

PART IV
LIVING ON THE EDGE:
ECONOMIC GROWTH AND
CONSERVATION ALONG THE COAST

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CHAPTER 9:**MANAGING COASTS AND THEIR WATERSHEDS**

The pressures of continuing growth are acutely felt in coastal areas. While largely attributable to activities taking place at the coast, some pressures originate hundreds of miles away in inland watersheds. To more effectively manage coasts, states need a stronger capacity to plan for and guide growth—one that incorporates a watershed approach to govern coastal and ocean resources. In addition, to assist states in such development and support the move toward an ecosystem-based management approach, federal area-based coastal programs should be consolidated to better integrate and capitalize on the strengths of each. Finally, to reach the goal of economically and environmentally sustainable development, changes should be made to federal programs that currently encourage inappropriate growth in fragile or hazard-prone areas.

ATTRACTING CROWDS, CREATING OPPORTUNITIES**People, Jobs, and Opportunities**

While coastal counties (located entirely or partially within coastal watersheds) comprise only 17 percent of the land area in the contiguous United States, they are home to more than 53 percent of the total U.S. population. A study of coastal population trends predicts average increases of 3,600 people a day moving to coastal counties, reaching a total population of 165 million by 2015.¹ These figures do not include the 180 million people who visit the coast every year.²

Population growth and tourism bring many benefits to coastal communities, including new jobs and businesses and enhanced educational opportunities. Burgeoning industries associated with tourism and recreation in coastal areas (such as hotels, resorts, restaurants, fishing and dive stores, vacation housing, marinas, and other retail businesses) have created one of the nation's largest and fastest-growing economic forces (Appendix C).

Coastal Activities Are Big Business

Across the country, more than 89 million people a year participate in marine-related recreation, such as swimming, scuba diving, surfing, motor boating, sailing, kayaking, and wildlife viewing.³ In just four South Florida coastal counties, recreational diving, fishing, and ocean-watching activities generate \$4.4 billion in local sales and almost \$2 billion in local income annually⁴ and more than 2.9 million people visit the Florida Keys each year.⁵ During the summer of 2000, beach activities in Los Angeles and Orange counties stimulated an estimated \$1 billion in spending.⁶ The Hawaiian Islands and many U.S. island territories are particularly dependent on tourism for their economic health. Hawaii alone attracts some 7 million tourists each year.⁷ In 2001, over 8 million people took to the sea aboard cruise ships, and approximately 135 million people visited the nation's marine aquariums and zoos.^{8,9} Although golf and tennis are recognized as major U.S. industries, it is estimated that more Americans participate in recreational fishing than in both of these sports combined.¹⁰

Implications of Growth

The popularity of ocean and coastal areas increases pressures on these environments, creating a number of challenges for managers and decision makers. Increased development puts more people and property at risk from coastal hazards (Chapter 10), reduces and fragments fish and wildlife habitat (Chapter 11), alters sedimentation rates and flows (Chapter 12), and contributes to coastal water pollution (Chapter 14).

The rise in privately owned coastal land, coupled with the need to protect sensitive habitats, makes it increasingly difficult to provide public access to the shore. Every year, millions of dollars are spent replenishing sand at the nation's beaches and protecting coastal development from storms, waves, and erosion. And continued coastal development, coupled with rising sea level, results in ever-increasing wetlands losses.

Polluted waters limit fishing, swimming, and other water-related recreational and economic activities. One of the most serious impacts on ocean and coastal areas is the increasing amount of polluted runoff from urban, suburban, and agricultural areas, which is exacerbated by increases in impervious surfaces, such as roads, parking lots, sidewalks, and rooftops. Evidence indicates that ecosystem health is seriously impaired when the impervious area in a watershed reaches 10 percent. If current coastal growth trends continue, many healthy watersheds will cross the 10 percent threshold over the next twenty-five years.¹¹

Although the rate of population growth in coastal counties is not greater than in other areas of the country, the sheer numbers of people being added to fixed coastal land areas, combined with the fragile nature of coastal resources, create disproportionate impacts (Appendix C). In many cases, these impacts are destroying the very qualities that draw people to the coast.

The pattern of coastal growth—often in scattered and unplanned clusters of homes and businesses—is also significant. Urban sprawl increases the need for infrastructure such as roads, bridges, and sewers, degrading the coastal environment while making fragile or hazard-prone areas ever more accessible to development. Because of the connections between coastal and upland areas, development and sprawl that occur deep within the nation's watersheds also affect coastal resources.

STRENGTHENING COASTAL PLANNING AND MANAGEMENT

Multi-layered Decision Making

A complex combination of individuals and institutions at all levels of government make decisions that cumulatively affect the nation's ocean and coastal areas. These institutional processes determine where to build infrastructure, encourage commerce, extract natural resources, dispose of wastes, and protect or restore environmental attributes.

Many of the decisions that affect the nation's coastal areas are made by local governments through land use planning, zoning, subdivision controls, and capital improvement plans. Local decisions are shaped in turn by state policies and requirements. Some coastal states have developed statewide goals and policies for transportation, land use, and natural resource protection, with a few states putting specific emphasis on coastal resources. Recognizing that sprawling patterns of growth are not sustainable, several coastal states have instituted programs intended to manage growth, including Maine, Oregon, Florida, Washington, and Maryland. By applying a variety of land use planning tools, techniques, and strategies, these programs attempt to steer population growth toward existing population centers and away from fragile natural areas.

The Smart Growth Movement

For more than a decade, there has been a call for smart growth, characterized by more compact, land-conserving patterns of growth, through infill and reuse of building sites, pedestrian-friendly and transit-oriented development, and protection of green space. For example, in 1997, Maryland instituted its Smart Growth and Neighborhood Conservation Initiative, which tried to direct growth to more environmentally suitable areas and away from some of the state's most ecologically and economically important landscapes. Under this initiative, state agencies limited funding for infrastructure outside of designated growth areas. The Maryland experience, which has since been scaled back under new budgetary pressures, provides one model of growth management for consideration by other state and local governments.

Existing federal, state, and local institutional processes have made substantial progress in managing activities that affect the nation's coastal resources. However, local and state governments continue to face a number of obstacles in planning and managing the cumulative impacts of growth, including: disincentives to long-term planning due to the pressures of short political and business cycles; lack of shared values or political will; inadequate information, including locally relevant socioeconomic indicators; difficulty in addressing problems that cross multiple jurisdictions including upland areas; insufficient resources dedicated to protecting coastal resources; and multiple institutions at different levels of government that address isolated aspects of connected problems. Improved policies for managing growth in coastal areas will be essential in protecting and restoring the natural resources that sustain the character and economies of coastal communities.

Although most coastal management activities take place at state and local levels, coastal decision-making is also influenced by federal actions, including funding decisions and standard setting. Of the many federal programs that provide guidance and support for state and local decision-making, some address the management of activities and resources within designated geographic areas, while others address the management of specific resources, such as fisheries or marine mammals.

Federal Area-based Coastal Programs

The major area-based coastal programs include the Coastal Zone Management Program, National Estuarine Research Reserve System, and National Marine Sanctuaries Program of the National Oceanic and Atmospheric Administration (NOAA); the National Estuary Program of the U.S. Environmental Protection Agency (EPA); and the Coastal Program and Coastal Barrier Resources System of the U.S. Fish and Wildlife Service (USFWS). (These programs and others are also summarized in Appendix D.) In addition to their shared geographic focus, these programs are all implemented at the state and local level and highlight the importance of science, research, education, and outreach in improving the stewardship of ocean and coastal environments.

Coastal Zone Management Program

The Stratton Commission's 1969 report called for a national program to address development and environmental issues in coastal areas and to enhance the capacity of state and local governments to manage activities that affect these areas.¹² Three years after that report's release, Congress enacted the Coastal Zone Management Act (CZMA), the federal government's principal tool for fostering comprehensive coastal management. The CZMA created the Coastal Zone Management Program, a unique partnership between the federal and coastal state governments, whose goal is to balance the conservation of the coastal environment with the responsible development of economic and cultural interests.

Administered by NOAA, the CZMA provides two incentives for coastal states to voluntarily develop and conduct coastal management programs: federal grants and federal consistency authority. Federal consistency

provisions require federal activities affecting land, water, or natural resources of a state's coastal zone to be consistent with the enforceable policies specified in that state's approved coastal management program.

Currently, thirty-four of thirty-five coastal states and territories have coastal programs in place, covering 99 percent of the nation's marine and Great Lakes coastlines. The tools, assistance, and resources provided by the CZMA have enabled states and territories to increase their management capacity and improve decision making to enhance the condition of their coastal areas. These programs facilitate public access to ocean and coastal areas, protect people and property from coastal hazards, conserve critical natural resources and stimulate economic development by revitalizing urban waterfronts and promoting coastal-dependent industries. The CZMA has also enhanced communication and coordination between federal and state governments and between state and local governments.

Under the CZMA, participating states are given the flexibility to design coastal management programs that address their individual priorities and the programs are approved as long as they meet certain minimum national guidelines. This flexibility has been hailed by many as the CZMA's greatest virtue and by others as its most serious shortcoming.

State-by-state implementation has resulted in wide variations in the strength and scope of state coastal management programs. NOAA has few options to ensure that the programs are meeting national guidelines other than withholding funding or withdrawing program approval. No state program has ever been disapproved. The geographic boundaries of state coastal management programs also differ greatly. The CZMA defines the coastal zone—the area subject to the enforceable policies of a state's program—as stretching from the seaward boundary of state ocean waters (generally 3 nautical miles) to the inland extent deemed necessary by each state to manage activities that affect its coastal resources. Individual state discretion regarding the landward reach of its coastal zone has resulted in major variations. For example, Florida, Delaware, Rhode Island, and Hawaii include the entire state in their coastal zones, while the inland boundary of California's coastal management program varies from a few hundred feet in urban areas to several miles in rural locales.

The Coastal Zone Management Program can be strengthened by developing strong, specific, measurable goals and performance standards that reflect a growing understanding of the ocean and coastal environments, the basic tenets of ecosystem-based management, and the need to manage growth in regions under pressure from coastal development. A large portion of federal funding should be linked to program performance with additional incentives offered to states that perform exceptionally well. In addition, a fallback mechanism is needed to ensure that national goals are realized when a state does not adequately participate or perform.

The landside boundaries of state coastal management programs should also be reconsidered. At a minimum, each state should set the inland extent of its coastal zone based on the boundaries of coastal watersheds (discussed in Chapter 1). In creating new management areas, state programs should consider additional factors such as large or growing population centers, areas of considerable land use, and particularly sensitive natural resources, such as wetlands. Social and natural resource assessment and planning at the watershed scale should become a high priority in each state's program.

What Is a Coastal Watershed?

Everyone in the United States lives in a watershed. A watershed is a geographic area in which water flows on its way to a larger water body, such as a stream, river, estuary, lake, or ocean. The nation's coastal and ocean resources are affected not only by activities in coastal areas but also by those in upland watersheds.

A coastal watershed, as defined by the National Oceanic and Atmospheric Administration, is that portion of a watershed that includes the upstream extent of tidal influence. In the Great Lakes region, a coastal watershed includes the entire geographic area that drains into one of the lakes.¹³

Funding for CZMA implementation remains a significant concern, having been capped at \$2 million per coastal state since 1992. This level hampers program implementation and should be considerably increased to enable states to effectively carry out important existing and planned program functions, including the inclusion of coastal watersheds.

Recommendation 9-1. Congress should reauthorize the Coastal Zone Management Act (CZMA) to strengthen the planning and coordination capabilities of coastal states and enable them to incorporate a coastal watershed focus and more effectively manage growth. Amendments should include requirements for resource assessments, the development of measurable goals and performance measures, improved program evaluations, additional funding to adequately achieve the goals of the Act, incentives for good performance and disincentives for inaction, and expanded boundaries that include coastal watersheds.

Specifically, CZMA amendments should address the following issues:

- **resource assessments**—State coastal management programs should provide for comprehensive periodic assessments of the state’s natural, cultural, and economic coastal resources. These assessments will be critical in the development of broader regional ecosystem assessments, as recommended in Chapter 5.
- **goals**—State coastal management programs should develop measurable goals based on coastal resource assessments that are consistent with national and regional goals. State coastal programs should work with local governments, watershed groups, nongovernmental organizations, and other regional entities, including regional ocean councils, to develop these goals.
- **performance measures**—State coastal management programs should develop performance measures to monitor their progress toward achieving national, regional, and state goals.
- **evaluations**—State coastal management programs should continue to undergo periodic performance evaluations by the National Oceanic and Atmospheric Administration. In addition to the existing evaluation criteria, the performance measures developed by state programs should also be reviewed. The public, representatives of watershed groups, and applicable federal program representatives should participate in these program evaluations.
- **incentives**—Existing incentives for state participation—federal funding and federal consistency authority—should remain, but a substantial portion of the federal funding received by each state should be based on performance. Incentives should be offered to reward exceptional accomplishments, and disincentives should be applied to state coastal management programs that are not making satisfactory progress in achieving program goals.
- **boundaries**—Coastal states should extend the landward side of their coastal zone boundaries to encompass coastal watersheds. Mechanisms should also be established for coordinating with watershed management groups outside of a state’s designated coastal zone boundary.

Coastal Barrier Resources System

The Coastal Barrier Resources Act established the Coastal Barrier Resources System in 1982 to promote coastal conservation on barrier islands and minimize the loss of human life and property from coastal hazards. Through this program, which is administered by USFWS, the federal government discourages development on designated barrier islands in the Atlantic and Gulf coasts, Puerto Rico, the U.S. Virgin Islands, and the Great Lakes by restricting certain federal assistance, including flood insurance coverage, loans, funding for U.S. Army Corps of Engineers development projects, and construction of sewer systems, water supply systems, and transportation infrastructure. Nearly 1.3 million acres of land along the East Coast, Great Lakes, and Gulf of Mexico are part of the system. The program does not ban all development in these areas; rather, it creates disincentives by denying federal subsidies and imposing the full costs of development on the developer or property owner.

National Estuarine Research Reserve System

The CZMA established the National Estuarine Sanctuaries Program in 1972 for the purpose of creating “natural field laboratories in which to study and gather data on the natural and human processes occurring within the estuaries of the coastal zone.” That program evolved into NOAA’s National Estuarine Research Reserve System (NERRS), which provides funds to states for acquiring estuarine areas and developing and operating research facilities and educational programs. The NERRS program currently includes twenty-five reserves in twenty-one states.

National Marine Sanctuary Program

In 1972, one hundred years after the first national park was created, a similar commitment was made to preserving marine treasures by establishing the National Marine Sanctuary Program within NOAA. Since then, thirteen national marine sanctuaries have been designated, representing a variety of ocean environments. The mission of the program is to serve as the trustee for these areas and to conserve, protect, and enhance their biodiversity, ecological integrity, and cultural legacy. Sanctuaries are designated for many objectives, ranging from protecting the breeding and calving grounds of humpback whales to preserving the remains of historic shipwrecks.

National Estuary Program

Created by the 1987 amendments to the Clean Water Act, the National Estuary Program (NEP) was established to improve the quality of estuaries of national importance. EPA administers the program, and provides funds and technical assistance to local stakeholders to develop plans for attaining or maintaining water quality in designated estuaries. The program requires stakeholders to develop a comprehensive conservation and management plan that includes measures for protection of public water supplies, protection and propagation of fish, shellfish, and wildlife populations, allowance for recreational activities in and on the water, and control of point and nonpoint sources of pollution that supplements existing pollution control measures. Currently, twenty-eight estuaries are included in the program. In several cases, more than one state participates in a single NEP. In contrast to the CZMA’s broad scope and focus on state and local government decisions throughout the coastal zone, the NEP concentrates on bringing together stakeholders in particular areas that are in or approaching a crisis situation.

The assessment and planning process used by the NEP holds promise for the future of ecosystem-based management. However, the lack of federal funding and assistance for the implementation of NEP plans limits their effectiveness, as do the intergovernmental obstacles that arise when an estuary spans multiple states.

Coastal Program of the U.S. Fish and Wildlife Service

Through its Coastal Program, the USFWS undertakes habitat conservation efforts in bays, estuaries, and watersheds along the U.S. coastline, including the Great Lakes. The program targets funding to sixteen high-priority coastal ecosystems, providing assessment and planning tools to identify priority sites for protection and restoration, conserving pristine coastal habitats through voluntary conservation easements and locally initiated land acquisition, and forming partnerships to restore degraded habitat.

Linking Area-based Programs

The area-based programs described above have made significant progress in managing coastal resources in particular locations, working with communities and decision makers in those areas, and fostering improved coordination between different levels of government. However, because these programs generally operate in

isolation from one another, they cannot ensure effective management of all ocean and coastal resources or achievement of broad national goals. As NOAA is strengthened through the multi-phased approach described in Chapter 7, consolidation of area-based coastal resource management programs will result in more effective, unified strategies for managing these areas, an improved understanding of the ocean and coastal environment, and a basis for moving toward an ecosystem-based management approach.

Recommendation 9-2. Congress should consolidate area-based coastal management programs in a strengthened National Oceanic and Atmospheric Administration (NOAA), capitalizing on the strengths of each program. At a minimum, this consolidation should include the Coastal Zone Management, National Estuarine Research Reserve System, and National Marine Sanctuary programs currently administered by NOAA and additional programs administered by other agencies: the Coastal Barrier Resources System; the National Estuary Program; and the U.S. Fish and Wildlife Service Coastal Program.

Other Relevant Federal Programs

In addition to the area-based programs discussed above, a number of other laws significantly affect coastal resources, including the National Environmental Policy Act, Clean Water Act, and Clean Air Act. Programs related to transportation, flood insurance, disaster relief, wetlands permitting, dredging, beach nourishment, shoreline protection, and taxation also exert a profound influence on the coast. While these laws and policies address specific issues, and have each provided societal benefits, in many cases federal activities under their purview have inadvertently led to degradation of coastal environments. For example, road construction can have negative impacts on coastal areas and resources—including habitat destruction, increased runoff, and encouragement of inappropriate development—that could be mitigated if transportation infrastructure activities were implemented in the context of comprehensive, ecosystem-based goals and plans.

Regional coordination of federal agency activities, as recommended in Chapter 4, along with establishment of regional ocean councils and regional ocean information programs, as recommended in Chapter 5, would greatly improve federal project planning and implementation. Enhancing the relationships between federal agencies, state coastal resource managers, and all decision makers would also help to ensure compatibility among the many activities that affect ocean and coastal environments.

Recommendation 9-3. The National Ocean Council should recommend changes to federal funding and infrastructure programs to discourage inappropriate growth in fragile or hazard-prone coastal areas and ensure consistency with national, regional, and state goals aimed at achieving economically and environmentally sustainable development.

Examples of programs to be reviewed include:

- *Federal Emergency Management Agency hazards-related programs that may encourage development in high-hazard, flood, and erosion areas (see Chapter 10).*
- *U.S. Army Corps of Engineers wetland permitting, dredging, beach nourishment, and shoreline protection programs (see Chapters 11 and 12).*

LINKING COASTAL AND WATERSHED MANAGEMENT

In recent years there has been a growing interest in watershed management. This approach addresses water quality and quantity issues by acknowledging the hydrologic connections between upstream and downstream areas and considering the cumulative impacts of all activities that take place throughout a watershed.

The environmental and political characteristics of the nation’s watersheds vary tremendously. As a result, watershed management initiatives can differ widely in size and scope. Many watershed groups are formed at the local level by community members concerned about water quality or the health of fish and wildlife populations. Often, these groups work to improve watershed health through partnerships among citizens, industry, interest groups, and government.

The value of a watershed approach was articulated by the National Research Council in a 1999 report: “[w]atersheds as geographic areas are optimal organizing units for dealing with the management of water and closely related resources, but the natural boundaries of watersheds rarely coincide with political jurisdictions and thus they are less useful for political, institutional, and funding purposes. Initiatives and organizations directed at watershed management should be flexible to reflect the reality of these situations.”¹⁴

The benefits of a watershed focus have been recognized at state, regional, national, and international levels. For example, Oregon has defined watershed groups in law, and has also created a process for their legal recognition and funding. The New Jersey government includes a Division of Watershed Management that provides coordinated technical, financial, and planning support for twenty watershed management areas within the state. New Jersey also participates, along with Pennsylvania, Delaware, and New York, in the Delaware River Basin Commission—a regional body authorized to manage activities within a river system that transcends political boundaries. The Chesapeake Bay Program, the California Bay-Delta Program (known as CALFED), and the Northwest Power Planning Council are other notable examples of current initiatives that aim to address natural resource issues on a watershed scale. Some existing bi-national watershed initiatives include the Great Lakes Commission, Shared Strategy for Puget Sound, and the Gulf of Maine Council on the Marine Environment. Federal agencies have also begun to adopt a watershed management focus. For example, beginning in the 1990s, EPA launched efforts to address certain problems at the watershed level, rather than on a source-by-source or pollutant-by-pollutant basis.

As interest in watershed management continues to grow, so does the need for a framework to guide such initiatives and evaluate their effectiveness. The federal government can play an important role by helping to develop a framework and by providing technical and financial assistance to states and communities for watershed initiatives.

Recommendation 9–4. Congress should amend the Coastal Zone Management Act, the Clean Water Act, and other federal laws where appropriate, to provide better financial, technical, and institutional support for watershed initiatives. Amendments should include appropriate incentives and flexibility for local variability. The National Ocean Council should develop guidance concerning the purposes, structures, stakeholder composition, and performance of such initiatives.

LINKING COASTAL AND OFFSHORE MANAGEMENT

As discussed in Chapter 6, the growing number of activities that take place in offshore waters calls for a more comprehensive offshore management regime. While the focus of this chapter is on coastal and watershed management, it is important to recognize the strong relationship between the management of onshore and offshore resources. States have long asserted their interests offshore, both by acting as the trustee for public resources in and beneath state waters, and by exerting their responsibilities (principally through the CZMA federal consistency provisions, described on the next page) for activities that take place in federal waters but affect state resources. Several states, including Oregon, California, and Hawaii, have developed comprehensive plans to guide ocean activities, resolve conflicts, and anticipate new uses in their waters. Other states, including Florida, Maine, Mississippi, and North Carolina have conducted extensive studies of ocean issues affecting their states. In 2003, Massachusetts launched a specific ocean planning initiative.

Balancing Federal Ocean Activities with State Coastal Management Programs: The Federal Consistency Tool

In the area of natural resource management, one of the more interesting, innovative, and sometimes contentious features of the nation's system of federalism is the relationship between the federal government and coastal state governments with respect to the control and shaping of ocean activities in federal waters.

Historically, this relationship has taken on many hues and forms, but its policy and legal aspects have been largely structured over the last three decades by the development of one section of a single law, the so-called federal consistency provision (Section 307 of the Coastal Zone Management Act (CZMA)). As noted earlier in this chapter, the promise of federal consistency was one of two incentives (the other being grant money) Congress provided to encourage state participation in this voluntary program.

In very general terms, it is a promise that federal government actions that are reasonably likely to affect the coastal resources of a state with an approved coastal management program will be consistent with the enforceable policies of that program. Essentially, under some circumstances, it is a limited waiver of federal authority in an area—offshore waters seaward of state submerged lands—in which the federal government otherwise exercises full jurisdiction over the management of living and nonliving resources.

The underlying principle of federal consistency represents a key feature of cooperative federalism: the need for federal agencies to adequately consider coastal state coastal management programs by fostering early consultation, cooperation, and coordination before taking an action that is likely to affect the land or water use or natural resources of such state's coastal zone. It facilitates significant input at the state and local level from those who are closest to the issue and in a position to know the most about their coastal resources.

The process, however, is not one-sided. For states to exercise federal consistency authority, they must submit and receive approval of their coastal management programs from NOAA. Congress established the general criteria for approval of the programs, including a review by other federal agencies before the plans are officially authorized. A core criterion for program approval is whether the management program adequately considers the national interest when planning for and managing the coastal zone, including the siting of facilities (such as energy facilities) that are of greater than local significance.

Once a state has received approval, federal consistency procedures are triggered. Under current practice, states only review federal actions that have reasonably foreseeable coastal effects. There is flexibility in the law to allow agreements between states and federal agencies that can streamline many aspects of program implementation. For example, there may be understandings with respect to classes of activities that do not have coastal effects. Otherwise, the decisions about such effects are made on a case-by-case basis.

There have been disagreements between federal agencies and states on some coastal issues, the more high profile ones largely in the area of offshore oil and gas development (Chapter 24). Nevertheless, in general, the federal consistency coordination process has improved federal-state relationships in ocean management. States and local governments have to consider national interests while making their coastal management decisions and federal agencies are directed to adjust their decision-making to address the enforceable policies of a state's coastal management program.

In the event of a disagreement between the state and a federal agency, the agency may proceed with its activity over the state's objection, but it must show that it is meeting a certain level of consistency. In a separate part of the federal consistency section, the coastal activities of third party applicants for federal licenses or permits are required to be consistent with the state's program. If the state does not certify that the activities will be consistent, the federal agency shall not grant the license or permit and the proposed action may not go forward. An applicant can appeal such a decision to the Secretary of Commerce, who has certain specified grounds on which he or she can overturn the state's finding of inconsistency.

Today, after some thirty years of evolution in the practice and implementation of this rather unusual intergovernmental process, federal agencies do not take the consistency standard lightly, as it is a fairly high threshold to meet. The result, according to NOAA, has been an outstanding level of cooperation and negotiation between states and federal agencies¹⁵ such that approximately 93-95 percent of the activities are approved.¹⁶

INCREASING UNDERSTANDING OF COASTAL ECOSYSTEMS

To improve the management of the nation's oceans and coasts, decision makers at all levels will need to gain a better understanding of ecosystems, both how they function and how human activities and natural events affect them. The creation of regional ocean information programs, as recommended in Chapter 5, is one important vehicle for enabling decision makers to better communicate their information needs to the scientific community, and ensuring that new information is converted into useful products. Coastal and watershed management activities, and growing efforts to link these two approaches, should provide the information necessary for the public to be responsible stewards of the nation's oceans, coasts, and watersheds.

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CHAPTER 10:**GUARDING PEOPLE AND PROPERTY AGAINST NATURAL HAZARDS**

Rising populations and poorly planned development in coastal areas are increasing the vulnerability of people and property to storms, hurricanes, flooding, shore erosion, tornadoes, tsunamis, earthquakes, and sea level rise. To lessen the threat from natural hazards, the federal government should coordinate the efforts of all coastal management agencies to reduce inappropriate incentives created by federal infrastructure investments. It should also improve a number of natural hazards-related activities implemented by the Federal Emergency Management Agency, including hazards information collection and dissemination, the National Flood Insurance Program, and hazards mitigation planning.

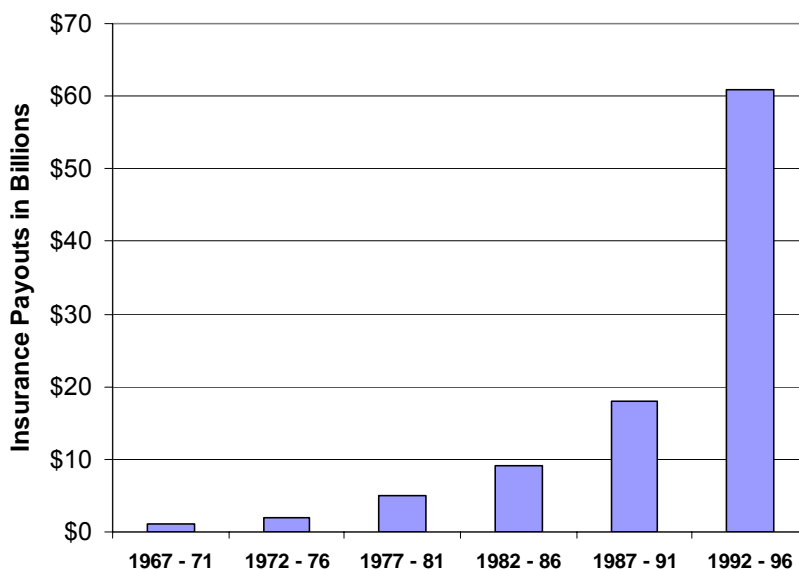
ASSESSING THE GROWING COST OF NATURAL HAZARDS

The nation has experienced enormous and growing losses from natural hazards. Conservative estimates, including only direct costs such as those for structural replacement and repair, put the nationwide losses from all natural hazards at more than \$50 billion a year, though some experts believe this figure represents only half or less of the true costs.¹ More accurate figures for national losses due to natural hazards are unavailable because the United States does not consistently collect and compile such data, let alone focus on specific losses in coastal areas. Additionally, there are no estimates of the costs associated with destruction of natural environments. Between 1967 and 1996, insurance payouts (which cover only a small portion of losses) rose steadily from \$1 billion between 1967 and 1971, to \$61 billion between 1992 and 1996, roughly doubling every five years (Figure 10.1).² While stricter building codes, improved forecasts, and early warning systems have helped save lives, deaths from natural hazards are expected to rise along with development and population along the nation's coasts.³

Hurricanes Wreak Havoc along the Coast

In 1989, Hurricane Hugo hit the U.S. Virgin Islands and Puerto Rico before coming ashore at Charleston, South Carolina, causing twenty-six deaths in the United States and an estimated \$9.7 billion in damages. Just three years later, in 1992, Hurricane Andrew struck southern Florida and Louisiana, causing twenty-three deaths directly and dozens more indirectly. Andrew wrought an estimated \$35 billion in damages, making it the costliest hurricane in U.S. history. And in 1999, Hurricane Floyd, the deadliest of recent hurricanes, made landfall along the Mid-Atlantic and northeastern United States, causing fifty-six deaths and an estimated \$4.6 billion in damage. (All figures adjusted to 2000 dollars.)⁴

Figure 10.1. The Growing Cost of Natural Disasters



In the thirty years between 1967 and 1996, insurance companies have experienced a 6,000 percent increase in payouts to federal and private insurance holders for damages due to natural catastrophes.
Source: Consumer Federation of America. *America's Disastrous Disaster System*. Washington, DC, January, 1998.

IMPROVING FEDERAL MANAGEMENT OF HAZARDS IN COASTAL AREAS

Many federal agencies have explicit operational responsibilities related to hazards management, while numerous others provide technical information or deliver disaster assistance. The nation's lead agencies for disaster response, recovery, mitigation, and planning are the Federal Emergency Management Agency (FEMA) and the U.S. Army Corps of Engineers (USACE). These agencies implement programs that specifically target the reduction of risks from natural hazards. The National Oceanic and Atmospheric Administration (NOAA) and the U.S. Fish and Wildlife Service (USFWS) also have a significant influence on natural hazards management.

NOAA's weather forecasting and ocean observing functions are vital to hazards management. NOAA's National Weather Service plays a key role in collecting atmospheric weather and oceanic real-time data for management, assessments, and predictions. Through its implementation of the Coastal Zone Management Act, the agency also plays a notable role in discouraging coastal development in areas at risk from natural hazards. (Additional discussion of these roles, and recommendations for enhancing NOAA's contributions, are found in Chapters 9 and 26.) The Coastal Barrier Resources Act administered by USFWS (Chapter 9), also has significant implications for natural hazards management.

This chapter focuses on those federal programs that specifically target the reduction of losses of life and property due to natural hazards along the nation's coasts. Among the opportunities for improving federal natural hazards management, four stand out: amending federal infrastructure policies that encourage inappropriate development; augmenting hazards information collection and dissemination; improving the National Flood Insurance Program (NFIP); and undertaking effective and universal hazards mitigation planning.

Changing Inappropriate Federal Incentives

The federal government has made substantial investments in infrastructure designed to reduce human exposure to hazards, including flood control and coastal erosion projects. These efforts often eliminate or conflict with the natural buffers that would otherwise help shield communities. Furthermore, because such projects are not accompanied by strict restrictions on subsequent construction, they may actually encourage further commercial and residential development in hazard-prone areas. In some cases, a federal infrastructure project intended to reduce a hazard merely drives the problem to a nearby location, such as when erosion control efforts lead to further coastal armoring up or down the coast. The cumulative impact of such projects may be weakening the ecosystem's natural resilience to hazards and creating the potential for even greater losses to property, health, and natural resources.

Of course, the federal government is not the sole driver of infrastructure development in coastal areas. State and local governments also build roads and bridges along and over the water, underwrite wastewater treatment, and support water supply projects, all of which have impacts on coastal development and vulnerability.

The great majority of federal infrastructure programs are implemented by USACE, whose hazards-related activities include flood control efforts such as dams, dikes, and levees, and coastal erosion projects such as groins, sea walls, revetments, and beach nourishment. USACE also has responsibilities for dealing with disaster response efforts such as construction of emergency infrastructure.

New Orleans at Risk

Prior to 1965, New Orleans—a community that sits as much as 10 feet below sea level—had suffered substantial losses of protective barrier islands and wetlands and developed an elaborate system of flood control measures. After Hurricane Betsy struck in 1965, causing \$1 billion in damages,⁵ hundreds of millions of dollars were spent to upgrade the flood control system that now includes more than 520 miles of levees, 270 floodgates, 92 pumping stations, and thousands of miles of drainage canals.

While the new protections did reduce risks to people and property in developed areas, they also encouraged additional development in flood-prone regions.⁶ New Orleans Parish and the adjoining suburban Jefferson Parish ranked first and second among communities receiving repeat payments for damage claims under the National Flood Insurance Program between 1978 and 1995. These two communities alone accounted for 20 percent of the properties with repeat losses, at an average of nearly three claims per property, for a total of \$308 million in claims.⁷

New Orleans' protective levees are designed to withstand only a moderate (category three) hurricane storm surge. Were they to fail, the city and surrounding areas could suffer upward of \$25 billion in property losses and 25,000–100,000 deaths by drowning.^{8, 9}

Evolving public values that favor environmental protection, as well as a growing understanding of the complex workings of natural systems, have propelled USACE to adopt more environmentally conscious initiatives, including the pursuit of nonstructural approaches to some flood control projects. However, such initiatives are not universally embraced within the agency, by all stakeholders, or in Congress, and remain greatly outnumbered by traditional, engineering-oriented USACE projects that may disrupt natural hydrological and geomorphological processes, harm ecosystems, and create incentives for additional human development in high-risk regions.

USACE has also been the focus of debates about the cost-benefit analyses used to review proposed projects. Some experts have suggested that these analyses are often flawed by a reliance on incorrect assumptions and

faulty methodologies. In 2001, the National Research Council (NRC) began a comprehensive review of USACE programs and procedures. A 2002 NRC report recommended external review of all controversial or complex USACE civil works projects.¹⁰

Recommendation 10–1. The National Ocean Council should review and recommend changes to the U.S. Army Corps of Engineers’ Civil Works Program to ensure valid, peer-reviewed cost-benefit analyses of coastal projects, provide greater transparency to the public, enforce requirements for mitigating the impacts of coastal projects, and coordinate such projects with broader coastal planning efforts.

Improving Understanding

The federal government plays an important role in acquiring complex hazards-related data and translating them into information that states and communities can use to reduce their vulnerability to natural disasters. A number of federal agencies and departments, including NOAA, the U.S. Geological Survey, the National Aeronautics and Space Administration, and the U.S. Department of Defense, are charged with increasing both basic understanding and site-specific knowledge about natural hazards. These agencies’ principal contributions include: developing and deploying new technologies for understanding land, ocean, and atmospheric processes and their interactions; tracking and predicting hazards, especially meteorological hazards; assessing hazards risks; conducting post-disaster research; and communicating this information to end users. These contributions have significantly improved the quality and timeliness of weather-related warnings, increasing the lead time for protective measures and evacuations. Implementation of the Integrated Ocean Observing System (discussed in Chapter 26) would improve weather-related warnings and provide additional predictive capabilities for tsunamis and for chemical and biological hazards, such as sudden pollutant loadings, harmful algal blooms, and pathogens.

FEMA, as the lead disaster management agency, collects, analyzes, and disseminates hazards-related data as well as assesses the effectiveness of its programs. However, these efforts fall short of shaping an effective overall national policy and providing the information state and local decision makers and individuals need to fully understand their risks from coastal hazards. The absence of a standard, centralized data collection system that could produce accurate accounting for losses from natural hazards is only one example. An inability to provide adequate, useful information at the local, state, and regional levels can lead to incorrect estimates of risk, which then affect cost-benefit analyses of proposed development and mitigation projects. Local land use decisions are frequently made without information about cumulative impacts or the vulnerability of individuals and groups in the community, and without an ability to judge the full impact of disasters on humans, institutions, the economy, natural resources, and ecosystem services. This lack of accurate information is likely to reinforce the tendency to underestimate risks from natural hazards and delay taking action to prevent future problems. These concerns are documented in a 2000 report issued by the H. John Heinz III Center for Science, Economics and the Environment, *The Hidden Costs of Coastal Hazards*.

Flooding is the most costly of natural hazards, and maps produced by the National Flood Insurance Program are the federal government’s primary tool for communicating flood risks to communities and individuals.¹¹ Most existing flood hazard maps are not georeferenced, limiting their usefulness for hazards planning. (Chapter 25 includes a broader discussion of coastal mapping needs.)

The combination of mounting federal and nonfederal disaster expenses, vigorous advocacy by the insurance community, state and local governments, and others who rely on flood maps, and the incorporation of FEMA into the U.S. Department of Homeland Security spurred Congress to provide substantial financial support to an ambitious FEMA map modernization program beginning in fiscal year 2002. This effort will create a digital base map, update and digitize flood hazards information, and provide standard protocols that state and local governments and others can use to incorporate and relate information about other natural and

manmade hazards. Though FEMA's map modernization effort is intended to target the highest-risk communities first, the initial selection made in 2003 did not include any coastal communities—despite their status as high-population, high-risk regions—because of technical difficulties in mapping coastal flood hazards. FEMA's plans call for updating priority coastal community maps starting in fiscal year 2004 when these obstacles are resolved.¹²

Although many communities are in a position to benefit from this opportunity, others may be constrained by a lack of technical and financial resources and expertise. National maps that reflect all hazards (for example, coastal erosion, localized stormwater drainage flooding, potential flood control structure failures, and increased risk from development, land subsidence, and sea level rise) are needed to communicate the true vulnerability of a community, its social and physical infrastructure, and the surrounding ecosystem. Such maps will also be essential in informing prospective purchasers of coastal property about potential hazards. FEMA and other relevant agencies will need to work together to make such comprehensive mapping a reality.

Recommendation 10–2. The National Ocean Council should establish a task force of appropriate federal agencies and representatives from state and local governments, with the Federal Emergency Management Agency in the lead, to improve the collection and usability of hazards-related data.

The hazards-related data task force should develop a coordinated effort that includes the following functions:

- *systematic collection, storage, analysis, and dissemination of data on post-disaster losses and the cost of mitigation efforts.*
- *development and transmittal to communities of the information and tools they need to understand the risks of hazards to their residents and their social, physical, economic, and environmental infrastructures.*
- *expansion of the federal government's mapping mandate beyond flood hazards to achieve—in partnership with state and local governments—comprehensive, digitized, georeferenced mapping and identification of all natural hazards.*
- *development of adequate funding proposals for the National Flood Insurance Program map modernization initiative, including a high-priority effort to update maps for high-risk coastal communities.*

The National Flood Insurance Program

Enacted in 1968, the National Flood Insurance Program (NFIP) is the federal government's primary tool for managing flood hazards through a combination of incentives and regulation. In addition to the development of maps identifying flood-prone areas, the NFIP provides (or helps private companies provide) flood insurance to owners of commercial and residential structures in communities that adopt appropriate construction standards. Premiums and fees from property owners cover most program costs. Other NFIP responsibilities include identifying flood hazards, assessing risks, and implementing measures for reducing losses. While the NFIP is a national program, the majority of its policies, total coverage, and premium revenues are associated with coastal communities.

Without the NFIP, many of the more than 19,000 participating communities most likely would not have had the incentive to develop active programs to manage flood risks. Unlike private-sector insurers, the federal government can carry debt over the long term and replenish funds depleted by catastrophic disasters over time. For this reason, the federal government is able to undertake the expense of mapping flood hazards nationally and subsidize coverage for older buildings. FEMA estimates that NFIP building standards and other floodplain management measures reduce flood losses by \$1 billion per year.¹³

As impressive as these accomplishments are, concerns have been raised that the NFIP may inadvertently be facilitating inappropriate coastal development and redevelopment. While many factors weigh heavily in such decisions, including the market forces that make real estate in coastal floodplains and estuarine areas so valuable, the availability of flood insurance also plays a role. Determining the extent of this role is difficult because the impacts of the NFIP have never been comprehensively evaluated. FEMA recently commissioned

such an evaluation, with several reports expected to be issued, including a final comprehensive report scheduled for September 2005. This study will help inform the National Ocean Council and determine any further action. Nonetheless, three aspects of the program—treatment of erosion hazards, coverage of repetitive losses, and availability of insurance in undeveloped floodplain and erosion zones—are issues that merit immediate attention.

Informing the Public about Erosion Risks

Property owners within 500 feet of the shoreline face as large a risk from erosion as from flooding. Under current conditions, approximately one-quarter of all homes within 500 feet of the coast will be lost to erosion in the next sixty years. Insurance rates in areas designated as coastal high-hazard zones would need to double over the next thirty to sixty years to keep pace with increasing erosion risks.¹⁴ Although FEMA has developed a plan for undertaking erosion mapping and reflecting actual risks in future NFIP insurance rates, the agency is awaiting congressional authorization to implement the plan. If erosion mapping and rating are not carried out, higher rates will have to be spread across all policyholders, losing an important opportunity to discourage building in the riskiest areas.

Repetitive-loss Properties

The NFIP requires that substantially damaged properties be removed or elevated. However, local governments are responsible for determining whether a property is substantially damaged and they are often reluctant to do so when a property owner does not have the financial resources to move or elevate the home.¹⁵ Absent this designation, many of these properties have been rebuilt in place, leading to repeated claims. Although only 2 percent of NFIP covered properties have received repetitive-loss payments, they account for 40 percent of overall NFIP payments, many at cumulative totals exceeding the property's value. Although repetitive losses occur around the country, between 1978 and 1995, Louisiana and Texas accounted for \$1.1 billion, or 40 percent of the \$2.75 billion in total repetitive-loss claims paid by the NFIP.¹⁶

Approximately 90 percent of repetitive-loss payments are for buildings that predate NFIP maps.¹⁷ This demonstrates the effectiveness and success of NFIP building standards for new construction in flood-prone areas, but also underscores the program's lack of authority for reducing the vulnerability of older buildings. Many property owners underestimate their risk, resist investments in structural improvements that do not directly translate into higher home prices, and then rely on federal disaster assistance as a fallback when floods occur. For some properties, the most acceptable and economical solution for all concerned will be voluntary buyouts at prices that allow property owners to relocate out of harm's way.

Eliminating Incentives for Development in Floodplains and Eroding Areas

The NFIP was created both as a more desirable alternative to federal disaster relief in the wake of flooding and as a tool to guide development away from flood prone areas through state and local floodplain management. However, of the 6.6 million buildings located in the 100-year floodplains of participating communities, more than a third were built after the NFIP maps were created and floodplain management requirements imposed.¹⁸ As one of the federal government's principal tools for influencing development in high-hazard areas, the NFIP's risk assessment, mitigation, and insurance components should be revamped to better achieve the original goal of discouraging communities from building in harm's way.

Recommendation 10–3. The National Ocean Council should recommend changes in the National Flood Insurance Program (NFIP) to reduce incentives for development in high-hazard areas.

Specifically, NFIP changes should:

- *establish clear disincentives to building or rebuilding in coastal high-hazard zones by requiring property owners at risk of erosion to pay actuarially sound rates for insurance.*
- *enforce measures that reduce vulnerability to natural hazards, including assistance in retrofitting older structures and buyout programs for susceptible structures with repetitive-loss histories.*
- *create enforceable mechanisms to direct development away from undeveloped floodplains and erosion zones.*

Hazards Mitigation Planning

Hazards mitigation planning—the process of assessing potential hazards and evaluating and identifying actions to reduce or eliminate vulnerabilities—has been required of states for nearly two decades as a condition of receiving disaster relief and other FEMA funding. However, the quality of those plans, and the degree to which they are based on a sound process with adequate stakeholder involvement, vary widely. Major disaster losses in the 1990s led FEMA to increase its attention to hazards mitigation planning, establishing a unit dedicated to that purpose in 1998.

Congress also recognized that deficiencies in mitigation planning prevented the most effective use of disaster assistance funds. Communities recovering from disasters receive little guidance during the rebuilding process to improve their resilience to future disasters. In the Disaster Mitigation Act, passed in 2000, Congress directed FEMA to impose more stringent mitigation planning requirements on states. States that fail to meet FEMA's new criteria can be denied disaster assistance and some other types of funding, while states that develop excellent mitigation plans are eligible to use a greater proportion of their disaster funding to implement further hazards mitigation projects.

Effective hazards mitigation planning is fully consistent with watershed and ecosystem-based management approaches because they all attempt to consider communities and the effects of human activities within the broader environmental context. Effective watershed management plans that include a hazards component can be used to satisfy FEMA's mitigation planning requirements. The agency has also expressed a goal of integrating sustainable redevelopment into its program, recognizing the interdependence among economic opportunity, community well-being, and protection of the natural environment.

In 2002, FEMA issued regulations implementing enhanced mitigation planning standards, with compliance required for most state and local governments by October 2004. However, many state and local governments are struggling to comply with the new criteria because of severe fiscal constraints, technical difficulties, and relatively low levels of federal support. In addition to providing greater technical and financial assistance, it may be appropriate to withhold other forms of hazards-related federal financial assistance until mitigation plans are in place. For example, the U.S. Small Business Administration has limited eligibility for its low-interest Pre-Disaster Mitigation Loan Program to communities with approved plans.

Recommendation 10–4. The National Ocean Council (NOC) should encourage Congress to increase financial and technical assistance to state and local entities for developing hazards mitigation plans consistent with requirements of the Federal Emergency Management Agency (FEMA). The NOC should also identify opportunities for conditioning federal hazards-related financial and infrastructure support on completion of FEMA-approved state and local hazards mitigation plans.

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- ² Consumer Federation of America. "America's Disastrous Disaster System." <<http://www.consumerfed.org/backpage/releases.html>> Posted January 30, 1998; Accessed October 22, 2003.
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- ⁶ Pielke, Jr., R.A., and C. H. Landsea. "Normalized Hurricane Damages in the United States: 1925–1995." Presented at the 22nd Conference on Hurricanes and Tropical Meteorology, May 19–23. Fort Collins, CO: American Meteorological Society, 1997.
- ⁷ National Wildlife Federation. *Higher Ground: A Report on Voluntary Property Buyouts in the Nation's Floodplains*. Washington, DC, 1998.
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- ¹³ Federal Emergency Management Agency, Federal Insurance and Mitigation Administration. *National Flood Insurance Program: Program Description*. Washington, DC, August 1, 2002.
- ¹⁴ H. John Heinz III Center for Science, Economics, and the Environment. *Evaluation of Erosion Hazards*. Washington, DC, April 2000.
- ¹⁵ Federal Insurance and Mitigation Administration. *National Flood Insurance Program: Program Description*. Washington, DC: Federal Emergency Management Agency, August 1, 2002.
- ¹⁶ National Wildlife Federation. *Higher Ground: A Report on Voluntary Property Buyouts in the Nation's Floodplains*. Washington, DC, 1998.
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- ¹⁸ Ibid.

CHAPTER 11: CONSERVING AND RESTORING COASTAL HABITAT

Wetlands, estuaries, seagrass beds, mudflats, sand beaches, mangrove forests, coral reefs... these are just some of the diverse habitats that make up the ocean and coastal environment and provide invaluable benefits to humans and marine life. Marine habitats face increasing pressures as activities within ocean and coastal areas intensify. Coastal habitat conservation and restoration should be integral to ocean and coastal management, as well as to the management of activities within watersheds, and should be strengthened through the development of national, regional, and local goals, the institution of a dedicated program for coastal and estuarine conservation, better coordination of federal habitat-related activities, and improved research, monitoring, and assessment.

ASSESSING THE THREATS TO COASTAL HABITAT

The diverse habitats that comprise the ocean and coastal environment provide tangible benefits such as buffering coastal communities against the effects of storms, filtering pollutants from runoff, and providing a basis for booming recreation and tourism industries. These habitats also provide spawning grounds, nurseries, shelter, and food for marine life, including a disproportionate number of rare and endangered species.¹

As more people come to the coast to live, work, and visit, coastal habitats face increasing pressures. Most human activities in coastal areas provide distinct societal benefits, such as dredging rivers and harbors to facilitate navigation, converting forests and wetlands for agriculture and development, and building dams for flood control and hydropower. But these activities can also degrade coastal habitats and compromise their ability to adapt to environmental changes.

Serious habitat degradation is evident in every region, state, territory, and community along the nation's coastline. Since the early settlers arrived in the United States, the nation has lost more than half of its wetlands—over 110 million acres.² California has lost 91 percent of its wetlands since the 1780s.³

Many mangrove forests, seagrass beds, and coral reefs have also fared poorly. Shallow-water reefs near urbanized coasts in the United States have been degraded by environmental and human disturbances such as hurricanes, fishing activities, coastal development, runoff, and sedimentation.⁴ More than 50 percent of the historical seagrass cover has been lost in Tampa Bay, 76 percent in the Mississippi Sound, and 90 percent in Galveston Bay. Extensive seagrass losses have also occurred in the Chesapeake Bay, Puget Sound, San Francisco Bay, and Florida's coastal waters.⁵ Climate change, rising global temperatures, and sea level rise will place additional stresses on coastal habitats.

CONSERVING COASTAL HABITAT

Conserving valuable ocean and coastal areas not only protects significant habitat and other natural resources, it also precludes the need to undertake costly restoration efforts after an area has been degraded or lost. Current conservation needs, however, are not being met—a situation that will continue to worsen with increasing pressures on ocean and coastal environments and rising demands for coastal land.

Habitat Conservation Programs

Millions of coastal acres have been designated for conservation by various levels of government, and the tools for implementing conservation programs are found in a multitude of statutes. A number of federal programs aim to preserve the natural attributes of specific areas while providing varying levels of access to the public for educational, recreational, and commercial purposes. These include the U.S. Department of the Interior's (DOI's) National Parks and Seashores, National Wildlife Refuges, National Monuments, and National Wilderness Areas; the National Oceanic and Atmospheric Administration's (NOAA's) National Marine Sanctuaries and National Estuarine Research Reserves; and the U.S. Environmental Protection Agency's (EPA's) National Estuary Program.

DOI's U.S. Fish and Wildlife Service (USFWS) administers several programs that provide grants for the acquisition, restoration, and enhancement of coastal lands, including the National Coastal Wetlands Conservation Grants Program and a number of regional programs, such as the Pacific Islands Coastal Program. NOAA administers several programs that aim to conserve valuable coastal lands, restore degraded habitat, and advance the science of restoration technology. The U.S. Department of Agriculture's (USDA's) Wetlands Reserve Program facilitates the purchase of conservation easements from landowners to restore, enhance, or create wetlands, including coastal wetlands. The U.S. Army Corps of Engineers (USACE) conducts a variety of environmental stewardship and restoration programs. And both USACE and EPA are involved in conserving wetland habitats through the wetland permitting program under the Clean Water Act. (All of these programs and authorities are summarized in Appendix D.)

Coastal habitat conservation programs also exist at the state, territorial, tribal, and local levels. For example, marine protected areas (discussed in greater detail in Chapter 6) can be designated by different levels of government for a variety of reasons, including habitat conservation.

Nonregulatory conservation techniques—including fee simple land acquisition, the purchase or donation of easements, tax incentives and disincentives, and tradable development rights—play a special role in enabling willing landowners to limit future development on their land for conservation purposes. Land acquisition and easements are often implemented through partnerships among governments, nongovernmental organizations such as land trusts, and the private sector. These groups work together to leverage limited resources from project partners to fund projects and ensure that areas acquired for conservation purposes are properly managed. As coastal populations grow and demands on coastal lands intensify, the resources needed to make such conservation partnerships work will continue to increase.

Funding for Habitat Conservation

The Land and Water Conservation Fund is a major source of federal funding for conservation projects, authorized to provide up to \$900 million a year in support of these projects. However, since the fund's inception in 1965, Congress has appropriated less than half of the amount authorized.⁶ An even larger source of federal funding is administered by USDA's Natural Resources Conservation Service, whose conservation programs will handle a projected total of \$38.6 billion over the next ten years.⁷ Though neither of these funding sources is specifically targeted for the conservation of coastal and ocean resources, the funds can be

used in those areas. Moreover, conservation of habitat in upland watersheds that enhances water quality indirectly benefits coastal areas.

Nevertheless, support for the direct conservation of coastal habitats represents a small fraction of federal spending. In 2002, Congress appropriated money for the Coastal and Estuarine Land Conservation Program to provide a dedicated funding source to support coastal conservation partnerships at state and local levels, but this program has not been made permanent.

Conservation is important to maintain critical habitats and the benefits they provide. It is also cost-effective, avoiding the much larger expense and scientific uncertainties associated with attempting to restore habitats that have been degraded or lost.

Recommendation 11–1. Congress should amend the Coastal Zone Management Act to authorize and provide sufficient funding for a dedicated coastal and estuarine land conservation program.

In order to achieve this:

- *each state coastal management program should identify priority coastal habitats and develop a plan for establishing partnerships among willing landowners for conservation purposes, with participation from local government, nongovernmental, and private-sector partners.*

RESTORING COASTAL HABITAT

Once critical habitat has been lost, or the functioning of those areas diminished, restoration is often needed. Habitat restoration efforts are proliferating in response to heightened public awareness of and concern for the health of the nation's oceans and coasts. Several large-scale efforts are underway to restore the nation's unique ecological treasures, including coastal Louisiana, the Florida Everglades, the Chesapeake Bay, the San Francisco Bay-Delta, and the Great Lakes. The goals of these initiatives are extremely ambitious—reestablishing thousands of square miles of water flow and habitat to sustain healthy levels of fish and wildlife populations while maintaining water supply for human uses and allowing future development.

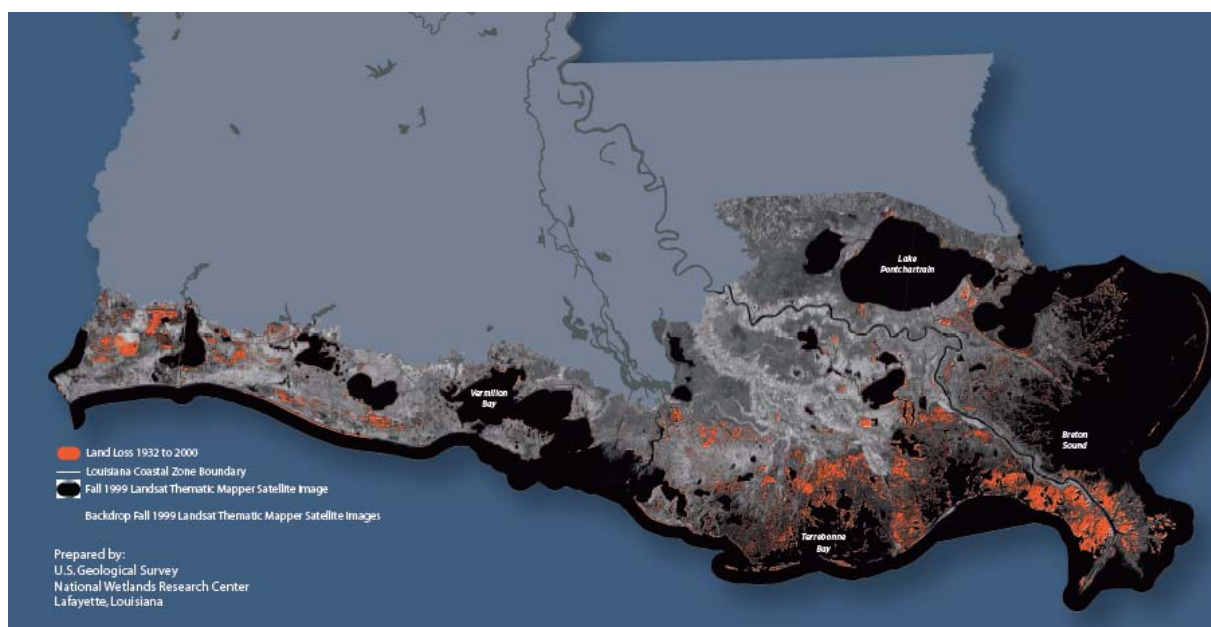
Large-scale restoration efforts are challenging in a number of ways. First, the success of these efforts requires an understanding about how to recreate natural systems and restore historical ecosystem functions, a field still in its infancy. Second, these efforts cross political boundaries and affect a broad range of human activities, requiring support and intense coordination among a wide range of governmental and nongovernmental stakeholders. While some restoration projects have been successful, continued progress will depend on sustained funding, government leadership and coordination, scientific research, and stakeholder support.

Improved regional coordination and the creation of regional ocean councils, as discussed in Chapters 5 and 6, would enhance the success of regional restoration initiatives. These mechanisms, in concert with the new regional ocean information programs, will place restoration initiatives in a necessary regional context and will meet the information needs so vital to the progress of these initiatives. Restoring historical ecosystem functions is one step—albeit a significant one—in sustaining the health of the nation's ocean and coastal resources. Over time, the regional ocean councils will also improve the management of all activities that affect coastal habitats and the well-being of coastal communities.

Examples of Coastal Habitat Loss and Restoration Efforts

Coastal Louisiana

Figure 11.1. Dramatic Coastal Land Loss in Louisiana



From 1932 to 2000, coastal Louisiana lost 1,900 square miles of land—an area roughly equivalent to the size of Delaware. An additional 700 square miles is expected to be lost over the next fifty years if no new restoration takes place, putting more than 2 million coastal residents at risk from floods and storms.

Source: U.S. Geological Survey. "Without Restoration, Coastal Land Loss to Continue." News release.

<http://www.nwrc.usgs.gov/releases/pr03_004.htm> (Accessed January, 2004). Map courtesy of U.S. Geological Survey, Lafayette, LA.

Nowhere is the problem of habitat loss more compelling than in coastal Louisiana, which experiences about 80 percent of the total annual coastal land loss in the continental United States.⁸ From 1956 to 2000, an average of 34 square miles of Louisiana's wetlands disappeared into the sea every year (Figure 11.1). If this rate of loss continues, an estimated 700 additional square miles of coastal wetlands will be lost over the next fifty years, threatening billions of dollars worth of resources vital to the state's—and the nation's—economic well-being.⁹

The devastating losses are the result of a number of converging factors, including both human activities and natural processes. Chief among them are the dams, levees, and channels developed along the Mississippi River and its tributaries, as well as a network of canals that provide access to oil and gas well sites. These projects, which have supported nationally important infrastructure, navigation routes, and energy supplies, have also resulted in a 67 percent decrease in the supply of sediments to the coastal area and have disrupted the natural flow of water that kept the wetlands healthy.¹⁰ Sea level rise, coastal storms, destruction of marsh plants by muskrat and nutria, and the subsidence of the region over geologic time intensify the problem and put the state's more than two million coastal residents at increasing risk.

Restoration efforts have intensified since the passage of the Coastal Wetlands Planning, Protection, and

Restoration Act in 1990 (also known as the Breaux Act), which focused national attention and significant federal funding on hundreds of conservation and restoration projects. In 1998, a more comprehensive ecosystem-based plan to restore the natural processes of the region's coastal wetlands was jointly developed by the state of Louisiana and the federal government.¹¹ Strategies being developed in the Louisiana Comprehensive Coastwide Ecosystem Restoration Study, currently under review by the National Research Council, will determine the feasibility of sustaining Louisiana's coastal ecosystem.

The Florida Everglades

Another extensive effort to restore a regional ecosystem dramatically altered by human activities is taking place in the Florida Everglades, an unparalleled network of mangroves, coastal marshes, seagrass beds, lakes, rivers, estuaries, and bays that once stretched from Orlando to Florida Bay. A long history of water diversions, flood control projects and agricultural and urban development in South Florida has reduced the size of the Everglades by half, threatening or endangering numerous plant and animal species in the process.¹² As a result of altered water flows and development, the region has experienced numerous environmental problems such as nutrient enrichment, pesticide contamination, mercury buildup in plants and animals, widespread invasion by exotic species, increased algal blooms, seagrass die off, and declines in fishing resources.¹³

In 1992, Congress authorized a comprehensive review of the potential to restore the Everglades ecosystem. This review resulted in the development of the Comprehensive Everglades Restoration Plan, the largest restoration effort ever pursued based on the size of the ecosystem and the nearly 200 individual projects being developed to implement the plan.¹⁴ Many of these projects involve massive and expensive engineering and construction feats designed to restore natural hydrological functions and water quality throughout the entire region. For example, the plan calls for the removal of 240 miles of levees and canals and the construction of a network of reservoirs, underground storage wells, and pumping stations to recreate historic water flow quantities, quality, timing, and distribution, while meeting the freshwater and flood protection needs of Florida's growing population. The National Research Council, which is performing an independent scientific peer review of the restoration effort, referred to it as demanding "the most advanced, interdisciplinary, and scientifically sound capabilities that the nation has to offer."¹⁵

Despite its immense size and scope, the Comprehensive Everglades Restoration Plan is only one component of an initiative to restore the southern half of the state and the nearshore waters of Florida. The larger effort is being headed by the South Florida Ecosystem Task Force, which is charged with developing a strategy for coordinating hundreds of projects carried out by several different federal, state, tribal and local entities, universities, and other stakeholder groups. The Task Force is made up of senior level officials from seven federal agencies, the Florida Department of Environmental Protection, the Miccosukee and Seminole tribes, the South Florida Water Management District, the Florida Governor's Office, and two local governments.

In addition to the large-scale, regional restoration efforts described above, there are numerous small-scale efforts that collectively make significant contributions—such as the restoration of particular wetlands, bays, riverbanks, and streams. These activities often demonstrate the power of public-private partnerships, bringing together community members, government agencies, and businesses to solve common problems. However, as long as each project continues to be planned and implemented in isolation, its overall impact will be constrained.

A Small-scale Habitat Restoration Effort: Friends of Heeiea State Park

There are thousands of examples of local efforts in which concerned citizens, government entities, business, and other stakeholders have helped restore coastal habitats valuable to both native plant and animal species and to the culture of the local community. Friends of Heeiea State Park, a nonprofit educational institution located on the Hawaiian Island of Oahu, coordinates several community restoration activities each year during which local volunteers help clean up beaches and streams, monitor water quality, and remove invasive species. Recently, the group received a grant from the Environmental Protection Agency to conduct a project replacing non-native coastal plants, which were preventing adequate filtering of waters from the watershed to the Heeiea Bay, with native species. The project was part of a larger effort to restore portions of the entire Heeiea watershed that had become degraded by nonpoint source pollution originating from various human activities. Thousands of volunteers participated in the project.¹⁶

These and other local restoration efforts are vital components of the overall goal of improving the health of coastal habitats nationwide. They also serve a valuable role in promoting coastal stewardship by instilling a sense of ownership and responsibility throughout the community. Improving communication and coordination among these efforts, and enhancing the research efforts needed to determine the most effective restoration strategies, will strengthen the ability of individual restoration projects to contribute to the overall improvement of ocean and coastal health.

Because coastal habitat restoration efforts are costly and complicated, they require the participation of a wide range of stakeholders to accomplish goals not achievable by any one party. Over the past ten years, the Coastal America partnership has proven to be a useful mechanism for bringing together disparate groups to improve the health of the coastal environment, one project at a time. Coastal America was officially formed in 1991 through a Memorandum of Understanding signed by several federal departments and agencies. A major impetus for the program was the need to overcome institutional barriers and inconsistent federal agency jurisdictions and authorities to develop and implement mutual restoration goals. Since its inception, Coastal America has facilitated over 600 collaborative projects enlisting the help of 12 federal departments, 250 state and local governments, and over 300 private businesses and organizations.¹⁷ Project activities have included wetlands restoration, dam removal, species protection, and pollution mitigation.

The success of individual coastal habitat restoration efforts—whether large- or small-scale—can be enhanced through the development of comprehensive regional restoration strategies which will vary according to the unique circumstances in each region. An overarching national strategy that sets goals and priorities can also enhance the effectiveness of regional efforts and provide a basis for evaluating progress.

In 2000, the Estuary Restoration Act called for a national strategy to include the goal of restoring one million acres of estuarine habitat by 2010. The Act established an interagency council to develop the strategy, create a comprehensive approach to estuarine habitat restoration efforts, foster coordination of federal and nonfederal activities, and administer a program for setting priorities and providing appropriate technical and financial assistance. In 2002, the Estuary Habitat Restoration Council—chaired by USACE and made up of designees from NOAA, EPA, USFWS, and USDA—published its final strategy, which encourages an ecosystem-based approach, including strengthening public-private partnerships and applying innovative restoration technologies, monitoring capabilities, and performance measurement tools.¹⁸

It is too soon to speculate on the success of the Estuary Habitat Restoration Council or its strategy, although the establishment of a forum for federal agency coordination and communication at the national level is a significant and positive step. There remains, however, a need for a federal coordinating forum with responsibilities and membership that is broader than the Estuary Habitat Restoration Council—one that can

coordinate the development and implementation not only of estuarine habitat restoration efforts, but activities that affect all types of coastal habitat and include conservation as well as restoration measures.

IMPROVING HABITAT CONSERVATION AND RESTORATION

Currently the many entities that administer conservation and restoration activities operate largely independently of one another, with no framework for assessing overall benefits in an ecosystem-based context. The multitude of disjointed programs prohibits a comprehensive assessment of the progress of conservation and restoration efforts and makes it difficult to ensure the most effective use of limited resources.

Recommendation 11–2. The National Ocean Council should develop national goals for ocean and coastal habitat conservation and restoration efforts and should ensure coordination among all related federal activities. The regional ocean councils and regional ocean information programs should determine habitat conservation and restoration needs and set regional goals and priorities that are consistent with the national goals.

ENHANCING INFORMATION AND UNDERSTANDING

One of the most significant obstacles to conservation efforts is the lack of adequate knowledge about the structure and functioning of coastal habitats and the relative effectiveness of restoration techniques. Furthermore, many individual efforts do not benefit from the knowledge and positive experiences that do exist. Enhanced support for ecosystem restoration science and applied research on effective restoration techniques is needed, as is support for programs that educate practitioners on how to implement these techniques. A better understanding of the connections between human activities and their impacts on coastal habitats will lead to better management of coastal resources and a strengthened stewardship ethic among all stakeholders and citizens.

Coordinated and comprehensive inventories and assessments are essential for identifying critical habitats, evaluating the causes of habitat loss and degradation, and setting priorities for conservation and restoration efforts, thus enabling decision makers to focus limited resources on the most pressing needs. The regional ecosystem assessments to be developed through the regional ocean information programs (Chapter 5) will provide timely and comprehensive information on the status of coastal habitats.

In addition to improved understanding and broad national assessments and inventories, the nation needs better ongoing monitoring. Currently, most federal funding available for conservation and restoration efforts can only be used for direct implementation, not for the equally important tasks of monitoring the success of these efforts and further advancing restoration science.

Finally, conservation and restoration efforts must build on past successes to achieve progress. Currently, there is no accessible nationwide system for sharing information, including research results, planning processes, conservation and restoration techniques, and funding opportunities. A broadened and redefined Estuary Habitat Restoration Council could serve as a mechanism for this type of information sharing. Information pertinent to coastal habitat conservation and restoration efforts can also be shared through the regional ocean councils and regional information collection programs.

Recommendation 11–3. Congress should amend relevant legislation to allow federal agencies greater discretion in using a portion of habitat conservation and restoration funds for related assessments, monitoring, research, and education.

PROTECTING THE NATION’S WETLANDS: A SPECIAL CASE

Coastal wetlands, including marshes, swamps, and bogs, are an important and integral component of coastal habitats. USACE regulations define wetlands as those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support vegetation that typically lives in saturated soils. Coastal watersheds currently include about 30 percent of all wetlands in the lower forty-eight states, or approximately 27 million acres.¹⁹ Like other coastal habitats, wetlands provide a variety of valuable ecosystem services, such as improving water quality, providing natural flood control, recharging groundwater, stabilizing shorelines, contributing to recreational value, and serving as nursery areas for thousands of species of plants, fish and other animals.

The functions and values wetlands provide have not always been recognized. Prior to the 1970s, federal policies for agriculture, development, and insect control encouraged the draining and filling of wetlands—referred to disparagingly at the time as swamps. A 2001 National Research Council report found that, as a result, by the 1980s the wetland area in the contiguous United States had decreased to approximately 53 percent of what it had been one hundred years earlier.²⁰

By the late 1980s, the protection of wetlands had become a national priority and federal policies began to shift. In 1989, President George H.W. Bush acknowledged the importance of wetlands by establishing the goal of “no net loss of wetlands,” a goal that has been supported by subsequent administrations. As a result of these shifts in attitude and policy, the rate of wetlands loss has decreased substantially, although there is uncertainty as to the extent of the decrease, especially with regard to the functional value of wetlands.²¹ Nevertheless, wetlands continue to be lost due to subsidence, erosion, storms, and human activities, including the conversion of such areas for other uses.

There is no single, comprehensive federal wetlands protection law. Instead, multiple federal statutes and programs provide protections in different forms, including the various conservation and restoration programs described earlier in this chapter. State and local wetland programs add to the complexity of wetlands protection efforts.

The Clean Water Act Section 404 program is the primary federal regulatory program providing protection for the nation’s wetlands. The goal of the program is to avoid deliberate discharges of materials into wetlands, or minimize discharges where they cannot be avoided. The program requires a permit for any discharge of materials, such as soil or sand, into U.S. waters. If a permit is issued for a project that will result in the loss of wetlands, compensatory mitigation is often required; that is, wetlands must be restored, enhanced, preserved, or created elsewhere to replace the permitted loss of wetland acres and functions.

Although it has had some success in slowing the rate of wetlands loss, the Section 404 program is not a true national wetlands management and protection program. The program is limited to fill permitting and does not address the many other activities that affect wetlands. In addition, several major categories of activities are not required to obtain permits, including ongoing farming, ranching, silviculture, and USACE Water Resources Development Act projects. The program has also generally failed to give sufficient consideration to the cumulative impacts associated with issuing multiple individual permits in the same geographic or watershed area. (A more detailed discussion on improving the ability of USACE to address the regional, cumulative impacts of its activities is provided in Chapter 12.)

As the nation recognizes the interconnectedness of upland and downstream areas, considers entire watershed systems, and moves toward an ecosystem approach, comprehensive wetlands protection should be considered as an integral part of ocean and coastal management.

Recommendation 11–4. The National Ocean Council should coordinate development of a comprehensive wetlands protection program that is linked to coastal habitat and watershed management efforts and should make specific recommendations for the integration of the Clean Water Act Section 404 wetlands permitting process into that broader management approach.

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CHAPTER 12: MANAGING SEDIMENT AND SHORELINES

The natural flow of sediment over land and through waterways is important for sustaining coastal habitats and maintaining attractive beaches. However, excess, insufficient, or contaminated sediment can erase beaches, destroy habitats, poison the food chain, and endanger lives. Because navigational dredging, infrastructure projects, farming, urban development, and many other necessary and beneficial human activities can interfere with natural sediment processes, their impacts should be understood and managed. A national strategy for managing sediment on a multi-project, regional basis, that accounts for ecosystem and economic needs and involves all relevant parties, is needed to promote greater beneficial uses of sediment with less harm to natural resources. Improved methodologies for evaluating beneficial uses, along with additional research, monitoring, assessment, and technology development, will also be necessary to achieve improved sediment management.

UNDERSTANDING THE DUAL NATURE OF SEDIMENT

Sediment in Great Lakes, coastal, and ocean waters is composed of inorganic and organic particles created through erosion, decomposition of plants and animals, and human activities. Sediment may be carried by wind or water from upland areas down to coastal areas, or may originate in the marine environment. Once sediment arrives at the ocean, it is transported by wind, waves, and currents in dynamic processes that constantly build up and wear away cliffs, beaches, sandbars, inlets, and other natural features.

From a human perspective, sediment has a dual nature—desirable in some locations and unwanted in others (Figure 12.1). Sediment can be used to create or restore beaches and to renew wetlands and other coastal habitats. Such activities are referred to as beneficial uses. Undesirable sediment can cloud water and degrade wildlife habitat, form barriers to navigation, and contaminate the food chain for marine plants, animals and humans.

Whether sediment is desirable or not, its location and movement can have large economic and ecological consequences. For example, excess sediment in shipping channels may cost ports millions of dollars in delayed or limited ship access, while in other locations insufficient sediment deposits could result in the loss of valuable coastal wetlands.

Figure 12.1. Sediment: Friend or Foe

Too much sediment can lead to ...	Too little sediment can lead to ...	Valuable uses of sediment include ...
obstructed channels overflowing rivers smothered reefs high turbidity that blocks sunlight	disappearing beaches eroded riverbanks wetlands losses altered river profiles	construction material sand to replenish beaches wetland nourishment replacement of agricultural soil

Sediment levels that are too high or too low can be detrimental to both natural environments and man-made structures, including extreme cases where structures are lost due to beach and cliff erosion. But sediments such as sand and gravel can also be viewed as a valuable resource.

Source: Martin, L. R. *Regional Sediment Management: Background and Overview of Initial Implementation*. Institute for Water Resources Report 02-PS-2. Alexandria, VA: U.S. Army Corps of Engineers, July 2002.

The dual nature of sediment as both a threat and a resource to humans and the environment makes its management particularly challenging. To complicate matters further, the natural processes that create, move, and deposit sediment operate on regional scales, while management tends to focus on discrete locations—a single beach, wetland, or port. In addition, the policies that affect sediment location, transport, and quality fall under the jurisdiction of diverse programs within multiple agencies at all levels of government. This complex governance approach makes it difficult to manage sediment at the appropriate scale and in consonance, rather than in conflict, with natural processes.

FEDERAL ROLES IN SEDIMENT MANAGEMENT

The federal government’s role in managing sediment in the marine environment covers five areas: navigation-related dredging; beneficial use of sediment; construction of infrastructure to reduce flooding and erosion hazards; management of contaminated sediment; and basic and applied research into sediment processes. As with many ocean and coastal issues, numerous federal agencies are involved.

The U.S. Army Corps of Engineers (USACE) plays a large part in nearly all of these areas and is the lead agency for all but contaminated sediment. The U.S. Environmental Protection Agency (EPA) has environmental oversight of dredging projects and is tasked as the lead agency for disposal of contaminated dredged materials and cleanup of contaminated sites. The National Oceanic and Atmospheric Administration (NOAA) administers the Coastal Zone Management Program, which requires participating coastal states to have enforceable policies to protect ocean and coastal resources, including policies that affect sediment management. NOAA’s National Marine Fisheries Service and the U.S. Department of the Interior’s (DOI’s) U.S. Fish and Wildlife Service have responsibilities for living marine resources and habitat that also give them a role in evaluating the impacts of proposed sediment projects. DOI’s Minerals Management Service identifies and authorizes access to sand deposits in federal waters suitable for beach nourishment and wetlands protection projects. The U.S. Geological Survey advances research on the sources, transport, impacts, disposal, beneficial use, and other aspects of sediment. USACE, NOAA, and EPA also conduct related research efforts, and the National Science Foundation and Office of Naval Research fund many relevant academic studies.

Other federal programs have less direct, but no less important impacts on sediment. The U.S. Department of Agriculture’s Natural Resources Conservation Service plays a central role in efforts to reduce agricultural soil erosion, much of which finds its way to the ocean. USACE and DOI’s Bureau of Reclamation operate flood control, water storage, and hydroelectric projects which retain, and occasionally release, large amounts of

sediment. Sediment also is addressed extensively through the nation's regulation of point and nonpoint sources of pollution, with EPA and NOAA as the principal federal agencies involved.

Some activities that affect sediment, such as dredging and shoreline erosion control projects, fall within the authorities of specific laws, often implemented in isolation from each other. Other activities are addressed under broader, less specific authorities. No mechanism exists to ensure that each individual sediment-related project is considered in the context of other overlapping activities. Even well designed projects can sometimes create more problems than they solve, or encounter frustrating delays, because of poor communication among stakeholders and confusion about the many programs that remove, relocate, prevent, or accelerate the transport of sediment.

ALTERING SEDIMENTS THROUGH HUMAN INTERVENTION

Changing Sediment Quantities

Many human interventions in sediment processes are unintentional, occurring as a by-product of routine economic activities that overload or deprive natural systems of sediment. Activities such as forestry, agriculture, and urban development yield great benefits to the nation, but also accelerate natural erosion. Excess sediment suspended in the water column or accumulating at the bottom of water bodies can create problems for other industries, such as shipping, fishing, and tourism, and can harm aquatic life.

Conversely, flood control, water supply, and hydroelectric projects prevent the natural movement of sediment, contributing to downstream erosion and subsidence problems. As older components of this infrastructure become too costly to maintain, or are rendered obsolete for structural or economic reasons, disposing of the enormous quantities of trapped sediment will pose a new set of problems. Development in coastal communities can also disrupt natural sediment movement, causing erosion in some places and accretion in others. Such projects may have unintended effects on neighboring jurisdictions, both upstream and downstream, that had no role in the planning process.

Changing Sediment Quality

Over the last fifty years, lakes, rivers, and harbors have accumulated bottom sediments contaminated with heavy metals (such as lead, copper, and arsenic) from mining and industrial activities, as well as long-lived toxic chemicals (such as DDT, MTBE, PCBs, and dioxin). Continued discharges from municipal waste and industrial plants, and polluted runoff from agricultural and urban sources, perpetuate the problem, while newly identified contaminants such as flame retardants are now being detected in ocean and coastal sediments. Toxic chemicals from sediment can accumulate in marine plants and animals, causing reproductive failure, impaired growth, disease, and death. They may also pose health risks to humans who consume or come in contact with tainted marine products.

Of the 12 billion cubic yards of sediment that comprise the top two inches underlying U.S. waters, an estimated 10 percent is thought to be contaminated at levels that pose possible risks to marine life, wildlife, and humans.¹ Of the 300 million cubic yards of sediment the USACE dredges annually to facilitate navigation, an estimated 5 to 10 percent is contaminated.² Once a portion of sediment becomes contaminated, it becomes a source of further contamination downstream.

Currently, six laws and seven federal agencies are involved in dredging or remediation of contaminated sediment, depending on whether the material is to be removed, deposited, or treated. Different sets of laws apply when navigational dredging or environmental cleanup are the primary focus of activity. A 1997 National Research Council report concluded that this patchwork of laws generally fails to manage contaminated sediment according to the risk it poses to the environment, does not adequately weigh the costs

and benefits of different solutions, and imposes lengthy and unnecessary delays in addressing problems.³

The Comprehensive Environmental Response, Compensation and Liability Act, more commonly referred to as Superfund, provides for the cleanup of uncontrolled or abandoned hazardous waste sites. At over one hundred locations, bottom sediments in rivers and harbors are so contaminated they are designated as Superfund sites. The EPA estimates that cleanup of the thirty most highly contaminated sites in rivers, lakes, and coastal areas may cost hundreds of millions of dollars.⁴

The Legacy of Sediment Contamination

Long-term remedial response action is required at areas on EPA's Superfund list, one of which is Fox River and Green Bay, Wisconsin. From 1954 to 1971, PCBs were released during the manufacture of carbonless copy paper by seven companies along the banks of the river. The chemical releases left 11 million cubic yards of contaminated sediment in Fox River and Green Bay. The EPA estimates that up to 70% of the PCBs entering Lake Michigan via its tributaries come from the Fox River. This contamination has affected water quality, recreation, and the health of people, fish, and birds. Elevated PCB concentrations in some Lake Michigan fish have prompted health advisories. Native Americans in the area have been particularly affected because of the importance of subsistence fishing to their community.^{5,6}

The presence of contaminated sediment greatly complicates the management of dredged materials. For example, contaminated sediment would be inappropriate for use in wetland restoration or erosion control projects. Costs are also much higher for the safe and secure disposal of these materials. The very process of dredging contaminated sediment increases ecological and human health risks because some of the sediment inevitably becomes resuspended and carried to new locations during removal.

DEVELOPING REGIONAL STRATEGIES FOR SEDIMENT MANAGEMENT

Sediments flow continuously downstream to the coast, on and offshore, and back and forth along the coast. A project-by-project approach to sediment management can result in expensive actions that may undermine the interests of other stakeholders. For example, flood and erosion control structures, while temporarily protecting targeted locations, interrupt the natural transport of sediment along the coast, preventing the accumulations that create beaches and maintain wetlands, exacerbating coastal erosion, and potentially threatening life, property, and coastal economies in other locations. Similarly, upstream sediment diversions or contamination can have major impacts in estuaries and coastal areas.

Coastal stakeholders have increasingly recognized the need to develop more proactive and preventive strategies. However, their absence from broad watershed planning efforts—where decisions about land use and water management could reduce excess and contaminated sediments at their source—makes such change difficult to realize. (A more detailed discussion of watershed planning efforts appears in Chapter 14.) The nation needs both a better understanding of the interactions between human activities and sediment flows, and a better mechanism for involving all potentially affected parties.

Moving toward an ecosystem-based management approach is a critical step. The new National Ocean Policy Framework outlined in Part II creates a structure for regional coordination and cooperation among the many parties affected by sediment. Participation by federal, state, and local entities in watershed management efforts, along with key stakeholders such as coastal planners and port managers, is one way to diminish upland sources of excess and contaminated sediment that harm the marine environment. Ecosystem considerations should be included in the process for permitting any activity that alters sediment flows.

Recommendation 12-1. The National Ocean Council should develop a national strategy for managing sediment on a regional basis, taking into account both economic and ecosystem needs. The strategy should: consider adverse impacts on marine environments due to agriculture, dredging, pollutant discharges, and other activities that affect sediment flows or quality; ensure involvement of port managers, coastal planners, and other stakeholders in watershed planning; and require that ecosystem-based management principles serve as the foundation for permitting processes for activities that affect sediment.

Regional sediment management will require coordination among diverse interests, political jurisdictions, and levels of government to achieve environmental, social, and economic goals. For example, construction and restoration projects in coastal areas often face long permitting and planning delays, which can substantially add to project costs and be ecologically detrimental. A regional sediment planning process that identifies pre-approved beneficial use sites through a collaborative stakeholder process could help expedite projects, resulting in quicker realization of economic benefits to the region.

A regional approach could also help prioritize projects. In considering beach nourishment proposals for two nearby sites, priority might be given to one of the sites if natural sediment transport processes would result in secondary nourishment of the down-coast site, doubling the impact of the investment. Regional sediment management could also inform coastal land use planning and permitting decisions, moving new development or post-disaster rebuilding away from erosion hot spots, as discussed in Chapter 10.

One of the difficulties in undertaking a regional approach to managing sediment is that the definition of a region may differ substantially among parties engaged in land use planning, port management, coastal development, wetlands protection, or fisheries. To understand the sources and transport of sediment, a region might extend tens to hundreds of miles up and down rivers and the coastline. Alternately, for management of dredged material at a port, the region might be linked to the size of that port. Coastal erosion and living marine resources may define other scales. These definitions should be reconciled to achieve effective sediment management in an appropriate regional context.

Moving Toward Regional Sediment Management at USACE

USACE's traditional protocols for dredging and other sediment management projects consider the impacts of those projects individually and on short-term and local scales—typically from one to thirty years, across areas of less than ten miles—despite widespread recognition that coastal processes operate at regional scales with time frames of up to 250 years and geographic extents of dozens of miles from a project's location.⁷ In many cases, this disregard for the scale over which natural processes operate has resulted in projects having unintended adverse impacts on nearby coastal resources, placing too much sediment in the wrong place or too little where it is needed.

More recently, USACE, with support from Congress, has begun pursuing alternatives to its project-by-project approach. For example, USACE created the Regional Sediment Management Program based on general direction from Congress to develop long-term strategies for disposing of dredged materials and cooperate with states to develop comprehensive plans for coastal resource conservation. Under the program, USACE collaborates with states, communities, and other diverse stakeholders to develop plans to manage sediment across a region that encompasses multiple USACE dredging projects.

To date, the Regional Sediment Management Program has undertaken six demonstration projects around the country. Early results have yielded technology improvements, information sharing, and the building of a base of experience in more comprehensive management of construction activities affecting sediment. Nevertheless, scientific, technological, and institutional hurdles remain to implementing truly regional sediment management.⁸

WEIGHING THE COSTS AND BENEFITS OF DREDGING

Navigational Dredging

Widespread adoption of regional sediment management practices will help address many problems. However, until such practices are common—and even once such frameworks are in place—certain sediment activities merit special attention. Dredging for navigational purposes is perhaps the most direct and prominent way humans affect sediments in marine waters. The federal government is most clearly in charge of dredging activities for this purpose.

Navigational dredging in ports and waterways seeks to remove accumulated sediment that blocks or endangers vessels and prevents access by ships that continue to increase in size and draft, requiring wider and deeper channels. An estimated 400 million cubic yards of sediment (300 by USACE and another 100 by private, permitted contractors) are dredged annually to maintain and improve navigation.⁹ As the volume and value of goods transported by water continues to grow, the importance of maintaining efficient, modern ports increases. (Chapter 13 includes a broader discussion of port planning in the context of maritime commerce and transportation.) All dredging, whether related to navigation or not, can have negative impacts. These impacts may include habitat disturbance and the dispersion of sediment—frequently contaminated—to new locations, with unintended impacts on the ecosystem.

One frequent complaint associated with dredging projects is the time involved from conception to completion. Currently, the process of planning, permitting, and completing a navigation channel improvement project (widening or deepening) can take more than twenty years. Reasons for delay include inconsistent funding allocations and congressional approvals, the complexity of the project review process, and scientific uncertainties. Such lengthy time frames can be ecologically and economically detrimental to a region. Delayed access to a port may reduce ship traffic and trade, and environmental impact statements may become outdated. At the same time, certain projects may be legitimately questioned by those who believe there are less costly or environmentally damaging alternatives.

EPA and USACE are currently investigating mechanisms for improving the efficiency of the planning and permitting process for management of dredged material. These efforts should be encouraged. A streamlined process should be designed to evaluate the necessity of a proposed dredging project, look for opportunities to improve sediment management, and set priorities among projects.

Beneficial Uses of Dredged Material

Dredged materials have long been used to create new land for commercial, residential, and infrastructure developments, as well as to bolster beaches and barrier islands to protect against storm and erosion hazards and enhance tourism and recreation. Since the 1970s, these beneficial uses of dredged materials have also included environmental enhancement, such as restoration of wetlands, creation of wildlife habitat, and improvement of fish habitat. Surprisingly, navigation-related dredged materials do not find their way into beneficial use projects as often as perhaps they should. This is due in part to sediment contamination, but also to USACE policies that favor disposal in open waters or in upland dump sites. These policies may be unnecessarily foregoing opportunities to support economic growth or environmental protection and may have serious unintentional consequences for aquatic ecosystems.

Beach Nourishment: A Special Use of Sediment

Dredging of sediments does take place outside the navigation context, most notably for use in beach nourishment projects. Beach nourishment can be important in protecting natural systems such as reefs and downstream coastal environments. However, beach nourishment for recreation, tourism, and protection of beachfront property has been the primary area of contention. As fervently as some champion beach nourishment as a source of national economic benefit essential to protecting life, property, and beach-dependent economies, others decry it as a costly taxpayer-subsidized activity that creates incentives for inappropriate development in coastal areas subject to storm, flooding, and erosion hazards. USACE can help fund beach nourishment projects when a federal navigation or other infrastructure project has eroded the beach, or when a local community makes a specific request that is authorized and funded by Congress.

As the National Research Council noted in a 1997 report, the process for determining when, where, and how to use dredged sediments for beach nourishment suffers from a number of deficiencies, including a lack of performance criteria, inadequate technical and economic methodologies, outdated design standards, insufficient stakeholder involvement, an inadequate understanding of the physical and biological mechanisms of beach and littoral systems, and a failure to plan for the long term or in a regional context.¹⁰ Because the high costs of undertaking and maintaining these projects are borne in large measure by the public, investments should target projects that will render the greatest benefit and where other alternatives, such as moving development away from eroding areas, are not possible. Achieving this goal will require a better understanding of sediment processes and a method for considering beach nourishment proposals in a regional context.

Techniques of Cost-Benefit Analysis

Under current USACE policies, navigation-related dredged material is primarily viewed as a waste stream and diversion for beneficial use is considered extraneous to the navigation mission. For the federal government to cover the costs of a navigational dredging project, USACE regulations require that the dredged material be disposed of in the “least costly, environmentally acceptable manner consistent with engineering requirements established for the project.” During its project evaluation process, USACE determines the least-costly disposal method, designated as the Federal Standard, and decides on the appropriate cost sharing structure with nonfederal partners. If the Federal Standard option is not used, the nonfederal partners must assume a larger portion, sometimes over 50 percent, of the project costs.

Because USACE cost-benefit methodologies tend to undervalue the benefits of projects that use dredged materials, while failing to account for the full costs, including environmental costs, of traditional disposal methods, the least-cost option generally favors open-water disposal of dredged materials. A more accurate system for selecting and ranking projects would be based on a comparative net economic and environmental return for the United States rather than a narrow cost-benefit analysis for a specific project. Recognizing the advantages of beneficial-use projects may also justify spreading the costs among a wider array of stakeholders.

Recommendation 12-2. The U.S. Army Corps of Engineers should ensure that its selection of the least-cost disposal option for dredging projects reflects a more accurate accounting of the full range of economic and environmental costs and benefits for options that reuse dredged materials, as well as for other disposal methods.

National and Regional Dredging Teams

Recognizing the benefits of improved sediment management, several ports have developed long-term plans for managing dredged materials. These include the ports of Baltimore, Boston, Houston, Long Beach, Los

Angeles, New York and New Jersey, Oakland, Seattle, and Tacoma. These long-term plans were intended to avoid delays caused by new environmental testing procedures, the determination that some dredged materials were not suitable for ocean disposal, and the lack of disposal alternatives, all of which had added years to the expected completion of some port expansion and navigational dredging projects.

Long-term planning efforts for managing dredged materials can bring together federal agencies, port authorities, state and local governments, natural resource agencies, public interest groups, the maritime industry, and private citizens to forge agreements that, among other things, increase the likelihood of beneficial use of dredged materials. These types of initiatives were encouraged by a 1994 Interagency Working Group report to the Secretary of Transportation, *The Dredging Process in the United States: An Action Plan for Improvement*.

The Action Plan concluded that early acknowledgment of environmental concerns and effective public outreach could substantially reduce potential conflicts and delays. Specific recommendations included: creation of a timely, efficient and predictable regulatory process; support for port or regional scale planning by partnerships that involve the federal government, port authorities, state and local governments, natural resource agencies, public interest groups, the maritime industry, and private citizens prior to seeking project approval; involvement of dredged material managers in watershed planning to emphasize the importance of reducing sediment loadings and contamination at their source; and encouragement for the environmentally sound, beneficial use of dredged materials, such as wetlands creation and beach replenishment. The Action Plan also emphasized the need to continually integrate the best available science. Three years after the Action Plan's publication, a 1997 National Research Council report echoed the plan's findings and recommendations.¹¹

Implementation of the task force recommendations has been uneven. The National Dredging Team was established in 1995, but not all of the recommended regional teams were established. EPA's coastal and Great Lakes programs are currently forming regional teams, co-chaired by EPA and USACE, with participation by NOAA, the U.S. Fish and Wildlife Service, and local agencies that have regulatory roles in management of dredged material.

Recommendation 12-3. The National Dredging Team and regional dredging teams should begin to implement more ecosystem-based approaches. The National Dredging Team should implement the recommendations of the 1994 report to the Secretary of Transportation, *The Dredging Process in the United States: An Action Plan for Improvement*, with a priority of developing and implementing a streamlined permitting process. Regional dredging teams, working with regional ocean councils, should establish sediment management programs that include watersheds, coastal areas, and the nation's shoreline.

IMPROVING UNDERSTANDING, ASSESSMENT, AND TREATMENT

An enormous stumbling block to improved sediment management is a poor understanding of sediment processes in the marine environment and a paucity of effective management techniques. This is particularly true for contaminated sediment.

Numerous ongoing research programs exist to improve the nation's understanding of sediments and sediment management techniques, but they are generally fragmented, uncoordinated, and often inadequately funded. Despite some scientific advances, these programs have not produced the needed engineering models, innovative management techniques and technologies, or comprehensive information about the source, movement, location, volume, quality, and appropriate use or disposal of sediment on a regional and national basis.

The National Shoreline Management Study, a USACE initiative launched in 2002, holds promise for yielding information to better coordinate and synthesize federal sediment activities. The study is examining why, where, and to what extent U.S. shorelines erode or accrete and will investigate other aspects of sediment management such as economic and environmental issues and the roles of stakeholders in shoreline management. The study's results could help establish national priorities for shoreline management, but only if there is a mechanism for translating those results into action. In addition to maintaining the National Shoreline Management Study, which looks primarily at physical shoreline processes, USACE should significantly expand support for research and monitoring of ecological and biological functions and processes.

USACE's role in major construction projects that significantly alter watersheds brings with it an obligation to understand the potential impacts of these activities prior to their implementation. Current project-by-project planning and funding, along with severely limited discretionary funds for broader ecosystem research, have made this extremely difficult. Existing funding formulas also severely limit post-project monitoring, precluding long-term analyses of project outcomes and adoption of adaptive management.

Recommendation 12-4. The U.S. Army Corps of Engineers (USACE), National Oceanic and Atmospheric Administration, U.S. Environmental Protection Agency, and U.S. Geological Survey should develop a strategy for improved assessment, monitoring, research, and technology development to enhance sediment management. Congress should modify its current authorization and funding processes to encourage USACE to monitor outcomes from past projects and study the cumulative, regional impacts of its activities within coastal watersheds and ecosystems.

Because substantial reductions of contaminated sediment from upland sources remains a challenge, additional severely tainted marine sites are likely to be created. Yet the characterization, containment, removal, and treatment of contaminated sediment continue to be technically difficult and prohibitively expensive.

Recent EPA and National Research Council reports recognize the difficult ecological and economical problems associated with contaminated sediment management and stress the importance of adopting an adaptive management approach to the problem.^{12,13} Scientifically sound methods for identifying contaminated sediment and developing innovative technologies to improve dredging and treatment of this material are critical steps toward improving the economic and ecological health of coastal areas. To be successful, these efforts will require new resources and effective regional planning.

Recommendation 12-5. The U.S. Environmental Protection Agency, working with other appropriate entities, should develop a coordinated strategy for assessment, monitoring, and research to better understand how contaminated sediment is created and transported, and to develop technologies for better prevention, safer dredging of such sediment, and more effective treatment after it is recovered.

¹ U.S. Environmental Protection Agency. *The Incidence and Severity of Sediment Contamination in Surface Waters of the United States*. EPA-823-F-98-001. Washington, DC, 1998.

² National Research Council, Committee on Contaminated Marine Sediments. *Contaminated Sediments in Ports and Waterways: Cleanup Strategies and Technologies*. Washington, DC: National Academy Press, 1997.

³ *Ibid.*

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- ⁴ Evison, L. *Contaminated Sediment at Superfund Sites: What We Know So Far*. Office of Emergency and Remedial Response, Workshop on Environmental Stability of Chemicals in Sediment. U.S. Environmental Protection Agency, San Diego, CA, April 2003.
- ⁵ Balas, M. *Fox River Cleanup Is Talk of the Town, But What About Restoration*. The Green Bay News-Chronicle. October 22, 2003.
- ⁶ Wisconsin Department of Natural Resources and U.S. Environmental Protection Agency. *Superfund Record of Decision for Operable Units 3, 4, and 5*. Madison, WI, and Washington, DC, June 2003.
- ⁷ Lawson, M., J. Rosati, and N.C. Kraus. *Overview of Regional Coastal Sediment Processes and Controls*. Coastal and Hydraulics Engineering Technical Note CHETN-XIV-4. Vicksburg, MS: U.S. Army Engineer Research and Development Center, 2002.
- ⁸ Martin, L. R. *Regional Sediment Management: Background and Overview of Initial Implementation*. Institute for Water Resources Policy Studies Program. IWR Report 02-PS-2. Vicksburg, MS: U.S. Army Corps of Engineers, July 2002.
- ⁹ Interagency Working Group on the Dredging Process. *The Dredging Process in the United States: An Action Plan for Improvement. A Report to the Secretary of Transportation*. Washington, DC: U.S. Environmental Protection Agency, 1994.
- ¹⁰ National Research Council. *Contaminated Sediments in Ports and Waterways: Cleanup Strategies and Technologies*. Washington, DC: National Academy Press, 1997.
- ¹¹ Ibid.
- ¹² U.S. Environmental Protection Agency. "Draft Contaminated Sediment Remediation Guidance for Hazardous Waste Sites." *Federal Register* 67 (December 3, 2002): 71964.
- ¹³ National Research Council. *Bioavailability of Contaminants in Soils and Sediments: Process, Tools and Applications*. Washington, DC: National Academy Press, 2003.

CHAPTER 13:**SUPPORTING MARINE COMMERCE AND TRANSPORTATION**

Marine commerce and transportation are vital to the nation's economy and security. The waterborne movement of cargo and passengers requires an efficient marine transportation system that is smoothly connected to the nation's inland highway and rail infrastructure to meet current and future demands. In addition, improving the nation's marine transportation system depends on improved interagency coordination including between marine transportation and other important ocean and coastal activities, enhanced emergency preparedness and security at the nation's ports, and improved strategic planning to ensure that increased levels of marine commerce are managed in the most effective, safe, secure, and environmentally responsible manner possible.

CONNECTING PEOPLE, PLACES, AND PRODUCTS**Value of the Marine Transportation System**

The U.S. marine transportation system is the nation's link to global commerce and an essential and growing component of the national economy. The movement of manufacturing jobs from the United States to overseas, the nation's dependence on raw materials from other countries, global competition to provide high-quality goods at competitive prices, and consumer demand have combined to increase the nation's dependence on the import of foreign materials and goods. At the same time, increasing affluence in foreign nations, coupled with worldwide population growth, has stimulated international demand for U.S. agricultural and manufactured products.

The world's oceans and inland waterways are the highways of choice for the global movement of this vast international trade. As the world's largest trading nation, the United States imports and exports more merchandise than any other country and has one of the most extensive marine transportation systems in the world (Table 13.1).¹ U.S. marine import-export trade accounts for nearly 7 percent of the nation's gross domestic product.² Domestically, coastal and inland marine trade amounts to roughly one billion tons of cargo, worth more than \$220 billion a year.³

Table 13.1. The Leading Role of the United States in International Trade
In 2000, the United States led the world in the value of trade conducted. U.S. trade accounted for 19 percent of total world imports and 12 percent of total world exports of merchandise.

Rank in 2000	Exporters	Value (Billions of current U.S. Dollars)	Percent	Rank in 2000	Importers	Value (Billions of current U.S. Dollars)	Percent
1	United States	781	12.3	1	United States	1,258	18.9
2	Germany	552	8.7	2	Germany	503	7.5
3	Japan	479	7.5	3	Japan	380	5.7
4	France	298	4.7	4	United Kingdom	337	5.1
5	United Kingdom	284	4.5	5	France	305	4.6
6	Canada	277	4.3	6	Canada	245	3.7
7	China	249	3.9	7	Italy	236	3.5
8	Italy	238	3.7	8	China	225	3.4
9	Netherlands	213	3.3	9	Hong Kong	214	3.2
10	Hong Kong	202	3.2	10	Netherlands	198	3

Source: U.S. Department of Transportation, Bureau of Transportation. *International Trade Statistics, 2001*. [http://www/wto.org/english/res_e/statis_e/its2001_e/i05.xls](http://www.wto.org/english/res_e/statis_e/its2001_e/i05.xls) (Accessed June, 2002).

The U.S. marine transportation system is a complex public-private sector partnership with many participants. It is an aggregation of state, territorial, local, and privately-owned facilities wherein federal, state, territorial, and local governments participate in management, financing, and operation. The system is a highly complex and interconnected mix of waterways, ports and terminals, water-based and land-based intermodal connections, vessels, vehicles, equipment, personnel, support service industries, and users. This system provides a number of services, including: supporting the waterborne movement of foreign and domestic cargo; moving passengers and vehicles through numerous ferry systems; serving recreational boating, commercial fishing vessels, and cruise liners; and generating millions of jobs for Americans and for the nation's international trading partners. The U.S. marine transportation system also plays an important national security role as a point of entry for foreign shipments and a conduit for the movement of military equipment, supplies, and personnel to and from overseas locations.

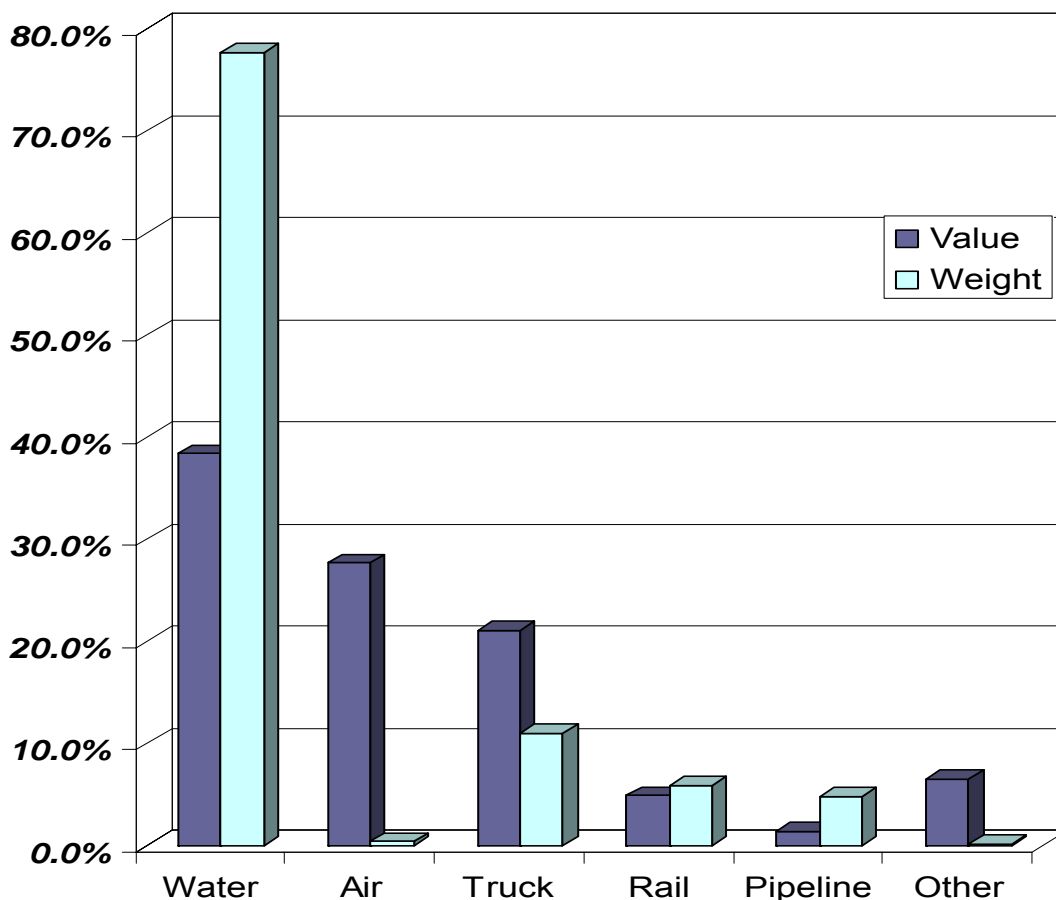
Components of the Marine Transportation System

Each element of marine transportation is a complex system within itself and is closely linked with all the other components. More detailed information about the U.S. marine commerce and transportation sectors is provided in Appendix 5.

Ports

The nation's marine, Great Lakes, and inland ports are critical components of the overall transportation infrastructure (Figure 13.2). Their efficiency and capacity are essential to U.S. importers, exporters, consumers, and domestic suppliers. The majority of U.S. international marine commerce flows through a relatively small number of ports that have the capacity to accommodate large vessels. Out of a total of 326 ports nationwide, 10 of them handle 85 percent of all containerized ship-borne cargo, with the ports of Los Angeles and Long Beach accounting for nearly 40 percent of all such cargo.⁴ Ports in Hawaii, Alaska, and the five U.S. trust territories and commonwealths play a special role because they are the primary economically viable link for the movement of commodities to and from these areas.

Figure 13.2. Ports Are the Primary Gateway for International Trade

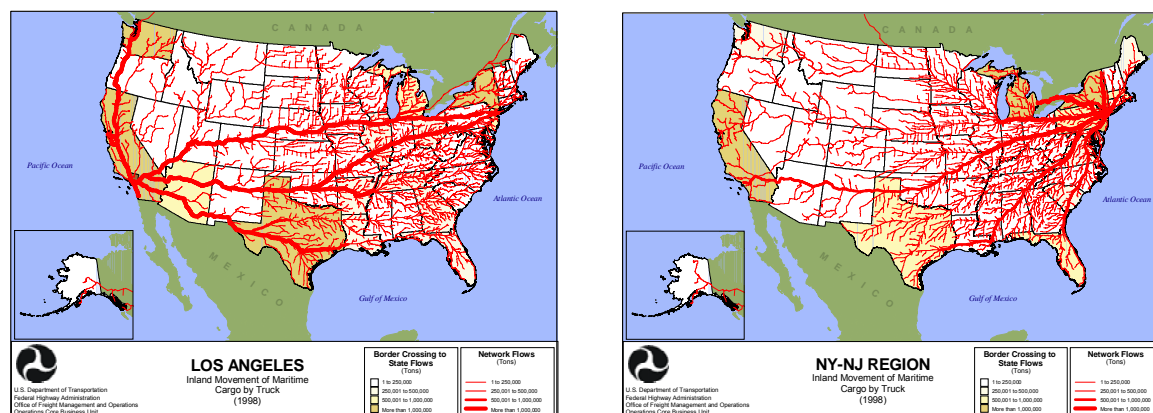


In 2001, U.S. ports were the major portal through which international trade entered and left the country. Marine commerce accounted for 78 percent of total U.S. international trade by weight (1,643 million tons) and 38 percent by value (\$718 billion).

Source: U.S. Department of Transportation, Bureau of Transportation Statistics. *U.S. International Trade and Freight Transportation Trends*. Washington, DC, U.S. Government Printing Office, 2003.

With international and domestic marine cargo projected to double over the next twenty years, a key issue will be the ability of the nation’s intermodal transportation system—its waterways, railways, highways, and airports—to move cargo into and out of U.S. ports (Figure 13.3). Some of the nation’s larger ports are already facing significant obstacles to moving cargo due to inadequate intermodal connections, particularly connections between ports and highways. Complicating this situation is the potentially competing demands being placed on the nation’s ports and waterways by passenger ferries, cruise liners, fishing vessels and recreational boating. With the possible exception of fishing vessels, all other marine sectors are expected to continue to show significant growth.

Figure 13.3. Goods Traveling through U.S. Ports are Transported Nationwide



Highways are major arteries for the flow of international freight throughout the United States. As seen in these two maps, the ports of Los Angeles/Long Beach and New York and New Jersey are hubs for the distribution and collection of truck cargo traveling throughout the nation.

Source: U.S. Department of Transportation, Federal Highway Administration. *Freight Analysis Framework*.

<<http://www.ops.fhwa.dot.gov/freight/Ports%20and%20Border%20Crossings/By%20State.htm>> (Accessed January, 2004).

Vessels

Ships entering and leaving U.S. ports include a mix of foreign and U.S.-registered vessels, and a broad variety of vessel types and sizes ranging from large container ships, tankers, and bulk carriers, to medium-sized barges, passenger ferries and cruise liners, and smaller fishing and recreational boats. As the number and size of vessels increase, additional pressures will be placed on the nation's ports and waterways. (For a discussion of issues related to vessel safety and environmental protection, see Chapter 16.)

The vast majority of international trade is carried out using foreign-registered and foreign-crewed vessels that can be operated at considerably lower cost than U.S.-registered vessels crewed by U.S. merchant mariners. The top twenty international merchant fleet nations operate more than 28,000 vessels worldwide. While the United States is ranked fourteenth, its share of the international fleet is only 454 vessels, or about 1 percent of the total. In contrast, the domestic U.S. marine fleet numbers more than 30,000 tugboats, towboats, and barges.⁵ The domestic fleet is protected from foreign competition in U.S. waters by the Merchant Marine Act, more commonly known as the Jones Act.

As international marine commerce has grown, ships have grown in size to accommodate increased amounts of cargo. The container ships of the 1960s could carry only a few hundred containers (commonly measured in 20-foot equivalent units, or TEUs). Today, 5,000 TEU vessels are quite common, and the largest container vessels can carry more than 8,000 TEUs, requiring navigation channels up to 50 feet deep. Bulk cargo ships are also increasing in size. For example, ultra-large crude oil carriers, known as super tankers, are approaching lengths of 1,500 feet and widths of 300 feet, requiring channels deeper than 90 feet.⁶

The U.S. marine transportation system also moves millions of passengers every year on cruise liners and ferries. The cruise industry has experienced constant growth worldwide since 1980. Globally, there were more than nine million cruise passengers with a little more than 70 percent, or 6.4 million passengers, embarking from U.S. ports in 2002 (Chapter 16, Figure 16.1), and 176 U.S. and foreign flag cruise ships operated in the North American cruise industry.⁷ This annual growth rate of just over 8 percent is expected to increase as the demand for cruise vacations grows.

The 168 U.S. passenger ferries, operating in thirty-five states, transported nearly ninety million people for work, leisure, and other purposes in 1999.⁸ Continued population growth in coastal metropolitan areas, coupled with increased vehicle traffic on the nation's highway systems, makes commuter passenger-vehicle ferries attractive transportation options for the future in selected areas. The U.S. passenger ferry industry has shown consistent growth, largely because coastal municipalities and states have invested in ferry systems to ease highway congestion.

Shipbuilding and Repair

Shipbuilding in the United States has historically been considered a strategic industry, supporting both military and commercial interests. Despite this important domestic role, the U.S. shipbuilding and repair industry is in serious decline. Employment is about 50 percent of what it was in the early 1980s, and companies have had to consolidate to survive.

Currently, the U.S. shipbuilding and repair industry consists of about 250 private companies and five publicly owned and operated repair yards.⁹ In 2002, the United States had only twenty-four major commercial shipbuilding yards capable of building vessels over 122 meters in length, and only nine of these were actively building ships.¹⁰ Combined, they accounted for only about 1.5 percent of total world ship tonnage on order that year.¹¹ Much of the U.S. commercial shipbuilding and repair industry works in niche markets, building and repairing mid-sized vessels including ferries, offshore oil and gas supply boats, research and patrol boats, small to mid-size container ships, tugboats, towboats, barges, fishing boats, luxury yachts, and U.S. military vessels. Although high operating costs prevent the U.S. shipbuilding and repair industry from being competitive internationally, the Jones Act insulates the U.S. industry from foreign competition on contracts related to the U.S. domestic and military fleets.

Navigational Aids

Aids to navigation—including buoys, warning lights, maps and charts, hydrographic and environmental data, and communications, positioning, and control systems—are essential to the protection of life and property and the enhancement of marine efficiency, especially as the number of larger and faster vessels visiting U.S. ports increases. Particularly important are recent advances in highly accurate and dependable navigation technology that have revolutionized safe marine passage, including harbor approaches and entrances, and avoidance of shallow water, bottom obstacles, and other vessels. Today's satellite-based global positioning system enables a wide range of mariners to plot a course within a few yards of their actual position. In addition, the National Oceanic and Atmospheric Administration (NOAA) has developed a suite of electronic navigational charts that incorporate global positioning information with high-accuracy data, such as real-time tide and current display capabilities for major U.S. ports and harbors. These charts are especially useful to mariners in meeting real-time navigation requirements to avoid collisions and groundings and in determining the best delivery routes.

Harbors, Channels, and Waterways

The nation's network of harbors, channels, and intracoastal and inland waterways is a vital component of both the U.S. marine transportation system and the overall U.S. intermodal infrastructure. In addition to providing corridors for international trade, this network links U.S. inland ports with coastal and Great Lakes ports, enabling the waterborne movement of domestic cargo, much of which is destined for the international market.

Dredging harbors, channels, and waterways to maintain and increase water depth and to widen and lengthen channels to accommodate wider and deeper-draft ships is critical for the successful operation of the nation's

ports. In 2001, the federal government spent \$868 million on dredging projects to maintain and deepen the nation's harbors and channels.¹² (See Chapter 12 for a discussion of the complex issues associated with dredging and other sediment management projects.)

Personnel

The U.S. marine transportation system requires a highly skilled and diverse workforce to handle increasingly computerized equipment and vessels, sophisticated electronic navigational aids, and new port technology for the movement of cargo. The U.S. Merchant Marine Academy, the six state-operated marine academies, and other marine education and training facilities in the United States offer training that covers virtually all facets of the U.S. marine transportation system, including at-sea ship operations, port management, marine business, marine facilities and environmental engineering, and marine safety and environmental protection. As the U.S. system becomes more complex, training requirements will increase. In this area as in many others, the nation should be positioned to meet the demand for the highly skilled workforce of the future.

POSITIONING THE U.S. MARINE TRANSPORTATION SYSTEM FOR THE FUTURE

For the nation's marine transportation system to meet current and future demands, ongoing maintenance, improvement, and expansion will be required. A key prerequisite for a robust system is better coordination, planning, decision making and allocation of resources at the federal level. In particular it will be essential to enhance the connections between this system and other modes of transportation, such as highways, railways, and airports. At the same time, in moving toward an ecosystem-based management approach, planning for the movement of cargo and passengers should be coordinated with the management of many other ocean and coastal uses and activities, and with efforts to protect the marine environment.

Federal Roles

Within the federal government, responsibility for marine commerce and transportation is spread among numerous agencies, primarily the U.S. Department of Transportation (DOT), U.S. Coast Guard, U.S. Army Corps of Engineers, NOAA, U.S. Customs Service, and U.S. Environmental Protection Agency. These agencies have many roles, including vessel traffic management, national security, marine safety, waterway maintenance, environmental protection, and customs.

In 2004, a National Research Council (NRC) report concluded that federal responsibilities for the marine transportation system are highly dispersed, decentralized, and poorly coordinated and do not mesh well with the structure and function of such system.¹³ Unlike the highway system, which is primarily the responsibility of DOT's Federal Highway Administration, and the U.S. aviation system, which is the responsibility of DOT's Federal Aviation Administration, the marine transportation system does not have a clearly defined lead federal agency. Statutory, regulatory, and policy differences among federal agencies with roles in marine transportation lead to fragmentation, competition, and in some cases, an inability to work collaboratively due to conflicting mandates. The NRC report was based on an analytical framework that examined four key federal interests: safety, security, commerce, and environmental protection. Federal policy makers can use this framework to identify critical needs within the system and target efforts to meet those needs most efficiently.

National leadership and support will be needed to achieve better integration within the federal government, better links with the rest of the nation's transportation infrastructure, and coordination between marine transportation and other important ocean and coastal uses and activities. The logical agency to assume this responsibility, as it does for the highway, aviation, and railway systems, is DOT.

Recommendation 13-1. Congress should designate the U.S. Department of Transportation (DOT) as the lead federal agency for planning and oversight of the marine transportation system and DOT

should submit regular reports on the condition and future needs of the system. The National Ocean Council should identify overlapping functions in other federal agencies and make recommendations concerning the advisability of transferring those functions to DOT.

Even with one clearly mandated lead federal agency, coordination will be needed among the federal and non-federal participants in the marine transportation system, given the significance of domestic and international trade to the nation and the complexity of the components that make up the system. In an effort to address this, eighteen federal agencies with responsibilities for various aspects of the U.S. marine transportation system signed a memorandum of understanding in 2000 that created the Interagency Committee for the Marine Transportation System.¹⁴

Federal Members of the Interagency Committee for the Marine Transportation System

U.S. Coast Guard	Federal Highway Administration
Maritime Administration	Federal Transit Administration
U.S. Army Corps of Engineers	Bureau of Transportation Statistics
National Oceanic and Atmospheric Administration	Research and Special Programs Administration
U.S. Navy	U.S. Air Force
U.S. Environmental Protection Agency	St. Lawrence Seaway Development Corp.
National Geospatial-Intelligence Agency	U.S. Department of Agriculture
U.S. Customs Service	Minerals Management Service
Federal Railroad Administration	Bureau of Export Administration

The committee’s goal is to enhance information exchange among the member agencies; its safety, security, and environmental subcommittees also serve as forums for the resolution of shared issues. However, the ability of the committee to engage in more substantive policy or budgetary planning is very limited. To become more effective, the responsibility and accountability of the committee will need to be elevated.

Recommendation 13–2. Congress should codify the Interagency Committee for the Marine Transportation System and place it under the oversight of the National Ocean Council.

The Committee should:

- *be chaired by the U.S. Department of Transportation.*
- *improve coordination among all participants in the U.S. marine transportation system.*
- *promote the integration of marine transportation with other modes of transportation and with other ocean and coastal uses and activities.*
- *recommend strategies and plans for: better informing the public of the importance of marine commerce and transportation; devising alternate funding scenarios to meet short- and long-term demands on the marine transportation system; matching federal revenues derived from marine transportation with funding needs to maintain and improve the system; and delineating short- and long-term priorities.*

Because marine transportation involves many actors outside the federal government, the Marine Transportation System National Advisory Council was created to serve as a forum for coordination among nonfederal participants in the marine transportation system and a venue for providing input to the federal government on important national issues.

Nonfederal Member Organizations of the Marine Transportation System National Advisory Council

American Association of Port Authorities	National Association of Regional Councils
American Great Lakes Ports Association	National Association of Waterfront Employers
American Maritime Congress	National Governors Association
American Pilots' Association	National Industrial Transportation League
American Trucking Associations	National Mining Association
Association of Metropolitan Planning Organizations	National Waterways Conference
Boat Owners Association of the U.S. (BOAT US)	North American Export Grain Assoc., Inc.
Chamber of Shipping of America	Pacific Maritime Association
Conference of Minority Transportation Officials	Passenger Vessel Association
Inland Rivers, Ports and Terminals, Inc.	Shipbuilders Council of America
International Longshore and Warehouse Union	The Ocean Conservancy
International Longshoreman's Association	U.S. Chamber of Commerce
INTERTANKO	U.S. Exporters Competitive Maritime Council
Maritime Security Council	United States Maritime Alliance, Ltd. (USMX)
MIT Center for Transportation Studies	World Shipping Council

This nonfederal advisory council should be maintained and have direct advisory links to the National Ocean Council as well as to DOT where its charter resides. This body could be very helpful in improving collaborations between coastal management programs and the transportation planning and priority setting process.

Links to the National Transportation Infrastructure

An important step in allowing the U.S. marine transportation system to grow, while minimizing increased congestion, delays, and costs to U.S. businesses and consumers, is to improve the movement of cargo into and out of ports. Existing intermodal connections are inadequate to meet the expected increase in foreign and domestic trade. The nation's transportation infrastructure is largely an agglomeration of competing transportation modes, each focusing on its own priorities. While this approach has produced an extensive infrastructure, a national strategy is needed to enhance the connections among these modes, including the nation's ports, and ensure greater overall effectiveness.

Recommendation 13–3. The U.S. Department of Transportation should draft a new national freight transportation strategy to support continued growth of the nation's economy and international and domestic trade. This strategy should improve the links between the marine transportation system and other components of the transportation infrastructure, including highways, railways, and airports. Based on the new strategy, investments should be directed toward planning and implementation of intermodal projects of national significance.

In developing the national freight transportation strategy, DOT should emphasize strategic planning with states, regions, and the public sector as is already being carried out for the U.S. highway system.

The movement of cargo by inland and coastal waterways, known as short sea shipping, is an emerging mode of transporting cargo. Significant increases in short sea shipping between U.S. ports would help to alleviate highway and landside port congestion by decreasing the volume of truck and railway cargo entering and leaving U.S. ports. It would also serve to bolster the U.S. shipbuilding industry and the U.S. Merchant Marine as demand increased for U.S. port-to-port conveyance.

Recommendation 13-4. The U.S. Department of Transportation should conduct a thorough analysis and assessment of the potential societal and economic benefits of increased short sea shipping.

Information Needs

Planning for the future of the U.S. marine transportation system requires accurate and timely information, including estimates of the volume of current and future cargo transportation, their origins and destinations, and the capacity of the various transportation modes. Such information is essential to understand the strengths and weaknesses of the current system and the challenges and opportunities for improving its effectiveness. Transportation planners and coastal managers also need better information to improve connections between marine and landside transportation systems and to improve the overall management of the wide range of interrelated ocean and coastal uses and activities that includes the marine transportation system.

Recommendation 13-5. The U.S. Department of Transportation (DOT), working with other appropriate entities, should establish a national data collection, research, and analysis program to provide a comprehensive picture of freight flows in the United States and to enhance the performance of the nation's intermodal transportation system. DOT should periodically assess and prioritize the nation's future needs for ports and intermodal transportation capacity to fulfill the needs of the nation's expected future growth in marine commerce.

The freight information collection program should include:

- *economic models that project trade and traffic growth and determine the impacts of growth on U.S. ports and waterways and the inland infrastructures connected to them.*
- *models and guides to identify bottlenecks and capacity shortfalls.*
- *consistent, nationally accepted definitions and protocols for measuring capacity.*
- *innovative trade and transportation data collection technology and research to fill critical data gaps.*
- *assessment of the social and economic ramifications of marine transportation investments as compared to other transportation investments.*

Emergency Preparedness

Natural disasters, labor disputes, terrorist attacks, ship collisions, spills of hazardous materials, and many other human and naturally caused events can disrupt the flow of marine cargo and passenger services, causing severe economic and social ramifications nationally and internationally. Diminished port capacity might also affect vital military operations. A strategic scenario of a terrorist event conducted in 2002 demonstrated the potential for \$60 billion in losses in the case of a twelve-day closure of all ports in the nation.¹⁵

Labor disputes can also present significant interruptions in port operations. A ten-day lockout of workers at twenty-nine West Coast ports in October 2002 caused an estimated \$15.6 billion in losses to the national economy, and demonstrated the cascading consequences of a major port shutdown.¹⁶

Port Security

In the wake of the September 11, 2001 attacks, a major challenge has arisen to increase security at the nation's ports, including enhanced control of the six million imported containers and many hazardous cargo tank ships that move through U.S. ports annually. The U.S. Department of Homeland Security is coordinating extensive efforts to address port security, including the development of a National Maritime Transportation Security Plan, area-based security plans, and requirements for certain vessels and port facilities to conduct security threat assessments, develop security plans, designate security officers, perform drills, and take appropriate preventive measures.

Ship Collisions and Groundings

Ship collisions, groundings, and other types of underwater obstructions in and near ports can cause port closures, particularly when safe navigation is impeded. Cleanup operations in response to spills associated with such incidents may complicate the restoration of traffic flow. Further constraining the ability to plan for and respond to such problems is the lack of adequate salvage capabilities nationwide.

Natural Disasters

There are many historical examples of natural disasters—such as hurricanes, earthquakes, tsunamis, and droughts—affecting safe navigation and port operations. A 1994 tropical rainfall in Houston, Texas, caused the closure of the Houston Ship Channel for several days due to flooding, dangerous currents, pipeline breaks and fires, shoaling, and channel obstructions. Similarly, in September 2003, Hurricane Isabel forced closures and limited operations at major ports and shipping channels along the mid-Atlantic coast over the period of a week.

Escalating traffic flow combined with the increased potential for emergency port closures call for enhanced emergency preparedness and improved contingency planning for U.S. ports.

Recommendation 13–6. In developing a national freight transportation strategy, the U.S. Department of Transportation should work closely with the U.S. Department of Homeland Security and the Federal Emergency Management Agency to incorporate port security and other emergency preparedness requirements. The strategy should focus on preventing threats to national security and port operations and on response and recovery practices that limit the impacts of such events, including an assessment of the availability of alternative port capacity.

¹ National Chamber Foundation. *Trade and Transportation: A Study of North American Port and Intermodal Systems*. Washington, DC: U.S. Chamber of Commerce, 2003.

² Marine Transportation System National Advisory Council. *U.S. Economic Growth and the Marine Transportation System*. Washington, DC: U.S. Department of Transportation, December 18, 2000.

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⁴ U.S. Department of Transportation. *U.S. International Trade and Freight Transportation Trends*. Washington, DC, 2003.

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