

Climate Change and Biodiversity in Ecosystems of Eastern Washington

The Nature Conservancy
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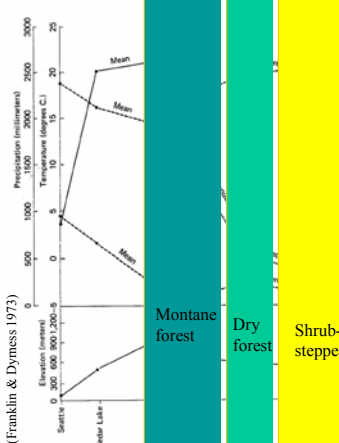
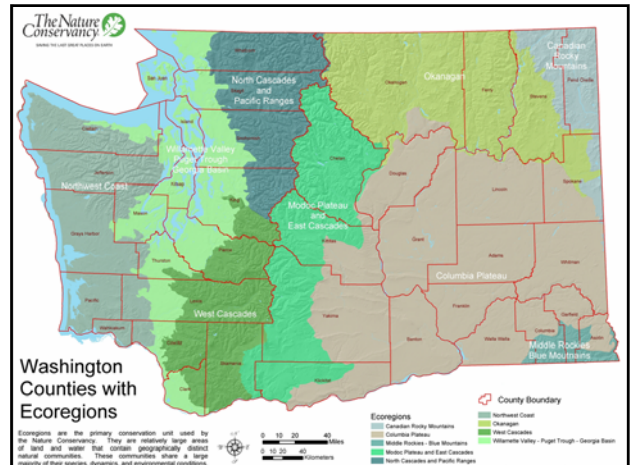
The Nature Conservancy



"To preserve the plants, animals and natural communities that represent the diversity of life on Earth by protecting the lands and waters they need to survive."

Climate Change and Biodiversity in Ecosystems of Eastern Washington

- Overview of major habitat types
- Effects of increasing temperature
- Effects of altered atmospheric chemistry (C, N)
- Interactions
- Strategies



Temperature and
moisture gradients
across the Cascades



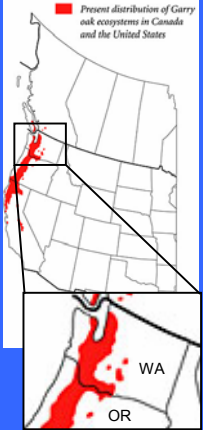
Natural disturbance regimes

- Frequent, low-intensity wildfires




UGA4800012

Oregon white oak woodlands

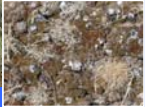



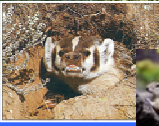
WA
OR

Oregon white oak woodlands



Shrub-steppe Habitats




sage grouse

Land use changes





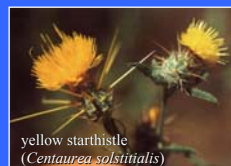

Land Use Changes

60% of WA shrub-steppe converted
(Dobler et al. 1996)



Invasive plant species: Impacts

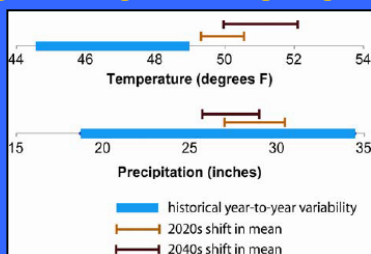
- Compete with native plant species
- Alter ecosystem properties
- Disrupt wildlife-habitat relationships



yellow starthistle
(*Centaurea solstitialis*)

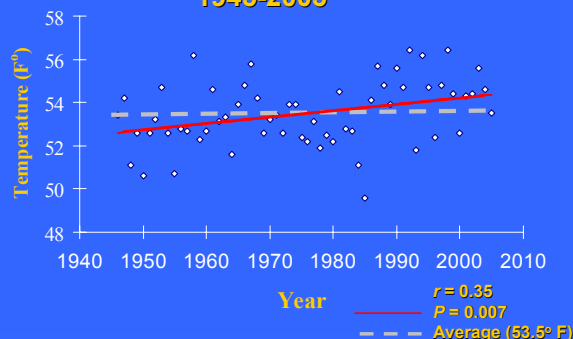
diffuse knapweed

Changes in temperature & precipitation

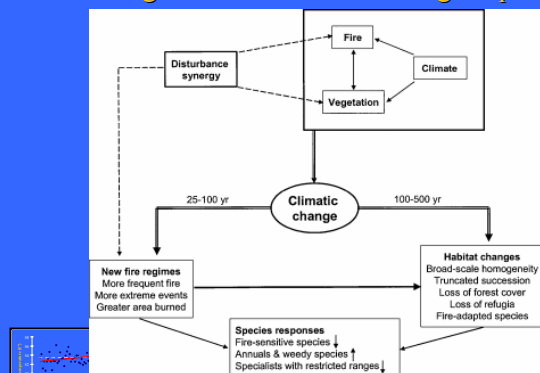


Comparison of historical year-to-year variations in temperature and precipitation with projected shifts in average temperature and precipitation (Casola et al. [UW Climate Impacts Group] 2005).

Annual Average Temperature Hanford Meteorological Station (223.5m) 1945-2005

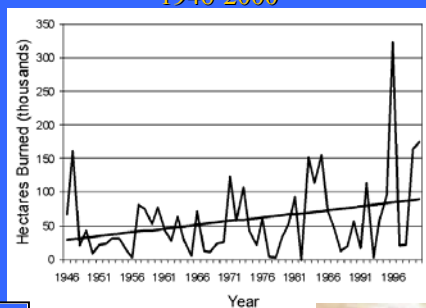


Wildfire regimes: Effects of increasing temperature



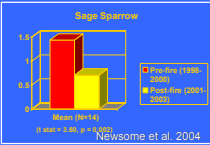
Longer periods of moisture stress.
Longer windows for extreme fire weather

Increase in shrub-steppe area burned, WA, OR, ID, 1946-2000



(Rich et al. 2005)





• Sagebrush obligate species decline

(Newsome et al. 2004, Vander Haegen et al. 1999, Dobler 1994, Brandt & Rickard 1994)



• Biological soil crusts scarce and species-poor in areas of recent severe fire

(McIntosh 2003)

Shrub-steppe dependent wildlife

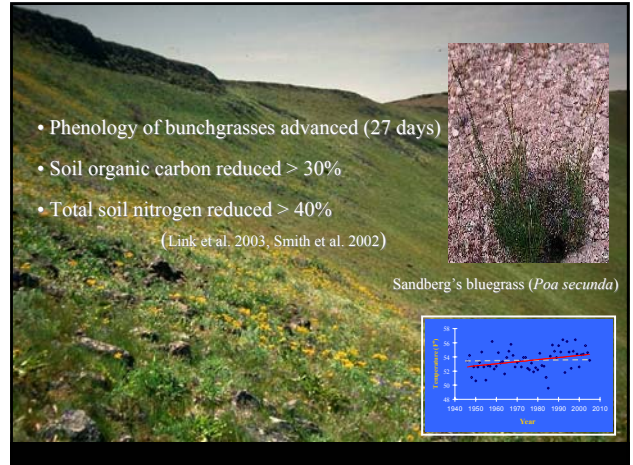
- **Pygmy rabbit**
(Fitzner & Gray 1991)
- **Sage grouse**
- **Small mammals**
(Gitzen et al. 2001, Brandt & Rickard 1994, Yensen et al. 1992)
- **Invertebrates?**
(Welch 2005, Fielding & Brusven 1994)



Switch from stand-maintaining to stand-destroying fire regime

Changes in species composition

Shift in ecotone position



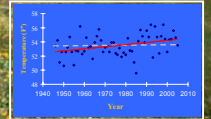
• Phenology of bunchgrasses advanced (27 days)

• Soil organic carbon reduced > 30%

• Total soil nitrogen reduced > 40%

(Link et al. 2003, Smith et al. 2002)

Sandberg's bluegrass (*Poa secunda*)



CO₂

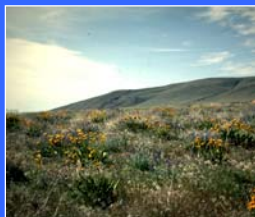


Species	CO ₂ (ppm)		Source
	340-350	650-680	
big sagebrush	25.1	27.5	Johnson & Lincoln 1990
Indian ricegrass	10.4	11.4	Smith et al. 1987
Smith's wheatgrass	20.5	26.8*	Smith et al. 1987
Cheatgrass	9.6	14.8*	Smith et al. 1987

* P < 0.05

Implications

- ↑ Fuel loads +
- ↑ Fuel continuity =
- ↑ Fire frequency



Cheatgrass

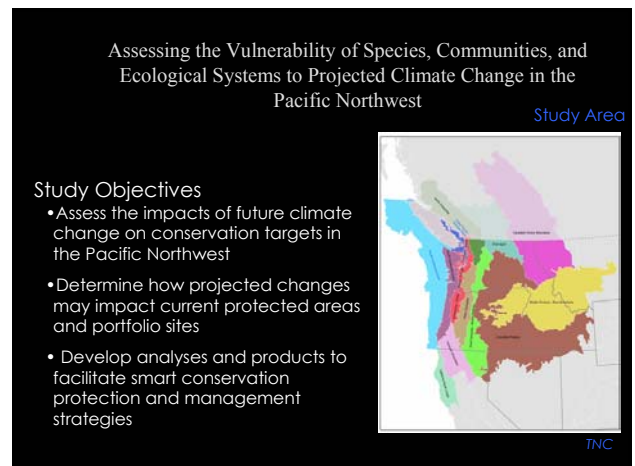
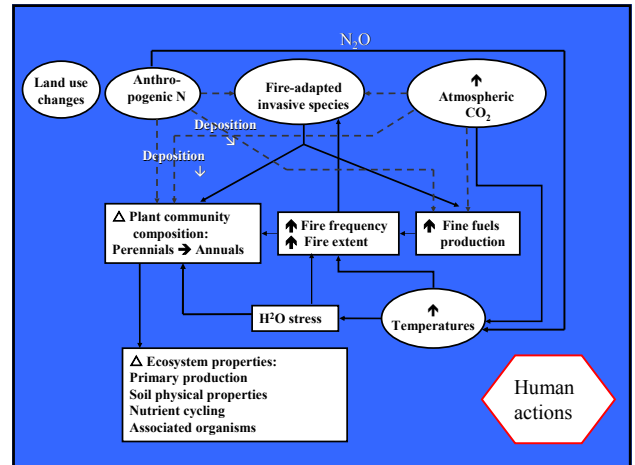
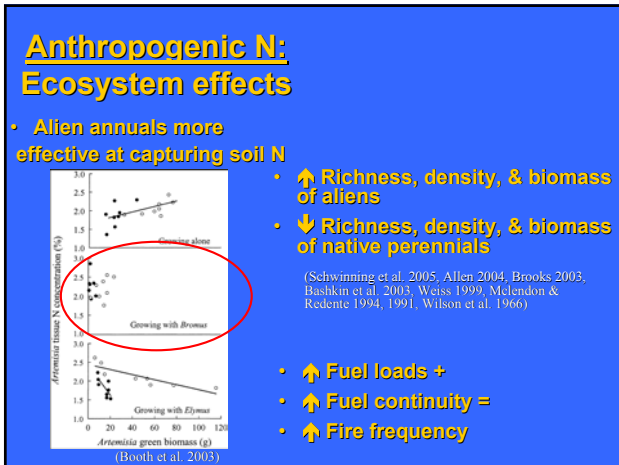
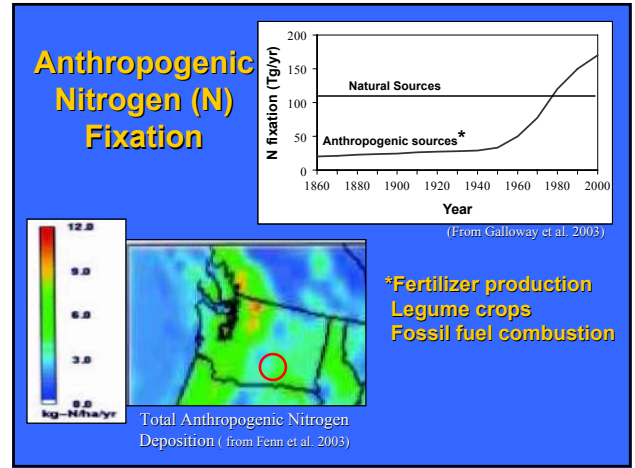


Bromus tectorum

Cheatgrass/wildfire cycle:

- Outcompetes native perennial seedlings
- ↑ frequency and extent of wildfires
- Replaces fire-sensitive perennial shrubs, grasses, and forbs.
- Conversion of shrub-steppe to annual grassland





Proposed products include

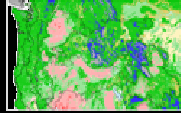
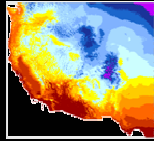
- Projected change maps

Climate

Vegetation

Birds and mammals

- Portfolio-site specific analyses



Figures, top to bottom: Flato et al., CGCM3.1 data; Shafer 2000; USGS

Yellow-bellied Marmot



stable
expansion
contraction

