



Fuels Treatments and their Effects on Fire Behavior, Wildlife, and other Resources

Carl N. Skinner

Research Geographer

USFS Pacific Southwest Research Station

Redding, CA





Acknowledgement

Kerry Farris

**Wildlife Conservation
Society**

Luke George

Humboldt State Univ.

Bill Laudenslayer **USFS PSW (retired)**



Steve Zack

**Wildlife Conservation
Society**



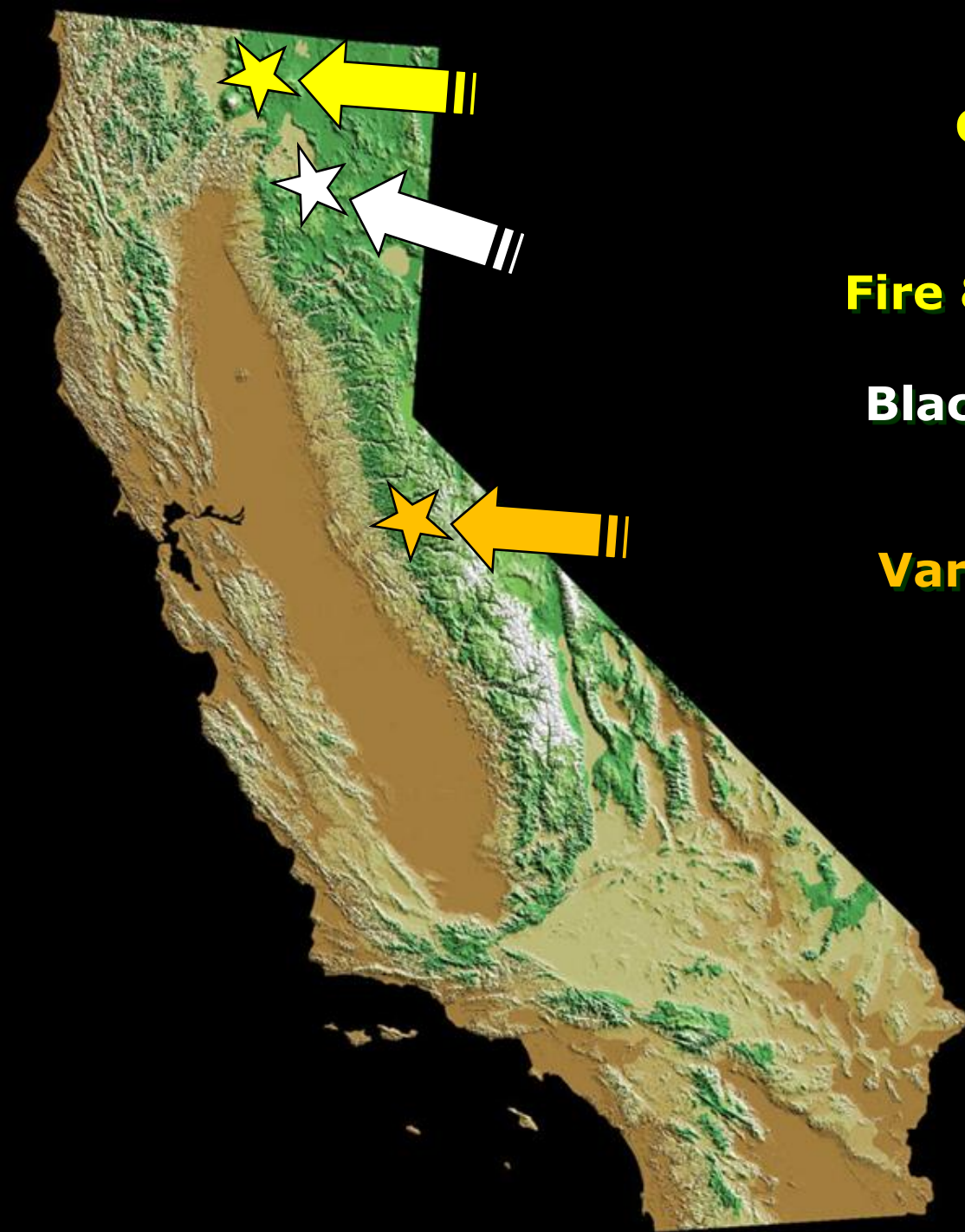
Research Projects & Scale

- Stand Scale - Experimental
Blacks Mountain Exp For
Gooseneck AMA / Fire Surrogates
Stanislaus-Tuolumne Exp For
- Landscape Scale?? - Retrospective
Thompson Ridge
Hayfork
etc.



Projects

- **Blacks Mountain Interdisciplinary Ecological Study – Lassen N.F.**
Ecological effects of stand structural complexity
Cone Fire
- **Gooseneck Adaptive Management Area Study & Fire Surrogates Study – Klamath N.F.**
Ecological effects of accelerating growth of large trees
Ecological effects of fire hazard reduction treatments
- **Variable Density Thinning - Stanislaus-Tuolumne Exp. For. – Stanislaus N.F.**
Ecological effects of restoring variable tree density



**Goosenest Adaptive
Management Area
+
Fire & Fire Surrogates Study**

**Blacks Mt Interdisciplinary
Ecological Study**

**Variable Density Thinning
Study**

Blacks Mountain study

Objective: understand ecological ramifications of within-stand structural complexity

High diversity

- Leave large trees
- ~ 10-15% of stand untreated,
- ~ 10-15% in 0.25-2ac gaps,
- ~ thin from below - large trees retained

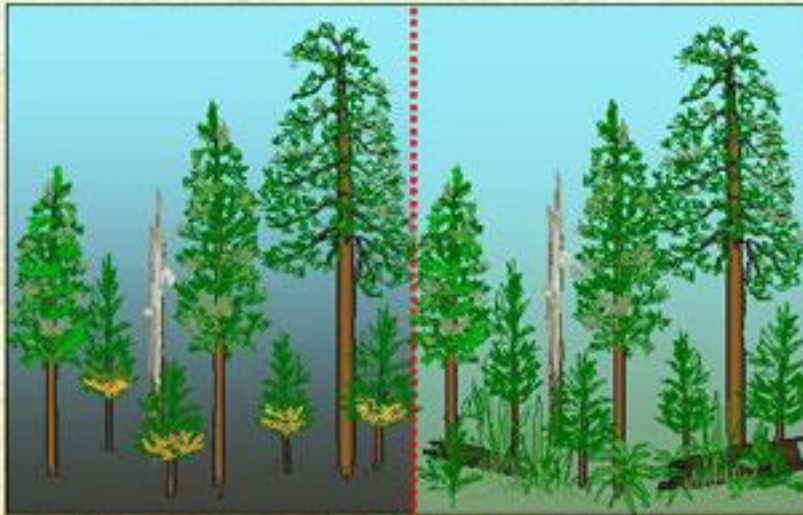
Low diversity

- large trees removed,
- intermediates evenly spaced



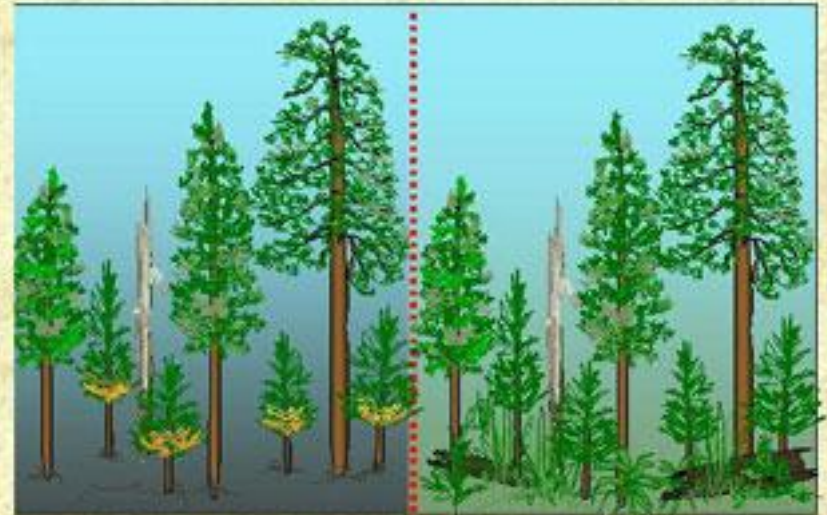
HIGH STRUCTURAL DIVERSITY

GRAZING



**WITH
FIRE**

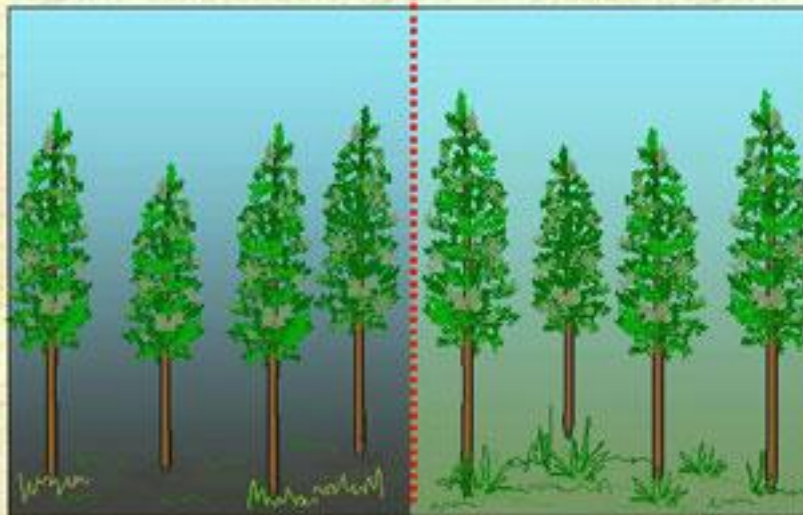
**WITHOUT
FIRE**



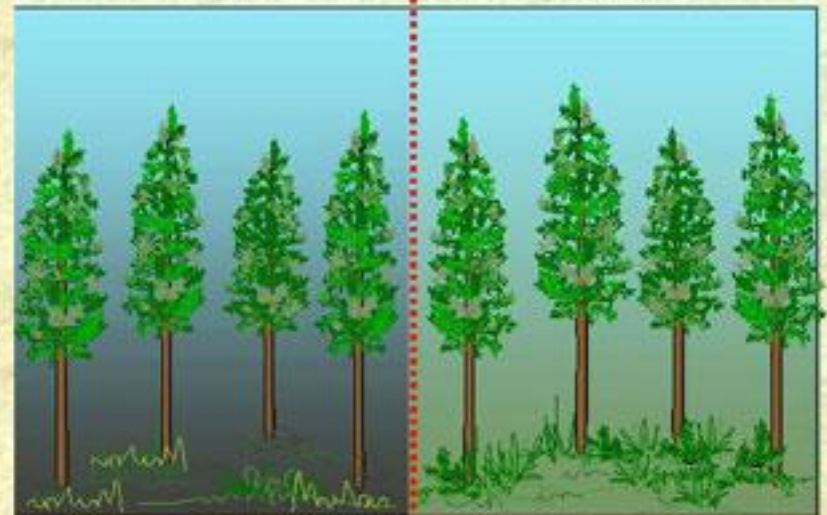
**WITH
FIRE**

**WITHOUT
FIRE**

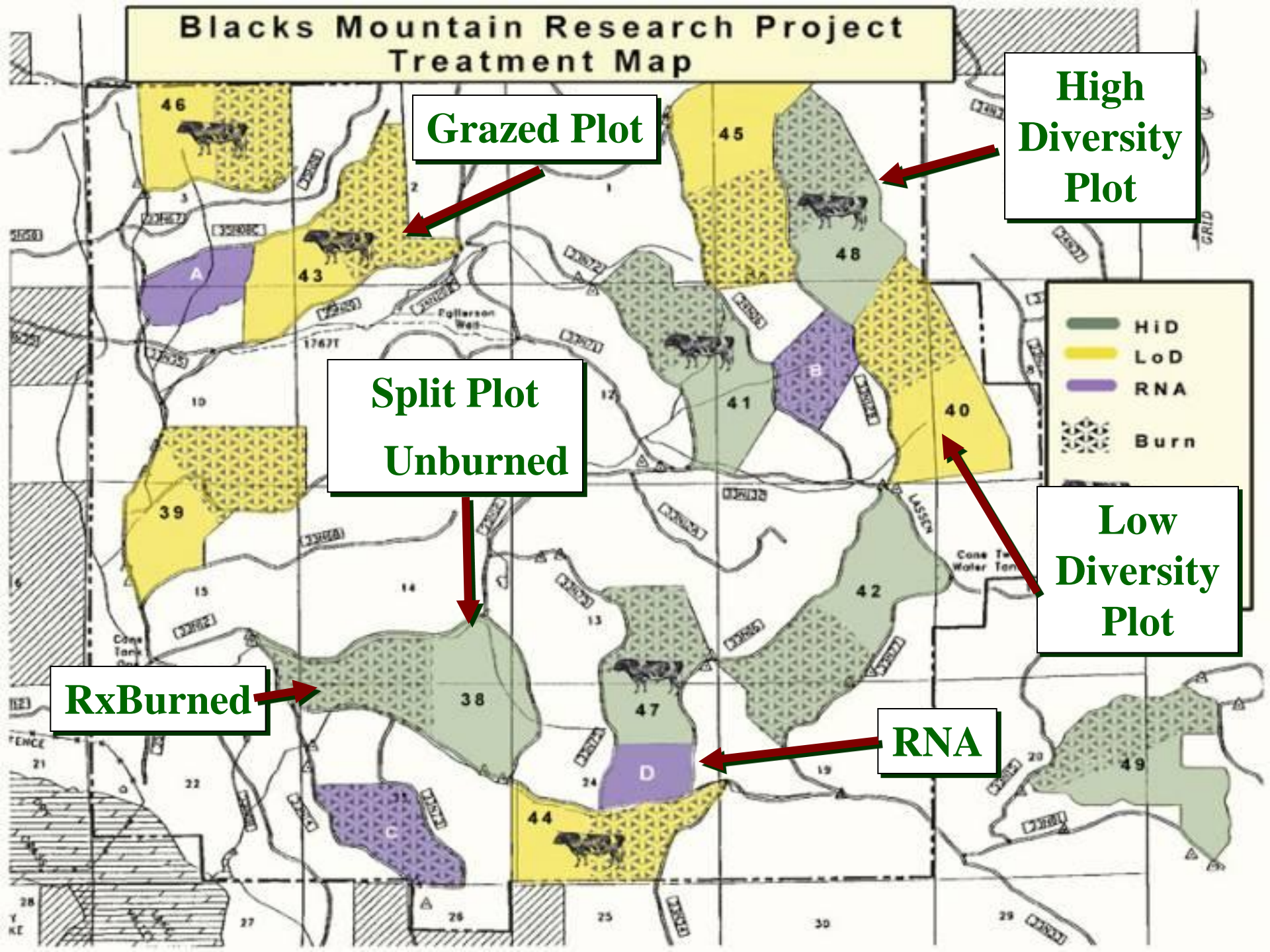
NO GRAZING



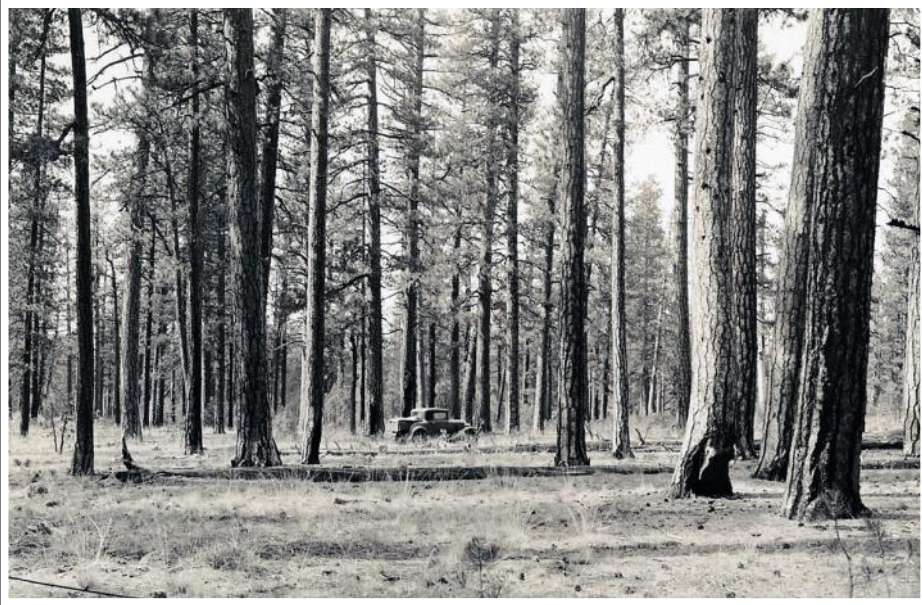
LOW STRUCTURAL DIVERSITY



Blacks Mountain Research Project Treatment Map



Stand Structure & Species Composition Changes over 20th Century



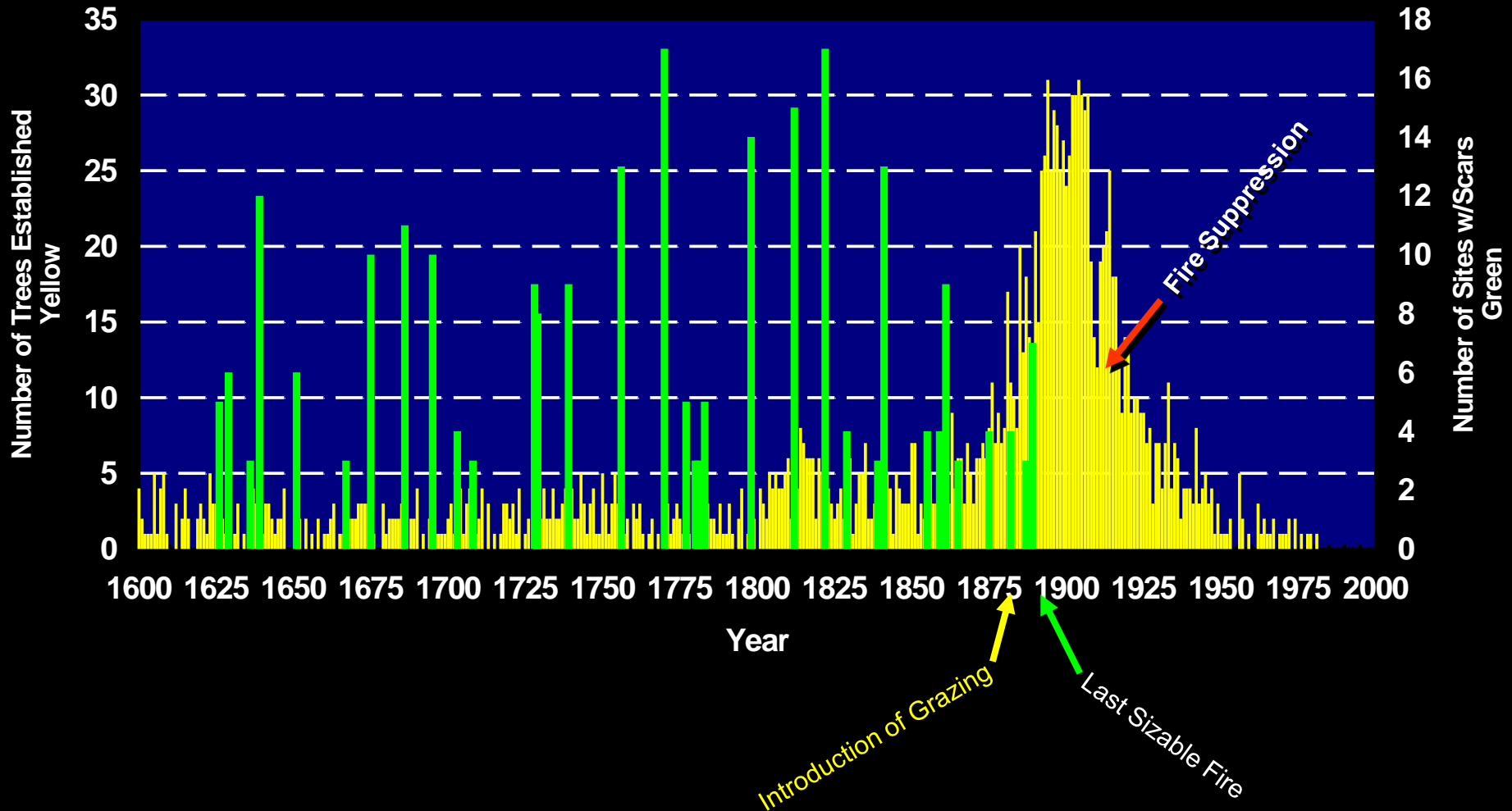
**Original
Stand
Structure**

**Fire exclusion has helped
lead to increasing stand
density.**



Fire Occurrence & Tree Establishment

Blacks Mountain Experimental Forest





Untreated RNA

1yr Post Rxfire



4yrs Post Rxfire





Large Trees – No RxBurn



Large Trees – RxBurn



Intermediate Trees – No RxBurn



Intermediate Trees – RxBurn

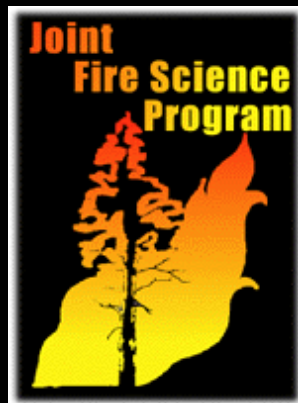


Questions?



**Blacks Mt. Exp. Forest
September 2002
Cone Fire**

**Fuel Treatment
Effectiveness**





Wind Direction

Origin



Unthinned

Unthinned

**Unit 46
LoD**

**Thinned
No RxBurn**

**Thinned+
RxBurn**

**Cone Fire – September 2002
Patchwork of pre-fire treatments and fire effects.
Blacks Mountain Experimental Forest**

1:49 PM

Cone Fire

- • Survival was greatest in areas that had both thinning and prescribed fire prior to the wildfire event.
- • Survival in thinned-only areas was greater than untreated areas but substantially less than the areas with both treatments.
- • Bole scorch and crown scorch was substantially reduced in the treated areas.

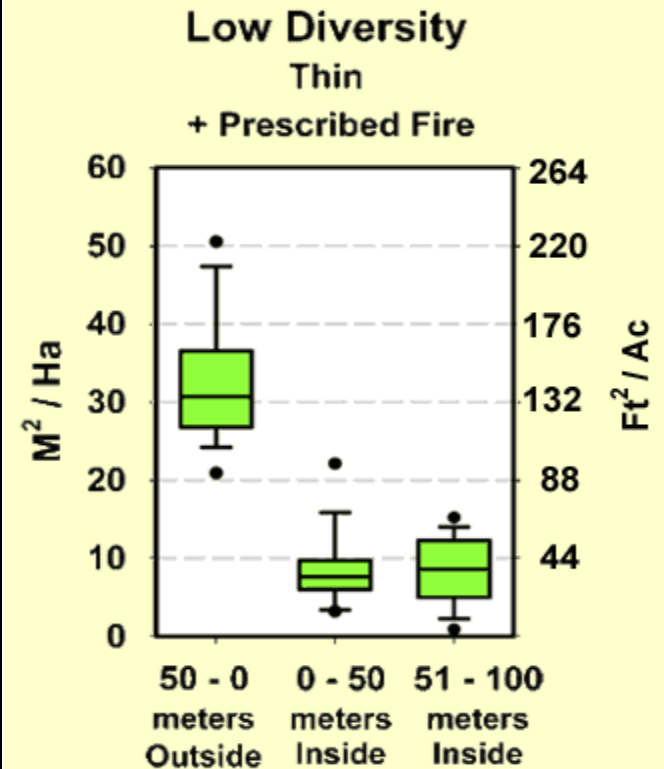
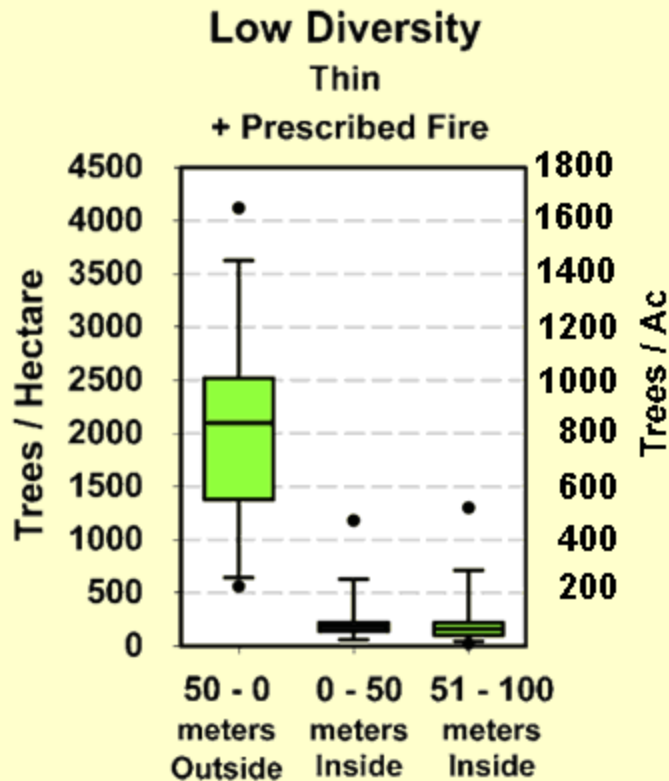


Cone Fire

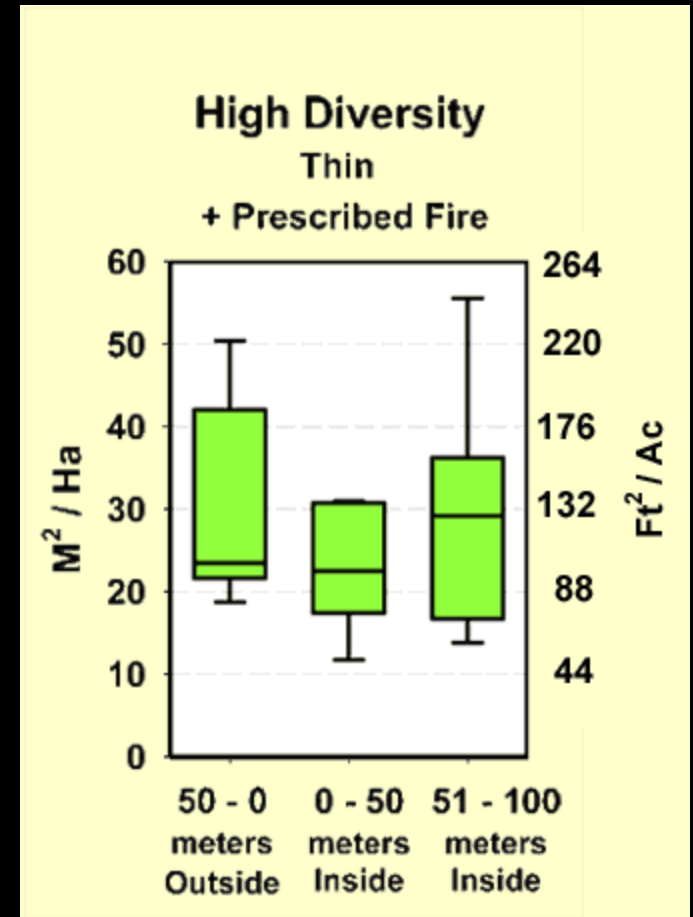
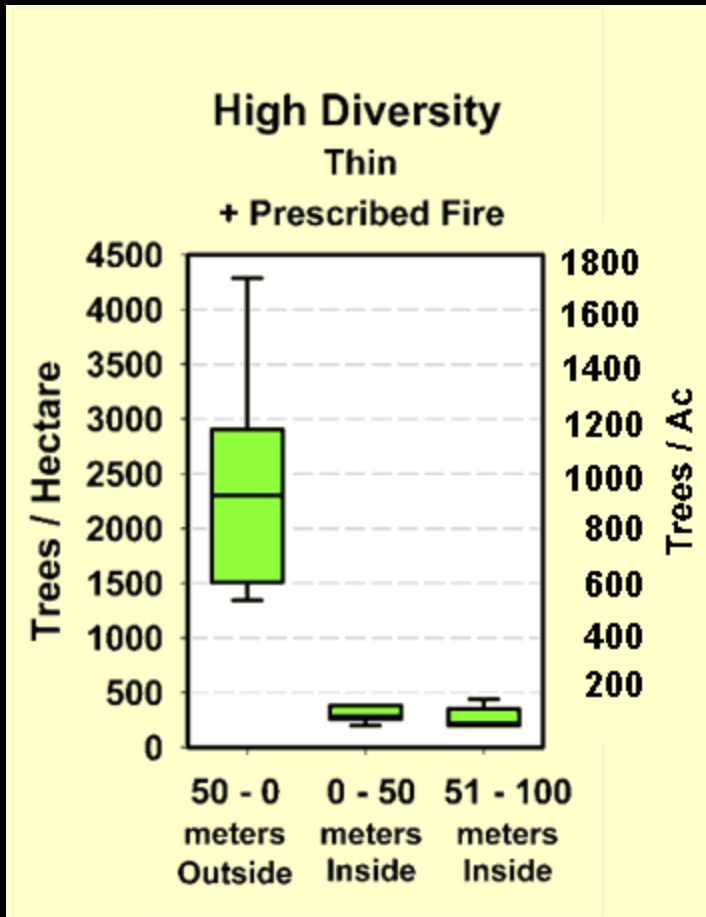
- A. No Treatment
- B. Thinned – No RxBurn
- C. Thinned with RxBurn



Low Diversity Tree Density & Basal Area



High Diversity Tree Density & Basal Area

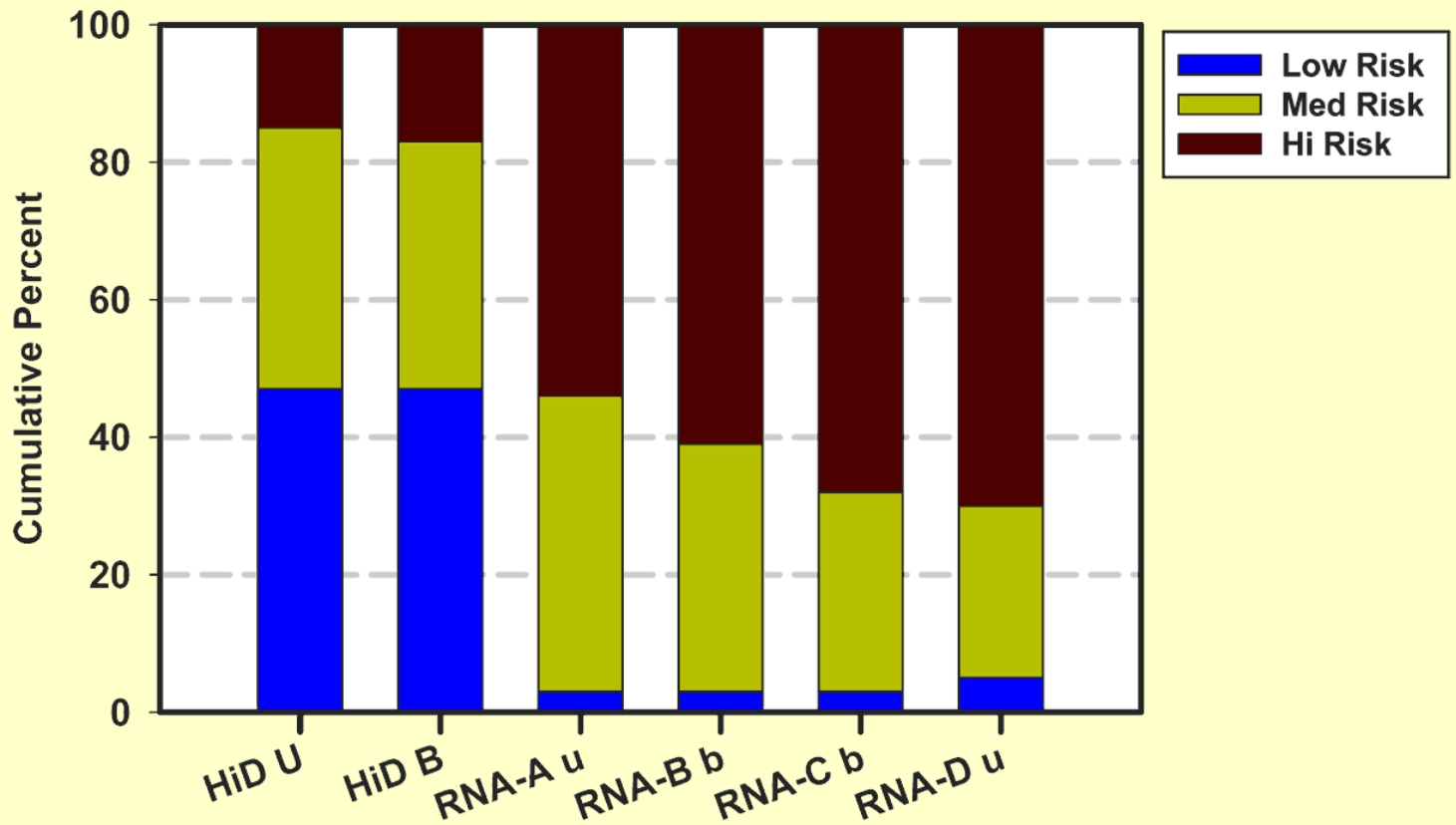


Old Trees

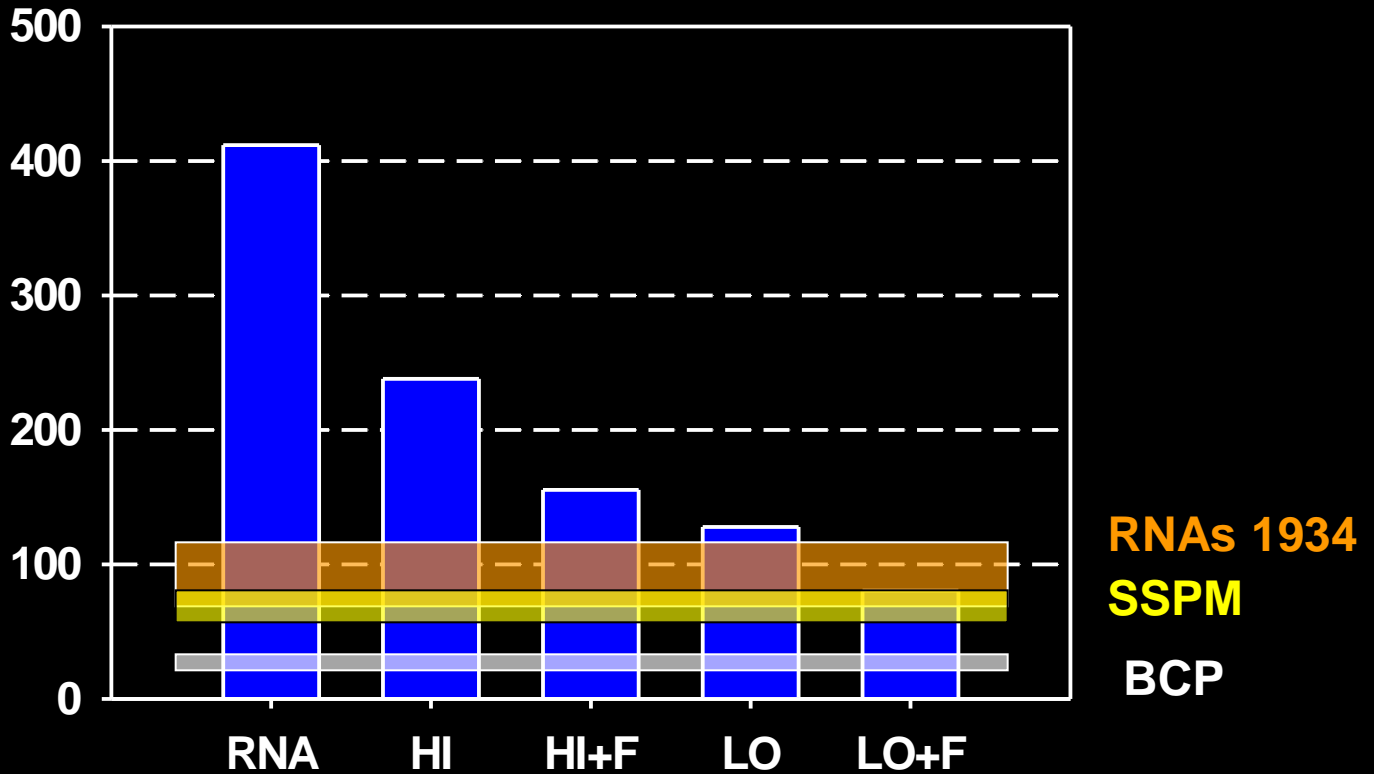
- Over a period of about 65 years, the condition of large old trees at Blacks Mountain deteriorated substantially. There was an influx of young poles and saplings and a substantial decrease in density of large trees > 24 inches in diameter.
- Evaluation of post treatment survival and growth indicates the decline is continuing in untreated Research Natural Areas. Prospects for the largest trees are bleak in these unthinned stands as reduced growth rates and increased mortality are continuing.
- Treated stands have much lower rates of mortality and higher growth rates, increasing the numbers of large trees.



Old Trees – Risk of Dying



Blacks Mt Stand Structure



Ritchie et al. 2008
Zhang et al. 2008
Stephens & Gill 2005
Oliver 2001

Costs at BMEF

Treatment	Net Value / Acre
Low Diversity	
Mechanical Thin Only	\$2,600
Mechanical Thin + RxFire	\$2,475



Costs at BMEF

Treatment	Net Value / Acre
Low Diversity	
Mechanical Thin Only	\$2,600
Mechanical Thin + RxFire	\$2,475
High Diversity	
Mechanical Thin Only	-\$300
Mechanical Thin + RxFire	-\$425

Costs at BMEF

Treatment	Net Value / Acre
Low Diversity	
Mechanical Thin Only	\$2,600
Mechanical Thin + RxFire	\$2,475
High Diversity	
Mechanical Thin Only	-\$300
Mechanical Thin + RxFire	-\$425
RNA Burn Only	
RxFire	-\$310

Small Mammals



- • Yellow pine chipmunk, golden-mantled ground squirrel, and the deer mouse were the most common species found at Blacks Mountain (over 80%).
- • Number of captures and captured individuals of yellow-pine chipmunks and deer mice decreased as basal area (m^2ha^{-1}) increased, but the opposite occurred with the golden-mantled ground squirrel.
- • Golden-mantled ground squirrels were captured more frequently in high structural diversity (HiD) treatments, whereas, yellow-pine chipmunks were captured more frequently in low structural diversity (LoD) treatments.

Birds



- • Blacks Mountain had a higher abundance of woodpeckers and bark-gleaning bird species and a lesser abundance of foliage-gleaning bird species, relative to “typical” eastside ponderosa pine forests.
- • Few differences in occupancy of bird species and no differences in species richness were found between structural treatments.
- • Estimates of species-richness ranged from 17 to 37 (mean= 24 ± 1 se), regardless of structural treatments or prescribed fire.
- • Treatments did not change snag (standing dead tree) densities and cavity availability. Snag retention may partially explain why there were no substantial shifts in species richness.



Questions?



Goosenest Adaptive Management Area study



- **Objective:** accelerate development of large tree component of late-seral stands
- **Treatments:** pine emphasis, pine emphasis w/ fire, large tree emphasis, control
 - Pine emphasis: all dom/codominant pines >12" retained; leave trees spaced based on dbh; 15% of area in 0.5-3ac group openings - planted
 - Large tree emphasis: thinning from below keeping largest trees, even spacing
- **100 acre units + buffer; implementation completed 2001**
- **Multidisciplinary – wildlife (birds, small mammals), tree growth, understory veg. etc.**



Goosenest Adaptive Management Area



Interdisciplinary Studies

Fuels **Soils** **Wildlife** **Finances**
Entomology **Vegetation**

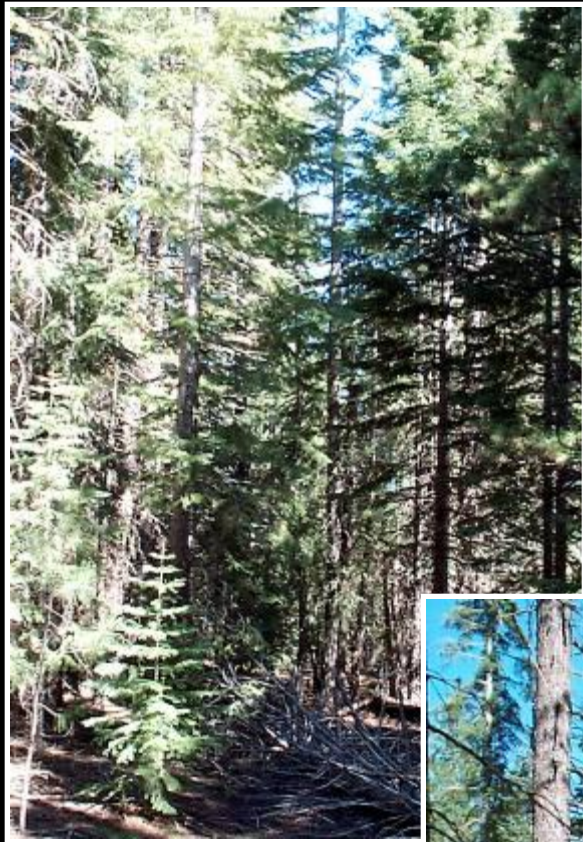
Gooseneast Adaptive Management Area



National Fire & Fire Surrogates Study

Interdisciplinary Studies

Fuels **Soils** **Wildlife** **Pathology**
Entomology **Vegetation** **Finances** **Social**



**Untreated
Control**



**Prescribed
Fire
Alone**



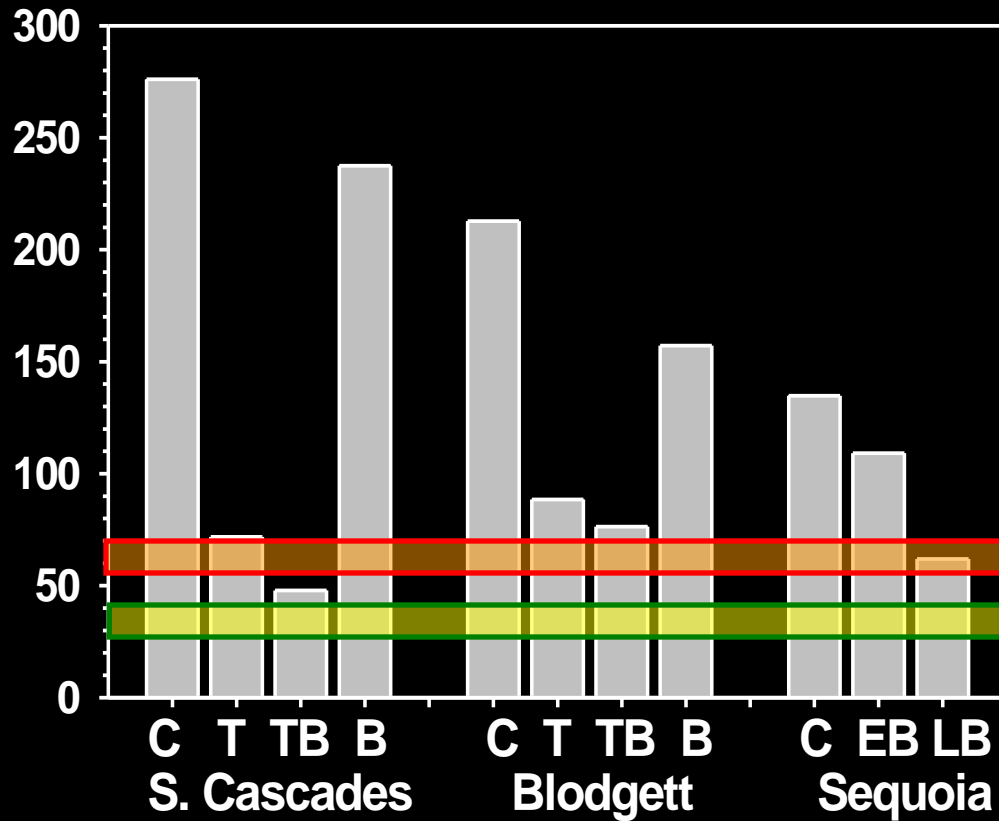
**Mechanical
Thin
Alone**

**Mechanical
Thin +
Prescribed
Burn**





Density of trees > 4 inches

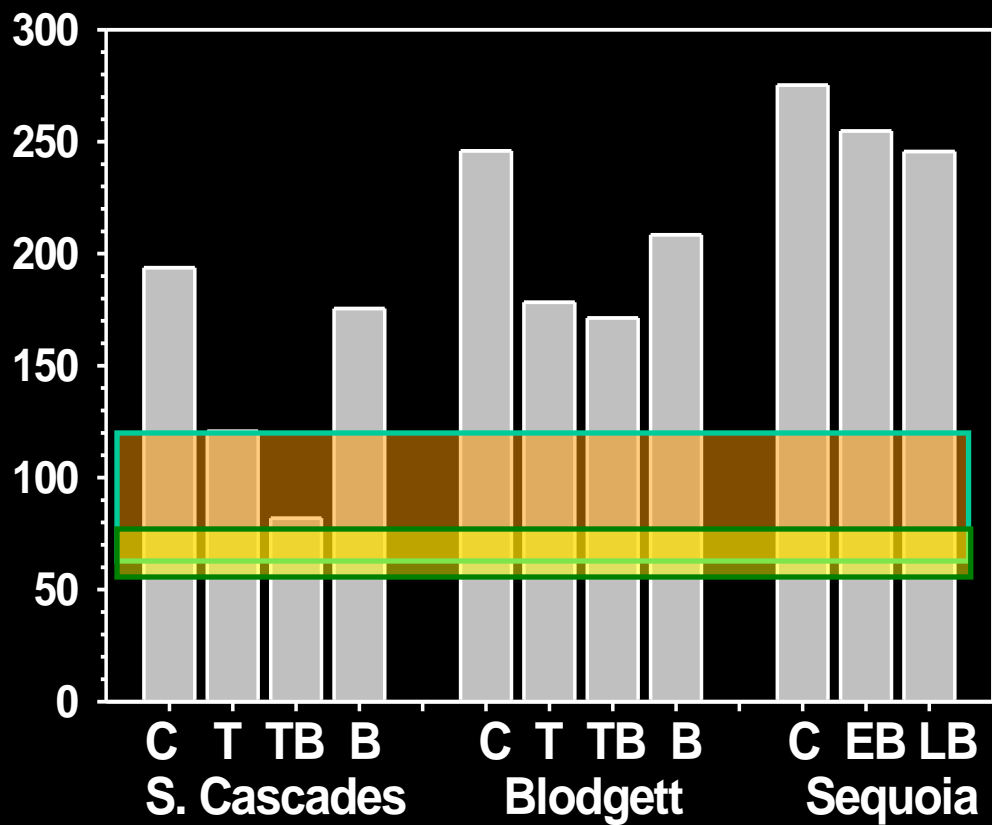


**Sierra
San Pedro Martir**

**Beaver Creek
Pinery**



Basal Area

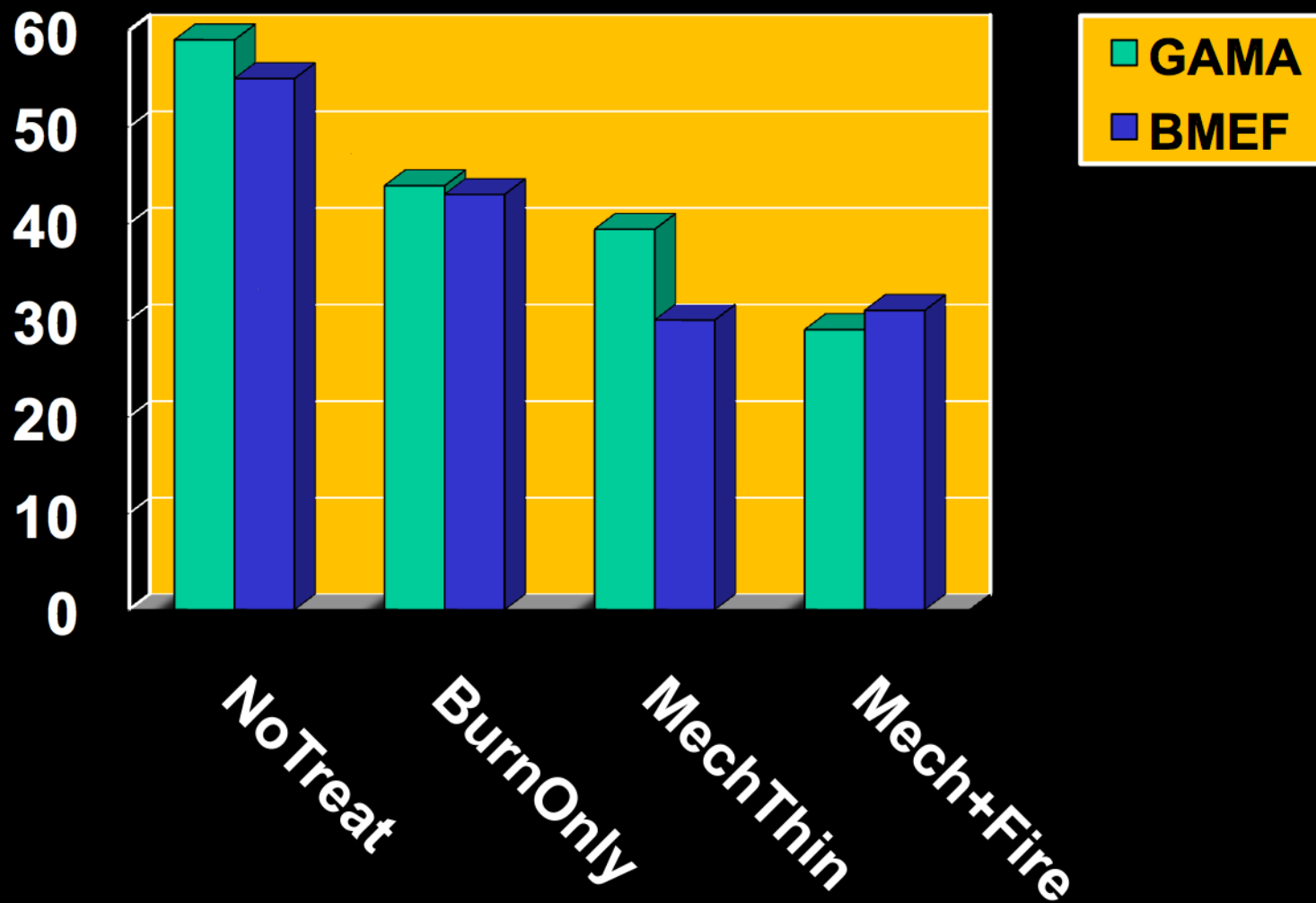


**Sierra
San Pedro Martir**

**Beaver Creek
Pinery**

Percent Canopy Cover

Site Tube



Ground nesting Dark-eyed Junco



“The potentially negative effect of prescribed burning through reduction of litter and increase in bare ground was offset by novel nesting strategies and increased food availability.”

Bark Foraging Birds

In general, bark foraging birds did well in treated stands.

Conditions they were more strongly associated with were:

- Large diameter trees
- Bark beetles



Comparing Guilds

BMEF vs GAMA

Guild	BMEF	GAMA
Woodpeckers	+	
Bark Gleaners	+	
Foliage Gleaners		+
Flycatchers	+	

No difference in diversity.
Tree size associated with differences.

Small Mammals

Response to treatments were generally subtle and short-lived.

Conditions they were more strongly associated with were:

- Surface wood
- Understory shrubs and herbs





Questions?



Variable Density Thinning

Objective: understand ecological ramifications of restoring variation of within-stand tree density



Investigators:

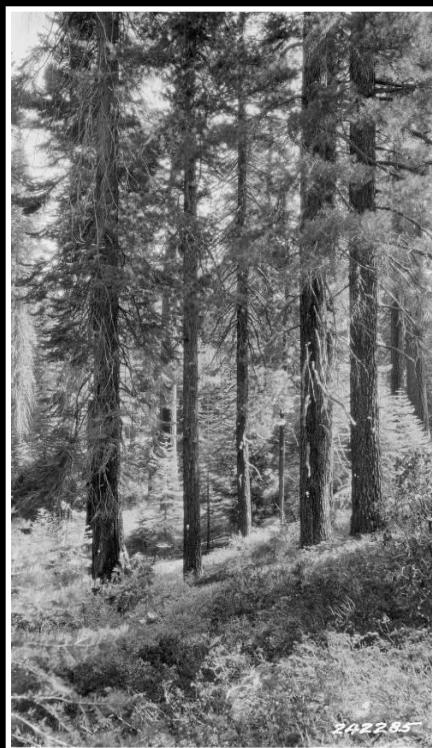
Eric Knapp – Vegetation, fuels, and fire
(PSW Redding)

Pat Manley – Wildlife (birds & small mammals)
(PSW Hilo)

The virgin forest is uneven-aged, or at best even-aged by small groups, and is patchy and broken; hence it is fairly immune from extensive devastating crown fires.”

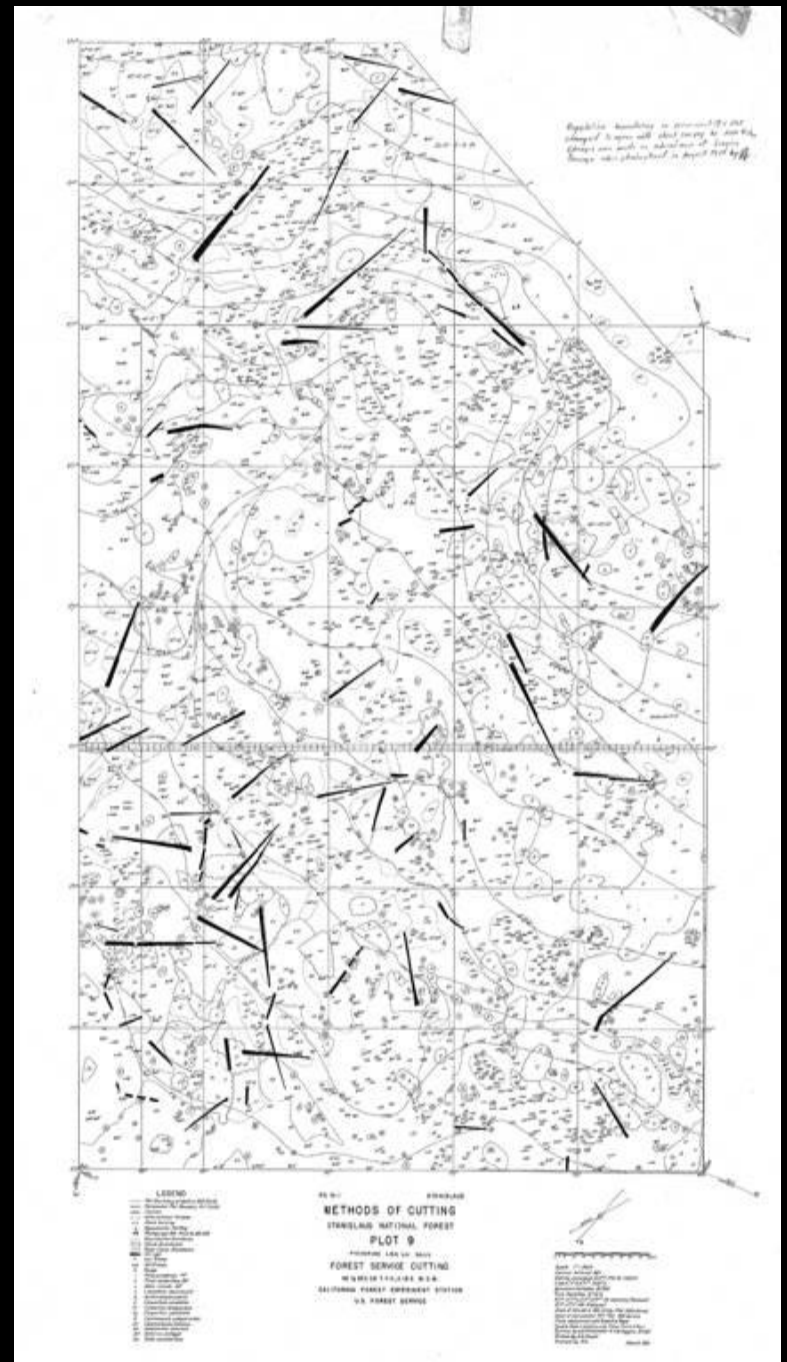
“fire creates a patchy scattered distribution of reproduction”

(Show and Kotok 1924)

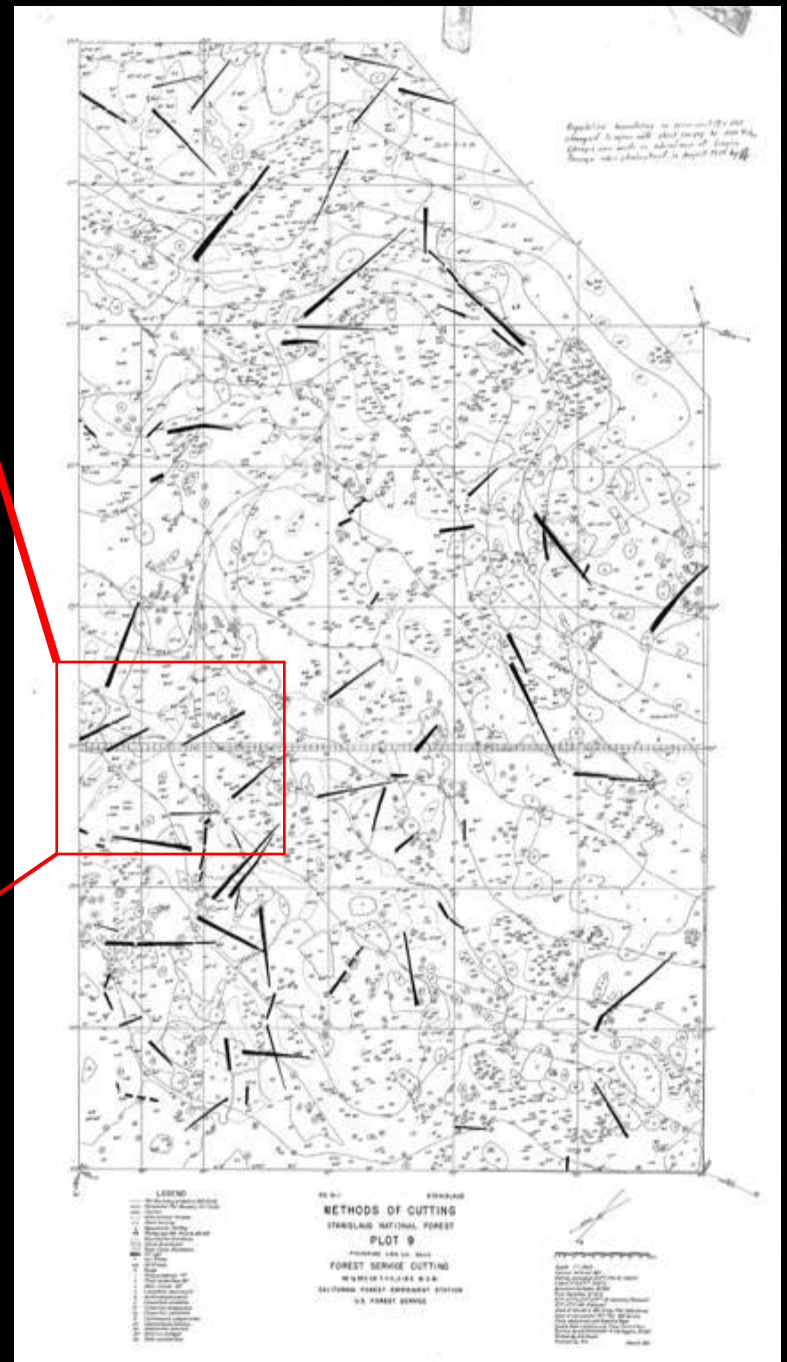
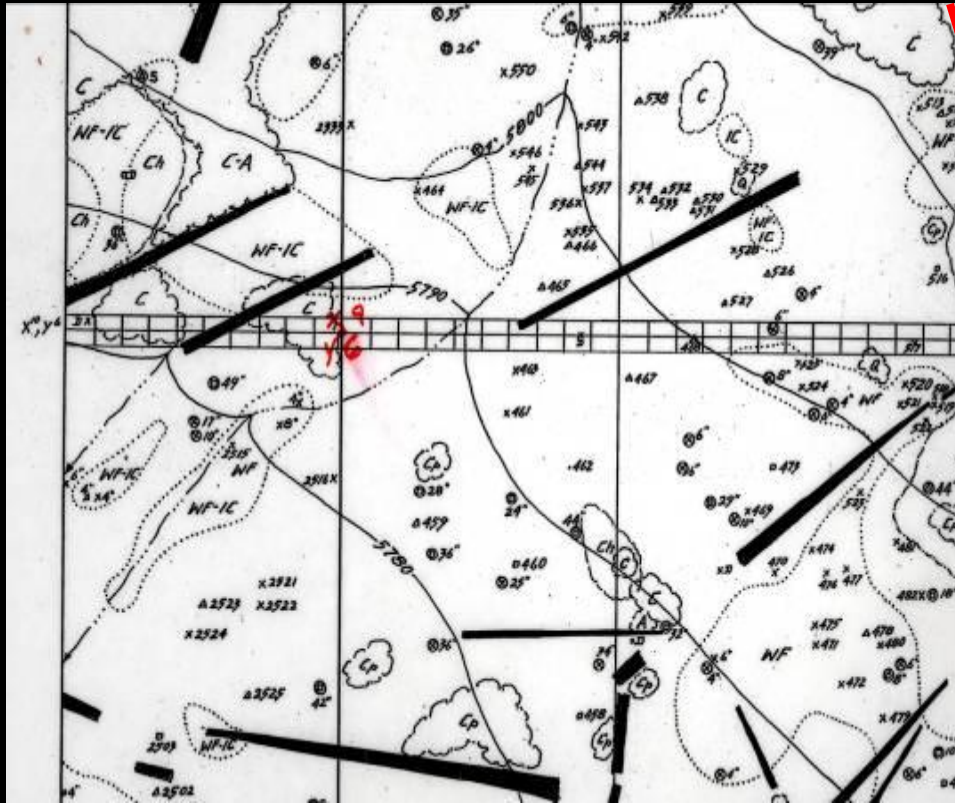


Stanislaus NF - 1929

10 acre stand maps with vegetation transect



10 acre stand maps with vegetation transect





How do contemporary & historical structures differ in:

- wildlife habitat?
- natural pine reproduction?
- understory vegetation?
- long-term resilience to fire?



Some lessons learned

- **Marking** – challenges posed by non-standard prescriptions
- **Wildlife studies require large units**
 - trade-offs with replication / statistical power
 - Expensive
- **Questions are long-term**, but difficult to secure long-term funding for studies



Research Projects & Scale

- Stand Scale - Experimental
Blacks Mountain Exp For
Gooseneast AMA / Fire Surrogates
Stanislaus-Tuolumne Exp For
- Landscape Scale?? - Retrospective
Thompson Ridge
Hayfork
etc.

A low-angle photograph of a large tree trunk and its branches, looking up towards a bright sky. The tree trunk is thick and textured, with a dark brown color. The branches are spread out, and the leaves are green. The sky is bright and blue, with some white clouds. The text "Thank You!" is overlaid in the center of the image in a bold, yellow font with a black outline.

Thank You!