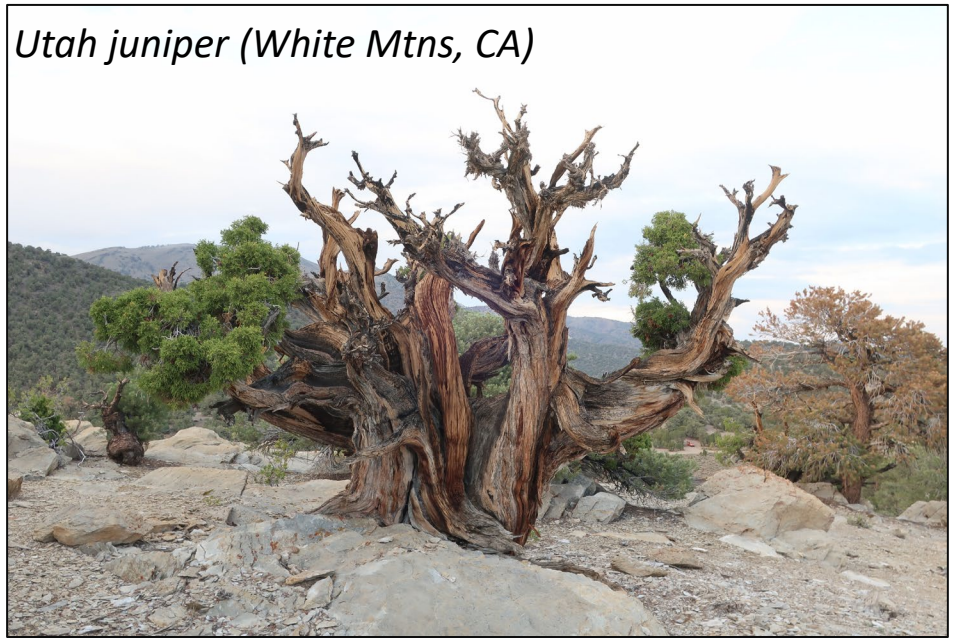
Old-growth Pinyon and Juniper Woodlands: Ecological Characteristics, Values, and Considerations for Conservation

Peter Weisberg
University of Nevada, Reno
Dept. Natural Resources & Environmental Science
pweisberg@unr.edu

Key Themes

1. **Old-growth pinyon-juniper (PJ) can take many forms.** How can we recognize it? Map it?
2. **Old-growth PJ is about more than just old trees**.
3. **The current distribution of old-growth is the outcome of historical events.**
4. **Old-growth PJ woodlands, forests, and savannas are ecologically and culturally important.**
5. **Old-growth PJ faces numerous threats.** These include contemporary land management as well as natural disturbance interacting with climate-change-driven heat and drought and invasive plants
6. **There is huge regional variation.**

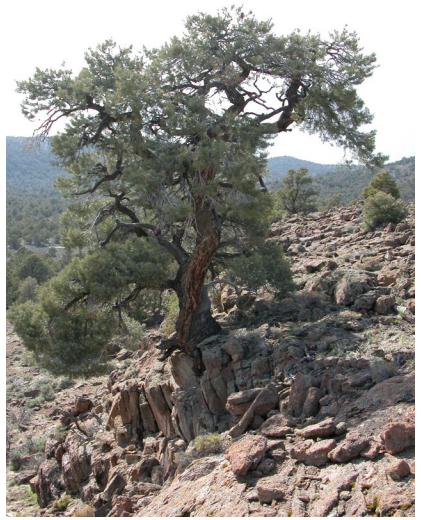
Utah juniper (White Mtns, CA)



Singleleaf pinyon pine woodland (Wassuk Range, NV)

1. Old-growth PJ can take many forms







Distinguishing old-growth PJ trees (without coring)

Tree Size Characteristics (DRC, Height) useful but less predictive as trees age (Landis & Bailey 2006; Weisberg & Ko 2012).

Morphological Indices (Weisberg & Ko 2012):

a. **Size.** Diameter, Height, Lower Branch Diameter, and Crown Area, with deeply Furrowed Bark

b. **Crown Diminishment.** Larger in bole and lower branch dimensions, but smaller in crown area

c. **Stubbiness.** Large diameter relative to height

Dead wood in canopy, **exposed polished wood** on basal stems and large roots + all the above (Jacobs et al. 2008)

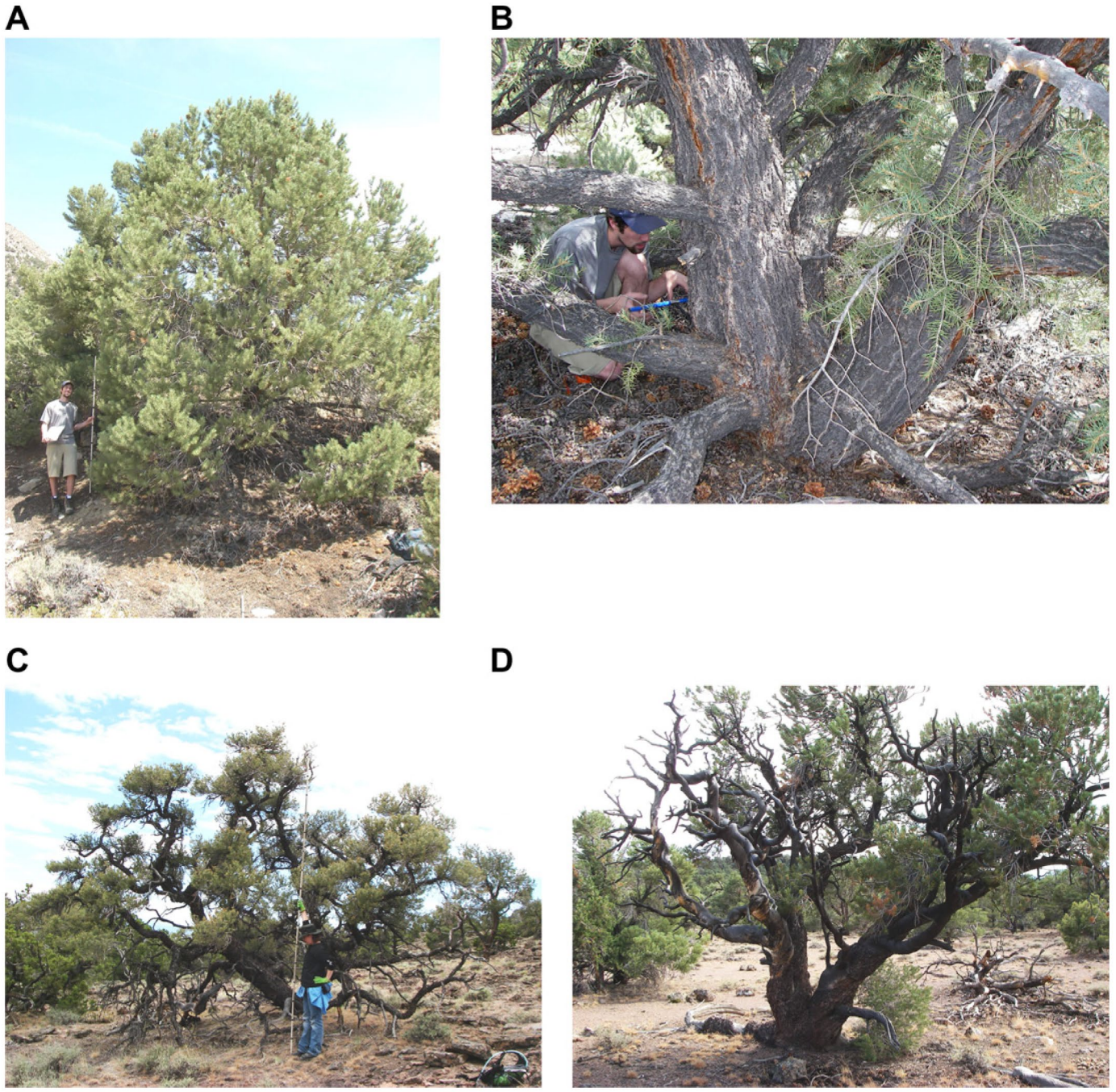
Juniper-specific: Furrowed bark, strip bark, crown mortality, rounded tops, and lichen in tree canopies (Waichler et al. 2001).

A. 61 yrs. Symmetrical full green crown, small diameter

B. 140 yrs. Forked stem, thickened lower branches, large diameter

C. 286 yrs. Crown dieback, diminished canopy volume, thick lower branches, crown asymmetry, sinuous branching

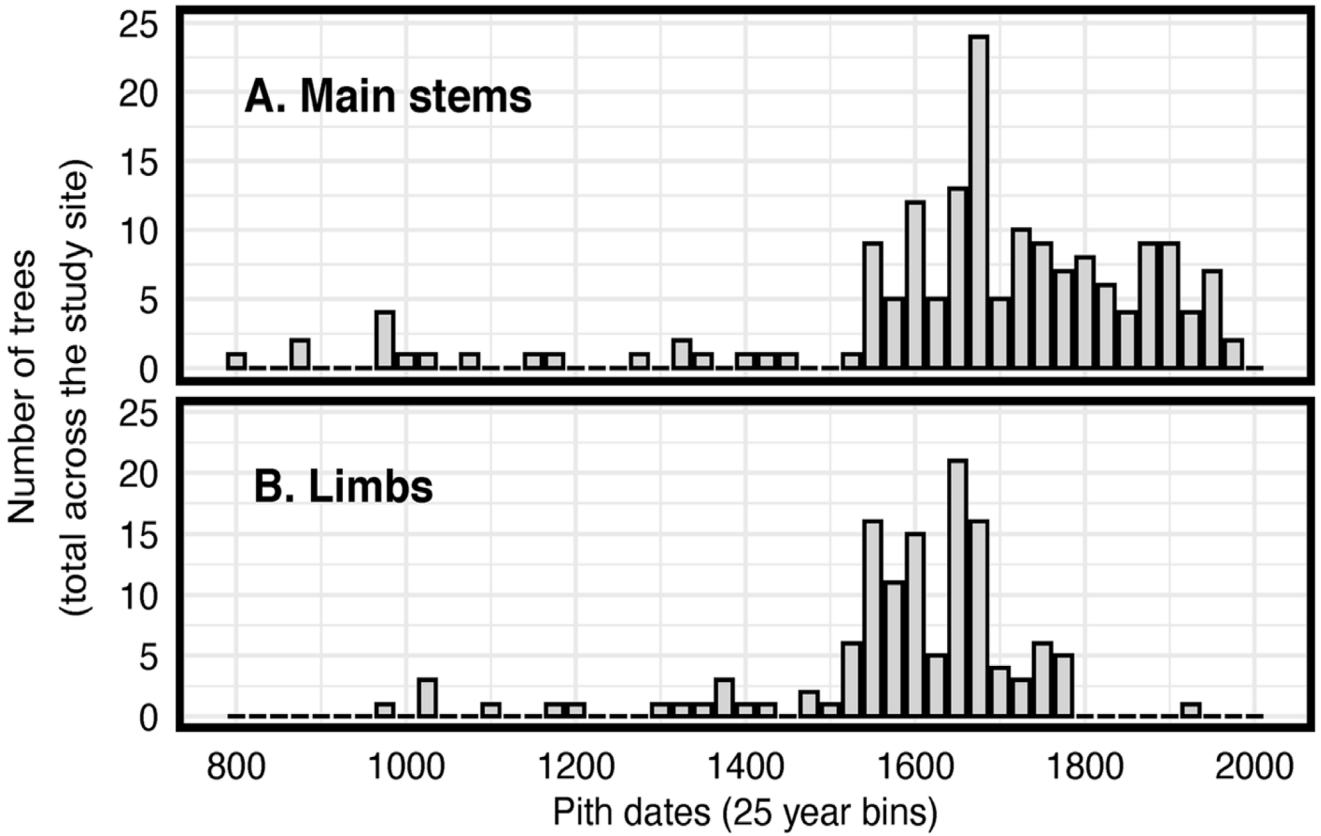
D. 307 yrs. Extensive crown dieback and canopy diminishment, thick lower branches, “short but stubby” growth form.



Weisberg & Ko, 2012

2. Old-growth PJ is about more than just old trees

- **Uneven-aged, diverse age structure**
- Structural complexity
- Snags, logs (large woody debris)
- Plant and animal communities
- People



Age structure of western juniper for a 130-ha landscape in central Oregon (Loehman et al. 2023)

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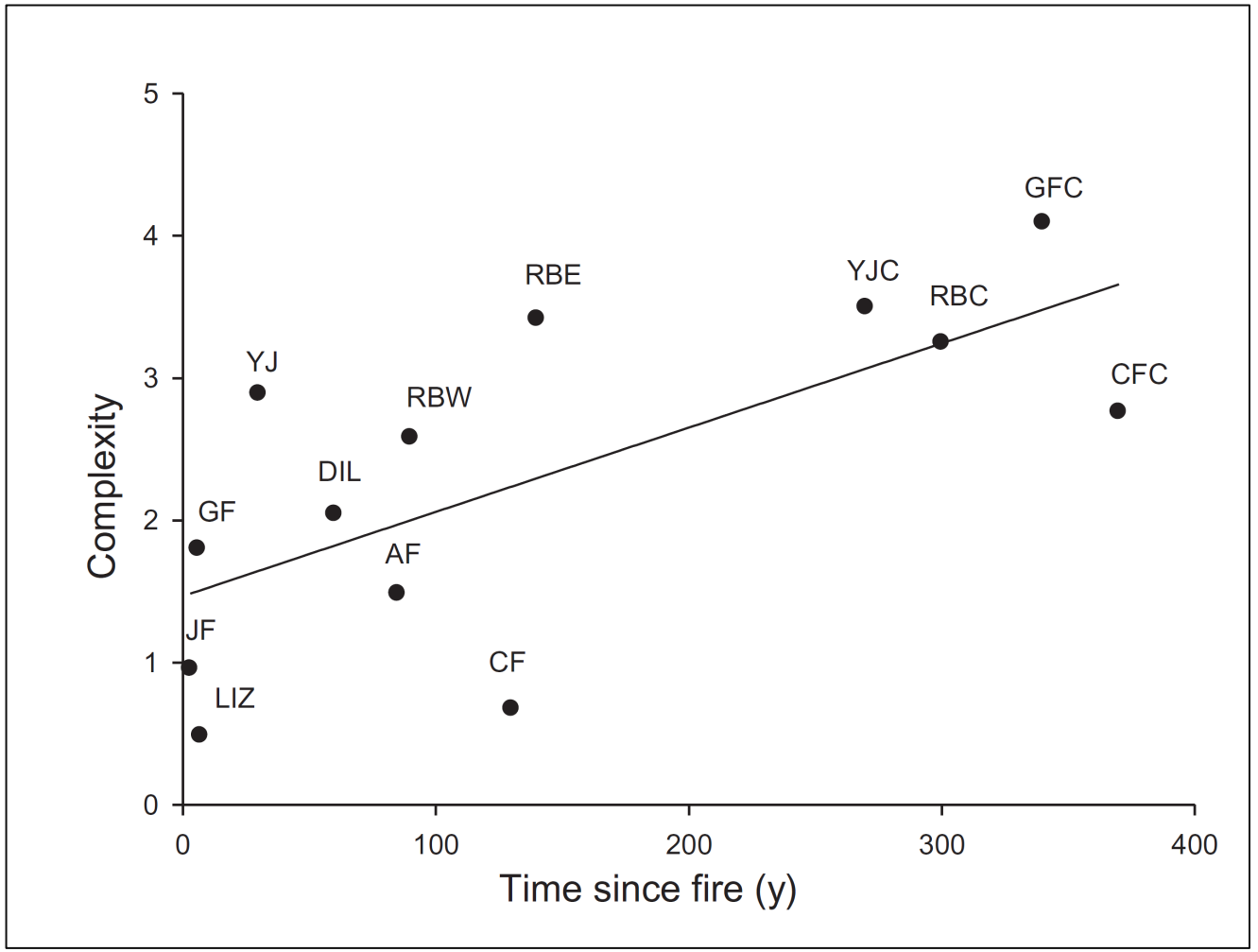
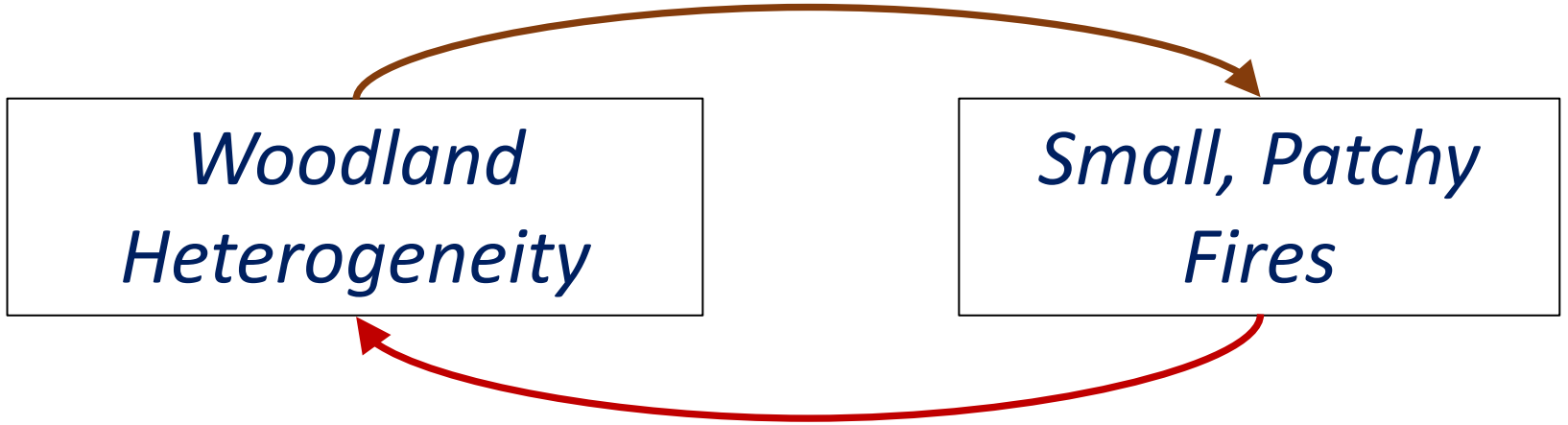


Huffman et al. 2012



- Sparse and discontinuous fuels **=>** small and patchy fires
- Historically: small and patchy fires in PJ break up fuel continuity
- Slow post-fire tree regeneration favored persistence of shrub-herbaceous patches
- Woodland patches with long fire-free intervals experienced fine-scale mortality from drought and biotic disturbance agents
- Small fire extents, protracted woodland recovery, biotic disturbance, long-lived tree species would have generated:
  a. patchiness at both stand and landscape scales,
  b. uneven-aged stand structures within the woodland patches

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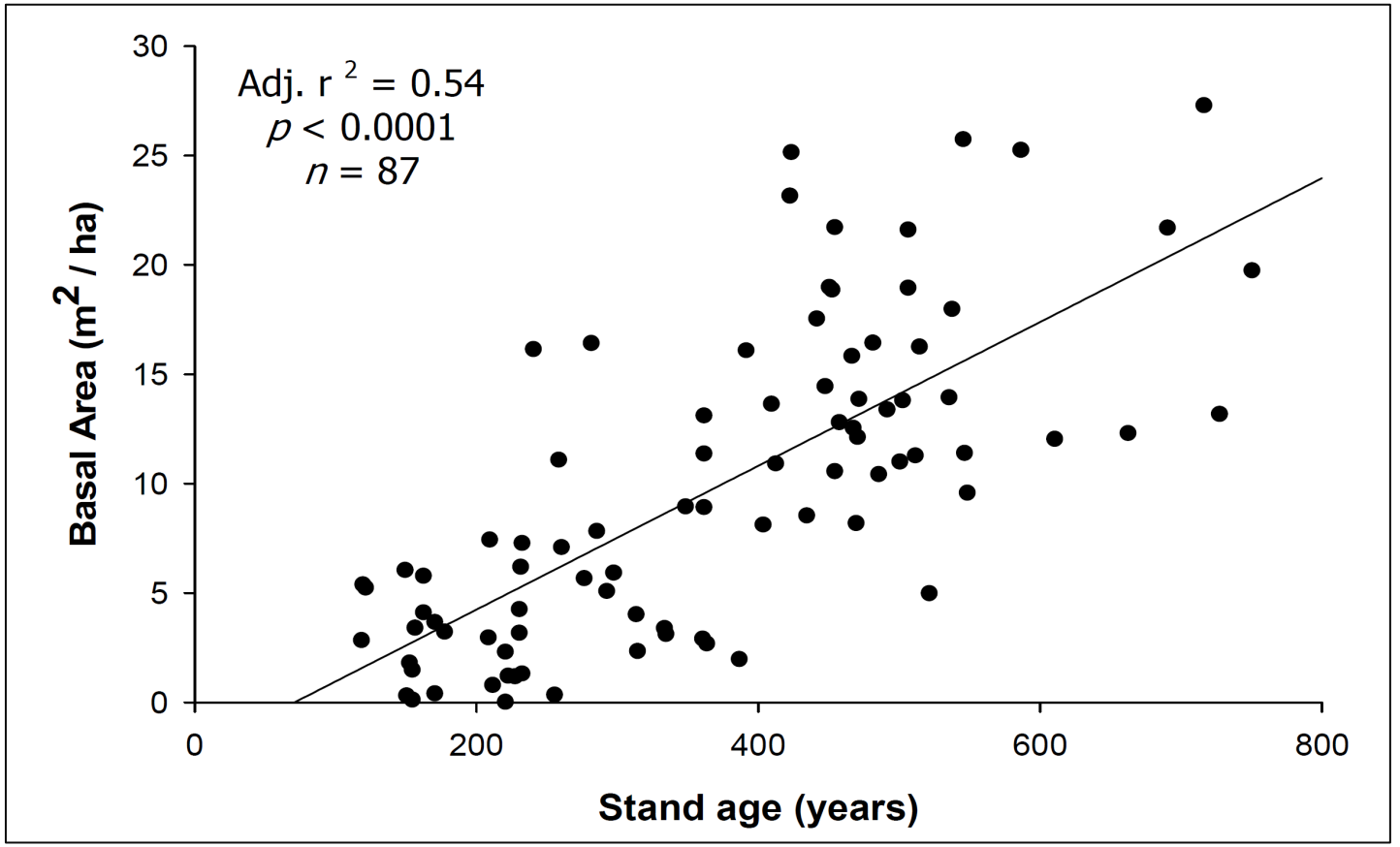
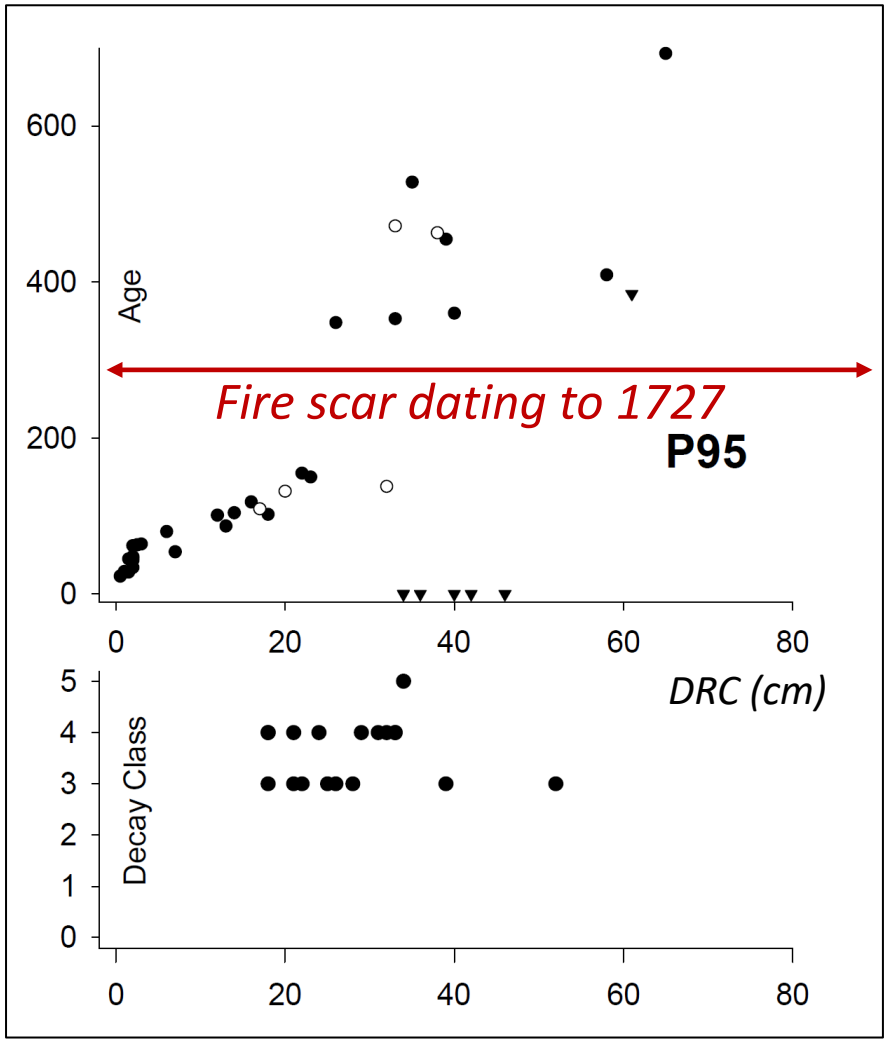


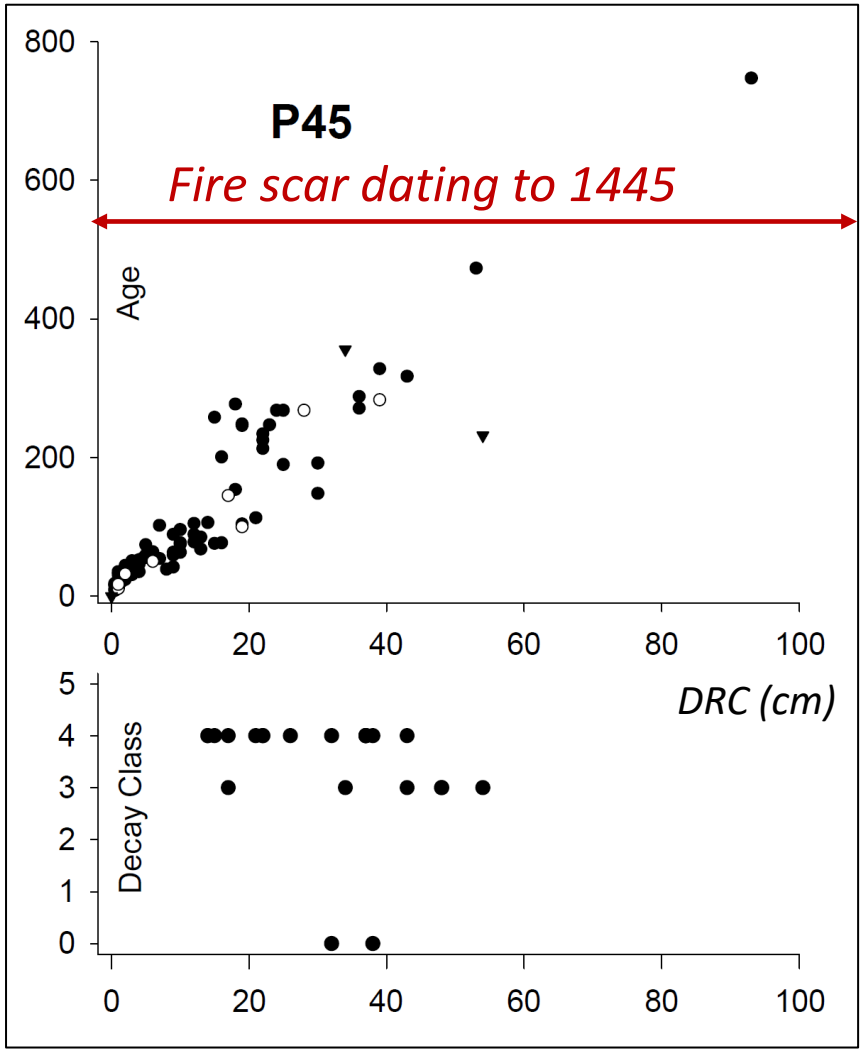
Basal area (m2/ha) of coarse woody debris as a function of stand age, for 87 plots in the Shoshone Mts, central Nevada (from Bauer 2006).

Two contrasting old-growth stands in the Shoshone Range, central NV



Live Trees

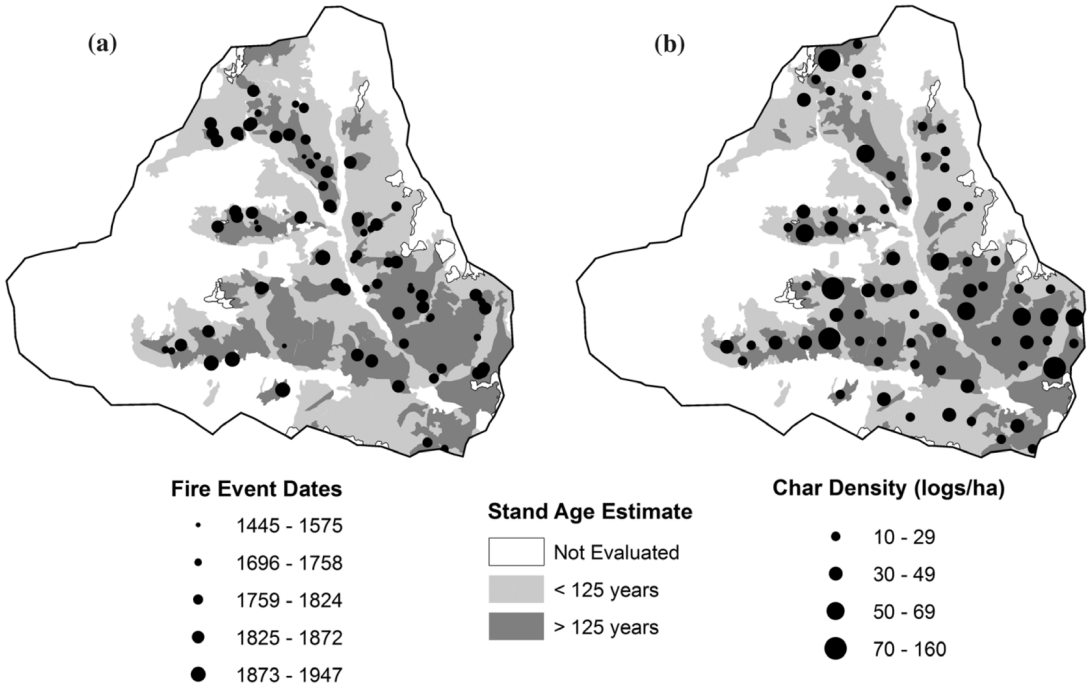
Logs



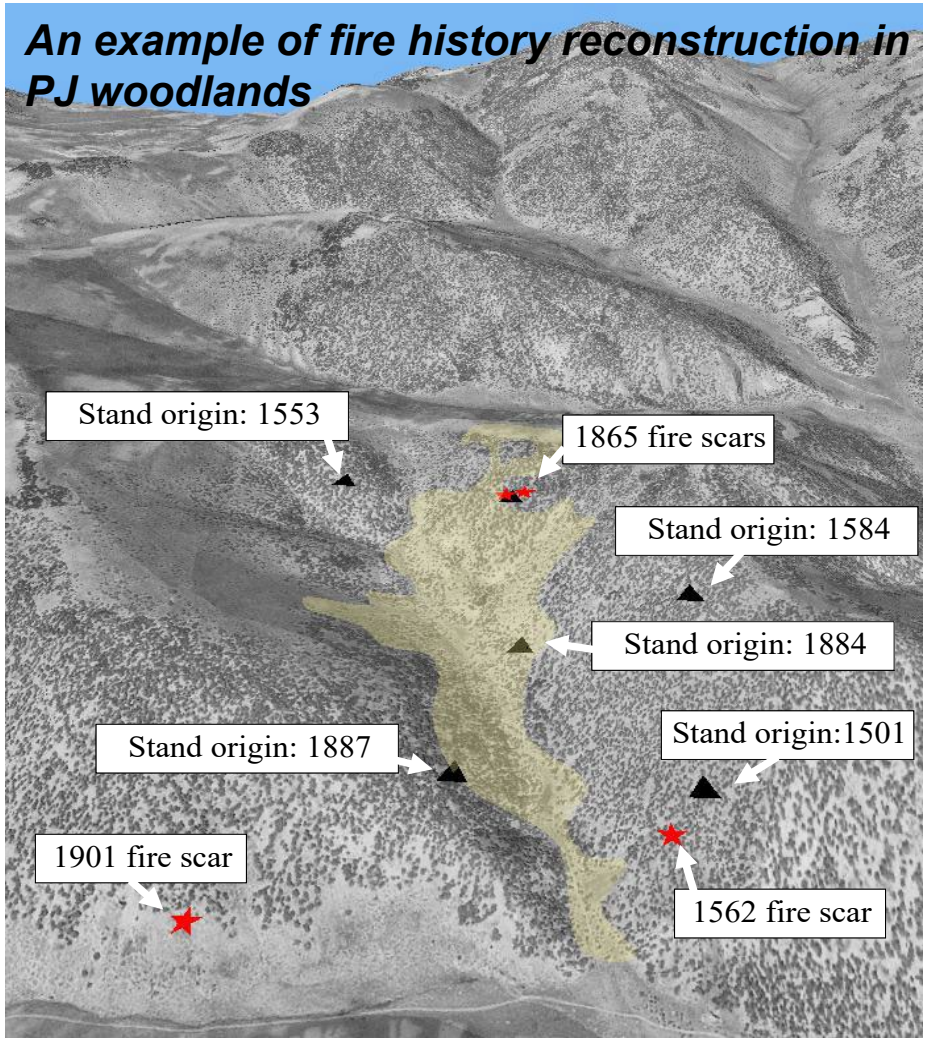
Bauer (2006)

3. The current old-growth distribution is the outcome of historical events

- Often the history is hidden (sometimes in plain sight)
- History of disturbance (e.g. fire), land-use, and recruitment interacts with the physical environment



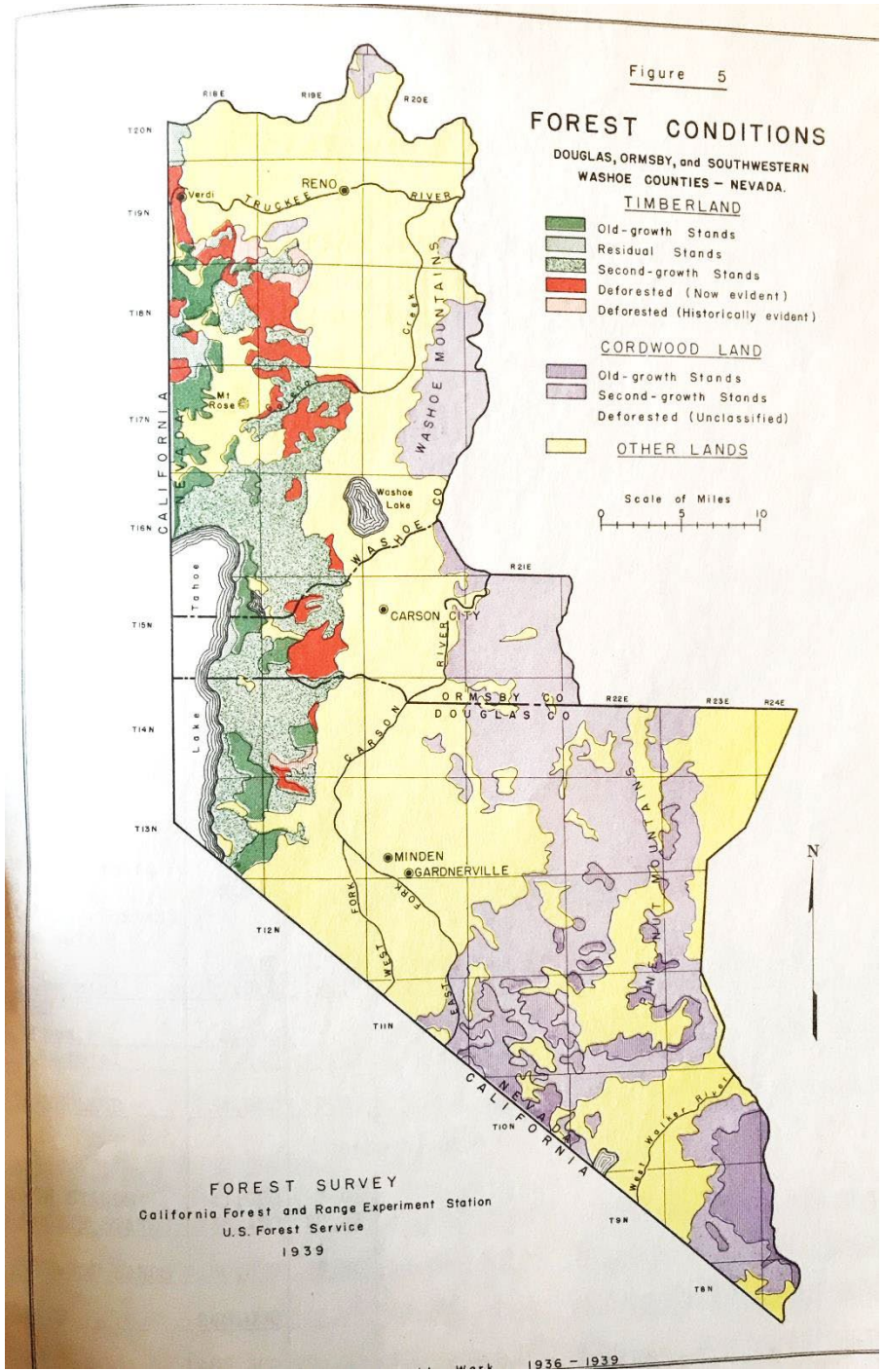
Bauer and Weisberg 2009.



"Over four-fifths of the total cordwood acreage... contains second-growth stands of piñon and juniper types...Clear-cutting has been largely responsible for the reduction of the virgin forest acreage, although fires have also played a role."

"Natural reproduction has reforested the cutover land with an open stand of trees... The oldest stands contain enough wood to allow cutting for fuel and posts, but most of the stands are too low in volume per acre to be economically cut at present."

Wilson, R. C. 1941. Vegetation types and forest conditions of Douglas, Ormsby and Southwestern Washoe Counties, Nevada. Forest Survey Release No. 2, Calif. Forest and Range Experiment Station, Berkeley.

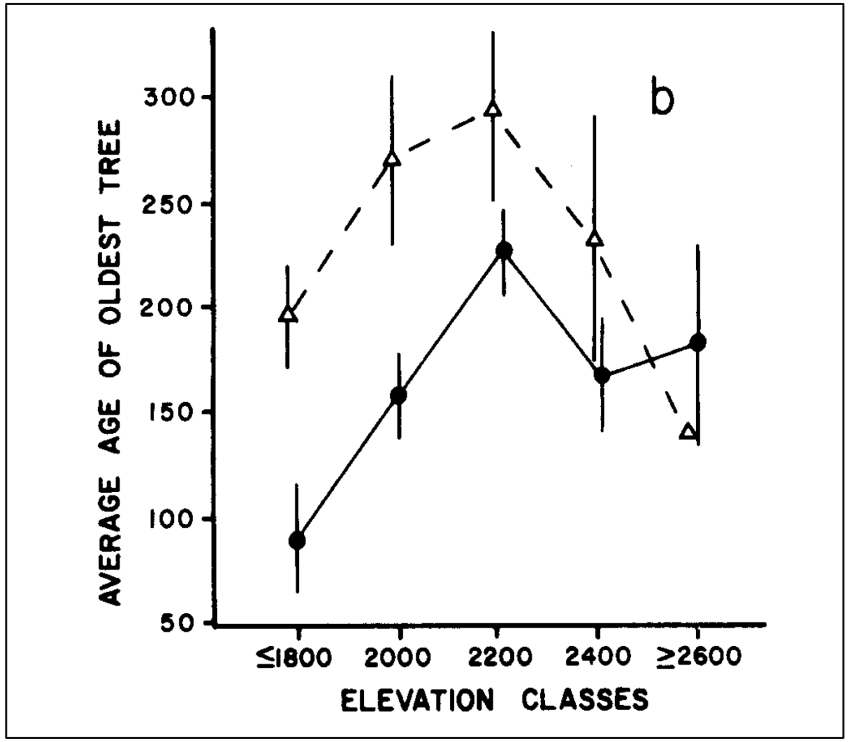


1939 Forest Survey:

- PJ woodlands in western NV largely cut over, growing back slowly and sparsely
- Locations of uncut "old-growth" mapped

Environmental controls on old-growth distribution are strong in some areas, weak in others

- Fire-safe sites with lower productivity: shallow, skeletal, rocky soils (Miller et al. 2019)
- Soil moisture controls distribution, but not necessarily linked to fire (Jacobs et al. 2008)
- Soils: More productive sites with deep soils, sometimes (Miller et al. 2019)
- Elevation: Lower elevations? Middle elevations? Higher elevations? Observations have been mixed, likely for different reasons in different places (Tausch et al. 1981; Johnson & Miller 2008; Weisberg et al. 2008; Loehman et al. 2023)



Tausch et al. (1981) found the oldest P & J trees in the intermediate elevations, and suggested greater natural and human-caused disturbance at upper and lower elevations.

4. Old-growth PJ forests, woodlands, savannas are ecologically and culturally important

- Partial canopy mortality and thinning crowns provide a mosaic of sunlit and shaded microsites => understory plants
- Deep, furrowed bark beneficial for insects and arthropods
- Increased habitat heterogeneity benefits many bird, small mammal, reptile species
- Breeding habitat for cavity nesters
- Habitat for tree-dwelling animal taxa and epiphytic plants (Floyd et al. 2003).
- Carbon sequestration
- Aesthetic, recreational, spiritual, cultural values.

5. Old-growth PJ faces numerous threats

- Contemporary land management

  - Can we do a better job of identifying and conserving mature and old-growth woodlands?

Old-growth PJ faces numerous threats

- Contemporary land management
- Larger and more severe wildfires
- Increasingly hotter and drier climate conditions, longer fire seasons
- Dense and homogeneous woodlands increase continuity of canopy fuels
- Biotic disturbances (insect pests) and drought-related tree mortality
- Exotic annual grasses and the grass-fire cycle
- Interactions among all the above!

Take-Aways

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5. **Old-growth PJ faces numerous threats.**
6. **There is huge regional variation.** Adapt and learn; don't over-generalize.

Utah juniper, White Mts.

curlleaf mountain mahogany, Magruder Mtn.

Thanks for listening!

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