

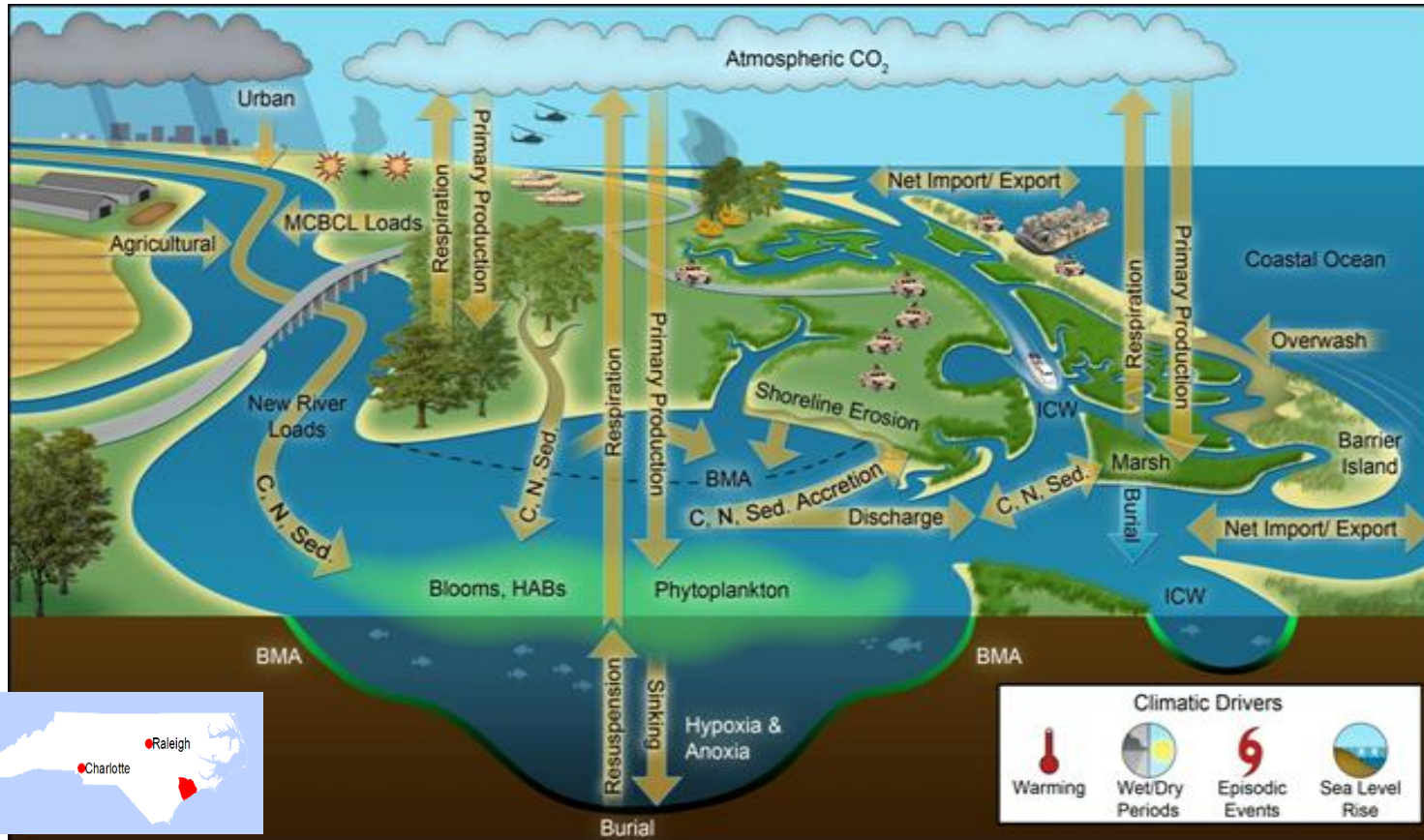
A New Mission: Strategies to Reduce Climate Impacts on Military Operations in Coastal North Carolina



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Dr. Susan Cohen is the associate director of the Institute for the Environment at UNC Chapel Hill. Before UNC, she worked as a biologist for the NAVFAC Engineering and Expeditionary Warfare Center, coordinating the Defense Coastal/Estuarine Research Program at Marine Corps Base, Camp Lejeune. Prior to working with Department of Defense, Cohen worked at the USDA Forest Service Southern Research Station in North Carolina's Research Triangle Park as a research biologist with an emphasis on processes in fire adapted forest ecosystems and plant communities. She also served in the U.S. Peace Corps as a forestry extension volunteer in the Dominican Republic from 1992-1995. Her current research efforts continue to emphasize interdisciplinary teams with a focus on ecosystem resilience. Cohen earned a bachelor's degree in Anthropology from the University of Massachusetts Amherst, and holds both a master's degree and a doctoral degree in Forestry from North Carolina State University.

Defense Coastal/Estuarine Research Program (DCERP) Marine Corps Base Camp Lejeune, NC 2007-2017



Sustaining the military mission of training and readiness through understanding of the function, resilience, and vulnerability of ecosystems in the context of climate change.

**New River
Estuary**



**Coastal
Marshes**



**Onslow
Island**



**Coastal
Forests**



DCERP's Technical Objectives

1. Understand the function and processes of ecosystems and their connections at MCB Camp Lejeune, from observations and measurements.

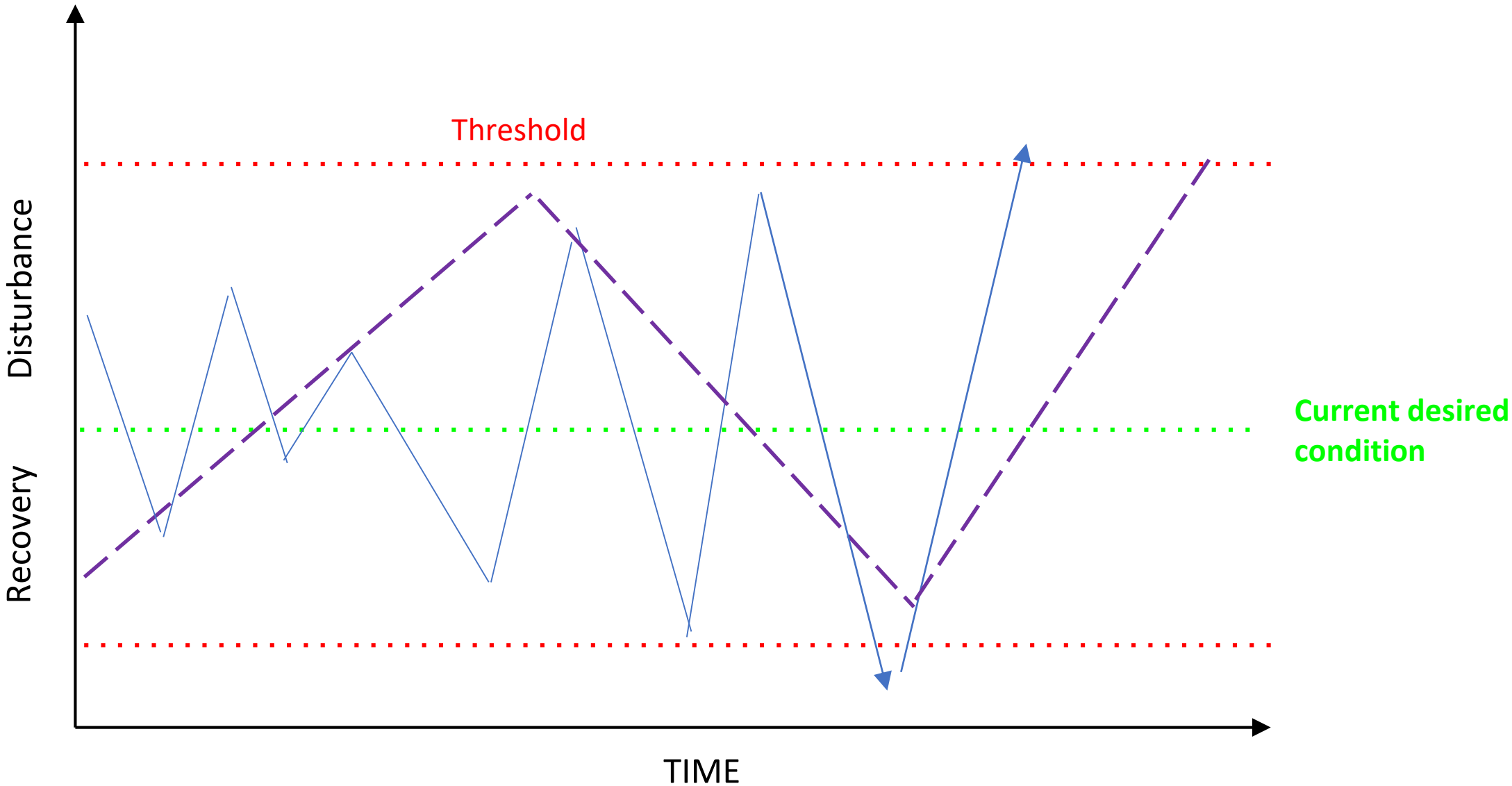
(What are the drivers/stressors? How do we measure them?)

2. Determine how ecosystem processes respond to climate change.

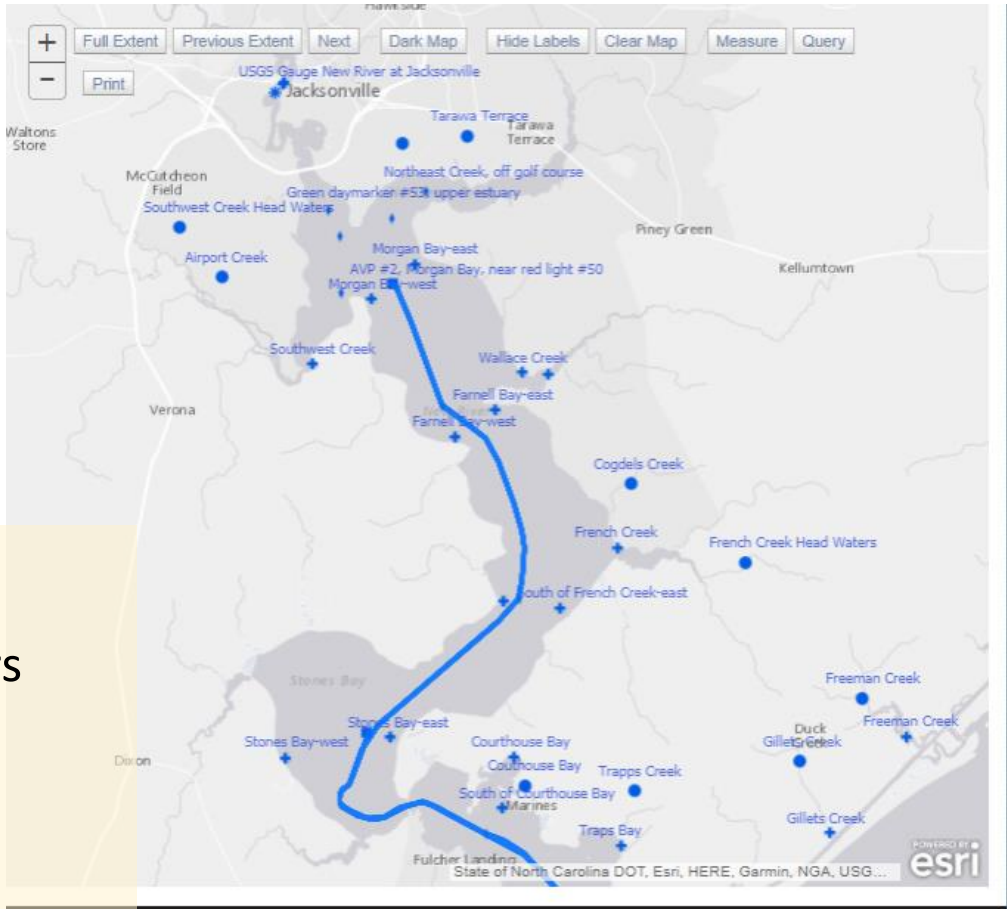
3. Develop models, tools, and indicators to evaluate current and projected future ecosystem state changes and translate scientific findings into information for installation managers.

4. Develop a coastal carbon budget

Incremental change over time vs. rapid change through extreme events.



Aquatic/Estuarine - New River, tributary creeks, and New River estuary

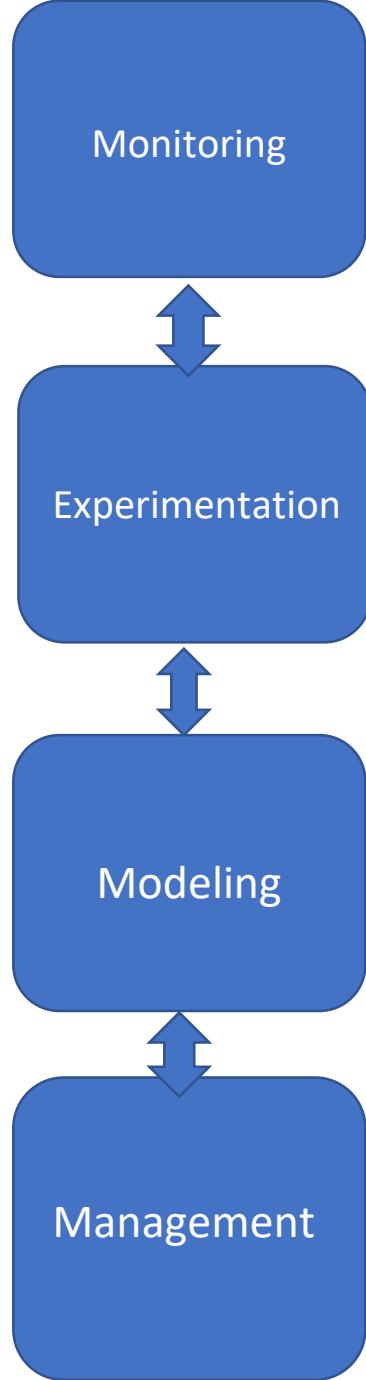


- What are the water quality challenges to the estuary?
- What are the system drivers, stressors, and source of stressors (how does it work)?
- Is the NRE a source or sink for carbon?
- Will managing water quality be more challenging in the future with population growth and land use and climate change?
- How is MCBCL already managing for resilience?

Experimentation

Models

Management

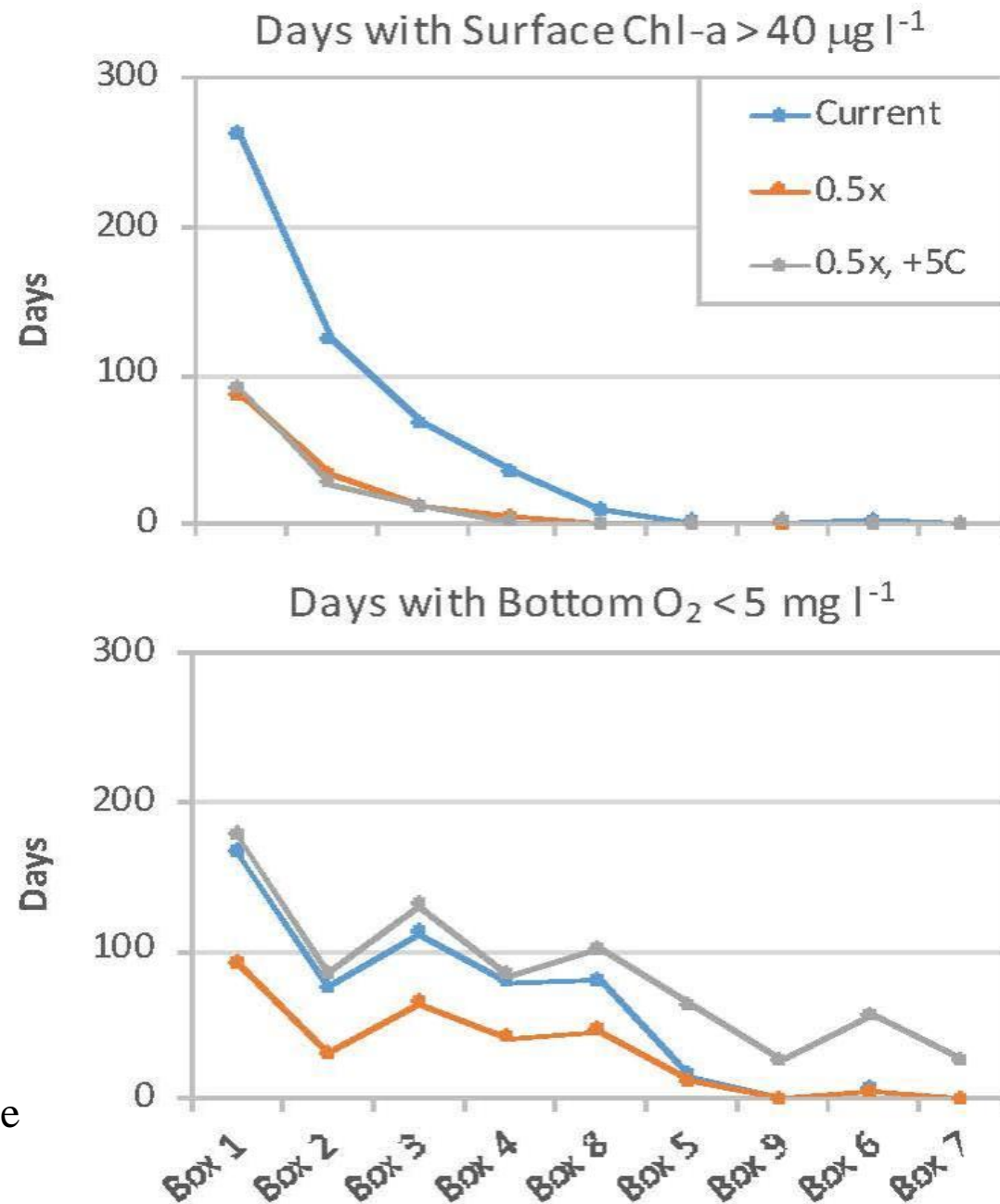


Impacts of Future Climatic and Human Stressors on Water Quality

Estuarine Simulation Model

The interactive effects of nutrient loading and climate warming were assessed by running the model with nutrient loading reduced by half (0.5 times), and with this same reduction concurrent with a +5°C warming (0.5 times, +5°C).

Values represent means over the period 2007-2015.



Conclusions and Management Implications

- The estuary is sensitive to N loading due to long residence time (river flow)
- Current N sources are largely off-base in upper watershed
- Overall low contributions of nutrient loading from Camp Lejeune to the NRE are positive, but past trends do not guarantee no change in the future – monitor.
- Climate warming will require larger load reductions to achieve the same level of water quality improvement achievable under current conditions
- Consequently, managing water quality within the estuary will require a watershed approach

A comprehensive management effort among MCBCL, Onslow County, and the City of Jacksonville will be required to reduce nutrient loadings into the estuary from all point and nonpoint sources in the watershed

“...fire started during a training mission of the U.S. Army 7th Special Forces Group.”
Wildfire Today, March 2019

“The fire, began on a Camp Lejeune firing range... has consumed some 9500 acres”
WITN, March 2011

“...training ignited blaze at Fort Carson, officials say.”
Army Times, March 26, 2018

Risk of Wildfire forces Military to Alter Training.
“...banned pyrotechnics (smoke grenades, artillery simulators) and tracer ammunition...”
New York Times Sept 2011

Military base training suffers due to increased wildfires

“Several U.S. military bases have cut back on certain training maneuvers due to wildfire risk... according to a GAO report released last week.”
Wildfire Today, July 2014

Prescribed Fire



- Training in drought conditions
- Reduce fuels/control fires when started
- Fire adapted ecosystem type
- Manage for T&E species

You don't need a large research program to do resilience. You are probably doing some management for resilience now (like managing for longleaf pine), but is it based on today's conditions?

Decision Analysis

“A formalization of common sense for decision problems which are too complex for informal use of common sense” (Keeney 1982).

Try to quantify resilience - measurable and testable metrics to define objectives, monitor change and evaluate management actions. (Brown and Williams 2015). Quantify the management response.

Learn the effects of management on natural systems and apply that to improve management over time (monitoring is generally unfunded and unsatisfying)

Brown, E.D. & Williams, B.K. Environmental Management (2015) 56: 1416

Keeney, R.L. Operations Research, Vol. 30, No. 5. 1982

So what are some of the issues?

- Expertise - climate change efforts can be rolled into existing efforts/staff without an influx of resources. Do managers don't understand the science?
- Complicated structure
- Need to justify decisions
- Support from leadership
- CYA, someone needs to make the decisions
- Trying to apply information not genuinely suited to management, generally has a marginal outcome because it is a poor fit.
- The benefit from management for resilience is not readily apparent or urgent

What are our expectations from DoD management and decision makers?