



# Advancing Management Adaptation to Climate Change



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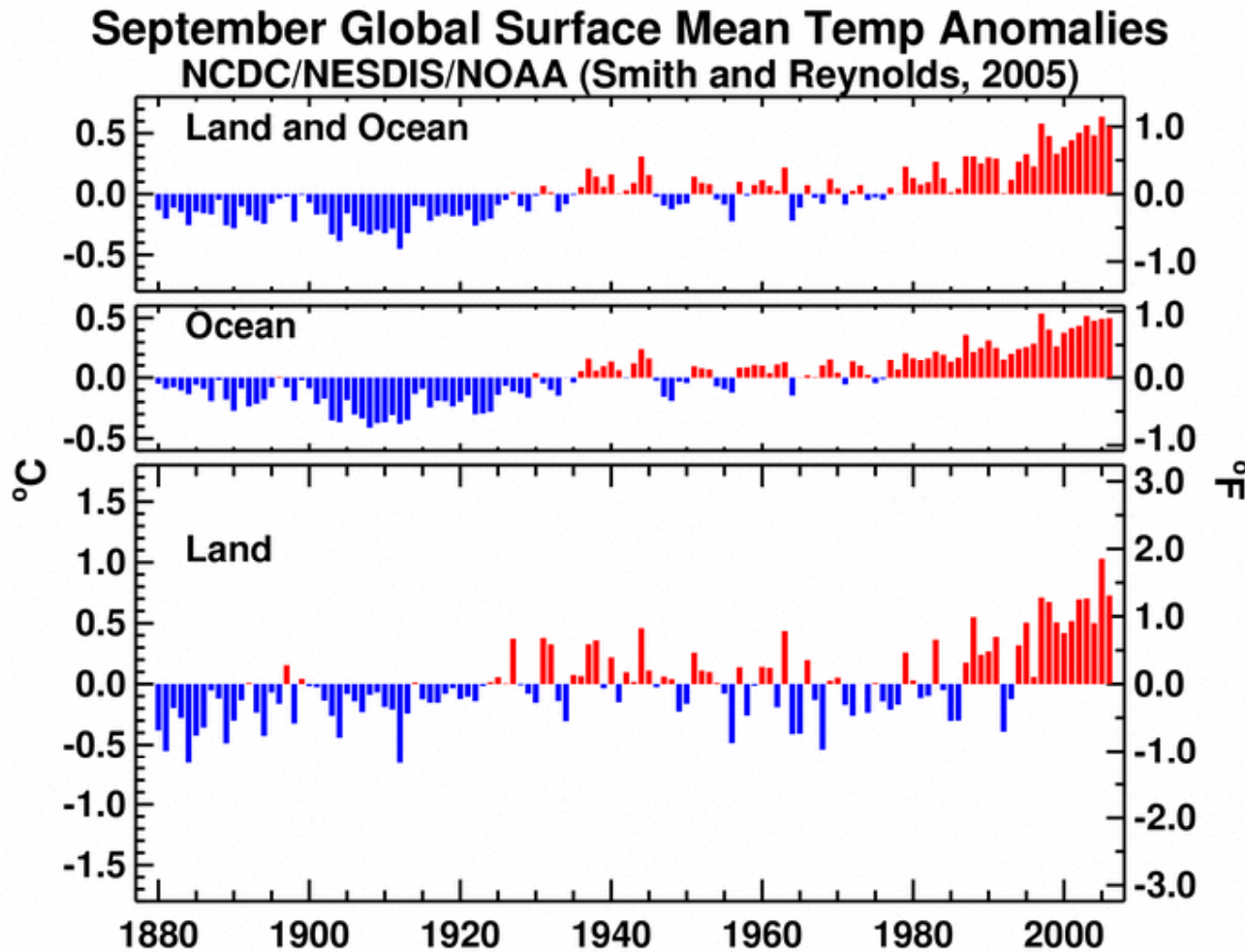
NOAA Coral Reef Watch  
NOAA Coral Reef Conservation Program

\*The views expressed are those of the authors and do not necessarily represent the official policy of the US EPA or NOAA

# Climate Change is Impacting Coral Reefs

“Warming of the climate system is unequivocal”

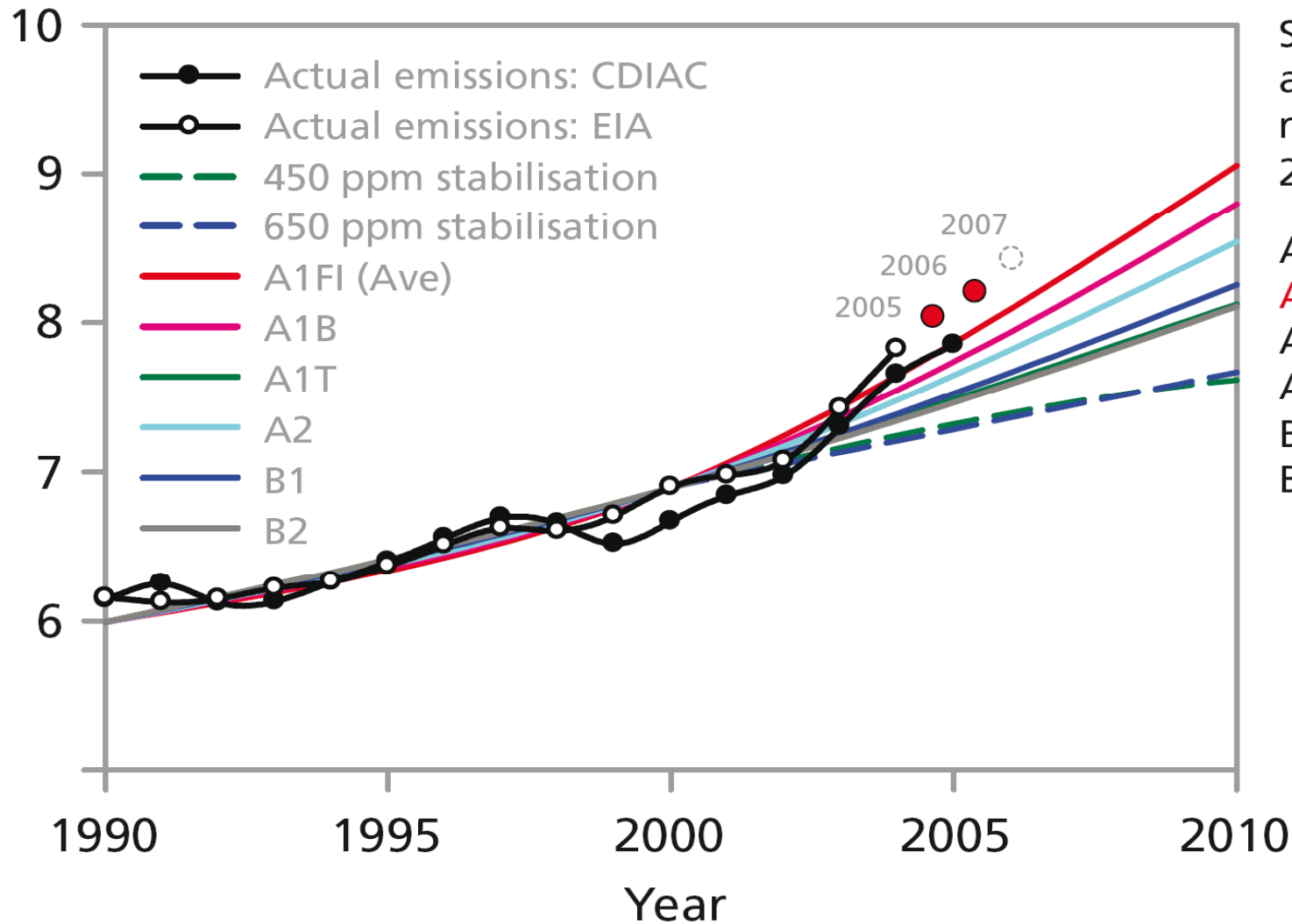
– IPCC 4AR 2007





# Addressing Climate Change Impacts on Reefs:

## 1) Reduce Global CO<sub>2</sub>



SRES (2000)  
average growth  
rates in % y<sup>-1</sup> for  
2000-2010:

- A1B: 2.42
- A1FI: 2.71**
- A1T: 1.63
- A2: 2.13
- B1: 1.79
- B2: 1.61

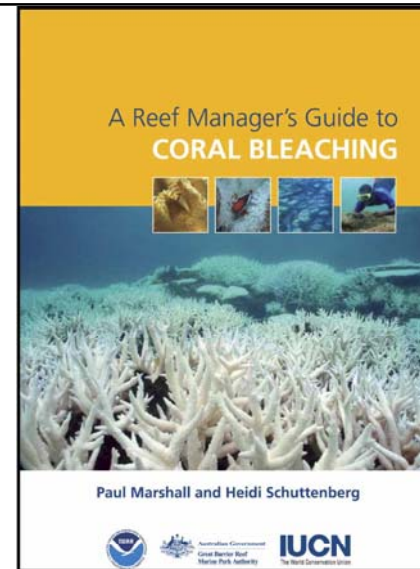


# Addressing Climate Change Impacts on Reefs:

## 2) Management Adaptation

### Increase Resilience:

- Reduce bleaching
  - Reduce stress
  - Acclimatize, Adapt
- Increase survival
  - Improve water quality
  - Reduce disease prevalence
- Aid recovery
  - Restoration / Fragmentation
  - Enhanced recruitment
  - Protect ecosystem functions
- Enhance MPA networks



# Resilience

The amount of change or disturbance that an ecological system can absorb without undergoing a fundamental shift to a different set of ecological processes and structures

## 3 Parts to Resilience to Bleaching:

- Resistance
- Survival
- Recovery



# Management Adaptation



Adjustments in human social systems (e.g., management) in response to climate stimuli and their effects

***Goal:*** *To reduce the risk of adverse environmental outcomes through activities that increase the resilience of ecosystems to climate change*



# Framework for Adaptation Planning



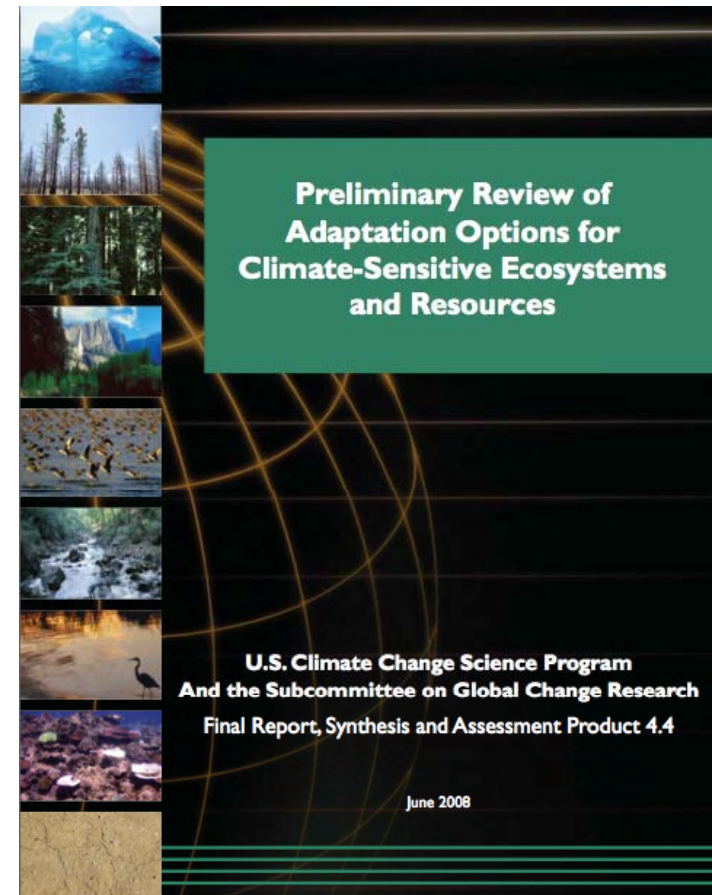
- Review **management goals**
- Identify **key ecosystem components and processes** essential to achieving goals
- Assess **CC threats** to key components and processes
- Identify **adaptation approaches** & specific strategies
- Analyze **barriers and opportunities** for implementation

Adapted from the US Climate Change Science Program's SAP 4.4: *Preliminary Review of Adaptation Options for Climate-Sensitive Ecosystems and Resources*

# Adaptation Approaches

1. Protect key ecosystem features
2. Reduce anthropogenic stresses
3. Representation
4. Replication
5. Restoration
6. Refugia
7. Relocation

Adapted from the US Climate Change Science Program's SAP 4.4: *Preliminary Review of Adaptation Options for Climate-Sensitive Ecosystems and Resources*







# Barriers and Opportunities for Implementation



## *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 based on scenario planning to address high levels of uncertainty



# For Discussion



- “Adaptation approaches” and associated options are available to maximize ecosystem resilience to climate change.
- Levels of confidence in the efficacy of different approaches vary and are difficult to assess, yet are essential to consider.
- Increased adaptive capacity will require collaboration and may necessitate re-organization of program goals and authorities.
- For coral reef management, where do the greatest gaps, barriers, and needs still exist?
- As an interagency working group, how can the CCWG support continued management adaptation to climate change?