The Nation's Responses To Flood Disasters: A Historical Account

A report by the Association of State Floodplain Managers

Written by James M. Wright
April 2000

Edited by Wendy L. Hessler

Cover photo provided by Paul Osman --
Illinois River Levee Failure, 1993

The floodplain management community is homogeneous and multi-faceted. The one thing that binds us together is our history.

James M. Wright

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PREFACE

One will only have to read a few pages of the following text to realize that a professional historian did not prepare it. Encouraged by Gilbert F. White and with support from the Compton Foundation, this report was prepared by a water resources engineer with a long interest in our nation's responses to flood disasters. It expands on my previous reports about floodplain management history in the United States that I wrote to understand what happened before I became involved in the field during the late 1960s.

The goal of this undertaking was to produce a balanced and accurate account of the forces and events that have changed floodplain management in the United States during the past 150 years. While I view it as a reasonably accurate portrayal of what happened, it is not balanced. It does not give adequate credit to non-federal contributions. It does not adequately document the overall impacts of the National Flood Insurance Program. My contacts and sources revealed that usable or readily available information about these subjects has not been compiled. A number of other subjects may also not be adequately treated.

Each chapter represents a specific time period that reflects certain broad policy and management trends. The quotes highlighting each chapter are passages from the text that I felt captured the essence and overall direction of the eras covered.

No historical description could ever be considered complete. Further inquiry and research will always reveal additional information that should be included. In this instance, the project was completed during a short time with limited resources.

The following report is not an exhaustive account of what has happened, but rather a starting point. I hope that others, particularly professional historians, will take it, correct historical inaccuracies, and build on this work. All responsibility for the facts, interpretations, and conclusions in this document rests with the author.

I have immensely enjoyed being part of the floodplain management community for more than 30 years and hope to continue to be actively involved well into the 21st century.

James M. Wright
Knoxville, Tennessee
April 2000

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I also wish to thank the following distinguished individuals who reviewed a draft of the document. All of them have contributed in numerous ways, during a period of decades, to shaping our nation's history of dealing with floods. Their comments greatly contributed to improving the accuracy and content of the present work.

- Gerald E. Galloway, Jr., Secretary, U.S. Section, International Joint Commission; Brigadier General, U.S. Army Retired; former Dean, U.S. Military Academy.
- Larry A. Larson, P.E., Executive Director, Association of State Floodplain Managers.
- Martin Reuss, Senior Historian, Office of History, U.S. Army Corps of Engineers, Ft. Belvoir, VA.
- Michael Robinson, Federal Emergency Management Agency, Washington, DC.
- Frank Thomas, Mitigation Consultant; former Deputy Associate Director, Mitigation Directorate, Federal Emergency Management Agency, Washington, DC.
- Gilbert F. White, Distinguished Service Professor Emeritus of Geography, University of Colorado, Boulder.

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OVERVIEW

The floods of the 1990s and preceding years became sobering reminders of work yet to be done to further reduce the nation's vulnerability to extreme natural events.

Approaches to dealing with floods in the United States changed dramatically during the 20th century. Damage reduction efforts initially centered on structural measures to control flooding. However, changing needs, values, and priorities resulted in new approaches to adjust future development and modify flood risk. The environment became a value in itself. During the last 30 years of the 20th century, the nation significantly progressed in applying new mitigation measures to reduce economic and environmental losses.

The floods of the 1990s and preceding years became sobering reminders of work yet to be done to further reduce the nation's vulnerability to extreme natural events. These disasters heightened the debate about appropriate uses of vulnerable areas, about governmental programs (particularly federal) rewarding inappropriate behavior, and about the fair obligation of floodplain inhabitants to pay the full price for assumed risk.

The nation is entering a new era in hazards and emergency management—one in which a comprehensive multi-hazard approach, a strong emphasis on mitigation, and an increased use of technological advances play leading roles. This shift requires new approaches to managing the nation's floodplains, redefining national policies, and adjusting existing programs. The changes in policy and practice will likely require a transformation in national values regarding the current balance of individual and community property rights. Such change happens slowly, making this evolution a long-term issue.

This document examines the forces and events that have shaped floodplain management policy and practice. One major result of past influences was the merging of flood control, disaster assistance, and resource protection programs. Future concerns lay in needed policy changes suggested by a number of floodplain and natural hazard response assessments conducted during the 1990s. Floods continue to teach us about the need for fundamental policy changes in disaster response, recovery, and mitigation and for long-term floodplain management. Because policy changes during the last decades of the 20th century were largely the result of agency initiatives, the outlook for significant Congressional actions going into the 21st century are not promising for either providing overall direction on national flood policy or in coordinating federal programs and policies. If the conjunction of major natural disasters and an impressive array of

assessments and policy analysis documents placed before the public and Congress during the 1990s have yielded little results, what will trigger national policy changes in the future?

1

PRE-20TH CENTURY: ISSUES OF FEDERAL AUTHORITY AND RESPONSIBILITY

A battle was raging. A battle to widen the responsibilities of the federal government to encompass…the flood problems within the lower Mississippi Valley.

THE GENESIS OF A PROBLEM

Water draws people to it. Native Americans established villages along rivers. European colonists built homes along streams that provided transportation, water, power, waste disposal, and commercial links. Succeeding generations continued to settle along America's waterways, risking periodic floods for the opportunity and convenience that came with easy access to water.

And floods did come. These natural phenomena occur when water runoff from the land exceeds the capacity of the stream channel. Floodwaters replenish soils, recharge groundwater, and maintain wetlands. They became an economic and political problem only when humans occupy space that streams require for their own natural flood patterns. Both history and myth record innumerable floods. Our reactions to those floods help define our humanity.

Perhaps members of Hernando De Soto's expedition in 1543 observed the earliest, large recorded flood along the Mississippi River. The Spanish adventurers witnessed and noted an awesome event that had shaped the lives of local Indians for centuries—one that would profoundly affect future generations of settlers. They also saw something as significant as the flood itself. The Indians, they wrote, "built their houses on the high land, and where there is none, they raise mounds by hand and here they take refuge from the great flood."[1] Approaches and programs for dealing with floods in the

1 Clark C. and others, Planet Earth, FLOOD, (Alexandria, VA: Time-Life Books, 1982), pp. 65-87.

United States have continuously evolved since these primitive levees were erected to protect an early people from the ravages of the river. Federal authority and responsibility for flood control was mainly battled over the nation's greatest flood problem: the lower Mississippi River's overflow into its vast and rich alluvial valley.

The modern flood problem began when the French Crown built a fortified shipping center near the mouth of the Mississippi River. They chose this location because the waterway offered a superb avenue of transportation to the Gulf of Mexico. By 1727, Nouvelle Orleans, the first permanent European settlement on the Mississippi, existed in a saucer of land that actually was lower than the mighty river and was guarded from periodic inundation by an embankment only 4 feet high. In this manner, civilization and attempts at flood control came concurrently to the lower Mississippi Valley. The rich and immense valley became an important national agricultural resource, served by cities that thrived on river commerce. A patchwork system of levees kept pace with the growth of population and development of the floodprone delta.

GROWING FEDERAL GOVERNMENT INVOLVEMENT

Early in the 19th century, debates over federal involvement in carrying out flood control measures erupted. While the Constitution did not specifically prohibit federal funding of "internal improvements," it did not categorically authorize them either. Those wishing for a national road system and federally funded navigation improvements on the nation's rivers focused on Article I, Section 8 of the Constitution. The so-called Commerce Clause gave Congress authority "to regulate commerce…among the several states." Supporters of internal improvements argued that the right to regulate commerce meant the right to facilitate or aid in its movement by funding road and river navigation projects. President Madison, in 1817, and President Monroe, in 1822, both disagreed, and both vetoed federal transportation bills. The issue was hotly debated until 1824, when, in the landmark decision of *Gibbons* v. *Ogden*, the Supreme Court construed the Commerce Clause to permit the federal government to finance and construct river improvements.[2] Within two months, Congress had appropriated funds and authorized the U.S. Army Corps of Engineers (the Corps) to remove certain navigation obstructions from the Ohio and Mississippi rivers.

But a battle was raging. A battle to widen the responsibilities of the federal government to encompass other internal improvements, such as canals and roads. The fight included the flood problems within the Lower Mississippi Valley. After more than a century of individual, group, and state efforts to confine the great river, the Valley's inhabitants realized that the nation must help with flood control. Agitation for federal help began in the late 1820s and continued into the 1830s, but a parsimonious Congress,

2 Arnold, Joseph L., The Evolution of the 1936 Flood Control Act, (Fort Belvoir, VA: Office of History, U.S. Army Corps of Engineers, 1988), p. 4.

aware of the large costs for flood control, refused to allocate funds. River conventions in the 1840s rekindled the agitation.

Large floods in the lower delta during 1849 and 1850 finally moved Congress to action. Passed partially in response to these floods, the Swamp Land Acts of 1849 and 1850 transferred "swamp and overflow land" from federal hands to most state governments along the lower Mississippi River on condition that the states use revenue from the land sales to build levees and drainage channels. The acts required no federal funds, but they provided a means of putting millions of acres of land into agricultural use, ultimately exacerbating the flood problem.

Aside from passage of the Swamp Land Acts, the federal response to flood control was relatively modest. However, one act, passed in 1850, had an unforeseen and substantial impact on employment of future flood control measures. The act appropriated $50,000 for a "topographical and hydrographical survey of the Delta of the Mississippi, with such investigations as may lead to determine the most practicable plan for securing it from inundation." The appropriation was eventually split in order to fund two separate surveys.[3]

Two sharply disagreeing reports were produced.[4] The first, by Charles S. Ellet, Jr., a leading civil engineer, insisted the flood problem was growing as cultivation increased in the valley. [5] Ellet suggested enlarging natural river outlets, constructing higher and stronger levees, and building a system of headwaters reservoirs on the Mississippi River and its tributaries. Most engineers of the period disagreed or thought the proposals too expensive, His ideas were not widely accepted and were never realized because Ellet was killed during the Civil War. The second report took a decade to complete.[6] Captain Andrew A. Humphreys, Corps of Topographic Engineers, assisted by Lieutenant Henry L. Abbot, unequivocally backed completing the existing levee system and excluded alternative flood control plans, partly for economic reasons.[7]

Before the policy could take effect, the Civil War started. Existing flood control works fell into disrepair. At the war's end, the lower Mississippi basin residents battled to restore and improve the levy system. This conflict was as threatening as the combat that had just passed. Humphreys' first assignment after the Civil War was to inspect the Mississippi levees and recommend the most urgent repairs. He recommended rebuilding many, a plan consistent with the position he took in his earlier report. However, no federal funds were appropriated because of disagreements as to where the money would be used. In 1866, Humphreys became Chief of Engineers of the U.S. Army and labored constantly to quash opposition to the "levees only" policy he espoused. This course

3 Arnold, p. 6.
4 Moore, J. W. and D. P. Moore, The Army Corps of Engineers and the Evolution of Federal Flood Plain Management Policy, (Boulder: University of Colorado, Boulder, Institute of Behavioral Science, 1989), p. 1.
5 Ellet, Jr., Charles, The Mississippi and Ohio Rovers, (Philadelphia: Lippincott, Grambo, and Co., 1853).
6 Humphreys, Andrew and Henry Abbot, Report upon the Physics and Hydraulics of the Mississippi River, (Professional Papers of the Corps of Topographic Engineers, United States Army, no. 4 (reprint, Washington, DC, 1876.), 1861).
7 Moore and Moore, p. 2.

became the Corps' gospel for more than 60 years, or until the 1927 Mississippi River flood decisively showed the policy's limitations.[8]

Flooding in the Mississippi Valley in 1862, 1865, 1869, and 1874 heightened public interest in a comprehensive solution to recurrent flooding. In 1879, Congress created the Mississippi River Commission and gave it authority to survey the Mississippi and its tributaries, formulate plans for navigation and flood control, and report on the practicability and costs of the various alternative courses of action. Those opposing the Commission believed that flood control was the responsibility of state and local governments and thought the Commission would lead to massive federal expenditures. Also in opposition, the Corps thought it unnecessary and an unwarranted intrusion into the agency's responsibilities.[9] By 1890, the entire 700-mile, lower Mississippi Valley, from St. Louis to the Gulf of Mexico, was divided into state and locally organized levee districts. Even as the levee system expanded, the frequency and fury of floods continued without letup, partly because of the silt that was choking the captive river. In doleful succession, major floods struck the region in 1881, 1882, 1883, 1884, 1886, and 1890.

To some, 1879 marked the turning point in the long battle to garner federal support for flood control. From that time forward, Congress gradually increased federal government responsibility to develop flood control throughout the nation. Between 1879 and 1917, federal money funded some flood control work recommended by the Mississippi River Commission. But throughout this period, Congress insisted that the Commission focus on *navigation* with its incidental benefits of bank stabilization, surveys, and gaging assisting in flood control.

8 Arnold, p. 6.
9 Reuss, Martin A., Office of History, U.S. Army Corps of Engineers, personal correspondence with author, 4 February 2000.

2

THE EARLY 20TH CENTURY: A GROWING FEDERAL INTEREST

The 1927 flood event was arguably the greatest natural disaster to befall this nation in terms of total human misery and suffering.

A PERIOD OF FLOODS AND ACTS

Flooding continued along the lower Mississippi with major inundations in 1903, 1912, and 1913. In 1913, floods in the Ohio Valley killed 415 people and caused about $200 million in property loss. The Mississippi River Commission proposed major improvements to the levee system. Public interest in the national flood control problem after the 1912 and 1913 flood disasters led to the creation of basin-wide levee associations and other lobby groups. Under continual public and political pressure from the beleaguered states adjoining the lower Mississippi River, the federal government was inexorably drawn into greater participation in flood control.

The Flood Control Act of 1917. The first break in the wall of congressional intransigence came in 1916 with the creation of the House Committee on Flood Control.[10] Supported by congressmen from the lower Mississippi River and Ohio Valley states, the committee created a permanent forum for congressional flood control proponents. The most concrete result of the Progressive Era's[11] flood control movement was the passage of the Flood Control Act of 1917,[12] the most important piece of flood control legislation prior to the Flood Control Act of 1936. While its scope was limited to the lower Mississippi and Sacramento Rivers (the latter devastated by hydraulic mining), the act established important precedents and frameworks for the 1936 act.

10 Arnold, p. 13.
11 The era lasted approximately from 1900 to 1920.
12 Public Law (P.L.) 64-367.

The Flood Control Act of 1917 was important in four respects:[13]

1. It marked the first time that Congress appropriated funds openly and primarily for the purpose of flood control. As one congressman said during the debate on the bill, the measure "removes the mask" from years of covert federal flood control spending under the "pretext" of navigation improvements.[14]

2. It established a congressional commitment to fund a long-range and (it was believed) comprehensive program of flood control for the lower Mississippi and Sacramento Rivers. Specifically, the act authorized the Secretary of War to spend $45 million for flood control and navigation improvements along the lower Mississippi south of the mouth of the Ohio River and $5.6 million for the Sacramento River, which included the first use of flood bypass measures.

3. It introduced the principle of including the requirement for local financial contributions in flood control legislation. The act stipulated that local interests should pay at least one dollar for every two dollars spent by the federal government. In addition, local interests were to pay the cost of acquiring rights-of-way for construction and maintenance expenses once levees were completed. This meant that the local levee boards actually paid about half the total cost of the levee program between 1917 and 1928.[15]

4. It authorized the Corps to undertake, on a watershed basis, examinations and surveys for flood control improvements and to provide information regarding the relationship of flood control to navigation, waterpower, and other uses.

Despite talk of a nationwide plan for flood control when the House Flood Control Committee was established, nothing was done beyond the programs for the lower Mississippi and Sacramento rivers. According to Arnold "the doors had been opened, but not very wide."[16]

During this time, the Corps remained committed to the "levees only" policy endorsed some 50 years earlier to control the Mississippi River. Having successfully passed a major flood in 1923, the Mississippi River Commission proclaimed in 1927 that the levee system "is now in condition to prevent the disastrous effects of floods."[17] However, conditions were developing that would forever change the nature of flood control on the Mississippi River and its tributaries.

13 Arnold, pp. 13-15.
14 Arnold, p. 14.
15 Ibid.
16 Arnold, p. 15.
17 Clark, p. 73.

The Great Flood of 1927. The great flood of 1927 tested the "levees only" policy and demonstrated the major problems associated with a one-sided approach to flood control. Much of the levee system along the lower Mississippi was breached or overtopped, and the flood torrent fanned out over the flat delta. At the flood's highest point, the river spread 50 to 100 miles wide in a "chocolate sea" stretching 1,000 miles from Cairo, Illinois, at the mouth of the Ohio River, to the Gulf of Mexico. The official death toll was 246 but may have reached 500. More than 700,000 people were homeless. Over 150 Red Cross camps cared for in excess of 325,000 refugees for several months after the flood. Some 137,000 buildings and homes were damaged or destroyed. Property damage topped $236 million, an enormous figure even in those pre-Depression years. Nearly 13 million acres of land (about 20,000 square miles) were flooded.[18] In the book *Rising Tide*,[19] John Barry provides a compelling account of the events leading up to the 1927 Mississippi River flood and how the calamity changed America. The 1927 flood event was arguably the greatest natural disaster to befall this nation in terms of total human misery and suffering.

The flood of 1927 united the nation with respect to flood control, at least insofar as the Mississippi River was concerned. Doubts still lingered about a nationwide flood control policy. Public opinion favored a program in which the federal government paid for flood control in the Mississippi Valley. Adopting this position meant reversing the current federal policy, which was based on the reasoning that even though the protective levees benefited the whole nation, local interests benefited the most and should share in the protection costs. To President Coolidge, federal funding meant federal control and abdication of local responsibility. When congressional plans emerged without any local cost contribution, the President threatened a veto.[20]

The Flood Control Act of 1928. A series of political compromises ensued, leading to the Flood Control Act of 1928. In passing the act, Congress adopted a flood control plan that abandoned the levees only approach. The government recognized that major floods, such as happened in 1927, involved drainage from far outside the lower Mississippi valley, that locals were unable to finance effective flood control measures, and that local governments were already making enormous contributions to flood control. The act provided that the federal government would pay for building expanded protective measures. The non-federal contribution would consist of providing rights of way (for the levees along the main stem; the federal government ended up paying for flowage rights of way) and having levee districts and state governments maintain the levees.

18 Moore and Moore, p. 6.
19 Barry, John M., Rising Tide: The Great Mississippi Flood of 1927 and How It Changed America, (New York: Simon and Schuster, 1997).
20 Moore and Moore, p. 6.

In 1927, Arkansas City on the Lower Mississippi River was affected by a break 60 miles upstream. U.S. Army Corps of Engineers File Photo

During the previous 200 years, local governments had paid an estimated $292 million in lower Mississippi flood protection works. Now in a single act, the Congress authorized expenditures of $325 million.[21] Reuss stated that "probably no other water project involved as great a percentage of the federal budget at the time of its authorization as did Mississippi Valley flood control."[22]

The Flood Control Act of 1936. Early in 1936, the New England region suffered from its worst flood in at least 300 years. That same year, paralyzing floods occurred in the upper Ohio River basin, taking 184 lives and causing about $200 million in property damage. In the wake of the devastation, a flood relief bill already drawn up was expanded into a bill to establish a national policy of river development for flood control.[23]

The Great Depression of the 1930s established the historical context that led to the Flood Control Act of 1936.[24] This economic catastrophe created an urgent need for work relief projects but communities and states—already in financial straits—found it impossible to undertake such projects themselves. Consequently, Congress and the

21 Clark, p. 78.
22 Reuss, Designing the Bayous: The Control of Water in the Atchafalaya Basin, 1800-1995. (Alexandria, VA: Office of History, U.S. Army Corps of Engineers, 1998), p. 121.
23 Moore and Moore, p. 12.
24 P.L. 74-738.

President authorized some, though hardly all, otherwise marginal flood control projects in order to provide jobs. The act provided for constructing some 250 projects using work relief moneys. It appropriated $310 million to initiate construction and $10 million to carry out numerous examinations and surveys.[25] The act's Declaration of Policy stated that:

> it is hereby recognized that destructive floods upon the rivers of the United States, upsetting orderly processes and causing loss of life and property, including the erosion of lands, and in impairing and obstructing navigation, highways, railroads, and other channels of commerce between the States, constitute a menace to national welfare; that it is the sense of Congress that flood control on navigable waters or their tributaries is a proper activity of the Federal Government in cooperation with States, their political subdivisions, and localities thereof; that investigations and improvements of rivers and other waterways, including watersheds thereof, for flood-control purposes are in the interest of the general welfare; that the Federal Government should improve or participate in the improvement of navigable waters or their tributaries, including watersheds thereof, for flood-control purposes *if the benefits to whomsoever they may accrue are in excess of the estimated costs, and if the lives and social security of people are otherwise adversely affected*.[26] (emphasis added)

The Flood Control Act of 1936 set up a two-pronged attack on the problem of reducing flood damages. On one side, the Department of Agriculture would develop plans to reduce runoff and retain more rainfall where it fell. On the other, the Corps would develop engineering plans for downstream projects. In theory, the plan required cooperation between the two agencies but included no mechanism to ensure coordination. In reality, the major work fell to the Corps.

FEDERAL GOVERNMENT ASSUMES LARGER ROLE

Record floods in the Ohio River basin in 1937 helped to sharpen federal policy enunciated by the 1936 act. Twenty-two states were affected, 244 lives were lost, and $31 million in relief expenditures were required. As a consequence, Congress enacted the Flood Control Act of 1938. This act authorized the construction of a large number of basin-wide flood control plans prepared under the authority of the 1936 Act. Cost-sharing provisions were also changed, providing for federal assumption of the entire cost of both reservoir and channel modification projects. The Flood Control Act of 1941 further modified the 1938 provision by making channel modifications subject to cost sharing.

25 Moore and Moore, p. 13.
26 Arnold, Appendix A.

These policies did not change significantly until after a 1966 report from a Bureau of the Budget Task Force on Federal Flood Control Policy (see Chapter 3, "Bureau of the Budget Task Force") recommended a unified national program for managing flood losses.

In 1954, federal involvement in flood control was again broadened when Congress enacted the Watershed and Flood Prevention Act,[27] which authorized flood protection structures in upstream watersheds (defined as smaller than 250,000 acres). This act authorized the U.S. Department of Agriculture's (USDA) Soil Conservation Service (SCS) (now the Natural Resources Conservation Service (NRCS)) to participate in comprehensive watershed management projects in cooperation with states and their subdivisions. It remains the authority for the USDA's federally-assisted watershed projects.

Between 1936 and 1952, during the height of building activity, Congress spent more than $11 billion for flood control projects that were built primarily to store floodwaters. This massive construction program subsequently prevented substantial flood damages. Initially, Congress tended to think in terms of single-purpose flood control projects but later adopted the important concept of comprehensive and coordinated development of the resources of the nation's major river basins.

In a retrospective view of the nation's responses to flood disasters, Adler[28] states that the mission-oriented flood control laws of the early 20th century, were due, in part, to the prevailing view that we could build our way out of almost any problem, with engineers revered in American society then as only rock stars and sports heroes are today. Many still believe technology can be used to control nature,[29] although engineers no longer enjoy such reverence in our society.

27 P.L. 83-566
28 Adler, Robert W., "Addressing Barriers to Watershed Protection," Environmental Law, 25(1995), p. 1013.
29 See Dennis S. Mileti, Disaster by Design: A Reassessment of Natural Hazards in the United States. (Washington, DC: National Academy Press, 1999).

3

THE 1930S TO THE 1960S: BROADENING SOLUTIONS TO THE NATION'S FLOOD PROBLEMS

The nation now moved closer to a balanced approach to flood hazards.

CALLS FOR A BROADER APPROACH

Even as federal involvement in controlling floods through structural works increased, calls came for a more comprehensive approach to the nation's flood problems due to some disturbing trends that had developed by the mid-1950s. Both the potential nationwide damage from flooding and the cost of protection were rising. America's rapidly increasing urban population lay at the heart of the problem. The national flood damage potential was increasing faster than it could be controlled under existing flood protection construction programs. With this in mind, many pointed out the fallacy of relying entirely on measures to redirect the paths of flood waters, citing lessons learned from the "levees only" policy adopted some 75 years earlier for the lower Mississippi River Valley. Others saw wise land use management practices within floodprone areas as a neglected alternative to construction programs.

EVOLVING VIEWS ON HUMAN ADJUSTMENT TO FLOODS: HARLAN H. BARROWS AND GILBERT F. WHITE

These cries of concern as to how we, as a nation, use our floodplains, did not originate in the 20th century. A report issued in the early 1850s, at the direction of the Congress, insisted the flood problem in the Mississippi River delta was growing because more cultivation was taking place in the floodplain.[30] W J McGee, in his 1891 article

30 Ellet, 1853.

"The Floodplains of Rivers," published in *Forum,* XI, stated that "as population has increased, men have not only failed to devise means for suppressing or for escaping this evil [flood], but have with singular short-sightedness, rushed into its chosen paths."[31]

Harlan H. Barrows. In a report on the evolution of federal flood control policy, Moore and Moore state that the concepts that would eventually alter national approaches to flood problems probably began in the 1920s with the work of Harlan H. Barrows. [32] Barrows, a professor of Geography at the University of Chicago and a member of the Public Works Administration's Mississippi Valley Committee (which would later become the Water Resources Committee) had the widest possible view of the geography and espoused a need for interdisciplinary research. He inspired his students to look at the world in a similar fashion.

As one of two non-engineers on the Roosevelt administration's 12-member Water Resources Committee (WRC) in the late 1930s, Barrows had ample opportunities to promote his belief that good planning required linking land and water use. He expressed his views in a report[33] prepared by the WRC for the President in 1938. With one notable exception, all sections of the drainage report reflected the engineering orientation of most of its authors and generally endorsed structural solutions to water problems. The exception was the section submitted by the Ohio-Lower Mississippi Regulation Subcommittee, which Barrows chaired. The report stated "if it would cost more to build reservoir storage than to prevent floodplain encroachment, *all relevant factors considered*, the latter procedure would appear to be the best solution." Reuss[34] described this section of the report as containing some remarkable language. Reuss goes on to state that:

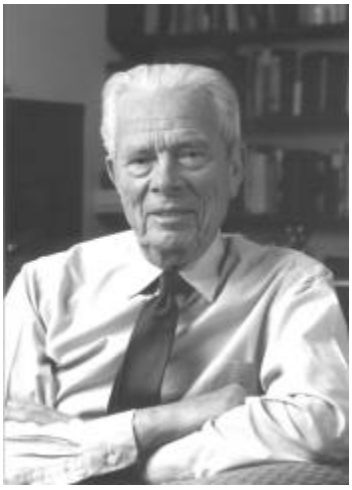
> for the first time, an official government document recommended something other than building dams, floodwalls, and levees to protect life and property. Barrows' subcommittee (which included the Chief of Engineers) recommended the consideration of zoning laws and relocation. It warned that flood control reservoirs simply promoted the occupation of previously flood-prone lands, and this inevitably produced new demands for protection. The WRC's receptivity to the subcommittee report must have encouraged Barrows. The full committee explicitly noted that most of the subcommittee recommendations applied equally to other basins and were 'essential elements in a sound national flood-control policy.' Barrows was not content to publish his views in the drainage report. He looked for a definite change in policy. When President Roosevelt forwarded to the

31 McGee, W. J., "The Floodplains of Rivers," Forum, XI(1891), p. 221.
32 Moore and Moore, p. 35.
33 Water Resources Committee, Drainage Basin Problems and Program, (National Resources Committee, 1938).
34 Reuss, "Coping With Uncertainty: Social Scientists, Engineers, and Federal Water Resources Planning," Natural Resources Journal, 32(Winter 1992), p. 119.

WRC in January 1938, a Corps of Engineers document calling for the construction of 82 reservoirs in the Ohio and Mississippi River basins, Barrow wrote Abel Wolman, who headed the WRC, that further studies were needed. Then he noted 'the practicability of avoiding flood damages by zoning valley bottoms and by other remedial measures with respect to the occupation and use of flood plains has not been sufficiently explored.' Wolman personally took Barrows' concerns to the President in April 1938. Repeating Barrows' message, Wolman emphasized to the attentive President that more studies were necessary.

The need for more studies temporarily ended further construction proposals.

Gilbert F. White. Among those who studied under Barrows was a bright, young aspiring geographer named Gilbert F. White. In 1934, having completed all the requirements for his doctorate except a dissertation, White went to work for Barrows in Washington, DC and stayed eight years in government service. His work for Barrows decisively influenced White. While on the staff of the Mississippi Valley Committee and of the Water Resources and Land Resources committees, White probed deeply into the issues of floodplain occupancy. Like others in the Roosevelt administration, he concluded that many current problems (floods, dust bowl, etc.) were the inevitable result of human modification of natural conditions. In 1936, in what would become a broad thesis, White asked if land use planning were not an effective alternative as a method of reducing flood damage.



GILBERT WHITE
Natural Hazards Center File Photo

At a national conference on planning in 1938, White suggested that federal funds for constructing flood control dams in California should not be authorized unless the state enacted legislation to control any further encroachments upon floodplains. Word of those views reached the California delegation. Shortly thereafter, the appropriate Congressional committee was directed to investigate the youthful staff member of the National Resources Planning Board[35] who was promoting "un-American" ideas. White survived the congressional hearing, and the dams were authorized without any such conditions.[36]

35 The National Resources Planning Board was created by President Roosevelt in 1934 to serve as an advisory body to the Administration on resource planning within the federal government.

36 White, Gilbert F., Looking Toward the Horizon: Prospects for Floodplain Managers, (Association of State Floodplain Managers Annual Conference, Little Rock, AK, 1997).

White penned his Doctor of Philosophy dissertation, entitled *Human Adjustment to Floods*,[37] in 1942. He based the document on his own views and experiences, his knowledge of the history of the government programs with which he had been involved, and the evidence and ideas surrounding floodplain management that surfaced within the Water Resources Committee. In it, he characterized the prevailing national policy as "essentially one of protecting the occupants of floodplains against floods, of aiding them when they suffer flood losses, and of encouraging more intensive use of floodplains."[38] He instead advocated "adjusting human occupancy to the floodplain environment so as to utilize most effectively the natural resources of the floodplain, and at the same time, of applying feasible and practicable measure for minimizing the detrimental impacts of floods."[39]

Many were convinced that his concepts offered a real alternative to existing flood control practices. Among those were Harvard professor Arthur Maass who, in his 1951 book *Muddy Waters*, [40] presented White's concepts to a broader audience. In 1955, two noted hydrologists, William G. Hoyt and Walter B. Langbein, also endorsed White's concepts in their book *Floods*. The authors traced the evolution of public flood control policies, laid out current problems, and suggested that changes were needed. "Our present policy towards floods hinges essentially on water control," they said. "It seems imperative to have, in addition to a policy of control, a comprehensive national policy of flood management."[41] Gilbert F. White later characterized their work as the first to coherently pull together the scientific information about floods, an effort respected by scientific groups. It is widely accepted that Gilbert F. White's seminal study stimulated the interest and set the course for the emergence and evolution, in ensuing decades, of broader approaches to flood problems.

LAND USE PLANNING: A. J. GRAY, JIM GODDARD, AND THE TVA EXPERIMENT

The Tennessee Valley Authority (TVA) was the first federal agency to broadly apply alternative approaches to control flood damage, choosing to add land use planning methods to the popular structural measures already used to control the paths of floodwaters. Congress created the TVA in 1933 as a government corporation armed with power to plan, build, and operate multipurpose water resource development projects within the 40,000 square mile Tennessee River basin.[42] Having basically completed its initial mission of bringing about the maximum degree of flood control feasible along the

37 White, Human Adjustment to Floods, A Geographic Approach to the Flood Problem in the United States, (University of Chicago, Department of Geography, 1942).
38 White, p. 32.
39 White, p. 2.
40 Maass, Arthur, Muddy Waters, The Army Engineers and the Nation's Rivers. (Boston, MA: Harvard University Press, 1951).
41 Hoyt, William and Walter Langbein, Floods, (Princeton, NJ: Princeton University Press, 1955), pp. 91-113.
42 President Roosevelt proposed extension of the TVA concept to other basins such as the Arkansas, White, and Red, but Congress was never willing to extend such authority or duplicate it.

Tennessee River and its major tributaries, TVA turned its attention to the many areas of the basin that received little or no flood protection from its floodwater detention reservoir system.

Instrumental was the 1950 internal report *Major Flood Problems in the Tennessee River Basin*.[43] This report noted that many communities had flood problems but because of insufficient development in floodprone areas, flood control projects could not be justified. The only remedy proposed was that TVA establish a flood warning system throughout the basin to warn people living in flood plains of impending disasters. As Chairman of the TVA Board, Gordon Clapp reacted to the report by saying, "what should TVA do, wait for development of the flood plains so that a flood control project could be justified?"[44] He recommended that the report be circulated to other TVA staff, particularly the Division of Regional Studies, to get other reactions and possible alternative approaches to the problem.

JIM GODDARD
ASFPM File Photo

Aldred. J. "Flash" Gray directed the Regional Studies staff. Gray knew of White's earlier writings concerning alternative approaches to the resolution of flood problems. As a fellow geographer, he understood those concepts. He, and other TVA staff, would take White's ideas and make them an operational program.

Gray viewed flood damage prevention planning as only being successful if it was part of comprehensive community planning. The problem, as he viewed it, was lack of land use planning and not a flood warning issue. After its review of the report, the Regional Studies staff proposed an entirely different approach to the problem. The staff started with the proposition that the problem related primarily to the control of land use and development in areas subject to flooding and that the state and local planning staffs must have a key role in any regional or local effort to minimize flood hazards. They proposed that the new approach be tried in Tennessee, which had a strong state planning agency under the leadership of Harold Miller, as well as a strong program of local planning assistance. Under this approach, TVA and the state staffs would join in a technical appraisal of the possible application of flood data to planning programs. The joint appraisal would include research into the types and forms of flood information needed by state and local planning programs and how such data might be applied to community planning, land use controls, and capital improvement programs. According

43 Interview with A. J. Gray, 1 April 1994; In the interview, Gray gave me a copy of a draft document he had prepared about early TVA involvement in addressing flood problems. His report was never published and was a rough working draft.

44 From an unpublished draft report by A. J. Gray.

to Gray, sometime during its early work in this area, TVA coined the term "floodplain management."

TVA was well positioned to carry out its role. In its earlier water resource development activities, TVA had gathered data on historic floods and investigated the potential magnitude of future floods within the basin. The agency, therefore, had the database and engineering capability to define the flood problems at any location in the Tennessee River basin. TVA also had the breadth of staff—engineers, economists, city planners—that could put this new planning concept into operation. The agency had also carefully developed a good working relationship with state and local governments and organizations.

Because of its primary role as a data gathering body, the Regional Studies staff could not handle the technical issues involved in defining local flood problems. Jim Goddard, a TVA engineer, was selected to help lead the ongoing investigations. Goddard was instrumental in designing the two-section reports that would provide an understanding of the nature and magnitude of flood problems in specific communities or areas and that would be used at the local planning level. The report's first section provided an analysis of the history of floods in the community, information on the size of floods that could reasonably be expected in the future, and maps showing the areas covered by these floods. The second section indicated the size of the floodway needed to pass floods downstream, defined the types of uses that might be permitted in such areas, and delineated the flood fringe area beyond the floodway where further development could be permitted, subject to appropriate adjustment to the flood risk.[45]

In 1953, TVA embarked on a pioneer cooperative program to tackle local flood problems. TVA, in cooperation with each of the Tennessee River watershed states, prepared an initial list of 150 communities with significant, known flood problems and agreed upon an order for undertaking factual flood hazard information studies. Communities having the most urgent need could request a study and report on their flood problems from the TVA, which funded the entire process.

This offer of free flood hazard information did not meet with universal acceptance. There were those communities that, for various reasons, did not want their flood problems publicized. There were others that did not want the federal or state governments "meddling" in local affairs. Many communities were not interested in the data until after the occurrence of a new flood event in their locality. Some made the request because the state planner who assisted them recommended they do so. A few asked for the study as a routine action: they applied for any program which was free of charge.[46]

45 Ibid.; The concepts of the floodway and flood fringe as part of floodplain regulations were also originated by TVA.
46 Floodplain Management: The TVA Experience, (Knoxville, TN: Tennessee Valley Authority, December 1983), p. 16.

The flood hazard information developed by TVA for the early reports included data on historic floods and a future hypothetical flood termed the "maximum flood of reasonable regional expectancy." This hypothetical flood measure led to numerous problems for its potential use in local land use planning. These problems included its unwieldy name and its unlikely occurrence. On the other hand, TVA was hesitant to develop a lesser flood measure since this might imply that it was recommending a lesser planning standard. The strong difference of opinion among TVA engineers and others over the development of a hypothetical flood suitable for land use planning purposes was a considerable problem that significantly retarded the early progress of TVA's floodplain management assistance program.

To solve this impasse, two hypothetical floods were computed: the "maximum probable" and the "regional." At that time, the TVA used the maximum probable flood to design flood control works. The maximum probable flood's computed size was equivalent to the Corps' "standard project flood" and was generally larger than the TVA's flood of reasonable regional expectancy. Determining the regional flood size involved defining a flood comparable in magnitude to the largest known floods on similar streams within 60 to 100 miles of the stream reach under study. The regional flood for most streams studied was significantly smaller than the flood of reasonable regional expectancy or maximum probable flood and rapidly became the standard for floodplain regulations within the basin. TVA engineers thought it was large enough to use in planning, and state planners felt it was fair and reasonable since it was based on actual flood occurrences in the vicinity of the studied streams. Therefore, local officials and citizen members of the planning commission, who would ultimately be called upon to enforce the regulations, rapidly embraced it. The basic data in the TVA flood hazard information reports would not change substantially until the mid-1970s when the "100-year," and sometimes the "500-year," flood profiles and flooded area outlines were included, generally in response to the requirements of the National Flood Insurance Program (NFIP).[47]

Goddard and his staff were primarily responsible for preparing local flood studies, while Gray and his staff were responsible for working with state and local planners to adjust the land use in areas subject to flooding. Demonstrations in a few Tennessee communities, such as Athens, Lewisburg and Pulaski, were an immediate success instigating the program's rapid spread to communities throughout the basin. By 1965, TVA had prepared 92 floodplain information reports covering 112 communities. Forty-three had officially adopted floodplain regulations in their zoning ordinances or subdivision regulations or both.[48]

Goddard and Gray applied their leadership and energy by first working with state and local governments in the Tennessee River watershed encouraging a full range of

47 Ibid., p. 17.
48 Annual Report for Fiscal Year 1965, (Knoxville, TN: Tennessee Valley Authority, Division of Water Control Planning, 1965).

policies and actions for ensuring wise use of floodprone lands and later in sharing the TVA experience nationally. TVA files contain dozens of papers advancing the concepts and application of floodplain management principles and practices that they and their staffs presented at regional and national conferences in the 1950s and 1960s. Goddard, a man of great energy, unrelenting dedication, and strong-will, was particularly active in this endeavor. His personality was well suited to being in the limelight. Gray was more reserved, but equally effective.

Goddard sought permission to reproduce and distribute every document he discovered on the subject during this period. Through this process, more than 200 documents were reprinted and distributed throughout the nation. Under his direction, TVA supported a series of pioneering, nationally significant academic studies, such the first comprehensive floodproofing study by John R. Sheaffer in 1960 as part of a University of Chicago Geography Department dissertation,[49] in the field of floodplain management. Goddard's seemingly inexhaustive activity continued into his later work with the Corps in the mid-1960s and for several decades thereafter.

After only a few years of experience, TVA was convinced that this floodplain management assistance program had real merit and was suitable for national application. TVA transmitted a report to Congress in 1959 proposing a program to reduce the national flood damage potential.[50] In the Letter of Transmittal, the TVA stated that it "believes that local communities have the responsibility to guide their growth so that their future development will be kept out of the path of floodwaters. With the States and communities of the Tennessee Valley, TVA has developed a means of putting this proposition into action." The report spelled out past uses of TVA's flood reports. At Lewisburg, Tennessee, flood data were used to prevent development of two proposed subdivisions in areas subject to frequent flooding. If finished, the development would have been flooded the following year. Officials in Chattanooga, Cleveland, Dayton, and Spring City, Tennessee. used the flood data in locating public buildings and facilities. Lacking local land use regulations, Maggie, North Carolina, used the data to plan development. Knoxville and Shelbyville, Tennessee, reduced flood damage by using the flood information in planning urban renewal projects.

The report's transmittal letter went on to state "this experimental program…is saving lives and property in the area while diminishing the future demands on the nation for flood-relief and flood-control expenditures. We believe the same results can be accomplished by adapting this experience to other areas throughout the United States. The pace of river control development in relation to the even greater rate of urban encroachment makes it urgent that this broader concept be made a part of our national flood control policy." An appendix to the report presented a detailed plan for flood

49 Sheaffer, John R., Flood Proofing: An Element in a Flood Damage Reduction Program, (University of Chicago, Department of Geography, Research Paper No. 65, 1960).

50 U.S. Senate Committee on Public Works, A Program for Reducing the National Flood Damage Potential, 86th Cong., 1st sess., 31, Aug. 1959.

damage reduction at Lewisburg, Tennessee. This plan was likely intended as an example of the TVA and state-assisted planning effort carried out at the local level and as an illustration of the level of floodplain management assistance envisioned in the TVA proposal for reducing the national flood damage potential.

Floodplain management formally entered the federal agenda when TVA transmitted their 1959 report on reducing national flood damage. It could not have come at a better time. Due to an increasing urban population, potential damage and protections costs from floods were rising faster than could be controlled under existing flood protection construction programs. On average, between 1900 and 1948, the United States experienced floods causing $50 million or more in damages about once every six years. Between 1940 and 1960, despite the fact floods did not increase in magnitude or frequency, the $50 million total was exceeded about every two years.[51] With this in mind, studies and programs on wise land use management practices within floodprone areas began to gain acceptance.

THE UNIVERSITY OF CHICAGO STUDIES

Gilbert F. White returned to University of Chicago in 1955 as a member of the Geography Department after serving nine years as president of Haverford College. Upon his return, he turned to his previous research interest on floodplain occupance.[52] White thought it would be a good idea to find out what had been happening to the nation's floodplains since enactment of the 1936 Flood Control Act. This idea, with the support of Resources for the Future, started a series of research activities on floodplain occupancy and its implications.

A 1958 study by White and others entitled *Changes in Urban Occupance of Flood Plain*[53] revealed what had been happening during the last two decades. The study's findings were discussed in a special workshop attended by representatives from a number of federal agencies, including the Corps. With land use pressures and few incentives to stay out of the hazard areas, floodplain occupancy was increasing—even in urban areas where population was declining. Federal programs, principally highway construction, urban renewal, and the construction of flood protection works, accelerated growth in flood hazard areas. Federal incentives were creating a new perception that if a serious flood hazard developed, the federal government would somehow deal with it. Ignoring the possibility of a flood disaster, individuals and public facilities were moving to and building in the floodplain thus contributing to the rising level of flood damage with each passing year.

51 Moore and Moore, p. 37.

52 Reuss, Martin, Water Resources People and Issues, Interview with Gilbert F. White (Office of History, U.S. Army Corps of Engineers, Ft. Belvoir, VA, January 1993), p. 34.

53 White, et. al, Changes in Urban Occupance of Flood Plains, (University of Chicago, Department of Geography, Research Paper No. 57, November 1958).

One of the main topics identified by workshop attendees was the role of floodplain regulations in bringing about changes. However, more research was needed to fully understand the issue. The University wanted to include views from engineers in the Corps, the key water resources agency. To assist, Francis C. Murphy, an engineering planner in the flood control field, was chosen to come to Chicago and work with the Geography Department. His 1958 study *Regulating Flood Plain Development*.[54] stated that no more than eight communities had enacted floodplain zoning before 1955 and listed the 49 that had ordinances in 1958. According to Murphy, provisions concerning development in floodprone areas started to appear in floodplain regulations after World War II. He was not able to find or compile a list of cities utilizing subdivision regulations to regulate development in floodplains but stated that "their number is certainly far greater than the number of cities which have adopted flood-plain provisions in their zoning ordinances."[55] To convince others of the need for more regulations, he argued that regulating development on the floodplain was a necessary and practicable way to reduce the drain of both floods and protective measures on the national economy. He pointed out that governments were reluctant to enact land use management practices because they had no flood maps or other data that indicated the extent and character of local flooding. As a first step, he recommended programs to assist communities in obtaining comprehensive flood risk reports.

Collectively, these and other cited studies provided valuable information for policy makers regarding what had happened in the nation's floodplains during the preceding three decades. These University of Chicago research studies were revolutionary because they introduced ideas about:[56]

- the role of perception in looking at alternative methods of dealing with flood losses;[57]
- the decision making processes surrounding floodplain land use; [58]
- how industrial groups respond to flood hazards;[59] and
- the differences between agricultural approaches and urban approaches in addressing flood hazards.[60]

54 Murphy, Francis C., Regulating Floodplain Development, (University of Chicago, Department of Geography, Research Paper No. 56, November 1958).
55 Murphy, p. 87.
56 Interview with Gilbert F. White, 20 July 1994.
57 Kates, Robert W., Hazard and Choice Perception in Floodplain Management, (University of Chicago, Department of Geography, Research Paper No. 78, 1962).
58 White, Choice of Adjustment to Floods, (University of Chicago, Department of Geography, Research Paper No. 93, 1964).
59 Kates, Robert W., Industrial Flood Losses: Damage Estimation in the Lehigh Valley, (University of Chicago, Department of Geography, Research Paper No. 98, 1965).
60 Burton, Ian, Types of Agricultural Occupance of Flood Plains in the United States, (University of Chicago, Department of Geography, Research Paper No. 75, 1962).

THE FIRST URBAN FLOODPLAIN MAPPING STUDY

During this same time, the Northeastern Illinois Metropolitan Planning Commission, created in the 1950s to plan growth in the Chicago metro area, demonstrated what could be done in a region when a metropolitan area works in conjunction with a regional land use planning group. A committee, co-chaired by White, arranged to have the region's floodplains mapped and helped develop a floodplain management program. This was the first time a metropolitan area in the United States was so mapped. The Cook County Forest Preserve District, the nation's largest, supplied financial support when they learned that mapping would make it easier to acquire land in hazardous areas that could advance the Preserve's goals. Fresh from preparing a flood-hazard map for Topeka, Kansas, the U.S. Geological Survey (USGS) provided technical support for the mapping. This venture affected subsequent USGS mapping efforts by drawing the agency into this type of activity. White characterized the work of the Commission and District as a pioneering effort in floodplain mapping and in demonstrating that floodprone lands could be used for multiple purposes that excluded residential and commercial development.[61]

REGULATING FLOODPLAINS: AN IDEA WHOSE TIME HAD COME

The 1960 census and subsequent changes in congressional districts and representation resulted, for the first time in the nation's history, in a majority of members in the House of Representatives from urban areas. This brought about changes in programs and methods to address national problems. Urban problems received more attention and resources. Water resource development projects, including flood control, received less Congressional support. During this time, a growing national environmental movement became better organized, more vocal, and more influential in the need to protect and preserve natural resources. Its impact culminated in the adoption of the National Environmental Policy Act (NEPA) at the end of the decade and the creation of the U.S. Environmental Protection Agency (EPA).

National demographic changes, including a more affluent and mobile population, led to greater coastal development that placed more people and property in the paths of coastal storms. A growing recognition of the rising cost of annual flood losses resulted as a consequence of several major hurricanes and riverine flood events that occurred around this time.

The support that the 1958 White and Murphy studies received, the growing loss of property and cost of flood damage, and other developments, suggested that regulating floodplain land use was an idea whose time had come. This idea was endorsed by the Council of State Governments during a two-day conference on floodplain regulation and

61 White, 20 June 1994.

flood insurance held December 1958 in Chicago, one month after White and Murphy published their studies. Delegates recommended that one federal agency be directed by Congress to cooperate with other federal agencies and state governments to prepare reports providing basic data on flood magnitude and frequency for flood risk areas. In addition, a number of states began to study local floodplain zoning programs. In April 1959, flood problems were discussed at the Southeastern Water Resources Conference in Atlanta. Here, Goddard presented the experiences of the TVA to an attentive audience. Resources for the Future held a roundtable in May where discussion focused on the recently published White and Murphy studies.

A number of people were interested in new ideas to address the nation's flood problems. Views were exchanged in conferences that began to address the relationships among flood control project construction, a flood insurance program, and floodplain management. White's 1964 study *Choice of Adjustment to Floods*,[62] based on a field study in LaFollette, Tennessee, critiqued existing methods and practices and addressed alternative means of dealing with flood problems by occupants, communities, and federal agencies. His study aided the ongoing discussions and debates concerning the paths that should be taken and the ways of canvassing the whole range of alternatives for achieving desirable land use.

THE CORPS' EXPANDING ROLE IN BROADER APPROACHES

By the late 1950s, Murphy and others had pointed to the lack of basic flood risk information as a major impediment for communities to consider and carry out regulation of floodplain development. Prudently anticipating a demand for basic floodplain information in the future, the Corps prepared draft legislation in 1958 providing for the systematic collection and dissemination of flood data as a new Corps' mission. The next series of major floods would activate interest in a national flood insurance program, the Corps reasoned, and efforts to have some government agency provide the data to serve both an insurance program and the needs of communities for floodplain regulation would follow. This was a task the Corps felt it could do. If the agency did not step forward and volunteer to assume this function, other federal agencies would initiate programs and preclude a Corps' role,[63] such as the TVA proved with their initial 1954 and ensuing community reports.

The report of the Senate Select Committee on National Water Resources,[64] published in January 1961, became the vehicle through which the concepts of floodplain management were officially recommended. The report called for major efforts in five specific categories. Among these was a recommendation that the federal government

62 White, Research Paper No. 93.
63 Moore and Moore, pp. 50-51.
64 Moore and Moore, p. 52.

delineate flood hazard areas and encourage enactment of land use regulations for the floodplain. Following up on earlier preparatory work by the Corps, the Congress, in the Flood Control Act of 1960, had already granted authorization for the Corps to compile and disseminate information on floods and flood damages at the request of a state or responsible local agency. In response to this Congressional authorization, the Corps could now carry out expanded floodplain management services such as supplying communities with flood data, advising on the use of floodplains and local planning, and preparing local floodplain information studies if asked by the state or locality. To carry out their mandate, the Corps formally established a Floodplain Information Services Program. In preparing local flood studies and providing floodplain information, the Corps borrowed substantially from the earlier efforts of TVA and the work of Goddard and White. Between 1962 and 1967, program appropriations averaged around $1 million annually, rising to around $5 million annually by the end of the decade.[65]

With a national program now in place for identifying local flood hazard areas, there was a need to establish uniform procedures for agencies to use in defining flood hazards. The Corps, with Goddard as its spokesman, chaired a work group of representatives from 26 federal agencies.[66] In July 1967, the group adopted a draft of *Proposed Flood Hazard Evaluation Guidelines for Federal Executive Agencies.* This brief document dealt with methodologies and standards to be used in developing information about flood hazards, including delineation of the floodplain, elevations that would be reached by floods of various magnitudes, flood velocities, and the probability of floods of various magnitudes. The 1 percent annual chance flood[67] (referred to as 100-year flood throughout the rest of this document because it is the commonly used, although inaccurate, term) emerged as a measurement to balance avoiding inordinate flood losses with avoiding excessive regulation of floodplain development. The *Guidelines* were transmitted to the Bureau of the Budget, which tasked the Water Resources Council (WRC) (see Chapter 4, "Water Resources Council") to carry out a more detailed review, revise where appropriate, and issue the *Guidelines*. In 1969, the WRC published revised *Guidelines* to be reviewed through experimental use by federal agencies, states, and consultants.[68] The revised guidelines defined the floodway as that portion of the floodplain needed to accommodate passage of the 1 percent annual chance flood without increasing the level of the flood by more than a "significant amount" (or a rise of one foot).[69] After comments were received on their use, the guidelines were further revised and published by the WRC as *Flood Hazard Evaluation Guidelines for Federal Executive Agencies* in May 1972.

Besides setting up extensive federal guidelines, the Corps published the first major nationwide inventory of urban places with flood problems in 1967. Some 5,200

65 Ibid., p. 118.
66 Ibid., p. 101.
67 A flood that has a 1 percent chance of being equaled or exceeded in any given year.
68 Proposed Flood Hazard Evaluation Guidelines for Federal Executive Agencies, (Water Resources Council, Washington, DC, September 1969).
69 Moore and Moore, p. 102.

localities made the list. The following year, the Corps authorized the creation of a Floodplain Management Services (FPMS) Branch in the Planning Division of the Office of Chief of Engineers. George Phippen, a geographer with considerable experience in water resource planning, was appointed branch chief.

THE U.S. GEOLOGICAL SURVEY'S ROLE

Historically, the USGS has been actively involved in flood issues and problems. Flood data are documented in a multitude of USGS observations, reports, and publications. Starting in the mid-1950s, the agency played an important role in developing procedures still used for estimating flood risk at a particular site.

The USGS was also involved in early flood inundation mapping efforts at the national level by helping to initiate the change from reporting only elevations and discharges of floods to publishing more interpretative information, such as areas covered by floods of selected frequencies. For instance, in reporting data on the floods of 1959 in Ohio, the USGS adopted for the first time, flood-inundation maps as another means of depicting flood information. Publishing flood-inundation maps delineating boundaries of inundated areas, providing water surface profiles, and showing flood-frequency relations became a standard means of reporting about specific floods.[70]

In 1954, USGS employee Walter Langbein designed a report format consisting of a map with pertinent text in the margins. This report became Hydrologic Investigations Atlas No. 1 (HA-1). The successful format was repeated when HA-14 "Floods at Topeka, Kansas" was published in 1959, the first of a series of flood atlases for that area. A second flood atlas, HA-39, "Floods near Chicago Heights, Illinois," followed in 1960. The third flood atlas published in 1961, HA-41, "Floods at Boulder, Colorado," summarized results of a special study of Boulder Creek at Boulder, Colorado, in which areas inundated by floods of several frequencies were constructed synthetically from past records and physical surveys of the flood plain.

Interest in the flood maps grew, and cooperative programs with the USGS to map metropolitan areas rapidly increased in the early 1960s. Following the 1959 flood, the Ohio Legislature appropriated funds to finance a cooperative agreement with the USGS to prepare flood atlases for the 12 cities that had suffered the most severe flooding. After HA-39 was published in 1960, the Northeastern Illinois Metropolitan Planning Commission entered into an agreement to cooperatively finance a flood-inundation mapping project for six counties in northeastern Illinois, involving the preparation of flood atlases for 43 7.5-minute quadrangles. The project was later expanded, and 31 additional atlases were completed by 1973. By the end of 1966, USGS had prepared 69 flood atlases at sites in 17 states.

70 Hudson, H. H. and J. S. Cragwell, Jr., A History of the Water Resources Division, U.S. Geological Survey, (vol. VI, 1996).

THE SOIL CONSERVATION SERVICE PREPARES LOCAL FLOOD STUDIES

Section 6 of the Watershed Protection and Flood Prevention Act of 1954 provided the legislative authority for the SCS to prepare local flood hazard studies. However, the agency only began preparing the studies after a Bureau of the Budget Task Force on Federal Flood Control Policy (see below, "Bureau of the Budget Task Force") recommended it in 1966. By the end of the decade, the SCS had resources to prepare flood hazard information studies and had technical assistance to offer local officials.[71]

Thus, the SCS joined the TVA, the Corps, and the USGS in these efforts to define flood dangers. In addition, the National Weather Service and the Delaware and Susquehanna River Basin Commissions prepared a small number of studies in the 1960s and 1970s. Floodplain management measures could now be put into practice. Engineering techniques were available to produce maps showing areas inundated by floods of various magnitudes and to define a floodway, along with the provision of other needed flood data.

SEVERAL STATES LEAD THE WAY IN FLOODPLAIN MANAGEMENT

Murphy reported in 1958 that only seven states (Connecticut, Indiana, Iowa, Massachusetts, New Jersey, Pennsylvania, and Washington) had enacted and were enforcing state floodplain management regulations, principally for narrow channel encroachment areas. Six of these programs were adopted in response to catastrophic floods. Based on his evaluation of the regulations, he concluded "that they are not in major conflict with existing developments nor unduly restrictive to new developments."[72]

However, by the late 1960s, a number of states had statutes regulating broader flood hazard areas:[73]

- A 1962 Washington state statute provided that the state establish flood control zones when data were available for that purpose. Any activity to construct, reconstruct, or modify any structure or works affecting flood waters within any established zone required a state permit.
- A 1965 California state code encouraged "local levels of government to plan land use regulations to accomplish floodplain management and to provide state assistance and guidance as appropriate."[74]

71 Buie, Eugene C., A History of Water Resource Activities of the United States Department of Agriculture, (U.S. Department of Agriculture, Soil Conservation Service, 1979).
72 Murphy, p. 16.
73 Regulation of Flood Hazard Areas To Reduce Flood Losses, (U.S. Water Resources Council, vol. 1, Parts I-IV, 1971), pp. 60, 127-175.
74 Ibid., p. 171.

- A 1966 New Jersey act authorized a state agency to delineate and mark flood hazard areas, to identify reasonable and proper use of these areas according to the relative risk, and to develop and disseminate other floodplain information.
- A 1967 Nebraska state act established floodway encroachment lines of a 100-year frequency flood along watercourses by the state, when sufficient data had been acquired for this purpose. If an affected locality did not then adopt sufficient land use regulations within these areas, the state's floodway would be enforced.

TOM LEE
Wisconsin DNR File Photo

- A 1966 comprehensive act enacted by Wisconsin's state legislature provided for the adoption of a reasonable and effective floodplain zoning ordinance by every county, city, and village before January 1, 1968. If they failed to do so, the state could adopt an ordinance applicable to the locality. Regardless of the method of adoption, the locality was required to administer and enforce the ordinance. Tom Lee started as Wisconsin's first floodplain management administrator in 1967, modeling Wisconsin's state-assisted floodplain management program after the Iowa program he had started three years earlier. During his tenure in Wisconsin, he introduced approaches and techniques that demonstrated successful floodplain management principles. Lee later emerged as a state-level national leader by showing how flood protection could be incorporated into community ordinances. He succumbed to cancer in 1976, at the height of his professional career.
- By 1969, Michigan, Minnesota, and Vermont mandated regulation of flood hazard areas. A Michigan statute regulated the subdivision of land to include the control of residential building development within floodplain areas. Minnesota required that whenever sufficient data were available, local units of government were to prepare and adopt floodplain management ordinances that met state standards. Vermont regulated the permitted use, type of construction, and height of floor levels within areas designated by the state as subject to periodic flooding.

By the end of the decade, a number of states had acquired sufficient experience and expertise that some officials, such as Tom Lee, served as consultants to emerging federal floodplain management programs. Papers based on state experiences in floodplain management also appeared regularly in national publications.

BUREAU OF THE BUDGET TASK FORCE ON FEDERAL FLOOD CONTROL POLICY

The most significant step toward a more unified federal policy for managing the nation's floodplains came in 1965 when the Bureau of the Budget Task Force on Federal Flood Control Policy was established. Concerns about rising costs of federal flood control, climbing flood losses and increasing windfall profits from land development in newly protected floodplains hastened the formation of the Task Force. The Bureau of the Budget requested Gilbert F. White to prepare a report on the matter. He countered with a proposal to chair a committee composed chiefly of representatives from the federal water resources agencies that would address a number of issues being raised in connection with the above concerns. The Bureau agreed to the proposal, and White immediately enlisted Goddard. The two men handpicked the remainder of the task force, including Richard Hertzler from the Department of the Army, John Krutilla of Resources for the Future, Walter Langbein of the USGS, and Harry Steele from the Department of Agriculture. In addition to bringing together knowledgeable and capable people who knew how to get things done in government, they also identified the best mechanisms to change thinking within various federal agencies.

The Task Force published its report—House Document 465, *A Unified National Program for Managing Flood Losses*—in 1966.[75] In short, the report called for an integrated flood-loss management program involving federal, state, and local governments and the private sector. The report also:

1. cited numerous problems, such as mounting flood losses, inadvertent encouragement of floodplain encroachments, increasing damage potential under existing policies, and the inability of current programs to prevent catastrophes
2. advocated a broader perspective on flood control within the context of making wise use of floodplains
3. included recommendations for improving basic knowledge about flood hazards, coordinating planning of new developments on floodplains with regulations to minimize flood-loss potential, and providing technical assistance to managers of floodplain property
4. spelled out a cautionary approach toward a national program for flood insurance and adjusting federal flood control policy to sound criteria and changing needs, and
5. suggested that if initial policy were not carefully tested, it might be counter-productive.

75 Task Force on Federal Flood Control Policy, A Unified National Program for Managing Flood Losses, (House Doc. 465, 89th Cong., 2d sess., 1966).

Two major developments came out of the Task Force's work. First, President Johnson, in transmitting the report in same year, issued Executive Order 11296, *Evaluation of Flood Hazard in Locating Federally Owned or Financed Buildings, Roads, and Other Facilities, and in Disposing of Federal Lands and Properties*. This order mandated, for the very first time, that federal agencies incorporate flood planning formally into their programs. Executive agencies were to evaluate flood hazards when planning construction of new federal buildings, structures, roads, or other facilities and to apply flood-proofing measures whenever practical and economically feasible. Agencies responsible for administering federal grant, loan, or mortgage insurance programs were to evaluate flood hazards in order to minimize potential flood damage. The Corps would prepare all flood hazard information reports except those within the Tennessee River basin where the TVA would conduct the studies. The Corps obtained authorization to spend up to $7 million per year to prepare reports.[76]

Second, the Task Force's work aided in creating the National Flood Insurance Program (NFIP) in 1968.[77] The first investigation into a national flood insurance program occurred in 1951 following massive flooding in Kansas and Missouri that caused more than $870 million in damage. As a result of these losses, the federal government initiated a study to determine the feasibility of a flood insurance program. A study financed by the insurance industry generally did not favor such a program, and in short time interest in the subject diminished. Interest was revived after a series of hurricanes and flooding in the Northeast in 1955 and in the far-Western states in 1955 and 1956, resulting in damages exceeding $500 million. As a result, Congress enacted the Federal Flood Insurance Act of 1956.[78] However, no workable program that satisfied Congress could be devised, and the legislation was never implemented.

A sequence of hurricane-induced disasters in the early 1960s again revived interest in providing some form of insurance. The program that finally emerged utilized the recommendations of the Bureau of the Budget Task Force and an U.S. Department of Housing and Urban Development (HUD) task force, which was convened at about the same time as the Bureau's and chaired by Marion Clawson of Resources for the Future. Congress created the NFIP in 1968 and George Bernstein was appointed as the first administrator. Bernstein, however, did not follow the Bureau of the Budget Task Force's strong advice to carefully experiment with premiums and regulatory policy in sample basins before setting up a national program. Instead, he established a national program without the benefit of experience, believing that Congress intended full-scale implementation.

76 P.L. 89-789, Flood Control Act of 1966.

77 Congress established a National Crop Insurance Program in 1938, employing the principle of insurance in order to lessen the cost, both financial and human, of future crop disasters. Some thought a similar program could be established to reduce flood damage and losses.

78 P.L. 84-1016.

Thus, the Bureau of the Budget Task Force's work, published as House Document 465, helped redirect federal involvement from structural control to a more comprehensive floodplain management approach. Subsequent assessments would generously in evaluate the Task Force's contributions. William Donovan, later chief of the Corps floodplain management services program, called it the "Magna Carta of contemporary nonstructural floodplain management planning…[it] provided the impetus…toward a unified floodplain management program."

MOVING CLOSER TO A BALANCED APPROACH

In the three decades since the Flood Control Act of 1936, the nation had relied almost entirely on engineering solutions to solve its flood problems, yet overall flood losses were not reduced. Despite federal expenditures of $12 billion, annual losses increased to an estimated $1 billion in 1958 and to $2 billion by 1972. In most cases, engineering had substantially reduced flood losses where they were built, but people continued to move into unprotected areas.

By the late 1960s, though, the pace of federal flood control projects began to slow mainly because of difficulties justifying the projects' economic and environmental aspects and new legislation limiting development. At this time, projects with the highest economic potential had already been built while rising interest rates added to new project costs. Executive branch actions and congressional legislation reduced development in floodprone areas.

On the eve of establishing the NFIP (1968) and passing of NEPA (1969)—two major legislative acts that significantly impacted floodplain management—the nation moved closer to a balanced approach to flood hazards. Later, White summarized why it had taken so long.[79] Agencies, he said, had been reluctant to consider alternatives because they were charged with carrying out particular programs. Intramural quarrels like the upstream/downstream controversy over authority for planning for flood control in mainstream and in tributaries delayed interagency cooperation. Few nonstructural precedents existed for flood control. Planners found it easier to manipulate a single engineering tool than several more intricate measures. Because much federal policy had been enacted after floods, the emotional context of a disaster often worked against consideration of alternatives. At all times, contractors and local engineers strongly supported construction measures, as did members of Congress, who translated construction projects into votes.

79 Moore and Moore, p. 71.

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THE 1970S AND 1980S: THE FLOOD INSURANCE ERA

The NFIP would ultimately have a profound impact in two important areas; first, by accelerating the identification of floodprone areas on maps, and, second, in providing incentives for state and local units of government to enact measures to regulate development in these identified areas.

A NATIONAL FLOOD INSURANCE PROGRAM

On August 1, 1968, Congress established the NFIP in enacting the Housing and Urban Development Act of 1968.[80] Other provisions of the act provided for urban property protection and reinsurance, and assured the availability of insurance for property located in the District of Columbia. According to Frank Thomas, a former NFIP official, the program came into existence as a result of political compromises. Some urban interests wanted relief from property losses caused by recent urban riots in a number of major cities. Some rural interests wanted flood insurance to indemnify property owners from their losses. Without including urban property protection and reinsurance provisions in the act, the NFIP would not have been established at that time.[81] In a retrospective view, the NFIP grew into a major national program, and the other provisions of the act never gained importance. Thomas characterized the NFIP as an accident that occurred from political tradeoffs and that survives by every flood disaster.[82]

The act created the Federal Insurance Administration (FIA) within HUD to oversee the program. A number of individuals, including Gilbert F. White, advocated proceeding with the NFIP on an experimental pilot basis because of the needed commitments identifying flood hazard areas, setting insurance rates, and providing technical advice to states and communities on floodplain management matters. Their

80 P.L. 90-448.
81 Personal interview with Frank Thomas, 13 October 1999.
82 Ibid.

advice fell on deaf ears. The first administrator, George Bernstein, convinced that Congress wanted a national program established promptly, blanketed the nation with this new program.[83]

Congress established the NFIP as a "quid-pro-quo" program. Through it, relief from the impacts of flood damages in the form of federally-backed flood insurance became available to participating communities contingent on flood loss reduction measures embodied in state and local floodplain management regulations. Occupants of existing structures in floodprone areas would benefit from subsidized[84] flood insurance premiums, but new floodplain occupants would have to pay actuarially-based premiums. Those already living in the floodplain likely did not understand the flood risk involved in their locational decisions, but future occupants would through information provided by the NFIP. The program would be strictly voluntary in terms of community participation and individual purchase of insurance. As history would reveal, the NFIP would ultimately have a profound impact in two important areas: first, by accelerating the identification of floodprone areas on maps, and; second, in providing incentives for state and local units of government to enact measures to regulate development in these identified areas.

Passage of the National Flood Insurance Act (Title XIII of the Housing and Urban Development Act of 1968) marked an important change in federal flood control policy. Adler, in his article *Addressing Barriers to Watershed Protection*,[85] stated that in theory it represented a quantum shift in policy. Primary responsibility for managing the floodplains still remained with local government, but now development was to occur consistent with the flood risk. The act was to return the cost for location decisions back to the landowner and to account for the total cost in any decision regarding occupancy or use of flood hazard areas, thereby shifting the burden from the taxpayer.

The FIA managers came from the insurance industry and established an actuarially sound program. *Insurance* views and considerations drove many of the early program measures, such as initial determinations of flood hazard areas. A number of federal agencies resented the program because it impinged upon traditional program areas. [86] In addition, countless communities were not ready to accept the program's requirement for floodplain management.

Congress tasked the FIA to carry out studies to determine local flood hazard areas within which flood insurance provisions and appropriate land use regulations would be applied. The FIA adopted the 1 percent annual chance as a minimum national standard for floodplain management, based upon a recommendation of a special review committee of national experts that met at the University of Chicago in December 1968.

83 Reuss, Water Resources People and Issues, p. 55.
84 Subsidized in the form of payment from other policyholders.
85 Adler, Robert W., "Addressing Barriers to Watershed Protection," Environmental Law, 25(1995), p. 1034.
86 Thomas interview, 13 October 1999.

But, the Federal Insurance Administrator did not have the capability to conduct studies in-house to determine local flood hazard areas. As a result, it became impossible to rapidly map these areas to meet the NFIP needs. Also, the actuarially sound rates for flood insurance coverage could not be quickly established, restricting the rate at which communities entered the program. A community could not join the NFIP until a study had been completed and actuarial rates established. The first communities that joined became eligible using USGS and the Corps data and studies.

Because of the eligibility difficulties, only two communities had entered the program—Metairie, Louisiana, and Fairbanks, Alaska—when Hurricane Camille struck the Gulf Coast in 1969. After the hurricane, Congress amended the National Flood Insurance Act of 1968[87] to provide an emergency program through which property owners in participating localities could obtain flood insurance coverage on existing structures at federally subsidized rates, even though the required studies and rate maps would not be completed for some time. Communities could enter the NFIP by agreeing to adopt minimum land use and control measures for new construction in floodprone areas. By 1973, the emergency provision had attracted more than 3,000 communities.

Despite this record, it became apparent that a truly "national" flood insurance program would not be achieved on a strictly voluntary basis, whereby localities could choose to join or not join and individuals could choose or not choose to purchase insurance coverage. Few incentives or requirements existed. Some form of penalty had to be applied to non-participating communities and their citizens to get participation. After a series of flood disasters struck the nation in 1972, Congress again amended the National Flood Insurance Act of 1968 in 1973[88] to strengthen incentives for local participation. The Flood Disaster Protection Act of 1973 reaffirmed the use of the 1 percent annual chance flood and contained two major provisions. First, it prohibited federal agencies from providing assistance for acquisition or construction purposes in the designated floodplains of a community unless the community participated in the NFIP. The provisions applied not only to direct federal financial assistance, but also included financial institutions regulated or insured by the federal government, thereby covering virtually all types of financial assistance. Second, if a community participated, federal agencies and federally regulated or insured lenders required flood insurance as a condition of grants and loans. Later amendments[89] in 1977 permitted federally regulated or insured lenders to make conventional loans in floodprone areas of non-participating communities. All in all, the 1973 congressional statute greatly accelerated the entry of floodprone communities into the NFIP.

87 P.L. 91-152.
88 P. L. 93-234.
89 P. L. 95-128.

National floodplain mapping begins

From the beginning, inadequate funding, limited capabilities of federal agencies that traditionally mapped floodplains, and the sheer enormity of trying to identify the nation's floodplains on a sound scientific and credible basis greatly hindered FIA's ability to carry out studies and keep pace with community enrollment. The FIA had initially relied upon its small in-house staff to utilize base maps provided by communities desiring to participate in the program. These were augmented with flood data generated by other federal agencies, including the Corps, the TVA, the SCS, the National Weather Service, and the USGS. As FIA identified more and more floodprone communities,[90] program participation increased making it clear that the scope of the mapping task far exceeded staff capabilities. In order to keep up with demand, the FIA selected three private engineering firms to: 1) identify communities for which flood data existed, 2) prepare Flood Hazard Boundary Maps (FHBM) showing the approximate boundaries of areas subject to flooding during a 1 percent annual chance flood, and 3) identify communities without flood information so another federal agency could study and generate floodprone data.

The interim boundary maps were intended to provide data for some degree of floodplain regulation until detailed studies could be completed. The approximate floodplain limits were outlined on USGS topographic maps, which included floodplain information from past Corps and TVA studies. At first, floodprone areas on the FHBM were shown as rectilinear or blocked shaded areas that followed easily identifiable land features such as streets or roads. This practice made the maps easier for lenders, insurance agents, and other lay persons to interpret. But it also resulted in an artificial representation of true flood boundaries, which followed land contours and were curvilinear. Rectilinear flood boundaries were used in all NFIP mapping until the Flood Disaster Protection Act of 1973 was passed. At this point, the maps needed to be very accurate because the act required mandatory purchase of flood insurance in a number of situations. To rectify the situation, some 10,000 FHBM were revised from rectilinear to curvilinear flood boundaries.[91]

For many communities, regulating with the topographic map data became difficult because of inaccurate, easily refutable technical data; inadequate flood maps; delays in getting data and maps; and difficulties in obtaining corrections. Because of staff limitations, about 200 full-time equivalent employees, NFIP could not provide adequate technical assistance or monitor the needs of some 17,000 communities.

By mid-1976, appropriations for studies had approached $100 million annually. In that fiscal year, more than 2,300 flood insurance studies were initiated, equaling the

90 Original estimates were that about 5,000 floodprone communities existed nationwide, based on a previous Corps study. As knowledge of local flood-hazard areas increased, it was subsequently determined that more than 20,000 communities were floodprone.

91 The National Flood Insurance Program: Chronology of Significant Events, (FEMA, unpublished document provided by Michael F. Robinson in 1998).

total number started in the five previous years. By the end of 1976, comprehensive revisions to the NFIP minimum floodplain management requirements and procedures had been carried out, based on a number of years of program experience.[92]

During the same time, community and individual participation in the flood insurance program rose as fast as spending for floodplain studies. Participation in the NFIP increased from approximately 3,000 in 1973 to approximately 15,000 by the end of 1977. The number of flood insurance policies in force enjoyed a similar level of growth, increasing from 300,000 to 1.2 million during the same period. Total loss coverage exceeded $37 billion.

For all of the problems encountered, the NFIP grew at a rapid pace between its inception in 1968 and 1978 when the *initial* identification of floodprone communities was essentially completed. More than 19,000 FHBM had been produced to aid regulation of national floodplains.

Land use regulations

Even though mapping the nation's floodplains through cost-effective study approaches became a daunting challenge, land use regulations posed another hurdle. In the early 1970s, many communities in the United States had not adopted comprehensive plans, zoning ordinances, or building codes. In some states, rural communities did not have the authority to adopt the regulations necessary to join the NFIP. These states had to amend their statutes to enable communities to join. For many communities, the NFIP became their first experience with regulating land use or building codes.

By the 1980s, more and more communities became accustomed to and began implementing more fully their responsibilities under the NFIP. By the start of the 1990s, the nation saw a shift in the value system of its citizens, particularly towards conservation land ethics. More recognition and acceptance of the need for compromises emerged, such as in floodplain development and use, that respected the needs and interests of the entire community.[93] Robinson contended that "one of the lasting contributions of the NFIP is that it did break the ice for land use regulation and building codes in many areas of the country."[94]

Government establishes FEMA and buyout programs

In June 1978, President Carter established the Federal Emergency Management Agency (FEMA) as an independent agency within the Executive Branch to coordinate federal hazard mitigation efforts and to consolidate the programs of five agencies with disaster related responsibilities into a single agency. The effective date of the

92 Ibid.
93 Thomas interview, 13 October 1999.
94 Robinson, Michael F., Federal Emergency Management Agency, personal communication, 19 January 2000.

reorganization was April 1, 1979. At that time, the NFIP transferred from HUD, where it had been since 1968, to the new FEMA.

President Carter's 1978 Water Policy Initiatives included funding of the NFIP Section 1362 program that spent $35 million in over 100 communities to purchase more than 1,000 repetitively damaged properties. Before being superceded by buyout programs after the 1993 Midwest flood, the Section 1362 program provided valuable experience in applying this mitigation approach.

State and local assistance

State floodplain management capability to assist communities to interpret and utilize flood insurance study data and to enact and enforce required floodplain management measures did not exist in most states. Funding, first provided in 1979 under FEMA's State Assistance Program, aided in developing this capability. Later, in the 1980s, this program transitioned into a Community Assistance Program to focus state floodplain technical assistance and encourage local program development and enforcement of NFIP requirements. The assistance program worked, and by the early 1980s, community participation exceeded 16,500.

From around 3,000 communities in 1980 to around 8,000 communities in 1984[95] had received flood insurance studies from the FIA and had entered the flood insurance program's Regular Program phase, with development regulations in identified flood-hazard areas that at least met the minimum floodplain management requirements set forth by FIA. More than 8,000 communities still participated in the Emergency Program, employing a minimal form of land use regulation based on best available data until more studies could be completed.

The Coastal Barrier Resources Act and continued deregulation

The Coastal Barrier Resources Act (CBRA),[96] adopted in 1982, prohibited new federal expenditures (including the issuance of federal flood insurance and the provision of most disaster assistance) in designated units of undeveloped coastal barrier islands off the Atlantic and Gulf coasts on and after October 1, 1983. Congress added more land units to the system in 1990.

According to FEMA official Michael F. Robinson, CBRA reflected the politics of the time. Much of the environmental community believed that flood insurance and other federal programs encouraged development of barrier islands and other sensitive areas. They also realized that further federal involvement in regulation was not likely to happen under the Reagan administration. If anything, regulatory programs at that time were in jeopardy. CBRA became an attempt to marry environmental protection and

95 Ibid.
96 P. L. 97-348.

conservative principles with federal spending reductions in a way that would be acceptable to the full range of the political spectrum. By taking away all federal financial assistance, development would be slowed and cost savings and environmental protection achieved without actually regulating floodplain development. In other words, people could develop property at their own risk. The idea did not work well, and the anti-regulation fervor of the early Reagan administration died down.[97]

In 1983, the Vice President's Task Force on Regulatory Relief, the Grace Commission, and the President's Commission on Housing scrutinized both Executive Order 11988–Floodplain Management and the concept of the 100-year frequency flood used for floodplain delineation and as the minimum regulatory flood level in local ordinances. Generally, the concerns expressed by the Reagan administration were the cost, but not the benefits, of compliance with the Executive Order and impacts on affordability of housing.[98] FEMA reviewed these measures and its NFIP regulations under the direction of the Office of Management and Budget (OMB). The final report concluded that all should be retained.

Insurance: Privatizing policies and reducing premiums

Insurance policies during the 1970s were issued through private sector insurance companies but were centralized in the FIA. In 1983, the FIA initiated the Write Your Own (WYO) Program, a re-involvement of private sector insurance companies. Participating insurance companies could and did begin selling NFIP policies under their own company names, even though the FIA still assumed financial risk. In 1985, the NFIP became self-supporting, with policy premiums paying for claims, mapping, personnel, and administrative costs. The self-supporting program, then, on average, collected enough in premiums to pay all claims and program operating expenses that would be expected based on claims experience. Since that time, the program has remained self-supporting even though it has borrowed from the Federal Treasury (with repayment and interest) on a few occasions when large numbers of flood insurance claims depleted NFIP resources.

In 1990, FEMA implemented a Community Rating System that allowed for flood insurance premium reductions for those communities participating in other designated flood loss activities. It was designed to reward communities that were doing more than the minimum to protect their citizens from flood losses and to encourage other communities to initiate new flood protection activities. At the end of 1999, some 900 communities participated in this special program, representing 65 percent of the total flood insurance policies in the nation. About 90 percent had achieved a Class 9 or a Class 8 rating, resulting in premium reductions of 5 and 10 percent, respectively. Two

97 Robinson, 19 January 2000.
98 Ibid.

communities nationwide had achieved a Class 5 rating, resulting in a 25 percent reduction in premiums.[99]

New programs, technology, and information bolster community participation

By the mid-1980s, studies had been carried out to determine cost-effective measures to convert participating communities in the Emergency Program with low-growth potential to the Regular Program without incurring the time and cost for a detailed flood insurance study. This process allowed several thousand communities to be identified and converted utilizing less detailed floodplain information. Also during this period, FEMA produced its first digital flood insurance maps to allow more efficient changes to the maps in the future and their incorporation into other digital geographic information systems.

The FEMA experience demonstrated that preparing maps for floodplain management and flood insurance rate purposes was a dynamic process. There was a constant need for periodic map revisions because of factors such as community and watershed land use changes that affect flood risk, utilization of better data and analysis procedures, and corrections of past mapping errors.

To meet its program purposes, FEMA had *mapped over 100 million acres of flood hazard areas nationwide* by the end of the 1990s and had *designated some six million acres of floodways along 40,000 stream and river miles.* The total federal costs for these studies approximated *$1.3 billion*.[100]

In carrying out its program missions, FEMA, and its predecessor, prepared or funded scores of manuals, reports, and studies on just about every subject pertaining to flood insurance and floodplain management. Some occurred as more experience was gained in implementing the programs. These materials provided needed information, guidance, explanation, and consistency in interpreting and applying program policies on mandatory requirements for flood insurance (as a condition for many loans and for federal assistance) and adoption of local floodplain management measures. FEMA's programs advanced state-of-the-art practices, particularly in floodproofing and retrofitting. This, in turn, led to innovations in building practices. Riverine flood events and coastal storms tested a number of buildings constructed to NFIP floodplain management requirements. They performed well during these events, demonstrating the effectiveness of the requirements in reducing flood damages.

The 30-year-old NFIP is another story. During its existence, many have asked for an assessment of the program's effects on land use and vulnerability of communities

99 Data from Federal Emergency Management Agency web site on the Internet, (http://www.fema.gov; Prevention/Mitigation, Community Rating System, January 2000).

100 Buckley, Mike, Federal Emergency Management Agency, personal correspondence, 20 December 1999.

around the country. According to Gilbert F. White, "we do not have a sense of what has happened on the land, locally, as a result of this program."[101] In 1997, FEMA funded a literature review to try to answer questions about the program's effectiveness by assessing two central concerns: 1) the relationship between floodplain development and insurance availability, and 2) the quality of enforcing floodplain management requirements at the local level. The review examined three dozen published studies or reports that had addressed the first concern. The well-prepared report, published in 1999, stated that "none of the studies offered irrefutable evidence that the availability of flood insurance is a primary factor in floodplain development today. Neither does the empirical evidence lend itself to the opposite conclusion." [102] Noting that "it is there, in the day-to-day decisions by local officials, that the [NFIP] either succeeds or fails to accomplish its statutory mandate" and that "a number of tools and oversight systems have been devised to monitor, support and evaluate the quality of community enforcement," the report offered no conclusions regarding the second concern.

The program has also suffered its share of legal battles. Beginning in the 1970s, a number of court cases challenged the NFIP program and floodplain regulations adopted by a participating community. The courts consistently held that no "takings" of property occurred when proper legal process had been carried out in the implementation of NFIP adoption and enforcement actions.

By the end of 1999, there were more than 4.2 million flood insurance policies in effect, with total insurance coverage of over $510 billion dollars. The five states with the most policies were Florida, Texas, California, New Jersey, and Louisiana, which all have extensive coastal areas. Except for Social Security, flood insurance represented the largest potential demand on the Federal Treasury. Since 1969, loss and loss adjustment expenses to policyholders have totaled $10.1 billion.[103]

With more than 19,000 of some 22,000 identified floodprone communities participating in the flood insurance program, it has had a profound effect on floodplain management activities during the past quarter century. However, as revealed later, it fell short of achieving its objective of shifting a fair burden of flood losses from the taxpayer to the individual property owner.

THE WATER RESOURCES COUNCIL

Congress created the U.S. Water Resources Council (WRC), an independent agency composed of the secretaries of six federal agencies with water resource management responsibilities, as part of the Water Resources Planning Act of 1965.[104] Charged with a number of water resource planning and coordination responsibilities, it

101 White, 1997.
102 Evatt, Dixie Shipp, National Flood Insurance Program: Issues Assessment, A Report to the Federal Insurance Administration, 31 January 1999.
103 Data from Federal Emergency Management Agency web site on the Internet, (http://www. fema.gov/nfip/qkf1199.htm, January 2000).
104 P. L 89-80.

also undertook numerous activities that became important in addressing flood-related issues.[105]

The Bureau of the Budget assigned responsibility to the WRC to follow-up on the 1966 House Document 465 recommendations.[106] The WRC also became instrumental in preparing Executive Order 11296, which was issued in 1966. As cited earlier, the WRC also revised and distributed the *Flood Hazard Evaluation Guidelines for Federal Executive Agencies* in 1969 (see Chapter 3, "The Corps' Expanding Role"). Through its hydrology committee, the Council began work in 1966 on determining the best methods of flood frequency analysis. It published the committee's efforts in 1967 as Bulletin No. 15, *A Uniform Technique for Determining Flood Flow Frequencies*. The WRC adopted the techniques presented in the bulletin for use in all federal planning involving water and related land resources, and recommended their use by state and local government and private organizations. Efforts to improve the recommended methodologies continued, and in 1976, the WRC published an extension and update as Bulletin 17, *Guidelines for Determining Flood Flow Frequency*. A second revision, published in 1981 as Bulletin 17B,[107] is the guide used by practically every government agency conducting flood frequency studies.

JON KUSLER
ASFPM File Photo

In 1968, the WRC contracted the University of Wisconsin's Center for Resource Policy Studies to prepare a study on using regulations to guide adjustment of individual land uses to meet flood threats and avoid flood damages. Jon Kusler and Doug Yanggen, the principal investigators, were attorneys on the Center's faculty. Kusler, a person of noteworthy ability and energy, had worked cooperatively with Tom Lee, Wisconsin Department of Natural Resources, on a number of projects while at the university. The WRC published the first volume of the report *Regulation of Flood Hazard Areas to Reduce Flood Losses* in 1971.[108] The report explored selected issues in the regulation of private and public land uses to reduce flood losses and presented valuable draft statutes and local ordinances for regulation of land uses in riverine and coastal flood hazard areas that a number of states and localities subsequently used. The WRC published the second volume in 1972, with Kusler as the principal author.[109] This volume explored in more detail techniques of regulating subdivision of lands in flood

105 Floodplain Management in the United States: An Assessment Report, (Federal Emergency Management Agency, Washington, DC, 1992), pp. 7-2 to 7-4.
106 See "Bureau of the Budget Task Force on Federal Flood Control Policy" in Chapter 3 of this report for more on House Document 465.
107 Guidelines for Determining Flood Flow Frequency (Bulletin 17B of the Hydrology Committee, U.S. Water Resources Council, 1981).
108 Regulation of Flood Hazard Areas to Reduce Flood Losses, (vol. One, Parts I-IV, U.S. Water Resources Council, 1971).
109 Ibid., (vol. Two, Parts V-VI, 1972).

hazard areas and regulating coastal flood hazard areas. Like the first volume, it contained draft regulations, dealing with subdivision regulations and regulation of coastal flood hazard areas. A number of states and localities also used the draft regulations.

An interagency work group developed *Guidelines for Implementing Executive Order 11988 – Floodplain Management*, issued by the WRC in February 1978. The report was designed to assist federal agencies in the preparing regulations and procedures for implementing the order. Utilizing an eight-step decision-making process, the document spelled out ways governmental agencies were to avoid supporting, directly or indirectly, floodplain development whenever a practicable alternative existed. The report also:

- adopted the 1 percent annual chance flood (also referred to as the "Base Flood" by the NFIP) as the minimum level of flooding to be used by a community in its floodplain regulations,
- defined the regulatory floodway as the river channel or watercourse and adjacent land areas to be reserved in an unconfined and unobstructed manner in order to allow the discharge of the base flood, and
- adopted the one-foot criterion as the permissible limit of increase in the water surface elevation of the 1 percent annual chance flood.

Fifty-five federal agencies came under the purview of the Executive Order. The WRC, the Council on Environmental Quality, and the FIA oversaw implementation. Most agencies adopted implementing measures within a few years, but a few took more than a decade, citing internal conflicts with other mandates.

Around 1980, the WRC contracted with Kusler to prepare a report to update and supplement the two earlier volumes on *Regulation of Flood Hazard Areas to Reduce Flood Losses*. The report emphasized the lessons drawn from the floodplain management experiences of the 1970s and included new directions for the 1980s. It focused on state and local programs, including innovations that could exemplify effective future flood-loss reduction. The work used surveys of state and local regulations and court decisions from the previous decade to document progress and identify problems. It included a number of state statutes and case study profiles for some 150 communities with innovative floodplain management programs. One chapter even addressed the use of natural resource systems as effective hazard mitigation measures. The Natural Hazards Research and Applications Information Center at the University of Colorado, Boulder, published, in two special publications,[110] the main report's appendices documenting the survey of state and local floodplain management programs. The third volume of *Regulation of Flood Hazard Areas to Reduce Flood Losses* was prepared at the time of

110 Bloomgren, Patricia A., Strengthening State Floodplain Management, (Natural Hazards Research and Applications Information Center, Special Publication 3, 1982); Kusler, Jon A., Innovation in Local Floodplain Management, A Summary of Community Experience, (Natural Hazards Research and Applications Information Center, Special Publication 4, 1982).

WRC's demise. Frank Thomas, the council's acting director, arranged for the TVA to complete the study and publish the report, which the TVA did in 1982.[111] These three volumes greatly advanced the understanding and application of land use regulations in flood-hazard areas as a principal tool in reducing vulnerability to flood risk.

Funding for the council ceased in September 1982, but the council was never officially dissolved. During its 16-year existence, the WRC had done much to foster interagency approaches to floodplain management, as evidenced by the above record. Its work in obtaining consensus for a Unified National Program for Floodplain Management (see following section) and creating the Federal Interagency Floodplain Management Task Force (see section on task force below) were particularly noteworthy. Both would continue long after the demise of the council.

TOWARDS A UNIFIED NATIONAL PROGRAM FOR FLOODPLAIN MANAGEMENT

In creating the NFIP in 1968, Congress stated in Section 1302C of the act that "the objectives of a flood insurance program should be integrally related to a unified national program for floodplain management and directed that…the President should transmit to Congress for its consideration any further proposals for such a unified program." The Bureau of the Budget assigned responsibility to prepare such a proposal for Congress to the Water Resources Council (WRC). From 1970 to 1975, the WRC prepared a number of draft reports, but none proved satisfactory to reviewers.[112]

In mid-1975, the WRC invited Frank Thomas, a geography professor at Georgia State University and formerly at Southern Illinois University, to accept a one-year appointment to the council staff to, among other duties, prepare a satisfactory report. Thomas' background in economic and social well-being studies pertaining to water resources made him well suited for the task. He directed the efforts of a special work group that prepared and issued a report on a unified national program for floodplain management in 1976.[113] At the end of his appointment, Warren Fairchild, the Director of the WRC, asked him to remain with the council permanently. He accepted the offer and became the leading spokesperson for a unified national program for floodplain management during the ensuing 20 years. He first served as chair of an interagency floodplain management task force in the WRC and later in FEMA when the unified national program was transferred to that agency. At FEMA, he became the leading advocate and manager for the floodplain management component of the NFIP.

The 1976 unified national program report provided what it called "a conceptual framework of general and working principles" and set forth management "strategies" and

111 Kusler, Jon A., Regulation of Flood Hazard Areas to Reduce Flood Losses, (Prepared for the U.S. Water Resources Council, 1982).
112 Thomas interview, 13 October 1999.
113 A Unified National Program for Floodplain Management, (U.S. Water Resources Council, July 1976).

implementing "tools" to guide federal, state, and local decision-makers in implementing *A Unified National Program for Floodplain Management.* Several executive-level actions quickly outdated this document, including floodplain management policy articulated in President Jimmy Carter's 1977 environmental message, Executive Order 11988 on Floodplain Management, Executive Order 11990 Protection of Wetlands, and in the President's 1978 Water Policy Initiatives. An interagency task force updated and refined the 1976 report in a document submitted to the President in 1979.[114]

FRANK THOMAS
FEMA File Photo

The interagency task force further submitted an updated proposal to President Ronald Reagan in 1986,[115] noting that the previous report had again become dated by the relative success and changes in federal programs and by the strengthening of floodplain management capability at the state and local levels. The 1986 report, which built on earlier reports and subsequent legislation, directives, and activities, set forth two broad goals for floodplain management: 1) to reduce loss of life and property from flooding, and 2) to reduce loss of natural and beneficial resources from unwise land use. The document addressed two seemingly disparate issues when it brought together the concerns of mounting flood losses with the increasing interest in maintaining important natural functions of floodplains and wetlands.

The updated *Unified National Program for Floodplain Management* report presented four primary strategies to achieve the two floodplain management goals: 1) Modify susceptibility to flood damage and disruption, 2) Modify flooding, 3) Modify the impact of flooding on individuals and the community, and 4) Restore and preserve the natural and cultural resources of floodplains. The report identified specific tools that could be employed under each strategy and describes them in detail.

THE FEDERAL INTERAGENCY FLOODPLAIN MANAGEMENT TASK FORCE

Upon assignment of the Unified National Program for Floodplain Management to the Water Resources Council, the council found it had to bring the agencies together on a

114 A Unified National Program for Floodplain Management, (U.S. Water Resources Council, September 1979).
115 A Unified National Program for Floodplain Management, (Federal Emergency Management Agency, March 1986).

regular basis to carry the program responsibilities. This led to the creation of a floodplain management technical committee. The council abolished all its technical committees around 1976 in an internal reorganization, and the Federal Interagency Floodplain Management Task Force succeeded the floodplain management technical committee. [116]

The task force consisted principally of representatives from the departments of Agriculture, Army, Commerce, Energy, HUD, Interior, and Transportation; the EPA; the TVA; and FEMA. The group met regularly (about every six weeks with work groups meeting various other times) during the Frank Thomas "administration," which spanned several decades in two agencies. The task force provided continuity of communication between member agencies on floodplain management issues. The process was extremely valuable because the same agency representatives met and worked together over a long period of time.[117] This built trust and understanding among the members, provided a forum for airing interagency issues, and helped agencies avoid duplicating studies and investigations.[118]

The task force was not just a closed group of federal representatives. State representatives, through the Association of State Floodplain Managers (ASFPM), attended as observers. The task force also established working coalitions with professional organizations, including invitations to attend meetings and share agendas.

The task force became a vehicle for carrying out specific projects that worked towards a Unified National Program for Floodplain Management. In addition to preparing program reports in 1976, 1979, 1986, and 1994, the task force undertook or sponsored a number of other important initiatives and studies.[119] (See Appendix 2 for a list of other reports.)

FLOODPLAIN MANAGEMENT ACTIVITIES OF OTHER FEDERAL AGENCIES

A number of federal agencies with programs that traditionally supported floodplain loss reduction measures remained active. Some activities kept with agency missions while others supported NFIP's floodplain mapping needs.

The Army Corps of Engineers

Technical services. The NFIP initiative created problems in sorting out agency responsibilities between the Corps and the FIA. The FIA proposed that the Corps assume

116 Thomas interview, 13 October 1999.
117 Principal agency representatives were: Frank Thomas and Ross MacKay, Federal Emergency Management Agency; Jerry Peterson and Bob Plott U.S. Army Corps of Engineers; Jeanne Melanson, U.S. Environmental Protection Agency; Don Von Wolffradt, Soil Conservation Service; Billy Colson, U.S. Geological Survey; Phil Thompson, Department of Transportation; Terry Martin, Department of Interior; Truman Goins, Housing and Urban Development; and Jim Wright, Tennessee Valley Authority.
118 Thomas interview, 13 October 1999.
119 Floodplain Management in the United States: An Assessment Report, (Federal Interagency Floodplain Management Task Force, 1992).

responsibility for all the technical study functions under the NFIP, freeing itself to provide program management services and guidance to communities. The Corps concluded that this function required a large number of additional personnel, which the OMB would not approve. Then too, the Corps was not comfortable with the idea of merely rendering technical support to the FIA. In the end, both the FIA and the Corps generated technical reports. The Corps' Floodplain Management Services Branch also assisted in other ways, including conducting studies on the effects of wave regeneration in coastal flooding to assess the probabilities of damage, alluvial fan flooding, and tsunami propagation problems.[120]

In fiscal year 1971, the OMB compared the budget requests of the Corps and the FIA, and because of duplicating services, suggested phasing out the Corps' floodplain information studies program, one part of the Corps' Floodplain Management Services Program. In short order, the Corps was struggling with OMB to save its program. Two years later, in its 1973 report *Water Policies for the Future*, the National Water Commission recommended increased funding for the Corps' Floodplain Management Services Program. Following that report, OMB approved more than $10 million for fiscal year 1974 and comparable sums in following years to fund the Corps' floodplain management programs.

Beginning in 1976, the Corps again came under pressure from OMB to phase out its floodplain information studies because of similar studies being carried out by FIA. As this work came to a close in 1978, the Corps had completed some 1,800 Floodplain Information Reports covering 3,500 communities. More than 1,600 communities had adopted floodplain regulations based on the Corps' studies and 300 more were developing regulations. By 1980, the Corps' role had changed from conducting its own studies to carrying out flood insurance studies for the FIA under interagency agreements. By that time, the Corps had over 2,200 interagency studies underway.[121]

By the end of the century, the Corps had, since the early 1960s, provided an estimated million instances of technical services and planning assistance to communities and states, in addition to having published the above cited floodplain information studies. This assistance was provided through 1) the Floodplain Management Services Program, which offered a range of technical services and planning guidance to support local flood damage reduction measures and 2) the Planning Assistance to States Program, which provided, on a cost-share basis, assistance in developing comprehensive plans.

Flood control projects. Starting in the 1970s, the Corps developed and implemented a number of flood control projects that did not involve major engineering works to contain and/or direct floodwaters. Working with local interests that desired this approach, the Corps carried out projects in the upper Charles River Basin in Massachusetts and the Indian Bend Wash Greenbelt in the Phoenix, Arizona, metropolitan area. Other projects

120 Moore and Moore, p. 119.
121 Ibid., p. 120.

involving permanent floodplain evacuation and relocation occurred in Prairie du Chien, Wisconsin, and Baytown, Texas.

Reports and documents. The Corps also prepared several notable reports and documents including *Guidelines for Reducing Flood Damages*[122] and *Flood-Proofing Regulations*.[123] Since its initial distribution in 1972, state and local officials have requested more than 100,000 copies of the latter document. An ad-hoc committee of Corps officials involved in various flood-proofing studies has met since 1978 to coordinate activities and share information. A formal National Flood Proofing Committee was formed in 1985 and has done exemplary work on advancing the application of flood-proofing techniques, resulting in a number of additional studies and reports. Among these are *Flood Proofing – How to Evaluate Your Options* (1993), *Local Flood Proofing Programs* (1994), revisions to *Flood-Proofing Regulations* (1995), and *Flood Proofing Techniques, Programs and References* (1996).

How many communities adopted regulations before the advent of the NFIP and how many more adopted measures because of the Corps technical assistance and planning guidance programs are unknown, but the numbers are probably substantial. During the first decade of the NFIP, the Corps played a substantial role on a national level in developing floodplain information reports and providing the planning and technical assistance required for communities to adopt sound and workable floodplain management regulations.

Tennessee Valley Authority

Studies and reports. By 1974, well before the NFIP affected the identification of floodprone areas and before the adoption of local floodplain management measures, the TVA had prepared 130 floodplain information reports for 153 communities. Ninety-one communities had officially adopted floodplain regulations in zoning ordinances or subdivision regulations or both.[124]

Like the Corps, TVA had by this time started to curtail its publication of flood hazard information reports in favor of FIA flood insurance studies. The TVA subsequently prepared several hundred flood insurance studies involving Tennessee River basin communities for the FIA. At this point, the FIA notified communities that received TVA flood insurance studies that they had to adopt and enforce land use regulations that, at a minimum, met the standards of the NFIP. When the Tennessee River basin communities compared the NFIP national regulatory standard (the 100-year flood) with the TVA "regional flood," the basis of most local floodplain regulations, they realized that in virtually all cases the 100-year flood was a lower standard. In practically

122 Guidelines for Reducing Flood Damages, (U.S. Army Corps of Engineers, May, 1967).
123 Flood-Proofing Regulations, (U.S. Army, Office of the Chief of Engineers, June 1972; Revised by the Corps' National Flood Proofing Committee, 31 March 1992).
124 Tennessee Valley Authority Annual Report, Fiscal Year 1974, (Division of Water Control Planning).

all instances, local officials opted for the lower standard and amended their existing regulations accordingly, despite the advice of TVA staff to stick with a standard that more accurately reflected regional flood risk. As a consequence, only a few communities in the TVA area retained a regulatory standard larger than the 100-year flood.

In 1980, TVA again prepared floodplain information reports in response to requests from state and local officials who were not satisfied with the pace of flood insurance studies. The TVA studies included areas never before studied and where changes in the floodplain and/or watershed had rendered existing data obsolete. The reports included information on the "100- and 500-year" floods so they could be used for the NFIP. Utilizing its own resources, TVA produced several dozen reports during the 1980s.

Technical assistance. Three decades of working with Tennessee valley communities taught TVA that local awareness of flood hazards and the willingness to take action generally depended on the level of assistance provided to local planners and decision-makers. Experience showed that, without adequate assistance, the most sophisticated technical information available failed to stimulate local action. The turnover of appointed and elected officials necessitated continued follow up contacts with local government and ongoing technical assistance in the administration of local regulations.

TVA staff engineers, versed in hydraulics, hydrology, flood damage reduction techniques, community planning, and land use regulations worked with local communities as technical advisors, assisting them in their efforts to adopt and administer floodplain regulations. This assistance changed over time from providing encouragement and support in enacting such measures to helping communities to understand and apply data provided through the NFIP to local regulations. Staff engineers also supplied flood hazard information for specific locations to a variety of governmental and private users to serve many purposes. On an average, the TVA provided about 400 instances of technical assistance and 400 site-specific flood hazard evaluations annually.

In 1983, Gilbert F. White told S. David Freeman, Chairman of the TVA Board of Directors, that many who might benefit from the agency's example had insufficient information about the TVA's approach to working with state and local officials in floodplain management. To fulfill this need, the staff prepared a report on TVA's 30-year floodplain management program.[125]

Evaluation procedures. A few years later, the TVA's floodplain management program staff decided that the agency's nearly 35-year record of floodplain management assistance lent itself to both subjective and quantitative analysis regarding its effectiveness in flood damage prevention. The TVA sought assistance in carrying out such an evaluation from the Natural Hazards Research and Applications Information Center (Natural Hazards Center) at the University of Colorado, Boulder. The Natural

125 Floodplain Management: The TVA Experience, (Tennessee Valley Authority, 1983).

Hazards Center formed an advisory group of recognized national experts in floodplain management, developed the initial evaluation procedures, and conducted a pilot test in several TVA area communities. Program staff surveyed 18 communities using the new evaluation procedures, and TVA published the results of the limited study in 1986.[126]

The evaluation procedures drew considerable interest from other federal agencies, and in 1984, the Federal Interagency Floodplain Management Task Force sponsored a seminar in Washington to evaluate the effectiveness of floodplain management techniques and community programs. Jon Kusler chaired the seminar, which many federal and state agency employees attended. The Natural Hazards Center published the seminar's proceedings in 1985.[127] The TVA also prepared a report documenting how others could use the evaluation procedures to judge community floodplain management programs by measuring various elements of local programs. The TVA staff envisioned that the community evaluation process could also be used to directly or indirectly evaluate the effectiveness of federal, state, and regional floodplain management assistance efforts.[128]

Evacuation and relocation projects. During the early 1980s, TVA actively worked with a number of communities in planning and implementing a variety of flood damage reduction programs. Following record floods in southwest Virginia in 1977, TVA provided technical and financial assistance to four communities in carrying out floodplain evacuation and relocation projects. In total, local officials acquired several hundred properties and the land became public ownership, often as linear parks along streams. TVA carried out similar projects in other areas, all involving voluntary relocations. TVA prepared a number of reports describing the projects. The agency's experience in floodplain evacuation and relocation drew considerable interest from other federal agencies, particularly FEMA, which benefited from what it learned in providing later assistance for evacuation-relocation projects nationally.

Throughout the 1970s and 1980s, TVA continued its leadership role in floodplain management by conducting or actively participating in a number of nationally important projects and studies. As described later, this pioneering program would be terminated through agency "redirection" by the mid-1990s.

Soil Conservation Service

Studies and technical assistance. By the early 1970s, the SCS had started to prepare local flood hazard studies. These studies, carried out as cooperative efforts with state and local governments, contained data equivalent to the FIA flood insurance studies. To ensure that the technical data presented in the reports were understood and used by the

126 Boggs, D. Lee III, Determining the Effectiveness of Efforts to Reduce Flood Losses: The TVA Experience, (Tennessee Valley Authority, 1986).
127 Natural Hazards Research and Applications Information Center, Evaluating the Effectiveness of Floodplain Management Programs and Techniques, Special Publication 10, 1985.
128 Boggs, A Guide to Evaluate a Community's Floodplain Management Program, (Tennessee Valley Authority, 1985).

responsible local government, SCS staff provided technical assistance. By the end of 1977, 123 study reports were completed in 28 states and 77 studies were underway. These 200 studies covered 360 communities.[129] Under its program, the SCS prepared flood hazard maps for nearly 600 rural communities and provided numerous instances of floodplain management assistance.

In April 1973, the FIA requested the SCS to quickly conduct two major nationwide studies because the SCS was identified as the only federal agency with a technical delivery system that could meet the demands of these studies. The first study ran from June to September 1973 and involved compiling a list of all floodprone communities in the nation on a county-by-county basis. The SCS, using every one of their field offices, collected information on more than 13,500 floodprone communities. The second effort, which finished in October 1973, focused on obtaining copies of community maps for the 13,500 floodprone communities.

The SCS joined many other federal agencies in carrying out reimbursable studies for the FIA. Starting in 1969 with its first detailed flood insurance study, the SCS completed, or had in progress, 349 detailed flood insurance studies by 1977, the last year data were available.[130]

U.S. Geological Survey

The USGS greatly aided the FIA's initial floodprone area mapping efforts initiated to rapidly inform individuals and communities of the general extent of flooding. The agency began outlining approximate floodplain boundaries on USGS topographic maps in 1968. Initial efforts focused on defining flood limits in populated areas having significant flood hazards and urgently needing flood information. In 1970, the FIA altered the scope of the mapping program to just outlining the 100-year flood areas. A second mapping phase, implemented during fiscal year 1973, expanded aerial coverage to include areas subject to future development. To guide this phase, the USGS published a report to assist its Water Resources Division offices in preparing floodprone area maps and pamphlets.[131] The mapping effort, completed in the late 1970s, provided floodprone area delineation on nearly half (15,000) of the 33,000 7.5 minute topographic quadrangles available for the 50 states and Puerto Rico.[132]

In fiscal year 1983, the USGS agreed to assist the FIA in its continuing mapping efforts by preparing detailed flood insurance studies, restudies, and limited detailed studies (carried out where comprehensive studies could not be justified). This assistance

129 Buie, Eugene C., A History of United States Department of Agriculture Water Resource Activities, (Soil Conservation Service, USDA, September 1979), p. 80.

130 Ibid., pp. 81-82.

131 Edelen, George W., Jr., National Program for Managing Flood Losses: Guidelines for Preparation, Transmittal, and Distribution of Flood-Prone Area Maps and Pamphlets, (U.S. Geological Survey, Open File, 1973).

132 U. S. Geological Survey, Washington, DC, Internal communication provided by Bill Kirby, 26 October 1999, in personal correspondence with the author.

continued through at least fiscal year 1987, the last year for which information was available.[133]

The USGS maintained a network of nearly 7,000 stream gages nationally. These gages provided the actual stream flow history from past floods; data which is critical in predicting future flood events when mapping flood hazard areas.

National Weather Service

The National Weather Service (NWS) used USGS stream gage data, combined with predicted rainfall and/or snowmelt to forecast flood stages and provide flood forecasts and warnings to communities and citizens. The NWS also tracked the paths of hurricanes and other coastal storms and issued forecasts and warnings. These warnings often resulted in population evacuations from threatened areas and, in some instances, the relocation of damageable property from harm. Despite large increases in population living in or near riverine and coastal flood hazard areas, the number of deaths due to flooding essentially remained constant over the last half of the century. This was due to greatly improved warnings from the NWS as a result of both technology and process.

U.S. Environmental Protection Agency

Representatives of the EPA's Office of Wetland Protection provided the Federal Interagency Floodplain Management Task Force with an increased understanding of the importance of natural resources and the functions that floodplains provide. The wetland protection office sponsored or actively participated in a number of workshops throughout the country on this subject. EPA's other contributions include

- supporting adoption of a second floodplain management goal, preserving and restoring the natural resources and functions of floodplains, in the 1994 report on *A Unified National Program for Floodplain Management*,
- preparing a well-constructed guide for local officials on protecting floodplain resources,[134] and
- promoting river restoration and integrating floodplain and wetland management programs in conjunction with the ASFPM and the Association of State Wetland Managers.

133 Ibid.
134 Federal Interagency Floodplain Management Task Force, Protecting Floodplain Resources: A Guidebook for Communities (Smardon and Felleman, FEMA publication 268, 1996).

THE ASSOCIATION OF STATE FLOODPLAIN MANAGERS

In the late 1950s, water resources officials from some dozen Midwest states (Ohio to the Dakotas) started meeting annually to discuss common concerns with flooding, including flood control, hydrology, mapping, and other water resource issues. These conferences opened channels of communication among the states for airing interstate issues. Working together over a period that spanned several decades, the officials developed an understanding and respect of each other's positions on how to address flood problems, problems that often extended beyond state boundaries and among numerous federal agencies. This experience set the table for the subsequent formation of a national association, and annual conferences, of state floodplain managers that ultimately replaced the annual Midwestern States Water Resources and Flood Control Conferences. A number of these officials played lead roles in creating the ASFPM.

The ASFPM evolved from a number of issues related to the NFIP. The principal issues consisted of identifying flood-hazard areas and adopting local floodplain regulation. Of the federal Region V states—Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin—five had statutory authority that affected the preparation of flood insurance studies. Several had active floodplain management programs that pre-dated the NFIP.

By the mid-1970s, the states had trouble fulfilling the needs of the accelerated flood insurance study program because they could not complete their study reviews in a timely manner. FIA officials held a meeting with the Region V states in Chicago in November 1976 to discuss coordination problems and other NFIP issues. At this meeting, the states decided to meet the following year during the regional FIA meeting.

Concerned with delays in issuing flood insurance study reports, the FIA, in August 1977, decided to circumvent the state review and approval process that occurred prior to sending the studies to local governments for use in local floodplain management programs. The states in Region V objected to this unilateral policy and indicated that studies without state approval would not be used for regulation in the state. In October 1977, the FIA met with the Region V state coordinators in Chicago.[135] As a result of this meeting, the FIA revised the study policy and addressed other issues. The states' success in reversing this policy change solidified their cause and pushed them to form an association that eventually evolved into the ASFPM, an organization that acts on their collective behalf.

135 Attendees at the 1977 meeting between the FIA and the Region V state coordinators included French Wetmore, Brent McMahon, Larry Sanders, Chuck Morris and Frank Rupp from Illinois; Gordon Lance and Bill Trakimas from Indiana; Jim Boulton and Dan Morgan from Michigan; Pat Bloomgren and Jim Wright from Minnesota; Peter Finke from Ohio; and Larry Larson, Terry Hampton, and Tom Muellner from Wisconsin.

Most of the new group's activities from 1976 to 1978 involved attending the FIA's annual meeting in Chicago to meet with FIA officials during the day and hold their own meetings at night. These meetings provided opportunities for the states to talk among themselves about the problems of implementing their programs and coordinating federal programs with state and local programs. Following those meetings, ASFPM's chair would send a letter to the FIA outlining the Association's concerns on a number of topical issues. Gordon Lance served as the first chair in 1977 followed by Patricia Bloomgren in 1978. The Association held its first annual meeting in St. Paul, Minnesota, in April 1979. Bloomgren invited other states to the meeting to discuss problems and issues related to the NFIP. Representatives from about fifteen states attended.[136] In 1979, the association members elected Larry Larson as chair, and in June of that year, Gloria Jimenez, FIA's administrator, invited the states to the first joint FIA/States meeting in Washington. Discussions occurred during the formal sessions and at great length throughout the evening.

During that time, the Association moved its attention from reacting to NFIP efforts to reaching out to other states. Each year from 1979 attendance at the annual meeting grew as more states participated. The 1980 meeting in New Orleans was the first held outside the Midwest. At that point, the ASFPM truly became national in its focus.

By many accounts, 1982 was the Association's watershed year. The annual conference held in Madison resulted in the first technical program for training participants rather than a program reacting to federal issues. The program was developed by Jon Kusler and Larry Larson. That year also saw the creation of the first state association in Arizona which became the first ASFPM Chapter in 1984.

Since 1982, this all-volunteer organization has continually expanded in two important areas: federal relations and service to members. The ASFPM established a formal Washington presence by funding either a person or an organization to monitor developments and provide representation at important meetings. Encouraged with funding support from the FIA, the Association began a quarterly newsletter that became the voice of local and state floodplain managers with all pertinent federal agencies, especially policy offices such as the Water Resources Council and The White House Office of Domestic Policy. As it matured, the Association added a constitution, membership dues, a Board of Directors, standing committees, a budget, and a logo. It became an official tax exempt, non-profit organization in 1988. State programs grew, too, particularly after FIA's State Assistance Program, which sprouted from seeds planted by Association members, began in 1980.

The Association advanced during the 1980s as the office became more professional, as relationships developed with federal agencies, and as members worked more and more with other national organizations, including the Council of State

136 Larson, Larry A., Association of State Floodplain Managers: History of Activities, (Association of State Floodplain Managers, Inc., September 1990).

Governments, the National Governors Association, the National Emergency Management Association, the National Wildlife Federation, and the Association of State Wetland Managers. The ASFPM's work with these organizations dealt with common issues such as floodplain management, dam safety, disaster assistance, wetlands protection, coastal zone and multi-objective management, and by the 1990s, with watershed management and river restoration.

The Association was a major force in federal legislation to enact and implement flood mitigation programs such as the 1988 changes to the Disaster Relief Act and the 1994 Reform of the NFIP.

FLOODPLAIN MANAGEMENT 1980S: STATE AND LOCAL PROGRAMS

In his 1982 document prepared for the Water Resources Council,[137] Kusler reported state and local floodplain management experiences from the 1970s. During the 1980s, the ASFPM published information about state and local floodplain management programs in its 1985 annual report and in its report *Floodplain Management 1989: State and Local Programs*.

ASFPM's 1985 state activity survey

In the first report, the ASFPM published activity summaries of 28 states, as reported by regional representatives, in its 1985 annual report.[138] The states reported a number of activities carried out by initiatives and resources independent of the NFIP. For example:

- *Maryland's* Comprehensive Flood Management Grant Program funded 14 watershed studies to identify floodprone areas and to investigate mitigation opportunities. Beneficial projects were eligible for up to 50 percent funding from the grant program. Since 1980, nearly $7.7 million in state funds had been used to acquire floodplain properties.
- *Pennsylvania* funded three professional and one clerical positions to provide technical assistance to local municipalities.
- *Illinois* adopted state regulations for development in the designated floodway portion of the regulatory floodplain and revised a handbook for local officials charged with carrying out floodplain management measures.
- *Indiana* prepared a similar handbook for local floodplain management officials, regulated floodway development, and state-funded four staff.

137 Kusler, Regulation of Flood Hazard Areas.
138 Annual Report of the Association of State Floodplain Managers, Inc., (Association of State Floodplain Managers, Inc., 1985).

- *Michigan's* state-funded program included state approval for some types of development in floodplain areas.
- *Minnesota* amended its floodplain management act in 1973 (prior to the NFIP amendments that same year) to require floodprone communities to participate in the NFIP. The state's action accelerated community entries into the program, which resulted in early completion of their flood insurance studies. The state had more restrictive floodplain management standards than the NFIP and had the Corps' *Flood-proofing Regulations* document adopted into the state building code.
- *Wisconsin* also had more restrictive floodplain management standards than the NFIP. A large staff of 15 employees in one central office and six district offices assisted communities with implementing these standards. Considerable resources were devoted to determining the degree of community compliance.
- *Louisiana* founded a Floodplain Management Association in 1984 that consisted of local permit officials, local elected officials, state agencies, planning agencies, and private consultants involved in floodplain management activities.
- *Iowa* started regulating floodplain development in 1957. It had a state-level permit system in the mid-1980s but delegated some permit programs to communities that had received flood insurance studies. The state maintained oversight authority over communities and provided technical assistance to them.
- *Nebraska* established a state permit program for floodplain development and state-funded staff.
- The *Arizona* Floodplain Management Association had a large membership. The state staff developed a floodplain management handbook for local officials.
- *California* had a state floodplain management association.
- *Washington's* Flood Control Assistance Account Program, authorized by the 1984 state legislature, provided up to 50 percent state funding to assist local flood control projects. The state also had a regulation permit program in designated flood hazard areas.

In addition, a large number of other activities had been carried out in the states during the early 1980s under FEMA's State Assistance and subsequent Community Assistance Programs, created to provide financial support to states for NFIP-related floodplain management activities. The information in the 1985 annual report represented only slightly more than half the states and was not compiled through a formal survey. Therefore, the document may greatly underreport the degree of state activity in floodplain management.

ASFPM's 1989 state activity survey

The second report summarized ASFPM's first formal survey of state and local programs completed in 1989.[139] The organization developed the survey and mailed it to the NFIP coordinator in each state and the District of Columbia. All coordinators completed and returned the forms. Using this type of standardized reporting form made it possible to summarize state floodplain management activities at the end of the 1980s.

As in 1985, a state's activities varied according to the state's participation in various FEMA-funded assistance programs, the financial status of state government and the regional economy, the types of flooding common to the area, the political situation, and the prevalent attitudes toward regulation and resource preservation. Some generalizations can be made about the state's activities.

Coordinated NFIP activities. Almost all states coordinated NFIP activities (distributed maps, reviewed flood insurance studies, and provided technical assistance to localities); conducted some kind of information and education program; and monitored the safety of dams and other control structures. Between the Kusler study in the early 1980s to the 1989 survey, the number of states that undertook activities in support of the NFIP dramatically increased. Several states regulated, or required localities to regulate, floodplain areas to standards stricter than those of the NFIP. More than half also regulated wetlands and had other floodplain resource protection programs. About half the states did some floodplain mapping on their own, collected data for flood warning systems or operated such a system, and provided disaster assistance to local governments and businesses.

Types of activities. According to the published report, the activities funded by FEMA had the most state participation. Fewer states engaged in the most expensive activities and activities requiring the most technical expertise. The report noted that the collected data might not reflect total state activities because of the perspective and position of the survey respondents. It further noted that, in many cases, a lack of coordination among the agencies within a state made obtaining comprehensive data on state programs difficult.[140] This could happen because a number of agencies—emergency preparedness and response, natural resources, environmental protection, structural flood protection measures, planning, and economic development—may have been responsible for various aspects of flood hazard management. In general, state involvement in floodplain management during the 1980s increased over that of the 1970s.

Minnesota, South Carolina, and Wisconsin were among those that reported changes in state activities since the 1985 survey. In 1987, the *Minnesota* legislature established a Flood Hazard Mitigation Grant Assistance Program that provided a 50 percent state/50 percent local, cost-share grant program for flood damage reduction

139 Floodplain Management 1989: State and Local Programs, (Association of State Floodplain Managers, Inc., 1989).
140 Ibid., p. 43.

activities. During the first two years of the program, $2.3 million was available for 30 approved projects. In 1988, the *South Carolina* legislature acted to restrict new development along erosion-prone beachfronts. In *Wisconsin*, a Governor's Executive Order directed every state agencies to ensure that all construction, funding, and permitting actions consider flood hazard standards. State administrative rules, applicable to local floodplain regulations, were also strengthened.

Local activities. Because it was not possible to survey all the nation's floodprone localities in the 1989 ASFPM study, the states provided information about *local* programs. The ASFPM requested information about typical local floodplain management activities in the states even though it recognized the difficulty of determining a community with a typical floodplain management program. Seventeen states provided information about local activities.

Local programs tended to vary most dramatically according to the size of the community. Small communities generally lacked technical expertise, operated with part-time personnel, and had only limited resources. Small, especially rural, communities and in particular those in certain parts of the country tended to resist planning and regulation. Larger towns and urban areas almost always accepted and provided for such measures as an effective strategy for accommodating their populations and maintaining a certain quality of life.

The reported approaches of local communities to flood hazard reduction varied from state to state. Some states had statutes mandating localities to regulate in certain ways, to certain standards, and take other flood loss reduction measures. Other states left the decisions more fully in local hands. This had a significant effect on community action. Unless the flood hazard was extremely serious, small communities generally regulated to NFIP or minimum state floodplain management standards. A 1980 study[141] concluded that for most sizeable localities, flooding was simply not a salient concern compared to other problems faced by local officials.

In an overview of state and local programs in effect at the end of the 1980s, the ASFPM survey report stated that "in the information about local and state programs, the NFIP minimum criteria and other 'federal requirements' are mentioned repeatedly. It is clear that federal standards are compelling state and local governments to take certain measures to cope with flood hazards. In some cases, the state and/or local activity would not even be taking place if not for the fact that it is required by the federal government; in other instances, complying with the federal requirement is the first step that sets the state or locality off on its own tailored effort."[142] Without question, by the end of this decade, requirements imposed on states and localities to receive certain federal benefits to prepare

141 French, S. P., and R. J. Burby, Managing Flood Hazard Areas: The State of Practice, (University of North Carolina at Chapel Hill, 1980).
142 Floodplain Management 1989, p. 44.

for, deal with, or recover from the consequences of flood disasters had "institutionalized" many floodplain management approaches.

THE NATURAL HAZARDS RESEARCH AND APPLICATIONS INFORMATION CENTER

The Natural Hazards Center at the University of Colorado, Boulder, is a national clearinghouse for research data on the social, economic, political, and behavioral aspects of natural disasters and related technological risks. In other words, the center collects and shares information on how society prepares for, responds to, recovers from, and mitigates disasters.

The concept of the Natural Hazards Center originated from a research project carried out in the early 1970s by a group of scholars at the University of Colorado.[143] The project involved an extensive analysis of the state of natural hazards research in the United States. It was initiated to determine the reasons why, despite tremendous governmental expenditure on hazard reduction programs, economic losses from disasters continued to rise. The researchers examined most natural disasters and made a list of recommendations for constructive research and better hazards management. One of the recommendations was to develop a system for making research findings available to public officials and agencies so they were better prepared to take action necessary to reduce vulnerability to disasters. This recommendation included the specific suggestion to create a clearinghouse service to facilitate rapid and wide circulation of information among the producers and users of research on natural hazards.

In 1975, Gilbert F. White, one of the principal authors of the study, founded the Natural Hazards Center at the University of Colorado, Boulder. Though based in Colorado, the center is national in scope. A consortium of federal agencies and the Institute for Business and Home Safety fund the Center, which has a core staff of seven and graduate students who act as research assistants. Many of the students obtain professional careers in natural hazards management.

Operations and services

The main goal of the center is to strengthen communication among the researchers, individuals, organizations, and agencies that are concerned with individual and public actions to reduce damages from disasters. Over the years, the Center has carried out this work in three major operational areas: information dissemination, information services, and an annual workshop. It also has a modest research program.

143 White, Gilbert F. and J. Eugene Haas, Assessment of Research on Natural Hazards, (Cambridge: MIT Press, 1975). This study followed an international study of natural hazards sponsored by the International Geographical Union and published by Oxford University Press in 1974.

Information dissemination. The information dissemination program has three distinct areas: 1) publishing and distributing a bimonthly newsletter, the *Natural Hazards Observer*; 2) publishing monographs, working papers, bibliographies, and other special reports; and 3) maintaining Internet activities, including an electronic newsletter and an extensive Web site.

Information services. The Center's information services program maintains a large natural hazards library and responds to information requests. The library has more than 17,000 books, articles, reports, journals, and other documents that comprise perhaps the most extensive library on the social, economic, and behavioral aspects of natural disasters in the country. The holdings, about one-third of which are annotated, are catalogued in HAZBIB, a computerized, bibliographic database. HazLit, the web-based version, is available for online searching.

Annual workshop. The Center convenes a workshop each summer in Boulder, Colorado, to strengthen the link between the research and the applications communities by bringing the groups together to establish contacts and share hazard-related problems and ideas for solutions. The workshop is unlike most conferences in that it brings together people from different disciplines, organizations, and thought. This diversity promotes interchange among disciplines and different levels of organizations. The workshop is structured specifically to provide the opportunity for people to learn how their work impacts others and vise versa.

Research and cooperative programs. The Center's small research projects focus on floods. At the TVA's request, the Center evaluated the agency's floodplain management program in the mid-1980s. Literature surveys on hydrology, socioeconomic factors, and historical trends of floods were conducted for the Scientific Assessment and Strategy Team led by the USGS after the 1993 Midwest flood. The Center completed research assessing long-term resiliency of the Red River of the North basin for the International Joint Commission.[144] The nation's floodplain management community also has strong connections with the Center. ASFPM's executive director serves on the Center's national advisory committee. The Center also operates a specialized "Floodplain Management Resource Center," under contract to the ASFPM, and publishes the ASFPM's annual conference proceedings as part of its special publication series.

To many involved in various aspects of flood hazard research and applications, the Center has been a very valuable, central resource. The breadth of knowledge available and the invaluable information programs on natural hazards are not found elsewhere in government, the private sector, or academia.

144 Myers, Mary Fran, Natural Hazards Research and Applications Information Center, Boulder, Colorado, personal correspondence 13 October 1998.

5

A GROWING INTEREST IN THE ENVIRONMENT

During the 1970s, a widespread recognition of the value of natural resources developed. Many started to believe that the natural and beneficial resources and functions of floodplains, wetlands, and coastal barrier islands must be restored and preserved.

THE CONSERVATION MOVEMENT AND ITS PROGRAMS

At the end of the 19th century, the notion of conservation was a mere whisper in the popular consciousness. Although there were a number of prominent naturalists, their voices had little effect. Fewer than 500 buffalo, which once had numbered as high as 60 million, remained in the nation. The passenger pigeon, a species once numbering in the billions, would be extinct in less than 15 years. The dawn of the 20th century marked the beginning of a new ethic, starting with an act of Congress to save birds whose feathers were decorating women's hats.[145] During the next ten decades, the idea of conservation grew from a whisper to a roar. The 20th century brought momentous changes to our nation's attitudes, environmental laws, and understanding of the natural world. "The history of America," wrote President Kennedy in 1963, "has been the story of Americans seizing, using, squandering and belatedly protecting their natural heritage."[146]

Many of our nation's most biologically productive, environmentally sensitive, and culturally important areas are found in floodplains. Because of the physical nature of floodplains, many enlightened observers saw the benefits of integrating environmental protection measures with existing flood loss reduction strategies.

A number of single-purpose federal laws and programs were established to protect various natural resources, such as national parks and forests, wildlife habitat, and

145 Lacey Act of 1900 that prohibited the shipment from one state to another of birds and other animals killed in violation of state laws.
146 "How Conservation Grew From A Whisper to a Roar," National Wildlife, Vol. 38, No. 1, December/January 2000. p. 23.

open space for conservation and recreation. However, the natural resources of floodplains and other natural systems were not formally recognized and incorporated in the federal decision-making process until passage of the NEPA in 1969. This act declared environmental quality as a national goal and established a procedure to assess the environmental impact of proposed federal projects and programs that could significantly affect the environment. It required federal agencies to develop implementation procedures and assign staff for this purpose. Thus, it laid the legislative and administrative foundation for evaluating environmental resources associated with river corridors and coastal zones.

Other programs subsequently aided these initial environmental efforts, including creating the EPA's Office of Wetlands Protection and the National Park Service's Rivers, Trails and Conservation Assistance Program.

The primary missions of the Office of Wetlands Protection focus on non-regulatory initiatives and protecting the nation's wetlands in response to continuing loss and degradation. Through this program, EPA regional offices provide technical assistance on how to maintain and/or restore the natural functions and beneficial resources of riverine and coastal floodplains. This assistance includes identifying the natural resources, describing their benefits, explaining impacts from proposed development or use, and suggesting preventative or mitigating actions and techniques.

The Park Service designed its Rivers, Trails and Conservation Assistance Program to assist other governmental agencies, private groups, and landowners to prepare plans to protect river corridors. The program's technical assistance focuses on prioritizing various interests, promoting more comprehensive and objective decision-making, and avoiding conflicts among competing uses of an area. Technical assistance usually consists of statewide river assessments and river corridor plans that can be initiated by a government agency or a private group, such as a land trust or a watershed organization. This process provides a positive way for landowners and government interests to help shape the future of important river corridor areas

OTHER LEGISLATIVE AND EXECUTIVE ACTIONS

Congress emphasized protection and enhancement of environmental quality in other legislation enacted in the two decades following NEPA, including: the Wild and Scenic Rivers Act of 1968, the Coastal Zone Management Act of 1972, the Endangered Species Act of 1973, the Clean Water Acts of 1972 and 1977, the Coastal Barrier Resources Act of 1982, and the Water Quality Act of 1987.

One significant legal tool that garnered protection for wetlands was Section 404 of the Clean Water Act of 1972. The section supplemented the existing Corps' permitting program for activities in navigable waters, pursuant to section 10 of the Rivers and Harbors Act of 1899. It required permits for the discharge of dredged or fill materials

into all "waters of the United States." Later court decisions interpreted this to include most of the nation's wetlands making Section 404 an important wetland protection measure.

Congress authorized federal projects containing major "non-structural" features in the Water Resources Development Act of 1974.[147] Section 73 of the act directed all federal agencies to consider nonstructural alternatives when reviewing any project involving flood protection and to pay at least 80 percent of the cost of nonstructural flood control measures. For the first time, there would be a more equitable consideration of flood damage reduction alternatives at the federal, state, and local levels.

During the 1970s, a widespread recognition of the value of natural resources developed. Many started to believe that the natural and beneficial resources and functions of floodplains, wetlands, and coastal barrier islands must be restored and preserved. Implementation of legislation protecting and enhancing environmental quality helped set the stage for two important executive orders that affected floodplain development and use. Executive Order 11988—Floodplain Management and Executive Order 11990—Protection of Wetlands were issued by President Carter in 1977 as part of a comprehensive environmental message. The two orders united the heretofore separate goals of reducing flood losses and reducing environmental harm by recognizing the important resources and functions of relatively undisturbed floodplains and wetlands. They were also closely related and similar in structure, and the federal government's implementation of both orders highlighted their relationship. Because most inland wetlands are located within riverine floodplains, the orders often covered the same areas. Experience in implementation strongly suggested the need for integrated management of wetlands and floodplains within river corridors.

INCREASING AWARENESS OF FLOODPLAIN NATURAL RESOURCES AND FUNCTIONS

Jon Kusler[148] became very involved in early efforts to coordinate floodplain management and wetland protection measures. Because of the interrelation of non-tidal wetlands with riverine floodplains, wetland managers, floodplain managers, and other natural resource managers discovered that program goals often overlapped and that they shared many interests and needs. Kusler led a series of eight floodplain and wetland seminars conducted by the U.S. Water Resources Council (WRC) during 1978 to 1979. The seminars dealt with problems, issues, and opportunities in joint management approaches.

147 P.L. 93-251.

148 John Kusler was an attorney at the University of Wisconsin's Center for Resource Policy Studies and was influential in promoting flood loss reduction through floodplain regulations. See The Water Resources Council section of Chapter 4 for more details.

Building on Kusler's earlier work and leadership, the Federal Interagency Floodplain Management Task Force conducted a number of regional and national workshops from 1987 to 1992. These workshops focused on the natural resources and functions of floodplains, multi-objective planning, and the various regulatory and protection techniques commonly employed. The well-attended workshops attracted considerable interest from local, state and federal officials.

Kusler's work on integrating floodplain and wetland management approaches continued during the last two decades of the 1900s. He was instrumental in forming the Association of State Wetland Managers in 1982 and has served as its executive director since that time. The Association seeks to strengthen state, federal, and local wetlands programs by facilitating and improving cooperation among these governmental entities, and by integrating public, private, and academic efforts to achieve wetland protection and management goals. It has carried out many cooperative activities with those in the floodplain management community.

All the previous work promoting the importance and integration of natural resources in floodplain management efforts set the stage for latter advancements. Over the past few decades, better methodologies have developed to identify and quantify the natural resources in relatively undisturbed floodplains, the beneficial functions they perform, and how these benefits can be impaired or even lost. This greater understanding of floodplain function led to other important milestones including:

- The 1994 document, *A Unified National Program for Floodplain Management*, groups floodplain resources into three categories—water, biologic, and societal—and lists the natural functions they provide.
- In 1994, the Federal Interagency Floodplain Management Task Force, with funding from the EPA and the Corps, commissioned a guidebook for community officials and other interested parties to aid in developing local programs to protect and restore important floodplain resources and functions. *Protecting Floodplain Resources: A Guide for Communities* provides information on flood hazard mitigation methods to preserve the integrity of floodplain natural systems.[149]
- A section of the National Flood Insurance Reform Act of 1994[150] established a federal interagency Task Force on Natural and Beneficial Functions of the Floodplain comprised of a number of nationally recognized experts who can identify floodplain functions and develop recommendations. The task force convened in 1996 to identify the natural and beneficial functions of the floodplain that reduce flood-related losses, and develop recommendations on how to reduce flood losses by protecting these functions. The group's report is expected in 2000 or shortly after.

149 Federal Interagency Floodplain Management Task Force, Protecting Floodplain Resources.
150 P. L. 103-325.

- A 1998 report by the National Wildlife Federation focused on efforts to restore floodplains through voluntary buyouts and relocations of homes and other structures from high-risk flood areas.[151] It included sections on the history of buyout programs in the United States and the 1993 Midwest flood.

This increasing awareness of natural resources and functions is tempered by the absence of sufficient nationwide data to accurately measure the success or failure of current management approaches devoted to resource protection and restoration. The inability to provide for a quantifiable measurement has hindered needed policy changes, incorporation of natural resource protection into floodplain management decision-making, and a share of limited fiscal resources.

151 Higher Ground: A Report on Voluntary Property Buyouts in the Nation's Floodplains, (National Wildlife Federation, 1998).

6

THE 1990S: DISASTER ASSISTANCE PREVAILS

The flood control construction program of the 1930s-1950s era seemed to be replaced by an equally massive federal relief and recovery assistance program for flood disasters in the 1990s.

A GROWING FEDERAL ROLE IN DISASTER RESPONSE AND RECOVERY

Federal disaster relief for victims of natural disasters dates from an 1815 act "for the relief of inhabitants of the late county of New Madrid, in the Missouri territory, who suffered from earthquakes." Congress authorized that the federal government could exchange plots of land up to 160 acres with owners of land damaged by the earthquakes.[152] Respecting flood events, Congress subsequently enacted relief bills from time to time for victims of specific disasters.

In 1933, in response to a major California earthquake, and contrary to past traditions, Congress enacted legislation that provided direct assistance to private citizens suffering disaster damage by issuing federal loans through the Reconstruction Finance Corporation. The legislation was adopted only after a lengthy debate about whether Congress should establish the precedent of expanding federal disaster relief to include aiding individuals in rebuilding their homes and businesses. In enacting the legislation, Congress realized in principle that, in the event of a natural disaster, the federal government should provide the necessary services to rehabilitate devastated communities when private and local interests were unable to perform those services. The following year, in response to several intervening disasters that befell communities in disparate

152 Mitler, Elliot, A Fiscal Responsibility Analysis of a National Earthquake Insurance Program, (The Earthquake Project of the National Committee on Property Insurance, 1992).

parts of the country, Congress enacted legislation that made loans available to victims of all natural disasters, including floods.

Congress established the foundation of a national natural disaster relief program in 1950.[153] Instead of enacting relief bills for victims of specific disasters, Congress enacted legislation to provide "an orderly and continuous means of assistance by the Federal Government to the States and local governments in carrying out their responsibilities to alleviate suffering and damage resulting from major disasters." The legislation authorized the President to determine what constituted a major disaster, and after making this declaration, to direct federal agencies to provide aid to the victims. This law formally took notice of the fact that natural disaster relief was a local responsibility, but some disasters would be of such severity that relief and rehabilitation would be beyond the financial capabilities of state and local governments. State governments had to formally request the President to declare a major disaster. If granted, the federal government would then provide disaster assistance "to supplement the efforts and available resources of States and local governments in alleviating the disaster." [154]

Following the 1964 "Good Friday" earthquake in Alaska, Congress ushered in the direct subsidy or grant as a federal disaster relief policy. One year later, following Hurricane Betsy, which struck southern Florida and the Mississippi River delta, Congress enacted further legislation that permitted the forgiveness of loans for the reconstruction of homes, small businesses, and farms damaged by natural disasters. Since then, some form of grant provision has been included in virtually every subsequent disaster relief act.

The Disaster Relief Act of 1974 consolidated and reorganized disaster assistance provided by federal agencies. Initially, HUD coordinated disaster relief but coordination transferred to FEMA when the agency was created in 1979.

Post-disaster recovery assistance aids mitigation. In 1980, the OMB directed that "all Federal programs that provide construction funds and long-term recovery assistance must use common flood disaster planning and post-flood recovery procedures."[155] In response, twelve federal agencies signed an interagency agreement to provide technical assistance to states and communities for nonstructural, flood damage reduction measures in flood recovery efforts. The agencies formed an Interagency Flood Hazard Mitigation Task Force charged with carrying out the agreement. The task force representatives were to ensure that personnel from their agencies were available to participate on post-disaster, interagency hazard mitigation teams. They were also to review agency programs and policies to identify and remove obstacles to implementing flood hazard mitigation measures recommended by the interagency teams.

153 Disaster Relief Act of 1950, P.L. 81-875.
154 Mitler, p. 19.
155 "Nonstructural Flood Protection Measures and Flood Disaster Recovery" (memorandum, Office of Management and Budget, July 1980).

Subsequent disasters saw deployment of interagency teams to investigate opportunities to employ nonstructural, flood damage reduction measures and to rapidly issue recommendations before recovery and reconstruction had advanced to the point that such alternatives could not be considered. A number of problems arose, including assigning personnel in a timely manner, quickly identifying and agreeing on viable recovery measures, swiftly preparing an interagency report on recommended measures, and obtaining agency support and funding for the measures. In concept, the need and goals of the agreement were sound. In reality, it enjoyed a few successes, but never approached its potential.

Because the reports were seldom finished in the timeframe envisioned, they did not become useful in the recovery process. Several steps were taken to correct this problem. During the 1990s, FEMA appointed a Deputy Federal Coordinating Officer for Mitigation to raise the profile of mitigation at the Disaster Field Office (DFO). Developing early implementation strategies at the DFO expedited the mitigation process. Another approach established Presidential Long Term Recovery Task Forces (e.g., 1997 Red River floods). These task forces operated at a higher administrative level and became much more visible (At times, President Clinton was personally involved.). Recovery and mitigation became increasingly integrated and in some disasters became one and the same. Increasing available mitigation funding drove the entire process.[156]

The Robert T. Stafford Disaster Relief and Emergency Assistance Amendments of 1988 significantly changed existing disaster relief programs in an attempt to increase post-disaster mitigation measures and reduce vulnerability to damages from future disasters. It stressed hazard mitigation, including 1) funding to acquire destroyed or damaged properties and not for rebuilding in flood hazard areas, 2) rebuilding in non-hazardous areas, and 3) reducing exposure to flood risk in reconstruction.

After the 1993 Midwest flood, Congress enacted the Hazard Mitigation and Relocation Assistance Act of 1993 to increase federal support for relocating floodprone properties and to significantly increase the amount of mitigation funds available after a disaster, from 10 percent of a portion of the disaster costs to 15 percent of all federal disaster costs. The act also clarified acceptable conditions for the purchase of damaged homes and businesses, required the complete removal of the structures, and dictated that the purchased land be dedicated "in perpetuity for a use that is compatible with open space, recreational, or wetlands management practices." An estimated 20,000 structures have been acquired and removed through this program.

These and other mitigation measures occurred because of the significant, newly available funds for flood mitigation. By around the mid-1990s, funding reached several hundred million dollars per year. In addition, several hundred million dollars of

156 Robinson, 19 January, 2000.

supplemental appropriations occurred during the end of that decade. This made mitigation a major player in post-disaster activities.[157]

THE NATIONAL ASSESSMENT

One of the recommendations in the 1986 *Unified National Program for Floodplain Management* report was to "provide evaluation of floodplain management activities with periodic reporting to the public and to the Congress on progress toward implementation of a unified national program for floodplain management."[158] To follow up on this recommendation, the Federal Interagency Floodplain Management Task Force in 1987 initiated an assessment of the nation's program for floodplain management, the first comprehensive study, assessment, or statement on managing the nation's floodplains since House Document 465 was issued in 1966. The national assessment provided a comparative basis for justifying program budgets and evaluating, over time, the effectiveness of various tools, policies, and program planning efforts for floodplain management.

Because of the TVA long history of floodplain management experience, expertise, and leadership, the task force requested that TVA manage the interagency effort, including contracting of professional services. TVA's James Wright served as project manager.

The task force contracted Larry R. Johnston Associates to prepare the assessment. In carrying out the assessment, the contractor sought the judgments and views of many professional individuals and groups actively involved with or affected by floodplain management activities, reviewed the published literature, and collected all relevant and available data. The task force assembled a special National Review Committee, chaired by Gilbert F. White and comprised of prominent floodplain and natural resource management professionals, to evaluate the effectiveness of floodplain management. The committee's report to the task force significantly aided in carrying out the assessment.[159]

Larry Johnston, principal author of the assessment, died suddenly in late 1990 when the report was nearly completed. At the time of his death, Johnston was viewed as one of the few true experts on floodplain management because of his breadth of knowledge of national issues. Had he lived, he would have undoubtedly remained an invaluable contributor in a number of important ways.

The task force subsequently contracted with Geoffrey Steadman, an associate of Johnston, and with the Natural Hazards Center to complete the assessment, which

157 Ibid.
158 A Unified National Program for Floodplain Management, 1986, p. I-7; For more, see "Towards a Unified National Program for Floodplain Management" in Chapter 4.
159 Action Agenda for Managing the Nation's Floodplains, (National Review Committee, 17 October 1989).

included preparing the Summary Report and an Executive Summary. The two summaries were principally prepared by Jacquelyn L. Monday, who was under contract with the Natural Hazards Center. Johnston's untimely death delayed completion of the assessment by about a year.

The task force published its two-volume *Floodplain Management in the United States: An Assessment Report*[160] in 1992. Some of the key findings were:

- *Individual Risk Awareness*. Although substantial progress has been made in increasing institutional awareness of flood risk, individual awareness falls far short of what is needed, resulting in unwise use and development of flood hazard area.
- *Migration to Water*. People are attracted to riverine and coastal environments for a variety of reasons, usually unrelated to economic necessity. In recent decades, the annual growth rate in these areas has greatly exceeded the nation as a whole. This has exposed property and people to unnecessary risk. However, because of technological advances in flood warning and response, flood-related deaths are not increasing on a per-capita basis.
- *Floodplain Losses*. Despite attempts to cope with the problem, the large-scale development and modification of riverine and coastal floodplains has resulted in increasing damages and loss of floodplain resources.
- *Short-term Economic Returns*. In many instances, private interests develop land to maximize economic return without regard to long-term economic and natural resource losses. This increases public expenditures for relief, recovery, and corrective actions.
- *Enhanced Knowledge and Technology*. Institutions and individuals that deal with floodplain problems must have a broad range of information, a variety of technologies to deal with emerging problems, and standards to which they can refer for guidance. Research has enhanced our knowledge and provided new and better tools to deal with physical, biological, and social processes.
- *National Flood Protection Standard*. Because of avoidance of high-hazard areas (such as riverine floodways) and changes in construction practices, most new floodplain developments have improved flood protection. However, controls over development within the regulatory floodplain, defined by the limits of the 1-percent annual chance flood event, have concentrated developments just beyond these limits or levels. Protection from the effects of greater, less frequent flooding is still needed in those places where such flooding will cause unacceptable or catastrophic damages.

160 Floodplain Management in the United States: An Assessment Report, Volume 1, Summary Report, and Volume 2, Full Report, (Prepared for the Federal Interagency Floodplain Management Task Force, 1992), Chapter 15.

- *Limited Governmental Capabilities*. Some states and most communities lack the full resources necessary to bring about comprehensive local action to mitigate flood problems without federal support. Local governments invariably misjudge their ability to deal with severe flood events. However, they are necessary partners to any successful solution.

- *Need for Interdisciplinary Approaches*. Consideration of plans to solve flood problems should encompass the entire hydrologic unit and be part of a broader water resources management program. A lack of familiarity with all the available techniques biases the investigation and selection of solutions for specific flood problems. Training in a variety of disciplines is needed in devising and carrying out mitigation strategies.

- *Application of Measures*. Nationwide mapping of floodplain areas has resulted in detailed studies of most developed floodplain areas. A variety of strategies have been used 1) to restore and preserve the natural and cultural resources of floodplains and 2) to reduce economic losses by modifying susceptibility to flood damage and disruption, flooding, and impacts of flooding on individuals and the community. Although there are some notable exceptions, measures implemented at the local level typically involve only floodplain regulations (to meet the requirements of the NFIP and, in some instances, more restrictive state programs) and the purchase of individual flood insurance. Storage or control of floodwaters is still the preferred political approach at the local level.

- *Effectiveness of Mitigation Measures*. Structural flood control measures have been effective in reducing economic losses to floodplain occupants. The application of additional structural measures is viewed as limited because of economic and environmental considerations. Land use regulations required by some federal programs and implemented by state and local governments have reduced the rate of floodplain development but have not arrested it. Compliance with regulatory controls is a significant problem. New technologies and techniques associated with risk assessment, forecasting, warning, and construction practices have substantially improved the application and effectiveness of these activities. A national flood insurance program has not realized its full potential because less than one-fifth of floodplain residents have purchased and maintained policy coverage.

- *Role of Disaster Assistance*. Liberal federal assistance in post-flood relief and recovery has reinforced expectations of government aid if and when flood disasters occur. This mindset has resulted in limited mitigation planning and actions by communities and individuals.

- *National Goals and Resources*. Despite great strides, the United States still lacks a truly unified national program for floodplain management. Ambiguity in national goals has hindered the effective employment of limited financial and human resources.

THE 1994 UNIFIED NATIONAL PROGRAM FOR FLOODPLAIN MANAGEMENT

The Federal Interagency Floodplain Management Task Force developed further proposals for *A Unified National Program for Floodplain Management* report in 1993 to reflect a number of trends affecting floodplain management and to include the findings and conclusions of the 1992 national assessment. The task force essentially completed its work before the 1993 Midwest flood, but the report was not published until 1994.[161]

The task force identified several floodplain management issues that needed direct attention and development. First, intensified public concern for environmental protection made the resource protection aspects of floodplain management not only more attractive to decision-makers, but also practically essential to a successful program or project. Second, a set of achievable national goals to ensure "wise" use of the nation's floodplains also should be developed. Such goals would provide both a sense of direction and the means to measure progress or lack of it. Agencies at all levels of government and the private sector could work, each within its own role, towards these goals.

The report set out intermediate- and long-term goals to enable the nation to use its floodplains more wisely. These goals were based in part on the opportunities identified in the national assessment and in other documents and forums and on a number of national and global trends. The task force prepared its report prior to, and independent of, the subsequent report of the Administration's Floodplain Management Review Committee. The task force's report recommended four broad goals for a Unified National Program: 1) Formalize a national goal-setting and monitoring system; 2) Reduce by at least half the risks to life and property and the risks to the natural resources of the Nation's floodplains; 3) Develop and implement a process to encourage positive attitudes toward flood-plain management, and 4) Establish in-house floodplain management capability nationwide.

The report also identified objectives necessary to achieve each goal and set target dates for completing them. The phasing of goals and objectives set an "action agenda" and facilitated feasible estimates of progress. The President received the task force's report in 1994 and transmitted it to Congress on March 6, 1995.

This document represented just one of the many reports prepared and activities carried out by the task force over nearly two decades to promote a unified national program for floodplain management. Much of the success of the task force could be attributed to the continuity of its agency representatives. Many served together for more than a decade, gaining considerable knowledge of the programs and activities of the other agencies, developing professional respect for each other, and learning to work effectively together in a common mission.

161 A Unified National Program for Floodplain Management, (Federal Interagency Floodplain Management Task Force, 1994).

By the end of 1995, most of the agency representatives on the task force had retired from federal service, including Frank Thomas who had provided sound leadership and direction. Thus, the task force lacked continuity and follow-up mechanisms for its recent work, including the recommendations from the 1994 report. In an effort to consider and implement the recommendations, FEMA convened a group of about 40 nationally recognized experts at the ASFPM's' annual conference in Little Rock, Arkansas, in May 1997. FEMA prepared a report on the forum,[162] but no action has been taken on the 1994 recommendations. In addition to problems of continuity in leadership, the Unified National Program for Floodplain Management has traditionally suffered from lack of high-level attention from presidential administrations. No entity exists to act upon the report's recommendations and those of the national assessment.

THE GREAT FLOOD OF 1993

The 1993 flood in the upper Mississippi and lower Missouri River basins from mid-June through early August provided sobering evidence that the nation had yet to reach an accommodation between Nature's periodic need to occupy her floodplains and their present human occupancy and use. The flood reached record levels at many locations within these basins. Various sources attempted to assign recurrence intervals (e.g., a "500-year" flood) to the flood, but they were subject to considerable error because of the complex and widespread nature of this event, the short historic data record upon which to base an analysis, changing observation methods, and the difficulty of assigning flow rates and elevations to past historic events. Although labeled by various media as the "flood of the century," the 1927 flood on the lower Mississippi (see Chapter 2, "A Period of Floods and Acts"), was the greatest flood disaster in our nation's history in terms of overall human suffering and misery. A comprehensive evaluation of the 1993 flood is contained in a book published in 1996.[163] Table 1 compares the two floods.

No source prepared a final account of the costs/losses from the flood. In remarks delivered several years after the flood, Gerry Galloway stated "the flood is over. No one now cares."[164]

162 Report on the Forum on the Unified National Program for Floodplain Management Goals, (Federal Interagency Floodplain Management Task Force, 1997).
163 Changnon, Stanley A., ed., The Great Flood of 1993: Causes, Impacts and Responses, (Boulder, CO: Westview Press, 1996).
164 Galloway, Gerald E., National Flood Policy, Progress Since the 1993 Floods, (paper delivered at the Association of State Floodplain Managers Annual Conference, San Diego, CA, 1996).

Table 1. Comparison of the 1927 and 1993 Floods on the Mississippi River[165]

Conditions	1927 flood	1993 flood (Estimates)
Area flooded, millions of acres	12.8	20.1
Property damage, billions of dollars	12.3[166]	12.7
Number of deaths	246	52
Buildings damaged	137,000	70,000
Number of people made homeless	700,000	74,000

ISSUES ARISING FROM THE GREAT FLOOD OF 1993

Changes in national policies dealing with flood losses have largely been event driven. The 1993 flood resulted in some policy changes. Changes continue to evolve as flood disasters continue. Four broad issues, which may be viewed as a microcosm of any major flood event, were examined, discussed and debated by politicians, officials, media, and some in the public in the aftermath of this major flood. The issues were: 1) whether to repair or reconstruct the hundreds of damaged flood control levees (or other structural protective measures in other flood instances) and who would pay for permitted repairs, 2) whether to permit repair or rebuilding of thousands of substantially damaged structures so they could again be inhabited, 3) whether to commit community planning and financial assistance to develop alternative mitigation strategies to the typical repair/rebuild scenario, and 4) whether to use the experience of risk insurance as a mitigation tool.

Levees

By some counts, more than 8,000 miles of levees of various descriptions existed in the Upper Mississippi River basin.[167] Many became part of the public "experience" of the 1993 flood. The news media widely reported massive and heroic local flood fighting efforts—and some subsequent spectacular failures—principally through construction of emergency levees or the reinforcement and/or raising of existing levees.

Approximately 1,600 levees (of which 1,400 were nonfederal) were damaged enough to require some form of rehabilitation or repair. Fewer than 500 of these levees

165 Changnon, p. 253.
166 Adjusted to 1993 dollars, $0.65 billion in 1927 dollars.
167 Sharing the Challenge: Floodplain Management Into the 21st Century, (Report of the Interagency Floodplain Management Review Committee, Executive Office of the President, 1994), p. 42.

came under the Corps' emergency flood control repair program[168]. Eligibility for inclusion in the Corps program required: that a levee be a primary one providing an adequate amount of protection, that the levee be sponsored by a public entity, that the levee's sponsor maintain the levee to a standard established by the Corps, and that the cost of any levee repair be shared 20 percent by the local sponsor and 80 percent by the federal government.

The levee repair/reconstruction debate involved a number of significant *land use issues*. Some of the most productive farmland in the nation was flooded, and in some instances, heavily damaged by deposition of sand and other sediment or by erosion from water flow over the land. Several questions were posed. What were the potential opportunities and possible future uses of land no longer suitable for agricultural purposes? If flood protection were not available for agriculturally suitable land, would farmers (and lenders) be willing to take the risk in continuing to farm? Should flood risk of highly productive farm land be considered a cost of doing business to be borne by the individual? Many contended past practices (particularly subsidies) resulted in land uses that were not sustainable, and as a matter of public policy, only sustainable uses should be allowed or supported. Thus, strong support emerged for restoring lost or impaired wetlands that could serve as natural flood storage areas, provide distinctive habitat, improve water quality, and conserve other important and beneficial natural resources. Many felt that both agricultural and conservation goals could be accommodated while restoring or improving the natural flood conveyance and storage functions of floodplain lands.

Those involved in the permitting and/or funding reconstruction or repair of the levees had difficulty striking a balance between the need to restore flood protection quickly and the need for long-term planning for alternative flood protection that incorporated broader concerns, such as protecting the natural floodplain environment. The challenge was to not develop short-term "fixes" that foreclosed more comprehensive long-term solutions. Myers and White suggested a variety of ways to buy time, such as providing interim insurance protection rather than rapid levee repair.[169]

To study the whole levee issue and to facilitate the search for appropriate alternatives, the OMB issued guidance in late August 1993 that established an unprecedented review procedure to assess strategies for levee reconstruction. Comprised of representatives from five federal agencies, state and local governments, and other interested organizations, participants considered alternatives to levee repair that would provide flood control benefits and natural resource protection. The review committee affected decisions not to rebuild a few levees, but its overall impact was not felt until later in other post-flood recovery situations such as occurred in California in 1995.[170]

168 P.L. 84-99.
169 Myers, Mary Fran and Gilbert F. White, "The Challenge of the Mississippi Flood," Environment, 35(December 1993), p. 32.
170 Zwickl, Kenneth, U.S. Army Corps of Engineers, Washington, DC, personal correspondence, 8 December 1999.

Flooding on the Mississippi River inundated Grafton, Illinois in 1993.

Photo by Paul Osman, Springfield, IL.

Given the gravity of Midwest flood situation, and because less than 15 percent of the nonfederal levees that were damaged qualified for repair consideration under the Corps' emergency flood control repair program, the Administration and Congress provided supplemental funding for levee repair. To receive this federal funding, levee districts or sponsors had to join the Corps' program. About three dozen districts or sponsors took this action.[171] Under the authority of Public Law 84-99, the Corps rehabilitated the 115 levees already eligible under its program and another 241 non-federal levees utilizing supplemental funding. In total, levee repairs cost $230 million.[172]

Rapid land use recovery from the 1993 flood was, in some instances, dramatic. In 1994 most farmers throughout the Midwest reaped the benefits of the best soybean and corn crops in history. Missouri, hard hit by flooding, had a stunning agricultural recovery. Although officials had predicted a bad year because sand deposits from flooding had ruined floodplain fields, farmers removed the sand over the winter, leveled the land, and planted crops on all but 27,000 sand-buried acres.

171 Zwickl, Personal correspondence, 29 November 1994.
172 Zwickl, Personal correspondence, 17 December 1999.

Substantially damaged buildings

The extent of the area inundated by floodwaters affected an estimated 149,000 households, although estimates vary widely. Whole communities were flooded. The depth and duration of flooding and other factors resulted in substantial damage to several thousand residences and other structures. As a result several other questions arose. Should such structures be acquired and relocated or demolished? Should those located in certain areas (e.g., floodways) be permitted to be repaired or rebuilt? Do farmhouses and other buildings have to be located in floodprone areas in order to sustain agricultural use of floodplain lands?

Where repair or rebuilding was permitted, local codes of communities participating in the NFIP required structures damaged beyond 50 percent of their value to be rebuilt in compliance with certain minimum standards. These standards required that the lowest floor must be at or above the level of a 1 percent chance flood. This requirement was intended to reduce future exposure to flood risk through elevating the structure in place or relocating it outside the regulatory floodplain. Following a flood, this often presented an overwhelming economic burden on those who needed to replace or repair their property.

Because of the widespread nature of the flood and the large number of properties affected, it was difficult to document what happened to the substantially damaged structures. No reliable data was gathered, although such information would have been useful to policy makers. Thousands of structures were elevated, acquired, or relocated using flood recovery funds. Others, undoubtedly, were brought into compliance with local codes using owner funds. Still others (perhaps most not using recovery funds) were reoccupied, circumventing local codes that likely were not rigorously enforced. And finally, a number of structures were just abandoned.

Alternative mitigation measures

Many individuals and communities affected by the Great Flood of 1993 had never before had to deal with floods and their consequences. Because of their lack of experience, they did not know what to do then and in the post-flood recovery phase. There, however, seemed to be a consensus that rebuilding or restoring to pre-flood conditions was not an acceptable policy position.

Federal funds for the disaster response and recovery effort were earmarked for about three dozen programs administered by various agencies. The Administration established buyouts of flood-damaged properties as the first priority for Midwest flood mitigation funds. According to FEMA data, 9140 properties in 140 communities were elevated, acquired, or relocated under the Hazard Mitigation Grant Program.[173] Projects

173 Soong, Mable, FEMA, personal correspondence, 24 February 2000.

ranged in size from elevations of one or two homes in a neighborhood to whole communities relocating to new locations (Valmeyer and Grafton, IL, and Rhineland and Pattonsburg, MO). This initiative represented a turning point in flood recovery policy: *it was the first time that buyouts had been attempted on such a large scale.*

Many viewed buyouts as an appropriate governmental response to the 1993 flood, and future floods like it. Thousands of structures were acquired in a number of subsequent disasters during the 1990s. Under the right circumstances, buyouts not only reduce flood damages and protect people and property, but also achieve other objectives, such as improving the quality of affordable housing, increasing recreational opportunities and wildlife values, and resulting in general betterment of the community.

Insurance as a mitigation tool

In enacting the Federal Crop Insurance Act (Public Law. 75-430) in 1938, the National Flood Insurance Act (Public Law. 90-448) in 1968, and subsequent acts, the Congress recognized disaster insurance to be a more fiscally prudent public policy than relief and other forms of federal assistance. Despite a number of important successes, such as identifying hazard areas and increasing controls over inappropriate floodplain land use, neither the crop insurance nor flood insurance programs have come close to meeting the congressional intent of transferring the cost of floodplain occupancy and use from the taxpayer to the individual. The Federal Crop Insurance Corporation estimated that slightly more than 50 percent of the insurable crop acres in the states affected by the 1993 flood were insured against losses.

The Floodplain Management Review Committee noted that although policy holders filed 16,167 flood insurance claims, FEMA approved 89,734 applications for the Disaster Housing Program and 38,423 applications for Individual and Family Grants. The Small Business Administration approved 20,285 loans for individuals and businesses.[174]

Admittedly, many of the applications, or loan approvals, were for persons outside of identified flood hazard areas or for renters who do not normally purchase flood insurance. Still the numbers were disturbing. In the counties and communities affected, it was estimated that *only 10 to 20 percent of insurable properties had flood insurance coverage*.[175] Similar statistics exist for other flood disasters since the Midwest disaster. Flood insurance claims payments totaled $297 million—a very small percentage of the $3.1 billion federal response and recovery costs and loans for the flood.[176] The flood insurance problems led to amendments to the NFIP and the Federal Crop Insurance Program.

174. Sharing the Challenge, p. 131.
175 Ibid.
176 Ibid., pp. 22, 27.

POST-FLOOD ACTIVITIES AND STUDIES

Report of the Administration's Interagency Floodplain Management Review Committee

In January 1994, the Executive Office of the President assigned a broad mandate to the federal Interagency Floodplain Management Review Committee led by the U.S. Army's Brigadier General Gerald E. Galloway. Part of the Committee's mission involved delineating the major causes and consequences of the 1993 Midwest flooding and evaluating the performance of existing floodplain management and related watershed management programs. The final report was based on the group's research and interactions with federal, state, and local officials; businesses; special interest groups; and individuals inside and outside the Mississippi River basin.[177] Taken with the assessment of the nation's program for floodplain management,[178] and the revised proposals for a unified national program for floodplain management,[179] the committee's report provided an opportunity for "a blueprint for change" in the nation's programs and policies affecting its coastal and riverine floodplains. Some of the more salient statements in the report included:

- The goals for floodplain management are clear. The means to carry out effective floodplain management exist today but need improving and refocusing. Responsibility and accountability for accomplishing floodplain management needs to be shared among all levels of government and with citizens of the nation.
- Full disaster support for those in the floodplain should be contingent on their participation in self-help mitigation programs such as flood insurance. But, only a small percent of those eligible purchase flood insurance. Measures that internalize risks reduce the moral hazard associated with full government support.
- State and local governments must have a fiscal stake in floodplain management. Without this stake, few incentives exist for them to be fully involved in floodplain management.
- People and property remain at risk throughout the nation. Many of those at risk neither fully understand the nature and the potential consequences of that risk nor share fully in the fiscal implications of bearing that risk.
- The lessons of the flood of 1993 are clear. The nation should not carry the burden of massive federal flood disaster relief costs that current policies generate each time a major flood occurs.

177 Sharing the Challenge.
178 Floodplain Management in the United States: An Assessment Report, 1992.
179 A Unified National Program for Floodplain Management, 1994.

- The dominant federal role in funding flood damage reduction and recovery activities limits the incentive for many state and local governments, businesses, and private citizens to share responsibility for making wise decisions concerning floodplain activity.
- Increased state involvement will require greater state technical capabilities in floodplain management. Few incentives exist, however, for the state to build this expertise.
- The federal government should not undertake actions that lower the incentive for those in the floodplain to avoid risk because they know the federal government will pay compensation for damages resulting from the risk.
- During the 1993 flood, environmental easement and land acquisition programs became tools in assisting recovery and in removing people from long-term flood vulnerability. In addition to meeting the needs of disaster relief victims, these programs can be effective in achieving the nation's environmental goals.

Other recommendations. The committee also recommended changes in federal policies, programs, and activities that, in its view, would most effectively achieve risk reduction, economic efficiency, and governmental enhancement in the floodplain and related watersheds. The 89 recommendations in "a blueprint for the future" included a number of significant suggestions. First, to ensure a long-term, nationwide approach to floodplain management, the committee proposed legislation to develop and fund a national floodplain management program with principal responsibility and accountability at the state level. Second, it supported revitalizing the federal Water Resources Council to coordinate and direct federal activities for water management. Third, it proposed limited restoration of some river basin commissions for basin-wide planning and issuing a Presidential Executive Order requiring federal agencies to follow floodplain management principles in the execution of their programs. The report was well received by the Administration.

Action on the Administration's report. Shortly after issuing the report in mid-1994, the Administration's Floodplain Management Task Force established two multi-agency work groups within the OMB to determine how to implement the report's recommendations. The work groups met over three years to address "high priority" recommendations, including: 1) drafting a national floodplain management act to submit to Congress, 2) revising the Floodplain Management Executive Order, 3) developing common procedures for federal buyout programs of flood-damaged properties, and 4) revitalizing the Water Resources Council to increase federal coordination.

Interest in other initiatives and loss of OMB staff that directed the work groups resulted in diminished administrative support to take any formal action on the report.

However, federal agencies, states, and local governments in response to flood events in other parts of the nation subsequently adopted a number of its recommendations.[180]

Amendments to the NFIP

The Congress had, for several years prior to the 1993 flood, considered changes to the NFIP. These changes would have, in all likelihood, been made, but probably received renewed attention because of the flood. The Riegle Community Development and Regulatory Improvement Act of 1994 (Public Law 103-325), otherwise known as the "National Flood Insurance Reform Act of 1994," contain the changes.

The legislation was intended to improve compliance with the mandatory requirements of the program involving those individuals who have mortgaged homes or businesses in flood hazard areas but have not purchased or maintained flood insurance coverage. It created a supplementary mitigation insurance program to provide expanded coverage to rebuild repetitive and substantial loss properties to current building code standards. It also created mitigation assistance grants for activities that were technically feasible and cost-beneficial. The legislation also prohibited the non-waiver of flood insurance purchase requirements of recipients of federal disaster assistance to repair or rebuild structures damaged by floods. It decreed that agricultural structures were no longer eligible for federal disaster assistance and prohibited such assistance to anyone if the previous recipient had let a flood insurance policy lapse. As the historical record indicates, these provisions can be easily waived by future post-flood response and recovery legislation.

Amendments to the Federal Crop Insurance Program

On October 13, 1994, the Congress enacted legislation to reform the Federal Crop Insurance Program (Public Law 103-354). As a condition for receiving support payments for 1995 and subsequent crops, or for obtaining a direct loan or loan guarantee, a producer had to obtain catastrophic risk protection insurance coverage.[181] Designed to provide producers a financial "safety net" against the risk of major crop loss, the insurance guaranteed payment for at least 50 percent of the producer's average yield. Higher levels of insurance protection were available under the program. The U.S. Department of Agriculture subsidized the premiums for additional coverage to encourage participation by farmers and ranchers.

Congressional Directed Assessment of 1993 Flooded Areas

There were a number of calls for a broader review of post-flood recovery alternatives. One looked at the entire upper Mississippi and lower Missouri watershed.

180 Galloway, Gerald E., "What's Happened in Floodplain Management Since the '93 Mississippi Flood?," Natural Hazards Observer, XXII (May 1998), p. 2.
181 Hammond, M., U.S. Department of Agriculture, Washington, D.C., personal correspondence, 2 December 1994.

The ensuing public discussions generated congressional authorization and appropriations for the Corps to conduct comprehensive, system-wide studies to evaluate the floodplain management needs in the areas that were flooded in 1993. The assessment began in January 1994 and took 18 months.

The report compared impacts with the costs of implementing a wide array of alternative policies, programs, and structural and nonstructural measures by assuming that those steps had been taken at the time of the 1993 floods.[182] It explored three scenarios involving changes in flood insurance, state and local floodplain regulation, flood hazard mitigation and disaster assistance, wetland restoration, and agricultural support policies. Among its findings, the Corps determined that 1) structural flood protection prevented significant damage, 2) restored floodplain wetlands little affected floods the magnitude of those in 1993, and 3) increased reliance on flood insurance better assured appropriate responsibility for flood damage. Although the OMB took no formal action on the study, subsequent studies exploited it and it likely stimulated various subsequent floodplain management measures.

Congressional task forces

The Emergency Supplemental Appropriations Act of 1994, cited earlier, provided for the establishment of a Bipartisan Task Force on Funding Disaster Relief. Both the House and Senate subsequently established task forces to look for more effective ways to confront natural disasters and mitigate their impacts on the federal budget. A report by the task force, issued in 1995,[183] concluded that Congress needed to improve financial preparedness for catastrophic events. The report noted that between fiscal years 1977 and 1993, the federal government spent $64 billion in direct disaster relief and $55 billion indirectly through low-cost loans. In addition, the federal government spent nearly $10 billion through the Federal Crop Insurance Program. The report also spoke of the need for more responsibility by those living in the floodplain. Congress took no action on the task force report, likely because of diminished interest in the subject after the 1993 Midwest flood.

FLOODPLAIN MANAGEMENT 1990S: STATE AND LOCAL PROGRAMS

A series of surveys, carried out every 3 to 5 years provide important information on state and local floodplain management programs. The first study, by Jon Kusler for a Water Resources Council (WRC) study[184] in the early 1980s, focused on innovations in state and local floodplain management programs that could serve as examples for

182 Floodplain Management Assessment of the Upper Mississippi River and Lower Missouri Rivers and Tributaries, (U.S. Army Corps of Engineers, 1995), 439 pp.

183 Federal Disaster Assistance, Report of the Senate Task Force on Funding Disaster Assistance, U.S. Senate Doc. No. 104-4, 15 March 1995, Executive Summary.

184 Regulation of Flood Hazard Areas, 1982.

effective flood loss reduction in the future. His study report included a number of state statutes and case study profiles for some 150 communities. Subsequent studies by the ASFPM started in 1985[185] with a second survey of state and local programs in 1989[186] (see Chapter 4, "Floodplain Management 1980s: State and Local Programs").

ASFPM's 1992 state activity survey

The 1992 ASFPM survey,[187] like the 1989 survey, consisted principally of information from a questionnaire mailed to the state NFIP coordinators. In the 1992 report, the Association described changes in state activities since Kusler's 1981 survey. Results showed an increase in state activities and state participants. The biggest change occurred in restoring and preserving natural resources in floodplains. Previous surveys gathered little information about these kinds of state and local programs, partly because of a perception that there was little activity to report and partly because such activities only started being considered an integral part of floodplain management toward the end of the 1980s. The 1992 survey discovered that a sizable number of states participated in activities to restore and preserve the natural and cultural resources of floodplains and that many of them identified the environmental benefits of floodplain management programs as the key to obtaining wide public support.

The states' growth was obvious in other areas, too. By 1992, at least 12 states had some form of floodplain management standards that exceeded federal requirements. States also demonstrated increased capability to undertake a variety of activities in support of the NFIP. State budgets for floodplain management increased from $4 million in 1981 to $14 million in 1991, a significant increase even when inflation was taken into account. Comparisons of the number of staff "specifically dedicated" to floodplain management between the two decades was not possible because of different personnel descriptions. However, the 1992 survey reported that 39 states had more than 175 full-time equivalent personnel.

Local actions to reduce flood damages and to restore and preserve the natural resources of floodplains also increased. State floodplain management agencies identified improved public awareness as the single most visible trend in floodplain management. About a dozen states noted the increased attention given to flood hazards by the public. A number of states identified increased public awareness of environmental resources of all kinds, including floodplains. The 1992 study highlighted the public's tendency to endorse environmental protection and the benefits of that endorsement to floodplain management.

185 Annual Report of the Association of State Floodplain Managers, 1985.
186 Floodplain Management 1989: State and Local Programs, Association of State Floodplain Managers, Inc.
187 Floodplain Management 1992: State and Local Programs, Association of State Floodplain Managers, Inc.

The study also noted the increased capability of local officials to manage their floodplain programs along with the growing acceptance of the need to regulate land use. A number of states reported a tremendous increase in local requests for technical assistance in understanding and applying technical studies in carrying out local floodplain management programs. But the apparent trend was not universal, tempered by strong property rights movements in various parts of the nation.

ASFPM's 1995 state activity survey

The latest ASFPM survey of state and local programs was conducted in 1995 and was also based on information from a questionnaire mailed to the state NFIP coordinators.[188] The report described a number of disturbing trends since 1992 that reversed some of the continuous advances since the late 1960s. State floodplain management programs faced challenges in budget, organization, and authority that threatened their ability to be full, active partners with the federal government and local communities in reducing flood losses. The report noted that this was particularly alarming considering the number of flood disasters in the nation during the previous three years. The Association's report concluded that erosion of state capability appeared to result from one or a combination of the following initiatives:

- *Legislative dilution*. Property rights advocates and other special interest groups were getting proposals introduced in some state legislatures that would relax or eliminate state regulations designed to reduce flood losses. These sorts of regulations, by necessity, restrict locational decisions or development standards.
- *Budgetary restrictions*. Some state floodplain management programs were being constrained or reduced in effectiveness by the loss of funding. The net effect was an inability to enforce regulations and/or assist local governments.
- *Organizational dissection*. State agencies with regulatory functions were being reorganized or, in some cases, eliminated. This action scattered regulatory authority, technical personnel, and funding among several agencies. The result, again, was loss of capability to ensure sound land use decisions and an inability to help local governments reduce flood risks.

The report noted that the impetus for these changes probably laid in the desire to reduce the size of government, cut back on the cost of government operations, or reduce government regulation that citizens believed impinged on their property rights. The report went on to state that "left unchecked, this trend of failing to address hazards will mortgage our children's economic well being by guaranteeing the escalation of future disaster costs. The next triennial report will reveal whether this trend has continued or abated."[189] The 1995 survey was conducted around the period of a conservative political

188 Floodplain Management 1995: State and Local Programs, Association of State Floodplain Managers, Inc.
189 Ibid., Foreword.

trend to cut budgets at all levels and to make government smaller and less intrusive in daily lives, as manifested in a change in the political leadership of the Congress. The Association has not been able to obtain adequate funding support to undertake a survey of state and local programs since 1995 to determine whether "this trend has continued or abated."

However, the ASFPM report also noted in its summary of local programs that, in general, floodplain management at the state and local levels appeared to be progressing, although not as quickly as expected given the high visibility of flooding issues from 1992 to 1995. In response to the extensive survey, 18 states reported that floodplain management within their jurisdictions had grown steadily stronger during the decade, six states reported that it had stayed about the same, and six reported that it was weaker now than at the end of the previous decade. The remaining 10 states that responded indicated mixed changes.

The 1995 report highlighted two somewhat contradictory, yet discernable and diverging, streams of change. On the one hand, states reported more floodplain management activities than ever before, including numerous examples of successful and effective work. On the other hand, the fundamental components of state-level programs did not seem as robust as in prior years. State floodplain management budgets (unadjusted for inflation) were down 12 percent from their 1992 levels, reported as "a disturbing statistic in itself." The legal authority under which programs operated had been weakened in some state legislatures and challenged both there and in the courts. More than one-fifth of the state floodplain management programs had been reorganized in the past few years and more were anticipated. More instances of these kinds of fundamental changes—to the detriment of floodplain management—occurred during the 1992-1995 period than in previous periods. The Association concluded that "this was a troubling finding, because without strong financial, legal, and operational foundations, effective state and local floodplain management is doomed. It is possible that the tighter budgets are simply a short-term fluctuation, and that it is just a coincidence that the number and extent of state-level reorganizations and other apparent threats are occurring at the same time. In any case, these potential shifts in the status of state and local floodplain management will need careful scrutiny over the next three years so that potential threats to effective programs can be detected and defused. The next state and local programs report should shed further light on their meaning and impacts."

Of note during the 1990s were a number of state efforts. *Virginia* completed *The Floodplain Management Plan for the Commonwealth of Virginia*. The plan, considered the only one of its kind in the nation, provided a comprehensive assessment of the state's flood problems, alternative approaches to reducing flood damages, and solutions involving local, state, and federal entities. A number of states, including *Maine*, *Michigan*, *Ohio*, and *Wisconsin*, developed floodplain management handbooks to assist local officials in carrying out their responsibilities. At the sub-state level, two regional agencies, the *Northeastern Illinois Planning Commission* (Chicago, Illinois, area) and the

Urban Drainage and Flood Control District (Denver, Colorado, area), were also noteworthy in assisting local jurisdictions in floodplain management endeavors.

THE ASFPM: A NATIONAL VOICE

The ASFPM was instrumental in heightening interest to reform the NFIP in the early 1990s. Over a six-year period, Congress frequently requested assistance from the Association in preparing legislation that resulted in passage of the NFIP Reform Act of 1994. Rebecca Quinn led the Association in these efforts, working with Washington liaisons Martha Braddock, Merrie Inderfurth, and others.[190]

PROMOTERS OF THE FORMATION OF A NATIONAL ASSOCIATION:
Jim Goddard, Larry Larson, French Wetmore, Jon Kusler, Gilbert White
ASFPM File Photo

Congressional interest in ASFPM policies also led to new federal programs and closer relations between the Association and federal agencies. The Association influenced aspects of flood insurance to address repetitive losses, post-disaster mitigation funding, the Community Rating System, and a national council on mapping standards. At the end of the 1990s, Association representatives sat on a number of national committees and work groups involving mapping, hydrology, mitigation, insurance, dam safety, coastal issues, stream gaging, and information systems issues.

Members services. The Association's member's services had also grown significantly. From four newsletters a year in 1982, ASFPM's publications by the 1990s included

190 Larson, ASFPM History and Accomplishments, (Association of State Floodplain Managers, Inc., Nov. 1999).

twelve newsletters each year, an annual National Directory of Floodplain Managers, a periodic comprehensive status report on state and local floodplain management in the nation, annual conference proceedings, and numerous topical and technical reports. These and more than 700 other publications were cataloged and housed in the National Floodplain Management Resource Center at the University of Colorado. The Association established an Executive Office in Madison, Wisconsin, in 1996. The staff of three continued to rely heavily on the volunteer efforts of members to accomplish numerous Association activities.

The ASFPM annual conference attracted around 500-600 participants who came for training, technical and policy updates, and invaluable networking with fellow professionals. The Association also produced a number of other conferences on special topics, such as community mitigation planning and implementation, arid regions flooding, coastal flooding, multi-objective management, stormwater management, river restoration, and floodproofing applications.

Other membership services included awards to recognize programs and persons who have done outstanding work in flood hazard management, a graduate fellowship program funded by FEMA for pursuing advanced degree and research in floodplain management, and the Flood Hazard Fellowship Fund which provides small monetary awards to pursue special projects.

Other activities. The ASFPM established a foundation in 1997 to "attract funds that support, through education, training and public awareness, projects and programs that will lead to the wise management of our nation's floodplains." Foundation donations helped develop the national professional certification program and a specialized flood property acquisitions conference. The Board of Trustees was composed of a diverse group of professionals uniquely positioned to assist the foundation in fundraising.

A Certified Floodplain Manager (CFM) Program, initiated in 1999, grew out of member interest. The ASFPM's Professional Development Committee, chaired by John Ivey, and a 10-member Certification Board of Regents developed the program with initial support from federal partners (FEMA, USDA's NRCS, the Corps, and the National Oceanic and Atmospheric Administration's Coastal Services Center). The program aimed to advance the knowledge of floodplain managers, enhance the profession of floodplain management, and provide a common basis for understanding floods and flood losses. Certification involves an exam to test knowledge of the applicant and a continuing education credit requirement to maintain certification.

In order to broaden public awareness and provide a stronger unified voice for local communities, the Association supported the creation of state floodplain management associations and encouraged their chapter membership in ASFPM. As of 1999, 12 states enjoyed chapter membership (Arizona, Arkansas, Colorado, Indiana, Illinois, Louisiana, Michigan, North Carolina, New Mexico, Oklahoma, South Carolina,

and Texas). A number of other states formed associations, with many working toward chapter status.

The Association maintained a web site (http://www.floods.org) that details activities, conference information, goals and actions of its 14 policy committees, key policy papers, and other matters of interest to members and those concerned about flood loss prevention in the nation.

THE PRIVATE SECTOR AND ACADEMIC INQUIRY

The private sector is often overlooked when assessing who is involved in preserving and restoring the natural functions and resources of relatively undisturbed floodplain lands. Many historical preservation societies actively preserve sensitive areas since many of the nation's earliest settlements were located along rivers and contain valuable archeological and historical sites. Conservation organizations, such as the *Sierra Club*, the *Izaak Walton League*, and the *National Wildlife Federation* are involved in a myriad of activities relating to land use and resource conservation. The latter organization prepared a report in 1998[191] describing efforts to restore floodplains through voluntary buyouts of property in high-risk areas. Nonprofit organizations, such as *The Nature Conservancy* (which also has an extensive database on local natural resources) and the *National Audubon Society*, acquire and preserve sensitive natural areas throughout the United States. Much of the land targeted is wetland or has some water access, including floodplains.

Land trusts operate at the municipal, regional, or state level. These organizations preserve land for its natural, recreational, scenic, historical, or productive value. Their numbers have increased tenfold over the past three decades. *The Trust for Public Land*, a national land trust, assisted in the acquisition of critical areas. Foundations provide financial support for projects or programs they deem worthwhile and within their area of interest. The *Compton Foundation* has supported a number of studies that provided valuable information for floodplain management application. The *H. John Heinz III Center for Science, Economics, and the Environment*, with help from an expert panel, conducted a two-year study to help develop new strategies to identify and reduce weather-related hazards costs associated with rapidly increasing coastal development activities. The panel's 1999 report *The Hidden Costs of Coastal Hazards*[192] presented the study's findings and offered the first in-depth study that considers the costs of coastal hazards to natural resources, social institutions, business, and the built environment.

Academic inquiry has greatly contributed to our present knowledge of the forces and factors contributing to the occupancy and use of the nation's riverine and coastal

191 Higher Ground: A Report on Voluntary Property Buyouts in the Nation's Floodplains, (National Wildlife Federation, 1998).
192 The Hidden Costs of Coastal Hazards: Implications for Risk Assessment and Mitigation, (The H. John Heinz Center for Science, Economics and the Environment, 1999).

floodplains. Gilbert F. White (see Chapter 3, "The University of Chicago Studies") and others during several decades have made significant contributions through their research efforts. Among those, who collectively published studies that number in the dozens, are Raymond J. Burby at the University of North Carolina at Chapel Hill and the University of New Orleans, Rutherford H. Platt at the University of Massachusetts at Amherst, Howard C. Kunreuther at the University of Pennsylvania, Eve Gruntfest at the University of Colorado at Colorado Springs, and Dennis S. Mileti and Mary Fran Myers at the University of Colorado at Boulder.

OTHER ACTIVITIES AND STUDIES

The demise of TVA's floodplain management program

It became rather ironic that the Tennessee Valley Authority (TVA), which pioneered many applications in the first regional demonstration of floodplain principles and practices in the early 1950s, essentially terminated its program by the mid-1990s. TVA refocused its resources on stewardship activities, targeting its flood risk reduction efforts towards public lands and projects in its care and to the floodplains along the rivers regulated by TVA dams.[193] The seven states in the region and the several hundred floodprone communities that had benefited from TVA's technical and planning assistance, had to turn to other agencies for the help they needed. At the end of the decade, TVA no longer received Congressional appropriations for its resources management programs and relied instead on the proceeds from selling power to utility companies to fund those programs.

Multi-hazards management

From time to time the nation has had to deal with simultaneous hazards in post-recovery efforts. A number of federal agencies have shown interest in integrating flood loss reduction strategies and measures with those for other natural hazards such as land subsidence, earthquakes, dam failures, and hurricanes and other high winds.

As evidence, FEMA developed a National Mitigation Strategy and began "Project Impact" in the late 1990s to foster multi-hazard mitigation. (There is now a fairly well established consensus that the disaster cycle of preparedness, response, and recovery must include the fourth component of mitigation.) Such a strategy offers innovative approaches for combining funds and coordinating activities with the private sector and citizens. Under this strategy, both the federal government and the private sector provide leadership, coordination, and research support, including financial incentives to communities, businesses, and individuals for mitigation activities. The

193 Miller, Barbara A., et. al, unpublished paper.

project emphasizes building safer communities now while utilizing safe building practices in recovery measures and implementing wiser land use decisions after a disaster.

Publication of the International Building Code and the International Residential Code in 2000, resulted, for the first time, in a national model building code that was compliant with the provisions of the NFIP. In addition, the codes are substantially equivalent to the requirements of the National Earthquake Hazard Reduction Program Recommended Provisions (1997), and the state-of-the-art wind load provisions of American Society of Civil Engineers 7-98, *Minimum Design Loads for Buildings and Other Structures*. The International Residential Code represented the first time that wind, flood, and seismic loads were comprehensively addressed in a model for one- and two-family dwellings. Communities that adopt and enforce the international codes will have improved disaster resistance. They also benefit from having NFIP technical provisions contained within the code and from having the option of using the code in lieu of a separate floodplain ordinance to achieve compliance with NFIP provisions.[194]

A reassessment of natural hazards in the United States

Some 20 years after publication of the first *Assessment of Research on Natural Hazards*[195] a number of hazard researchers, led by Dennis Mileti of the University of Colorado at Boulder, conducted a follow-up study to reassess the state of natural hazards knowledge in the United States. The researchers began the "Second U.S. Assessment of Research and Applications for Natural Hazards" in 1992 and involved more than 120 experts during the following years. The study report *Disasters by Design: A Reassessment of Natural Hazards in the United States*[196] was published in 1999. Participants published other "spin-off" reports. Among many conclusions, researchers found that: 1) one of the central problems in coping with disasters is the belief that technology can be used to control nature, 2) most strategies for coping with hazards fail to take into account the complexity and changing nature of hazards, and 3) losses from hazards result from shortsighted and narrow concepts of the relationship of humans to the natural environment. To redress these shortcomings, the researchers recommended that the United States shift to a policy of "sustainable hazard mitigation." This concept links wise management of natural resources with local economic and social resiliency.

This study added to the wealth of knowledge gathered during the 1990s and supplemented other reports such as *Floodplain Management in the United States: An Assessment Report*[197] and the *Report of the Administration's Interagency Floodplain*

194 Robinson, 19 January 2000.
195 White and Haas, 1975.
196 Mileti, Dennis S., Disasters by Design: A Reassessment of Natural Hazards in the United States, (Joseph Henry Press, National Academy of Science, 1999).
197 Floodplai n Management in the United States: An Assessment Report, 1992.

Management Review Committee.[198] Its content and findings have the potential to alter our thinking about hazards.

The International Decade for Natural Disaster Reduction

A United Nations resolution in December 1989 designated the 1990s as the International Decade for Natural Disaster Reduction. Its objective was to reduce, through concerted international action, especially in developing countries, loss of life, property damage, and social and economic disruption caused by natural hazards.

The U.S. Committee for the Decade coordinated national activities and supported a series of scientific studies of the occurrence of natural hazards around the world. It was expected that, during the Decade, average annual losses from all of the world's disasters would be reduced by about one-half. This obviously did not happen. The Decade achieved little, if anything, of substance in the United States. Few in the floodplain management community were even aware of it.

DISASTER ASSISTANCE IN THE 1990s

Disaster relief policies and programs are fluid and are subject to public sentiment for the disaster "victims," often strong political pressure "to do something," and resultant legislative changes—often more liberalized assistance through federal grants. The number of major disaster declarations almost doubled since the 1980s, from an average of 24 a year to an average of 46 a year in the 1990s.[199] In response, Congress approved an average of $3.7 billion a year in supplemental disaster aid in the 1990s compared to less than $1 billion a year in the 1980s, a boon to people in disaster-prone areas.[200] Nine of the top ten major flood and hurricane disasters, ranked by FEMA costs, occurred during the 1990s.[201]

The flood control construction program of the 1930s-1950s era seemed to be replaced by an equally massive federal relief and recovery assistance program for flood disasters in the 1990s. The end of the 1990s saw increased national support for public relief for those who suffer in and after floods[202] as illustrated by the fact that 85 percent of all applications for federal declarations were granted. FEMA became a highly efficient "disaster response and relief" organization. The President promoted FEMA's Director to Cabinet status in 1996.

A 1999 study by Rutherford Platt and others traced the historical evolution of the federal role in disaster assistance during the past century and analyzed disaster

198 Sharing the Challenge, 1994.
199 Data from FEMA.gov web site on the Internet, (http://www.fema.gov; Library, FEMA Facts, January 2000).
200 Allen, Scott, "Storm brewing over disaster relief," The Boston Globe, 20 September 1999, p. 1.
201 Data from FEMA.gov web site on the Internet, (http://www.fema.gov; Library, FEMA Facts, January 2000).
202 White, 1997.

declarations and federal assistance provided under the Stafford Act[203] since 1988. Titled *Disasters and Democracy: The Politics of Extreme Natural Events*,[204] it attempted to answer some questions that have plagued officials: Does "federalizing" the costs of disasters help lighten the overall burden of disasters or is it making the matter worse? Does it remove incentives for individuals and localities to protect themselves? Are people more likely to invest in hazardously located property if they believe the federal government will bail them out?

Platt believes that politics distort the process of disaster aid as local politicians highballed initial damage estimates in hope of receiving federal aid. If the President doesn't declare a disaster necessary for federal aid, Platt states, governors apply public pressure and accuse the President of "playing games" with disaster victims. Having no problem with declarations for major disasters such as those that struck the Midwest, Florida, and North Carolina in the 1990s, Platt contends there were also "a lot of small-end disasters that are being declared willy-nilly."[205]

Has disaster assistance now become an "entitlement" as some would contend? Did major disasters become more frequent in the 1990s or has eligibility for federal disaster assistance been significantly liberalized?

203 P.L. 93-288, Robert T. Stafford Disaster Relief and Emergency Assistance Act of 1988.
204 Platt, Rutherford H., et al, Disasters and Democracy: The Politics of Extreme Natural Events, (Covelo, CA: Island Press, 1999).
205 The Boston Globe, Sept. 20, 1999.

7

POSTSCRIPT

Over the last 30 years the nation has learned that effective floodplain management can reduce vulnerability to damages and create a balance among natural and human uses of floodplains and their related watersheds to meet both social and environmental goals. The nation, however, has not taken full advantage of this knowledge. The United States simply has lacked the focus and the incentive to engage itself seriously in floodplain management.

Sharing the Challenge: Floodplain Management Into the 21st Century

What assessments can be made of the nation's responses to flood disasters during the 20th century, particularly during the last three decades after creation of the NFIP, a watermark event? Judged by the record, the response has been mixed. More than 19,000 communities adopted some form of regulation over development in identified flood-hazard areas. Awareness of floodplain functions and resources, and of their importance and value, greatly increased. Floodplain management became "institutionalized." Average annual flood losses continued to increase, tracking a similar finding at mid-century after a massive effort of flood control starting in the 1930s. Congress did not assign authority or give responsibility to address the nation's flood problems and causes to a single agency nor did it provide a coordinated approach to federal efforts to reduce flood losses and protect floodplain natural functions. Instead, present approaches involve many laws, executive orders and directives, administrative regulations, agency policies and programs, and interagency actions. The federal response during the 1990s generally involved liberalized programs of disaster assistance.

There have been other judgments. The Interagency Floodplain Management Review Committee noted in its 1994 report that "over the last 30 years the nation has learned that effective floodplain management can reduce vulnerability to damages and create a balance among natural and human uses of floodplains and their related

watersheds to meet both social and environmental goals. The nation, however, has not taken full advantage of this knowledge. The United States simply has lacked the focus and the incentive to engage itself seriously in floodplain management."[206]

The committee expressed a concern that disaster-specific changes in federal/non-federal cost-share percentages for FEMA disaster assistance programs may have an adverse effect on floodplain management. (The original 75/25 federal/non-federal cost-share was adjusted to 90/10 for Hurricane Andrew, the Midwest flood, and the Northridge earthquake.) It cautions that these cost-share changes have two potentially significant consequences. First, they set up an expectation of similar treatment in subsequent disasters and increase political pressure to provide a lower non-federal share. This perpetuates the dominant federal role in recovery and increases federal costs, a situation that the committee suggests, throughout its report, should be reversed. Second, they argue that these changes may defeat the fundamental purpose behind cost-sharing, which is to increase the amount of local involvement, responsibility, and accountability. They go on to point out that by lessening the non-federal investment, state and local governments have less at stake and, therefore, may have a lower incentive to develop and adopt sound floodplain management policies and practices.

Other calls for changes in the way the nation responded to flood disasters and managed its floodplains were frequently found on the editorial pages of major newspapers. *USA Today* printed many opinions on this subject during the 1993 Midwest flood, which kept the flood and its consequences in the public eye for nearly eight months. In an attempt to shape public opinion, the newspaper continued its attack on policy in the aftermath of massive federal assistance that followed a number of subsequent disasters.

On a more positive note, the Federal Interagency Floodplain Management Task Force's 1994 report on *A Unified National Program for Floodplain Management* observed "in the past 25 years since Congress first called for a unified national program to reduce flood losses, the Nation has made great progress in *recognizing* the wide range of human and natural resources that are at risk in floodprone areas; *accepting* nonstructural mitigation measures as cost-effective components of floodplain management efforts; *assessing* the status of floodplain management in the United States and using those evaluations as a foundation for improvement of management approaches and measures; and *achieving* experience with and acceptance of mitigation as a principal means of reducing losses."[207] (emphasis added)

206 Sharing the Challenge, 1994, p. v.
207 A Unified National Program for Floodplain Management, 1994, Foreword.

The ASFPM also observed that a host of positive changes occurred, particularly during the latter part of the 1990s, and many more were on the brink of happening.[208] It noted that many aspects of floodplain management changed quickly, including

- national understanding of "mitigation" and its many non-structural approaches, such as acquisition of over 20,000 structures during the past five years of the 1990s;
- acceptance of mitigation in the emergency management profession—the absence of insistence on rebuilding after a disaster to restore conditions exactly as they were;
- attention to the problem of repetitively damaged properties
- the awareness that national floodplain regulations are not adequate to create sustainable communities;
- acceptance that mitigation works most effectively if based on locally developed plans; and
- broad recognition by federal agencies and Congress that the key to reducing flood losses rests in effective local approaches through creating incentives for local officials (which the ASFPM believed is not yet known how to do).

Regarding federal assistance, the Association found strong public support to stop providing aid to help those who knowingly live in flood risk areas. The group believes the erosion of cost-share support occurred because of heightened media coverage of long-lasting events.

What does the future hold for the field of floodplain management? In developing proposals for a unified national program[209] and carrying out an assessment of the nation's floodplain management activity,[210] the Federal Interagency Floodplain Management Task Force identified future directions for floodplain management. In its 1994 report, the Interagency Floodplain Management Review Committee[211] also provided a blueprint for change in managing the nation's floodplains through sharing of responsibility among federal, state, tribal and local governments, businesses, and citizens. Both the task force and review committee studies identified a number of attitudes, conditions, and situations that hamper any truly meaningful changes in policies and programs, particularly at the federal level.

The conjunction, in the last three decades of the 1900s, of flood events and rethinking public policies regarding natural disasters promised the best opportunity for meaningful policy alterations since resulting changes from the 1966 Task Force on Federal Flood Control Policy. In its report, the Floodplain Management Review

208 Larson, Association of State Floodplain Managers, Madison, WI, personal communication, 13 January 2000.
209 A Unified National Program for Floodplain Management, 1994.
210 Floodplain Management in the United States: An Assessment Report, 1992.
211 Sharing the Challenge, 1994.

Committee noted that "the time is ripe for serious attention to be paid to how this nation responds to the threat of floods."[212]

The Federal Interagency Floodplain Task Force stated "the floods and severe storms of the last few years have been a sobering reminder of work yet to be done to further reduce the vulnerability of residents of the United States to extreme natural events, and to more closely safeguard the valuable natural resources and functions that are found within the Nation's floodplains. The Nation is entering a new era in hazards and emergency management—one in which a comprehensive multi-hazard, multidisciplinary approach, with stronger emphasis on mitigation, and use of technological tools like geographic information systems, will play leading roles."[213]

With the wide differences in points of view towards the issues that exist today, it is doubtful that any resolutions will emerge easily. Most likely any significant changes in federal policy will be based on compromise. Given the extent of federal outlays for disaster assistance during the 1990s, the final outcome may be driven by constraints imposed by the federal budget. Nevertheless, many observers believe a change in national policies and the public response to living and investing in floodprone areas is necessary.[214]

212 Ibid.
213 A Unified National Program for Floodplain Management, 1994, Foreword.
214 Kitch, H. E., "Limiting the impact of future floods," USA Today, July 1994, vol. 123(2590), p. 39.

APPENDIX A: ABOUT THE AUTHOR

James M. Wright has always had a strong interest in history. He combined this interest, his earlier inquiry into the origins of floodplain management in the United States, and his own knowledge and involvement in this field of endeavor in developing this historical account.

Wright is a licensed professional engineer in three states. He holds an undergraduate degree in civil engineering and a Master of Science degree in water resources engineering, with additional post-graduate study in water resources. Since 1980, he has been a member of the adjunct faculty at the University of Tennessee, teaching graduate-level floodplain management courses.

Upon graduating from Virginia Tech in 1960, he was employed as a water resources engineer with the TVA in Knoxville, Tennessee, and was principally involved in studies examining local flood damage prevention planning. In 1968, he became an assistant to Tom Lee, helping to carry out Wisconsin's recently established floodplain management program. He left in 1970 to develop and administer Minnesota's state program. In 1978, he returned to TVA where he later became manager of its floodplain management program. He left the agency in 1994 to pursue other career interests.

During his three decades of federal and state service, he has served on numerous national task forces, panels, and technical committees established to develop policies and procedures for managing floodplains to reduce economic losses and losses of natural and beneficial resources. He has authored several dozen papers in this field, including numerous invited papers and has prepared a number of works for publication in magazines, reports, and books.

He has received several national awards for his work in dealing with the nation's flood problems. Since his retirement from federal service, he has served, on occasion, as a Disaster Assistance Reservist with FEMA in a number of roles. He is currently an associate with the Floodplain Management Group in Knoxville, providing specialized services to state and federal agencies and national organizations.

APPENDIX B: SELECT PUBLICATIONS, FEDERAL INTERAGENCY FLOODPLAIN MANAGEMENT TASK FORCE

- *Floodplain Management Guidelines for Implementing E.O. 11988* (1978)
- *Nonstructural Floodplain Management Study: Overview* (White 1978)
- *Floodplain Acquisition: Issues and Options in Strengthening Federal Policy* (Kusler, 1978)
- *Improved Formulation and Evaluation of Nonstructural Elements for Water Resources Plans in Flood Hazard Areas* (Shabman, 1979)
- *Options to Improve Federal Nonstructural Responses to Flood* (Platt, 1979)
- *Economic Aspects of Wildlife Habitat and Wetlands* (Midwest Research Institute, 1979)
- *Emerging Issues in Wetland/Floodplain Management – Supporting Materials for a Report of a Technical Seminar* (Kusler, 1979)
- *Emerging Issues in Wetland/Floodplain Management – Summary Report of a Technical Seminar Series* (Kusler, 1979)
- *Sources of Wetlands/Floodplain Research Information* (1980)
- *Workshop Report on Bottomland Hardwood Wetlands* (National Wetlands Technical Council, 1980)
- *Nonstructural Measures in Flood Damage Reduction Activities* (Galloway, 1980)
- *The Influence of Regulations and Practices on the Implementation of Nonstructural Flood Plain Plans* (CME Associates, Inc., 1980)
- *An Assessment of Storm Surge Modeling* (Hydrology Committee, 1980)
- *State and Local Acquisition of Floodplains and Wetlands* (Field Associates, 1981)
- *Analysis of Methodologies Used for the Assessment of Wetland Values* (U.S. Waterways Experiment Station, 1981)
- *Floodplain Management Handbook* (Owen, 1981)
- *Cooperative Flood Loss Reduction: A Technical Manual for Communities and Industry* (Owen, 1981)
- *Estimating Peak Flow Frequencies for Natural Ungaged Watersheds (A Proposed National Test)* (Hydrology Committee, 1981)

- *Evaluating the Effectiveness of Floodplain Management Techniques and Community Programs* (1985)
- *Further Advice on Executive Order 11988, Floodplain Management* (1987)
- *Floodplain Management in the United States: An Assessment Report* (L. R. Johnston Associates, 1992)
- *Protecting Floodplain Resources: A Guidebook for Communities* (Smardon, Felleman, 1996)
- *Addressing Your Community's Flood Problems: A Guide for Elected Officials* (Wright, Monday, 1996)

GLOSSARY

ASFPM, "the Association"	Association of State Floodplain Managers, Inc.
the Corps	U.S. Army Corps of Engineers
EPA	U.S. Environmental Protection Agency
FEMA	Federal Emergency Management Agency
FIA	Federal Insurance Administration
FHBM	Flood Hazard Boundary Maps
HUD	U.S. Department of Housing and Urban Development
Natural Hazards Center	The Natural Hazards Research and Applications Information Center
NEPA	National Environmental Policy Act
NFIP	National Flood Insurance Program
NWS	National Weather Service
NRCS	Natural Resources Conservation Service
OMB	Office of Management and Budget
SCS	Soil Conservation Service (now called the Natural Resources Conservation Service)
TVA	Tennessee Valley Authority
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
100-year flood	A common but inaccurate term widely used during the 1900s to describe the 1 percent chance flood.
1 percent chance flood	A flood that has a 1 percent chance of being equaled or exceeded in any given year. Referred to as 100-year flood throughout this document because the 100-year flood is the common, although inaccurate, term used historically to describe this type of flood event.

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