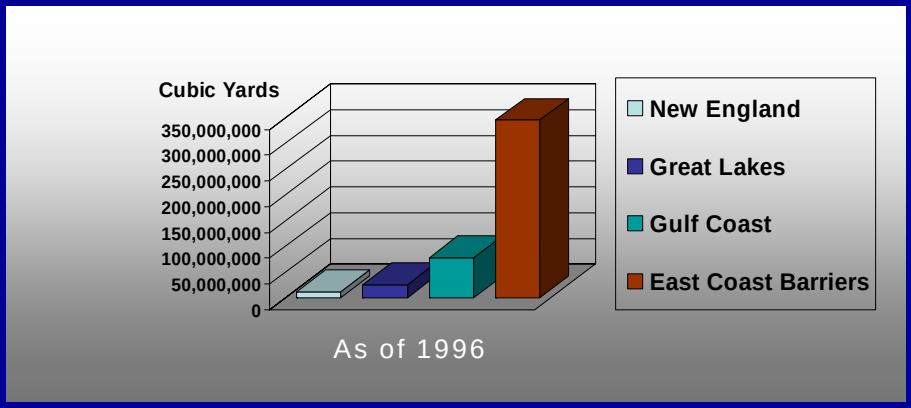
Beach Nourishment:

- Introduction of new sand to the beach by truck or dredge
- Large beach >1 million cubic yards (100,000 dump truck loads)
- Funding is a combination of federal, state, local & private
- Also called replenishment, beach dredge & fill and artificial beaches


1969
1989

US Beach Nourishment Experience:



As of 1996

The East Coast Beach Nourishment Experience:

	Episodes	Projects	Volume (mcy)	Cost (m)	'03 Adjusted Cost (m)
New York	81	28	146	$206	$524
New Jersey	136	46	98	$642	$890
Delaware	56	22	8	$21	$54
Maryland	8	2	17	$122	$162
Virginia	50	3	21	$139	$177
North Carolina	134	21	63	$149	$216
South Carolina	39	20	24	$79	$110
Georgia	9	2	8	$25	$39
Florida	167	51	101	$364	$535
TOTAL	**680**	**195**	**486**	**$1,747**	**$2,707**

Sand Sources:

Sand Quality

1. Ebb Tidal Delta
2. Flood Tidal Delta
3. Navigation Channel
4. Upland
5. Continental Shelf
6. Lagoon
7. Harbor Dredging

1=Best 7=Worst

Cost

1. Flood Tidal Delta
2. Ebb Tidal Delta
3. Navigation Channel
4. Lagoon
5. Harbor Dredging
6. Upland
7. Continental Shelf

1=Cheap 7=Expensive

Projects by Sand Source:

- Ebb Tidal Delta: **Ocean Isle Beach, NC**
- Ebb Tidal Delta w/ jetty: **Assateague Island, VA**
- Flood Tidal Delta: **Folly Beach, SC**
- Navigation Channel: **St. Augustine, FL**
- Upland: **Virginia Beach, VA**
- Continental Shelf: **Myrtle Beach, SC**
- Lagoon: **Figure 8 Island, NC**
- Harbor Dredging: **Bogue Banks, NC**

"Bad" Beaches (ecologically)

- Miami Beach, FL: **Quartz sand replaced by carbonate sand**
- Jacksonville, FL: **Shell Hash**
- Oak Island, NC: **Limestone cobbles**
- Bogue Banks, NC: **Mud**

Impact of the Loss of the Nearshore Ecosystem:

From meiofauna to mole crabs to birds to fish to turtles

Miami Beach

Miami Beach

Jacksonville Beach, FL


Oak Island, NC


Emerald Isle, NC
1/18/2003 4:05pm

The Ebb Tidal Delta Problem

- Best & Cheapest Sand
  - **Problem: On natural inlets, loss of sand leads to erosion on adjacent islands (Ocean Isle Beach, NC 2001)**
  - **On jettied inlets, this is a good source of sand (Wrightsville Beach, NC)**
  - **On very large ebb tidal deltas, such as off Jekyll Island, GA, taking sand from well offshore is OK**

“Successful” Beaches

- Virginia Beach, VA: **48 episodes**
- Wrightsville Beach, NC: **21episodes**
- Myrtle Beach, SC: **3 episodes**
- Tybee Island, GA: **5 episodes**
- Pompano Beach, FL: **4 episodes**
- Delray Beach, FL: **6 episodes**

Longevity Factors:

FLORIDA: Jupiter Island v. Miami Beach
NEW JERSEY: Ocean City v. Atlantic City

- Storm Intensity
- Storm Frequency
- Beach Density (volume/unit length)
- Beach length??
- Grain Size??
- Groins??
- Seawalls??
- Offshore Bathymetry??

How to Measure Beach Longevity:
(underwater sand doesn't count)

- Renourishment Interval
- Dry Beach Width
- Low Tide Beach Width
- Erosion Hot Spot Behavior

Federal Funding:

1. Storm Protection (most)
2. Navigation
3. Emergency
4. Mitigation
5. Erosion
6. Ecosystem restoration

* Categories 1-5 used to justify nourishment of Wrightsville Beach, NC

The Atlantic Beach Story...

Bogue Banks, NC

- Sediment Source**: Dredge spoil from harbor**
- Cost**: Free to community**
- Sampling: **Harbor rather than spoil site**
- Monitoring: **Corps agreed, in writing, to stop project if too muddy**
- The Beach: **Muddiest we have ever seen**

Atlantic Beach, NC (2005)

...The Atlantic Beach Story (Continued)...

- Action Taken: None
  - No state/federal agency voiced concerns
  - Corps did not stop because town did not object
- Lessons:
  - Agreements must be air tight
  - Don't rely on the Corps or anyone else
  - Must arrange mid-project stoppage

...The Atlantic Beach Story... ...Who was Responsible?

State
- Division of Coastal Management
- Coastal Resources Commission
- Division of Water Quality
- Division of Land Resources
- Division of Marine Fisheries
- Division of Water Resources
- Wildlife Resources Commission

Federal
- US Army Corps of Engineers
- National Marine Fisheries Service
- US Fish and Wildlife Service
- US EPA

Local
- Community
- County
- Residents

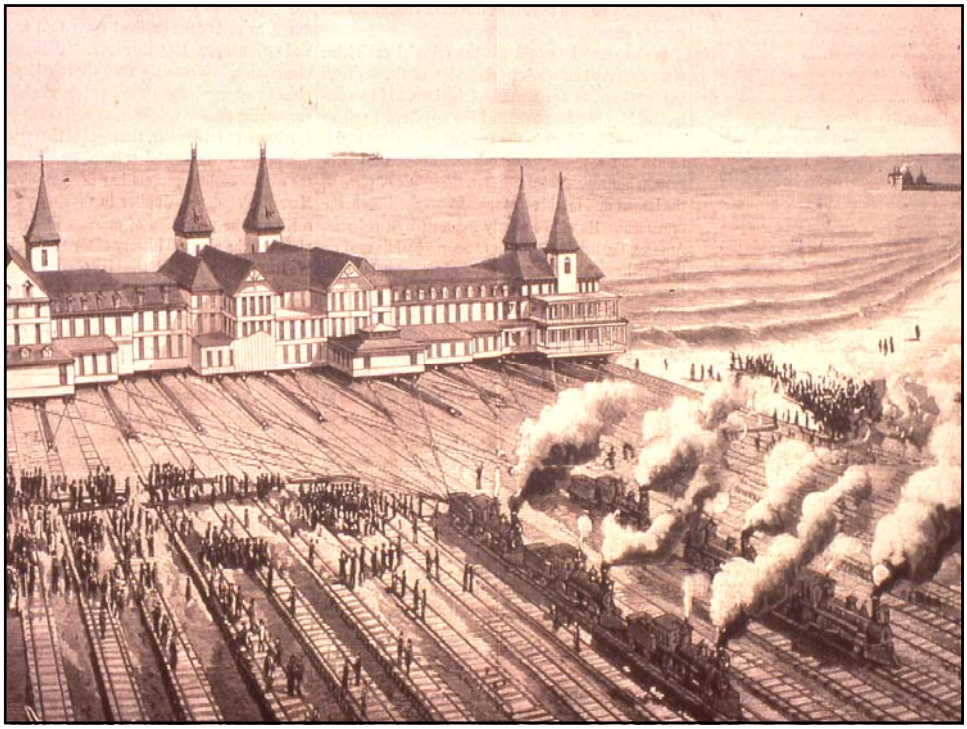
Future Estimated Decadal Beach Nourishment Costs

Location	Miles	Cost/mile	Life	10-Year Cost
New Jersey	110	$9,709,899	4	$2,670,222,325
North Carolina	160	$1,538,616	4	$615,446,524
South Carolina	105	$2,279,015	4	$598,241,529
Florida--Northeast	118	$1,986,734	5	$468,869,172
Florida--Southeast	167	$2,049,931	7	$489,054,924
Florida--Gulf Coast	145	$2,496,158	6	$603,238,224
Total	**805**			**$5,445,072,699**

- Miles = All developable miles. Excludes publicly-owned land and includes areas not yet developed.
- Cost/mile = Based on past 10 years
- Life = Life Span based on Pilkey/Dixon (*The Corps and the Shore*)

The Long View:

- Feds stepping out
- The more local the control the less the quality control. Local projects tend to be:
  - **1) on the cheap**
  - **2) poor quality**
- With rising sea level and increased human impact, costs will become too great leading to:
  - **Seawalls or Retreat**




This aerial was taken June 22, the sixth day after the move began. The inset, above right, was taken June 27, approaching midway on the move corridor, placing the lighthouse out of harm's way at 1,000 feet, eleven days into the move.
Thanks to relocation – At the first dawn of the twenty-first century the Cape Hatteras Light Station will look as it did in the last rays of sunset of the nineteenth century.

Research Needs:

Unfundable: A political "hot potato"
Needed: A nitty-gritty broad regional view

- Biological impacts
- Cumulative biological impacts of repeated episodes
- Factors that control beach longevity
- A look back at project cost:benefits
- A look back at project design models

Batik from "A Celebration of the World's Barrier Islands"

For More Information...

- **How to Read a North Carolina Beach**
  The Corps and the Shore
  A Celebration of the World's Barrier Islands
  Living with the Georgia Shore (also NC, SC, FL and 18 others)

http://www.nicholas.duke.edu/psds/docs.htm

An Analysis of Replenished Beach Design Parameters on U.S. East Coast Barrier Islands
Lynn Leonard, Tonya Clayton and Orrin Pilkey
Journal of Coastal Research, 6(1):15-36, Fort Lauderdale, Florida, Winter 1990

A Comparison of Beach Replenishment on the U.S. Atlantic, Pacific, and Gulf Coasts
Lynn A. Leonard, Katharine L. Dixon and Orrin H. PIlkey
Journal of Coastal Research, SI #6, 127-140, Fort Lauderdale, Florida, Summer 1990

Comparison of Beach Nourishment along the U.S. Atlantic, Great Lakes, Gulf of Mexico, and New England Shorelines
Arthur C. Trembanis, Orrin H. Pilkey, Hugo R. Valverde
Coastal Management, 27: 329-340, 1999

Summary of Beach Nourishment Episodes on the U.S. East Coast Barrier Islands
Hugo R. Valverde, Arthur C. Trembanis, and Orrin H. Pilkey
Journal of Coastal Research, 15(4):1100-1118, Royal Palm Beach, Florida, Fall 1999

Summary of the New England Beach Nourishment Experience (1935-1996)
Tonya C. Haddad and Orrin H. Pilkey
Journal of Coastal Research, 14(4):1395-1404, Royal Palm Beach, Florida, Fall 1998

Summary of Beach Nourishment Activity Along the Great Lakes' Shoreline 1955-1996
Michael K. O'Brien, Hugo R. Valverde, Arthur C. Trembanis, and Tanya C. Haddad
Journal of Coastal Research, 15(1):206-219, Royal Palm Beach, Florida, Winter 1999

Summary of Beach Nourishment along the U.S. Gulf of Mexico Shoreline
Arthur C. Trembanis and Orrin H. Pilkey
Journal of Coastal Research, 14(2):407-417, Royal Palm Beach, Florida, Spring 1998

Beach Replenishment Activities on U.S. Continental Pacific Coast
T.D. Clayton
Journal of Coastal Research, 7(2):1195-1210, Fort Lauderdale, Florida, Fall 1991

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