Balancing Freshwater Inflows in a Changing Environment

Collaborating for Water Conservation on the Texas Coast

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06/27/13
Freshwater Inflows: Determining flow regimes in the face of land use, climate change, and other unknowns

OBJECTIVE 1
Examine the effects of land use and climate change on freshwater inflows to the Guadalupe-San Antonio and Mission-Aransas.

OBJECTIVE 2
Improve inputs to the TxBLEND salinity model of the Texas Water Development Board.

OBJECTIVE 3
Collaborate with intended users to identify and conduct a priority research project related to a focal species mentioned in the BBEST report.

OBJECTIVE 4
Develop shared systems learning among the local stakeholders and scientists for construction of a system dynamics model.

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Objective 1
Examine the effects of land use and climate change on freshwater inflows to the Guadalupe-San Antonio and Mission-Aransas.

Land Use/Land Cover
- Open Water
- Developed, Open Space
- Developed, Low Intensity
- Developed, Medium Intensity
- Developed, High Intensity
- Barren Land
- Deciduous Forest
- Evergreen Forest
- Mixed Forest
- Shrub/Scrub
- Grassland/Herbaceous
- Hay/Pasture
- Cultivated Crops
- Woody Wetlands
- Emergent Herbaceous Wetlands
Objective 1
Examine the effects of land use and climate change on freshwater inflows to the Guadalupe-San Antonio and Mission-Aransas.

What time horizon(s) would you like to see included in the land use and climate change modeling?
1. **2020 (32%)**
2. 2040 (23%)
3. **2060 (34%)**
4. 2080 (6%)
5. 2100 (5%)

Which of the following approaches would you prefer to see used for the land use and climate modeling?
1. Monthly (3%)
2. Seasonal (9%)
3. Annual (0%)
4. Monthly & Seasonal (16%)
5. Monthly & Annual (3%)
6. **Seasonal & Annual (50%)**
7. **Monthly, Seasonal, & Annual (19%)**

Which climate change scenarios would you prefer to see used for the climate change and land use modeling?
1. A2 (High) (6%)
2. A1B (Medium) (18%)
3. B1 (Low) (3%)
4. **A2 & B1 (High & Low) (21%)**
5. **All three (53%)**
### Objective 1

Examine the effects of land use and climate change on freshwater inflows to the Guadalupe-San Antonio and Mission-Aransas.

### Timeframe:
- 2020, 2060

### Emissions:
- A2 (High), B1 (Low)

### Approach:
- Annual, Seasonal

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#### SCENARIOS

<table>
<thead>
<tr>
<th>Scenario 1</th>
<th>Scenario 2</th>
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Changing Landscape . . .

Integrated Climate & Land Use Scenarios
Indicator: Population & Residential Water Use

Assumes 149 gal/person/day
Indicator: Population & Residential Water Use

Assumes 129 gall/person/day

Assumes 143 gall/person/day
Indicator: Land Use

- Developed Open Space
  - Developed Medium Intensity 2020 A2: 56,878
  - Developed High Intensity 2020 A2: 67,876
  - Developed High Intensity 2060 A2: 63,063
  - Developed Medium Intensity 2060 A2: 77,746
  - Developed Low Intensity 2060 A2: 347,471
  - Developed Low Intensity 2020 A2: 266,367
  - Developed Open Space 2020 A2: 1,896,046
  - Developed Open Space 2060 A2: 2,239,650

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Indicator: Land Cover
Indicator: Irrigation Water Use

\[
\text{Irrigation Water Use} = \text{Acres of Cropland} \times \text{Water Use Assumption (inches/acre/year)} \times \% \text{ of Acres Irrigated Assumption}
\]

Source: “Status and Trends of Irrigated Agriculture in Texas” (TWRI, 2012)
17 in/acre/year
Indicator: Irrigation

50% of Cropland Irrigated
Objective 2

Improve inputs to the TxBLEND salinity model of the Texas Water Development Board.

Tiltmeter
Objective 2

Improve inputs to the TxBLEND salinity model of the Texas Water Development Board.
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Improve inputs to the TxBLEND salinity model of the Texas Water Development Board.

Wind: Meters/second

Current: Centimeters/second

Line length: Speed in a direction

Line Color: % time in a direction
Objective 2

Improve inputs to the TxBLEND salinity model of the Texas Water Development Board.
Objective 3

Collaborate with intended users to identify and conduct a priority research project related to a focal species mentioned in the BBEST report.

Freshwater Indicator Species
Objective 3

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Freshwater Indicator Species
Selecting Tidal Stream Transport

Phase 1: Position Maintenance
During the day and nocturnal ebb tides, megalopae maintain their position near the bottom.

Phase 2: Vertical Migration/Ascent
During nocturnal flood tides, megalopae ascend into the water column in response to rising salinity.

Phase 3: Hydrodynamic Transport
Megalopae swim in response to high turbulence to maintain their position in the water column and are transported up-estuary by strong flood-tide currents.

Phase 4: Settlement/Habitat Selection
Near the end of flood tide, megalopae are cued to settle by declining turbulence.
Objective 3

Collaborate with intended users to identify and conduct a priority research project related to a focal species mentioned in the BBEST report.

Blue Crab Research

**DROUGHT**
Add hypersaline water

35 ppt

40 ppt

**LARGE-SCALE CITIZEN SCIENCE SURVEY OF DAILY MEGALOPAL SETTLEMENT**

**SMALL-SCALE LAB EXPERIMENTS ASSESSING TRANSPORT BEHAVIOR AS A FUNCTION OF SALINITY**

**MONTHLY SURVEYS OF JUVENILE ABUNDANCE IN MESQUITE BAY**
Objective 3

Collaborate with intended users to identify and conduct a priority research project related to a focal species mentioned in the BBEST report.

Blue Crab Research
Daily Megalopal Abundance

The graph shows the daily abundance of megalopae on collectors from May 1 to December 11. The data is represented for two locations: Horace Caldwell Pier (dashed line) and UTMSI (solid line). The y-axis represents the number of megalopae on the collector, ranging from 1 to 10,000. The x-axis represents the dates from May 1 to December 11.
Objective 3

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Blue Crab Research
Objective 3

Collaborate with intended users to identify and conduct a priority research project related to a focal species mentioned in the BBEST report.

Rangia Clam Research

WHERE ARE THEY?

ARE THE POPULATIONS VIABLE?

ENVIRONMENTAL CONDITIONS WHERE THEY ARE FOUND?
Objective 3

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Rangia Clam Research

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Objective 4

Develop shared systems learning among the local stakeholders and scientists for construction of a system dynamics model.

Mediated Modeling
Implementing the RESTORE Act in Texas

Workshop Description

Join us for a workshop exploring the RESTORE the Gulf Coast States Act and what it may mean for Texas. Sessions will provide an overview of the Act, including how it links with other regional restoration and recovery processes, and then focus on the various mechanisms it creates, opportunities for public participation, and local, state, and regional restoration priorities and principles. Participants will learn about the latest developments in Texas and have the opportunity to discuss priorities and potential next steps.

Details

Date: Tuesday, July 16, 2013; 9:00 am - 4:00 pm
Location: Visitors Center Auditorium, University of Texas Marine Science Institute (750 Channel View Drive, Port Aransas, TX)
Registration: Click here to register online or email hbwade@tamu.edu

Tentative Agenda

9:00  Welcome
9:15  Overview of Gulf Restoration & Recovery Processes
10:00  In-Depth Look at the RESTORE Act
11:00  Participating in RESTORE Act Implementation in Texas
12:00  Lunch (provided)
1:00  Ocean and Coastal Restoration: Challenges & Priorities
2:00  Local and Statewide Restoration Priorities
2:45  Moving Forward: Next Steps
3:45  Wrap-Up & Evaluations
Questions?

Paulami Banerjee – Texas A&M University College Station
Kimberly Bittler – University of Texas Marine Science Institute
Catherine Buchalski – University of New Hampshire
Dr. Ed Buskey – Mission-Aransas NERR
Dr. Zack Darnell – Mission-Aransas NERR
Dr. Ken Dunton – University of Texas Marine Science Institute
Dr. Bill Grant – Texas A&M University College Station

Kristin Hicks – Mission-Aransas NERR
Dr. Kiersten Madden – Mission-Aransas NERR
Sally Palmer – Mission-Aransas NERR
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Candace Peyton – Mission-Aransas NERR
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Dr. Lindsay Scheef – Mission-Aransas NERR

This project is funded by the National Estuarine Research Reserve System Science Collaborative, a partnership of the National Oceanic and Atmospheric Administration and the University of New Hampshire.
National Estuarine Research Reserve System Science Collaborative
**Future Land Use**

This scenario consists of a low population projection and a slightly compact development pattern, which results in the least altered landscape for most areas of the U.S..

**B1**: Rapid social development in developing regions.
Population rises rapidly until mid-century, then falls below replacement levels.
Fertility and average U.S. household size decrease.
Domestic migration is low, but net international migration is high.

**LAND USE**
- Commercial/Industrial
- Urban (<0.25 acres/unit)
- Suburban (0.25 – 2 acres/unit)
- Exurban (2 – 40 acres/unit)
- Rural (>40 acres/unit)

**ICLUS: INTEGRATED CLIMATE AND LAND USE SCENARIOS**
Future Land Use

This is the highest ICLUS population projection and for most areas in the U.S. represents a “worst case” pattern of development.

A2: Slower rate of economic growth.
Restricted flow of people and ideas across regions.
Fertility and average U.S. household size increase.
Domestic migration is high, but net international migration is moderate.

ICLUS: INTEGRATED CLIMATE AND LAND USE SCENARIOS

<table>
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<tr>
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<tbody>
<tr>
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<td>Urban (&lt;0.25 acres/unit)</td>
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<td>Rural (&gt;40 acres/unit)</td>
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