

CHAPTER VI
INFORMATION AND DECISION-MAKING IN
FLOOD DAMAGE REDUCTION

Having run its course of interviews, observations and miscellaneous data, this final chapter comes full circle, reconsidering in the light of the findings decision-making and the role of information in individual flood damage reduction. But first an attempt will be made to answer a basic question.

Why Do They Live There?

Almost anyone who has studied flood problems has been asked, usually informally, the perennial query, "But why do they live there?"

The question ought not to be taken at face value. People live and work in flood plains for a variety of locational reasons including certain intrinsic advantages to flood plain location. Therefore, the question might better be rephrased as follows: "Why do people persist in living and working in areas subject to repeated floods?"

This study has provided raw material with which to undertake an answer. It has found that people persist in areas subject to flood hazard for any of the following reasons:

1. They do not know about the flood hazard and are therefore not unduly concerned.
2. They know about the flood hazard, but personally do not expect a future flood, and therefore are not unduly concerned.
3. They expect a future flood, but do not expect to bear a loss, and are therefore not unduly concerned.
4. They expect to bear a loss, but not a serious one, and are therefore not unduly concerned.
5. They expect to bear a serious loss and they are concerned. Therefore they have undertaken or are planning to undertake some action to reduce such losses.

The first four states lead managers to ignore rationally flood hazard despite the opinions of technical personnel or even repeated flood experiences. The fifth state in which managers are found leads to their taking action to reduce the flood hazard.

However, such action may be casual, improvised, ineffective, and far from optimal.

This is a major finding of the study. In the face of community knowledge and experience, there is a variety of personal perceptions of hazard and potential loss that rationally leads managers to ignore flood hazard.

A second major finding is that there is strong evidence for an underlying orderliness in the proportions of managers that hold a particular perception in any small urban area. It seems likely that a certainty-uncertainty scale, measuring in part the perceived frequency of flooding at a place, accounts for this observed order.

In areas of high certainty, both the expectation of bearing future losses and the perception and adoption of alternatives to reduce such losses are widespread. In areas of lesser certainty, knowledge of a past flood might be widespread, but only a minority would expect to bear a future loss, and fewer still a serious loss. Finally in areas of great uncertainty, any knowledge of floods (and certainly the heightened sense of bearing a future loss) might be absent among managers.

Thus the answer to the original query, "Why do they live there?" will vary from place to place. In Darlington one could answer that people persist in living there because, having recognized the potential for serious loss from repeated flooding, they have evolved a satisfactory series of adjustments to reduce such losses. In Watkins Glen the answer might be that managers do not expect a future flood. In El Cerrito-Richmond a complex answer would be required. Some managers don't know about floods, others don't expect to bear a loss, and at least one who is quite concerned has effectively protected his establishment against most floods.

Decision-Making by Flood Plain Managers

The attitudes and behavior of flood plain managers now may be examined in the light of the major assumptions of decision-making analysis that were discussed in the second chapter.

The rationality of man.--Almost all the findings confirm the a priori assumption of a boundedly rational man. This rationality is not overly impressive, being contained by the limits of a manager's experience and leading to less than optimal behavior.

Rational behavior appears to be weakened according to the location of a place on the certainty-uncertainty scale. The tendencies for differences of personality to create behavioral

differences is most pronounced in areas of intermediate certainty. An example might be those respondents who for a variety of motivations deny to a flood the characteristics of a real flood. In areas of high certainty, each new occurrence would make such a denial more difficult. In areas of uncertainty there may not be any known floods to which characteristics might be denied.

Processes of choice.--Following from the boundedly rational behavior observed in this study, the most common choice mechanisms appear to be conscious ones. However other processes are present. The response to frequent flooding in Aurora or Darlington almost appears habitual. There is also a minority whose reactions to flood hazard might result from an unconscious choice process related to a need to eliminate that which is uncomfortable and threatening from their world.

In ascribing such unconscious processes to a minority, the study does not ignore the many managers who share in a desire to bring order to their future and eliminate uncertainty. However, in most cases such desires are in accord with both the common experience and knowledge, and the conscious goals of the possessors of technical knowledge as well and does not lead to the denial of unpleasant facts.

The conditions of knowledge.--The conditions of knowledge under which resource management decisions are made are traditionally distinctions between known and unknown probability distributions described as certainty, risk, and uncertainty. For those familiar with these concepts flood hazard is usually considered a risk. It is a hazard with a known probability distribution. In the light of this study, the assumption is questionable. It would be better to think of flood hazard as lying somewhere between risk and uncertainty, that is, as having an ill-defined probability distribution best described within a range.

If on careful scrutiny flood hazard is closer to uncertainty than to risk, only a minority of managers appear to behave as if they operated under such a condition of knowledge. This minority finds flood hazard actually less risky, and closer to certainty, than the conventional assumption of the economic analyst. They do this by perceiving nature in a deterministic fashion, being oblivious to the independence of flood events, and failing to perceive the probability of floods occurring which are much greater than recent common experience.

Thus both engineers, economists and flood plain managers appear to ignore some of the uncertainties of flood hazard; the former for the practical needs of their analyses and the latter for what appears to be a conscious effort to order their environment

in a deterministic and comprehensible way.

A second concern related to the conditions of knowledge might be recalled: the variation of information within a community of individual managers. Again, the findings in LaFollette and the other sites suggest the influence of the certainty-uncertainty scale, with the variation greatest in areas of intermediate certainty.

The improved quality of information is exemplified by possession of a broader range of choice that is loosely scaled and increases in complexity up to the adoption of some flood loss reduction alternative.

In terms of broad alternatives flood plain managers share between them as wide a range of choice as possessors of technical knowledge. However, no single manager would perceive all the possible alternatives and in general the quality of such perceived alternatives is of a lower order than the technical perception.

Evaluation criteria.--It has been difficult to define the evaluation criteria used by managers to choose between alternative loss reduction measures. There is no simple format or set of rules.

At best it might be said there are few signs of conscious optimizing or maximizing, and the consistent application of any economic criteria is in doubt. Alternatives adopted under the momentary stress of a flood can be described by Simon's satisficing. After repeated experiences, a stable habitual series of adjustments appear to be evolved.

Decision-making analysis in resources management.--All decision-making analyses suffer from the need to abstract the decision process from the context of daily life and being ends-means schemes tend to simplify real life situations. The ends of one endeavor are the means of another and frequently means become ends in themselves. For flood-loss-reduction decisions such problems make it extremely difficult to make meaningful analysis. Except for the short period in which a flood occurs this entire area of decision-making is relegated to minor status.

Many areas of decision-making in resources management are similar. Most resource activities might be broken up into components that would appear to be minor when considered individually and yet whose sum is a major livelihood activity.

In considering the utility of this type of analysis, it must be judged finally by its results--the degree to which it has helped illuminate the process of resource use. If new and valued insights have been derived then despite conceptual problems of application it is a useful approach, having focused on aspects of

resources problems too frequently ignored in other types of analysis.

The types of perception described in the previous paragraphs are derived from a description of the behavior and attitudes of flood plain managers. But the world in which flood plain managers make decisions is not a static one. A host of factors change. The perceived frequency can change dramatically with the occurrence of a series of floods in rapid order. The perceived utility of flood plain land might change; witness the interest in evacuating the flood plain at LaFollette to secure a highway oriented location. The social rules with which decisions must conform might change, or the information upon which such decisions are based. It is to the last factor to which the following will be addressed.

Information and Human Adjustment to Floods

In the light of what has been learned of decision-making in urban flood plains it may be asked what effect improved information might have on managers' actions to reduce flood damages.

An improved information program would share with flood plain managers the best information that men possess concerning the flood hazard of the area in question and the possible adjustments to it. It is the writer's conclusion that the yield from such a program in terms of managers taking individual actions to reduce flood losses would be negligible in the face of the rapid increase of damage potential.¹ For on close scrutiny, it appears that the information would be least accurate in the area where the greatest opportunities for damage reduction exist and even foregoing accuracy, managers may not be able to use the information.

Flood frequencies.--This study has included a series of examples illustrating various approaches taken by technical personnel to flood frequency analysis. All such analyses suffer the limiting effects of small samples of extreme events. In the range of probabilities smaller than .02 or .01 these limitations become aggravated and the variance of probability estimates becomes so large as to cause great difficulty in interpretation. Yet floods having these probabilities are those that Holmes identified as

¹This conclusion refers to a program of improved flood hazard information. Most persons concerned with the rising toll of flood damages view improved hazard information as but one item in a comprehensive program of community and individual activity.

contributing some 50 per cent of all flood losses.¹

Further, even if frequencies had a higher order of accuracy than they now possess, there is considerable doubt as to their utility in their present form given the fact that they are based on long-run averages, while individual short-run use of flood plains is the predominant occupation.

The prison of experience.--A major limitation to human ability to use improved flood hazard information is the basic reliance on experience. Men on flood plains appear to be very much prisoners of their experience, and the effect of such experience is not consistently in the direction of taking individual action to reduce flood damage.

Improved flood hazard information would include data on floods greater than those flood plain managers have experienced. The observations in LaFollette and elsewhere suggest that managers have a great deal of difficulty conceptualizing and acting upon this information.

Floods need to be experienced, not only in magnitude, but in frequency as well. Without repeated experiences, the process whereby managers evolve emergency measures of coping with floods does not take place. Without frequent experience, learned adjustments wither and atrophy with time.

Conversely, limited experience encourages some managers to feel that floods are not so bad after all and they lose their motivation to seek further for alternatives. With limited experience, other managers appear to decide that they have received the flood that nature has had in store for them and that they will not have another flood for some time.

Recently experienced floods appear to set an upper bound to the size of loss with which managers believe they ought to be concerned. Since much flood damage is caused by floods greater than have recently been experienced, this experience serves to negate the effect of improved information that seeks to expand the expectation of the flood plain manager.

The simplification of choice.--Compared to the kinds of information that managers presently use in LaFollette and elsewhere, improved information will be considerably more complex. Yet both managers and technical personnel share in the widely observed need to simplify choice processes. Whether such action is thought of as simplifying, abstracting or constructing models, it usually results in the boiling down of masses of information and the reduction of a large number of choices.

¹Holmes, p. 17.

This tendency works adversely on flood hazard information in several ways:

It may emasculate flood hazard information by so simplifying it that the very qualities that provide the improvement are removed. Complex data, when reduced to essentials, might provide little improvement over what was previously known.

More commonly it might cause managers to abdicate all individual decision-making and "leave it to the experts." Faced with a need to simplify for himself complex data that he feels unable to understand or that leaves him confused and uncertain, a manager might find himself unable to take any individual action based on such information.

Of course improved information does not have to imply more complex information. The process of simplification can be done by technical personnel. Continuous functions can be made into discrete choices. Arbitrary or intuitive risk levels can be chosen. An average of contrasting frequency estimates can be used. However, when this is done by technical personnel, and it is being done, a new element has been introduced into individual decision-making. Technical personnel of public agencies, unlike private consultants, are guided by what they perceive as broad community requirements. They interpose their judgment into the decision process. The judgment is related to the perceived long-range needs of the community and may not be in the best short-run interest of a particular individual decision-maker.

When the TVA offers communities data on three groups of floods, having distilled these from a mass of collected data, these levels might actually be quite unsuitable for use by an individual decision-maker planning to take action to reduce his flood losses.

The need to simplify the world in order to deal with it can also lead to distorting the content of information as well as removing detail. Flood plain managers are more prone to doing so than technical personnel who seem to have a higher tolerance for uncertainty. For some managers, a belief that floods come in cycles reduces an uncertain world into a more predictable one. They might be expected to develop interpretive mechanisms that would enable them to transform any hazard information by selective abstraction into a buttress for their existing belief. Managers in LaFollette appear to do this with their observed experience and might find it even easier to do so with information conveyed by maps or printed word.

The effect of the certainty-uncertainty scale on information.--All the previous tendencies that lessen the utility of

information are aggravated in areas other than those of certainty. But it is in areas of certainty like Darlington and Aurora that managers actually have a reduced need for additional or improved information to encourage them to take individual action to reduce flood damages. Such actions are already highly developed. In the other areas, where the opportunity to reduce flood damage is greatest, the inaccuracies of the data, the restraint of experience, and the need to simplify choice, all act to reduce the effectiveness of improved flood hazard information.

Improving the effectiveness of information for individual flood damage reduction activity.--Despite the general gloomy conclusion about the effect of improved information inducing individual flood damage reduction actions, a number of insights were obtained in the study that point to minor ways of increasing the effectiveness of such data.

A major consideration in the presentation of flood hazard data might be to ask how such data might enlarge the prison of experience and make more real the experience of others.

The approach that the TVA has evolved along these lines has much to recommend it although subject to criticism on other grounds. For the people of the Valley, many still with strong ties to the land, pointing out floods that have occurred on such and such a creek can be quite effective. For the new urbanite, with creeks buried beneath a maze of concrete, making real any flood experience other than his own becomes a difficult task.

This task is complicated by the lag between peoples' perception of a more real past and the realities of the present day. The great floods of the depression era still provide the basic reference for a flood perception which is perpetuated by the use of rural-oriented books and films in present-day conservation education or by such venerable and moving products of that era as the Pare Lorentz film, "The River." The complexity of water management problems posed by any metropolitan area is of a different qualitative order than the popular image of flood problems.

With its accent on forested uplands, great engineering works, and the like, the perception of the great river flood can only serve to discourage individual action to reduce flood damages.

Flood hazard information could seek to change this perception--to focus on the tributary streams of the nation where damage potential is being spurred by the suburbanization of both residence and industry and is very much the product of individual locational decisions.

The actions taken by managers in LaFollette to elevate

sites or make structural changes long after the 1950 flood suggests that a neglected opportunity for flood hazard information might be to seek to exploit the latent opportunities for flood damage reduction that expansion and remodeling present.

On one level, detailed technical data might be channeled into professional architectural and construction activities. On another level, popular material can be made available to lumber and building supply dealers, the how-to-do-it magazines, newspaper columns and the like, introducing simple practices designed to reduce flood damages and to be undertaken when remodeling or new construction is being planned.

A further opportunity to make information more effective might be to help dispel the widely held illusion that comprehensive household policies insure against flood losses, while conversely making known the actual opportunities that do exist in obtaining insurance.

The three suggestions cannot result in any massive activity to reduce flood damages by individual action. The leadership, encouragement, and mandate to reduce flood damages must come primarily from the community and there is a considerable distinction between private and community decision-making.

This study has been preoccupied with individual decision-making. Individuals play a social role as well as having a private life and their social role in the community has been a part of this study. However the writer is convinced of a deep hiatus between individual and community interest. The calculus of individual decision-making when summed over all the individuals in the community does not equal the costs and benefits (in their broadest sense) of the community. In this case the whole is not equal to the sum of its parts.

Three reasons might be suggested for this state of affairs:

1. Spillover effects or social costs and benefits that cannot be allocated or captured by the market may not be reflected in individual decision-making.

2. Substantially different probability distributions of risk exist for communities and individuals. The mobility and short planning horizons of individuals provide for the lower probabilities of discrete flood events. An individual's probability is compounded of the probability of his being on the flood plain and the probability of there being a flood.

3. Communities are subject to a political process that creates demands on the community for flood protection on the basis of considerations that individuals making such demands would not employ themselves. Individuals demand flood protection that they

are unwilling to pay for directly, or even indirectly through their local community. Such demands are perfectly rational from the individual point of view as the cheapest means of protecting one's self from flood losses. For the citizens of the national community they might prove to be a costly and uneconomic means of dealing with the problem.

Therefore a community might be motivated to seek flood damage reduction alternatives, not because the toll of individual flood damages seriously places a burden on the community, but because they give rise to irrational demands on the part of the individual members to have the community provide protection all out of keeping with the magnitude of the losses.

There are other distinctions between the stance upon which community and individual decision-making rests, but these will suffice to warn the reader not to extend any conclusions derived from a study of individual decision-making to flood loss reduction for the community as a whole.

In the last analysis, there is a justification for better information not contingent upon the reduction of flood losses. It would follow from a philosophy of an open society that no citizen suffer an unexpected loss if the opportunity for informing him is available. It may be an act of faith to feel that information, even if not suitable for flood loss reduction, will in the long-run contribute to a more informed community decision-making. If it is an act of faith, it is one the writer feels little need to apologize for. Despite the limits of human ability to handle certain levels of information, as a society we should aspire to an ever-increasing ability for rational decision-making. However, information that frankly acknowledges some human limits and seeks to relate to this frailty would probably prove most effective.

And so full circle is reached. The paradox of rising damages with increased flood control with which this study began will probably exist for some time. It is not a major problem as problems go--the catastrophe of floods and the magnitude of flood control expenditures are dwarfed by the accepted realities of the nuclear age. Yet in the need for new approaches, insights, and actions, it is symptomatic of a variety of resource problems accompanying the increase of man's numbers and the spread of his works.