

Beaches and Shorelines : Assessment of Current Situation

Team Leader

Dr. Scott Douglass, Assistant Professor, Department of Civil Engineering, USA
sdouglass@usouthal.edu

Habitats to Consider

Beaches and dunes; Intertidal marshes and flats (including armored shorelines);

Issues to consider

Sand management, sea level rise, erosion, shorebird nesting habitat, fragmentation, habitat protection, public access, waterfront public facilities

Stresses on Ecosystem Services provided by Beaches and Shorelines

The below tables are the result of an exercise completed by 30 scientists/resource managers to evaluate the level of impact of thirteen stressors on the ecosystem services provided by Beaches and Dunes and Intertidal Marshes and Flats that represent the edge between upland and aquatic habitats. The rating scale was from 0-3 with 0 being no impact and 3 being severe impact. For the purposes of analysis the committee defined significant stress as any average value over 2.0. These values are highlighted in the table below. Beaches and Dunes values in the 1.7-1.8 range were highlighted to indicate potential for future stresses.

| Habitat | Eco-Service | Chemical Contamination | Dredging/Filling | Fire Suppression | Fragmentation | Invasive Species | Land Use Change | Nutrient Enrichment | Pathogens | Sedimentation | Sea Level Rise | Climate Variability | Freshwater Discharge | Resource Extraction |
|-------------------|---------------------------------------|------------------------|------------------|------------------|---------------|------------------|-----------------|---------------------|-----------|---------------|----------------|---------------------|----------------------|---------------------|
| Beaches and Dunes | Biodiversity | 1.5 | 1.5 | 0.4 | 2.3 | 1.9 | 2.5 | 0.8 | 1 | 1.1 | 1.7 | 1.6 | 0.8 | 1 |
| Beaches and Dunes | Carbon Sequestration | 0.6 | 0.9 | 0.3 | 1.2 | 0.5 | 1.7 | 0.4 | 0.2 | 0.9 | 1.2 | 0.9 | 0.5 | 0.6 |
| Beaches and Dunes | Fisheries habitat | 0.5 | 0.6 | 0 | 0.4 | 0.4 | 0.6 | 0.6 | 0.6 | 0.9 | 0.6 | 0.6 | 0.5 | 0.3 |
| Beaches and Dunes | Flood control | 0.3 | 1.4 | 0 | 1.4 | 0.4 | 1.8 | 0.5 | 0.4 | 1.1 | 1.3 | 0.9 | 0.5 | 0.5 |
| Beaches and Dunes | Groundwater replenishment | 0.8 | 0.5 | 0 | 0.9 | 0.4 | 1.2 | 0.5 | 0.3 | 0.7 | 0.9 | 0.6 | 0.8 | 0.7 |
| Beaches and Dunes | Nesting habitat for birds and turtles | 1.2 | 1.9 | 0.3 | 2.1 | 1.3 | 2.4 | 0.6 | 0.7 | 1.2 | 1.7 | 1.7 | 0.6 | 1 |
| Beaches and | Oyster production | 0.4 | 0.4 | 0 | 0.1 | 0.2 | 0.4 | 0.5 | 0.5 | 0.4 | 0.3 | 0.2 | 0.3 | 0.5 |

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|----------------------------|--|------------------------|------------------|------------------|---------------|------------------|-----------------|---------------------|-----------|---------------|----------------|---------------------|----------------------|---------------------|
| Dunes | | | | | | | | | | | | | | |
| Beaches and Dunes | Primary production | 0.9 | 0.9 | 0.2 | 1.1 | 0.8 | 1.6 | 0.5 | 0.3 | 0.6 | 1.1 | 1 | 0.3 | 0.6 |
| Beaches and Dunes | Sediment and nutrient retention and export | 0.4 | 1.4 | 0.1 | 1 | 0.7 | 1.8 | 0.7 | 0.1 | 1.5 | 1 | 0.7 | 0.4 | 0.7 |
| Beaches and Dunes | Storm buffer/hazard protection | 0.6 | 1.8 | 0.2 | 2 | 0.5 | 2.4 | 0.5 | 0.5 | 1.3 | 1.8 | 1.3 | 0.7 | 0.6 |
| Beaches and Dunes | Water quality enhancement | 1.1 | 1.4 | 0.1 | 1 | 0.5 | 1.6 | 1.1 | 0.9 | 1.1 | 0.8 | 0.7 | 0.8 | 0.6 |
| Beaches and Dunes | Wildlife habitat | 1.5 | 1.8 | 0.8 | 2.2 | 1.6 | 2.4 | 0.9 | 1 | 1.3 | 1.8 | 1.6 | 0.7 | 1.1 |
| Intertidal Marsh and Flats | Biodiversity | 1.7 | 2.4 | 0.7 | 2.2 | 1.8 | 2.3 | 1.6 | 1.1 | 2.3 | 2.3 | 1.5 | 1.8 | 1.2 |
| Intertidal Marsh and Flats | Carbon Sequestration | 1.1 | 1.8 | 0.6 | 1.7 | 1 | 2.3 | 1.5 | 0.7 | 1.9 | 1.9 | 1.4 | 1.1 | 0.7 |
| Intertidal Marsh and Flats | Fisheries habitat | 1.6 | 2.6 | 0.4 | 2 | 1.4 | 2.4 | 1.7 | 1.2 | 2.4 | 2.3 | 1.6 | 1.8 | 1.3 |
| Intertidal Marsh and Flats | Flood control | 0.9 | 1.9 | 0.6 | 1.7 | 0.9 | 2.4 | 0.8 | 0.5 | 1.7 | 1.9 | 1.4 | 1.6 | 0.9 |
| Intertidal Marsh and Flats | Groundwater replenishment | 0.8 | 1.1 | 0.1 | 1 | 0.6 | 1.5 | 0.9 | 0.6 | 1 | 1 | 1 | 1.2 | 0.8 |
| Intertidal Marsh and Flats | Nesting habitat for birds and turtles | 1.3 | 2.2 | 0.9 | 2 | 1.5 | 2.3 | 1.3 | 1 | 2 | 2.1 | 1.6 | 1.3 | 1.2 |
| Intertidal Marsh and Flats | Oyster production | 1.6 | 2.1 | 0.4 | 1.4 | 0.9 | 1.6 | 1.3 | 1.5 | 1.8 | 1.5 | 1.2 | 1.7 | 1.3 |
| Intertidal Marsh and Flats | Primary production | 1.2 | 2.1 | 0.7 | 1.6 | 1.1 | 2.2 | 1.7 | 0.8 | 2.3 | 2.1 | 1.6 | 1.6 | 1 |

| Habitat | Eco-Service | Chemical Contamination | Dredging/Filling | Fire Suppression | Fragmentation | Invasive Species | Land Use Change | Nutrient Enrichment | Pathogens | Sedimentation | Sea Level Rise | Climate Variability | Freshwater Discharge | Resource Extraction |
|----------------------------|--|------------------------|------------------|------------------|---------------|------------------|-----------------|---------------------|-----------|---------------|----------------|---------------------|----------------------|---------------------|
| Intertidal Marsh and Flats | Sediment and nutrient retention and export | 0.8 | 2.1 | 0.5 | 1.8 | 0.9 | 2.3 | 1.6 | 0.5 | 2.4 | 2.1 | 1.4 | 1.6 | 1 |
| Intertidal Marsh and Flats | Storm buffer/hazard protection | 0.7 | 2.1 | 0.5 | 1.9 | 0.9 | 2.3 | 0.7 | 0.6 | 2 | 2.2 | 1.4 | 1.4 | 1.1 |
| Intertidal Marsh and Flats | Water quality enhancement | 1.8 | 2.2 | 0.6 | 1.7 | 0.9 | 2.2 | 1.9 | 1.5 | 2.1 | 1.7 | 1.3 | 1.8 | 1.1 |
| Intertidal Marsh and Flats | Wildlife habitat | 1.4 | 2.4 | 0.8 | 2.1 | 1.5 | 2.2 | 1.6 | 1.2 | 2 | 2.2 | 1.6 | 1.6 | 1.1 |

Strengths

What is in place currently that supports the health/sustainability of this value?

Research, Monitoring, Management Plans

1. **Coastline inventory** – A scientific assessment of shoreline changes along the Alabama coastline over a 26 year period beginning in 1979.
<http://www.mobilebaynep.com/images/uploads/library/State-of-Mobile-Bay-Final.pdf> pp. 20
2. **Wave Basin** - University of South Alabama College of Engineering - A 20x30x3 foot custom built basin designed to make waves of any shape. It will be used to study waves and their effect on beaches and built infrastructures such as roads, bridges, and breakwaters.
<http://www.usouthal.edu/usacterec/wavebasin.html>
3. **Hydrodynamic modeling** - University of South Alabama Department of Civil Engineering's computer-based, numerical models of tides, waves, sediment transport, and morphology which explain the impact of natural (e.g., storms) and anthropogenic (e.g., dredging, nourishment, etc.) stressors on beaches and sand resources. Examples:
http://www.mobilebaynep.com/hydrodynamic_modeling/
http://www.mobilebaynep.com/images/uploads/library/CoastalProcesses_MonLouisIsland_DrBretW_ebb.pdf
4. **Coastal Alabama Living Shorelines** – Designed to educate public, state and federal regulatory agencies, and private contractors about the benefits of installing natural erosion control structures as an alternative to seawalls and bulkheads to protect private and public shoreline properties.
<http://masgc.org/pdf/masgp/11-042-07.pdf>
5. **Re-nourishment Program for Gulf Shores and Orange Beach** – A five segment project to dredge offshore water bottom and replace the 5.2 million cubic yards of beach compatible sand along a 16.5

mile stretch of gulf shoreline which has succumbed to severe erosion brought on by storms since 1995.

6. **Beach Erosion and Deposition on Dauphin Island** – This research focused on the recession/accretion/recession pattern on the eastern end of the state’s western-most barrier island in relation to accepted coastal engineering practices.
<http://www.jstor.org/discover/10.2307/4298218?uid=3739920&uid=2129&uid=2&uid=70&uid=4&uid=3739256&sid=21101381976897>
7. **Alabama Beach Bacteria Monitoring Program** – With more than two dozen sites, this program utilizes trained volunteers to test bacteria levels in and around Mobile Bay including the waters of the Gulf of Mexico from sites established in Gulf Shores, Ft. Morgan and Orange Beach. There are also sites along Mobile and Weeks Bay as well as some tributaries like Dog and Fowl Rivers and Cotton Bayou.
<http://adem.alabama.gov/programs/coastal/beachMonitoring.cnt>

Ecosystem Restoration, Protection, Conservation

1. **Regional Sediment Management Study, Gulf of Mexico Perdido Pass**- An evaluation of the ongoing practice and costs of annually moving hundreds of millions of tons of sediment to determine a more environmentally friendly and cost effective procedure.
http://water.epa.gov/type/oceb/oceandumping/dredgedmaterial/upload/5_1Parson.pdf
2. **Living Shorelines** – A program that uses living plant material, oyster shells, earthen material, or a combination of natural structures with riprap or offshore breakwaters to protect property from erosion. The result of wind, water, and wave action, erosion results in loss of residential and commercial property, reduction of storm buffering capacity, aquatic and terrestrial habitat loss, increased suspended solids and water quality degradation. <http://www.masgc.org/page.asp?id=235>
3. **100-1000 Restore Coastal Alabama** - This effort brings together both public and private entities to build 100 miles of oyster reefs along the state’s coastline which will assist in providing the conditions necessary to plant, support and promote more than 1000 acres of coastal marsh and seagrass. Not only will it help replenish needed habitat, but it will also help reduce wave energy, decrease erosion, stabilize sediments and decrease turbidity. <http://100-1000.org/>
4. **Bon Secour Wildlife Refuge** – Originally designed as a coastal dune ecosystem preservation project, it is now one of the largest pieces of undeveloped land on the Alabama Gulf coast. It is home to a number of threatened and endangered species which contributes to its designation as one of the 10 natural wonders of the state. <http://www.fws.gov/bonsecour/>
5. **Alabama Dune Restoration Project** - A collaborative effort from the members of the Coastal Alabama Dune Restoration Cooperative to restore natural resources damaged by the Deep Water Horizon Oil Spill response efforts. The initiative will utilize native dune plants and install dune fencing to assist 55 acres of primary dune habitat in and around the Gulf Shores, Orange Beach and Fort Morgan areas. <http://www.doi.gov/deepwaterhorizon/upload/AlabamaDuneRestorationF.pdf>
6. **Alabama Beach Mouse** -With loss of habitat being the primary reason for its decline, several previously cited efforts like coastal dune restoration and dedicated wildlife refuges are underway to restore and protect the ecosystems that support the health and well being of the endangered Alabama Beach Mouse http://www.wec.ufl.edu/faculty/olim/Reprints_Oli/Oli_et_al_2001_Mice_PVA.pdf

Federal, State, Local Regulations and Policies, Technical Training

1. **ADEM and ADCNR Coastal Permitting**- Projects having the potential to impact Alabama's coastal resources are subject to review pursuant to ADEM's Coastal Rules. These project include but are not limited to:
 - a. Construction on Gulf-fronting properties
 - b. Commercial and Residential Development on Properties Greater than 5 Acres
 - c. Projects Impacting Wetlands and/or Water Bottoms
 - d. Construction of new, or expansion of existing marinas
 - e. Installation of Groundwater Wells with a Capacity Greater than 50 gallons per minute (GPM)
 - f. Siting, Construction and Operation of Energy Facilities
 - g. Shoreline Stabilization Projects
 - h. Discharges to Coastal Waters

<http://adem.alabama.gov/programs/coastal/coastalPermitting.cnt>
2. **USACE Section 404 Fill Permits** <http://water.epa.gov/type/oceb/habitat/cwa404.cfm#how>
3. **USACE Nationwide Permits**
http://www.usace.army.mil/Portals/2/docs/civilworks/nwp/2012/NWP2012_sumtable_15feb2012.pdf
4. **Cities of Orange Beach and Gulf Shores** – In efforts to further protect their coastal environment, these Alabama beachfront cities have established their own regulations.
http://www.cityoforangebeach.com/pages/community_development.htm
<http://www.gulfshoresal.gov/building/index.html>

Volunteer programs, outreach, education

1. **Share the Beach** – Aimed at locating sea turtle nests before the eggs hatch and monitoring them until the reptiles successfully complete entry into the Gulf of Mexico.
<http://www.alabamaseaturtles.com/>
2. **Volunteer Field Observer (VFOB)** –Developed in response to the Deep Horizon Oil Spill as a means to document changes that may occur along Alabama shorelines as a result of the accident, the program uses volunteers to regularly assess estuarine shorelines. <http://saveourgulf.org/>
3. **Swim Guide** – Developed specifically for the “technical generation,” swim conditions in area waters are now instantly available by application on many digital devices.
<http://mobilebaykeeper.org/programs/swim-guide.html>
4. **Break the Grip of the Rip** –This coastal program is designed to educate people on the dangers of rip currents which kill more than 100 people every year. Swimmers also learn techniques on how to survive should they find themselves caught in a rip current. <http://www.masgc.org/page.asp?id=236>
5. **Climate Community of Practice** - The Climate Community of Practice brings together extension, outreach and education professionals and community official in the Gulf to learn how coastal communities can adapt to sea-level rise, precipitation changes and other climate-related issues.
<http://masgc.org/cop>
6. **Dauphin Island Sea Lab** – The State of Alabama’s premier marine science education and research facility. The DISL Estuarium, the only public coastal aquarium in the state, is also located on the campus on the east end of the barrier island. <http://www.disl.org/>

7. **Coastal Clean Up** – A part of the International Coastal Cleanup designed to not only remove but document every piece of litter (marine debris) found on a shoreline. In Alabama it is a project of ADCNR SLD and Alabama PALS just celebrating its 25th year, and now the largest volunteer event in the state. <http://www.alcoastalcleanup.com/>

Weaknesses/Threats

What stresses are currently putting negative pressure on the long-term viability of this value?

1. **Sea Level Rise**- The melting of ice sheets and glaciers is adding more water to oceans. Meanwhile, the ocean water is warming and expanding. Both phenomena are resulting in a continued trend of lost shoreline. <http://www.epa.gov/climatechange/science/indicators/oceans/sea-level.html>
2. **Dredge and disposal practices**- related to maintenance of the Mobile Ship Channel have resulted in extreme degradation to barrier islands. <https://www.usm.edu/gcrl/mec/docs/nosb/historical.changes.in.the.MS.AL.barrier.islands.pdf>
3. **Waterfront Development/land use changes** – While development is needed to keep a community viable, there has to be a balance reached between anthropogenic development and protection of the environment. It is estimated that by 2025 the coastal population of Alabama will increase nearly 90 percent. Pg. 5 and 6 <http://www.mobilebaynep.com/images/uploads/library/State-of-Mobile-Bay-Final.pdf>
4. **Increased intensity of storms** – As ocean temperatures rise, so does the intensity of hurricanes, according to many scientists. Regardless of the cause, stronger storms result in significant erosion of beaches, intertidal marshes and many coastal habitats. <http://www.gfdl.noaa.gov/global-warming-and-hurricanes>
5. **Marine debris** – Defined as any man-made object that has somehow found its way into a coastal or marine environment. Last year along Alabama coasts, volunteers removed some almost 1.5 million pounds of marine debris. This global problem affects the economy, environment, navigation, fishing, human health and safety. <http://marinedebris.noaa.gov/>
6. **Technological disasters** – Defined as any disaster partially or wholly caused by human error, intent or negligence resulting in significant injury or death. An example along the Gulf coast would be the Deep Water Horizon oil spill of 2010. <http://www.emdat.be/technological-disasters-trends>
7. **Current state regulations regarding shoreline armoring/bulkheading** of private and commercial property along Alabama bays, bayous and beaches. The effects of the common practice have resulted in the elimination of miles of estuarine beaches and intertidal habitat. <http://www.southalabama.edu/cesrp/Tide.htm>
8. **Lack of access** – As more development occurs along Alabama coastlines, access to water resources for the general public tends to diminish. <http://www.southalabama.edu/cesrp/albeach.htm>

Opportunities

Are there any opportunities to support the long term sustainability of this value?

1. **Coordinated re-nourishment program for Alabama beaches** – Sharing of successful practices mean congruency along miles of Alabama beachfront.

2. **Consistent shoreline monitoring** – This established program can be enhanced.
3. **Mobile Pass** - An opportunity exists to reestablish how the Mobile Ship Channel is maintained to better benefit the Mobile Bay estuary.