

Appendix A: Coastal Erosion

Coastal erosion, a relentless geophysical process is irreconcilable with the present expanding use of the shoreline. The Corps of Engineers considers coastal erosion to be "critical" along 2,700 miles of coastline, especially on the Atlantic coast and Great Lakes shore area. Average annual losses are in excess of \$300 million. It is estimated that more than 25 percent of the U.S. coastline is exposed to a variety of wind, wave, and water phenomena: hurricane surge, tsunami, seiche, erosion, scour, undermining, wave impact, landsliding, liquefaction, and normal annual cycles of rainfall and storms.¹

In the face of social, economic, and demographic trends pointing toward the continuing desirability of coastal development, researchers have suggested new land management policies for the reduction or control of widespread shoreline loss.

Knowledge about the complex processes that take place along the shoreline is inadequate. Consequently, scientists have been unable to suggest appropriate public policy responses to the problem. For example:

- It is not clear to what extent coastal erosion is a product of short-term events, such as storms, hurricanes, etc., or to long-term geophysical change. The former suggests a possible role for actuarial indemnifications, prudent land management, setback provisions, and public acquisition. It would not seem practical for public policymakers to expend limited resources, in the latter case, to buy time in the face of a dynamic, evolutionary, and inevitable shoreline erosion process.
- In attempting to evaluate the effects of specific events on erosion, research scientists find shortcomings in current measurement techniques. It is very difficult to quantify the loss from a single meteorological event, unlike those events that have their greatest damage impact on buildings, highways, and services.
- Since a large proportion of affected shorelines are privately owned (for example, the 3,000-mile Michigan shoreline is 82 percent privately owned), options for policymakers seem to be limited to mitigation policies that do not challenge traditional rights of ownership. In this regard, coastal erosion faces problems similar to those in flood management, since legal precedents have not been clearly set for public intervention in some aspects of flood hazards management. Table A- I illustrates one hazards research team's suggestions on needed

¹D. Earl Jones, "Housing and Related Coastal Problems- Current Practices Offer Improved Solutions," Oct. 17, 1977, convention paper.

Table A= I.-Research Opportunities- Coastal Erosion

Topics	Level of support	
	Man-years	Duration (years)
Shore morphology	2	
Central data systems	40	10
Socioeconomic loss	5	2
Nourishment/dredging	20	10
Nourishment cost	5	2
Effects of manmade structures	20	10
Remedial structures	40	10
Private adjustments	10	10
EUM programs	26	10
Delineation of risk zones	40	10
Public participation	10	10
Dynamic models of shore change	15	10
Comprehensive hazard insurance	5	5
Total	238	

SOURCE: Gilbert F. White and Eugene J. Haas, *Assessment of Research on Natural Hazards* (Cambridge, Mass.: The MIT Press, 1975), pp. 360-372.

coastal erosion research. An important feature of these opportunities is the emphasis on long-term commitment to continuing research on fundamental physical and social problems. Although policy measures for coastal erosion have been slow in being affected, the manifestations of human intervention in the runoff-sedimentation process are quite evident. A major dislocation of the sediment balance can be traced to inland structures, such as dams and levees, that have produced the unanticipated impact of upstream soil and sand entrapment. This blockage threatens the useful lifespan of a dam, and forces many coastal communities to maintain beachfronts by dredging and structural protection to augment the decreased amount of natural sedimentation available.

The most striking effects on shoreline sediment and soil processes have resulted from direct development in coastal areas and the unintended impacts of modification of natural sedimentation patterns. Development along the shoreline is increasing, and has contributed to spiraling erosion losses by deforestation, construction, and mining of beach sand, and by the interdiction of natural sediment processes by jetties, breakwaters, groynes, and piers. These structures accumulate sand and sediment, interfere with the transport of sand down the coast, and often initiate the construction of additional protective structures, which results in a permanent modification of shore zone processes.²

²Douglas L. Inman and Birchard M. Brush, "The Coastal Challenge," *Science*, July 6, 1973, pp. 20-32.

The prospects for constructive responses to the erosion hazard would be improved if answers could be provided by research to questions such as the following:

- **To what extent is coastal erosion a hazard in itself, rather than a symptom, or effect of other coastal phenomena?**
- **How are short-term erosion fluctuations and long-term geophysical trends differentiated? Which policy options match short-term erosion fluctuations, and which options are feasible in the face of long-term trends?**
- What kinds of innovations in measurement can be expected soon? Can verification and measurement be reliable and unambiguous so that public expenditures can be justified and effectively allocated?
- What rights of intervention are available to public jurisdictions seeking to use setbacks and public acquisition of vulnerable coastal property?