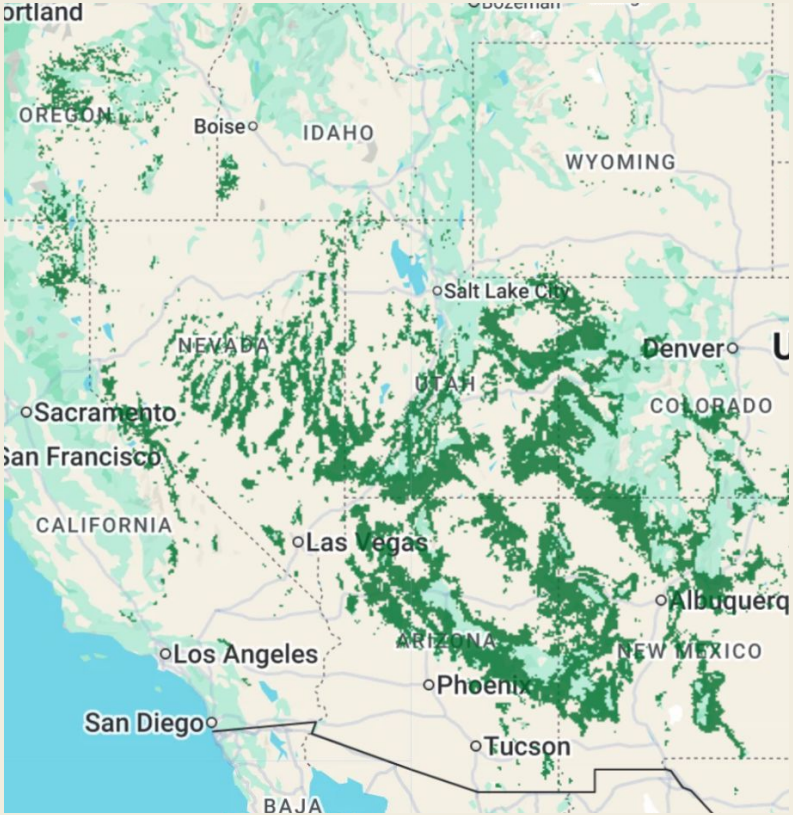
Pinyon-juniper woodlands: Partnering to build resilience

Mandy Slate | Assistant Professor, Ohio State University

Mariah McIntosh | Science to Implementation Specialist, Intermountain West Joint Venture

Miranda Redmond | Associate Professor, University of California Berkeley

Diverse woodlands of the arid West




UGA1274018


UGA1459086

Managers are asking increasingly difficult questions

Where should we invest our limited resources?

What approaches will meet management goals?

What does resilience look like under future climate conditions?

When should we intervene vs let systems change?

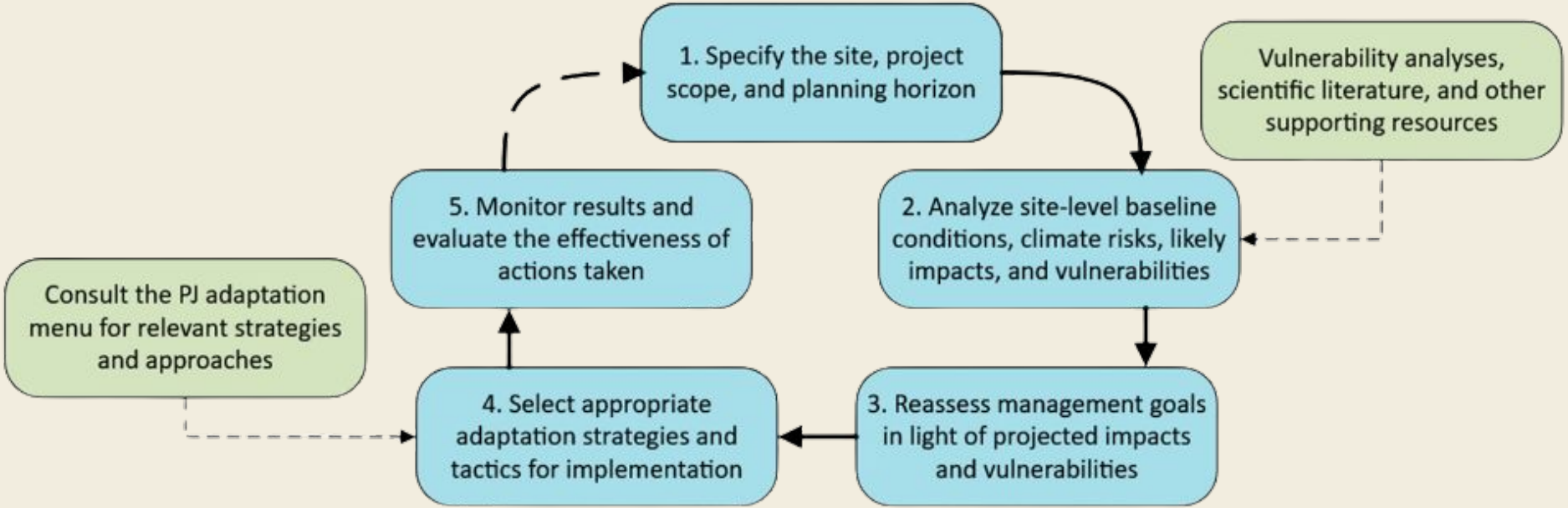
Adaptation Menu process

Fort Collins - 2023

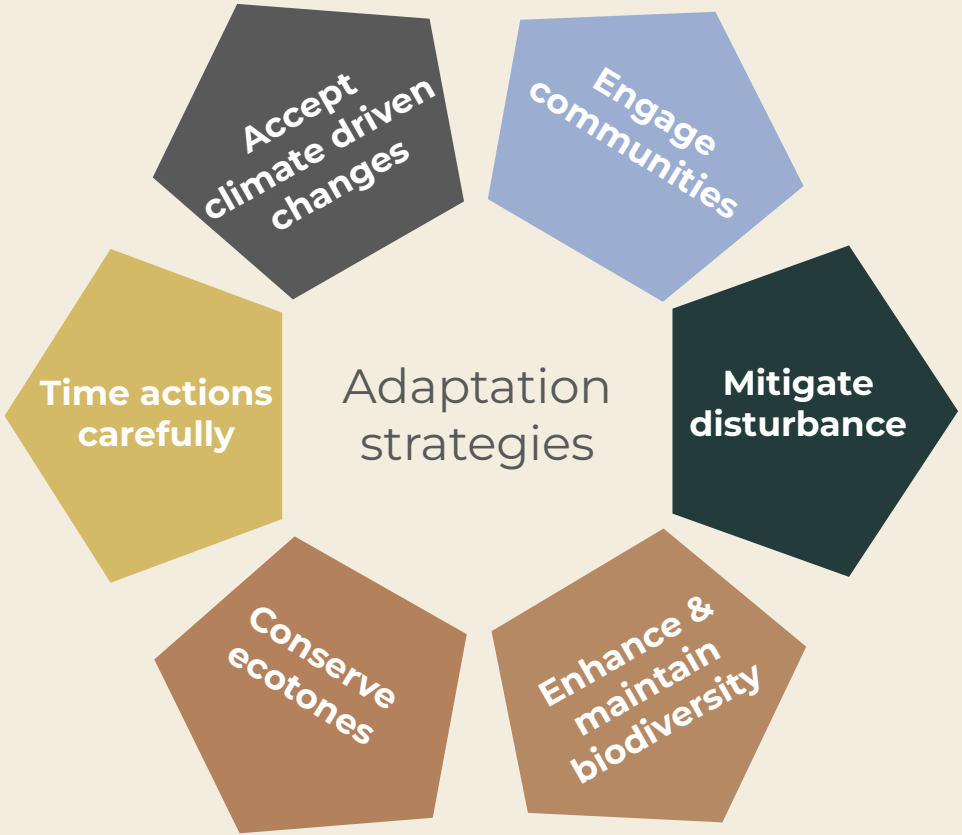
Flagstaff - 2024

1. **Priorities determination**: identify key management priorities with expert advice.
2. **Literature review**: review scientific literature for management recommendations.
3. **Approach assembly**: Collect old and develop new approaches
4. **Menu structuring**: Compile approaches into framework of strategies
5. **Workshop pilot test**: Test draft menu with stakeholders, gather feedback
6. **First revision:** Refine menu based on pilot workshop feedback
7. **Small focus group:** Assess clarity and effectiveness with highly engaged experts
8. **Second revision**: Incorporate focus group feedback into revision
9. **Second workshop test**: test revised menu with additional stakeholders
10. **Final revision:** Finalize adjustments based on workshop feedback

Five-step Adaptation Menu process



Adaptation strategies



forests

MDPI

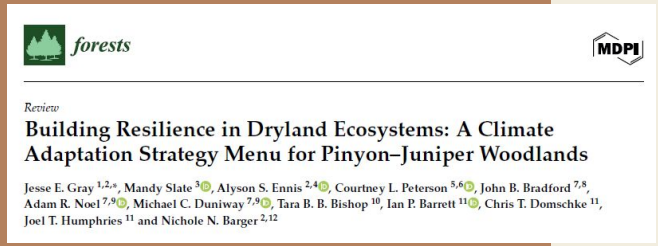
Review

Building Resilience in Dryland Ecosystems: A Climate Adaptation Strategy Menu for Pinyon–Juniper Woodlands

Jesse E. Gray [1,2,*], Mandy Slate [3], Alyson S. Ennis [2,4], Courtney L. Peterson [5,6], John B. Bradford [7,8], Adam R. Noel [7,9], Michael C. Duniway [7,8], Tara B. B. Bishop [10], Ian P. Barrett [11], Chris T. Domschke [11], Joel T. Humphries [11] and Nichole N. Barger [2,12]

Adaptation strategies

Strategies	Approaches
1. Solicit community input	1A. Seek partners with shared interests
	1B. Establish local relationships
	1C. Promote awareness and education
	1D. Align plans with community values
	1E. Monitor land uses
	1F. Share monitoring data
2. Mitigate disturbance	2A. Mitigate invasion during actions
	2B. Minimize soil impacts during actions
	2C. Protect agaist fire
	2D. Reduce fuel accumulations
3. Enhance and maintain biodiversity	3A. Prioritize viable sites
	3B. Maintain and restore soil health
	3C. Use microsites for revegetation
	3D. Assisted migrations
	3E. Control invasive plants
4. Conserve ecotones	4A. Manage for diverse wildlife needs
	4B. Maintain and enhance connectivity
	4C. Create refuges for climate shifts
	4D. Increase habitat diversity
5. Time actions carefully	5A. Control invasives with strategic grazing
	5B. Effective timing for vegetation control
	5C. Effective timing for plant establishment
	5D. Reduce interruptions to wildlife activity
	5E. Flexible climate management plans
6. Accept climate-driven changes	6A. Accept ecosystem transformations
	6B. Redirect investments to suitable areas
	6C. Use changing sites as references
	6D. Consistent invasive species control



Not every acre needs the same strategy

Resist

Protect old-growth woodlands

Build resilience

Reduce fuels, invasive species

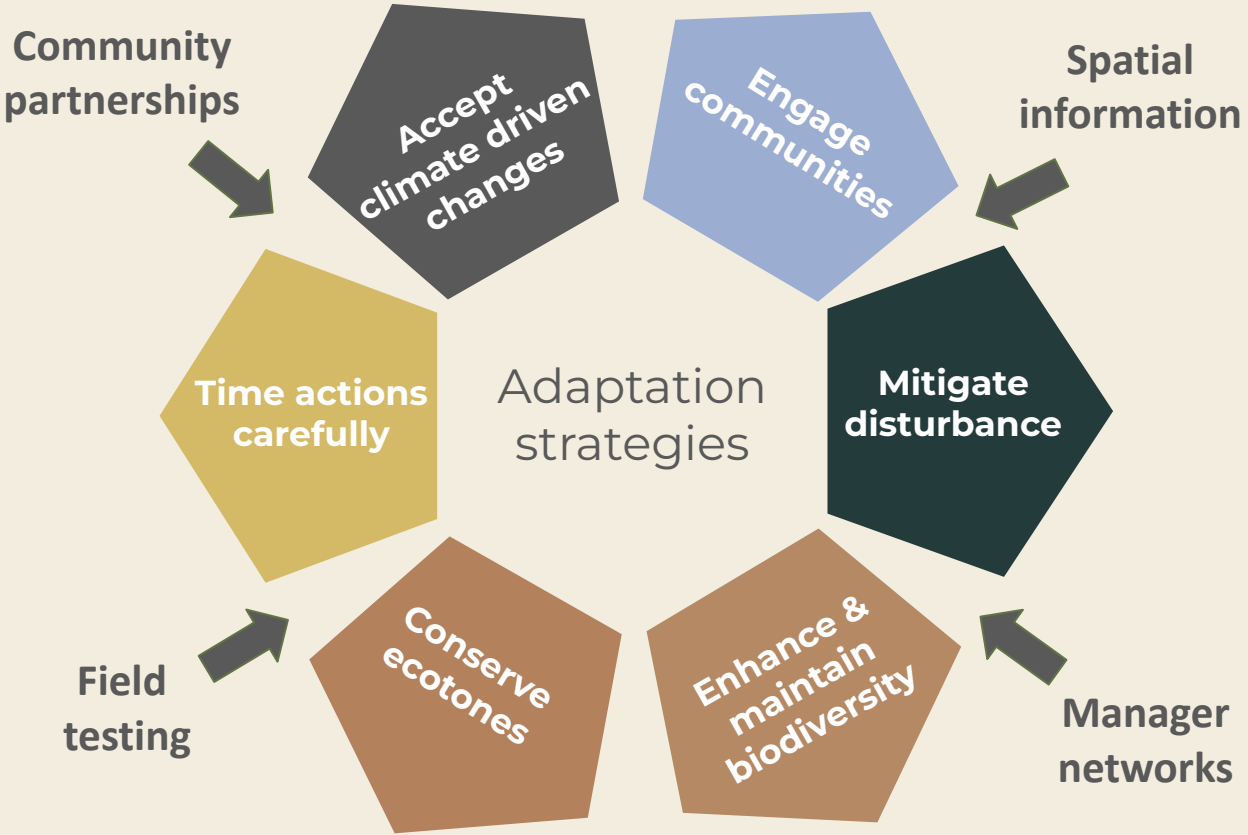
Facilitate change

Climate-adapted restoration

Accept transformation

Monitor transformation areas

Adaptation strategies



Intermountain West Joint Venture

Our mission is to conserve and enhance bird habitats at meaningful scales through capacity building, science, communications, and strategic partnerships.

www.iwjv.org

IWJV Western Forest Program

Where we work

The Pinyon-Juniper Management Network

- **For Who?** Pinyon-juniper woodland managers
- **What?** Management-focused community of practice
- **Why?** To facilitate knowledge exchange and connection on topics like fire risk, drought, insects and disease, wildlife habitat, and more.
- **When/Where?** Through regular virtual meetings and other formats

Pinyon-Juniper
MANAGEMENT NETWORK

www.iwjv.org/PJMN

The Pinyon-Juniper Management Network

- Filling Knowledge Gaps: The Pinyon-Juniper Project and the Dawson Project
- Ask an Expert Panel Session
- State of the Science: Pinyon Jays
- Tribal Stewardship with the PiCCA Network

Pinyon-Juniper
MANAGEMENT NETWORK

www.iwjv.org/PJMN
to join our mailing list!

The Pinyon-Juniper Management Network

- Filling Knowledge Gaps: The Pinyon-Juniper Project and the Dawson Project
- Ask an Expert Panel Session
- State of the Science: Pinyon Jays
- **Tribal Stewardship with the PiCCA Network**
  - **September 29th 1:00-2:30 PM Pacific**

Pinyon-Juniper
MANAGEMENT NETWORK

www.iwjv.org/PJMN
to join our mailing list!

Pinyon-Juniper Mapping Project

- **Who?** Collaboration between federal, state, Tribal, NGO, and academic institutions
- **What?** Manager-relevant, westwide PJ maps considering:
  - Ecological integrity
  - Threats
  - Trends
- **Why?** Support active management, prioritization, and planning
- **How?** Existing data + new analyses

www.iwjv.org/PJMap to learn more!

Pinyon-Juniper Mapping Project

Upcoming maps:

- Areas of PJ expansion and contraction
- Romme types (persistent woodlands, savannas, and wooded shrublands) current extent and trends
- Defining and quantifying ecotones or transition areas between vegetation types

Pinyon-Juniper Mapping Project

Upcoming maps:

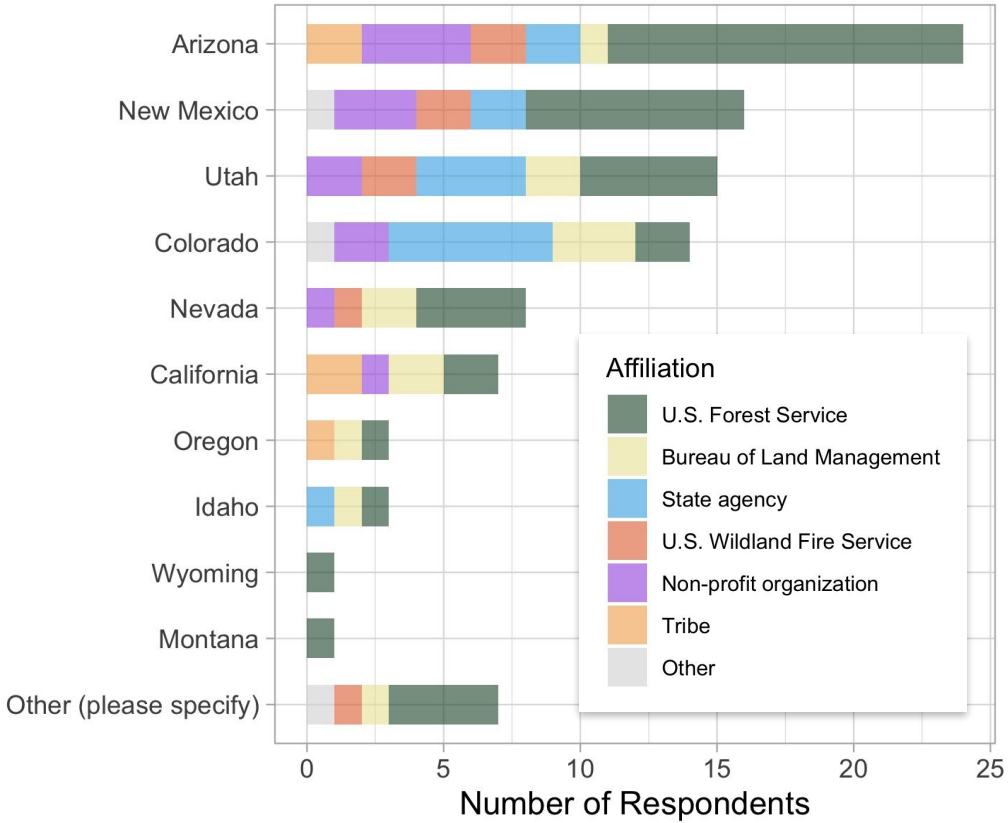
- Areas of PJ expansion and contraction
- Romme types (persistent woodlands, savannas, and wooded shrublands) current extent and trends
- Defining and quantifying ecotones or transition areas between vegetation types
- Ecological integrity index and individual integrity metrics

How can you get involved?

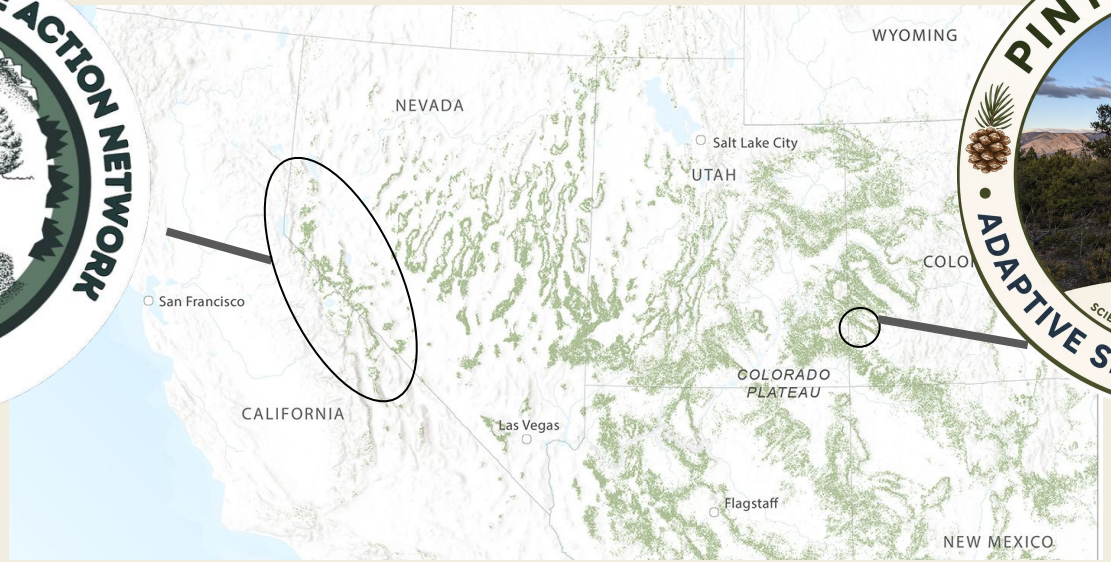
Pinyon-Juniper Manager Survey

- **For Who?** Pinyon-juniper woodland managers
- **What?** A survey to understand what you're doing and what you need going forward
- **Why?** To inform PJ research, outreach, and management efforts

Take the survey!



From regional efforts to local action



PINYON COMMUNITY CLIMATE ACTION NETWORK

"PiCCA"

PINYON–JUNIPER ADAPTIVE SILVICULTURE PROJECT
SCIENCE • STEWARDSHIP • RESILIENCE

"PJAS"

Miranda Redmond, Associate Professor, UC Berkeley; mir@berkeley.edu

Pinyon-Juniper Adaptive Silviculture Project

Pinyon-Juniper Adaptive Silviculture Project

Ian Barrett, Tyler Corbin, John Ott, James Savage, Diane Maston Dixon, BLM,
Miranda Redmond, Gill Revenis, UC Berkeley,
Ali Urza, Jose Negron USFS RMRS,
Peter Weisberg, Krisi Ramsey, UNR,
John Bradford USGS,
Chad Hoffman, Gunnar Ohlson CSU

Pinyon-Juniper Adaptive Silviculture Project

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

NATIONAL SYSTEM OF PUBLIC LANDS
U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

THE UNIVERSITY OF CALIFORNIA BERKELEY 1868

FOREST SERVICE
US
DEPARTMENT OF AGRICULTURE

UNIVERSITY OF NEVADA RENO
OMNIA PRO PATRIA
1874

USGS
science for a changing world

COLORADO STATE UNIVERSITY
EDUCATION · SERVICE · RESEARCH · EXTENSION
1870

Thinning treatments that vary in intensity and spatial heterogeneity

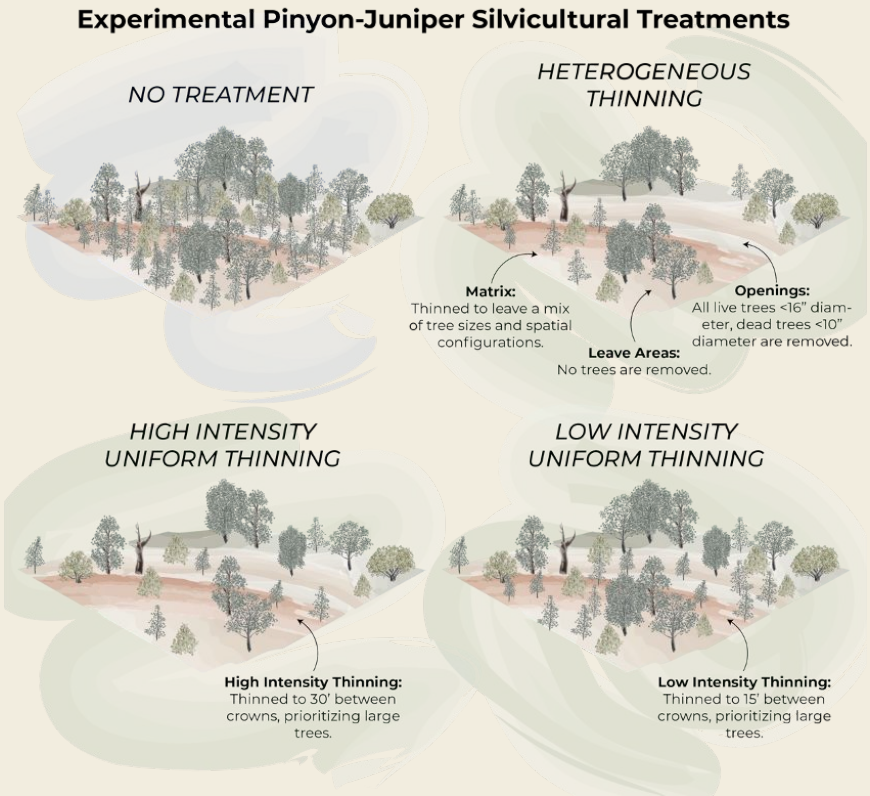
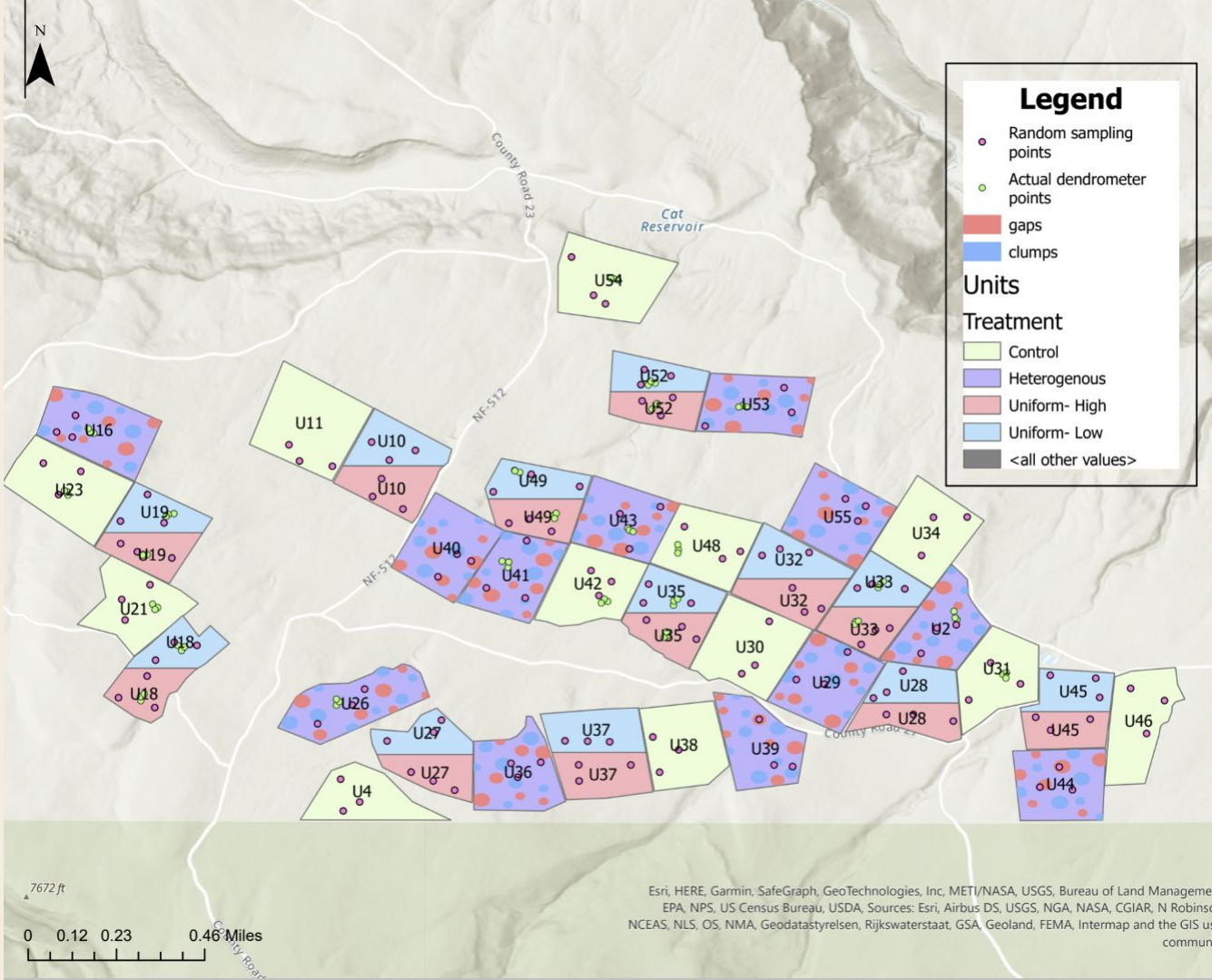


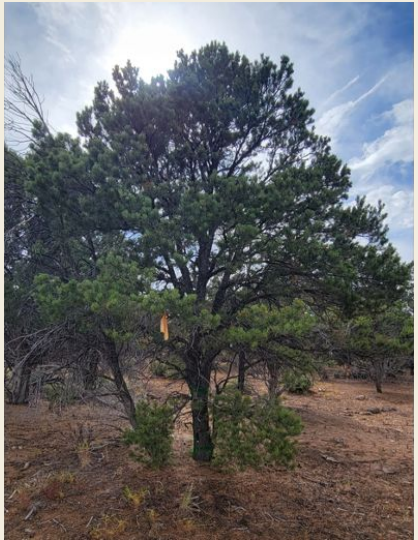
Figure courtesy of Mariah McIntosh

- A lot of discussion between researchers and practitioners
- Balance between prescription complexity and feasibility
- Iterative process → developed the prescriptions, field tested and refined, tested again to check for clarity

Replicated treatments span a 6500-7500 ft elevational gradient in southwest Colorado

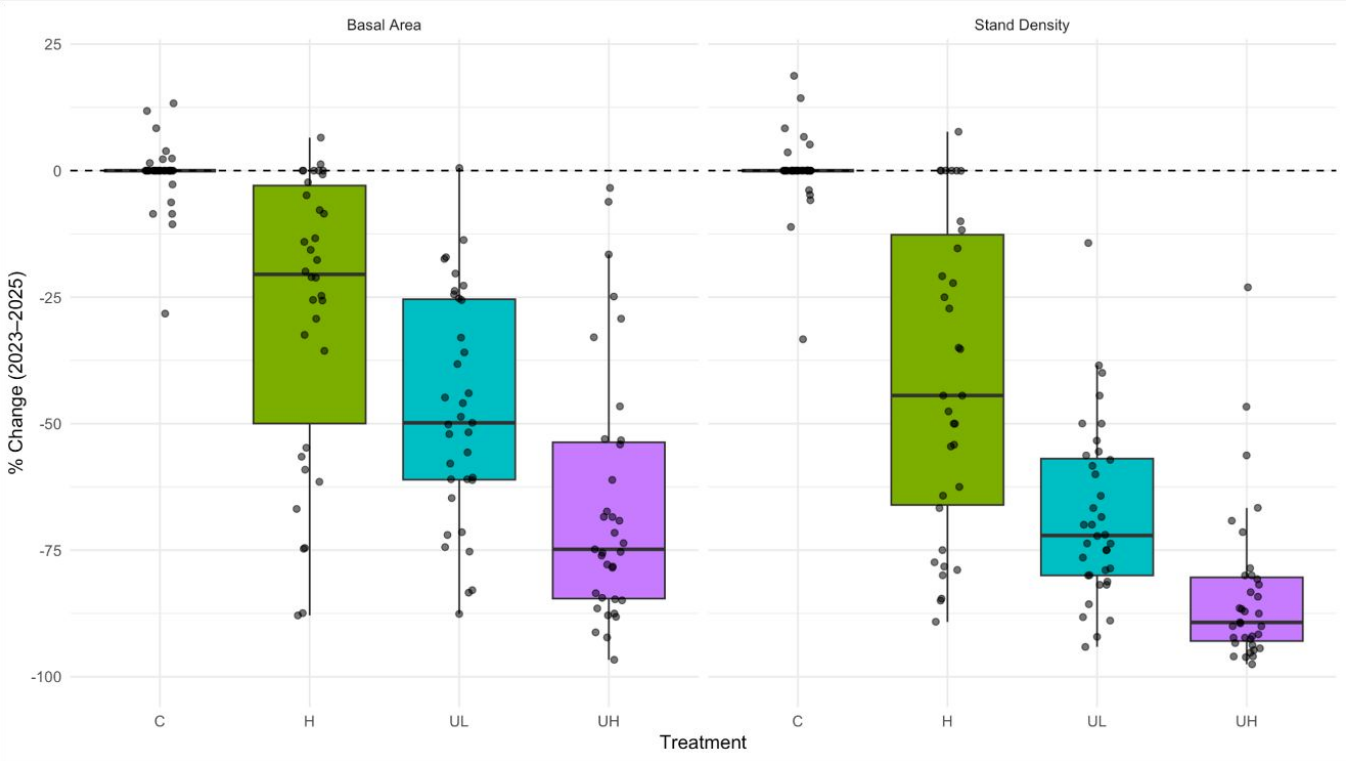


Sampling design characterizes woodland structure, understory vegetation, and fuels



- 192 plots sampled across the study area to characterize woodland structure, understory vegetation, and fuels
- Point dendrometers installed on 72 trees to continuously monitor tree growth and air temperature
- Soil moisture and temperature sensors installed post-treatment
- Terrestrial lidar scans at sensored sampling point for further fuel characterization

Changes in stand structure

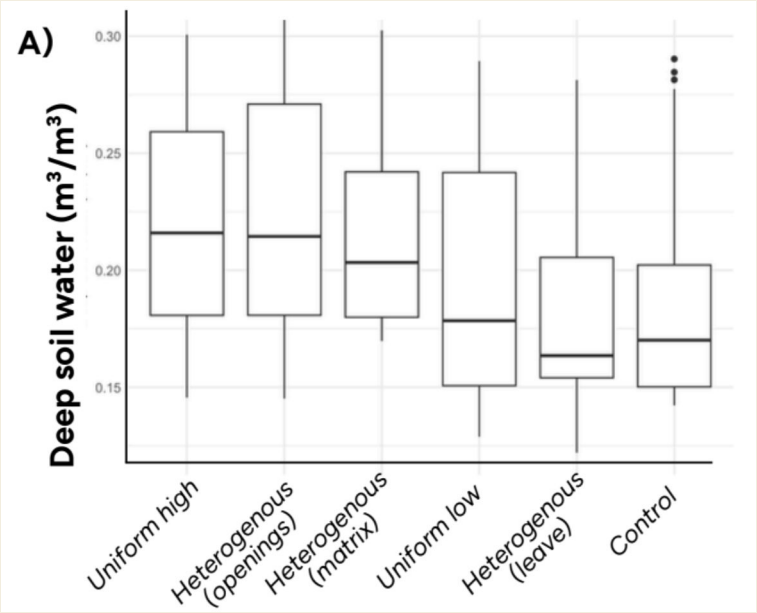


- Greatest reduction in stand density and basal area in uniform high-intensity
- Most variable effects in heterogeneous plot as intended

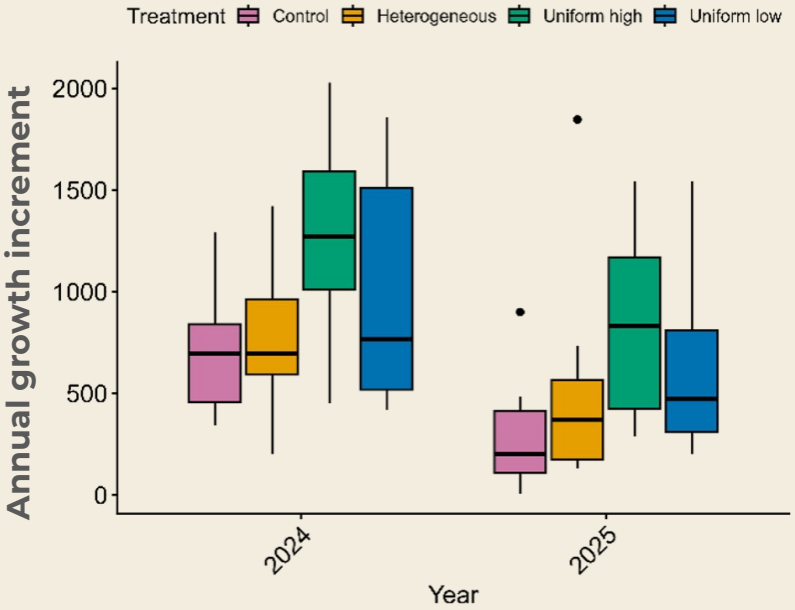
C = Control; H = Heterogeneous; UL = Low-intensity Uniform; UH = High-intensity uniform thinning

Post-treatment results

- Higher deep (23 cm) soil moisture in areas with the greatest amounts of thinning during spring drawdown period
- Greater tree growth during spring and summer in higher intensity thinning treatments.

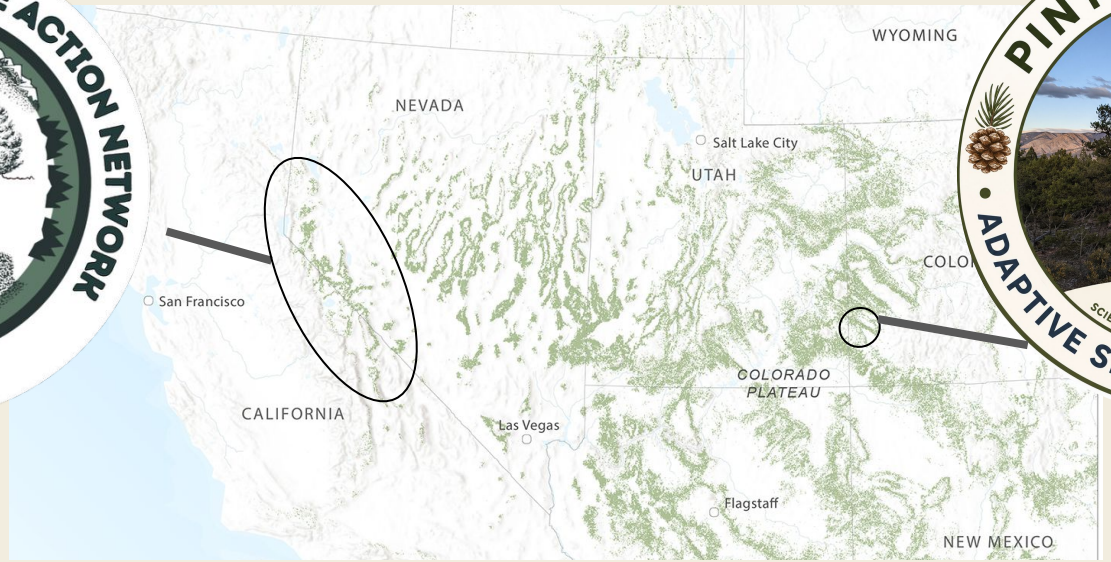


Kristina Ramsey et al., In Prep



Gillian Revenis et al., In Prep

From regional efforts to local action



PINYON COMMUNITY CLIMATE ACTION NETWORK

"PiCCA"

PINYON–JUNIPER ADAPTIVE SILVICULTURE PROJECT
SCIENCE • STEWARDSHIP • RESILIENCE

"PJAS"

Miranda Redmond, Associate Professor, UC Berkeley; mir@berkeley.edu

PINYON COMMUNITY CLIMATE ACTION NETWORK

An interdisciplinary effort aimed to increase the climate resilience of pinyon-juniper woodlands and the communities that live around them

- Big Pine Paiute Tribe Historical Preservation Office
- Bishop Paiute Environmental Management Office
- Bridgeport Indian Colony
- Washoe Tribe Environmental Protection Department

- US Forest Service Inyo National Forest
- Bureau of Land Management

- UC Berkeley
- Stanford University
- USFS Rocky Mountain Research Station

- Eastern Sierra Land Trust
- Friends of the Inyo
- Sierra Business Council

Key areas of focus

Increasing the long-term climate resilience of pinyon-juniper woodlands and the communities that live around them.

1 WOODLAND MONITORING

Creating a monitoring network for tree health

2 PINYON REGENERATION

Understanding the factors that impact regeneration

3 COMMUNITY VALUES

Learning how communities use and value forest landscapes

4 TRIBAL STEWARDSHIP

Elevating Tribal stewardship and knowledge sharing

5 PARTNERSHIPS

Fostering effective and inclusive partnerships

Monitoring and stewardship efforts

Bishop Paiute Tribal Stewardship and Citizen Wunupu Monitoring

Tribal Citizen Wunupu (Pinyon, Pine Nut Tree) Monitoring

Bishop Paiute Tribe

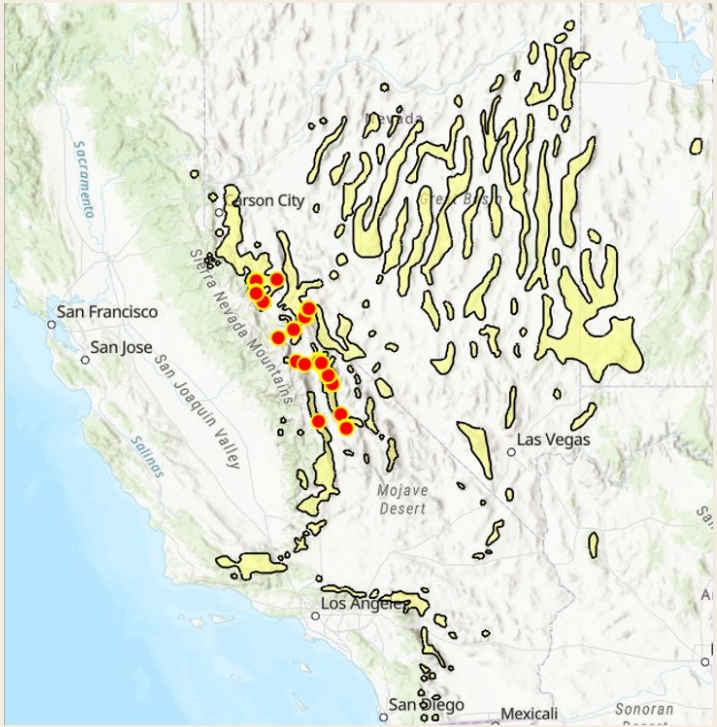
The wunupu (the pine nut or pinyon trees) that are so important to the Nuumu, Newe, Washishu, and other indigenous communities are showing signs of threat from disease, pests, fires, and changing climate. As a Tribal community we want to provide a way for Tribal citizens to collect information about the health of the wunupu groves that they care about because they have always gone there to collect tuba (pine nuts) or they are important places for other plants and animals. This monitoring process is designed to be something that anyone can do without any special tools. You can collect the information on a paper form or on your phone if you have the Survey123 link. The information will be transmitted to the Tribe. The Tribe and other Tribes in the region are working with land management agencies (the Forest Service and the Bureau of Land Management) and with university researchers to identify wunupu groves that are unhealthy or at risk and ways to protect them as much as possible. The information that you collect will only be shared with these agencies as summaries so that any locations or specific information you share cannot be identified exactly.

The information collected by the Tribal community will be summarized and shared with the community at events like the annual pine nut blessing and through publications like the Tribal newsletter. If you have any questions about this effort, you can contact the Bishop Paiute Tribal Environmental Management Office at 50 Tu Su Lane, Bishop, Ca 93514. Phone: 760-873-3584.

If you are from another Tribe and are interested in your Tribe using this same monitoring process, please contact your Tribe. The Bishop Paiute Tribe will share this same monitoring protocol with other Tribes in the region.

Monitoring and stewardship efforts

Bishop Paiute Tribal Stewardship and Citizen Wunupu Monitoring

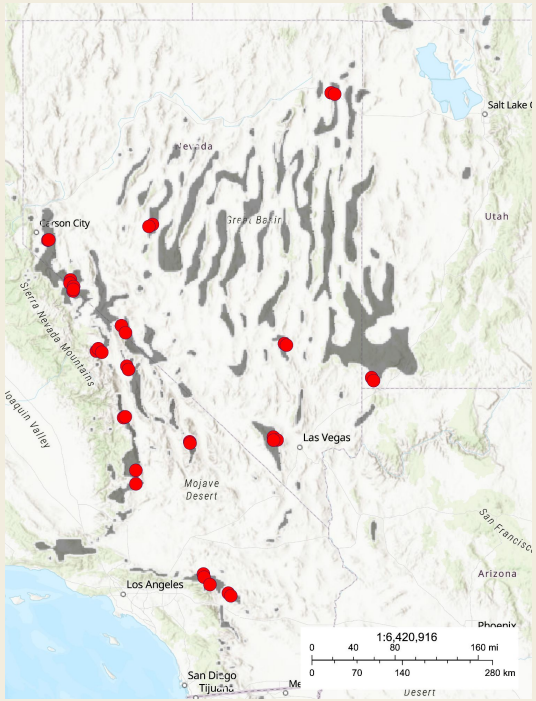


510 observations (38 monitors) within *P. monophylla* range.

Slide Courtesy Ana Bacoch, Big Pine Paiute Tribe Pinyon Specialist

Monitoring and stewardship efforts

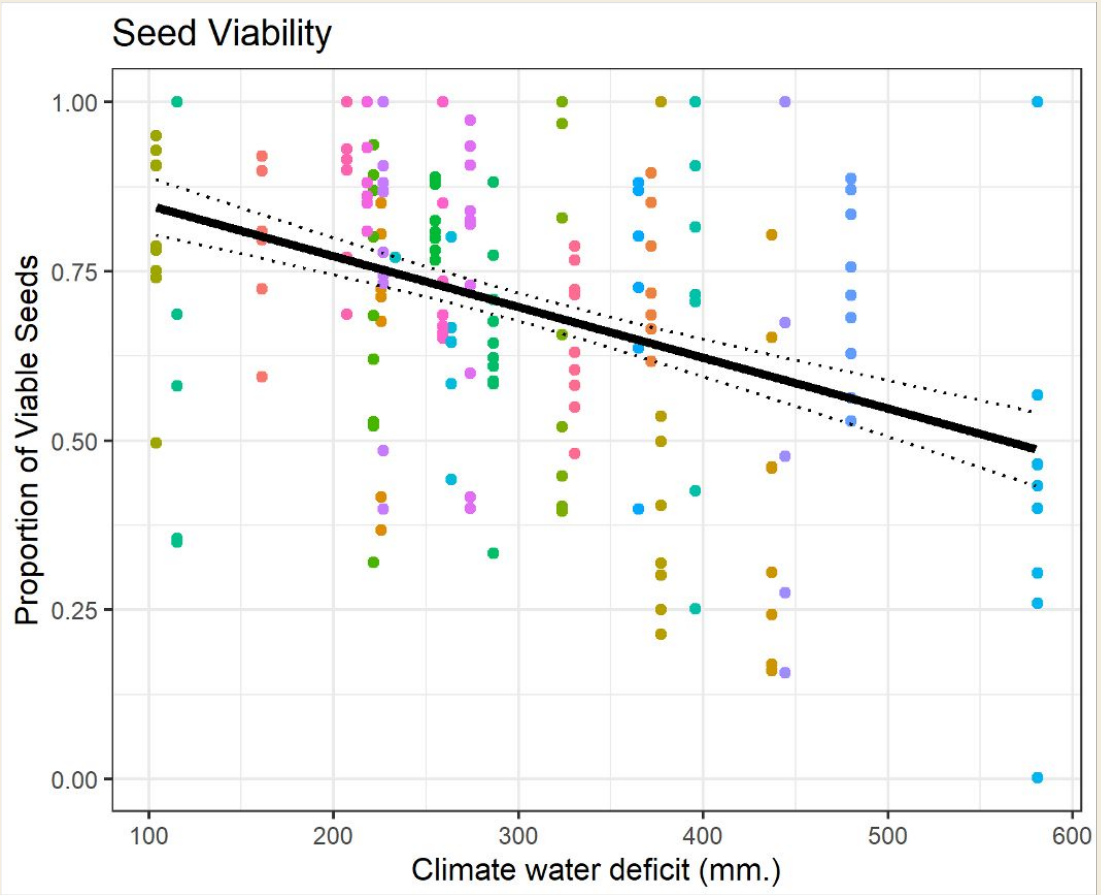
309 trees sampled across 36 plots (14 mountain ranges) to characterize current and historic cone production across singleleaf pinyon pine's range



Takeaways:

- Climate was strongly associated with seed viability
- Limited relationship found between neighborhood tree density and cone or seed production

Monitoring and stewardship Efforts



Monitoring and stewardship efforts

Pinyon Propagation and Reforestation

Lessons learned and conclusions

- Pinyon-juniper woodlands are facing increasing climate stress, requiring new approaches to building resilience to drought, wildfire, and other environmental change.

- Working alongside Tribal communities, local stakeholders, researchers, and land managers ensures that research is both scientifically rigorous and relevant to real-world stewardship.

- Effective adaptation will require place-based strategies that recognize variation in ecological conditions, management objectives, and community values.

Contact information

Mandy Slate: slate.41@osu.edu
Mariah McIntosh: mariah.mcintosh@iwjv.org
Miranda Redmond: mir@berkeley.edu

Date: September 10, 2026
Time: 1-2 pm EST; 11am-12 pm MTN
Title: Pinyon-juniper woodlands: Partnering to build resilience
Description: Managing pinyon-juniper woodlands for resilience is increasingly challenging as climate change, altered disturbance regimes, and diverse stakeholder priorities reshape western landscapes. Across the West, these landscapes provide a wide range of ecological, cultural, economic, and recreational values, including wildlife habitat, Tribal and community resources, watershed function, livestock forage, recreation opportunities, and wildfire mitigation. Because conditions, management goals, and available resources vary substantially across this vast region, land managers face difficult decisions about where, when, and how to invest in actions that will sustain resilient pinyon-juniper ecosystems and the benefits they provide. These challenges underscore the need for collaborative approaches and tools that help managers balance multiple objectives while adapting to future climate conditions.

This webinar highlights complementary efforts that are advancing the science and practice of pinyon-juniper woodland management across the western United States. We first present a climate-informed decision support framework developed through collaboration among researchers, land managers, and stakeholders to support the planning, prioritization, and evaluation of management actions across the Colorado Plateau. We then introduce two biome-scale initiatives led by the Intermountain West Joint Venture: the Pinyon-Juniper Mapping Project (PJMap), which is developing a spatial framework to assess woodland extent, condition, ecological integrity, and management needs across the biome; and the Pinyon-Juniper Management Network (PJMN), a manager-focused community of practice that facilitates knowledge exchange and supports the integration of science and practitioner expertise into management decisions.

Finally, we highlight two place-based efforts that are testing and applying these concepts on the ground: the Pinyon-Juniper Adaptive Silviculture Project in southwestern Colorado, which evaluates how thinning intensity and structural heterogeneity influence drought resilience and wildfire risk, and the Pinyon Community Climate Action (PiCCA) project in the Eastern Sierra Nevada, an interdisciplinary partnership among Tribal Nations, land managers, community organizations, and researchers working to strengthen woodland resilience under future climate conditions. Together, these initiatives demonstrate how collaborative science, manager-focused tools, and adaptive management strategies can help sustain resilient pinyon-juniper ecosystems across the West.