Mission-Aransas Pilot Study: A Proof-of-Concept Demonstration of the *Gulf EcoHealth Metrics* Decision-Support Framework

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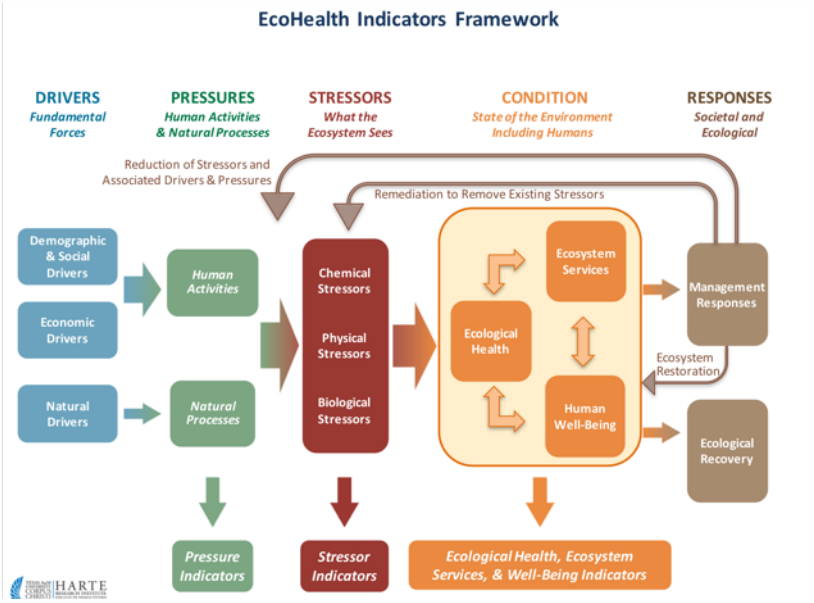
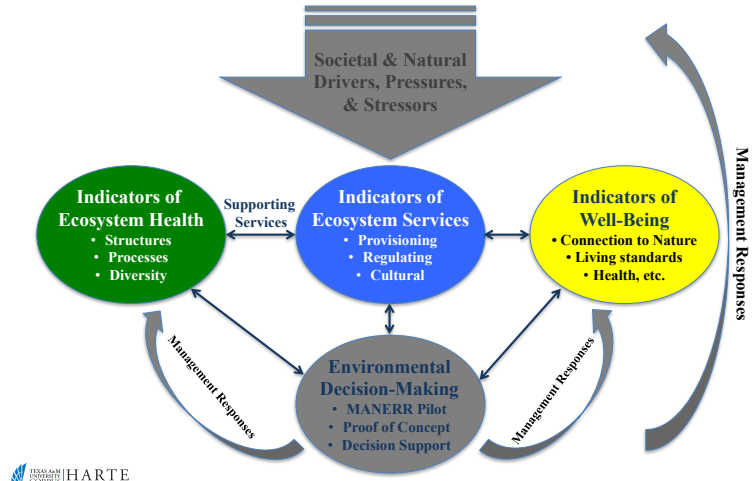
Mission-Aransas Reserve Pilot Study



Linking Ecosystem Health, Services, and Well-Being



Goals:

- **To test the integrated assessment framework and associated indicators in a real-world environmental management application.**
- **To specify key indicators for assessing ecological health and ecosystem services and identify their linkages to well-being.**
- **To conduct a proof-of-concept pilot study focused on specific management issues of the Mission-Aransas NERR.**

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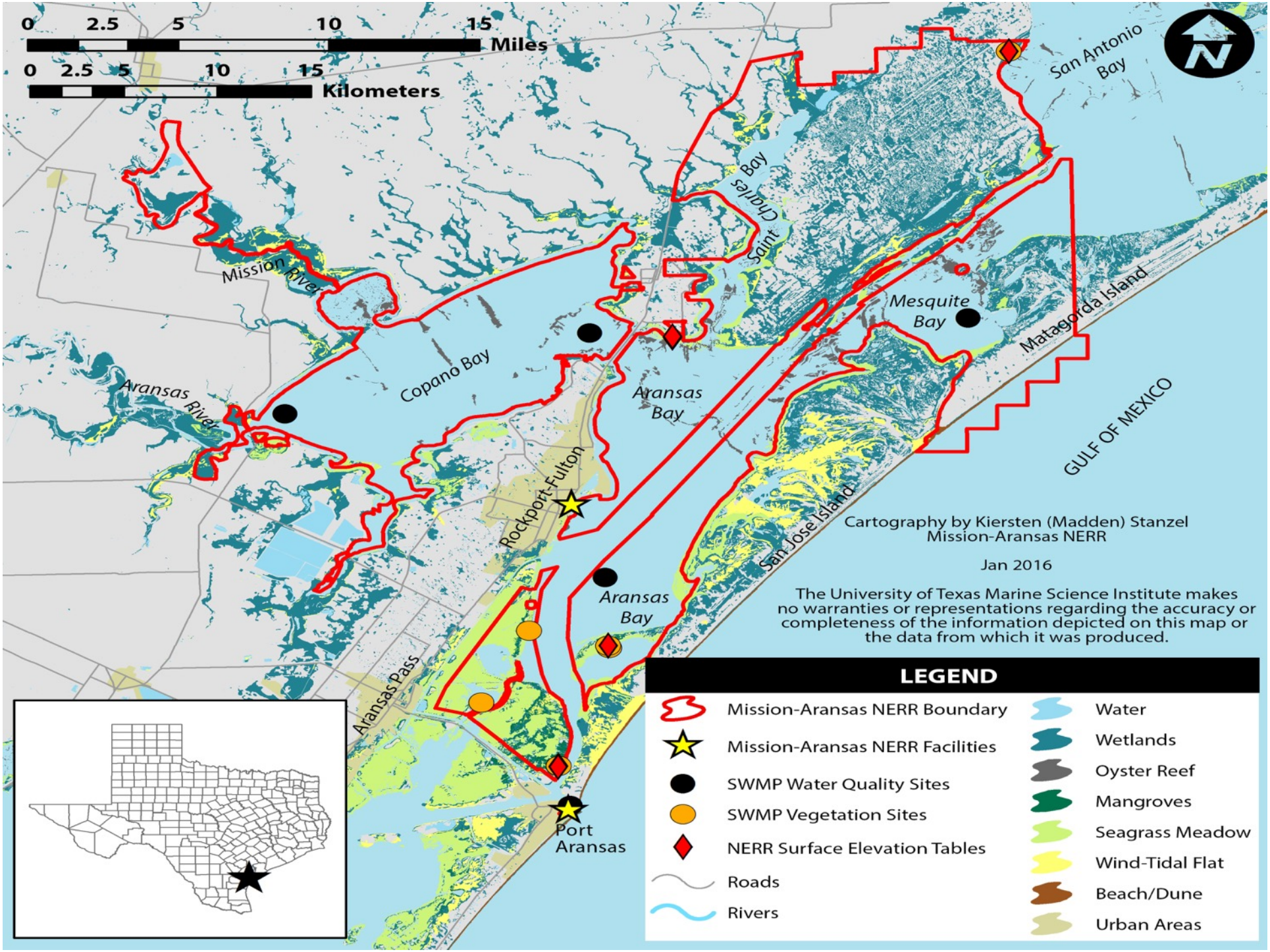

0 2.5 5 10 15 Miles
0 2.5 5 10 15 Kilometers
San Antonio Bay
Saint Charles Bay
Mission River
Aransas River
Copano Bay
Aransas Bay
Mesquite Bay
Matagorda Island
GULF OF MEXICO
Rockport-Fulton
San Jose Island
Aransas Pass
Port Aransas
Cartography by Kiersten (Madden) Stanzel
Mission-Aransas NERR
Jan 2016
The University of Texas Marine Science Institute makes no warranties or representations regarding the accuracy or completeness of the information depicted on this map or the data from which it was produced.
LEGEND
Mission-Aransas NERR Boundary
Mission-Aransas NERR Facilities
SWMP Water Quality Sites
SWMP Vegetation Sites
NERR Surface Elevation Tables
Roads
Rivers
Water
Wetlands
Oyster Reef
Mangroves
Seagrass Meadow
Wind-Tidal Flat
Beach/Dune
Urban Areas

Decision Support Framework

Problem Formulation

- *Determine Management Needs*
- *Identify Ecological & Societal Needs*
- *Determine Project Goals/Objectives*
- *Develop Case-Specific Conceptual models*

Propose Alternatives

- *Acquire Baseline Information*
- *Identify Alternative Actions*

Alternative Analysis

- *Conduct Scenario-Consequence Analysis*
- *Conduct Feasibility Analysis*
- *Identify Trade-Off Analysis*

Decision

- *Select Optimal Alternative*
- *Establish Monitoring Plan*
- *Identify Goals/Targets*

Mission-Aransas Reserve Pilot Study

Management Goal:

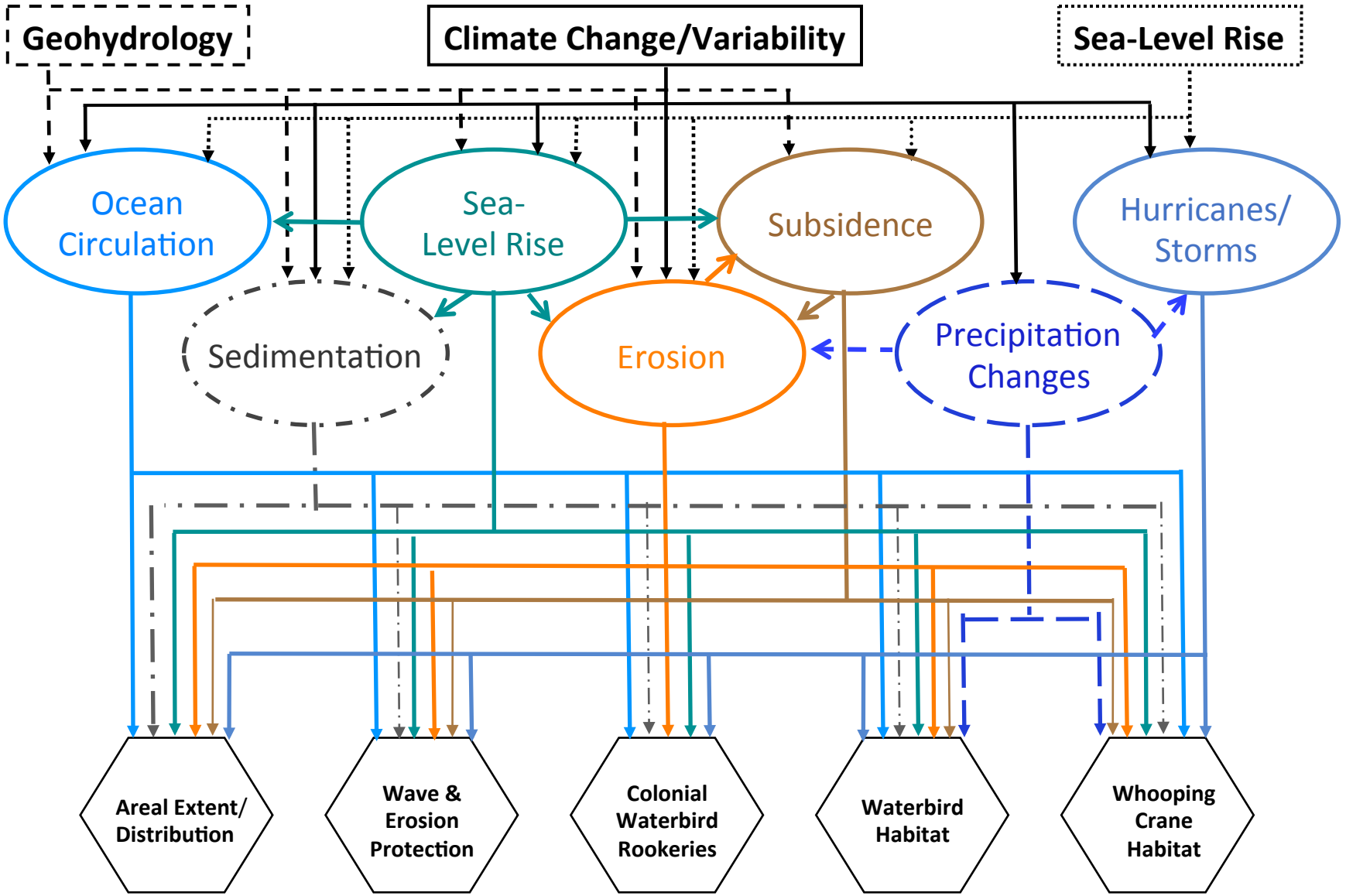
To create or extend rookery islands in the coastal systems of the Reserve in order to enhance nesting, breeding, and foraging habitat for resident and migratory coastal birds, which provide ecosystem and well-being services to a range of beneficiaries.

Approach:

A structured decision-support framework, using geospatial ecosystem-based management tools and scenario-consequence analyses, is employed to assess the trade-offs inherent in managing the complex interactions of coupled human and natural systems.

Mission Aransas Dredged and Natural Islands

Climate Change & Physical Processes



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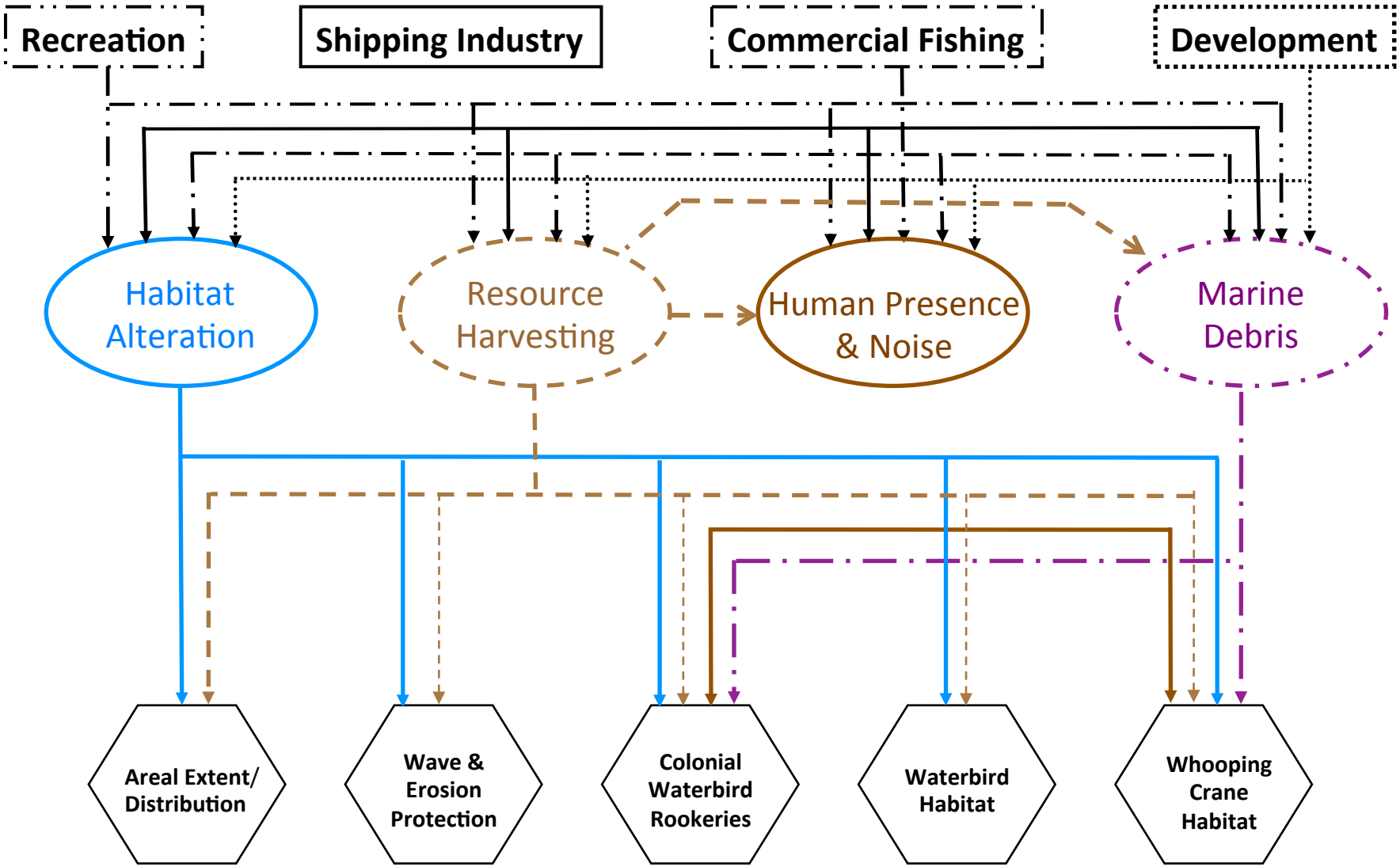
Mission Aransas Dredged and Natural Islands

Human Activities



ECOLOGICAL MATRICES

Rookery Islands VECs

Structural Attributes

Stressors	Physical																	
	Hydrology	Salinity Regime	Precipitation Regime	Sedimentation	Erosion	Habitat Alteration	Fire Regime	Sea-Level Rise	Inundation	Hurricanes/Storms	Resource Harvesting	Marine Debris	Solid Waste Disposal	Temperature Changes	Turbidity	Noise	Subsidence	SAV *Damage*
Areal Extent/Location S	H	-	-	H	H	H	-	H	H	H	H	-	-	-	-	-	M	-
Diversity of habitats on/around islands S	M	M	M	M	M	H	M	H	M	M	M	L	L	L	M	-	H	M
Structural Complexity of Island S	H	M	M	L	H	H	M	H	M	M	L	L	L	L	L	-	H	M
Successional Patterns S/F	H	M	M	L	H	H	M	M	M	M	L	L	L	L	L	-	M	L
Breeding-Residents: Terns, Skimmers, Herons & Egrets	H	H	H	L	L	L	L	H	H	H	L	L	L	L	L	H	L	L
Wintering-Migratory: Plovers, Sandpipers, Knots - S	H	L	M	L	L	L	L	H	H	H	L	L	L	M	L	M	L	L

Functional Attributes

Wave And Erosion Protection F	H	-	-	M	H	H	-	H	H	H	M	-	-	-	-	-	M	-
Colonial Waterbird Breeding Habitat F	H	-	-	M	H	H	-	H	H	H	M	H	L	-	-	L-H	L	-
Waterbird Non-Breeding Habitat F	H	-	H	M	H	H	-	H	H	H	M	L	L	L	-	-	M	-
Whooping Crane Habitat F	H	-	H	M	H	H	-	H	H	H	M	H	L	L	-	L-H	M	-
Fish Habitat F	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	M
Invertebrate Habitat/Community F	M-H	M	M	M-H	L	M	L	L	L	L	L	L	L	L	L	L	L	M
Seagrass habitat F	M	M	L	M	M	H	-	M	L	L	L	L	L	L	H	-	M	H
Oysters habitat F	M	H	M	M-H	M	H	-	M	L	M	H	L	L	M	H	-	M	L
Marshes habitat F	H	H	M	M	M	H	L	M	M	M	L	L	L	L	L	-	M	L

ECOLOGICAL MATRICES

Rookery Islands VECs

Structural Attributes

Stressors	Chemical										Biological								
	Nutrient Loading	Organic Loading	Toxic Metals	Petroleum Releases	Petroleum Spills	Other Chemical Spills/Releases	Pesticides/Herbicides	Hypoxia	Atmospheric Deposition	Pharmaceuticals	Altered Food Availability	Predation	Pathogens	Invasive Species	Resource Harvesting	Harmful Microalgal Blooms	Harmful Macroalgal Blooms	Marsh Management	Human Presence
Areal Extent/Location S	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Diversity of habitats on/around islands S	H	M	L	H	H	H	H	M	L	L	L	L	L	M	M	M	M	M	L
Structural Complexity of Island S	H	M	L	M	M	M	M	M	L	L	L	L	L	H	L	L	L	L	L
Successional Patterns S/F	L	M	L	M	M	M	M	M	L	L	L	L	L	H	L	L	L	L	L
Breeding-Residents: Terns, Skimmers, Herons & Egrets	H	L	L	H	H	H	H	L	L	L	H	H	L	L	L	H	H	L	H
Wintering-Migratory: Plovers, Sandpipers, Knots - S	L	L	L	M-H	M-H	M-H	L	L	L	L	H	M	L	L	L	M	L	H	H

Functional Attributes

Wave And Erosion Protection F	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Colonial Waterbird Breeding Habitat F	-	-	L	H	L	L	-	-	-	-	-	-	?	L	-	-	-	-	H
Waterbird Non-Breeding Habitat F	L	-	L	H	L	L	-	-	-	-	-	-	?	L	-	-	-	-	L
Whooping Crane Habitat F	L	-	L	H	L	L	-	-	-	-	-	-	?	L	-	-	-	-	H
Fish Habitat F	L	L	L	H	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Invertebrate Habitat/Community F	L	L	L	H	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Seagrass habitat F	H	H	M	H	H	H	H	H	L	L	L	L	L	L	L	H	H	H	L
Oysters habitat F	H	H	H	H	H	H	H	H	L	M	L	L	H	L	H	H	H	H	L
Marshes habitat F	L	L	L	H	H	H	H	M	L	L	L	L	L	M	L	L	L	L	L

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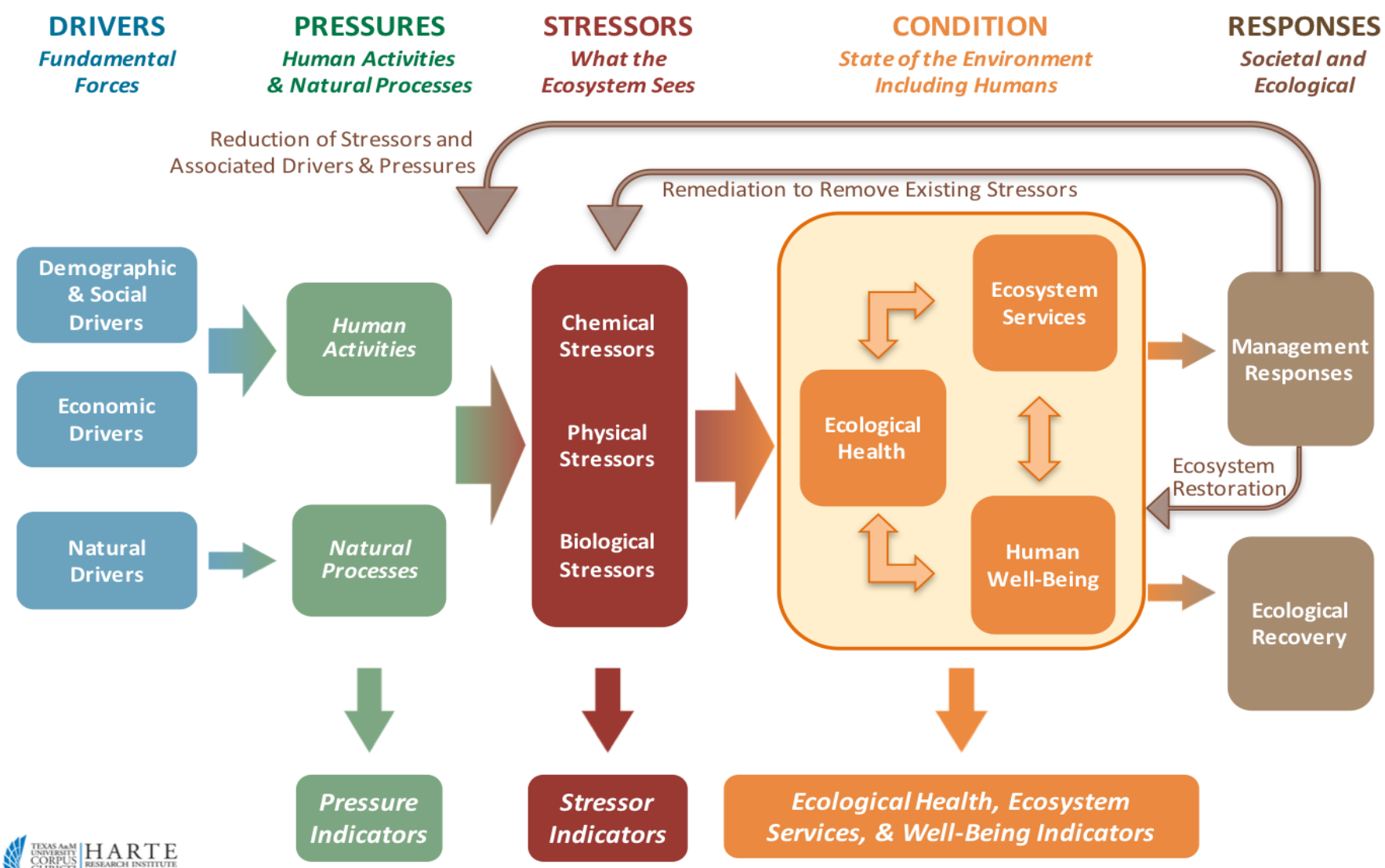
EcoHealth Indicators Framework



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Rookery Island DPSCR Framework

Pressures/Stressors

Physical
- Hydrology
- Salinity
- Precipitation
- Erosion
- SLR/Inundation
- Storms
- Noise

Chemical
- Nutrients
- Petroleum releases
- Pesticides/Herbicides

Biological
- Food Availability
- Predation
- HAV
- Human Presence

Condition Attributes

Structural Attributes
- Areal Extent
- Habitat diversity
- Structural complexity
- Successional Patterns
- Breeding Residents
- Winter-Migratory

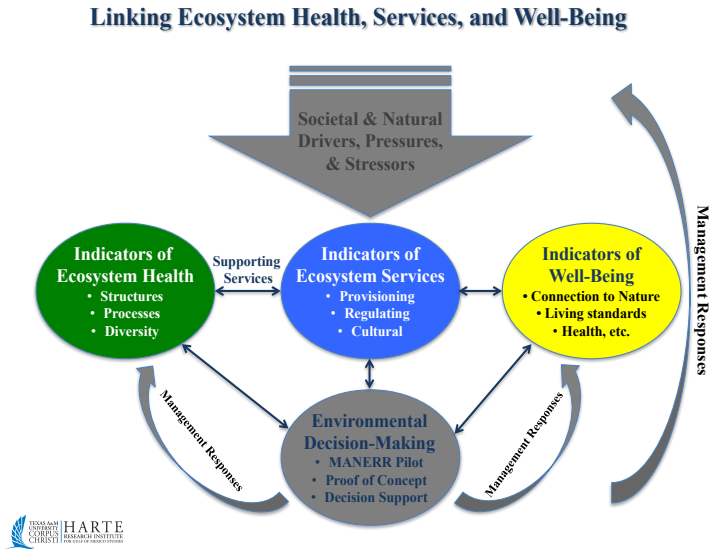
Functional Attributes
- Erosion Protection
- CWB Breeding Habitat
- WB Non-Breeding Habita
- Whooping Crane Habitat
- Fish Habitat
- Invertebrate Habitat
- Seagrass Habitat
- Oyster Habitat
- Marsh Habitat

Eco-Services

- Hazard Mitigation
- Recreation
- Navigation
- Habitat Value
- Food Provisioning

Well-Being

- Health
- Economic
- Recreation
- Cultural



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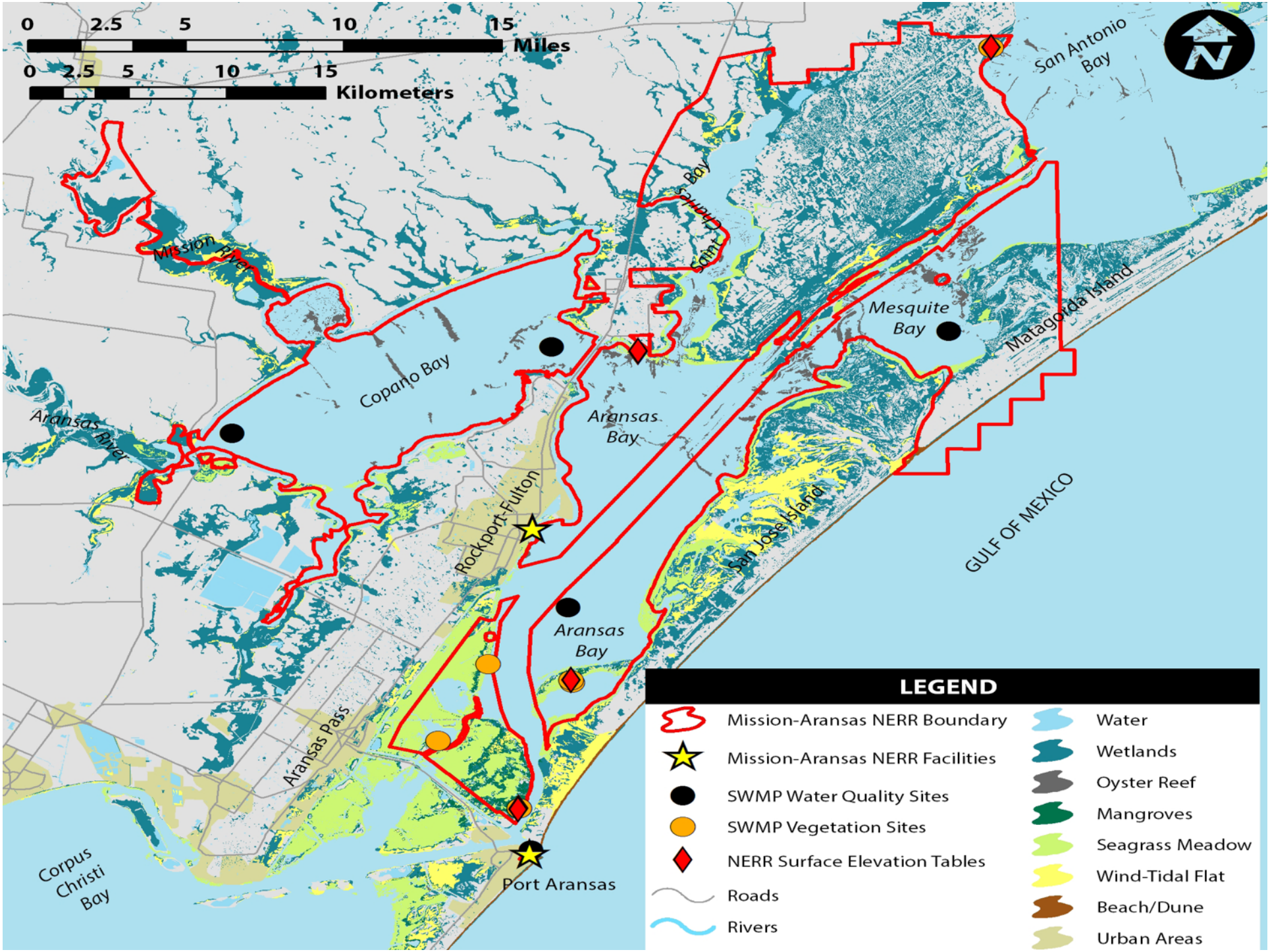
0 2.5 5 10 15
Miles
0 2.5 5 10 15
Kilometers
N
San Antonio Bay
Mission River
Copano Bay
Aransas River
Aransas Bay
Mesquite Bay
Matagorda Island
GULF OF MEXICO
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LEGEND
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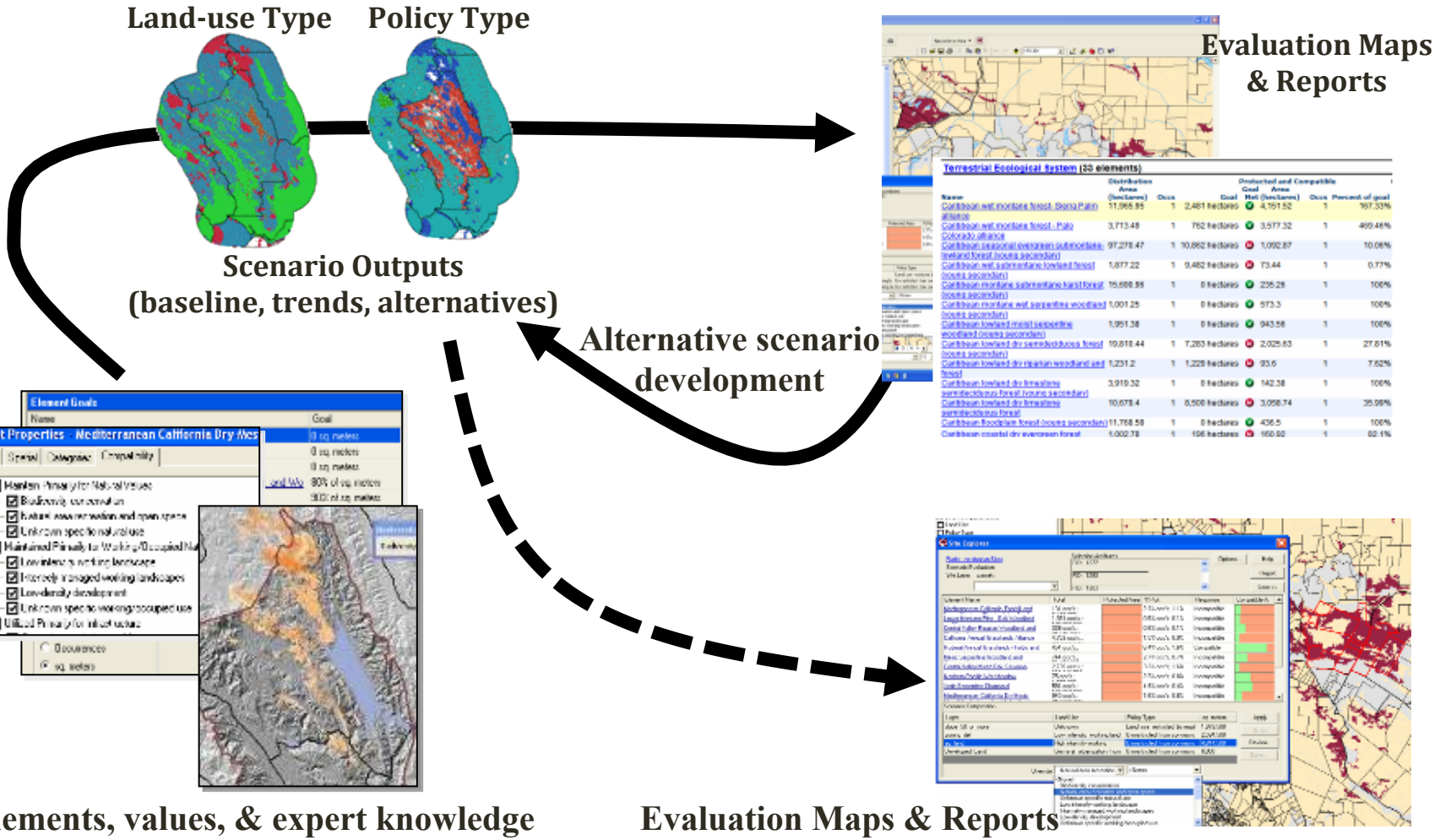
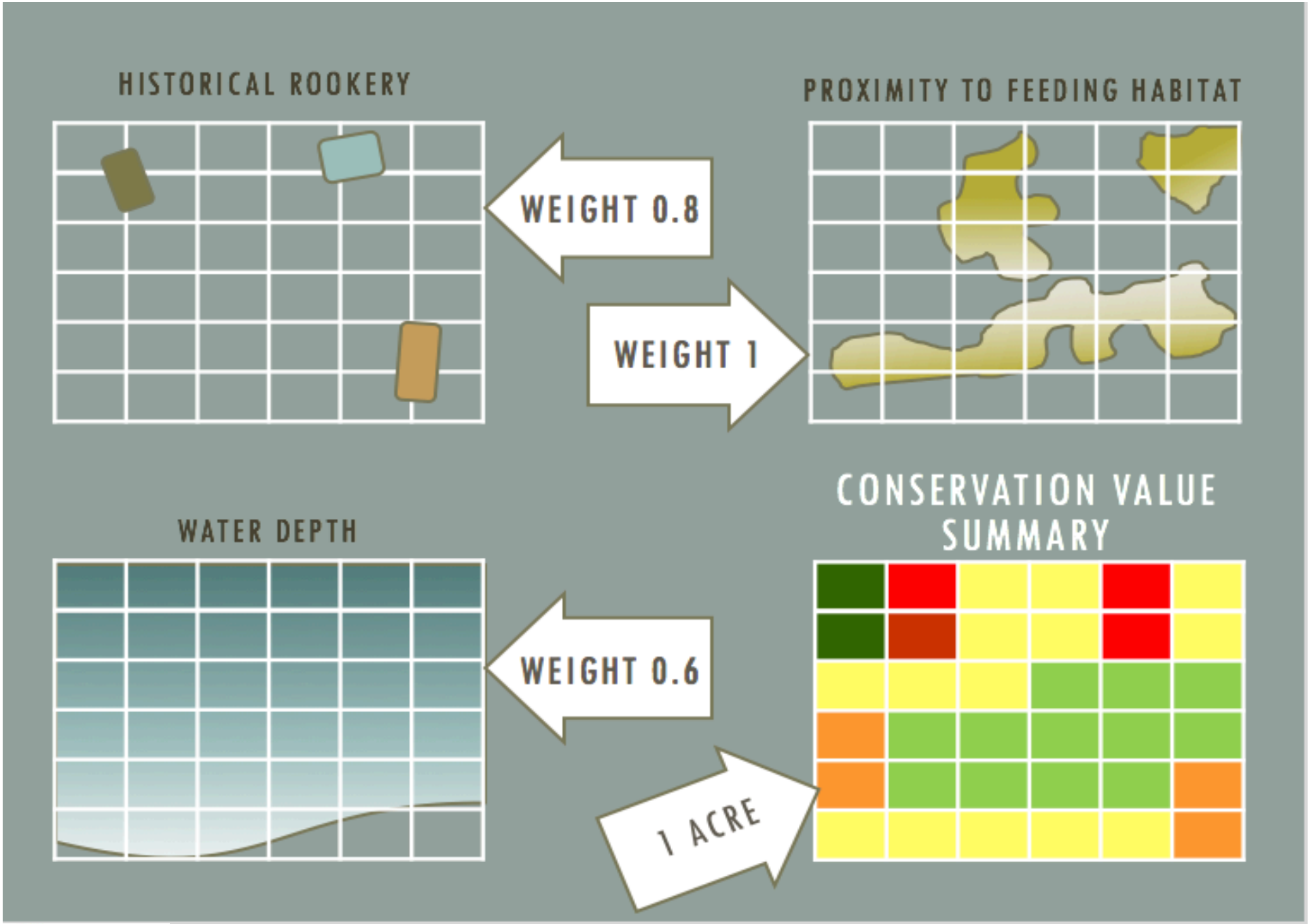
SWMP Water Quality Sites
SWMP Vegetation Sites
NERR Surface Elevation Tables
Roads
Rivers
Water
Wetlands
Oyster Reef
Mangroves
Seagrass Meadow
Wind-Tidal Flat
Beach/Dune
Urban Areas

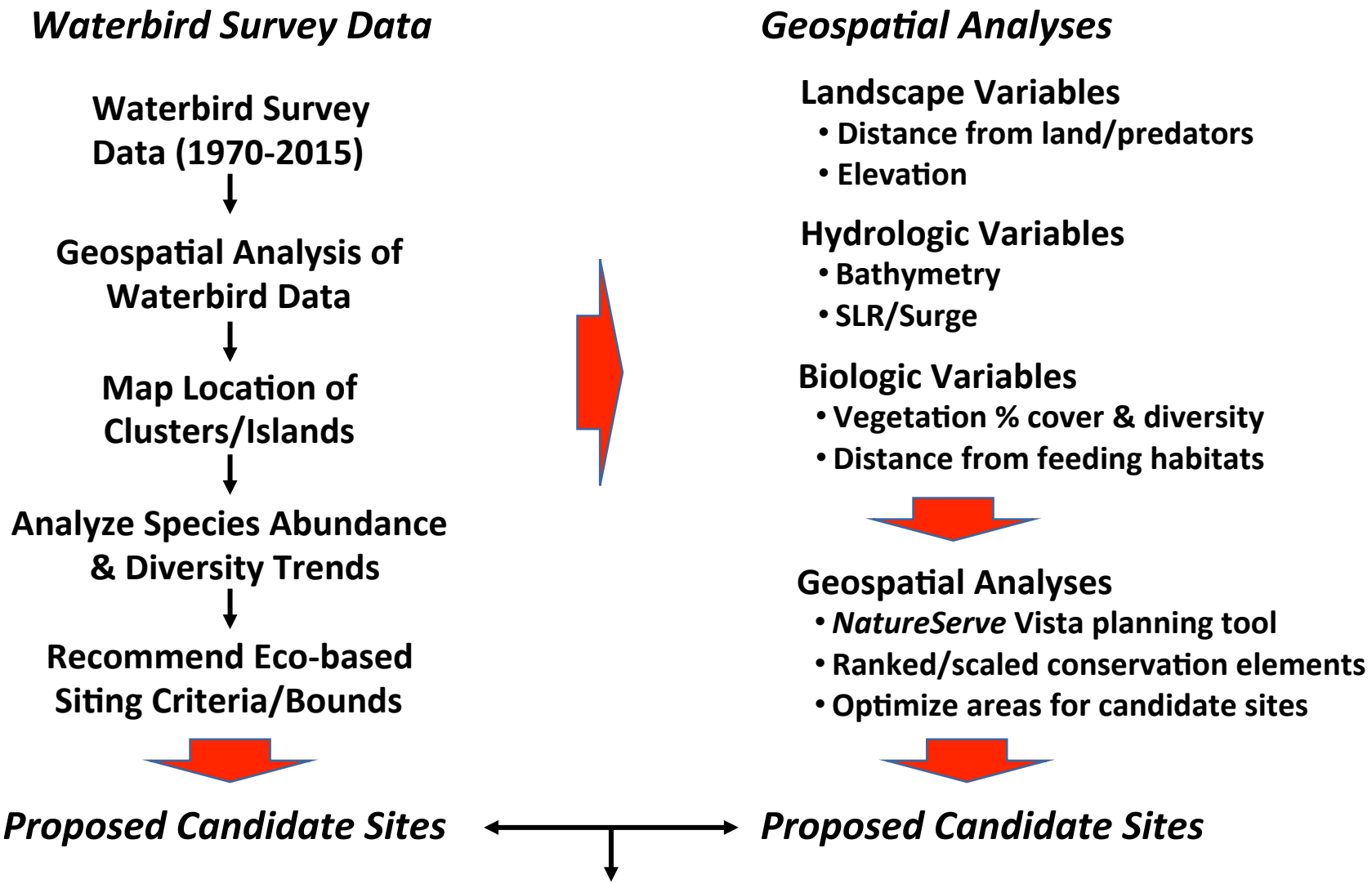
NatureServe VISTA.

Facilitates the capturing of spatial and non-spatial information and conservation requirements for elements, defining scenarios for land use, management, conservation, disturbance, etc., and evaluates the impacts of scenarios on the element.




HISTORICAL ROOKERY
PROXIMITY TO FEEDING HABITAT
WEIGHT 0.8
WEIGHT 1
WATER DEPTH
CONSERVATION VALUE SUMMARY
WEIGHT 0.6
1 ACRE

Rookery Island Site NatureServe Conservation Elements



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Refugio
Woodsboro
San Antonio Bay
Matagorda Island
Aransas
Sinton
San Patricio
Taft
Rockport
Aransas Pass
Portland
Port Aransas
Corpus Christi
Robstown
Nueces
Corpus Christi Bay
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus
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Mission-Aransas Reserve Pilot Study

Next Steps:

- Complete mapping of "conservation elements"
- Use INVEST to link VISTA geospatial indicators to ecosystem services in the scenario analysis
- Conduct scenario-consequence analyses to assess feasibility & trade-offs
- Demonstrate the utility of conceptual and decision support frameworks
- Complete project during this fiscal year
- Prepare manuscript for peer-reviewed publication on integrated assessment/decision framework and pilot study