SECOND SKIDAWAY INSTITUTE OF OCEANOGRAPHY
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NATIONAL STRATEGY FOR BEACH PRESERVATION

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"And everyone that heareth these sayings of mine, and doeth them not, shall be likened unto a foolish man, which built his house upon the sand. And the rain descended, and the floods came, and the winds blew, and beat upon that house, and it fell, and great was the fall of it."

Matthew 7:26-27

Sea level is rising and the American shoreline is retreating. We face economic and environmental realities that leave us two choices: (1) plan a strategic retreat now, or (2) undertake a vastly expensive program of armoring the coastline and, as required, retreating through a series of unpredictable disasters.

INTRODUCTION

For the first two or more centuries of America's history our principal national economic goal was the development of our industrial and economic base, and growth, without regard for environmental impacts. This growth and expansion depended greatly upon developing harbors and exploiting our navigable rivers and coastal resources. Frequently, this involved dredging and deepening rivers and coastal inlets and the construction of jetty systems or other protective structures. These structures often led to unpredicted erosion and other adverse effects on adjacent coastal beaches and shorelines. Our ports and navigation systems must still play an important part in our national economy, but we cannot ignore increasingly expensive shoreline problems.

In this century population pressures, general affluence, the attraction of our beautiful coastal beaches and demands for increased recreation have accelerated the exploitation of our beaches, the less accessible coastal lands and the barrier islands. As construction along open ocean and Gulf beaches intensifies, the shoreline continues to recede, and protecting development becomes more complex and more costly. Costs that run into the millions of dollars per mile have been accompanied by serious environmental consequences, economic dilemmas for federal, state and local treasuries, and often by loss of the very property for whose preservation the battle is being fought. As we face the largest and most rapidly growing federal budget deficits in history, Americans have begun reassessing many national priorities and the role of government itself. Few policies so clearly need rethinking as management of our Gulf and ocean beaches.

A generally accelerating sea level rise, coupled with a diminishing supply of sand and frequent storms, underlies our Gulf and Atlantic shoreline problems.

Since it is difficult to measure this rise precisely, its consequences are often assigned to other forces such as storms, ocean currents, and shifting dunes. What may seem to be a new record to the inland reach and destructive magnitude of these forces often results from the relatively small rise in sea level extending their power across a much greater land area. Greater development in the danger zone also sets the stage for increased destruction.

Pacific and Great Lakes shores are generally retreating as well. On the Pacific coast factors such as storm frequency, durability of shoreline cliffs and bluffs plus the reduction of beach sand supplied by dams on rivers are perhaps more important than sea level rise in determining erosion rates. Large seasonal natural changes in the width of sand beaches are common and are particularly prevalent on the Pacific coast. Great Lakes shoreline erosion problems are directly related to fluctuating lake levels; the higher the levels, the greater the problems.

Historically, Americans have responded to shoreline retreat by applying technological solutions. Our present position evolved from harbor and navigational work to modest attempts to save a few cottages and stabilize a few inlets and beach fronts. Until the construction of Miami Beach in the 1920's almost all beach development stayed clear of areas directly and frequently affected by storms or gradual erosion. The few exceptions, like Galveston, Texas, often proved the wisdom of traditional restraint. Galveston suffered America's worst hurricane disaster in 1900 when 6,000 people died. The city responded by confronting the Gulf with a great seawall.

The beginning of this century saw a marked change in willingness to risk large investments along the beaches. The belief that human ingenuity could tame any natural force led individuals and developers in many communities to build closer and closer to the ocean and to respond to danger by confrontation. In many places the confrontation has led quickly to huge and desperate protective measures. Typical defense structures include groins, jetties, seawalls, revetments, and bulkheads, known as "hard" stabilization. It is now clear that halting the receding shoreline with protective structures benefits only a few and seriously degrades or destroys the natural beach and the value it holds for the majority. Protective structures divert the ocean's energy temporarily from private properties, but usually refocus that energy on the adjacent natural beaches. Many interrupt the natural sand flow in coastal currents, thus robbing many beaches of vital sand replacement.

The present most acceptable approach to beach stabilization is beach nourishment, the addition of large quantities of compatible sand to rebuild beaches seaward. (Some sands may be too coarse or too fine to stay in place or suite local needs.) Not only does nourishment improve beach quality, it also provides some storm protection. These projects have provided benefits over only short time periods in some cases. In others, for example the Miami Beach project, the nourished beach has been remarkably stable. In most areas where beaches erode rapidly, a substantial portion of the eroded sand undoubtedly is transported along shore, thereby benefitting adjacent beaches.

The costs of beach nourishment are relatively high, and frequently serious environmental issues must be resolved. The availability of suitable offshore sand may also limit a project's value. Beach nourishment is most viable economically in areas of dense development, large available sand supplies,

relatively low wave energy, and reconcilable environmental issues. Very few localities, however, are fortunate enough to have all of the factors that justify this approach to a long range solution. Florida, however, has recently announced plans to spend $300 million dollars over a ten year period to replenish retreating beaches around the state.

Individual property owners usually prevail upon the community at large, through local, state or national government's tax powers, to bear most of the cost of protection. Many studies have shown that rational economic behavior does not govern individual responses to natural hazards. Public policy and spending are usually dictated by property owners in trouble and by the empathy their situation generates in the public at large. The staggering costs of irrational decisions to fortify the beaches have forced many beach communities to depend on federal subsidies. The economic and environmental interests of the vast majority of Americans strongly justify an entirely new approach to beach management, a new national shoreline policy.

To reverse our losses, we must learn how to retreat from the shoreline. Where development already confronts the ocean, we must adopt corrective measures that are sure and fair. Where beaches are relatively undeveloped, we must apply preventive measures. A commitment to retreat as a guide to public policy and private investment would achieve the following goals:

1. Reduce the loss of property and lives by replacing present high risk development with stable, safe development in suitable locations away from the open beaches.
2. Meet increasing demand for public beaches by improving public access to natural beaches.
3. Develop a more stable economic future for coastal communities.
4. Eliminate unessential government spending and move coastal investment closer to a marketplace mechanism where economic decisions include realistic risk and cost without the benefit of direct or indirect government subsidies.
5. Facilitate removal of many of the defensive structures and developments that now magnify the effects of erosion and the costs of disasters.

SCIENTIFIC BACKGROUND

Sea level rising worldwide underlies the U.S. Gulf and Atlantic shoreline erosion problem and is also a factor in erosion along the Pacific shoreline. The present rate of relative rise is perhaps one foot per century, but task forces assembled by both the Environmental Protection Agency (EPA) and the National Academy of Sciences have estimated that the rate of rise not only will continue but will accelerate in the immediate future. EPA predicts that by the year 2100 sea level will probably stand four feet above the present level.

The greenhouse effect (excess production of carbon dioxide from burning fossil fuels), deforestation, and other human actions combined with natural phenomena, warm the atmosphere and are primarily responsible for the rising ocean levels. The warming atmosphere poses a double threat: the melting of glaciers and the vast West Antarctic ice sheet as well as the physical expansion of warmer ocean waters.

The most serious and persistent erosion occurs on low sandy beaches of the Atlantic and Gulf coasts. On these gently sloping coastal plains a small rise in sea level will increase the horizontal inland reach of the sea by many times

its vertical measure. The average rate of long term shoreline erosion varies greatly, but measured on an annual basis, it probably averages two to three feet per year. In some cases it averages over ten feet per year. Even if a precise measure of the rise of sea level can be argued, there is no doubt that most of the American shoreline is receding and the sea is advancing.

Seasoned shoreline residents accepted the consequences of erosion and planned for it. In the 1950's lots sold in South Nags Head, North Carolina (where the erosion rate is 6 ft. per year) were 600 feet deep, which allowed moving threatened buildings back from the beach. Today, competition for space, over-confidence in new building techniques, subsidized insurance, an absence of great Atlantic storms for twenty-five years, ignorance, and the temptation of great profits have erased the lessons of experience and history. In Myrtle Beach, South Carolina, high rise condominiums are being built near the surf zone. In Texas a new beach-front condo has been built at the west end of the Galveston seawall where the erosion rate is fifteen feet per year. Some states have taken steps to discourage impractical and dangerous development, the most common measure being to increase the building set-back line. Although preferable to no action, the set-back solution simply postpones the erosion problem for a few years.

Older shoreline developments have been protected by various hardening and sand trapping devices. This practice has yielded indisputable evidence that hard stabilization eventually degrades the beaches. Many miles of beach, including such famous shorefronts as Daytona Beach, Florida; Virginia Beach, Virginia; Myrtle Beach, South Carolina; Ocean City, Maryland, and Atlantic City, New Jersey, are now much narrower than they were or would have been in their natural state. In some long-developed and long-stabilized communities like Monmouth Beach, New Jersey, or Galveston, Texas, the beaches have essentially disappeared.

In the impassioned arguments for protective measures, we often hear estimates of the great economic value of the property that might be saved. After the 1984 Thanksgiving Day storm hit eastern Florida, such arguments resulted in permit applications for several miles of structural stabilization.

Current development practices and government policies do not require private enterprise to accept the risks as well as the profits. Nor do they consider that in a free market, investors, knowing and bearing all the costs of their decisions, most likely would build where their investments are secure--out of the ocean-front danger zones. History shows that entrepreneurs who want to profit from coastal attractions can find handsome profits in safe areas. Motels, amusement parks, restaurants and retail stores can prosper well back from the open ocean beaches.

While many people testify about the benefits of growth and development in public hearings on beach management, we seldom hear estimates of the economic value of the natural beaches--the natural resource values and the value of recreation opportunities. However, the value of natural resources and recreation can be measured. It is expressed in the number of days people spend at the beach and the amount of money people spend for beach recreation. It is expressed in the popularity of bond issues for anti-pollution measures and park acquisition. It is also expressed directly when beach users are asked what a day at the beach is worth to them or by their willingness to spend

transportation money and pay entrance fees to get on the beaches. These public values have only rarely been weighed during the emotional pleas for the protection of threatened private development.

The beach has been the source of development and wealth for ocean-front communities. In general, the more beach, the more popular the community and the richer its citizens. History makes clear that as the beaches disappear, a community's problems grow. But once begun, stabilization can seldom be reversed and generally calls for progressively larger and more massive defenses. The cost of providing protection has in large part been assigned to all Americans through state and federal taxes.

An example of the ultimate consequence of shoreline stabilization and its failure as a management strategy is illustrated by the long walls of Sea Bright, New Jersey. When in 1984 a northeaster struck the town, community officials claimed $82 million dollars in damages. Although relatively few buildings had been seriously damaged, that dollar figure equalled the approximate assessed value of all the buildings in town. Most of the damage was attributable to the seawall. If the damage claims are accurate, economic sense will direct abandonment of the whole community in the next few decades! Not a popular statement but one that more and more communities may find themselves facing in the next few years.

The impetus for shoreline stabilization comes mainly from owners of beach-front buildings and from sympathy generated for the loss of private property. Beach-front property owners, however, are only a small fraction of the population who use beaches. Taxpayers, increasingly aware of these facts, have begun to resist paying for expensive stabilization. As taxpayers intensify their efforts to reduce the tax burden, their resistance will probably increase.

Shoreline erosion and the advancing ocean are not a problem for beaches--only for buildings and the people who develop and own them. In this context the familiar cry of "Save the beach," is not only a mistatement, it is misleading and often dishonest. In reality it is a cry to save the private property and sacrifice the beach. If beaches are allowed to continue their slow retreat, unencumbered by stabilization, they will retain the natural form and width that have made them one of the public's most valued natural resources.

Several coastal states, including Florida, North Carolina, New York, Massachusetts, and Maine, have taken or are considering steps to halt the construction of hardened defenses. Unquestionably, other states will follow the lead of North Carolina whose Coastal Resources Commission recently adopted a general prohibition on such structures. The North Carolina position is, in essence, a call to retreat. In some cases, buildings there are already being moved and relocated out of the high hazard zones.

Strategic retreat, whether on the beach or in war, has often been the key to ultimate self-preservation and victory. The greatest resistance comes from a misplaced sense of pride and from the very real possibility of short-term but large, private economic set-backs. In a country whose economy has been built on the private use of natural resources, the interests of private property owners are important and politically powerful. The wisdom of strategic retreat will not be accepted emotionally or legally unless the needs of property owners are adequately addressed.

For better understanding of some of the terms used in the recommendations that follow, we refer the reader to definitions in the appendix.

RECOMMENDATIONS TO BE CONSIDERED

We are fortunate to have a variety of legal and economic tools to create a strategy that is fair to property owners without destroying the traditional public interest in coastal resources. These tools range from simple restraint to foresight in planning for new development to measures that mitigate the losses of existing property owners. The choice of tools must be made from a clear understanding of erosion rates, the functions of primary and secondary dunes, the dynamics of barrier islands, the role of plant communities, volumes of sand supply, and the economic value of development. Because each situation will require its own combination of tactics, we offer a variety of recommendations. Some will suit many beaches, others only a few. The number of possible solutions, however, should underline how many options are available to solve our problems.

We believe that overwhelming evidence now demands that all decisions begin with two important facts:

1. Struggles against shoreline problems, even many which seem small, short lived or very local, are struggles against worldwide rising sea level that is expected to continue to rise for many generations.
2. Stabilizing the retreating shoreline to defend private property causes larger than natural changes in adjacent beaches or beaches up and down the coast, destroying many areas of great public interest.

Our response to these facts must be to adopt a policy of retreat from the hazard zones. Some cities have grown so large and so important to their regions that they cannot be dismantled or abandoned. Even for these cities, however, steps can be taken to retreat from immediate threats.

Wherever there is any doubt, decisions should begin from a foundation of sound oceanographic and geologic evidence. Offshore sand supplies, for instance, should not be locked up to serve communities at the head of the supply area. The Easthampton, New York beaches face erosion problems, but to lock up offshore sand supplies would be to use sand that would naturally move westward, helping maintain the rest of Long Island's ocean beaches.

The impact of beach stabilization in the natural system is typically negative. Since almost all communities must ultimately rely on achieving protection by integrating development and the natural system, stabilization must be severely restricted. This fact and the changing scenario created by rising sea level means we must also continually reevaluate the costs and benefits of existing structures. In some instances legal or natural processes have forced the removal of buildings, including some larger buildings. We must be ready to remove, revamp, demolish or relocate some major structures when their existence becomes more burden than benefit to either the natural environment or the public *per se*.

How to Retreat

How to put a policy of retreat in place will be answered differently by different communities. Some less developed areas can rely on performance standards, building codes, setbacks and land use plans. More developed communities will have to address the problem of existing buildings and defensive structures. Communities where defensive structures have already destroyed the natural beaches will have to consider restoration measures. In all areas safety must be paired with conservation of the natural environment.

Since the general public interest is at stake, government must take the lead. In "coastal high hazard areas" we recommend that the following measures be considered. The problems are so diverse that their solutions will require many different actions by the several levels of government as well as the private sector.

Federal Government:

1. End all federal expenditures, direct or indirect, in support of private coastal development. Require private coastal development to pay its full cost.
2. Replace economic incentives for private development in high risk areas with incentives to relocate and build in other areas.
3. Acquire undeveloped areas to preserve natural features or the recreational beaches important to the public.
4. Discontinue government backed insurance programs for new development and substantial rebuilding and require flood insurance for existing structures to be actuarially sound. Also condition the use of insurance receipts or disaster payments on rebuilding outside coastal hazard areas.
5. Permit the use of offshore sand supplies for beach nourishment only where the value and extent of development outweighs other values and where nourishment would not deprive other communities of natural sand supplies.
6. Encourage research in new technologies for managing beach areas, especially inlets and navigation channels, without disturbing natural processes.
7. Provide special tax incentives and disincentives to limit development in the units of the Coastal Barriers Resources System and V Zones, including the following:
    a. Remove the limits on deductions for gifts of land to government or conservation groups if the land is in a threatened area.
    b. Allow tax deductible gifts with the right of the owner to use improvements until damaged by erosion or storms.
    c. Eliminate casualty loss tax deductions for properties in high risk zones purchased or built after adoption of a new policy.
    d. Eliminate Accelerated Cost Recovery System for property in high risk zones.
    e. Treat gains on property in high risk areas as ordinary income, rather than as capital gains.
    f. Put businesses and homeowners on an equal footing by disallowing as business expenses the costs of draining, filling, or building protective measures on properties in the high risk zone.
    g. Repeal the deduction for interest paid on loans for properties in the high risk zones.
    h. Allow tax exempt financing for the financing of public acquisition of properties in the hazard areas.
    i. Give preferential tax treatment to profits made on sales to public

bodies or conservation groups.

8. Amend the Interstate Land Sales Act to require the disclosure of the possible consequences of buying or building in hazard zones.

9. Stimulate full disclosure by removing the "private offering" exemption in Section 4(2) of the Securities Act of 1933 for proposed private investment and development in units of the Coastal Barrier Resources System and in V Zones identified by the National Flood Insurance Program.

10. Establish a firm policy that all usable (compatible) sand material from navigation projects be placed on adjacent beaches.

State Government:

1. End all state expenditures, direct or indirect, in support of private coastal development. Require private coastal development to pay its full cost.

2. Halt tax free exempt financing of private development on ocean beaches.

3. Acquire undeveloped areas with natural features or recreational beaches important to the public.

4. End state funding for roads and other public works serving high risk areas unless most of the benefits accrue to public coastal areas.

5. Halt stabilization, including sea walls, groins, jetties and other hardened construction, especially since such structures usually set off a chain of greater and greater defenses that typically lead to appeals for public subsidy, while destroying nature's system of beach maintenance.

6. Create a property transfer tax to fund acquisition of important coastal resources, public beaches and beach access, as already done in Florida and Massachusetts.

7. Create a tax check-off system or provide for earmarking tax refunds for public purchase of property in the high risk zones.

8. Allow special favorable tax assessments for land in high risk zones whose owners donate conservation easements or adopt uses compatible with preserving the natural beaches (e.g., fishing camps, some recreational uses, parks, etc.).

9. Establish building set-backs that protect natural beaches and primary dunes and that prohibit permanent structures in threatened areas. Where seasonal changes in beaches create new beach areas, prohibit building on newly accreted land.

10. Require developers and real estate agencies marketing property to disclose in writing the risks of being in the high hazard areas, including the costs associated with such risks during the expected life of their building.

11. Require when recording each change of ownership or new financing, a current plat be filed showing the lot lines, location of buildings and the shoreline location. Deed descriptions might note specific risks of hazard zones.

12. Require a successful applicant for a permit to rebuild in a hazard area to waive their rights to petition government for public aid when future damage occurs.

13. Educate the public about the nature of open ocean beaches, public and private property interests, and the economic consequences of beach management options and about how hardened defenses of private property burdens the taxpayer and denies citizens access to and use of their public beaches.

14. Enact enabling legislation, if necessary, to allow local government to create transferable development rights programs.

Local Government:

Land use planning should guide a variety of specific measures. Local land use plans should identify areas threatened by coastal erosion and flooding. Many coastal management acts already identify these areas. Land use plans and development regulations ought to prohibit unmovable buildings whose life spans will at any time place them in the path of the retreating shoreline.

1. Adopt zoning and land use controls that encourage development in safe areas by providing property owners who have to move back from the shore with development incentives elsewhere - e.g., cluster development, transferable development rights, extra building height, or total area.
2. Assign a non-conforming status to high risk uses of land just as zoning codes consider certain uses non-conforming. Regulations could prohibit non-conforming uses from being rebuilt after a certain level of damage has been sustained.
3. Require new subdivisions to set aside lands in safe areas for those who must retreat from the shore. Where shoreline retreat is likely to threaten buildings, lots could be required to have space for at least one back step large enough to safeguard the relocated building from rising sea level for at least the term of its projected life or require developers to set aside areas of land for future relocation.
4. Remove or require demolition of structures that become a threat to public safety, including seawalls and other structures in the surf zone and high risk buildings.
5. Remove hard stabilization structures that no longer serve their purpose and cause adverse affects to nearby shoreline.
6. Establish a fund to buy up property that should not be built upon. Such a fund would allow government to move quickly to buy storm damaged property when owners are most likely to sell at the lowest prices.
7. Establish a system of Transferable Development Rights in which presently developed or undeveloped oceanfront property is endowed with separable development rights that can be used or sold further inland if the oceanfront areas cannot be rebuilt or developed. If a government were to prohibit building or severely limit the density allowed on a given property, it could provide economic relief to the owner by assigning transferable and thus salable development rights.
8. Develop zoning provisions that have special standards for areas of unstable beaches, including a "floating zone" in which zoning designation and standards move with natural features such as mean high water, dune, or vegetation line.
9. Levy special impact assessments on risky development to provide a reserve fund for buying out damaged properties.
10. Using what is known of long term erosion rates, set time limits on the residential use of certain beach fronts, enabling the owners to plan a realistic depreciation and income projection into their financial plans.
11. Establish building set-backs that protect natural beaches and primary dunes and that prohibit permanent structures in threatened areas. Where seasonal changes in beaches create new beach areas, prohibit building on newly accreted land.

All Levels of Government:

1. Tailor infrastructure planning to discourage high risk development. One of the strongest motivations to development is the extension of public works--water, sewer, and roads. Federal and state funding should not be available for infrastructure in areas threatened by erosion except to service recreational use of the beaches. Local planning for infrastructure should direct it toward safe areas.
2. Adopt user fees to assess the users of public investment for the cost of goods and services, in keeping with the tradition of individual responsibility. Part of such a policy would be to adjust insurance rates to reflect the real cost of insuring oceanfront property, to price utility service to reflect the greater cost of installation and maintenance.
3. Adopt a policy for triggered removal judged by measurement of sea level rise and longterm shoreline retreat. Rather than wait for disaster to strike with all its expenses and dangers, regulations might establish a "trigger" mark after which a threatened structure would have to be removed within a specified time.
4. Coordinate protection and regulation. Where beach nourishment or other stabilization projects help a community protect property or preserve a public beach, permission or funding (or both) of the protective measure could be coupled with restrictions on further development.
5. Let buildings fall in. In many cases this will be the only feasible response to shoreline retreat and accompanying natural disasters.

Private Sector:

1. Develop innovative technologies to adapt to changing public policy, with emphasis on new modes of sand by-pass, inlet maintenance, and residential construction.
2. Real estate organizations such as the National Association of Realtors and the National Association of Homebuilders should educate their members about the need for new policies and about development patterns that can minimize the effects of new regulations.
3. Professional appraisers and economists should develop standards for assessing the effects of new policies on property values.

CONCLUSION

Our creativity can serve us as constructively in these new directions as it tried to do in building defensive structures. We already have the technical, legal, scientific, and economic tools to help property owners, to protect local treasuries, and to assure the public that its valuable beaches will be preserved and available.

Most of these tools have been available for many years. Our faith in builders and inventors and our preference for winning a battle once begun, have made us ignore these less spectacular and tangible tactics. Repeated and costly defeats on the ocean beaches, however, should convince all but the most reckless that the time is overdue to build a new strategy based on our new understanding. Only a foolhardy strategist eliminates retreat as an option, and it is even more foolhardy not to learn how to turn retreat into victory.

APPENDIX

DEFINITIONS

Floating Zone. A zone with performance standards to protect public safety, welfare and other interests, whose location shifts or floats as its seaward and landward limits physically move. For example, the public open beach area under the Texas Open Beaches Act moves as its landward line, the vegetation line, shifts. The consequence of this is that shoreline erosion has left many structures once in residential zones now in a public beach zone.

Hazardous area. Any area designated as a unit of the Coastal Barrier Resources System, included in a Velocity (or V) Zone as designated on Federal Flood Insurance Maps, or areas where the erosion rate is expected to threaten any structures within thirty years.

Open beach. A beach directly exposed to the Atlantic or Pacific Oceans or the Gulf of Mexico.

Safe areas. Areas outside the V zone, units of the Coastal Barrier Resources System, and thirty year erosion zone, but not damaging other environmentally sensitive areas.

Transferable Development Rights (TDRs). A system in which government assigns rights to build a certain number of building units (apartments, houses, stores, etc.) to an area of land. When these rights are made transferable an owner of land that cannot use all or any of the development rights (perhaps because their use would damage the beach) can still realize economic gain by selling his development rights to the owner of another property who can use more rights than those presently assigned to his property.

This document is the result of the Second Skidaway Institute of Oceanography Conference on America's Eroding Shoreline. It follows the First Skidaway Institute of Oceanography Conference (1981), "Saving the American Beach: A Position Paper by Concerned Coastal Geologists". Both are available by writing:

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