Improving Understanding of Drought Impacts in Coastal Ecosystems

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Carolinas Integrated Sciences & Assessments
University of South Carolina, Department of Geography
Regional Integrated Sciences & Assessments

NOAA’s RISA programs support research teams that help build the nation’s capacity to prepare for and adapt to climate variability and change.

RISA teams work with public and private user communities to:

- Understand decision contexts
- Develop actionable knowledge
- Maintain diverse, flexible networks
- Innovate services to enhance the use of science in decision making
CISA works to be a regional resource for a variety of stakeholders to incorporate climate information into water and coastal management, public health, and related decision making processes.

CISA’s Core Focus Areas:
- Drought
- Climate & Watershed Modeling
- Coastal Management
- Public Health
- Adaptation

Partner Organizations:
- Southeast Regional Climate Center
- NC Sea Grant
- SC Sea Grant Consortium
- NC & SC State Climate Offices
- Federal, State & Local Agencies
- Private Sector
- NGOs
National Integrated Drought Information System (NIDIS)
Regions in the US where NIDIS is currently developing drought early warning information systems

- California Pilot DEWS
- Upper Colorado River Basin DEWS and Four Corners Pilot DEWS
- Missouri Basin Pilot DEWS (in development)
- Southern Plains Pilot DEWS
- Chesapeake Bay Watershed Pilot DEWS (in development)
- Carolinas Coastal Ecosystems Pilot DEWS
- Apalachicola-Chattahoochee-Flint River Basin Pilot DEWS
Ecological impacts
Drought impacts interviews

- **Purpose:** to learn first-hand about
  - On-the-ground drought impacts in coastal regions of the Carolinas
  - Mechanisms for coping with drought impacts
  - Drought information use and needs
  - Other stressors

- **Locations**
  - Beaufort County, SC
  - Carteret County, NC
Carteret County, NC

Beaufort County, SC
Who we interviewed

- **Commercial fisheries businesses (n=14)**
  - Shrimpers, crabbers, other commercial fishermen
  - Seafood houses
  - Researchers/regulators of commercial industry

- **Recreational fishing (n=11)**
  - Outfitters, charter boats

- **Outdoor recreational businesses (n=11)**
  - Kayakers, ecotourism companies

- **Land/resource managers (n=14)**
  - National Wildlife Refuges
  - Public and private parks and preserves
  - National Estuarine Research Reserves
Documenting drought impacts: What are we looking at/for?

- **Direct physical impacts**
- **Interactions with other climate, biological, and human stressors**
- **Indirect impacts on individuals, business, and communities**
- **Responses & adaptations by affected groups**
- **Secondary, indirect impacts**
## Ecological Impacts

<table>
<thead>
<tr>
<th>Ecological Impacts</th>
<th>Outdoor Recreation (n=11)</th>
<th>Natural Resource Management (n=14)</th>
<th>Recreational Fishing (n=11)</th>
<th>Commercial Fishing (n=14)</th>
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</thead>
<tbody>
<tr>
<td><strong>Aquatic</strong></td>
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<tr>
<td>Declines/Movement of Brackish Water Species</td>
<td></td>
<td></td>
<td>81-100%</td>
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<tr>
<td>Saltwater Species Moving Inland</td>
<td></td>
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<td>41-60%</td>
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<tr>
<td>Decline of Freshwater Species</td>
<td></td>
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<td>1-20%</td>
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<tr>
<td><strong>Terrestrial &amp; Aquatic</strong></td>
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<tr>
<td>Abnormal Conditions, Ecological Stress, Disease</td>
<td></td>
<td></td>
<td>21-40%</td>
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<tr>
<td>Species Composition Changes</td>
<td></td>
<td></td>
<td>41-60%</td>
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</table>

1-20% 21-40% 41-60% 61-80% 81-100%
<table>
<thead>
<tr>
<th>Interacting Stressors</th>
<th>Outdoor Recreation (n=11)</th>
<th>Natural Resource Management (n=14)</th>
<th>Recreational Fishing (n=11)</th>
<th>Commercial Fishing (n=14)</th>
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<tbody>
<tr>
<td>Human/Social-Cultural</td>
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<td>Runoff, Pollution, Toxins</td>
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<tr>
<td>Habitat, Resource Loss</td>
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<td>Economic Pressures</td>
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<tr>
<td>Policies, Regulations</td>
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<tr>
<td>Weather/Climate</td>
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<tr>
<td>Temperature Change</td>
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<tr>
<td>Severe Weather Events</td>
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<tr>
<td>Species Phenological/ Range Shifts</td>
<td></td>
<td>1-20%</td>
<td>21-40%</td>
<td>41-60%</td>
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<tr>
<td>Sea Level Rise</td>
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<tr>
<td>Responses</td>
<td>Outdoor Recreation (n=11)</td>
<td>Natural Resource Management (n=14)</td>
<td>Recreational Fishing (n=11)</td>
<td>Commercial Fishing (n=14)</td>
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<tr>
<td>Diversification</td>
<td></td>
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<tr>
<td>Follow The Catch or Import From Other Areas</td>
<td>21-40%</td>
<td>41-60%</td>
<td>61-80%</td>
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<tr>
<td>Shift Resource Management Practices</td>
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<td>41-60%</td>
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<td>Increase Monitoring</td>
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Decision-Making Continuum for N.C. & S.C. Fishing Industries

Factors Influencing Decisions:
- Customer Expectations/Demand/Market Trends
- Regulations
- Access / Availability of Species
- Landing Trends
- Weather / Extreme Events
- Climate Variability
- Cost of Gas
- Economic Conditions

Decisions:
- Where/How Far to Travel
- Diversify Target Species
- Equipment Maintenance/Upgrade
- How Many People to Employ
- Diversify Business Strategies

Operational Seasonal Annual 3+ Years

Short-term Long-term
## Information

<table>
<thead>
<tr>
<th>Information Variable of Interest (all interviewees)</th>
<th>% of Total Respondents Reporting Use</th>
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<tbody>
<tr>
<td>Salinity levels (amount, location)</td>
<td>29%</td>
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<tr>
<td>Hydrology (discharge, flows, groundwater)</td>
<td>12%</td>
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<tr>
<td>Precipitation</td>
<td>10%</td>
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<tr>
<td>Vegetation and soil conditions (general health, soil chemistry)</td>
<td>10%</td>
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<tr>
<td>Water temperature</td>
<td>10%</td>
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<tr>
<td>Contaminants</td>
<td>7%</td>
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<tr>
<td>Fish biology (health, abundance, class impacts)</td>
<td>7%</td>
</tr>
<tr>
<td>Phenology</td>
<td>5%</td>
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</tbody>
</table>
Information Use & Sources

• **Fishing and recreation**
  ▫ Short time frames
  ▫ Local knowledge, observations

• **Natural resource/land managers**
  ▫ Greater use of external information
  ▫ Independent monitoring
What we are learning: needs for a drought early warning system

• **Impacts matter**
  - Limited use of existing drought information and tools (all groups), yet concerned about impacts
  - Industry- and sector-specific
  - Context-dependent: local variability and diversity, micro-climates

• **Fishing and recreation**
  - Short time frames
  - Local knowledge, observations
  - Lack of trust in state, federal agencies and information

• **Natural resource/land managers**
  - Longer time frames
  - Independent monitoring
  - Greater use of external information, partnerships with peer groups

• **Drought is one component of a broader weather-climate continuum**
  - Timing of precipitation (including drought busters), duration, seasonality matters
  - Flooding is just as significant for many industries, decisions
What we are learning: possible components of a drought early warning system

• **Natural Resource Managers**
  ▫ Biological impacts, thresholds, and responses to extreme events
  ▫ Adaptive and scenario-based planning, ecological indicators
  ▫ Baseline data
    • What is “normal” (e.g. frequency of drought events, recovery periods, groundwater recharge rates)
  ▫ Early warning, seasonal forecasts might be useful

• **Fisheries**
  ▫ Attention to communication channels and messengers
  ▫ Incorporate secondary, indirect impacts into information provision and communications
Next steps

• Connections to other NIDIS-Carolinas pilot projects
  ▫ Development of a real-time salinity index (USGS-led)
  ▫ Assessment of ecological indicators

• Connections to drought decision making
  ▫ State climatology offices
  ▫ State drought response committees
  ▫ Local water and resource managers and planners
  ▫ National Weather Service offices
  ▫ National partners
    • NIDIS, National Drought Mitigation Center
April 28-29, 2014
Charlotte, NC
www.cisa.sc.edu/ccrc
Thank you!

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