Vegetation responses to climatic change in the interior Pacific Northwest

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Climate in eastside forests features cold winters and hot summers (relatively)

- Much of winter precipitation is snow
  - Snowpack duration is 3-6 months
  - Snowpack stores winter precipitation for use in summer
  - Helps to synchronize growth phenology and soil water availability
- Summers are warm and sunny
- Result is fairly predictable extended summer dry period

What are the important climate change predictions for eastside forests?

- Warmer winter temperatures
  - Could reduce winter snowpack at lower elevations
- Altered precipitation patterns
  - Winter precipitation important for snowpack
  - Spring and summer precipitation mitigate drought stress somewhat
- Growing season temperatures
  - Importance depends on water availability

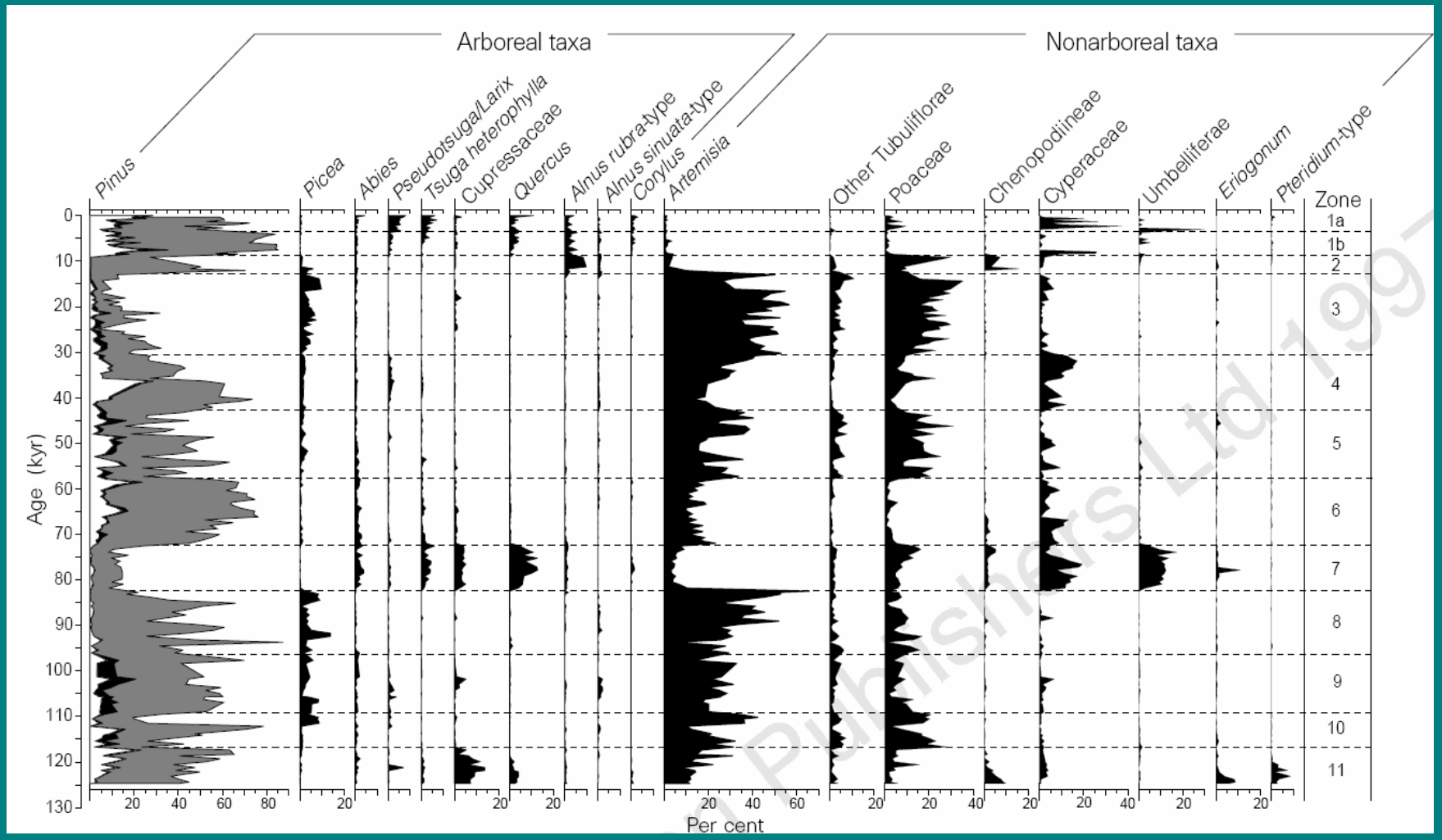
Climate influences on vegetation varies across elevation gradient

- Snowpack and temperature limit tree growth in subalpine forests
  - Snowpack delays growth onset
  - Delayed release of winter precip
  - Suboptimal growth temperatures
- Soil water availability limits growth in low elevation forests
  - Early snowmelt & growth onset
  - Soil moisture deficits limit growth
  - Temperatures above optimal

Climatic influences at middle elevations spatially and temporally variable…

- Winter temperature and precipitation influence snowpack water storage
  - Growth phenology
  - Soil water recharge timing
  - Summer drought onset and intensity/duration
- Spring/summer temperature and precipitation affect soil water availability, and drought timing, intensity, and duration

Pollen records show vegetation has changed with climate in the past…



Carp Lake, NW of Goldendale, WA

Whitlock and Bartlein 1997, Nature

At lower treeline, forest zone shifts may become evident following disturbances

- Mature trees tolerate stress better than seedlings
  - Can mask “extinction debt”
- Disturbances like fire kill mature and regenerating trees
  - Release growing space & resources
  - Reduce shading and access to deep soil resources
  - Alter seed availability
- Regeneration may be limited by
  - Lethal temperatures
  - Drought stress
  - Seed availability

Within forest zone, species shifts depend on disturbances, competition

- In closed-canopy forest, trees modify understory environment
- Shade tolerance may be more important than drought or temperature tolerances
- After disturbance, climate can exert more influence on establishment, competition, & survival

Much learning is still needed…but disturbances will likely be the big story!

- Regeneration
  - Climatic influences on seedling establishment and survival
- Mortality

- Wildfire will increase if fire season is extended in mixed conifer forests
- Insects and diseases are already a big problem and could become more so