Achieving landscape scale piñon-juniper ecosystem treatment efficiency

Seeking a smarter use of WUI dollars in PJ stewardship

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Flow of the Talk

A. Questions: a PJ Conundrum or Misconception

- PJ ecosystem health and fire risk
- Stem density, ecosystem health, fire risk

B. PJ Ecosystems: a Closer Look

- PJ ecosystems in the West and in NM
- PJ ecosystem types and dynamics

C. Managing PJ: Seeing it Whole

- PJ management goals
- Ecosystem services, values, benefits

D. Conclusions: for Consideration

- Conclusions for treatment strategies
- Next steps, questions and dialog



Questions: A PJ Conundrum or Misconception

Questions for a Conversation

An invitation to a dialogue...

- Why are PJ system degrading?How effective are PJ treatments?
- How can we use WUI dollars more efficiently in PJ ecosystems?
- >Why is this question relevant?
- >What is going on in PJ ecosystems?



Stem Density Reductions in PJ

General effects of stem density reductions:

- A. Reduction of fire frequency and fire intensity in the short-term
- B. Increased risk and signs of ecosystem degradation in the short- and long-term
 - Erosion, watershed degradation (Allen et al. 2008)
 - Aridification (Litvak 2020)
 - Non-conserving, "leaky" communities (Miller et al. 2019)
 - Inadequate PJ ecosystem recovery ten years after thinning in many CFRP projects (Mahan 2019)





Ecosystem degradation symptoms and causes

Root Causes

- History of intensive grazing and absence of fire
- History of mass vegetation conversions (chaining, fire, clear cut, die off)
- Ongoing drought, insect and other disease stresses
 → periodic mass die offs (e.g., around 2003)
- Urbanization and recreation use; increase of NM WUI area in PJ Ecosystems (guess: ~70%)

Symptoms and Stressors

- Decline of PJ traditional uses
- Erosion, sedimentation, and flooding
- Decline of PJ specific bird communities
- PJ invasion into grassland; poor grass regeneration
- Cheatgrass proliferation





Management Conundrum or Misconception?

Ecosystem Health



Fire Safety

Stem Density

Stem Density: Ecosystem Health and Fire Risk

Ambiguous causal relation between stem density and:

- PJ fire risk and fire frequency
- PJ ecosystem health

There are many other factors to consider: such as **PJ Type** and **herbaceous cover**











PJ Ecosystem Types

Three Main Ecosystem Regions:

- Romme et al. (2008) focus on CO Plateau:
 - 3 PJ types
 - ✓ Persistent Woodland
 - ✓ PJ Shrubland
 - ✓ PJ Savannah
- NM FWRI (2007-2019) focus on NM:
 - 5 PJ types
 - ✓ See above
 - \checkmark Open Woodland
 - \checkmark Grassland with PJ

Also: Riparian PJ Shrubland; Juniper Savannah; Ponderosa pine and PJ woodland

• Miller et al. (2019) - research focus on Great Basin and CO Plateau



- At least 100M acres (possibly up to 136M) across the West, depending on definition
- 46M acres across the Southwest
- 8.8M acres in NM
- 11.3% on NM land area
- 54% of all forest / woodland in NM

Persistent Woodland





Ortiz Mnt: Santa Fe Co., NM; 8,500 ft. Rocky, steep terrain, medium dense, patchy woodland structure

Mesa Verde NP: Montezuma Co., CO; 7,000 ft. Rocky and loamy, rolling terrain, dense woodland structure

PJ Shrubland (upland)



Wind Mountain, Rio Grande del Norte NM: Rio Arriba County, NM; 8,300 ft. Loamy, nearly flat, open shrub land with sagebrush and PJ



Mesa de la Cejita: Rio Arriba Co., NM; 7,300 ft. Steep and flat rocky cliffs and mesas, dense shrubland of PJ, mountain mahogany, Apache plume, cliff rose, etc.

PJ Savannah



Wind Mountain, Rio Grande del Norte NM: Rio Arriba County, NM; 8,500 ft. Stony, rolling, dense PJ savannah with moderately frequent fire

Galisteo Basin: Santa Fe, Co., NM; 6,500 ft. Gravelly and sandy PJ savannah



North of **Golden:** Santa Fe Co., NM; 6,700 ft. Gently

Open Woodland



Natural Bridges NM: San Juan Co., UT; 6,500 ft. Rocky and sandy, rolling terrain, scattered, open woodland structure **Glorieta Mesa:** Santa Fe County, NM; 7,600 ft. Stony, loamy, gently sloping, moderately dense with old trees



Wind Mountain, Rio Grande del Norte NM: Rio Arriba County, NM; 8,500 ft. Stony, loamy, gently sloping, variable structure with many old trees



Grassland with PJ



Rowe Mesa: San Miguel Co., NM; 7,200 ft. Loamy and sandy grassland with PJ, partly encroached due to low level fire and grazing impacts **Glorieta Mesa:** Santa Fe Co., NM; 7,250 ft. Gently sloping, sandy and loamy grassland with PJ





San Pedro Open Space: Santa Fe Co., NM; 6,800 ft. Gently sloping, loamy and sandy grassland with PJ encroachment

PJ Shrubland (riparian)



Eldorado Community Preserve: Santa Fe Co.; 7,200 ft. riparian marsh area with willows, Rocky Mnt juniper, NM olive, chamisa, four-wing saltbush

Glorieta Mesa: Santa Fe Co.; 7,500 ft. Willow wetland with Rocky Mnt juniper and wetland forbs



Cañadita del Agua: Rio Arriba Co.; 7,300 ft. Spring wetland area in PJ woodland with willows, mountain mahogany, etc.



PJ Woodland with Mixed Conifer Overstory

Ortiz Mnt. : Santa Fe Co., NM; 8,000 ft. Rocky, moderately steep terrain, medium dense, patchy woodland structure with ponderosa pine, Douglas fir and white fir overstory; N-facing slope; 2nd or 3rd generation forest.



PJ Woodland with Ponderosa Pine Overstory

Ponderosa Ridge: Santa Fe Co., NM; 7,500 ft. Rocky, moderately steep terrain, medium dense, patchy woodland structure with ponderosa pine overstory; Nfacing slope; 2nd or 3rd generation forest.



Ecological PJ Dynamics

Source: Romme et al. 2009. Historical and modern disturbance regimes, stand structures, and landscape dynamics in piñon-juniper vegetation of the western United States. Rangeland Ecology & Management 62(3), 203-222.



PJ Ecosystems: Critical Factors

PJ Type and Fire Regime is determined by:

- Climate (summer vs. winter precipitation; dry vs. moist; warm vs. cool)
- ✓ Elevation and topography
- ✓ Soil texture and OM content
- ✓ Current plant community and past disturbance history





Fire Dynamics in PJ Types in New Mexico

	Winter Precipitation	Bi-Modal Precipitation	on Summer Precipitation
	Higher Elevation	Mid Elevation	Lower Elevation
Mesic	Persistent (, ; 200-600 y		
	PJ- Shrubland (🔥 🔥 ; 50-100	y ?)	
		Riparian (?; Mod Fr)	
			PIPO-PJ (, ;Mod Fr)
	Op	oen PJ Woodland (🔥 ; Mod Fr	r)
		PJ Savannah (🄥 ; <25 y)	
Dry		Grassla	and w/ PJ (
			Juniper Savannah (

Wild Fire Risk Factors in PJ

Ignition risk = ignition sources + fine fuel load + fuel conditions + atmospheric conditions

Spread risk = atmospheric conditions + fine fuels connectivity + canopy connectivity + vegetation vitality

Crown fire risk = surface fuel conditions + crown height + vegetation vitality

Values at risk = fuel connectivity + potential of high fire intensity + proximity to valued resources





Key PJ fire management conditions

- *Ecosystem health* (soil health, tree health, vegetation type structure)
- Patch structure (crown height, canopy continuity, clump structure)
- Fuel distribution (herbaceous fuel, fine woody fuel)

A PJ Management Opportunity





Fire Safety

Stem Density (+)

Managing PJ: Seeing it Whole

PJ Management Goals in WUI Areas

Goals for managing PJ in WUI Areas:

- ✓ Reducing risk of frequent, high intensity and high severity fire in WUI
- ✓ Maintaining multiple goals for a broad audience: esp. WUI residential and recreational qualities and wildlife habitat/corridor qualities

PJ Management Success:

Treatments with:

- □ Many Benefits, High Values
- □ Long Duration
- □ Large Area
- Relatively Low Cost





Ecosystem Benefits

Traditional Agricultural & Contemporary Residential and Recreational PJ Uses

- Ceremonial uses
- Firewood
- Fence posts
- Craft wood and construction wood
- Livestock forage and shelter
- Piñon nuts
- Christmas trees
- Hunting of small game and deer
- Wind protection and soil cover
- Carbon sequestration, ecosystem functions/services
- Educational and stewardship opportunities
- Recreational landscape (trail users)
- Semi-rural, residential setting (WUI)







Ecosystem Services and Functions



If we want:....

- *Water* (e.g., infiltration, clean water, flood control)
- *Soil health* (e.g., organic matter, microbiome)
- Plant production (e.g., woody biomass, mast crop, plant vigor)
- Biodiversity (e.g., habitat, spatial diversity, species richness)

We need to manage for:

- Plant cover and plant litter (on soil), esp. in inter-canopy spaces
- Plant density
- Plant species richness
- Clumps with diverse species
- Multiple plant canopies
- > Soil aggregate stability (roots and microbiome)
- Richness of animal life (incl. birds, insects, etc.)

Conclusions: How to manage PJ?

Management Limitations

A. Limited Information, about:

- Fire frequencies in different PJ types and fire intensity and severity
- Specific relationships between ecosystem health and fire behavior
- Effects of treatment on ecosystem health and fire behavior
- **B.** Limited Time
- C. Limited Money



Managing the Whole PJ Ecosystem

Management principles for achieving ecosystem health and fire resilience

- >Maintain clumps + gaps (sizes dependent on PJ Type)
- Masticate or spread slash in the (large) bare openings between clumps
- Treat outside active bird season and tree growing season
- Do not prune up trees (if not necessary)
- Do not remove snags or woody biomass; do not remove shrubs, oak, etc.
- Include soil health improvement practices (erosion control, optimal soil cover, sowing native herbaceous seed, include managed grazing if feasible)



WUI Management Options in PJ Types

	Very Little to No Action	Some Manageme	ent .	Active Management
	Ecosystem Health + Fuel Re-distribution (No Stem Density Reduction)	Rx of Selective Combinations of Activities	e Rx includ of Re-	ling Fire, Grazing, Fuel distribution and Stem Density Reductions
No Rx Fire	Persistent (, ; 200-600 y)			
	PJ- Shrubland (🥀 🎸 ; 50-100 y 3	?)		
		Riparian (🔥 🎝 ?; Mod F	?r)	
			PIPO-PJ (🔥 🔥 ;Mod	l Fr)
	Open	PJ Woodland (🔥 ; Mod	d Fr)	
		PJ Savannah (🄥 ; <25 y)		
Rx Fire		Grassl	land w/ PJ (🔥 🔥 ?;	Mod Fr)
			Juniper	Savannah (🔥 🎝 ?; Fr)

Conclusions for Treatment

> Treat appropriately to the PJ type and disturbance history

- ➤Conduct rigorous, site-specific research
- >Monitor the project
- Address all ecosystem benefits and functions
- ➢ Restore the entire ecosystem
- Be very careful: treat lightly or do not treat at all
- ≻Use all the tools in the toolbox:
 - Mastication or mechanical thinning
 - Pile burns and other prescribed fire
 - Redistribution of fine fuels and slash
 - Soil conservation BMPs
 - Minimizing soil and herbaceous cover disturbance
 - Preventing weed invasion and reseeding
 - Managed grazing



Summary of PJ Management Approach

Identify and Manage relative to:

- PJ ecosystem type
- □ Fire risk: fuel types, fuel connectivity
- Past disturbances, degradation stage
- □ Current uses, values, ecosystem services
- □ Recent and expected weather/climate
- □ Least invasive treatment, greatest effect
- □ How to reduce any degrading effects



Conclusions and Benefits

Benefits from this approach

- ✓ Diverse cultural, social, economic uses and values
- ✓ Beneficial side effects
- ✓ Diverse training and employment opportunities
- ✓ Selective site selection: more acres treated
- ✓ Comprehensive approach: landscape scale
- ✓ More long-term effects
- ✓ More satisfied constituents
- ✓ Dollars reach greater acreage: cost efficiency
- ✓ More types of funding can be mobilized
- **Greater success over time and over a larger area**





Questions & Dialog

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