Coastal Restoration Measures

Summary of Habitat Evaluation Team (HET) activities and role in the LACPR process.

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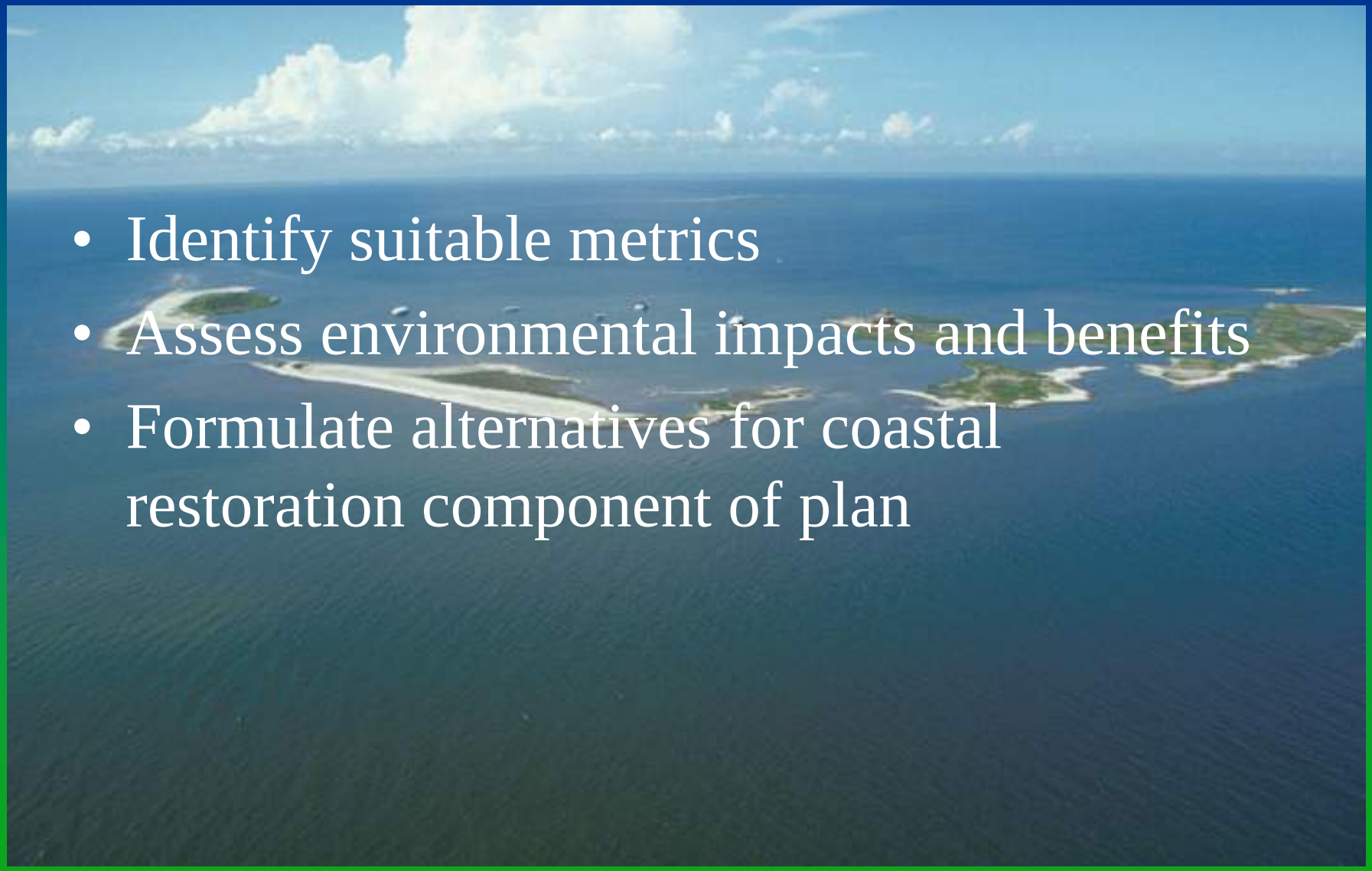
- Craig Fischenich - ERDC Environmental Laboratory

HET Tasks



- Identify suitable metrics
- Assess environmental impacts and benefits
- Formulate alternatives for coastal restoration component of plan

HET Goal Statement

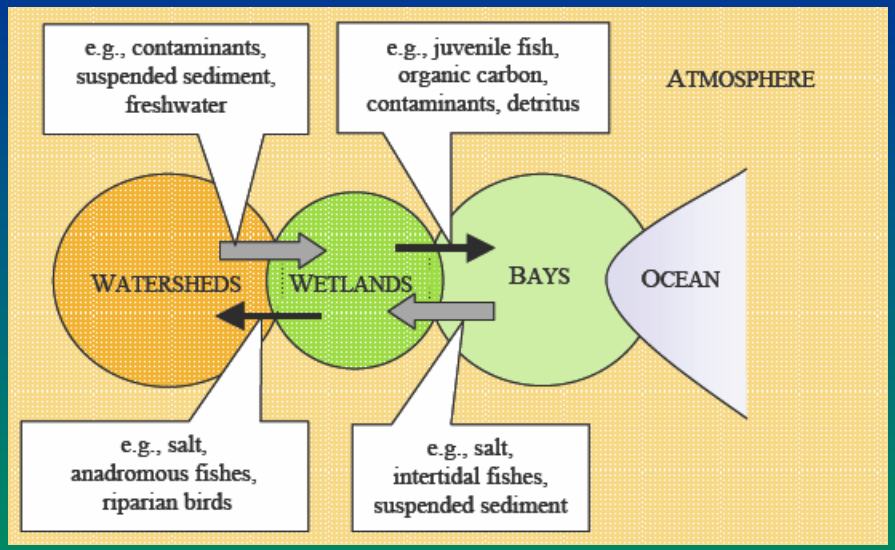
"Achieve ecosystem sustainability in coastal Louisiana to the greatest degree possible"

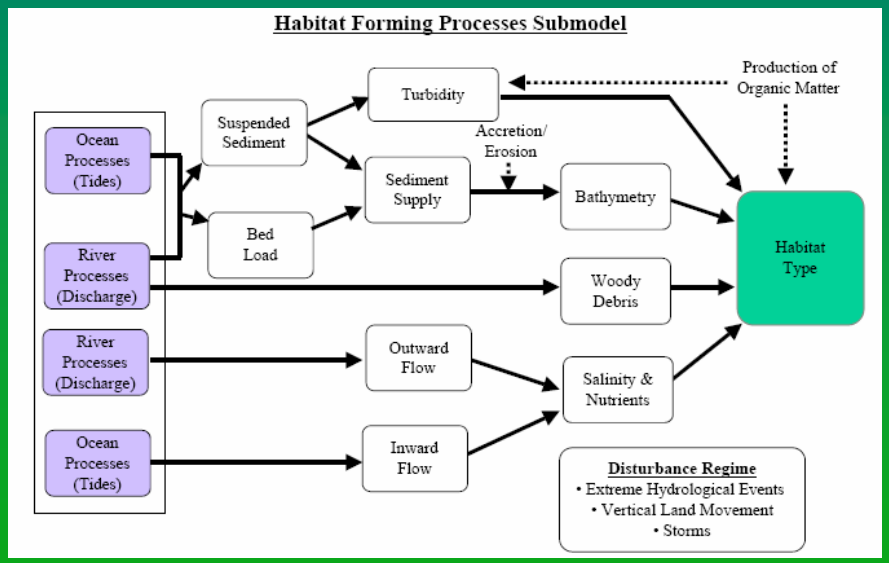
This will be accomplished through:

- Examination of coastal restoration strategies that contribute to sustainable hurricane protection;
- Inclusion of individual measures of varying sizes to restore and maintain landscape features and essential wetland maintenance processes;
- Identification and programmatic assessment of combinations of individual measures which provide ecosystem-level synergistic benefits;
- Programmatic assessment of the potential of alternative plans to achieve or exceed no-net loss of coastal wetlands;
- Examination of the potential for trade-offs associated with various restoration alternatives (e.g. near-term protection vs. long-term sustainability and fisheries changes vs. deltaic processes).

Conceptual Model

- Provides linkage between restoration actions and the physical, chemical and biological system response.
- Consistent with general estuarine models, but emphasizes importance of deltaic processes and high loss rates in LA.



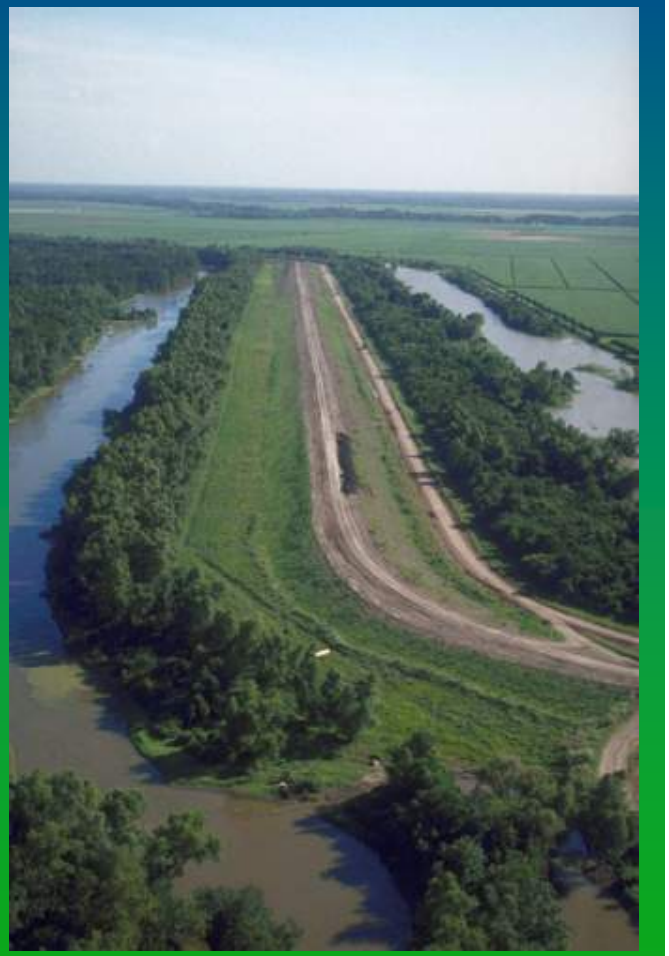


Principles

- Restoration of key processes and dynamics is critical, and it is important to recognize that these processes vary spatially and temporally
- While several scales are important, the basin scale is the most relevant for analyses in the LACPR
- Where possible, causes of accelerated degradation should be addressed directly
- Existing, relatively intact estuarine ecosystems are the keystone and should be preserved and protected
- Position of features within the landscape has a direct influence on the potential benefits
- Measure combinations should seek to enhance resilience and self-sustainability
- Flexibility is required to permit adaptive management as conditions change and more is learned

Metrics

- For Structural Measures
  - Direct Impacts (wetland acres)
  - Indirect Impacts
  - Mitigation Costs
- For Coastal Restoration Plans
  - Storm Damage Reduction
  - Wetland Acres
  - Estuarine Integrity



Direct Impacts

- Impacts computed as levee footprint plus borrow area
- Impacts totaled separately by wetland type
- Computation under revision to reflect revised LOP

Example – Planning Unit 1:

Levee-Protection Measures	Fresh Marsh (acres)	Int Marsh (acres)	Brackish Marsh (acres)	Saline Marsh (acres)	Swamp (acres)	Wetland Shrub/Scrub (acres)	Bottomland Forest (acres)
State Alt 1Levees*							
1-1	-1,459	-1,694	-3,461	0	0	-542	-800
1-2	-76	-362	-917	0	-227	-643	-4,223
1-3	-1,172	-1,528	-4,037	0	0	-519	-331
Corps' RR alt	-1,459	-1,694	-3,902	0	0	-543	-881
Corps' BP alts							
Alt BP 1a	-724	-1,261	-2,369	0	0	-405	-937
Alt BP 2a	-723	-1,261	-3,185	0	0	-411	-937
Alt BP 3a	-724	-1,261	-1,781	0	0	-405	-937
Alt BP 4a1	-749	-1,315	-1,136	0	0	-522	-1,156
Alt BP 4b1	-699	-1,286	-1,737	0	0	-369	-1,002
Alt BP 5a1	-870	-1,316	-1,394	0	0	-552	-1,157
Alt BP 5b1	-820	-1,287	-1,995	0	0	-400	-1,003
Alt HLP 1a	-975	-1,682	-2,253	0	-469	-1,025	-6,732

Indirect Impact Matrix

- Four factors, based on professional judgment
- Scaled adverse, neutral, positive impacts
- Includes annotation/discussion

Example – Planning Unit 1:

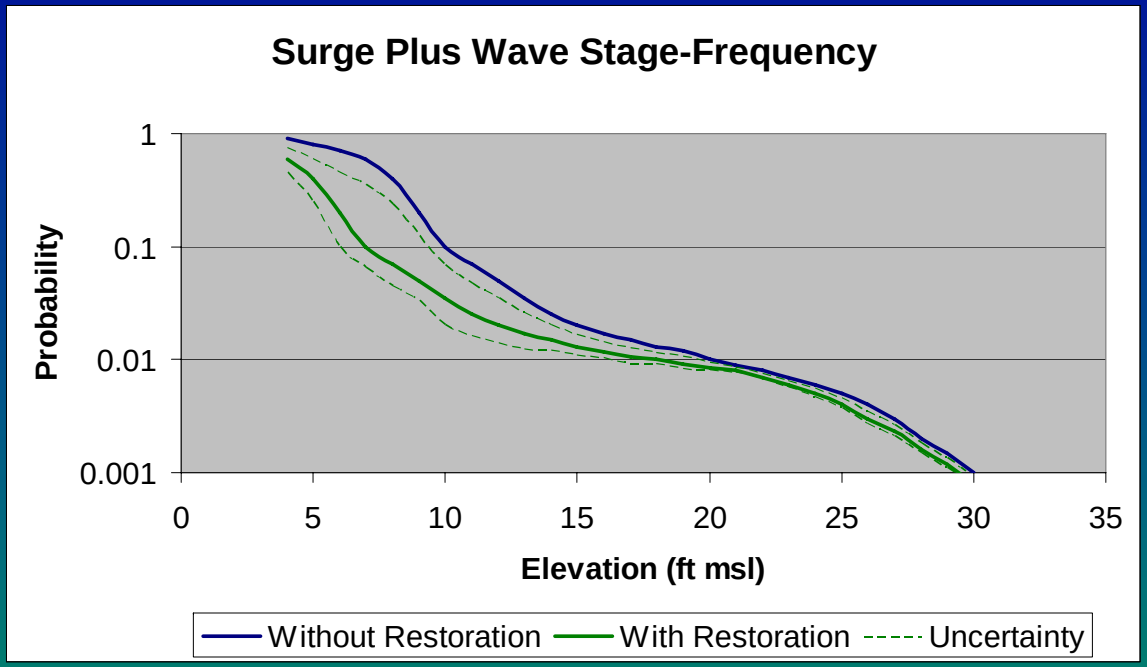
Levee Reach	Hydrologic Impacts	Fishery Impacts	Induced Development	Ecological Sustainability/ Consistency	Notes on Ecological Sustainability/Consistency
Laplace (west of Bonnet Carre)	=[1]	=[1]	+[1]	+[1]	levee would preclude diversion-related flooding of communities, but its design must accommodate diversion channel(s)
Labranche area (Bonnet Carre to Kenner)	=	=	-[2]	=	levee would hinder FW introduction from Miss. River into enclosed and adjacent non-enclosed wetlands
New Orleans/New Orleans East	=	=	=	=	levees already exist and would not enclose any additional wetlands
Golden Triangle Alt. - on L.Borgne	=	=	--	=	assume enclosure impacts reduced/avoided by open structures & diversions
Golden Triangle Alt. - in "funnel"	=	=	=	=	minimal additional wetlands would be enclosed
NO East Landbrige Alt. - Hwy 90	--	--	--	--	basin-wide enclosure-related wetland impacts
NO East Landbrige Alt. - RR	--	--	--	--	basin-wide enclosure-related wetland impacts
Rigolettes north up Pearl River basin	--[3]	-	-	-	impacts to enclosed Fritchie Marsh
North Lake Pontchartrain shore	-[4]	=	-[5]	=	levees would enclose fewtidal wetlands
Caemarvon to White's Ditch	=	=	=	=	levees would not enclose additional wetlands
White's Ditch to Monsecour	-[6]	-[6]	-[6]	--	levee may preclude White's Ditch or other future diversions in this area where no "back" levee nowexists
Miss. River Flood Protection Levees	=	=	=	=	levees would not enclose additional wetlands

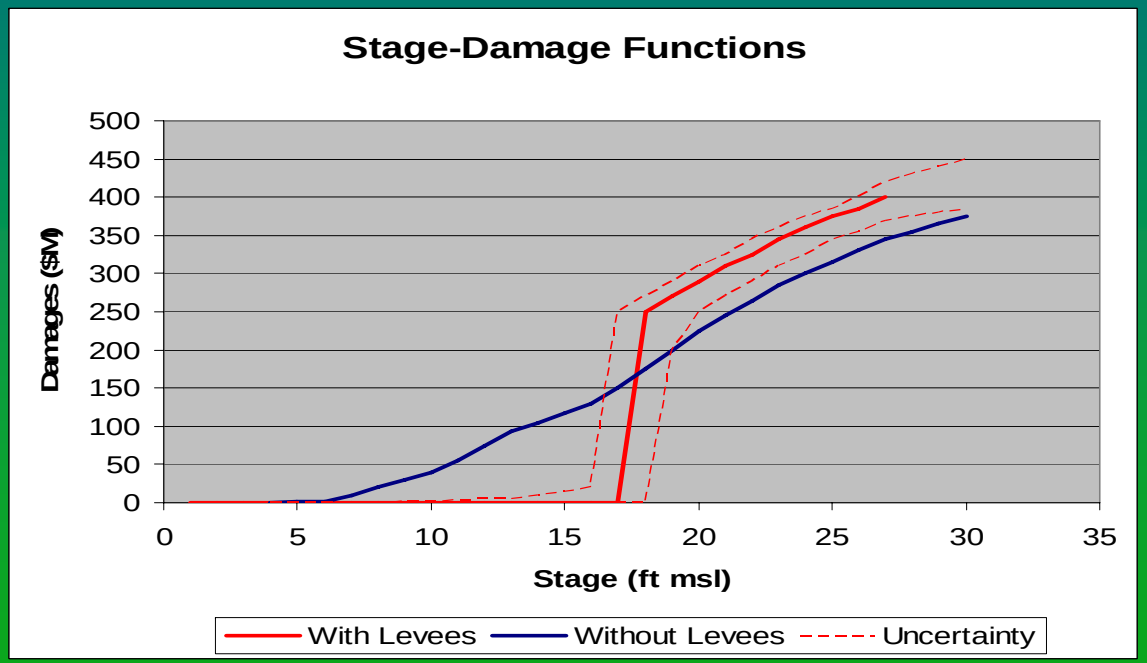
Storm Damage Reduction

- Benefits quantified as reduction in Expected Annual Damages ($)
- Analysis using ADCIRC/STWAVE models for with- and without-coastal features
- Uncertainty captured through two model parameters (resistance, bathymetry)
- Differences with and without coastal features captures in stage-frequency curve, then integrated with stage-damage curve for benefits

Example

Stage	No Action	Restoration Only	Levees Only	Restoration and Levees
4	0.00	0.00	0.00	0.00
5	0.80	0.40	0.00	0.00
6	1.40	0.40	0.00	0.00
7	6.00	1.00	0.00	0.00
8	8.00	1.40	0.00	0.00
9	6.00	1.50	0.00	0.00
10	4.00	1.40	0.00	0.00
11	3.85	1.38	0.00	0.00
12	3.75	1.50	0.00	0.00
13	3.29	1.60	0.00	0.00
14	2.63	1.58	0.00	0.00
15	2.34	1.52	0.00	0.00
16	2.21	1.53	0.00	0.00
17	2.25	1.58	0.00	0.00
18	2.28	1.75	0.00	0.00
19	2.38	1.82	0.00	0.00
20	2.25	1.91	0.00	0.00
21	2.21	1.96	2.25	2.00
22	2.12	1.86	2.16	1.89
23	2.00	1.71	2.03	1.74
24	1.80	1.50	1.86	1.55
25	1.58	1.26	1.63	1.30
26	1.32	0.99	1.38	1.04
27	1.04	0.79	1.08	0.83
28	0.71	0.57	0.75	0.60
29	0.55	0.44	0.58	0.46
30	0.38	0.30	0.40	0.32
Total:	67.10	33.64	14.11	11.73

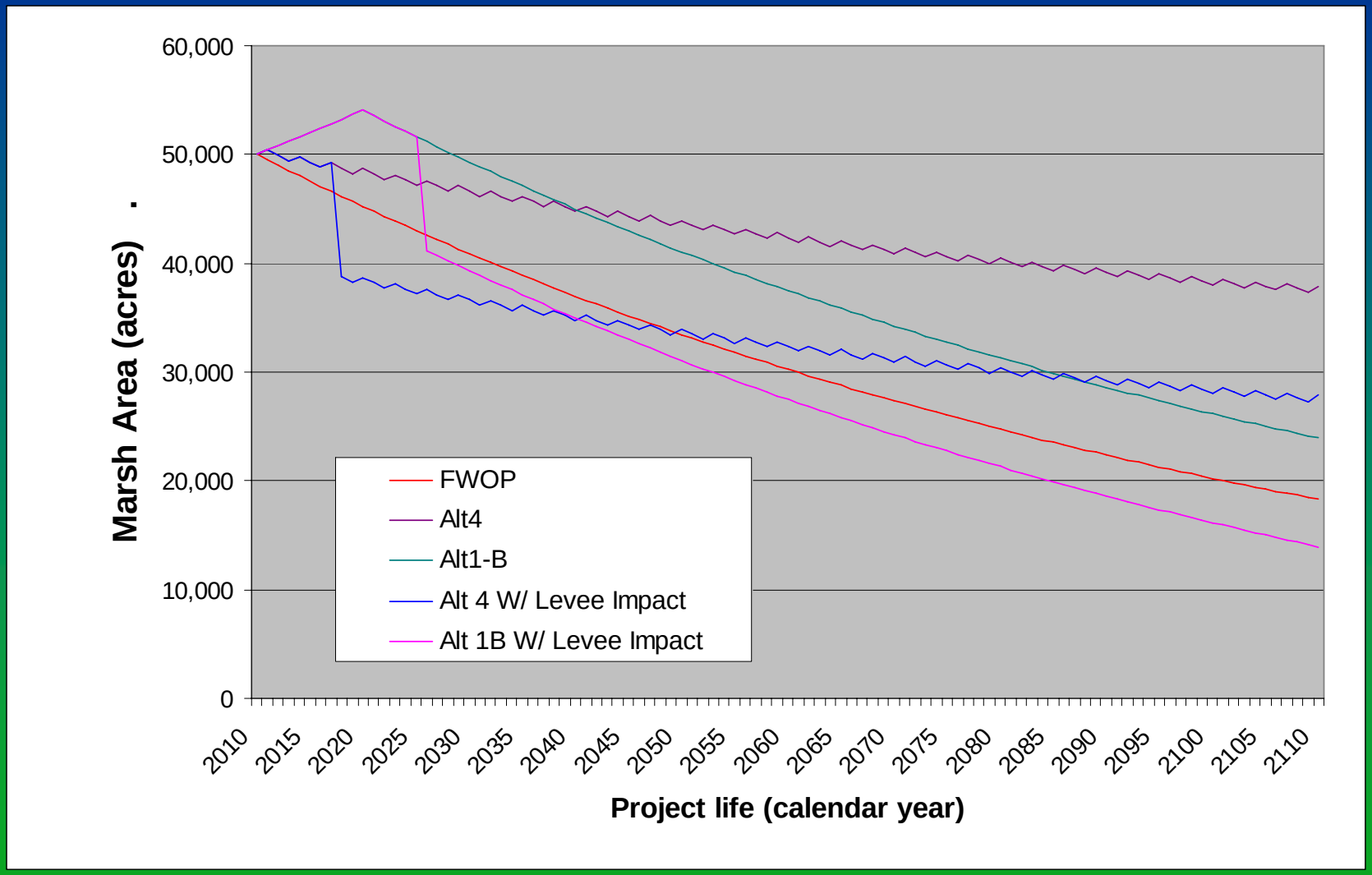




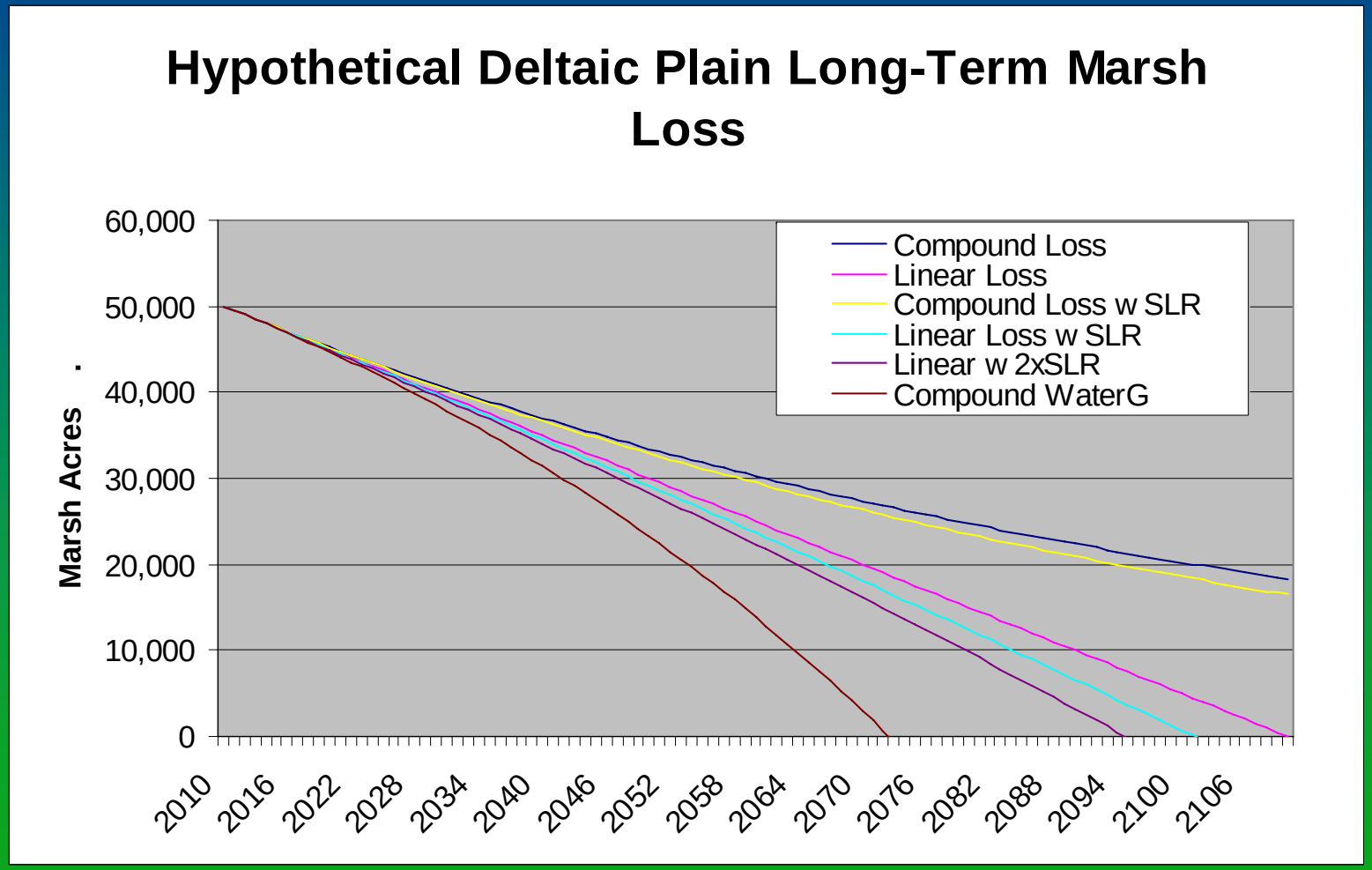
Wetland Acres

- Computed by wetland type for each PU
- Net acreage includes direct losses from structural measures plus gains from marsh creation and diversions
- USGS loss rates applied, with varying assumptions to represent uncertainty
- Marsh creation computed directly, diversion land building determined from modified NRCS model
- Can be integrated for average annual acres

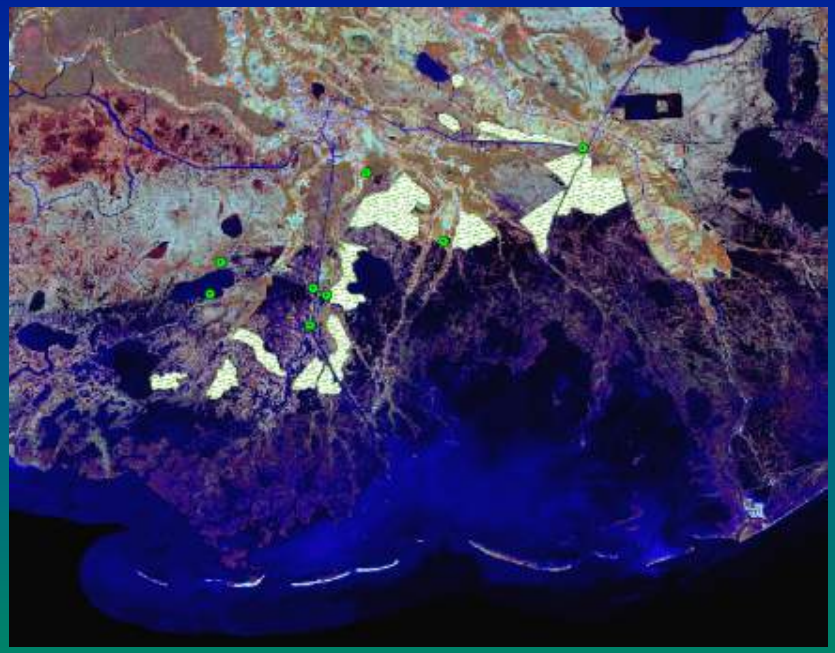
Example

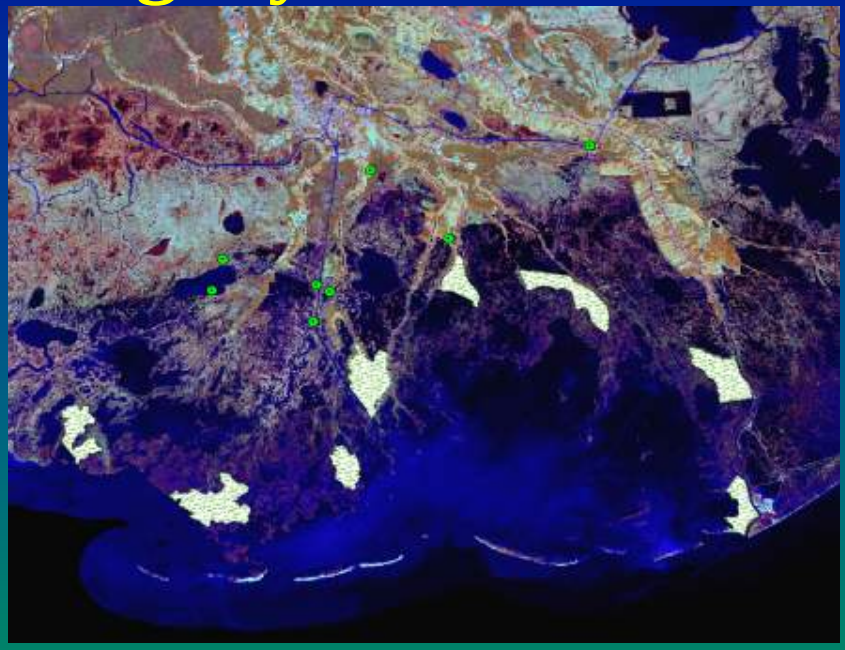

60,000
50,000
40,000
30,000
20,000
10,000
0
Marsh Area (acres)
FWOP
Alt4
Alt1-B
Alt 4 W/ Levee Impact
Alt 1B W/ Levee Impact
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
2080
2085
2090
2095
2100
2105
2110
Project life (calendar year)

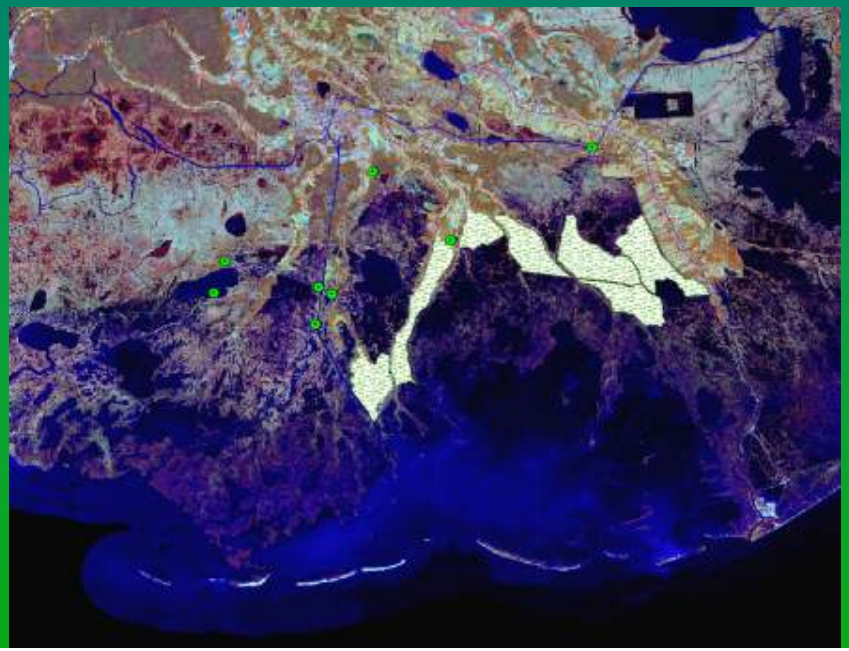
Loss Rate Assumptions

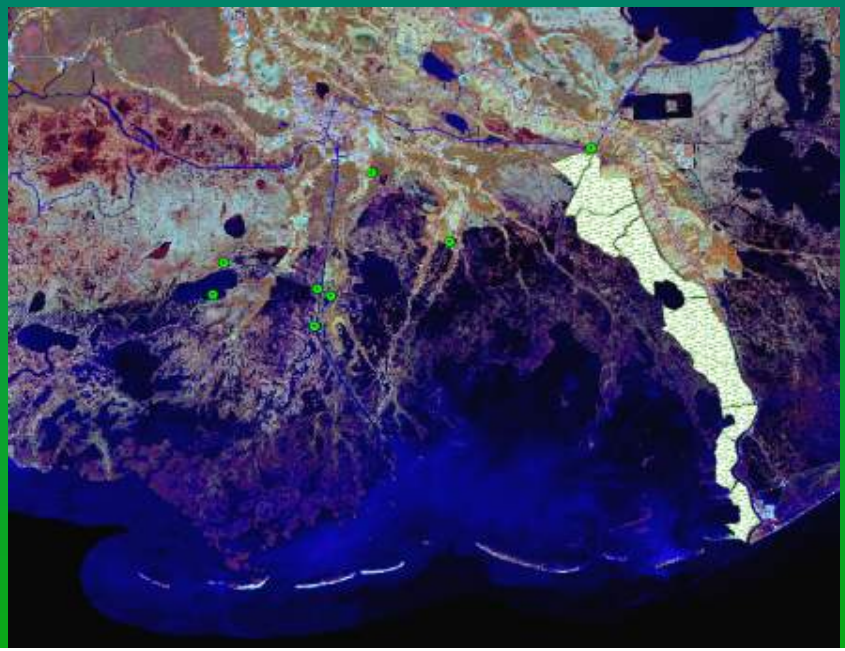


Estuarine Integrity









Estuarine Integrity

- Index to capture relation between spatial extent, heterogeneity, and geometry of elements of the landscape on the flow of energy, animals, and materials through the landscape
- Spatial metric based on landscape ecology principles, applied at the basin scale
- Characteristics under investigation:
  - Wetland habitat fragmentation
  - Open water connectivity
  - Wetland buffer structure and composition
  - Wetland habitat patch size-frequency
  - Channel density
  - Edge/area ratio
- Likely a combination of one metric each representing area, edge, and interspersion

Plan Formulation

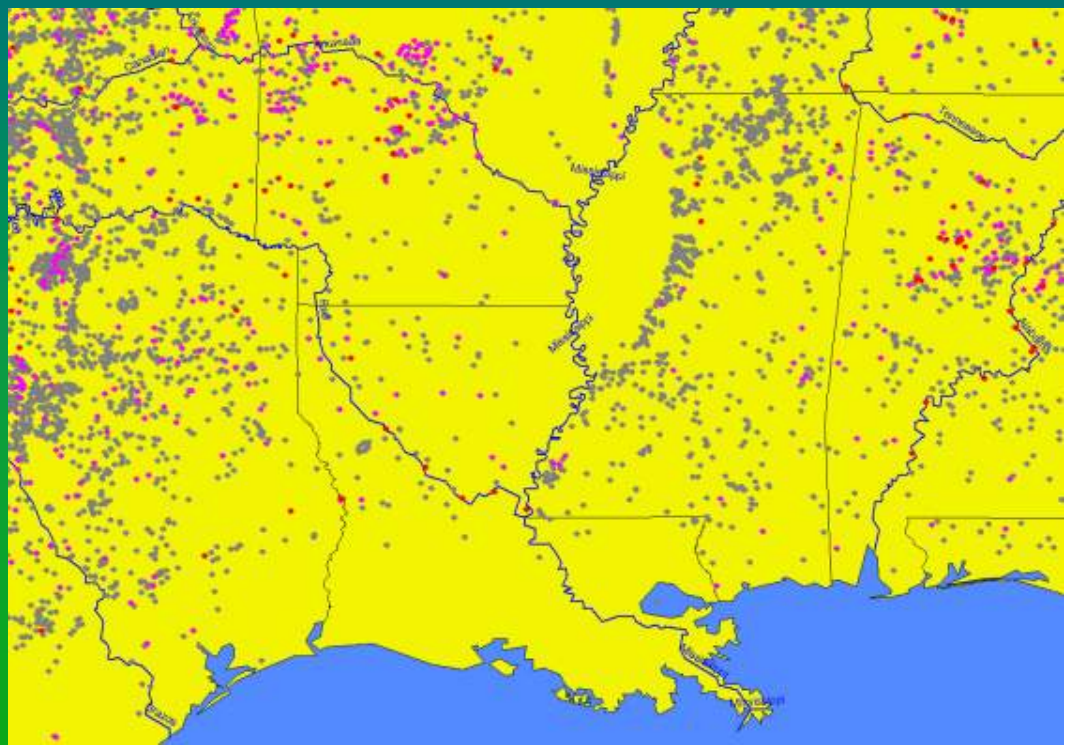
- Combinations of measures that represent four distinct plans for evaluation
- Array of measures developed in several collaborative venues
- Measures subject to screening and prioritization
- Plans conform to the relative constraint of available water and sediment resources
- Strategies for plan characterization likely to vary by Planning Unit
- One possible plan combination:

	Land-building using natural processes		
Land-building using mechanical means	High-High	High-Medium	High-Low
	Medium-High	Medium-Medium	Medium-Low
	Low-High	Low-Medium	Low-Low

Plan Formulation Measures

- Primary focus on measures that contribute to estuarine maintenance at a basin scale:
  - Freshwater diversions
  - Marsh creation
  - Ridge/Chenier restoration
  - Barrier island restoration

Other Practices



Measure Screening

- Factors (partial listing)
  - Scale of influence
  - Availability of sediment sources, both riverine and offshore
  - Availability of freshwater for sustainability
  - Existing structure to aid in sediment confinement
  - Average depth of open water areas
  - Potential for flood and infrastructure protection Preferred sediment grain size for restoration (sands vs. fines)
  - Proximity of pipeline right-of-ways
  - Land / water distribution
  - Rate of local/basin loss rates
  - Need for shoreline protection
  - Landowners affected
  - Oyster leases/fisheries affected
  - Access for construction

Prioritization
(Features Using Dredged Material)

- Based on three primary factors:
  - Structural Importance
  - Functional Lifespan
  - Synergy with Diversions
- Scaled 0 – 3
- Weighted

Example of Prioritizations

PU	Creation & Protection Features	Structural Import.	Function Lifespan	Synergy w Diversion
3a	3DR-east red polys (9,10,11,16,19,21,22,28)	3	3	1
3a	Terr Bay N. Rim (JeanCh. To B.Terr)	3	3	1
3a	South Caillou Lake Landbridge MC (polys 20-22)	3	3	0.5
3a	Timbalier Islands Restoration	3	3	0
3a	Isle Demiers Restoration	3	2	0
3a	DuLarge-Grand Caillou Landbridge MC	2	3	1
3a	Small Bayou la Pointe Ridge	2	3	1
3a	3DR-east orange polys (S1,13,17,20,29,30)	2	3	0.5
3a	Bayou DuLarge Ridge	2	2	1
3a	3DR-west green polys (1,2,3,4,8)	2	2	0.5
3a	South Caillou Lake Landbridge MC (polys 19,23,24)	2	2	0
3a	Bayou Pointe au Chene Ridge	2	2	0
3a	3DR -east blue polys (8)	1	3	1
3a	3DR-west blue polys (5,6,7)	1	3	0
3a	Terr Bay N. Rim (Pt.Chen to JeanCh.)	1	2	1
3a	Margaret's Bayou Ridge	1	2	1
3a	Terr Bay N. Rim (Latch to Pt.Chene)	1	1	1
3a	Terr Bay N. Rim (B.Terr to west end)	1	1	0
3a	Bayou Terrebonne Ridge	0	3	0
3a	3DR-east green N polys (2,7,12,14)	0	2	1
3a	3DR-east green S polys (N1,3,4,5,6,15,16,18,23-27)	0	2	0

Next Steps

- Prioritize diversions and compute benefits
- Plan formulation strategies and development
- Scientific monitoring, modeling and adaptive management needs
- Peer review sought for approach and evaluation metrics