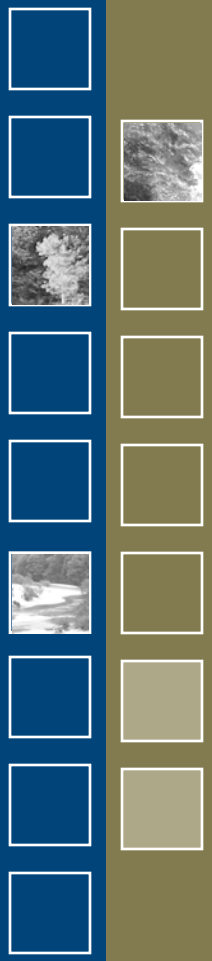
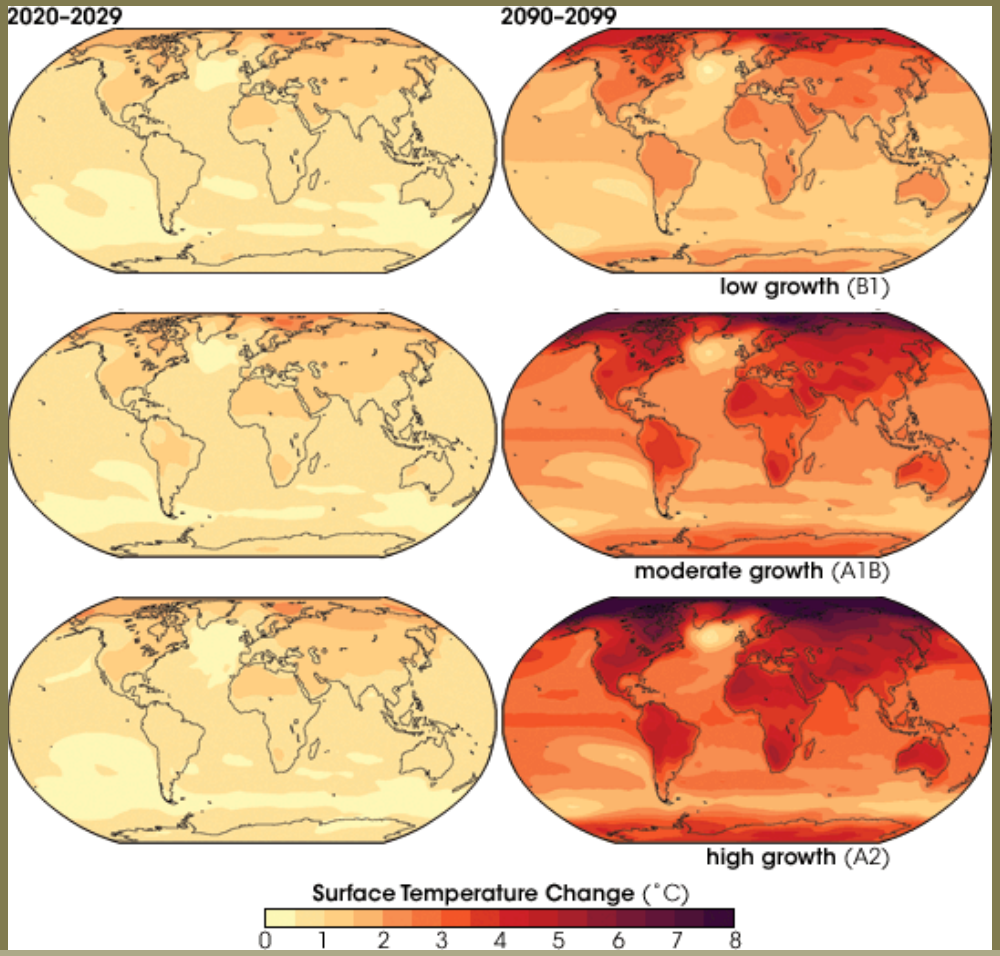


Environmental Evaluation in the Age of an Uncertain Climate

Prepared for:
Environmental Evaluators' Networking Forum

Prepared by:
Diana Lane and Chuck Herrick
Stratus Consulting
Boulder, CO and Washington, DC
June 13, 2008

Why do evaluators need to think about climate change? (Isn't that someone else's job?)



Source: IPCC, 2007, as presented by NASA Earth Observatory.

Ability to project regional impacts has increased greatly in the last 10 years

- Regional studies available from multiple sources (examples):
  - California
    - California Climate Change Center at UC Berkeley http://calclimate.berkeley.edu/research
  - Northeast
    - Northeast Climate Impacts Assessment http://www.northeastclimateimpacts.org/
- Recent Synthesis Report from U.S. Climate Change Science Program (May 28, 2008)
  - The Effects of Climate Change on Agriculture, Land Resources, Water Resources, and Biodiversity in the United States
  - http://www.climatescience.gov/Library/sap/sap4-3/default.php

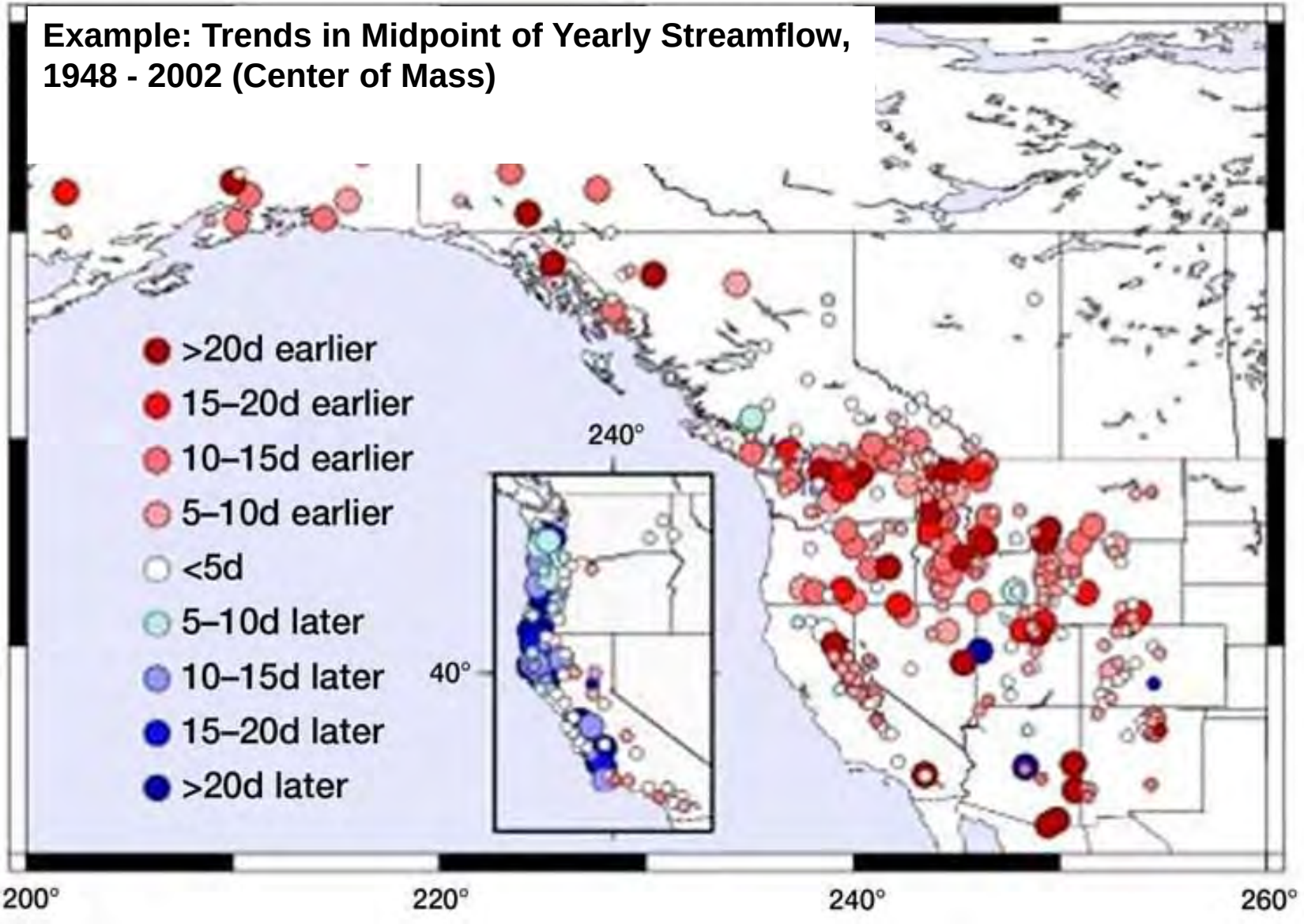
What climate change impacts should you worry about?

- Sea-level rise – projections for 2100 range from 28 to 150 cm (or more)
  - Storm surges magnify the impacts of sea-level rise
  - Impacts on coastal ecosystems, coastal populations, salt-water intrusion into freshwater systems, barrier islands

What climate change impacts should you worry about (cont.)?

- Temperature increase – and non-linear impacts of temperature increases
  - Decrease in snow and ice-cover
  - Changes in snow melt timing
  - Changes in species distributions
  - Insect outbreaks
- Changes in precipitation – absolute amounts and changes in timing and intensity
  - Intensification of drought cycles
  - Increased flooding risks

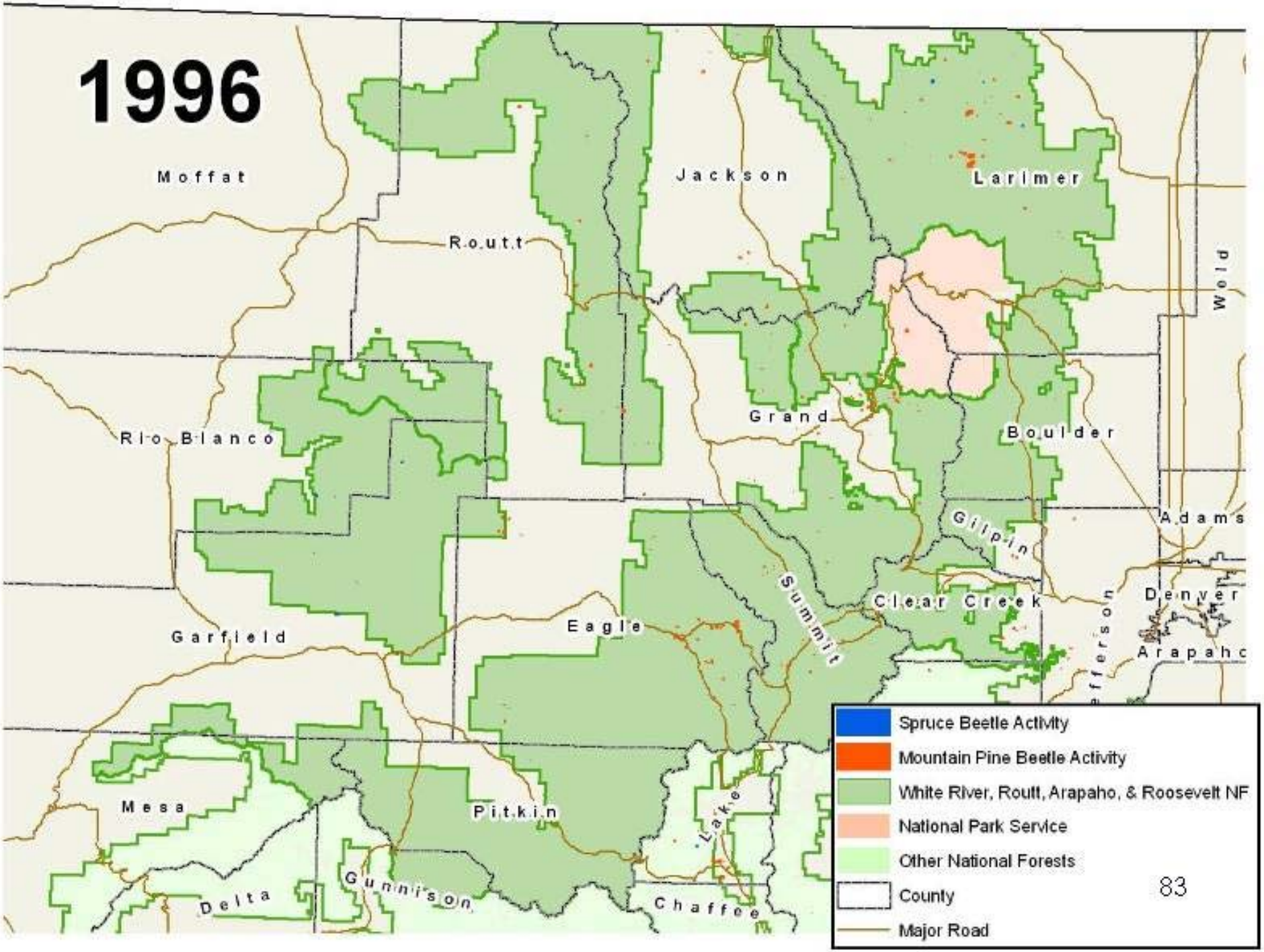
Example: Trends in Midpoint of Yearly Streamflow, 1948 - 2002 (Center of Mass)

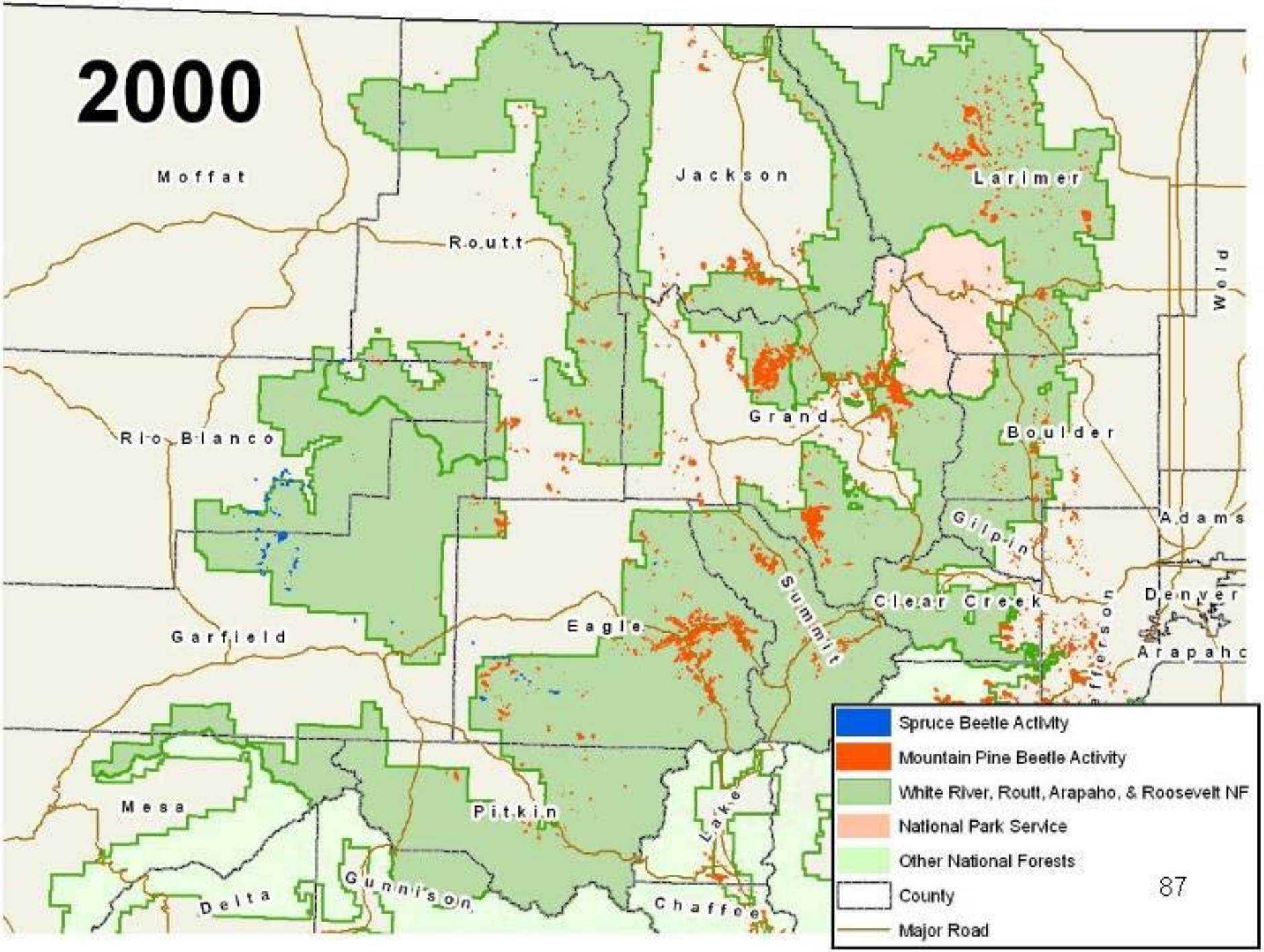


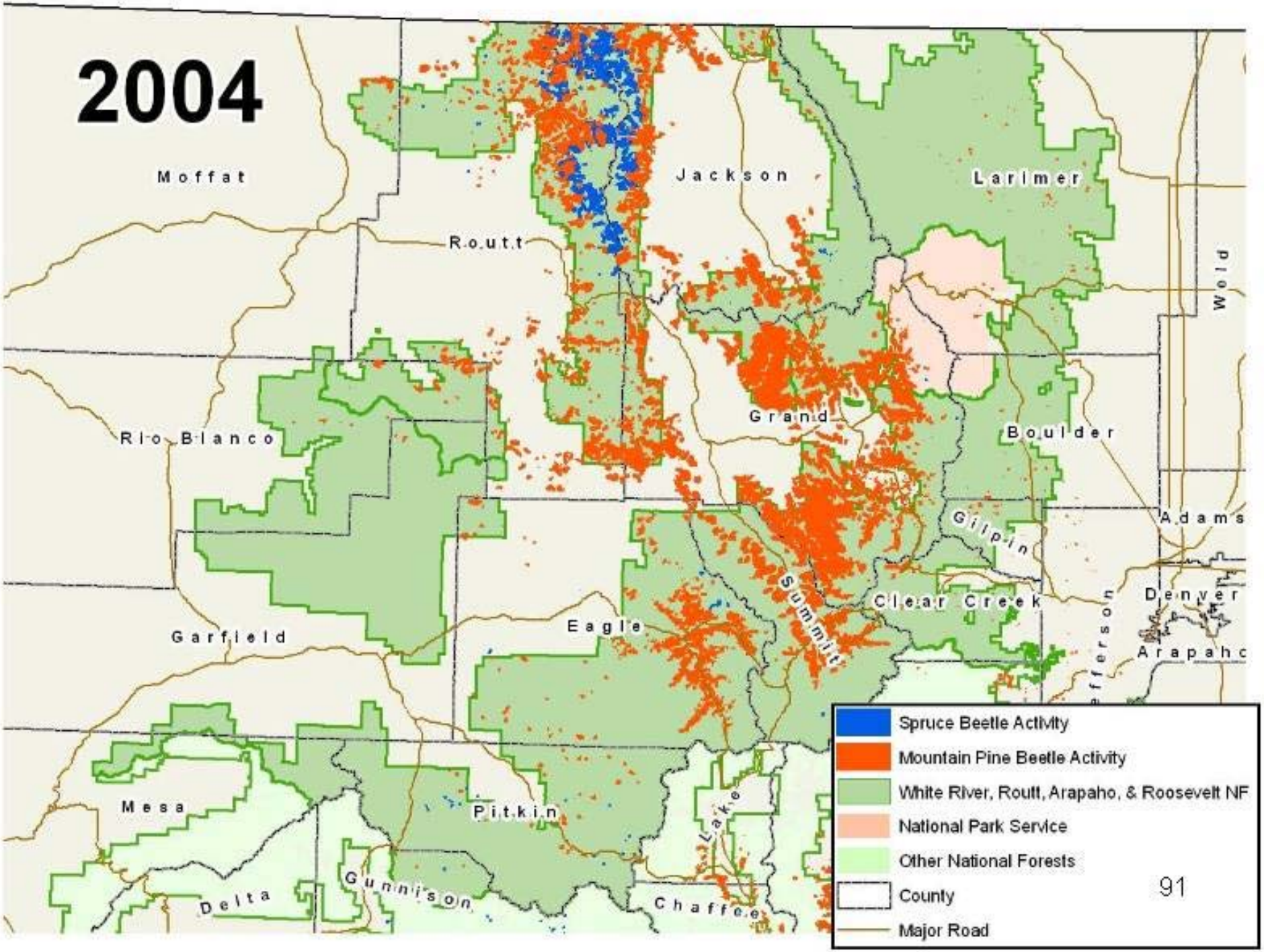
Source: Stewart et al., 2005, Figure 2b.

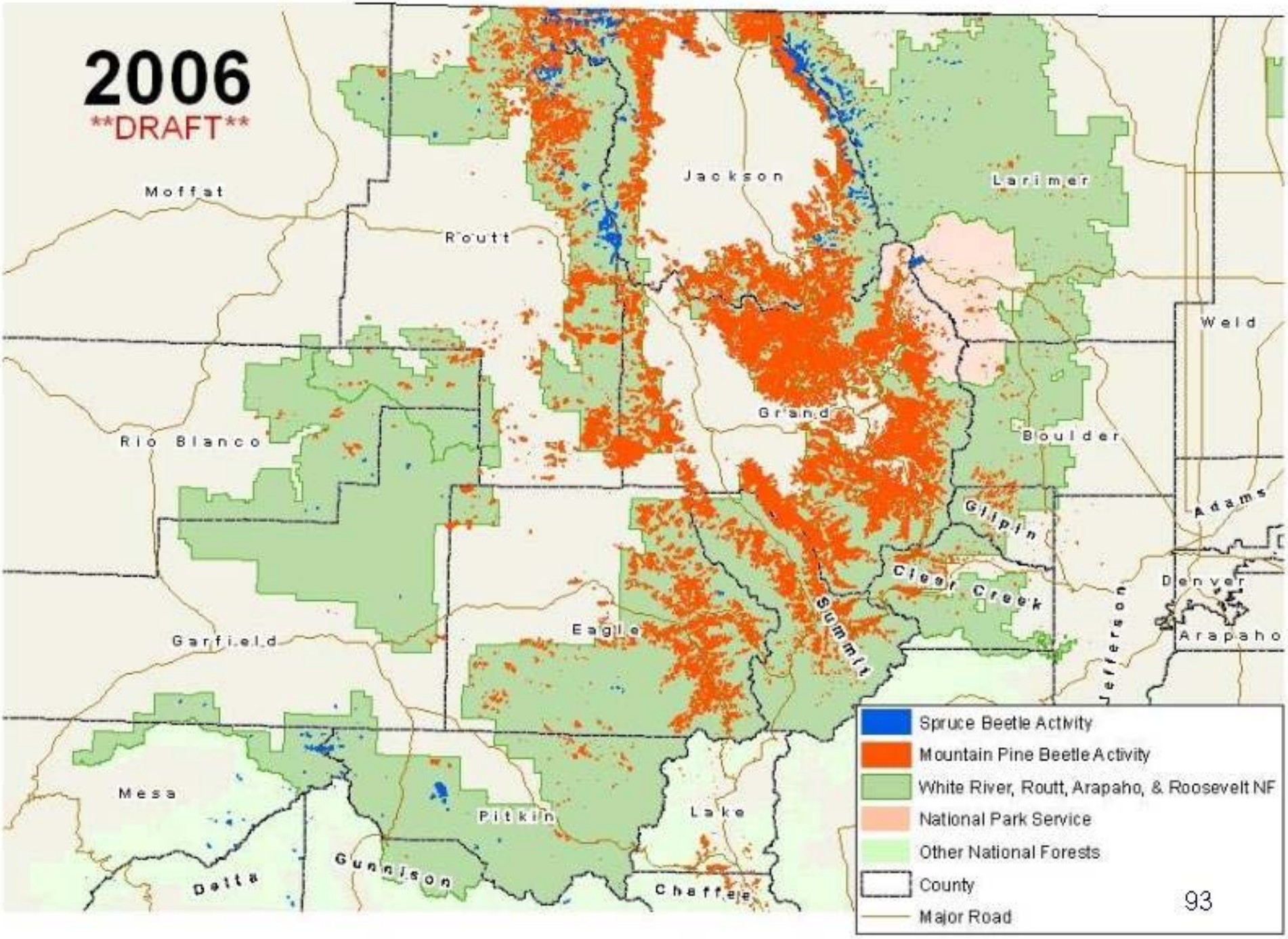
Example of insect outbreaks in just 10 years in Colorado

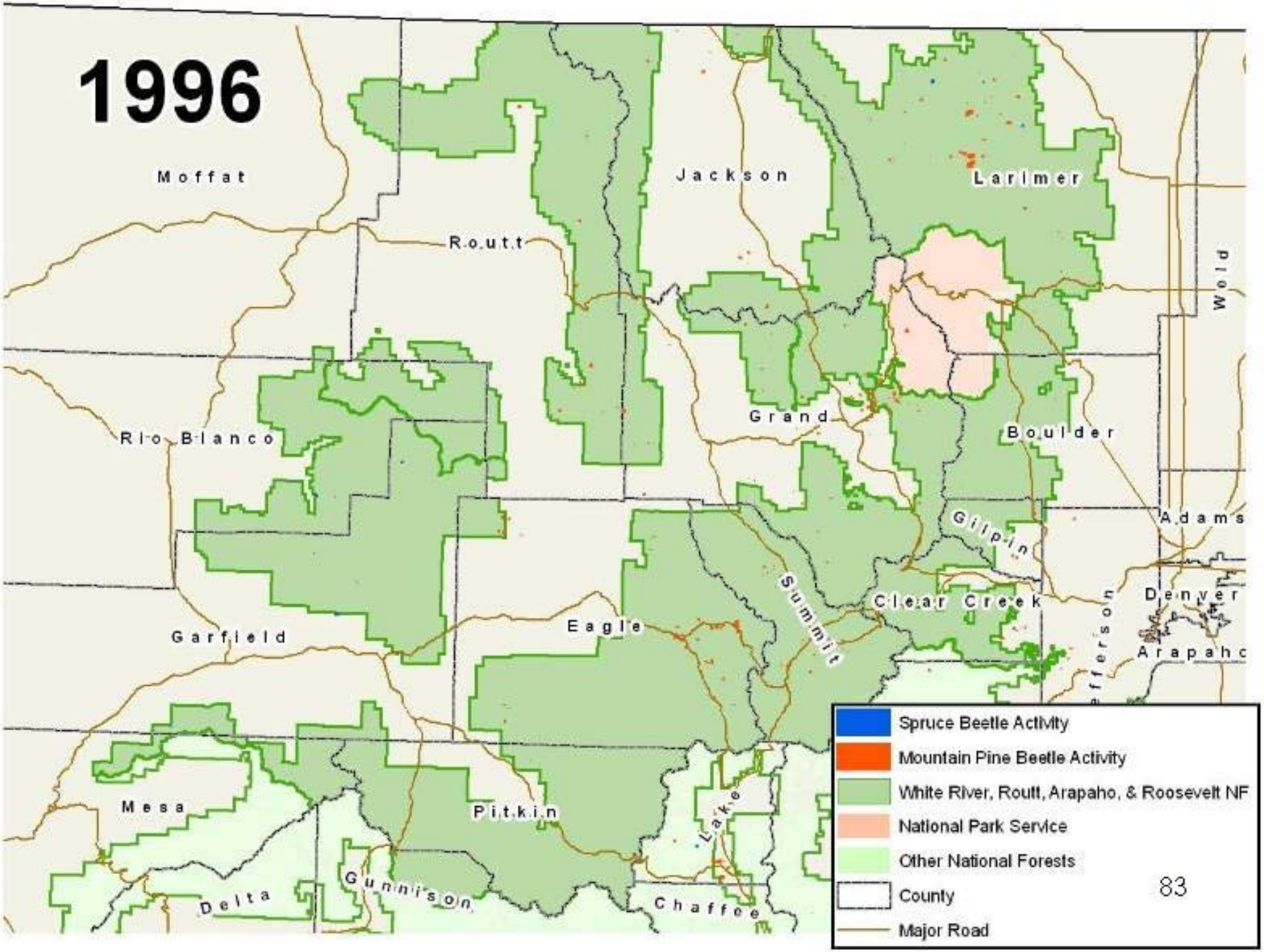
- Next set of slides shows how insect outbreaks can dramatically change a forest landscape in just 10 years
- Data source: USDA Forest Service aerial survey data


1996
Moffat
Jackson
Larimer
Routt
Weld
Rio Blanco
Grand
Boulder
Gilpin
Adams
Summit
Clear Creek
Denver
Eagle
Garfield
Arapaho
Mesa
Pitkin
Lake
Gunnison
Delta
Chaffee
Spruce Beetle Activity
Mountain Pine Beetle Activity
White River, Routt, Arapaho, & Roosevelt NF
National Park Service
Other National Forests
County
Major Road


2000
Moffat
Jackson
Larimer
Routt
Weld
Grand
Boulder
Rio Blanco
Gilpin
Adams
Summit
Clear Creek
Denver
Eagle
Garfield
Arapaho
Mesa
Pitkin
Lake
Gunnison
Delta
Chaffee
Spruce Beetle Activity
Mountain Pine Beetle Activity
White River, Routt, Arapaho, & Roosevelt NF
National Park Service
Other National Forests
County
Major Road


2004
Moffat
Jackson
Larimer
Routt
Weld
Grand
Boulder
Rio Blanco
Gilpin
Adams
Summit
Clear Creek
Denver
Garfield
Eagle
Arapaho
Mesa
Pitkin
Lake
Gunnison
Delta
Chaffee
Spruce Beetle Activity
Mountain Pine Beetle Activity
White River, Routt, Arapaho, & Roosevelt NF
National Park Service
Other National Forests
County
Major Road


2006
DRAFT
Moffat
Routt
Jackson
Larimer
Weld
Rio Blanco
Grand
Boulder
Garfield
Eagle
Summit
Clear Creek
Gilpin
Adams
Jefferson
Denver
Arapaho
Mesa
Pitkin
Lake
Gunnison
Delta
Chaffee
Spruce Beetle Activity
Mountain Pine Beetle Activity
White River, Routt, Arapaho, & Roosevelt NF
National Park Service
Other National Forests
County
Major Road


1996
Moffat
Jackson
Larimer
Routt
Weld
Rio Blanco
Grand
Boulder
Gilpin
Adams
Summit
Clear Creek
Denver
Eagle
Garfield
Arapaho
Mesa
Pitkin
Lake
Gunnison
Delta
Chaffee
Spruce Beetle Activity
Mountain Pine Beetle Activity
White River, Routt, Arapaho, & Roosevelt NF
National Park Service
Other National Forests
County
Major Road

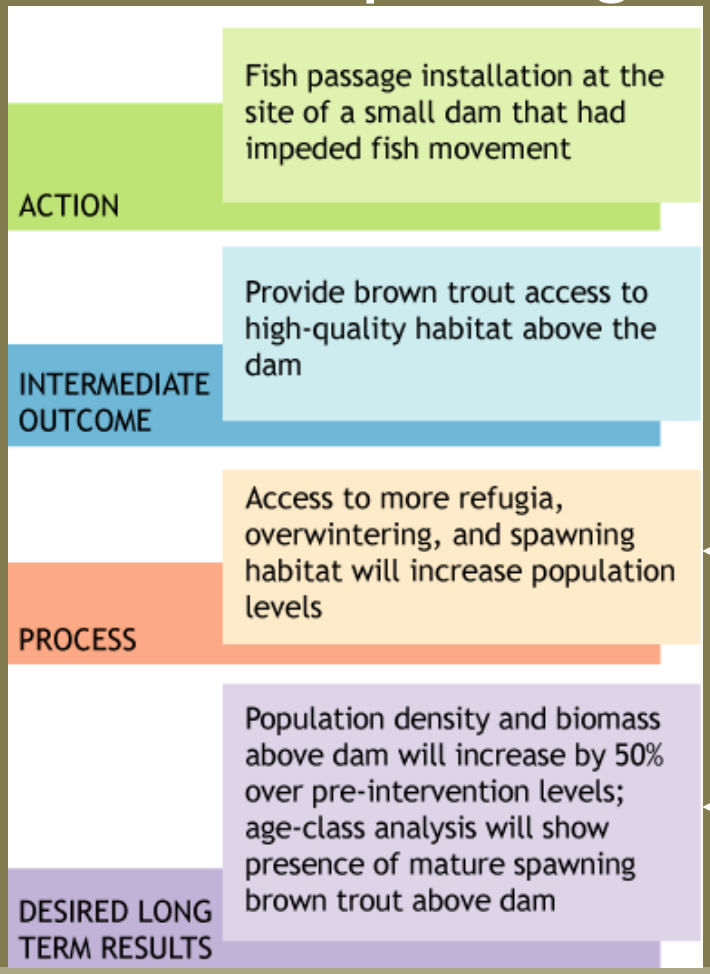
Where do you find reliable information about regional climate impacts?

- Intergovernmental Panel on Climate Change (IPCC)
  - http://www.ipcc.ch
- U.S. Global Change Research Program
  - http://www.usgcrp.gov/usgcrp/default.php
- U.S. EPA Climate Change Program
  - http://www.epa.gov/climatechange/
- NOAA Regional Integrated Sciences and Assessment
  - http://www.climate.noaa.gov/cpo_pa/risa/
- Pew Center on Global Climate Change
  - www.pewclimate.org/regional_impacts
- "Downscaled" climate models
  - http://gdo-dcp.ucllnl.org/downscaled_cmip3_projections/

Questions evaluators should address when thinking about climate change

- What is the theory of change for a program or project?
- How would an altered climate, or responses to an altered climate, affect that theory?
- Are outcome targets still reasonable?
- Are program goals still attainable?

Example – Conceptual model for construction of fish passage structure



Fish are near thermal tolerance; habitat not suitable without increased shading

Goal of 50% increase not realistic because of increased stress

Example: Water-banking in the Southwest

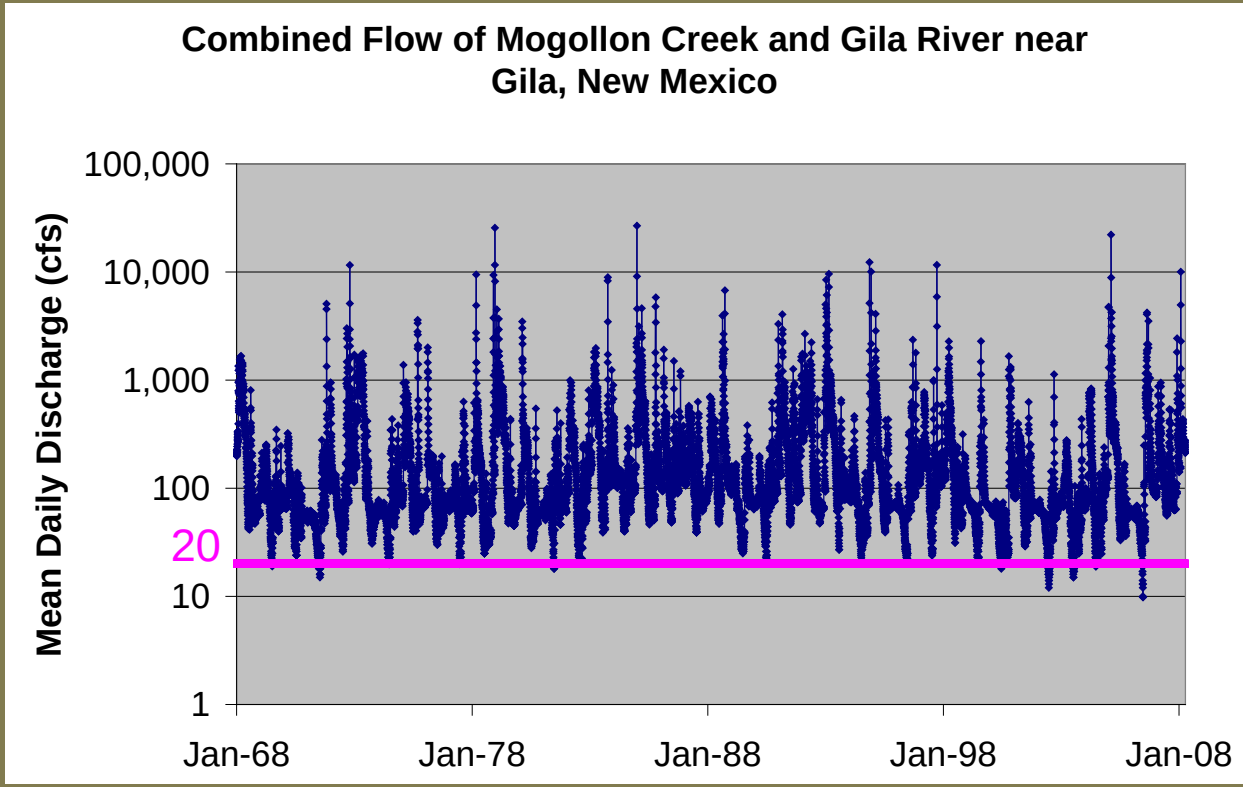


- Action: Create a water bank that guarantees minimum flows
- Intermediate Outcome: Contracts in place with irrigators to return flow to river for flows below target level
- Pathway/process: Minimum flows prevent fish kills during low-flow situations
- Long-term results: Stable population of threatened/ endangered fish species is maintained

- Key evaluation question: Are contracts flexible or adequately robust to address projected changes in water availability and/or variability?

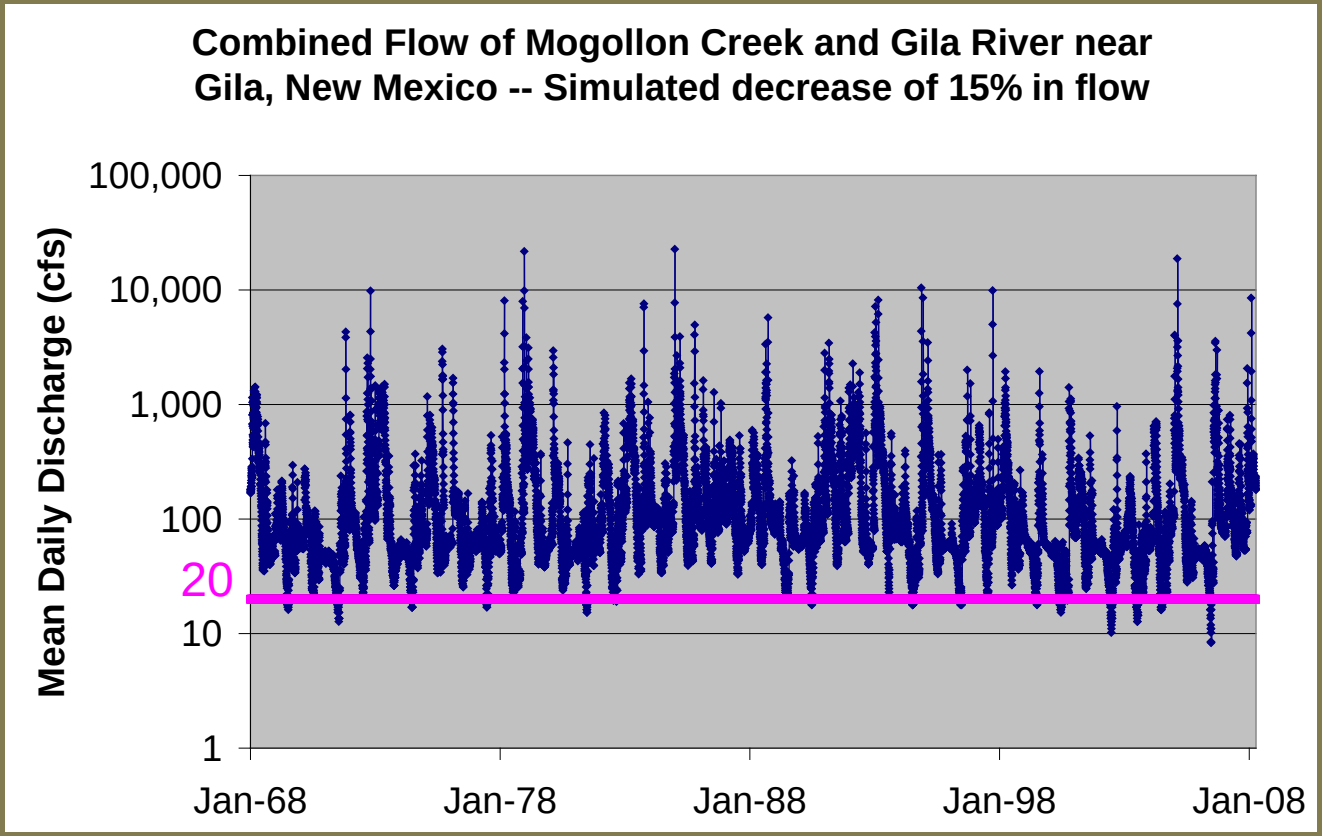
Example: Water-banking in the Southwest (cont.)

- Are contracts to maintain 20 cfs a good investment for the water bank?



Example: Water-banking in the Southwest (cont.)

- Superimposing a 15% flow decrease on historical flow data (see Milly et al., 2005)



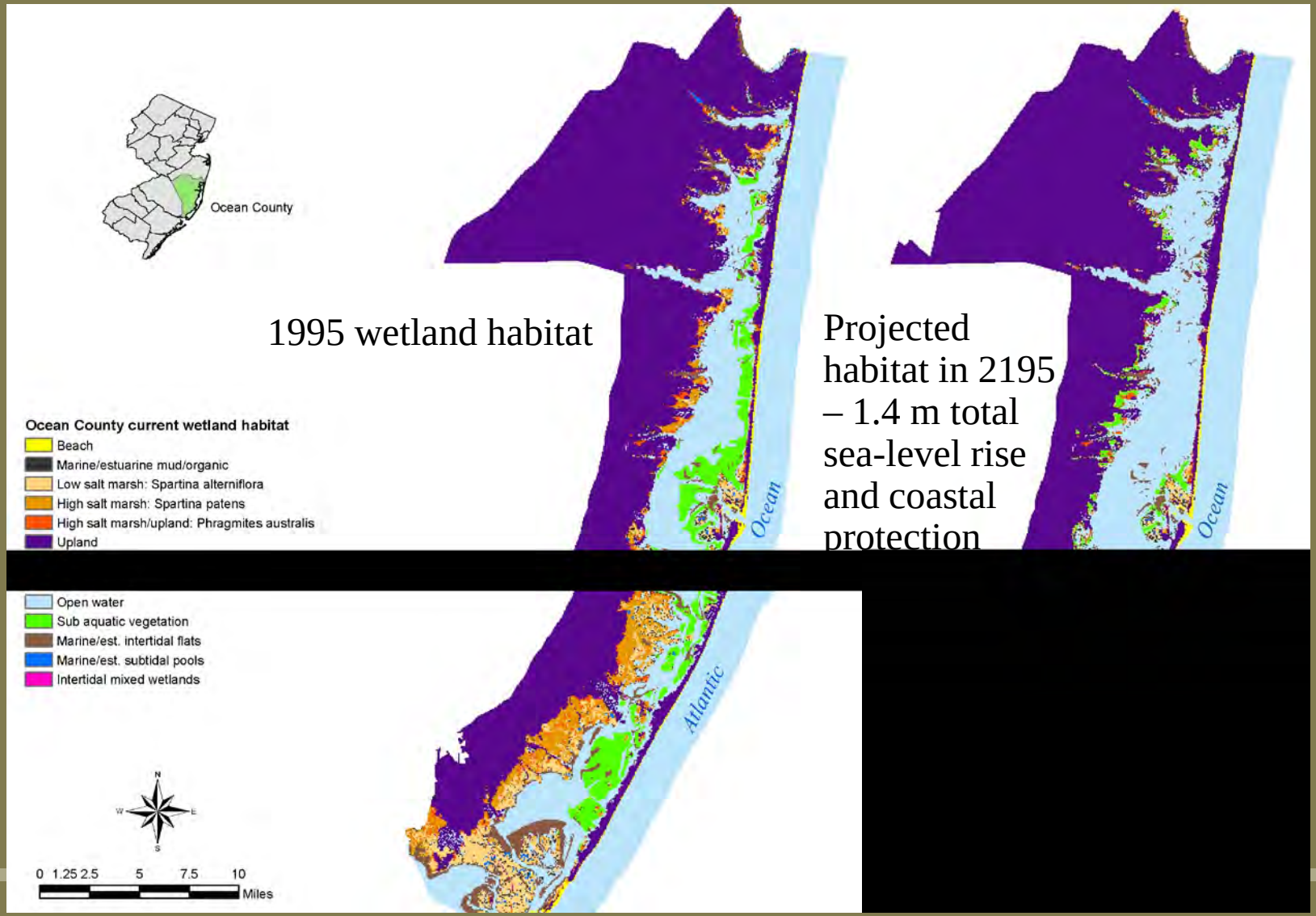


Example: Coastal marsh protection along the mid-Atlantic coast

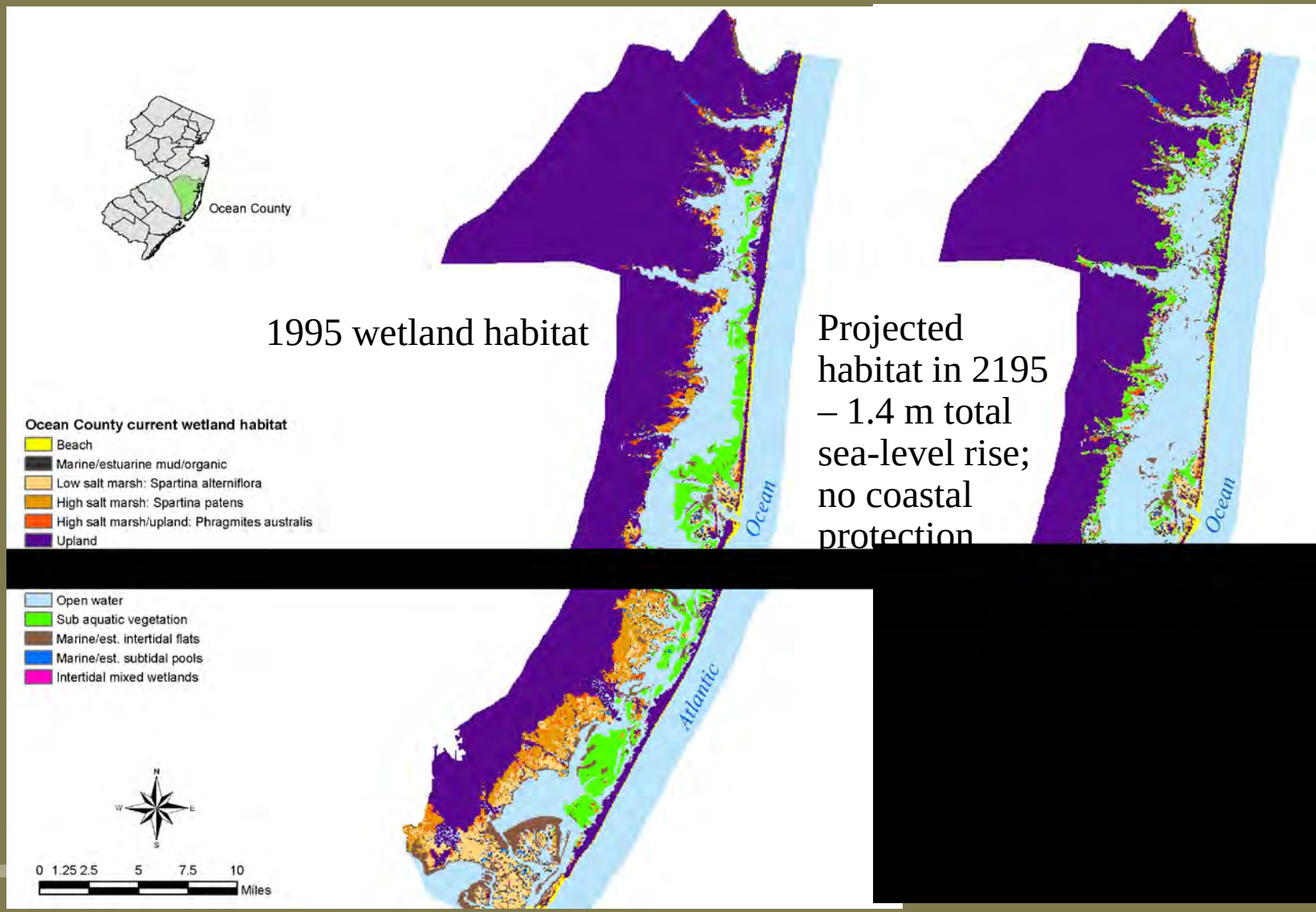
- Action: Protect coastal marsh habitat along the mid-Atlantic coast with purchase and easements
- Intermediate Outcome: Acres protected
- Pathway/process: Protection of coastal marsh maintains important habitat
- Long-term results: Stable populations of fish, invertebrates, birds, and other wildlife

- Key evaluation question: Is protection sufficient for maintaining habitat and wildlife populations in the face of projected sea-level rise ?

Example: Coastal marsh protection along the mid-Atlantic coast



Example: Coastal marsh protection along the mid-Atlantic coast



Conclusions

- Formative evaluations have always considered how future changes in a program's context might affect outcomes
  - Evaluators are good at this kind of thinking
  - Climate change becomes another lens through which one should evaluate long-term program sustainability and success
  - You don't need to become a climate expert, but . . .
  - You do need to think about the climate changes that are most likely to affect outcomes
- This is an area where networking and information sharing will be critical