Coastal Ecosystems: Salt Marshes and Mangroves

Marine Biology
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Factors Driving Coastal Ecosystems

- Latitude
  - temperature
  - light, seasonality
- Tidal cycles
  - amplitude
  - frequency
- Wave energy
- Degree of riverine input
  - freshwater input
  - alluvial sediments and deposition
  - turbidity

Factors Driving Coastal Ecosystems (cont.)

- Geological characteristics
  - rock
  - sand
  - sediment
- Hydrological characteristics
  - nearshore currents
  - transport
- Continental proximity
  - nutrient input
  - anthropogenic impacts

Recap: Rocky Intertidal

- Our example (Pacific Northwest): high latitude, so
- Cold Pacific waters, strong seasonality
- Tidal cycle: high amplitude, semi-diurnal
- Wave energy high
- Freshwater input – riverine characteristics modified by bay / estuary
- Geology: rocky cliffs, interspersed w/sandy beach
- Hydrology: strong nearshore currents & transport
- Continental edge, input via interaction with terrestrial systems

Salt Marsh Ecosystems

- Our example (southeastern U.S.: Gulf and Atlantic coasts): moderate latitude, so
- "Warm" Atlantic and warmer Gulf and Gulf stream waters, moderated seasonality
- Tidal cycle: low amplitude
- Wave energy low
- Freshwater input often critical – deltaic riverine input can result in extensive marsh systems, abundant alluvial sediment input. Salt accumulation a challenge.
- Geology: long-term alluvial sediment accumulation
- Hydrology: nearshore currents & transport important
- Continental edge, nutrient input via runoff, rivers

Salt marsh and tidal channels in coastal Georgia

Plants of the Salt Marsh Community

- *Spartina alterniflora* – marsh cordgrass
  - height depends on riverine or tidal flushing
  - export of dried mats during winter storms
  - exclude salt from roots
- *Salicornia* – a succulent
  - Salt pans
- Fresher water and soils / higher ground: other grasses (*Spartina patens*), rushes (*Juncus romerianus*), sedges
- Zonation based on topography, inundation of freshwater, fresh/salt fluctuation, tidal flushing, relative stresses, anoxia of soils, latitudinal gradient (*e.g*., east coast U.S.).

Salt marsh replanted after a break in an oil pipeline

Animals of the Salt Marsh Community

- *Geukensia demissa* – dominant mussel
  - lives in sediment
  - physiological variation with tidal cycles
- *Crassostrea virginica* – oyster
  - dense beds in well-flushed tidal channels
- *Littorina irrorata* – salt marsh snails; pulmonates
- *Thais haemostoma* – oyster drill
- *Uca pugnax*, other *Uca* spp. – fiddler crabs
- *Sesarma cinereum* - marsh crabs

(These examples are particularly for south Louisiana and coastal Georgia; other species will occur elsewhere, filling slightly modified niches depending upon range, region, and local conditions.)

An herbivore in the salt marsh community

Salt Marsh Communities:

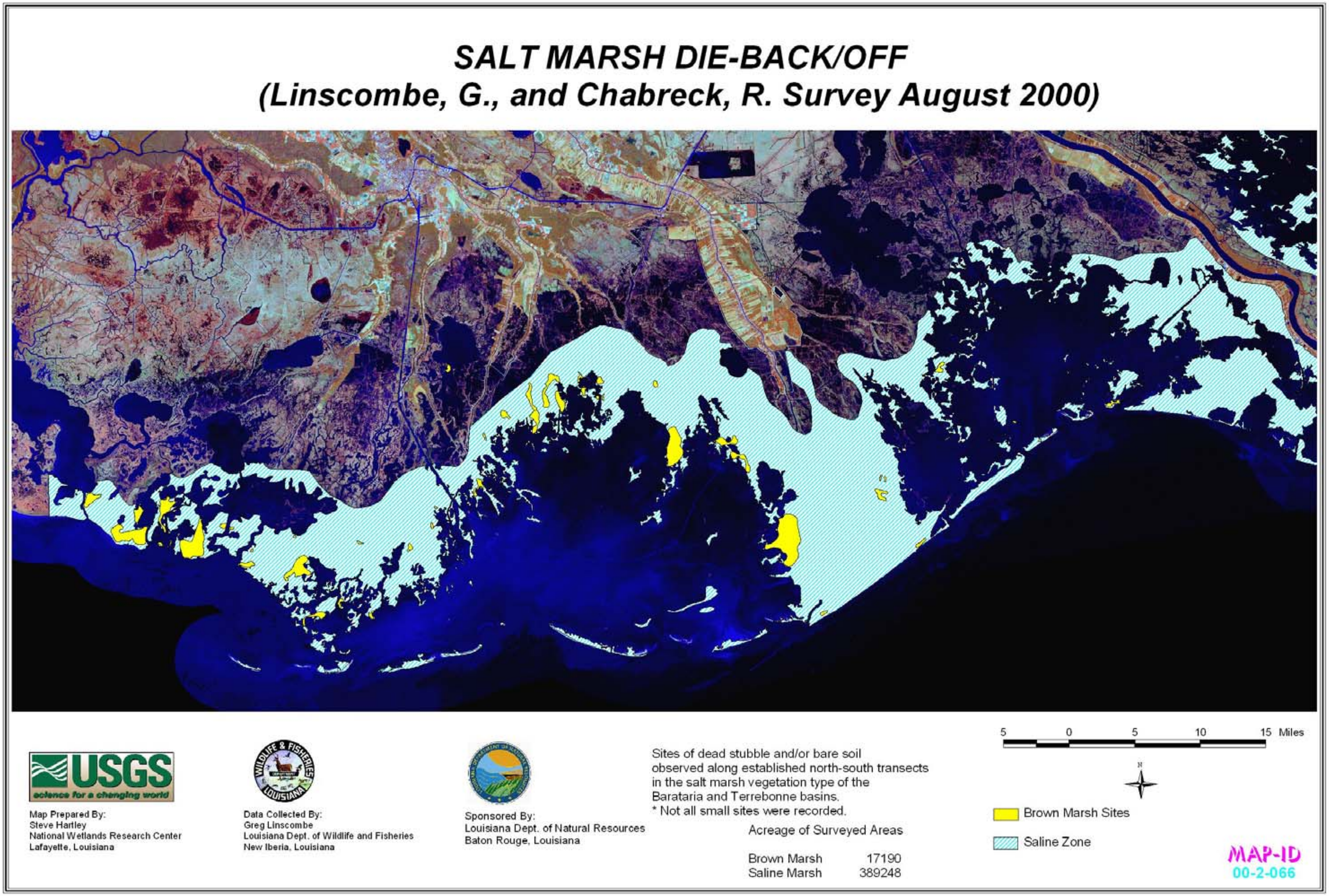
- Highly productive
- Very stressful
- Trap sediment
- Stabilize and extend coastlines, especially those with fluvial input
- Food webs detritus-based; herbivory may be more important than previously thought; “trophic relays” convey biomass to adjacent ecosystems
- Low diversity, high productivity

Wetlands Loss: Salt Marshes

- Coastal erosion and wetland loss due to channelization and levees along the Mississippi, dams on its tributaries, land settling from groundwater pumping and use, and channels cut through the marsh for offshore drilling platforms.

- Estimates of Louisiana coastal wetland loss for 1978-90 indicate a loss of about 35 square miles a year of freshwater and non-freshwater marshes and forested and scrub-shrub wetlands. From 1978-90, that equalled a 12-year loss of about 420 square miles, an area twice the size of the populated greater New Orleans area.

- http://www.lacoast.gov/news/press/1997-10-27.htm
- http://www.tulane.edu/~bfleury/envirobio/saltmarsh.html
- http://www.bonitanews.com/03/10/naples/e1631a.htm



Example of salt marsh decline in south Louisiana, http://www.brownmarsh.net

Mangrove Ecosystems

- Our example (south Florida): subtropical latitude, so
- “Warm” Atlantic and warmer Gulf and Gulf stream waters, limited seasonality (moving toward rainy/dry seasons)
- Tidal cycle: low amplitude
- Wave energy low
- Freshwater input important – can be sheetlike (Everglades) rather than distinctly riverine; alluvial sediment input. High tannins from leaf input.
- Geology: long-term alluvial and peat accumulation
- Hydrology: more inundated than salt marshes; nearshore currents & transport important
- Continental edge, nutrient input via runoff, rivers

Red mangroves, low tide, south Florida

Plants of the Mangrove Community

- *Rhizophora mangle* – red mangrove
  - – prop roots; extrudes salt
- *Avicennia germinans* – black mangrove
  - – pneumatophores; extends to coastal Louisiana where it, unusually, coexists w/ *Spartina*
- *Laguncularia racemosa* – white mangrove

- These have viviparous propagules
- Much higher diversity in the Indo-Pacific

Zonation and Distribution of mangroves is affected by flooding, salinity, temperature fluctuations (air/soil/water), and soil.

Animals of the Mangrove Community

- Prop roots of red mangroves provide substrate for benthic organisms (algae, sponges, hydroids, tunicates, bryozoans)
- Mangrove swamps provide critical protected nursery areas for fishes, crustaceans, and shellfish.
- Dense mangrove branches serve as rookeries for many coastal species of birds
- Organisms reared in mangrove swamps become food for fish (snook, snapper, tarpon, jack, sheepshead, red drum) oysters, and shrimp.

Prop root communities

Wetlands Loss: Mangrove Swamps

- Many acres of mangroves in south Florida have been lost to development and to anthropogenic changes in hydrology.
- Globally, many areas of mangroves are being cut for wood or converted to aquaculture or mariculture ponds (*e.g*., fish, shrimp, prawns for seafood restaurants).
- Concomitant declines in offshore fisheries can be expected and have been seen.

Mangrove swamp in Mexico

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