regional Guidebooks - Chapter 7, Verifying, Field Testing, and Validating Assessment Models," ERDC/EL TR-01-31, U.S. Army Engineer Research and Development Center, Vicksburg, MS.

Regional Guidebooks

Smith, R. D. and Klimas, C. V. (2002). "A Regional Guidebook for Applying the Hydrogeomorphic Approach to Assessing Wetland Functions of Selected Regional Wetland Subclasses, Yazoo Basin, Lower Mississippi River Alluvial Valley," ERDC/EL TR-02-4, U.S. Army Engineer Research and Development Center, Vicksburg, MS.

Shafer, D. J., et al. (2002). "Regional Guidebook for Applying the Hydrogeomorphic Approach to Assessing Wetland Functions of Northwest Gulf of Mexico Tidal Fringe Wetlands," ERDC/EL TR-02-5, U.S. Army Engineer Research and Development Center, Vicksburg, MS.

Hauer, F. R., et al. (2002). "A Regional Guidebook for Applying the Hydrogeomorphic Approach to Assessing Wetland Functions of Intermontane Prairie Pothole Wetlands in the Northern Rocky Mountains," ERDC/EL TR-02-7, U.S. Army Engineer Research and Development Center, Vicksburg, MS.

Rheinhardt, R. D., Rheinhardt, M. C., and Brinson, M. M. (2002). "A Regional Guidebook for Applying the Hydrogeomorphic Approach to Assessing Wetland Functions of Wet Pine Flats on Mineral Soils in the Atlantic and Gulf Coastal Plains," ERDC/EL TR-02-9, U.S. Army Engineer Research and Development Center, Vicksburg, MS.

Noble, C. V., et al. (2002). "A Regional Guidebook for Applying the Hydrogeomorphic Approach to Assessing Wetland Functions of Flats Wetlands in the Everglades," ERDC/EL TR-02-19, U.S. Army Engineer Research and Development Center, Vicksburg, MS.

Hauer, F. R., et al. (2002). "A Regional Guidebook for Applying the Hydrogeomorphic Approach to Assessing Wetland Functions of Riverine Floodplains in the Northern Rocky Mountains," ERDC/EL TR-02-21, U.S. Army Engineer Research and Development Center, Vicksburg, MS.

Upcoming Events

April 28-May 1, 2003—Fort Worth, TX, "Environmental and Natural Resources Conference," *http://hq.environmental.usace.army.mil/enr2003*

April 28-May 2, 2003—Vicksburg, MS, "Ecological Resources: Identification, Analysis, and Evaluation," USACE PROSPECT course, **POC:** *Antisa.C.Webb@erdc.usace.army.mil*

May 19-May 23, 2003—Vicksburg, MS, "Interdisciplinary Training for Ecosystem Restoration," USACE PROSPECT course, **POC:** *L.Jean.O'Neil@erdc.usace.army.mil*

July 14-July 18, 2003—Lafayette, LA, "Ecosystem Planning and Management Issues," USACE PROSPECT course, **POC:** *L.Jean.O'Neil@erdc.usace.army.mil*

August 11-August 15, 2003—Louisville, KY, "Riparian Zone Ecology, Restoration, and Management," USACE PROSPECT course, **POC:** *Richard.A.Fischer@erdc.usace.army.mil*

October 7-October 10, 2003—Kallispell, MT, "Wetland Riverine Functional Assessment Ecology for Project Managers Workshop," USACE PROSPECT course, **POC:** *Bob.L.Lazor@erdc.usace.army.mil*

US Army Corps of Engineers®
Engineer Research and Development Center

In this issue:

For the latest technology news from the Ecosystem Management and Restoration Research Program, view the EMRRP Web page at ***http://www.wes.army.mil/el/emrrp***

Ecosystem Management and Restoration Research Program

This bulletin is published in accordance with AR 25-30 as an information exchange bulletin of the Corps of Engineers. Its purpose is to disseminate research results on emerging problems addressed by the Corps' Ecosystem Management and Restoration Research Program. The contents of this bulletin are not to be used for advertising, publication, or promotional purposes nor are they to be published without proper credit. Citation of trade names does not constitute an official endorsement or approval of the use of such commercial products. Communications are welcomed and should be directed to Glenn Rhett (*Glenn.G.Rhett@erdc.usace.army.mil*), U.S. Army Engineer Research and Development Center, ATTN: CEERD-EM-W, 3909 Halls Ferry Road, Vicksburg, MS 39180-6199; telephone (601) 634-3717.

James R. Houston, PhD
Director

OFFICIAL BUSINESS
CEERD-EM-W

DEPARTMENT OF THE ARMY
ENGINEER RESEARCH AND DEVELOPMENT CENTER
WATERWAYS EXPERIMENT STATION, 3909 HALLS FERRY ROAD
VICKSBURG, MS 39180-6199

BULK RATE
U.S. POSTAGE PAID
Vicksburg, MS
Permit No. 85