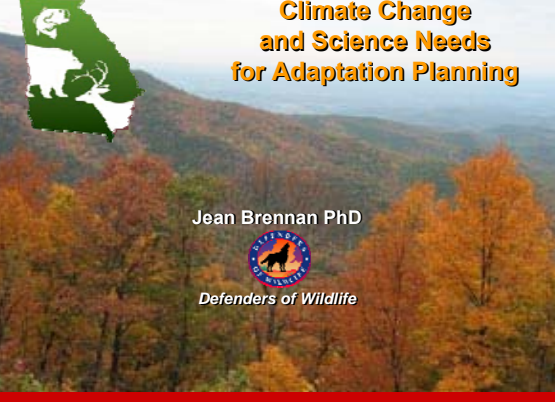




Climate Change and Science Needs for Adaptation Planning



Jean Brennan PhD

 Defenders of Wildlife

SEAFWA 2009. Challenges to the No Am Model in the 21st Century. Atlanta. Nov 3, 2009

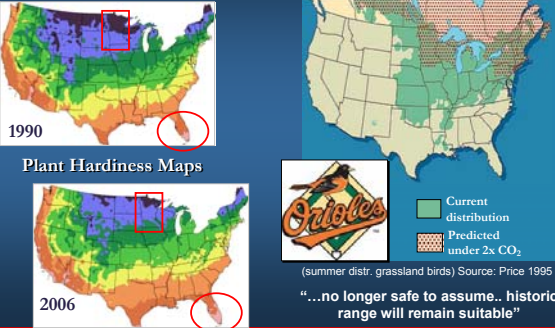
Outline



Climate Change
 • *Response of Natural Systems*
 and Science Needs

Response of Natural Systems

1. Shift Climatic Zones/Species Ranges




1990
 Plant Hardiness Maps
 2006

(summer distr. grassland birds) Source: Price 1995
 "...no longer safe to assume... historic range will remain suitable"

Source: Arbor Day Foundation McCartney 2001

Response of Natural Systems

2. Δ Community Structure



non-analog


Warming Warming

Source: Pounds et al. 1999

Response of Natural Systems

3. Δ Disturbance Regime

- pest and disease outbreaks
- fire



Warming

33 million acres lost BC

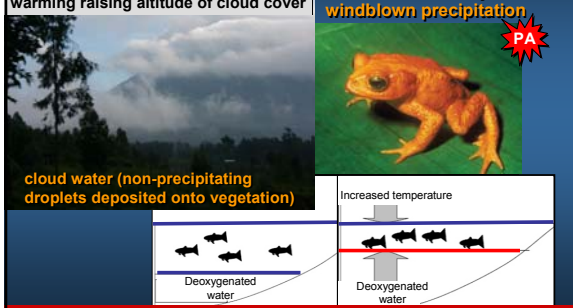
Based on: Peterson 2008 Source: Kutz et al., 2005

Response of Natural Systems

4. Loss of Critical Habitat

warming raising altitude of cloud cover

microclimate
 mist – low-intensity windblown precipitation



cloud water (non-precipitating droplets deposited onto vegetation)

Increased temperature

Deoxygenated water

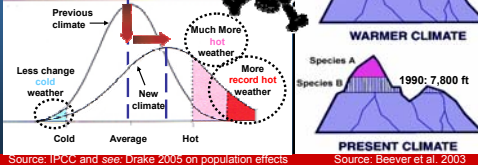
PA

Response of Natural Systems

5. Exceed Physiological Tolerance



⇒ selection events



Source: IPCC and see Drake 2005 on population effects Source: Beaver et al. 2003

Outline

1. Shift Climatic Zones/Species Ranges
2. Δ Community Structure
3. Δ Disturbance Regime
4. Loss of Critical Habitat
5. Exceed Physiological Tolerance

and Science Needs

- Information needs for managing healthy biological communities

Science Needs: NGO Community Response[^]

Research & info. needs to manage healthy ecosystems under CC

Basic Biological Information

Goal 1: enhance understanding of the diversity and status of wild populations across the landscape, that will need to be managed under future climate change.

Vulnerability and Risk

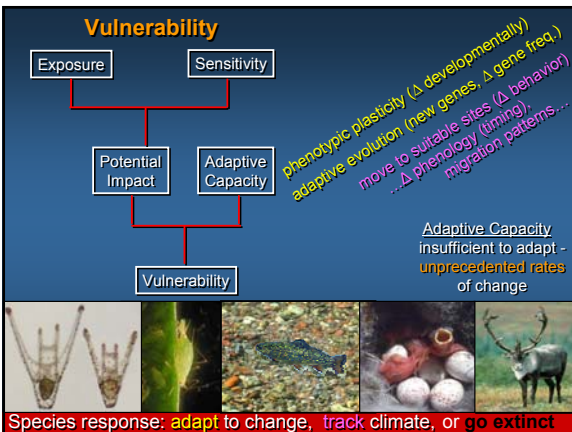
Management and Research Response

[^] Audubon, Defenders of Wildlife, Heinz Center, NCSEAS, National Wildlife Federation, Natural Resources Defense Council, NatureServe, Sierra Club, The Nature Conservancy, Wilderness Society, Wildlife Conservation Society (Aug 2007)

Science Needs: Basic Biological Information

- 1a. inventory conservation lands (*ecol. baselines*) and ID 'hotspots'
- 1b. ID (& address) gaps climatic data at local and regional levels
- 1c. investigate interactions & synergistic effects between CC and other stressors (ID those *ecol. stressors most amenable to control*)
- 1d. document impacts on fish, wildlife, natural plant communities, & Δ amt./rates (*flow/release, accretion/subsidence*), processes, etc.
- 1e. ID critical thresholds beyond which systems are unable to adapt to CC...develop models of "breakpoints"
- 1f. develop framework for modeling resilience of vegetation to CC, which incorporates process related variables
- 1g. develop approaches for measuring the capacity of different systems to adapt to climate changes

* Independent research; grant program (RFP)



Science Needs: NGO Community Response[^]

Research & info. needs to manage healthy ecosystems under CC

Basic Biological Information

Vulnerability and Risk

Goal 2: ID candidate conservation targets (*natural comm., species, populations, gene pool*) spatially and temporally vulnerable to climate-related environmental change.

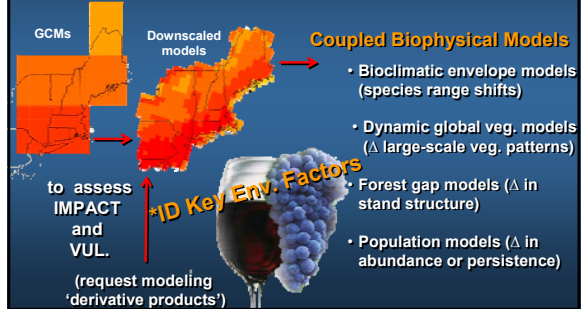
Science Needs: Vulnerability and Risks

- 2a. analyze **near-term vulnerability** due to such factors as altitudinal and range edge effects, in order to identify **time-sensitive conservation needs & ID systems in flux**
- 2b. determine climate influence on **disturbance regimes**, both physical (e.g. fire, wind, flooding) and biological (e.g. pests, pathogens, EIDs)
- 2c. evaluate **approaches to modeling** species distributions, vegetation changes, and other spatially-explicit impacts, to **gauge uncertainty** related to model differences
- 2d. evaluate risks and **possible unintended consequences** - various **mgmt actions** or responses by different sectors to assist **human adaptation** (such as carbon sequestration options, renewable energy alternatives infrastructure, water management, etc.)

* Meta-analysis

Science Needs: Vulnerability and Risks (cont.)

- 2e. develop regional-level climate projections => (**downscaled models**) - **likely impacts** based on **coupled climate modeling** (in terms of quantity and timing under CC scenarios)



Science Needs: NGO Community Response^

Research & info. needs to manage healthy ecosystems under CC

Basic Biological Information

Vulnerability and Risk

Management and Research Response

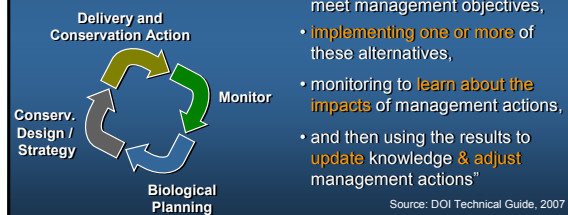
Goal 3: develop knowledge, tools, and strategies to **facilitate climate adaptation** or mitigate climate change damage to specific conservation targets on public & conservation lands.

Institute True Proactive Adaptive Management

"Contrary to commonly held belief, adaptive management is much more than simply tracking and changing management direction in the face of failed policies..." (DOI Technical Guide: Adaptive Management, 2007.)

"An adaptive approach"

involves...



"act and study" - treat as testable hypotheses

Science Needs: Management & Research Response

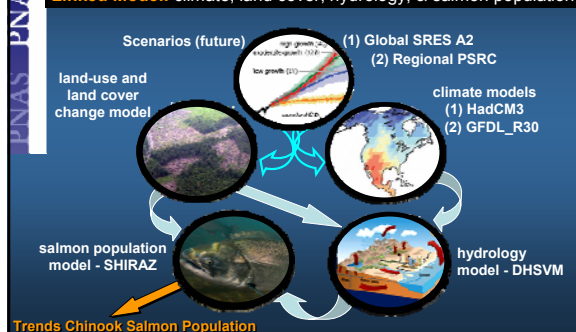
- 3a. ID mgmt activities & practices thought to build **resilience** for populations or habitats under current conditions, and **determine how** these might **need to be modified** under CC
- 3b. develop practical **strategies for reducing** the overall **vulnerability** of economically important, natural, and ecological systems sensitive to weather & climate variation
- 3c. **develop and deliver climate-species-habitat decision support tools** to assist managers in formulating habitat and population goals.
- 3d. develop **guidance** and supporting **training** materials on **how to utilize modeling results** to develop site based recommendations for management or land acquisition

* deliver CC sci., tech., practices - broadly (manager, decision-maker, stakeholder)

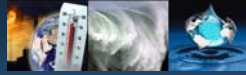
Projected impacts of climate change on salmon habitat restoration

James Battin¹, Matthew W. Wiley¹, Mary H. Ruckelshaus², Richard N. Palmer³, Elizabeth Korb³, Krista K. Bantz⁴

Linked Model: climate, land cover, hydrology, & salmon population



Outline



Climate Change

- *Response of Natural Systems*

and Science Needs

- *Information needs for managing healthy biological communities*

plus monitoring

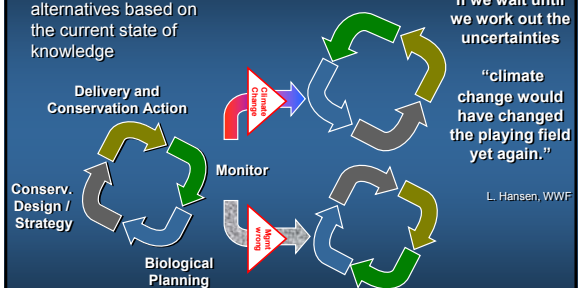


Science Needs: Monitoring & Adaptive Management

- ID **appropriate monitoring systems** and protocols
 - to track **impacts** of climate change,
 - monitor **climate-sensitive species**,
 - test long-term **accuracy of models** with current field data,
 - and to measure success and **efficacy of management** action and adaptation strategies
- determine clear, **measurable goals** and **metrics to use** as triggers or **thresholds** for **change in management** actions due to climate impacts
- **survey long-term datasets** and environmental indicators that currently exist that could potentially be **useful in establishing monitoring systems**

Institute True Proactive Adaptive Management

- **predicting outcomes** of alternatives based on the current state of knowledge



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jbrennan@defenders.org

