Context and Ecosystem Services Production Functions

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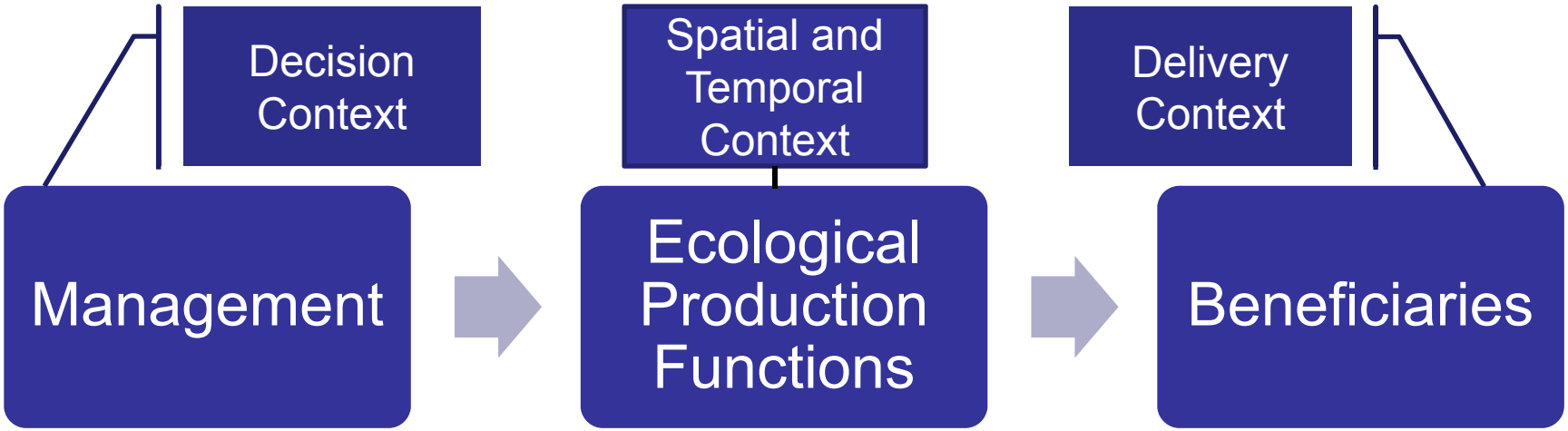
When Context Matters

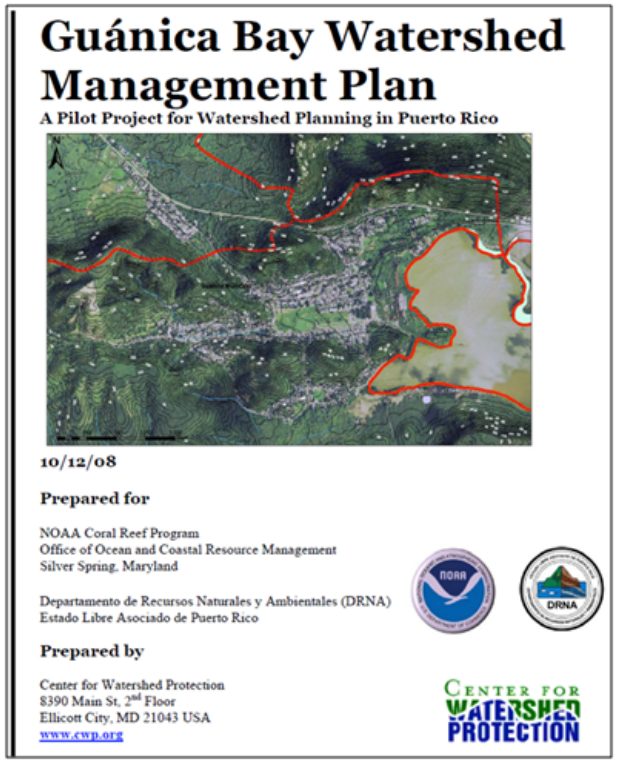


Decision Context

- Sets up the assessment
  - Constrains the scope of the decision space
    - What can be managed?
    - Spatial and temporal context
  - Identification of stakeholder values
    - Who are the beneficiaries?
    - Selection of EPF's to focus on

Guánica Bay, Puerto Rico

- US Coral Reef Task Force
- Erosion from farming, residential, commercial development
- Sediment runoff causing damage to reefs



Guánica Bay Watershed Management Plan

A Pilot Project for Watershed Planning in Puerto Rico

10/12/08

Prepared for

NOAA Coral Reef Program
Office of Ocean and Coastal Resource Management
Silver Spring, Maryland

Departamento de Recursos Naturales y Ambientales (DRNA)
Estado Libre Asociado de Puerto Rico

Prepared by

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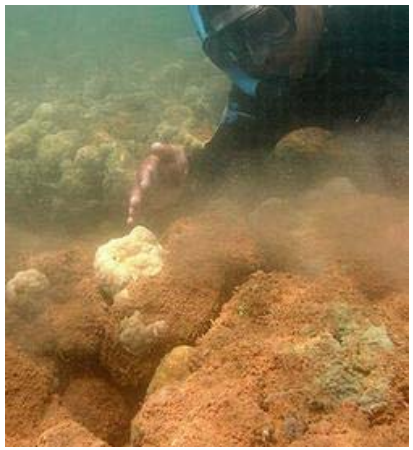
CENTER FOR WATERSHED PROTECTION

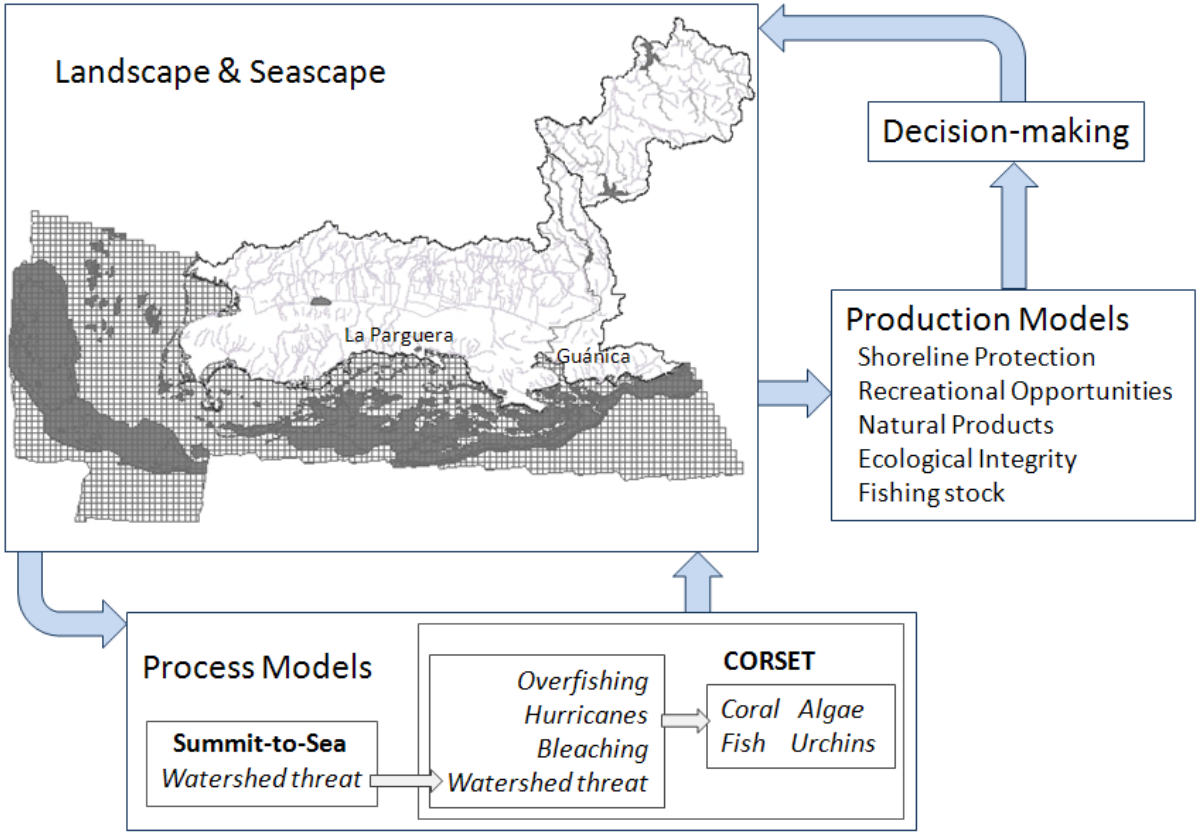
Primary goal:
Improve & Protect Coral Reefs



Puerto Rico Stakeholder Workshops

- Implementation of plan has been controversial
- Uncertainty about potential benefits of protecting reefs for tourism & fishing

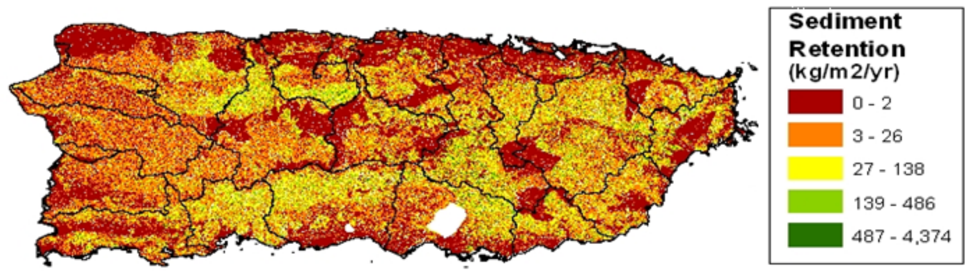
Economic Valuation Surveys

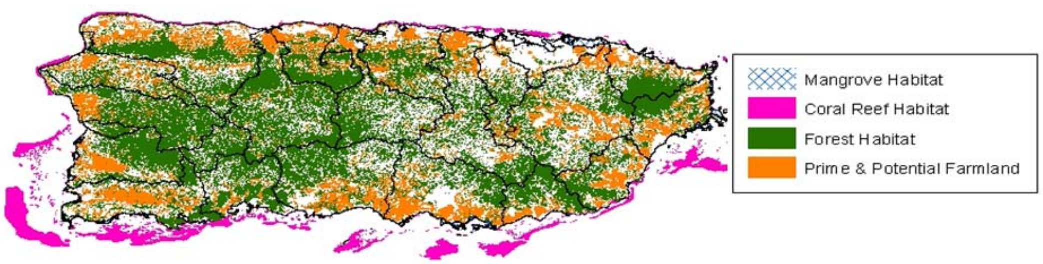


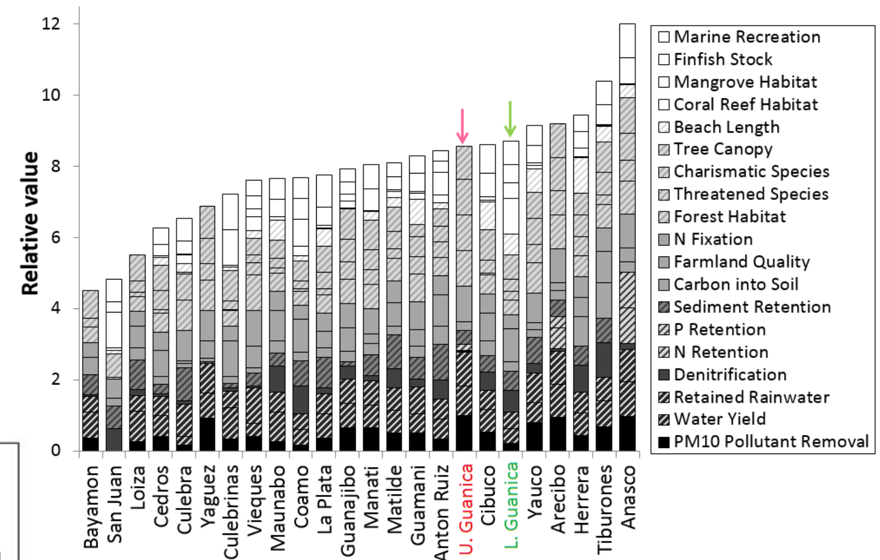
Uncertainty about Unintended Consequences Beyond Coral Reefs

- Productivity of farmland — Sediment & nutrient retention; farmland quality; carbon sequestration into soil
- Water supply for drinking & hydropower — Water yield
- Human health
  - Air quality — Air pollutant removal; Temperature regulation through shading;
  - Water quality — Floodwater retention; Denitrification;
- Integrity of important terrestrial species & habitat — Forest cover; Richness of endangered species;
- Recreational, spiritual, & aesthetic opportunities — Coastline designated as beach; Richness of charismatic species

Identifying Potential Tradeoffs or Multiple Benefits







- Sediment retention lower in Guánica than most other Puerto Rico watersheds
- Actions to improve sediment may have unintended benefits for farmland quality, air quality, recreation, water quality, terrestrial ecosystem integrity

- Policies to protect coastal resources may be more effective if they are responsive to potential benefits/tradeoffs between land and sea
- Decision context helps us identify what ecosystem services matter to stakeholders and to the decision at hand

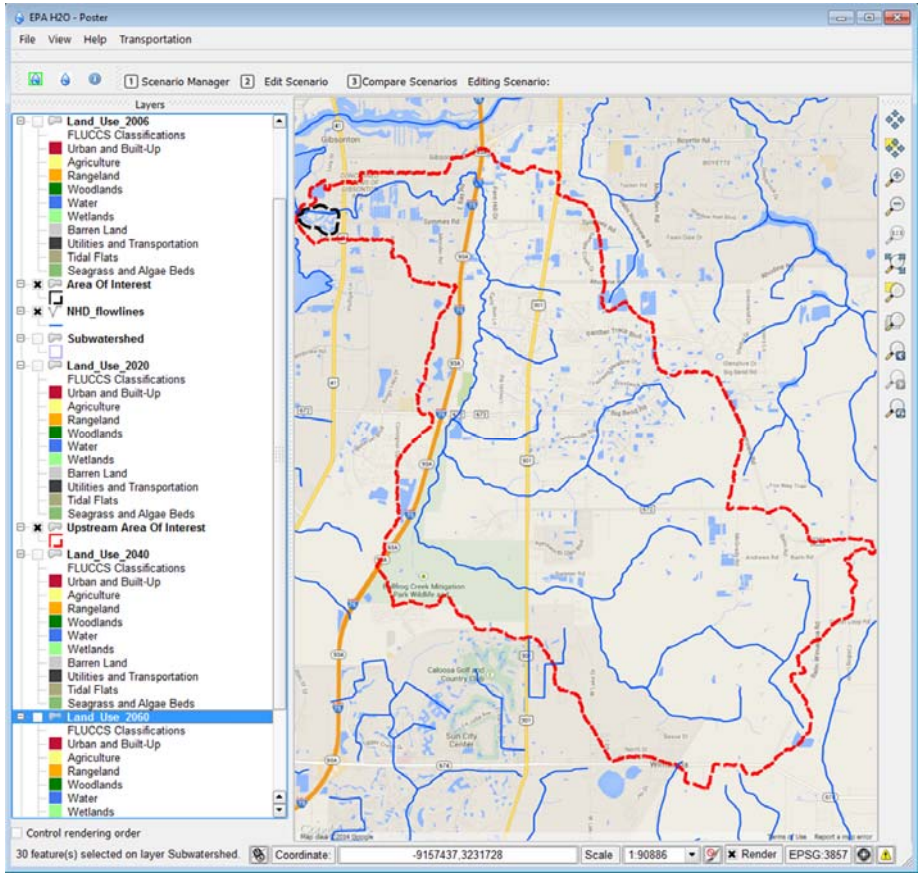
Spatial and Temporal Context

- Production can be in a different place than delivery
  - Watersheds, Airsheds, Via transportation
  - Scale of EPF's
- Longer temporal scales can require other factors to be considered
  - Climate change

Watersheds provide needed spatial context for assessing flow related EPF's such as:

- Water retention by soils
- Nutrient removal
- Sediment retention

Assessment of EPF's at the watershed scale includes the consideration of upstream and downstream connectivity

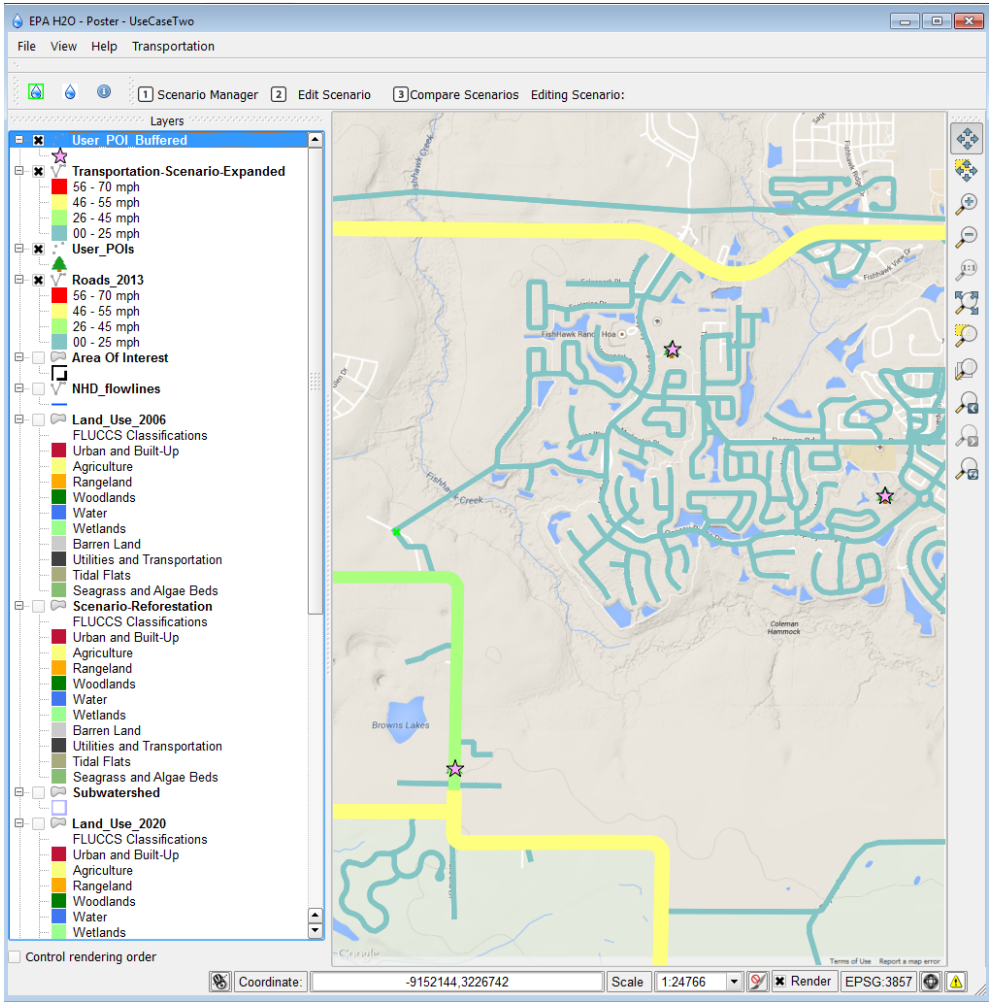


Screen shot from EPA H2O Ecosystem Services Assessment Tool

Context can make the difference between potential and realized service production

- Interactions with humans
- Complimentary goods and services
- Thresholds

Access to green space is an ecosystem service that requires direct interaction between humans and nature.

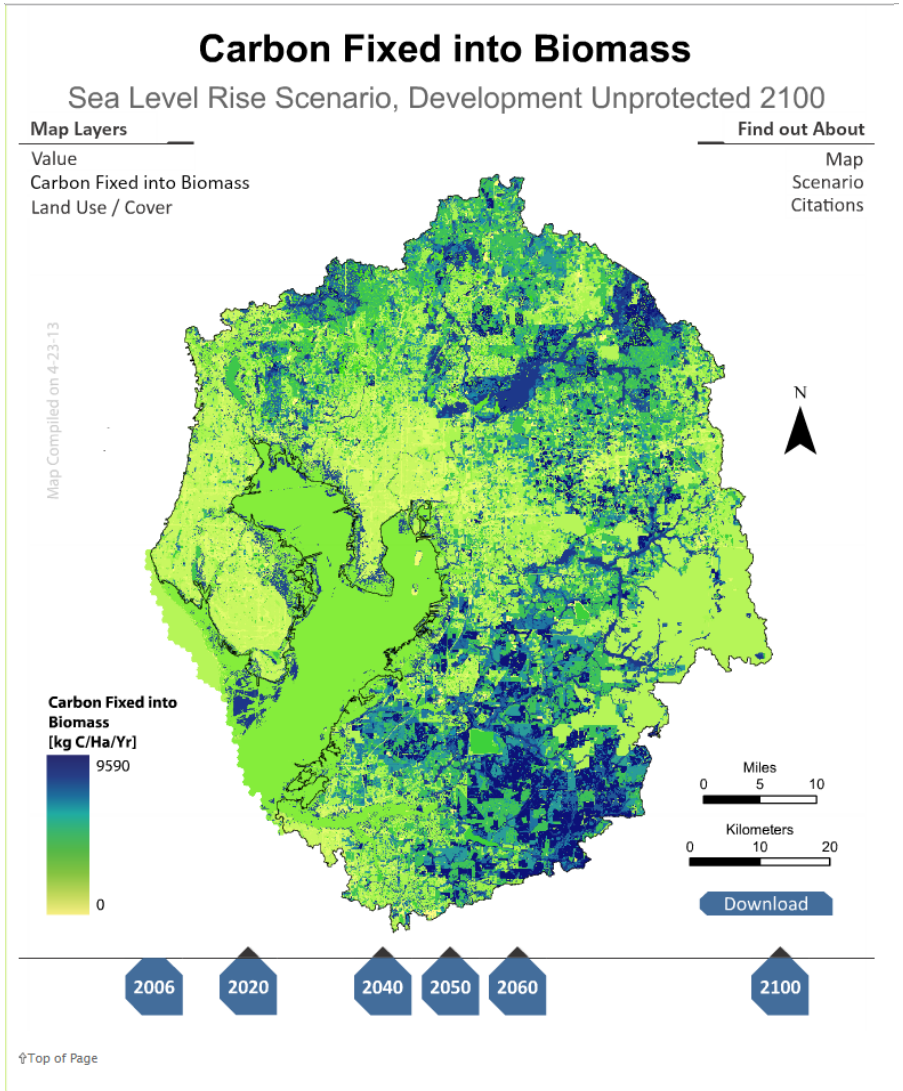


Screen shot from EPA H2O Ecosystem Services Assessment Tool

Climate change and other system wide variables provide context for EPF's

- EPF's interact with multiple factors
- Thresholds
- Spatial shifts

Sea level rise may require multiple different EPF's as habitats convert over time

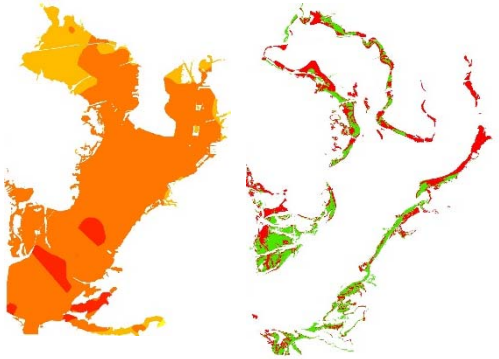


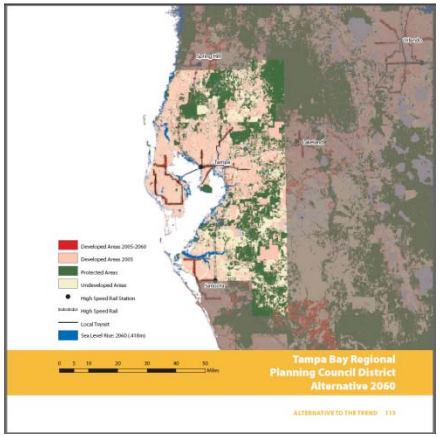
Screen shots from our website: http://www.epa.gov/ged/tbes/

Delivery Context

- If, when, and where stakeholders receive benefits
  - Production has to be needed
  - Production has to be at the right time and place
- Consider stakeholder values and needs
  - Translation to value
  - Relative importance of EPF's

Land use and Recreational Fishing in Tampa Bay



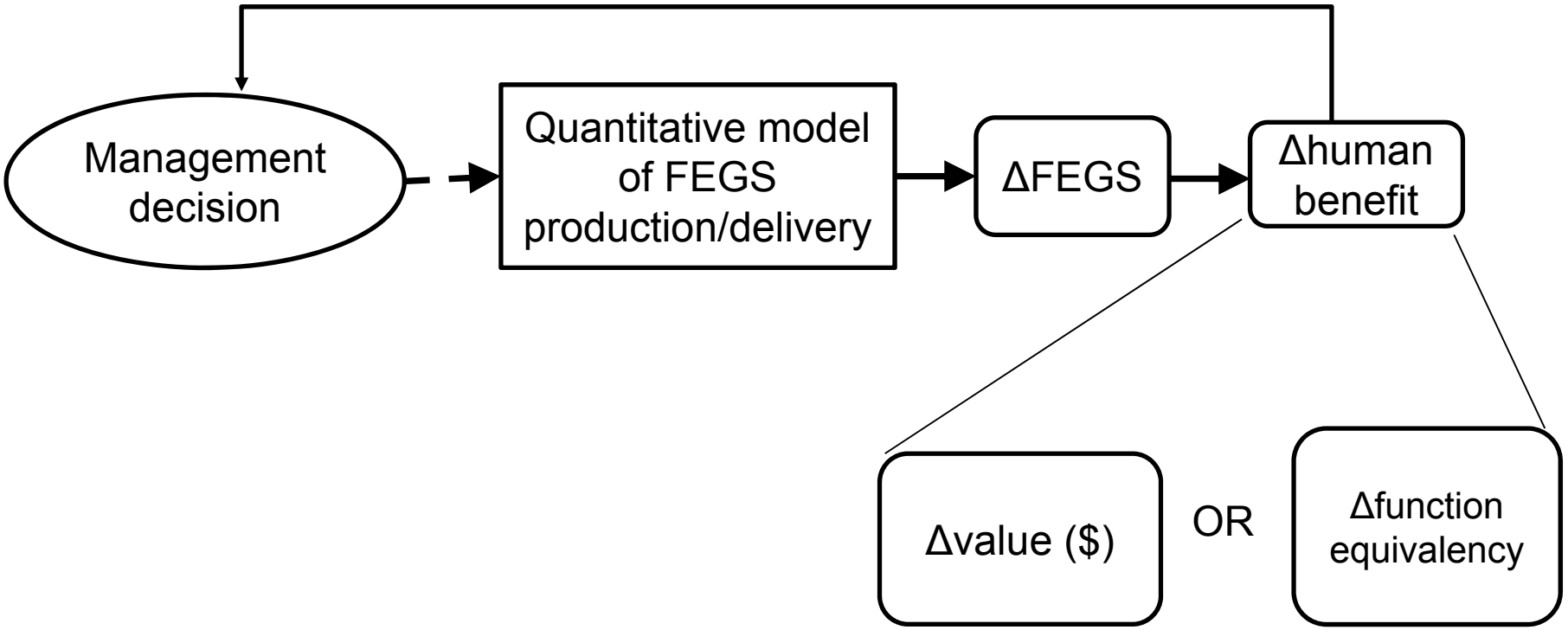


Alternative Futures

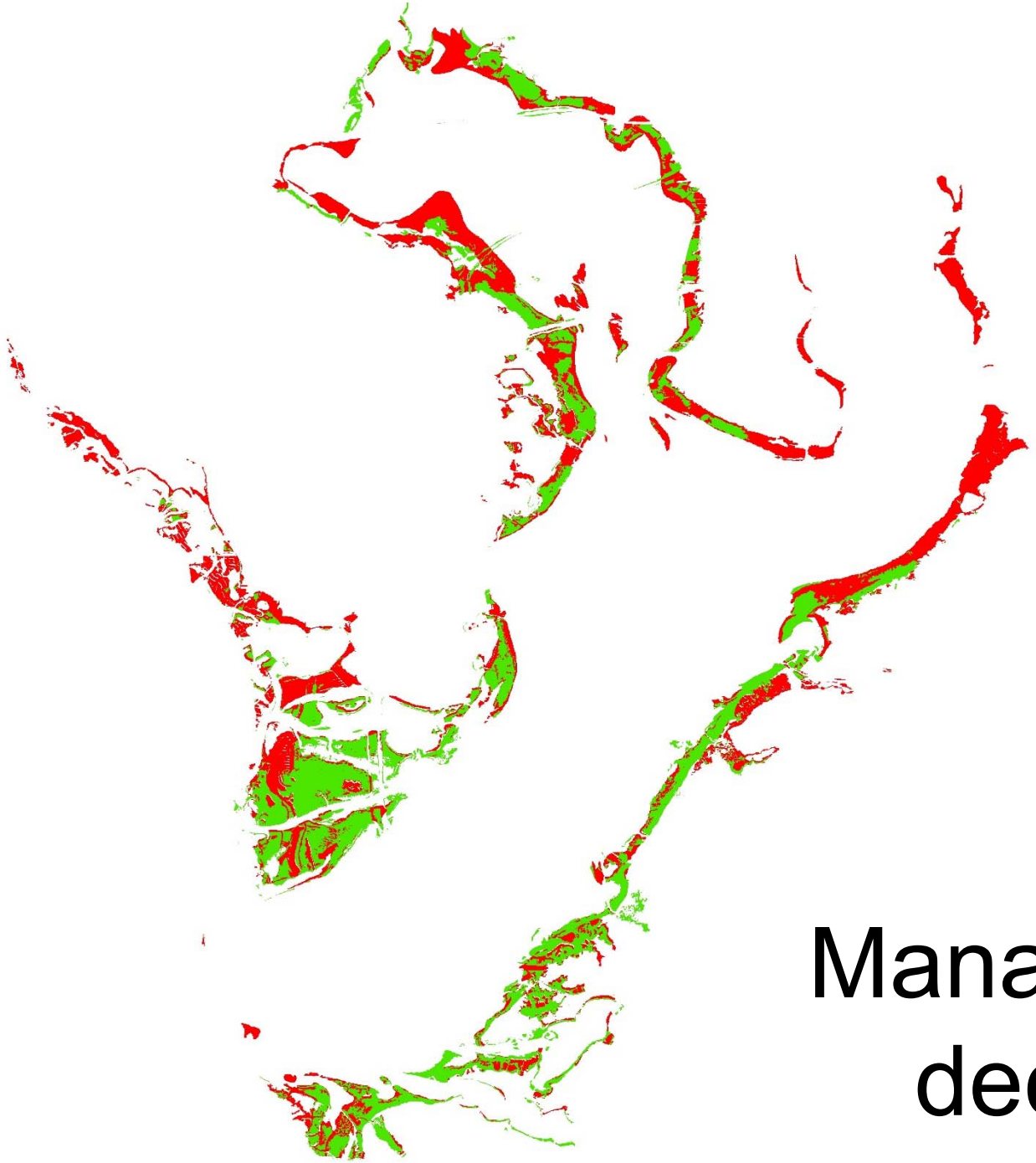
Ecosystem Services

Benefits

Delivery Context



FEGS = Final Ecosystem Goods and Services



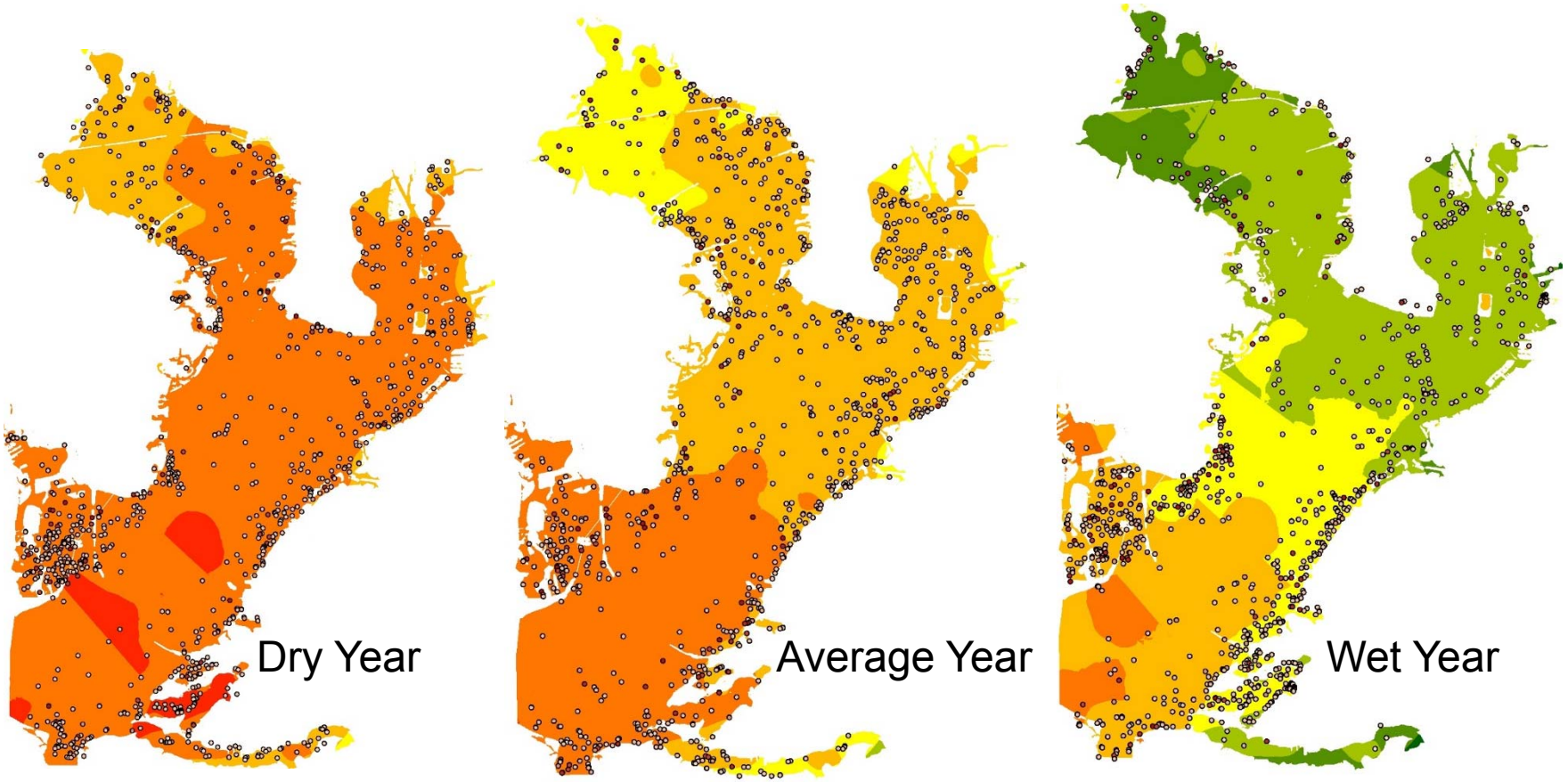
Seagrass restoration
in Tampa Bay

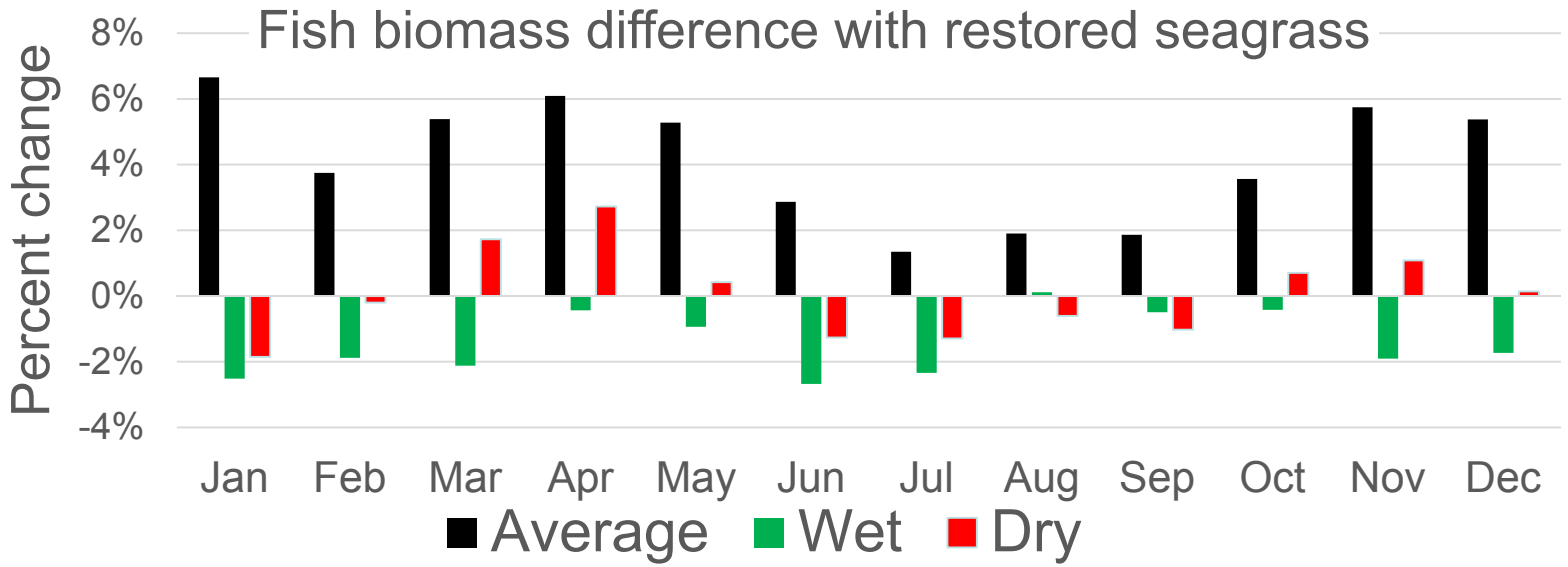
1950s

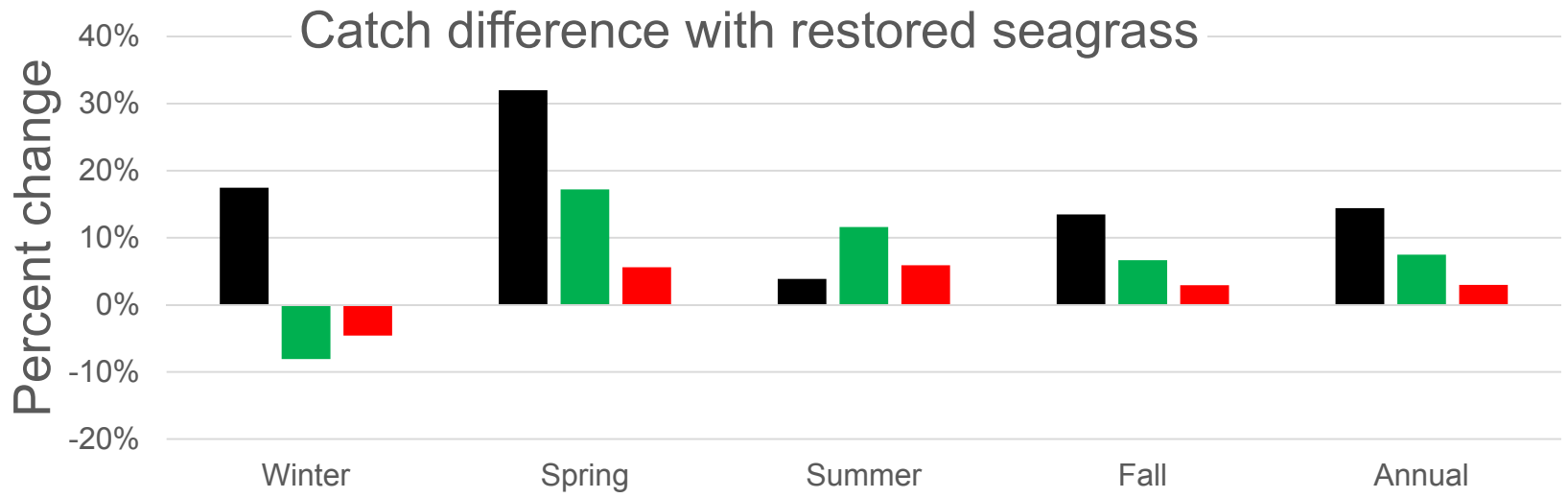
1990s

Management decision

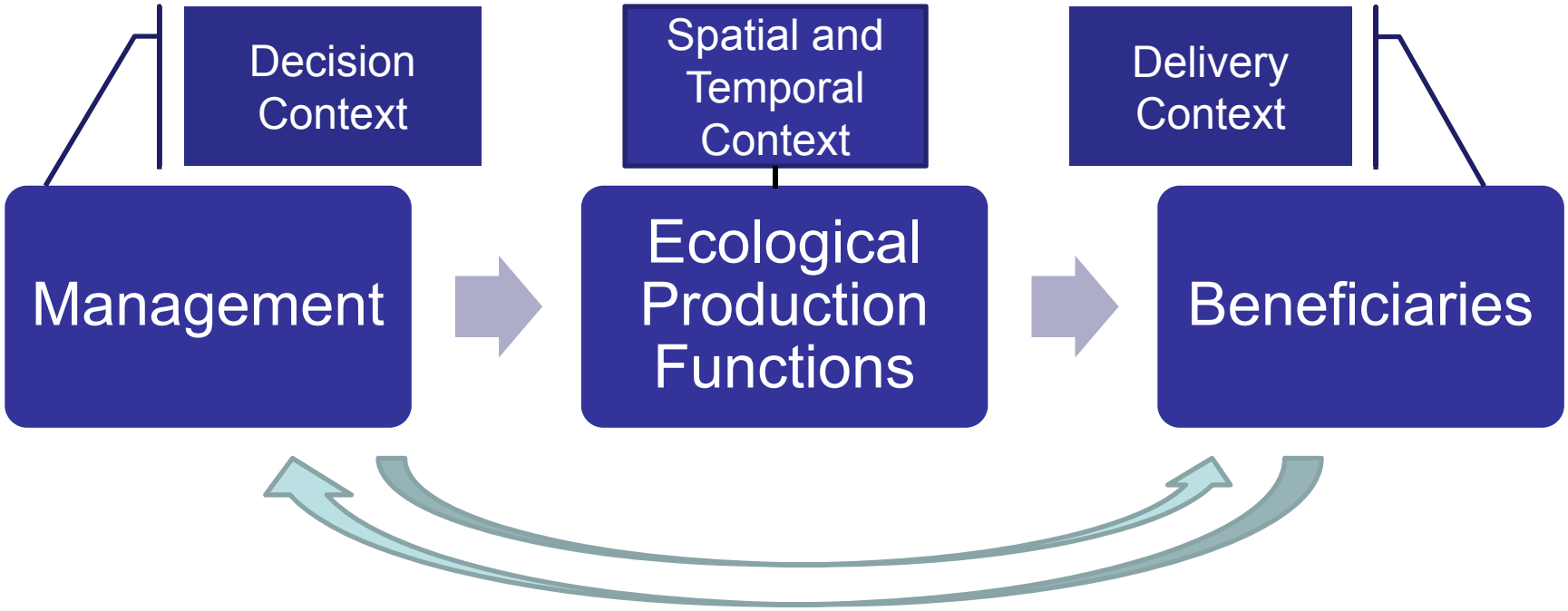
Climate Interacts with EPF




Fish biomass difference with restored seagrass
Percent change
8%
6%
4%
2%
0%
-2%
-4%
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Average
Wet
Dry


Catch difference with restored seagrass
Percent change
40%
30%
20%
10%
0%
-10%
-20%
Winter
Spring
Summer
Fall
Annual

Why Context Matters



Contextual information is required to guide the selection and scale of EPF's and for properly communicating EPF tradeoffs back to stakeholders.