

# Defining Coastal Marsh Restoration Success under Accelerated Sea- Level Rise Conditions

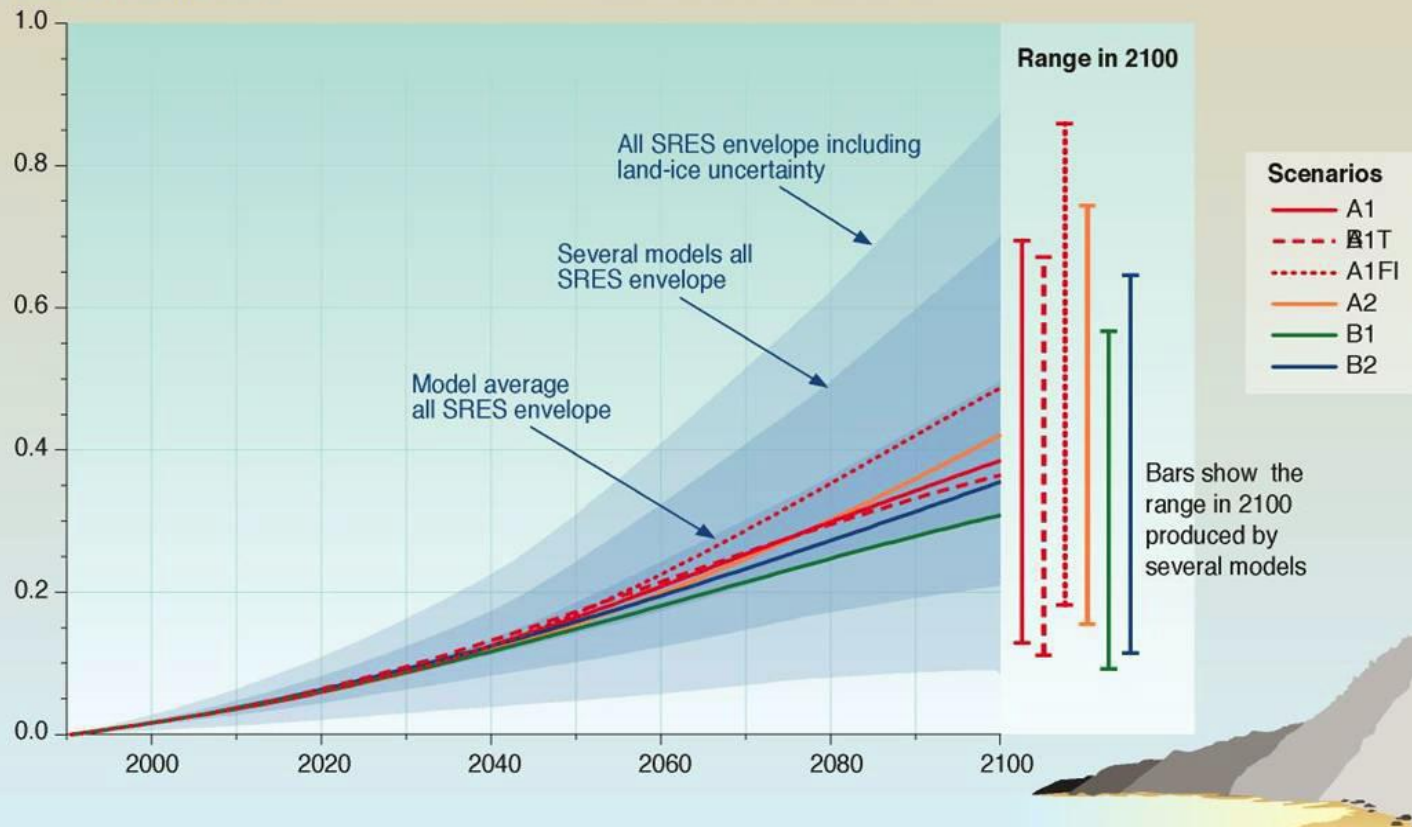
Cassandra Thomas





## Global average sea level rise (1990 - 2100) for the six SRES Scenarios

Sea level rise (metres)





## Sea-level Rise and Coastal Marsh Loss

- Sea level rise creates marsh loss because:
  - Greater inundation stresses plants
    - Higher salinity
    - Ramet recruitment failure
  - Higher energy causes erosion
    - Storm surge
  - No land available for migration
    - Development or agriculture
- Half of U.S. coastal marsh area lost since 1900
  - 1,900 squared miles lost in LA





## Marsh Restoration Approaches

- 1) Hydrologic restoration
  - Removes dikes, levees, or flood control structures from existing marsh
- 2) Ditch filling/plugging
  - Reduces high water flow through existing marsh
- 3) River Diversions
  - Marsh building through sedimentation
- 4) Berm, backfill, and plant
  - Creates new marsh platform

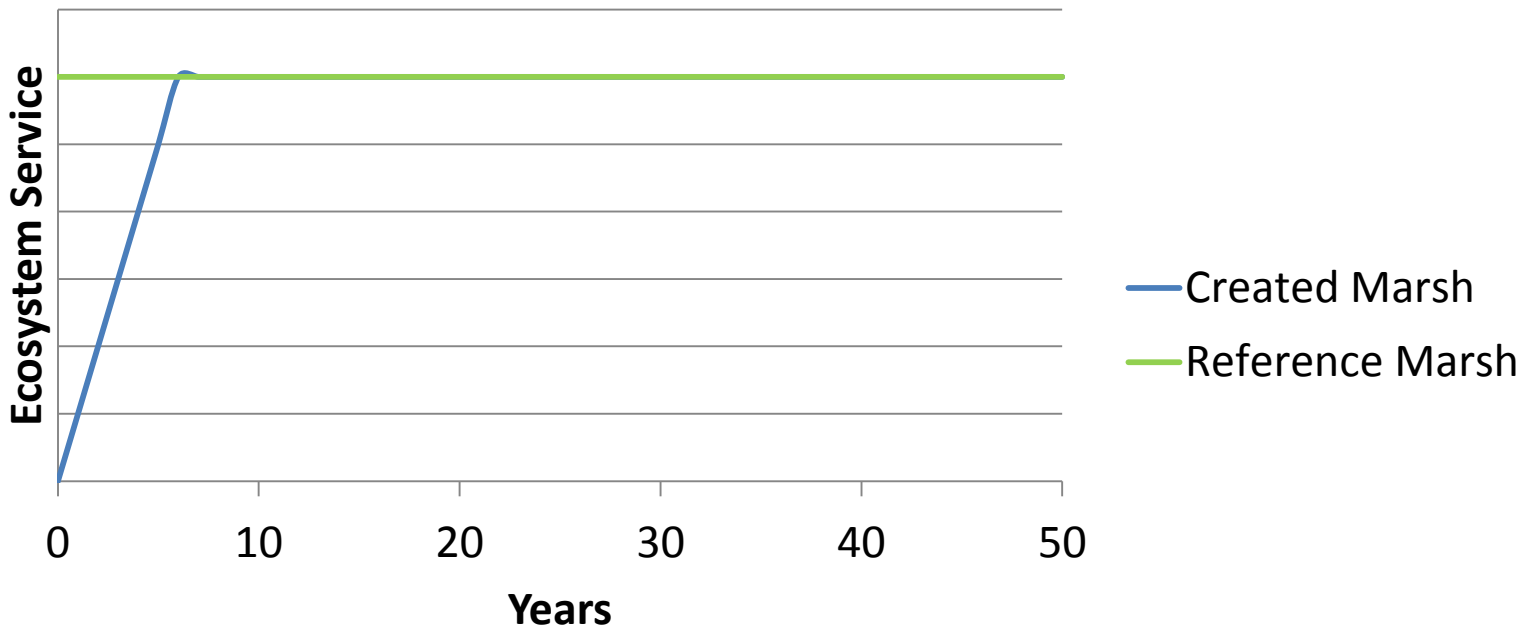


## Typical Restoration Success Criteria

- Comparison to “Reference” site(s)
- Structural Success Criteria
  - Vegetation % Cover
  - Vegetation species composition
  - Wildlife usage
- Monitoring
  - 5-10 year time frame
  - Annual/Bi-annual site visits

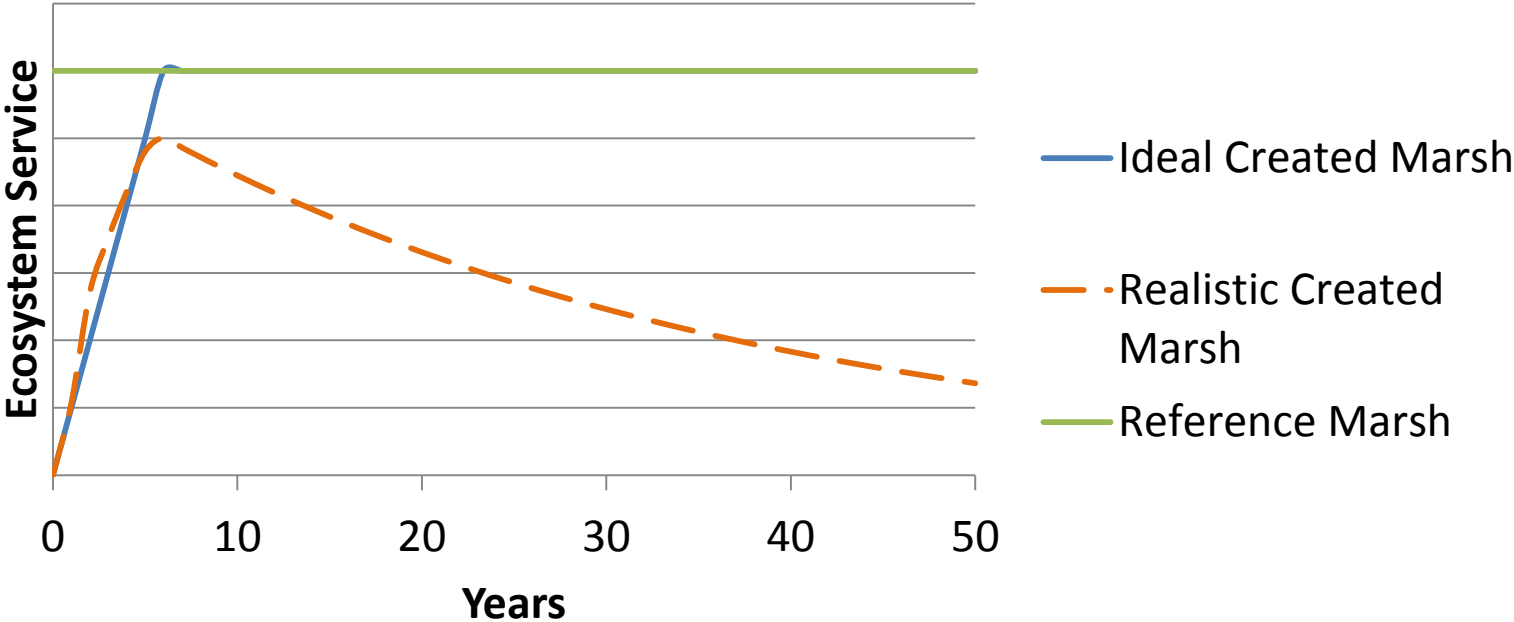


# Coastal Marsh Service with Time Typical Restoration Paradigm



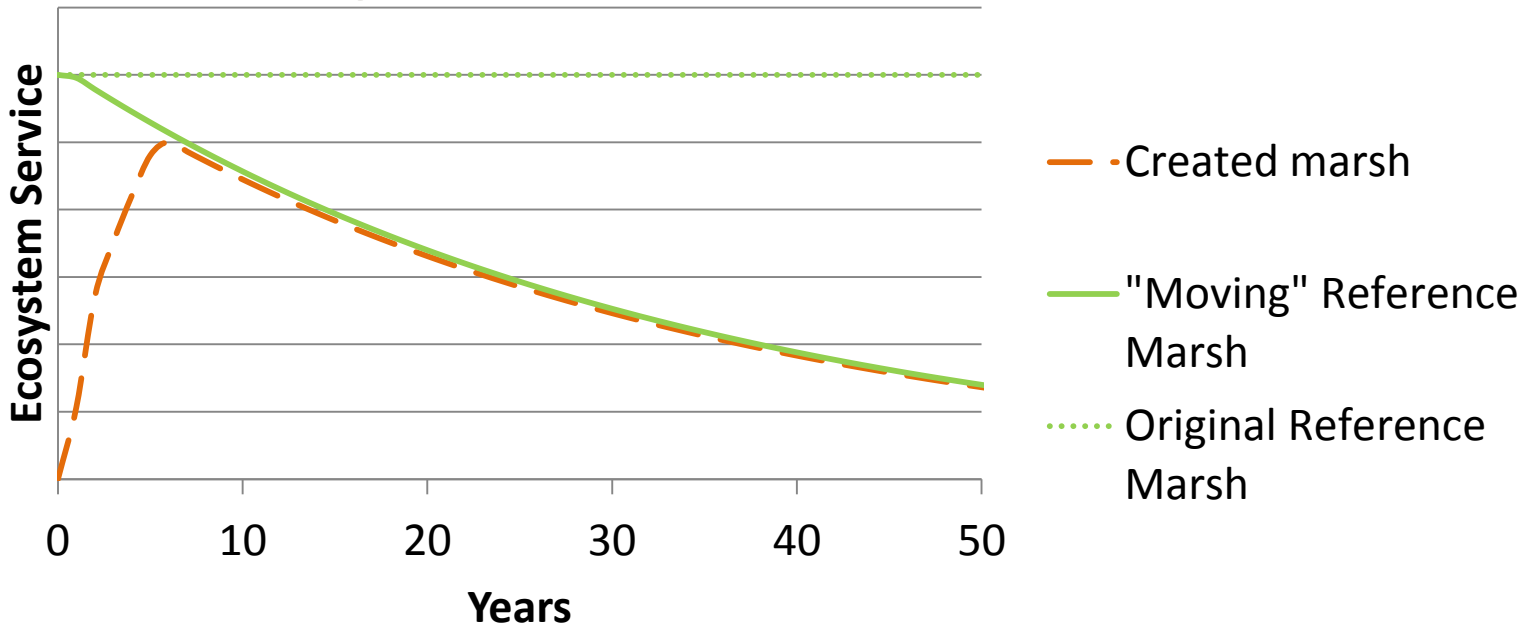


# Coastal Marsh Service with Time Failure?





# Coastal Marsh Service with Time Revised Restoration Paradigm – Reference is a MOVING Target







## Restoration Criteria Issues

Restoration Criteria do not assess Function

- Function determines longevity and sustainability

Temporal disconnects

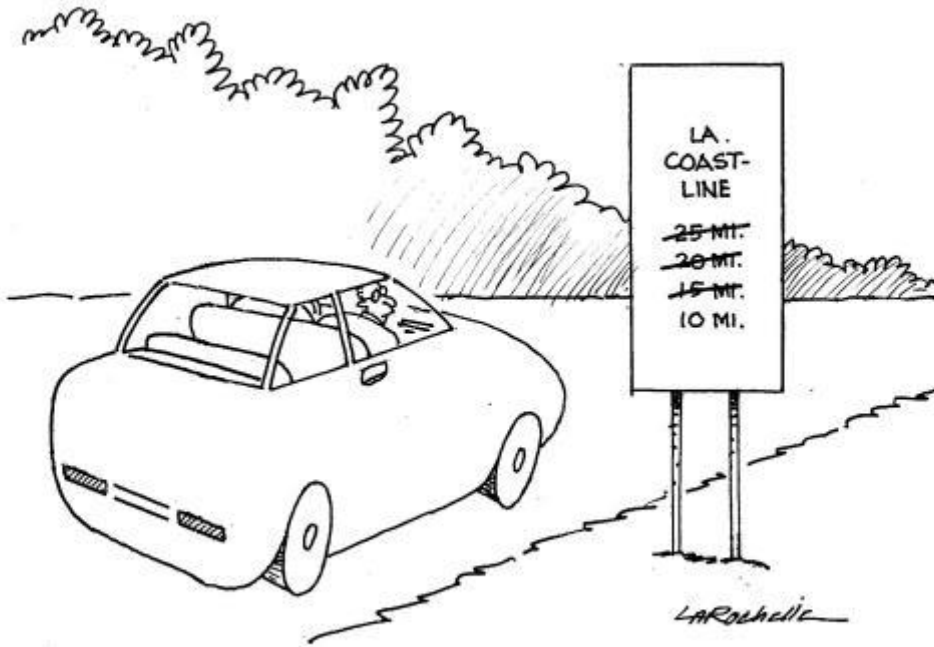
- Monitoring period (5-10 years)
- Functional criteria success (20-50 years)
- 1 ft of sea-level rise (80 years)
  - 75 km<sup>2</sup> wetland loss in LA (1 year)





## So What Do We Do?

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## Restoration Success Take 2

- 1) Prioritize Goals
- 2) Establish Functional Success Criteria that are in line with the restoration goal
- 3) Monitor at a frequency and duration adequate to capture function
- 4) Adaptive Management





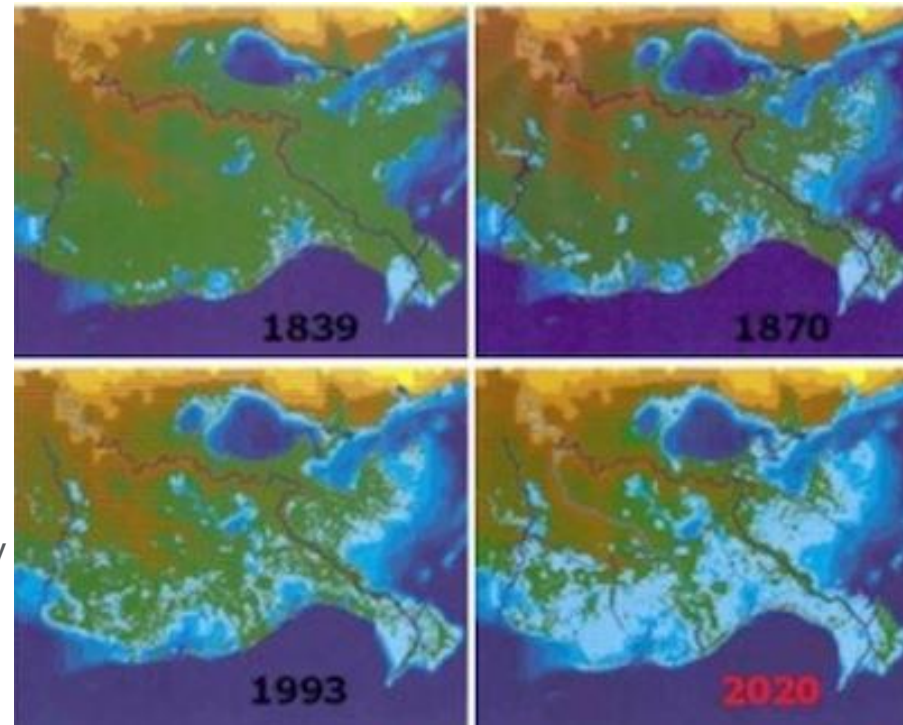
## Louisiana Example - Prioritize

### Prioritize Goals

- Prevent further erosion
- Create new wetland acreage

### Establish Functional Success Criteria

- Marsh surface accretion
  - Mineral
    - Sediment deposition
  - Organic
    - Belowground plant productivity

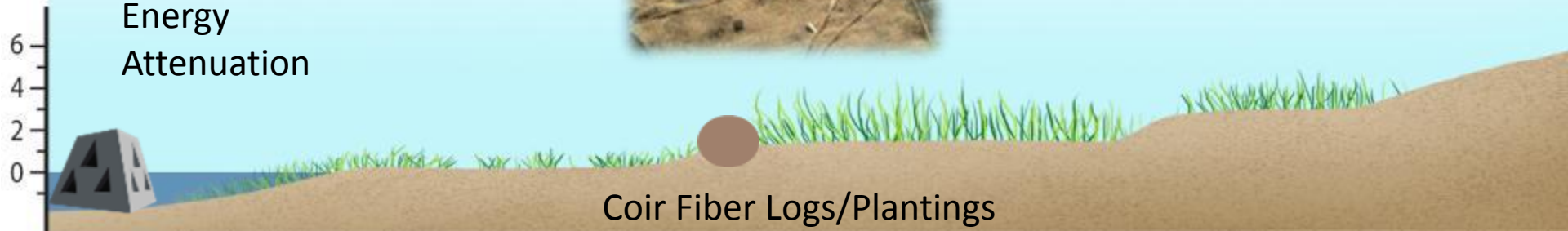




# Louisiana Example – Adaptive Design



Energy  
Attenuation



Coir Fiber Logs/Plantings



## Louisiana Example - Monitoring

### Monitoring frequency and duration

- Sediment Elevation Tables
  - Quarterly measurements the first 10 years
  - Annual measurements the following 10 years

### Adaptive management

- Annual assessment
  - Sediment addition
  - Replanting
  - Hydrologic modification





# Restoration Success Under Conditions of Accelerated Sea Level Rise

- 1) The marsh exists!
- 2) The marsh continues to exist 50 years after restoration
- 3) The marsh maintains area and elevation relative to sea level

## Caveats

- 1) The marsh does not need to be the same habitat type – build uphill!
- 2) The marsh does not need to provide all potential ecosystem services
- 3) Adaptive management needs only to focus on functions that promote the primary goal



## CLOSING ARGUMENTS

