Managing for woodland values and resilience

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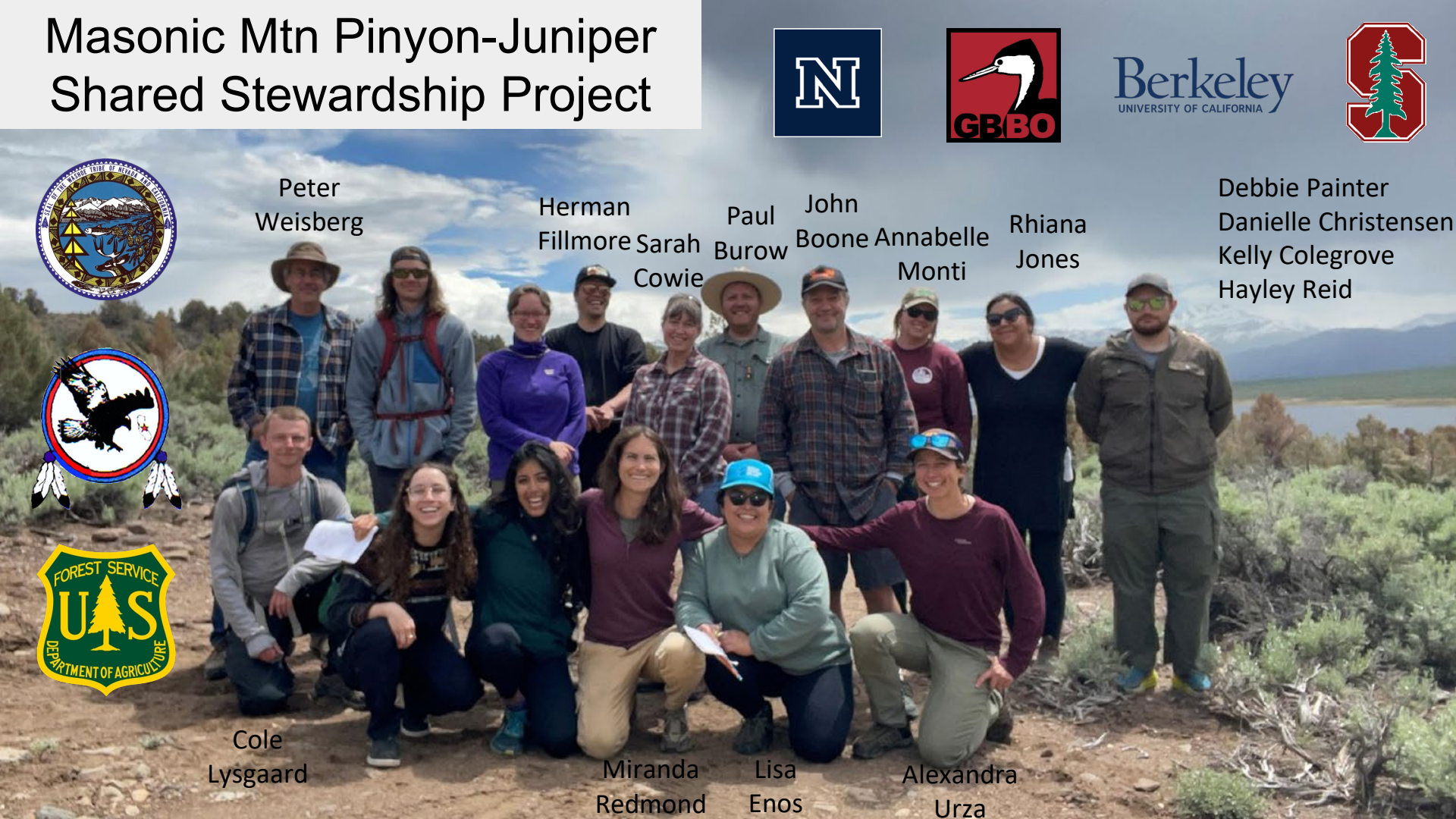
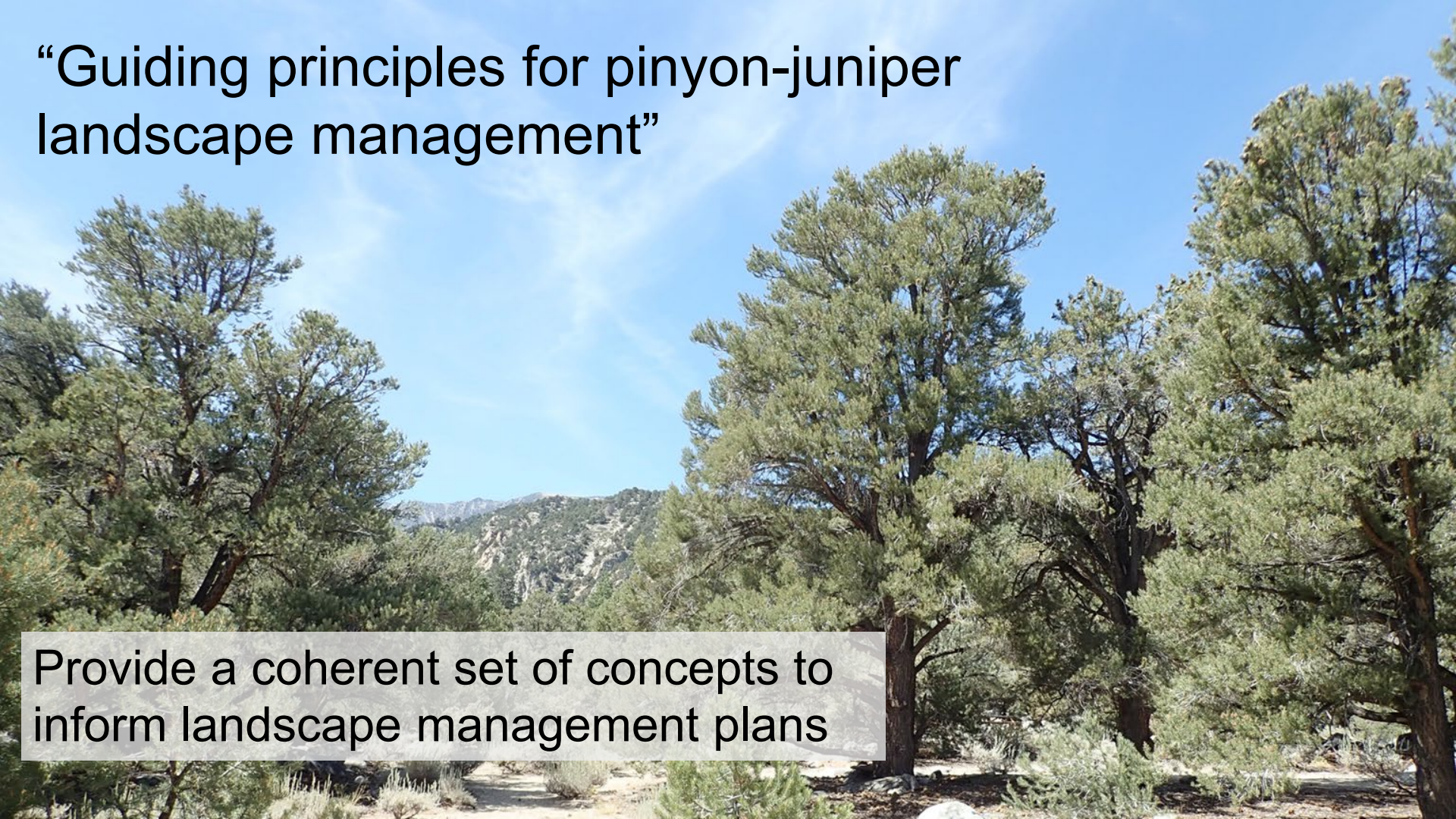
Masonic Mtn Pinyon-Juniper Shared Stewardship Project



Masonic Mountain Project: Collaborative management planning

SIERRA NEVADA CONSERVANCY



“Guiding principles for pinyon-juniper landscape management”

Provide a coherent set of concepts to inform landscape management plans

“Guiding principles for pinyon-juniper landscape management”

1. Managing for woodland ecosystem services
2. Recognition of Indigenous cultural values
3. Landscape-scale heterogeneity and temporal dynamism
4. Stand-scale structural complexity
5. Objective-based and context-specific management actions
6. Spatially aware management
7. Monitoring and adaptive management

Landscape-scale heterogeneity and temporal dynamism

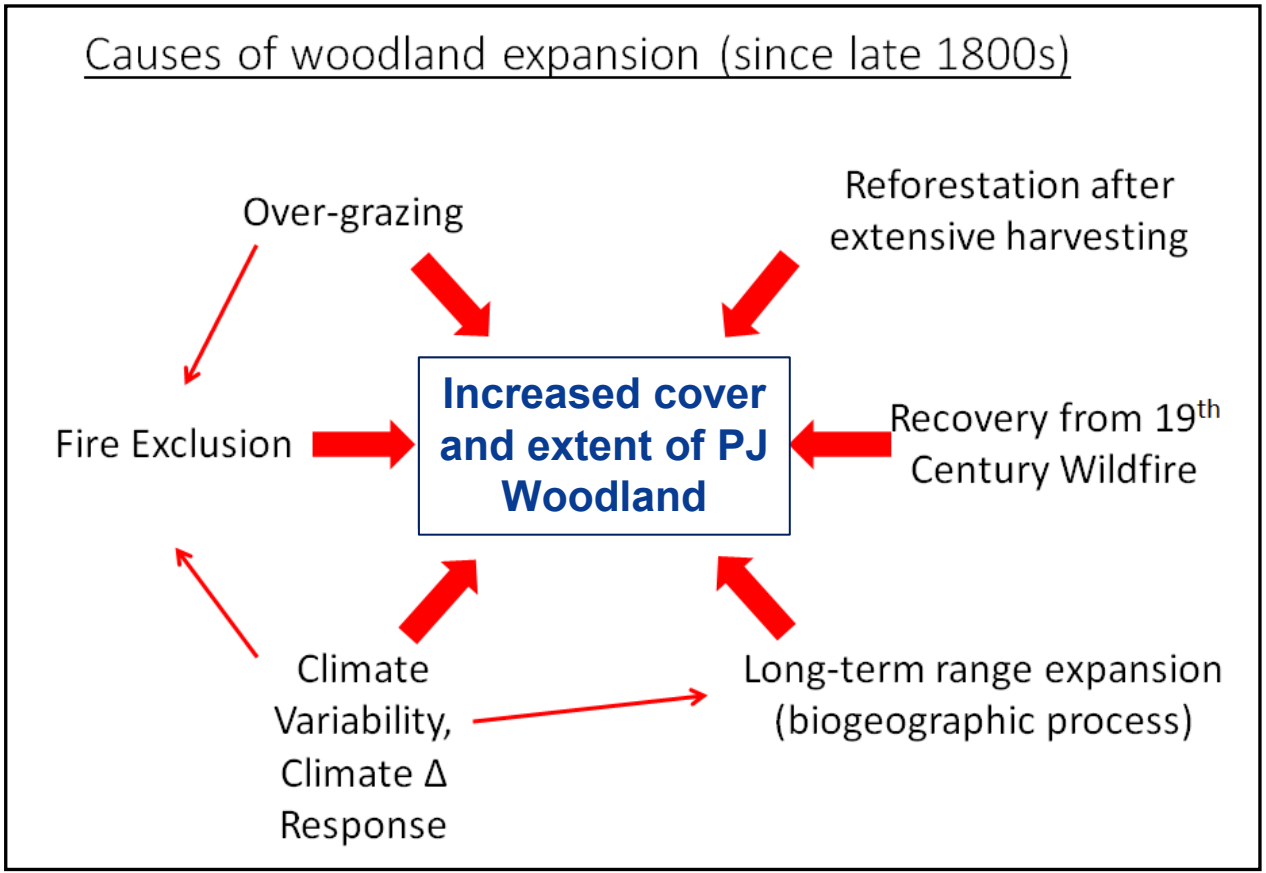
Pinyon-juniper woodland mosaics include patches of other vegetation types as well as a variety of woodland structures. The distribution of patch types within a landscape is expected to change over time.

- Uncertainties around historical distributions of old growth, historical fire regimes, land use legacies
- Different stand development trajectories
- Where to manage for mature/old growth and for how much

Landscape-scale heterogeneity and temporal dynamism

- Expansion of pinyon-juniper woodlands has been well-documented, in many areas, for the past 160 years
- Tree establishment into sagebrush valleys, canyon bottoms, high elevations.
- “In-filling”: Denser woodlands with increased tree canopy cover

Landscape-scale heterogeneity and temporal dynamism



- Many causes of apparent expansion
- Probably all have been important, at different times and places
- Different underlying causes might prompt different management objectives

Landscape-scale heterogeneity and temporal dynamism

In the Great Basin there has also been increasing woodland die-off/die-back since the 2013-15 multi-year drought

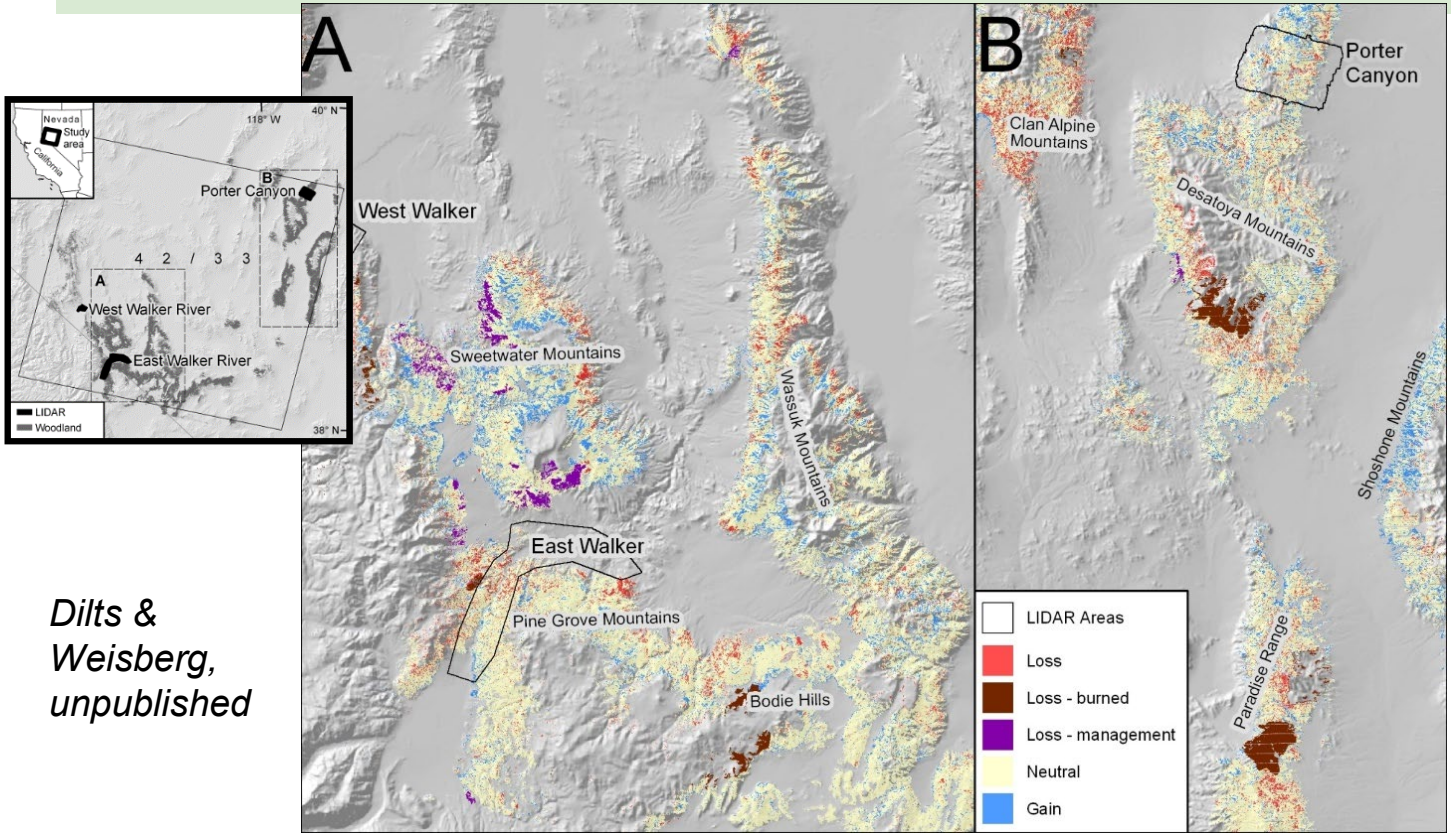
- Flake & Weisberg (2019) sampled > 5500 trees over 11 mountain ranges
- Pinyon pine experienced 10.9% stem mortality & 23% canopy loss
- Juniper experienced 0.6% mortality and 10% canopy loss
- Defoliation > beetle mortality

Landscape-scale heterogeneity and temporal dynamism

In dryland ecosystems such as PJ woodlands, woodland decline and expansion are complementary processes that require a long-term perspective

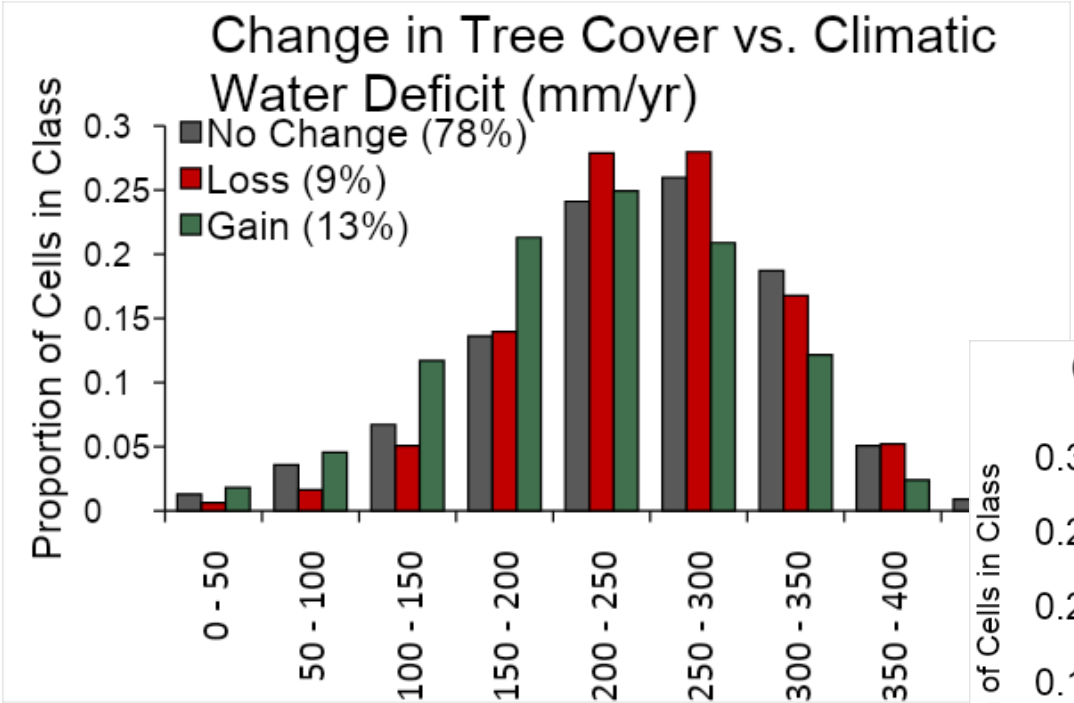
- = f(climate, disturbance and human influences)
- Currently more dieback on drier/hotter sites, expansion into wetter/cooler sites
- Pattern is broadly consistent with expected species-specific responses to climate change

Remote Sensing Study of Woodland Change from 1984 – 2016 for central western Nevada Great Basin LiDAR).



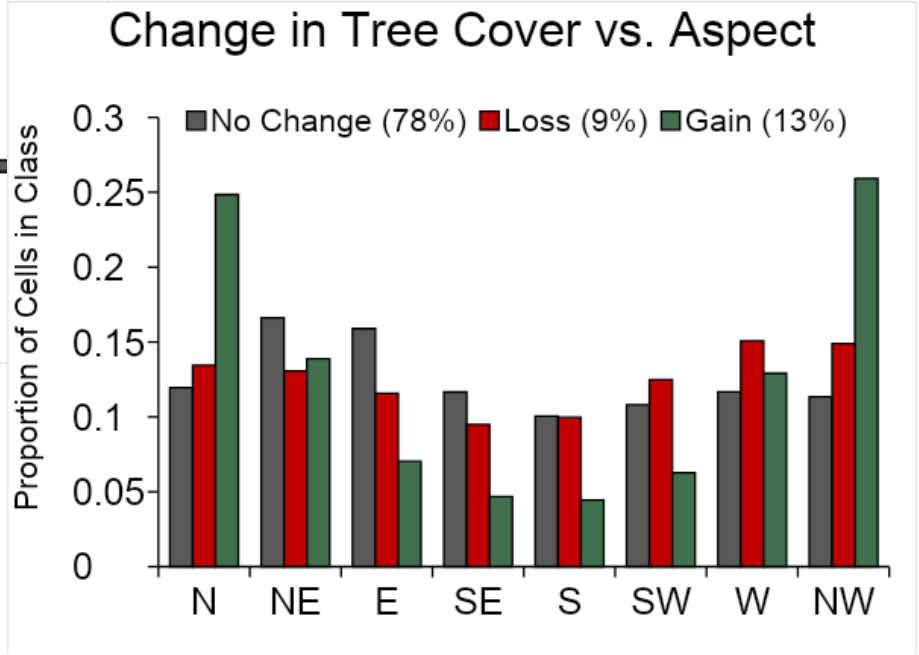
Dilts & Weisberg, unpublished

- LiDAR-derived tree cover used to train Landsat classifications
- For this region, recent declines (including from fire and management) nearly balanced expansion
- 12% cover decline, 13% increase



Gains: north-facing slopes, sites with lower water deficits, higher elevations

Losses: sites with greater water deficits, lower elevations



Landscape-scale heterogeneity and temporal dynamism

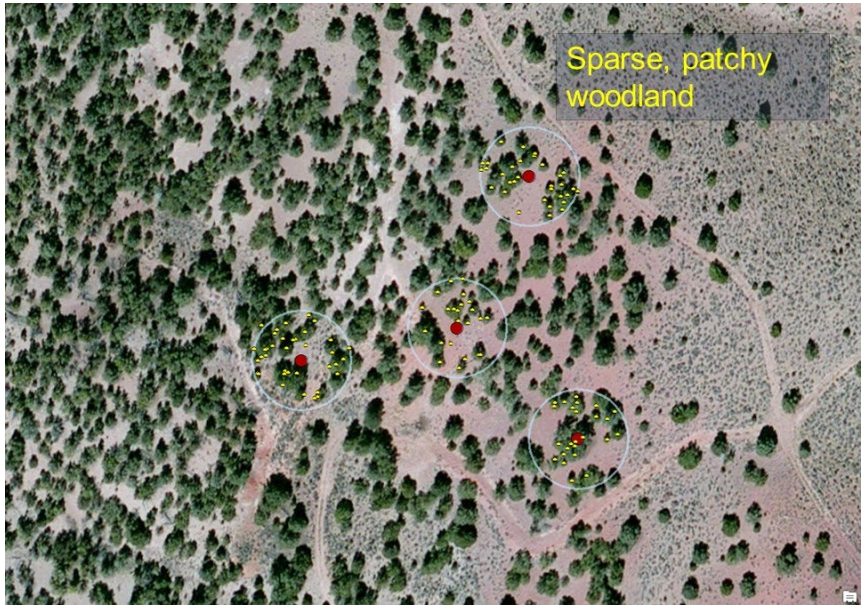
Forward-thinking land management: anticipate pinyon and juniper distributional shifts

- **Maintain resilience of woodland ecosystems to drought and disturbance**

- Silviculture for enhancing drought resilience in dense stands on vulnerable sites
- Steer vegetation transitions in “trailing edge” dieback areas towards desired/native understory species
- Facilitate tree regeneration and reforestation following disturbance

Stand-scale structural complexity

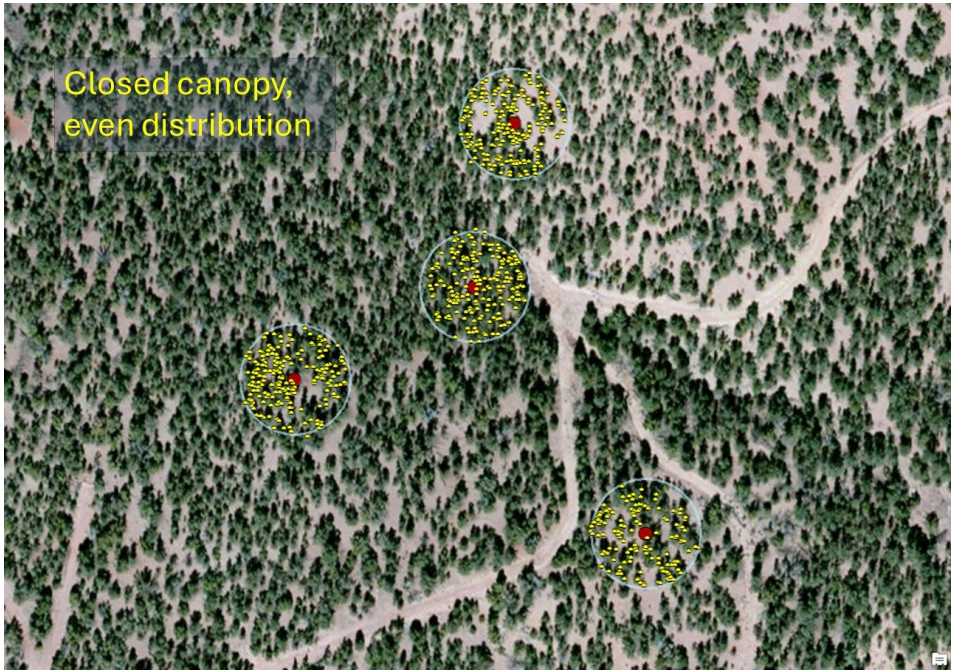
Pinyon-juniper woodland stands are characterized by uneven-aged tree populations with canopy clumps and gaps and variable understory vegetation.



- Large trees and small trees, snags & logs
- Gaps & clumps
- Complex stand structures increase resistance to pests, pathogens, drought-related mortality
- Native understory vegetation and soil crusts increase resistance to invasive annual grasses

Stand-scale structural complexity

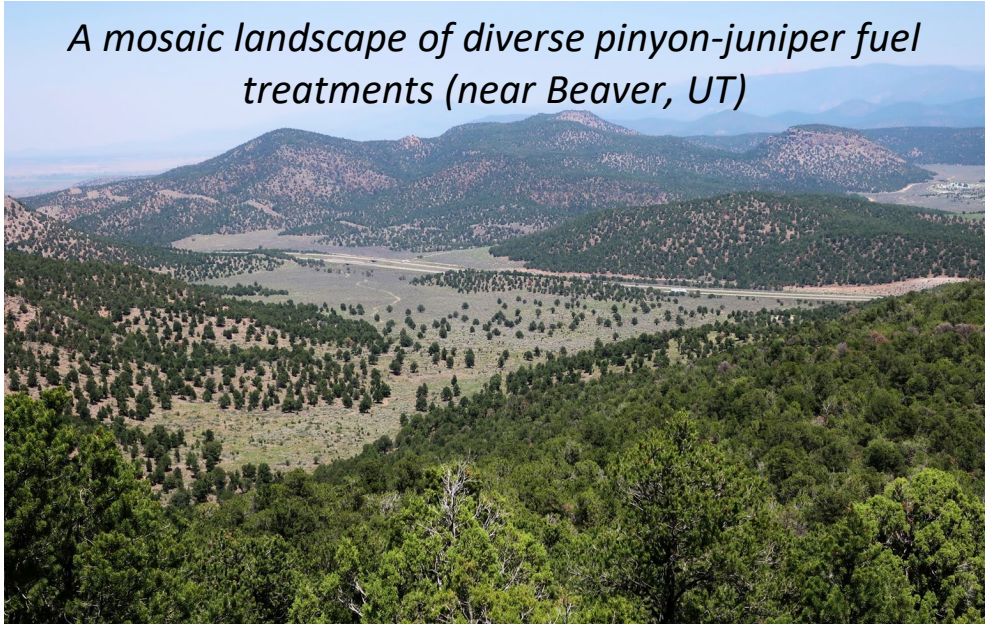
Goal 1: Increase woodland resilience to pests, pathogens, drought-related mortality.



- Management tool: uneven-aged silviculture to achieve target density/spacing by size class, and to create variable-size canopy gaps
- Maintain seed trees, tree cover and microsites as needed for tree regeneration
- Thinning may increase drought resilience in pinyon-juniper, but experimental studies are needed

Stand-scale structural complexity

Goal 2: Fire risk reduction through fuel treatments.



A mosaic landscape of diverse pinyon-juniper fuel treatments (near Beaver, UT)

- Uneven-aged silviculture, prescribed burning, low thinning, pruning lower limbs
- Some PJ studies show adverse effects of thinning on fire behavior due to increased fine fuels
- More large-scale experiments needed in PJ

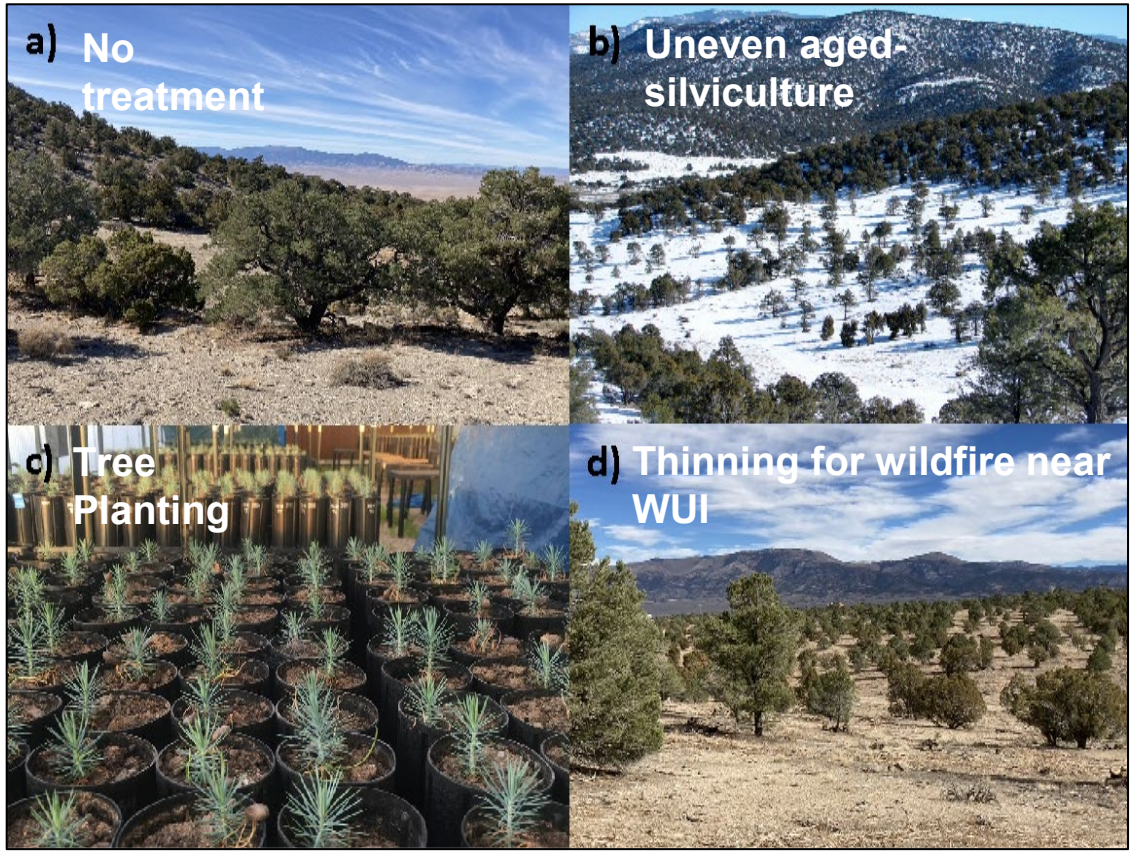
Objective-based and context-specific management actions

Management actions involve tradeoffs and must be based on specific objectives and the likelihood of a favorable outcome.

- Historic woodland structure and drivers of landscape change
- Current composition and structure of understory and overstory plants
- Future climate suitability
- Habitat and resource value

Redmond, Urza, & Weisberg, 2023. Managing for ecological resilience of pinyon-juniper ecosystems during an era of woodland contraction. *Ecosphere 14.*

Objective-based and context-specific management actions



Landscape prioritization:

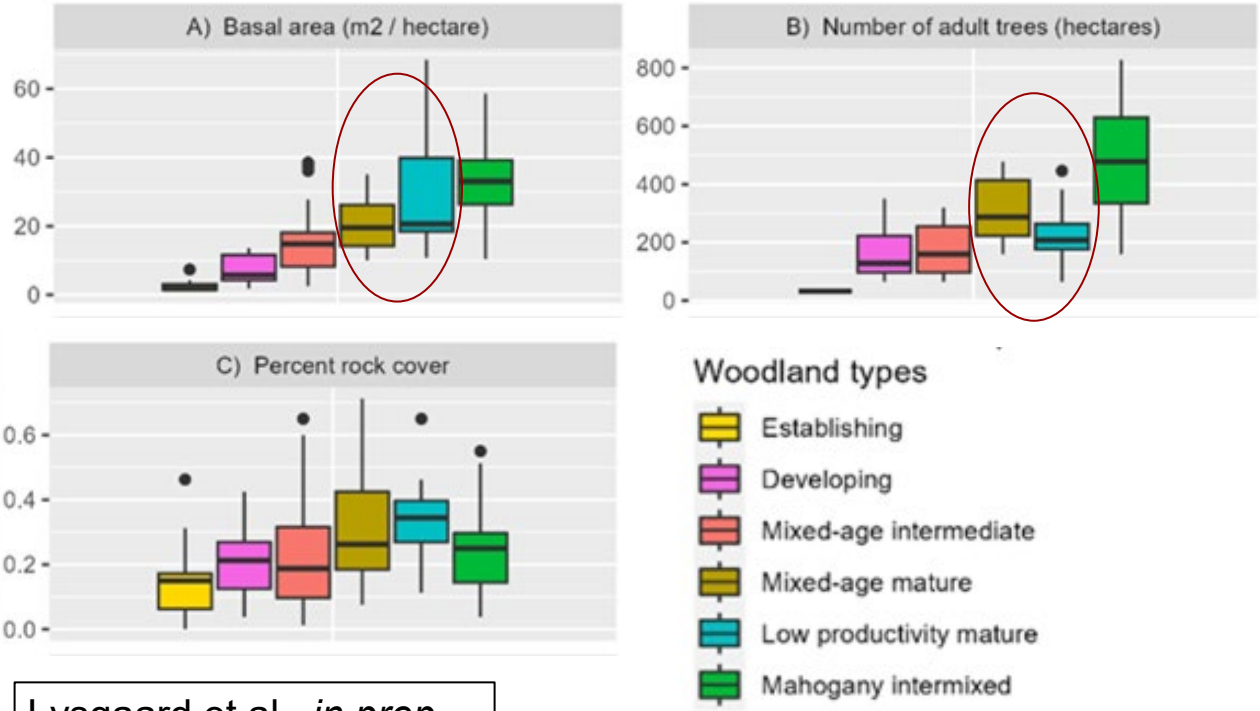
- Management objectives based on environmental, ecological, and social context
- No treatment, protect, and treatment alternatives
- Need: better understanding of the patterns & drivers of pinyon-juniper variability

Redmond, Urza, & Weisberg, 2023. Managing for ecological resilience of pinyon-juniper ecosystems during an era of woodland contraction. *Ecosphere 14.*

Objective-based and context-specific management actions

Pinyon-juniper woodland structural types in Masonic Mtn:

Two distinct types of old growth

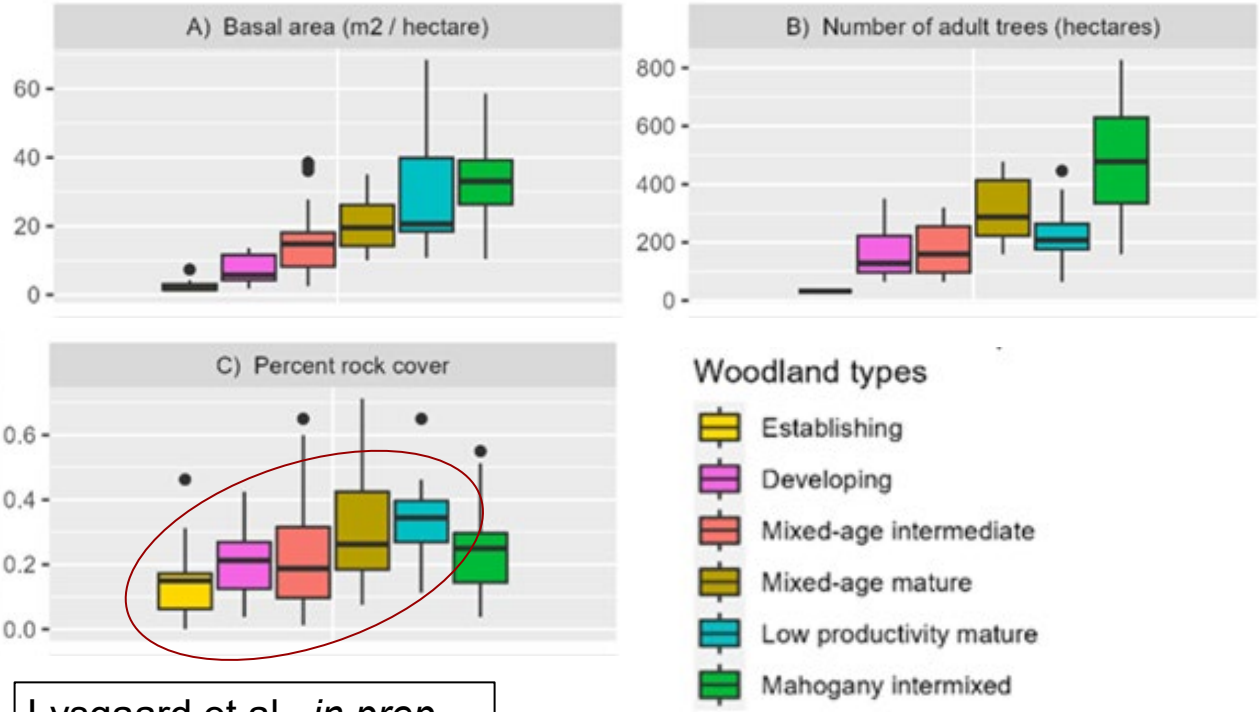


Lysgaard et al., *in prep.*

Objective-based and context-specific management actions

Pinyon-juniper woodland structural types in Masonic Mtn:

Developmental stages related to soil productivity

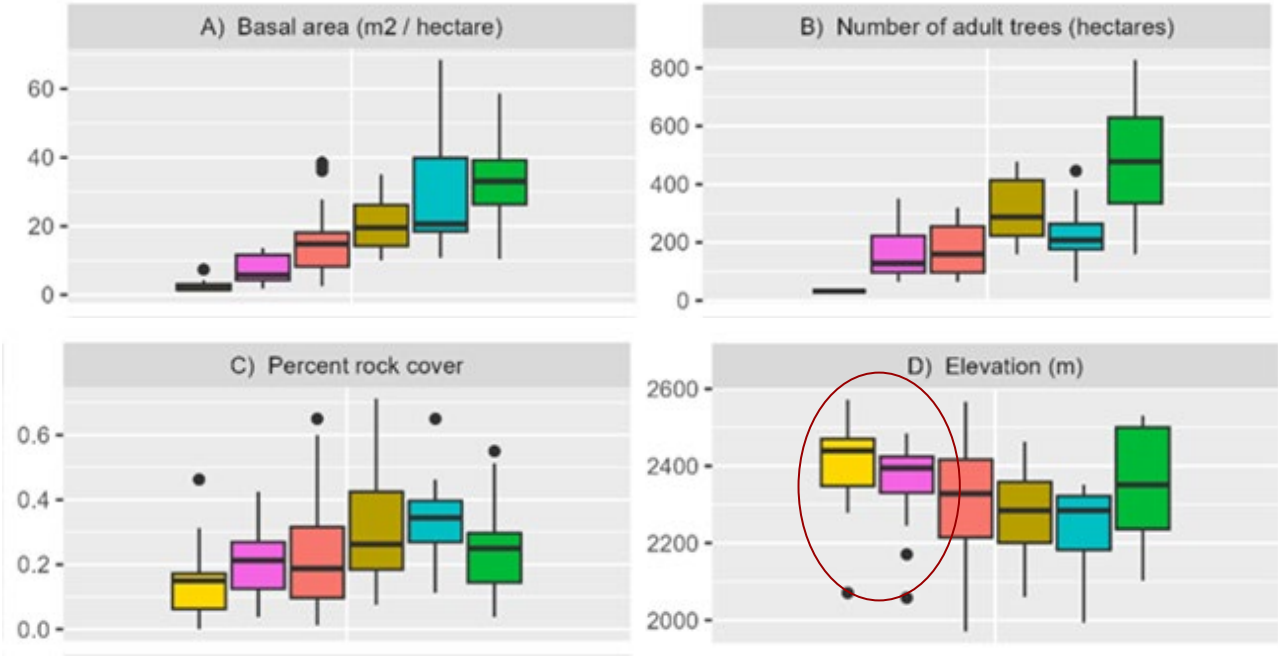


Lysgaard et al., *in prep.*

Objective-based and context-specific management actions

Pinyon-juniper woodland structural types in Masonic Mtn:

New establishment at upper elevations



Woodland types

- Establishing
- Developing
- Mixed-age intermediate
- Mixed-age mature
- Low productivity mature
- Mahogany intermixed

Lysgaard et al., *in prep.*

Spatially aware management

Management decisions that link landscape- and site-level objectives will best balance multiple objectives.

Site-level prescriptions:

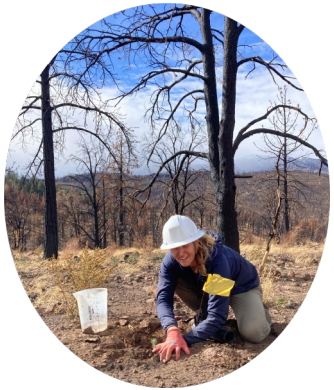
- What might make the stand more resilient to drought and fire?

Landscape-level vision:

- Would treatment improve the value of the surrounding landscape?
- Where can we focus our management actions to improve landscape metrics?

Monitoring and adaptive management

Monitoring ecological responses to management actions is needed to evaluate treatment efficacy and guide subsequent management efforts.

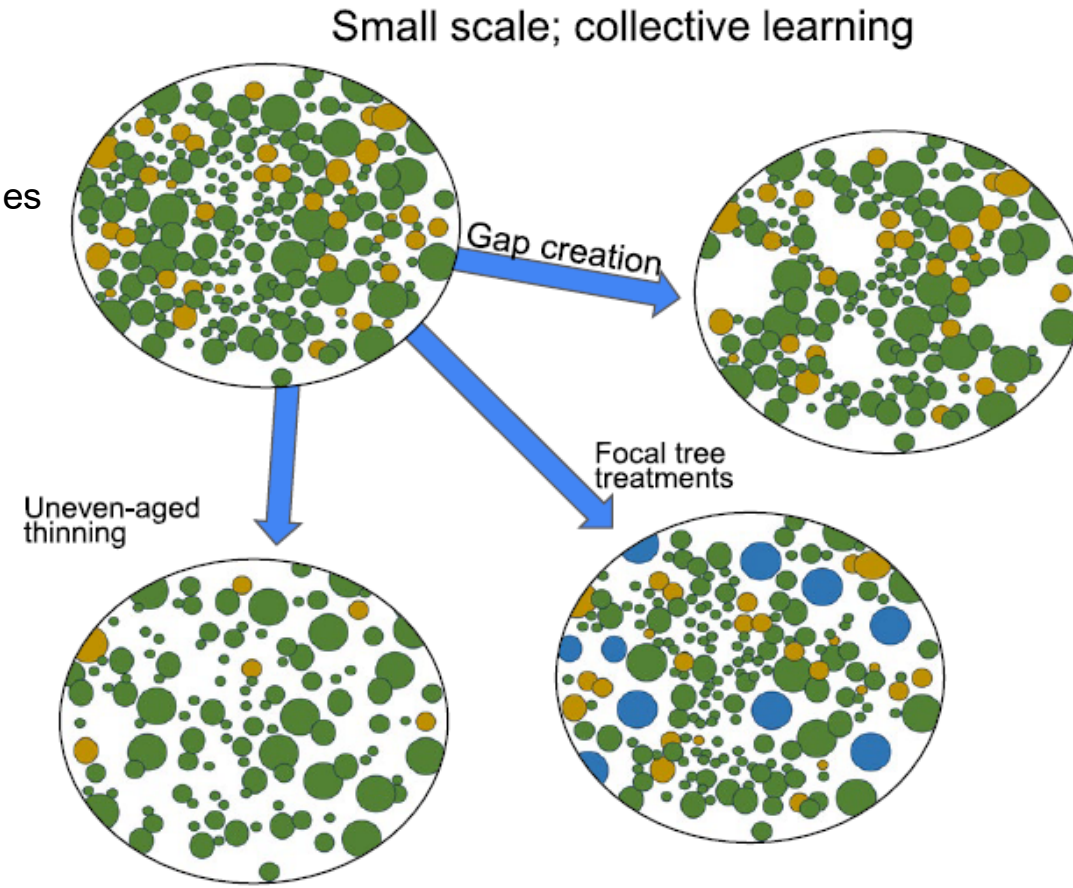


MANY knowledge gaps about pinyon-juniper ecosystems!

Hartsell, Copeland, Munson, Butterfield, & Bradford, 2020. Gaps and hotspots in the state of knowledge of pinyon-juniper communities. *Forest Ecology and Management 455.*

Masonic Mtn trial treatments:

- increase resilience to drought & fire
- reduce crown fuel continuity
- promote understory diversity in open patches
- increase pine nut production
- increase habitat diversity
- return Indigenous practices to the land



SW Colorado Pinyon-Juniper Adaptive Silviculture Project

Miranda Redmond U.C. Berkeley

Ali Urza U.S. Forest Service

Peter Weisberg and Krisi Ramsey University of Nevada, Reno

John Bradford U.S. Geological Survey

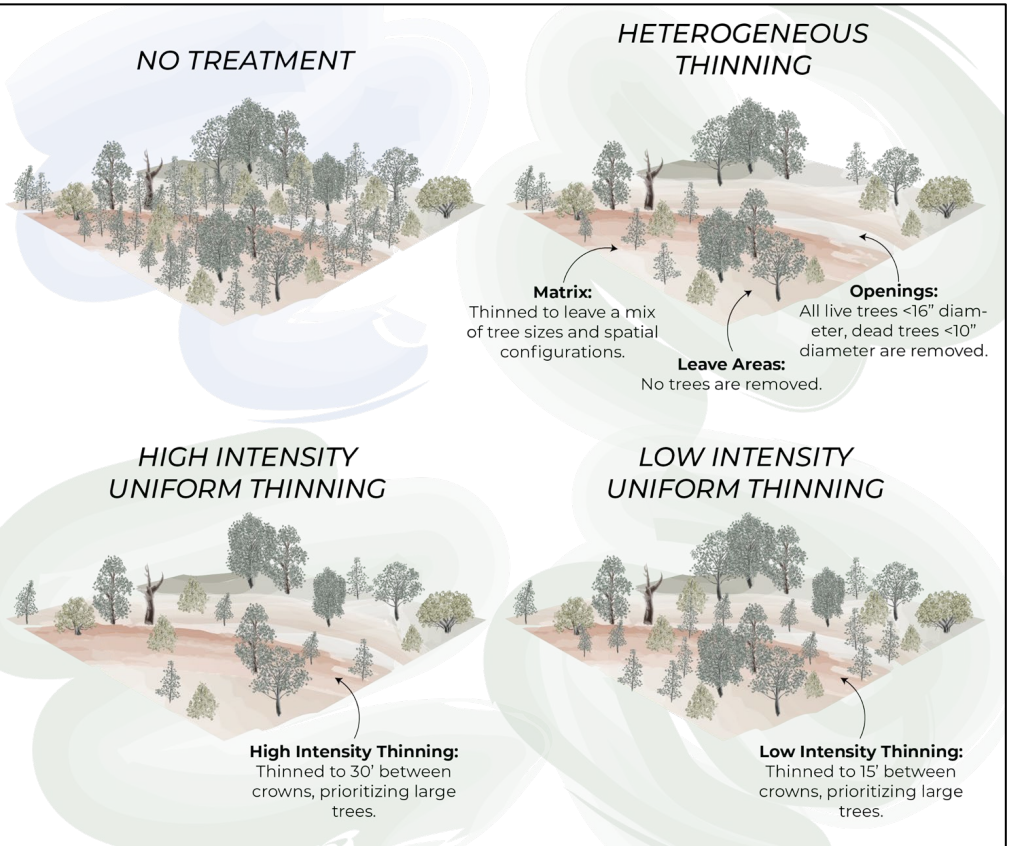
Chad Hoffman Colorado State University

Ian Barrett, James Savage, Tyler Corbin, Nathaniel West, and Chris Domschke BLM

Rosie Frederick University of California, Berkeley

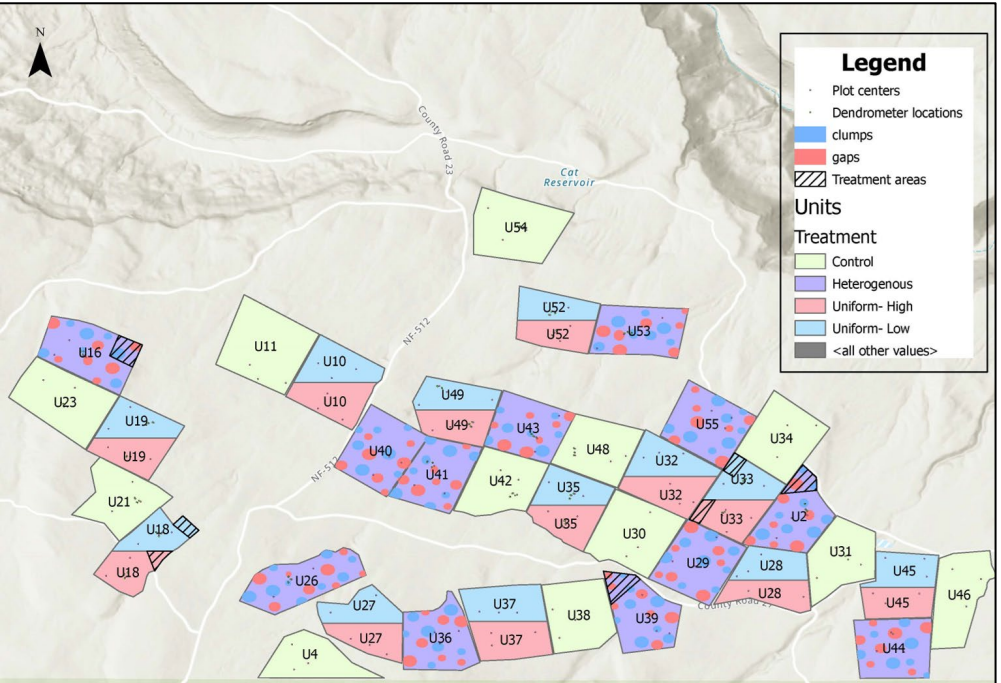
Goal: Experimentally assess the efficacy of different silvicultural treatments for increasing vegetation resilience and reducing fire risk across environmental gradients

SW Colorado Pinyon-Juniper Adaptive Silviculture Project



SW Colorado Pinyon-Juniper Adaptive Silviculture Project

Replicated experimental treatments:



Data collection:

Trees

Tree mortality & regeneration
Pine nut production
Disease and pathogen prevalence
Tree growth

Understory vegetation & groundcover

Understory plant composition and diversity
Ground cover (biological soil crusts, litter, bare, etc.)

Microclimate

Surface temperature
Soil moisture and temperature

Fire behavior

Down wood / fuel loads by size class
Canopy structure (terrestrial lidar scans)

Learning takes many forms - and we need them all

Adaptive management includes getting better at collaboration

- Building relationships of trust and reciprocity:
  - Listening; learning from each other
  - Making space for Indigenous knowledge systems
  - Connecting to the land together (field time)
  - Creating a community
  - Long-term commitment

- Agreement on a clear set of shared goals
  - Awareness of differences in capacity
  - Key committed individuals drive progress beyond larger group efforts
  - Creating opportunities to pivot/reconsider

Thank you!

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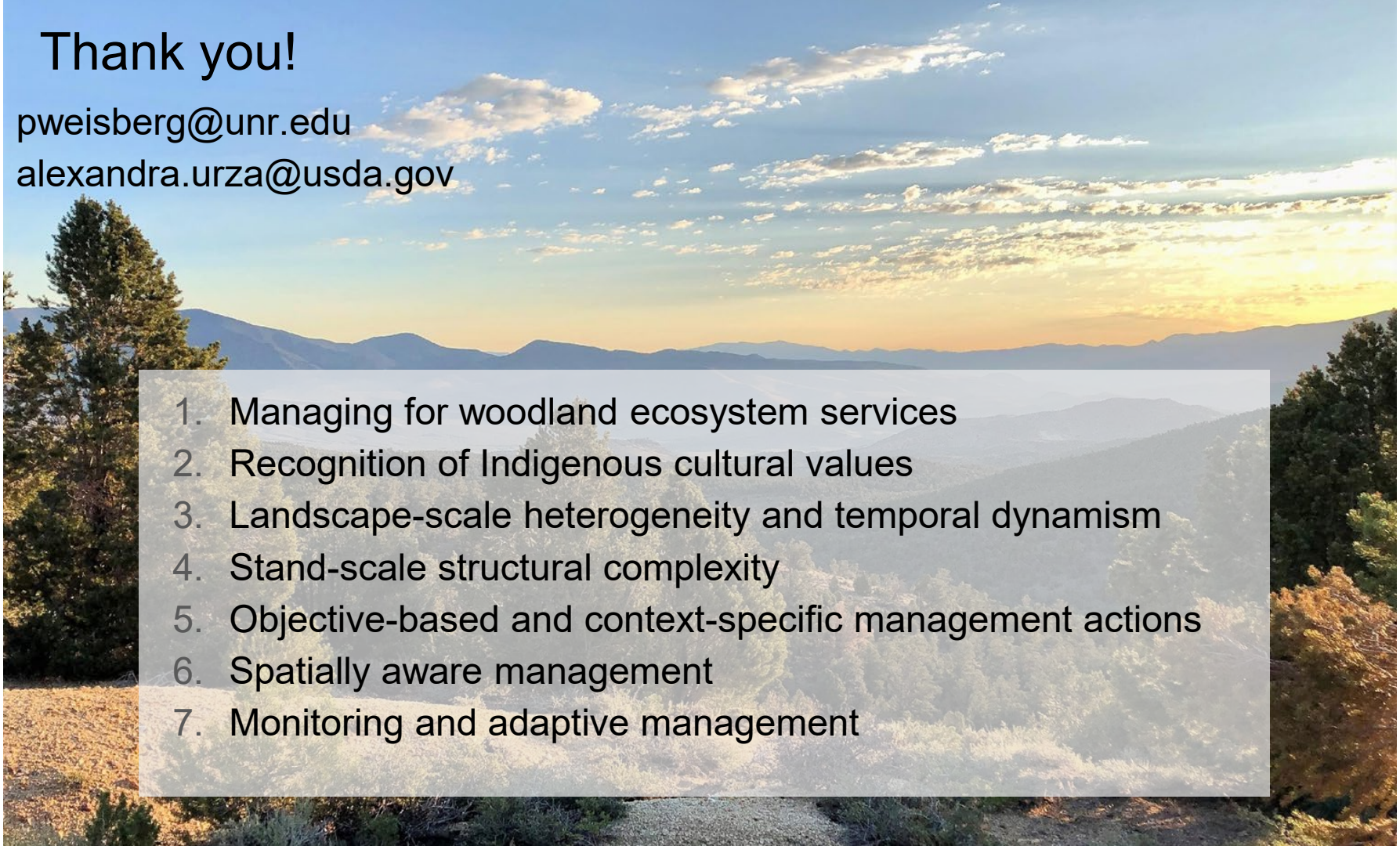

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