A planning framework for wetland beneficial use of dredge material through geochronology and marsh elevation modeling: Mobile Harbor, AL

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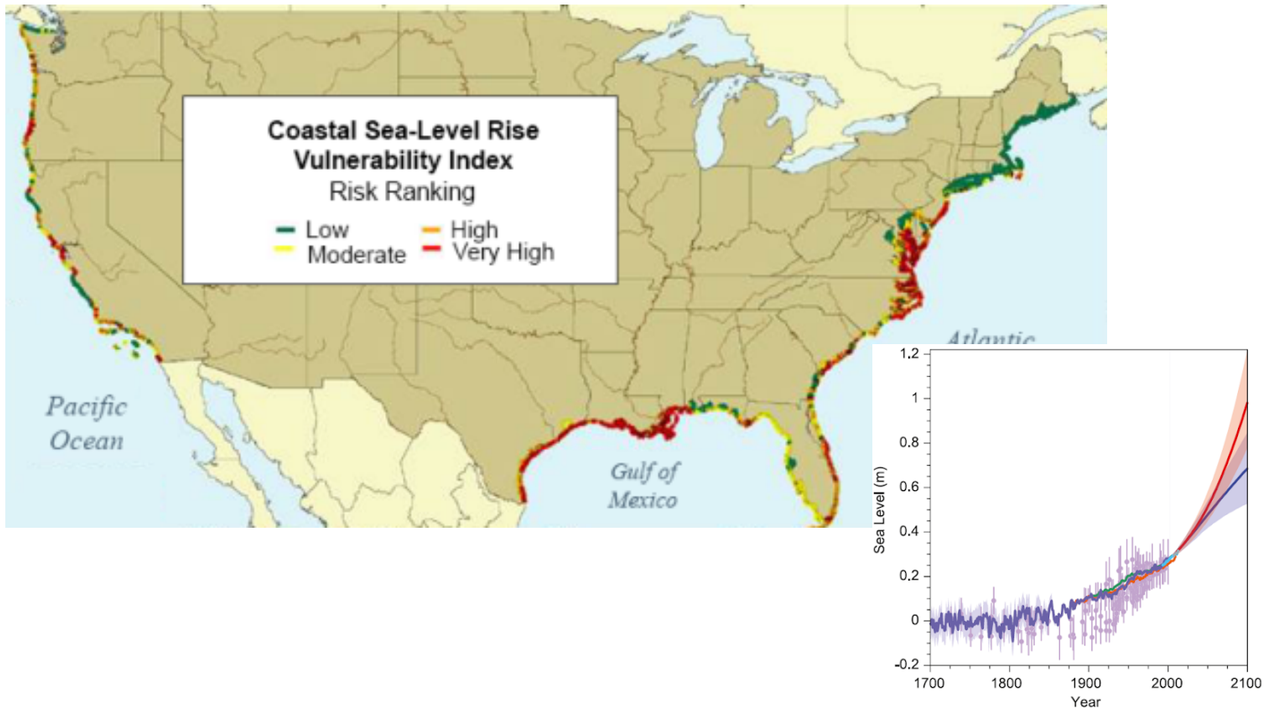
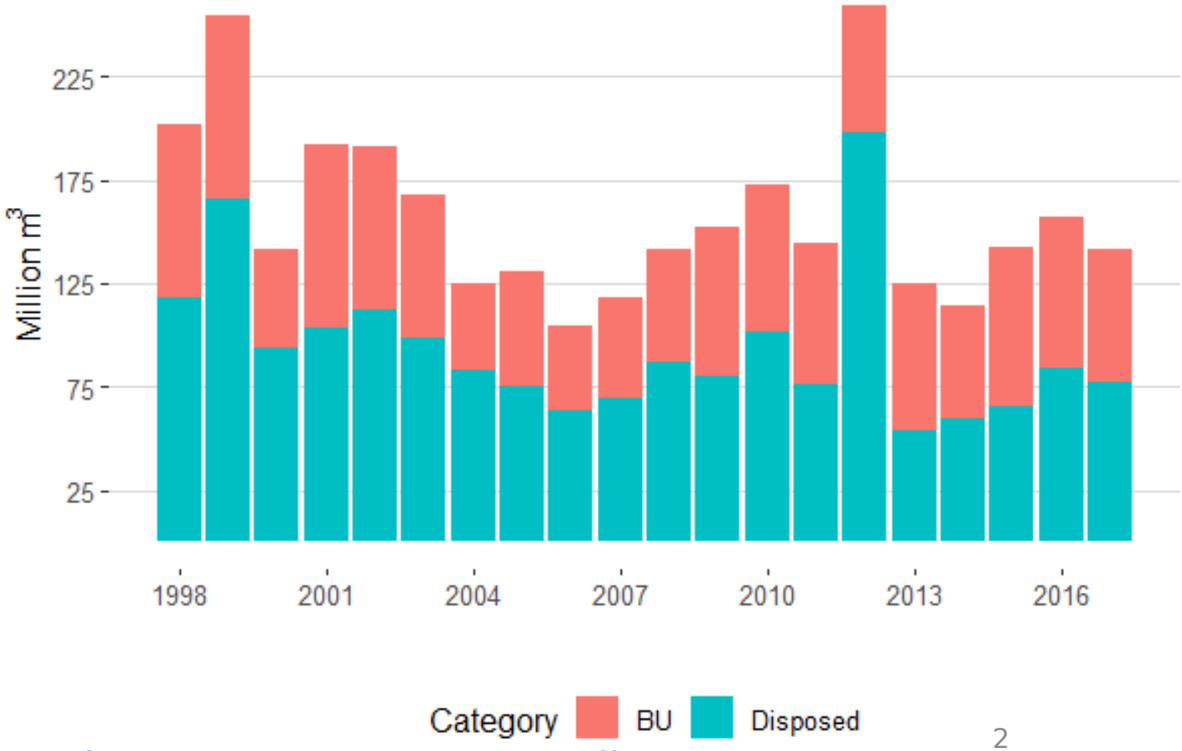
Don Mroczko, Elizabeth Godsey, Herbert Bullock, USACE SAM

Coastal vulnerability and dredging resources

- Projected sea level rise could lead to wetland loss
  - Wetlands provide ecosystem services
  - Sediment is a restoration need to improve resilience

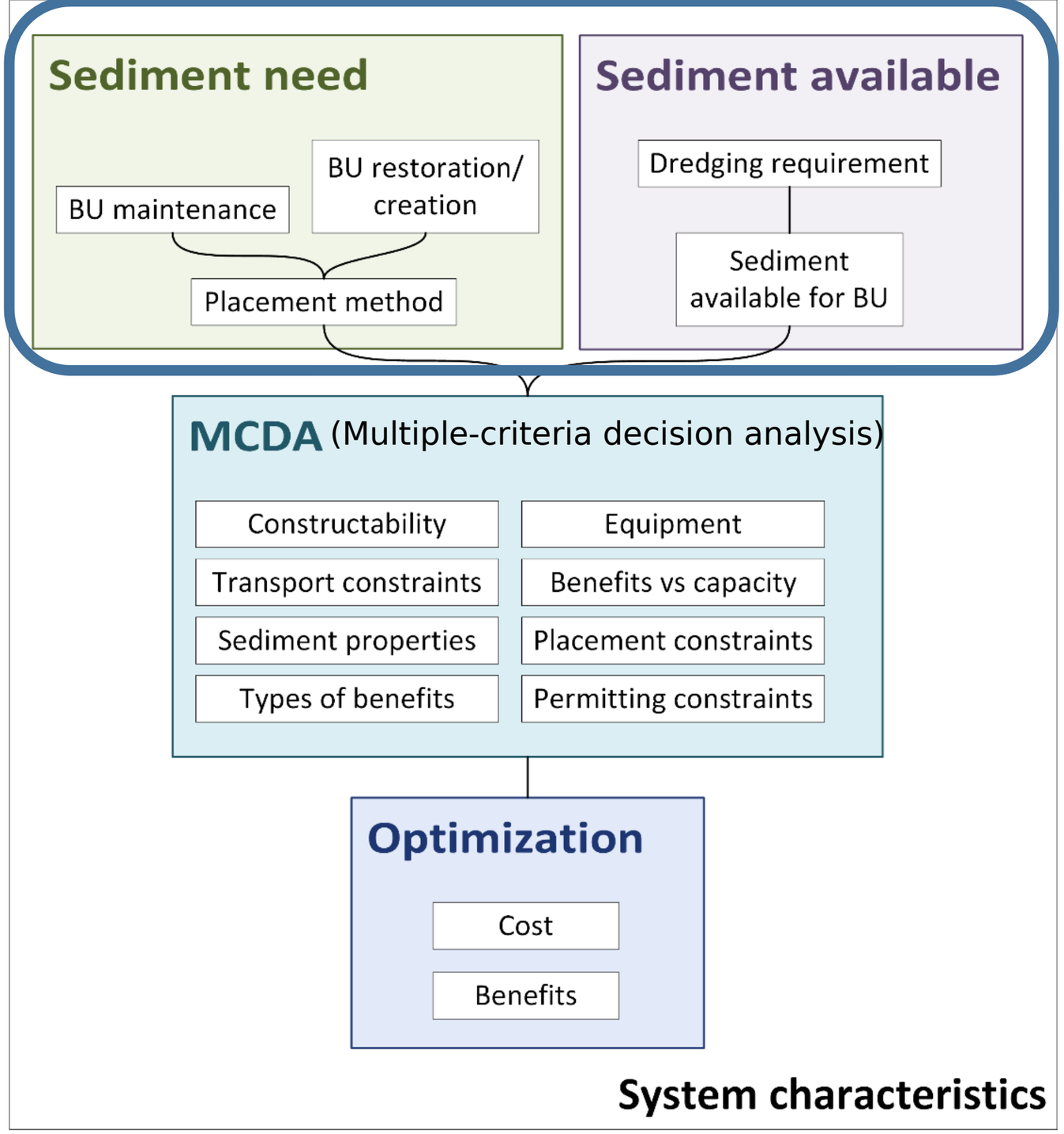


- Over 160 million cubic meters dredged annually
  - About 37% is used beneficially



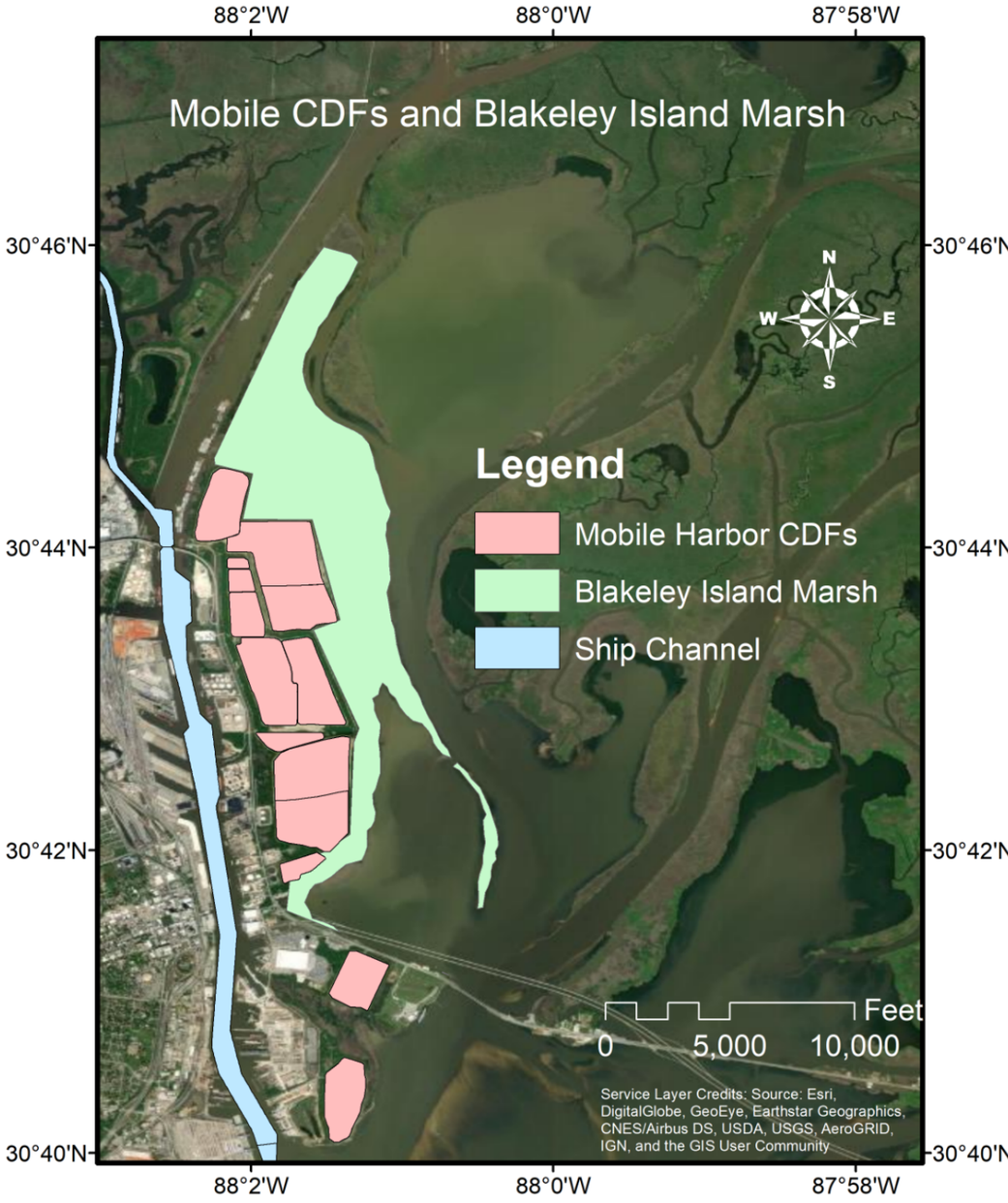
https://rsm.usace.army.mil/BUDB

Aligning needs



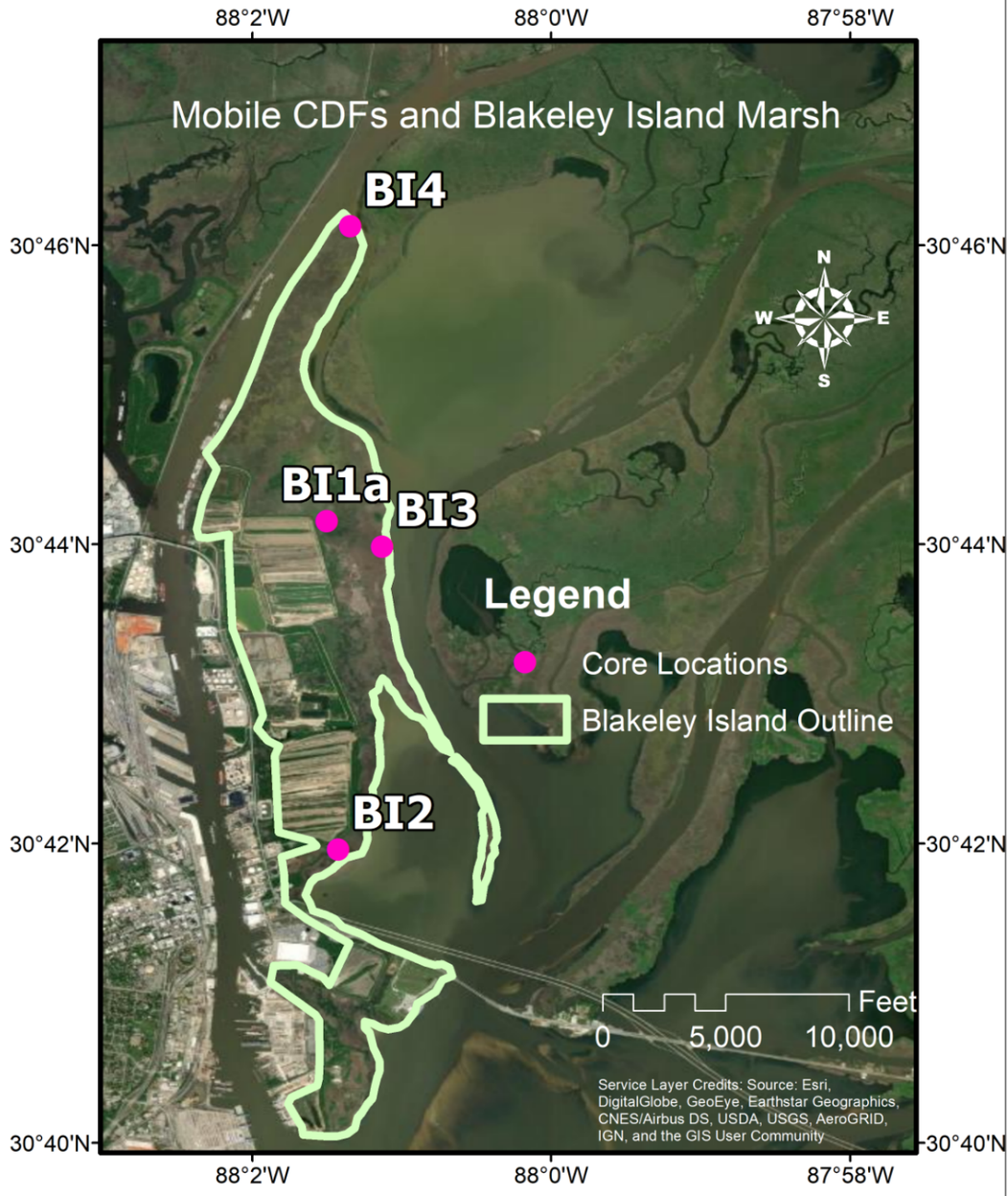
Case Study: Blakeley Island, Mobile Bay, AL

- Regular ship channel dredging
- Confined disposal facilities (CDFs) reaching capacity
- Vulnerable marsh



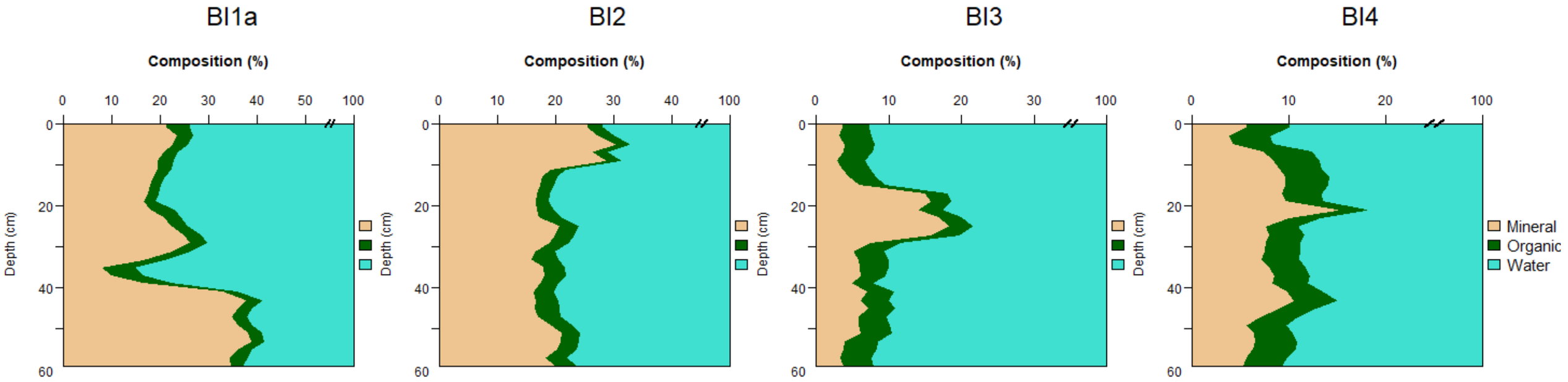
Assessing marsh conditions

- Examine sediment accretion
- Four soil cores collected among varying elevation and vegetation types (BI: Blakeley Island)



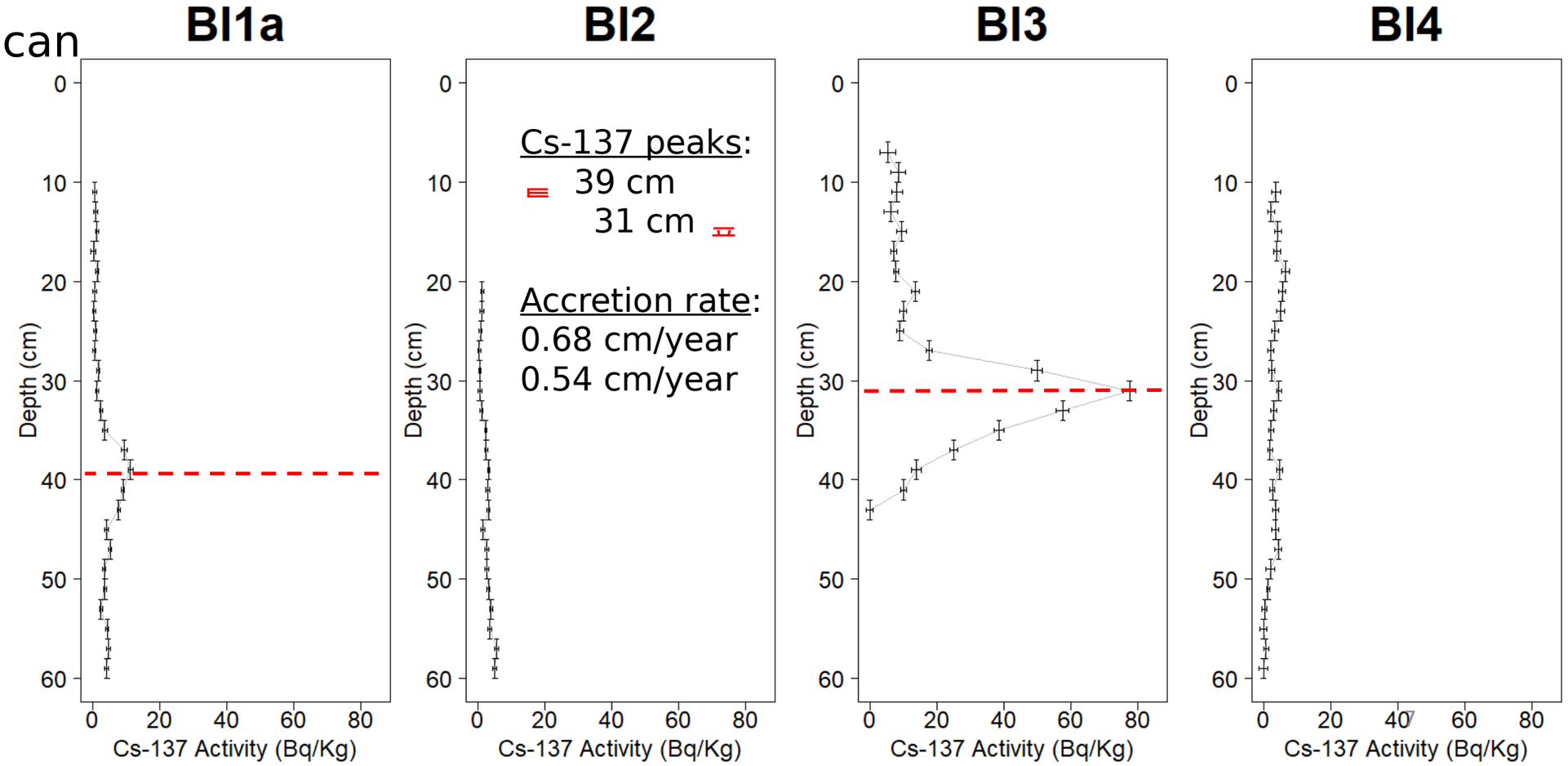
Assessing marsh conditions – soil composition

- Water content: 59% to 93%
- Of dried material:
  - Mineral content: 61% to 97%
  - Organic content: 3% to 39%



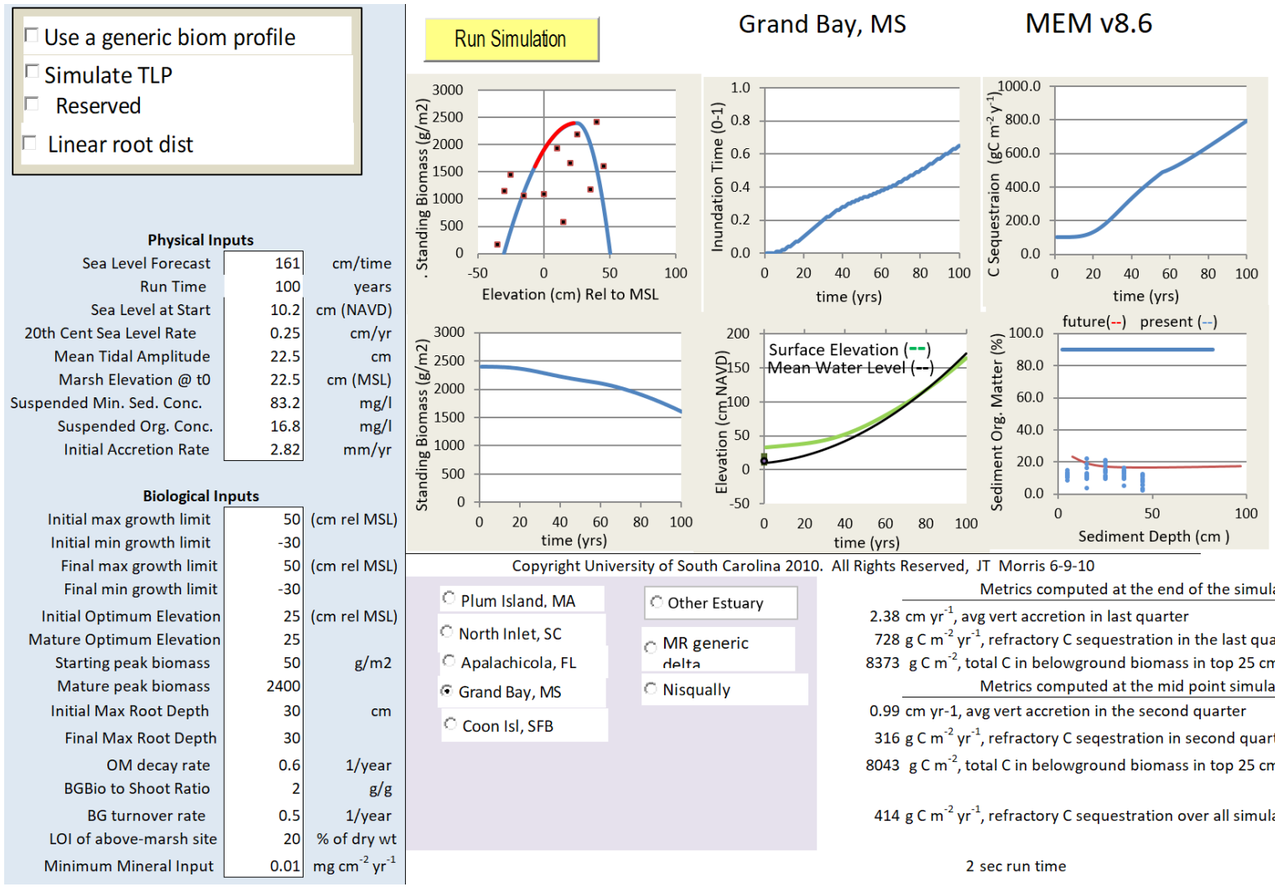
Assessing marsh conditions - Geochronology

- Sediment accretion rate can be examined through gamma spectroscopy
- Peak of Cs-137 can refer to 1963 horizon from nuclear testing



Marsh Equilibrium Model

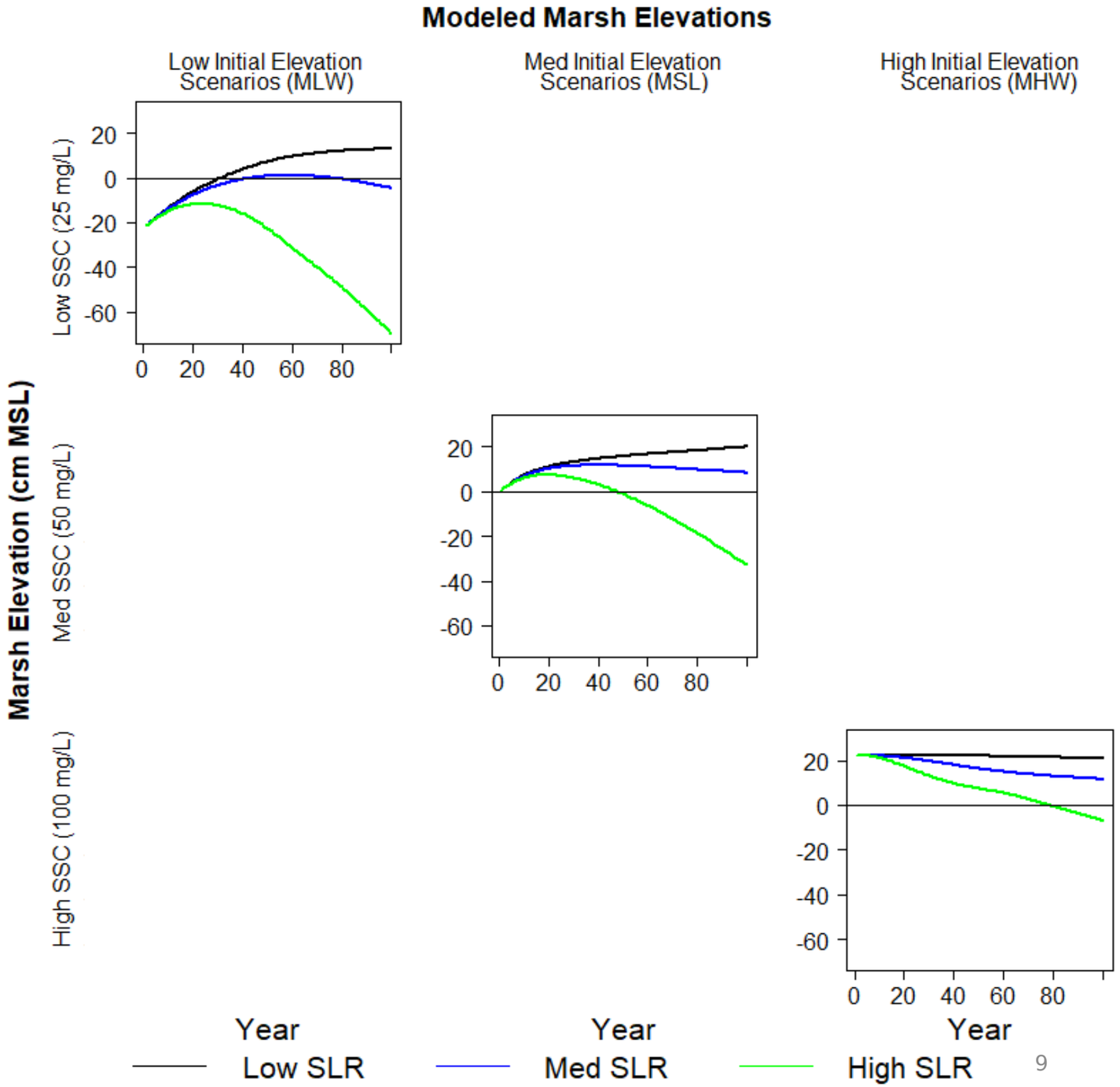
- 1-D numerical model to predict marsh elevation
- Exists in multiple formats (Excel, R, web tool)
- Simple to use and allows for sediment and ecological inputs
- Evaluates marsh elevation, soil composition, biomass, and organic content



Dr. Jim Morris, University of South Carolina
http://129.252.139.114/model/marsh/mem.asp

Model scenarios

- Range of:
  - Sea level rise (SLR)
  - Suspended sediment concentration (SSC)
  - Starting marsh elevation
- 27 total scenarios



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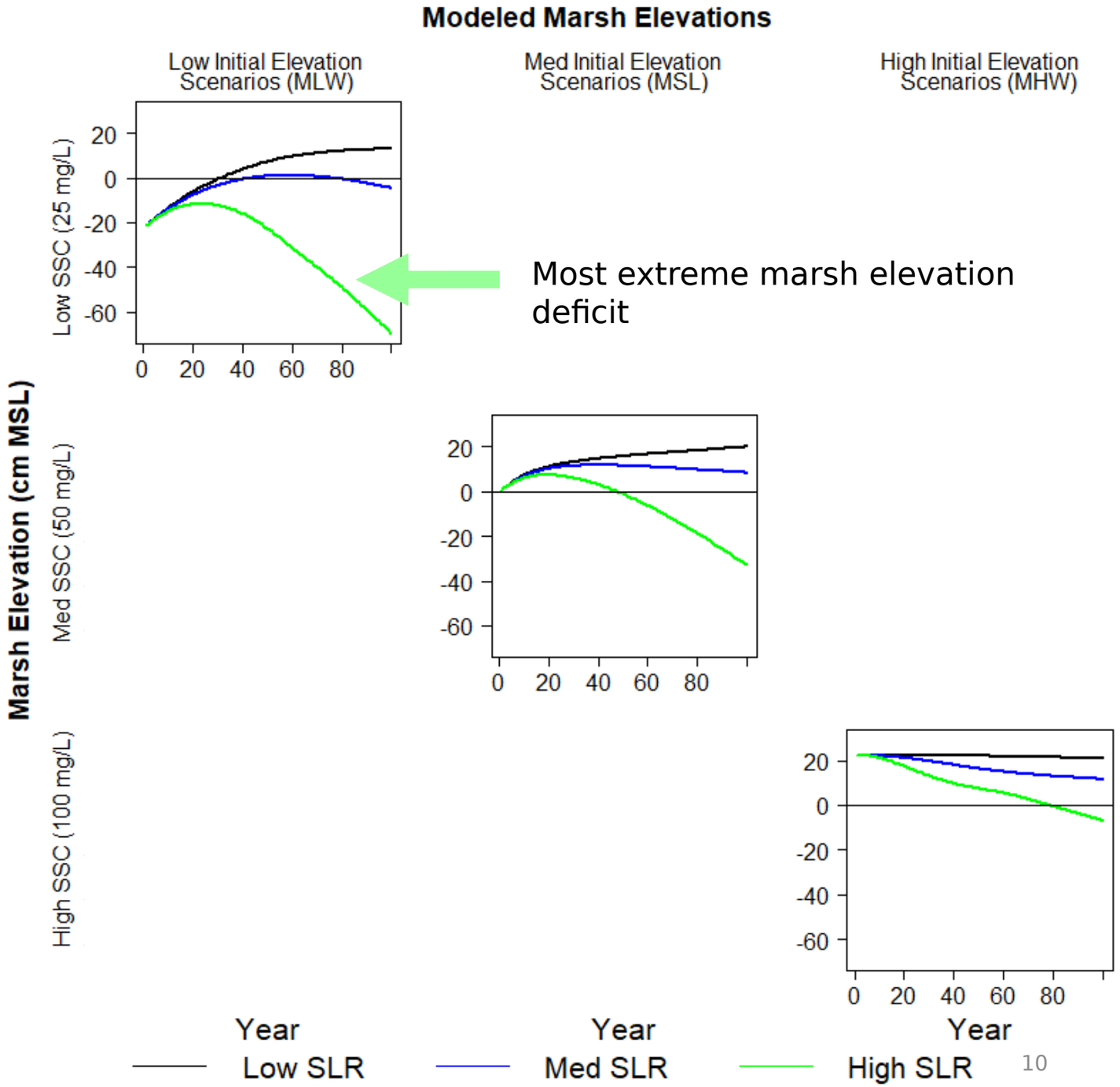
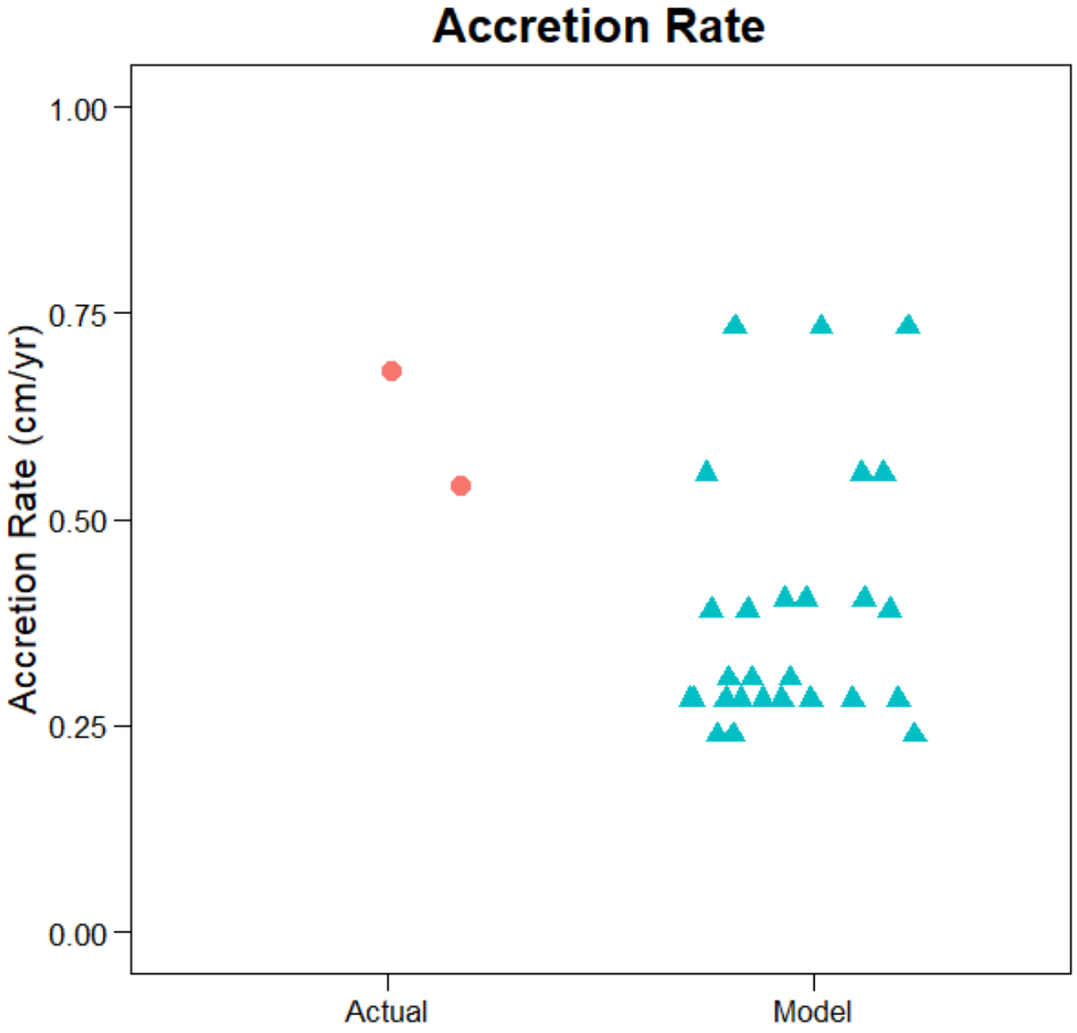


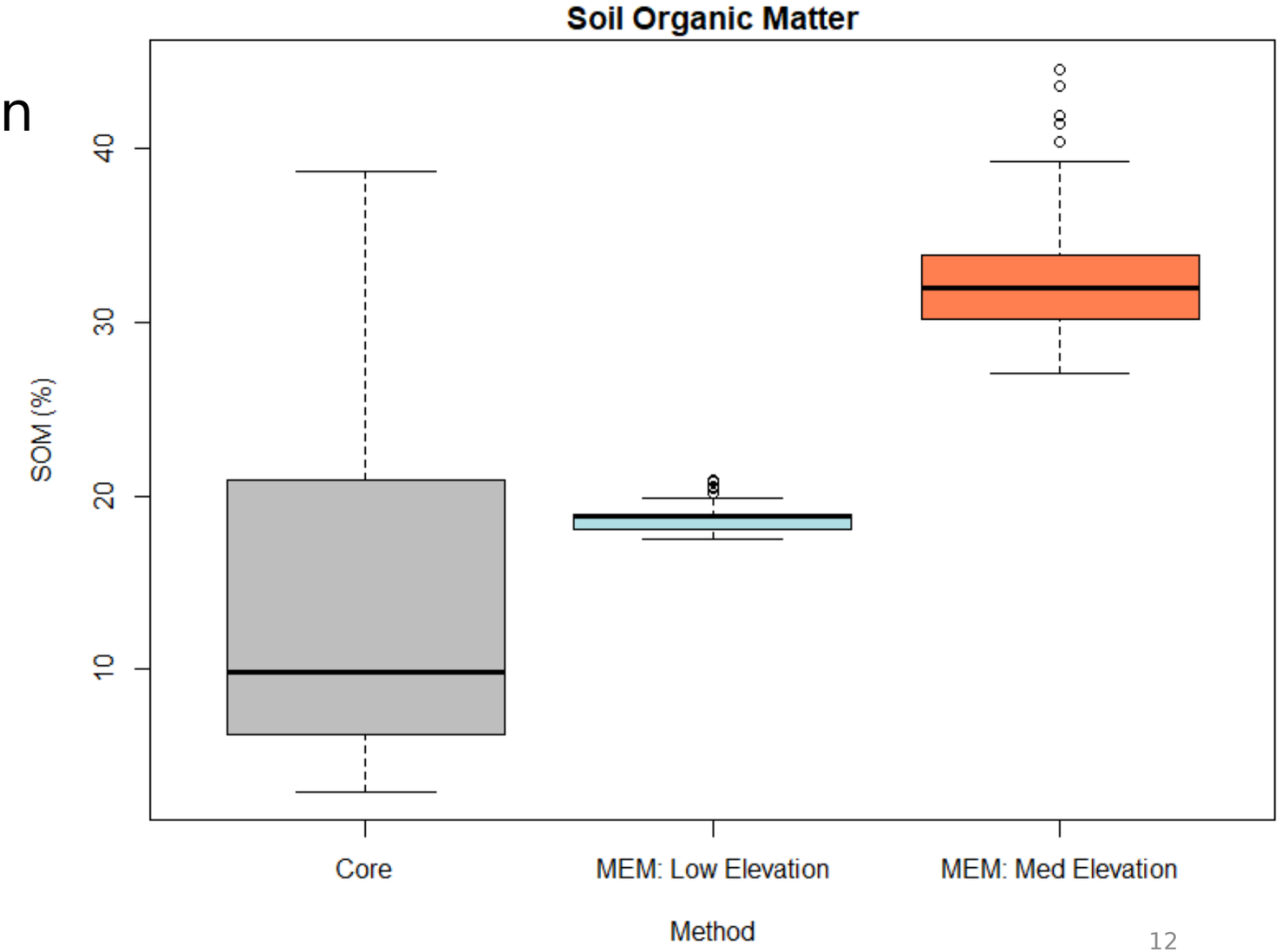
Model comparisons to field data



- Good agreement of accretion rate between measured (core) and model calculated (initial rate)

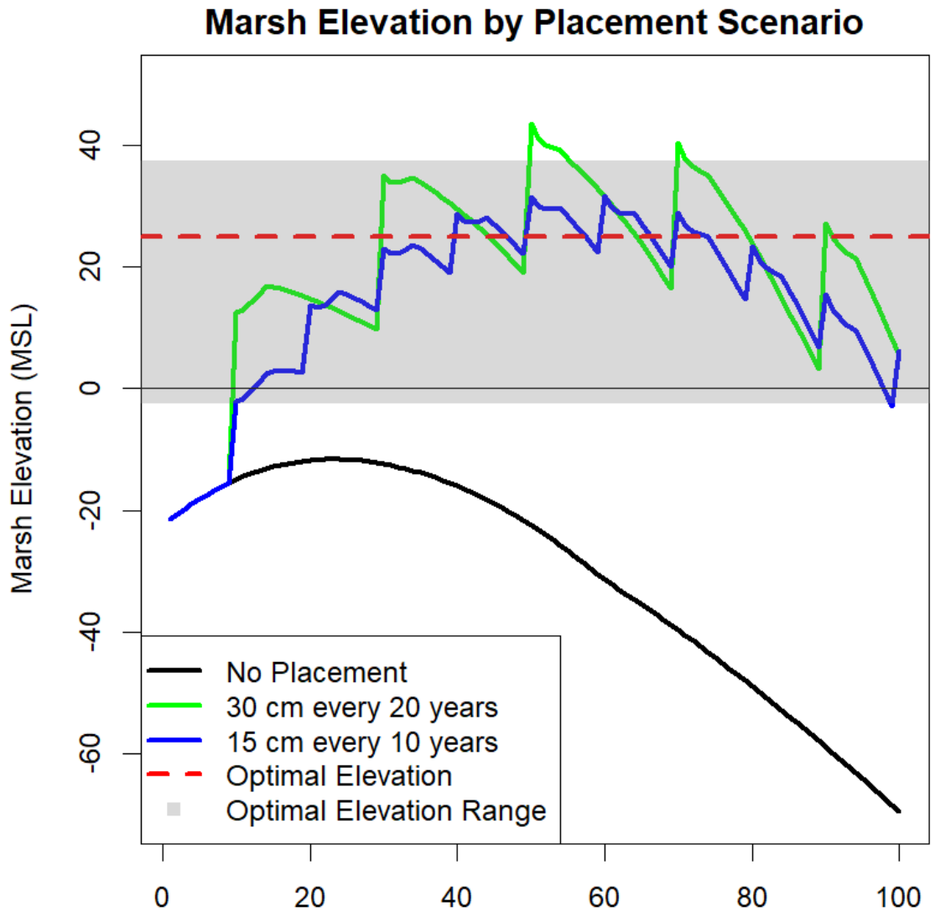
Model comparisons to field data

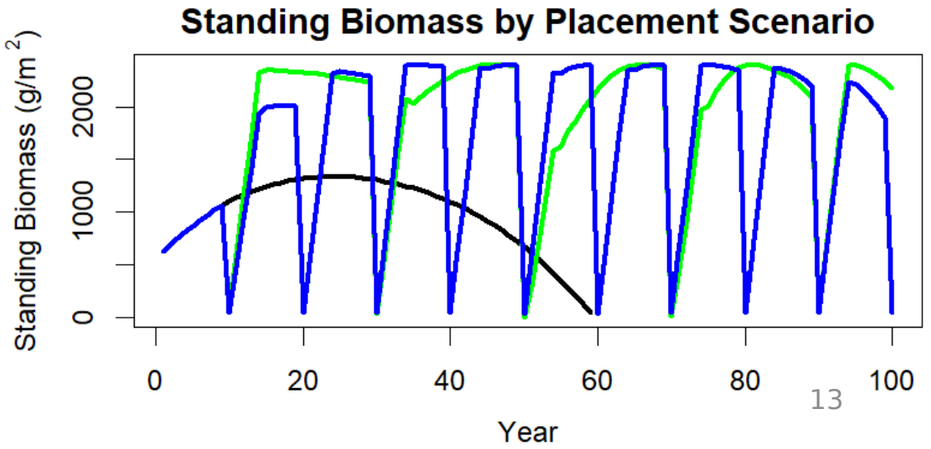
- Some agreement between core and modeled soil organic matter



Placement exercise

- Simulated two thin-layer placement scenarios on the most extreme scenario (high SLR, low SSC, MLW elevation):
  - 30 cm every 20 years
  - 15 cm every 10 years
- About 10.3 million cubic yards of material total





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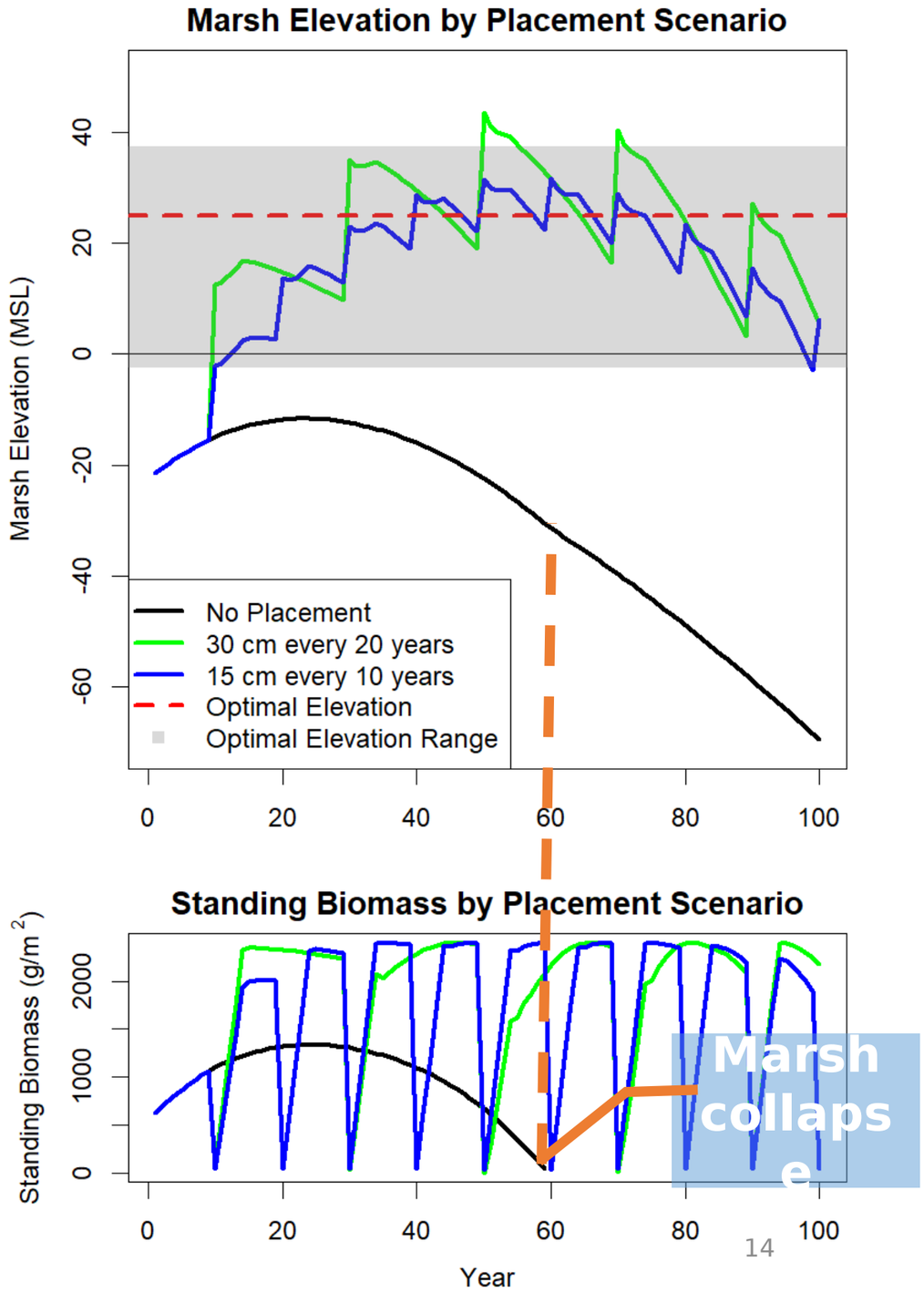
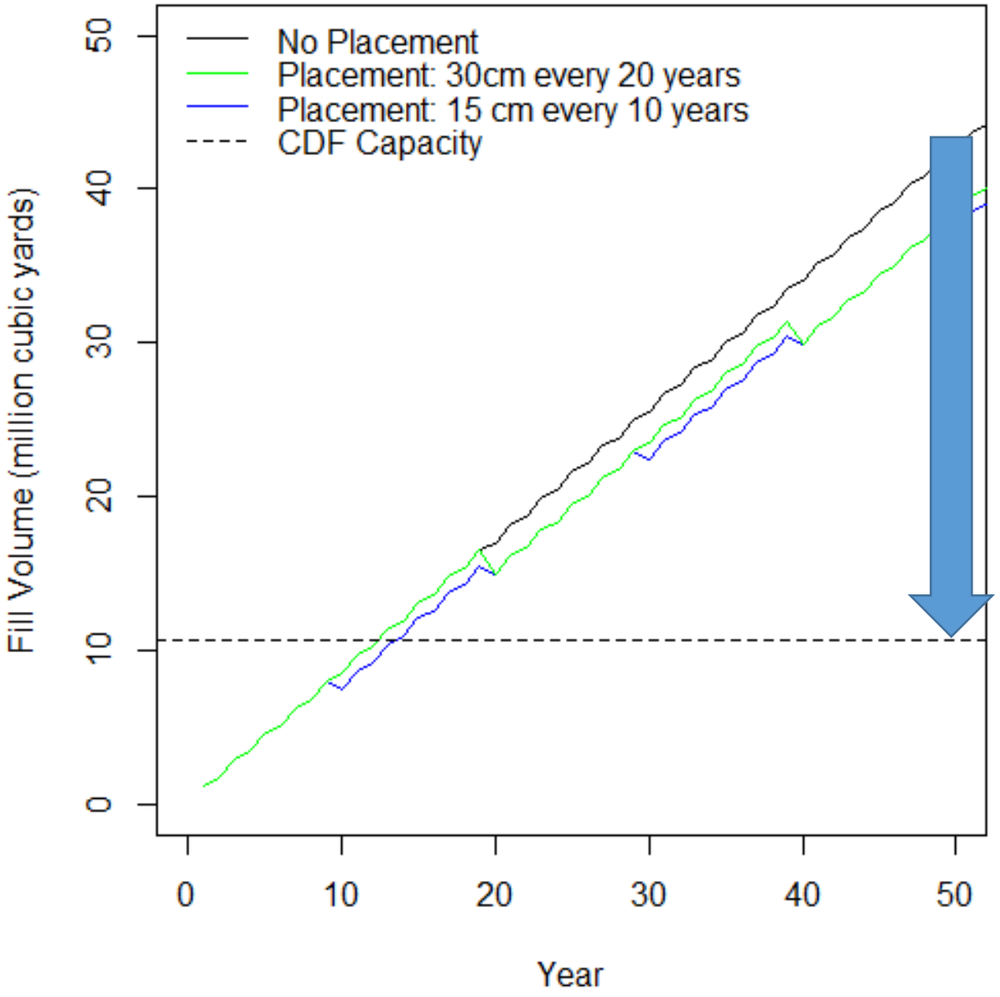


Confined disposal facility (CDF) capacity



- Beneficial use can reduce CDF fill and extend CDF lifespan, but placement at Blakeley Island provides little life extension
- Must expand the practice of BUDM
  - Similar placement on an additional 34 km^2 of marsh, about 6 times the area of Blakeley Island, extends the CDF lifespan about 40 years

Application

- Model predictions are dependent on the quality of data and operational constraints including:
  - Distance to site
  - Scheduling
  - Material/equipment
- Future plans for implementation to include a system-scale and adaptive management approach

Findings in case study

- Beneficial use of dredged material provides ecological and economic benefits
- Simple modeling exercise paired with field measurements can help understand restoration potential
- Many coastal systems have an excess of sediment resources to support beneficial use of dredged material
  - Capacity to conduct large amounts of restoration

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