

V. Trends and Images of the Future

Trends analysis is central to understanding the future. It is useful in at least three ways. First, insofar as they are stable, trends define the boundaries on alternative future developments. Second, the examination of trends automatically forces one to search for underlying factors that may either stabilize or perturb the trend. Such shifts may come about gradually or they may be sudden. The third use of trends is to suggest opportunities for policy interventions to modify what would be a stable undesirable development, or to promote a desirable but otherwise unlikely change.

Understanding the long-term trends is one basis for formulating public policy since they suggest how the system is likely to evolve. Most public policy actions are unlikely to have major short-term consequences for the quality of life or the public well-being. Therefore, the trends discussed below cover an interval of 5 to 30 years. Two levels of trends in relation to flood hazards management are discussed:

- trends directly related to floods, and
- trends having to do with natural hazards in general. These include long-term trends in American society over the last several decades that form an overall societal context for most public policies including the management of natural hazards.

The trends identified below are often conflicting if not contradictory. This ambiguity and uncertainty about trends—their duration, significance, and origin—make assessing impacts difficult but fruitful.

Trends analysis cannot be limited only to those trends that lend themselves to quantitative, fully objective presentations. Some place must be made for informed subjective judgment. There is a trade-off in the sense that those circumstances most likely to be reflected in fully quantitative terms sometimes emerge as trends that are not on the leading edge of important change. Some attempt is made to accommodate judgment, opinion, and wisdom in the identification of important trends.

TRENDS DIRECTLY RELATED TO FLOODS

Trends that will shape the future of exposure to flood hazards in the United States fall into four categories:

- trends affecting the degree of risk posed by floods,
- the effects of demographic trends on flood hazards,
- evolving patterns of floodplain use, and
- trends in public policy responses.

Trends Related to Flood Risk

The most important risk-related trend is that public policies, by continuing to encourage floodplain development, are causing losses to continually rise and may cause catastrophes of unprecedented scale. The number of lives lost in these potential major events could easily exceed even the previous loss of 6,000 lives due to hurricane flooding in the summer of 1900 in Galveston, Tex.¹ The property losses would dwarf by comparison the sizable and increasing losses that are currently taking place.

Additional trends are:

- The increasing loss of life from floods. While low compared with that of developing countries, the loss of life has shown a slight upward trend over the past several decades.
- Property loss has grown. It is not clear how much the effect has been of true increases, inflation, better reporting schemes, insurance availability, or other factors. Nevertheless, there has been an accompanying trend to demand more Federal postdisaster assistance, with or without adequate preplanning and land use control.
- Public policy continues to promote the potential for life and property loss by permitting—if not actually encouraging—development on hazardous terrain. In some areas policy, or its

¹James Cornell, *The Great International Disaster Book* (New York: Simon and Schuster, 1979), p. 112.

absence, causes more problems that it resolves. An example is that hotels, motels, highways, and housing are located along coastal shorelines, with little regard to potential hazardous conditions.

- “Acts of God” are a decreasingly important aspect of flood hazards. Advances in prediction and control techniques, in conjunction with proven measures to mitigate loss, improves the capability to reduce the number and severity of disasters.
- New and improved techniques for predicting phenomena, such as hurricanes and tornadoes, have created problems as well as benefits. The problems principally have to do with how to organize and manage an approach for dealing with the undesirable side effects of prediction.
- The technical ability to significantly modify weather, including specific phenomena such as hurricanes, is being continually improved. Society is only beginning to examine the ramifications of this capability.
- There are an increasing number of requests from communities for flood-warning services.

Trends in the Use of Flood Hazards Areas

The competition between land use and development interests for flood hazards areas has contributed to a variety of trends that are making development choices even more controversial. These include:

- A downtrend in the original historical reasons for the occupancy of floodplains. Business siting for cheap transportation, power, water-dependent processes, and housing close to the workplace no longer require proximity to bodies of water. The growth of the highway system, pipelines, railroads, and other transportation infrastructure has virtually eliminated the economic need to locate in floodplains.
- An increase in the population of floodplains, even in regions of zero or declining growth.
- A heightened awareness on the part of both the public and the Government of the need to take innovative action.
- An increase in policy conflicts over alternative uses and allocations of water, water resources, and bodies of water along with their adjacent areas.

- New competing interests for the use of floodplains: commercial and industrial development, housing, the growth of natural and commercial recreation areas, the desire for the conservation of natural resources—especially in wetlands—and historical preservation.
- An increasing amount of legislation relating to floodplains and coastal zones.

Demographic Trends

The distribution and composition of the population is a major incentive for social change. The emergence of flood hazards as compelling public issues is largely the result of demographic trends. Some of these trends are:

- More than half the U.S. population lives within 50 miles of the shoreline of an ocean or a Great Lake, and their number is growing annually.
- The continual shifting of the population to coastal zones and riverine floodplains that are subject to flood disasters is aggravating the environmental stresses in those areas. This population mobility -brings a constant stream of new residents, who are unfamiliar with the hazards of a particular area. Since flood disasters tend to occur in decade-long cycles, the existence of risks is not likely to be common knowledge.
- Increasing population density can create pressure to develop marginal hazard areas by, for example, the location of mobile home communities or parks.
- Space for building to meet a growing population is fast-disappearing in areas of almost totally mountainous terrain such as West Virginia.
- When there is heavy industrial development in areas with a diminishing amount of space on which to build but a need to be near the work force, the development of marginally hazardous areas also tends to be promoted.
- The movement of the elderly and retirees, in general, to warm coastal areas, coupled with the recreational demands of tourists, has been responsible for the intense development of these areas. Consequently, the number of people and homes that could be affected by a disaster is increasing.

Trends in the Management of Flood Hazards

The most consistent trend in flood hazards management has been the historical emphasis on structural control and protection measures as the solutions to exposure to a flood hazard. Recent trends have led to challenging the primacy of flood protection by physical methods, and have succeeded in establishing the need for a strategy that combines structural with nonstructural measures. Specific trends include:

- There has been a long-term preference for the use of physical and technological solutions to hazards, rather than of institutional or socio-technological ones. For the most part, flood control, rather than land use management, has been preferred historically. Physical measures are apparently more acceptable since they may bestow financial benefits with little risk to short-term investments. As noted in the following three trends, this situation is changing.
- There is an overall shift in emphasis from so-called structural to nonstructural prevention and protection measures. Closely related to this is a trend toward the integration of physical, economic, and administrative measures for flood hazards management.
- The traditional high priority on relief is shifting to emphasis on mitigation, prevention, and loss reduction.

- Progress is being made in dealing with natural hazards by a variety of legislative and regulatory mechanisms. (Chapters VII, VIII, and IX.)
- Land use planning is increasingly being used as a tool of flood hazards management.
- There is greater dependence on insurance and -- other indemnification schemes for flood disaster relief.
- There continues to be a considerable lag between the generation of knowledge from research and its application to flood hazards mitigation.

TRENDS RELATING TO NATURAL HAZARDS

While it is useful to isolate flood-related problems in order to address the conflicts they present, it should be kept in mind that flood hazards are part of a larger class of natural hazards. There are a number of similarities in the way natural hazards are perceived and managed. The changes in these perceptions and the responses to them are prompted by many of the same underlying trends. Table 13 presents more general trends in relation to natural hazards in the United States. These trends were identified by OTA staff during the course of preliminary analysis, and were discussed at the workshops.

Table 13.-Trends in Relation to Natural Hazards in the United States

General

1. The loss of life has remained relatively stable over the past several decades. It is not clear to what extent this is attributable to better planning, preparedness, fewer severe events, social factors, or disaster-reduction efforts. This overall trend may not necessarily hold for specific hazards.
2. There has been an increase in property loss. It is not clear whether this reflects actual increases, inflation, better reporting schemes, insurance availability, or other factors.
3. There is a potential for catastrophes of unprecedented size in certain areas, e.g., in coastal zones and in some river basins. These could take thousands of lives and cause many billions of dollars in property damage.
4. Public policy continues to promote the potential for catastrophic life and property loss by permitting—if not actually encouraging—the development of fragile, dangerous, or risky terrains. This is particularly so in flood- and earthquake-prone areas.

Management of Natural Hazards

5. There has been a long-term trend toward the use of physical and technological strategies for dealing with hazards rather than institutional or social-technological ones. Flood control, rather than land use management is usually the preferred measure. Physical measures seem to be politically more acceptable since they may bring financial benefits and minimally dislocate short-term investments. As is pointed out in the four following trends, this situation is changing.
6. There is an overall shift in emphasis from structural to nonstructural prevention and protection measures.
7. There is a trend in hazards management from the current high priority on relief to mitigation, prevention, and loss reduction.
8. The combination of prediction, control, and loss mitigation measures has reduced the unanticipatable, unplanned for elements in natural disasters. Consequently, they can no longer be thought of as “acts of God.”
9. Progress is being made in dealing with natural hazards through a variety of legal approaches.
10. Land use planning is on the increase.

Governmental

11. Throughout government, Federal interaction and intervention in what had previously been nongovernmental or State and local concerns is increasing.

12. There is an increasing Federal role in disaster assistance and indemnification for hazards losses.

13. There is a trend toward the partial transfer of risk burdens for disasters from the Federal Government to lower level jurisdictions and individuals through insurance programs and mandated land use planning.

Scientific and technical

14. Development of new prediction techniques, particularly dealing with earthquakes and weather-related phenomena such as hurricanes and tornadoes, are creating both new problems and new opportunities. The problems principally have to do with institutionalization of the techniques and the identification of an appropriate management scheme for the undesirable side effects of prediction capabilities.

15. Attempts to control natural hazards are increasing and may be expected to continue, e.g., earthquake control, hurricane modification, hail suppression, fog dispersal, and increasing snowfall.

16. Inadvertent and uncertain modification of weather and inadvertent modification of climate are continuing trends in the United States and throughout the world. Similar trends exist for terrain in terms of modifications of soil characteristics and modifications of land use and water runoff patterns.

17. There is widespread agreement among climatologists that the climate is shifting. The direction of that shift—warmer or colder—and its relation to longer term climate shifts is unclear.

18. Nonatmospheric changes are also occurring, such as a rise in sea level.

19. Man's actions are an increasingly significant component of geophysical and environmental phenomena in the world. In some regions the generation of CO₂ exceeds the local capabilities for assimilation.

20. There is an increasing amount of research on natural disasters and natural hazards. There is, however, no comprehensive or adequately coordinated hazards disaster program. Furthermore, the total volume of research on natural hazards from the point of view of the life cycle of hazards continues to be very poorly funded.

21. Remote sensing as a technological tool in relation to natural hazards is now well developed. Application and utilization of remote sensing remain to be more effectively institutionalized.

22. The mapping and the collection of hazards-related data are increasing throughout the country.

SOURCE: Office of Technology Assessment.