

Corridors and vegetated buffer zones— Guidelines for Corps of Engineers projects

by Richard A. Fischer and Chester O. Martin, U.S. Army Engineer Waterways Experiment Station

To effectively manage natural resources within watersheds, it is often necessary to establish vegetated buffer zones to protect aquatic systems from land-use activities that occur in uplands.

The majority of inland Corps of Engineers civil works projects are constructed along streams and rivers that have adjacent riparian corridors.

There is increasing interest in the value of riparian areas as corridors and buffer strips on Corps lands, especially as potential wildlife habitat. These landscape features typically comprise a very small proportion of the landscape, but they provide essential habitat for a variety of plants and animals.

Many riparian buffer zones and corridors on Corps lands are badly in need of restoration and management. However, Corps project managers currently have only limited information and few guidelines on design criteria.

This article describes work to develop technical guidelines for restoring and managing riparian buffer zones and corridors. The potential benefits—with regard to water quality and many important ecological functions—are significant.



Riparian buffer zones remove nonpoint source pollution from adjacent land-use practices, such as agriculture, and also provide critical wildlife habitat

Background

A variety of activities affect riparian habitats on Corps lands, including project construction and operation, agriculture, and recreation.

The operation of projects for flood control, water supply, navigation, and hydropower exerts considerable stress on the riparian habitats at many Corps projects.

These projects often modify natural flows and flooding regimes and divert ground and surface waters, thus producing substantial alterations to the riparian zone. Water-based recreation may also cause problems in some areas.

Corps projects are also influenced by surrounding land uses, including agriculture, livestock grazing, timber harvest, industry, and urbanization.

The adverse impacts of these activities are often detrimental to riparian and aquatic habitats, especially where protective buffer strips are not retained or established and subsequently managed as part of the project plan.



Some neotropical migrant songbirds, such as this red-eyed vireo, breed in buffer strips if enough interior forest habitat is available

These conditions can lead to long-term degradation of water quality, wildlife and fish habitat, and recreation resources, thus eliminating many economic benefits that could have been achieved through better guidelines.

Potential benefits of buffer zones

Buffer zones are usually viewed for their potential benefits to water quality, and numerous studies have addressed the influence of buffer zones on reducing nonpoint source pollution in watershed runoff.

However, recommended design criteria are highly variable, and relatively few studies have addressed the compatibility of recommended buffer strip widths for water quality with other important ecological functions.

For example, buffer zones can function as corridors for migration and dispersal of

animals if they are long enough to provide connections of disjunct habitats.

Buffer zones can also provide habitat for plants and animals if enough area is available to meet life-history needs.

Riparian zone width is often positively related to faunal species richness and density and is an important consideration in management of riparian ecosystems. The abundance of neotropical migrant birds in eastern riparian zones is often positively correlated with width of riparian habitat.

Common questions

Questions often asked regarding restoration and management of buffer zones and corridors include the following:

- What spatial attributes and dimensions (length, width, total area, configuration, continuous versus fragmented area) and vegetation characteristics (dominants, species diversity, vertical and horizontal layering) are required to provide a functional riparian buffer zone system from a broad ecological perspective?

- Should buffer strips connect habitats to provide conservation corridors for wildlife? If so, how? Would these corridors be beneficial to wildlife or only create movement lanes for predators?

- How do various land uses and activities affect the quality and integrity of riparian zones? What is the cumulative effect of these activities on riparian systems?

- What is the value of riparian zones to threatened, endangered, and other sensitive plant and animal species? Are special designs needed to protect these species?

- What are the most environmentally desirable and cost-effective means of restoring degraded riparian corridors and buffer zones?

- What plant species are most appropriate for establishment or improvement of buffer zones?

Research objectives

A 3-year research project on corridors and buffer zones was initiated during fiscal year 1997 at the U.S. Army Engineer Waterways Experiment Station (WES) as part of the Ecosystem Management and Restoration Research Program (EMRRP).

The goal of this research is to develop technical guidelines from current literature and field studies that will allow Corps personnel to make decisions for riparian buffer zone and corridor designs based on the most accepted scientific criteria.

Specific research objectives

- *Determine* the suitability of these landscape features to provide various project needs (for example, fish and wildlife habitat improvement/creation, river and stream conservation, erosion control, noise abatement/visual screening, and reduction of nonpoint source pollution).

- *Identify* measurable physical, biological, and ecological variables and integrate them with current design criteria.

- *Apply* these designs to improve planning for and management of buffer strips on Corps lands.

District needs and related research issues

The study was initiated with a 2-day workshop, at WES during May 1997, to discuss the application of corridors and buffer strips on Corps projects and to identify those issues that should be addressed by research activities.

Workshop attendees represented five Corps Districts (Fort Worth, Vicksburg, Mobile,

Louisville, and Rock Island) and one Corps Division (Mississippi Valley).

District representatives discussed ongoing or potential projects that would benefit from this work unit and identified many research needs and issues associated with corridors and buffers (Table 1).

**Table 1. Issues Associated with Corridors and Buffer Zones —
Identified During May 1997 Workshop**

Issue/Concern	Research Priority
Spatial aspects (dimensions and configurations)	High
Habitat diversity/biodiversity management	
Preserving/restoring riparian values	
Neotropical migrant birds	
Fee-title versus easement lands	
Landscape linkages	
Quantifying functions and values	
Buffer adjacent land uses	Medium
Channel maintenance	
Human dimensions (aesthetics, noise, visual, education benefits)	
Streambank/shoreline erosion (natural versus artificial)	
Aquatic habitat protection/provision	
Effects of recreational use	
Public safety (for example, hunting)	
Floodwater retention/attenuation	Low
Threatened and endangered species	
Plant species selection (cordgrass, smartweed, shrubs, etc.)	
Economic benefits	
Exotic plant species	

The following issues of concern with regard to corridor and buffer zone restoration and management were common to most of the Corps Districts:

- Better Corps guidelines, especially to determine appropriate corridor locations, designs and dimensions, and management requirements.
- Protection of Corps lands from adjacent land uses, especially urbanization, recreation activities (golf courses, campgrounds, etc.), and certain timber harvest practices (for example, clearcuts).
- Wildlife habitat development and improvements along riparian corridors.
- Provision of habitat for neotropical migrant birds.
- Maintenance of aesthetic qualities.
- Improved guidelines for biodiversity management in riparian areas.
- Bank protection.

Issues specific to buffer zones included

- Protection of scenic views.
- Screening of commercial or other off-project development, as well as developed recreation areas.
- Protection of wetlands.
- Maintaining the integrity of natural systems.
- Protecting threatened and endangered species habitat.

Other District concerns

Districts were particularly concerned about encroachments and abuse of project lands along boundaries and adjacent to stream and lakeside riparian habitats.

Several Districts reported that adjacent landowners have a tendency to cut trees on Government property to enhance their view of aquatic areas, especially along the edge of lakes.

Private landowners frequently build houses or other structures immediately adjacent to Corps property and clearcut large areas up to the project boundary.

In some cases, timber companies have made extensive clearcuts adjacent to project lands, and in some agricultural areas, adjacent landowners have requested permission to cut large trees within environmental easements to improve farm field conditions.

Trespassing and illegal dumping are other problems along corridors, especially in remote areas where surveillance and enforcement are limited.

In reservoir areas, one of the most critical concerns is the influx of requests for increased recreational development from local governments and private concessionaires who manage resorts, marinas, and other structures on Corps projects.

All Districts were interested in improved designs and wildlife habitat management strategies for corridors and buffers.

Specific concerns included fragmentation, provision of migration corridors, invasion of nuisance species, neotropical migrant bird habitat management, protection of natural areas, appropriate timber and forest management practices, wetland creation, restoring native plant species, reestablishment of bottomland hardwoods, monitoring of fauna and flora, and endangered species management.

Several Districts were interested in habitat management for black bears and establishing buffers for such species as bald eagles. A need for wildlife viewing areas in some locations was also noted.

Research approach

Replicated field studies will be conducted during fiscal years 1998 and 1999 to address the research priorities as identified by the Corps Districts.

There was consensus among workshop participants that the study design should be regionally based and include standard guidelines for determining width and dimensions of corridors and buffers that will protect water quality and also provide ecological benefits.

Several physical and biological variables have been identified and previously used in designing buffer zones and corridors.

Measurements of these and other parameters specific to Corps lands will be included.

For example, existing buffer zone recommendations for southeastern states (e.g., Best Management Practices) will be evaluated and tested for their efficiency in providing various ecological benefits.

Technical guidelines will be developed from current literature and field studies, and distributed through technical reports, on-line databases, and peer-reviewed publications.

These guidelines will allow Corps managers to make informed decisions concerning buffer strip and corridor designs.

Corps field study sites

District representatives suggested several Corps projects in the southeastern United States as potential field study sites.

Corps projects currently being assessed as study sites include the Ray Roberts Reservoir greenbelt, Texas; Bayou Bodcau, Louisiana;

and Corps projects in Mississippi, Georgia, and South Carolina.

Other Corps lands with ongoing or completed buffer zone/corridor projects will be visited to gain additional insight into proper designs and lessons learned.

Technology transfer

Several recent Corps studies have addressed various aspects of corridor management at Civil Works projects. Research needs for riparian systems were initially discussed at a Corps Riparian Zone Restoration and Management Workshop held in San Antonio, TX, during February 1986.

A proceedings document was published that summarized the presentations by Corps biologists and resource managers. Results of this workshop provided the background information on riparian zones for development of this work unit.

A riparian zone ecology and management training program was developed for Department of Defense (DoD) installation personnel as part of the DoD "Legacy" program, and the workshop "Riparian Zone Ecology, Restoration, and Management for DoD Land Managers: Northwestern United States" was conducted in Billings, MT, during June 1994.

A new Corps of Engineers' PROSPECT course, "Riparian Zone Ecology, Restoration, and Management," will be offered for the first time in Vicksburg, MS, during July 1998. Future sessions will be conducted in Augusta,

GA, in April 1999 and in Fresno, CA, in June 1999.

An investigation of the environmental value of riparian vegetation was recently conducted as part of the Environmental Impact Research Program. Also, several riparian ecology studies were performed under sponsorship of the Corps' Characterization and Restoration of Wetlands Research Program.

Work unit investigators participated in a symposium entitled "Corridors: Are They Effective in Conserving Biodiversity?" at the 4th annual conference of The Wildlife Society in Snowmass, CO, during September 1997.

Information resulting from this symposium will provide critical input to the work unit. Several papers from this conference are planned for publication in the internationally recognized journals *Landscape and Urban Planning* and *The Wildlife Society Bulletin*.

Work unit investigators also attended the National Conservation Buffers Technology Conference in San Antonio, TX, during January 1998 and presented a poster entitled "Riparian Corridor and Buffer Zone Issues on Army Corps of Engineers Lands."

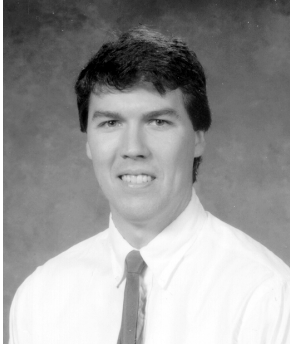
Points of contact for further information

Suggestions regarding this research project are welcomed from Districts involved in ongoing or planned corridor/buffer zone projects. Comments and questions concerning the WES buffer zone and corridor study

should be directed to **Dr. Richard A. Fischer**, (601) 634-3983, e-mail fischer@mail.wes.army.mil, or **Chester O. Martin**, (601) 634-3958, e-mail martinc@mail.wes.army.mil.

About the authors

Richard A. (Rich) Fischer is a research wildlife biologist in the Stewardship Branch of the WES Environmental Laboratory. 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 neotropical migrant birds on military lands and recently co-chaired a symposium on corridor management for biodiversity as part of The Wildlife Society's 1998 meeting.



Chester O. Martin is a research wildlife biologist in the Stewardship Branch of the WES Environmental Laboratory. He holds B.S. and M.S. degrees in wildlife and fisheries sciences from Texas A&M University. His research areas of interest include riparian zone ecology, wildlife habitat restoration, threatened and endangered species, and management for biodiversity. He was recently awarded the Federal Laboratory Consortium's Southeast Regional Award of Excellence for developing the Corps of Engineers Wildlife Resources Management



Ecosystem restoration training workshops

Registration will remain open until **June 15, 1998**, for two workshops of interest to many individuals involved in ecosystem restoration—engineers, planners, and project managers, natural resource/life cycle managers, regulators, real estate managers, and legal counsel. The Headquarters, USACE, proponent is Engineering Division/Hydraulics/Hydrology, which approved these workshops for the FY 99 PROSPECT survey of need. After June 15, requests for spaces should be submitted on DD Form 1556 through the local training coordinator.

- ***Hydrology for Constructed Mitigation Wetlands***

March 8-12, 1999 (36 hours) Apalachicola, FL
440/CECW-EH-W, Session 99-01 Tuition: \$1,580

Participants will interact with practicing experts in the field of wetland hydrology to apply the habitat functional approach to the design of constructed mitigation wetlands. Case studies will be used to examine important linkages among the many natural resource, engineering, and real estate considerations and opportunities. Water source models will be examined, and detailed water budget problems and solutions will be discussed.

- ***Constructed Wetlands for Habitat Mitigation***

August 2-6, 1999 (36 hours) Olympia, WA
439/CECW-EH-W, Session 99-01 Tuition: \$1,580

Participants will identify a “blueprint” for marketing and engineering future large-scale wetland ecosystem-level restoration and development projects that are consistent with existing Corps authorities and sponsor needs. A mix of highly facilitated panel discussions and field problem-solving sessions will provide participants with an overview of strategies for planning, engineering, constructing, acquiring real estate for, operating, and marketing constructed wetlands projects.

Course manager is Ms. Janie Hughes at the Corps' Professional Development Support Center, phone (256) 895-7440, fax (256) 895-7466, e-mail hughesj@smtp.hnd.usace.army.mil.



ecosystem management and restoration research program

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Upcoming events:

Ecosystem restoration training workshops (March and August 1999) — details inside

Look for the EMRRP home page, soon to be on-line at

<http://www.wes.army.mil/el/>

Among the items of interest will be an extensive database on buffer zones and corridors.



US Army Corps of Engineers



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ROBERT W. WHALIN, PhD, PE
Director

CEWES-EP-W
OFFICIAL BUSINESS

DEPARTMENT OF THE ARMY
WATERWAYS EXPERIMENT STATION, CORPS OF ENGINEERS
3909 HALLS FERRY ROAD
VICKSBURG, MISSISSIPPI 39180-6199