Hey, where'd all those trees come from?

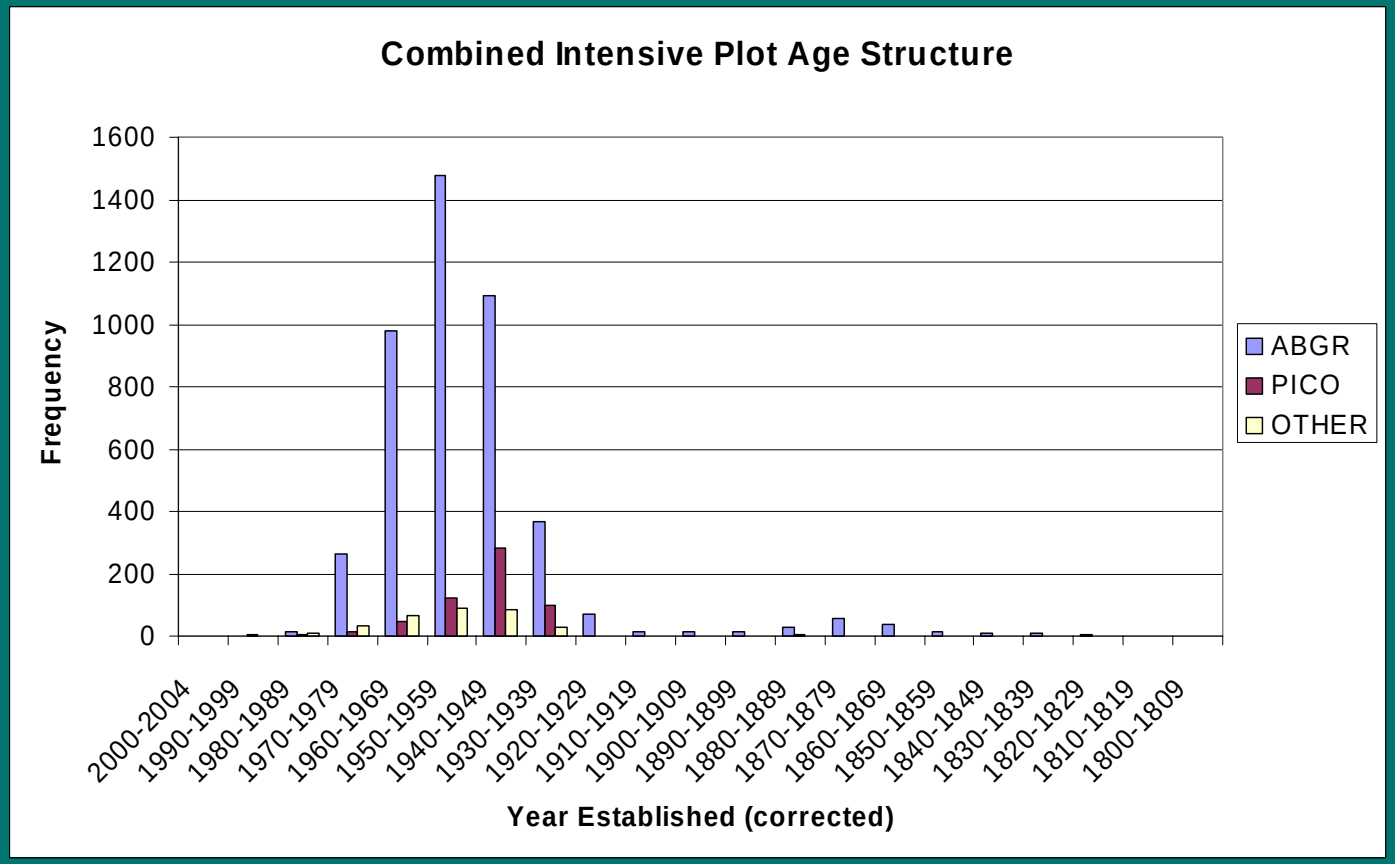
Causes and consequences of conifer encroachment

Objectives

- Consequences of conifer encroachment for ground-layer vegetation
  - Community and species level responses over time
  - Not quite there yet...
- Relationship between temporal patterns of conifer encroachment and potential causes
  - Climate variation
  - Grazing
  - Fire Regime / Native American use

Establishment Pulses

- 1850-1859 until 1880-1889, peak 1870-1879
  - Grand fir (*Abies grandis*)
- 1920-1929 until 1970-1979, peak 1950-1959
  - Grand fir, lodgepole pine *(Pinus contorta)*, others

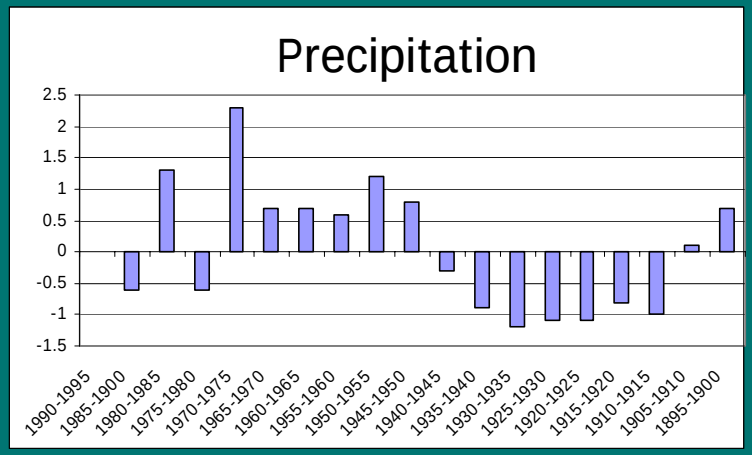


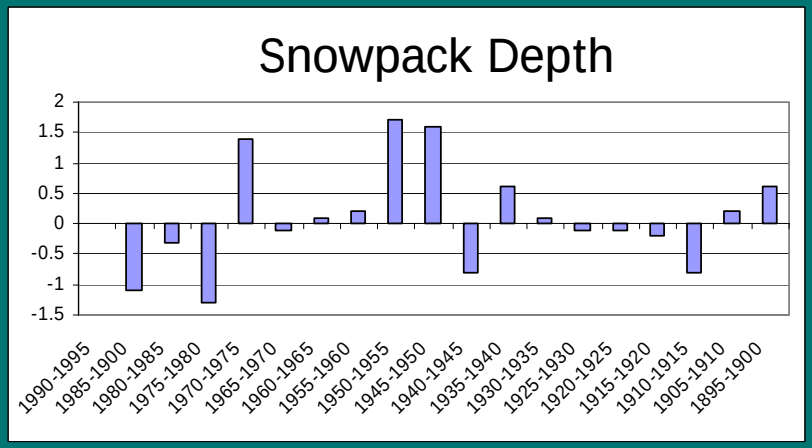
Climate and Conifer Establishment

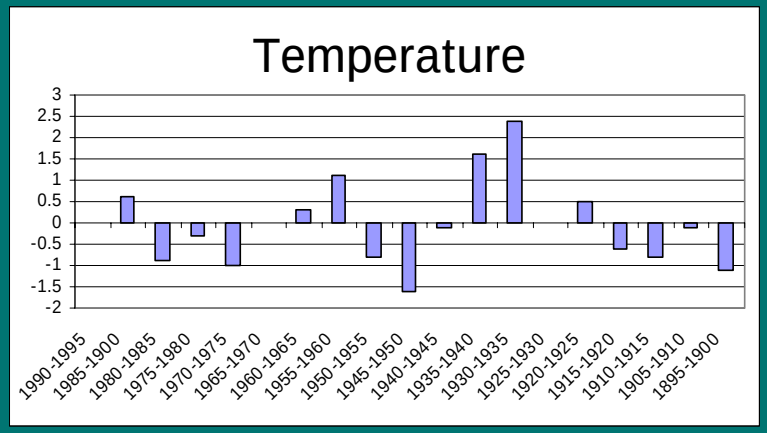
- Dry Meadow Habitat
  - Conifer establishment limited by moisture?
- Vale 1981, Increased precipitation, lower annual temps correspond to encroachment

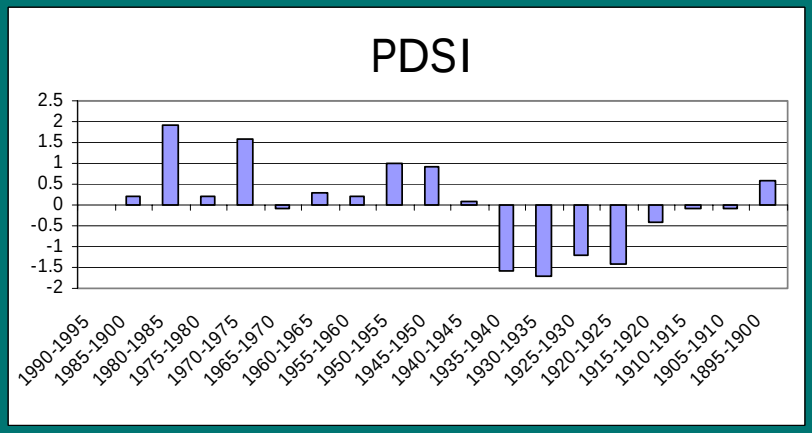
Climate and Conifer Establishment

- Precipitation, PDSI, Temperature, Snow Pack
  - Miller 1995









Climate and Conifer Establishment

- Precipitation, PDSI, Temperature, Snow Pack
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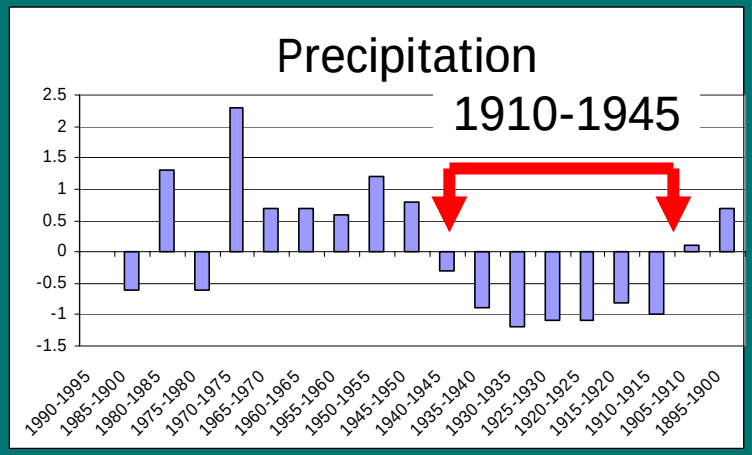

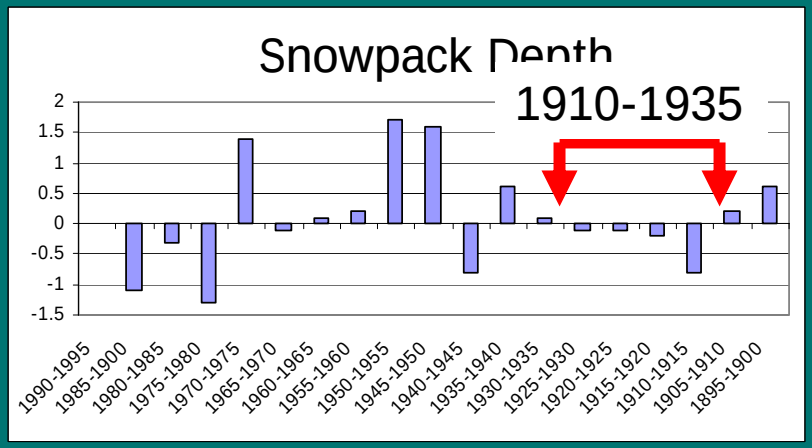

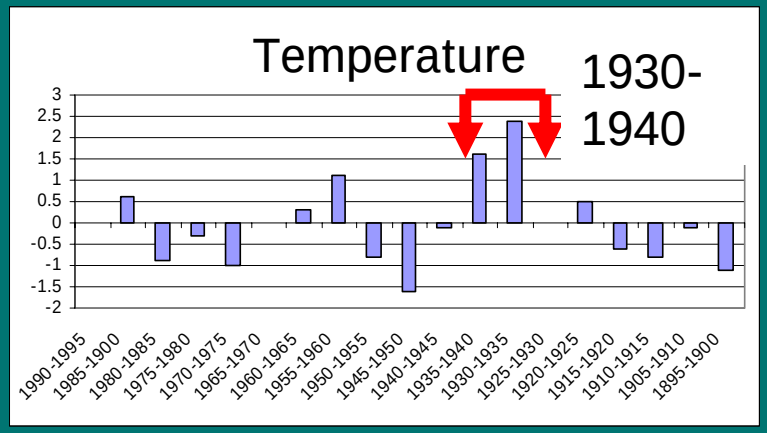

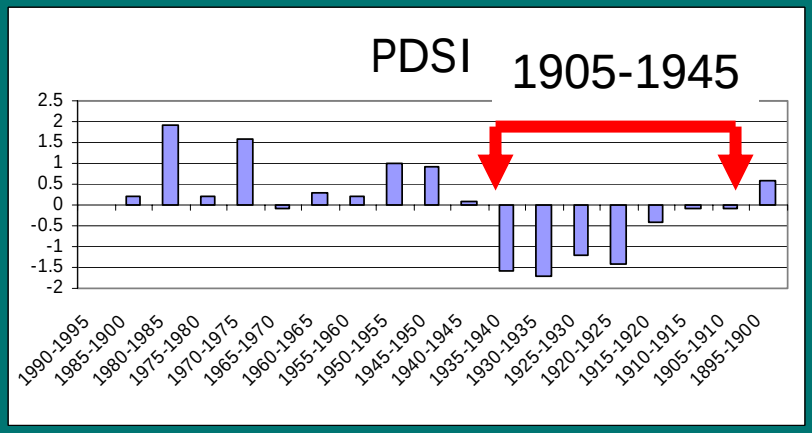

Climate and Conifer Establishment

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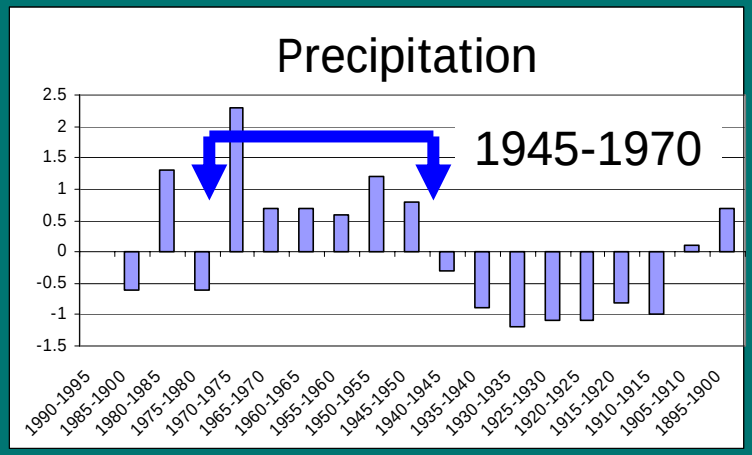
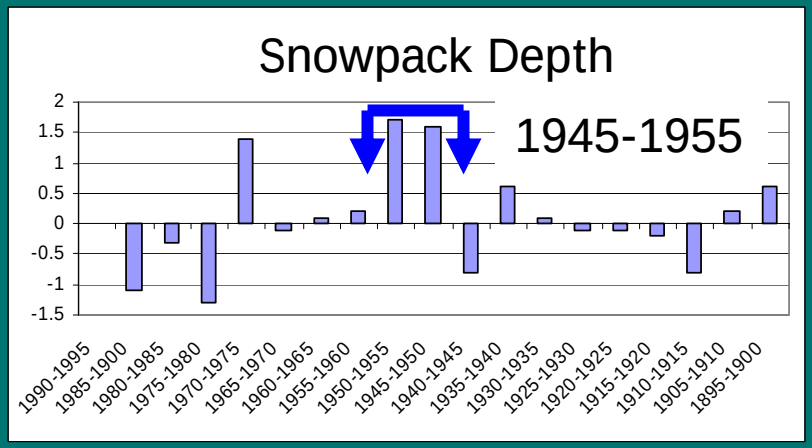
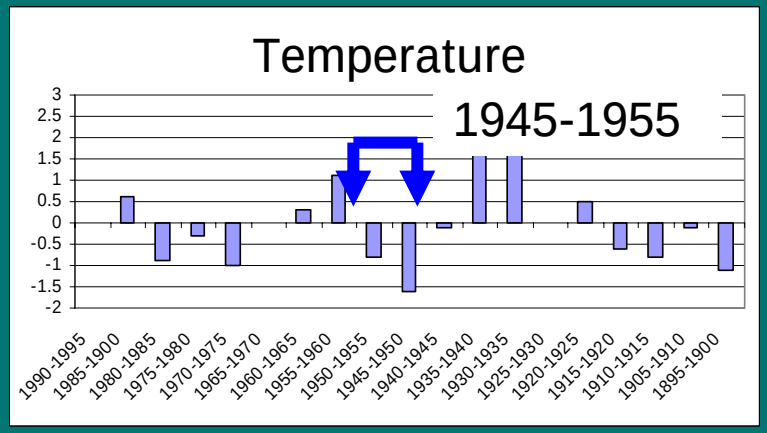
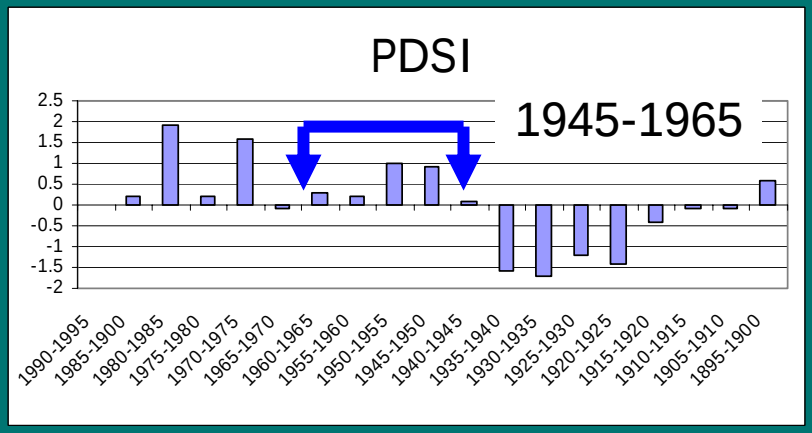








Climate and Conifer Establishment

- Spearman Rank Correlation
  - Positive correlation with snow pack ($p<0.01$)
  - 92.5% of total precipitation September through May
- Temp?, Precip?, PDSI? - nope
- Substantial conifer establishment 1930-1939

Fire and Bunchgrass

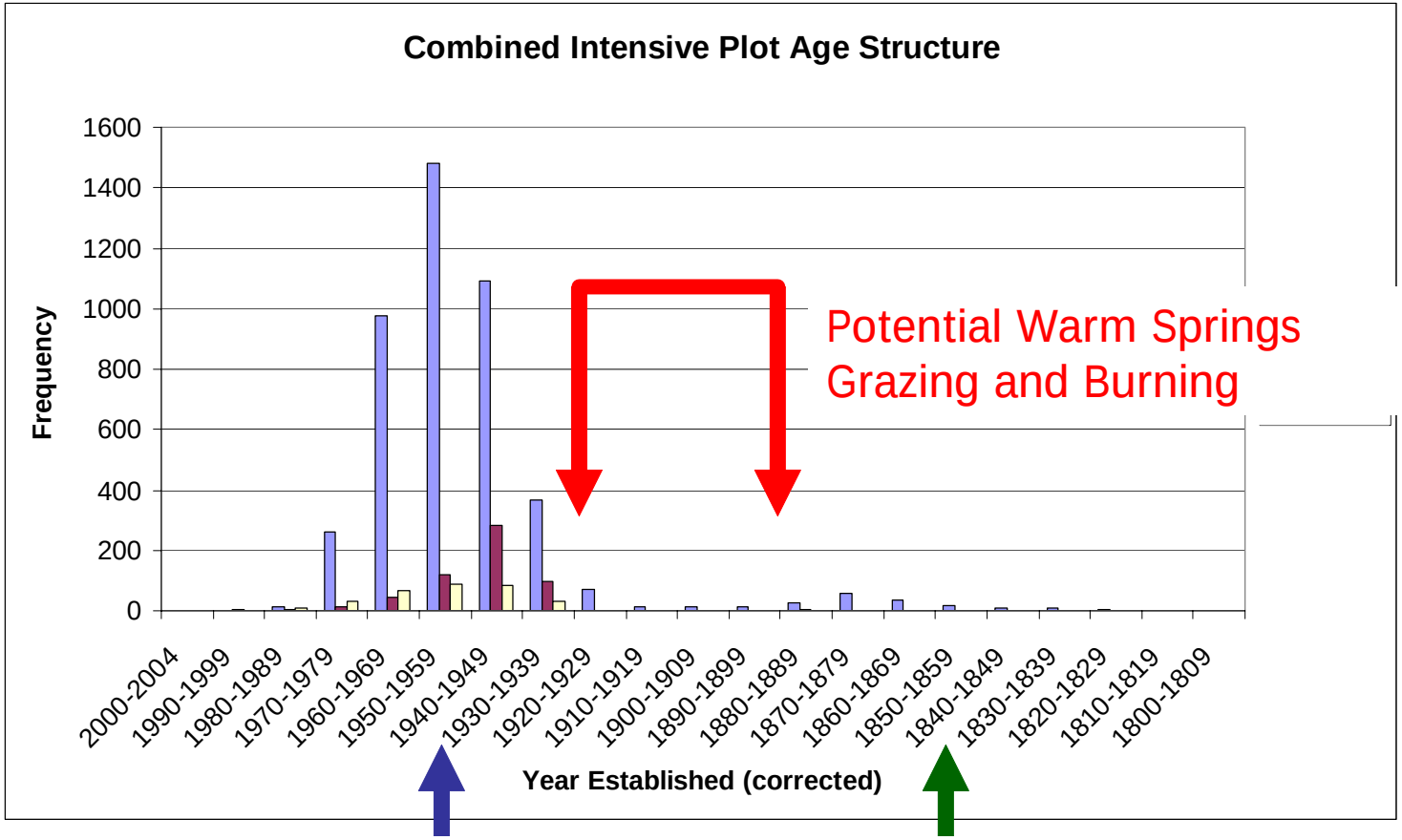
- Creation and maintenance of meadows (Kuramoto and Bliss 1970, Miller 1995)
  - Mixed-high severity landscape
  - No direct fire evidence

- Native American influences
  - Widely debated
    - Unique resources at Bunchgrass
    - Enhanced by a low severity fire regime

Native Americans and Bunchgrass

- Molalla Indians
  - Possible historic use of area
  - Archeological isolate; 2,000 to 6,000 ybp
- 1855 executive order ceded Molalla lands, relocated to Grand Ronde Valley
  - Disease epidemics 1830, 1832
- Warm Springs Indians
  - late 1800s to 1920s
  - Potential grazing and burning

Native Americans and Bunchgrass



Shift to Cooler,
Wetter Climate

Molalla Indians moved
to Grand Ronde

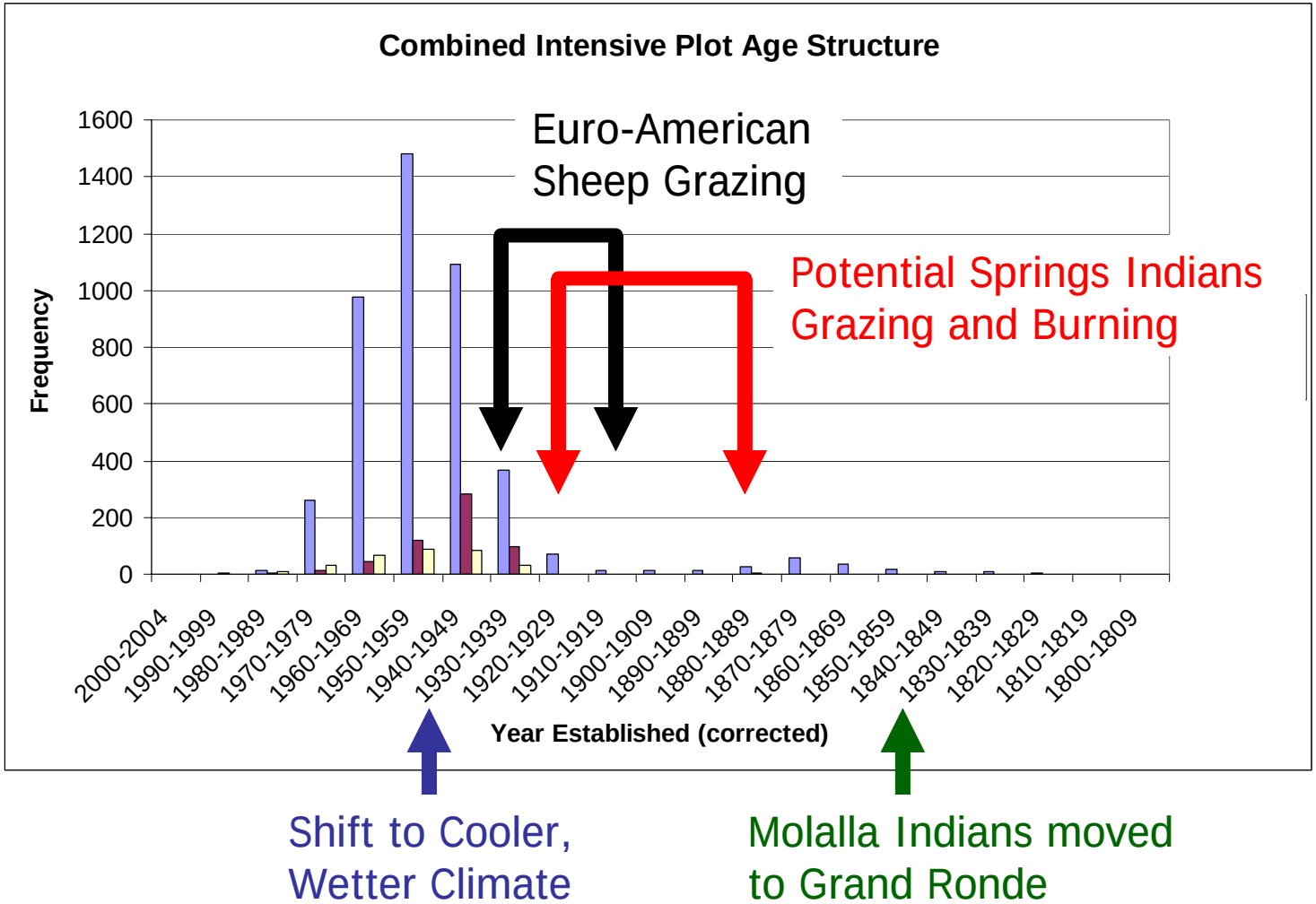
Sheep Grazing and Bunchgrass

- Sheep grazing common on Forest Service land throughout Cascades
  - Began 1800s
  - Early indications of habitat degradation
  - Poor records allotment numbers and locations
- Vale 1981, encroachment coincided with the end of grazing

Sheep Grazing and Bunchgrass

- Burke (1979)
  - Lookout Mountain / Mt. Washington Allotment
    - 1912-1938
    - 2445 avg. no./yr
- Historical Records Inventory, Willamette NF
  - Too many Bunchgrasses...

Bunchgrass History



Causes of Encroachment?

- Climate Variation, Sheep Grazing
  - Do not appear to be a primary cause
  - May have contributed to intensity of invasion
- Alteration of Native American activities
  - Coincide with pulses of conifer establishment
  - Potential use of fire
  - Lack of archeological and ethnographical evidence

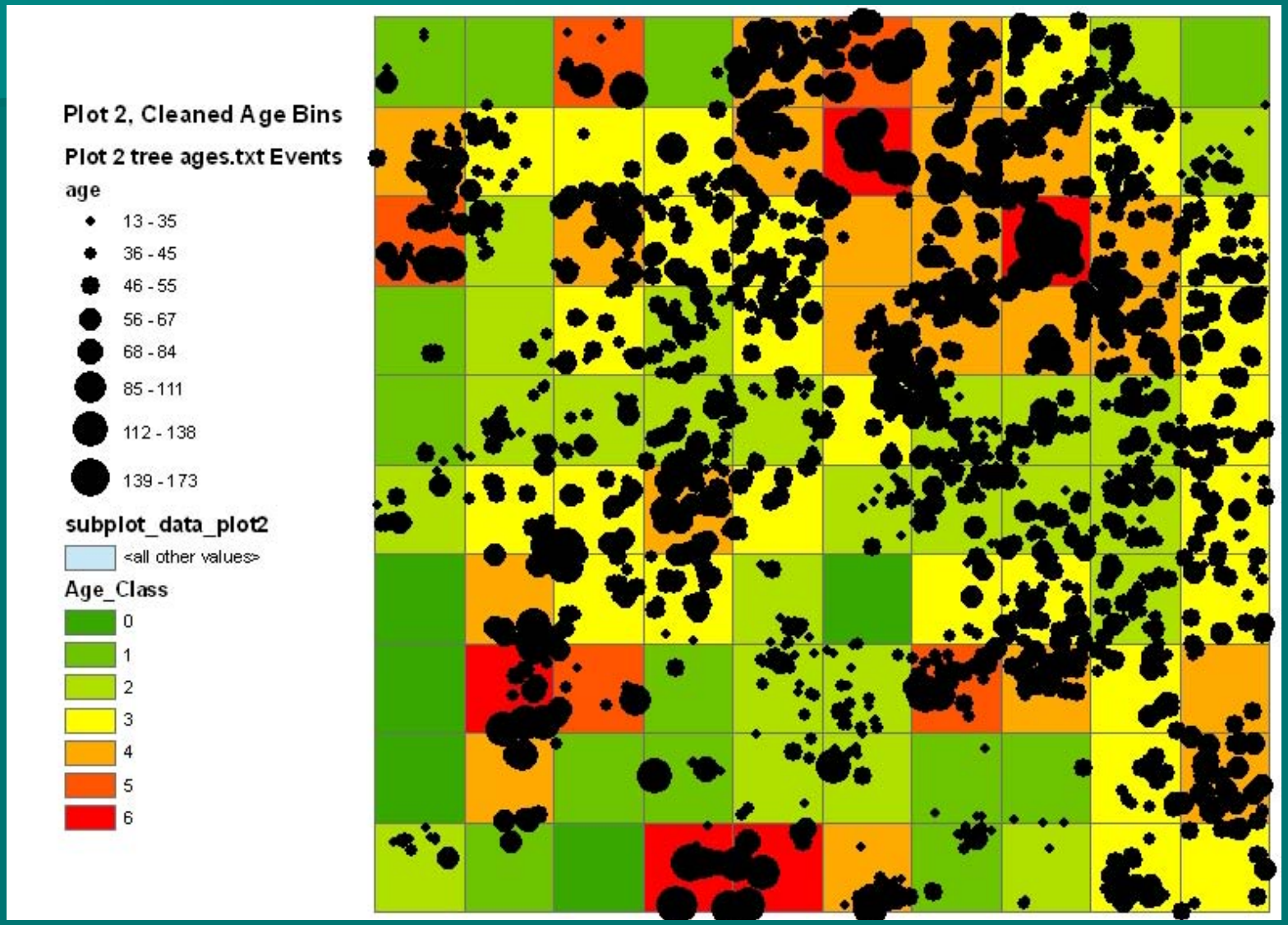
Taste of what's to come...

- Vegetation responses to conifer encroachment over time.
  - Subplots represent a chronosequence of encroachment histories
  - Place subplots into a "chronology"

Subplot Age Classes

- How to use the tree ages?
  - Oldest tree? Average tree age?
- Hierarchical clustering of plots based on 20 year age bins
  - Taylor and Skinner 2003

Subplot Age Classes



Finally, Vegetation Responses

- Change of forest structure over time
- Relationship between forest structure/age and vegetation composition/diversity
- Regression and ordination techniques
- Stay tuned...

- Thanks
  - Charlie Halpern, Joe Antos, Don Mckenzie
  - Nicki Lang, Jim Lutz, Kyle Smith, Halpern lab group and BG field crews

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