PUBLIC LANDS AND ECOSYSTEMS: MANAGEMENT CHALLENGES AND OPPORTUNITIES FACED BY THE U.S. FOREST SERVICE

Adaptation to Climate Change in the Desert Southwest: Impacts and Opportunities

Tucson AZ, January 22-23, 2009

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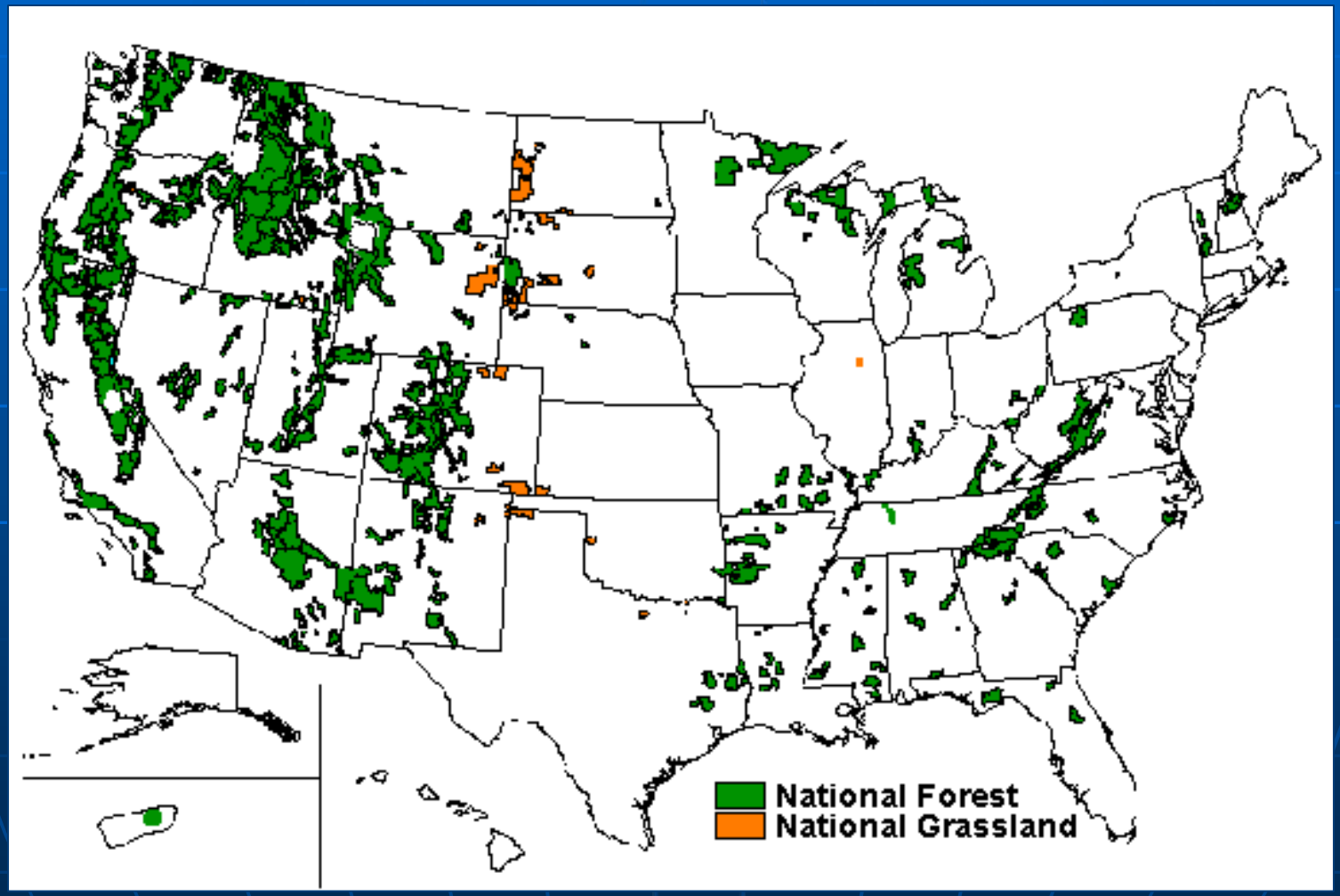
US Forest Service

Distribution of National Forests and Grasslands in the US.



Direct Effects of Climate Change: Gradually Increasing Temperatures

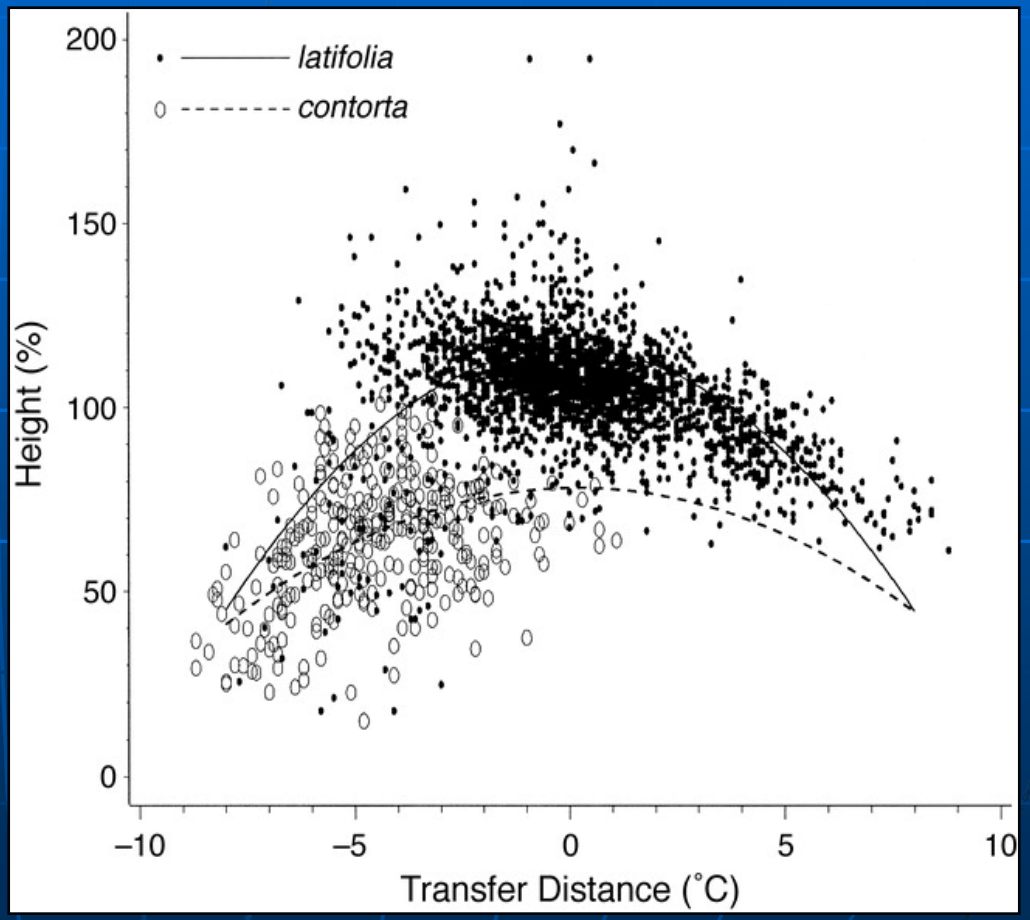
Growth slows, mortality increases

- Trees on poorest sites die first
- Large old trees and seedlings and saplings die more quickly

Long term climate change effects: Growth of Lodgepole pine varieties in BC transplant gardens

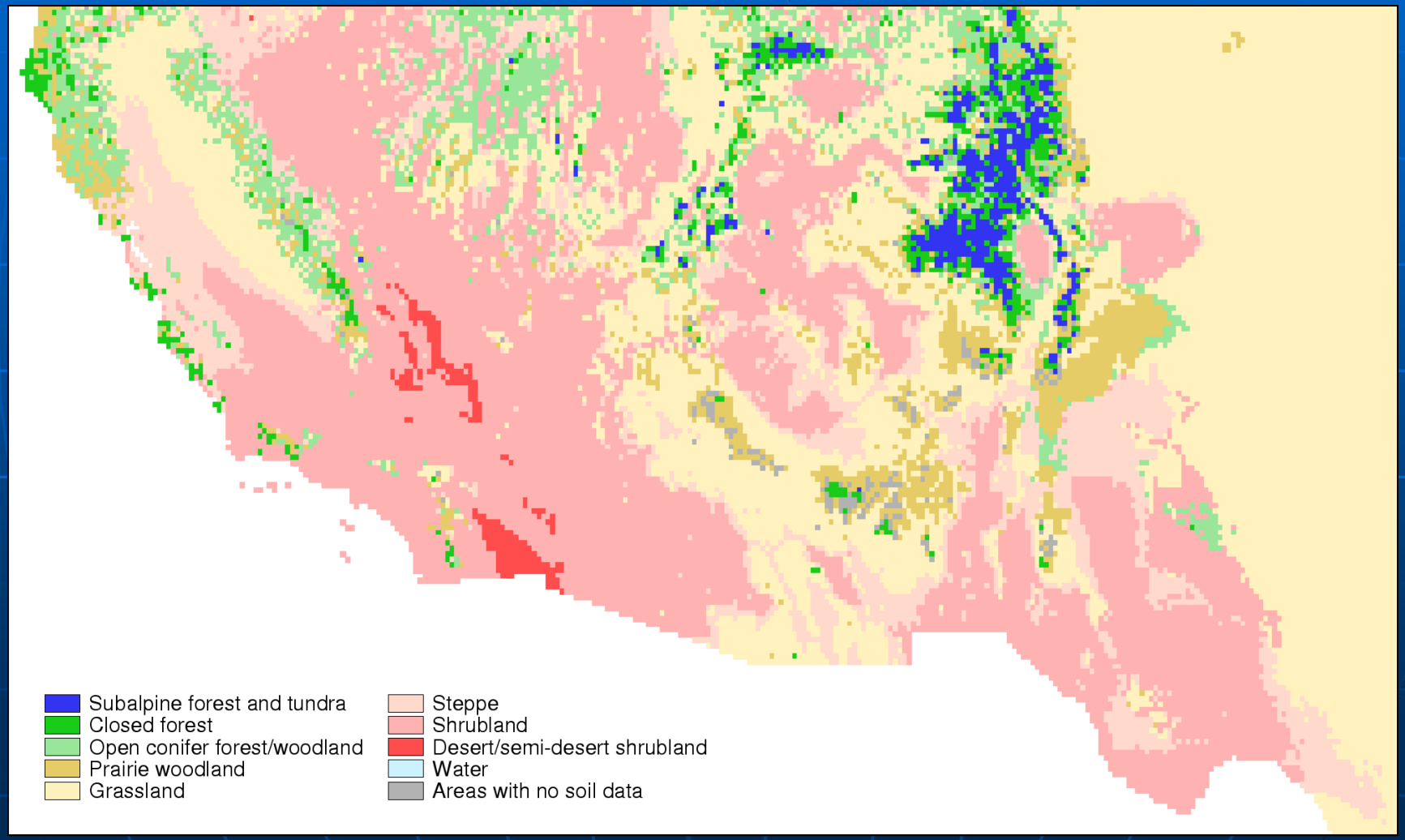
Pinus contorta latifolia growth (Rocky Mountain variety) is more sensitive, lessened as climate warms

Pinus contorta contorta (coastal variety) is less sensitive, increased as climate warms



Gerald E. Rehfeldt et al. (1999) Ecological Monographs

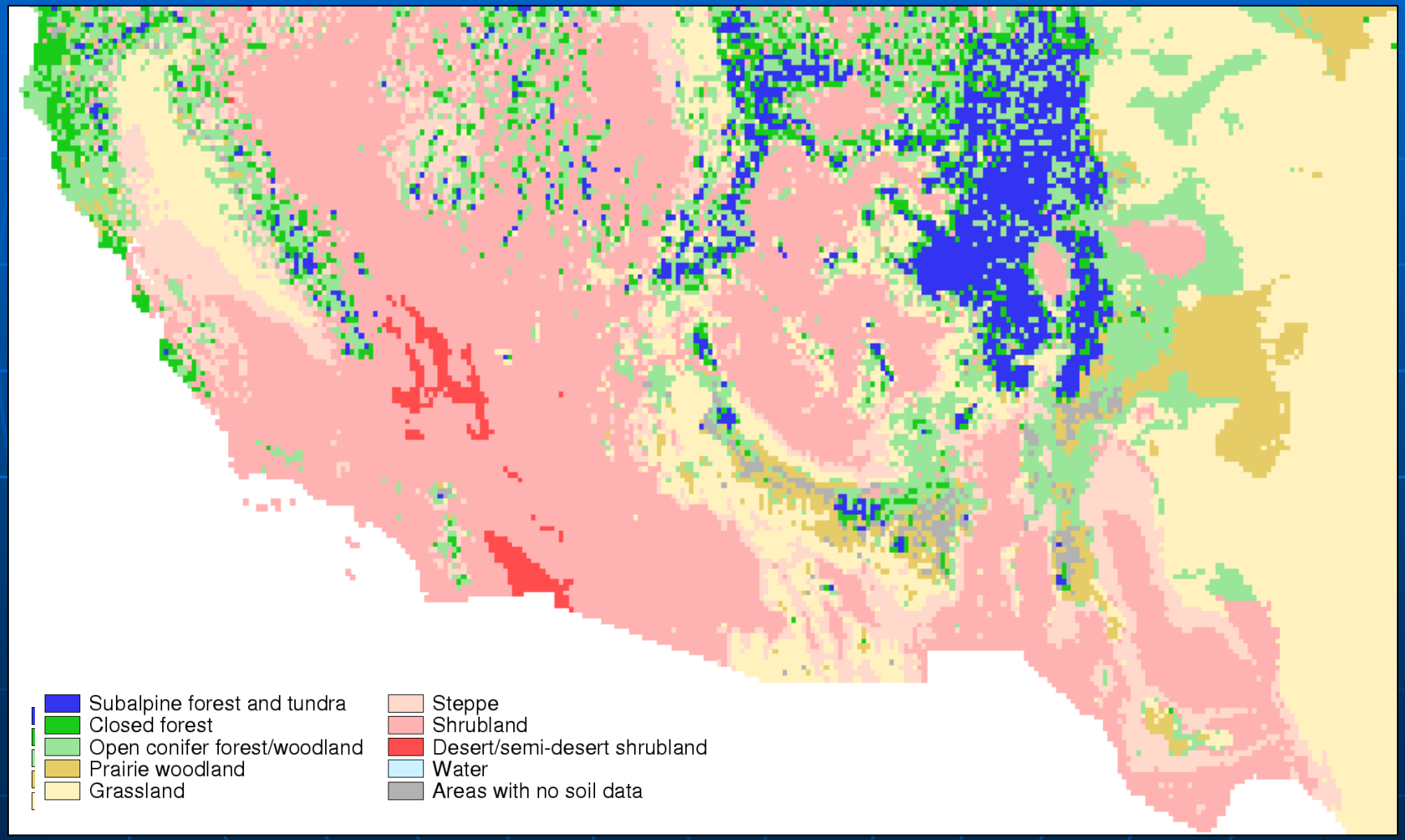
Simulated Potential Vegetation 1961-1990



Simulations by Sarah L. Shafer, USGS, unpublished; future climate from HADCM3 Climate model in the WCRP CMIP3 data set.

Simulated Potential Vegetation 1961-1990

With Climate of 2071-2100



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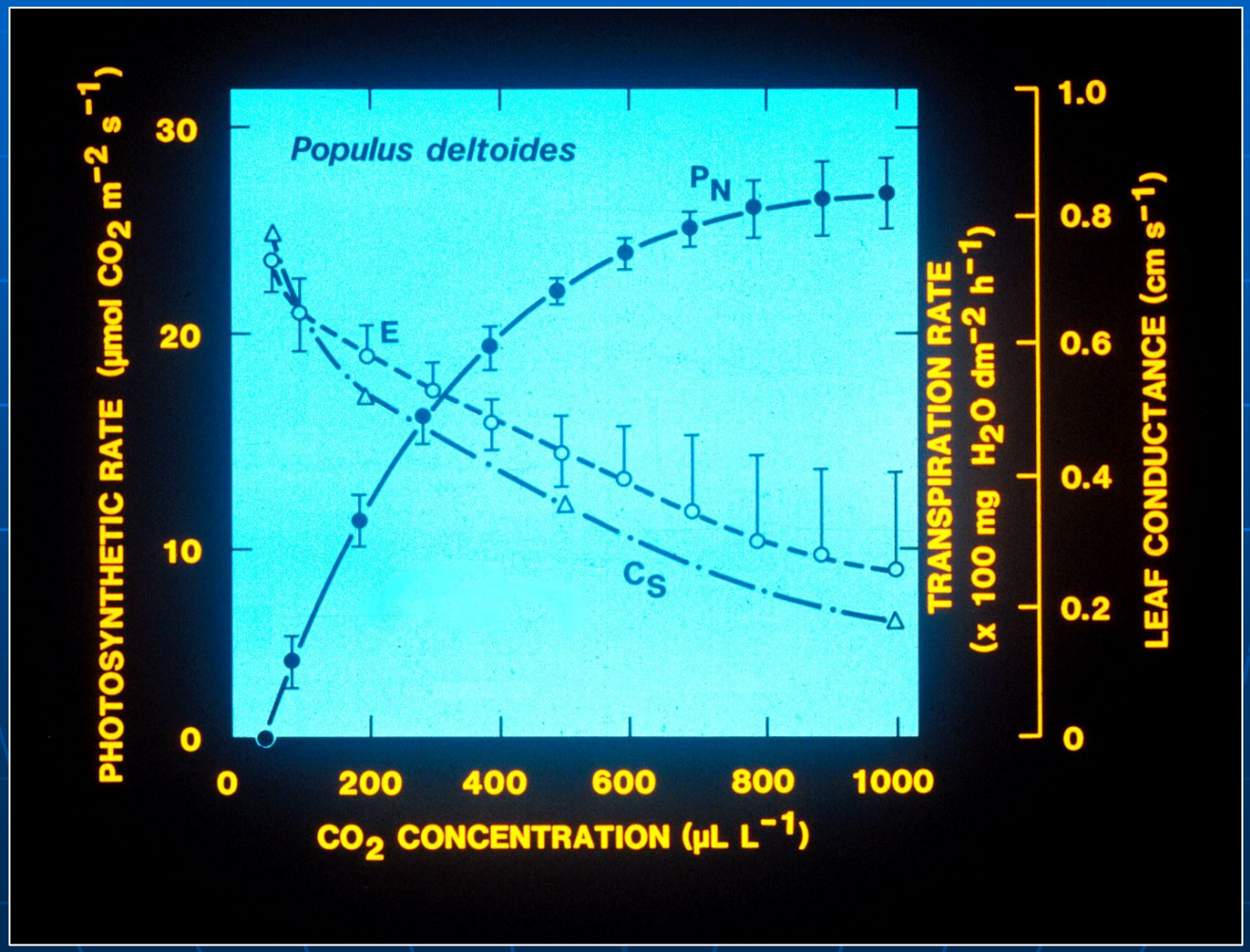
Direct Effects of CO_2: Greater Growth, More Drought Resistance



D.L Regehr, FA Bazzaz, WR Boggess, 1975. Photosynthetica 9:52-61

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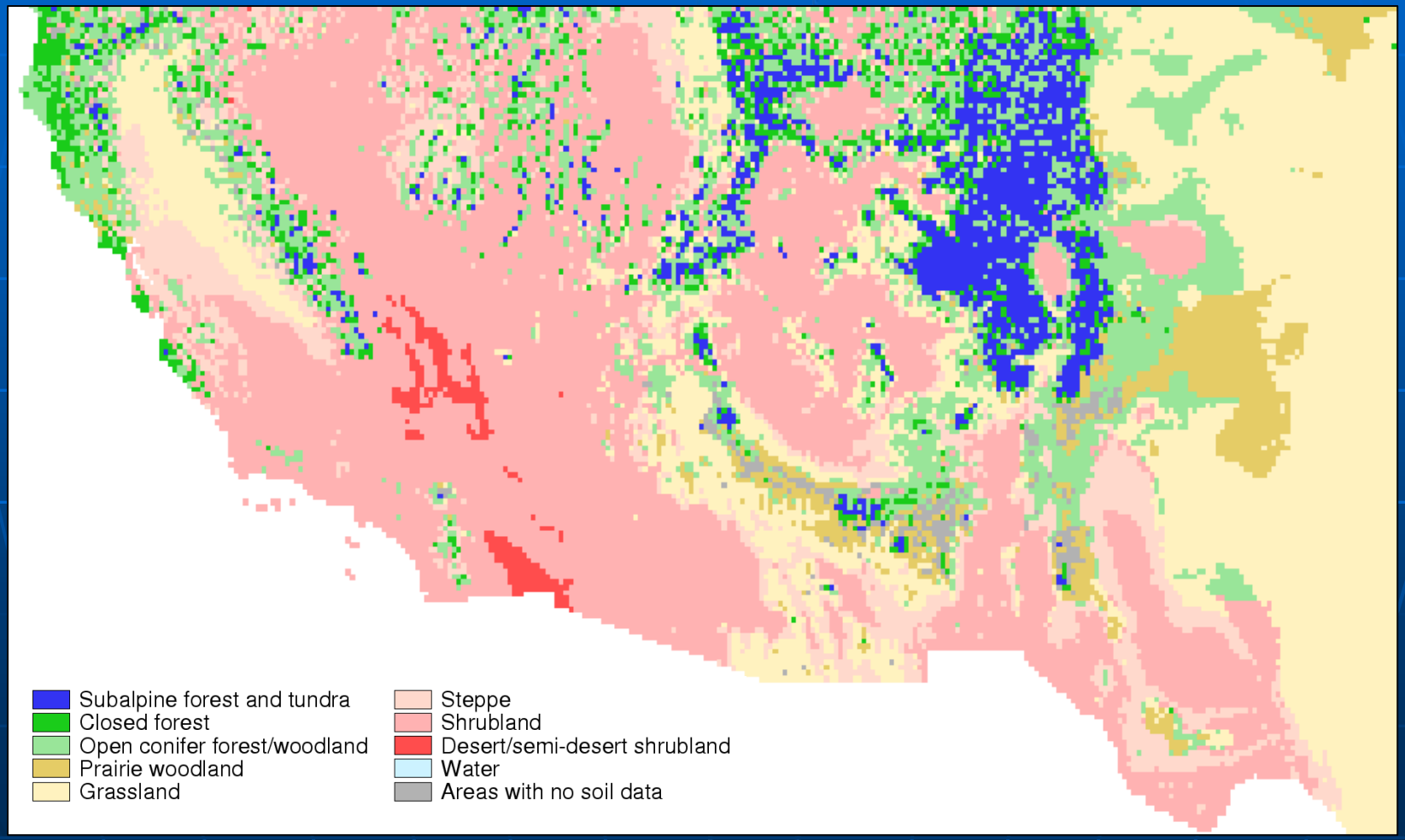

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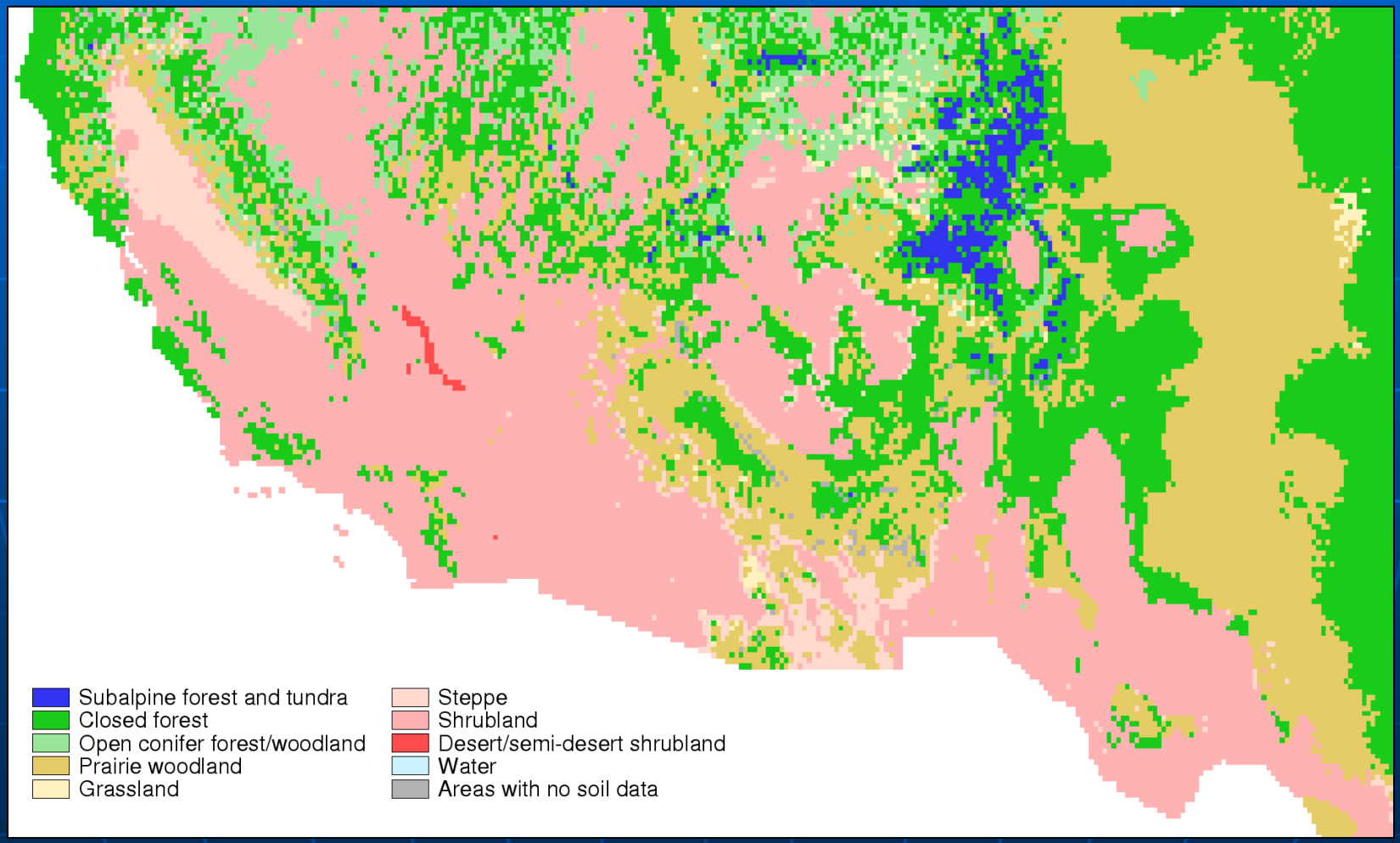
Simulated Potential Vegetation with Effects of Climate Change and CO_2 increase



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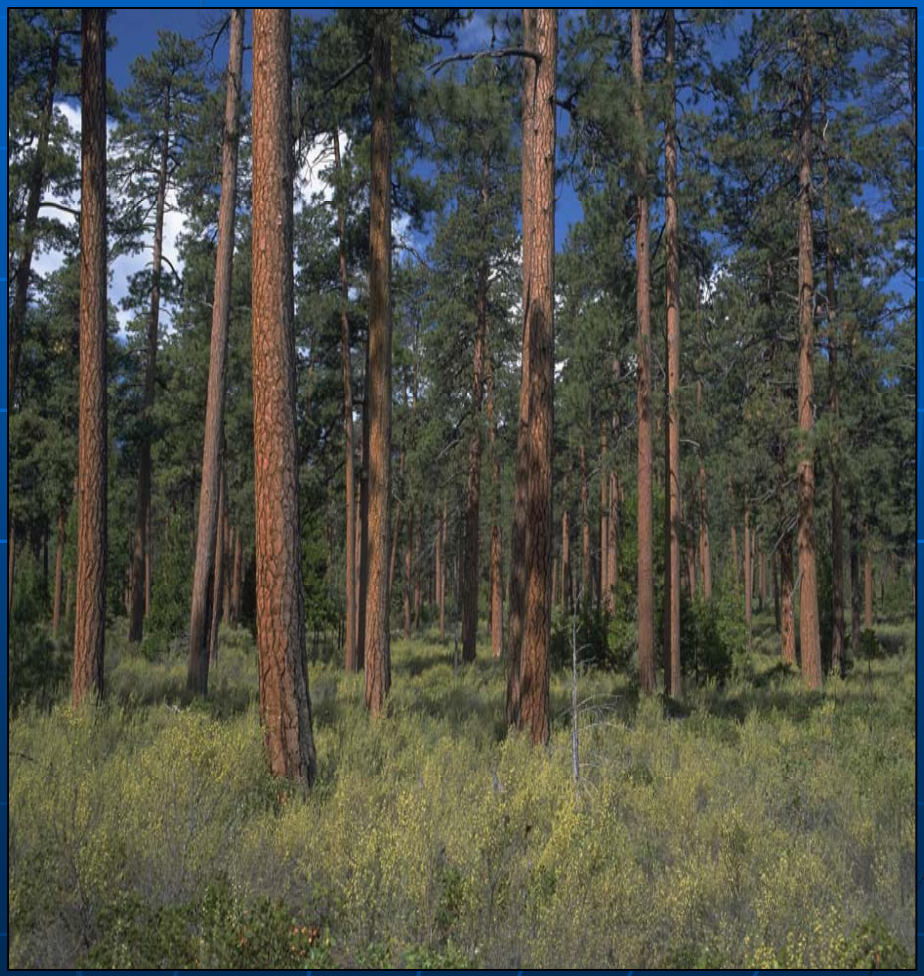
Direct Effects of Atmospheric CO_2 and Management on Forests: Enhanced Tree Density at All Vertical Levels

- Grazing consumed fine fuels for the past 100+ years
- Fire suppressed for the past 50 years
- Logging reduced for the past 20 years



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Indirect Effects of Climate Change on Forests: Drought and Pests

Warmth and drought enhance epidemics in forests.

Insect and disease epidemics are increasing in number and spreading rapidly.

Photos by Craig Allen, US Geological Survey

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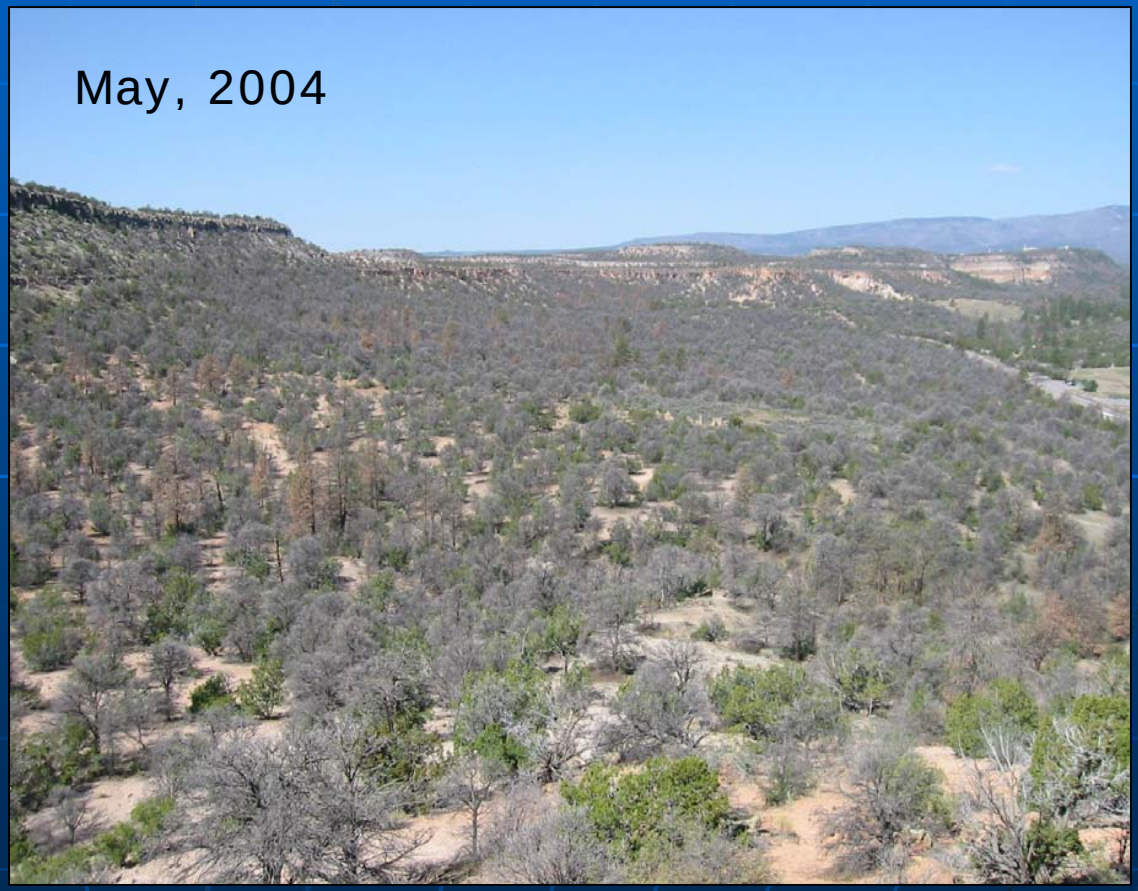


Photos by Craig Allen, US Geological Survey

Indirect Effects of Climate Change on Forests: Increasing Crown Fires

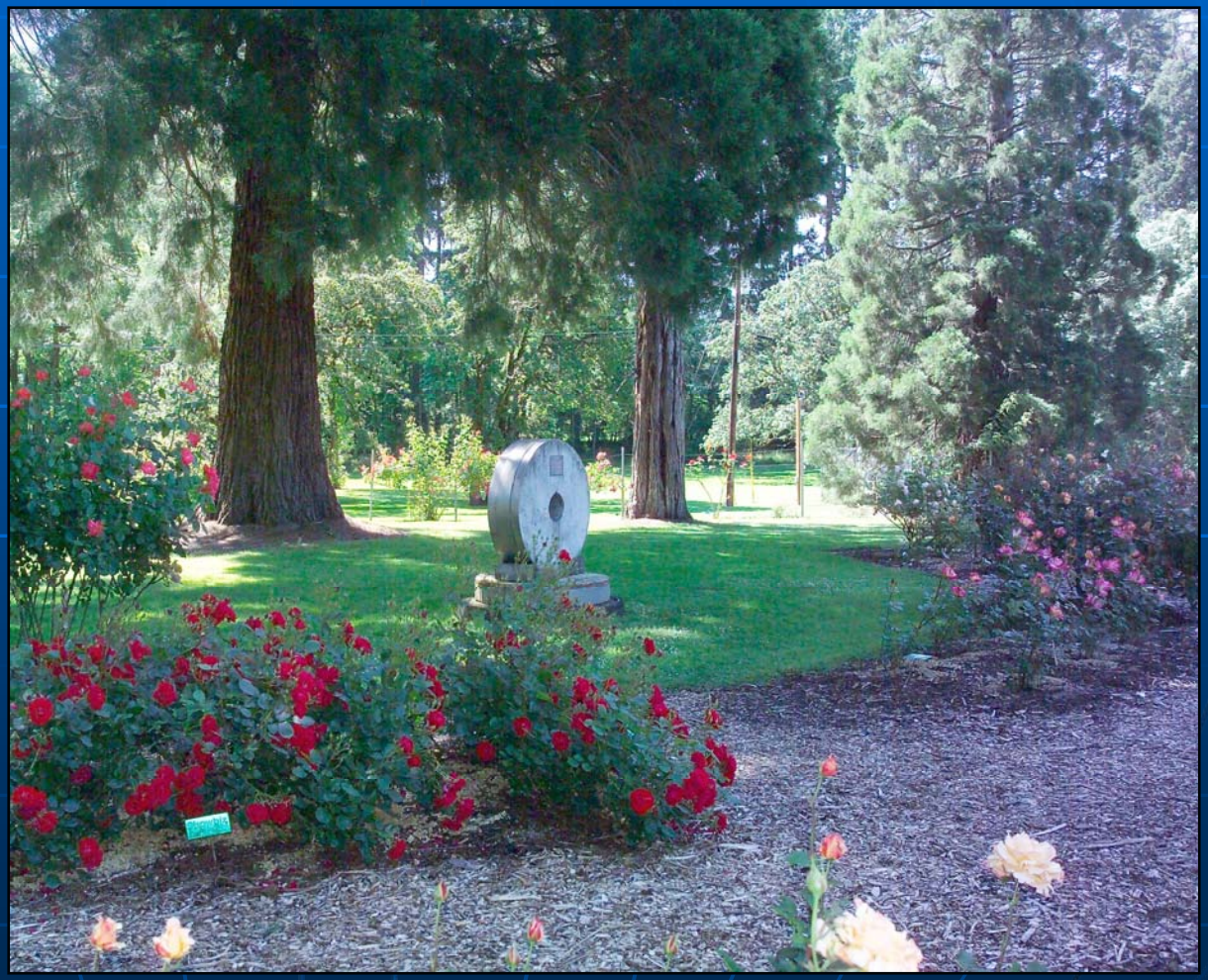
- Warming increases the frequency of intense stand-replacing fires
- Many large fires are in diseased and drought stressed forests

Indirect Effects of Climate Change on Forests: Slow Migration to Suitable Climate

- Climate change rate is an order of magnitude greater than measured migration rates
- Lodgepole pine, as N.Z. Wildings, into suitable sites
- Establishment is critical, then slow reproduction and spread

Increase Forest Resilience: Assist Migration of Tree Varieties and Species

- Established trees thrive beyond their natural boundaries
- Seedlings rarely survive outside their current boundaries
- Establish future species in today's montane forests now



Increase Forest Resilience: Enhance Species and Provenance Diversity

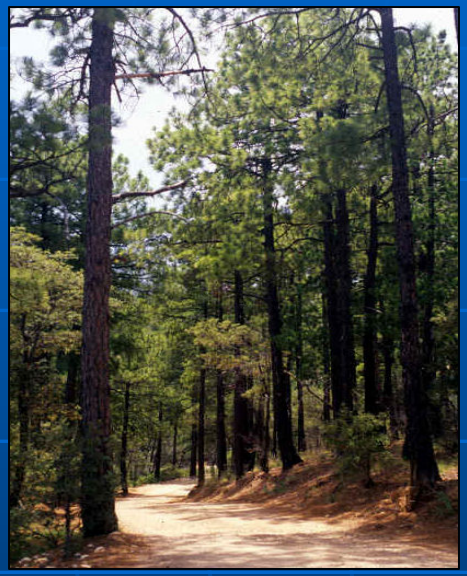
- reduce intensity of pest infestations
- increase probability that needed future species will be present

Increase Forest Resilience: Thinning while Retaining Forest Structure

- Increased water and nutrients for remaining trees
- Decreased fuels to carry wildfire to canopy
- Decreased food for, and increased resistance to insects

David Peterson, USFS PNW Station, Seattle WA

Forest Carbon Cycle: Normally a Process Taking Hundreds of Years

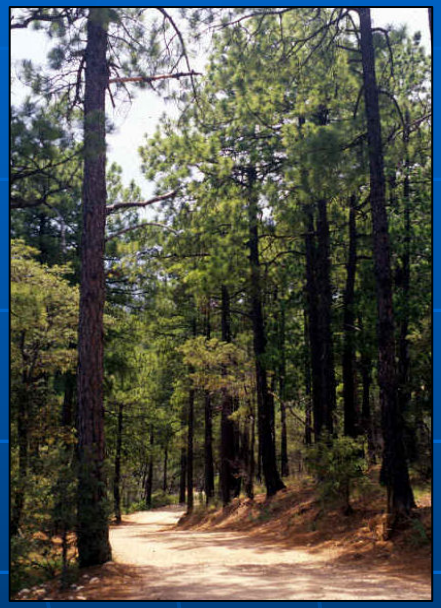


decades, centuries

years,
decades

days,
years

Forest Carbon Cycle: Now We Must Increase Cycling Rates



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Thank you.