

Drought and Coastal Ecosystems: Identifying Impacts and Opportunities to Inform Management

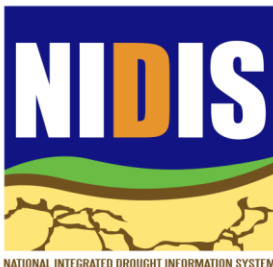
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2014 South Carolina Water Resources Conference
October 15-16, 2014

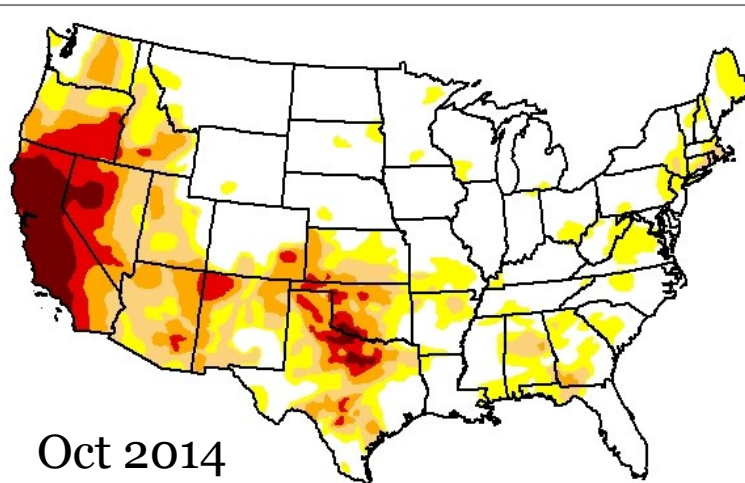
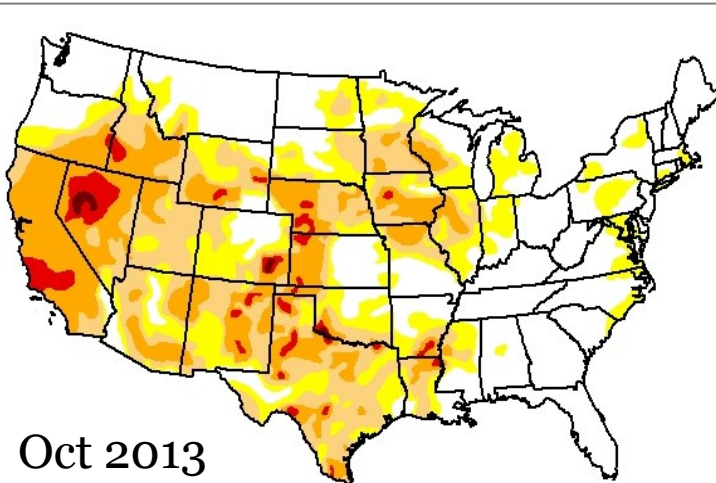
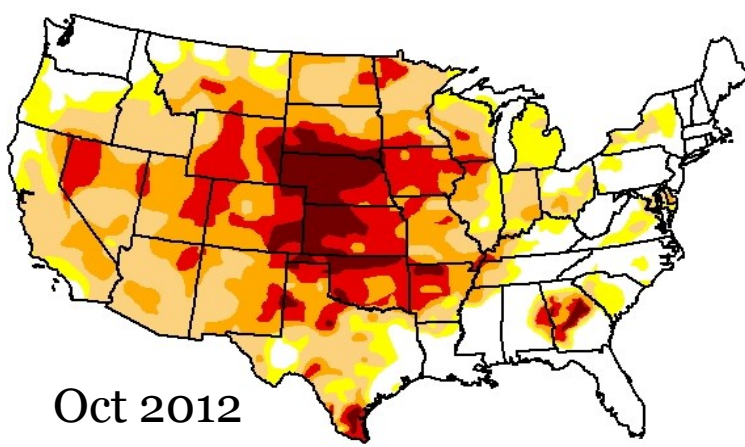
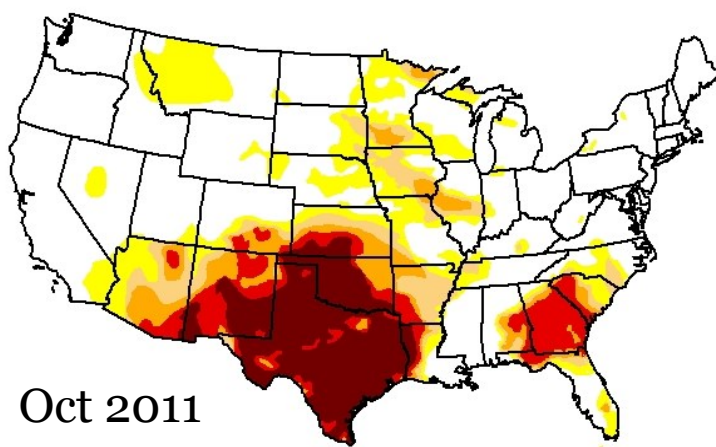
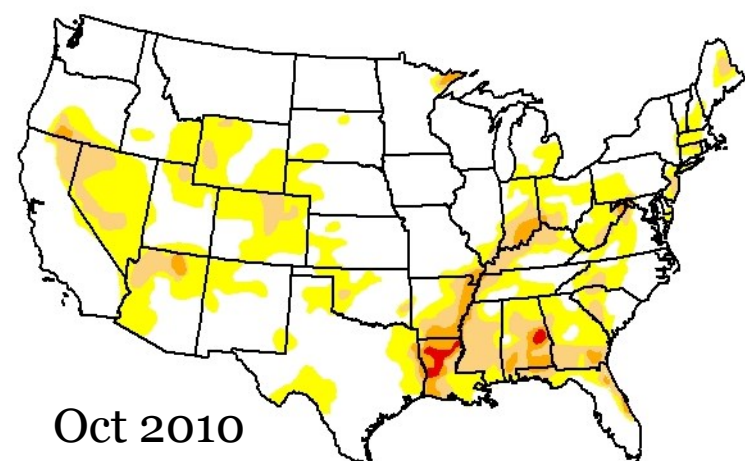
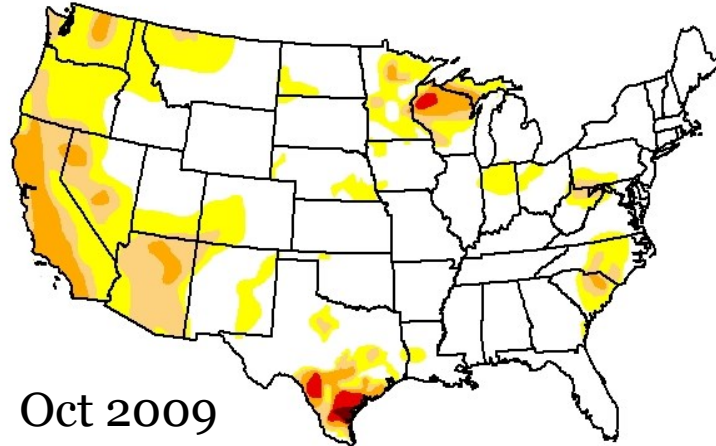


NIDIS-Carolinas Pilot Program Update

- Background
- Findings from CISA's drought impacts project
 - interviews with local decision makers
- Ongoing work and next steps

Background

- Why should we care about drought?
- Why a pilot program focused on drought and coastal ecosystems?
- Why do we need to know more about drought impacts?



Drought since 2000

- Percent area in D1-D4 (contiguous U.S.)
 - 7.74% (low, July 2010) to 65.45% (high, Sept 2012)
 - Average = 32.18%
- Percent area in D0-D4 (contiguous U.S.)
 - 21.35% (low, June 2010) to 80.75% (high, July 2012)
 - Average = 49.74%
 - Source: US Drought Monitor
- Estimated Costs
 - \$100 billion
 - Agriculture, forestry, fire
 - State and local assessments (if/when conducted)
 - Source: <http://www.ncdc.noaa.gov/billions/summary-stats>

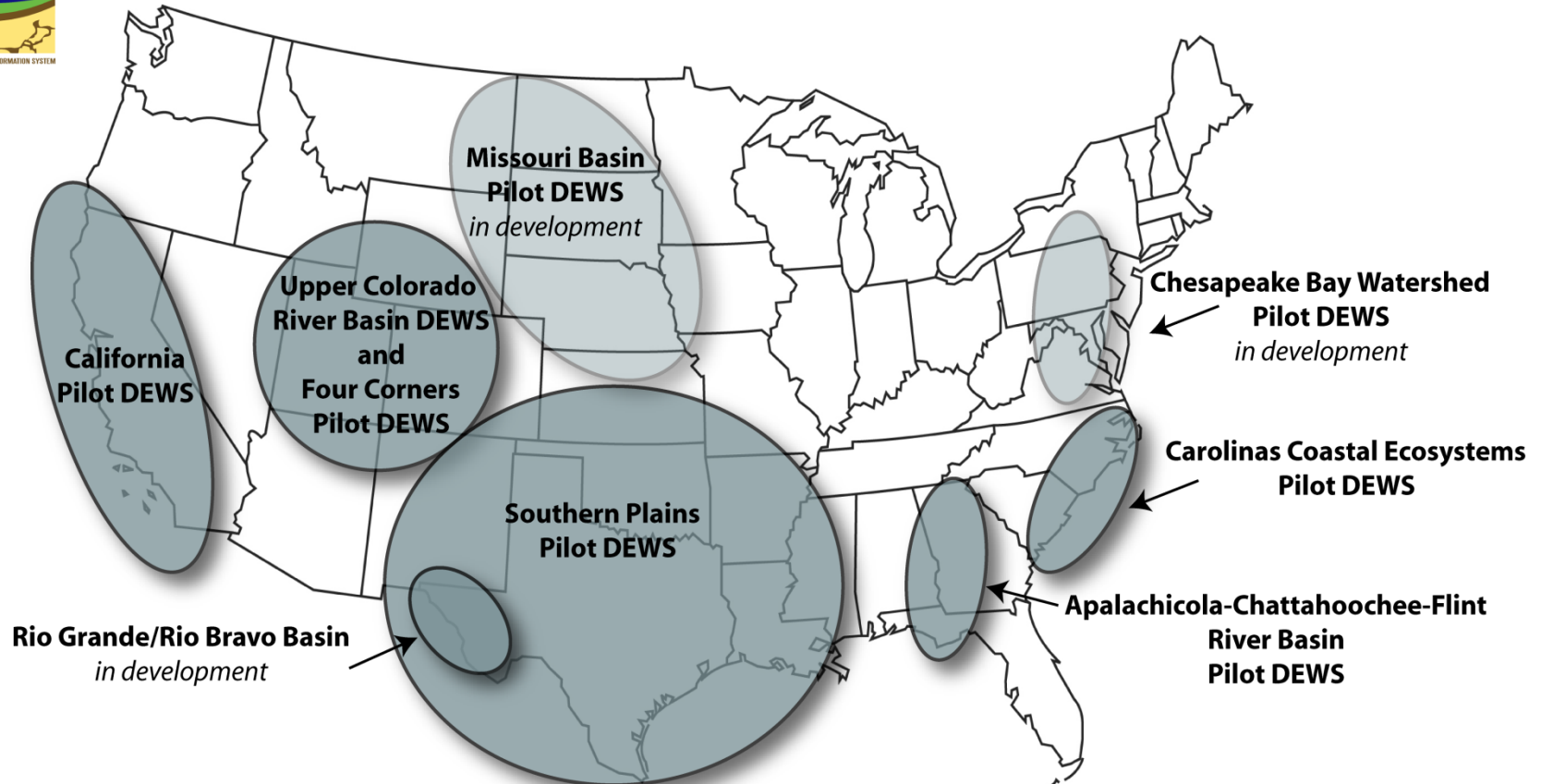
National Integrated Drought Information System

- Information and tools to monitor and forecast drought
- Stakeholder engagement, communications, outreach

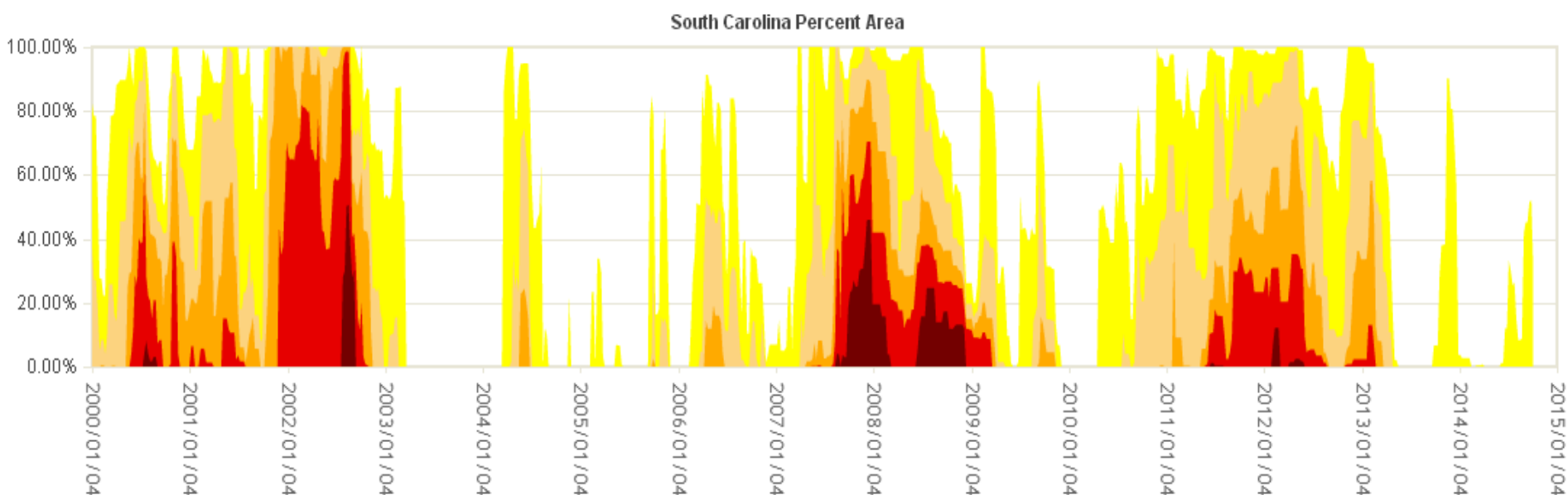


National Integrated Drought Information System (NIDIS)

Regions in the US where NIDIS is currently developing drought early warning information systems



- SC Drought Conditions, Percent Area, 2000-present
 - Source: US Drought Monitor



To zoom in, click and drag the cursor. To return to the full time series, double-click anywhere in the chart.



Why drought and coastal ecosystems?

- Drought is a significant stressor to coastal ecosystems, but ecological/drought information has not been systematically integrated into drought monitoring and response
- Available information is diverse, but not comprehensive
 - By ecosystem
 - How drought is defined and characterized
 - Temporal dimensions (seasonal v. multi-year events)
 - Episodic impacts v. broader, systemic change

NIDIS-Carolinas Pilot Program



- Carolinas Scoping Workshop, Wilmington, NC, Summer 2012
 - Drought indicators & indices
 - Drought impact reporting
 - Drought forecasting
 - Seafood safety

Why focus on “drought impacts”?

- Need to expand our understanding of drought beyond the four categories typically used:
 - Meteorological
 - Agricultural
 - Hydrological
 - Socioeconomic
- “Ecological drought”
 - Water deficiency causing stress to plants, animals, ecosystems
- Improved understanding of drought impacts and vulnerabilities can:
 - Inform the development of mitigation strategies
 - Improve understanding of how and what to monitor

**The Economic Impact
Of Travel on
South Carolina Counties
2012**

A Study Prepared for the
South Carolina Department of Parks, Recreation & Tourism
By the
U.S. Travel Association
Washington, D.C.
September 2013

GREEN MEANS GREEN.



**30 BILLION REASONS
WHY LIFE'S BETTER OUTDOORS**

**THE ECONOMIC IMPACT OF SOUTH
CAROLINA'S NATURAL RESOURCES**

DIVISION OF RESEARCH

2009

CISA's drought impacts pilot project

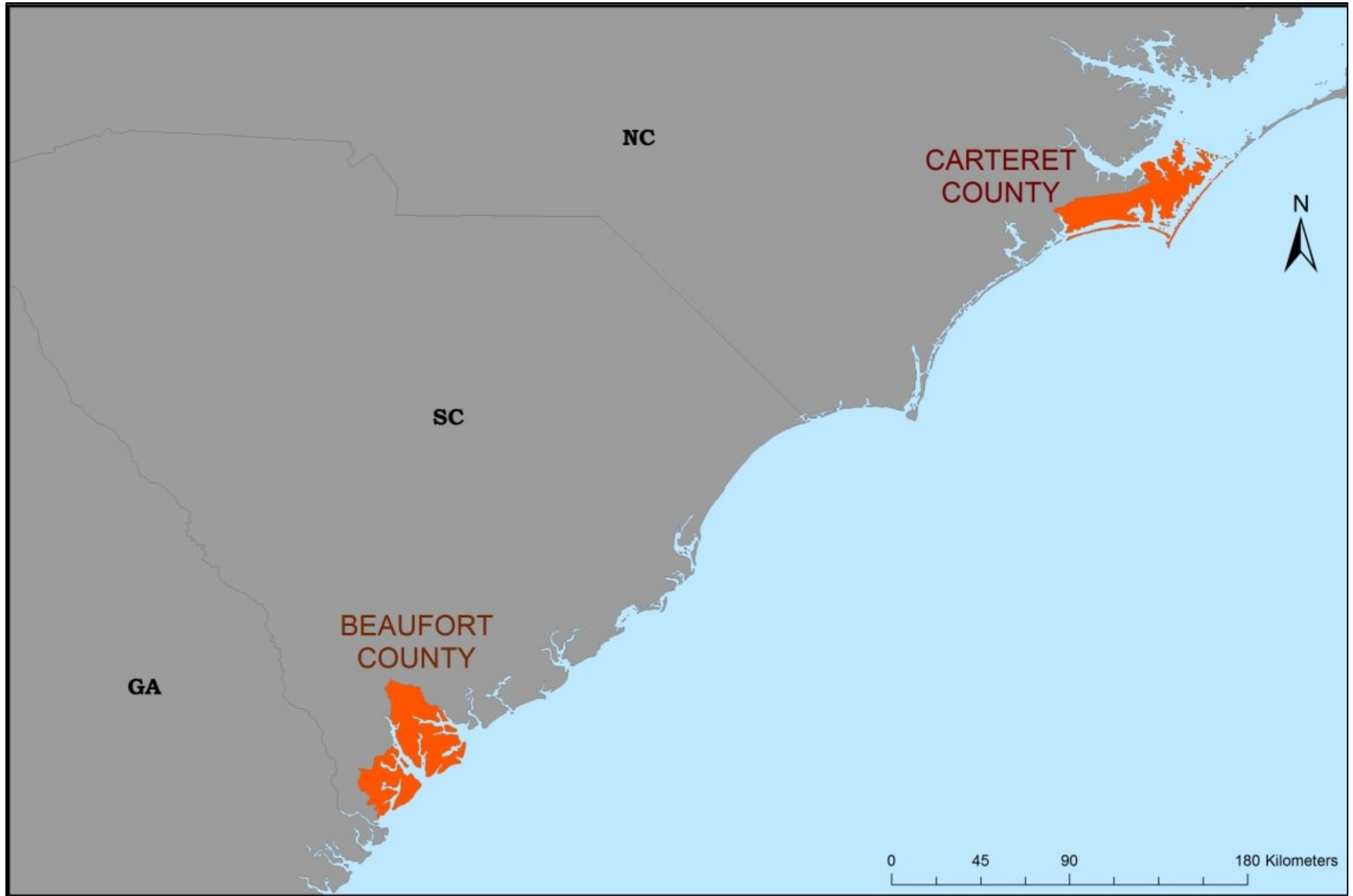
Findings from interviews with local
decision makers

Why interviews?

- 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
- 2 sets of interviews
 - March-June 2013
Beaufort County, SC
 - Oct-Nov 2013
Carteret County, NC



Study area



Who we interviewed

- Commercial fisheries businesses (n=13)
 - Shrimpers, crabbers, other commercial fishermen
 - Seafood houses
- Recreational fishing businesses (n=6)
 - Fishing guides, charter boats
- Fishing – research and extension (n=6)
- Outdoor recreational businesses (n=6)
 - Kayakers, ecotourism companies
- Land/refuge managers (n=11)
 - National Wildlife Refuges
 - Public and private parks and preserves
 - National Estuarine Research Reserves



Analysis of drought impacts: What are we looking for?



Direct
physical
impacts

Indirect
impacts on
species,
ecosystems

Interactions
with other
climate,
biological,
and human
stressors

Secondary,
indirect
impacts to
individuals,
businesses,
organizations

Responses &
adaptations
by affected
groups

Cascading impacts (commercial fishing example)

Direct impacts

Water quality conditions, salinity

Freshwater inputs (timing, availability)

Indirect (ecological) impacts

Habitat suitability; habitat stress or change

Movement, location, recruitment of species

Interacting stressors

Human: water quality, resource use, development, regulations, economics

Weather/climate: local conditions, water and air temperature, storms

Biological: disease

Socioeconomic impacts

Unavailable, inaccessible resources

Decreased quality, quantity; decreased landings

Additional costs; increased competition

Responses

Diversify species, locations

Diversify business activities and strategies

Cascading impacts (refuge management example)

Direct impacts

Water quality conditions, salinity

Freshwater inputs, water levels

Soil conditions

Indirect (ecological) impacts

Stressed vegetation

Species composition changes and shifts

Increased fire risk

Interacting stressors

Human: water management, land use

Weather/climate: local conditions, sea level rise

Biological: invasive species

Socioeconomic impacts

More difficult to manage refuges for optimal conditions

Fishing and hunting events cancelled; local businesses affected

Responses

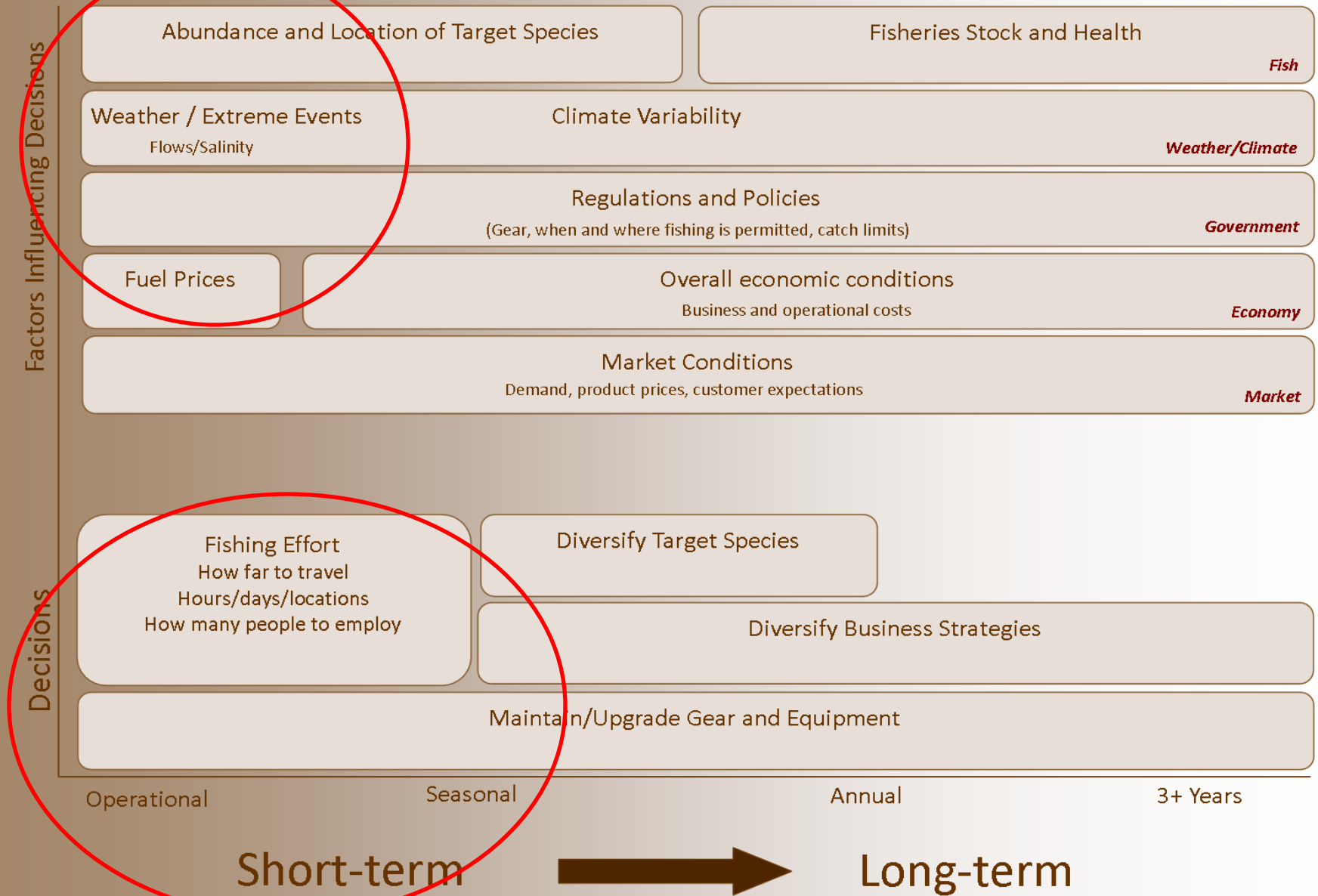
Balance competing interests and priorities

Long-term monitoring and adaptation projects

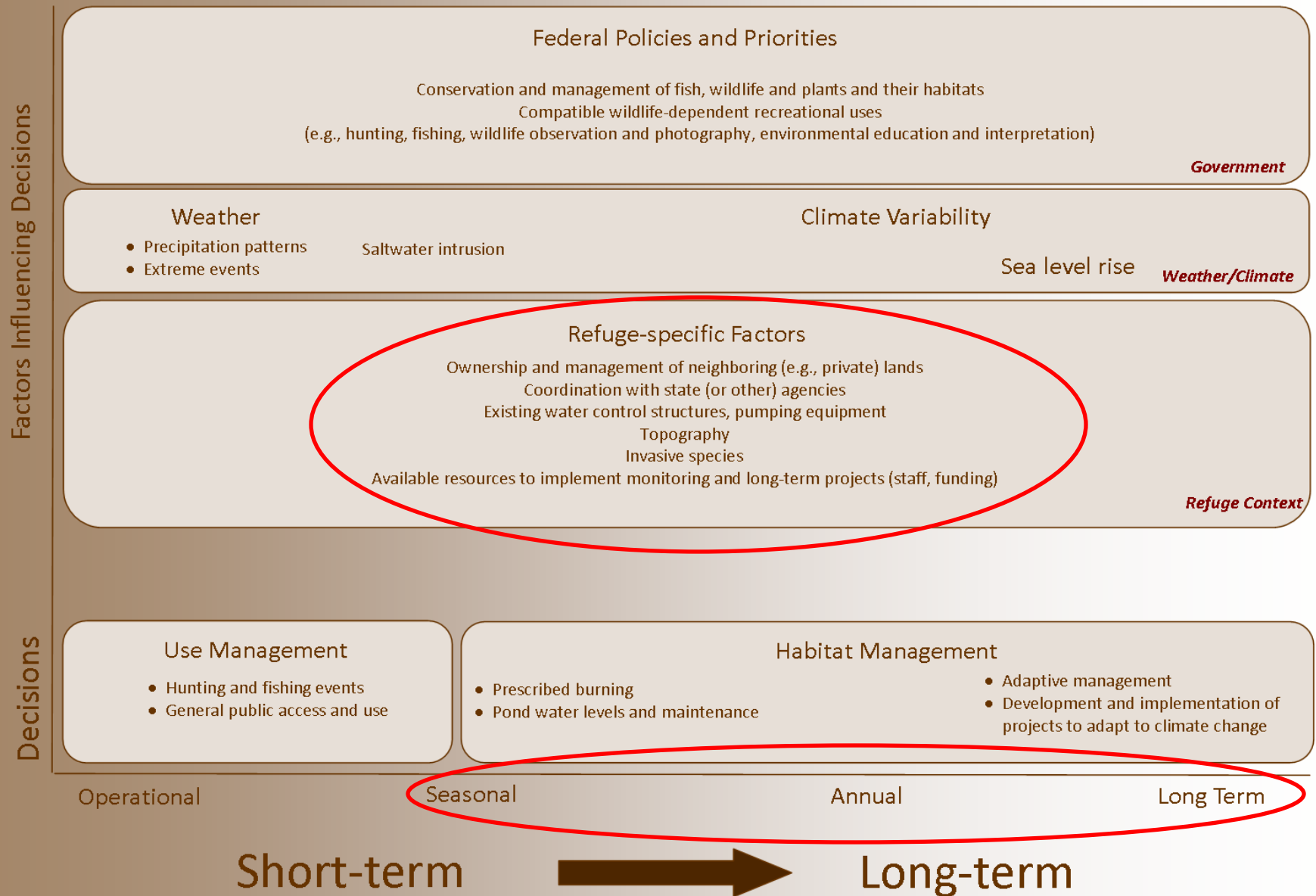
Information use and needs for a drought early warning system (all groups)

- Drought matters
 - But, limited use of existing drought information and tools
 - Concerns about impacts are:
 - Sector-specific
 - Context-dependent: local variability and diversity, micro-climates
- Salinity matters
 - Cross-cutting issue
- Drought is one component of a broader weather-climate continuum
 - Interest in extremes: timing, duration, seasonality
 - Flooding and “drought busters” are just as significant for many decisions

Decision-Making Continuum for Commercial Fishing Businesses



Decision-Making Continuum for Refuge Managers



Ongoing projects and next steps

Weekly Condition Monitoring Citizen Science Project

Connecting weather and climate to the environment



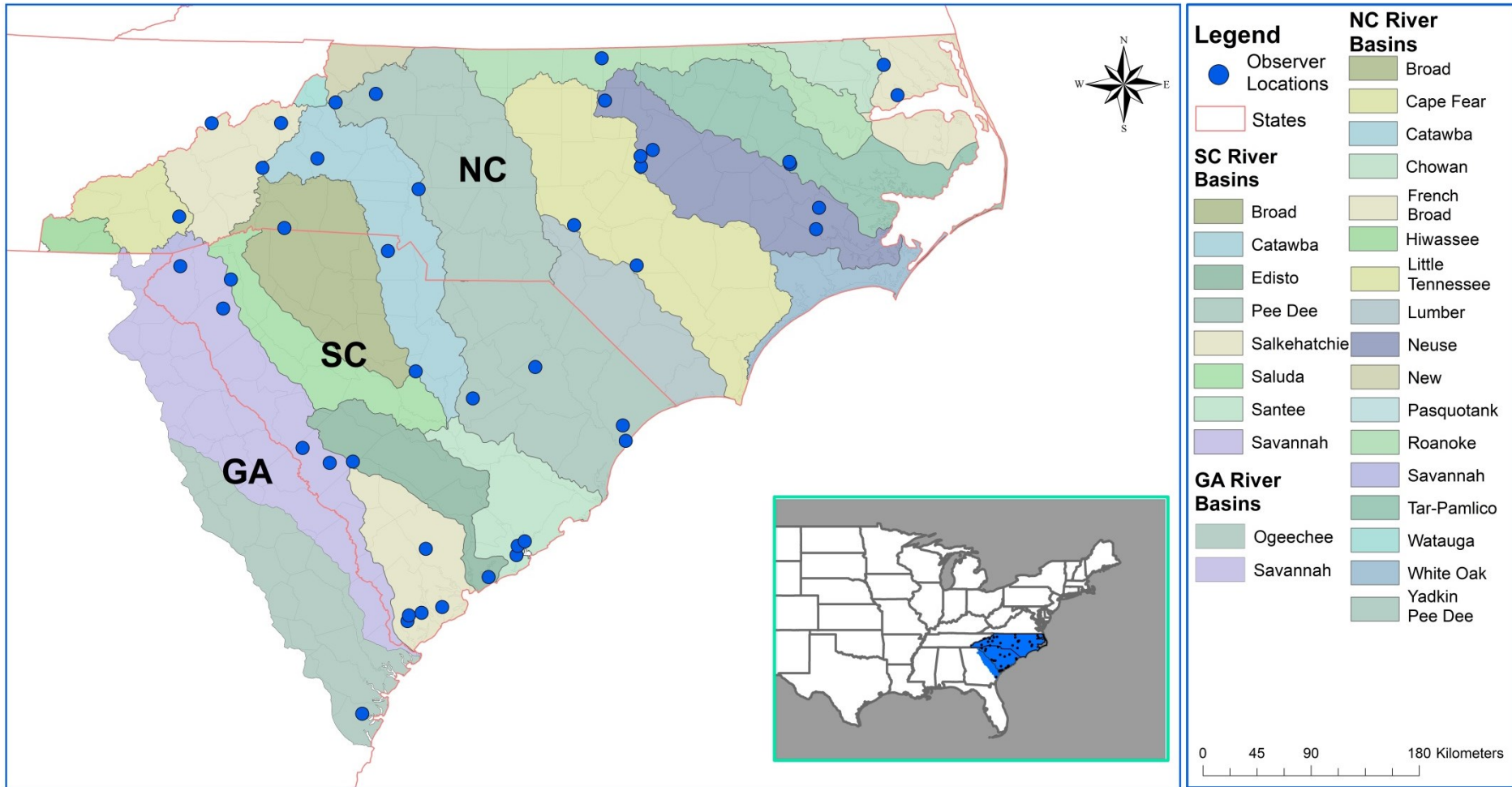
- CISA is working with CoCoRaHS volunteers to collect weekly condition monitoring reports in addition to their daily precipitation measurements
 - Uses existing tools developed by the Community Collaborative Rain, Hail & Snow network (CoCoRaHS)
- Regular observations help to:
 - Identify the early signs of drought
 - Identify when conditions begin to improve
 - Identify any lingering impacts



- Participating Groups
 - Current CoCoRaHS Observers
 - Master Naturalists
 - Master Gardeners
 - Chowan Edenton Environmental Group (NC)
- **43** observers submitting regular condition monitoring reports
- **551** reports received between September 2013 and August 2014



Project participants





COMMUNITY COLLABORATIVE RAIN, HAIL & SNOW NETWORK

"Because every drop counts"



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South Carolina

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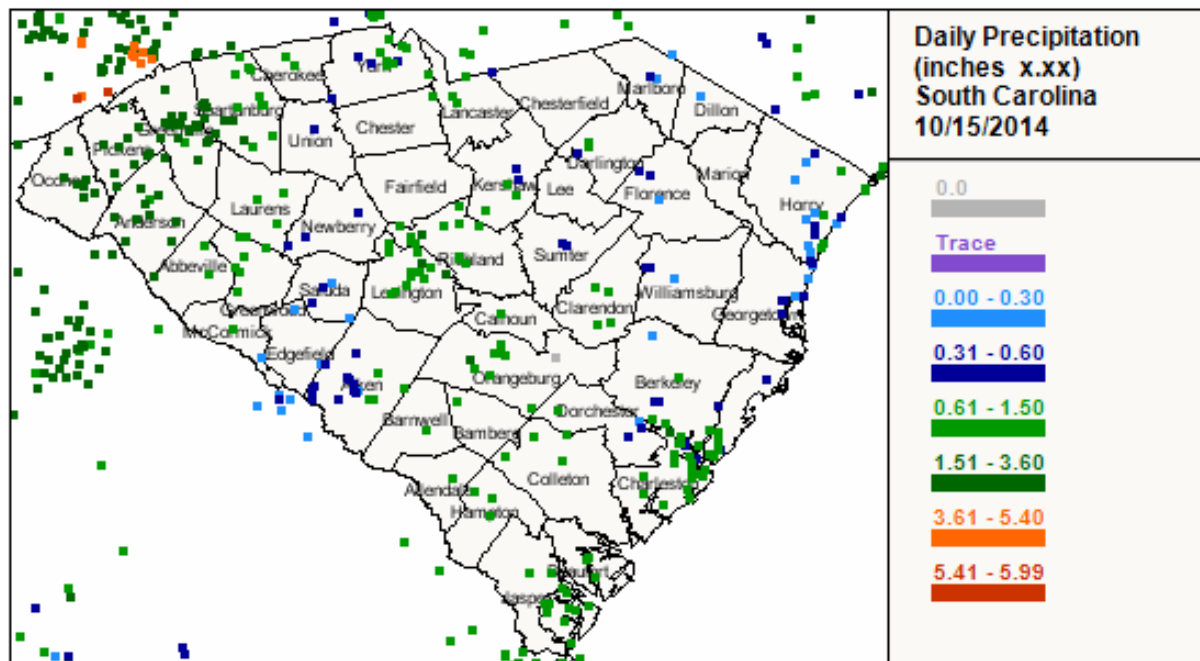
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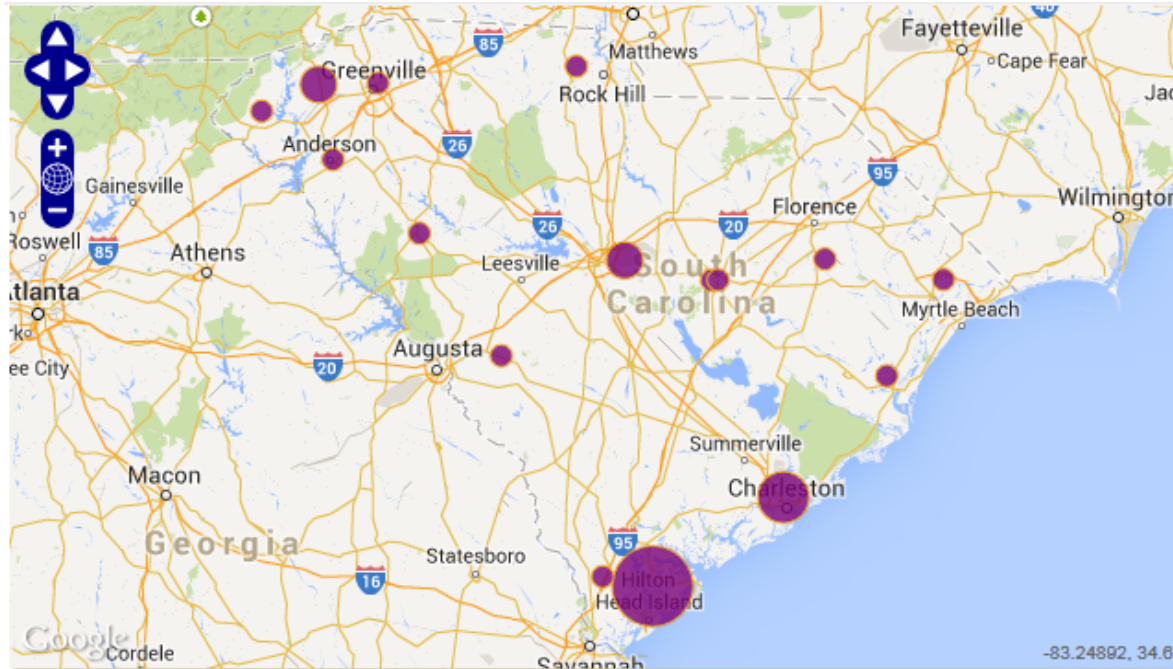
**COCORAHS
SOUTH CAROLINA**



Sumter County report, Aug 25-31

- *Ground conditions are very dry. Grasses are dying once cut by lawn equipment and this is causing excessive dust and dirt and clippings to be scattered about once lifted by either the wind or lawn equipment. Red Leaf Maple leaves are prematurely falling and Dogwood leaves are starting to prematurely turn from green to red. A false autumn.*

National Drought Impacts Reporter



- * SC CoCoRaHS Reports included in the national Drought Impacts Reporter for the last year

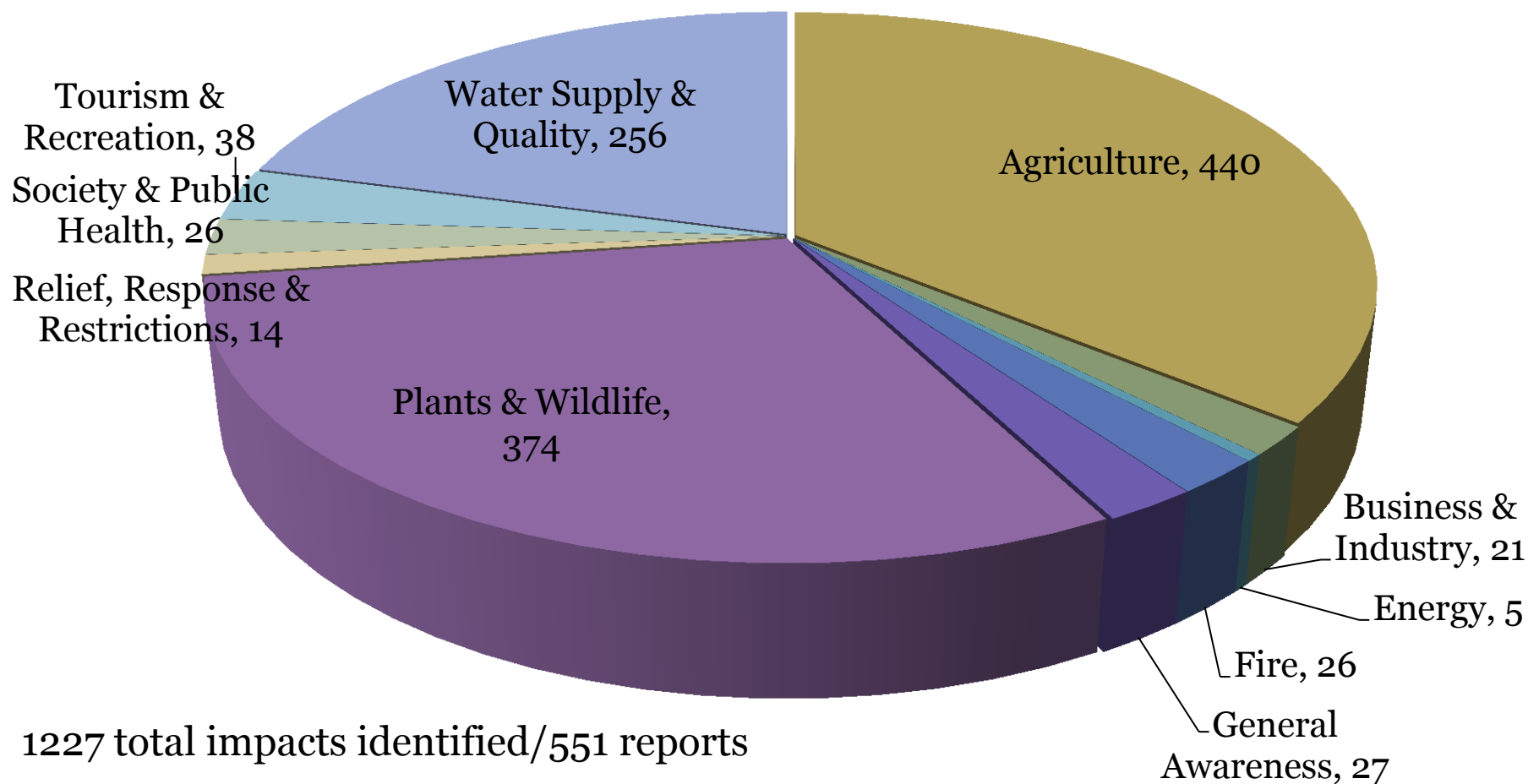
South Carolina | 10-09-2013 - 10-09-2014 |

Impact Counts	Impacts List Page 1/1	Report Counts	Reports List Page 1/27
Total Reports South Carolina		269	
Category			
General Awareness	181	Agriculture	12
Business & Industry	2	Fire	8
Plants & Wildlife	74	Society & Public Health	4
Water Supply & Quality	5		
Report Source			
CoCoRaHS	269		

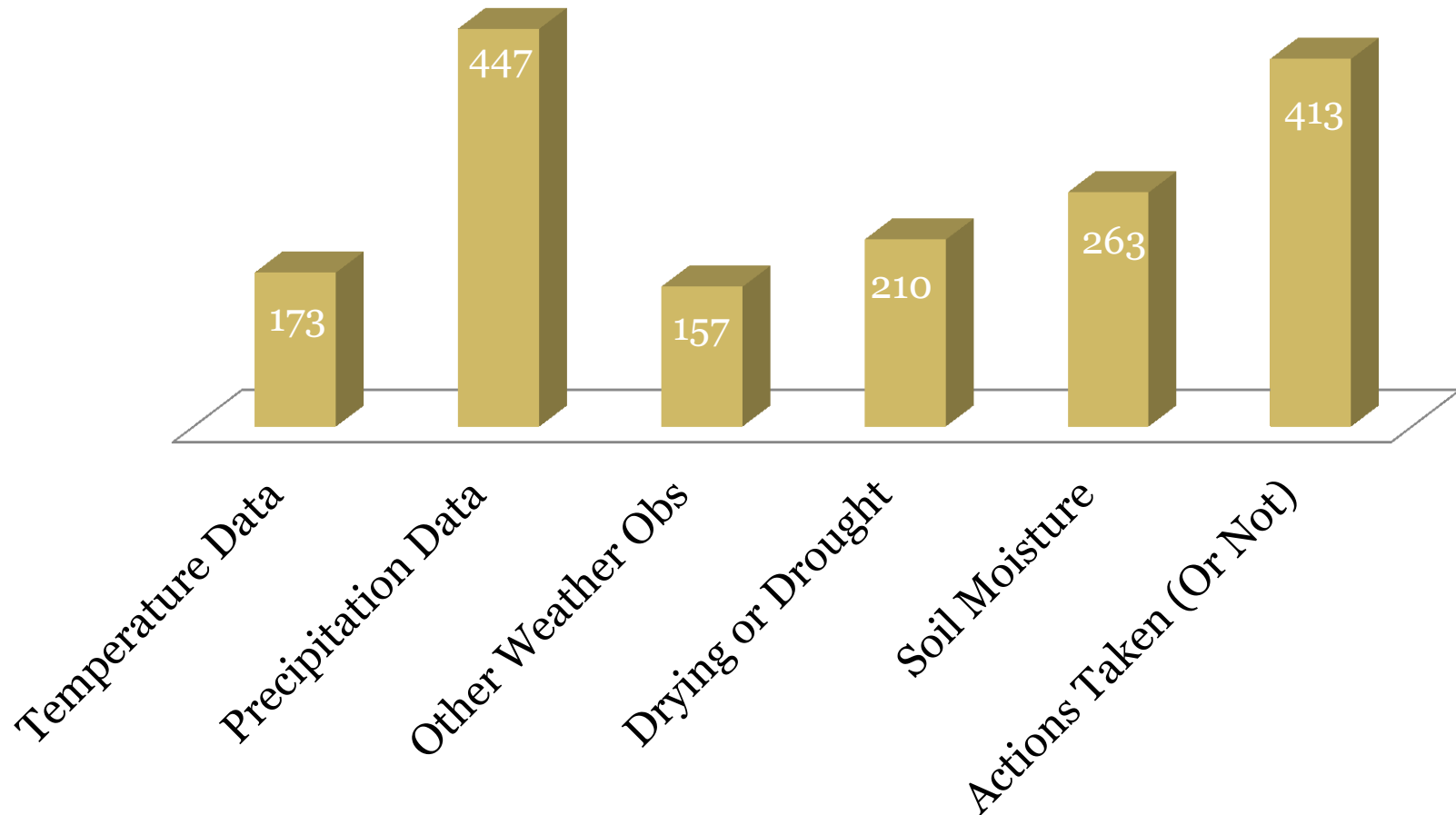


<http://droughtreporter.unl.edu/>

Types of information provided by participants, by Drought Impact Reporter categories



Other information included in reports



Next steps: evaluating the information provided by citizen scientists

- Effectiveness of CoCoRaHS-citizen science as a tool to improve understanding of drought impacts
- Usefulness of information for drought decision makers and resource managers
- Effectiveness of CoCoRaHS-citizen science as a tool to inform other drought monitoring efforts

NIDIS-Carolinas projects: ongoing work

- Atlas of Hydroclimate Extremes for the Carolinas
 - *CISA Team*
- Forecasting blue crab distributions using an individual-based population model (IBM)
 - Links freshwater discharge data with an IBM to forecast blue crab abundance and landings
 - *Michael Childress (Clemson University)*
- Real-time salinity drought index (SDI)
 - Based on USGS salinity and streamflow data
 - *Paul Conrads (USGS SC Water Science Center)*
- Indicators and indices of drought in southeastern coastal ecosystems
 - Work with refuge managers to characterize ecological drought
 - Relate ecosystem impacts of drought to the SDI, develop triggers and thresholds
 - *Dan Tufford (CISA), David Chalcraft (East Carolina Univ.)*
- Assessment of drought indicators for coastal zone fire risk
 - Which drought index is the best indicator of fire risk in coastal organic soils?
 - *Ryan Boyles (NC State Climate Office)*

For more information, visit:

<http://www.drought.gov/drought/regional-programs/coastalcarolinas/coastal-carolinas-projects>

<http://www.cisa.sc.edu/coping.html>

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