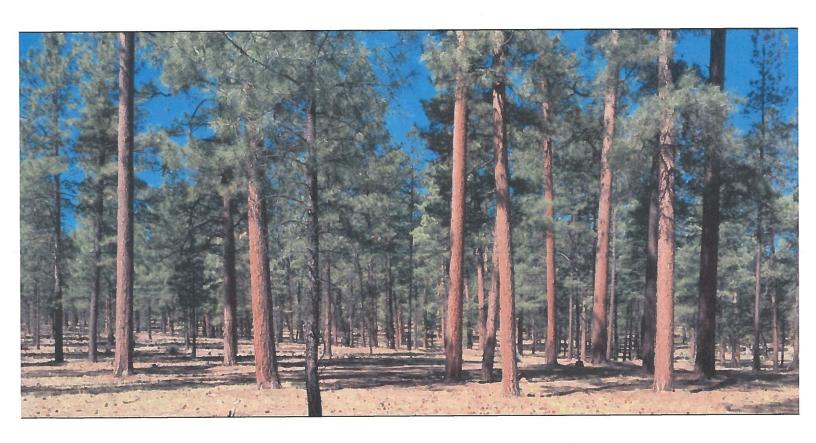
# Frequent-Fire Forests Desired Conditions Workshop

## August 1-2 2017, Reserve, NM and August 3-4 2017, Silver City, NM















A Cooperative Effort by New Mexico Forest and Watershed Restoration Institute-New Mexico Highlands University, Forest Service Southwestern Regional Office, Gila National Forest, Rocky Mountain Research Station, US Fish and Wildlife Service and Earth Systems Ecology Lab-University of New Mexico

## **Contents**

workshop Agenda	5
Presentations	7
Desired Conditions: What are They and Why Do They Matter?	7
Cat Luna	
Co-Regional Planner	
US Forest Service Southwestern Regional Office	
In a Dense Wood: Forest Restoration in New Mexico	9
Kent Reid	
Director	
New Mexico Forest and Watershed Restoration Institute	
New Mexico Highlands University	
The Role of Variability in Managing Forests	23
Matthew Hurteau	
Earth Systems Ecology Lab	
University of New Mexico	
Fire Ecology and Management in the Gila National Forest	31
José Iniguez	
Research Ecologist	
Rocky Mountain Research Station	
Why Here? Why Now?	38
Jim Youtz	
Regional Silviculturist	
US Forest Service Southwestern Regional Office	
Linking Mexican Spotted Owl Recovery Guidance with USFS Desired	Conditions55
Shaula Hedwall	
Fish and Wildlife Biologist	
US Fish and Wildlife Service	
and	
Joe Ganey	
Research Wildlife Biologist	
Rocky Mountain Research Station	
Mexican Spotted Owl: Supplemental Information Specific to the Gila Regior	
Mexican Spotted Owl Presentation: List of Literature	
ield Stop Descriptions and Maps	
Overview	77
August 3 <sup>rd</sup> , 2017 Tour Day 1	72

Field Stops #1-1 and #1-2	78
General Background	78
Field Stop #1-1	78
Field Stop #1-2	85
August 4 <sup>th</sup> , 2017 Tour Day 2	90
General Background	
Field Stop #2-1	90
Field Stop #2-2	
Field Stop #2-3	
Field Stop #2-4	
Ecological Response Unit Framework	
Introduction	103
General Descriptions	
Mixed Conifer-Frequent Fire	
Ponderosa Pine Forest	
Ponderosa Pine-Evergreen Oak	
USFS Regionally Consistent Desired Conditions	
Mixed Conifer-Frequent Fire	
Ponderosa Pine Forest	107
Ponderosa Pine-Evergreen Oak	
Wildland Urban Interface	

#### CD enclosure containing the following documents:

- 1. Forest Service Southwestern Region Desired Conditions and Process Paper, 2014 as revised 2017
- 2. Ecological Response Units of the Southwestern United States, 2014 working draft
- 3. Restoring Composition and Structure in Southwestern Frequent-Fire Forests, 2013, Rocky Mountain Research Station General Technical Reference (GTR)-310
- 4. An Ecosystem Management Strategy for Sierran Mixed-Conifer Forests, 2009, Pacific Southwest Research Station General Technical Reference (GTR)-220
- 5. Managing Sierra Nevada Forests, 2012 Pacific Southwest Research Station General Technical Reference (GTR)-237
- 6. Historical Range of Variation: Ponderosa Pine, Smith 2006, with introductory material by Schussman and Smith 2006, The Nature Conservancy Southwest Forest Assessment Project
- 7. Historical Range of Variation: Madrean Pine Oak, Schussman and Gori 2006, with introductory material by Schussman and Smith 2006, The Nature Conservancy Southwest Forest Assessment Project
- 8. Historical Range of Variation: Mixed Conifer, Smith 2006, with introductory

- material by Schussman and Smith 2006, The Nature Conservancy Southwest Forest Assessment Project.
- 9. 2012 Mexican Spotted Owl Recovery Plan
- 10. Signal Peak Landscape Assessment, 2006
- 11. Signal Peak Healthy Forest Restoration Project Environmental Assessment
- 12. Excerpts from Signal Fire Burned Area Emergency Response 2500-8, 2014
- 13. Signal Fire Burned Area Emergency Response Hydrology Report, 2014
- 14. Signal Fire Burned Area Emergency Response Soils Report, 2014
- 15. Signal Fire Treatment Effectiveness Monitoring: Monitoring Seeding Effectiveness in the Southwest, 2017
- 16. Northern Arizona University Ecological Restoration Institute Fact Sheet: Efficacy of Resource Objective Wildfires for Restoration of Ponderosa Pine Forests in Northern Arizona

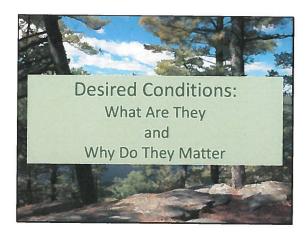
## Silver City Workshop Agenda

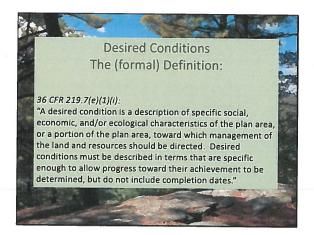
Day 1 - Thursday, August 3st	Grant County
	Conference Center
8:00am Welcome and Introductions	Kent Reid New Mexico Forest and Watershed Restoration Institute at New Mexico Highlands University (NMFWRI)
8:15am Forest Service Southwestern Region's Perspective	Cat Luna
<ul> <li>Desired Conditions: What Are They and Why Do They Matter</li> <li>Relation to Forest Plan Revision</li> </ul>	USFS Southwestern Regional Office
8:30am Setting the Stage  • Current Conditions – How We Got Here • Ecological Restoration – Definitions and Science	Kent Reid (NMFWRI)
9:00am The Role of Variability in Managing Forests  • Fire Ecology Fundamentals  • Variability and Desired Future Conditions  • Restoration Tools and Approaches	Matthew Hurteau University of New Mexico
9:30am Fire Ecology and Management in the Gila NF  • Ponderosa Pine Fire History in the Gila Wilderness  • From Suppression to Management  • Fire and Forest Structure	<b>José Iniguez</b> Rocky Mountain Research Station
10:00am Break	
10:15am USFS Desired Conditions	Jim Youtz
<ul> <li>Why Here? Why now?</li> <li>Adaptive nature of Desired Conditions</li> <li>How They Were Developed</li> <li>Restoration Objectives and Outcomes</li> <li>Measures of Success</li> </ul>	USFS Southwestern Regional Office
11:00am Linking Mexican Spotted Owl Recovery	Shaula Hedwall
Guidance with USFS Desired Conditions <ul><li>State of the Knowledge</li><li>Revised Recovery Plan</li></ul>	US Fish and Wildlife Service
<ul> <li>Links with USFS Mixed Conifer Desired</li> </ul>	Joe Ganey
Conditions <ul><li>Information Needs</li></ul>	Rocky Mountain Research Station
11:45am Description of Field Visits	<b>Nessa Natharius</b> USFS Gila NF
Safety	<b>Gabe Partido</b> USFS Gila NF

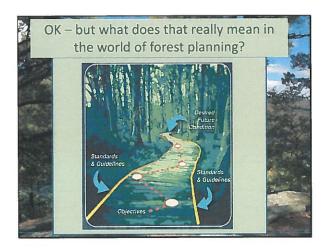
Noon	Lunch on your own		
1:00pm	Depart for Field Stop # 1-1, Signal Peak Healthy Forest Restoration Project and 2014 Signal Fire Stand Replacement Fire in Mixed Conifer		
2:45pm	Depart for Field Stop #1-2, Signal Peak Healthy Forest Restoration Project and 2014 Signal Fire Low Severity Surface Fire in Mixed Conifer		
4:30pm	Return to Grant County Conference Center		
Day 2 - Fri	day, August 4 <sup>th</sup>	Grant County Conference Center	
8:00 am	Depart for Field Stop #2-1, Sawmill Wildland Urban Interface Desired Conditions and Maintenance		
9:30 am	Depart for Field Stop # 2-2, Meadow Creek, Signal Peak Healthy Forest Restoration Project		
11:30 am			
Noon	Lunch (Bring your own)		
1:30 pm	Depart for Bathroom Stop at Lake Robert's and Field Stop #2-4, Gatton's Park Wildland Urban Interface		
4:00pm	Return to Grant County Conference Center		

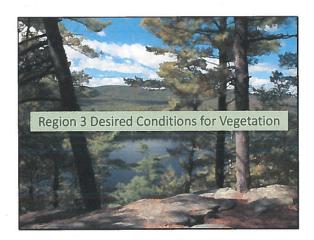
#### **Presentations**

## Desired Conditions: What Are They and Why Do They Matter



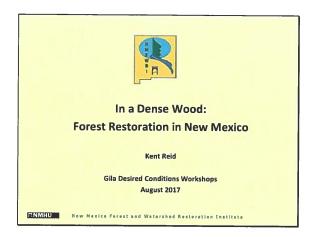


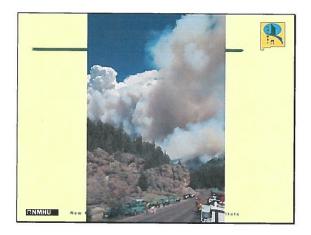




All Control	Region 3 Desired Conditions for Vegetation: An example (Carson NF)
	Mixed Conifer with Frequent Fire:
から 日本の日本の一十二十二十二十二十二十二十二十二十二十二十二十二十二十二十二十二十二十二十二	Landscape Scale: MCD is composed of multiple species of varying ages in a mosaic of seral stages and structures. Its arrangement on the landscape is similar to historic patterns, with groups and patches of variably-sized and aged trees and other vegetation. Portions of the forest may be in various stages of development (including temporary openings or groups of very young trees) providing a source of future old growth structure on the landscape. Evenaged structure may be present on up to 10% of the landscape to provide structural diversity.
A	Mid-Scale: At the mid-scale, appearance is variable, but generally uneven-aged and open. Occasionally small patches (generally less than 50 acres) of even-aged forest structure are present. Disturbances sustain the overall variation in age and structural distribution.
1	Fine Scale: Interspaces between groups are variably shaped, are comprised of a native grass-forb-shrub mix, and may contain individual trees or snags, interspaces typically range from 10% of an again in once productive sites to 50% in less productive sites.

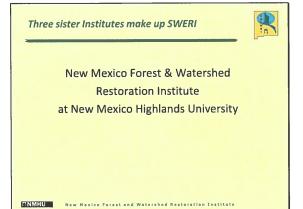
## In a Dense Wood: Forest Restoration in New Mexico

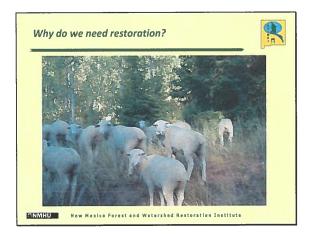




SOUTHWEST FOREST HEALTH AND WILDFIRE PREVENTION ACT OF 2004

An Act to establish Institutes to demonstrate and promote the use of adaptive ecosystem management to reduce the risk of wildfires, and restore the health of fire-adapted forest and woodland ecosystems of the interior West.





The greater ecosystems of the West are exhibiting alarming disease symptoms

Population irruptions and population crashes
Spread of invasive exotic plants
Decreasing diversity, increasing homogeneity at all levels of the ecosystem
Unnatural disturbance regimes: fire, insects
Downward spiral of ecological and social system health
All in the face of climate change

## Crownfires are the latest in a long series of symptoms of declining ecosystem health.



- Loss of herbaceous cover
- Increased erosion
- Tree population explosions
- Watershed degradation
- Loss of plant and animal diversity
- Loss of esthetic values
- Unnatural insect and disease epidemics
- Shift to catastrophic crownfires
- Destruction of human and wildlife habitats

ANNHU New Mexico Forest and Watershed Restoration Institute

#### If things don't change . . .



We anticipate disasters in the frequent fire landscapes of the West including increased fuel accumulations, lengthened fire seasons, and intensified burning conditions, all contributing to larger and more catastrophic fires.

New Mexico Forest and Watershed Restoration Institute

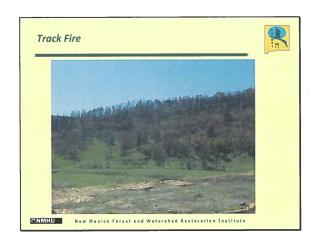
Las Conchas fire, Peralta – Plot 1 photo W

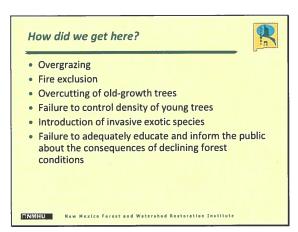


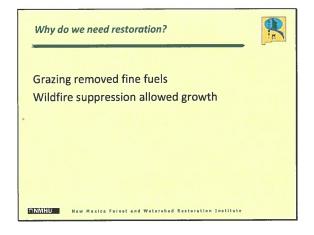


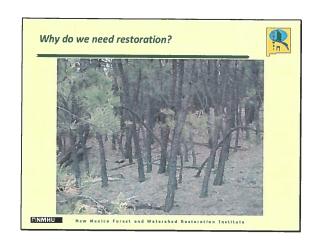


ONMHILL Box Marias Sanata di Managaria

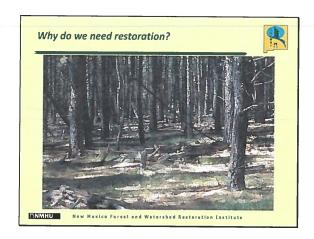


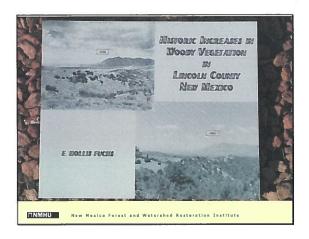












#### This is a big problem--but we can solve it



- Restoration based approaches are proven at a small scale (≈500 ac)
- They must be tested and refined as we apply them at large scales (100,000+ ac) in an adaptive management approach
- Multi-scaled collaborative approaches must be supported with best available science

_	-		
	NM	ΗU	
-			_

New Mexico Forest and Watershed Restoration Institute

#### What can be done?

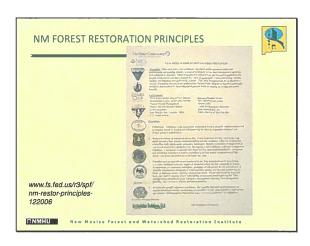


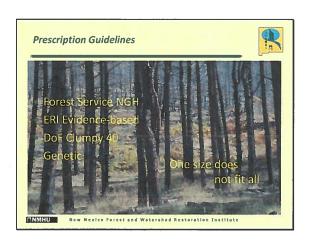
- Support collaborative prioritization of restoration treatments with best available science
- Insist on comprehensive landscape scale restoration solutions
- Use scientifically rigorous, operational adaptive management approach—learning by doing
- Act at a pace and scale consistent with the current forest landscape health crisis

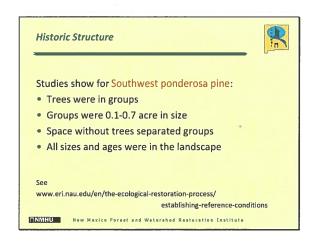
A	N	Ľ.	13	m

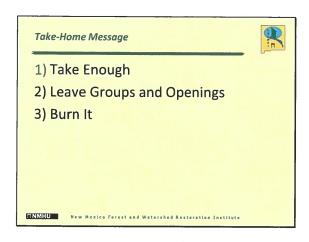
New Nexico Forest and Watershed Restoration Institute

	1
What can be done?	
Comprehensive landscape restoration can	
simultaneously reduce unnatural crownfire while restoring the ecologic and economic health of frequent fire landscapes.	
In short, restoration can change landscapes that have become a liability into assets for present	
and future generations.	
INMHU Now Mexico Forest and Watershed Restoration Institute	
, , , , , , , , , , , , , , , , , , , ,	
	_
What is watershed restoration?	
The recreation of historic structure (principally	
through the removal of small-diameter trees) in forests and woodlands,	
and maintenance of the structure and ecological	
processes by reintroduction of an historic fire regime.	
regime.	
NMHU New Mexico Forest and Watershed Restoration Institute	
	•
	1
Economics as an ultimate driver	
	2000000
"We can't grant our way to forest health."	
- Las Vegas flooring producer	
Behind every restored forest	*
is a restored forest industry. - after an idea of the former head of NMFIA	
	0000000000















#### Pyne



- All of North America has been shaped for 10,000 years by man using fire.
- In 1910, 3,000,000 acres burned in two days; six towns burned, 85 people died.
- In 1911, Congress and the new Forest Service said this will not happen again.
- New factors are homes in the forest, and a belief that current conditions are "natural".

PNMHU New Mexico Forest and Watershed Restoration Institute

#### Covington



- 1n 1994, predicted 15 to 20 years to correct overcrowding before forests began to see large-area crown fires, insect outbreaks, or overcrowding.
- Too many trees are like too many straws in the same punchbowl.
- Putting fire on the ground in existing forests is like forcing an obese man to run fast.

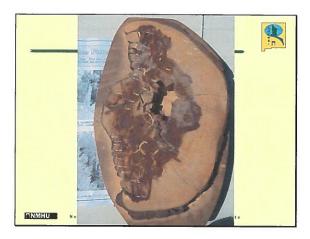
NMHU New Mexico Forest and Watershed Restoration Institute

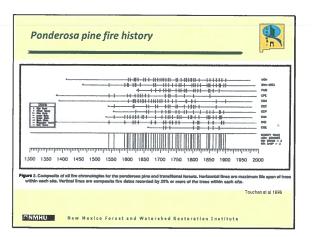
#### Swetnam

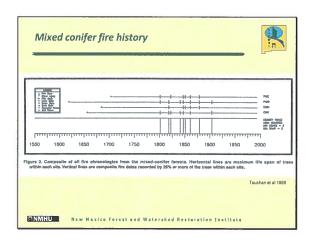


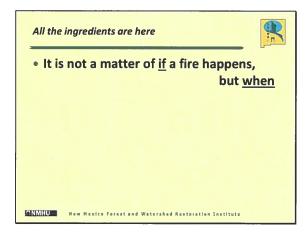
- · Low intensity fires recorded in tree rings.
- In ponderosa pine, fires every 4 to 7 years.
- Fires usually stopped when the railroad arrived, sometimes sooner, and almost always by about
- Tree rings also record drought; we are due for another dry period.

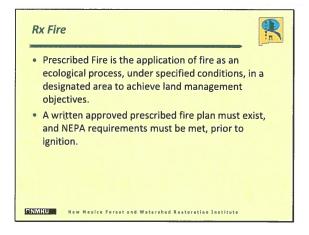
ANMHU New Mexica Forest and Watershed Restoration Institute

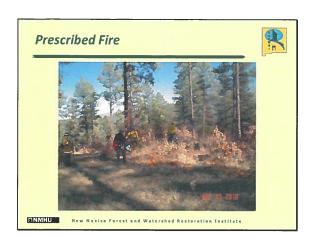


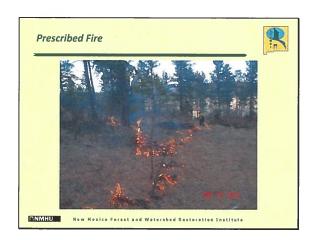


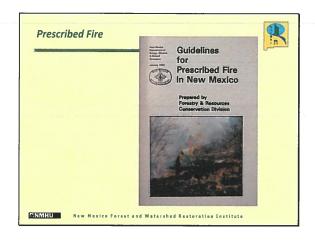


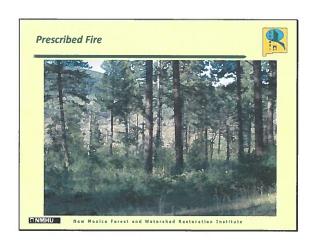


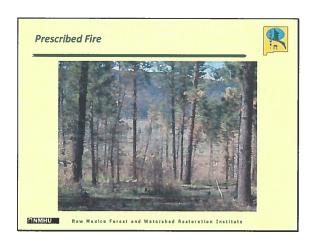


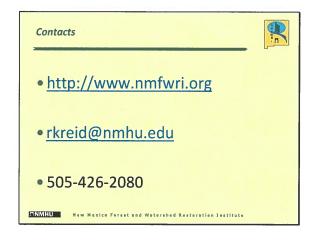




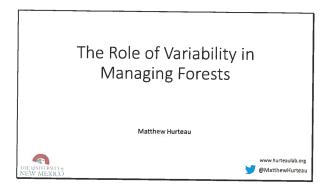


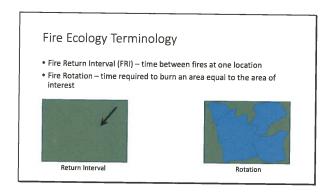


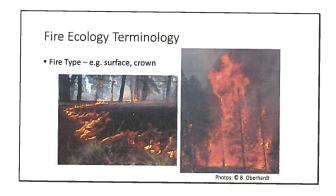




## The Role of Variability in Managing Forests







#### Fire Ecology Terminology

- Fire Severity fire effects on the ecosystem (e.g. low, mixed, high)
- Fire Intensity energy release by the fire



#### Fire Ecology Terminology

- Crowning fire in the forest canopy
- Torching combustion of individual or small groups of trees





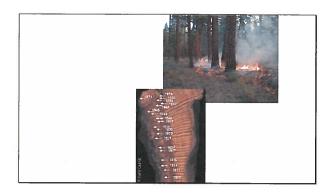
#### The Fire Type Dichotomy...

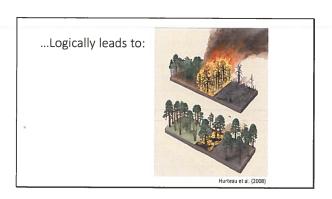


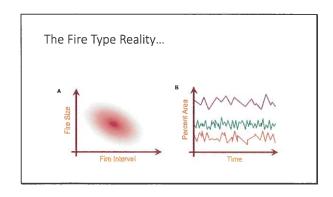


Photos: © B. Oberhard

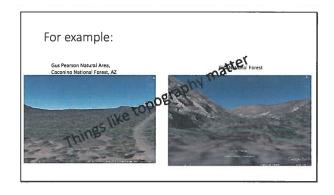


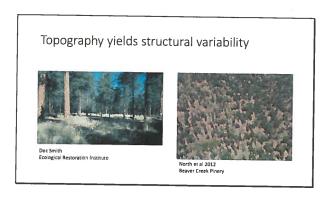


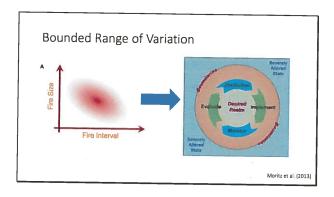




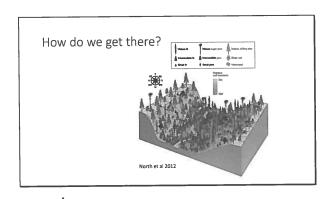








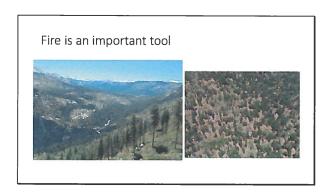


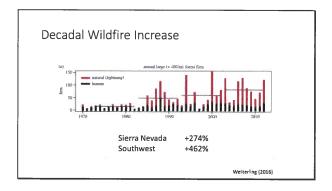


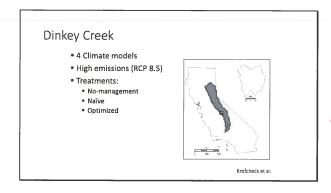


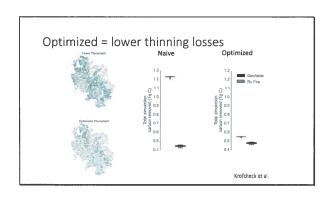
Can we thin our way out of this?

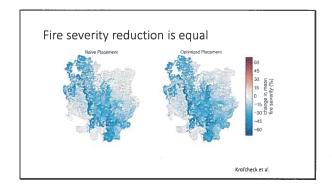
\$1400/ac X 500,000ac = \$700 million

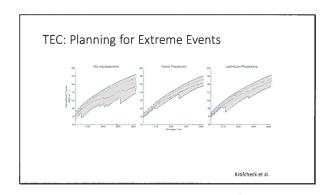


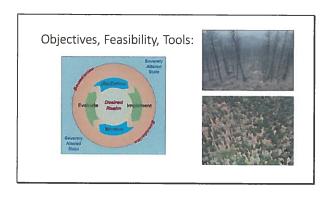






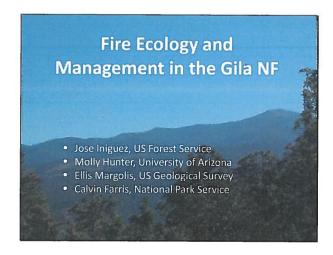








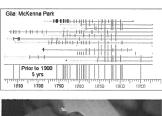
## Fire Ecology and Management in the Gila National Forest



#### Ponderosa pine fire history

Swetnam and Dietrich 1983

- Study Sites
  - McKenna Mesa
  - Langstroth Mesa
  - Gilita Ridge
- Fire interval pre-1900
  - Mean FI: 5-12 years
  - Range 1 61 years
  - Depending on site and time



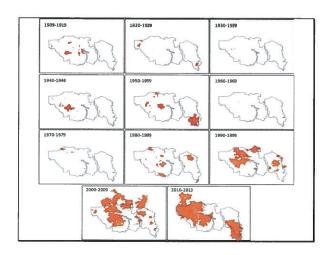


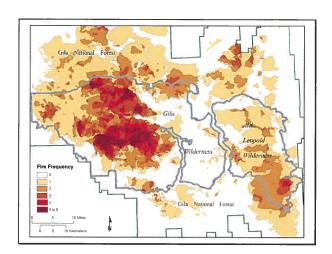
#### **Short History of Managed Fire**

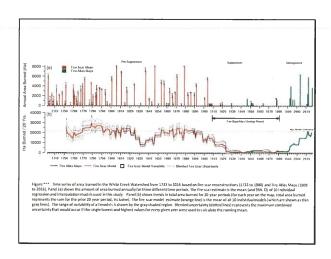
- 1968 Leopold Report
  - Recognizes fire as an "ecological process"
  - Initiates the idea of "Natural Fire Management Zones" with in National Parks
- 1972 White Cap Wilderness Fire Plan
  - In 1975 the Gila Wilderness initiates a naturallyignited fire program
  - Along with the Selway-Bitterroot NF the Gila NF becomes the premier natural fire program within the U. S. Forest Service.

#### **Lessons Learned**

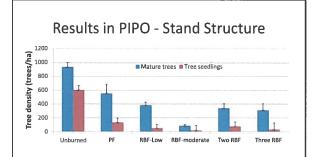
- Creating a landscape and a culture takes time
- Fire can be used to restore frequent fire forests
- Restoring fire in mixed conifer forests is challenging
- Collaboration is key
- Public support





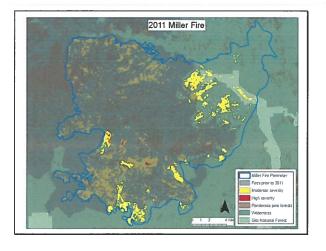


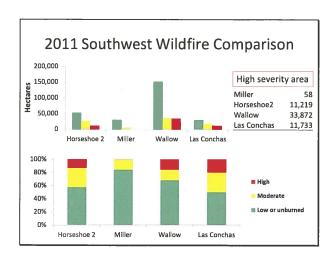
#### PF=Prescribed fire, RBF=Resource Benefit Fire

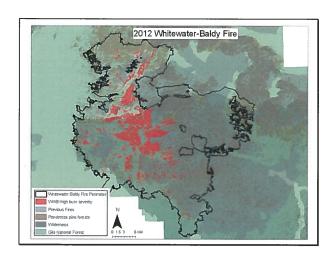


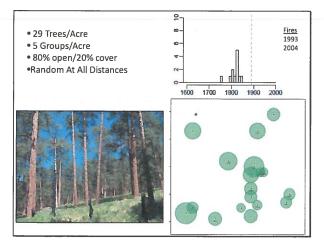
- Resource benefit fire (RBF) resulted in slightly different stand conditions compared to prescribed fire (PF)
- Low tree density was maintained in stands that experienced multiple fires

#### 

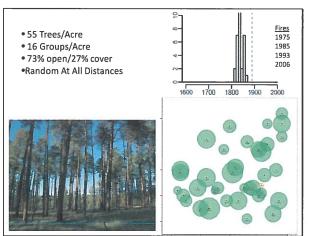


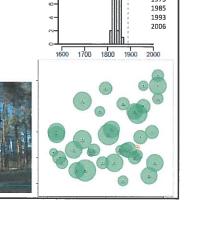




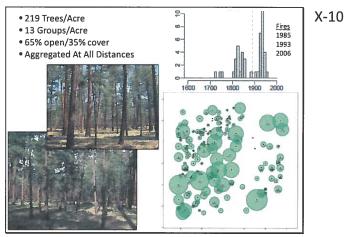


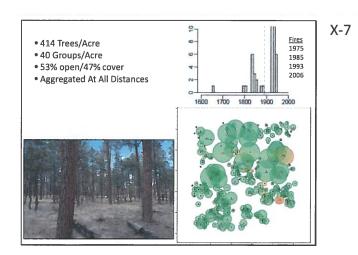
B-9



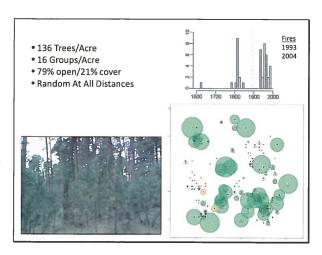


B-14

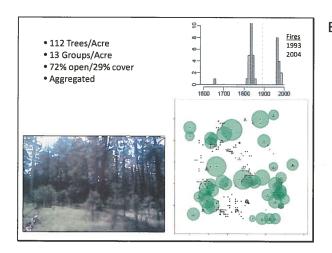




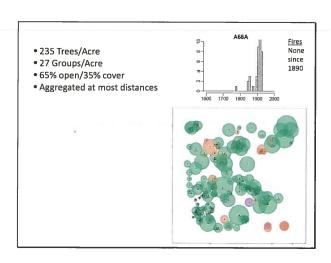
36

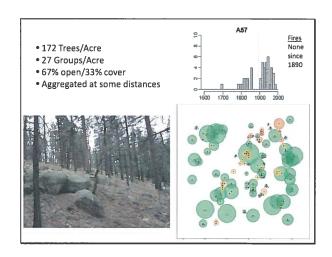


B-30



B-16





## Why Here? Why Now?



Why here why now?

Describe what we want our frequent-fire forests to look and function like to guide treatments

DC Dialogue will help describe the target we are shooting for

Frequent Fire Forests in the Southwest are significantly departed from historic condition.

Subject to uncharacteristic events wildfire, insect and diseases Las Conchas 2011, Wallow 2011, White Water Baldy 2012, Little Bear 2012

There is a need to view restoration in a broader way if we are to be successful.

Landscape scale, all lands (shot gun approach with small projects will not do)

### **OBJECTIVES**

- Describe SW forest types (classification)
- Begin a dialogue on desired forest conditions to develop a common understanding and a framework for shared learning
- Describe desired conditions for SW frequent fire forest types
- Describe links between desired conditions and ecological restoration
- Discuss use of desired conditions as a target and measure of success

Today we want to begin the dialogue about Desired Conditions (Dry Mixed Conifer) that we want to achieve and why they are important.

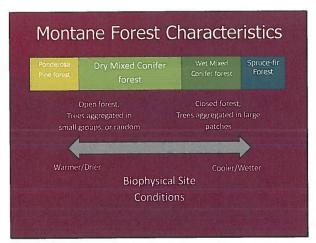
Our goal is to develop a common understanding and a framework for shared learning into the future.

Stay at high level (general conditions of) Openness, Density, Spatial Distribution of tree groups, age and species distribution and the basic functions of ponderosa pine and dry mixed conifer forest. There are a total of 8 forest types that have been described by this team in terms of Desired Condition. This workshop will focus on PP and dry Mixed Conifer.

Implementing the Desired Condition to achieve the openness, density and spatial distribution leads to ecological restoration.

Desired Conditions represent the target (picture of what we want the forest to look and function like).

The degree we can move toward Desired Conditions or achieve them is a measure of our success.

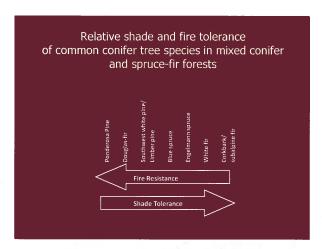


"Dry mixed conifer forest" refers to those mixed species forests that occupy the Montane Forest ecological gradient from warm/dry to cool/wet site conditions. It is not a homogenous type, but intergrades with ponderosa pine forest on warm/dry sites, and wet MC forests on cool/moist sites. It therefore spans a wide spectrum and is similar to adjacent forest types on sites where intergrade occurs.

<u>Dry mixed conifer is distinguished from</u> Wet MC by:

DMC = characteristic low severity frequent to relatively-frequent fire regime (7-35 yr. FRI) WMC = relatively infrequent higher severity fire regime (35- 100+ yr. FRI)

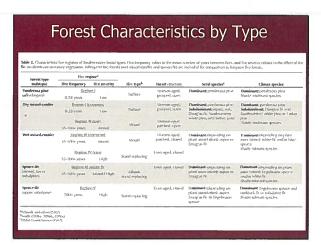
Dry mixed conifer = fire resistant species characteristically dominant under natural fire regime (ponderosa pine, SW white pine, Douglas-fir)
Wet mixed conifer = shade tolerant species not fire resistant, but characteristically dominant in late development forest stages (white fir, blue spruce)



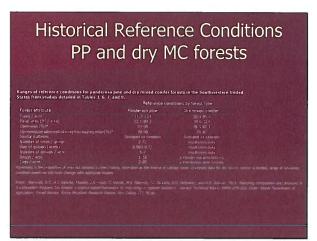
Fire resistance is inversely proportional to shade tolerance of tree species.

General Open forest conditions favor regeneration of shade intolerant, fire resistant species. Open forest conditions are naturally maintained by frequent fire.

Closed forest conditions favor regeneration of shade tolerant, non-fire resistant species. Non-fire resistant species can regenerate and develop to maturity when fire is infrequent.



Here's a comparison of general forest ecological characteristics for southwestern forest types.



We have a range of historical reference conditions for ponderosa pine and dry mixed conifer forest types, based upon multiple study sites throughout the southwestern US.

The DCs are based upon the full range of HRC.

# Development of R3 Desired Conditions

- History of development
  - DC developed for Forest Plan Revision
  - Iterative and adaptive process
- DCs guide project level development
- Based on best available science for forest ecology, wildlife ecology, natural range of variability, etc.

DC team commissioned in 2008 to develop common DC for vegetation types for Forest Plan Revision in an interactive process, based on science.

DC shared with public in plan revision

The team abstracted the desired conditions from a large body of scientific literature (reference Attachment B; Science Basis to the Setting the Stage Paper) on wildlife ecology and food webs, forest ecology, silvics, succession, restoration and historic range of variability, economics and ecosystem services. They are well supported by broad based peer-reviewed science. They fall within historic range of variability.

- abstracted from large body of scientific literature: wildlife ecology, forest ecology, HRV
- Supported by broad-based peerreviewed science
- Fall within HRV

# Desired Conditions: key elements

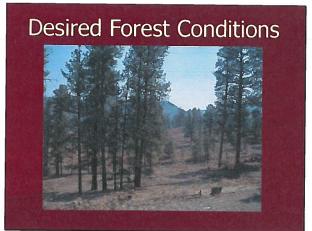
- Tree species and age composition
  - Sustaining a balance of tree ages
- Spatial characteristics of forests
  - Tree groups: size, density, arrangement
  - Interspace: composition, size, arrangement
- Processes and Functions
  - Biological diversity, foodwebs, hydrologic processes, nutrient recycling, etc.
  - Disturbances (fire, insects, disease, windthrow) at natural frequencies and levels

Focus on P pine and dry MC represent largest landscapes departed from natural conditions and most at risk for uncharacteristic disturbances. Public support to address these vegetation types at this time.

DCs for p pine and Dry MC are similar in key elements, but distinct from desired conditions for other forest types. They are similar because they have groups of trees scattered within a grass forb/shrub matrix and both are frequent fire types.

During this workshop we will be focusing on PP and dry MC. We will address the other vegetation types at another time.

At the mid-scale (10-1,000 acres), large patches of even-aged closed forest structure are desired and will occur; reflecting natural biophysical site conditions and habitat needs for T&E and sensitive species.



What are Desired Conditions?

Let's describe the desired conditions by key forest characteristics and functions

Bluewater p1012842

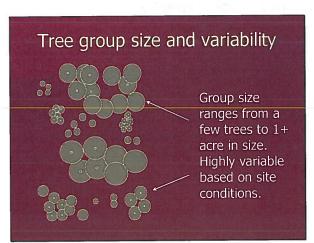
# Spatial and Age Characteristics Trees grouped with interlocking crowns Interspace between tree groups All age classes and as much old forest as is ecologically sustainable High interspersion of age classes

This forest structure and arrangement of trees allows, sunlight to reach the forest floor which results in grass forb/shrub occupied openings and to allow tree group rooting space and tree regeneration.

This spatial and age structure provides for greater plant and animal diversity than current condition

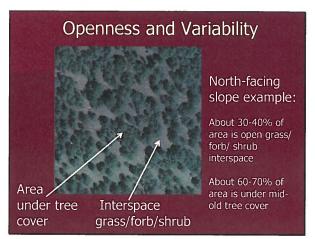
Not all trees are grouped. On wetter sites, trees will have a tendency towards random spacing and less aggregation into groups.

At the mid-scale (10-1,000 acres), large patches of even-aged closed forest structure are desired and will occur; reflecting natural biophysical site conditions and habitat needs for T&E and sensitive species.



Tree cover (canopy cover) is a vertical projection of the crowns to the ground.

Notice old trees – large tree cover in figure



Mixed conifer site on Cibola National Forest.

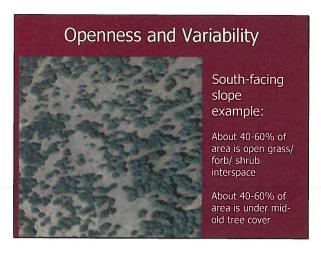
Example of area under tree cover and area that is generally open. Tree cover is a vertical projection of the crowns to the ground.

### Note:

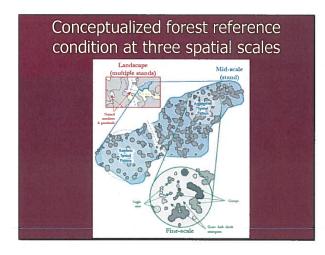
- Openness across site (mid scale)
- Openness varies within site (fine scale)
- Openness varies across landscape scale

Typically great variability on opposing slopes (south and north-facing).

Typically great variability across MC forest gradient (warm/dry to cool/moist).



Notice differences in overall tree density and size of tree groups between the south-facing slope location and the previous north-facing sloe



Conceptualized forest reference conditions at three spatial scales. The landscape-scale illustrates multiple stands and natural meadows and grasslands. The mid- and fine-scales illustrate grass-forb-shrub interspaces and uneven-aged stand conditions consisting of single and grouped trees of different vegetation structural stages, young to old, represented by different shades and sizes.

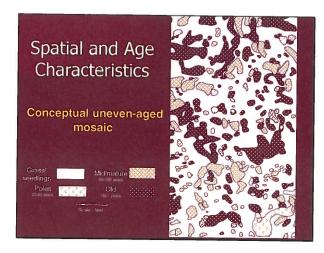
Land scape scale – 1,000+ acres Mid scale – 10 to 1,000 acres Fine scale – up to 10 acres

Meadow and Grassland inclusions within the Forested Type (different soils than Forested areas)

Grass/Forb/Shrub Interspace (areas occupied by G/F/S not intended to be occupied by tree canopy at the fine and mid scale) Gaps between tree groups and individual trees not under tree canopy. Major contribution to biological diversity and critical for carrying fire on a natural basis in the mixed conifer.

General openness of the area refers the areas not under mid to old tree canopy (interspaces and regeneration areas) Does not include natural meadows and grasslands that are not part of the Forest system.

Regeneration Areas (areas intended to be regenerated with trees



Mosaic of tree ages across the landscape with a well developed grass forb/shrub interspace component and variable tree group sizes and spacing.

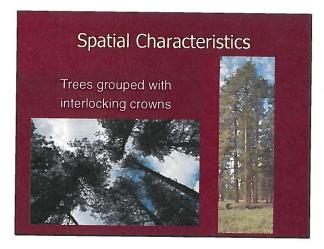
Interspersion of groups of trees with interspaces, variable group sizes and interspace sizes



This photograph illustrates characteristics of a restored Ponderosa Pine forest with multiple ages of tree groups, interspaces, density and herbaceous understory. Dry Mixed Conifer is very similar.

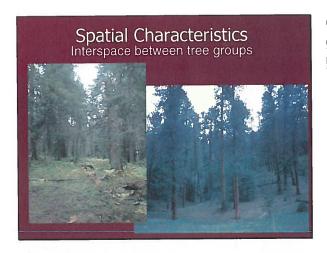
This is a highly productive site with limestone soil

Mosaic of tree ages across the landscape with a well developed grass forb/shrub component and variable tree group sizes and spacing.

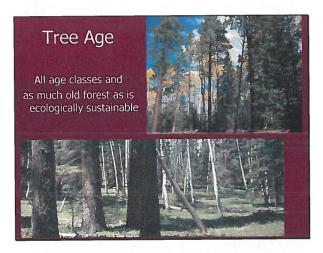


What defines a group? Interlocking or nearly interlocking crowns in mid- to old tree groups.

Provides dense tree cover and shading, crown to crown movement (within groups) for wildlife, and key habitat components.

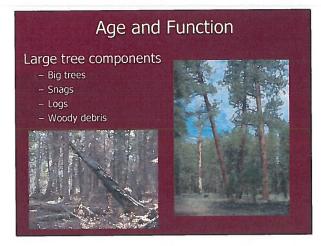


Grass/forb/shrub interspace between tree groups are variable depending on site potential and management objectives.

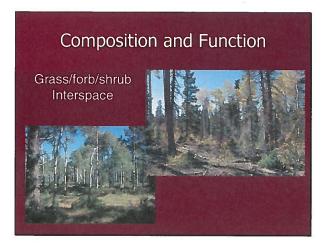


DC provides for all-age forest including old trees (=old growth condition).

Small groups and clumps of old trees interspersed with other age groups of trees.

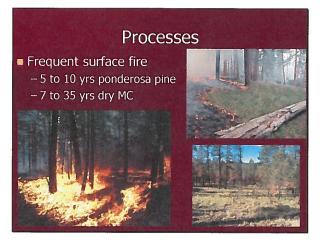


Large tree component in groups plus snags, woody debris and down logs which provide plant and animal habitat and for nutrient cycling.



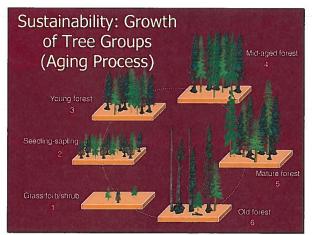
Grass forb/shrub interspace between tree groups

Biological Diversity, Wildlife Habitat, food webs are important.



Fire is the dominant recycler of nutrients in ponderosa pine; and a driver of horizontal and vertical structure, understory composition, productivity, and quality.

These DC acknowledge and feature natural surface fire as a critical function within these vegetation types.



Desired conditions include continuous growth of tree groups from young to old.

Represents a shifting mosaic of ages in a small area over time.

Tree groups typically range from few trees to occasionally 1+ acre in size.

### Concepts

- Desired Conditions are a work in progressWill be adapted to new science/information
- Desired Condition characteristics are presented in ranges, not single targets, to account for variability across most of a landscape. For example - dry MC:
  - Percent of area general openness, generally 50+% (less on some sites, ranges from 30-60%)
  - Typically 40 to 125 sq ft/BA per acre
  - Generally 8 to 16 tons woody debris per acre
- Desired Condition at three scales
  - Landscape
  - Mid scale
  - Fine scale

Ranges allow for wide variability across the landscape due to climate, weather, site quality, etc...

Desired conditions describe general openness generally greater than 50% of the area. As the forest transitions towards the wet/cold end of the gradient, some areas will be more closed with less than 50% openings.

# Links between desired conditions and ecological restoration

- The Desired Conditions fall within natural historic conditions
- Natural conditions are a good example of functioning, sustainable, and resilient ecosystems
- Attaining the Desired Conditions will achieve restoration objectives

We are not necessarily trying to return the forest to historic conditions, but are trying to restore natural composition, structure, processes, and functions, to create sustainable forest ecosystems.

# Challenges

- Desired Conditions may not be attainable in a single treatment
- Operational feasibility (funding, workforce, industry capacity, etc.) may constrain our ability to achieve desired conditions everywhere
- Necessitates prioritizing landscapes and strategies for achieving desired conditions
- Maintenance of desired conditions

If existing conditions are too departed achieving desired condition may require multiple treatments over many years.

Ideally we'd like to have entire landscapes at the desired conditions, but in many cases this may not be feasible. Constraints require us to prioritize where we go first and is a balance of ecological, economic and social values.

Strategies for restoration and maintenance could include cutting + burning and burn only

A full range of management treatments are available to maintain desired

### conditions

# Outcomes of Desired Conditions

- Reduced severity of fire effects
- Reduced fire hazards and increased flexibility for managing fires
- Increased resilience to climate variability and change, insects, disease



Fire that occurs on the surface is at low severity.

Keep fire as natural process of system.

### Outcomes (cont)

- Sustainable old growth condition
- Restored hydrologic function
- Sustainable wood supply
- Improved forage production
- Enhanced visual quality
- Improved plant and animal habitat, biodiversity, foodwebs

Old trees – distributed over the landscape along with all age classes (mimic natural conditions)

Hydrologic function – increase precip to ground, less transpiration, greater infiltration, ground water recharge, etc...

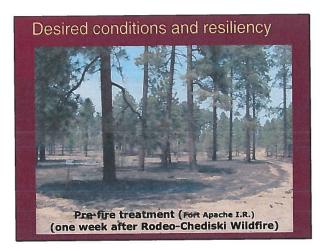
Sustainable wood supply - Industry

Improved grass forb shrub – for habitat and improved forage

Enhanced visual quality – All aged forest with openings

Nutrient recycling. Sustaining age variability including old tree component.

Don DeLorenzo will follow up with more detail on habitat, biodiversity, and foodwebs, using the Northern goshawk as an example.



White Tail Ridge site (Fort Apache Reservation) Following Rodeo-Chediski Wildfire.

This forest has many characteristics of desired conditions – all ages, groups and clumps, interspaces distributed in a mosaic

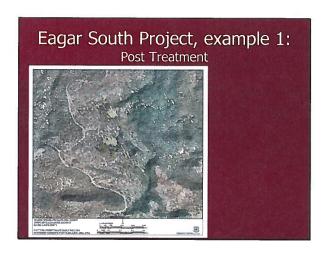
Example from Rodeo-Chediski fire – Fort Apache Reservation

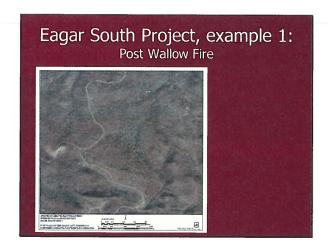
I will now describe and show three examples of restoration treatment areas from Eager South on the A/S.

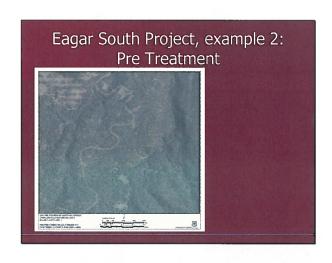
Pre-Treatment (2007) Post Treatment (2008) Post Wallow Fire (2011)



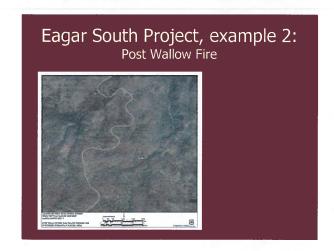
Area represents a Ponderosa pine forest type intergrading with a dry MC forest type







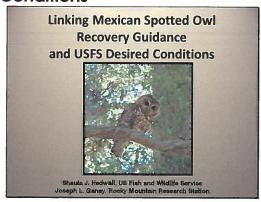




# Some References Reynolds, R.T., A. Sánchez Meador, J.A. Youtz, T. Nicolet, M.S. Matonis, P.L. Jackson, D. Delorenzo, and A.D. Graves. 2013. Restoring composition and structure in southwestern frequent-fire forests: a science-based framework for improving ecosystem resiliency. RMRS General Technical Report -310. Evans, A. M., R.G. Everett, S.L. Stephens, and J.A. Youtz. 2011. Comprehensive Fuels Treatment Practices Guide for Mixed Confer Forests: California, Central and Southern Rockies, and the Southwest. USDA Forest Service, Southwestern Region. 2013. Desired Conditions for Ecosytem Restoration in the Southwestern Region: Development and Science Basis. Unpublished white paper on file.



# Linking Mexican Spotted Owl Recovery Guidance and USFS Desired Conditions



### **Presentation Outline**

- Background
- Revised Recovery Plan Recommendations
- Links with Forest Service Desired Conditions for Mixed Conifer
- Need for additional information





### Background

- Listed as threatened in 1993 under the ESA, Critical Habitat designated in 2004
- Recovery Plan signed in 1995
- Recovery Plan Incorporated into Forest Plans by amendment in 1996
- Revised Recovery Plan 2012



The owl was listed under the Endangered Species Act primarily because of concerns over loss of late-successional coniferous forests to timber harvest and the risk of high-severity, landscape-level fire.

### Threats: Then and Now

- Listing 1993: Even-aged management, lack of regulatory mechanisms
- Recovery Plan 1995: Forest management, highseverity wildfire, lack of regulatory mechanisms
- Recovery Plan Revision: High-severity wildfire, forest management (Jones et al. 2016, etc.)

Threats to species at time of listing:

- –Current and future timber harvest practices
- Existing regulatory mechanisms inadequate
- -High-severity fire

Many people today point to wildland fire as the primary threat to Mexican spotted owl habitat. Many other people believe that the treatments designed to alleviate the wildland fire threat pose an equal or greater threat than wildland fire if such treatments are implemented on a landscape scale and result in a significant loss of forest diversity, simplified stand structure, and/or removal of features that are characteristic of Mexican spotted owl habitat such as large trees, large snags, and high canopy cover.

The Recovery Plan goals are to 1) protect existing forest suitable for spotted owls and 2) develop future forests with similar characteristics.

# What have we learned about owls and forest management?

- To date, few treatments have occurred in PACs
- More treatments conducted in unoccupied habitat, but....
- Very little pre- and posttreatment habitat and owl monitoring data available for any of these projects



The problem with the discussion regarding PAC treatments and treatments to develop replacement habitat is that after 24 years, we don't have the monitoring data we hoped we would at this stage to make science-based recommendations regarding thinning and burning treatments to managers.

Unfortunately, monitoring data has been scarce or collected in such a way that pre- and post-data could not be compared.

However, we do know that forest restoration does need to occur to increase forest resiliency and provide for forest sustainability over the long-term. We also know that owls evolved in this fire-adapted system, so we should be able to have ecological forest restoration that is conducive to sustaining owls as well as forests.

# California Spotted Owl Response to Thinning Treatments



- Stephens et al. 2014, northern Sierra Nevada
- Documented decline in the number of CSO territories as a result of landscape fuel treatments
- Factors driving decline unknown

# Results indicated **negative response of owls to the thinning treatments**.

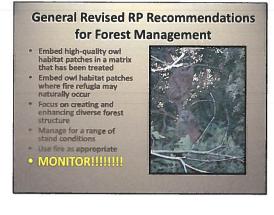
Foraging owls avoided the defensible fuel zones, owls had larger home ranges associated with increasing amounts of treatment within home ranges, and a 43% decline in the number of territorial CSO sites across the study area within 3 to 4 years of implementation. Also observed redistribution of owl sites over time — but — region-wide decline in CSO and increasing barred owl populations, at this point they have not been able to disentangle treatment effects from background pressures.

Not discussing Seamans and Gutierrez 2007 ("...territories in which ≥20 ha of mature conifer forest was altered experienced a 2.5% decline in occupancy probability..."





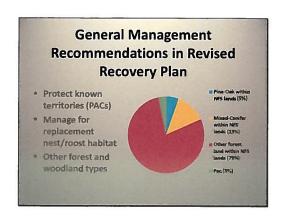
Implementing these types of treatments still requires maintaining patches of denser, multi-layered, late-successional forest on the landscape to provide for nesting/roosting habitat.

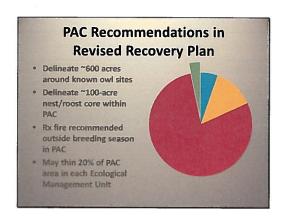


GOAL: Avoid degrading existing nesting habitat and work to reduce high-severity stand replacing fire risk to these areas. In unoccupied habitat, conduct forest management that sets the habitat on a trajectory towards providing future nesting and roosting habitat.

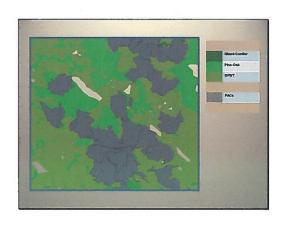
Both spotted owl conservation and fuel reduction should be considered within the broader goal of ecological restoration

By focusing on removal of smalldiameter trees and return of fire to the landscape, we can work to implement this overall recovery strategy by strategically placing restoration treatments in unoccupied habitats at the landscape scale, but also designing treatment within occupied habitats to minimize impacts to owls, focus management more on retaining (or enhancing) appropriate basal area and canopy cover, retain or recruit a diverse mix of tree sizes, and avoid attempting to develop a single management target across the landscape. Given the extent of ecological variability inherent to the southwest, the diversity in habitats used by Mexican spotted owls and other species, the goal of treatments should be managing for a range of stand conditions rather than trying to identify a single, assumed optimal condition across the landscape. In addition, if we can, planning and treating at the landscape level provides an unprecedented opportunity to implement management experiments and conduct monitoring that will allow us to conduct adaptive management.

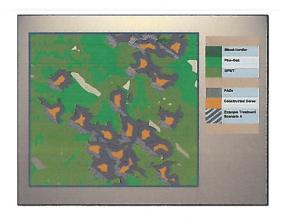














# Managing for Future Owl Habitat (nest/roost replacement habitat)



- Within a sub-set of recovery habitat, recommendation to manage for future nest/roost habitat
- In mixed-conifer, 25% of recovery habitat should be identified as nest/roost replacement habitat

### **Key Habitat Components**



- Multi-layered canopy with large overstory trees
- Species diversity (conifer and hardwoods)
- Moderate to high canopy closure
- Wide range of tree sizes ("uneven-aged")
- High levels of large snags and downed woody debris

Despite the diversity of cover types where Mexican spotted owls have been found, these owls most commonly use mixed-conifer forests throughout their range. In addition, in mixed conifer habitat, most Mexican spotted owl nest and roost sites are found on the lower third of north-facing slopes, which often corresponds to the distribution of mature mixed-conifer forests (see Vankat)

Spotted owls are heat intolerant and tend to select roosting and nesting sites that provide thermal protection. In the case of forested sites, research

indicates that large trees, dense canopy cover, and first or second order tributaries all act to create a cooler microclimate during warm ambient temperatures of the breeding season

However, the same types of structural features that result in cooler microclimates may be correlated with factors such as prey abundance, protection from predators, or availability of nest structures. For example, relatively dense forests with closed canopies and high basal area may provide improved hiding cover for owls in general, and especially for inexperienced juvenile owls. Such forests also may provide more and better den structures for small mammals, as well as large, decadent trees that provide suitable nest structures.

# Desired Conditions within PACs and Recovery Nest/Roost Habitat

- Diversity of patch size
- Horizontal and vertical habitat heterogeneity within patches
- Tree species diversity, esp. mix of hardwoods and shade-tolerant spp.
- Diverse herbaceous and shrub layer
- Openings (0.1 to 2.5 ac)
- Minimum canopy cover (60% in MC, 40% in PO)
- Diversity of tree sizes, with larger trees contributing >50% of stand BA

Minimum Desired Conditions Nest/Roost Habitat					
EMU(s) Forest Type	ि of area	% BA by size class		Minimum tree BA (ft <sup>2</sup> /acre)	Minimum density of large trees (trees/ac)
		12-18"	>18"		
BRE Mixed- conifer	20	>30	>30	145	15
CP. UGM, SRM, BRW Mixed- conifer	25	>3()	>30	120	12
CP, UGM, BRW Pine-oak	10	>30	>30	110	12

Table C.3. Minimum desired conditions for mixed-conifer and pine-oak forest areas managed for Recovery nesting/roosting habitat. Forest types are defined in Appendix C, above. Parameter values are based on averages among plots sampled within forest stands. Numbers of stands included in analysis: 74 for Basin and Range-East (BRE), 27 for mixed-conifer forest in other EMUs, and 47 for pine-oak forest.

<sup>1</sup>% of area pertains to the percent of the planning area, subregion, and/or region in the specified forest type that should be managed for threshold conditions.

<sup>2</sup>BAs in m<sup>2</sup>/ha (ft<sup>2</sup>/acre), and include all trees >1 inch dbh (i.e., any species). We emphasize that values shown are **minimums**, not targets.

<sup>3</sup>Trees > 46 cm (18 inches) dbh. Density is tree/ha (trees/acre). Again, values shown are minimums rather than targets. We encourage retention of large trees.

<sup>4</sup>Pine-oak forest type:  $\geq$ 10% of the stand BA or 4.6 m<sup>2</sup>/ha (20 ft<sup>2</sup>/ac) of BA consist of Gambel oak  $\geq$  13 cm (5 in) drc.

<sup>5</sup>Pine-oak recommendations apply only to the Mount Taylor and/or Zuni Mountains regions, within the CP EMU.

# Lincoln NF DFCs for N/R Replacement Habitat

- Only 22% of nest sites evaluated met all four conditions simultaneously
- Canopy cover and % BA trees > 18 inches dbh best predictors of nest sites
- Likely need to revise desired conditions in Sacramento Mountains
- Need to repeat assessment in other geographic areas

Ganey et al. 2016

### Ganey et al 2016

# FS DCs and Revised Recovery Plan Recommendations: Common Ground



- Provide diversity of tree species and age composition
- Diversity of forest spatial characteristics (e.g. openings, closedcanopy forest)
- Manage for biological diversity and natural frequency/level of disturbance (FIRE)

# How do we link Desired Conditions and Recovery?

- Integrate owl habitat and forest management objectives
- Plan at the landscape scale, but provide for flexibility in implementation
- · Monitor



### **Challenges**



- Scale
- Lack of information and/or data quality
- Cost of treatments, monitoring
- Stands vs. habitat
- Details, details, details...
- Conditions to the needs of the owl. As you heard earlier this morning, there are three scales at which the DCs are intended to occur landscape, mid-scale, and fine-scale. Need to think about the scale at which individual owls are using habitat and overall DC objectives and strive to provide for habitat at the correct scale.
- We don't know as much as we would like to know in terms of integrating forest restoration and owl habitat needs. However, though this should be a reason for caution, it should not be a reason for paralysis in terms of integrating treatments into owl habitat.
- Though we actually don't have data for this, it may be that thinning and fire treatments in owl PACs are more expensive (e.g., if multiple entries are needed to restore fire to area etc.) and the need for monitoring may also increase this cost. However, the cost of avoiding these areas is likely just as great.
- Stands vs. habitat Challenge of stand boundaries not actually containing "uniform" areas where one prescription is carried across the entire area. Knowing the ground and managing for unique patches on the landscape is critically important to being able to fit management of owl habitat into the larger paradigm of landscape scale restoration
- The Devil is always in the Details.
   Because of the lack of information,
   we will be making informed
   "guesses" as to how to best

proceed in implementing FS desired conditions and needs of owl. However, if we don't try, we don't make progress. This is one of the reasons why the Revised Recovery Plan is proposing to allow for more thinning in PACs with effectiveness monitoring.

# Implementation and Need for Additional Information

- We cannot move forward without learning from what we are doing. Research and monitoring are needed to understand how thinning and fire affects owls.
- If PACs are treated, it should be within an adaptive management framework.
- Monitoring should be dual-faceted: effectiveness and overall population monitoring needed.

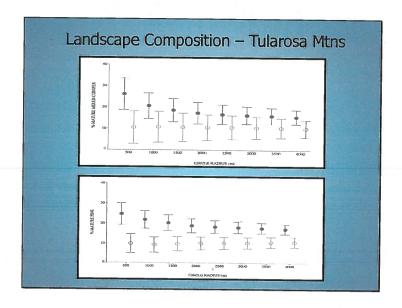
### **Wildfire Recommendations**

- Collaborate
- Avoid critical timing periods
- Implement tactics that keep fire severity low
- Avoid building fire line in habitat
- Avoid removal of snags and large trees





# Mexican Spotted Owl Presentation: Supplemental Information Specific to the Gila Region



Extra slides relative to Mexican spotted owls in the Gila region that didn't fit in the presentations due to time constraints. All studies cited here are included in the literature cited document in the workshop packet.

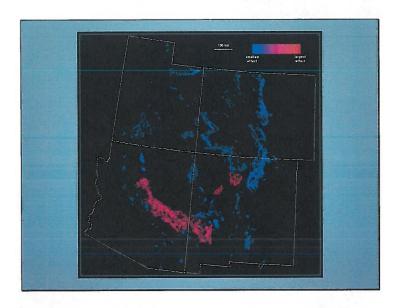
Peery et al. (1999) compared landscape composition in circles of varying size around nest and random sites. Means and 95% confidence intervals are shown here for mature mixed-conifer and pine forests.

Although owls sometimes occupy relatively small patches of mature forest, owls in this study

area selected areas with greater amounts of mature forest than were present in randomly selected areas, at all spatial scales evaluated.

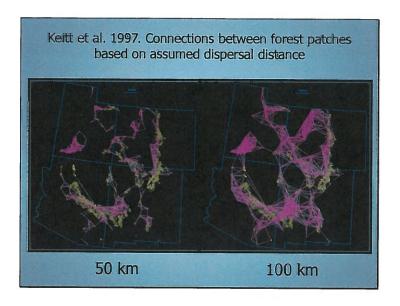
Selection for mature forests, especially mixed-conifer, was most pronounced at relatively fine scales, however. These areas typically included the nest site and nest vicinity.

Results generally suggest that owls selected home ranges in areas with considerable forest cover, and specifically selected smaller areas with unique features within those home ranges as nest sites.



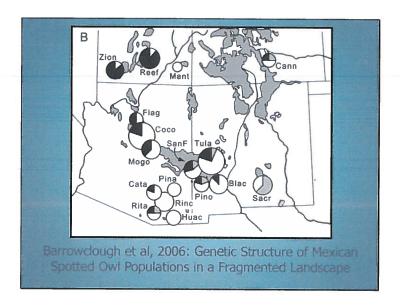
Keitt et al. (1997) evaluated landscape connectivity within the range of the Mexican spotted owl using a map of forest cover and assuming owls could disperse varying distances between forest patches. They then assessed the importance of individual forest patches by sequentially removing those patches and re-evaluating overall connectivity. This map shows results for an assumed effective dispersal distance of 50 km, a very reasonable estimate, with patches that had the largest effect on connectivity appearing red and patches with small effect appearing blue.

This analysis highlighted the importance of the Upper Gila Mountains region (including the Mogollon Rim and Gila region) due to its large size and location. But it also indicated that a couple of smaller islands north of the UGM were very important to overall connectivity, serving as stepping stones connecting distant parts of the range.



This map from the same paper shows individual connection pathways (purple) between forest patches (gold) assuming effective dispersal distances of 50 (left) and 100 (right) km. Note that most connections to the smaller, stepping stone patches identified in the previous slide ran through the Gila, especially at dispersal distance = 50 km. And at an assumed effective dispersal distance of 100 km, the Gila region also connects the large UGM owl population to the relatively large population in the Sacramento Mtns.

As in the previous slide, this suggests that the Gila region is very important in facilitating connectivity among different parts of the owls range.



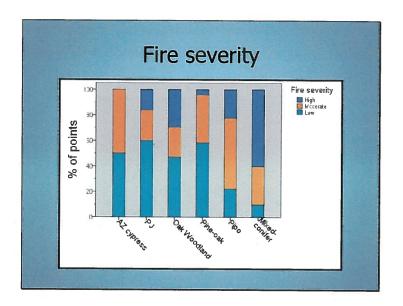
These conclusions about landscape connectivity from the previous slides also are supported by current knowledge of genetic structure in this subspecies. Barrowclough et al. identified three relatively distinct clades or genetic types in Mexican spotted owls. The proportions of these

clades in different parts of the owl' range are shown above. One clade (black pie section) was dominant in the northwestern portion of the range (southwestern Utah) and absent from the southeastern portion of the range (Sacramento Mountains, New Mexico). A second clade (gray section) dominated the southeastern portion of the range but was absent from the northwestern populations. A third clade (white) was most common in the Upper Gila Mountains Recovery Unit and southeastern Arizona, but was present throughout the range of the owl. All three clades were present in the Gila region, suggesting that populations within the Gila region facilitate gene flow across the range of the owl.

## Barrowclough et al: Conclusions

"...maintenance of stepping-stone habitat fragments between the large Upper Gila population and the rest of the population will be of importance in stabilizing Mexican spotted owl population viability..."

Viewing their results in light of Keitt et al's. (1997) analysis of connectivity, Barrowclough et al. (2006) suggested that maintaining stepping stone habitat fragments connecting the Upper Gila Mountains region to the rest of the population was important to maintaining population viability for Mexican spotted owls. The Gila region may be particularly important within the larger Upper Gila Mountains Ecological Management Unit, because of both its geographic location and the relative abundance of owls there.



One current general concern for spotted owls and their habitat relates to the effect of wildfires on owl habitat. This figure shows fire severity assessed at a series of sampled areas representing 6 forest types in the Chiricahua Mtns, AZ. Note that low to moderate severity fire dominated in most forest types. But in mixed-conifer forest, the forest type most closely associated with Mexican spotted owls, most areas burned at high severity. This pattern has been observed over numerous recent large wildfires in the southwestern US, resulting in considerable cumulative loss of the older mixed-conifer forests frequently occupied by Mexican spotted owls. Source: Ganey et al. 2017.



Because of the extent and intensity of recent wildfires, there is and will continue to be emphasis placed on reducing fuels and fire risk in southwestern forests. Perhaps the biggest issue facing us with respect to recovering spotted owls is how to accomplish fire-risk reduction while still

maintaining habitat for a species that appears to prefer older, decadent stands with high canopy cover. The Gila region may provide unique opportunities to evaluate relationships between spotted owls, fire, and forest habitat.



With its large roadless areas, the Gila National Forest represents an area where fire has had a freer hand than many other southwestern forests. This area has had large wildfires, and the Gila has also been using wildland use fire longer and more often than most other areas. The net result is the Gila provides a landscape that has lived with fire of varying extent and severity, creating considerable landscape heterogeneity. The Gila region features both abundant owls and forests that represent a wide range of fire effects, in terms of both fire severity and fire extent, and includes areas that have burned multiple times in recent history. Given this mosaic landscape and the relative abundance of owls there, the Gila provides unique opportunities in terms of understanding how fire affects spotted owls and their prey and habitat. Lessons learned in the Gila region regarding the effects of fire on spotted owls may be relevant throughout the region as fire managers strive to return southwestern forests to fuel conditions within the natural range of variability.

## Mexican Spotted Owl Presentation: List of Literature

Barrowclough, G. F., J. G. Groth, L. A. Mertz, and R. J. Gutiérrez. 2006. Genetic structure of Mexican spotted owl populations in a fragmented landscape. Auk 123:1090-1102. http://www.bioone.org/doi/abs/10.1642/0004-8038(2006)123%5B1090:GSOMSO%5D2.0.CO%3B2

Franklin, J. F., R. J. Mitchell, and B. J. Palik. 2007. Natural disturbance and stand development principles for ecological forestry. USDA Forest Service General Technical Report NRS-19. https://www.nrs.fs.fed.us/pubs/gtr/gtr\_nrs19.pdf

Ganey, J. L., and J. A. Dick. 1995. Habitat relationships of Mexican spotted owls: Current knowledge. Chapter 4:1-42 *in*: USDI Fish and Wildlife Service, Recovery plan for the Mexican

- spotted owl (*Strix occidentalis lucida*), Vol. II Technical supporting information. USDI Fish and Wildlife Service, Albuquerque, New Mexico, USA.
- http://www.fws.gov/southwest/ES/Documents/R2ES/MSO Recovery Plan.pdf
- Ganey, J. L., W. M. Block, J. S. Jenness, and R. A. Wilson. 1999. Mexican spotted owl home range and habitat use in pine-oak forest: Implications for forest management. Forest Science 45:127-135. <a href="https://www.fs.fed.us/rmrs/publications/mexican-spotted-owl-home-range-and-habitat-use-pine-oak-forest-implications-forest">https://www.fs.fed.us/rmrs/publications/mexican-spotted-owl-home-range-and-habitat-use-pine-oak-forest-implications-forest</a>
- Ganey, J. L., W. M. Block, B. E. Strohmeyer, and J. P. Ward, Jr. 2005. Home range, habitat use, survival, and fecundity of Mexican Spotted Owls in the Sacramento Mountains, New Mexico. Southwestern Naturalist 50:323-333.

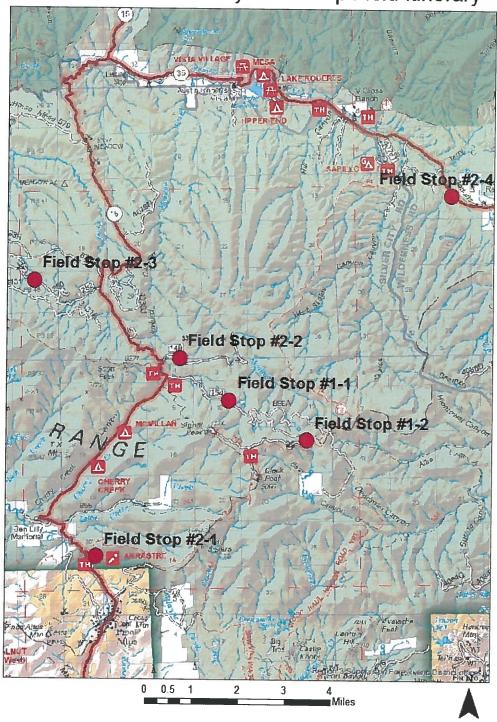
  <a href="http://www.bioone.org/doi/pdf/10.1894/0038-4909%282005%29050%5B0323%3AHRHUSA%5D2.0.CO%3B2">http://www.bioone.org/doi/pdf/10.1894/0038-4909%282005%29050%5B0323%3AHRHUSA%5D2.0.CO%3B2</a>
- Ganey, J. L., A. Telles, and M. A. Ramsey. 2008. Status and ecology of Mexican spotted owls in the Gila Region. In: Natural history of the Gila, a symposium. New Mexico Journal of Botany, Special Issue 1:34-48.
- Ganey, J. L., J. P. Ward, Jr., and D. W. Willey. 2011. Status and ecology of Mexican spotted owls in the Upper Gila Mountains Recovery Unit, Arizona and New Mexico. US Forest Service General Technical Report RMRS-GTR-256WWW. Rocky Mountain Research Station. Ft. Collins, CO. 94 pp. <a href="https://www.treesearch.fs.fed.us/pubs/37799">https://www.treesearch.fs.fed.us/pubs/37799</a>
- Ganey, J. L., D. L. Apprill, T. A. Rawlinson, S.C. Kyle, R. S. Jonnes, and J. P. Ward, Jr. 2013. Nesting habitat of Mexican spotted owls in the Sacramento Mountains, New Mexico. Journal of Wildlife Management 77:1426-1435.
  - http://onlinelibrary.wiley.com/doi/10.1002/jwmg.599/epdf
- Ganey, J. L., J. M. Iníguez, S. Hedwall, W. M. Block, J. P. Ward, Jr., R. S. Jonnes, T. A. Rawlinson, S. C. Kyle, and D. L. Apprill. 2016. Evaluating Desired Conditions for Mexican Spotted Owl Nesting and Roosting Habitat. Forest Science 62:457-462. <a href="http://www.ingentaconnect.com/contentone/saf/fs/2016/00000062/00000004/art00012">http://www.ingentaconnect.com/contentone/saf/fs/2016/00000062/00000004/art00012</a>
- Ganey, J. L, J. M. Iniguez, J. A. Sanderlin, and W. M. Block. 2017. Initial Stages in Developing a Monitoring Program for Bird Populations in the Chiricahua Mountains, Arizona, Using Citizen Scientists: A Case Study. USDA Forest Service General Technical Report RMRS-GTR-368. 30 pp. <a href="http://www.fs.fed.us/rm/pubs-series/rmrs/gtr/rmrs\_gtr368.pdf">http://www.fs.fed.us/rm/pubs-series/rmrs/gtr/rmrs\_gtr368.pdf</a>
- Jones, G. M., R. J. Gutiérrez, D. J. Tempel, S. A. Whitmore, W. J. Berigan, and M. Z Peery. 2016. Megafires: an emerging threat to old-forest species. Frontiers in Ecology and the Environment 14: 300-306. <a href="http://onlinelibrary.wiley.com/doi/10.1002/fee.1298/full">http://onlinelibrary.wiley.com/doi/10.1002/fee.1298/full</a>
- Keitt, T. H., D. L. Urban, and B. T. Milne. 1997. Detecting critical scales in fragmented landscapes. Conservation Ecology (online) 1(1):4. https://www.ecologyandsociety.org/vol1/iss1/art4/
- May, C. A., M. L. Petersburg, and R. J. Gutiérrez. 2004. Mexican spotted owl nest- and roost-site habitat in northern Arizona. Journal of Wildlife Management 68:1054-1064. <a href="http://www.bioone.org/doi/pdf/10.2193/0022-541X%282004%29068%5B1054%3AMSONAR%5D2.0.CO%3B2">http://www.bioone.org/doi/pdf/10.2193/0022-541X%282004%29068%5B1054%3AMSONAR%5D2.0.CO%3B2</a>
- Peery, M. Z., R. J. Gutiérrez, and M. E. Seamans. 1999. Habitat composition and configuration around Mexican spotted owl nest and roost sites in the Tularosa Mountains, New Mexico.

- Journal of Wildlife Management 63:36-43.
- http://www.jstor.org/stable/3802485?origin=JSTOR-pdf
- Seamans, M. E., and R. J. Gutiérrez. 1995. Breeding habitat ecology of the Mexican spotted owl in the Tularosa Mountains, New Mexico. Condor 97:944-952. http://www.istor.org/stable/pdfplus/1369533.pdf
- Seamans, M. E., and R. J. Gutiérrez. 2007. Habitat selection in a changing environment: the relationship between habitat alteration and spotted owl territory occupancy and breeding dispersal. Condor 109: 566-576. <a href="http://www.bioone.org/doi/pdf/10.1650/8352.1">http://www.bioone.org/doi/pdf/10.1650/8352.1</a>
- Stephens, S. L., S. W. Bigelow, R. D. Burnett, B. M. Collins, C. V. Gallagher, J. Keane, D. A. Kelt, M. P. North, L. J. Roberts, P. A. Stine, and D. H. Van Vuren. 2014. California spotted owl, songbird, and small mammal responses to landscape fuel treatments. BioScience 64: 893-906. <a href="https://academic.oup.com/bioscience/article/64/10/893/1781702/California-Spotted-Owl-Songbird-and-Small-Mammal">https://academic.oup.com/bioscience/article/64/10/893/1781702/California-Spotted-Owl-Songbird-and-Small-Mammal</a>
- U.S. Fish and Wildlife Service. 2012. Final Recovery Plan for the Mexican Spotted Owl, First Revision. U.S. Fish and Wildlife Service. Albuquerque, NM, USA. 413 pp. <a href="https://www.fs.usda.gov/Internet/FSE">https://www.fs.usda.gov/Internet/FSE</a> DOCUMENTS/fseprd475767.pdf

## Silver City Workshop Field Tour August 3rd and 4th, 2017

The following map provides an overview of the field tour itinerary. Field stops for August 3<sup>rd</sup> are labeled as #1-1 and #1-2. Field stops for August 4<sup>th</sup> are labeled #2-1 through #2-4. Following the map, background information and additional maps are provided for each field stop in the order in which they will be visited.

## Overview of Silver City Workshop Field Itinerary



## August 3rd, 2017 Tour Day 1

## Field Stops #1-1 and #1-2: Signal Peak General Background

This Signal Peak Healthy Forest Restoration Project was the result of four years of collaborative effort between federal, state and local agencies, businesses, organizations and individuals. This collaboration included the 2006 Signal Peak Landscape Assessment (2006). This assessment considered the Grant County Community Wildfire Protection Plan (2001) and the proximity of wildland urban interface (WUI) at the Lockney and Little Cherry Creek Ranch properties, and the village of Piños Altos. The environmental analysis was completed and the decision signed by the Silver City District Ranger in 2009. Of the 28,991 acres analyzed, 13,185 acres were identified by partners for priority treatment. Priority treatments included 4,753 acres of mechanical thinning and 13,185 acres of prescribed fire.

## **Treatment Objectives**

- Reduce the risk of uncharacteristic stand replacing fire by reducing fuel accumulations
- Safely restore frequent surface fire to regulate forest structure
- Promote herbaceous understory to provide fine fuels to carry frequent surface fire
- Provide conditions that support wildlife
- Provide for watershed protection

Implementation began shortly after the decision notice was signed in 2009. Funding was provided in part by the Collaborative Forest Landscape Restoration Program (CFLRP). Treatments were phased due to availability and timing of funding, and contractor and Forest Service personnel capacity.

Signal Fire was human caused and started on the afternoon of May 11<sup>th</sup>, 2014. Fuel moisture was low due to several years of recent drought. Driven by high temperatures, low humidity and sustained winds of 40 mph, with gusts up to 50 mph, the majority of the high and moderate burn severity occurred during the afternoon and evening of May 11<sup>th</sup>, most of which occurred within the dry mixed conifer forest type (Mixed Conifer-Frequent Fire Ecological Response Unit (ERU)). A lesser amount of high and moderate burn severity occurred in ponderosa pine forest types (Ponderosa Pine Forest and Ponderosa Pine-Evergreen Oak ERUs).

## Field Stop #1-1

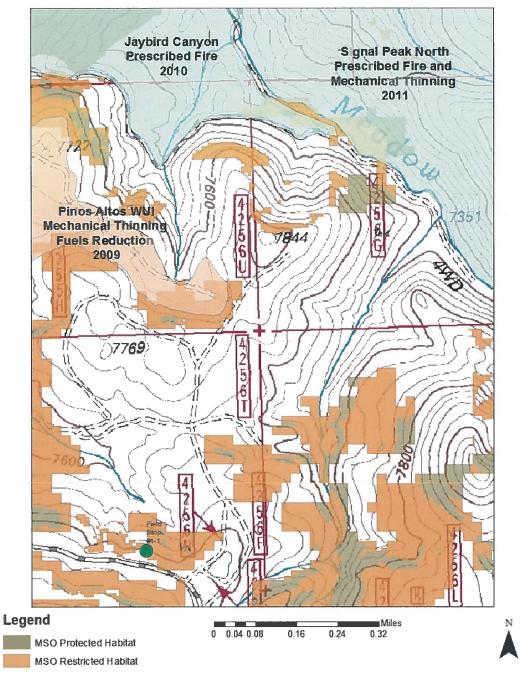
This stop is located between the Mixed Conifer-Frequent Fire ERU and Ponderosa Pine-Evergreen Oak ERU. At this stop, the mixed conifer potential occurs on the north side of the road on soils derived from basalt. In contrast, the Ponderosa Pine-Evergreen Oak potential occurs on soils derived from rhyolite/tuff. The basalt derived soils are moderately deep, contain significant amounts of clay accumulation with depth, and have sandy clay loam surface textures. Soils with these characteristics hold more moisture longer, which helps temperatures stay cooler, and influences both site productivity and vegetation community composition. The soils on rhyolite/tuff to the south of the road are shallow to moderately deep, contain significantly less clay in the subsurface, with loam surface textures. These characteristics contribute to relatively warmer, drier growing conditions as reflected in the plant community. Latitude, aspect, topography, clay mineralogy, and surface and subsurface rock content are among other physical site characteristics that play important roles in site productivity and community composition.

While there is no spatial data regarding vegetation management activities at Field Stop #1-1, there is anecdotal evidence that intensive historic logging and firewood gathering close to the developing

communities of Silver City and Piños Altos likely impacted the vegetation in this area. Contemporary vegetation and fuels management activities in the general vicinity of this field stop have been limited to recent prescribed fire and mechanical thinning for hazardous fuels reduction as displayed in the map below, including the relationship to Mexican spotted owl protected and restricted habitat and the field stop.

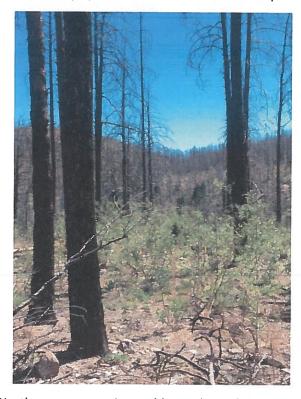
Protected and restricted habitat were designations/terminology specific to the Mexican spotted owl recovery plan in place at the time of project development. Since that time, the recovery plan was revised and the designations for protected and restricted habitat have been amended. Protected habitat is now described as being Protected Activity Centers or PACs, which are still the same as the old recovery plan. However, there is no longer protected habitat that occurs outside of PACs. What used to be protected habitat outside of PACs, as well as former restricted habitat, is now referred to as recovery habitat. Recovery habitat occurs in forest types and in rocky canyons used by owls for roosting, foraging, dispersal, and other life history needs, but are outside of PACs. Recovery habitat is intended to: 1) provide protection for areas that may be used by owls; 2) foster creation of roost/nest habitat; 3) simultaneously provide managers with greater management flexibility than is allowed in PACs; and, 4) facilitate development and testing of management strategies that could be applied in PACs (USFWS 2012). A photos of the field site follow the map.



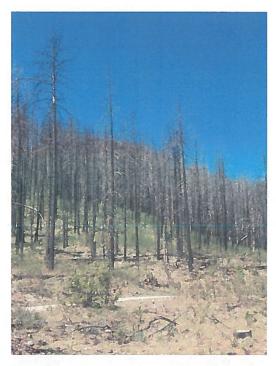




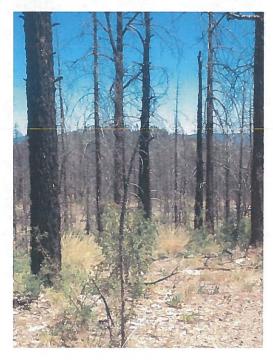
Looking roughly east southeast from Field Stop #1-1



View of Signal North treatment unit roughly north northeast from Field Stop #1-1



Looking south southwest from Field Stop #1-1



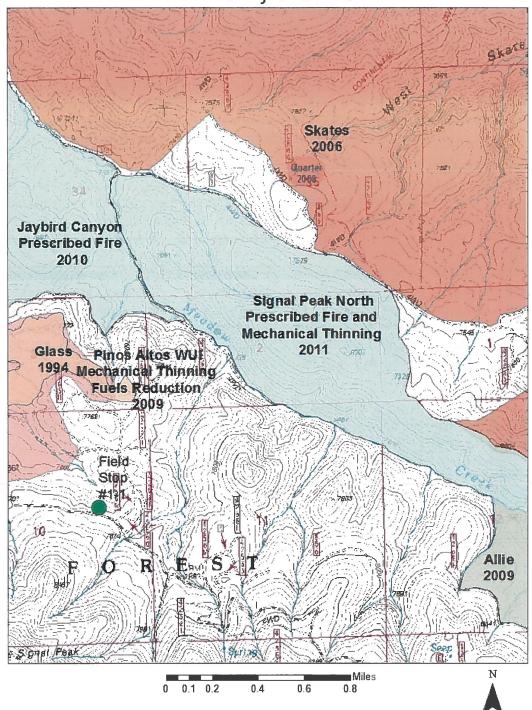
Another view of the Signal North area looking roughly east from Field Stop #1-1

The Signal North treatment unit, visible from field stop #1-1 contains Ponderosa Pine-Evergreen Oak, Mixed Conifer-Frequent Fire and Ponderosa Pine Forest. Ponderosa Pine-Evergreen Oak is by far the most common ERU in the unit. Prior to treatment implementation, silviculture examinations describe areas where ponderosa pine is dominant as being fairly even-aged with high tree density. The number of trees per acre ranged from 175 to 2300 with basal area between approximately 21 and 230 square feet. Tree canopy was continuous, with very few breaks in horizontal structure. These conditions contributed to forest vulnerability to insect infestation and stand replacement fire. Conditions were similar in areas dominated by Douglas fir with a component of Southwestern white pine and aspen. Trees per acre in these areas ranged between 360 and 1,170 with basal area between 60 and 280 square feet per acre. Dwarf mistletoe was and is present in the treatment unit, with some areas being highly infected.

Treatment targets were to have all size classes represented in clumps or groups of similar size classes leaving the best trees per clump and all oaks. In areas of high dwarf mistletoe infection rates, all infected trees were cut regardless of spacing. Openings created by treating the stand were capped at half an acre. A 9" diameter at breast height cap was imposed in PACS and an area a minimum of 600 acres delineated around known nest/roost sites or if unknown, the best nest/roost habitat. This diameter limit was also applied to several acres outside of PACS within other protected or restricted (now termed recovery habitat), with mixed conifer or pine-Gambel oak vegetation on slopes greater than 40% that had not been logged in the past 20 years. Prescribed fire was prohibited within 100 acre area in Mexican spotted owl nesting areas and areas of highest activity. Project work was not conducted during breeding season and limits on which areas within the larger treatment unit could have prescribed fire in a given year were established. Hand thinning or mechanical thinning was allowable in restricted habitat with a 12" diameter at breast height cap, provided that effects to oaks larger than 5" diameter at root crown, snags greater than 12" diameter at breast height and downed logs were minimized.

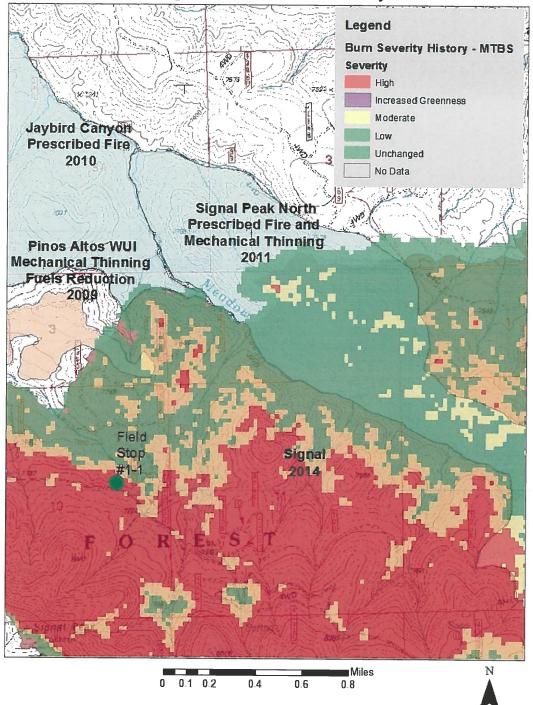
While there have been a few natural ignitions (lightning strikes) in the Signal Peak area over the period of Gila NF record, fire management has been focused on suppression given the proximity to WUI. The map below displays fire history from 1989 to 2010 in relationship to the field stop and treatment areas.

Field Stop #1-1: Management Activities and Fire History 1989-2010



The next map displays the burn severity data for the 2014 Signal Fire in relationship to the field stop and treatment units. No other wildfires occurred in the area between 2010 and 2014.

Field Stop #1-1: Management Activities and Signal Fire Burn Severity



## Field Stop #1-2

This stop is mapped as being in the Mixed Conifer-Frequent Fire ERU. Soils at the stop are formed from basalt, but may contain areas with higher clay content and subsurface rock fragments. The discussion of vegetation and fuels management activities under Field Stop #1-1 generally applies to

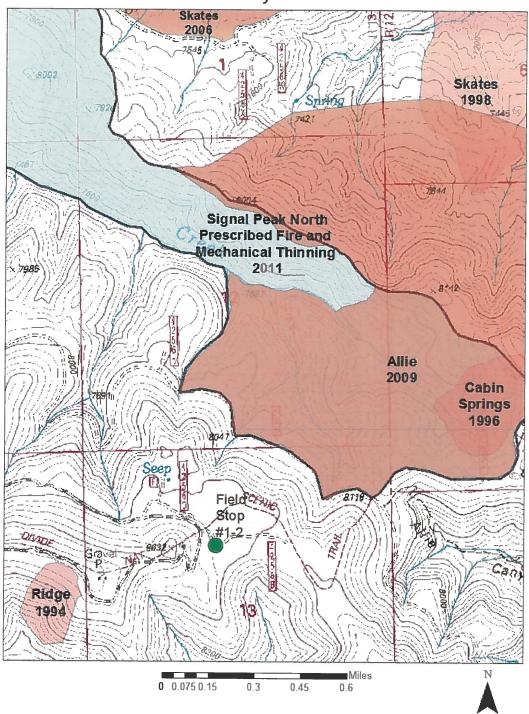
this field stop as well, with contemporary activities in the general vicinity being limited to prescribed fire as displayed in the map below, which again displays the field stop and Mexican spotted owl PACS, protected and restricted habitat.

Signal Peak North Prescribed Fire and Mechanical Thinning 2011 Legend Miles 0 0.075 0.15 0.3 0.45 0.6 MSO Protected Habitat MSO Restricted Habitat

Field Stop #1-2: Management Activities

The next map displays the fire history in the vicinity of this field stop with relation to treatment areas between 1989 and 2010, followed by a map displaying the 2014 Signal Fire burn severity. No other fires occurred in the area between 2010 and 2014. Photos of the field stop are included after the maps.

Field Stop #1-2: Management Activities and Fire History 1989-2010



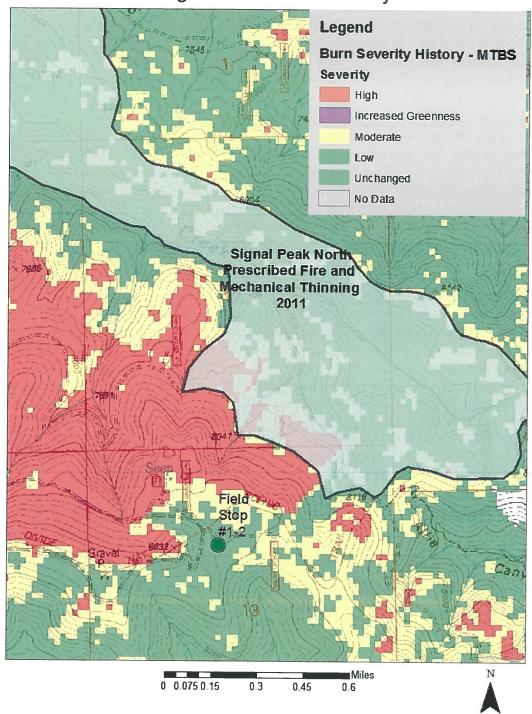


Looking roughly east at Field Stop #1-2



Gambel oak component at Field Stop #1-2

Field Stop #1-2: Management Activities and Signal Fire Burn Severity



## August 4th, 2017 Tour Day 2

## Field Stop #2-1 through #2-3: General Background

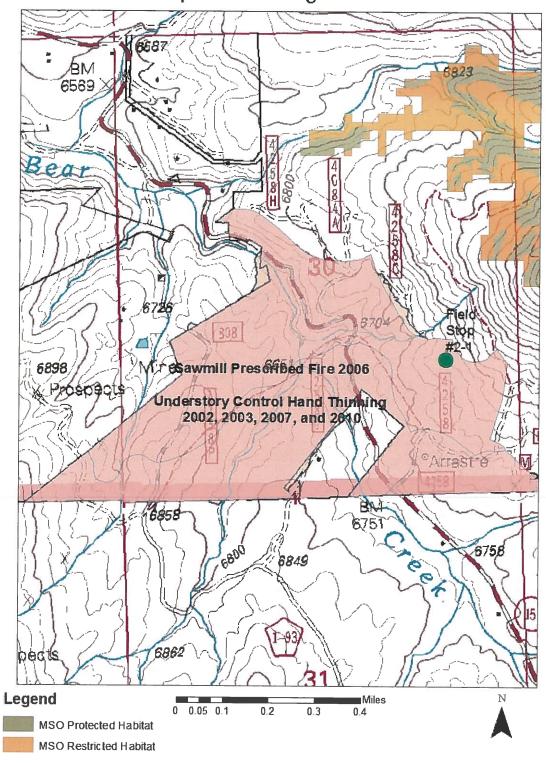
These stops are all within the Signal Peak Healthy Forest Restoration Project, as with sites visited on the first Silver City tour day. Background information related to the project previously presented are relevant to these sites as well. The 2014 Signal Fire information has limited relevance to field stop #2-2 as will be discussed and displayed in the narrative provided for that field stop.

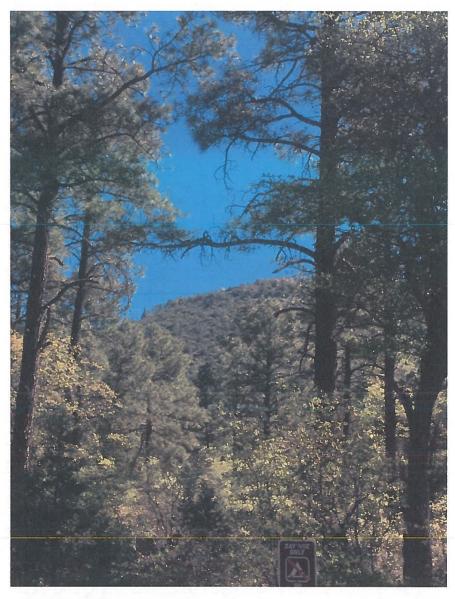
## Field Stop #2-1: Sawmill Wildland Urban Interface

This stop is within the Ponderosa Pine-Evergreen Oak ERU on soils formed from rhyolite/tuff, with mountain mahogany mixed shrublands adjacent. Landownership in this area is a patchwork of public and private. Public lands are administered by the Gila NF and the Bureau of Land Management (BLM). Management activities within the WUI, on both Forest and BLM, have focused on fuel reduction, particularly ladder fuels, to reduce the risk of undesirable fire behavior in close proximity to human life and property. A 2005 silvicultural evaluation described this treatment area as averaging 300-1000 trees per acre with the majority of trees being <12" diameter at breast height with basal area values ranging from 20-150 square feet per acre. Some trees were in poor health, being affected by insects and disease. Tree canopies were interlocking and stands were overstocked with ladder fuels. A need to thin the understory and midstories were identified.

Although treatments have been conducted repeatedly, both before and after the Signal Peak Healthy Forest Restoration Project analysis, re-sprouting and regeneration of evergreen oak in the understory continues to be a maintenance issue using mechanical treatments alone. The following map displays the prescribed fire and thinning treatments conducted in the vicinity of the field stop, and includes the proximity of Mexican spotted owl PACS, protected and restricted habitat (recovery habitat). The closet wildfires documented in the fire history data are the 1996 Cherry Fire (10 acres) and the 2003 Goose Chase Fire (32 acres) that are closer to field stops #1-1 and #1-2 than this stop. Wildfires in the vicinity have largely been full suppression efforts due to the proximity of human life and property. A photo of the field stop follow the map.

Field Stop #2-1: Management Activities



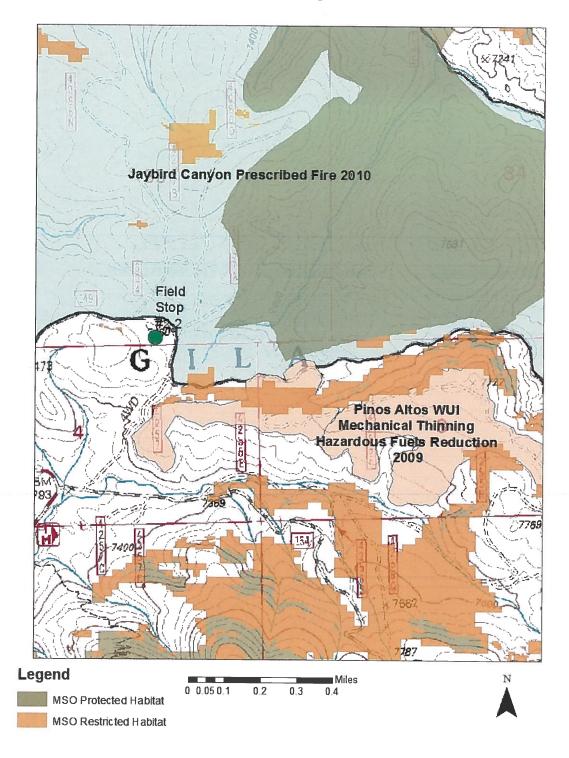


Field stop #2-1 at the Arrastra Site off Highway 15

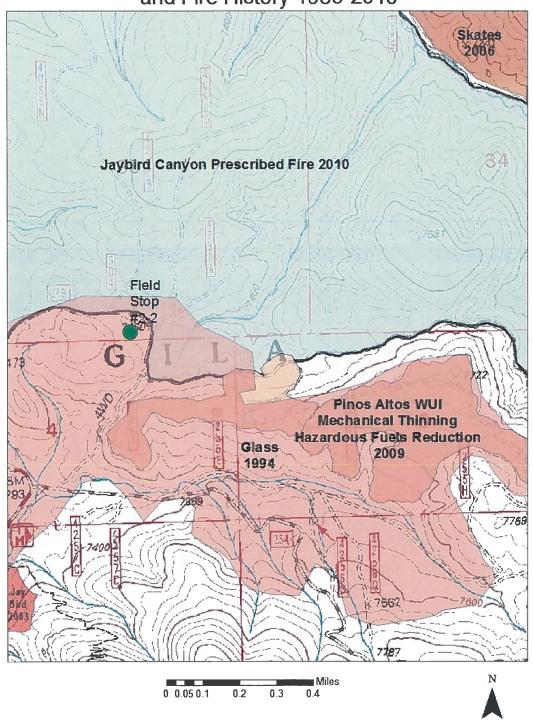
## Field Stop #2-2: Meadow Creek Signal Peak Healthy Forest Restoration Project:

This stop is within the Ponderosa Pine-Evergreen Oak ERU on rhyolite/tuff soils. Smaller areas of Mixed Conifer-Frequent Fire are present in the immediate adjacent area. Management activities at this site include mechanical thinning for hazardous fuels reduction and prescribed fire. The same silvicultural description and prescription described for field stops #1-1 and #1-2 are applicable to this area. Although this stop is in close proximity to the 2014 Signal Fire, it is not within the fire perimeter. Dwarf mistletoe is present in the area, but levels are generally low. The map below displays the field stop, its relationship to management activities and Mexican spotted owl protected and restricted activity centers. This is followed by a map displaying the fire history in the area prior to 2010, and then by a map displaying the proximity of this field stop and treatment areas to field stop #1-1 and the 2014 Signal Peak Fire burn severity. Photos of the field stop follow the maps.

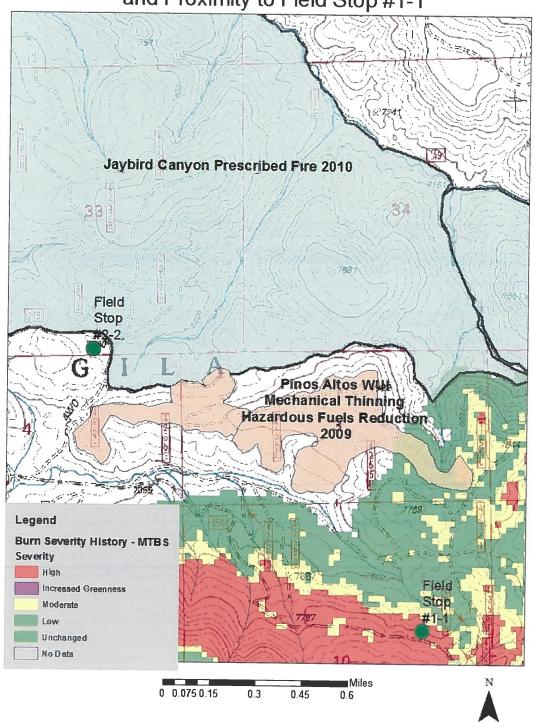
Field Stop #2-2: Management Activities

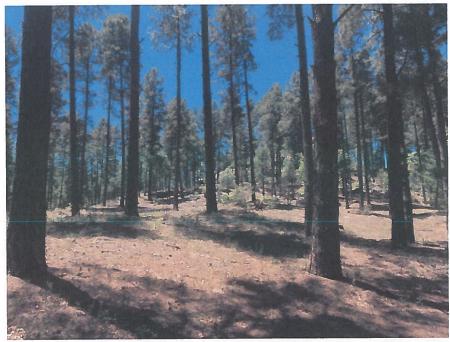


Field Stop #2-2: Management Activities and Fire History 1989-2010



Field Stop #2-1: Management Activities and Proximity to Field Stop #1-1





Looking upslope from Field Stop #2-2

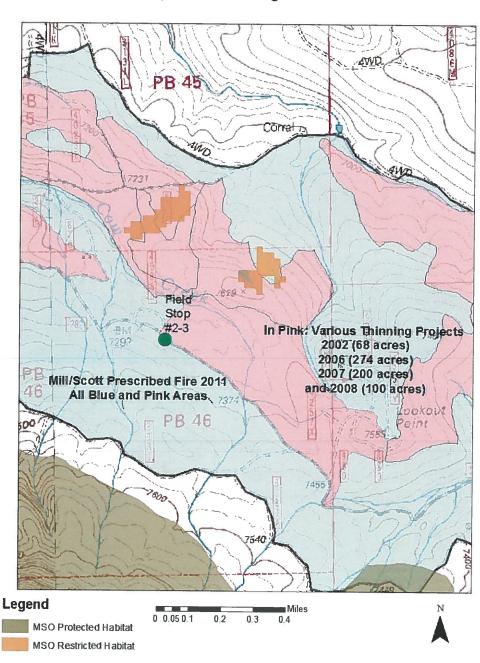


Gambel oak and silver leaf oak component in the understory at Field Stop #2-2

## Field Stop #2-3: Mill/Scott Treatment Unit at Sheep Corral Sheep Corral: Signal Peak Healthy Forest Restoration Project:

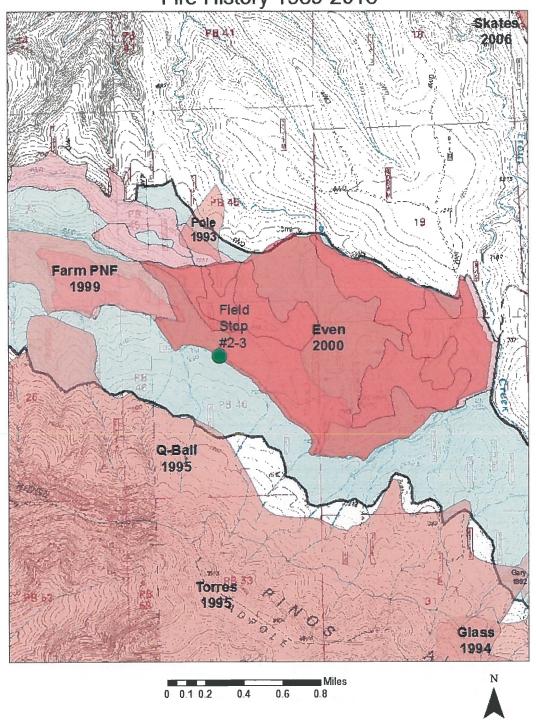
This stop is within the Ponderosa Pine-Evergreen Oak ERU with adjacent Mixed Conifer-Frequent Fire immediately to the southwest and Ponderosa Pine Forest to the northeast. Pre-treatment silvicultural descriptions of this site characterize basal area as between 100 and 119 square feet per acre with stand density indices of roughly 40-45% of maximum. Stand density indices are an indication of the degree of

competition between trees; these densities indicate the stands were at full occupancy with active competition and declining tree growth. The majority of trees fell within a diameter at breast height range of 5-16.9", with remnant larger trees being scattered. Between 20% and 55% of the stands are infected with dwarf mistletoe. The map below displays recent management activities in proximity to the field stop, as well as Mexican spotted owl protected and restricted activity centers. This is followed by another map that displays the fire history of the immediate area from 1989 to present and then photos of the site.



Field Stop #2-3: Management Activities

Field Stop #2-3: Management Activities and Fire History 1989-2016





Field Stop #2-3 off Sheep Corral Road



Gambel oak component and regeneration at Field Stop #2-3

## Field Stop #2-4: Gatton's Park Wildland Urban Interface

This field stop is located in the Ponderosa Pine-Evergreen Oak ERU on soils formed from old alluvium, not uncommon in this landscape position in the cold air drainage of the Mimbres valley. A map of the field stop vicinity is provided after this narrative, followed by photos of the site. Soils formed from alluvial deposits are often highly variable. These alluvial soils are dry, cold, very deep, and are predominantly low in clay content. The 2016 Gatton's Park prescribed fire was followed up in 2017 with thinning and piñon-juniper removal funded by Forest Service dollars. The 2016 prescribed fire was an initial entry in this stand, meaning it was the first time that it experienced fire that we know about, or have a record of. A 2006 silvicultural description of the surrounding area estimated 50-1550 trees per acre basal area between 50 and 120 square feet per acre. The stand density index described the site as being greater than 35% of maximum, indicating less than full occupancy, fairly open conditions with intermediate to maximum herbaceous production. However, in areas where there were more trees, crowns were interlocking and ladder fuels were present. Specific to the prescribed fire area, trees with 5 inch diameters or greater were measured at 67 per acre. Snags were measured at 27 per acre.

## **Prescribed Fire Resource Objectives**

- Reduce pine litter tons/acre and fuel bed depth
- Reduce juniper regeneration under ponderosa pine over-story
- Top kill browse species
- Retain large snags and logs (> 14")
- Reduce fuel loading near Old GOS Ranch (WUI), and along Hwy 35

The desired fire behavior for the prescribed burn was a mosaic pattern of low to moderate intensity fire. Desired fire effects related to prescribed fire objectives were mortality of some shrubs and woodland species and a more open understory. The intent was to create more space, sunlight, water, and nutrients for plant establishment and growth, including potential ponderosa pine regeneration, and regeneration of shrub species at a more palatable stage for wildlife. Some ponderosa pine mortality due to residual heat, isolated torching and scorch were also desired effects. Lower stand densities reduce competition between trees, allowing surviving trees to become more vigorous and resistant to fire, insects, disease, and other disturbance factors. The small openings created in the canopy provide space for ponderosa pine regeneration and the establishment of uneven-age stand structure. The burn achieved desired behavior and effects, reducing coarse woody fuel loading from 50 tons per acre to approximately 26 tons per acre and reducing evergreen oak shrub cover.

The 2017 thinning objectives were to reduce the horizontal and vertical continuity of fuels. Piñon-juniper removal targeted all species of juniper 16 inches or less diameter at root crown except where ponderosa was not present. Piñon pine less than 8 inches diameter at breast height were also targeted for removal, as were oaks less than 5 inches diameter at root crown. Ponderosa pine was cut only if the diameter at breast height was 6 inches or less and exhibited poor growth form. Remaining trees were limbed up to a base crown height of 5-6 feet. There were no restrictions imposed for threatened or endangered species as the project area was outside protected or restricted habitat, but operations generating pine activity slash were restricted to July 1<sup>st</sup> through March 1<sup>st</sup> to reduce potential for beetle infestation. Other species could be treated at any time of year. To achieve desired conditions with limited personnel and funding, multiple thinning entries will be needed.

Field Stop #2-3: Management Activities ites Tank . Park Gastons 15 GOS Ranch 16 Future Planned Prescribed Burn Gattons Park Rescribed Fire 2016 and Thinning/PJ Removal 2017 · Stap Park 8403 Wel 22 Legend ■Miles 0 0.075 0.15 0.3 0.45 0.6 MSO Protected Habitat MSO Restricted Habitat

101



Juniper component at Field Stop #2-4



Gambel oak component at Field Stop #2-4

## **Ecological Response Unit Framework**

## Introduction

Ecological Response Units are a classification system developed and employed by the USFS Southwestern Region to facilitate landscape scale analysis and planning. The framework represents all major ecological types within the region and are a stratification of biophysical themes, similar to LANDFIRE biophysical settings. Conceptually, ERUs combine themes of site potential, historic disturbance regimes and natural succession. Site potential is a term used to describe the characteristic ecological conditions at the latest successional state, or steady-stable-state, as reflected by stable, diverse and functioning climate-soil-vegetation systems.

The Terrestrial Ecological Unit Inventory (TEUI) is the foundational dataset for the ERU map product, although several remote sensing products are also used. The TEUI maps relationships between climate, geographic location, geology, geomorphology and geomorphic process, elevation, aspect, slope, soil and vegetation. The TEUI describes and classifies ecological types and maps ecological units to interpret both site potential and current ecosystem characteristics.

The ERUs on the Gila National Forest include five forested types, of which this workshop pertains to three: Mixed Conifer-Frequent Fire, Ponderosa Pine Forest, and Ponderosa Pine-Evergreen Oak. In addition to the five forested systems, there are also five woodland, one shrubland, three grassland and 12 riparian. Descriptions of other ERUs are provided by the 2014 Ecological Response Units of the Southwestern United States by Wahlberg and other, contained in the CD enclosure to this booklet.

## **General Descriptions**

## Mixed Conifer -Frequent Fire

This ERU spans a variety of semi-mesic environments in the Rocky Mountain and Madrean Provinces. Generally, annual precipitation ranges from 16 to 32 inches, with 45-55% coming between October 1<sup>st</sup> and March 31<sup>st</sup>. In the southwestern US, mixed conifer forests may be found at elevations between 6,000 and 10,000 ft., situated between ponderosa pine, pine-oak, and/or or piñon-juniper woodlands below and wet mixed conifer and/or spruce-fir forests above. Typically these types were dominated by ponderosa pine in an open forest structure (< 30% tree canopy cover), with minor occurrence of aspen Rocky Mountain Douglas-fir, white fir, and southwestern white pine. On contemporary landscapes, more shade tolerant conifers, such as Douglas-fir, white fir, and blue spruce, tend to increase in cover in late succession, contrary to conditions under the characteristic fire regime. However, historically, these species could have achieved dominance in localized settings where aspect, soils, and other factors limited the spread of surface fire. Historic management practices including but not limited to logging, fire suppression and overgrazing have transformed many of these forests across the context area and region. Currently, much of this type is dominated by closed structure (> 30% tree canopy cover) and late seral species as a result of fire suppression.

## Ponderosa Pine Forest

This ERU generally occurs on loose, well-drained soils derived from igneous, metamorphic, and sedimentary parent material at elevation ranging from 6,000 to 10,000 feet. Ponderosa pine forest is typically bounded at the upper elevation by mixed conifer forest, and at the lower elevation by grasslands or piñon-juniper woodlands, although extensive intergrading of species may occur at ecotone boundaries along gradients of slope, elevation, aspect, and moisture. Generally, annual precipitation

ranges from 17 to 28 inches, with 45 to 55% coming between October 1st and March 31st. The dominant species in this system is ponderosa pine. Other trees, such as Gambel oak, Rocky Mountain Douglas-fir, twoneedle piñon pine, and junipers may be present. There is typically a shrubby understory; such as currants/gooseberries, and buckbrush, mixed with a variety of grasses and forbs, such as Arizona fescue, mountain muhly, pine dropseed, blue grama, fleabanes, pussytoes, and others. This ERU sometimes occurs as savannah, depending on geomorphology, geology and soils, with extensive grasslands interspersed between widely spaced clumps or individual trees. This system is adapted to drought during the growing season, and has evolved several mechanisms to tolerate frequent, low intensity surface fires. Historic management practices including but not limited to logging, fire suppression and overgrazing have transformed many of these forests across the context area and region.

## Subclasses

## Ponderosa Pine / Bunchgrass

This subclass is characterized by open stands supporting an understory of primarily herbaceous species, and is commonly found above the Mogollon Rim. A grassy understory, and ample needle cast / duff are the primary carriers of fire, and support frequent, non-lethal fires. The role of fire in this subclass is essential to maintain canopy openings and prevent excess stocking. Common grass species include blue grama, Arizona fescue, and mountain muhley.

## Ponderosa Pine / Gambel Oak

While structurally similar to its counterpart subclass, the Ponderosa Pine / Gambel Oak subclass is typically found primarily distinguished by the presence of the deciduous Gambel oak in the sub-canopy. Other common species include alligator juniper, two needle pinyon, and New Mexico locust.

## Ponderosa Pine-Evergreen Oak

This ERU occurs in the mild climate gradients of central and southern Arizona and in southern New Mexico, particularly below the Mogollon Rim, where warm summer seasons and bi-modal (wintersummer) precipitation regimes are characteristic. Generally, annual precipitation ranges from 13 to 25 inches, with 40-45% coming between October 1st and March 31st. This ecological type occurs at elevations ranging from 5,500 to 7,200 feet, on sites slightly cooler-moister than the Madrean Piñon-Oak ERU, and with a much greater plurality of ponderosa pine. This system is dominated by ponderosa pine and can be distinguished from the PPF ERU by well-represented evergreen oaks such as Arizona white oak, gray oak, alligator juniper, and piñon pine. Though not an indicator in the ponderosa pine life zone, border piñon, along with oneseed juniper can occur as a dominant or codominant component. In terms of disturbance, this ERU averaged greater fire severity than the Ponderosa Pine Forest above the Mogollon Rim, and greater patchiness with less horizontal uniformity and more even-aged conditions. Site potential, fire history, and the importance of perennial grasses versus shrubs in the understory vary on a gradient between two provisional subclasses (described below). Understory shrubs include manzanita, Sonoran scrub oak, skunkbush sumac, and mountain mahogany. Historic management practices including but not limited to logging, fire suppression and overgrazing have transformed many of these forests across the context area and region.

## Subclasses

The following subclasses for this ERU are, at time of publication, provisional. To date, these subclasses have not been distinguished geographically in regional efforts such as the Climate Change Vulnerability Assessment (Triepke et al. in draft), FIA-FVS State Class Reporting, etc. The reference conditions and

contemporary seral states presented later in this section reflect this ERU as a whole, without differentiation among provisional subclasses.

## **Perennial Grass Subclass**

This subclass is distinguished from the Ponderosa Pine–Evergreen Shrub subclass by a more continuous layer of perennial grasses in the understory and a relatively minor shrub component. These circumstances may be less evident in the current condition depending on the degree of shrub encroachment. Trees occur as individuals or in smaller groups and range from young to old, but were historically more uneven-aged in structure. The understory is dominated by low to moderate density shrubs, with herbaceous plants in the interspaces. Common grass species include Arizona fescue, a variety of muhleys. Fire frequency varied, but averaged higher with less severity. These disturbance patterns create and maintain the uneven-aged (grouped) low to moderately-closed canopy nature of this type. Site potential and disturbance history also maintained oak, juniper, and pinyon as subdominant tree components, with herbaceous plants in the interspaces.

## **Evergreen Shrub Subclass**

This subclass differ from the former subclass by site potential, typically favoring high shrub cover, and by higher fire severity, and more even-aged conditions characteristic of mixed-severity fire regimes. This type is found on well-drained soils, frequently with coarse-textured or gravelly (stony) soil characteristics, that favor shrub layer development (particularly oaks). Trees occur as individuals or in small groups and patches and range from young to old, but typically groups or patches are even-aged in structure. The understory is dominated by moderate to high density shrubs, with limited grass cover. Typical disturbances (fire, insects, disease) worked collectively to favor mixed severity conditions (fire regime III), where sufficient tree canopy provides needle-cast to facilitate fire spread). Some high-density evergreen shrub patches exhibit infrequent, high severity fire (fire regime IV; stand replacement at 35-200 years). Areas where this pattern was persistent are likely to be mapped as Interior Chaparral ERU. More typical disturbance patterns created and maintained the even-aged tree groups, with a moderate to moderately-closed canopy.

## **USFS Southwestern Regionally Consistent Desired Conditions**

The following descriptions of desired conditions for the Mixed Conifer-Frequent Fire, Ponderosa Pine Forest and Ponderosa Pine-Evergreen Oak ERUs are excerpted and summarized from the USFS Southwestern Regional Office's process paper, included on the CD enclosure. They are described at three spatial scales: landscape (1,000-10,000+ acres), mid-scale (10-1,000 acres) and fine scale (<10 acres). Desired conditions for the Wildland Urban Interface, applicable to all Ecological Response Units follow the individual ERU desired conditions.

The presentations by Cat Luna (Co-Regional Planner) and Jim Youtz (Regional Silviculturist) also provide information on these desired conditions, the intent behind them, and their development. Desired conditions for the Wildland Urban Interface, applicable to all Ecological Response Units follow the individual ERU desired conditions.

# Regionally Consistent Desired Conditions for Mixed Conifer-Frequent Fire (aka Dry Mixed Conifer

# Landscape Scale

- The dry mixed conifer vegetation community is a mosaic of structural states ranging from young to old. Forest structure is variable but uneven-aged and open in appearance. Occasional areas of even-aged structure are present. Openness typically ranges from 10 percent in more productive sites to 50 percent in the less productive sites. Denser tree conditions exist in some locations such as north facing slopes and canyon bottoms. Where they occur, groups of aspen and all structural stages of oak are present.
- The forest arrangement consists of individual trees, small clumps, and groups of trees with variably-sized interspaces of grasses, forbs and shrub associations similar to reference conditions.
- Forest composition is predominantly vigorous trees, but declining trees are a component and provide for snags, top-killed, lightning-and fire-scarred trees, and coarse woody debris (>3" diameter), all well-distributed throughout the landscape and average 3 per acre. Smaller snags, 8" and greater at DBH, average 8 snags per acre.
- Coarse woody debris, including logs, ranges from 5-15 tons per acre. Downed logs (>12" diameter at mid-point, >8' long) average 3 per acre within forested areas.
- Grasses, forbs, shrubs, needles, leaves (fine fuels) and small trees support the natural fire regime. The amount of shrub cover varies by TEU. Organic ground cover and herbaceous species provide protection for soil, moisture infiltration, and contribute to ecosystem function and diversity. Species diversity is similar to site potential.
- Old growth occurs throughout the landscape, generally in small areas as individual old growth components, or as clumps of old growth. Old growth components include old live trees, dead trees (snags), downed wood (coarse woody debris) and structural diversity.
- Frequent low severity fires are characteristic of this type, including throughout goshawk home ranges.

# Mid-scale

- Dry mixed conifer vegetation communities are characterized by variation in the size and
  number of tree groups depending on elevation, aspect and soil type. More productive sites
  contain more trees per group ad more groups per area, resulting in less space between
  groups. Openness typically ranges from 10 percent in more productive sites to 50 percent in
  less productive sites.
- Tree density within forested areas generally ranges from 30-100 square feet basal area per
- The mosaic of tree groups generally comprises and uneven-aged forest with all age classes
  present. Infrequently, patches (generally less than 50 acres) of even-aged forest structure
  are present. Disturbances sustain the overall age and structural distribution.
- Ground cover consists primarily of perennial grasses and forbs capable of carrying surface fire, with basal values ranging between 5-20% depending on the TEU
- Fires burn primarily on the forest floor and do not spread between tree groups as crown fire.
- Forest conditions in goshawk post-fledging family areas (PFAs) are similar to general forest
  conditions except these forest contain 10-20% higher basal area in mid- to old-age tree
  groups than in goshawk foraging areas and the general forest. Goshawk nest areas have
  forest conditions that are multi-aged but are dominated by large trees with relatively
  denser canopies than other areas in this forest type.

## Fine-scale

- Trees typically occur in irregularly-shaped groups and are variably spaced with some tight clumps. Tree crowns in the mid- to old-aged groups are interlocking or nearly interlocking.
- Interspaces surrounding tree groups are variably-shaped and comprised of a grass, forb and shrub mix. Some may contain individual trees or snags.
- Trees within groups are of similar or variable ages and one or more species. Tree groups are typically less than 1 acre. Mid-to old-aged tree groups consist of approximately 2-50 trees.

# Regionally Consistent Desired Conditions for Vegetation

# Ponderosa Pine Forest

# Landscape Scale

- The Ponderosa Pine Forest is a mosaic of structural states ranging from young to old. Forest structure is variable but uneven-aged and open in appearance. Occasional areas of even-aged structure are present. Openness typically ranges from 10 percent in more productive sties to 70 percent in the less productive sites. Denser tree conditions exist in some locations such as north facing slopes and canyon bottoms.
- The forest arrangement consists of individual trees, small clumps, and groups of trees with variably-sized interspaces of grasses, forbs and shrub associations similar to reference conditions.
- Forest composition is predominantly vigorous trees, but declining trees are a component and provide for snags, top-killed, lightning- and fire-scarred trees, and coarse woody debris (>3" diameter), all well-distributed throughout the landscape. Ponderosa pine snags are typically 18" or greater at DBH and average 1-2 per acre.
- Coarse woody debris, including logs, ranges from 3-10 tons per acre. Logs average 3 per acre within forested areas of the landscape.
- Where it naturally occurs, Gambel oak is present with all sizes and ages. Large Gambel oak snags are typically 10" or larger in diameter and are well-distributed.
- Grasses, forbs, shrubs, needles, leaves (fine fuels) and small trees support the natural fire regime. Organic ground cover and herbaceous species provide protection for soil, moisture infiltration, and contribute to ecosystem function and diversity. Species diversity is similar to site potential.
- Old growth occurs throughout the landscape, generally in small areas as individual old growth components, or as clumps of old growth. Old growth components include old live trees, dead trees (snags), downed wood (coarse woody debris) and structural diversity.
- Frequent low severity fires are characteristic of this type.

# Mid-scale

- Ponderosa Pine Forest is characterized by variation in the size and number of tree groups
  depending on elevation, aspect and soil type. More productive sites contain more trees per
  group ad more groups per area, resulting in less space between groups. Openness typically
  ranges from 52 percent in more productive sites to 90 percent in less productive sites. In areas
  with high fine-scale aggregation of trees into groups, mid-scale openness ranges between 7890%.
- Tree density within forested areas generally ranges from 22-89 square feet basal area per acre.
- The mosaic of tree groups generally comprises and uneven-aged forest with all age classes present. Infrequently, patches of even-aged forest structure are present. Disturbances sustain the overall age and structural distribution.
- Ground cover consists primarily of perennial grasses and forbs capable of carrying surface fire, with basal values ranging between 5-20% depending on the TEU
- · Fires burn primarily on the forest floor and do not spread between tree groups as crown fire.
- conditions that are multi-aged but are dominated by large trees with relatively denser canopies conditions except these forest contain 10-20% higher basal area in mid- to old-age tree groups Forest conditions in goshawk post-fledging family areas (PFAs) are similar to general forest than in goshawk foraging areas and the general forest. Goshawk nest areas have forest than other areas in this forest type.

# Fine-scale

- Trees typically occur in irregularly-shaped groups and are variably spaced with some tight clumps. Tree crowns in the mid- to old-aged groups are interlocking or nearly interlocking.
- Interspaces surrounding tree groups are variably-shaped and comprised of a grass, forb and shrub mix. Some may contain individual trees or snags.
- Trees within groups are of similar or variable ages and may contain species other than
  ponderosa pine. Tree groups are typically less than 1 acre and average ½ acre. Mid-to
  old-aged tree groups consist of approximately 2-40 trees.

# Regionally Consistent Desired Conditions for Ponderosa Pine-Evergreen Oak

# Landscape Scale

- The Ponderosa Pine-Evergreen Oak perennial grass subtype is a mosaic of structural states ranging from young to old. Forest structure is variable but uneven-aged and open in appearance. Occasional areas of even-aged structure are present. Openness typically ranges from 10 percent in more productive sties to 70 percent in the less productive sites. Denser tree conditions exist in some locations such as north facing slopes and canyon bottoms.
- The forest arrangement consists of individual trees, small clumps, and groups of trees with variably-sized interspaces of grasses, forbs and shrub associations similar to reference conditions. In the perennial grasses subtype, shrubs occur in low densities which do not inhibit ponderosa pine regeneration. Shrub densities in the shrub subtype average >30%.
- Forest composition is predominantly vigorous trees, but declining trees are a component and provide for snags, top-killed, lightning-and fire-scarred trees, and coarse woody debris (>3" diameter), all well-distributed throughout the landscape. Ponderosa pine snags are typically 18" or greater at DBH and average 1-2 per acre, while snags greater than 8" average 5 per acre.
- Dwarf mistletoe is present in less than 15% of host trees in uneven age structures and less than 25% in even age structures.
- Coarse woody debris, including logs, ranges from 3-10 tons per acre. Logs average 3 per acre within forested areas of the landscape.
- Grasses, forbs, shrubs, needles, leaves (fine fuels) and small trees support the natural fire regime. Organic ground cover and herbaceous species provide protection for soil, moisture infiltration, and contribute to ecosystem function and diversity. Species diversity is similar to site potential.
- Old growth occurs throughout the landscape, generally in small areas as individual old growth components, or as clumps of old growth. Old growth components include old live trees, dead trees (snags), downed wood (coarse woody debris) and structural diversity.
- Frequent primarily low severity fires are characteristic of the perennial grasses subtype, while the shrub subtype typically experiences less frequent, mixed severity fire.

# Mid-scale

- The Ponderosa Pine-Evergreen Oak perennial grass subtype is characterized by variation in
  the size and number of tree groups depending on elevation, aspect and soil type. More
  productive sites contain more trees per group ad more groups per area, resulting in less
  space between groups. Openness typically ranges from 10 percent in more productive sites
  to 70 percent in less productive sites.
- Tree density within forested areas generally ranges from 20-80 square feet basal area per acre.
- The mosaic of tree groups generally comprises and uneven-aged forest with all age classes
  present, though tree groups and patches may be relatively even-aged. Disturbances sustain
  the overall age and structural distribution. Patch sizes range from less than 1 acre to 10s of
  acres.
- Ground cover consists primarily of perennial grasses and forbs capable of carrying surface fire, with basal values ranging between 5-15% depending on the TEU
- Fires burn primarily on the forest floor and do not spread between tree groups as crown fire.
   Mixed-severity fires occur with less frequency and over smaller spatial extent than low severity fires occur.
- Forest conditions in goshawk post-fledging family areas (PFAs) are similar to general forest
  conditions except these forest contain 10-20% higher basal area in mid- to old-age tree
  groups than in goshawk foraging areas and the general forest. Goshawk nest areas have
  forest conditions that are multi-aged but are dominated by large trees with relatively denser
  canopies than other areas in this forest type.

## Fine-scale

- Trees typically occur in irregularly-shaped groups and are variably spaced with some tight clumps. Tree crowns in the mid- to old-aged groups are interlocking or nearly interlocking.
- Interspaces surrounding tree groups are variably-shaped and comprised of a grass, forb and shrub mix. Some may contain individual trees, including large oaks.
- Trees within groups are of similar or variable ages and may contain species other than ponderosa pine. Tree groups are typically less than 1 acre. Mid-to old-aged tree groups consist of approximately 2-40 trees.

# Urban Interface (WUI) Applicable to All Ecological Response Regionally Consistent Desired Conditions for the Wildland Units

- Wildland fires in the WUI result in the minimal loss of life, property, or characteristic ecosystem function.
- Wildland fires in the WUI are low intensity surface fires as ladder fuels are nearly absent. Firefighters are able to safely and efficiently suppress wildfires in the WUI.
- In forested vegetation communities, the area occupied by interspace with grass/forb/shrub vegetation is on the Interspaces between tree groups are of sufficient size to discourage isolated group torching from spreading as upper end of, or above the range given in the Ecological Response Unit (ERU) desired conditions. Trees within groups may be more widely spaced with less interlocking of crowns than desirable in adjacent forest lands. crown fire to other groups.
- Tree basal area in the WUI is on the lower end of the range given in the vegetation community desired conditions. When WUI intersects vegetation types with a mixed or high-severity fire regime, such as spruce-fir, characteristic ecosystem function is modified to promote low intensity surface fires.
- In shrubland/chaparral vegetation communities, the live and dead fuel loading in the WUI is on the lower end of the range given for the ERU desired conditions. Enough cover exists to meet the needs of a variety of wildlife
- developments deemed to have special significance. Higher fuel loading or tree densities may occur in areas where Coarse woody debris, including logs, and snags, which often pose fire control problems, are present in the WUI, amounts in the infrequent fire ERUs. This light fuel load applies even in vegetation types with higher reference but at the lower end of the range given in the appropriate ERU desired conditions. Dead and down fuel load is between 1-10 tons per acre, depending on the ERU, with lower amounts in the frequent fire ERUs and higher it provides for important fine-scale habitat structure, as long as it meets the overall intent of protecting WUI fuel loads, such a Mixed Conifer with Aspen and Spruce-Fir to provide improved fire protection to human

=12.0