Assessing and Managing Climate Change Effects and Impacts on Maintaining and Restoring Global Environmental Security

A White Paper for:

Climate Change:
Global Change and Local Adaptation

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by

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Overview

DoD EPA DOE SERDP

- Global environmental security (GES) challenges of the Post Cold War era
- White paper objectives
- GES maintenance and restoration strategies
- Climate change effects and GES impacts
- Engagement of US military on climate change
- Ongoing research and development to inform GES planning and operations

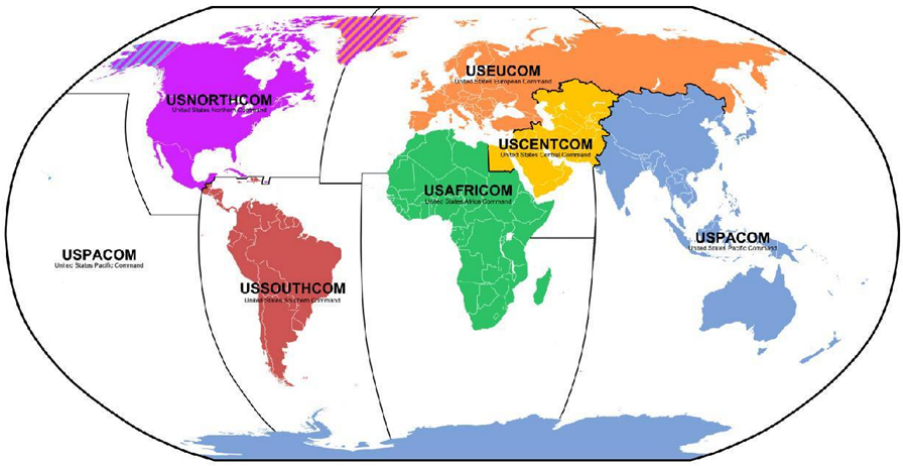
GES Challenges of the Post Cold War Era

- Responding to unknown future conventional instabilities on a global scale
- Contribution of climate change effects and impacts on crisis tipping points
- Identifying resilient and sustainable strategies and measures to maintain and restore GES in the face of climate change
  - Resilient – Able to return to intended system/process functionality after exposure to unexpected hazards
  - Sustainable – Sufficiently flexible and adaptable to evolve for continued functionality under non-stationary environmental conditions

White Paper Objectives

- Portray potential climate change effects and impacts on Unified Combatant Commands (UCCs)
- Understand current and potential future needs for maintaining and restoring GES by UCC
- Describe knowledge and tool building in current research and development of the Strategic Environment Research and Development Program (SERDP)

Unified Combatant Commands (UCCs)



GES Maintenance and Restoration Strategies

- Peacekeeping and peace-building, addressing water, food, shelter, health, and dispute issues globally
- Contingency operations via power projection globally
  - Combat missions
  - Combat service (i.e., power projection platforms)
  - Combat service support (e.g., installations)
- Regional security operations in UCCs
- Infrastructure rebuilding in UCCs

How could these be affected by climate change?

Example: USEUCOM

Potential impacts	Potential effects
●Sea level rise	●Saltwater intrusion into aquifers and surge-driven flooding
●Glacier retreat and decreased snow cover	●Decreased water availability – which will destabilize the region
●Decreased arable land	●Food shortages and greater reliance on imports
	●Ocean acidification and reduced productivity, distribution and species diversity
	●Migration
●Loss of Arctic sea ice	●Increasing maritime operating area and associated requirements

Example: USNORTHCOM

Potential impacts	Potential effects
●Sea level rise	●Flooding and increased storm damage resulting in loss of critical infrastructure
●Permafrost thaw	●Reduced terrain navigability and increased wetland formation
	●Methane release from tundra decomposition and increased CH_4 emissions at higher rates than CO_2
	●Habitat changes especially for anadromous fish species
●Altered precipitation and temperature regimes	●Increased risk of catastrophic fire events, changes in agriculture, and biome shifts (i.e., altered habitat and species distributions)
	●Ocean acidification and reduced productivity, distribution and species diversity
	●Altered watershed hydrographs (i.e., expected water supply becomes vulnerable)*
●Altered snowpack melt	●Increasing maritime operating area and associated requirements
●Loss of Arctic sea ice	

* Landscape changes that provide more carbon inputs into the atmosphere such that additional global warming occurs.

Engagement of US military on climate change

- Interviews with US Army Corps of Engineers (USACE) leadership for obtaining research guidance
- Interviews with USACE Liaison Officers (LNOs) to UCCs
- Analysis and synthesis of interviewee responses to inform research
- Development of resonant research themes

Research Method

- **Decision Partners conducted in-depth, one-on-one phone interviews with several LNOs**
  - **Sample questions provided by white paper team**
  - **Interviewees were sent background material in advance**
  - **Interviews ranged 30 – 75 minutes in length**
- **Interview topics included:**
  - **Relevance of a set of proposed research questions to the Interviewees' Area of Responsibility (AOR)**
  - **Opportunities to improve the relevance or clarity of the research questions**
  - **How these questions might be (or are currently being) addressed**
  - **Additional questions that should be asked**

Right Research Questions?

1. What are the potential climate change effects in Combatant Commands that could result in regional instabilities at present and as future changes may occur?

2. What types of vulnerability assessments are needed on the effects of climate change on advancement of contingency operations to either reduce/prevent conflicts from arising; and/or perform combat actions for return to stability?

Right Research Questions? (cont.)

3. What potential future issues or needs should we be prepared to address in the full spectrum of power projection capabilities (i.e., combat service support (CSS), combat service (CS), and combat) that may be affected by climate change?

4. What tools are needed to plan and accomplish robust and resilient stability operations (e.g., security operations, infrastructure re-building) to hedge against potential negative impacts of climate change in the near- and long-terms, as stability is returned during and after contingency operations?

Right Research Questions? (cont.)

5. Once assessments have been made to identify climate change response strategies, what management responses are needed / required to sustain power projection capabilities and evolve readiness and training (e.g., directives, funding, etc.)?

Research Themes Identified to Inform GES Planning and Operations

- Explain the science of climate change effects and impacts to UCCs for increased situational awareness and cultural transformation of planning and operations to include climate change considerations

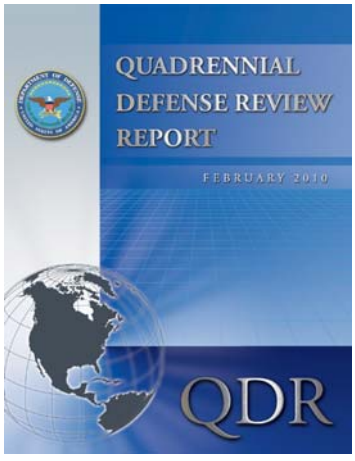
- Provide information and tools to support UCC mission planning and operations, with emphasis on integration of efforts across governments and agencies
  - Vulnerability assessment to GES
  - Identification of peacekeeping and peace-building strategies and measures as opportunities over military action
  - Identification of resilient and sustainable measures to support strategies

Future Vision

- Cultural posture of proactively addressing future plausible GES challenges, considering climate change effects and impacts
- Anticipatory planning across a multitude of partnering governments and their agencies to coordinate operational responses
- Scientifically informed strategies, tools, and protocols to support a full spectrum of GES planning and operations

FEB 2010 Quadrennial Defense Review

"Domestically, the Department will leverage the Strategic Environmental Research and Development Program (SERDP), a joint effort among DoD, the Department of Energy, and the Environmental Protection Agency, to develop climate change assessment tools."



SERDP Climate Change Projects

SERDP SI-1701 Project	SERDP SI-1699 Project
"Risk Quantification for Sustaining Coastal Military Installation Assets and Mission Capabilities"	"Integrated Climate Change and Threatened Bird Population Modeling to Mitigate Operational Risks on Florida Military Installations"

SI-1701 Technical Objectives

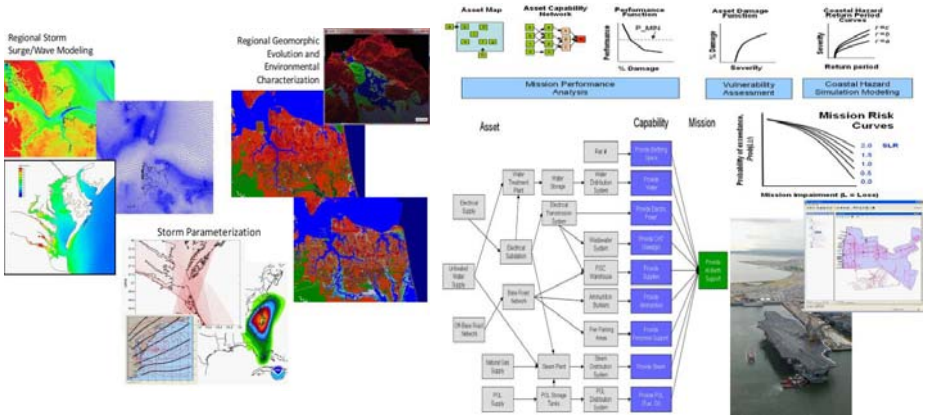
- Advance knowledge of coastal hazard risk assessment as a basis for risk management at installations
- Conduct quantitative modeling and risk assessment to:
  - Understand scope and magnitude of climate change effects in existing and future no-action coastal installation conditions
  - Identify thresholds at the onset of significant installation losses due to climate change effects
- Transfer demonstrated methods, tools, and technologies on risk assessment into military community of practice

SI -1701 Technical Approach

- Methodology development
  - Tiered operational risk assessment
    - Site selection in Hampton Roads region based on risk indicators
    - Installation-specific risk assessment
  - Database design/assembly to inform risk assessment scenarios

- Information development for climate change scenarios
  - Regional
    - Geomorphic and landscape evolution
    - Coastal hazard-frequency modeling (wind, water, sedimentation)
  - Installation-specific
    - Mission association to Asset Capability Network (ACN)
    - ACN operationalization
    - Nearshore hydrodynamics (surge/waves, runup, and overtopping)
    - Installation flood water routing (surge/waves, precipitation, surface runoff)

SI-1701 Project Overview



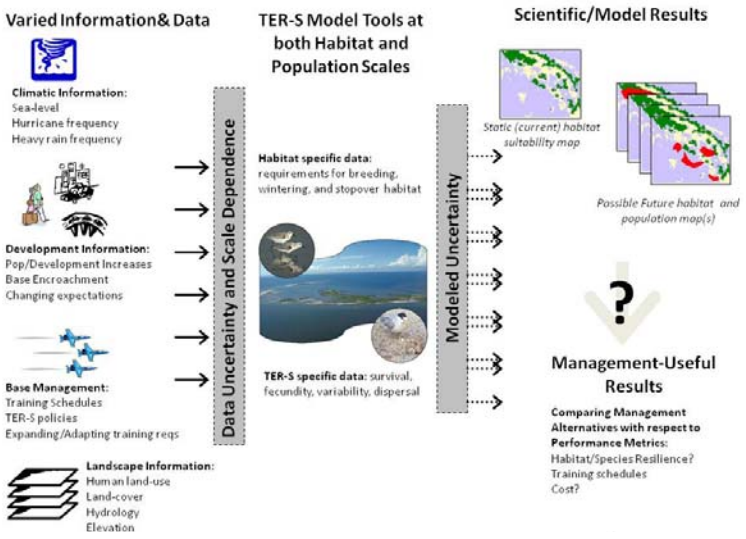
SI-1699 Technical Objectives

- Assess the needs of environmental managers of coastal military installations to ensure coastal areas remain intact and viable for training (e.g., amphibious landings):
  - Infrastructure maintenance and improvement
  - Threatened and endangered species and their habitats
- Enable land and facility managers to act in the face of uncertain outcomes and to balance multiple, potentially-conflicting objectives with their decisions

SI-1699 Technical Approach

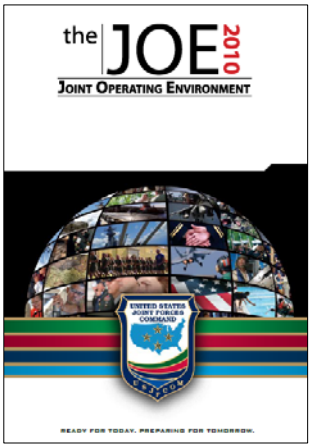
- Propose and test a an adaptive management-decision analysis framework that:
  - Integrates multi-scale climate, land use and ecosystem information into a systematic tool set
  - Explores how climate variability and change effects may affect habitat and population dynamics for Snowy Plover on selected coastal northwest Florida military sites

SI-1699 Project Overview



Future Opportunities for Demonstration and Fielding

- Joint Capability Technology Demonstration Program
  - Implements new and enhanced processes and technologies to meet joint forces planning and operations needs
- 579th Engineer Detachment (Forward Engineer Support Team – Main, or "FEST-M")
  - Brings specialized data, research, and expertise from USACE research centers, engineers, and laboratories to deployed areas of operation



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