Organic soils found in many wetlands compress under pressure, causing structural damage to buildings and roads. They are also unsuitable for onsite sewage disposal.

Photo by Richard Newton

scales that range from 1"=200' to 1"=1000'. Permits are required for fill, dredging, and other uses that may destroy or damage wetland areas. Maryland, Massachusetts, New Jersey, and New York have particularly effective programs.

At least seven states have adopted inland wetland protection regulatory statutes.[21] Massachusetts and Rhode Island have amended statutory wetland definitions to require permits for fill and structures in the 100-year floodplain. Aerial photos are usually used for mapping wetlands, although Connecticut uses soils maps. Rhode Island and, to a lesser extent, New Hampshire and Florida require state permits. In Connecticut, Michigan, New York, Virginia, and Wisconsin, local governments issue permits if they have adopted regulations consistent with state standards.

Several thousand local governments have combined wetland protection and floodplain management ordinances. Typically these establish tight protection standards (no fill or dredging) for wetland and floodway areas. Flood protection through elevation on fill or floodproofing is required for structures in outlying areas. In some instances, communities (e.g., Orono, Minnesota; Glastonbury, Connecticut) control development throughout the 100-year or even 500-year floodplain with the intention of protecting wetland areas.

Coastal Zone Management Programs

Congress adopted a national Coastal Zone Management Act in 1972.[22] During the 1970s, all coastal and Great Lakes states provided some regulatory control over coastal zone uses, often through a combination of statutes on beach, "navigable water," and wetland protection.[23] Regulations range from minimal beach setbacks (e.g., Florida and Hawaii) and wetland regulations in 15 states, to comprehensive coastal zone acts (e.g., California, North Carolina). Some wetland and broader programs involve direct state control. However, the Maine, North Carolina,

Minnesota, Washington, and Wisconsin programs rely primarily on local control within a framework of state standards.

State statutes define regulated coastal zone areas to include lands within specified distances of the water.[24] Coastal zone boundaries include a narrow, 200-foot shoreline area in Washington; 250 feet in Maine; 1,000 feet in Wisconsin, Minnesota, and Michigan; 1,000 yards in California; and all of the coastal counties in North Carolina. The Delaware and New Jersey coastal zone acts, directed toward industrial development, define coastal zone boundaries by particular roads.

Implementation of coastal zone programs usually involves mapping and more specific regulation of discrete coastal subzones such as wetlands, erosion areas, flood areas, and recreation areas. The Coastal Zone Management Act of 1972 and the basic enabling acts of several states require the identification of subzones of "particular concern," including many types of resource areas.

Some programs emphasize management of flood and erosion areas. Massachusetts has adopted an executive order prohibiting state investment in barrier beaches and it has a state building code incorporating wave heights for coastal hazard areas. It has also mapped erosion hazard areas and barrier islands and provided technical assistance and grants to aid communities.

The Rhode Island Coastal Commission regulates dunes, beaches, and wetlands. With funding from the state coastal zone management program, the University of Rhode Island provides erosion and flood maps and technical assistance to local coastal management programs. Many local governments such as South Kingston and Warwick have adopted flood hazard zoning.

The North Carolina coastal zone program also stresses flood and erosion hazards. It requires local governments to regulate flood and erosion areas of "critical concern." Erosion problems are emphasized in

Dune protection measures in Lewes, Delaware.

Photo by Jon Kusler.

the Michigan shoreline program, which has identified a 10-year erosion setback. The California coastal zone management program has also identified erosion and flood areas.

Shoreland Zoning Programs

Six states have adopted special legislation for the protection and management of shoreline areas:[25] Maine, Michigan, Minnesota, Vermont, Washington, and Wisconsin. Legislation adopted in Maine and Washington applies both to inland and ocean shorelines; legislation in Wisconsin and Minnesota applies to the Great Lakes as well as to other lake and stream areas. Statutes in all six states establish standards for local government regulation of shoreland areas. Several thousand communities and counties have adopted regulations pursuant to these statutes. Many contain flood hazard provisions.

States and communities have used two methods to classify shoreland areas more specifically. The first, applied in Wisconsin, identifies individual subzones such as wetlands around lakes. The second, used in Minnesota, classifies lakes in their entirety for "natural environment," "recreational development," and other uses. Varying shoreland use standards for each class apply to lot size, water frontage, building setbacks, and other matters. Both types of classification apply to floodplain maps and standards to supplement the more general classifications.

All shoreland regulatory programs authorize state standard-setting for local zoning, subdivision controls and, in some cases, sanitary codes. The six states have adopted standards to serve multiple goals: prevention of pollution, prevention of increased flood hazards; minimization of land use conflicts; protection of wetlands; protection of wildlife and scenic beauty; and protection and enhancement of recreation values. In general, programs permit low-density residential and recreational uses in

shoreland areas. However, they tightly restrict development and fills in wetland areas and flood hazard areas.

Michigan, Minnesota, and Wisconsin emphasize flood and erosion hazards in their shoreline programs. In Washington, the Department of Ecology has developed a detailed coastal zone atlas, including maps of flood and erosion hazard areas.

Other Resource Management Programs

Flood hazard mitigation has been achieved to a greater or lesser extent through a variety of other resource management programs. For example, Michigan communities have adopted combined floodplain and wild and scenic river regulations pursuant to a state "natural rivers" statute.[26] This statute directs the Department of Natural Resources to prepare river corridor plans for "wilderness," "wild scenic," and "country scenic" rivers. Plans are to manage rivers for "floodplain" and other natural values. Local governments are to adopt regulations consistent with state plans. Regulations apply to a 400-foot corridor on both sides of designated rivers. The state will directly regulate this area if local authorities do not. Michigan has prepared plans for 10 rivers and 1,100 miles of river corridor. Wild and scenic river programs have also been adopted in California, Oregon, New York, and other states.

Some communities have also adopted agricultural zoning for floodplains. Flood hazard mitigation is an incidental benefit of "prime agricultural land zoning," which excludes or restricts the density of non-agricultural structures.[27] For example, Northampton, Massachusetts, has placed approximately 1,500 acres of floodplain along the Connecticut River in an exclusive agricultural use district. Glastonbury, Connecticut, has zoned approximately 800 acres along the Connecticut River for agricultural use.

"Riparian" habitat protection programs can also be used to mitigate flood hazards.[28] California communities protect "riparian cover" or habitat along watercourses to reduce bank erosion, increase groundwater infiltration, and provide wildlife habitats. A 1974 ordinance adopted by Napa County, California, protects riparian cover from planting or cutting within specified distances of streams. Other California counties with riparian habitat protection ordinances are Shasta, Santa Cruz, and Sacramento.

Conflicts and Problems

Although resource protection and flood hazard mitigation standards are usually compatible, conflicts have arisen.[29] Problems are due partly to differences in enabling legislation and program goals. Flood hazard reduction programs have narrowly focused on protection of individual structures from flooding, and on protection against the aggravation of the existing hazard by new development in floodways. In contrast, resource management has a broader goal to protect resource areas or manage their use. For example, floodplain regulatory statutes usually permit fill in outer fringe areas. In contrast, wetland regulatory statutes, which are designed to serve broader wildlife protection and recreation goals, prohibit fill.

The differing philosophies of program managers also lead to conflicts. Floodplain engineers and building inspectors often take a narrow flood hazard reduction approach; community planners and conservation program directors often take an overall resource protection approach. Engineers view flood hazards as "a problem to be solved or avoided." Conservationists see natural values as an asset to be protected, managed, or restored.

Because engineers are often unfamiliar with natural values evaluation, they fear that environmental objectives will weaken floodplain

regulatory programs. On the other hand, botanists and others responsible for wetland protection often do not understand engineering. They tend to underemphasize natural hazards because they believe a hazard focus reduces the acceptability of their efforts.

Other problems in coordinating or integrating programs are lack of simple and inexpensive procedures to evaluate values and hazards, of expertise in specific programs, and of resource maps showing the boundary locations of wetlands, prime agricultural lands, and other resource areas. Conflicts in policy appear in all levels of government but are often most severe at the federal level.

Coordinating Hazard Mitigation and Resource Management

Several measures could reduce conflicts and encourage coordination or integration of hazard mitigation and resource management.

- Local governments should map or inventory wetlands, prime agricultural lands, sand and gravel deposits, habitat for endangered species, and other resources as part of floodplain management or broader land use planning.

- Local and state floodplain management should fully consider resource values in planning and managing floodplains. New development should be guided away from floodplains (not just floodways) having special values.

- Local, state, and federal agencies should widely disseminate resource protection and flood hazard boundary maps and other informational materials.

- Local, state, and federal agencies should more thoroughly cross-reference or integrate floodplain regulations and broader resource protection regulations. For example, wetland protection standards can be incorporated into flood restrictions to prohibit fill and structures in wetland areas. Mitigation of development impact should be required if activities are permitted in wetlands. Similarly, flood standards could be placed in wetland regulations.

- Federal agencies and states should provide resource managers with basic training in flood hazard assessment. Similarly, basic training in assessment and protection of broader resource values should be provided floodplain management staff. A simple guidebook should be developed for evaluating floodplain natural values.

- NFIP standards protecting coastal dunes and mangroves should be clarified and more effectively enforced. NFIP regulations could also be amended to require broader protection of wetlands that are important in reducing flood and erosion damage. Upgraded hazard mitigation standards would also help protect critical resource areas. For example, the incorporation of wave heights and erosion standards in coastal flood hazard standards would increase protection of beach, dune, and wetland areas. More stringent standards for floodway delineation, such as "zero-rise floodways," would help protect wetlands, flood storage areas, and aquifer recharge areas.

CHAPTER IV

Footnotes

1. See Kusler (1980).

2. For a discussion of mitigation approaches see Swanson (1979). See also references at footnote 28.

3. See Nordstrom and Psuty (1979).

4. Fla. Stat. Ann. §§ 161.052, 161.053 (West Supp. 1982).

5. N.C. Gen. Stat. §§ 113A-100 to 113A-134 (1978).

6. See Section 4 of Greeson *et al.* (eds.) (1979), and the many papers therein.

7. See for example, Fosberg (1971), Savage (1972), and Teal and Teal (1969).

8. See Teal and Teal (1969).

9. For discussion of the erosion control and wave attentuation functions of other types of wetlands see, for example, Newcombe *et al.* (1979), and Wayne (1974).

10. See Kusler *et al.* (1979).

11. See Grant and Patrick (1970). See also the papers and many references contained in Greeson *et al.*, (eds.) (1979).

12. Greeson *et al.* (eds.) (1979), Section 6, p. 490.

13. Greeson *et al.* (eds.) (1979), Section 8, p. 589.

14. Greeson *et al.* (eds.) (1979), p. 652.

15. U.S. Department of the Interior (1978).

16. Colo. Rev. Stat. §§ 24-65.1-201 *et seq.* (Supp. 1981).

17. See the references on wetlands in the bibliography of this report.

18. 33 U.S.C. § 1344(a) (1978).

19. 33 U.S.C. § 403 (1970).

20. See Kusler (1978).

21. *Id.*

22. 16 U.S.C.A. § 1454 (West Supp. 1982).

23. For a description of these programs, see references in the coastal areas section of this bibliography.

24. See Kusler (1980), p. 30, 187.

25. See Kusler (1980), p. 26.

26. Mich. Comp. Laws Ann. § 281.76 (West Supp. 1979).

27. For information on agricultural zoning see the bibliography for this chapter. See also Toner (1978), U.S. Library of Congress (1978), and Toner (1981).

28. For discussion of riparian habitat protection programs see Johnson and McCormack (coordinators) (1979).

29. See Kusler (1979a), for the conclusions and recommendations of a technical seminar series investigating problems and approaches for better coordination of wetland and floodplain management efforts.