Preparing for the Future by Looking at the Past
or is it
Asking the Right Scientific Questions?

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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.E. Douglas father of dendrochronology

Bristle Cone in the White Mountains - 8,700 tree ring record
From Eddy and Bradley 1991 & Tausch et al. 1993
Elevation: \([\sim 3^\circ\text{C} (500 \text{ m})-1]\).
Elevation (m)

Lake Bonneville Base Level
15000 – 20000 yr BP

Central Great Basin

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

= Current
= Late Pleistocene

Wells 1983
Temperature = +1.5°C to -1°C
Precipitation amounts and season
Migration, Adaptation, Extinction
Movement of upper tree line response to temperature
Ecological Amplitude
White Mountains 3500 m

Squirreltail (600-4200 m)
Astragalus purshii (450-3350 m),
Eriogonum ovifolium (600-4100 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
Transition Period

• 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
Scientific questions?

What are the characteristics of desirable functioning communities?

What are the suite of species?
Scientific questions?

Affect on soils, biodiversity, processes, carbon, and resiliency?
Can we direct succession towards desirable trajectories?
New Steady States
(State-and-Transition Models)

Multiple Climate Scenarios

Current

I

II

III

IV

V
Climate models
Vegetation Tools?

< 250 mm (10 in)
Preparing for the plant communities of the future?