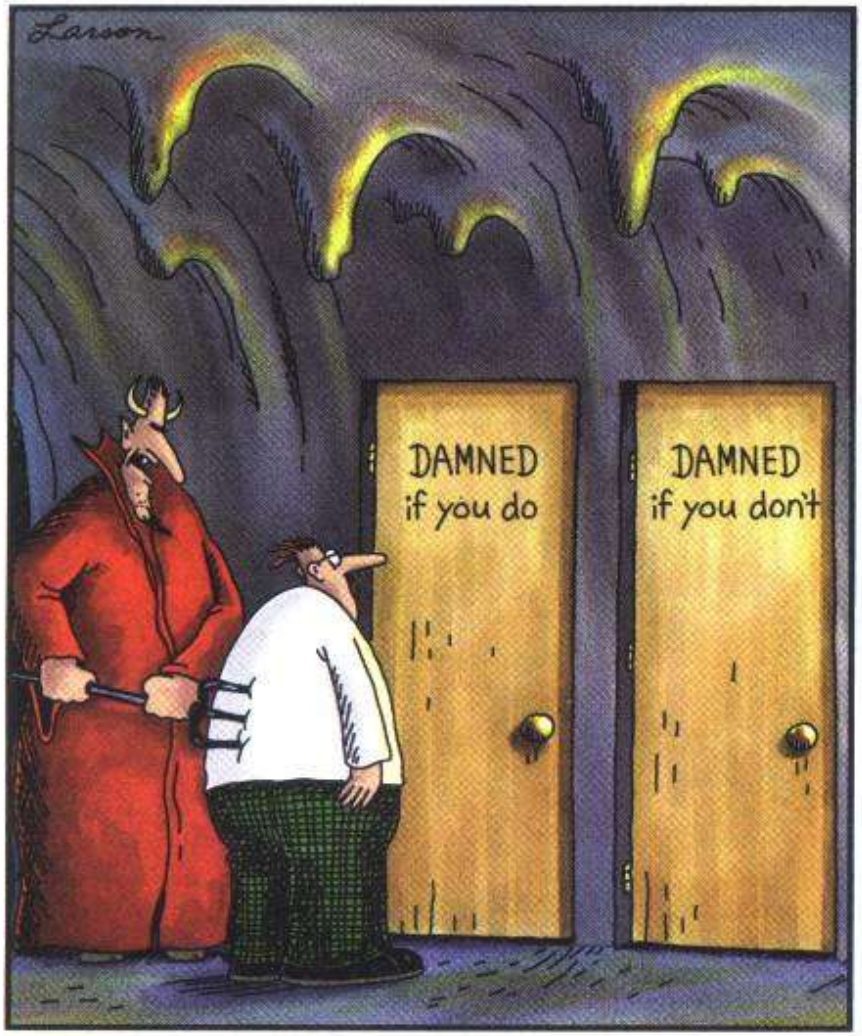
Adapting to Climate Change: A Risk Management Framework

Dave Peterson
U.S. Forest Service
Pacific Northwest Research Station

NCAP Vegetation Workshop
Seattle, WA
November 7-8, 2011

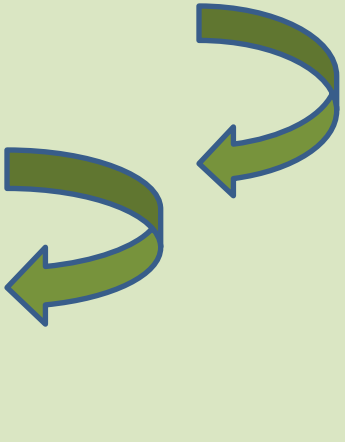
Management options for adapting to climate change?



"C'mon, c'mon—it's either one or the other."

Sources of uncertainty

- Emissions scenarios
- Global Climate Models (GCMs)
- Downscaling methods
- Effects models
- Interactions among multiple stressors
- Scale of effects assessment vs. management actions



Uncertainty ≠ ignorance

- Usually high confidence in broad scale projections
- High confidence in mid-21st century projections than late century
- High confidence in projections of some climate variables (temperature vs. precipitation)
- Evaluate the evidence and judge confidence in projected effects for specific areas – look for convergence among effects models

Address climate change effects as ***risk***

Address adaptation as ***risk management***

- Uncertainty and risk management are common in natural resource management
- But climate change poses new risk management challenges
  - ✓ Non-analog conditions
  - ✓ Rapid rate of change
  - ✓ Evolving scientific understanding
  - ✓ Many interactions

Adaptation definitions

- Adaptation = *adjustment in ecological, social, or economic systems* in response to climate stimuli and their effects.
- Adaptation options seek to *reduce the risk of adverse outcomes* through activities that increase ecosystem resilience to climate change.
- Adaptive capacity is the *ability of a system, region, or community to adapt to the effects of climate change*. Feasibility and effectiveness will depend on the adaptive capacity of the ecological system or social entity.

(from Joyce et al. [2009], SAP 4.4)

Adaptation strategies

Resistance

Resilience

Response

Realignment

Adaptation strategies

Resistance strategy

Includes actions that enhance the ability of species, ecosystems, or environments (including social) to resist forces of climate change and maintain values and ecosystem services in their present or desired states and conditions.

- Control or eradicate non-native species
- Monitor and protect rare plant populations

Adaptation strategies

Resilience strategy

Enhances the capacity of ecosystems to withstand or absorb increasing effects without irreversible changes in important processes and functionality.

- Increase rare plant populations
- Encourage heterogeneity and redundancy of habitats
- Reduce hazardous fuels

Adaptation strategies

Response strategy

Works directly with climate-induced changes to assist transitions to future states by mitigating and minimizing undesired and disruptive outcomes.

- Anticipate / plan for extreme events (droughts, big fires)
- Promote connectivity across landscapes
- Assist migration of isolated plant populations

Adaptation strategies

Realignment strategy

Uses restoration techniques to enable ecosystem processes and functions (including conditions that may or may not have existed in the past) to persist through a changing climate.

- Estimate future climatic and other conditions
- Use a diversity of approaches
- Build on existing restoration projects

Information sources

- Joyce et al. (2009). *Adaptation Options for Climate-Sensitive Ecosystems and Resources.* U.S. Climate Change Science Program.

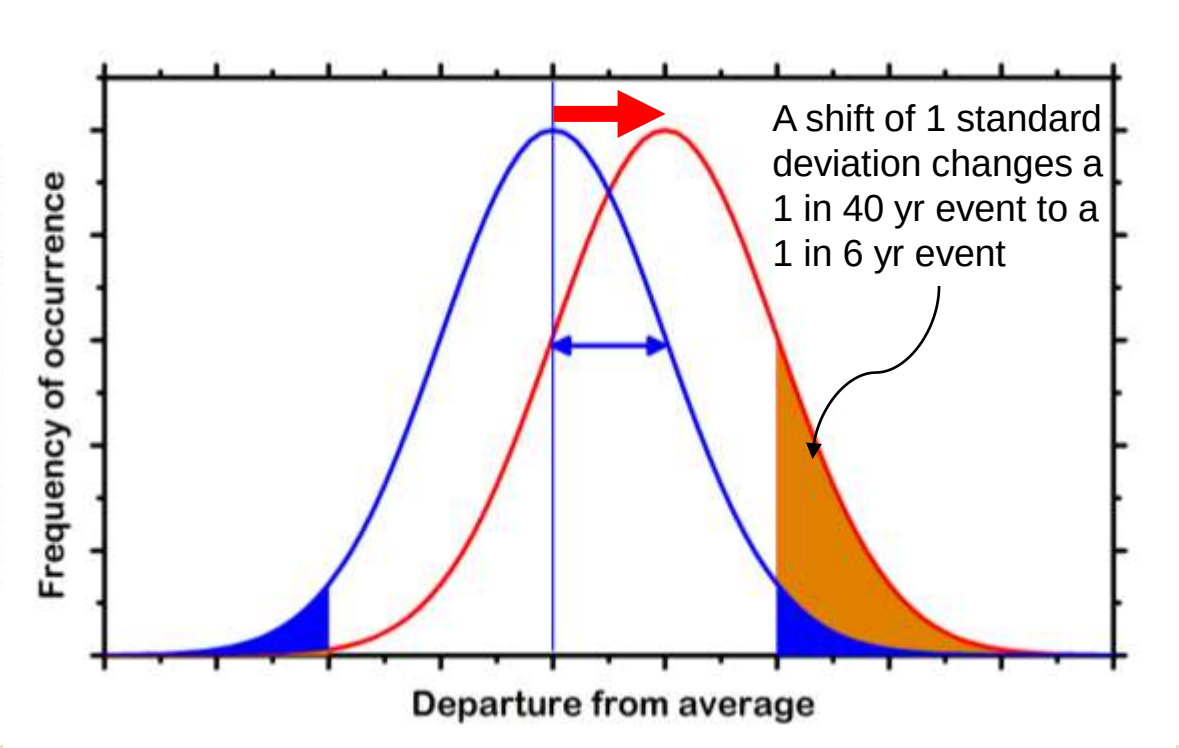
- Littell et al. (2011). *U.S. National Forests adapt to climate change through science-management partnerships.* Climatic Change.

- Halofsky et al. (2011). *Adapting to climate change at Olympic National Forest and Olympic National Park.* U.S. Forest Service.

- Peterson et al. (2011). *Responding to climate change on National Forests: a guidebook for developing adaptation options.* U.S. Forest Service.

Extremes matter!

Frequency, extent, and severity of disturbances may be affected by climate change, altering the mean and *variability* of disturbance properties.



A shift in *distribution* of fire regime properties has a larger relative effect at the *extremes* than near the mean.

Evaluate vulnerability and risks

- Start with existing conditions and stressors (*sensitivity*)
- Consider observed variability and trends along with projected trends (*exposure*)
- Determine *adaptive capacity*
  - Potential for natural resources to respond favorably to an altered climate
  - Capability of organizations and institutions to respond effectively

Adaptation options

Strategic	***Tactical***
Increase resilience to wildfires	Reduce hazardous fuels
Increase resistance to insects	Reduce forest stand densities
Conserve native plant populations	Early detection/ rapid response

We can adapt

- Truly implement adaptive management
- Climate smart management is mostly about managing for resilience to disturbance
- Choose your battles wisely
- Work with your neighbors – share your experiences

We are adapting!