Fire Ecology of the Eastern Cascades:

Implications for Dry Forest Restoration

Stephen A. Fitzgerald
Oregon State University
Extension Forestry Program

OSU Oregon State University Extension Service

Disturbance in Terrestrial Ecosystems

Natural	Human-Caused
Fire	Fire
Insects	Timber Harvesting
Disease	Livestock Herbivory
Wind	Landslides
Herbivory	
Floods	
Landslides	
Volcanic	


“Fires express their surroundings.”
Stephen J. Pyne

What are Fire Regimes?

Fire frequency

measured as "mean fire interval"

+

Fire severity

measured as "low-" "mixed-" or "replacement-severity"

Fire Regimes

Fire Regime Elements

Element	Description	Effects
Frequency	How often fire returns to an area	Species/regen.
Predictability	Variation in fire frequency	Species/regen.
Extent	Fire size	Patch size/recoloniz.
Magnitude	Intensity & severity	Mortality/soils/regen.
Seasonality	Fire occurrence/ growing season	Severity/plant damage & mortality
Synergism	Interaction w/ other disturbances	Intensity/succession/

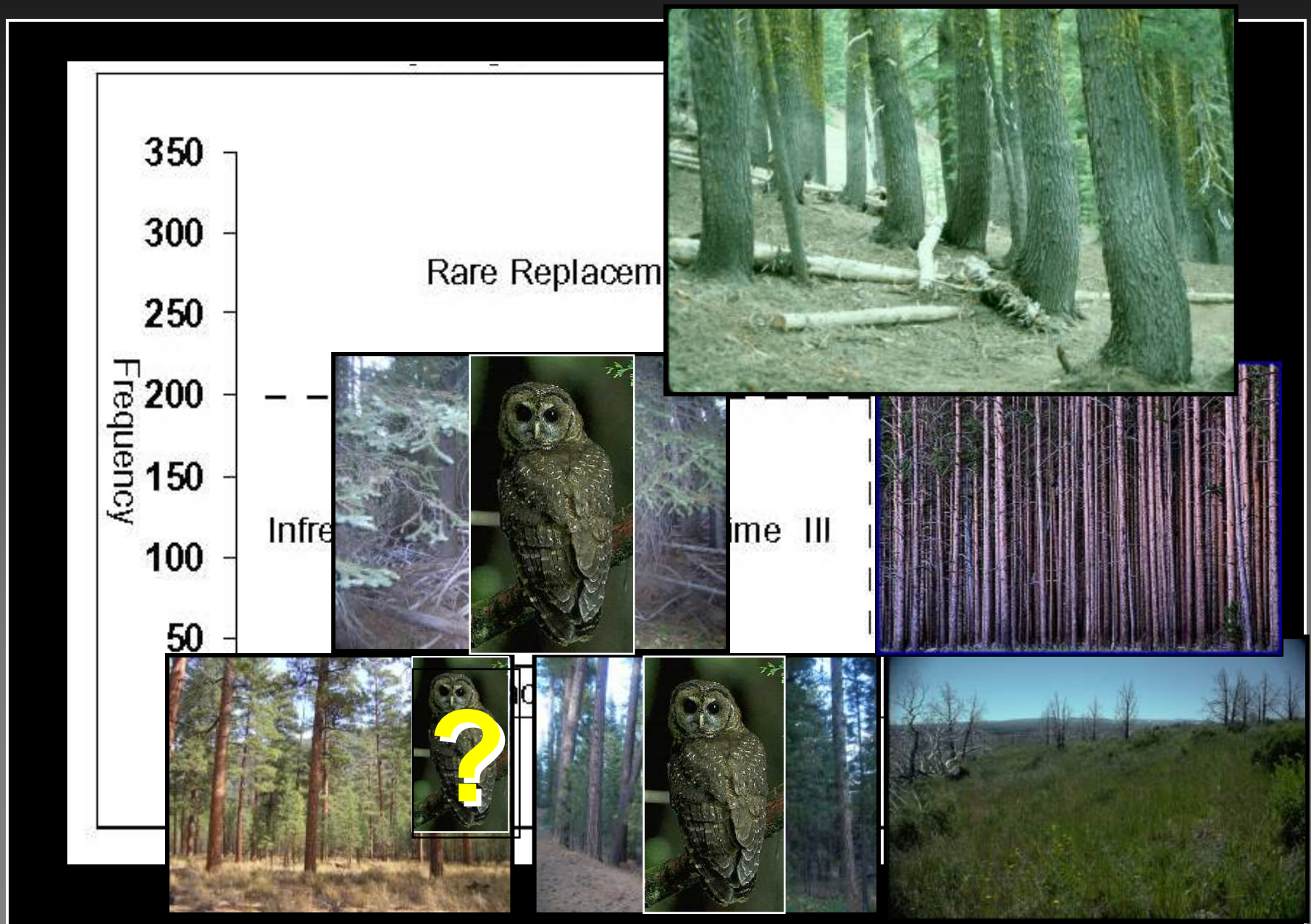
(Agee 1993)

Fire Regime Nomenclature

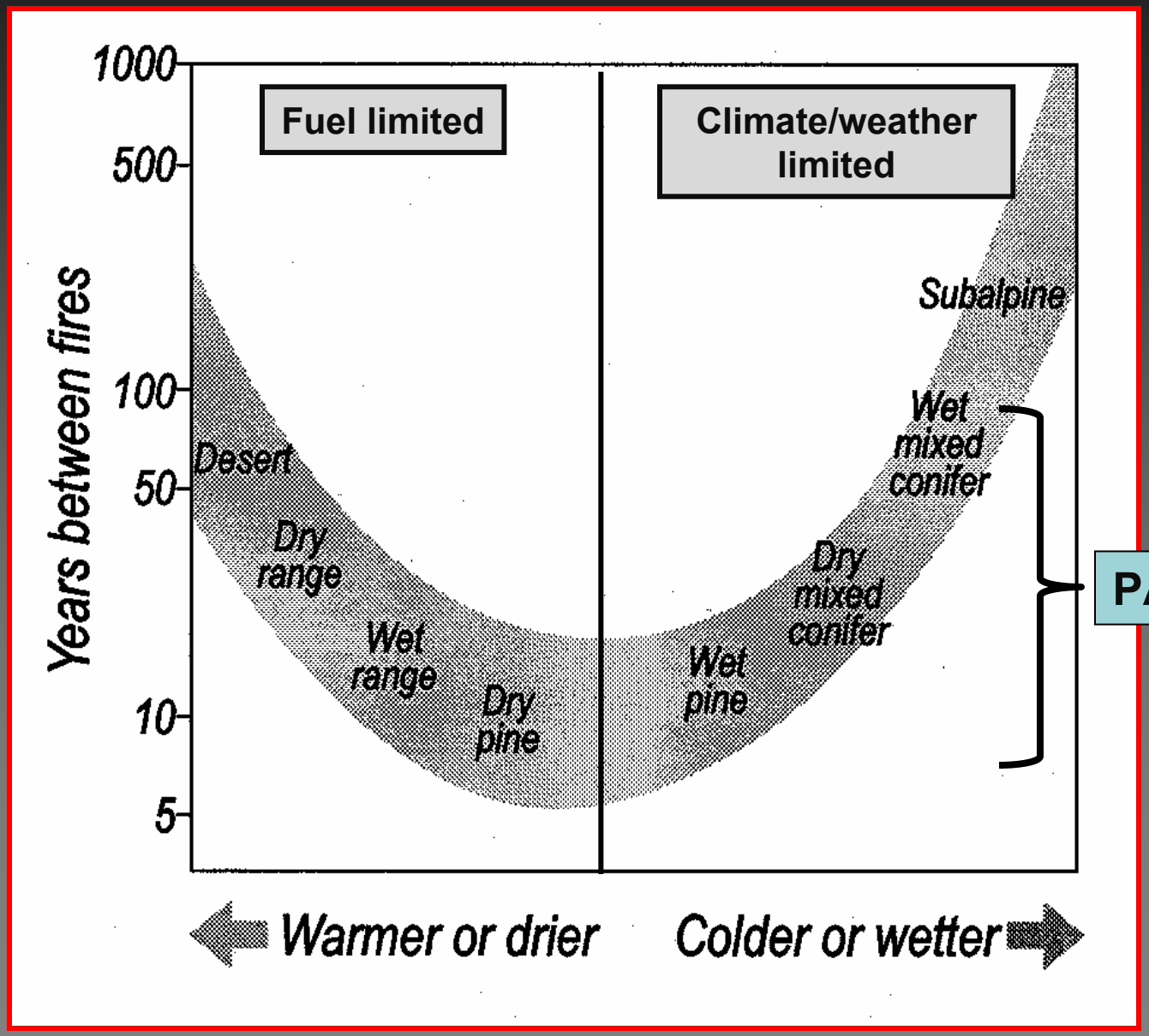
Fire Regime	Description
1	0-35 frequency, low severity
2	0-35 frequency, stand-replacement severity
3	35-100+ year frequency, mixed severity
4	35-100+ year frequency, stand replacement severity
5	200+ year frequency, stand-replacement severity

(Schmidt et al 2002)

Fire Regime Classification



Historic Fire Regimes



Fire Regimes & PAGs

Series	Associations	ppt.	Fire Regime
Ponderosa pine (PIPO)			
Dry	SYAL,CEPR,CAIN4,ARPA4, PUTR/FEID,PUTR2	17-24”	1
Moist	ARUV,CHUM	22-26”	1
Douglas-fir (PSME)			
Dry	SYAL, CEPR,CAGE2,ARPA6,PUTR	19-26”	1
Moist	TRLA2, CACH,SYMO,CHUM, HODI	24-27”	1
Grand fir (ABGR)			
Dry	SYAL,CARU,ARNE,CAIN9,ARPA6	27-34”	1
Moist	TRBOL,CACH7,MAST4,SYMO, CHUM,HODI	30-39”	1, 3
Wet	ASCA2,CLUN2,ACTR,LIBO3	41-50”	3
Western hemlock (TSHE/THPL)			
Wet & Moist	ASCA,CLUN2,ACTR,LIBO3,	43-62”	3,4

(Simpson 2007)

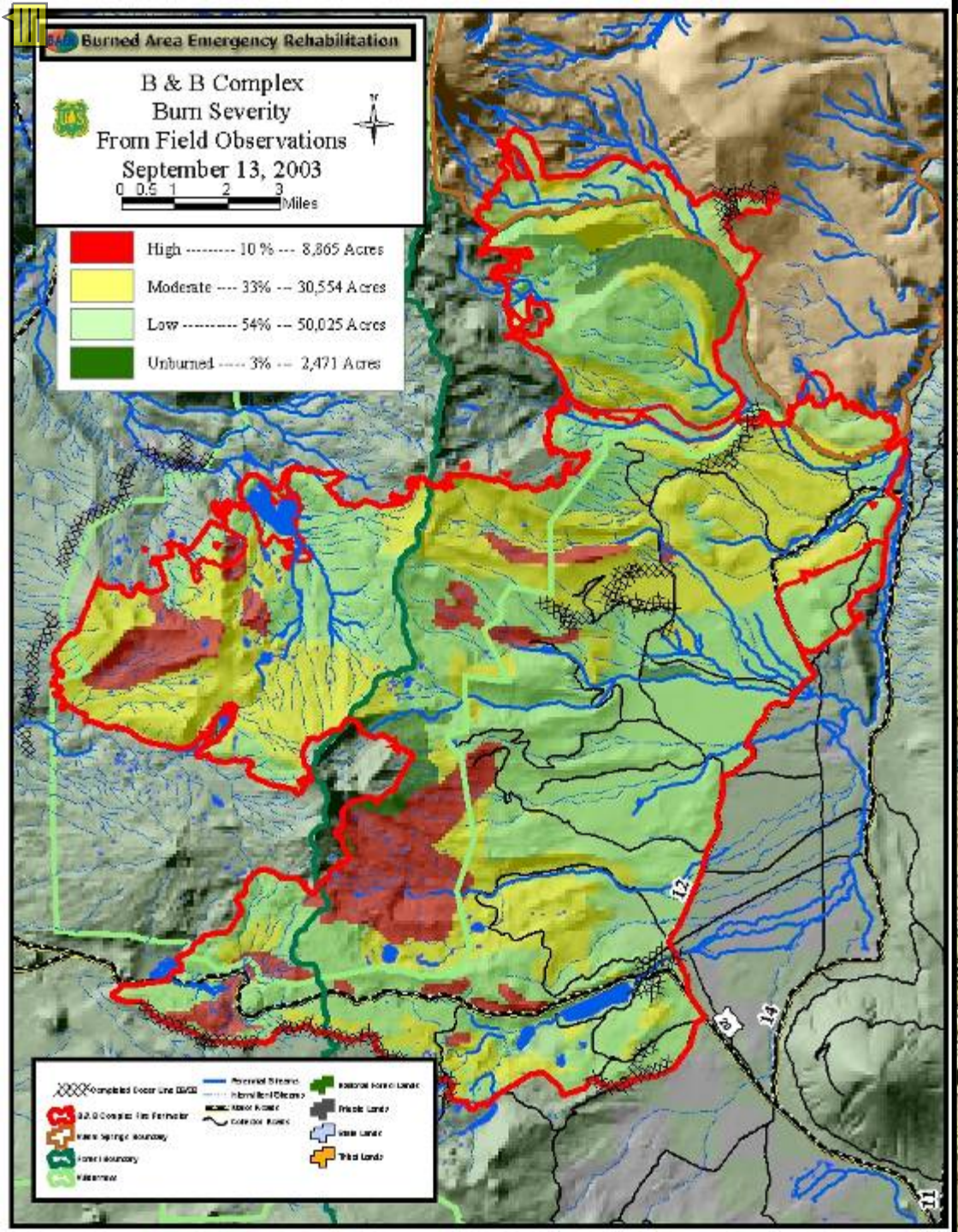
Fire Regime & PAGs: Studies

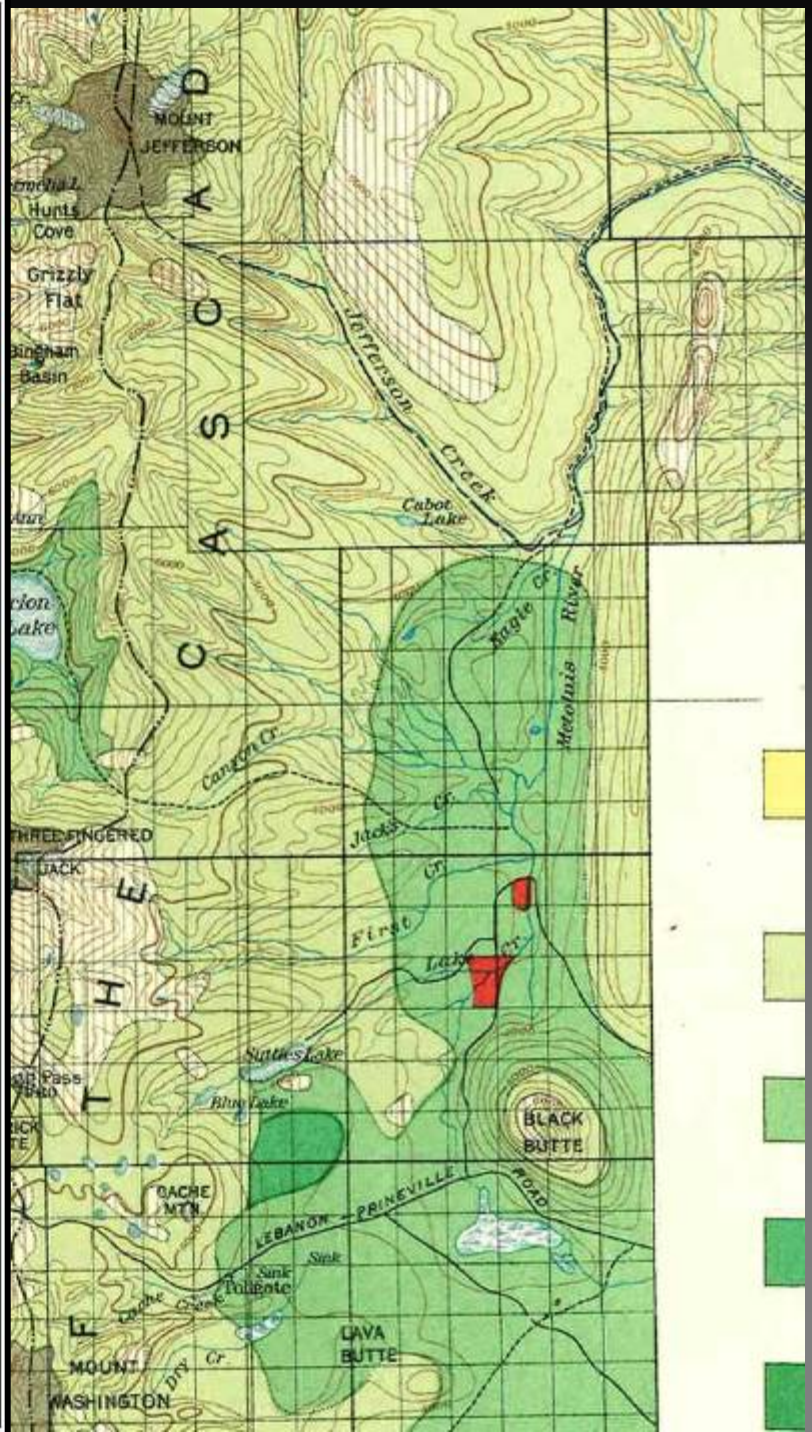
Statistic	Pine D/W	DryDF	DryGF		WetGF
Mean fire interval (MFI)					
Mean	---	18.8	20.6		23.9
	24.0/11.0	---	---	15.0	---
	---	---	---		53.0
Range	---	34.3	39.9		34.7
	22.0/13.0	---	---	16.0	---
Median fire interval (MedFI)					
Mean	---	15.5	17.4		20.6
Range	---	24.0	31.0		38.5

(Wright and Agee 2004 / Bork 1984 / Simon 1991)

Fire Extent & Pattern

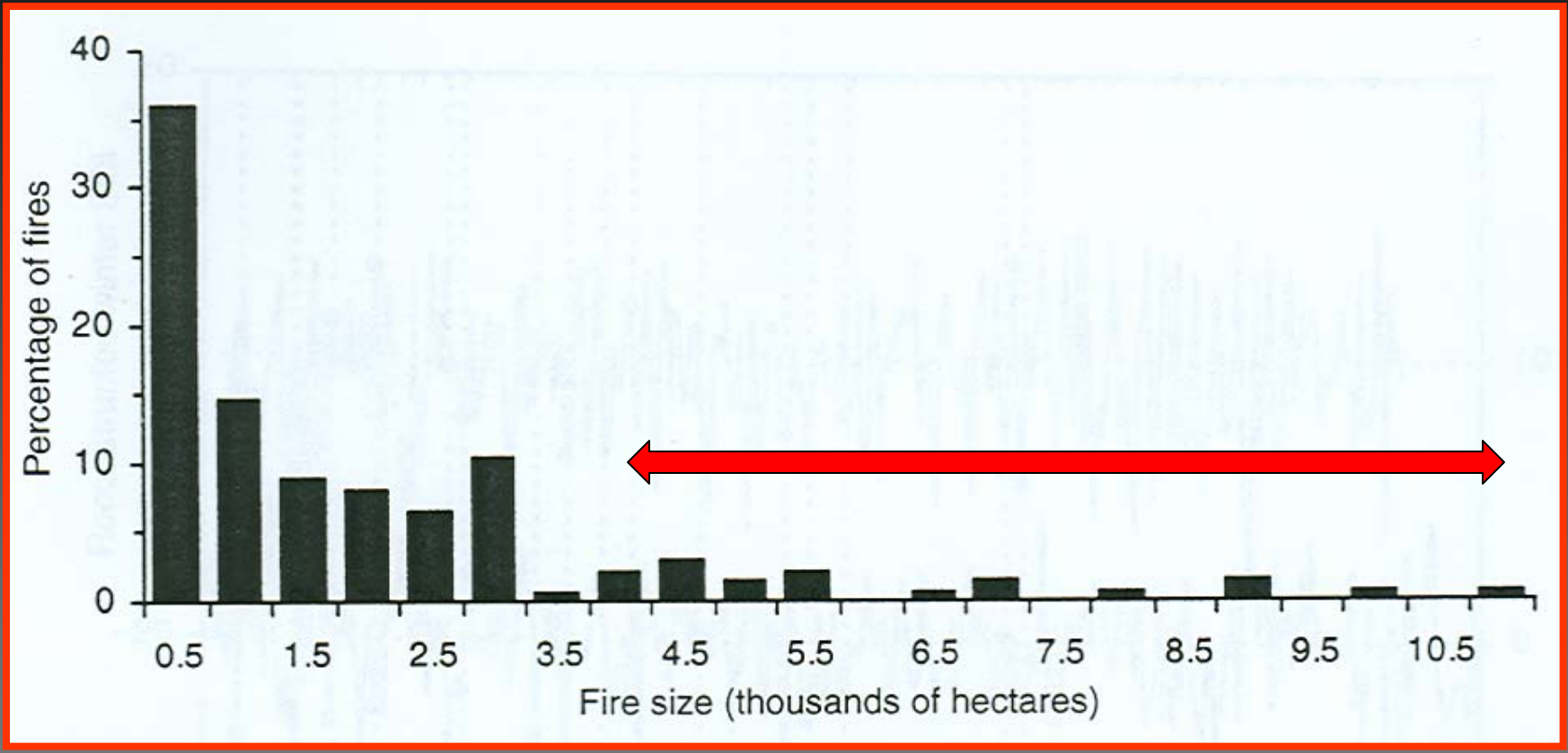
2003 B & B Burn


Burned Area Emergency Rehabilitation
B & B Complex
Burn Severity
From Field Observations
September 13, 2003
0 0.5 1 2 3
Miles
High ---------- 10 % --- 8,865 Acres
Moderate ---- 33% --- 30,554 Acres
Low ---------- 54% --- 50,025 Acres
Unburned ----- 3% --- 2,471 Acres


MOUNT JEFFERSON
Hunts Cove
Grizzly Flat
Jefferson Creek
Cabot Lake
Eagle Cr.
Metolius River
Canyon Cr.
Jacks Cr.
THREE FINGERED JACK
First Lake
Lake Cr.
Suttle Lake
Blue Lake
BLACK BUTTE
CACHE MTN
LEBANON - PRINEVILLE ROAD
Sink
Tollgate
Lodge Creek
LAVA BUTTE
MOUNT WASHINGTON
Dry Cr.

Extent

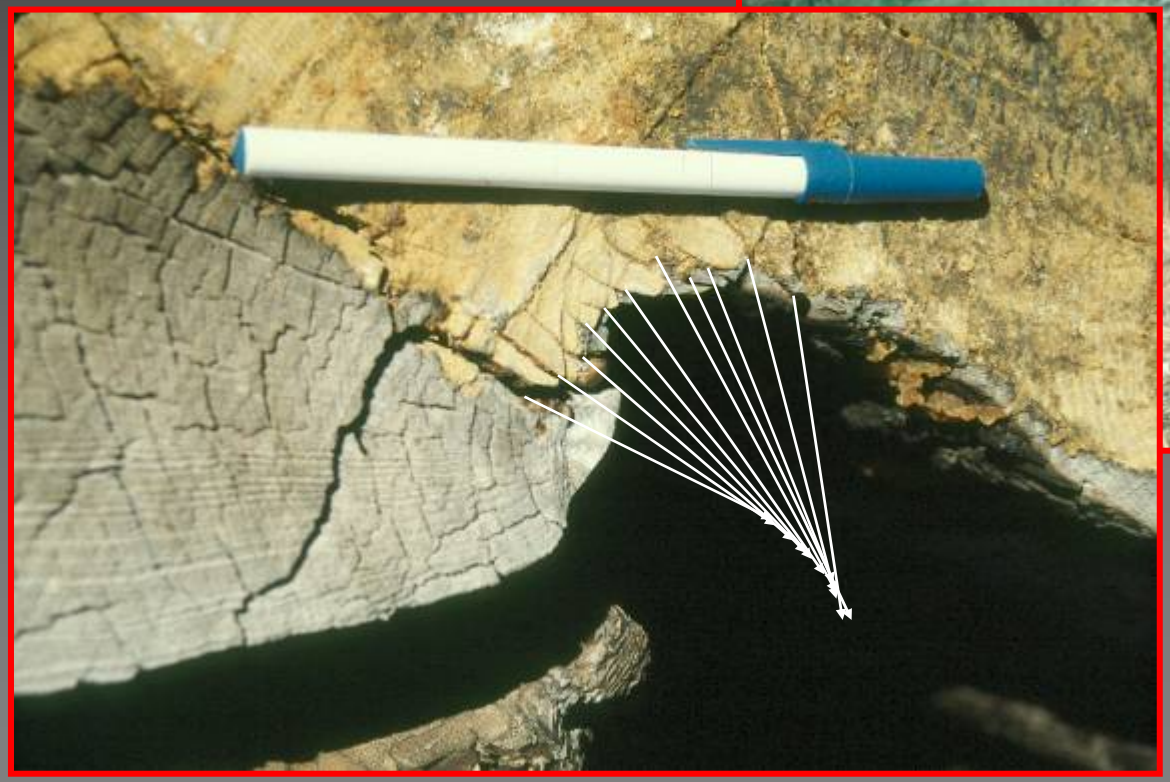
- Teanaway River Drainage
- 136 fires



- Wright and Agee (2004) found fire extent was variable and ranged from 30 to over 10,000 h (75 to over 26,000 acres) in central WA in DF, dry GF, and wet GF PAGs containing a significant component of ponderosa pine.
- Median size was 988 h (2,440 acres).
- Large fires of 4,000 h (>9880 ac) or larger were related to climate (SOI).

Historic Stand Structure - Pine

Frequent, low intensity,
with some mixed-severity

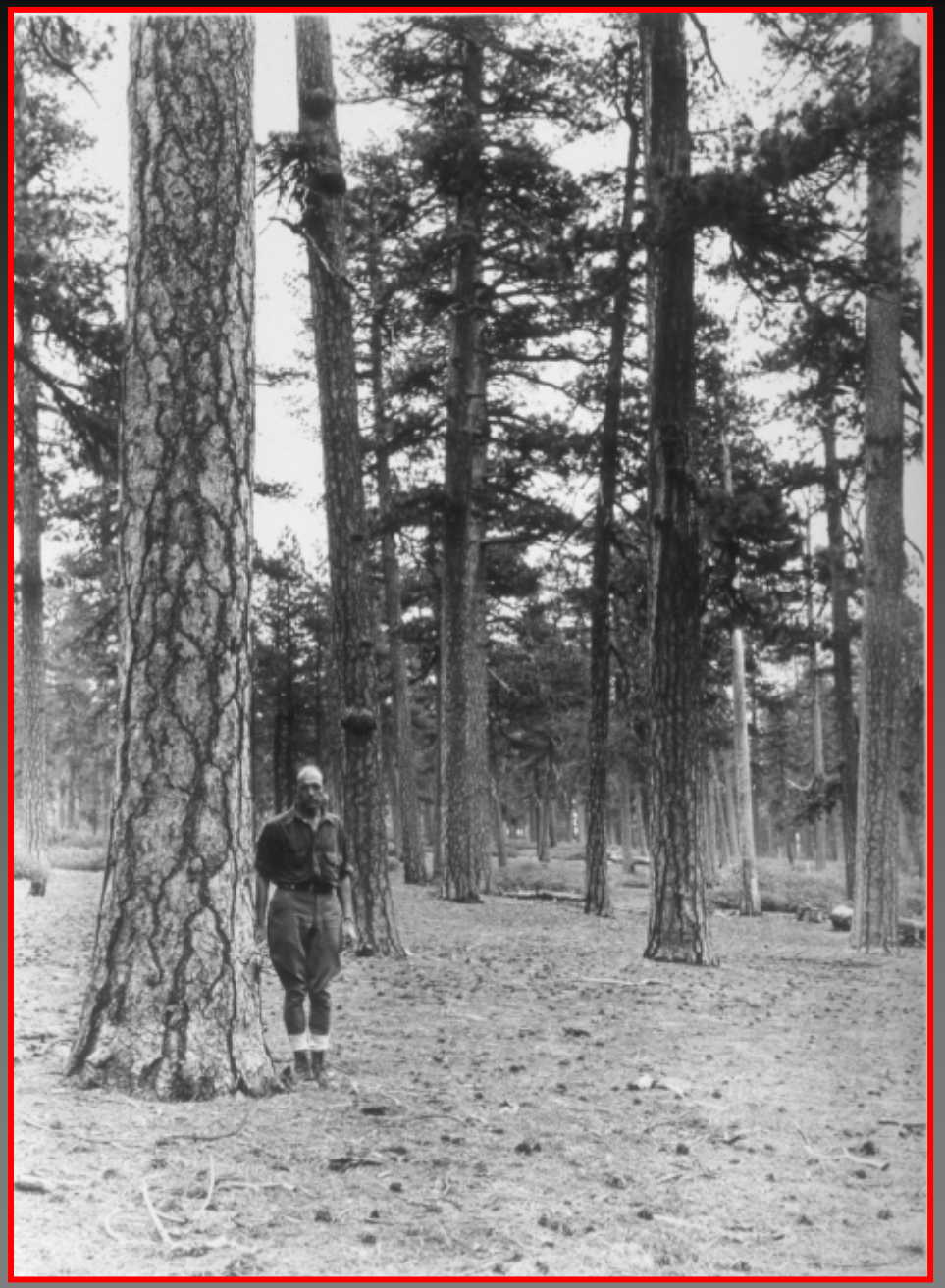


Historic Stand Structure

- Low surface fuels
- Widely spaced trees
- High crowns
- Large, fire-resistant trees

"In most of the pure yellow-pine forests of the State the trees are spaced rather widely, the ground is fairly free from underbrush and debris, and travel through them on foot or horseback is interrupted only by occasional patches of saplings and fallen trees."

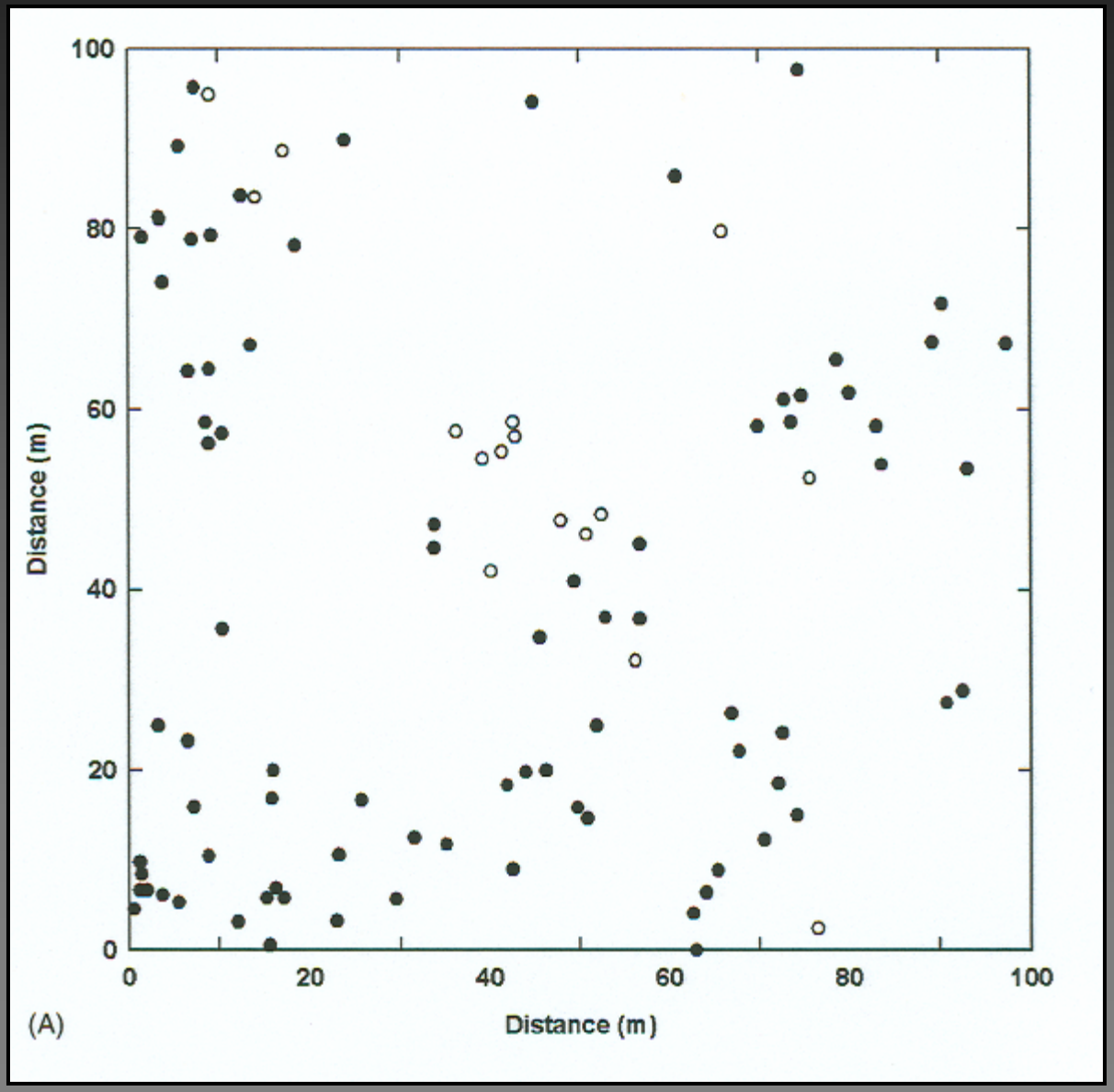
-Thorton Munger, 1917, *in* Western Yellow Pine in Oregon



Harold Weaver *circa* 1930, Klamath Indian Reservation

Historic Stand Structure - Pine

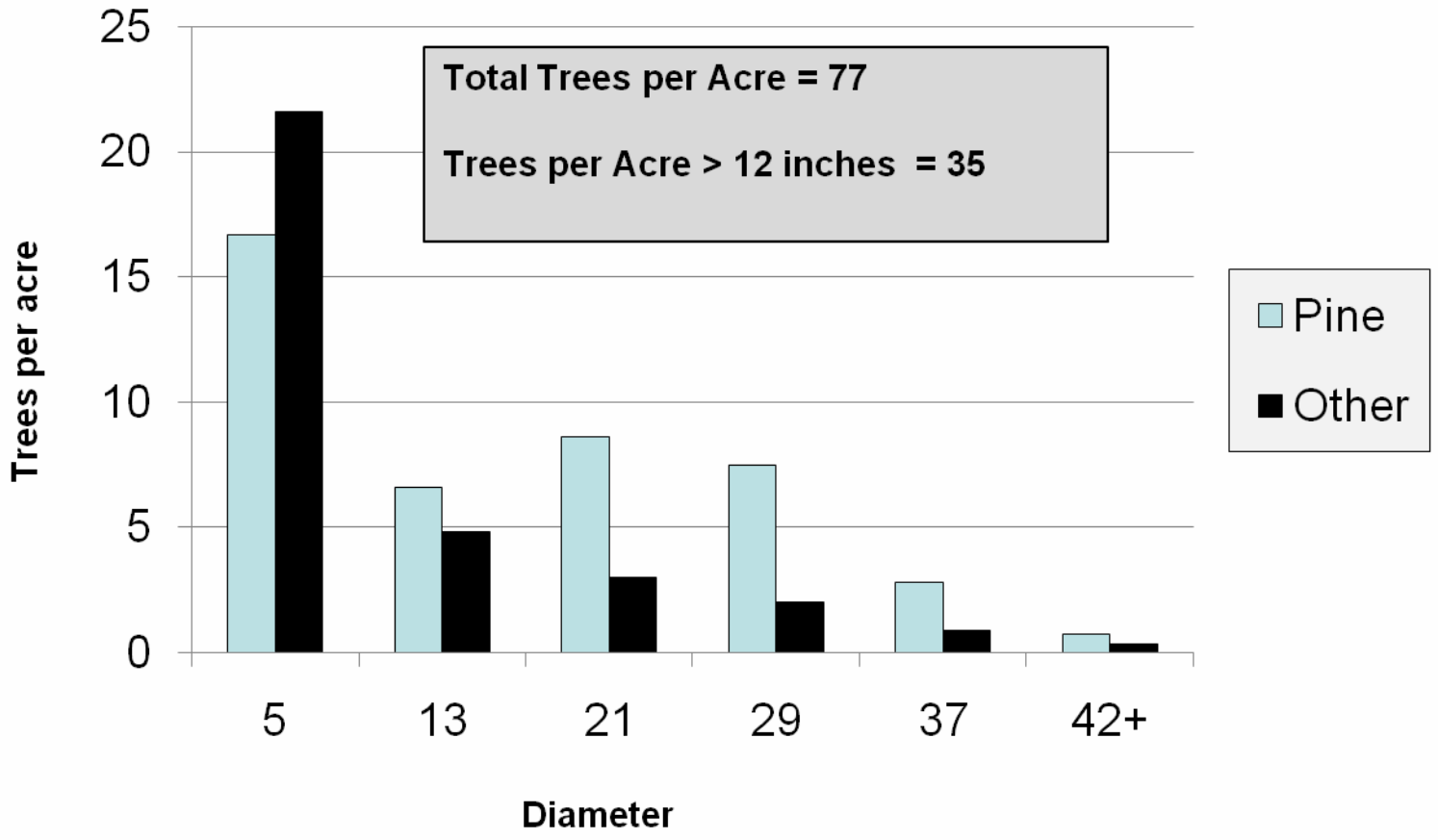
Tree Spacing Pattern



(Youngblood et al. 2004)

Current Stand Structure - Pine

Historic Stand Structure - MC



(Munger 1917)

Current Stand Conditions - MC

Changes in Forest Structure & Increases in Fuel in the Last Century

- Heavy grazing
- Successful fire suppression following 1910
- Selective logging of large fire-resistant trees
- Other land uses

Change in Fire Regime

Wildfire-burned acreage this year sets 45-year record; end in sight

By Christopher Smith
The Associated Press

BOISE, Idaho — The 2006 wildfire season has set a 45-year-high in the number of acres burned, but flames have mainly charred sparsely populated desert ranges and the loss of life on the fire lines is down from previous years.

Wednesday's running total compiled by the National Interagency Fire Center in Boise showed 8,693,994 acres, or 13,584 square miles, burned by 81,881 fires this year. That's just above last year's record of 8,686,753 acres, or 13,573 square miles for the year. Reliable records of wildfire acreage were not kept prior to 1960, officials say.

While this year's burn will set a record and is well above the 10-year average of 4.9 million acres, the season overall is not considered unusual by federal firefighting officials.

"On paper, it may be the worst in almost 50 years, but we have to keep ahold of the context that there was tremendous fire activity in January and February in Oklahoma and Texas, something we seldom have," said Rose Davis of the national fire control center. "The acres are certainly the largest we've had in a few decades, but it's basically been a normal, active fire season."

And it may almost be over. A cold front was moving into the Pacific Northwest on Wednesday that should drop temperatures 20 to 30 degrees across Washington, Oregon, Idaho and Montana by the weekend and bring snow to mountains above 6,000 feet elevation. Forecasters said a second system will follow it early next week.

"I don't know if this is going to be a season-ending event, but it's definitely going to allow fire crews to make some headway," said Miriam Rorig, a research meteorologist with the Pacific Wildlands Fire Sciences Laboratory in Seattle. "Lightning traditionally drops off in September so we would also expect to see fewer starts."

Wildfires on the rise in recent years

Wildfires have scorched more land this year than in the same period for the past seven years. There are currently 46 wildfires burning across a million acres in the U.S.

NOTE: Some fires not noted may be contained.

SOURCE: National Interagency Coordination Center AP

Reed Saxon / The Associated Press

Flames from a backfire race up a hillside along Golden State Highway as a fast-moving Los Padres National Forest wildfire continues to burn near nightfall Wednesday, near Castaic, Calif. The wildfire that had burned over 27,000 acres by 6 a.m. Wednesday threatened to leap across Interstate 5 on Tuesday, shutting down traffic in both directions on one of California's busiest freeways.

Climate Change Effects

?

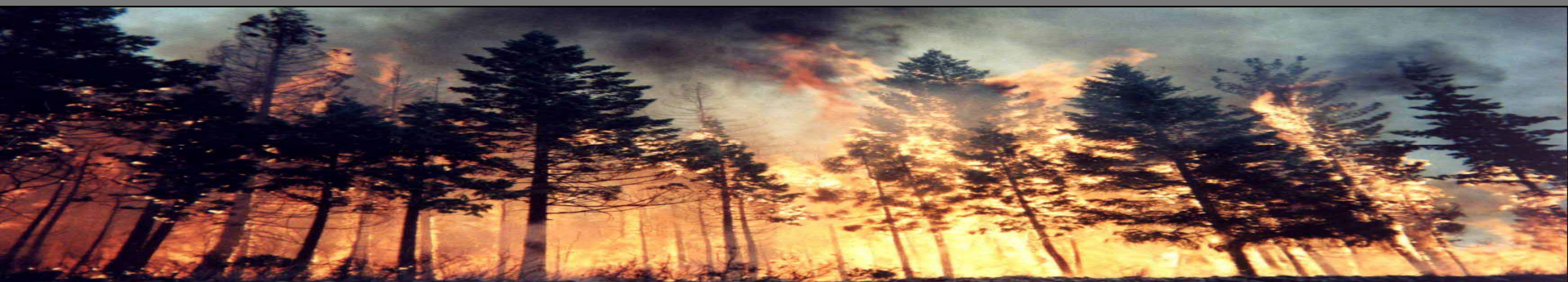
Megafires f(▲Fuel, ▲Structure, ▲Climate)

Consequences of Altered Fire Regimes

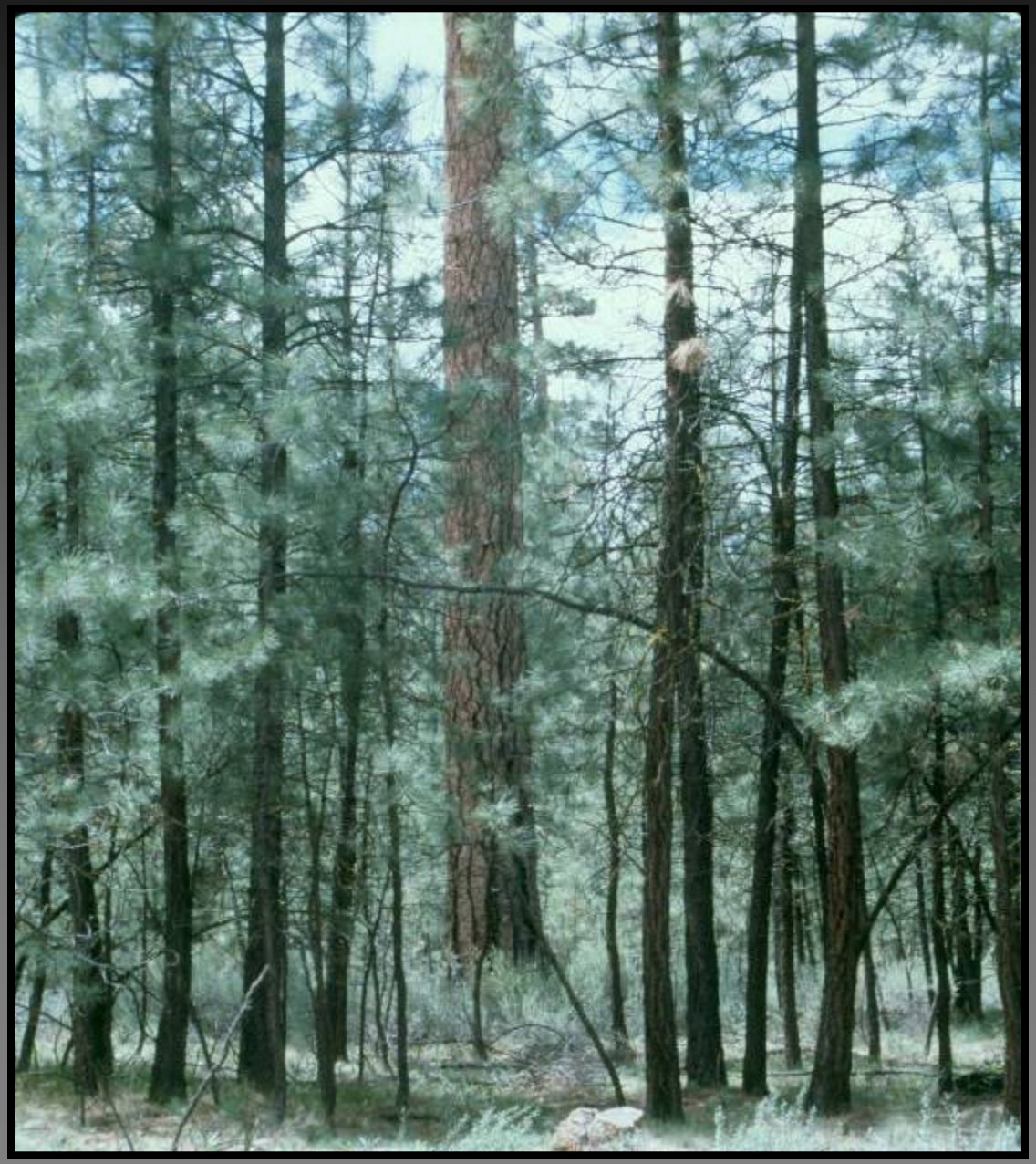
- Wildfire may:
  - Burn too often
  - Burn too little
  - Burn too hot
  - Burn too big of an area
- Cascading ecological effects:
  - Watershed damage
  - Invasive plants
  - Altered successional patterns, forest structure, and wildlife habitats
  - Create future problems
  - Lost options

Restoration Considerations

- Think big! Although restoration is achieved by treating one stand at a time, developing a landscape approach (goal) that considers appropriate spatial and temporal scales is necessary to guide specific treatments on the ground.
- In areas with significantly altered fire regimes, the first step is to arrest or stop uncharacteristic wildfire.
- Treatments should consider what is best to protect and enhance the vigor and longevity of large old trees while recruiting future large trees of appropriate species for the site.

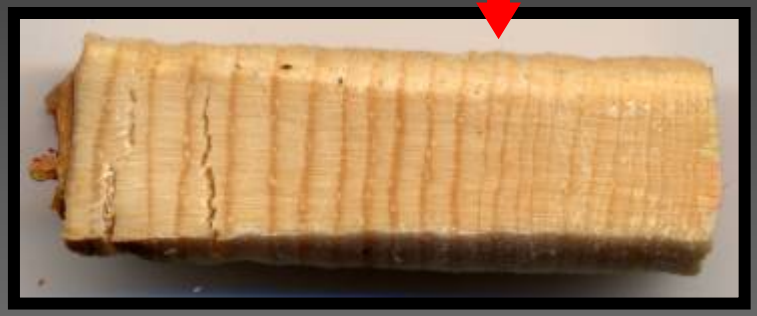


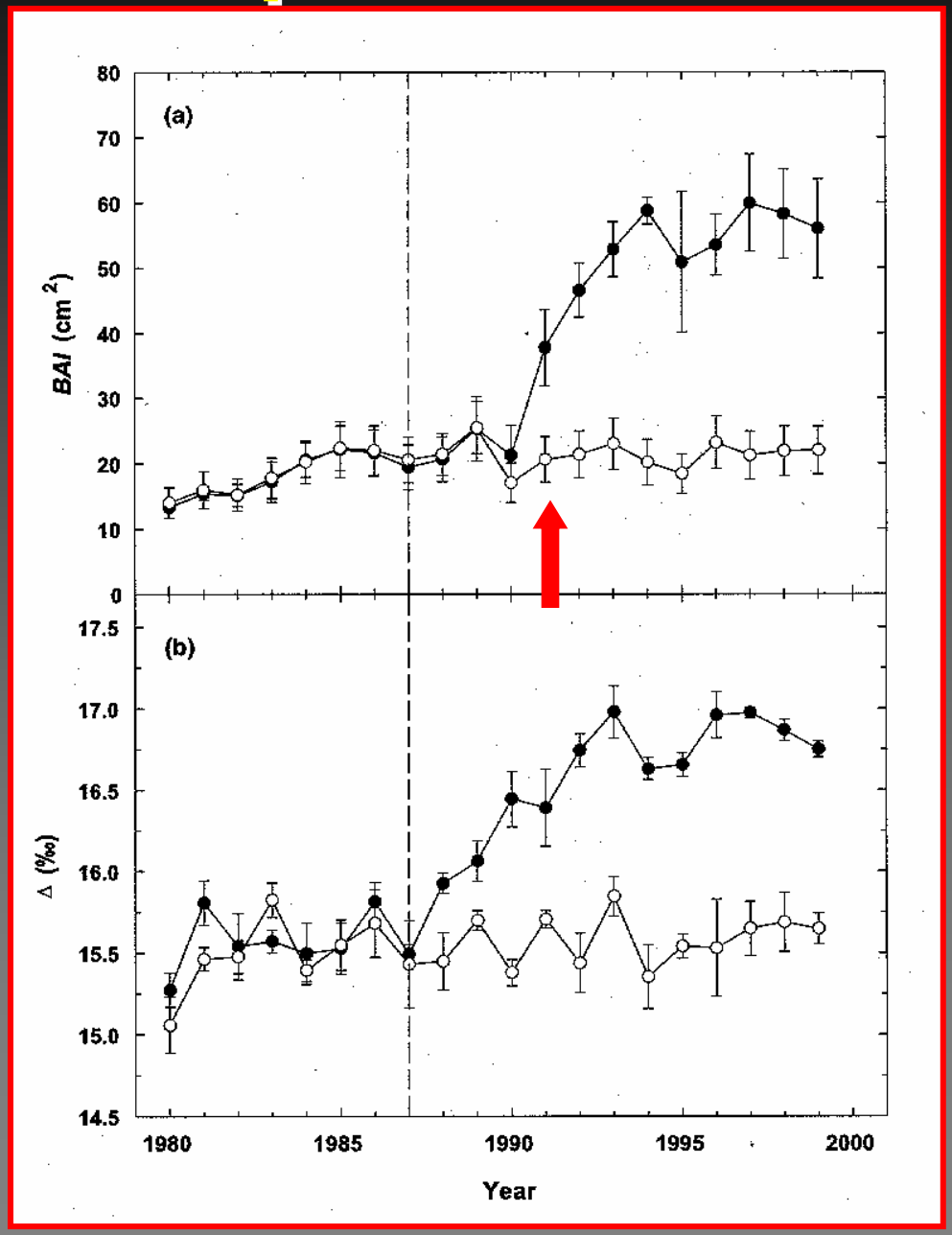
Sustaining Large, Old Trees



Sustaining Large, Old Trees

Old-Growth Pine Response to Density Reductions

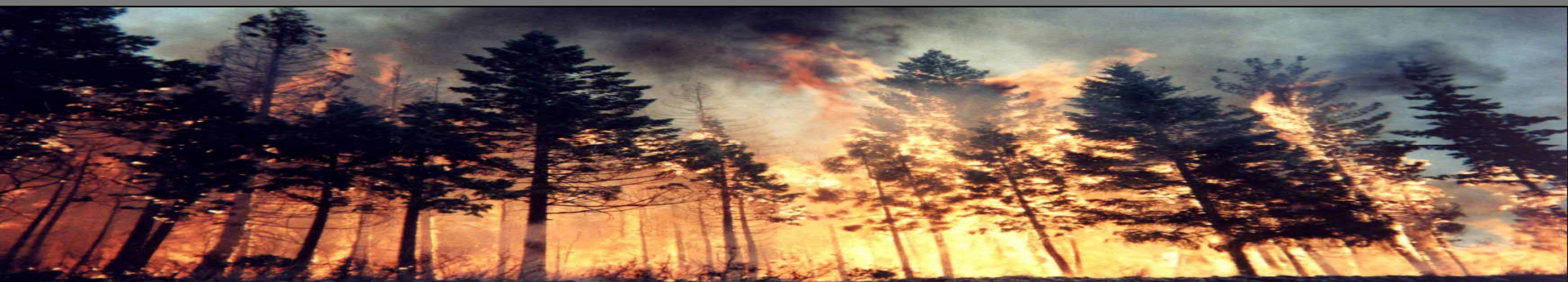




(McDowell *et al*. 2003)

Restoration Considerations

- In young stands, vary tree spacing when thinning and create openings. Follow up with prescribed underburning as appropriate.
- Prescribed fire may not always the best restoration tool, at least not as first treatment.
- Consider all the tools available & match the best one or combinations given your desired outcome.
- In considering treatment & retreatment timing, beware the speed of succession!



Succession (Camp Sherman)

(Ponderosa pine & lodgepole/ bitterbrush)

Photo series: Fred Hall

Succession (Camp Sherman)

Succession (Camp Sherman)

Succession (Camp Sherman)

Succession (Camp Sherman)

Succession (Camp Sherman)

Restoration (Camp Sherman)

Restoration (Camp Sherman)

Restoration (Camp Sherman)

Restoration Literature

Brown et al. 2004. Forest restoration and fire: principles in the context of place. Conservation Biology Vol. 18. No. 4: 903-912.

Craig et al. 2002. Ecological restoration of southwestern ponderosa pine ecosystems: a broad perspective. Ecological Applications, 12(5): 1418-1433.

McIver and Starr. 2001. Restoration of degraded lands in the interior Columbia River basin: passive vs. active approaches. Forest Ecology & Management 153: 15-28.

Noss et al. 2006. Recommendations for integrating restoration ecology and conservation biology in ponderosa pine forests of the southwestern Unites States. Restoration Ecology Vol. 14, No. 1 : 4-10.


Thank You!