

## **Natural and Beneficial Floodplain Functions: Floodplain Management More than Flood Loss Reduction**

Derived from a White Paper for ASFPM by David Fowler and Jacquelyn Monday

With the passage of the National Environmental Policy Act over three decades ago, the United States established a foundation for protecting the environment amidst human development. In Section 101 of the Act, Congress declared that

. . . it is the continuing policy of the Federal Government, in cooperation with State and local governments, and other concerned public and private organizations, to use all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans.

However, the reality is that we seldom achieve this “productive harmony” with regard to our rivers, streams, wetlands, and coastal lowlands. As we move into the new century, we face hard choices about our riverine and coastal floodplains<sup>1</sup>. Relatively unfettered economic development, with only a token allowance made for floodplain functions and resources, cannot continue as the status quo. Instead, we need to strike a balance between development and the benefits that would be realized if we were to protect the natural functions of floodplains and coastal areas.

Current floodplain management in this country has twin goals: (1) flood loss reduction, and (2) the conservation and protection of the natural and beneficial functions of our water resources. Although considerable effort has been expended on the first goal (with mixed success), the second has received only minor consideration. Until recently, activities that protected or improved the natural and beneficial uses of floodplains usually were only planned or executed as afterthoughts, or were included in a project only because of a regulatory requirement to mitigate the environmental impacts of another project. The restoration or rehabilitation of a waterway, coastline, or its related resources was rarely considered a project worthy of funding or of being undertaken on its own merits.

Amid significant alteration of our major waterways to optimize commercial benefits and in the name of flood “control,” flood losses have continued to rise each year. At the same time, environmental degradation, particularly of water-related resources, has increased, and anticipated changes in climate bring the potential for significant alteration of existing coastal areas, flood regimes, and already fragile ecosystems. We need to marshal unprecedented forces to preserve and improve the natural functionality of our floodplains and coastal areas and protect the resources they provide. In doing so, we will also mitigate damage and losses that floods bring to society.

This need is urgent. In the next 20 years the U.S. population is predicted to increase by 80-90 million people, a huge increase over the current 300 million. The added population will increase pressure to continue to allow development adjacent to the nation’s water resources. Paradoxically, that population will still expect the nation’s flood risk to be minimized and will demand additional open spaces and natural areas. We need to remember that we have a choice not to occupy our river floodplains and coastal areas and that, if we choose to do so, there is a very real cost associated with the degradation of these water resources—a degradation that is the inevitable byproduct of our occupation of these areas.

Management of floodprone areas has for too long been development-centered. The typical strategy has been to confine the waterway or water body to a predefined size and capacity that maximizes the extent of developable or agricultural land and also keeps the flood water away from people and their property. Under such a framework, the floodplain served a singular, human-centered role as a conveyance network to pass the “excess” water as quickly as possible, with no consideration of the loss of ecological function, the potential damage to downstream property owners, or the cultural, economic, or environmental effects of that strategy. Further, floodplains have been viewed as suitable sites for human development; the concern, if any, has been to ensure that structures built there are elevated above some minimal flood level, so they are considered “safe,” and also to insure them. In coastal areas, the typical approach has been to place development,

especially residences, as close to the water as possible and then, if necessary, to use structural measures to prevent the beach from migrating away.

In many cases, the communities responsible for these decisions about growth, development, and flood protection possess a minimal understanding of the natural processes that take place in riverine and coastal areas and lack adequate tools to deal with the flooding issues they face. Floodplain management decisions often are made outside of the context of regional or watershed-level planning and without appreciation of the complexities of the water-based ecosystem. Hence, as recent flood disasters and their aftermath have indicated, communities often respond to such disasters by applying more of the same techniques that caused or exacerbated the problem in the first place. Increasing flood losses and environmental degradation have made it clear that the floodplain cannot be viewed simply as a conveyance channel to keep water away from people. Nor can we continue to implement flood damage reduction measures without considering impacts to riparian and coastal ecosystems.

Flooding is a natural process that forms and maintains floodplains and coastal zones. Periodic flows of water that overtop the banks of a river and that encroach upon coastal areas are the lifeblood of the riparian corridors, marshes, beaches, and other natural areas. The seasonal variability of flow, incessant wave action, and intermittent extreme events all combine to determine both the physical structure and the biological diversity of floodprone areas. Successful, sustainable flood hazard reduction solutions need to be based on the forces at work in floodplains and coastal zones and also on the resources that these floodprone areas provide. These processes and attributes can be categorized as (1) hydrologic and hydraulic processes, (2) geomorphic processes, and (3) biologic processes. These processes have interrelated functions, which in their natural state provide numerous resources and benefits to society.

Flooding from hurricanes and storms is the key process in providing such tangible benefits as increased soil fertility, wetland creation, rejuvenation of spawning gravel, creation of barrier islands, promotion of aquatic habitat, transportation of large woody material that provides fish habitat and bank stability, promotion of plant establishment, and the evolution of channels and shoreline features such as dunes. These resources are described in detail in numerous documents, notably *A Unified Program for Floodplain Management* (Federal Interagency Floodplain Management Task Force, 1994) and *The Natural & Beneficial Functions of Floodplains* (Task Force on the Natural and Beneficial Functions of the Floodplain, 2002).

Naturally functioning riparian and coastal areas are the product of a tightly interconnected system of all of the Hydraulic, Geomorphic and Biological processes. The ecosystems sustain themselves by means of these ongoing processes. Human activity, especially urbanization and alteration of the flooding process as a means of controlling and/or storing water, interrupts these natural processes and thus disturbs the functions and overall health of the ecosystem. Attempts to transport runoff and flood waters efficiently through the watershed, we have used structural interventions (such as concrete lining, revetments, floodwalls, jetties, diversions, and dams and reservoirs) that interrupt or modify natural hydrologic, hydraulic, geomorphic, and biologic processes. The ground surface and natural vegetation are disturbed during construction. The structures change the natural movement of water in one or more ways such as altering the speed, restricting movement across the floodplain, and changing sediment loads. Floodwalls and levees increase flow discharge and elevation when they constrict high flows into a narrow path. Land use policies that allow encroachment into the floodplain can cause dramatic channel migration downstream. Changing the frequency of floodplain inundation can encourage invasive species to supplant the native vegetation. Most riparian and coastal animal species are specifically adapted to the flow patterns and other characteristics of their native habitat. This makes them vulnerable to disruptions in the flow and water levels.

Expanding in-stream storage to minimize flooding can result in reduced downstream flows. This reduction can, in turn, cause severe channel aggradation as the floodway fills with sediment. The result can be a cascade of impacts as tributary channels begin to fill in with sediment. In fact, the natural channel can be buried, reducing habitat diversity and eventually result in increased flood elevations as sediment accumulates and the channel's capacity is diminished.

If human activity for development or flood protection constricts or expands the channel, nearshore area, or floodplain, the sediment transport dynamics are altered. This can cause sediment to accumulate in unanticipated places, or the bed or offshore zone can be scoured. In either case, the channel bed and banks

can be destabilized rapidly both up- and downstream. For example, a new home may be constructed on a large meander with bank stabilization to protect it from erosion. In future years, increased lateral migration of the channel caused by that stabilization causes problems for existing structures downstream. The owners of those structures then take similar action to stabilize those streambanks, and so on. Such channel alterations march downstream, with individual homeowners exhibiting little understanding of—or having been given little guidance on—the overall impacts of their actions on channel dynamics or on the watershed. This results in the slow and almost imperceptible destabilization of a watershed, and loss of natural function—death by a thousand tiny impacts.

All of these activities in pursuit of development, urbanization, and flood protection have yielded specific, usually localized economic and social benefits, but the long-term impacts have placed both humans and nature at higher risk. Further, they have proved counterproductive, resulting in a system of “reactive” engineering through which the symptoms of the problem are treated at great expense while the underlying causes are not addressed and flood losses continue to rise.

After decades of using these approaches and failing to acknowledge the natural and beneficial functions and values of floodplains, we have destroyed a large proportion of our wetlands, deprived our river deltas of sediments needed to maintain marshes, prevented nutrient-rich flood water from reaching adjacent lands to replenish the soils, interrupted the protective functions of coastal barriers, and contributed to declines in water quality. We now realize that those wetlands, soils, marshes, unspoiled waterways, and related resources and their functions are crucial components of ecosystems vital to human life but which we had been taking for granted.

### **Solutions and Recommendations**

As pressures mount to utilize floodplains and coastal areas, it is imperative that we eliminate the attitude that it is acceptable to obtain short-term reductions in flood risk and/or short-term economic gains by shifting those costs to future generations or causing adverse environmental impacts. We need to replace this thought process with a new focus on ensuring the long-term environmental and economic sustainability of our floodplain ecosystems. In this context, we have presented below some suggestions for an overall policy change, more specific recommendations can be found in the full paper on the ASFPM Website..

To begin, we need to modify the widespread view of floods as destructive forces of nature. Floods do not cause damage or suffering. Our decisions about where to live, work, and play are the cause. By anticipating the flooding process and planning our development accordingly, we can begin to effect change. Instead of controlling the water, we should control how and where we allow human activities to adversely affect it. The recommendations below reflect this paradigm for managing our nation’s floodplains and flood risk.

In order to regain the sustainability of our water-based ecosystems and resources, we must adopt a new approach to floodplain management. The ASFPM sees this as a five-pronged strategy.

- (1) Set a policy that the natural functions and resources of floodprone areas are worthy of protection and should not be sacrificed for human development.
- (2) Prevent new development from encroaching on floodprone and environmentally sensitive areas.
- (3) Remove existing development from floodprone and environmentally sensitive areas whenever possible.
- (4) Rehabilitate and restore degraded riparian and coastal resources.
- (5) Incorporate into all public and private activities at all levels a respect for and understanding of the functions and resources of floodprone areas along our coasts and waterways.