

Adaptation Options for Public Land Managers to Climate Change

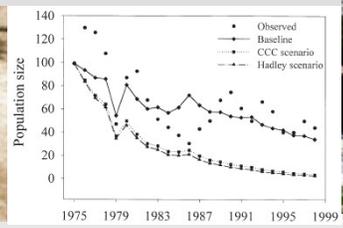
Jill Baron
US Geological Survey



Preliminary review of adaptation options for climate-sensitive ecosystems and resources

A Report by the U.S. Climate Change
Science Program and the Subcommittee
on Global Change Research

<http://www.climatescience.gov/>



Philosophy for adaptation:

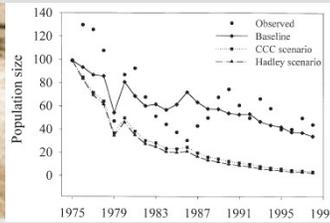
The onset and continuance of climate change over the next century requires natural resource managers to **think** differently about management than they have in the past.

Preparing for and adapting to climate change is as much a cultural and intellectual challenge as it is an ecological one.



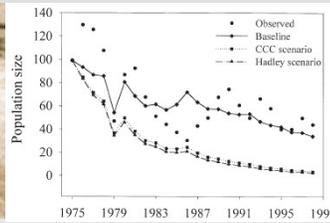


Meeting the challenge that climate change poses to our western landscapes requires nothing short of a paradigm shift in how we use science, how we plan, and how we implement conservation strategies across jurisdictional boundaries.



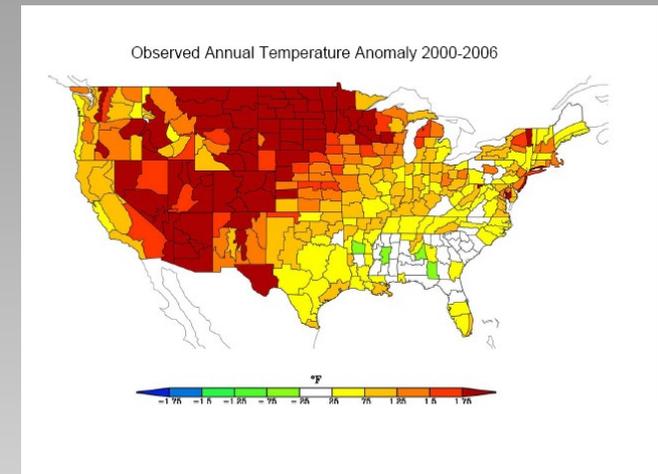


No action in the face of climate change
is a decision that may carry
the greatest risk.



Observed Changes in Climate

- Warming (air and water)
 - Erratic precipitation
 - Extreme drought
 - Extreme storms
 - Sea level rise
-
- Even if GHGs capped at current levels today, these changes are occurring now; further change is inevitable



Observed Responses to Climate Change



- Glaciers melting
- Earlier snowmelt
- Larger fires, longer fire seasons
- Phenological changes
- Species migrations
- Species winners and losers
- Ocean Acidification
- Coral Reef Bleaching



Climate change effects occur in addition to contemporary resource problems

- Four broad categories of human disturbances:
 - Altered Disturbance Regimes
 - Habitat Fragmentation and Loss
 - Invasive Species
 - Pollution
- Complexity:
 - Interactions among stressors and with climate change



Adapting to Climate Change

- Identify resources and processes at risk from climate change
- Develop monitoring and assessment programs for resources and processes at risk from climate change
- Define reference conditions for protection or restoration

Adapting to Climate Change

- Develop and implement management strategies for adaptation
 - Diversify portfolio of management approaches
 - Accelerate capacity for learning
 - Assess, plan, and manage at multiple scales
 - Let the issues define appropriate scales of time and space
 - Form partnerships with other resource management organizations
 - Reduce other human-caused stress to ecosystems
 - Nurture and cultivate human and natural capital

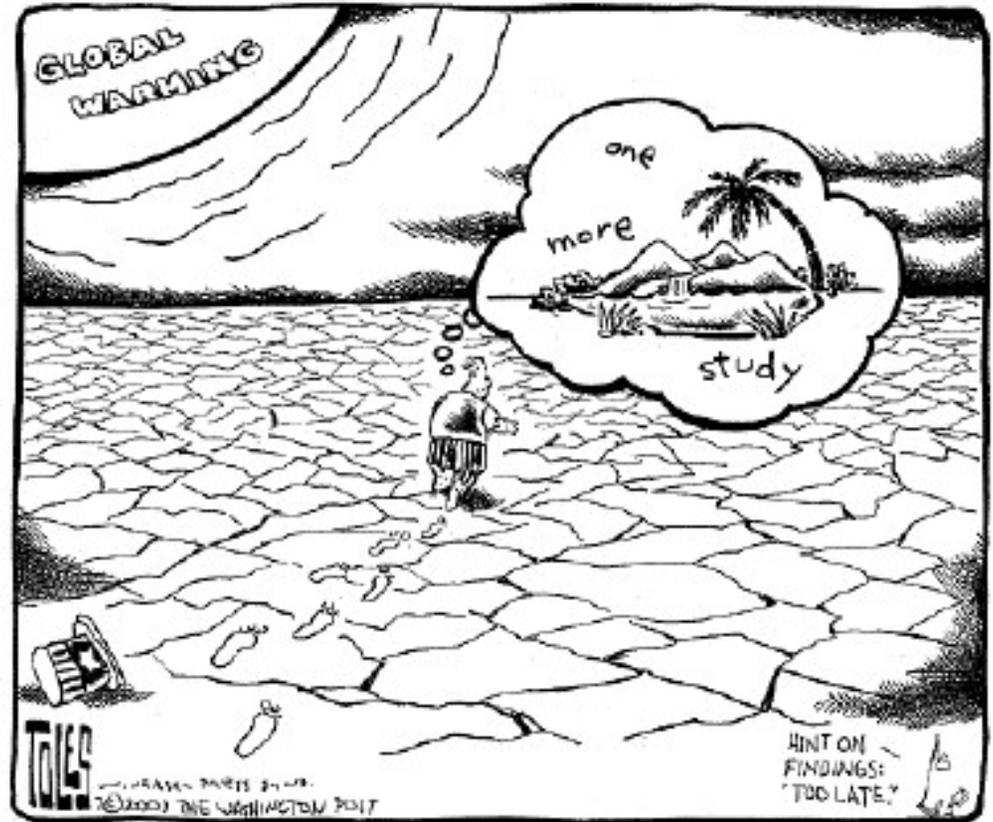
Adapting to Climate Change



- **Come to Terms With Uncertainty**
- **Incorporate Climate Change Considerations**
 - into Routine Operations
 - into Natural Resource Management

Coming to Terms with Uncertainty

- Scientific Uncertainty
- Social Uncertainty



Scientific Uncertainty

- Foreseeable and tractable changes
- Imagined or surprising changes
- Unknown changes



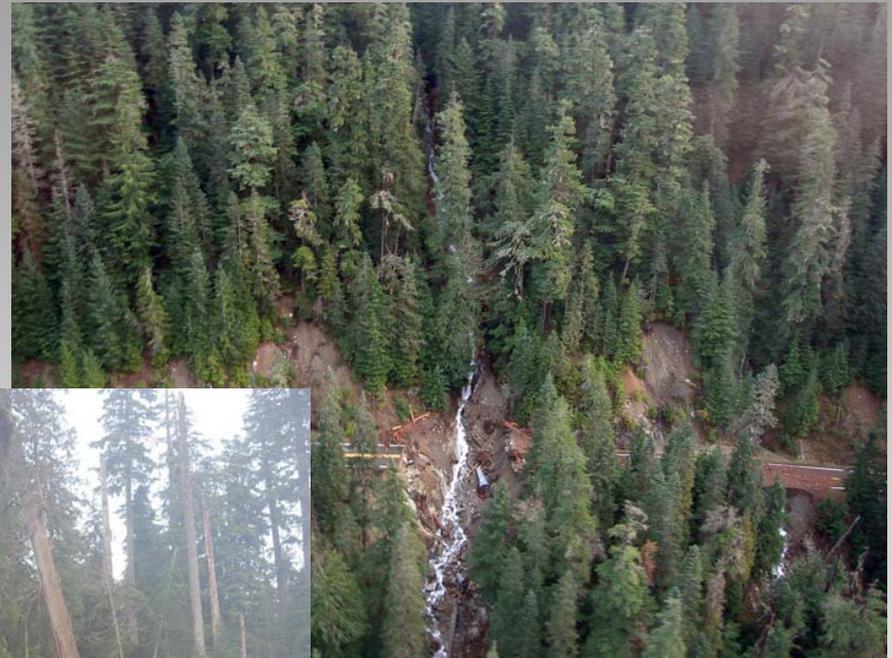
Arapahoe Glacier 1898



Arapahoe Glacier 2004

Scientific Uncertainty

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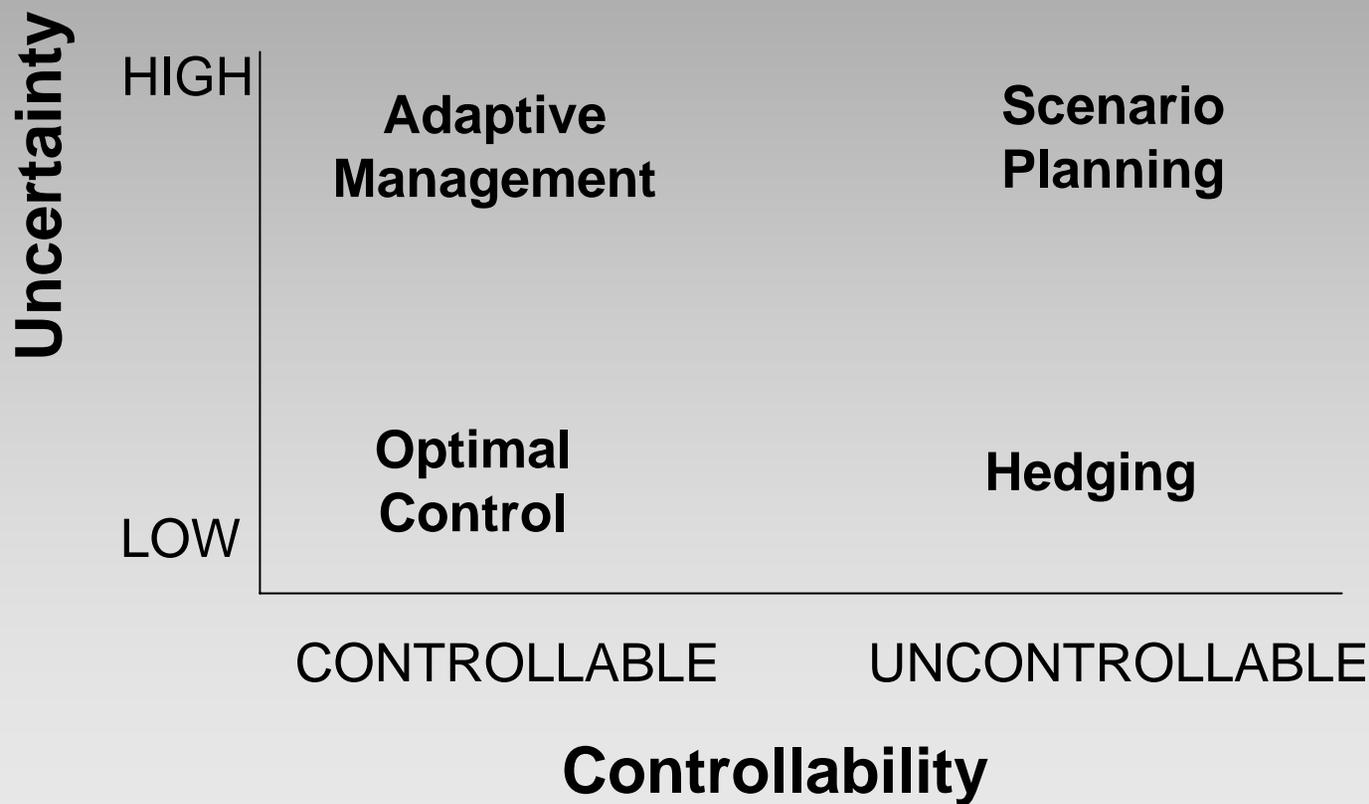
November 2006 Flood
Mount Rainier N.P.

Scientific Uncertainty

- Foreseeable and tractable changes
- Imagined or surprising changes
- **Unknown changes**



Approaches to Management Given Uncertainty



Optimal Control and Hedging

- Work best when uncertainty is low
 - Optimal Control examples: fire management, wildlife management



Elk management in ROMO
may involve culling



Large woody debris replacement
may improve fish habitat

Adaptive Management

- Treats management activities as hypotheses

- Accepts there is uncertainty
- Emphasizes learning through
- experiments and management



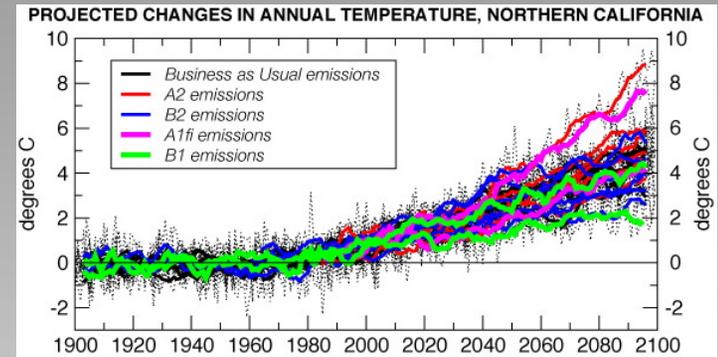
- Most successful when there is sufficient ecological resilience to accommodate mistakes

- AND where there is institutional willingness to experiment for the purpose of learning

- Requires trust, cooperation, other forms of social capital

Scenario-Based Planning

- Brainstorming alternative, but plausible, futures
 - Incorporates ideas of complexity
 - Assigns probabilities of occurrence
 - Forces consideration of low probability but high risk scenarios
- Informed by data and experts
- Uses discussions among knowledgeable persons
- Can be quantitative or qualitative
- Can be used to develop contingency plans





Scenarios

- Are stories about how the future might unfold for our organizations, issues, nations, and the world. Assumes the future is unpredictable.
- Are not predictions, rather, they are provocative and plausible stories about the diverse ways in which relevant issues outside our organizations might evolve.



Guidelines

- *Long View* - looking beyond immediate tasks far enough into the future to see new possibilities - asking "what if....."
- *Outside-In Thinking* - most think from the inside, the things they control, out to the world they would like to shape. Conversely, thinking from the outside-in begins with external changes that might, over time, profoundly affect resources.
- *Multiple Perspectives* - different from managing multiple stakeholders - diverse voices shed new light on strategic challenges, help understand one's own assumptions, expose new ideas that inform perspective and help to see the big picture of an issue or idea.

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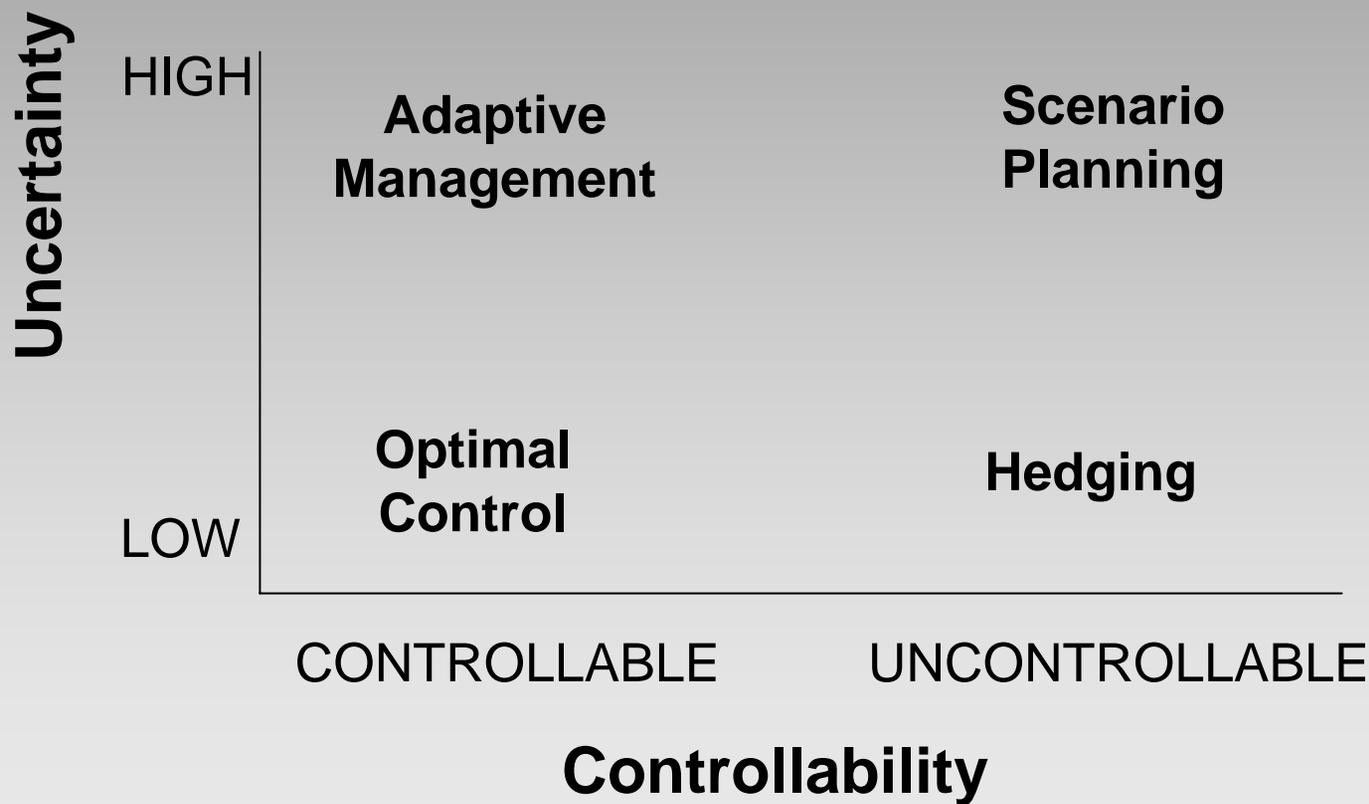


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Approaches to Management Given Uncertainty



Value Social Capital

- Resource management advances by incremental learning and gradual achievement of goals
- Some failure must be tolerated and even expected
- There are gradients between success and failure, with learning along the way
- As climate changes, even the most well-reasoned actions have some potential to go awry
- Protect and reward the wisdom and experience of front line managers



NPS has tried many ways to eradicate feral hogs, and failed often.

Climate Change: Coming to a Resource Near You!

