

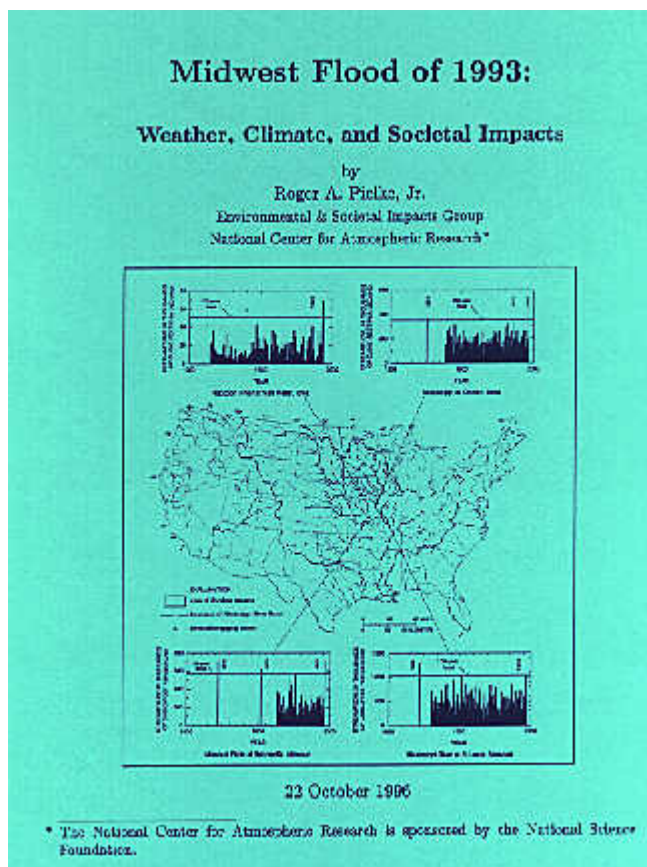
Pielke Jr., R. A., 1996: Midwest Flood of 1993: Weather, Climate, and Societal Impacts, Environmental and Societal Impacts Group, National Center for Atmospheric Research, Boulder, CO, October 22, 159 pp.

## **Midwest Flood of 1993: Weather, Climate, and Societal Impacts**

This report presents the results of the second case study of the extreme mesoscale events and impact project, sponsored by the National Science Foundation (the first report was on Hurricane Andrew). The report is meant to be foundational in the sense that it provides a resource for further research into the use and value of scientific information in social and decision processes to reduce vulnerability to floods.

### [Summary of Report](#)

### [Bibliographic and WWW Resources on Floods](#)



### Midwest Flood of 1993: Weather, Climate, and Societal Impacts

The graphic shows, for four streamflow gauging locations in Iowa and Missouri, peak discharge (volume) for the 1993 flood in relation to annual historical peak discharges. In these four locations, the 1993 flood was clearly an extreme, but not unprecedented, event.

Source: Parrett, C., N.B. Melchu, and R.W. Jones, 1993: *Flood Discharges in the Upper Mississippi Basin*, 1993, USGS Circular 1120-A, Figure 5, p. 7.

## Framework and Overview of the Report

The report has three general objectives. First, it seeks to review what is known about the U.S. flood problem in terms of societal vulnerability, with a focus on large-scale flood events. Second, it provides an overview of the various process that society has developed to address its flood problems. The third objective is to distill lessons from various assessments and retrospective analyses published in the aftermath of the extensive Midwest Floods of 1993.

**Chapter 1** is a discussion of nine "fallacies" that appear to limit progress with respect to improved societal responses to floods. This chapter synthesizes the material found in Chapters 2-5 and provides additional analysis. Because it draws heavily on the remainder of the report, this chapter serves in lieu of an executive summary.

**Chapter 2** is a discussion of the problems posed by floods in the United States. An analysis floods in the United States can provide insight to at least three interrelated problems. First, floods threaten people, property, and ecosystems. Efforts to reduce vulnerability to floods depends upon a better understanding of the sources of that vulnerability and how alternative responses to floods can contribute to the reduction of that vulnerability. Second, floods are part of a broader class of extreme weather and climate events that threaten the nation (e.g., such as those events associated with a changing climate or El Nino). Lessons learned from successes (and failures) in responding to floods can contribute to efforts to deal more effectively with weather and climate events more generally. And third, how society responds to the flood threat has potential to contribute to a better understanding of the connections of scientific research and societal benefits.

**Chapter 3** seeks in three sections to define the U.S. flood problem in terms of societal vulnerability. The first section argues that reliable problem definitions are essential to the development of effective courses of action as well as reliable assessments of progress (or lack thereof). The second defines, in general terms, what it means to define the U.S. flood problem in terms of societal vulnerability and then uses the framework of vulnerability to structure a review of available data on the problem. To foreshadow the Chapter's findings: data is lacking on important dimensions of the U.S. flood problem, meaning that substitute, and less meaningful, measures of vulnerability must be relied on. The third section discusses the strength and weaknesses of some of these substitute measures and also assesses the prospects for a more rigorous and reliable definition of the U.S. flood problem.

**Chapter 4** discusses societal responses to floods. From the 1700s through the middle of the twentieth century the primary means of responding to floods in the United States was structural, that is, by building engineered structures to physically hold water back from inundating communities and agricultural lands. In the early 1940s Gilbert White questioned the wisdom of structural approaches to floods and suggested that humans consider adjusting their

behavior in the floodplain environment in such a way so as to better use the floodplain while also reducing exposure. The approach pioneered by White has been known as non-structural responses to floods. This Chapter reviews structural and non-structural approaches to flood mitigation.

**Chapter 5** reviews numerous assessments of the impacts of and responses to the great Midwest Flood of 1993. This flood resulted in more than \$20.1 billion (1993 dollars) in damages and prompted close scrutiny of many aspects of flood policies. The studies of the 1993 event and those focused more generally are complemented by many others that together have distilled a number of useful principles of societal responses to floods. Yet it seems, as one observer has noted, "thoughtful past recommendations of how to attain flood mitigation had never been adequately implemented." In many respects society knows how to respond to floods in order to reduce detrimental impacts on environment and society. But for a number of reasons this knowledge has not been fully implemented as policy. This chapter seeks to distill and discuss some of the experience gained and a number of the lessons learned in aftermath of the 1993 flood.

**The report also has four appendices:**

*Appendix 1* presents the goals for floodplain management advocated by Federal Interagency Floodplain Management Task Force in their report entitled *A Unified National Program for Floodplain Management 1994*. This report is the closest to a national statement of flood policy. However, as some analysts have noted, there exists not the entity to implement the Task Force's recommendations.

*Appendix 2* is a table which contains trend data from the National Weather Service on economic losses and casualties related to flooding over the period 1903-1994.

*Appendix 3* is a brief review of World Wide Web and bibliographic resources on flooding.

*Appendix 4* reprints a book review that I wrote for *Climatic Change* (to be published in 1997) of S. Changnon's, *The Great Flood of 1993* published by Westview Press (Boulder, CO). This book is an excellent review of the flood event and is fairly unique from the standpoint of taking a close look at the causes, impacts, and lessons of a particular extreme event.

## Bibliographic Resources

The topic of floods is enormous. There are a wide range of issues related to flooding and water. The following resources provide a comprehensive introduction to the topic.

FIFMTF (Federal Interagency Floodplain Management Task Force) 1992. *Floodplain Management in the United States: An Assessment Report, Volume 2: Full Report* (L.R. Johnston Associates)

Machalek, J. 1992. *A Bibliography of Weather and Climate Hazards (2nd Edition)*. Topical Bibliography No. 16 Natural Hazards Research and Applications Information Center, University of Colorado, Boulder. 331 pp. [To Order](#)

Weiner, J. 1996. *The Socioeconomic Aspects of Flooding in the U.S.: A Topical Bibliography*, Topical Bibliography #19, University of Colorado, Natural Hazards Research and Applications Information Center.

### Links to WWW Resources

The following sites on the World Wide Web provide a wide range of information and resources on floods. See also the [Floods Page](#) on the [Societal Aspects of Weather website](#).

### *U.S. Government Institutions*

- [The National Flood Insurance Program](#) and some [additional information](#).
- U.S. Geological Service (USGS) [flood resources](#) and [flood overview](#).
- [U.S. Army Corps of Engineers](#).
- [Federal Emergency Management Agency \(FEMA\)](#)
- [Bureau of Reclamation](#)
- NWS River Forecast Centers (RFCs):
  1. [Arkansas-Red Basin \(ABRFC\)](#)
  2. [Colorado Basin \(CBRFC\)](#)
  3. [California-Nevada \(CNRFC\)](#)
  4. [Northwest \(NWRFC\)](#)

### *Other Web Resources*

- [U.S. Water News](#)
- [Red Cross](#)