Preparing for the Future by Looking at the Past

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“Through its influence on energy balance and water availability, climate is one of the significant long-term factors driving changes in the occurrence and distribution of ecosystems and communities.”

Bailey et al. 1994
Ecoregions of the US
A look into the past
Evidence

Pollen Cores

Ice Rafting

Packrat Middens

Middens from early cave dwellers

Carbon dating

Volcanic, aeolian soils, peat deposits
Bristle Cone in the White Mountains - 8,700 tree ring record

A.E. Douglas father of dendrochronology
From Eddy and Bradley 1991 & Tausch et al. 1993
Elevation: [\sim 3.3^\circ F \ (1000 \ ft) - 1].
Central Great Basin

Elevation (ft)

- J. osteosperma
- P. monophylla
- J. scopulorum
- P. ponderosa
- Pseudotsuga
- P. longaeva
- J. communis

Lake Bonneville Base Level
15000 – 20000 yr BB

= Current
= Late Pleistocene

Wells 1983
Elevation (m)

Central Great Basin

Southern Great Basin

J. osteosperma
P. monophylla

J. osteosperma
P. monophylla

= Current
= Late Pleistocene

Wells 1983
Early Holocene
10,500-7,500 BP

Mid Holocene
7,500 - 3,500 BP

Neo-Glacial
3,500 – 2,600 BP

Post Glacial 2600 – 1600 BP

Post-Drought Glacial & Medieval Warm Period 1600 – 650 BP

Little Ice Age
650-150 BP

Transition Period

From Eddy and Bradley 1991 & Tausch et al. 1993
From Eddy and Bradley 1991 & Tausch et al. 1993

Medieval warm period

Little Ice Age

°F

Year (A.D.)
Migration, Extinction, Adaptation
Movement of upper tree line response to temperature
Lower tree line
Pinyon & Juniper → White Bark → Bristle Cone
Diamond Craters, OR

% Juniper
Grass Sagebrush
Charcoal Pollen

Years BP (before present)

Relative Abundance

from Mehringer 1987
Temperature = +2.5°F to -2°F
Precipitation amounts and season
Ecological Amplitude
White Mountains 3500 m

Squirreltail (600-4200 m)
Astragalus purshii (450-3350 m),
Eriogonum ovifolium (1200-4100 m)
Arenaria congestus (1200-3300 m)
Raspberry buckwheat (*Eriogonum gracilipes*) confined to dolomite areas in the subalpine and alpine, 3,000 to 4,000 m (10,000 – 13,000 ft)
Drought = decline in vegetation cover & increased erosion
Building of Alluvial Fans
Drought of the late 1500s
Drought ➔ Infestation ➔ Dieback
Conclusions from the Past

Shifts in precipitation and temperatures -1 to 1.5°C had significant effects on vegetation & ecological processes.
Transition Period → Present

- Late 1800s: end of the Little Ice Age
- End of native burning, hunting, and food gathering
- Large build-up of livestock
- Decline in fire
- Introduction of new species
- Elevated CO2 levels, and increasing air pollutants
Large changes in vegetation

Photo taken in 1899 by W. H. Jackson of Enchanted Mesa, 100 km west of Albuquerque, NM
Plant succession

Pre & Post Weather

Ecological Site (climate)

Fire Behavior
severity & duration
crown or surface complexity, etc

Disturbance History

Current Vegetation
Drivers defined in an MLRA

**Ecological Site variables**

- Precipitation
- Temperature

- Soils
  - Texture
  - %OM
  - Depth
  - Structure
  - PM

- Topography
  - Elevation
  - Aspect
  - Slope
  - Micro topog
  - Landform
Drivers defined in an MLRA

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**Potential Site Conditions**
- Effective Moisture
- Soil Temperature
- Composition (current veg) Biomass
- Potential Vegetation Biomass

**Current Conditions**
- RESILIENCE
- RESISTANCE to weed invasion

**Ecological Site variables** → **Potential Site Conditions** → **Current Conditions**
Climate
Plant succession

- Pre & Post Climate
- Ecological Site
- Pre-fire Plant Composition
- Post Fire Environment
- Fire Behavior (Severity, intensity, complexity, etc.)
- Plant adaptations
Relatively resistant (often high elevation) communities will warm and become less resistant.
Plants: Change *in situ* in composition, migrate, or become extinct
Climate Change
Bird conifer seed dispersal