PLANNING TOOL TECHNICAL WEBINAR

December 10, 2015

Webinar Agenda

Welcome	Karim Belhadjali, CPRA
Master Plan Decision Framework	Karim Belhadjali, CPRA
Master Plan Metrics	Denise Reed, Water Institute
Alternative Formulation	David Groves, RAND
Additional Questions	
Adjourn	

***moderated by Nick Speyrer, Emergent Method**

Master Plan Decision Framework

Karim Belhadjali | CPRA

Objectives of the Coastal Master Plan

Flood Protection

Reduce economic losses from storm-based flooding

Natural Processes

Promote a sustainable ecosystem by harnessing the processes of the natural system

Coastal Habitats

Provide habitats suitable to support an array of commercial and recreational activities coast wide

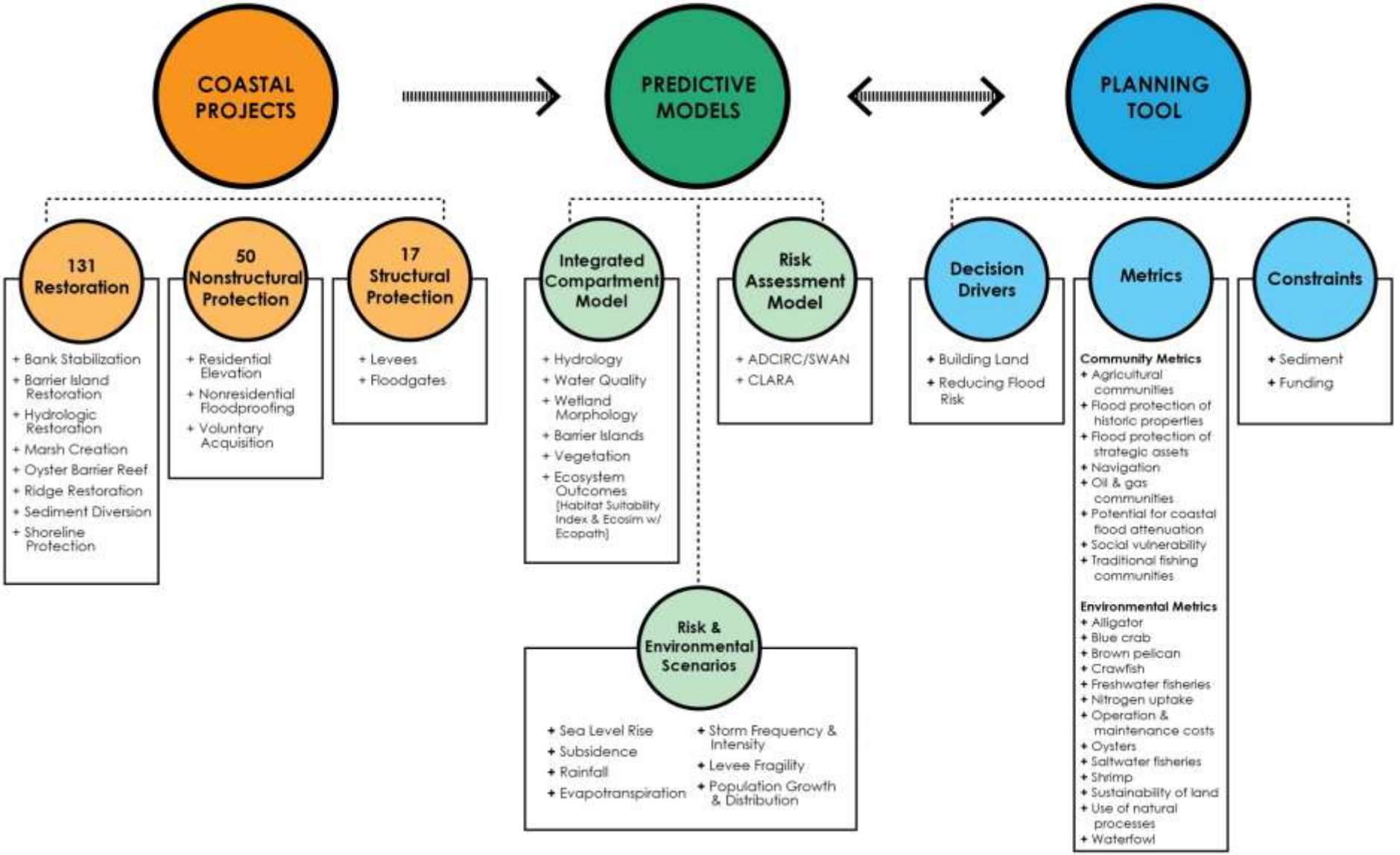
Cultural Heritage

Sustain Louisiana's unique heritage and culture

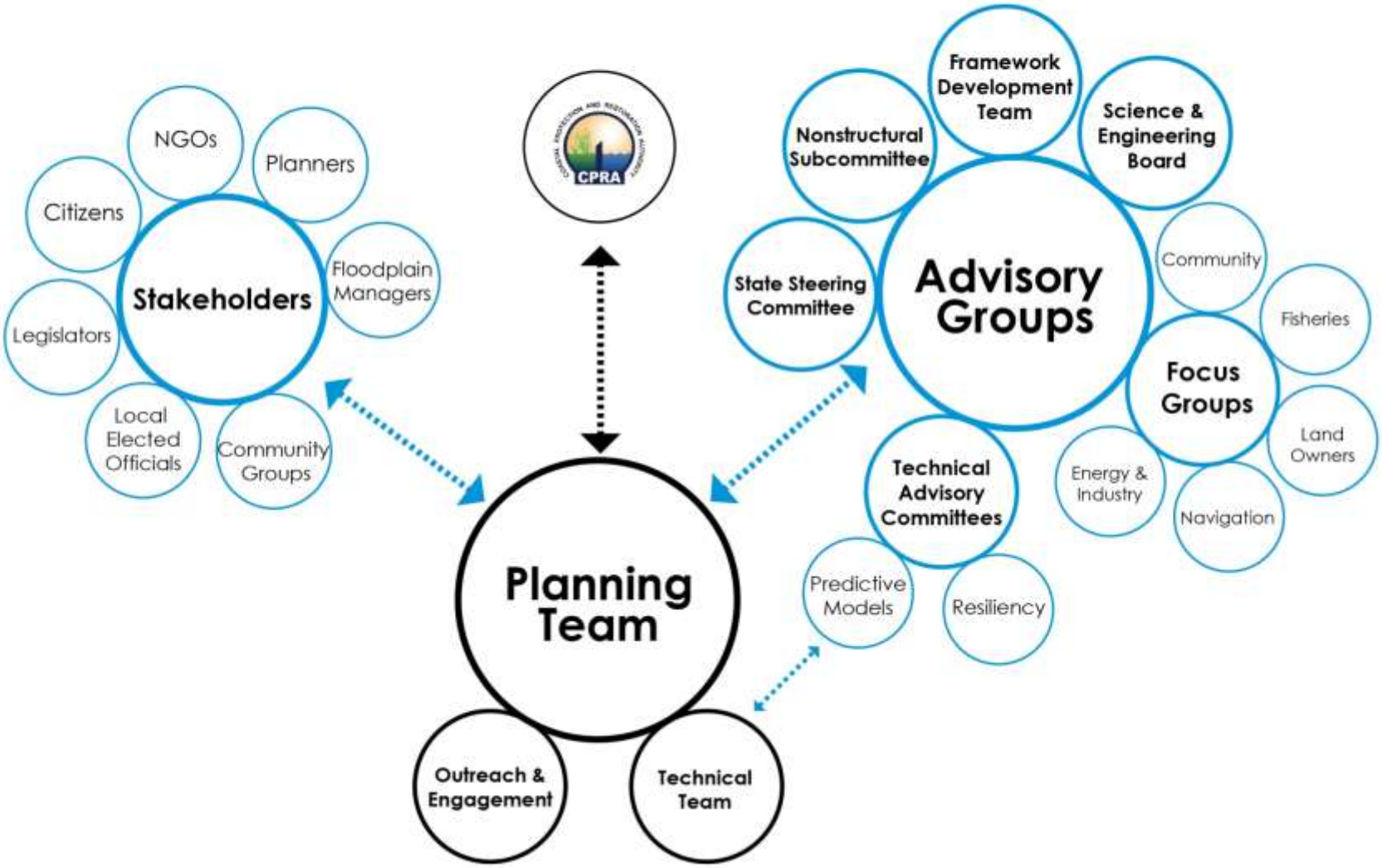
Working Coast

Support regionally and nationally important businesses and industries

2017 Planning Framework



Outreach + Coordination



Technical Process:
Developing the 2017 Coastal Master Plan

Step 1: Identify Candidate Projects

Step 2: Evaluate/ Model Projects

Step 3: Compare Projects & Develop Alternatives

Step 4: Model & Compare Alternatives

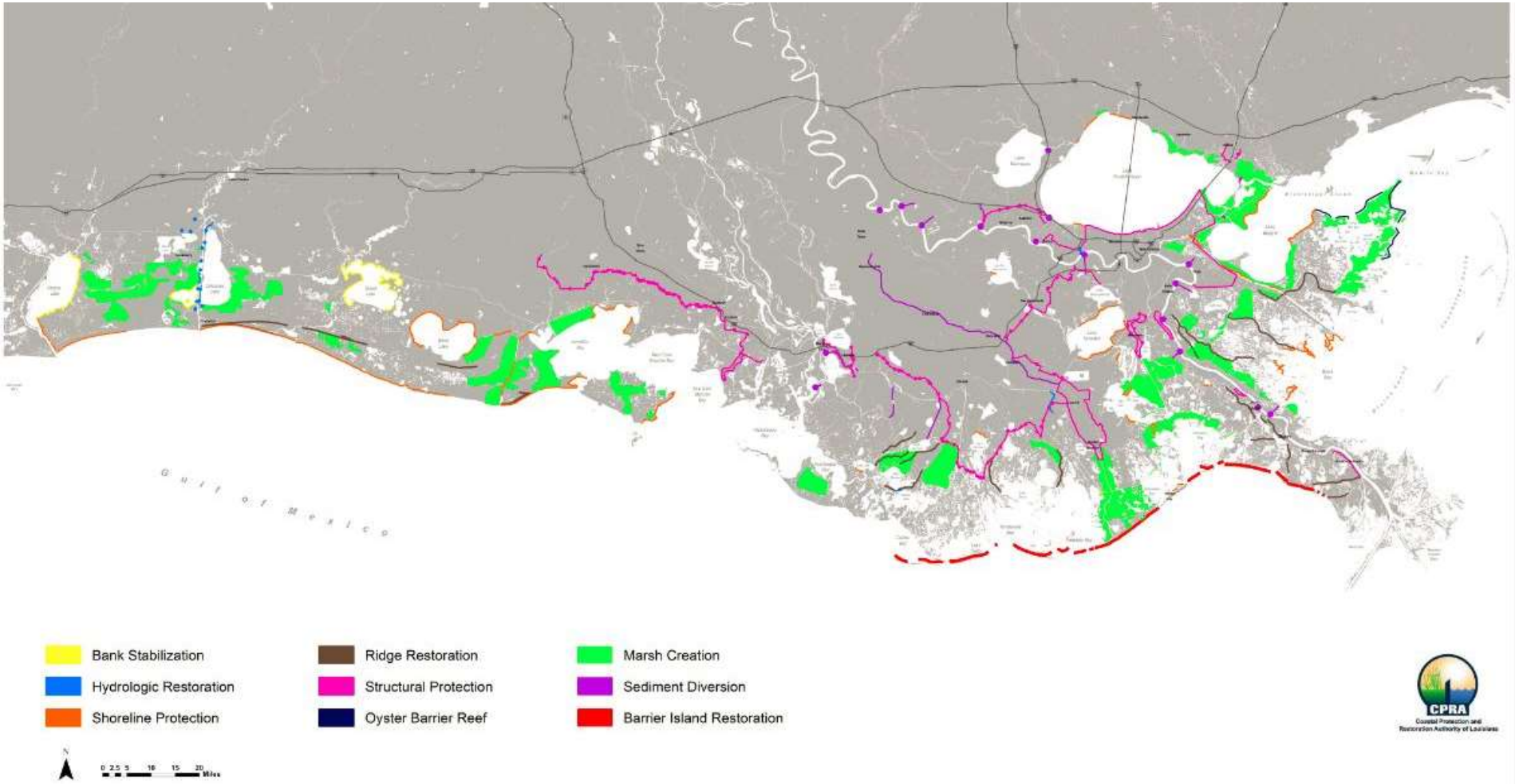
Step 5: Develop Draft & Final Plan

Step 1:
Identify Candidate Projects

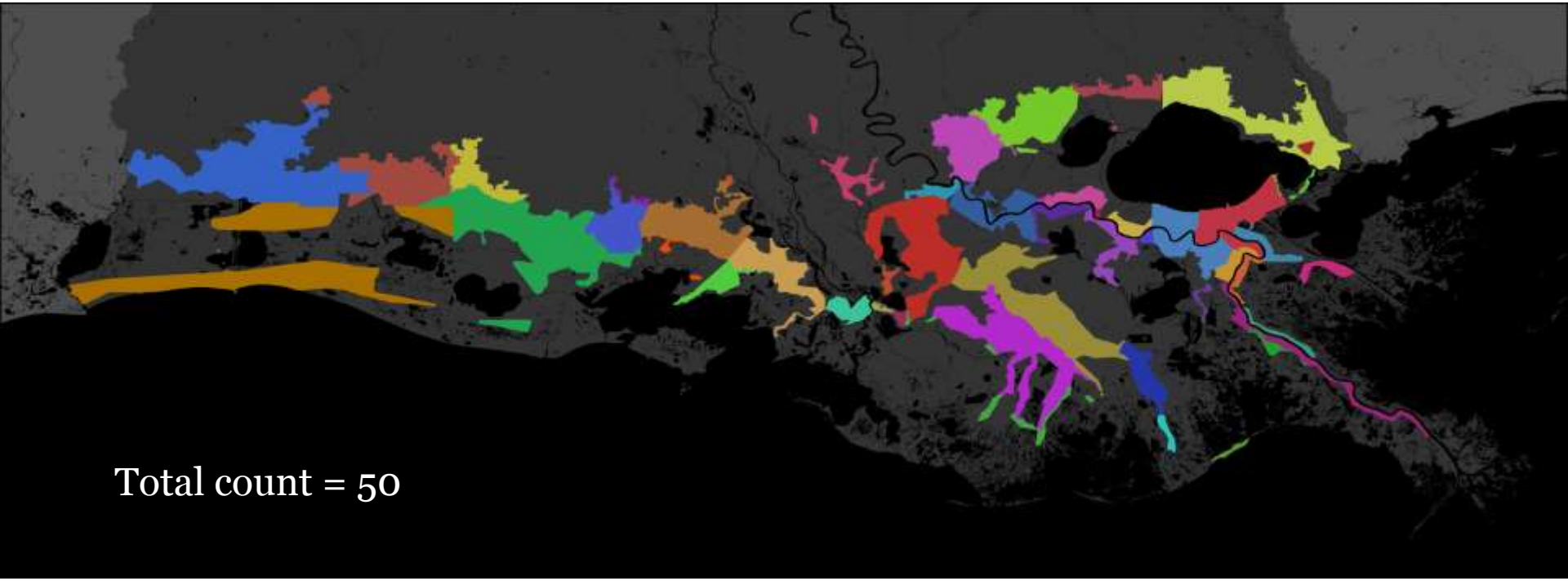
- 1A: Identify Projects
  - Refer to “Developing the List of Candidate Projects”

- 1B: Develop Project Attributes
  - Specific project details are required to define project features affecting the landscape and hydrology in the coastal system
  - Project attributes provide parameters needed for both the predictive models and the Planning Tool
  - Refinements and updates have been made based on best available and current information

2017 Candidate Projects



2017 Candidate Nonstructural Project Areas



Project areas divided by:

- Parish boundaries
- Existing or proposed levees

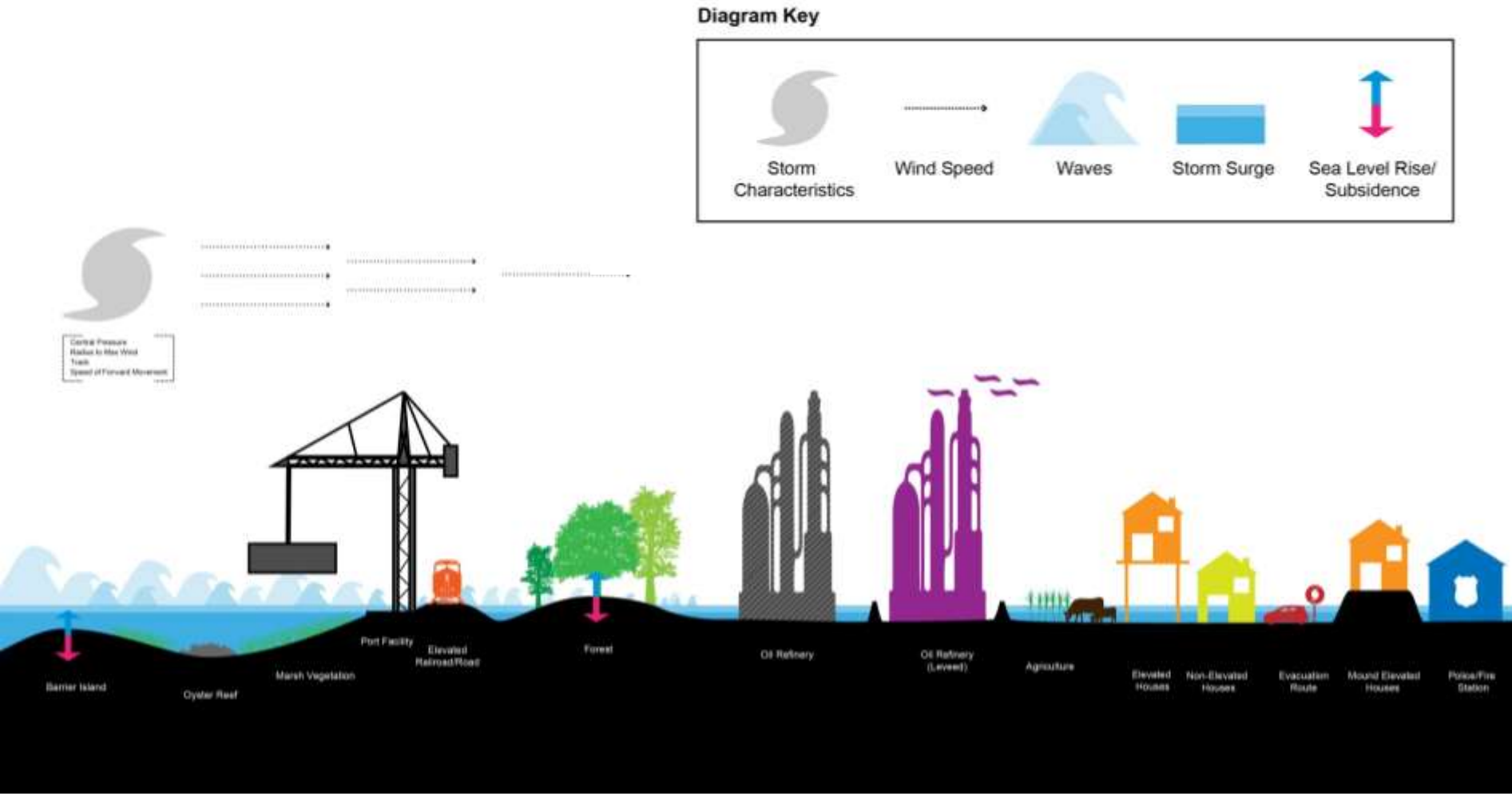
Step 2:
Evaluate Projects

- Use integrated compartment model to show effects on Landscape and Ecosystem outcomes/metrics
- Use storm surge and wave models and risk assessment model to show effects on risk reduction
- Determine what a future with no action might look like
- Analyze each project's benefits and drawbacks compared to future without action

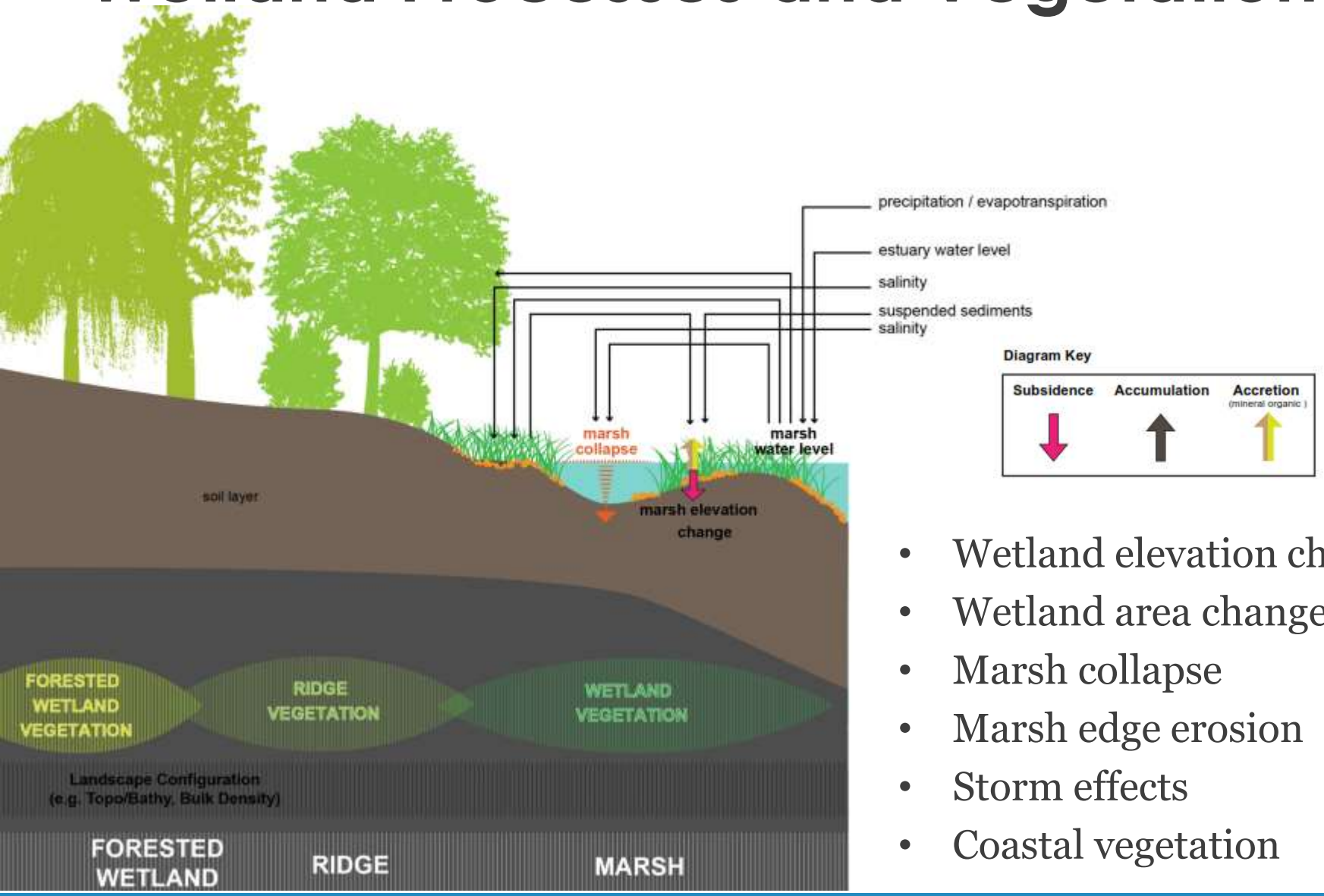
Projects for Evaluation:
50 Nonstructural Projects
17 Structural Projects
131 Restoration Projects

TOTAL 198 Projects

Which Damages are Considered



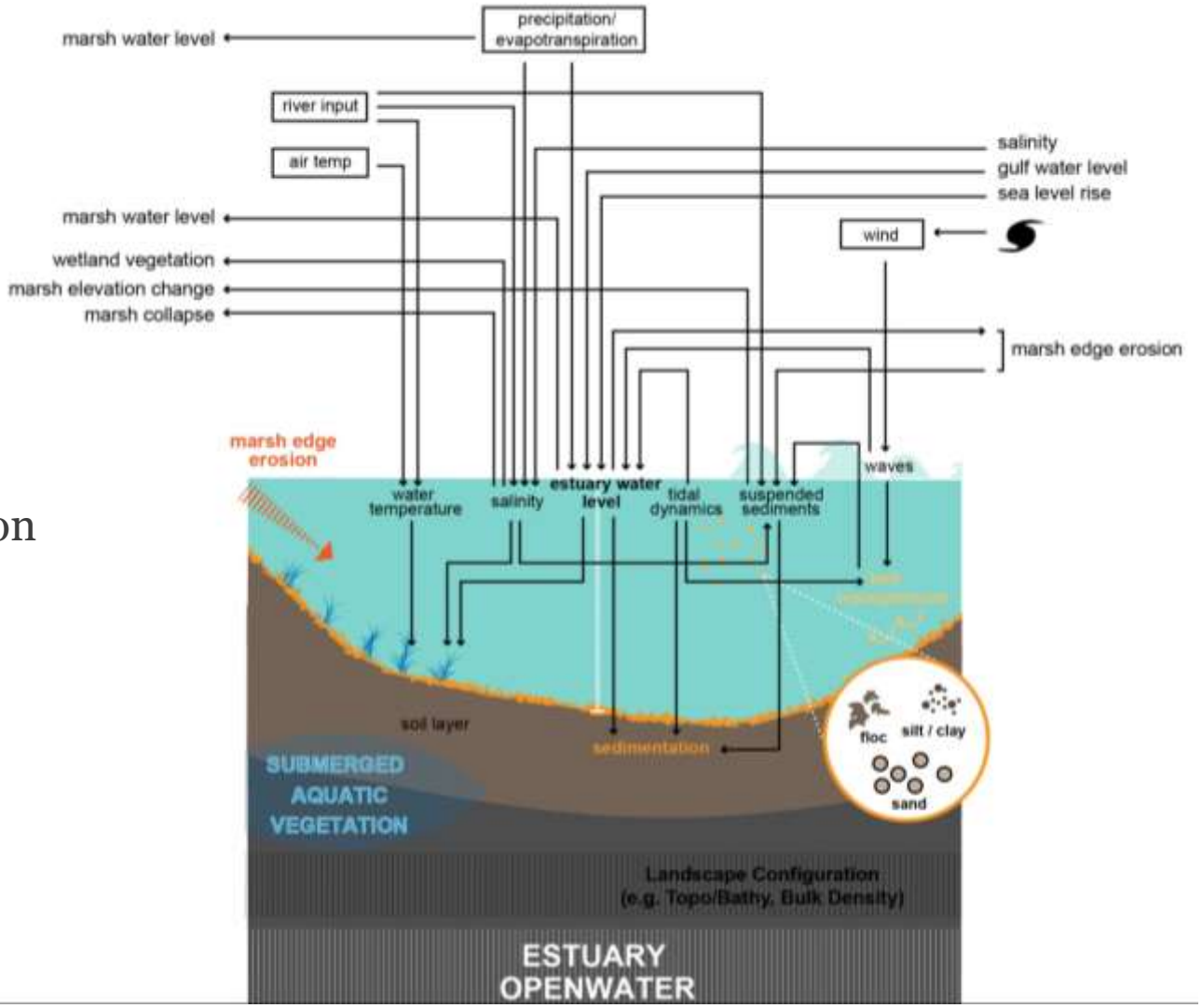
Wetland Processes and Vegetation



- Wetland elevation change
- Wetland area change
- Marsh collapse
- Marsh edge erosion
- Storm effects
- Coastal vegetation

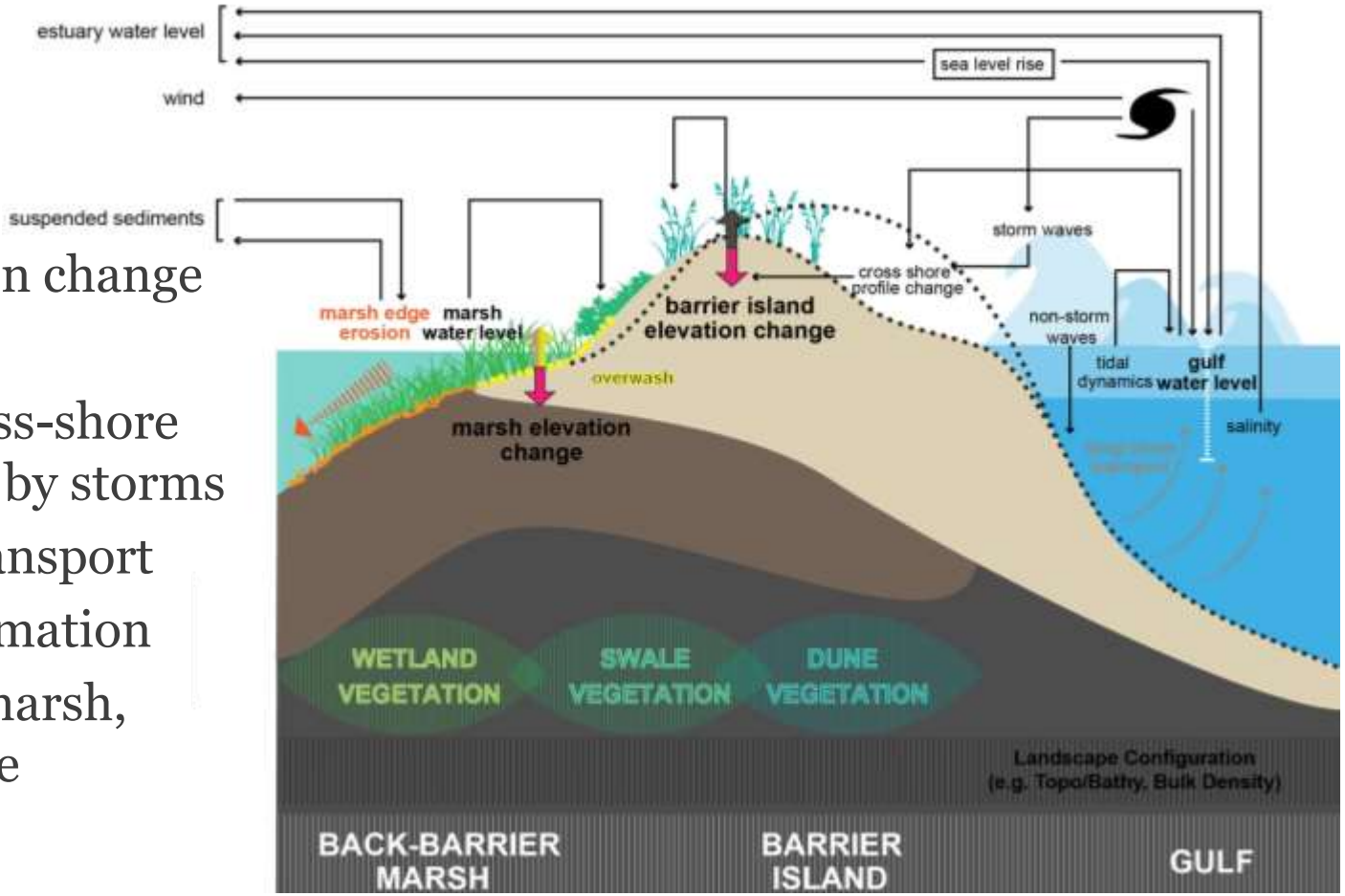
Estuary and Open Water Processes

- Hydrodynamics
- Water quality
- Sediment distribution
- Sedimentation
- Bed resuspension

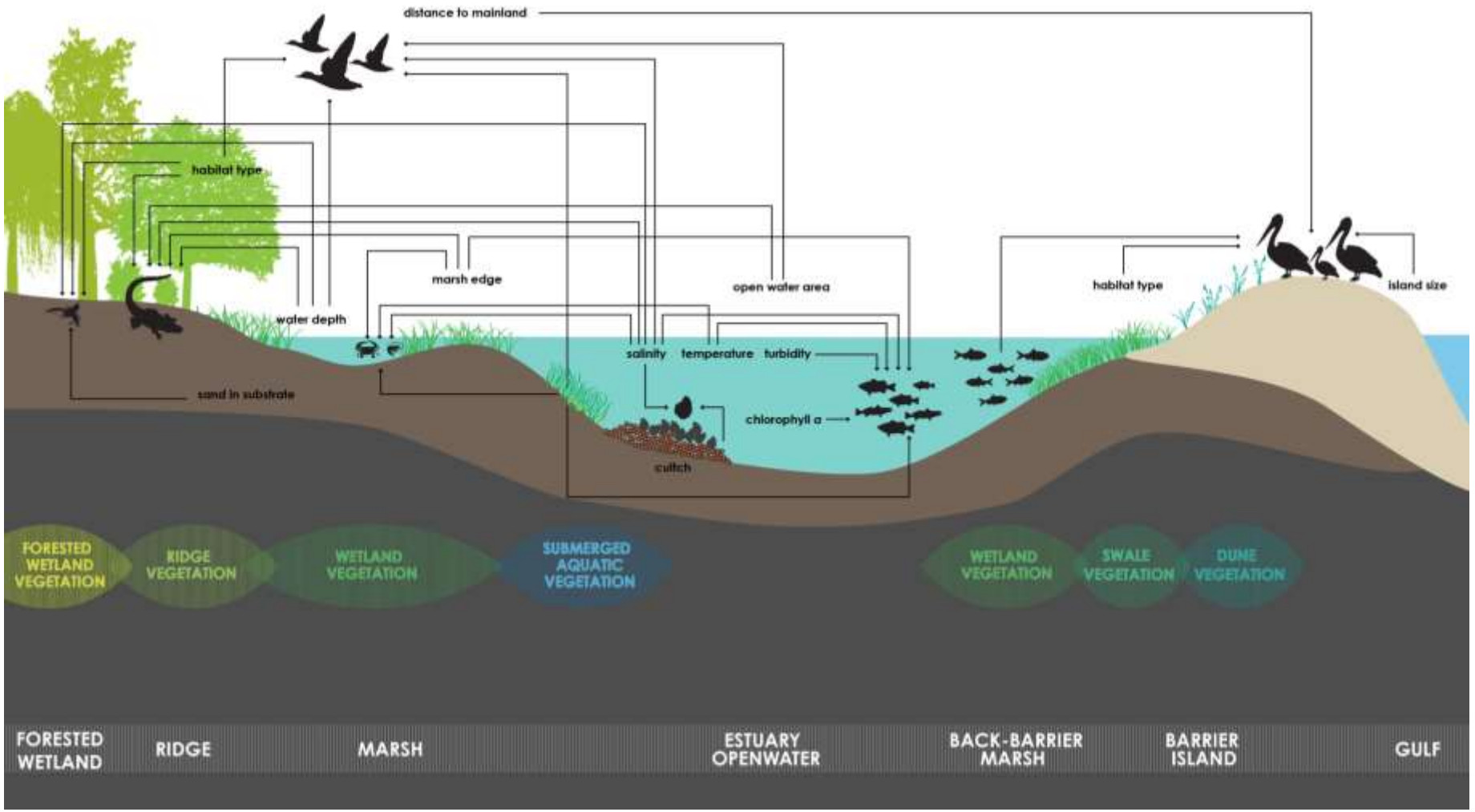


Barrier Island Processes

- Island elevation change
- Breaching
- Overwash/cross-shore profile change by storms
- Long-shore transport
- Wave transformation
- Back-barrier marsh, dune and swale vegetation

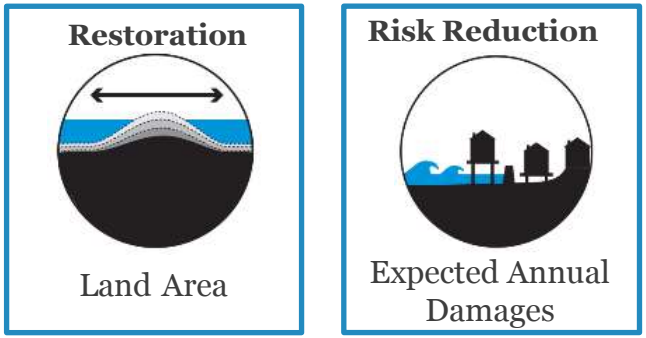


Habitat Suitability Indices



Step 3:
Compare Projects & Develop Alternatives

- Use Planning Tool to compare project benefits
- Account for constraints
  - Water, sediment, funding
- Develop alternatives that reflect the limits of our resources and diversity of possible choices



Balancing Diverse Objectives

Community Metrics

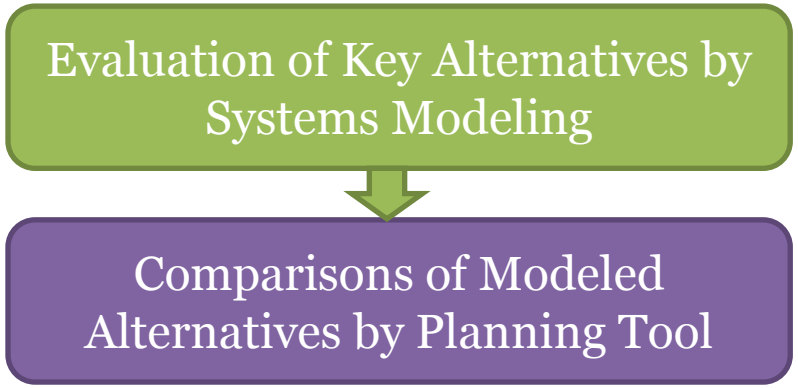
- Flood protection of historic properties
- Flood protection of strategic assets
- Potential for coastal flood attenuation
- Social vulnerability
- Support for agricultural communities
- Support for navigation
- Support for oil & gas communities
- Support for traditional fishing communities

Environmental Metrics

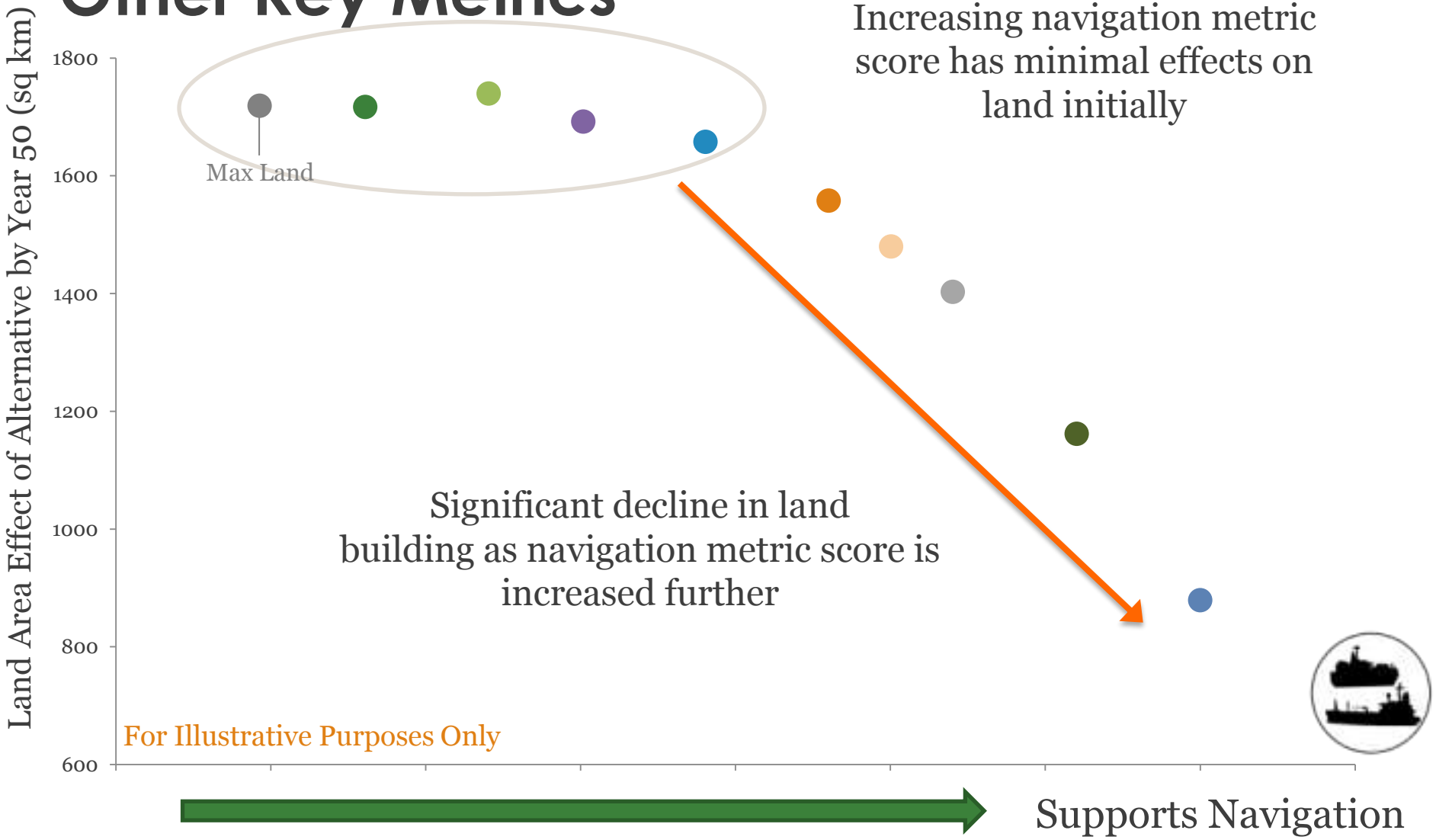
- Alligator
- Blue crab
- Brown pelican
- Crawfish
- Freshwater fisheries
- Nitrogen uptake
- O&M costs
- Oysters
- Saltwater fisheries
- Shrimp
- Sustainability of land
- Use of natural processes
- Waterfowl

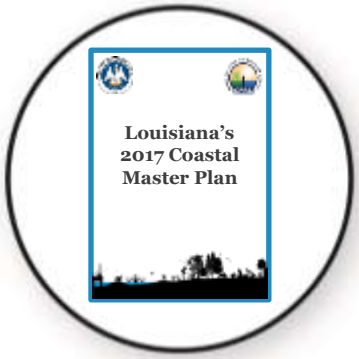
Step 4:
Model & Compare Alternatives

- Iterative use of models and Planning Tool
- Maximize land and risk reduction
- Application of additional metrics
- Use of interactive visualizations of the project alternatives



Different Alternatives can Reflect Other Key Metrics

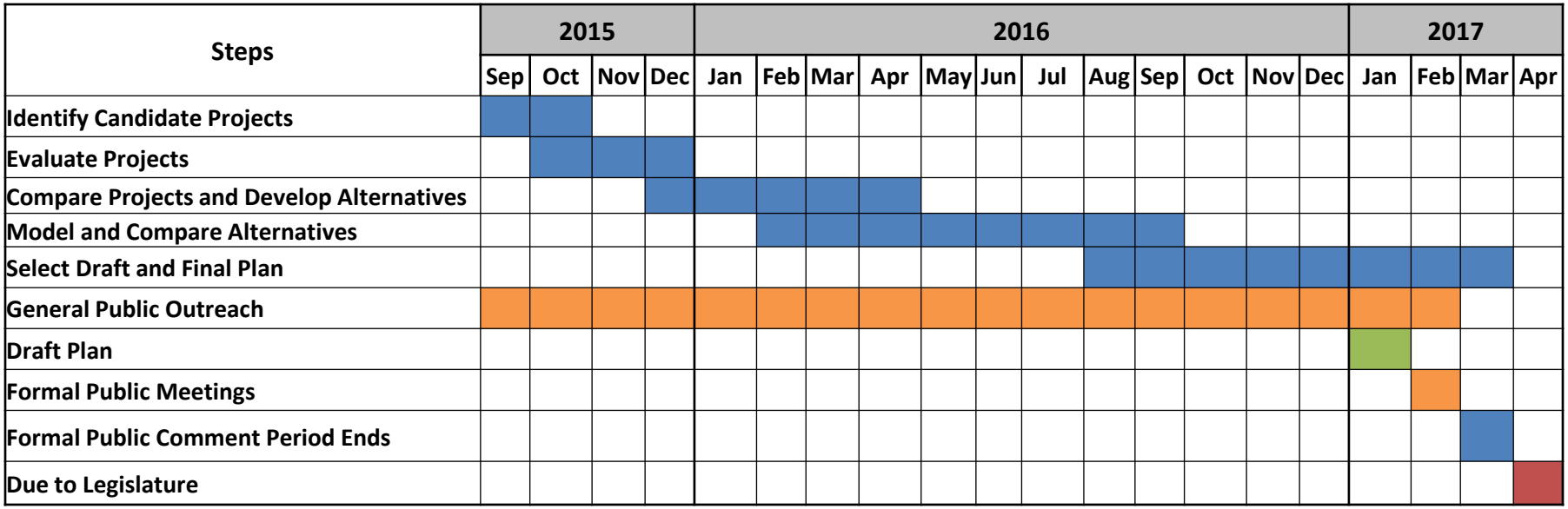




Step 5:
Select Draft and Final Plan

- The selected alternative will be the centerpiece of 2017 Coastal Master Plan
- Final list of selected projects as informed by technical tools and stakeholder input
- Maps and graphics showing the selected projects and their expected outcomes
- 10-year implementation focus on "no regrets" projects with longer 50-year planning strategy

2017 Master Plan Timeline



Key Dates:

- January 2017 – Draft Plan
- February 6-10, 2017 – Public Meetings
- April 25, 2017 – Plan Submitted to Legislature

Questions?

coastal.la.gov

MASTER PLAN METRICS

Denise Reed | The Water Institute of the Gulf

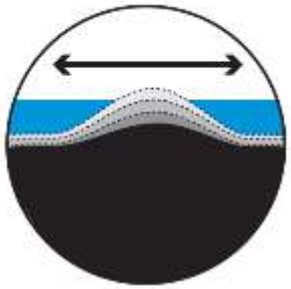
Planning Tool – Decision Drivers

- Two primary factors will drive decisions about the projects that should be selected in the 2017 Coastal Master Plan:
  1. How well did the projects reduce flood risk?
  2. How well did the projects build new land or maintain the land already in the system?

Risk Reduction

Expected Annual Damages

Restoration



Land Area

… While Balancing Diverse Objectives

Community Metrics

- Flood protection of historic properties
- Flood protection of strategic assets
- Potential for coastal flood attenuation
- Social vulnerability
- Support for agricultural communities
- Support for navigation
- Support for oil & gas communities
- Support for traditional fishing communities

Environmental Metrics

- Alligator
- Blue crab
- Brown pelican
- Crawfish
- Freshwater fisheries
- Nitrogen uptake
- O&M costs
- Oysters
- Saltwater fisheries
- Shrimp
- Sustainability of land
- Use of natural processes
- Waterfowl

2017 Master Plan Metrics

Metric	Scale for Application
Sustainability of Land	Project
Support for Navigation	Project
Use of Natural Processes	Project
Potential Coastal Flood Attenuation	Project
Social Vulnerability	Alternative
Traditional Fishing Communities	Alternative
Support for Oil and Gas	Alternative
Support for Agricultural Communities	Alternative
Flood Risk to Historic Properties	Alternative
Flood Risk to Strategic Assets	Alternative

Sustainability of Land

- Relevant Master Plan Objective:

- Two components:
  - Land built vs. land lost
  - Trajectory of land building years 40-50

Support for Navigation

- Relevant Master Plan Objective:

- Focus on federally authorized navigation channels
- Considers:
  - Land surrounding channels
  - Changes in bed elevation in channels
  - Cross-channel velocity changes for diversions
  - New obstacles to navigation, e.g., new gates

Use of Natural Processes

- Relevant Master Plan Objective:

- The approach evaluates three characteristics of the projects:
  - Degree to which a project establishes natural process connections within the coast
  - Degree to which a project impedes existing natural process connections (i.e., plugs or structures in natural waterways or wetlands)
  - Use of sediment from outside the coastal system
- Hydrology
  - Track the changes made to 'links' in the model to reflect project character
  - Scale +ve or –ve change by maximum change for any project
  - Score varies between -1 and +1
- Sediment from external borrow sources
  - Track the amount of sediment used (calculated by the model based on water depth)
  - Scale relative to maximum amount for any project
    - As in 2012, score varies between 0.1 and 0.4

Potential for Coastal Flood Attenuation

- Relevant Master Plan Objective:

- Reflects the effects of restoration projects during project level evaluation
- Storms included in the 50-year runs based on historical record with adjustments for each scenario
- For all designated communities
  - Daily depth for FWOA and FWP compared by 500m cell
  - Maximum difference for a cell in an ecoregion
  - Reported in m (differences <0.1m considered within model calibration)

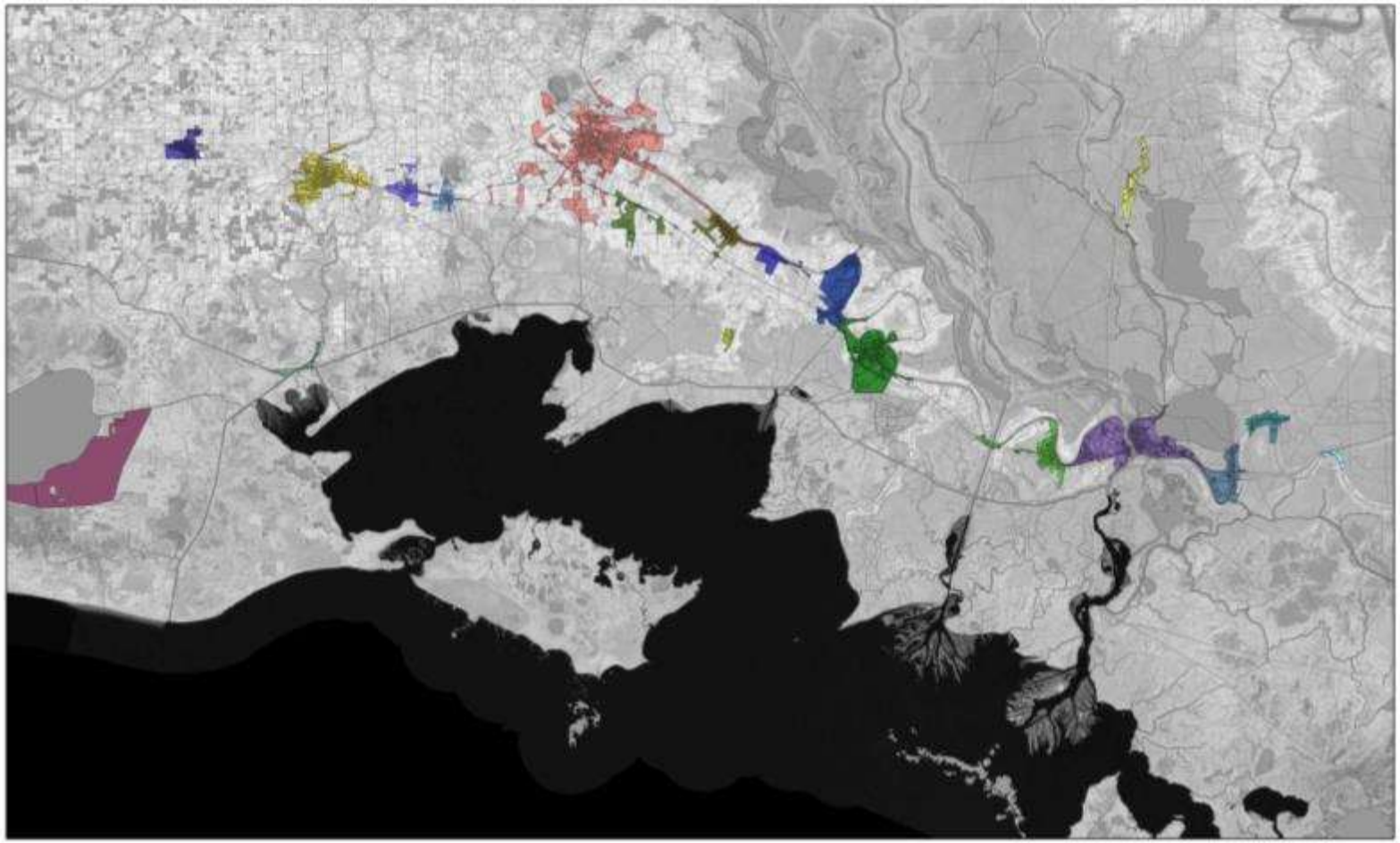
Identifying Communities

- Three factors:
  - Identify geographic population center for legal/Census Bureau designated communities
    - For others, use land cover maps and aerial photography to identify
  - Used a density of 1,000 people per square mile to establish the spatial extent of community development
    - Contiguous census blocks included with density of at least 500
  - Used National Land Cover Database (NLCD) to identify locations within or contiguous to these communities with high, medium, and low density developed land surface
- Developed land layers merged with population layers

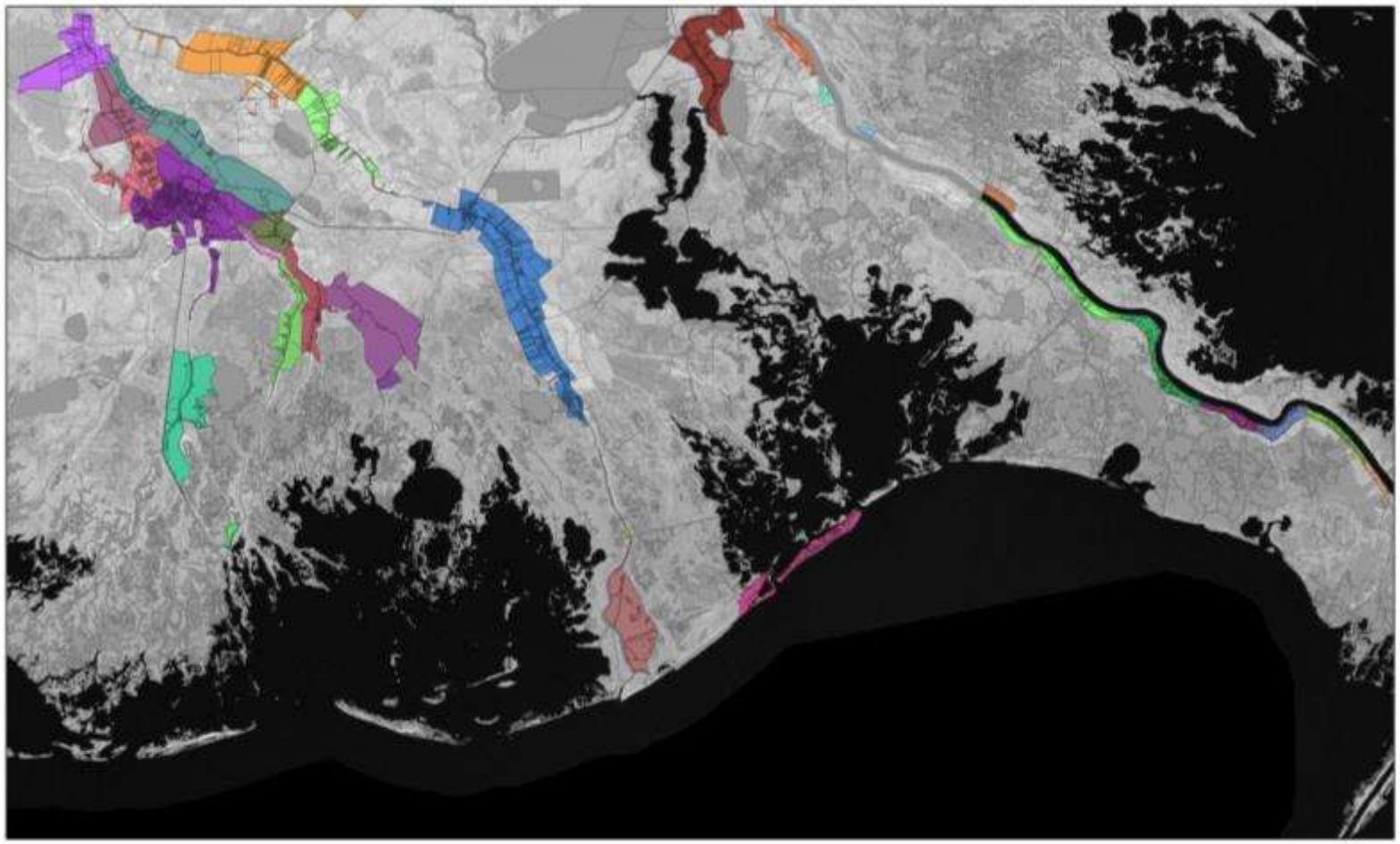
Updated Master Plan Community Boundaries (2010 Census Blocks)

Updated Master Plan Community Boundaries (2010 Census Blocks)

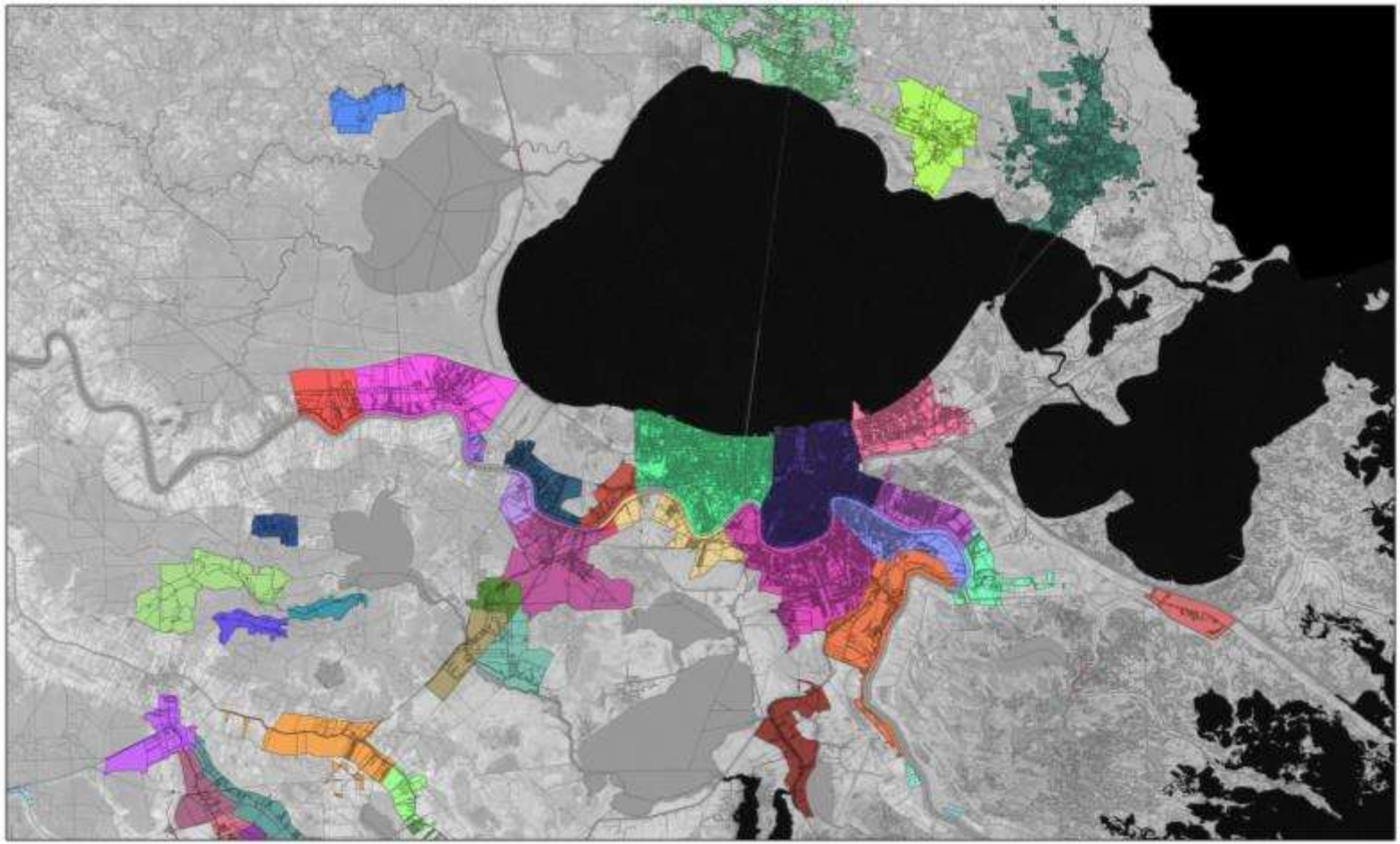
Updated Master Plan Community Boundaries (2010 Census Blocks)



Updated Master Plan Community Boundaries (2010 Census Blocks)



Updated Master Plan Community Boundaries (2010 Census Blocks)



Traditional Fishing Communities

- Relevant Master Plan Objectives:

- Fishing communities identified and associated with resources (e.g., shrimp) and areas where those resources are exploited by the community (as in 2012 Coastal Master Plan)
- Combines effects of risk reduction and restoration measures
- Key components:
  - Expected annual damages at year 50 scaled by initial condition in select communities
  - Changes in habitat within resource areas for designated fish/shellfish
    - Importance of habitat for each species is scaled by initial conditions

Support for Oil and Gas

- Relevant Master Plan Objective:

- Oil and gas communities identified in 2012 Coastal Master Plan and expanded through dialog with focus group
- Combines effects of risk reduction and restoration measures
- Two main components:
  - Expected annual damages at year 50 scaled by initial condition in select communities
  - Wetland area with a focus on retaining the land that exists under the initial condition

Support for Agricultural Communities

- Relevant Master Plan Objective:

- Agricultural communities identified in 2012 Coastal Master Plan
- Current agricultural practice was obtained from the 2014 USDA cropland data layer
  - Focus on rice, sugarcane, soybeans, pasture
- Combines effects of risk reduction and restoration measures
- Two main components:
  - Expected annual damages at year 50 scaled by initial condition in select communities
  - Effect of salinity on crops:
    - Based on two week average salinity
    - Thresholds developed with input from LSU Ag Center

Flood Risk to Historic Properties

- Relevant Master Plan Objective:

- Historic properties and historic districts identified by Louisiana State Historic Preservation Office
- Score is based on % of historic properties/districts in each area protected from flooding (50-year event) to a depth of greater than 30cm

Flood Risk to Strategic Assets

- Relevant Master Plan Objective:

- Strategic assets based on Homeland Security Infrastructure Program Gold and the data from the 2012 Strategic Assets list
- Score is based on % of strategic assets in each area protected from flooding (50-year event) to a depth of greater than 30cm

Social Vulnerability

- Social vulnerability analysis conducted at the census block group level to assess the effects of restoration & protection projects on coastal communities
- Based on 2010 Census and 2014 ACS, 35 socioeconomic variables analyzed/classified into significant overarching categories of vulnerability
- Categories of vulnerability combined to derive a composite social vulnerability score for each populated census block group in the coastal area

Questions?

coastal.la.gov

COMPARING PROJECTS AND DEVELOPING ALTERNATIVES

David Groves | RAND Corporation

Why Use a Decision Support Tool for the 2017 Coastal Master Plan?

- Future coastal conditions are complex and uncertain
- Approaches to improving coastal sustainability are:
  - Numerous
  - Varied
  - Provide different sets of benefits
- Louisiana and CPRA are committed to a science-based, transparent process to develop the 2017 Coastal Master Plan

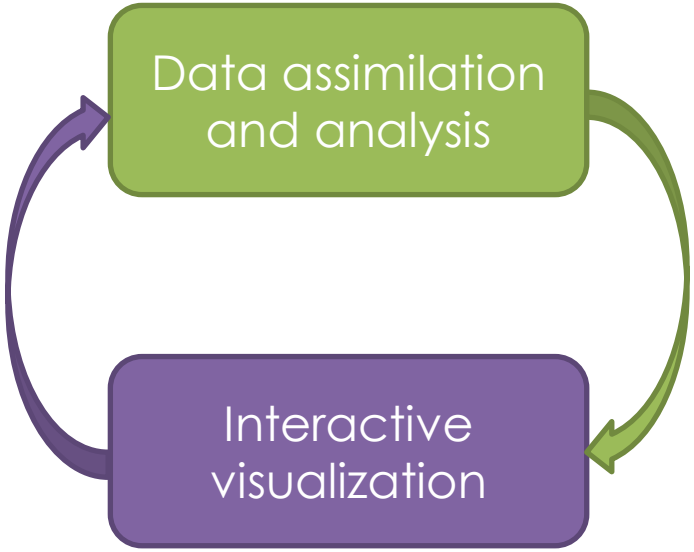
How Will a Planning Tool Help Develop the 2017 Coastal Master Plan?

- Summarize detailed information from systems modeling
- Present key information on projects for comparison
  - Cost and other attributes
  - Effects on the coast
  - Cost-effectiveness
- Identify alternatives (groups of projects) to meet state goals
- Support deliberations over refinements to master plan

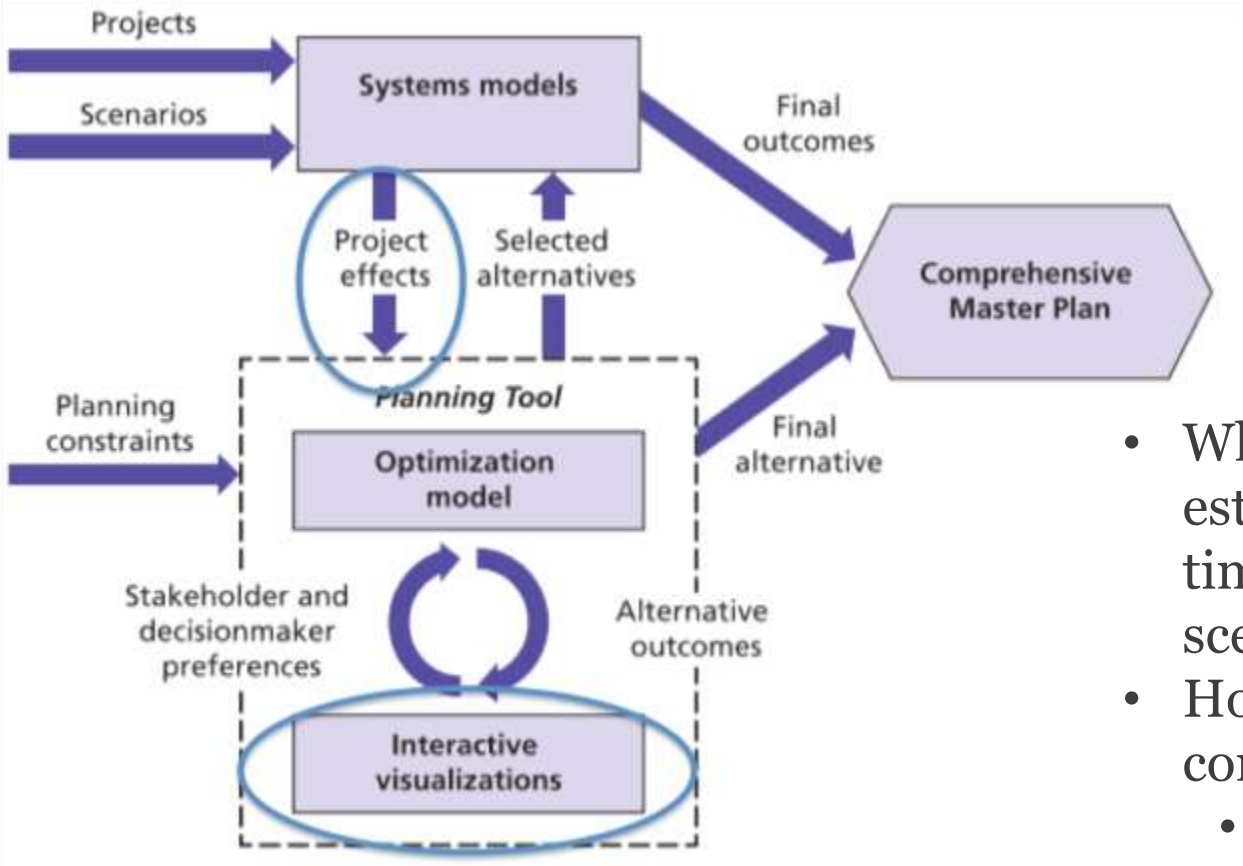
Overview of the Planning Tool

CPRA Planning Tool Supports Project Comparison and Alternative Formulation

- Planning Tool supports iterative and interactive planning
- Two key modules
  1. Data assimilation and analysis
  2. Interactive visualization

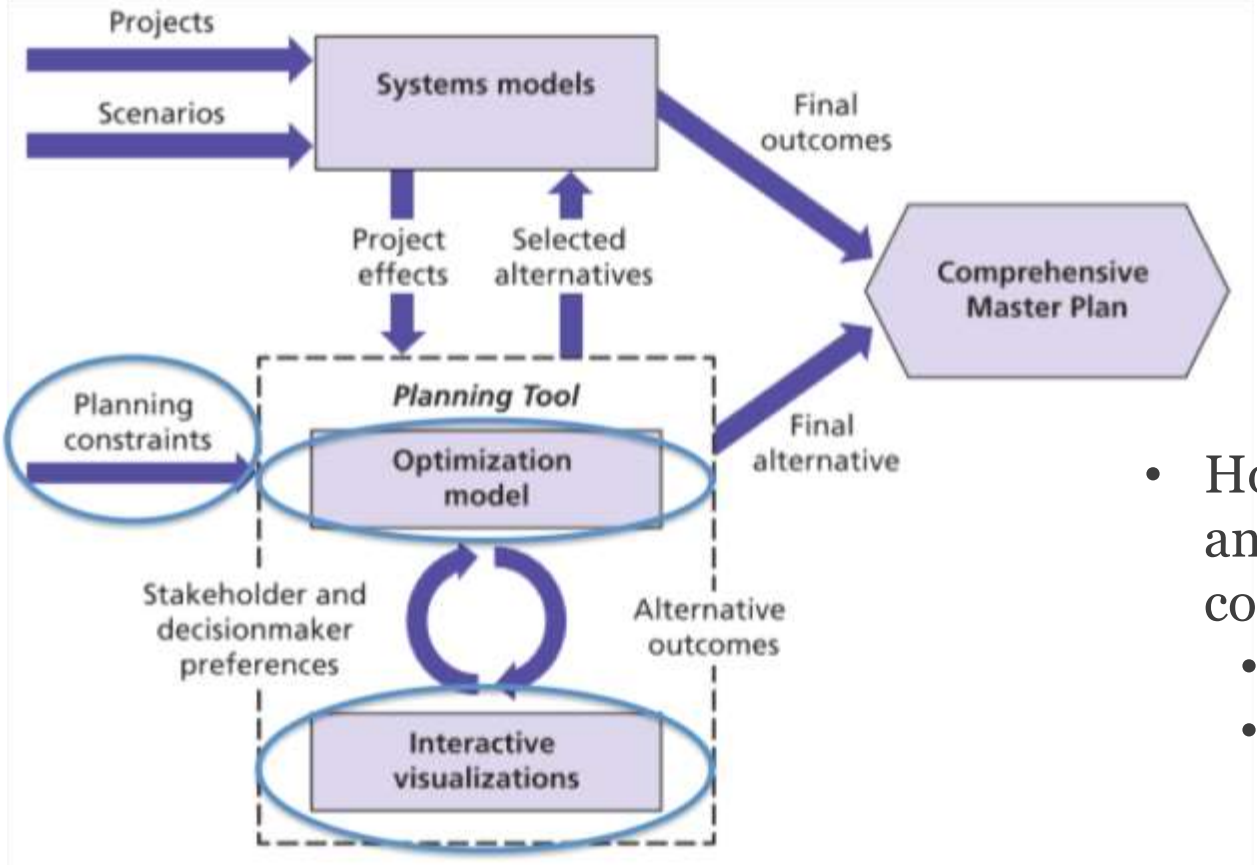


Planning Tool Will Help Compare Different Projects



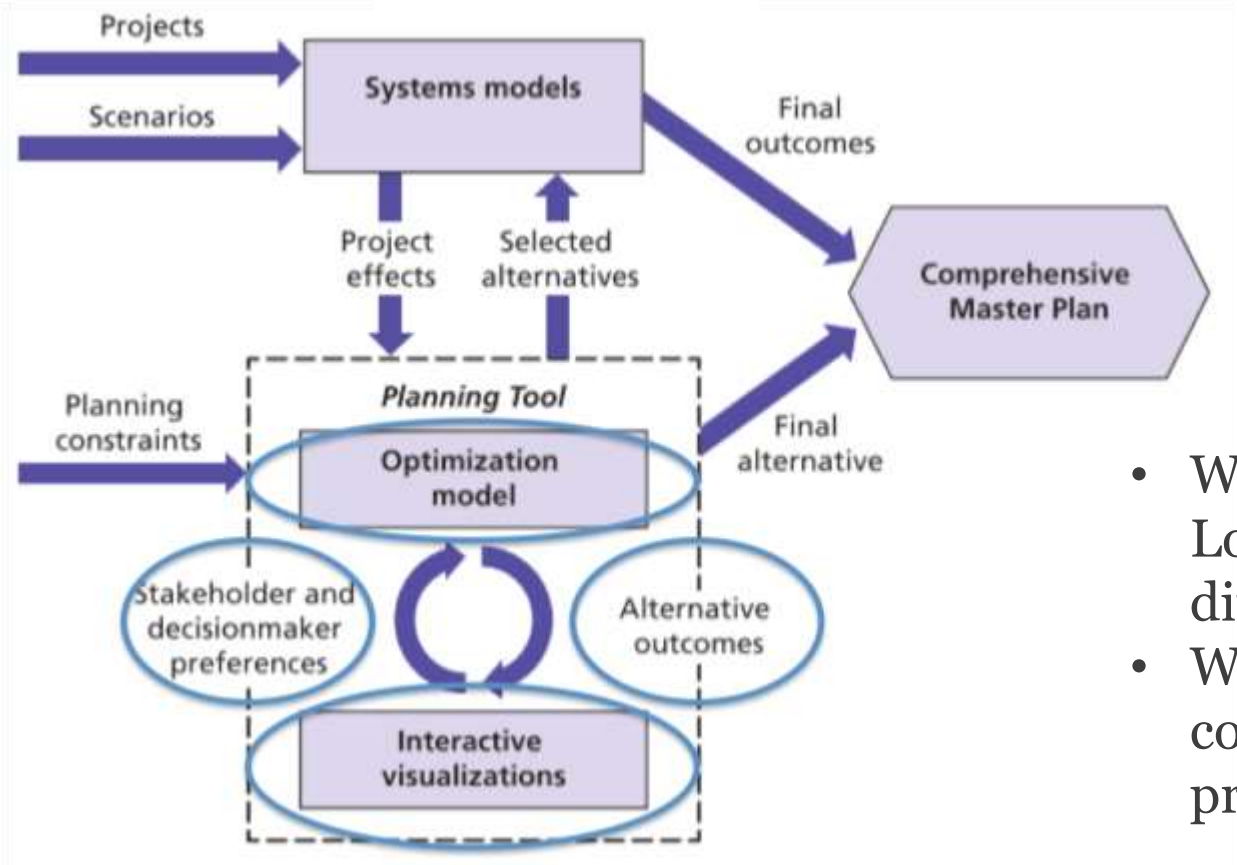
- What are the project's estimated effects over time and in different scenarios?
- How do the projects compare?
  - Effects
  - Cost-effectiveness

Planning Tool Will Develop Alternatives Consistent with Planning Constraints



- How much risk reduction and land building benefit could be achieved?
  - Funding
  - Available sediment

Planning Tool Will Develop Alternatives Reflecting Different Preferences

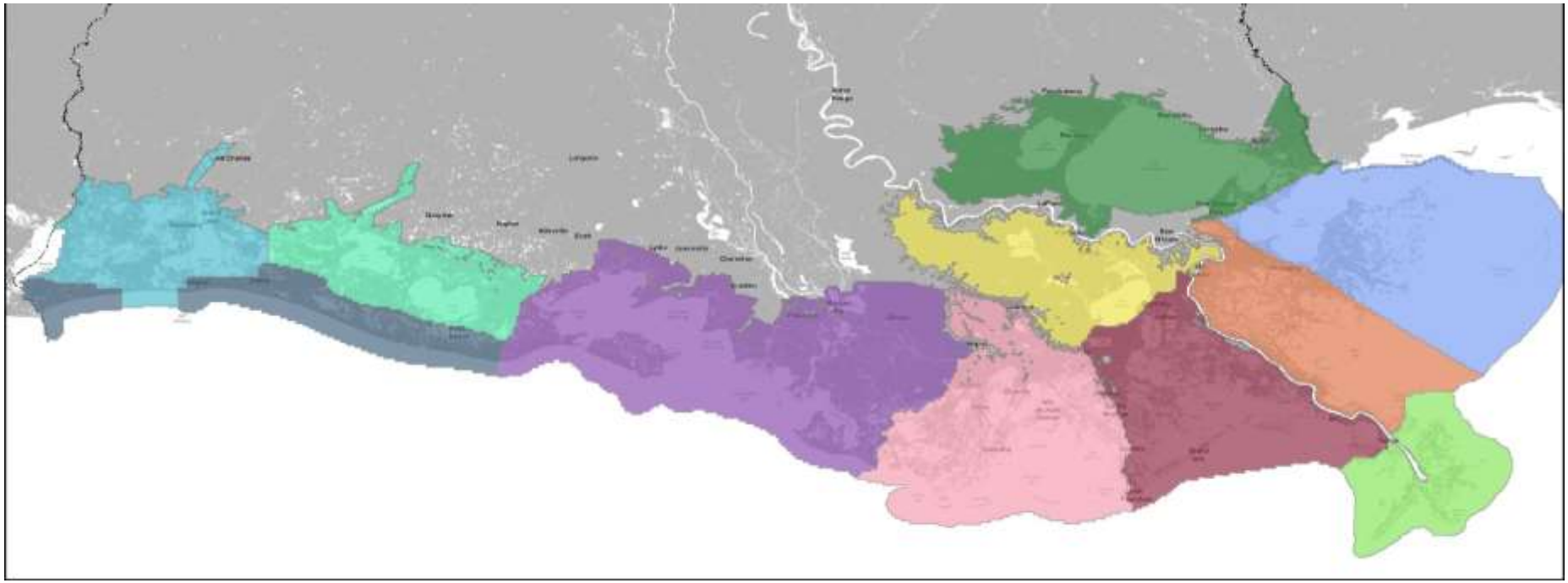


- Which projects best meet Louisiana's objectives for different preferences?
- Which projects are common across different preferences?

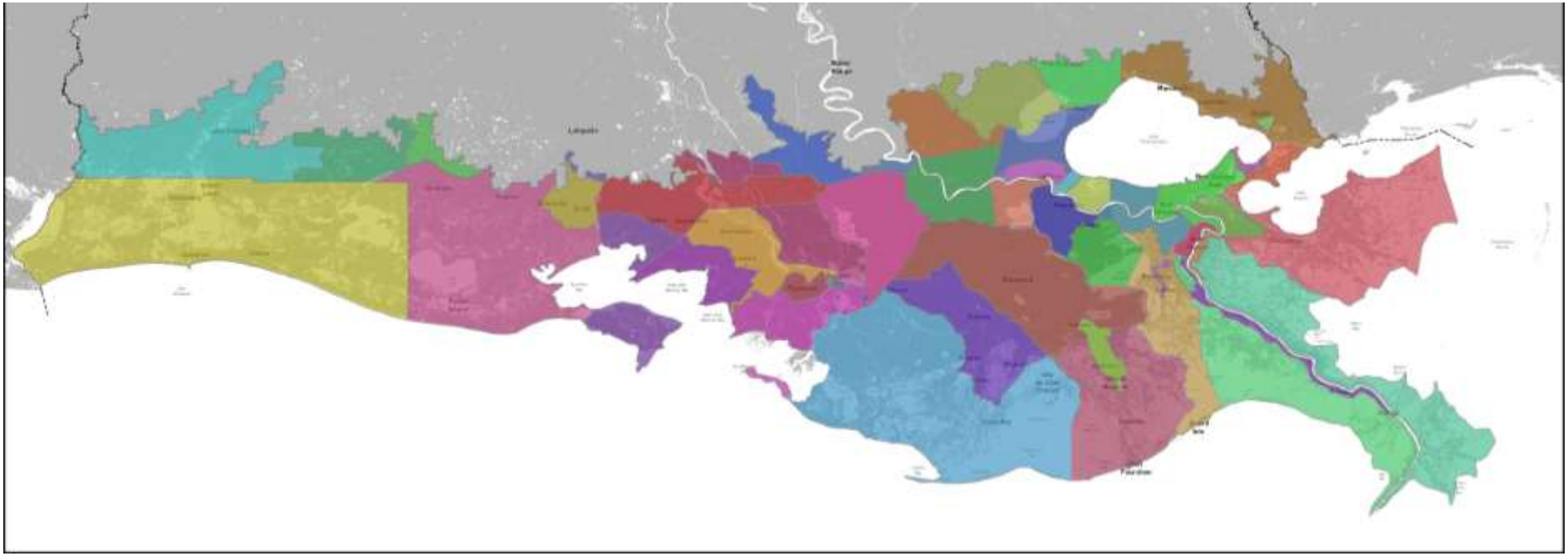
Planning Tool Assimilates Information about Estimated Coastal Conditions and Project Attributes and Effects

- Key inputs
  - FWOA conditions over time (through +50-years)
    - Flood risk metrics
    - Ecosystem metrics
    - Other metrics
- Project attribute information
  - Location, type, phasing
  - Cost (E&D, construction, and O&M)
- Estimated effects of *candidate projects* over time for range of *metrics* across *scenarios*
  - Flood risk
  - Ecosystem
  - Other

Systems Models Provide Estimates of Land and Restoration-Related Outcomes for 11 Ecoregions



Systems Models Provide Estimates of Risk-Related Outcomes for about 50 Risk Regions



Planning Tool Compares Projects by Their Effects on the Coast and Cost-Effectiveness

- Projects compared on a level playing field with respect to:
  - Effects of projects across key metrics
  - Costs of projects
  - Cost-effectiveness of projects for key metrics (mid-term and long-term)

$$\text{Mid-term Cost-Effectiveness (Land)} = \frac{\text{Project Effect (Land) (yr 25)} - \text{FWOA (Land) (yr 25)}}{\text{50-year Project Cost}}$$

Key Metrics:

- Net land area
- Expected annual damage ($)

Planning Tool Identifies Groups of Projects (Alternatives)

- Maximizes key *decision drivers*:
  - Mid-term (year 25) Land Area
  - Long-term (year 50) Land Area
  - Mid-term (year 25) Expected Annual Damage Reduction
  - Long-term (year 50) Expected Annual Damage Reduction
- Consistent with key *constraints*:
  - Funding availability
  - Available sediment
  - Project compatibilities
  - Performance thresholds
- For a specified *scenario*

Maximizes Outcomes

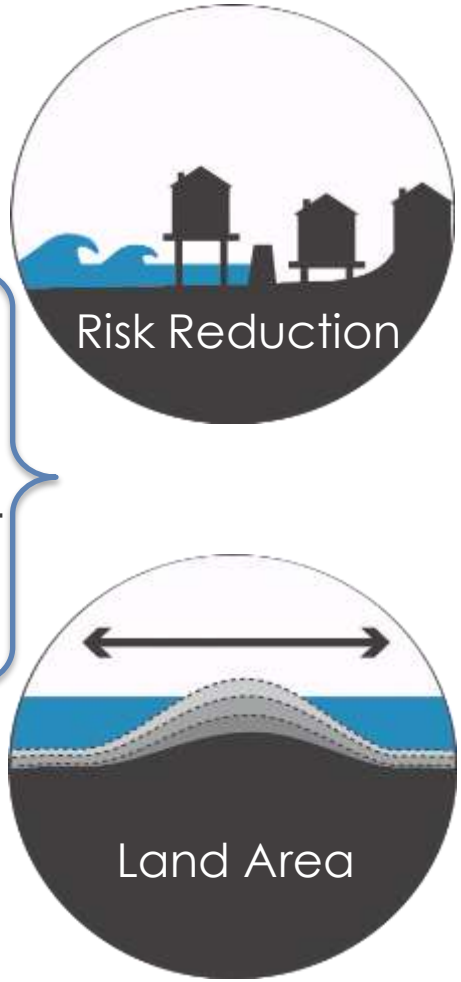
Within Constraints

Planning Tool Uses Constrained Mixed Integer Program to Select Projects

Choose projects by each implementation period to:

Maximize

- Mid-term EAD Reduction +
- Long-term EAD Reduction +
- Mid-term Coast wide Land Area +
- Long-term Coast wide Land Area



subject to ....

Planning Tool Uses Constrained Mixed Integer Program to Select Projects

…funding, sediment, and river flow constraints:

$$\sum_{p_e} \sum_i \left(\text{Cost}_{p_e,i,t} \times x_{p_e,i}\right) \leq \text{Restoration Funding}_t, \quad \text{for all values of t } (\forall\, t)$$

$$\sum_{p_r} \sum_i \left(\text{Cost}_{p_r,i,t} \times x_{p_r,i}\right) \leq \text{Risk Reduction Funding}_t, \quad \forall\, t$$

$$\sum_{p_e} \sum_i \left(\text{Sediment Required}_{p_e,i,t,s} \times x_{p_e,i}\right) \leq \text{Sediment Available}_{t,s}, \quad \forall\, t, s$$

$$\sum_{p_e} \sum_i \left(\text{River Flow Diverted}_{p_e,i,z} \times x_{p_e,i}\right) \leq \text{River Flow}_z, \quad \forall\, z$$

$$\sum_{p_e} \sum_i \left(\text{River Reach Indicator}_{p_e,k} \times x_{p_e,i}\right) \leq \text{Allowable Number of Diversions}_k, \quad \forall\, k$$

… and …

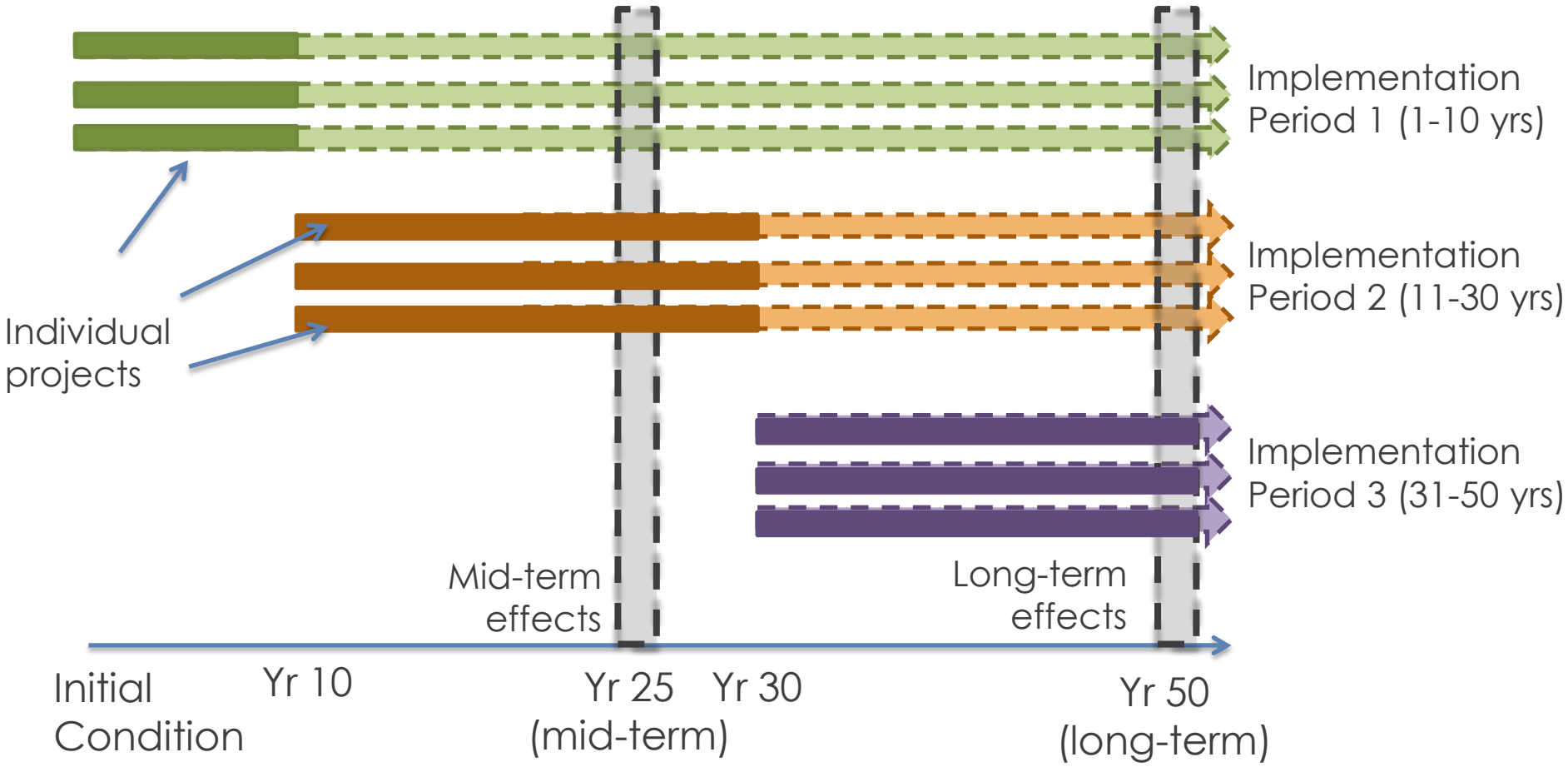
Planning Tool Assembles Different Project Combinations to Meet Louisiana's Objectives

…performance thresholds to balance ecosystem health, navigation, and other coastal interests

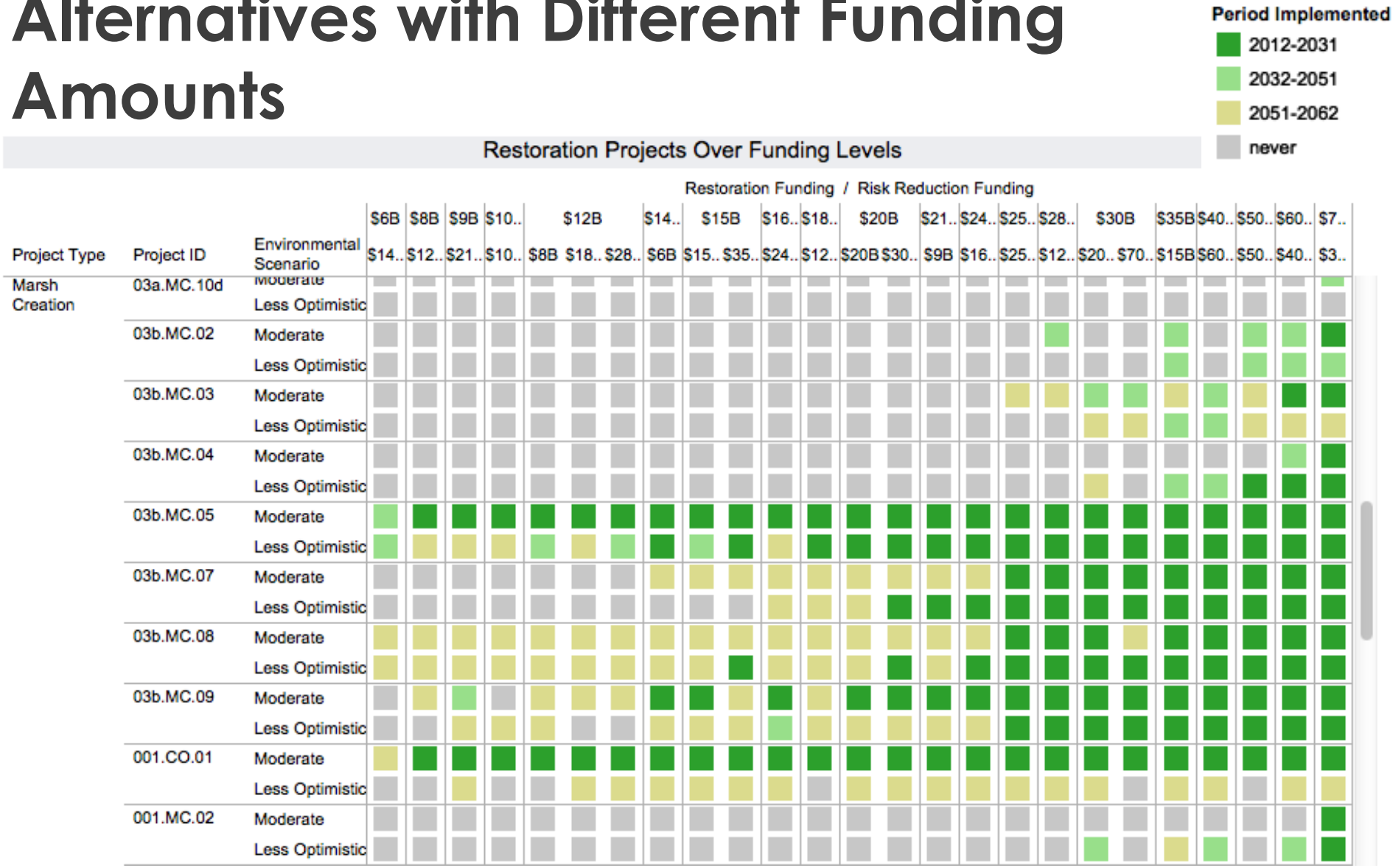
Metrics

$$\sum_p \sum_i \left(\text{Metric}_{p,i} \times x_{p,i}\right) \geq \text{Performance Threshold}$$

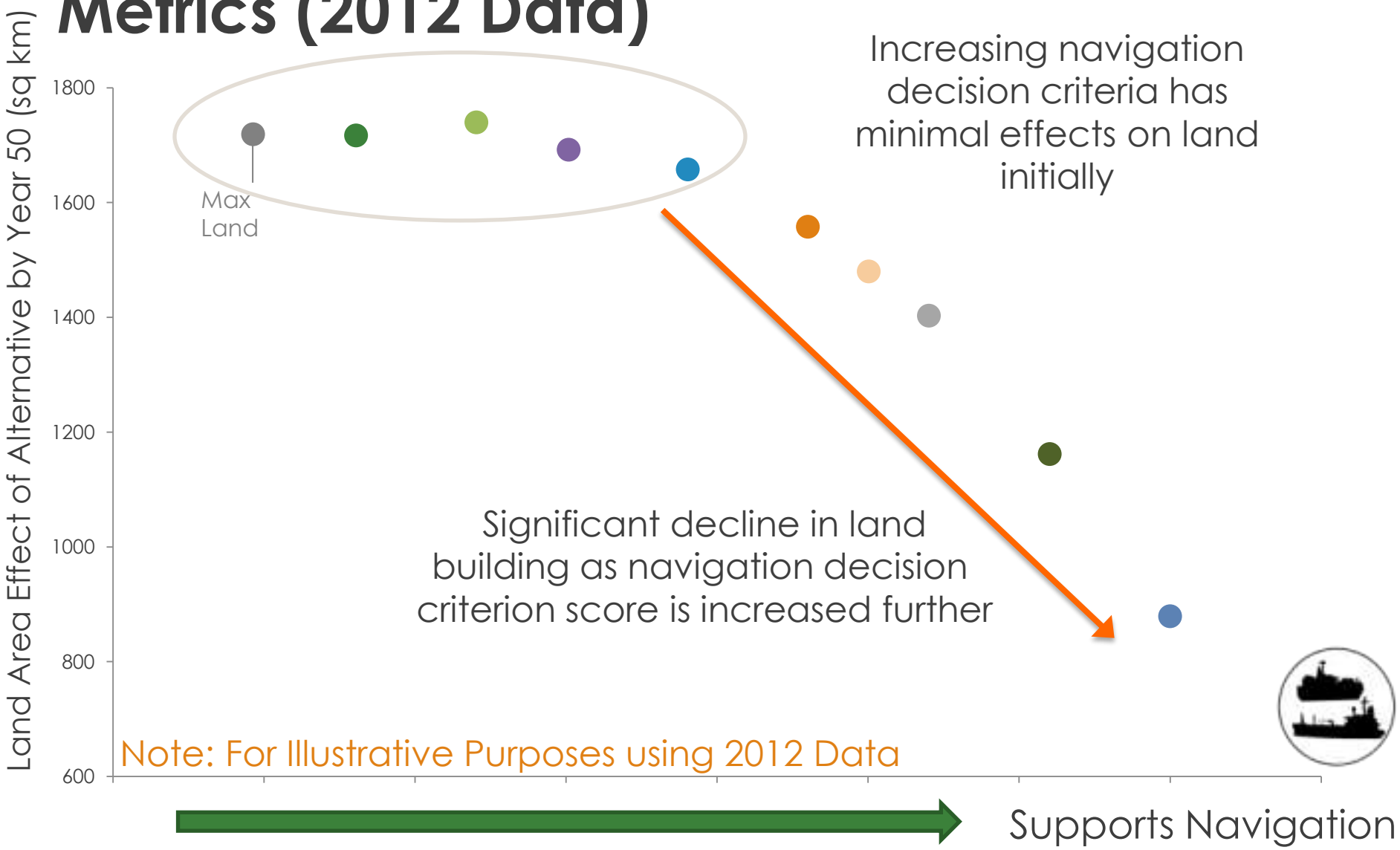
Alternatives Defined by Projects Implemented in One of Three Periods



Selection of Projects Across Alternatives with Different Funding Amounts



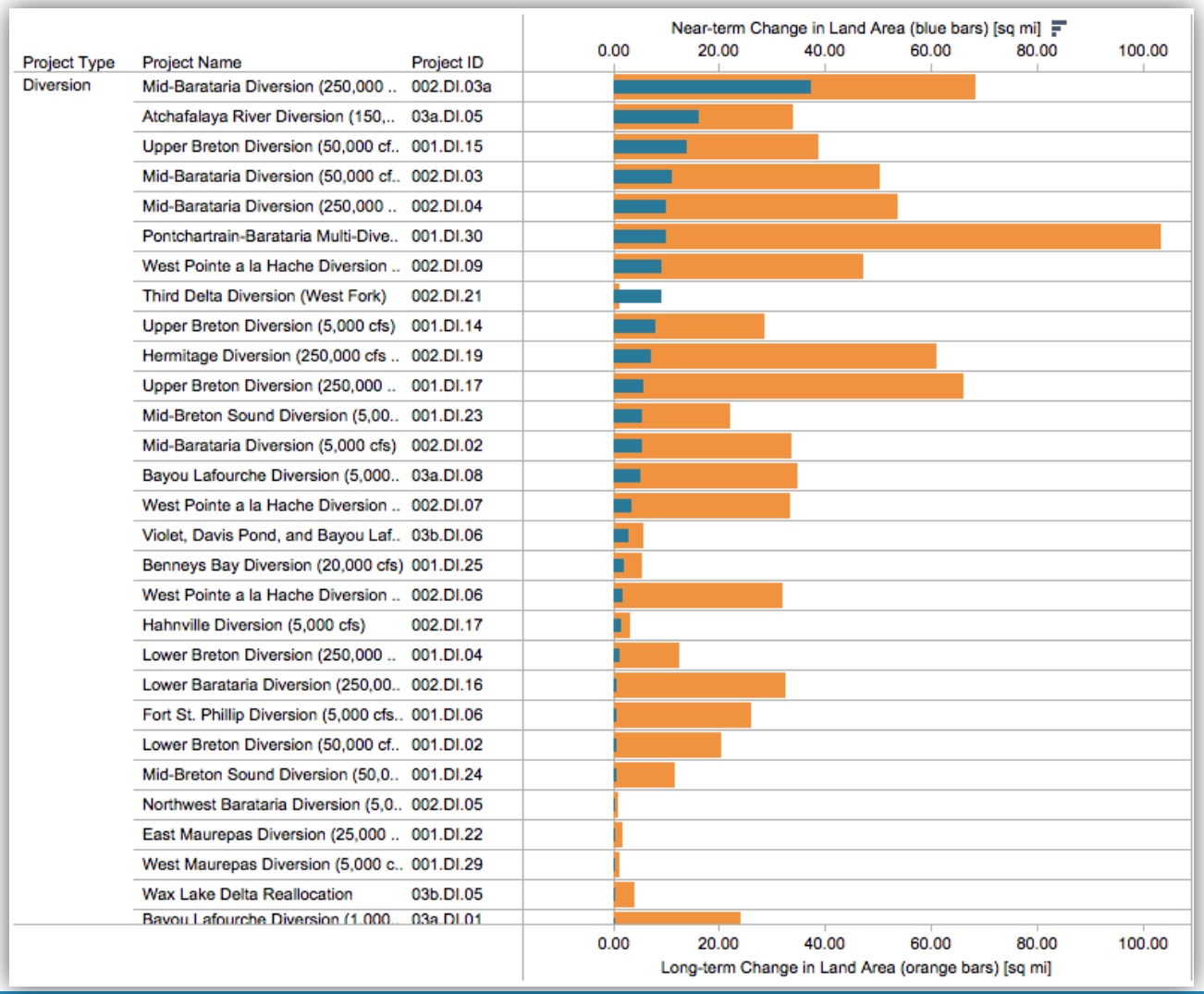
Different Alternatives Can Reflect Other Key Metrics (2012 Data)



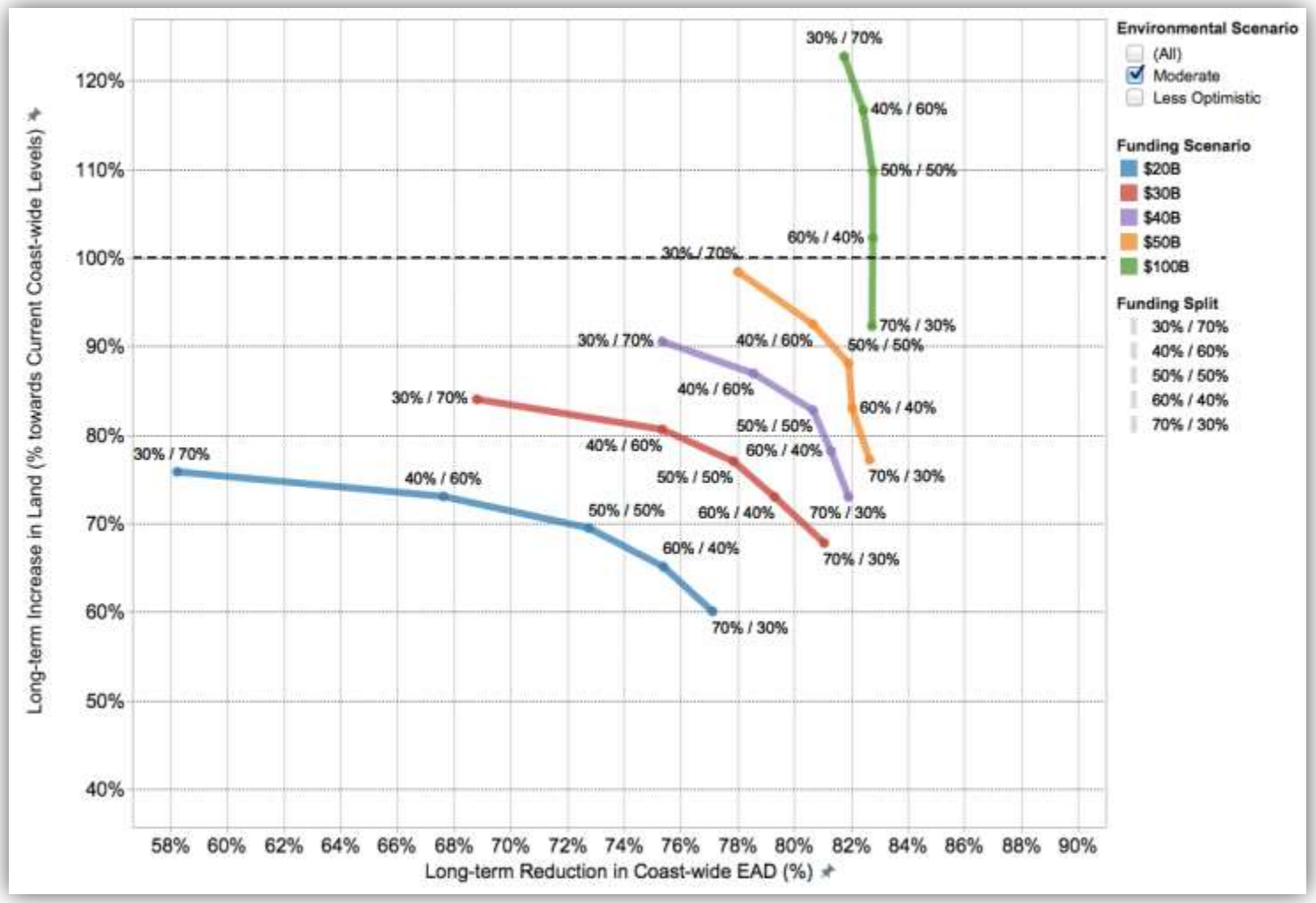
Interactive Visualizations Bring the Analysis to the Deliberations

- Key results presented for detailed inspection
  - Individual project attributes and costs
  - Project comparisons by cost-effectiveness
  - Projects included in alternatives
  - Estimated net effects of alternatives across scenarios
- Key outcome differences highlighted to support decision making

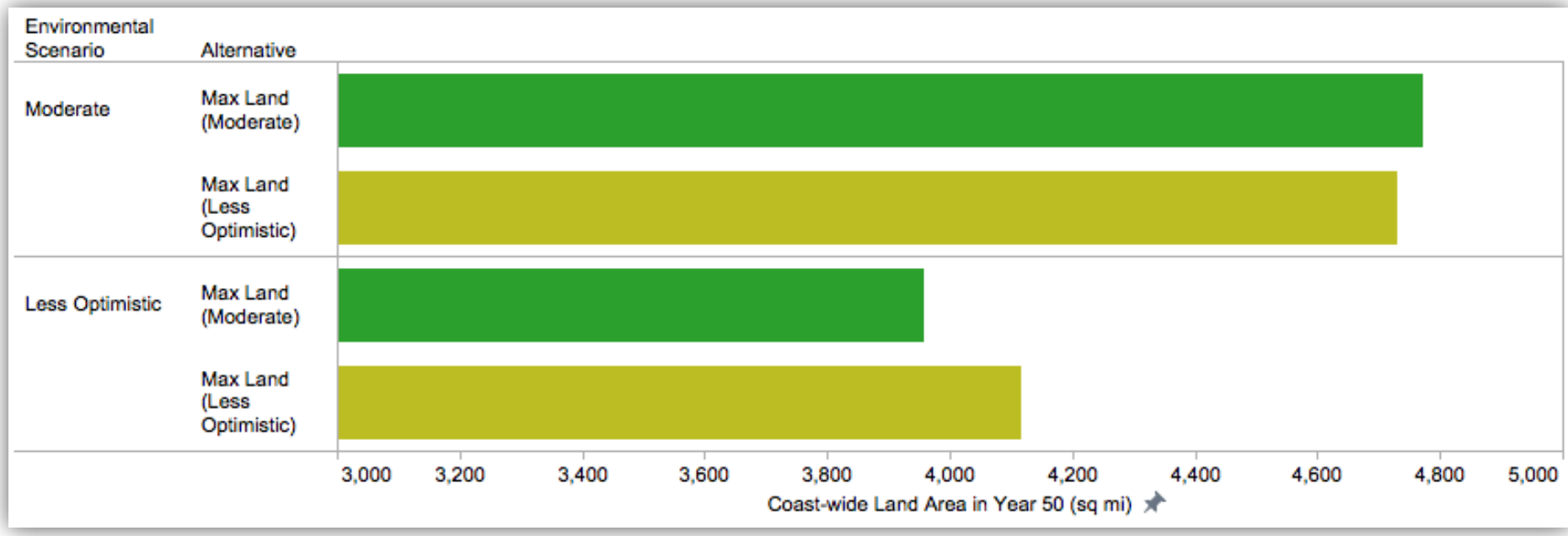
2012 Visualization: Project Comparisons (Near-Term and Long-Term Land)



2012 Visualization: Land and Risk Reduction Across Funding Scenarios



2012 Visualization: Coast Wide Land for Alternatives Across Different Scenarios



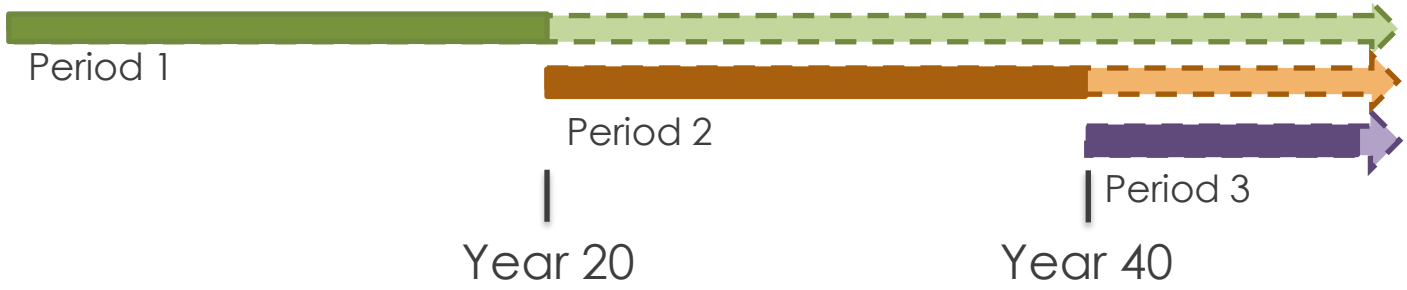
2017 Planning Tool Updates

- Refine approach for selecting projects
- Assimilate data from 2017 systems models
- Improved visualizations to support deliberations

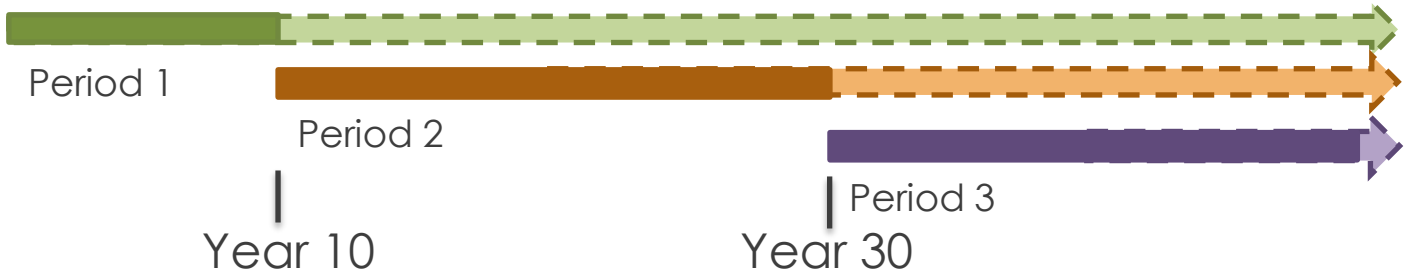
Goal: Provide More Guidance on Near-Term Implementation

Solution: Adjust the implementation timing

- 2012 project implementation periods



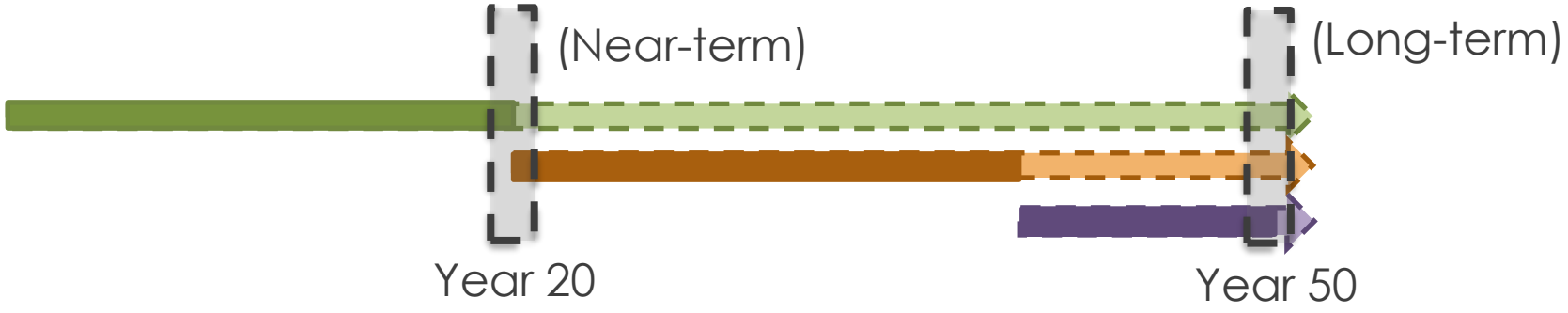
- 2017 project implementation periods



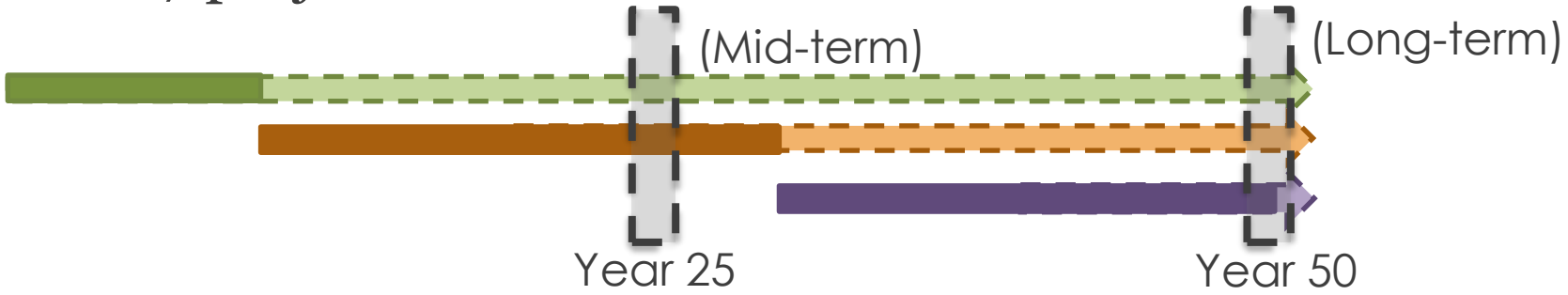
Goal: Capture More Near-Term Effects of Project Implemented Now

Solution: Adjust the timing of benefits evaluation

- 2012 project evaluation time slices



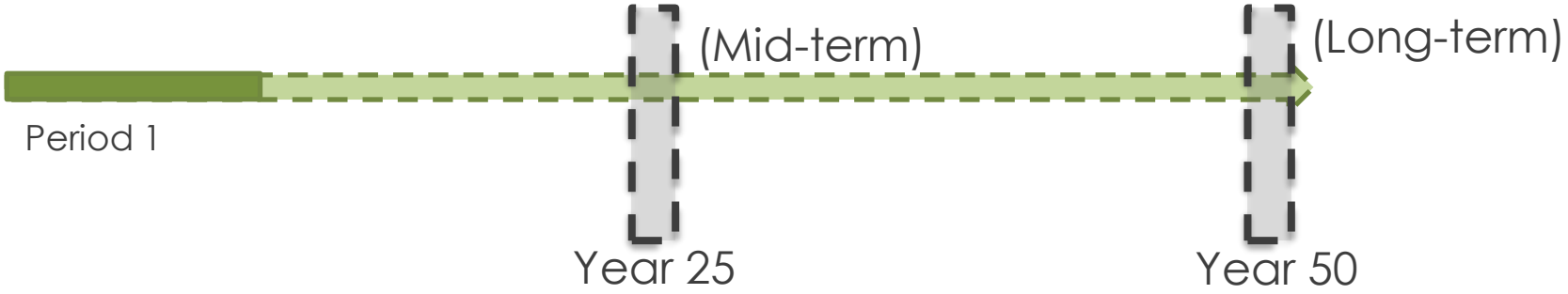
- 2017 project evaluation time slices



Goal: Select Most Cost-Effective Projects in the Near-Term

Solution: Optimization each implementation period in turn

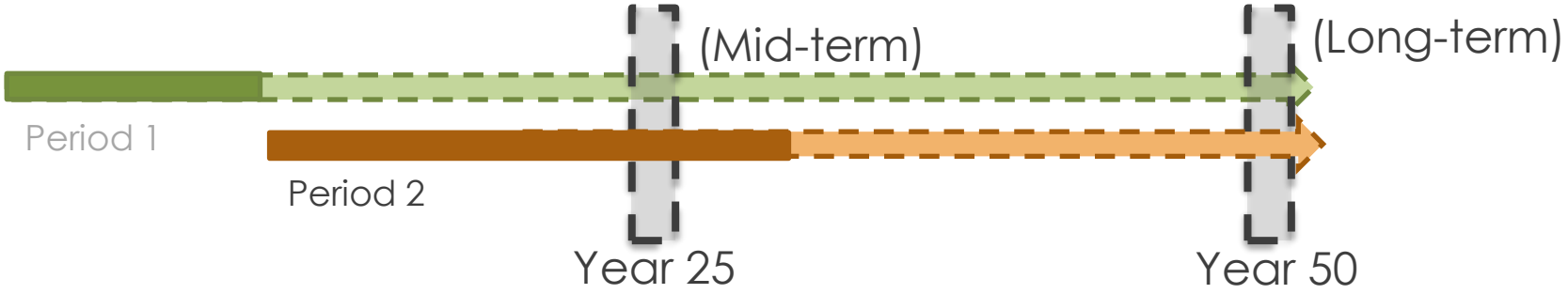
1) Select projects for implementation in Period 1, constrained by Period 1 available funding and sediment



Goal: Select Most Cost-effective Projects in the Near-term

Solution: Optimization each implementation period in turn

1) Select projects for implementation in Period 1, constrained by Period 1 available funding and sediment

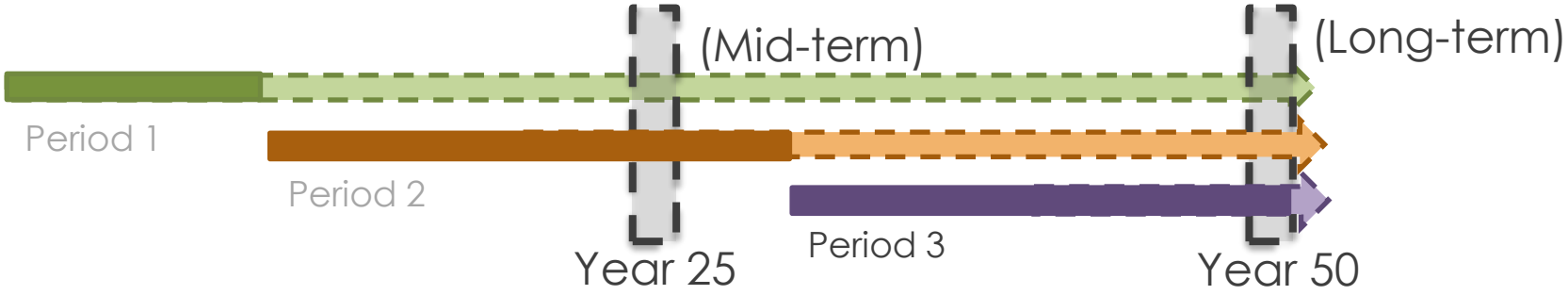


2) Select projects for implementation in Period 2, constrained by Period 2 available funding and sediment

Goal: Select Most Cost-effective Projects in the Near-term

Solution: Optimization each implementation period in turn

1) Select projects for implementation in Period 1, constrained by Period 1 available funding and sediment



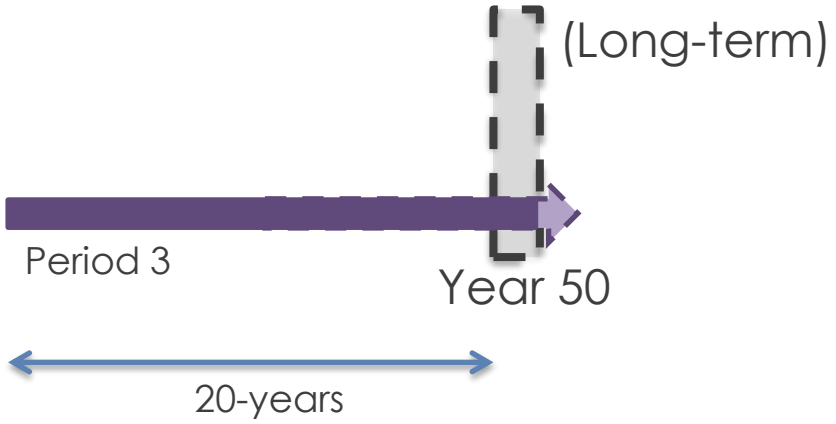
2) Select projects for implementation in Period 2, constrained by Period 2 available funding and sediment

3) Select projects for implementation in Period 3, constrained by Period 3 available funding and sediment

Goal: Ensure Restoration Projects Selected in 3rd Period Provide Sustainable Benefits

Solution: Apply Sustainability of Land metric threshold to 3rd period optimization

- Planning Tool selects projects with benefits in 20-years *and* has benefits that increase from year 40 to year 50.



Testing of New Planning Tool Approach

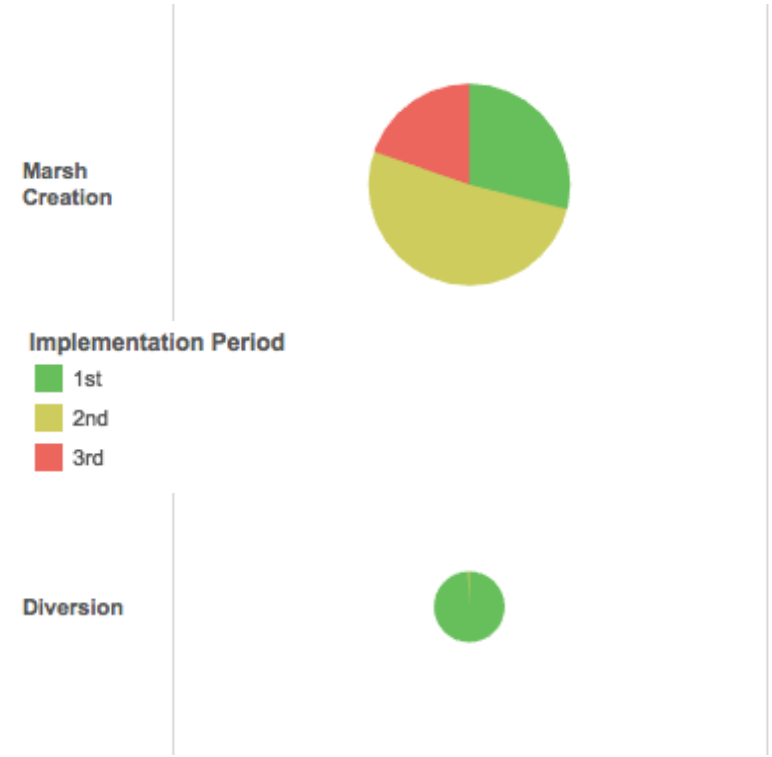
- Developed set of alternatives using 2012 Coastal Master Plan data on FWOA, project effects, and costs
  1. Maximize land and EAD Reduction – 2012 funding and implementation periods (20/20/10)
  2. Maximize land and EAD reduction – 2012 funding and implementation periods (20/20/10) and 2017 optimization
  3. Maximize land and EAD reduction – 2017 implementation periods (10/20/20) and 2017 optimization
  4. Maximize land and EAD reduction – 2017 implementation periods (10/20/20), 2017 optimization, and sustainability metric threshold

- Evaluated project selection

Sample Effects on Restoration Project Selection

2017 optimization with 20/20/10 year periods

Change to 10/20/20 year periods

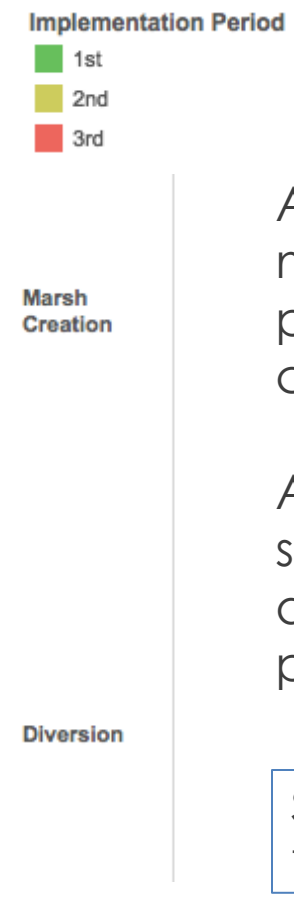


Shortening 1st implementation period pushes off some projects to 2nd implementation period.

Also leads to significant marsh creation projects in 3rd period.

Size proportional to expenditures

Sample Effects on Restoration Project Selection



Adding sustainability metric eliminates 3rd period marsh creation projects.

Also increases the selection of diversions in the 3rd period.

Size proportional to expenditures

Change to 10/20/20 year periods

Add sustainability metric threshold

Planning Tool Schedule

- Individual project comparisons across scenarios
- Round 1 alternatives
  - Maximize land and risk reduction
  - Application of additional metrics
- Round 2 alternatives
  - Additional refinements
  - Draft master plan
- Round 3 alternative
  - Adjustments
  - Final master plan

Winter
2015-16

Spring/Summer
2016

Fall
2016

Questions?

coastal.la.gov

Next Steps

- For additional information on the 2017 Coastal Master Plan, including technical reports: http://coastal.la.gov/a-common-vision/2017-master-plan-update/

- A recording of today's webinar will be posted to the master plan's Videos page: http://coastal.la.gov/resources/videos/#overview

- Please send any additional questions to masterplan@la.gov

THANK YOU

coastal.la.gov