Shoreline protection alternatives

The coastal shorelines and marine habitats of Alabama and Mississippi contain some of the most productive and diverse flora and fauna in the United States. Residential and commercial properties in the coastal region are located on beaches, bays, lagoons, peninsulas, tidal creeks and rivers.

In order to preserve and maintain the natural functions of these beautiful and ecologically valuable habitats, we as a society must change some of our developmental practices. This is especially true because of the intense growth that is occurring in the coastal region today.

It is vital that residents work to save pristine natural resources. Property owners can start by learning about more natural ways to control shoreline erosion to preserve salt marshes, submerged aquatic vegetation, wetlands and beaches that buffer the land during storm events and help control water quality.

Coastal homeowners need to understand that shorelines have been naturally changing over time as a result of the geologic processes that have controlled erosion and sedimentation for millions of years. These processes are governed by climate, geology, ocean currents, water-body depths and wind.

Efforts to try to prevent or reduce coastal erosion comes at a cost to property owners and the coastal ecosystem.

Another problem is that the stabilization structure likely will not provide lifelong success unless people can understand the big picture of the geology and topography of the coast and the many variables that shape the coastline. Unfortunately, even with an understanding of the many factors that control coastal erosion, only so much can be done, especially when storm events occur.

NOAA Ocean and Coastal Resource Management

Rock sill with marsh restoration is a living shoreline hybrid structure.

If property is located where erosion is occurring, it must be protected from erosion. The current trend in Alabama and Mississippi is to build seawalls or bulkheads to protect coastal properties. In Mobile Bay alone, more than 30 percent of the property owners have built some sort of hard structure for shoreline protection (Douglass and Pickel, 1999).

The current prediction is that within the next 5 to 10 years, 50 percent of the bay will have some type of hard structural protection.

With the declining fisheries in the Gulf of Mexico already occurring because of water pollution, loss of habitat and overfishing, residents need to take pride in the remaining coastal property and try to develop it in a more environmentally sustainable way.

Not only do hard structures reduce habitat through loss of the land and water interface, they reflect waves to areas that are not protected and scour the land underneath the seawall making the water body deeper and the edge steeper (Douglass and Pickel, 1999).

Property owners need to be aware there are other structural alternatives that can address erosion that might be more economical, aesthetically pleasing and environmentally sound.

Seawalls could be the best alternative in a medium- to high-erosional setting, but in lower erosional environments, other soft or non-structural stabilization alternatives could be the most economical choice.

Hybrid structures may be a good choice in medium wave environments. These structures combine vegetative planting and hard structural control, such as rock sills or breakwaters.

A non-structural alternative, such as a living shoreline created from vegetative plantings or a combination of seagrasses and a rock sill, also can be a very viable means of erosion control.

EROSION AND SHORELINES

What is erosion?

Erosion occurs when soil particles consisting of sand, silt and clay are moved from one place to another. Water currents, wind and wave action cause erosion.

What problems are linked to coastal erosion?

Erosion causes loss of residential and commercial property, reduction of storm buffering capacity, aquatic and terrestrial habitat loss, increased suspended solids and water quality degradation.

What factors create erosion?

Wind velocity, duration of wave energy, the fetch of the open water that generates waves, width and shape of beach, sediment type, boat wakes and storm-water runoff all create erosion.

What is a living shoreline?

A living shoreline uses living plant material, oyster shells, earthen material or a combination of natural structures with riprap or offshore breakwaters to protect property from erosion.

What are the benefits of living shorelines?

Living shorelines maintain natural coastal processes, create or preserve habitat, preserve access for aquatic and terrestrial organisms and maintain the land-to-water access for property owners. Living shorelines are an economical way to possibly facilitate sediment accumulation or formation of new land.

What erosion-control structures are available?

Vegetative cover, non-structural stabilization, riprap, offshore breakwaters, hybrid structures, groins and bulkheads help control erosion.

SHORELINE STABILIZATION STRUCTURES

This is a partial list of available shoreline stabilization structures:

Vegetative cover: Vegetative cover is the planting of native wetland plants, seagrasses and submerged aquatic plants. Vegetation holds soil in place with its roots, absorbs wave energy and filters water by collecting or storing sediment and absorbing pollutants. It creates a more natural habitat with water access.

NOAA Restoration Center

Natural shoreline preserves habitat.

Harrison County Soil and Water Conservation District

Dune grass planting protects against erosion.

Soft, non-structural stabilization: Some examples of soft, non-structural stabilization are beach nourishment, fringe marsh creation, coir logs, organic matting, erosion control blankets, geotubes, bioengineering and turbidity curtains. Non-structural alternatives create a natural buffer to protect shorelines from erosion by trapping sediment, which allows vegetation to grow. Vegetation helps create and preserve existing habitat. This type of stabilization should create shoreline habitat while allowing coastal processes to occur in an unconfined way.

Forida Sea Grant

This soft, non-structural stablization method uses natural vegetation, *Spartina alterniflora*.

Florida Sea Grant

Biologs help prevent erosion on beachfront property.

Shoreline revetment: Shoreline revetment uses rocks, coarse limestone, oyster shell, articulating concrete mats, gabions and other materials to protect the shoreline. This type of shore protection tends to lower the wave energy because it is constructed to meet a low-grade slope while using irregular-shaped stone or shell.

Mississippi-Alabama Sea Grant Consortium

Riprap creates a protective barrier.

Mississippi-Alabama Sea Grant Consortium

Riprap and plantings protect a shoreline.

Offshore breakwater: Breakwaters can be stone, concrete rubble, oyster shells, wave attenuation devices or headland breakwaters placed offshore. Oyster shells or coarse limestone followed by an application of juvenile oyster spat is an example of a living breakwater. Breakwaters buffer waves before they reach the shore, and sediments tend to settle in this zone to create a low-energy area with potential for marsh creation.

Mississippi-Alabama Sea Grant Consortium

Wave attenuation devices at Alonzo Landing, on Dauphin Island, Ala., tame wave energy before it reaches the shoreline.

S.L. Douglass

Breakwaters in the Brookley Headland Beach project in Mobile, Ala., are positioned in the direction of predominant wave action.

Hybrid structures: Marsh fringe with groins, marsh fringe with sills or rocks positioned parallel to shore, marsh fringe with breakwaters and beach nourishment with breakwaters are hybrid structures for shoreline protection. Hybrid structures are used to restore, protect and create shoreline habitat while maintaining natural sedimentation and water exchange.

Spencer Rogers/North Carolina Sea Grant

This wooden sill is designed to protect existing or newly planted wetland vegetation.

S.L. Douglass

A wooden breakwater with vegetative planting in Dog River, Mobile, Ala.

Groins: Groins are long, narrow walls or mounds of rock built perpendicular to the shoreline. They minimize transport of sand down a beachfront. Groins and jetties may accelerate or induce erosion problems on the adjacent shorelines. Areas downshore may be deprived of sediments, which may lead to scouring and erosion.

Project Oceanica, College of Charleston, oceanica.cofc.edu

Groins minimize transport of sand but may cause erosion on adjacent shorelines.

Mississippi-Alabama Sea Grant Consortium

Jetties are used to stabilize navigational channels and inlets.

TERMS

Breakwater: An offshore structure built parallel to the shore that protects land by reducing wave energy.

Bulkhead: A vertical shoreline stabilization structure that retains soil.

Gabion: A stone-filled wire mesh basket.

Groin: A long, narrow wall or mound of rock typically built perpendicular to the shore to interrupt longshore transport and to trap sand.

Headland breakwater: A series of breakwaters attached to a shoreline and angled in the direction of predominant wave approach.

Hybrid structure: A soil stabilization method that combines hardened structures and natural material, such as vegetative planting.

Longshore transport: Sediment transport down a beach caused by longshore currents and/or waves approaching obliquely to the shore.

Marsh fringe: Vegetation, such as *Spartina patens, Spartina alterniflora* or other grasses, growing on the edge of a water body.

Revetment: Shoreline armoring, typically made of large stone, graded riprap, concrete mats, timber, gabions and other materials, that hardens the slope face.

Riprap: Rocks placed on a shoreline to protect against erosion by absorbing wave energy.

Seawall: A vertical or near-vertical type of shoreline armoring characterized by a smooth surface. It retains soil and reflects wave energy.

Sill: A semi-continuous structure built to reduce wave action and preserve, enhance or create a marsh grass fringe for shore erosion control.

MORE INFORMATION

For more information about living shorelines, contact:

Chris Boyd
Mississippi State University
Coastal Research and
Extension Center
1815 Popps Ferry Road
Biloxi, MS 39532
(228) 546-1025
cboyd@ext.msstate.edu

Or go to these Internet sites:

- http://coastalmanagement.noaa.gov/initiatives/definitions.html
- http://www.habitat.noaa.gov/restorationtechniques/public/shoreline_tab1.cfm
- http://score.dnr.sc.gov/
- http://www.tampabaywatch.org

MASGP-07-026
This publication was supported by the National Sea Grant College Program of the U.S. Department of Commerce's National Oceanic and Atmospheric Administration under NOAA Grant NA06OAR4170078, the Mississippi-Alabama Sea Grant Consortium and Mississippi State University Coastal Research and Extension Center. The views expressed herein do not necessarily reflect the views of any of those organizations.

Bulkheads: Vertical walls built parallel to the shoreline are known as bulkheads. They are typically constructed of concrete, treated wood, steel, aluminum or PVC. Bulkheads or seawalls tend to alter or create a loss of natural habitat. These alterations affect water circulation patterns, increase suspended solids, create erosion and decrease the quantity of organic matter and biological organisms needed for the maintenance of wetlands. Erosion of adjacent areas may also occur because of reflection of wave energy.

Mississippi-Alabama Sea Grant Consortium

A timber bulkhead creates a loss of habitat.

Mississippi-Alabama Sea Grant Consortium

A bulkhead alters a shoreline.

SUMMARY

Property owners and developers need to make better decisions about the type of erosional structures they build on their property.

Erosional control contractors, consultants and engineers should provide their clients with structural alternatives to protect their property. Not only can living shorelines save money, they provide direct waterfront access, are habitat friendly and are aesthetically pleasing. Living shorelines also promote land creation.

If neighbors work together, they might exercise better bargaining powers with private contractors. Also, having a larger shoreline protection plan possibly can prevent more unintentional erosion in neighboring sites.

Before constructing any type of shoreline stabilization project, property owners must contact the state regulatory agency to apply for a construction permit.

In Alabama, contact the State Lands Division of the Alabama Department of Conservation and Natural Resources and the Alabama Department of Environmental Management.

In Mississippi, contact the Department of Marine Resources or the Commission of Marine Resources, depending on the location and nature of the activity.

Ask them for an application and information regarding the permitting process.

Property owners most likely will need to contact an engineer to perform a survey of their property to determine the type of structure that will be most suitable for erosion control.

REFERENCES

U.S. Army Corps of Engineers and University of Wisconsin. 2003. Living on the coast: Protecting investments in shore property on the Great Lakes. U. S. Army Corps of Engineers, Detroit District, Michigan.

Luscher, A. and C. Hollingsworth. 2005. "Shore erosion control the natural approach." Maryland Department of Natural Resources.

Herder, T. 2007. "Living Shorelines as Alternatives to Bulkheading/Shoreline Hardening." Alabama Current Connection 2(1).

Douglass, S.L. and B.H. Pickel. 1999. "The tide doesn't go out anymore – the effect of bulkheads on urban bay shorelines." Shore and Beach 67 (2&3):19-25.

National Research Council (NRC). 2007. Mitigating shore erosion along sheltered coasts. National Academies Press, Washington, D.C.