

Part 6. Protect Natural Floodplain Functions

- **Floodplain Natural Resources and Functions**

Chapter 8

Floodplain Natural Resources and Functions

Chapter Overview

Undeveloped floodplain land provides many natural resources and functions of considerable economic, social, and environmental value. Nevertheless, these and other benefits are often overlooked when local land-use decisions are made. Floodplains often contain wetlands and other important ecological areas as part of a total functioning system that impacts directly on the quality of the local environment. The goal of this chapter is to aid in the understanding of floodplain natural resources and functions. The next chapter examines strategies and tools to preserve and/or restore these resources.

Introduction

Many of the nation's most prominent landscape characteristics, including many of our most valuable natural and cultural resources, are associated with floodplains. These resources include wetlands, fertile soils, rare and endangered plants and animals, and sites of archaeological and historical significance. Floodplains have been shaped, and continue to be shaped, by dynamic physical and biological processes driven by climate, the hydrologic cycle, erosion and deposition, extreme natural events, and other forces. The movement of water through ground and surface systems, floodplains, wetlands and watersheds is perhaps the greatest indicator of the interaction of natural processes in the environment.

These natural processes influence human activities and are, in turn, affected by our activities. They represent important natural functions and beneficial resources and provide both opportunities and limitations for particular uses and activities. *Traditionally, while much attention has been focused on the hazards associated with flooding and floodplains, less attention has been directed toward the natural and cultural resources of floodplains or to evaluation of the full social and economic returns from floodplain use.* In recent decades, the natural resources associated with floodplains – particularly wetlands – have been the subject of increased scientific study and management.

Surface water, ground water, floodplains, wetlands and other features do not function as separate and isolated components of the watershed, but rather as a single, integrated natural system. Disruption of any one part of this system can have long-term and far-reaching consequences on the functioning of the entire system. In the past, lack of understanding of the overall natural system and its component processes contributed to significant alteration of the natural functions of floodplains, and in many cases to the degradation and destruction of these resources.

Floodplain resources, including wetlands and agricultural lands, are experiencing increasing pressure for use and development – for highways, for residential and commercial building sites, and for other urban uses. In response to these development pressures, knowledge and information regarding the natural resources, processes and functions of floodplains can contribute to assessments of the ecological, economic and social impacts on further floodplain development. This knowledge and information can help to protect and better utilize the benefits and values these resources provide. Improved knowledge and information about the natural resources of floodplains can be used to differentiate between lands that should remain in their natural condition, lands that can accommodate certain uses but not others, and lands that are most suitable for development.

The natural and cultural values associated with floodplain resources can be categorized in a variety of ways. Floodplain values can be thought of in terms of environmental quality values such as fish and wildlife habitat and water quality. They can also be thought of in terms of socioeconomic values, which are more easily understood by some because these values provide either dollar savings (related to flood and storm damage protection, for example) or financial profit (related to increased production from floodplain use).

A document initially prepared by the U.S. Water Resources Council in 1979 titled *A Unified National Program for Floodplain Management* divides riverine and coastal floodplain resources into three categories: 1) water resources, 2) living resources (habitat), and 3) cultural resources. Figure 8-1 provides a listing of specific resources associated with each category. The division between these three categories of resources – particularly between water resources and living resources – is somewhat arbitrary. These resources are closely related and interwoven, and are often of a synergistic nature. They are described below.

Water Resources

Natural Flood & Erosion Control

- Provide flood storage and conveyance
- Reduce flood velocities
- Reduce flood peaks
- Reduce sedimentation

Surface Water Quality Maintenance

- Filter nutrients and impurities from runoff
- Process organic wastes
- Moderate temperature of water

Groundwater Recharge

- Promote infiltration and aquifer recharge
- Reduce frequency and duration of low surface flows

Biologic Resources

Biological Productivity

- Support high rate of plant growth
- Maintain biodiversity
- Maintain integrity of ecosystem

Fish and Wildlife Habitats

- Provide breeding and feeding grounds
- Create and enhance waterfowl habitat
- Protect habitats for rare and endangered species

Societal Resources

Harvest of Wild & Cultivated Products

- Enhance agricultural lands
- Provide sites for aquaculture
- Restore and enhance forest lands

Recreational Opportunities

- Provide areas for active and passive uses
- Provide open space
- Provide aesthetic pleasure

Areas for Scientific Study and Outdoor Education

- Contain cultural resources (historic and archaeological sites)
- Provide opportunities for environmental and other studies

A Unified National Program for Floodplain Management, 1994, p. 41

Figure 8-1. Natural Resources of Floodplains

Not all floodplains contain the same natural resources, and efforts to protect the natural functions of floodplains have not always given equal weight and attention to all of the resources. While categories of values, like categories of resources, are useful to keep in mind for discussion

purposes, the values of floodplain resources are closely related. Information regarding the extent of these values seldom fits neatly into specific categories.

Natural and Beneficial Floodplain Resources and Functions

Floodplains that are relatively undisturbed (or have been restored to a nearly natural state) provide a wide range of benefits to both human and natural systems. These benefits take many forms: some are static conditions (such as providing aesthetic pleasure) and some are active processes (like filtering nutrients). There is some ambiguity over which of these benefits are properly termed “functions,” which are “resources,” and where the terms overlap. A fairly well accepted (but not necessarily comprehensive) list and descriptions follows. The resources and functions have been loosely grouped into three categories, and the categories have been labeled according to the primary recipient of the benefit or its relationship to a larger system. “Water resources” include those resources and functions of floodplains that are part of or provide a benefit to the hydrologic cycles on the earth’s surface and sub-surface, including natural moderation of floods, water quality maintenance, and groundwater recharge.

“Biologic resources” are floodplain resources and functions that benefit large and diverse populations of plants and animals. “Societal resources” are floodplain resources and functions that directly benefit human society, including historical, archeological, scientific, recreational, and esthetic sites, in addition to sites generally highly productive for agriculture, aquaculture, and forestry where these uses are compatible with natural systems.



Photograph of undisturbed watercourse.

Water Resources

Natural Flood Storage and Erosion Control

The characteristics of the floodplain and of flooding are closely interdependent. Floods shape floodplain topography and soils and influence ecology. In turn, the physical characteristics of the floodplain shape flood flows. Except in narrow, steep valleys and areas of coastal bluffs, floodplains provide a broad area to spread out and temporarily store floodwaters. This reduces flood peaks and velocities and the potential for erosion. Flood storage is particularly important in urbanizing areas where even small floods resulting from a 5- or 10-year storm can cause severe flood damage. One acre of floodplain land flooded one foot deep holds 330,000 gallons of water.

In their natural vegetated state, floodplains slow the rate at which the incoming overland flow reaches the main water body. Vegetation also reduces shoreline erosion. In coastal areas, beaches, bars, dunes, and wetlands act as natural barriers to dissipate waves and protect back-lying areas from flooding and erosion.

Water Quality Maintenance

Floodplains serve important functions in protecting the physical, biological, and chemical integrity of water. Water that runs off quickly over the surface, as over a barren floodplain, is capable of carrying with it large amounts of sediment and debris to the main water body. A vegetated

floodplain, however, slows the surface runoff, causing it to drop most of its sediment load on the floodplain. Vegetation also filters incoming floodwaters. Much of the sediment originating on the land drops out, as well as some of that scoured from the channel bank and bed. This filtering process may add rich nutrients to the floodplain soil. Another example of water quality maintenance is the beneficial shading effect of riparian (streambank) vegetation, which helps to avoid temperature stress on natural biota. Natural floodplain systems can further serve to reduce or avoid the environmental and economic costs associated with wastewater treatment and water quality maintenance.



Photograph of stream vegetative buffers.

Groundwater Recharge

The natural floodplain has surface conditions favoring local ponding and flood detention, plus subsurface conditions favoring infiltration and storage. The slowing of runoff across the floodplain allows additional time for the runoff to infiltrate and recharge available groundwater aquifers, when there is unused storage capacity. The slowing of runoff provides the additional benefit of natural purification of water as local runoff or overbank floodwater infiltrates through the floodplain alluvium. Natural purification comes from filtration, ion exchange, adsorption, absorption, and aerobic and anaerobic biological action.

This value extends into non-flood periods as groundwater discharge acts to naturally regulate the flow in a river or the level of a lake or pond. In other words, during periods of abundant water, the water can enter the groundwater system whenever there is available capacity rather than contribute to seasonal flood peaks. During low flow periods, the water flows from the higher groundwater system into lower surface waters, so that the frequency and duration of extremely low flows is reduced.

Biological Resources

Biological Productivity

The nation's coastal and riverine floodplains support large and diverse populations of plants and animals. In addition, they provide habitat and critical sources of energy and nutrients for organisms in adjacent and downstream terrestrial and aquatic ecosystems. The wide variety of plants and animals supported directly or indirectly by floodplains constitutes an extremely valuable, renewable resource important to economic welfare, enjoyment, and physical well-being. The variety of floodplains and associated wetlands across the country create habitat for many forms of fish and wildlife. Many spend their entire lives in floodplain wetlands.



Photograph of floodplain flora.

The floodplain is biologically important because it is the place where land and water meet and the elements of both terrestrial and aquatic ecosystems mix. Riparian floodplain ecosystems are distinct associations of soil, flora and fauna occurring along a river, stream, or other body of water and depend for survival upon high water tables and occasional flooding. They are generally more biologically diverse than surrounding uplands. Bottomland hardwood forests are the major types of riparian ecosystems found in the United States, covering large areas of the Southeast, around 30 million acres.



Photograph of biological resources.

The detritus provided by headwater woodlands frequently provides the major source of nutrients and energy that sustain production in woodland streams. Nutrients and energy that enter these upstream areas find their way far downstream into larger rivers and lakes via the aquatic food chain. Shading of the stream by floodplain vegetation moderates water temperatures; roots and fallen trees provide instream habitat, and near stream vegetation filters runoff, removing harmful sediments and buffering pollutants, to further enhance in-stream environments.

Coastal floodplains are widely recognized for their importance to many estuarine and marine fisheries. Here also floodplains, both riverine and coastal, provide much of the nutrients and energy for aquatic estuarine environments. Estuarine wetlands serve as breeding, nursery, and feeding grounds for estuarine and marine fisheries, and coastal floodplains are extremely important to waterfowl, furbearers, and other wildlife species.



Photograph of coastal resources.

Fish and Wildlife Habitats

Due to the abundance of water and vegetation, floodplains provide wetland, riparian and other habitat (including shelter and food sources) for large and diverse populations of fish and wildlife species. Floodplain wetlands, for example, are major sources of food and breeding habitat for both saltwater and freshwater fisheries and for many types of wildlife. Floodplains are especially important and productive sources of energy and nutrients in large part because they contain the elements of both terrestrial and aquatic ecosystems. The fish and wildlife resources supported directly and indirectly by floodplains represent a renewable resource of great economic importance to the states and the nation.

The variety of floodplains and associated wetlands across the country create habitat for many forms of fish and wildlife. Numerous fish and wildlife species depend on marshes and swamps for feeding or feed on organisms produced in wetlands, and many animals visit wetlands for drinking water. Wetlands are also crucial for the survival of numerous endangered species such as the American crocodile, the manatee, and the whooping crane, as well as numerous species of plants.



Photograph of coastal fauna.

Coastal barriers and associated wetlands and near-shore waters are especially important in maintaining the natural productivity of the coastal environment and provide invaluable habitat for fish and wildlife. The estuaries and bays protected by coastal barriers are among the most valuable and productive of all ecosystems.

Freshwater fishes also find wetlands important for survival. Wetland vegetation along rivers is important to fishes in many ways, including providing cover, shade for water temperature regulation, and food for aquatic insects that are eaten by fishes.

Floodplains and wetlands provide important habitat for waterfowl and other birds. Floodplain wetlands are crucial for the existence of many birds, ranging from waterfowl and shorebirds to songbirds. Some spend their entire lives in wetland environments, while others primarily use wetlands for nesting, feeding or resting. In addition to providing year-round habitats for resident birds, coastal and inland wetlands are especially important as breeding grounds, over-wintering areas and feeding grounds for migratory waterfowl and numerous other birds.

Societal Resources

Harvest of Products

Floodplains provide an excellent resource base for agricultural, aquacultural, and forest production. However, the flood risk must be considered for these uses and operations adjusted accordingly. The natural processes of sediment transport and deposition tend to replenish floodplain soils with nutrients. Agricultural operations are made easier by gently rolling terrain, and surface and groundwater supplies are more readily available. Aquacultural operations have grown into a viable industry producing a wide variety of aquatic crops. Bottomland hardwoods and associated species, which flourish in close proximity to water, are important to the timber industry and the overall economy of the country.

Recreational Opportunities

Because of their scenic value and locational and other beneficial characteristics, some of which are unique, floodplains are attractive for recreation. Water-oriented sports, boating, and swimming can be based in a natural floodplain park which also may be suitable for hiking and camping. Floodplain wildlife resources can be managed for observation as well as for recreational hunting and fishing. Natural floodplains are valued as constituents of the “wilderness experience” important in the American culture.



Photograph of river corridor recreation.

Areas for Scientific Study and Outdoor Education

Finally, floodplains contain cultural resources important to the nation and to individual localities. Native American settlements and early cities of European settlers located along the coasts and rivers in order to have access to water supply, waste disposal, water transportation, and transshipment. Consequently, floodplains include most of the nation’s earliest archeological and historical sites. In addition to their historical richness, floodplains may contain invaluable resources for scientific research. For example, where floodplains contain unique ecological habitats, they make excellent areas for scientific study. The bedrock geology of the area may also be exposed in the floodplain.