

ASSESSMENT OF RESEARCH ON INFORMATION NEEDED FOR
FLOOD PLAIN MANAGEMENT

by

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INTRODUCTION

This paper is concerned with information needs for a broad range of flood plain management decisions. These decisions include but are not limited to flood plain zoning and land use control. The paper summarizes major problems requiring research and includes references to types of research underway and the way research should be organized and carried out.

Flood plain management is assumed to include all reasonable means of achieving relevant social goals in areas subject to flood hazard. Figure 1 illustrates a range of possible flood plain management decisions to achieve a range of contributions to relevant goals. The decisions appear as inputs to a hydro-socio-economic system and the contributions to goals appear as outputs. The decision making process in flood plain management involves assessing social preferences for goals and estimating the hydro-socio-economic relationships between decisions and goals.

Flood plain management decisions are largely made by local governments although state and federal governments provide information, funding, authority, and policy inputs. Because flood plain management decisions are made in a continuing political process, detailed information needs and the resources available to meet these needs vary with time and place.

This is a background statement for a workshop at Quail Roost, North Carolina, July 25 and 26, 1975, to prepare a recommended program of research into urban and water related problems for the Office of Water Research and Technology.

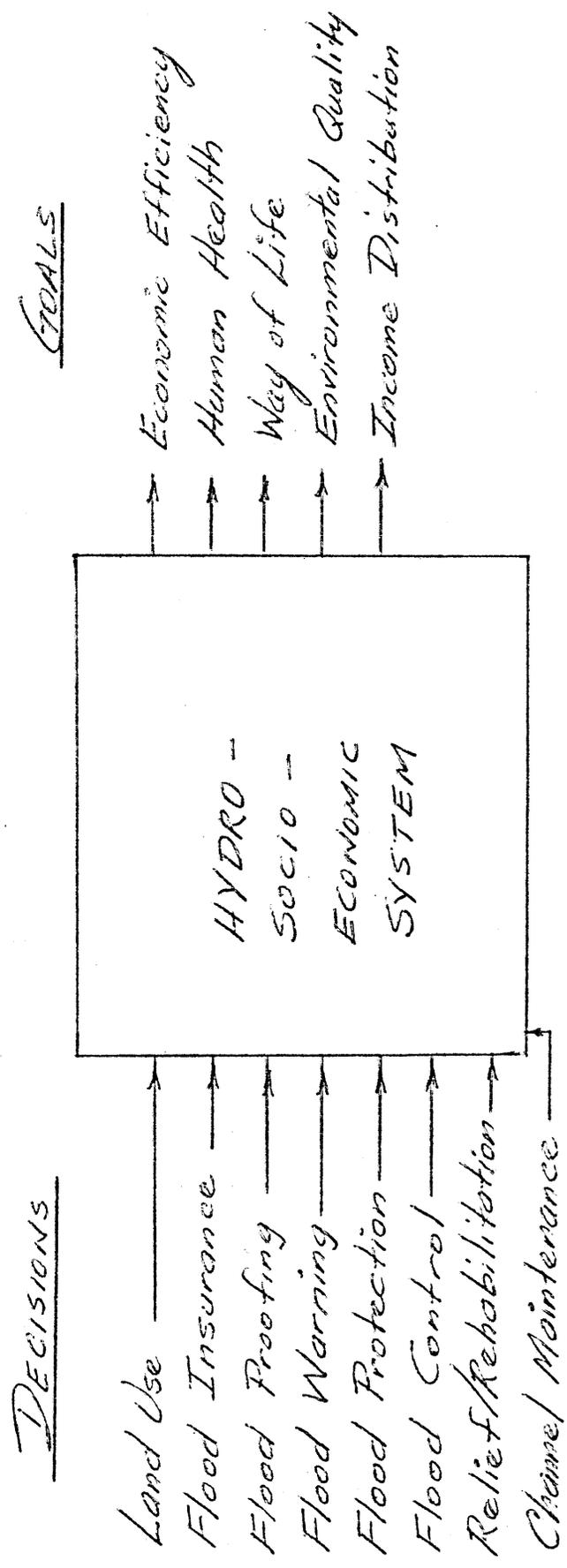


Figure 1 Input/Output View of Flood Plain Management

TYPES OF INFORMATION NEEDED

Information needs in flood plain management pertain (1) to values society places on contributions produced and (2) to relationships between decisions and contributions, including technology to define these relationships as well as data needed by them. Research is needed to improve technology (both physical and socio-economic), to improve data, to develop new sources of data, and to enunciate social preferences for contributions to goals.

Information also is needed on how conditions may change over time and on uncertainties in the many valuables involved.

SUMMARY OF RESEARCH NEEDS

Specific research and information needs are summarized below for the following: assessment of the flood hazard, flood warning, flood proofing, land management, flood insurance and relief, and rehabilitation. Present research is directed primarily to the physical aspects of these topics. Although present research should be expanded, substantial new efforts are needed in the social sciences.

Gilbert White and J. Eugene Haas have just published "Assessment of Research on Natural Hazards" [M.I.T. Press, 1975] which summarizes research needs for all natural hazards as perceived by an interdisciplinary team of 15 investigators. The work was funded by NSF. A large number of outside experts participated in the project. Reproduced from that report is Table 11-2 (pp. 270-271) showing flood hazard research opportunities and potential for contributions to national goals. Finally, Figure 3-3 from the report (p. 65) shows how one adjustment to floods may stimulate activity in another adjustment.

TABLE 11-2
RESEARCH OPPORTUNITIES-FLOOD

Research Opportunity	National Aims								Research Findings	
	Economic Efficiency — Reduction of Net Losses Benefits-Costs		Enhancement of Human Health — Reduction of Casualties		Avoidance of Social Disruption		Environment — Protection or Enhancement	Equity — Distribution of Costs and Benefits	Expected Success of Research	Likelihood of Adoption
	Average	Catastrophic	Average	Catastrophic	Average	Catastrophic				
Control and protection Urban sewer and storm drainage Channel hydraulics	High	Low	Low	Low	Med	Low-Neg	Low-Neg	Low-Neg	Med	High
Warning Systems and Flood-Proofing Forecasting methods Improved warnings Flood-proofing technology Aspects of proofing Feedback effects of flood-proofing	Med	Med, Low or Neg	Med	High	Med	Med	Low	Med	Med	Med
Land Use Management Adoption processes Social effectiveness Coordination of land measures	Med	Med	Low	Med	Low	Med	High	High	Med	Low
Insurance Hazard awareness and policy purchase Linkage with land use Compulsory insurance Influence on flood loss potential	Med	Low	Low	Low	Med	Med	Low	High	Med	Med
Relief and Rehabilitation Impacts Methods of providing relief	Low-Neg	Low Neg	Low	Low	Med	Med	Low	High	Med	Med
Basic Data and Methods Flood frequency estimation Hazard mapping Flood damage variables Public participation in choice Optional mix of adjustments	High	Med	Low	Low	Med	High	High	Low	High	NA

Med = Medium Neg = Negative ? = In doubt NA = Not applicable

FIGURE 3-3
 MATRIX OF INTERACTION OF ADJUSTMENTS TO FLOODS

Initial Adjustment	Other Adjustment Affected					
	Control and Protection	Flood-Proofing	Land Use Planning	Warnings	Insurance	Relief and Rehabilitation
Control and Protection		○	○	○	○	○
Flood-Proofing	○		○	●	?	○
Land Use Planning	○	?		●	●	○
Warnings	○	●	●		?	○
Insurance	○	?	?	●		○
Relief and Rehabilitation	●	○	○	○	○	

Stimulated by the initial adjustment:

- - High stimulation
- - Little or none
- ? - Doubtful

Assessment of the Flood Hazard

One of the most essential information needs is an assessment of the flood hazard. Research is needed to improve techniques and to better understand limitations of existing and new techniques.

Research is needed to explore inexpensive methods for assessing flood hazard in areas where potential benefits do not justify more extensive studies or where resources are so limited that extensive studies must be deferred. Such research should establish hydrologic limitations, socio-economic impacts of these limitations, and legal basis for accepting the inexpensive methods.

Research is needed to develop improved hydrologic methods for assessing the flood hazard that make better use of readily available data, to assess accurately the effects on the flood hazard of flood plain management decisions, and to make optimum use of stochastic and deterministic models of precipitation and runoff processes. Some of this research should be done in conjunction with actual flood plain management studies in order to assure a desirable balance between theory and practice in the research results.

The needed research

- . should apply to unengaged areas
- . should account for storage processes in the flood plain
- . should generate precipitation using a stochastic precipitation model and the generated storms should preserve published intensity-frequency duration relationships as well as the historical properties of individual storm events
- . should account for seasonal variations in the propensity for flooding to occur
- . should account for local effects of flood protection and control

- . should account for upstream land use caused by channelization, improved drainage, added impervious surfaces, and new storage detention facilities
- . should recognize the flood hazard depends on an ensemble of storm events and should give better understanding of the limitation of design storms to analyze effects of storage on land use and channelization on the timing and attenuation of flood events
- . should seek improved mechanisms of providing technical assistance to local governments to make optimum use of new techniques
- . should include objective methods for assessing the limitations of the research results
- . should recognize natural channel beds change geometry by erosion and sedimentation and these processes may be affected by upstream developments.

Flood Warning

Research is needed to improve and to evaluate effectiveness of flood warning systems. Some specific needs are as follows:

- . Research is needed to make optimum use of radar and satellite information to increase warning time, particularly in flash flood hazard areas.
- . Scientifically validated generalizations are needed about how humans do respond to flood messages and how they prefer to respond.
- . Research is needed on numerical forecast guidance models, including research into methods of assessing uncertainty in numerical forecast information.
- . Research is needed to find out how forecasts in present or modified form can best be used by those subject to flood hazard.
- . Research is needed to find out why communities respond in different ways to offers of flood warning services.
- . Flood warning research needs to be done in close collaboration with a warning system.

Flood Proofing

There are three categories of flood proofing; i.e., permanent, contingent, and emergency. The latter two are warning-dependent.

Research needs are as follows:

- . New and cheaper flood proofing measures are needed.
- . More effective utilization of existing measures is needed.
- . Accurate data on stage-damage relationships for different kinds of flood proofing is needed.
- . Such research needs to be done in close collaboration with professional architect and engineering groups and with agencies responsible for building codes and land use planning such as the Corps of Engineers, H.U.D., and the National Bureau of Standards.
- . Research is needed to understand what makes flood proofing appropriate in a given place.
- . Research is needed on cost-bearing and sharing schemes for flood protection works (which are often preferred to flood proofing because the cost is largely assumed by the federal government) to discover if more efficient use of flood proofing alternatives could be found where continued use of the flood plain is desirable.

Land Management

Flood plain land use management may well be the single alternative most likely to reduce flood damages in the U.S. But, many other contributions to relevant goals may be reduced by land use control. Therefore, it is not obvious the net social impacts of land use control are necessarily positive.

Historically, federal flood management policies seem to have been flood loss management policies rather than policies to improve net social benefits. Perhaps this has been due to lack of information on the net impacts of flood plain regulations.

- . Research is needed to understand why land use management in flood plains is adopted in some communities and not in others.
- . Information is needed on the historical effectiveness of existing land use control methods in reducing flood damage.

Flood Insurance

Information is needed on the contributions being made by the Flood Insurance Act of 1968 and the social perception of relationships between the provisions of this act to limit emergency relief and other legislation such as the Disaster Relief Act of 1974 needs to be studied. Research is needed to see if the flood insurance program needs to be modified to broaden its appeal.

Relief and Rehabilitation

- . Information is needed on the net contributions emergency relief measures make to relevant social goals.
- . Information is needed on the extent to which emergency relief permits flood plain occupants to externalize the costs of their activities thereby reducing the potential effectiveness of other flood management alternatives.
- . Information is needed on how to improve the net benefits gained from emergency relief measures.

SUMMARY

The above list of research items suggests we need to take a broader view of flood plain management decisions than has been taken in the past. As part of this there is need to better integrate physical and social science research in dealing with actual problems.

