Conifer Encroachment in a Montane Meadow, Western Cascade Range, OR.

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Conifer Encroachment

- Widespread phenomenon
- Three widely proposed causes
  - Fire suppression
  - Climate change
  - Sheep grazing
- Interactions among causes
  - Woodward et al. 1995, Miller and Halpern 1998
Bunchgrass Meadow, Oregon

- Site description
  - Dry, montane meadow, 1300m elevation
  - Grand fir and lodgepole pine
  - Soils formed under meadows

- Current studies
  - Process and consequences of encroachment
  - Experimental restoration
Bunchgrass Meadow, Oregon
4,1 ha Intensive Sampling Plots
Objectives

- Examine temporal patterns and potential causes of conifer encroachment
  - Climate variation
  - Grazing
  - Changing fire regime / Native American use

- Describe spatial patterns of conifer encroachment
  - Spatial distributions through time
  - Role of species interactions
Timing of Establishment

- 1825 - 1904, 1915 - 1984

Combined age structure

n = 5, 486 trees
Climate

- Precipitation, PDSI, Temperature, Snow Pack
  - Climate reconstructions from Miller 1995

- Spearman Rank Correlation
  - Positive correlation with snow pack (p<0.01)
  - 92.5% of total precipitation September through May

- Substantial conifer establishment 1930-1939
Sheep Grazing

• Burke (1979)
  – Lookout Mountain / Mt. Washington Allotment
    • 1912-1938
    • 2445 sheep/year

• Historical Records, Willamette NF
  – Too many “Bunchgrasses”...

• Substantial establishment prior to 1938
Fire History

• Mixed severity landscape
  • Morrison and Swanson (1990) and Stewart (1986)

• Lack of physical evidence

• Potential influence of Native Americans
  - Unique resources
  - Native American use of fire widely debated
Native Americans

• Molalla Indians
  - Possible historic use

• Disease epidemics 1830s

• 1855 executive order ceded Molalla lands, relocated to Grand Ronde Valley

• Warm Springs Indians
  - late 1800s to 1920s
  - Potential grazing and burning
Combined age structure

Number of stems per hectare

Shift to cooler, wetter climate
Molallas moved to Grand Ronde
Molalla Disease Epidemics

Euro-American sheep grazing
Potential Warm Springs grazing and burning
Spatial Patterns of Establishment

- Spatially and temporally complex
- Species specific
Plot 3

• 1904

- Grand fir
- Lodgepole pine
- Other species
- Dead grand fir (15-30 cm dbh)
- Dead lodgepole pine (15-30 cm dbh)
Plot 3

• 1904

Grand fir
Lodgepole pine
Other species
Dead grand fir (15-30 cm dbh)
Dead lodgepole pine (15-30 cm dbh)
Plot 3

- 1954

• Grand fir
• Lodgepole pine
• Other species
• Dead grand fir (15-30 cm dbh)
• Dead lodgepole pine (15-30 cm dbh)
Plot 3

1954

- Grand fir
- Lodgepole pine
- Other species
- Dead grand fir (15-30 cm dbh)
- Dead lodgepole pine (15-30 cm dbh)
Plot 3

• 1954

Grand fir
Lodgepole pine
Other species
Dead grand fir (15-30 cm dbh)
Dead lodgepole pine (15-30 cm dbh)
Lodgepole Establishment
Lodgepole – Grand Fir Facilitation
Lodgepole - Grand Fir Facilitation
Temporal patterns and potential causes

- Two periods of conifer establishment
  - 1825-1904
  - 1915-1984
- Climate, Grazing
  - Secondary influences
- Native American burning?
  - Encroachment coincides with changes in Native American activity
Spatial patterns

• Spatially and temporally complex
  - Initial establishment of lodgepole
  - Facilitation of grand fir – tree islands

• Ongoing research
  - Spatially explicit analysis
  - Vegetation responses to encroachment
• Joint Fire Sciences Program, HJ Andrews LTER

• Fred Swanson and John Cissel

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