



US Climate Change Science Program

SAP 4.4: Preliminary Review of Adaptation Options for Climate-Sensitive Ecosystems and Resources

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Presentation Outline

- SAP 4.4 Approach and Overview
- Findings for Coral Reefs
- Next Steps for Advancing Management Adaptation



Report Acknowledgements

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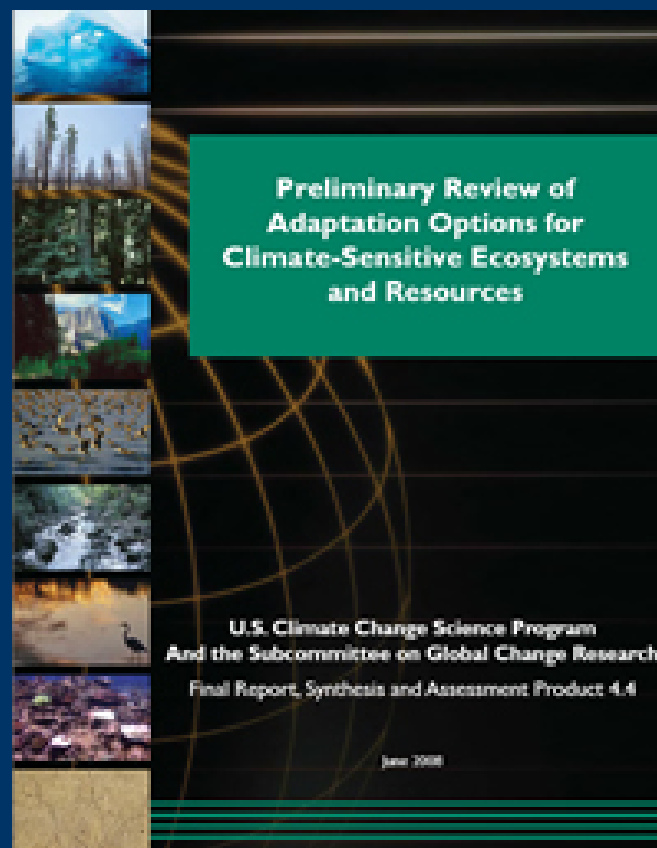
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Approach

Identify and assess:

- Climate sensitive management goals for
 - National Forests
 - National Parks
 - National Wildlife Refuges
 - Wild and Scenic Rivers
 - National Estuaries
 - Marine Protected Areas
- Implications of climate change for achieving management goals
- Adaptation approaches that reduce the risk of negative impacts on management goals
- Characteristics of human and ecological systems that enhance or inhibit implementation

Outcome: Enhance adaptive capacity of resource management community to respond to future changes in climate

Key Ecosystem Characteristics on Which Goals Depend

- Biodiversity
- Key species
- Habitat complexity
- Trophic linkages
- Connectivity
- Nutrient fluxes
- Larval dispersal and recruitment



Physical Effects of Climate Change on Coral Reefs

- Sea surface temperature / ocean heat content
- Likely effects on ENSO and other ocean oscillations
- CO₂ effects on ocean chemistry/calcification
- Sea level rise, tropical storms, coastal erosion
- Changes in salinity regimes
- Alteration of circulation patterns, currents, upwelling



- Reduce Anthropogenic Stresses
- Protect Key Ecosystem Features
- Representation
- Replication
- Restoration
- Refugia
- Relocation



Ex: “Reduce Other Anthropogenic Stresses”

Pollution & Habitat Degradation



Direct Physical Damage



Invasive Species



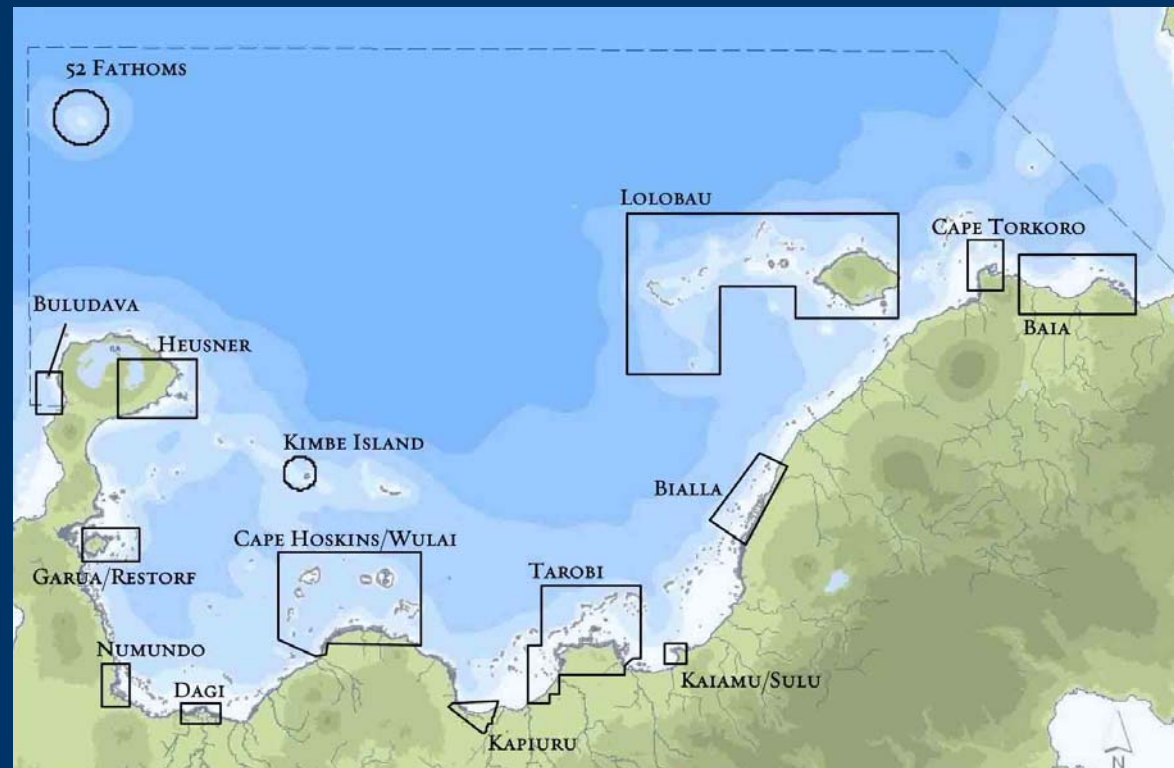
Unsustainable Harvest



Ex: “Representation” “Replication” & “Protect Key Ecosystem Features”

Protect a network of critical habitat

- as bet hedging strategy
- to protect key foundational species and habitats
- to facilitate recovery after disturbance (connectivity)



Adaptation Options for Marine Protected Areas

- Manage human stressors such as overfishing and excessive inputs
- Improve water quality by integrated coastal and watershed management
- Manage functional groups necessary for maintaining reef health
- Identify and protect areas that appear to be resistant and resilient
- Protect ecologically significant nursery grounds, spawning grounds, etc
- Design MPAs with dynamic boundaries to protect migratory/pelagic species
- Maximize habitat heterogeneity within MPAs and protect large areas
- Include entire ecological units (e.g., coral reefs plus mangroves) in MPAs
- Ensure that the full breadth of habitat types is protected
- Replicate habitat types in multiple areas to spread risks
- Restore mangroves for shoreline protection, expansion of nursery habitat, etc

Key Conclusions from MPA Chapter

- Ameliorate existing stressors & other factors that disrupt marine ecosystems
- Protect naturally resistant or resilient areas
- Establish additional highly protected marine zones
- Develop networks of MPAs
- Support research on connectivity & effectiveness of existing networks of highly protected zones
- Integrate climate change into MPA planning, management & evaluation

Converting Perceived Barriers into Opportunities

Category

Examples

- | | | |
|--------------------------------------|---|---|
| ▪ Legal or Regulatory | → | ▪ Re-evaluate existing legislation to determine how climate change can be addressed |
| ▪ Management Policies and Procedures | → | ▪ Take advantage of flexibility in planning guidelines to develop actions that address climate change |
| ▪ Human and Financial Capital | → | ▪ Link with other managers to coordinate training and share data and monitoring strategies |
| ▪ Information and Science | → | ▪ Diversify existing portfolio of management approaches to address high levels of uncertainty |

Advancing Adaptation Within the Coral Reef Community

- Identifying barriers and opportunities for coral reef managers
- Connecting management at the local scale to management at larger scales
- Expanding Interagency coordination, collaboration & lesson-sharing
- Managing for change in the long term