

Climate Change and Mixed Conifer/Aspen Systems in New Mexico: Considerations for Managers

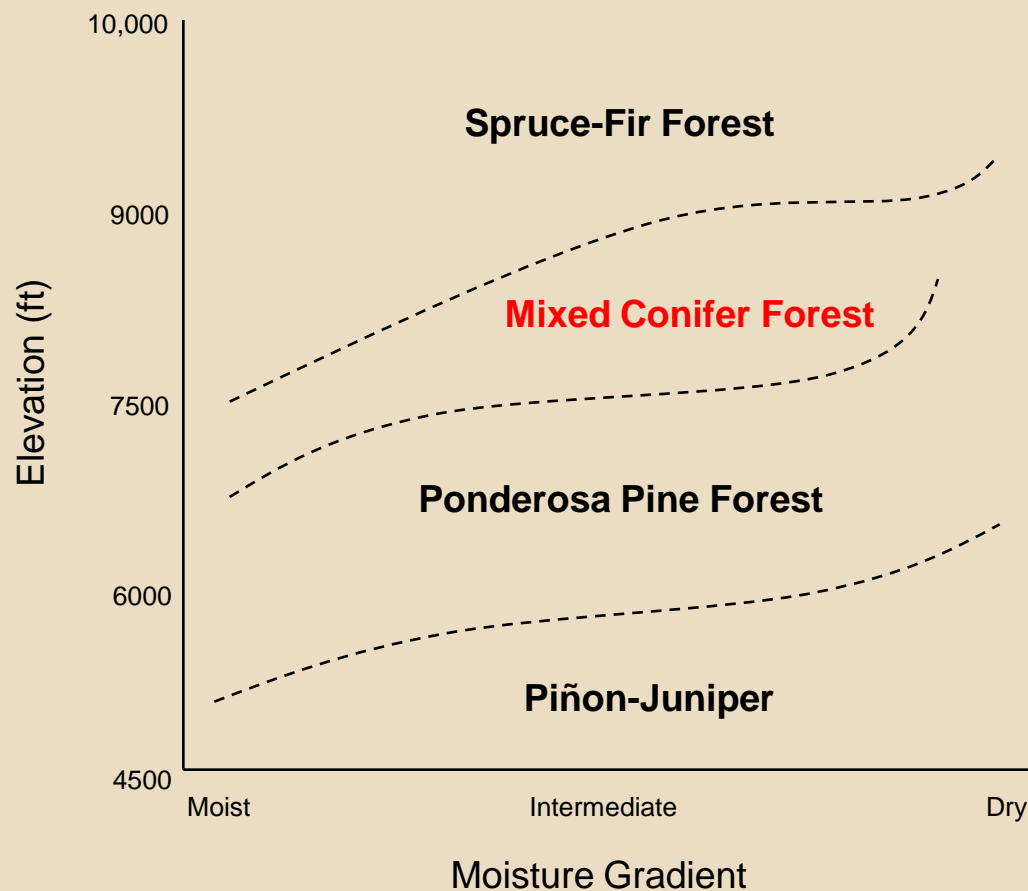
- Jim Youtz, USFS Region 3
- Marlin Johnson, Society of American Foresters
- Deb Allen-Reid, USFS Region 3
- Anne Bradley, The Nature Conservancy
- Bryan Bird, WildEarth Guardians
- Carol Bada, NM Forestry Division
- Zander Evans, Forest Guild
- Pete Fulé, Ecological Restoration Institute
- Ken Smith, NMFWRI

Highlights

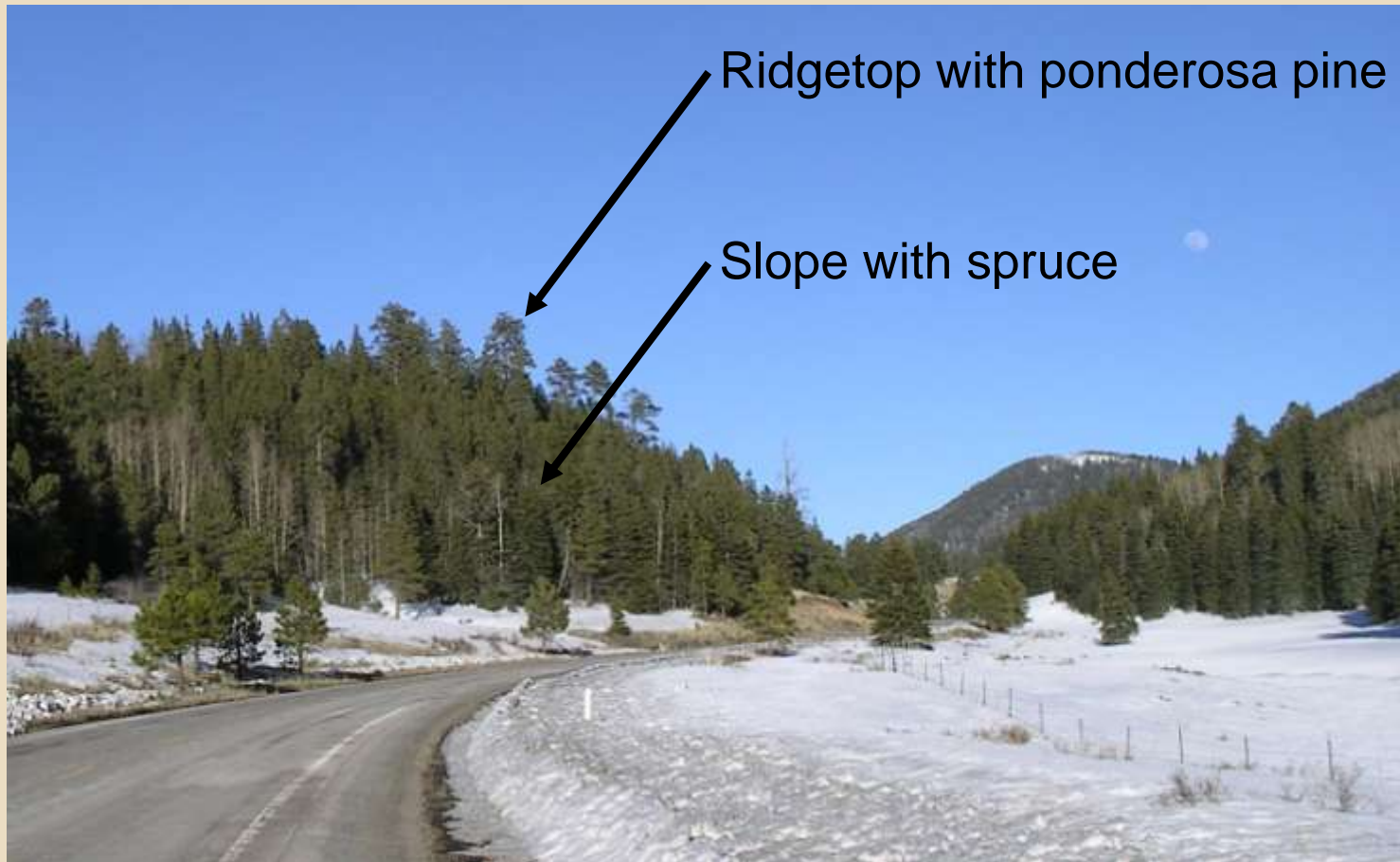
- General description of mixed conifer
- Historic and current conditions
- Issues of particular concern
- Management strategies and recommendations
- Concluding thoughts



Ecosystems Relative to Gradients in Elevation & Moisture



Valles Caldera National Preserve, NM

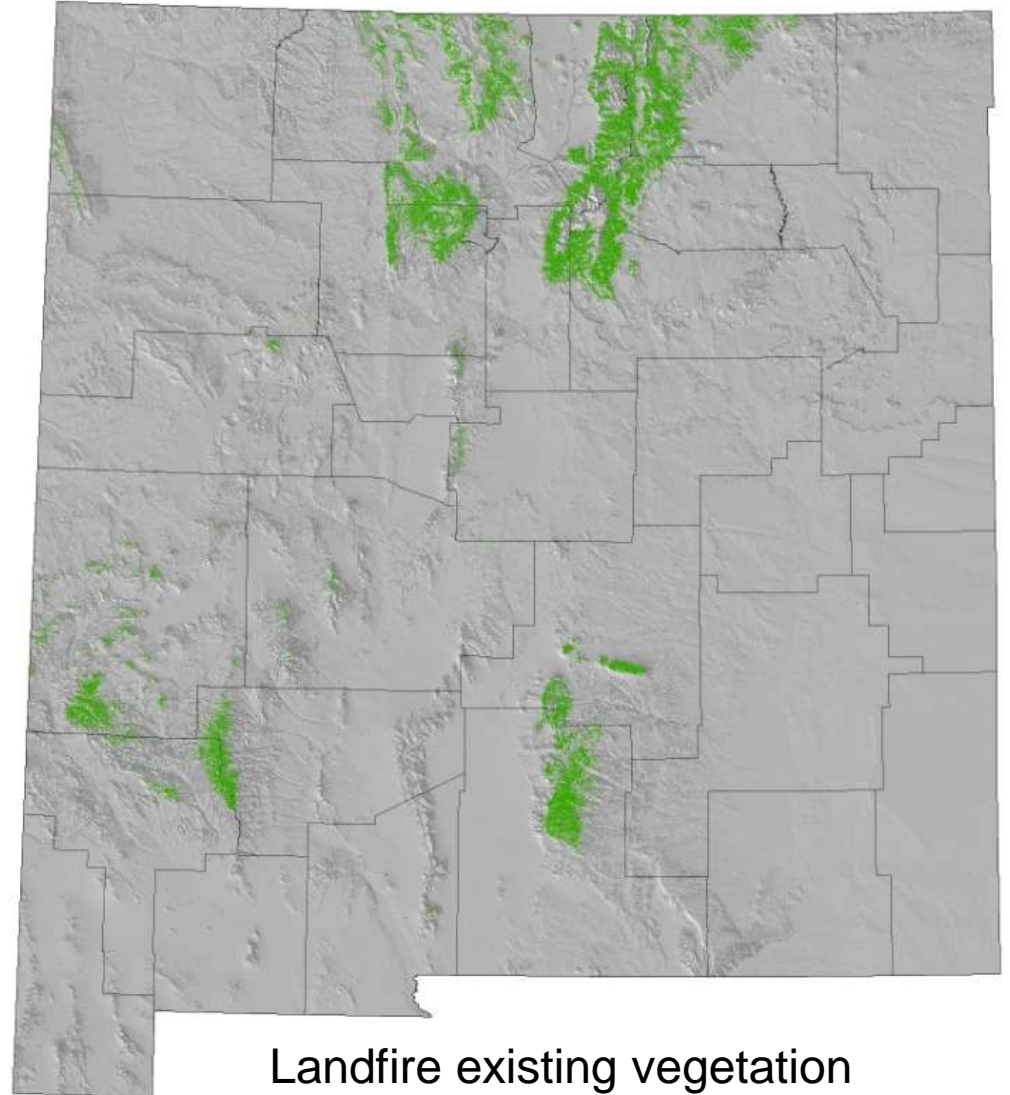


Piñon-Juniper/Doug-fir/white pine/Ponderosa/hardwood mix of species near Cloudcroft

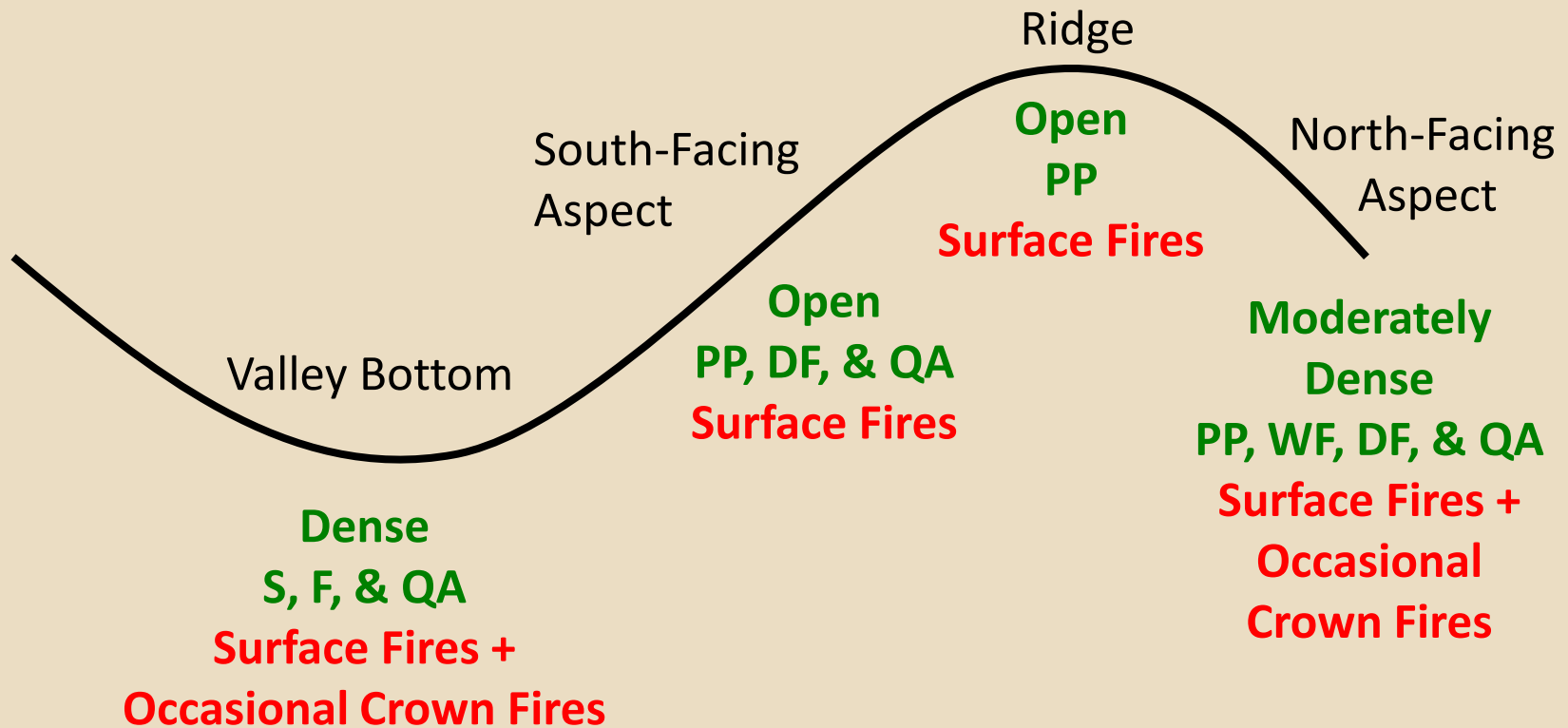


Mixed Conifer/Aspen Distribution

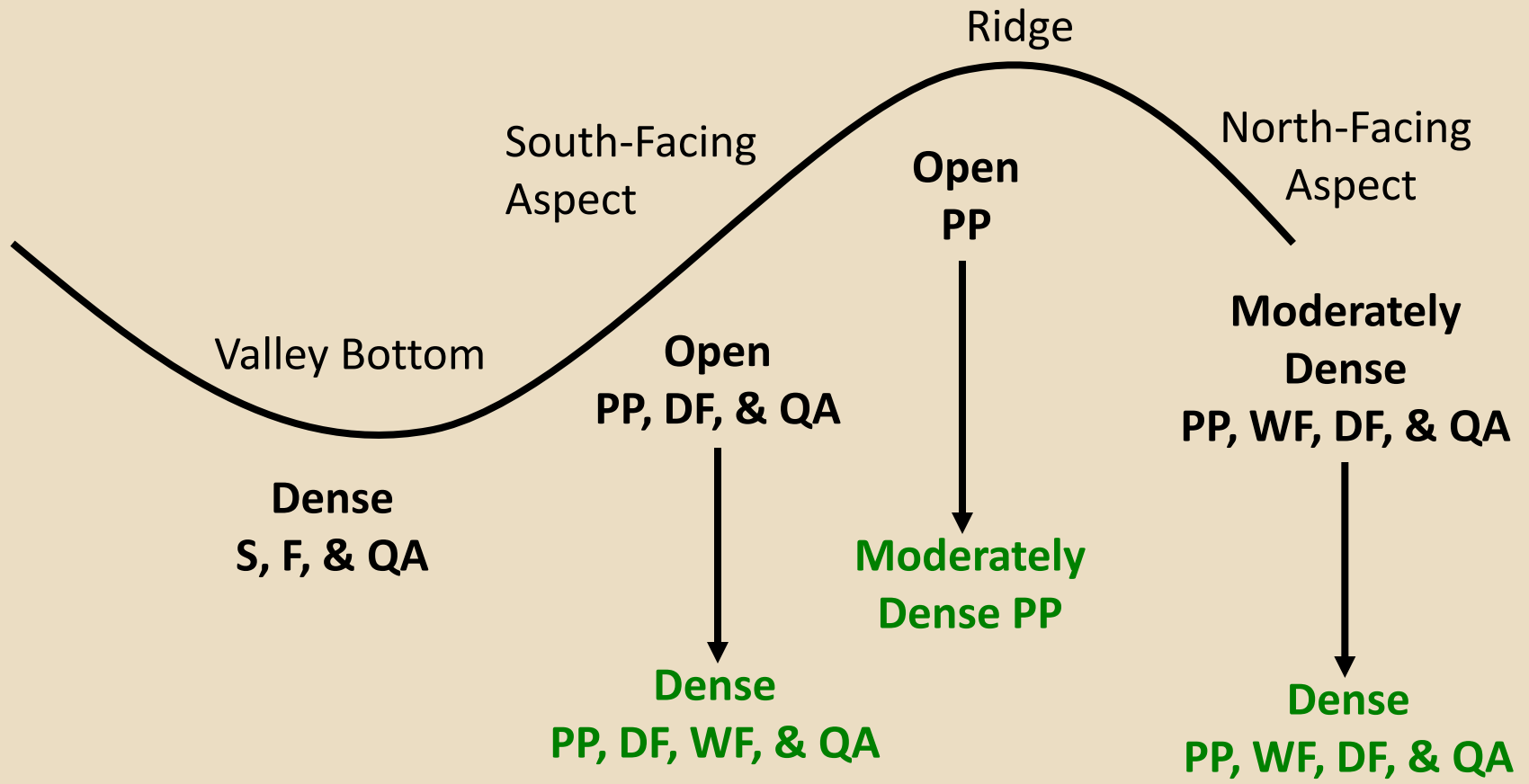
Approximately 2
million acres in NM



Historical Fire Pattern – Mixed Frequencies and Severities



With Fire Exclusion, Vegetation Became More Homogeneous



Distinguishing Between Mixed Conifer Forests



Dry/Frequent fire



Wet/Mixed frequency

Dry Mixed Conifer

- Warmer and drier sites
- Frequent and low – moderate intensity fires
- Ponderosa pine major component
- Uneven-aged and patchy distribution of trees

Changes in Dry Mixed Conifer

- Changes in fuel loading, stand structure, and species composition over time
- Currently a shift to “closed forests” with shade tolerant species in understory
- Seral species in decline
- Shift from FRCC 1 to FRCC 3

Wet Mixed Conifer

- Cooler and wetter sites extending up to the spruce-fir zone
- Mixed severity and frequency of fire
- Aspen and Douglas-fir are dominant seral species
- Closed forests with even-aged and uneven-aged stands across the landscape

Changes in Wet Mixed Conifer

- Currently late seral stages dominate the landscape
- Historically, early, mid, and late seral stages represented across the landscape

Issues of Particular Concern

- Sublimation
- Insects and diseases
- Fire regime change and wind
- Wildlife concerns

Sublimation

- Sublimation- the evaporation of water after snow interception by forest canopies
- Less evaporative loss when snow falls on the ground
- Warmer winter = less sublimation and earlier spring run-off?



Climate Change Effects on Selected Insects

Host	Causal Agent	Dry Winter	Warm Winter	Dry Summer
All conifers	Bark beetles			
Douglas-fir, white fir, spruce	Western spruce budworm	?	?	?
Douglas-fir and white fir	Douglas-fir tussock moth	?	?	?
All conifers in mixed conifer stands (Sacramento Mts.)	<i>Nepytia janetae</i> , a winter defoliating caterpillar of conifers			
Aspen	Western tent caterpillar	?	?	?

Climate Change Effects on Selected Diseases

Host	Causal Agent	Dry Winter	Warm Winter	Dry Summer
All species	Root diseases	?	?	?
Southwestern white, limber, and bristlecone pines	White Pine Blister Rust	?	?	
Conifers	Dwarf Mistletoes	neutral	neutral	neutral

Impacts of Insects or Disease Depend on Condition of the Host

more stress = greater vulnerability

- Conditions that cause reduced sap pressure (drought, competition, injury) favor bark beetles
- Interactions among host, weather, and defoliators are less understood
- Drought reduces spread of mistletoe but infected trees will be at even greater stress
- Biotic agent interactions with environment and host are complex

Aspen Decline

- Large-scale decline in vigor of aspen clones
- Drought followed by insects
- In New Mexico, shade tolerant conifers replacing aspen
- Elk and regeneration
- Change in fire frequency and intensity



Fire Regime Change and Wind

- Westerling et al. 2006 – increased wildfire frequency and duration and longer fire seasons in mid-elevation forests of the Rockies
- Fried et al. 2004 – warmer and windier conditions in northern California
- Earlier snowmelt combined with increased length of windy season during spring in New Mexico?

Longer Spring/Windy Season And Human Starts



Wildlife Concerns

- NM Department of Game and Fish indicates climate change, drought, fire regime change, and insect attack are threats to mixed conifer forests in New Mexico



Photo by Mark Watson

Wildlife Concerns

- These threats will alter wildlife habitat
- Riparian habitat embedded in mixed conifer requires attention too



MSO



Photo courtesy of Mark Watson

NM Forests and Climate Change

Mexican Spotted Owl

- Mixed conifer for nesting and roosting
- Prefers high canopy cover and complex structure
- Landscape planning key to resolving conflict about treatments
- Treat drier mixed conifer and create a mosaic of seral stages across the landscape

Amphibians

- Jemez Mountains salamander
- Prefers decayed Douglas-fir logs and wet sites
- Elevated site temperatures and lower site moisture negatively impact the salamander
- Maintenance of mid-late seral stage mixed conifer

Jemez Salamander



Photo courtesy of Mark Watson

Management Strategies and Recommendations

- We will address the three adaptive strategies presented in Millar et al. 2007
- Resilience
- Response
- Resistance

Resilience Option

- Improve capacity of system to return to desired condition after disturbance
- In dry mixed conifer, restoration of conditions so that the forest is resilient to disturbances within HRV
- Fuel loading, stand structure, and species composition compatible with frequent fire regime

Some Desired Changes (dry mixed conifer)

- Reduce tree density while promoting spatial heterogeneity
- Restore dominance of Ponderosa pine
- Regeneration of early seral species
- Reduce dominance of shade tolerant species
- Reduce fuel loadings
- Reintroduce surface fire

Resilience – Wet mixed conifer

- Restore a mix of seral stages across the landscape



Desired Changes (wet mixed conifer)

- Reduce landscape continuity of homogeneous forest phases (especially climax phases)
- Increase representation of stands at early or mid-successional stages
- Promote and protect aspen regeneration
- Reintroduce surface fire

Resilience Option

- Restoration of burned areas (uncharacteristically hot fires)
- Targeted reforestation on dry sites
- In wet mixed conifer, reforestation includes protection of aspen regeneration



Response Option

- Facilitate transition from current to new conditions
- On dry sites, convert from late seral stage to early seral stage (short-term goal)
- Long-term – see how site responds, then adapt
- At lower elevations, facilitate conversion to pine or pine/oak

Response Option

- In wetter zones, facilitate conversion of contiguous and homogeneous climax forests to a mix of seral stages (short-term)
- Apply historical reference conditions from drier sites to wetter sites
- Apply surface fire and thin fir (*Abies*) to enhance changes in vegetative composition

Resistance Option

- Adopt a protective strategy for important wildlife habitat (MSO, Jemez salamander)
- Southwestern white pine – manage to maintain or increase white pine composition
- Ponderosa on wet sites - protect

Constraints

- Managing small parcels, especially in the WUI
- Limited access and road infrastructure
- Limited financial resources
- Markets for thinning products
- Thinning and logging crews
- Smoke management
- Slash management and insects
- Multi-jurisdictional planning

Constraints

- Widespread nature of late seral mixed conifer
- Impacts of management in lower elevation forests

Concluding Thoughts

- Clear need for landscape-scale and multi-jurisdictional planning
- Forest ERA wood supply and Prather et al. 2008
- Create agreement over treatable acres and focus resources where most needed
- Use of New Mexico Forest Restoration Principles

Concluding thoughts

- Monitoring!

Mixed conifer working group

