

# **PROTECTING AND RESTORING RIPARIAN AREAS**

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This paper briefly examines the functions and values of “riparian” areas. It suggests some priority measures states, local governments, federal agencies, and not for profit organizations can take to better protect and restore riparian areas.

## **I. What Are “Riparian” Areas?**

There is no universally accepted definition for a riparian area. The term “riparian area” has often been applied to vegetated or partially vegetated areas adjacent to rivers and streams including but not limited to river and stream beds and banks. Riparian areas are the “ribbons of vegetative green” adjacent to and including rivers and streams. Riparian areas are often flooded or subject to high ground water. The term “riparian area” has been most commonly used to refer to such floodplain areas in the West and Southwest although it applies equally to stream and creek areas and adjacent lands in other parts of the Nation. The word "riparian" is derived from Latin *riparian*, meaning related to dwelling on the bank of a river or other water body.

U.S. Clean Water Act regulations recognize both riparian and floodplain areas as “Waters of the U.S.” See below. These regulations recognize the broader interest in and the importance of the functions and values of riparian areas. Background papers prepared by the U.S. Environmental Protection Agency (EPA) and the Army Corps of Engineers (ACOE) summarize the scientific and legal bases for such inclusion as Waters of the U.S.

The definition of riparian areas contained in the EPA/ACOE definition of “Waters of the U.S.” is as follows: “The term riparian area means an area bordering a water where surface or subsurface hydrology directly influences the ecological processes and plant and animal community structure in that area. Riparian areas are transitional areas between aquatic and terrestrial ecosystems that influence the exchange of energy and materials between those ecosystems.”

Other examples of definitions for riparian areas include the following:

Merriam Webster defines riparian as: “relating to or living or located on the bank of a natural watercourse (as a river) or sometimes of a lake or a tidewater.”

The definition of riparian area applied in EPA’s “National Management Measures to Protect and Restore Wetlands and Riparian Areas for the Abatement of Nonpoint Source Pollution” (2005) includes: “A vegetated ecosystem along a water body through which energy, materials, and water pass. Riparian areas characteristically have a high water table and are subject to periodic flooding and influence from the adjacent water body. These systems encompass wetlands, uplands, or some combination of these two landforms.”

## **II. Common Denominators in the Definition of Riparian Areas.**

What are common denominators in the definition of riparian areas?

- A. Geomorphic form shaped by periodic flooding and/or saturation.** Flooding and accompanying erosion and deposition determine the form and shape of riparian areas. From time to time rain falls on all lands of the U.S including arid regions such as Death Valley which receives less than three inches of rain a year. When rain does fall in these

areas, much of it quickly runs off due to compacted and impermeable soils and steep topography. A portion of the runoff is evaporated and returned to the atmosphere. A portion is absorbed by dry creeks and streams, arroyos, playas and alluvial fans. A portion joins larger and more permanent rivers, creeks, and streams.

- B. Vegetation determined by degree of flooding and/or saturation.** Riparian area vegetation type and condition are determined at least in part by periodic flooding or saturation. Riparian areas have often been considered too dry to be regulated as floodplains but not wet enough to be wetlands although they share many characteristics with wetlands and floodplains. Riparian areas are often subject to overbank flooding with greater than a 100 year flood interval. But, because rain is infrequent and runs off quickly riparian areas are often not recognized as floodplains. When flooding does occur it often causes severe flood and erosion damage to buildings and infrastructure, particularly where hillsides have been denuded by fires or grazing.
- C. Stream bed and bank erosion, stream meander. Riparian areas are often subject to** severe erosion and stream meander due to unconsolidated stream beds and banks and rapid runoff.
- D. Ecologically important functions and values.** Riparian areas are habitat for a broad variety of animal and plant species. Riparian areas are often the only vegetated areas in an arid or semi-arid landscape and therefore have particular function and value. See discussion in Appendix A.
- E. Legal “riparian rights and duties”.** Legally landowners with lands beneath and adjacent to rivers and streams have rights and duties to use waters and riparian lands consistent with the rights of other riparian owners.

### **III. Why Do Riparian Areas Need Strengthened Protection and Management?**

Riparian areas have often “fallen between the cracks” in government policy making and regulation. Governments have failed to recognize the severity of flood and erosion hazards in many such areas. For example, development has occurred on high hazard alluvial fans. Governments have also failed to recognize ecosystem services provided by riparian areas. See discussion below and in Appendix A.

More specific reasons why riparian areas need strengthened protection and management include:

1. Riparian areas are generally not regulated by community or state floodplain regulations although they are often high-risk flood areas. More than 19,000 local governments have adopted floodplain regulations in order to comply with the requirements of the National Flood Insurance Program. However these regulations often do not apply to smaller rivers and streams and adjacent floodplains and riparian areas. The floodplain regulations adopted by communities in the National Flood Insurance program also lack ecological standards for riparian areas.

2. Riparian areas are high-risk erosion areas resulting in widespread destruction of bridges, levees, groins, and commercial and residential development during flood events.
3. Nationally, much of the population growth and urban development is located in western state arid and semi- arid riparian areas. In states like Arizona and New Mexico and cities like Las Vegas, Phoenix, and Tucson, urban development is widely occurring in riparian areas.
4. Riparian areas often constitute the principal vegetation in arid and semi arid landscapes. Riparian areas are often critical habitat including habitat for rare and endangered species.
5. Riparian areas are subject to special “riparian rights and duties” and public trust responsibilities.
6. Riparian areas provide a variety of functions and values which need to be replaced if damaged or destroyed such as those described in Appendix A. For example, riparian areas often serve important pollution control functions for storm water retention and treatment and control of point and nonpoint sources of pollution. Riparian vegetation filters pollutants.

#### **Similarities Between Riparian and More Traditional Flood Areas**

- Both riparian areas and traditional flood areas are subject to flooding and/or high ground water although the flood and ground water characteristics differ.
- Both riparian areas and traditional flood areas possess similar ecological functions and values.
- Both apply similar criteria in definition and delineation:
  - Hydrology
  - Soils
  - Vegetation

#### **Differences Between Riparian and More Traditional Flood Areas**

- Riparian areas are often less frequently flooded and to lesser depths than traditional flood areas.
- Riparian areas are often characterized by moving water; traditional flood areas often have limited or no velocity.
- Erosion is often more of a problem with riparian areas in comparison with traditional flood areas.
- Riparian areas are often subject to deep sedimentation in comparison with traditional flood areas.

### **Differences between Riparian Areas and Wetlands**

- Many riparian areas do not meet criteria for wetlands; some do.
- Riparian areas are often characterized by moving water; traditional wetlands often have limited or no velocity.
- Riparian areas often have low organic content soils; wetlands high.
- Many riparian areas are infrequently flooded, or saturated; wetlands are commonly flooded.
- Riparian areas are often subject to severe erosion and sedimentation; wetlands are less so.
- Flash flooding is a common problem for many riparian areas; not so for many wetlands.
- Grazing is a common threat for riparian areas; less so for wetlands.
- Riparian areas are particularly important to protection of habitat in the Southwest although they are important habitat in other areas of the U.S. as well.

## **IV. What Are Priority Actions for Protecting/Restoring Riparian Areas?**

Some priority actions include the following:

### **A. Joint Actions**

States, local governments, federal agencies, and the private sector need to collectively build upon existing wetland, floodplain, watershed, and water quality regulations, planning programs, and habitat protection/restoration efforts.

States, local governments, federal agencies, and, others need to jointly adopt a common definition for “riparian” areas.

States, local governments and federal agencies should apply to riparian areas the no net loss functions and values standard presently applied under the Clean Water Act to wetland functions and values and the no adverse impact standard applied to floodplain areas.

States, local governments and federal agencies should apply “sequencing” requirements to permits for activities impacting riparian areas similar to those being applied to wetlands under the Clean Water Act.

States, local governments and federal agencies should apply “mitigation” requirements to alterations for riparian areas similar to those now being applied to wetlands.

The U.S. Fish and Wildlife Service, USGS and other agencies should continue to jointly develop models and other techniques for evaluating the natural, beneficial functions of riparian areas.

The U.S. Fish and Wildlife Service, USGS and other agencies should continue to jointly develop riparian area maps.

The U.S. EPA, Fish and Wildlife Service, USGS and other agencies should continue to jointly develop water quality standards for riparian areas.

States, local governments, and federal agencies should cooperatively control invasive species in riparian areas such as Salt Cedar.

States, local governments and federal agencies should reflect climate change in management policies for riparian protection and restoration areas such as setbacks for development.

States, local governments and federal agencies should work with land trusts to acquire, protect, and restore riparian zones through removal of levees, removal of drainage tiles, filling of ditches, control of invasive plant and animal species, and other approaches.

## **B. State Actions**

States should impose riparian protection conditions on their approval of Clean Water Act Section 401 permits.

States should develop and apply water quality standards including nondegradation standards for riparian areas.

States should establish riparian protection policies as part of their Wildlife Management planning efforts.

States should require building set-backs from rivers and streams as part of their comprehensive zoning, watershed management, and stormwater management regulations.

## **C. Federal Actions**

Federal agencies and Congress should clarify the definition of “Waters of the U.S.” under the Clean Waters Act by explicitly including floodplain and riparian areas.

Federal agencies should more consistently apply the Wetland and Floodplain Executive Orders in implementing public land use plans and carrying out NEPA (National Environmental Policy Act) evaluations for actions that may affect the environment.

EPA should require protection of riparian areas as part of water quality regulations under Sections 401, 402 and other sections of the Clean Water Act.

FEMA (The Federal Emergency Management Agency) should give credit to communities for protecting and restoring riparian areas as part of the flood insurance Community Rating system. This agency should also continue its “buy out” policies for areas subject to severe flood damages.

## **D. Local Actions**

Local governments should require building set-backs from rivers and streams as part of their comprehensive zoning, watershed management, or stormwater management regulations.

Local governments should amend existing floodplain and wetland ordinances to apply to riparian areas. They should also amend existing regulations to include ecological criteria for riparian areas.

Local governments should adopt special riparian protection regulations to prohibit or tightly control drainage, diking, and fills in riparian areas.

Local governments should include riparian protection as part of their floodplain management and disaster mitigation planning efforts.

Local governments should prepare and adopt greenway plans for riparian areas.

## **APPENDIX A RIPARIAN FUNCTIONS AND VALUES**

Riparian areas provide a variety of functions and values which often need to be replaced if damaged or destroyed such as the following:

### **Provide Flood Storage by Storing and Slowly Releasing Flood Waters**

**Values:** Reduce flood heights and velocities and flood damages, protect health and safety, prevent nuisances, reduce the economic impacts of flooding.

**Discussion:** Flood storage has been recognized as a riparian function for many years although there are only a small number of papers and reports dealing specifically with natural flood storage for wetlands, floodplains and riparian areas. Storage has proven difficult to evaluate on a case-by-case basis because the flood storage capability of a floodplain, riparian area or wetland depends not only upon the size, configuration, and elevation of the outlet of the riparian area, floodplain or wetland but the vertical and lateral connectivity of the drainage network with the surrounding topography. Flood storage also depends upon antecedent hydrologic and hydraulic conditions including ground and surface water levels. Further, the importance of a given amount of flood storage on downstream water levels depends upon the synchronization and desynchronization of flood flows from multiple sources reaching a particular area at a particular point in time.

### **Convey Flood Waters**

**Values:** Reduce flood heights and velocities at upstream, adjacent, and downstream points, protect health and safety, prevent nuisances, reduce economic damages and losses.

**Discussion:** Flood conveyance is a floodplain function broadly recognized in floodplain management for over 30 years. It is a function that is also subject to quantitative evaluation through "backwater models" such as HEC-RAS. The calculation of flood conveyance requires the calculation of a flood discharge (Q) and flood heights for a specific frequency of flood based upon the flood discharge, valley profile and stream valley cross section. Backwater computations can be carried out to calculate increases in flood heights which would occur if a floodplain/wetland/riparian area or portion of a floodplain/wetland/riparian area was filled, levee or otherwise blocked. Geomorphic studies may determine aggradation zones where sediment deposition (e.g., at delta areas) is creating backwater conditions and the blockage of ice flows. Documentation of this function may be particularly important in addressing "taking" issues for regulations because it is one of the few functions subject to clear "nuisance" implications and quantitative evaluation.

### **Induce Waves to Break Before Reaching Shore, Reduce Force of Water**

**Values:** Reduce wave damage, reduce water velocity, reduce threats to health and safety.

**Discussion:** Waves for a 100 year flood may add 3-15 feet or more to standing water flood elevations along major rivers, streams, lakes, and coastal areas. Waves have large kinetic energy and often not only damage but destroy houses, roads, and other structures. They can also erode foundations and pilings (resulting in building collapse), roads, lawns, parking lots, agricultural fields, etc. Large waves are generated where there is a combination of (1) high winds (particularly common in hurricanes and "northeasters" along the coast), (2) wide "fetch" (width of open water), and (3) at least moderate water depths.

Vegetated floodplains/wetlands/riparian areas can help reduce wave and erosion damage by (1) causing waves to "break" at offshore locations, and (2) binding and holding the soil. The Federal Emergency Management Agency has identified high velocity wave zones on some coastal flood hazard maps and requires protection of mangroves in local coastal floodplain regulations where mangroves reduce flood damages.

### **Reduce Erosion by Slowing Velocity of Water and by Binding Soil**

**Values:** Reduce erosion and stream meander, property losses, ecological damage, and sedimentation of lakes, streams, reservoirs, estuaries, and wetlands.

**Discussion:** A properly functioning floodplain is indicative of a stream channel in dynamic equilibrium where channel meander and slope, and subsequent erosive force of the flowing water are in balance with the sediment supply and erosion resistive qualities of the channel boundaries. An equilibrium channel is one where stream power is evenly distributed and erosion is minimized. Vegetated floodplains, riparian areas and wetlands reduce erosion in a broad range of contexts by slowing the velocity of waters and binding the soil. Sediment is deposited where water velocities are reduced, forming natural levees.



## **Recharge Ground Water**

**Values:** Maintain and enhance quantity and quality of ground water supplies for domestic, commercial, industrial, agricultural, wildlife protection and other purposes; maintain base flow of rivers and streams.

**Discussion:** In general, wetlands, riparian areas and floodplains are not recharge areas. But, some lake fringe and river fringe wetlands and riparian areas and other seasonally flooded wetlands, floodplains, and riparian areas may recharge ground water at least a portion of a year or function as both discharge and recharge areas.

## **Discharge Ground Water**

**Values:** Prevent damaging increases in ground water levels, basement flooding. Maintain floodplain/wetland/riparian and river and stream base flows.

**Discussion:** Many depressional, slope, lake, estuarine, and river fringe floodplain/wetlands/riparian areas are ground water discharge areas a portion of the year. If a floodplain/wetland/riparian areas is filled or covered with impermeable surface (e.g., a parking lot), this may block ground water discharge, increasingly ground water levels in the surrounding landscape and causing flood and saturation problems for basements, foundations, and septic tank/soil absorption fields.

## **Provide Natural Crops**

**Values:** Produce natural crops of commercial and recreational value such as cranberries, blueberries, salt marsh hay, timber, and wild rice.

## **Prevent and Treat Pollution**

**Values:** Prevent and treat pollution in rivers, streams, creeks, estuaries, coastal water, etc.

**Discussion:** Many wetlands, floodplains and riparian areas serve two related pollution control functions:

1. Prevent pollution from entering water bodies. Riparian areas, wetlands and broader floodplains intercept and trap debris, toxics, nutrients, and other pollutants which would otherwise reach water bodies from upland sources by slowing the velocity of water, causing sediment to drop out, and providing an opportunity for chemical break down of pollutants.
2. Treat (remove) pollution in water bodies. Wetlands, riparian areas, and some frequently flooded floodplain areas may also remove pollutants which have already reached water bodies by causing further chemical transformations.

### **Provide Habitat for Fish and Shellfish**

**Values:** Provide fish and shellfish for commercial fisheries, food, recreational fishing, and food chain support for other wildlife.

**Discussion:** The importance of coastal and estuarine wetlands, floodplains, and riparian areas to fish and shellfish are two of the most broadly recognized wetland, riparian area and floodplain functions/values. The importance of freshwater wetlands, and riparian areas to northern pike spawning and other fish is well-recognized. Riverine and other periodically flooded floodplain areas provide fish habitat and food sources. Storage of sediment and woody materials in stream channels maintains important fish habitat. Vegetated riparian areas reduce erosive scour.

### **Provide Habitat for Amphibian, Reptile, Mammal and Insect Species**

**Values:** Provide biodiversity in landscape, protect rare and endangered species, provide research and educational opportunities.

**Discussion:** Riparian areas, wetlands and broader floodplains provide critical habitat for a broad array of amphibian, reptile, mammal, and insect species. Functions/values depend not only upon floodplain and riparian characteristics but relationship to uplands, wetlands and floodplains, and open water bodies because most amphibians, mammals, and reptiles spend a portion of their time in wetlands, floodplains, and riparian areas.

### **Provide Habitat For Waterfowl**

(Note, this overlaps with other types of habitat.)

**Values:** Provide hunting opportunities, food sources for people, bird watching.

**Discussion:** Waterfowl nesting, resting and feeding were some of the first, widely recognized functions of riparian areas, wetlands, and floodplains. The prairie pothole wetlands and other wetlands and riparian areas in various "flyways" are particularly important. Because waterfowl can fly from wetland to wetland and riparian area to riparian area, waterfowl can make use of many types of isolated and semi-isolated wetlands, riparian areas, and floodplain areas.

### **Provide Habitat for Various Song Birds, Other Nongame Birds**

(Note, this overlaps with other types of habitat but has been set forth separately because "birding" and ecotourism have become such important services in some areas of the country.)

**Values:** Provide ecotourism opportunities, recreation, education, research.

**Discussion:** Bird watching has become a widespread activity in the last 20 years with bird watchers now outnumbering hunters in some areas. Bird watching is important in many local economics. A great deal of bird watching takes place in riparian areas due to the large numbers of nongame upland species which feed and nest in these areas.

### **Provide Habitat for Endangered or Threatened Species of Plants and Animals**

(Note, this overlaps with other habitat categories but has been set forth separately because of the high incidence of endangered species in riparian areas.)

**Values:** Provide heritage values, protect gene pools, provide ecotourism, provide bird and animal watching, research, education.

**Discussion:** An estimated 35-80% of endangered or threatened plant or animal species live in or are dependent upon wetlands and riparian areas. An even high percentage of threatened plant and animal species in arid or semi-arid regions live in riparian areas. Some animal species spend their entire lives in wetlands, riparian areas, or broader floodplains. However, most occupy wetlands or riparian areas only a portion of the time. Therefore adjacency of upland and deep water habitat and the connections between floodplains and these other habitats are important. Connections are also important to provide refuge during droughts and periods of fluctuating water levels. Because of the sensitivity of many of these species and their narrow ecological niches, it is particularly important to protect broader water regimes and adjacent upland habitat.

### **Sequester Carbon; Maintain Carbon Stores**

**Values:** Some riparian areas sequester carbon, help maintain carbon stores, reduce climate change.

**Discussion:** Wetlands, riparian areas, and some floodplains store large amounts of carbon and continue to sequester carbon.

### **Modify Micro-Climate by Cooling the Air or Preventing Temperature Rises**

**Values:** Riparian areas cool the air in urban area thereby reducing health problems, the costs of air conditioning.

**Discussion:** Riparian areas along with other open spaces moderate temperatures and increase air circulation.

### **Provide Recreation And Ecotourism Opportunities And Experiences**

**Values:** Provide recreation, promote health, provide ecotourism opportunities, provide economic benefits.

**Discussion:** Recreation is among the most important functions of riparian/wetlands/floodplains areas. It includes both water-based recreation such as fishing, canoeing, boating (in some instances) and land-based recreation such as bird watching, nature watching, jogging along trails, etc.

## **Provide Historical, Archaeological, Heritage, and Aesthetic Opportunities and Experiences**

**Values:** Provide heritage, cultural, educational, research, tourism, and aesthetic functions and values.

**Discussion:** Some wetlands, floodplains, and riparian areas have important historical or archaeological value. Well known examples include the confluence of the Mississippi River and the Missouri where Lewis and Clark began their westward journeys, the Concord Marshes, and the Everglades. Many others have heritage and cultural value for biodiversity, rare and endangered species, and open space.

## **Provide Education and Interpretation Opportunities**

**Values:** Educate students at all levels.

**Discussion:** Many types of education and nature "interpretation" are carried out in riparian areas, wetlands and floodplains at K-12, college and adult education levels. These range from observation of frogs and birds to sophisticated restoration projects by university faculty and students. Many trails and boardwalks and interpretative centers have been constructed in or adjacent to riparian/wetland/floodplain areas.

## **Provide Scientific Research Opportunities**

**Values:** Advance scientific knowledge; improve understanding of natural systems; educate students at all levels.

**Discussion:** Scientific research is carried out in rivers and streams, floodplains, wetlands, and riparian areas by schools, universities, resource agencies, and not-for-profit organizations.