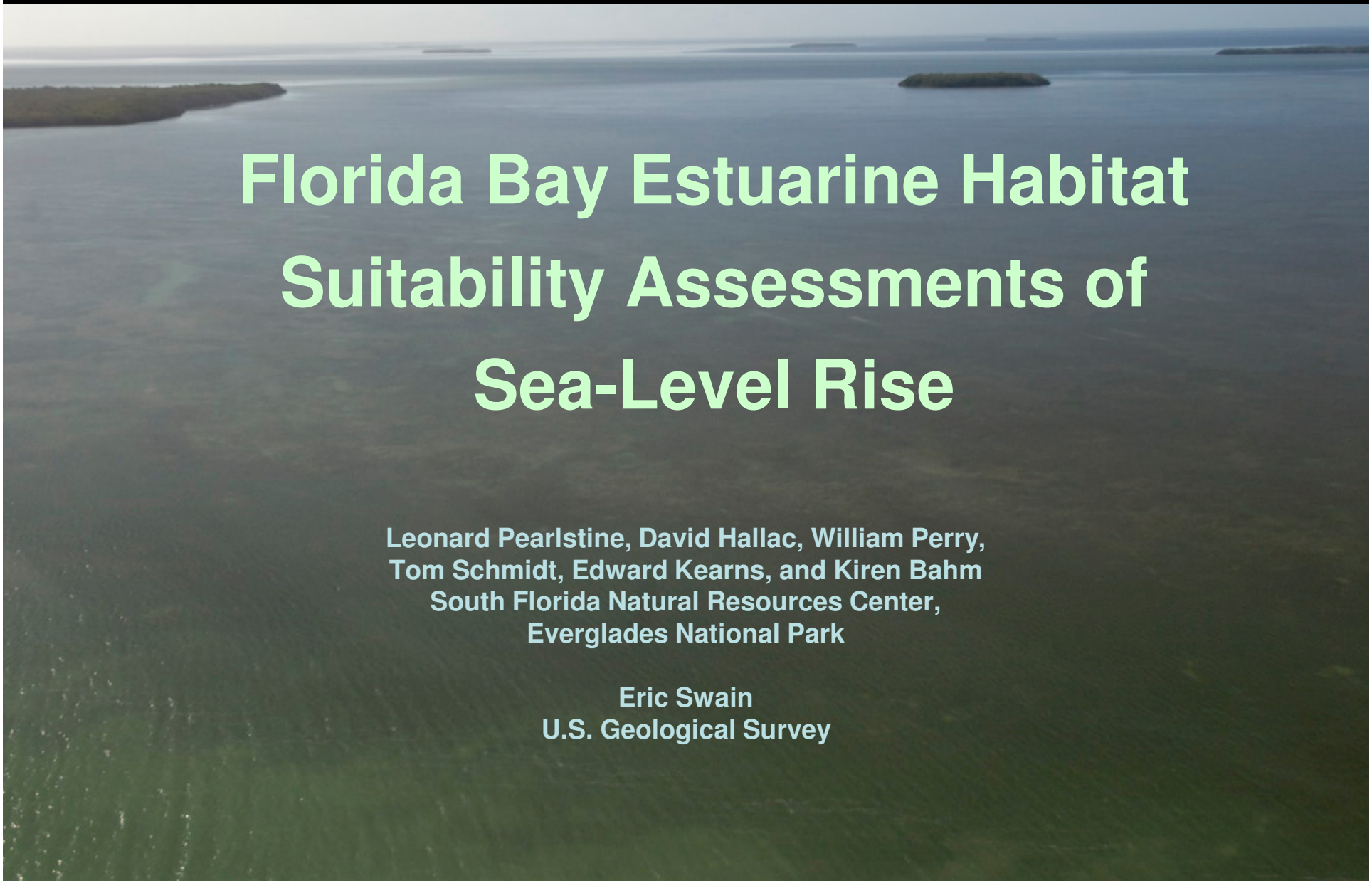
Everglades National Park
South Florida Natural Resources Center



Florida Bay Estuarine Habitat Suitability Assessments of Sea-Level Rise

Leonard Pearlstine, David Hallac, William Perry, Tom Schmidt, Edward Kearns, and Kiren Bahm
South Florida Natural Resources Center, Everglades National Park

Eric Swain
U.S. Geological Survey

Sea Level Rise Projections

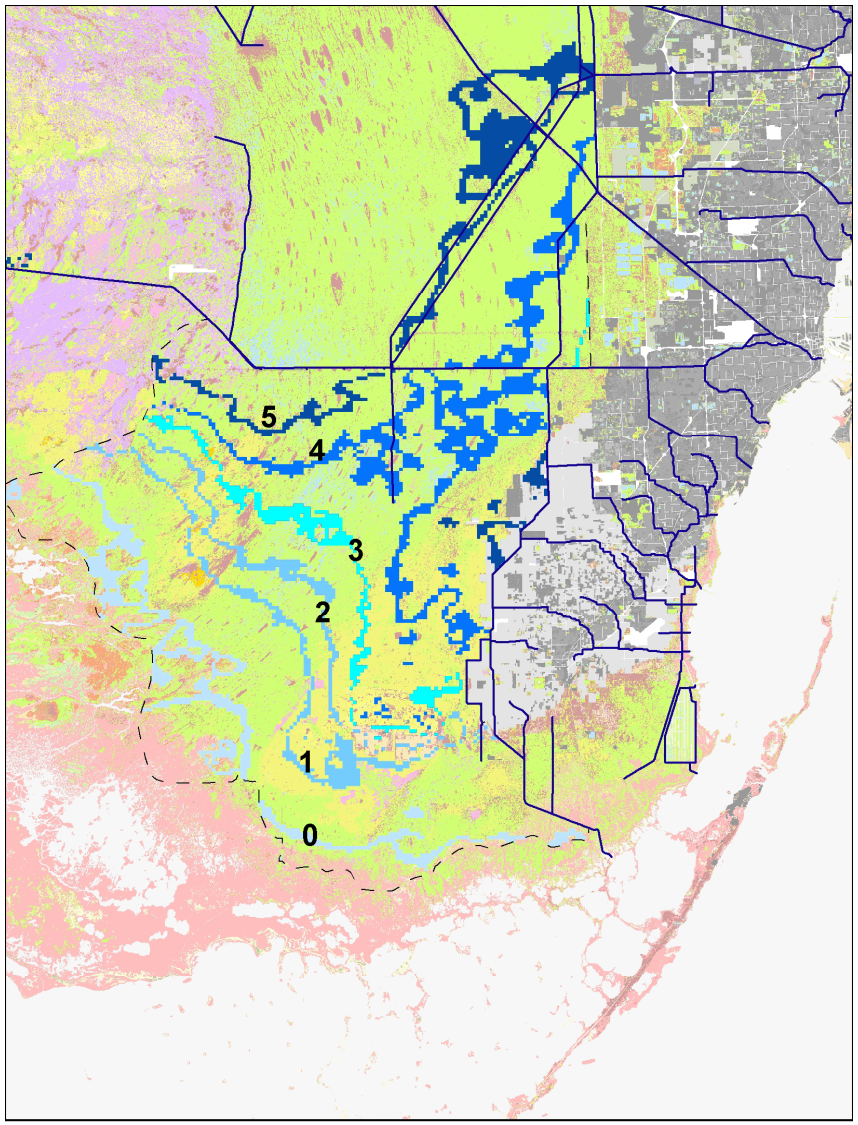
South Florida Natural Resources Center

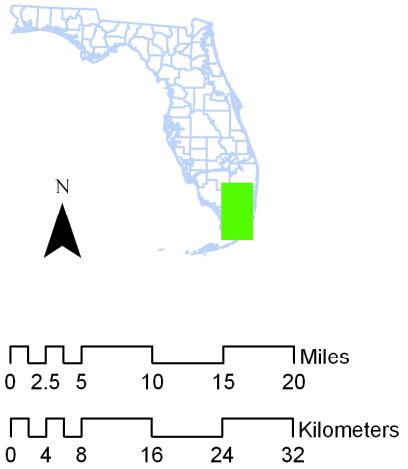
Sea level rise projections range from

3 inches to

28 inches

by 2050





Objective

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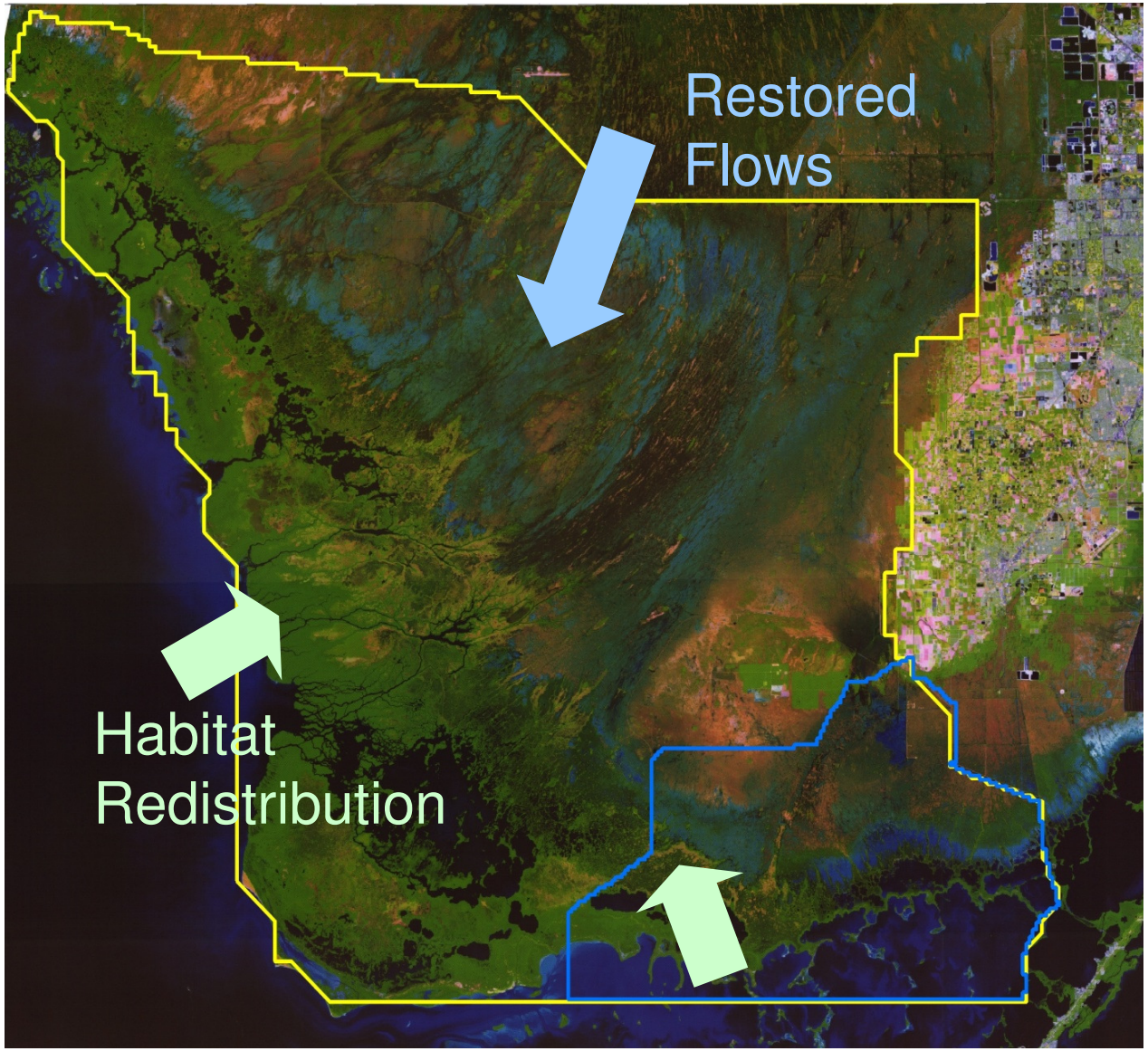
Couple Everglades hydrology models with habitat suitability models to examine habitat pattern shifts with sea level rise and restoration alternatives



Hydrology Models for Florida Bay

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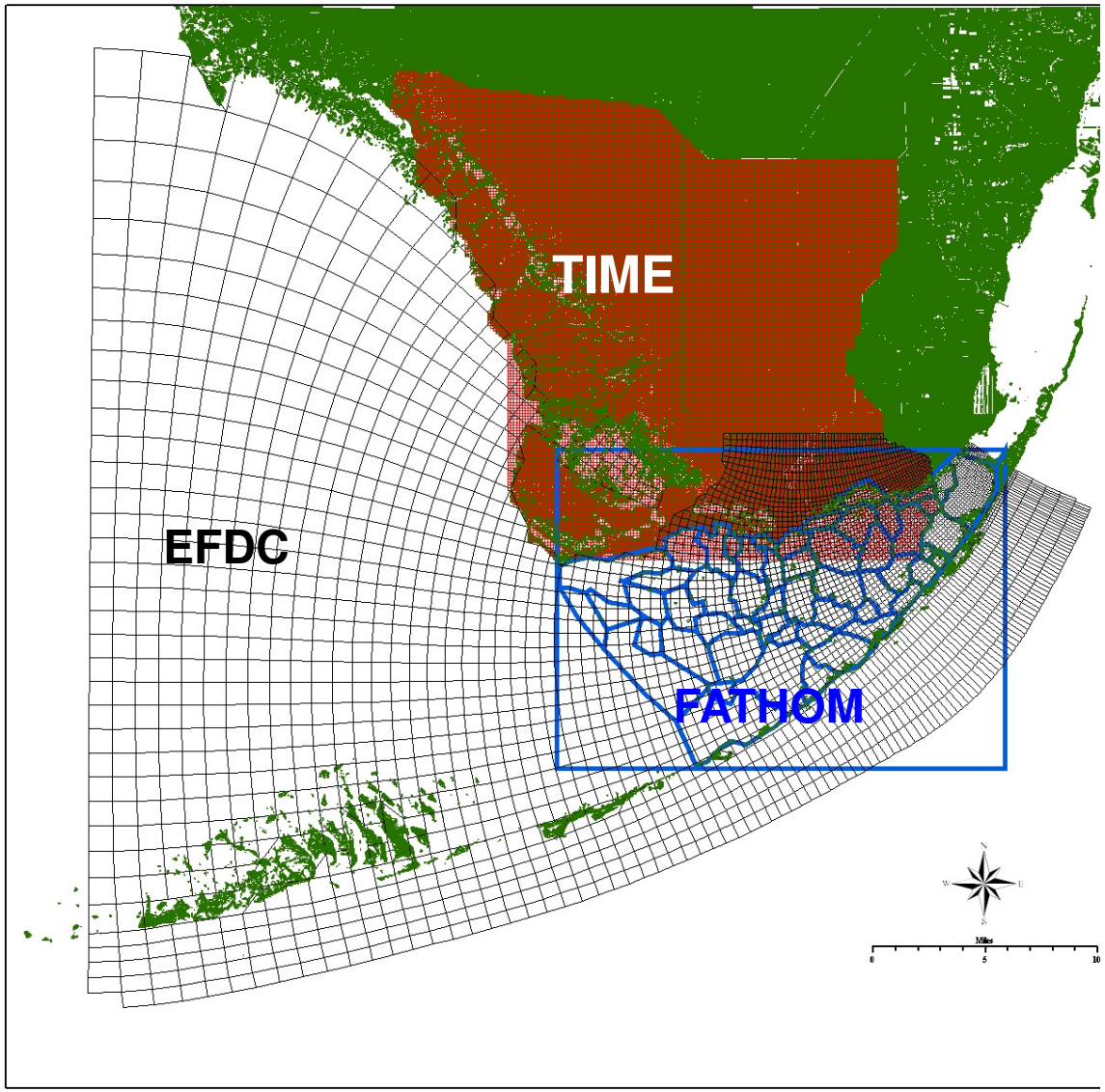
TIME

Coupled Surface Water & Ground Water Model (FTLOADDS)

Major Data Provided:

- Water Depths
- Water Levels
- Salinities
- Velocities



Habitat Models for Florida Bay

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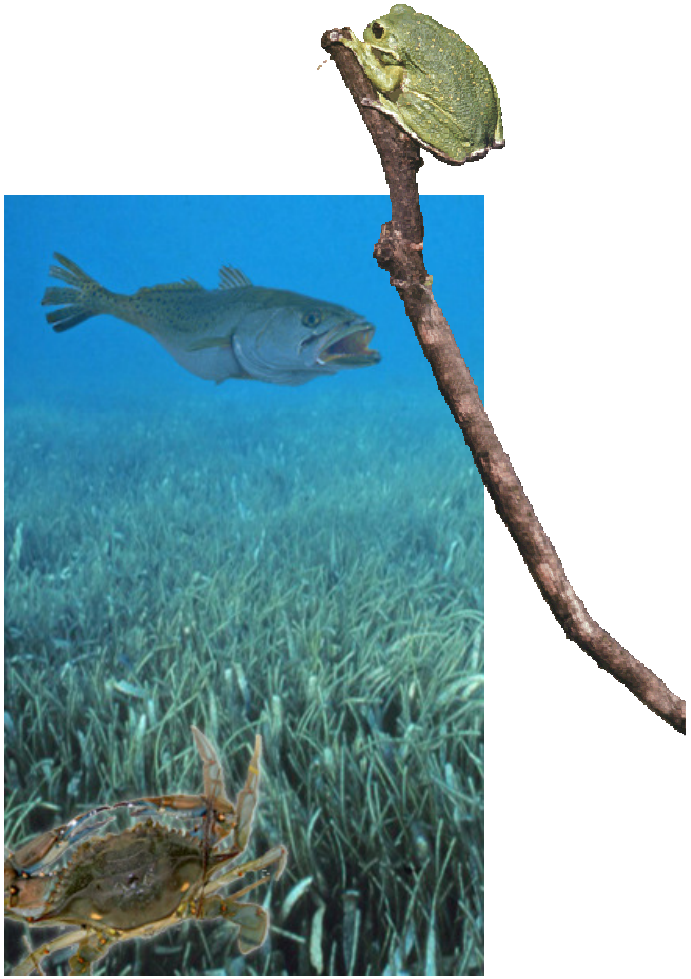
- Spotted Seatrout
- Blue Crab
- Turtle Grass
- Anuran Communities



Current Capabilities and Limitations

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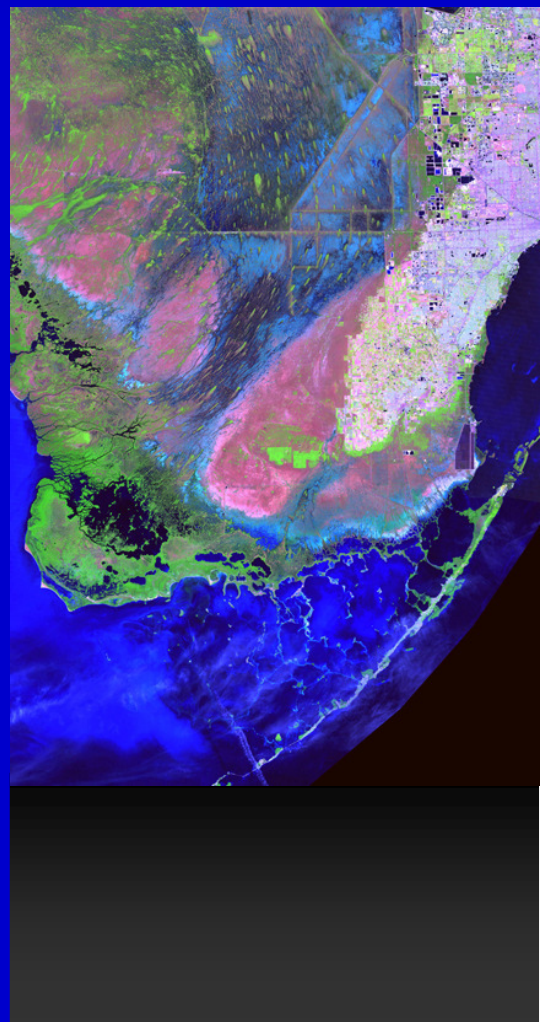
Capabilities

- Model known species niche
- Link temporal and spatial hydrology dynamics
- Estuary topography
- Coastal vegetation distribution patterns

Limitations

- HSI models developed individually
- No synergistic and interspecific interactions
- Sea level rise effects on hydrological and geomorphological properties in the watershed and bay incompletely understood



Spotted Seatrout Habitat Suitability

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$$HSI = \frac{CPUE}{CPUE_{MAX}}$$

Where CPUE = Catch Per Unit Effort

CPUE is modeled as a set of Multiple Regressions

Explanatory Variables:

- **Bottom Type**
- **Water Depth**
- **Salinity**
- **Temperature**

Blue Crab Habitat Suitability

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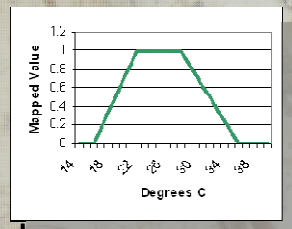
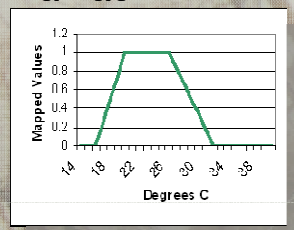
Temperature

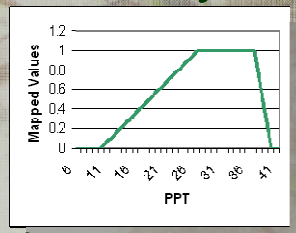


Larvae

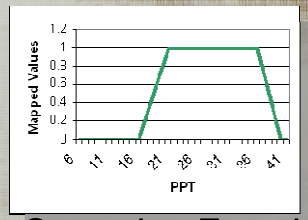


Spawning Female

Salinity



Larvae



Spawning Female

HSI = Temperature$^{0.5}$ * Salinity$^{0.5}$

Spawning Female
March - May

Spawning Female and Larvae
June - September

Larvae
October - December

HSI = Geometric Mean for spawning females

HSI = Minimum of spawning and larval HSI

HSI = Geometric Mean for Larvae

Turtle Grass Habitat Suitability

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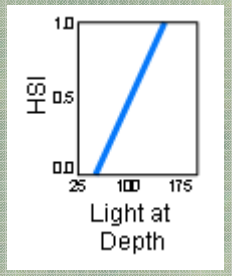
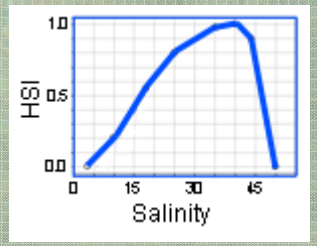
$$HSI = (Light\_Availability^{0.25} * Salinity^{0.25} * Temperature^{0.25} * Previous^{0.25})$$

Response to Light at Depth

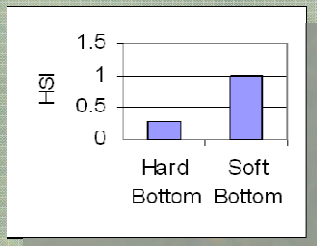


Light @ Depth = Lambert-Beer Eq. using Available Light & Salinity

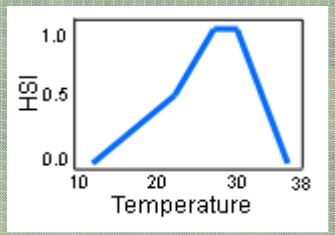
Response to Salinity



Response to Substrate



Response to Temperature



Anuran Community Habitat Suitability

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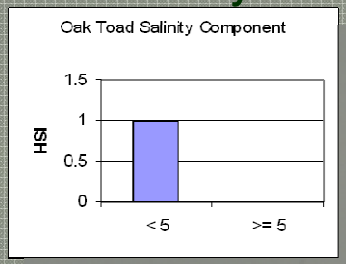
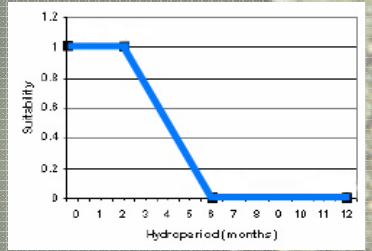
$$HSI = Land\_Cover^{0.33} * Salinity^{0.33} * Hydroperiod^{0.33}$$

Cricket Frog	Cuban Treefrog
Oak Toad	Eastern Narrowmouth Toad
Southern Toad	Green Treefrog
Greenhouse Frog	Pig Frog
Squirrel Treefrog	Southern Leopard Frog

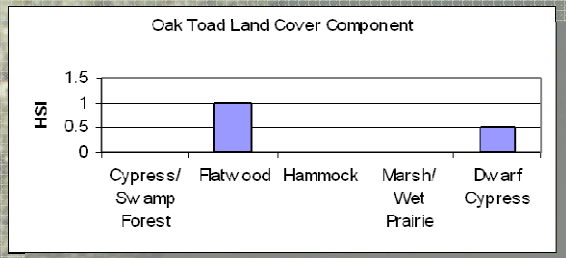
Response to Salinity



Response to Hydroperiod



Response to Land Cover



Blue Crab Habitat Suitability

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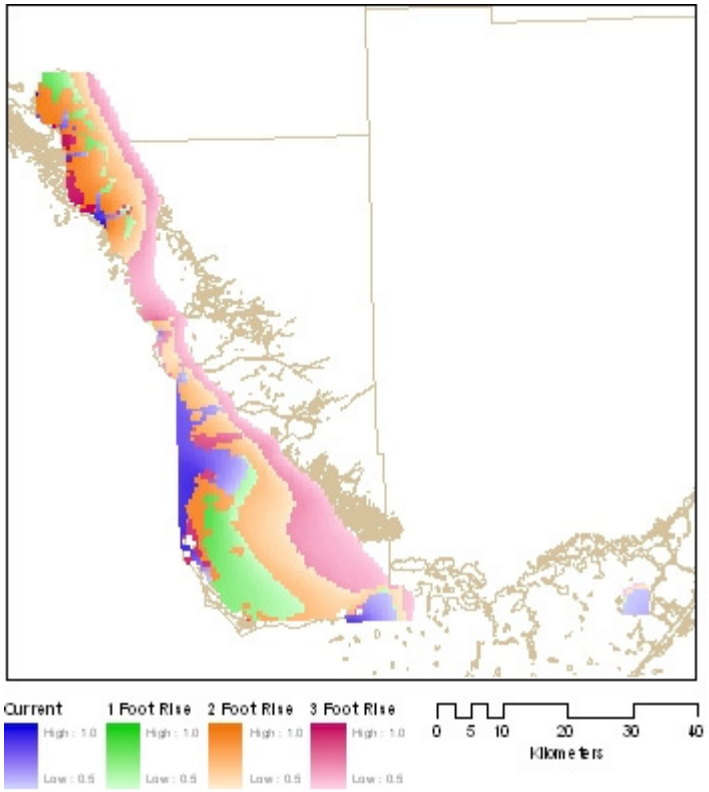
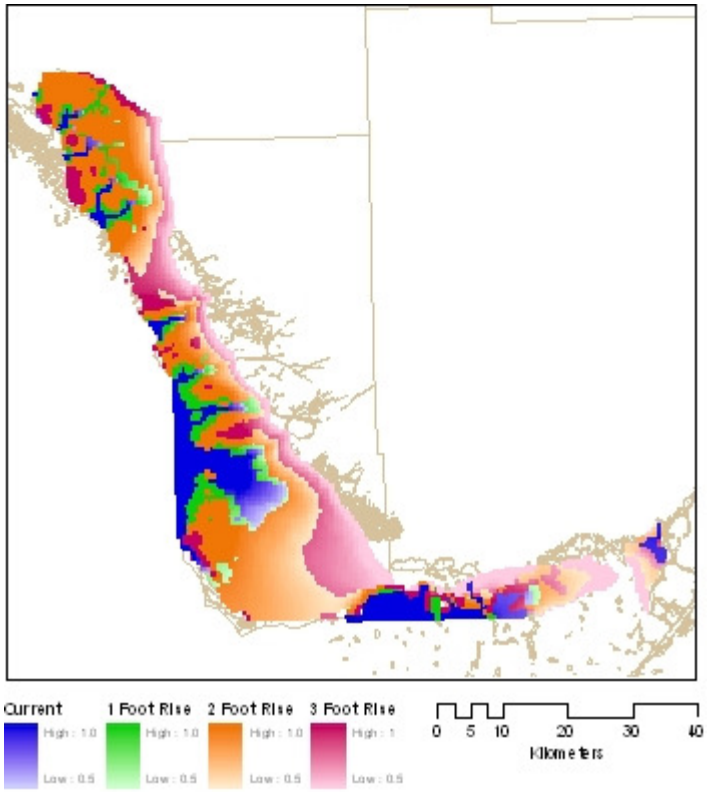
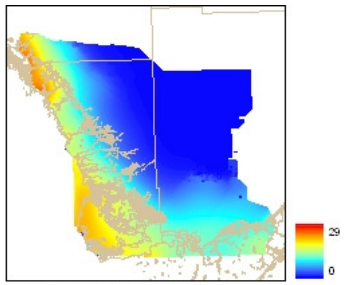


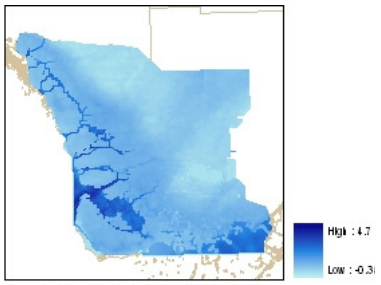
Larval 15Nov1995



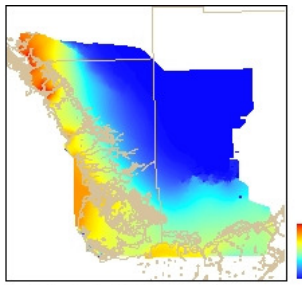
Spawning Females 15March1995



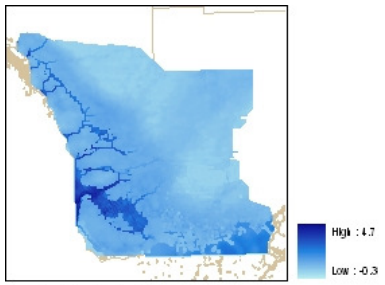
Salinity 15Nov1995 3 foot rise



Depth (m) 15Nov1995 3 foot rise



Salinity 15Mar1995 3 foot rise



Depth (m) 15Mar1995 3 foot rise

Juvenile Spotted Sea Trout Habitat Suitability

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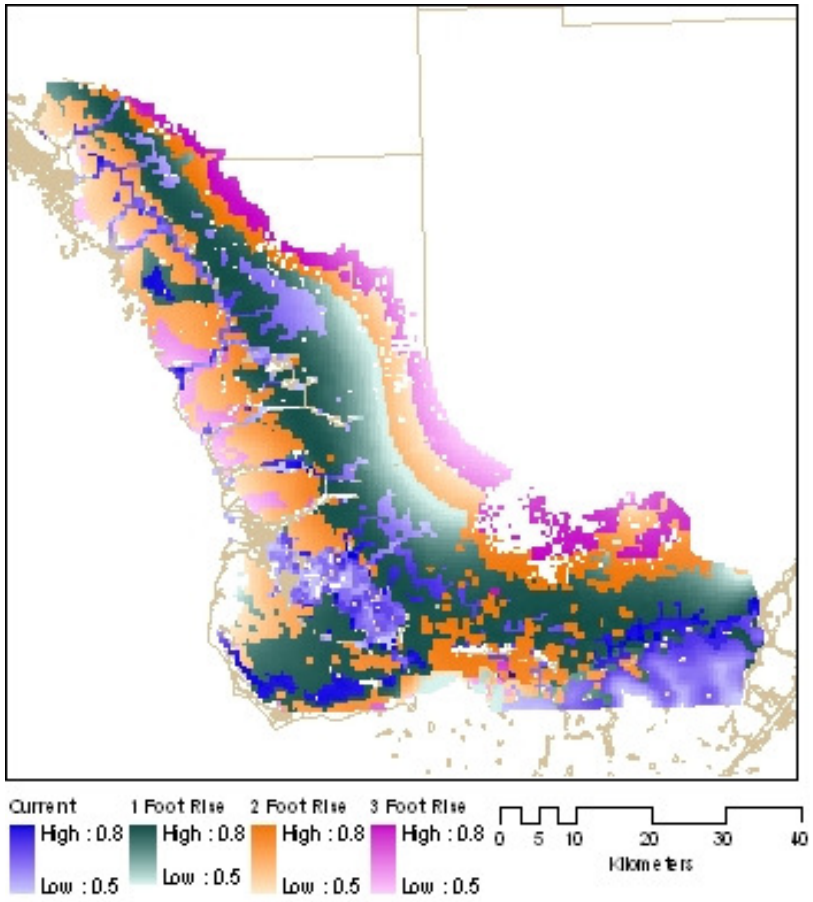
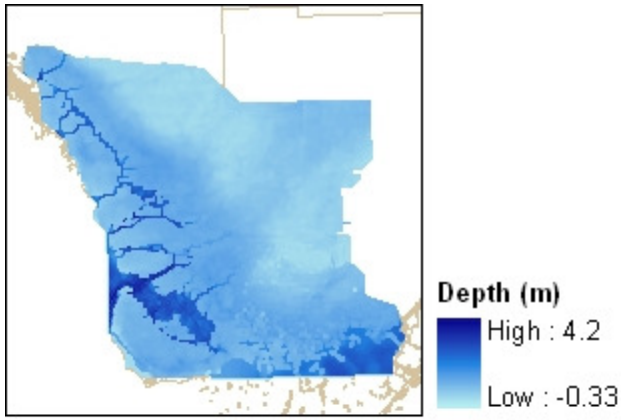
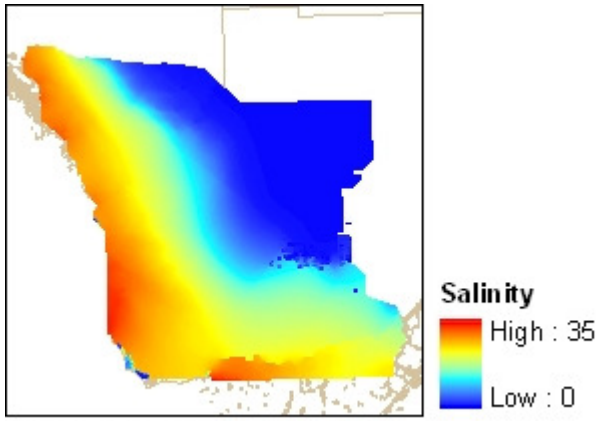


Trout 20July1995



Depth 20July1995 3 Foot Rise



Salinity 20July1995 3 Foot Rise

Juvenile Spotted Sea Trout Habitat Suitability

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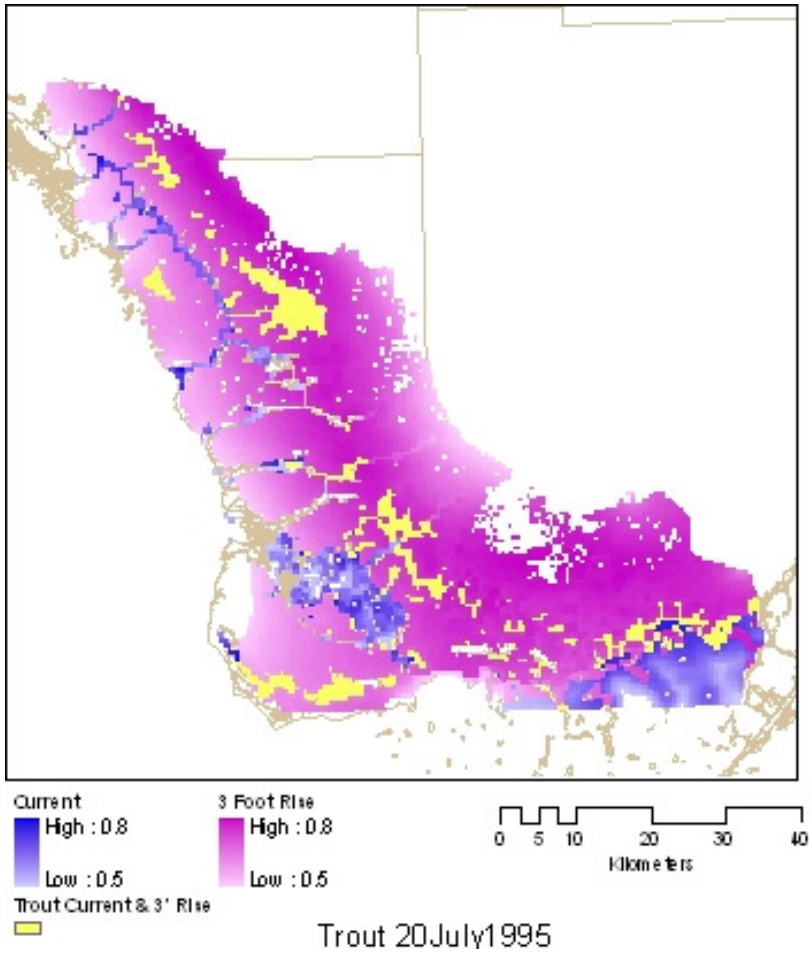

Turtle Grass Habitat Suitability

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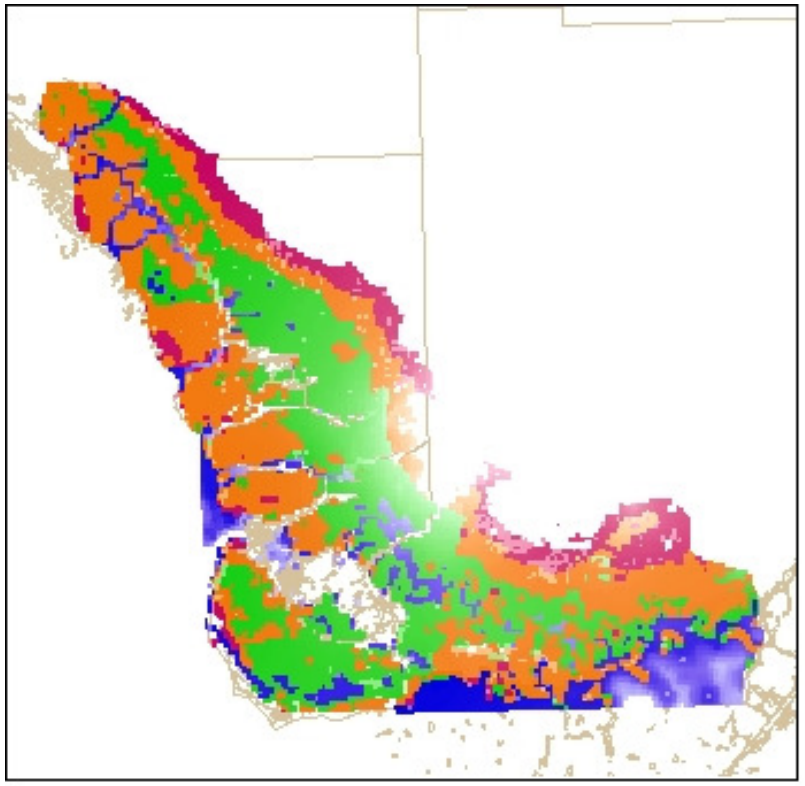
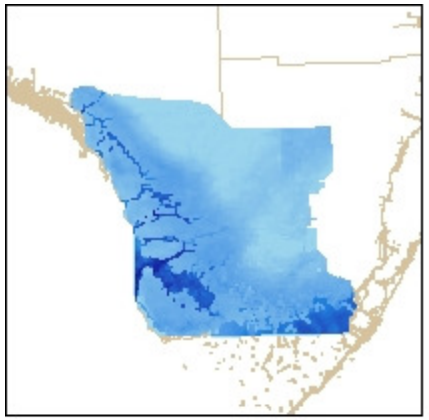
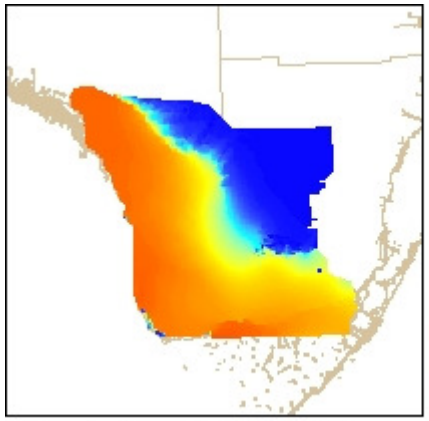


May 1994



Depth (m)
High : 4
Low : -0.5

Depth May1994 3 Foot Rise



Salinity
High : 41
Low : 0

Salinity May1994 3 Foot Rise

Turtle Grass Habitat Suitability

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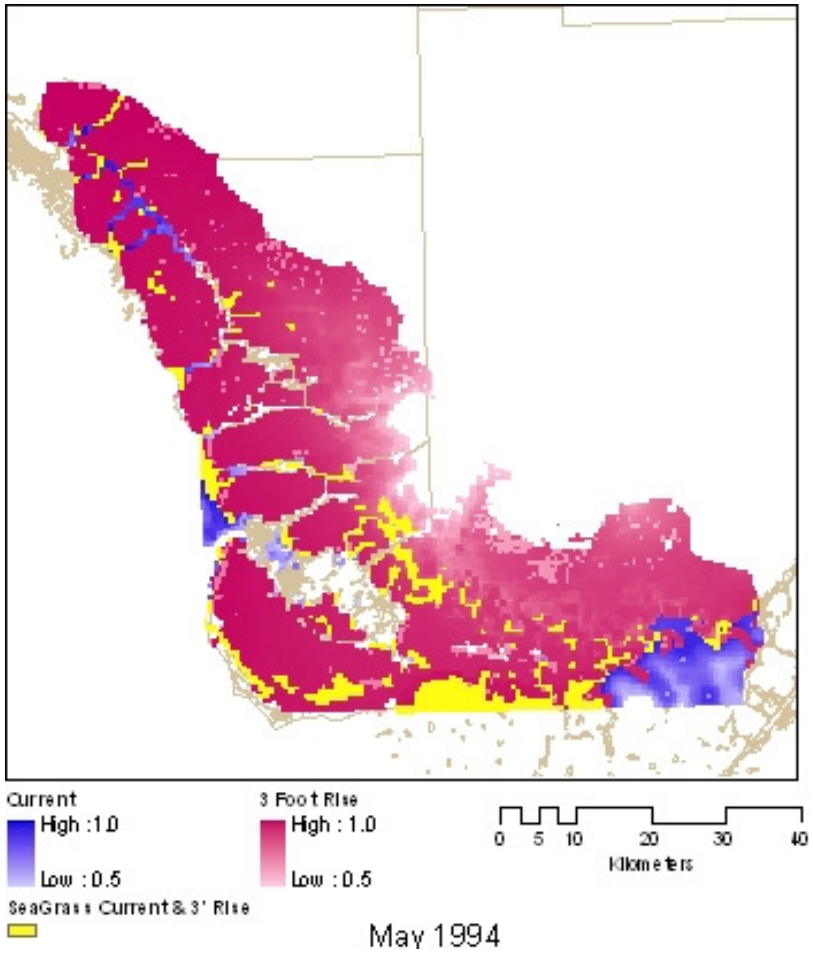

Anuran Community Habitat Suitability

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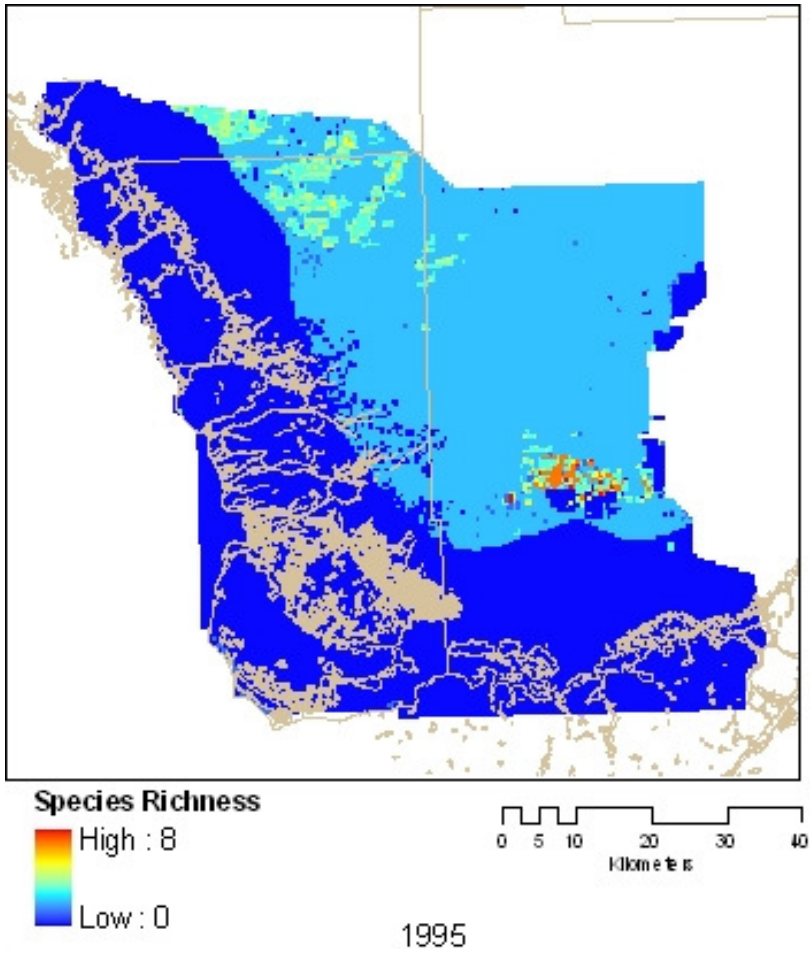
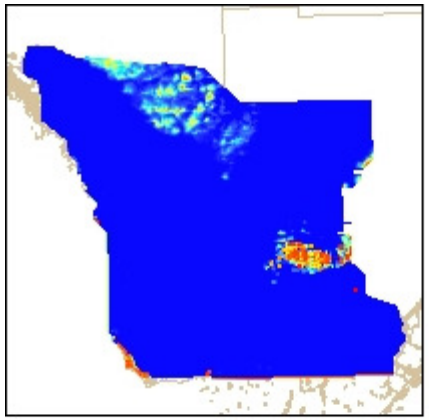
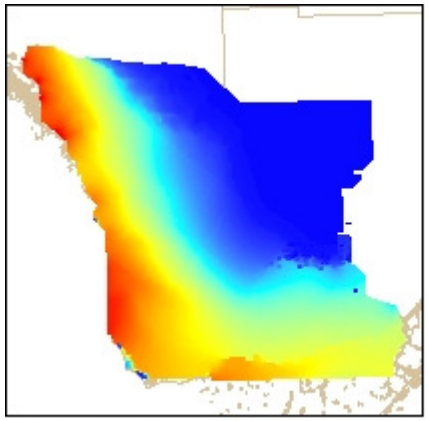


1995



HydroPeriod 3 Foot Rise 1995



Salinity 1995 3 Foot Rise

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What's Next?

- Model review and enhancement

- Vegetation succession and substrate subsidence

- Other climate variable impacts

- Species interactions

- Other hydrological models as input

- Examine interaction of hydrologic restoration alternatives