Recovering from the Rim Fire: A Workshop for Private Forestland Owners

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Groveland, CA

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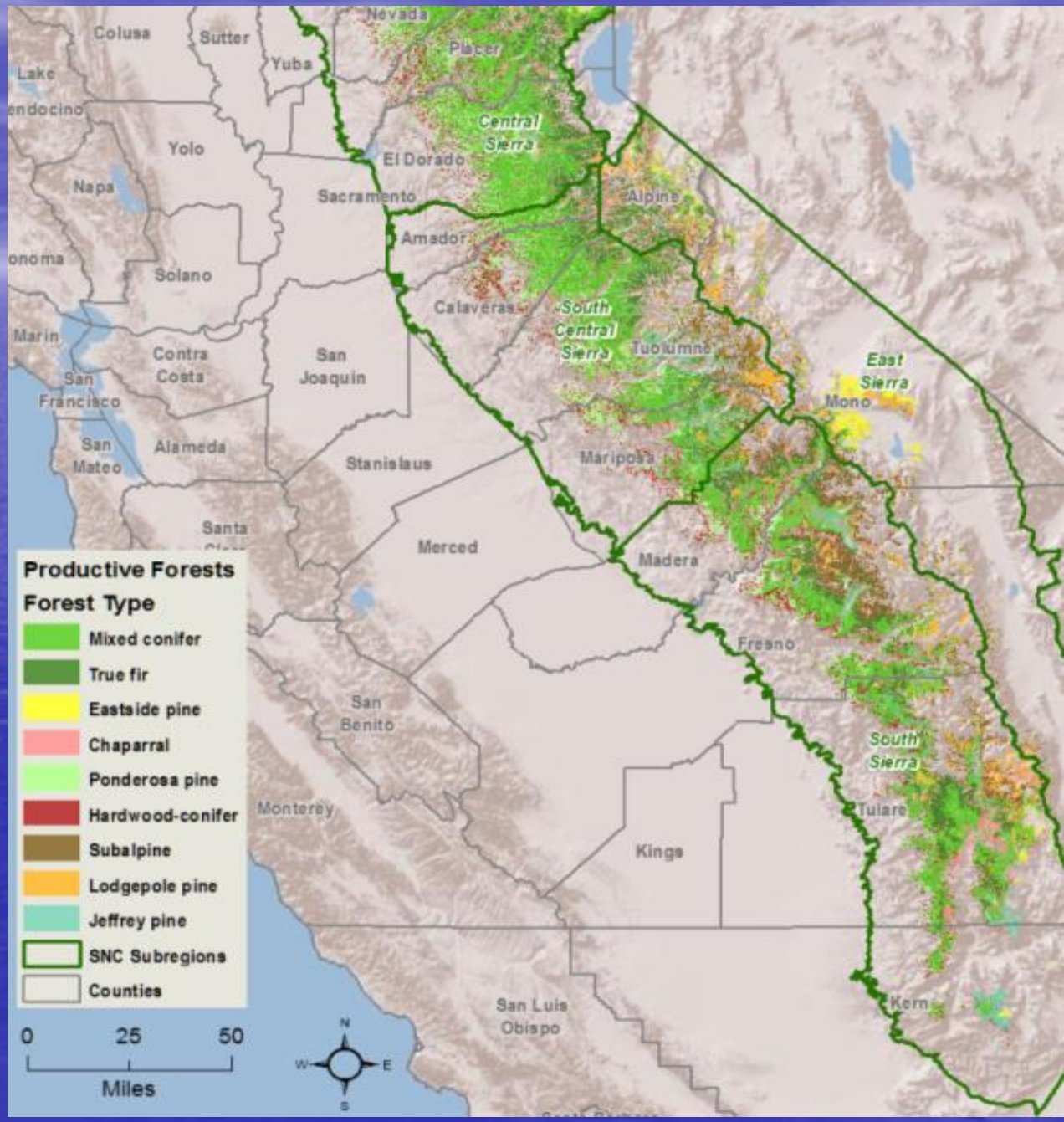
Presentation goals

- Give background and context on historical fire regimes and high severity fire in California vegetation types
- Discuss approaches to forest management post high severity fire and their pros and cons
- Show examples of post high severity fire treatment at the Angora fire

Central Sierra forest types

- Vary according to elevation and latitude
- Sierra Nevada mixed conifer most prevalent



Components of a Fire Regime

- *Frequency* – fire return interval is time between successive fires
- *Spatial extent* – size and complexity of fires
- *Magnitude*
  - Intensity = energy released
  - Severity = ecological effects
- *Seasonality*

Fire Return Interval

- Fire return interval: time between 2 successive fire events at a given site /area
- How do we know?
  - Ethnographic interviews with native American tribes
  - Dendrochronology (tree ring) studies - Past fire frequency can be determined from the years between fire scars on a single tree or on several trees in an area

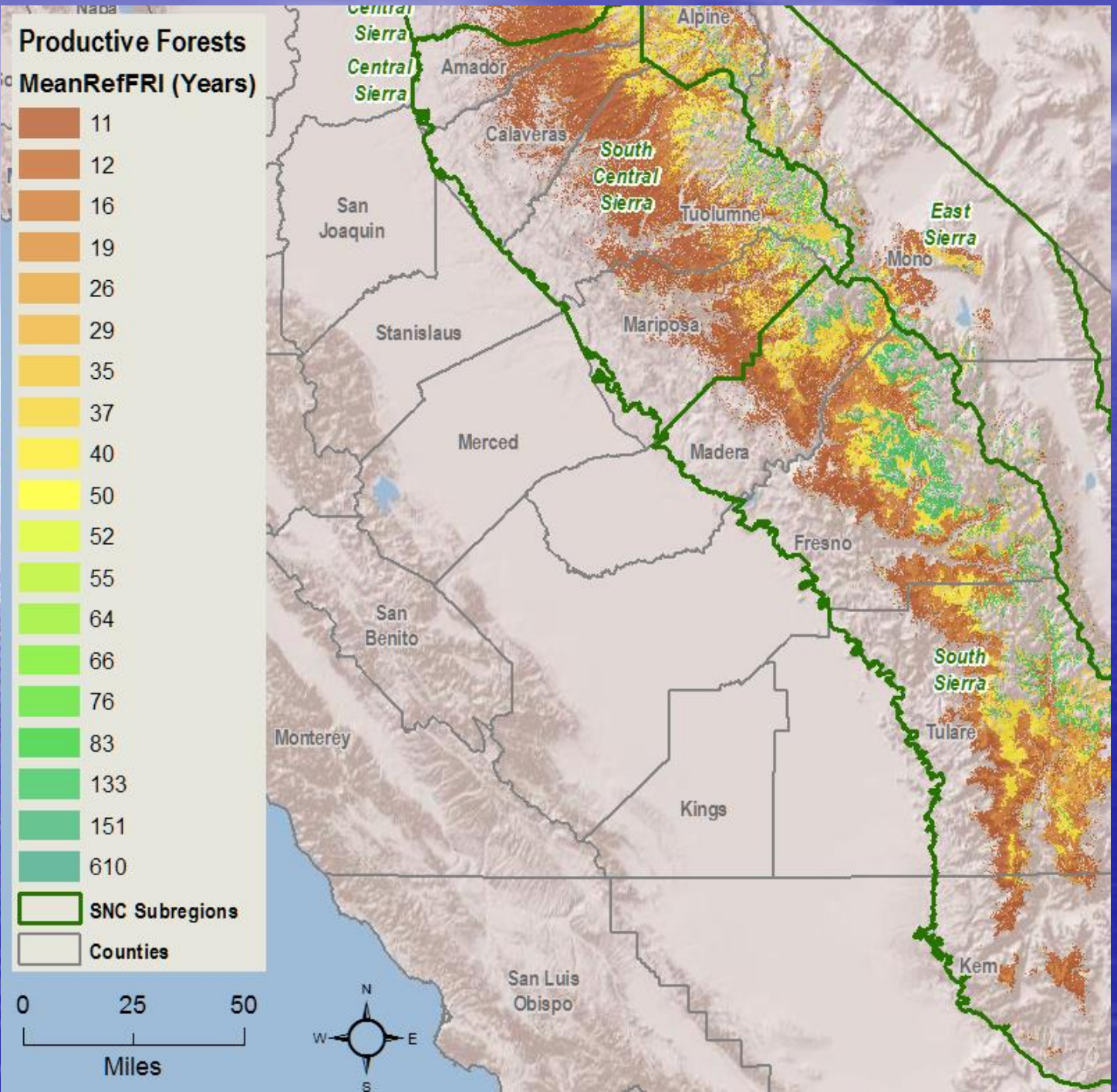
Fire Severity

- *Low* – doesn't burn the canopy, most needles remain on tree, some scorching, ground still has some litter cover
- *Moderate* – burns into canopy and burns needles from some but not all trees, consume part of ground cover, largest most vigorous trees survive
- *High* - Most trees killed, most foliage and litter consumed

Fire return interval and severity linked

Forest Types	Fire Return Interval	Severity
Ponderosa pine, mixed conifer, Douglas-fir, giant sequoia, oak woodlands	< 35 years	Low/ Mixed
White fir, red fir, mixed conifer moist, redwood	35-200 years	Mixed/ Low-Moderate
Chaparral, knob-cone pine, cypress, fir-hemlock, PNW Douglas-fir, rocky mountain lodgepole, pinon-juniper	35-200 years	High/ replacement

Adapted from Carl Skinner



Reference Fire Return Interval before fire suppression

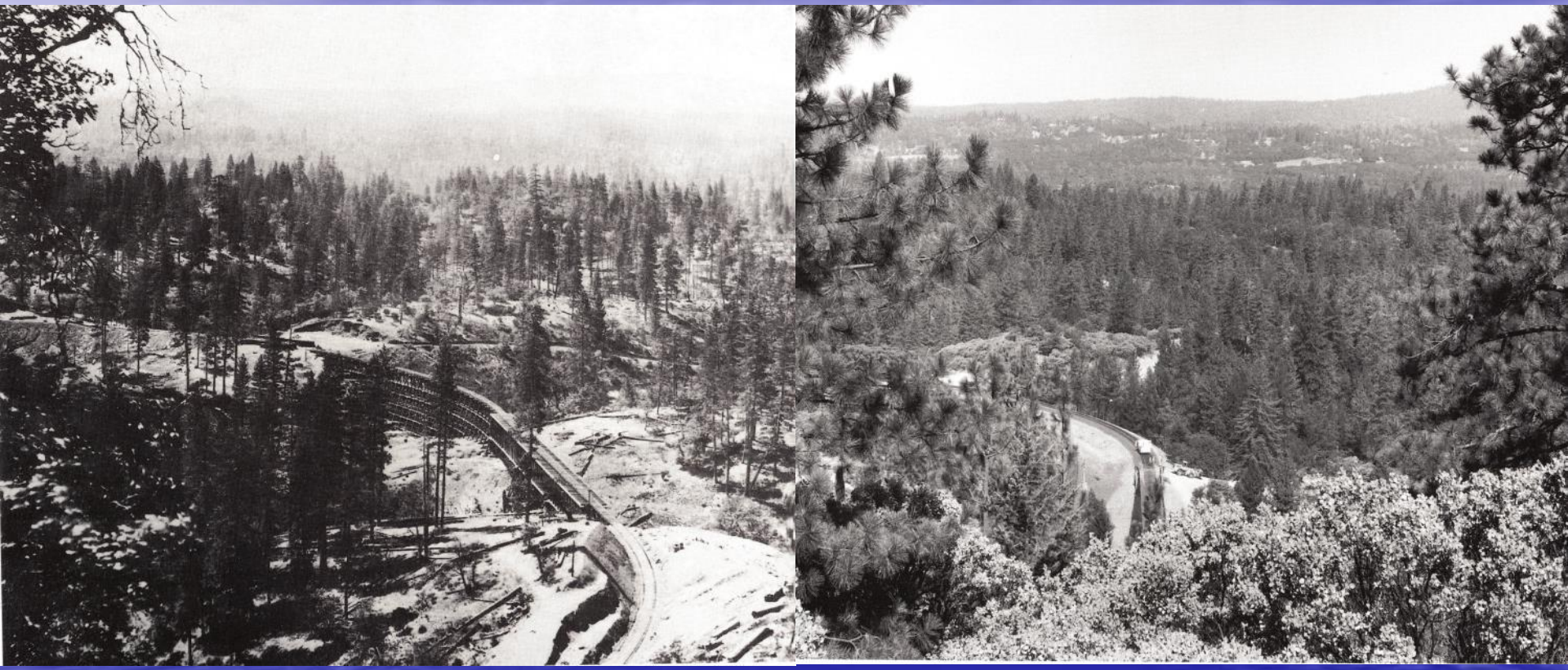
Forest structure has changed

- Early accounts suggest that the structure was more open. John Muir described the inviting openness of the mixed-conifer forest as one of their most distinguishing characteristics.
  - *"The trees of all of the species stand more or less apart in groves, or in small irregular groups, enabling one to find a way nearly everywhere, along sunny colonnades and through openings that have a smooth, parklike surface". John Muir 1894*

Fire returnal interval has increased

- Skies were likely smokey in the summer and fall in California before fire suppression.
  - *"Of the hundreds of persons who visit the Pacific slope in California every summer to see the mountains, few see more than the immediate foreground and a haze of smoke which even the strongest glass is unable to penetrate."* -- C.H. Merriam 1898, Chief, US. Biological Survey
- Recent estimates of Californian prehistoric fire area
  - between 4.4 and 11.9 million acres/ year or
  - 5% - 12% of the states lands burned annually

Consequences of Fire Suppression

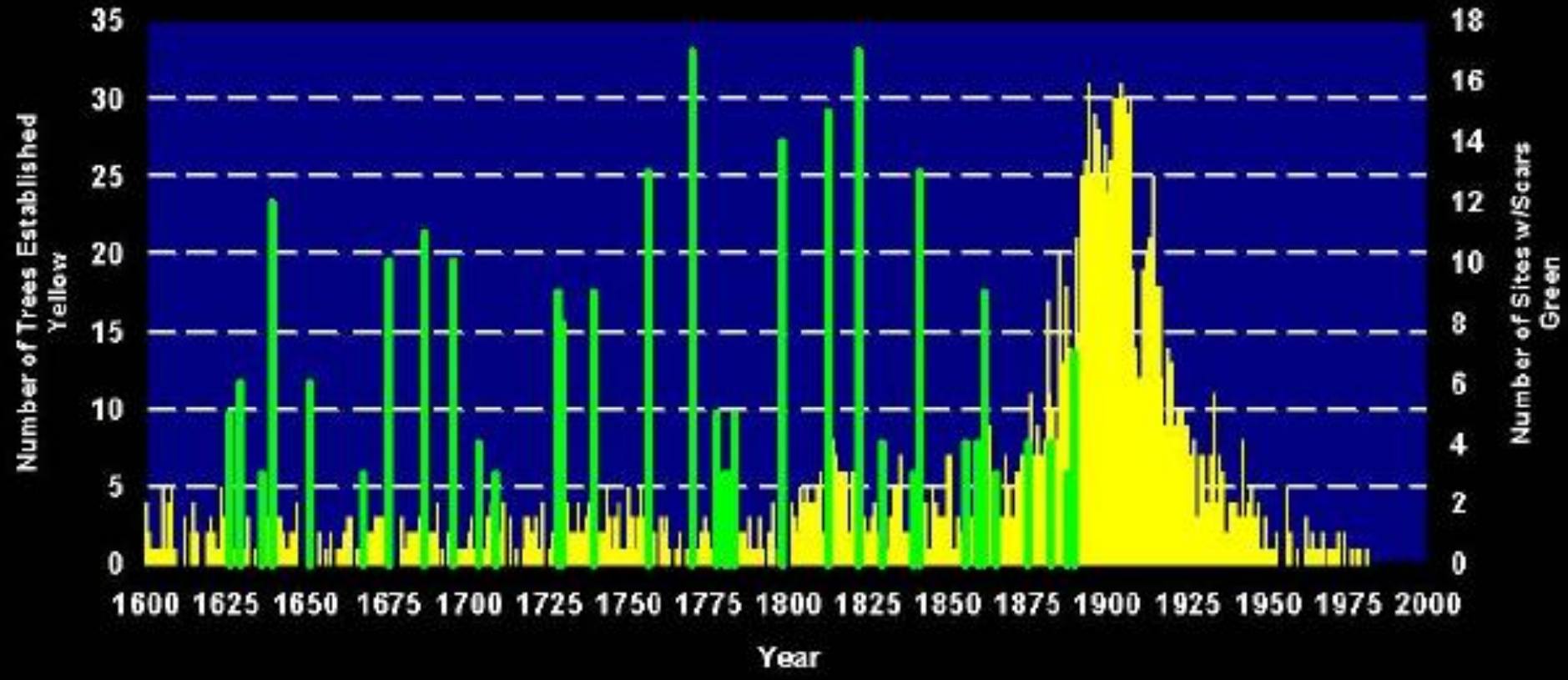


- Long Ravine railroad trestle near Colfax in 1867 and 1993, Placer County. Source: Gruel 2001

Consequences of Fire Suppression

Spaulding Lake in Nevada County, 1919 and 1993. Source: Gruel 2001

Blacks Mountain
Fires & Tree Ages



Green = Fires

Yellow = Tree Establishment

Ecological Consequences

- Increased stress due to water competition leaves trees more vulnerable to insect and disease
- Displacement and reduction of understory plants due to shade
- Conversion of shrub habitats to conifer thickets
- Displacement of deciduous vegetation by conifers, especially in riparian areas
- Loss of mountain meadows to conifer encroachment
- Reduction and loss of habitat of more open and non-forested habitats
- Build up in forest fuels lead to more high severity fires

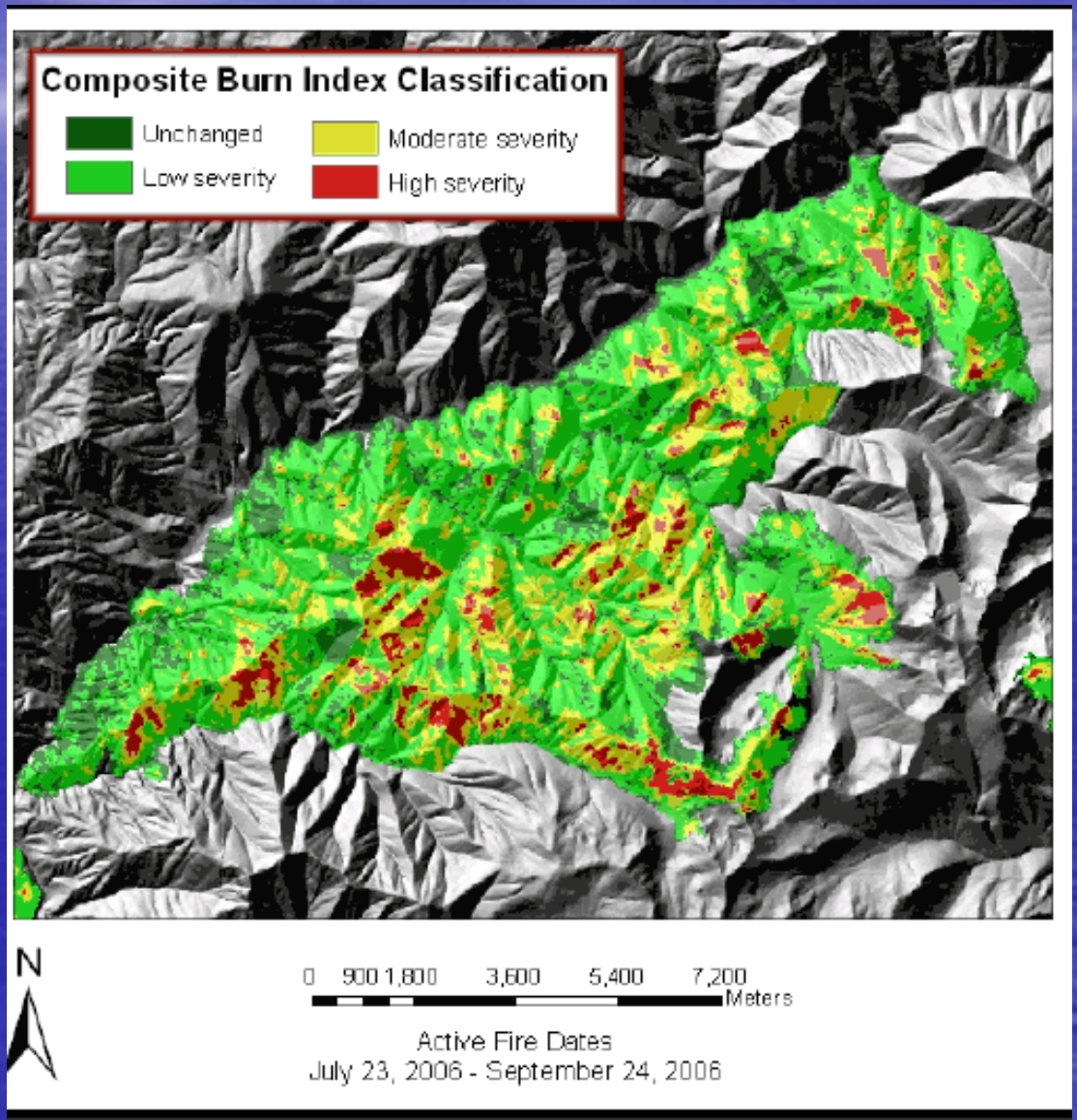
Increase in area burned at high severity

- Area burned at high severity increased from 17% to 30%
- High severity patches doubled from 1984 to 2006

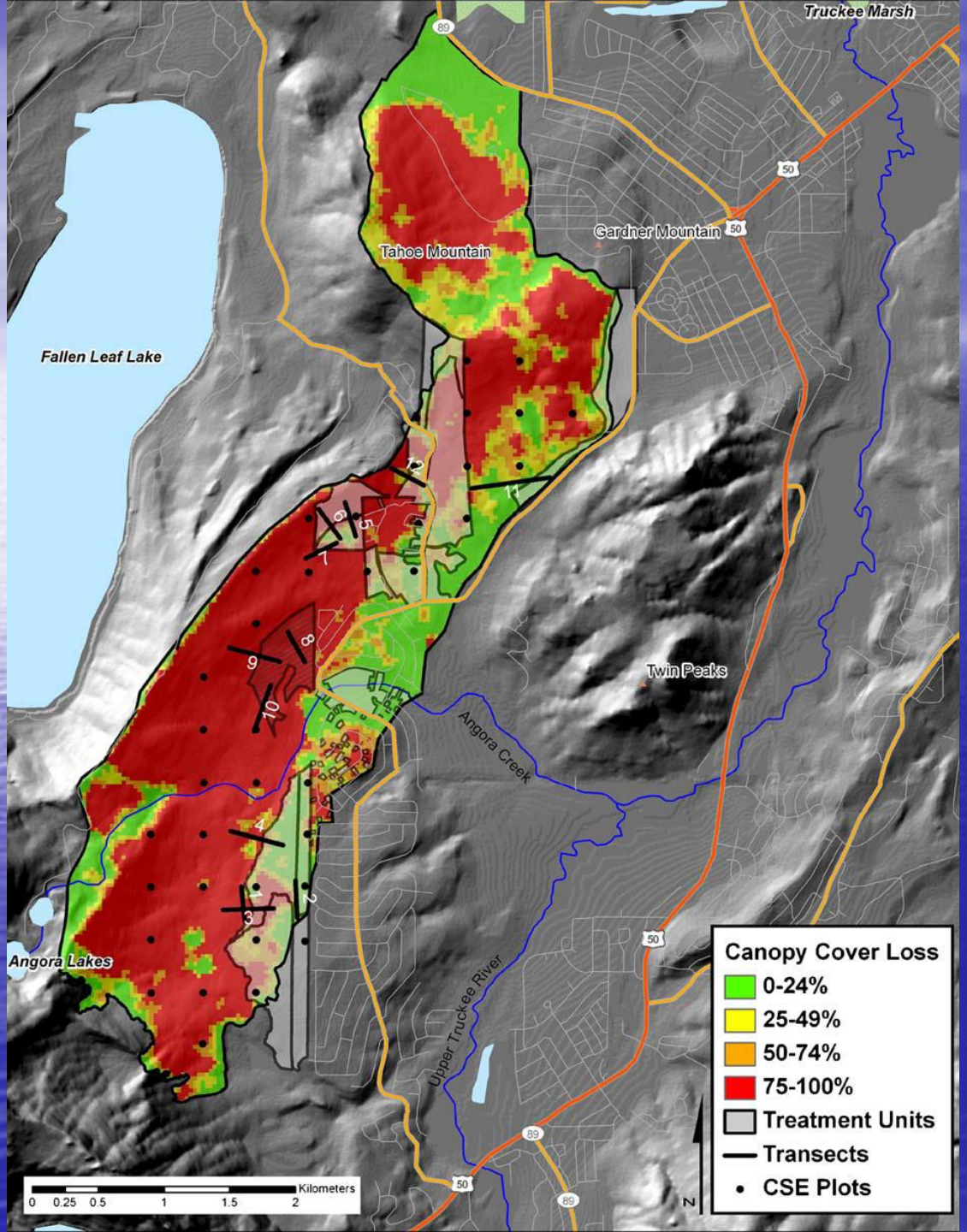
Year	10 year average percent high severity	Mean patch size of high severity fire	Mean max
1984	17%	6.9 acres	124 acres
2006	30%	13.0 acres	292 acres

Increase in high severity fires

- Fires are now more likely to be of high severity meaning that most or all trees are killed
- Still a lot of variety in severity
  - Hancock fire 2006

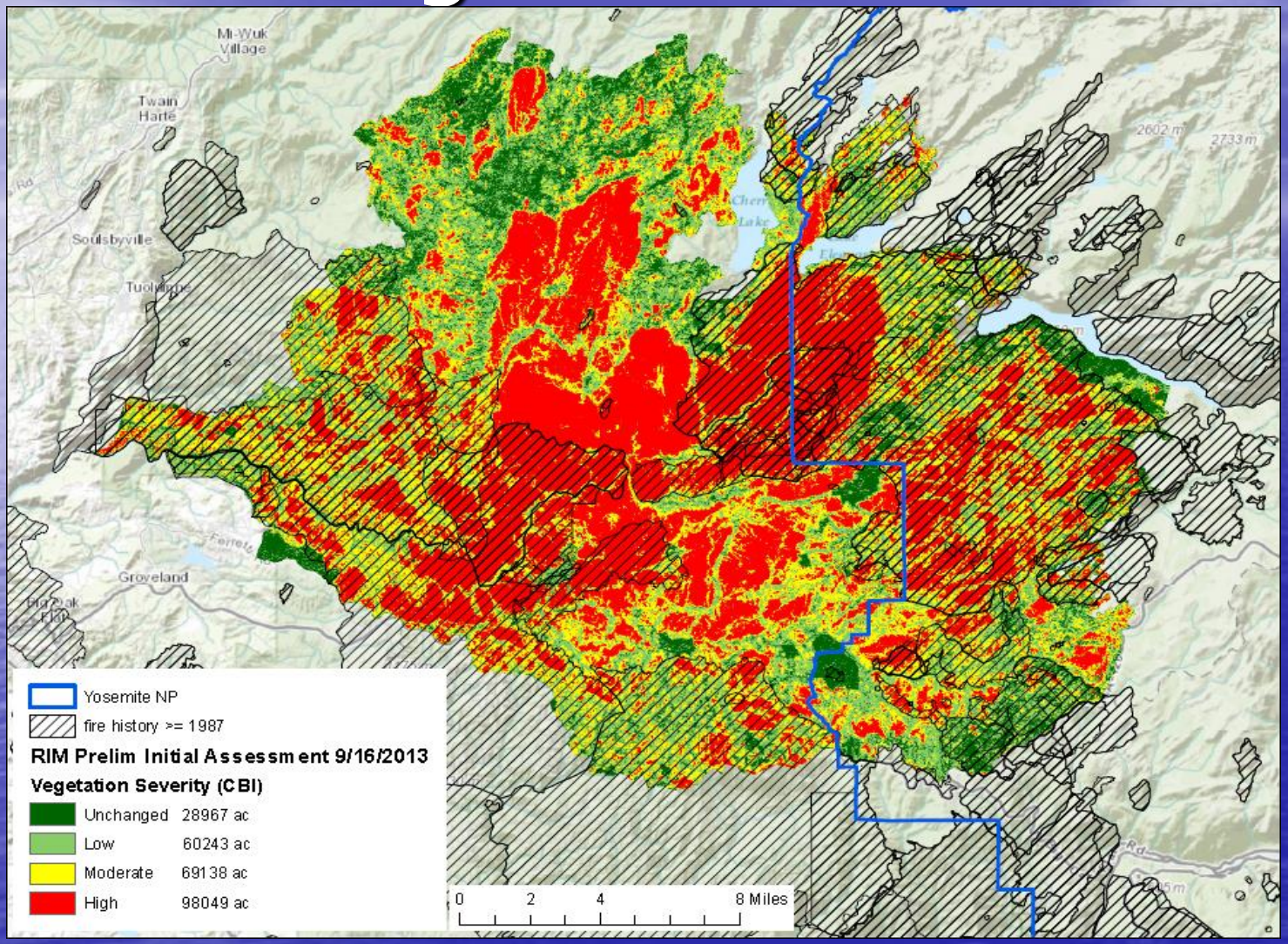


Angora Fire Severity



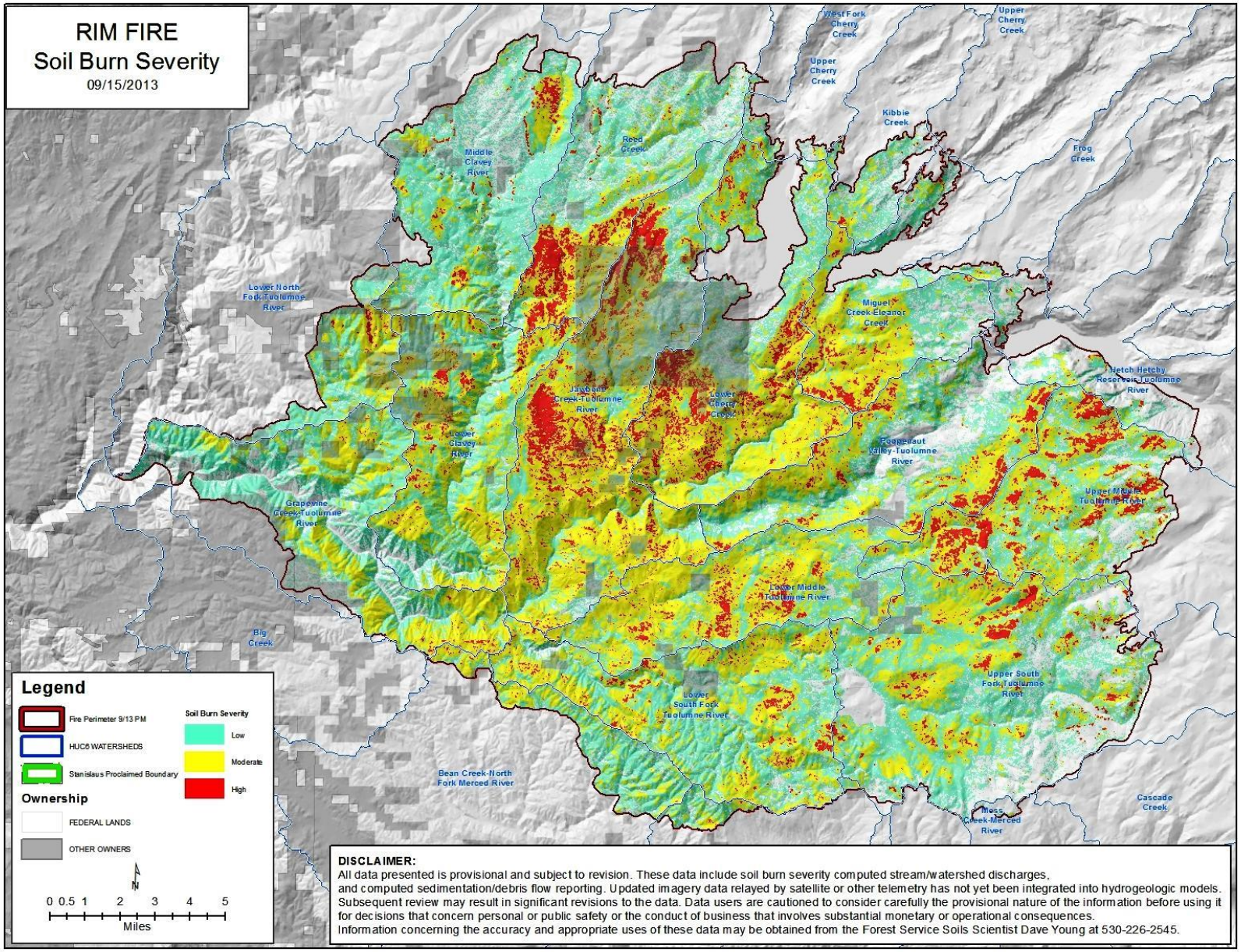
Source: Safford, et. al. 2009. *Effects of fuel treatments on fire severity in an area of wildland-urban interface, Angora Fire, Lake Tahoe Basin, California.*

Rim Fire Vegetation Burn Severity



High = 38%, Mod. = 27%, Low = 23%, None = 11%,
63,000 acre patch of high severity fire

Rim Fire Soil Burn Severity

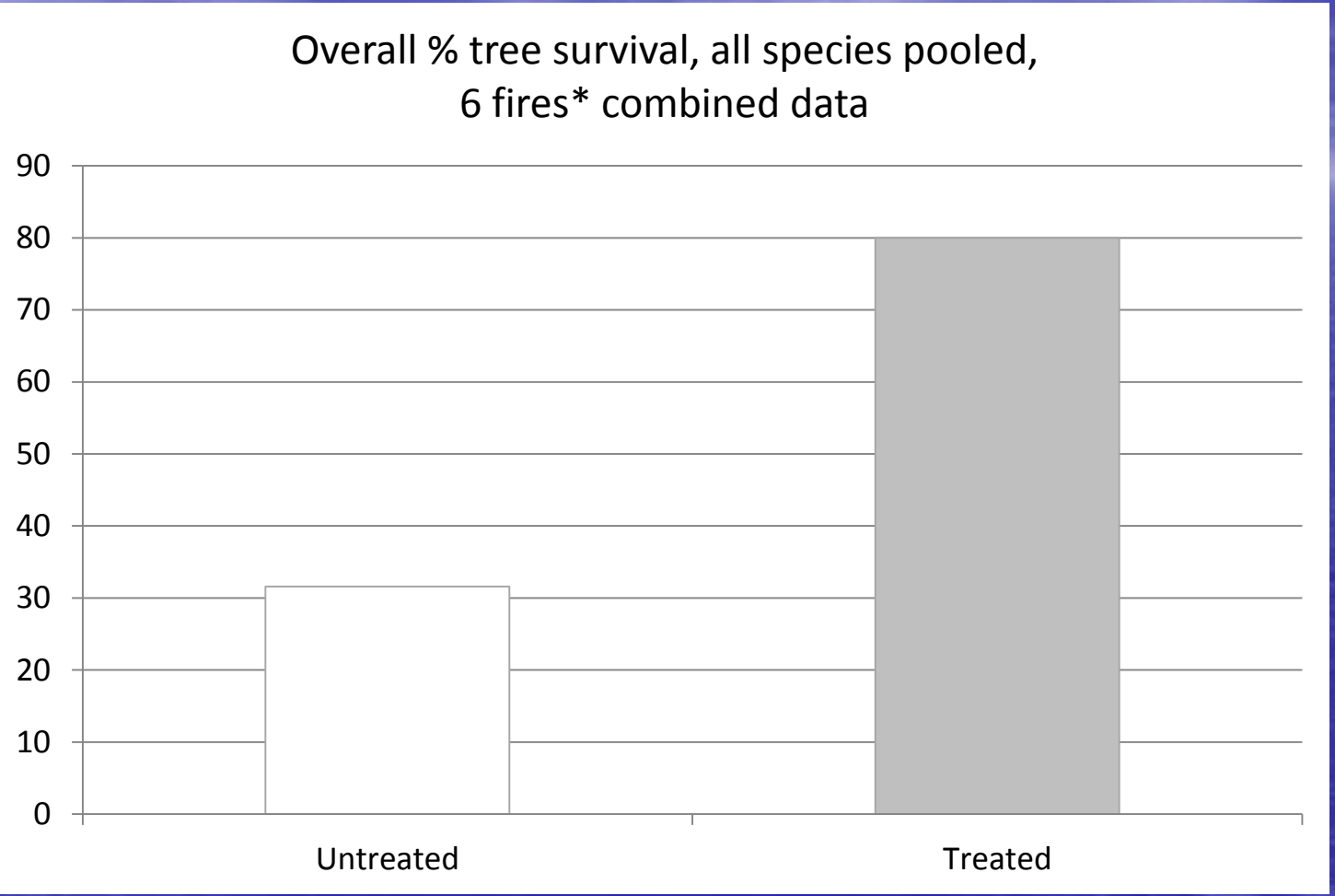


What can be done?

- Forest fuels removal projects are attempting to substitute for the historical fire regime by altering forest structure
- Some attempts to restore fire to forests, many barriers

Is it working? YES

Tree survival we know fuels reduction projects are increasing the percent of trees that survive



From Hugh Safford 2010

* Angora, Peterson, Rich, Antelope, Milford, American River fires

What to do after high severity fire?

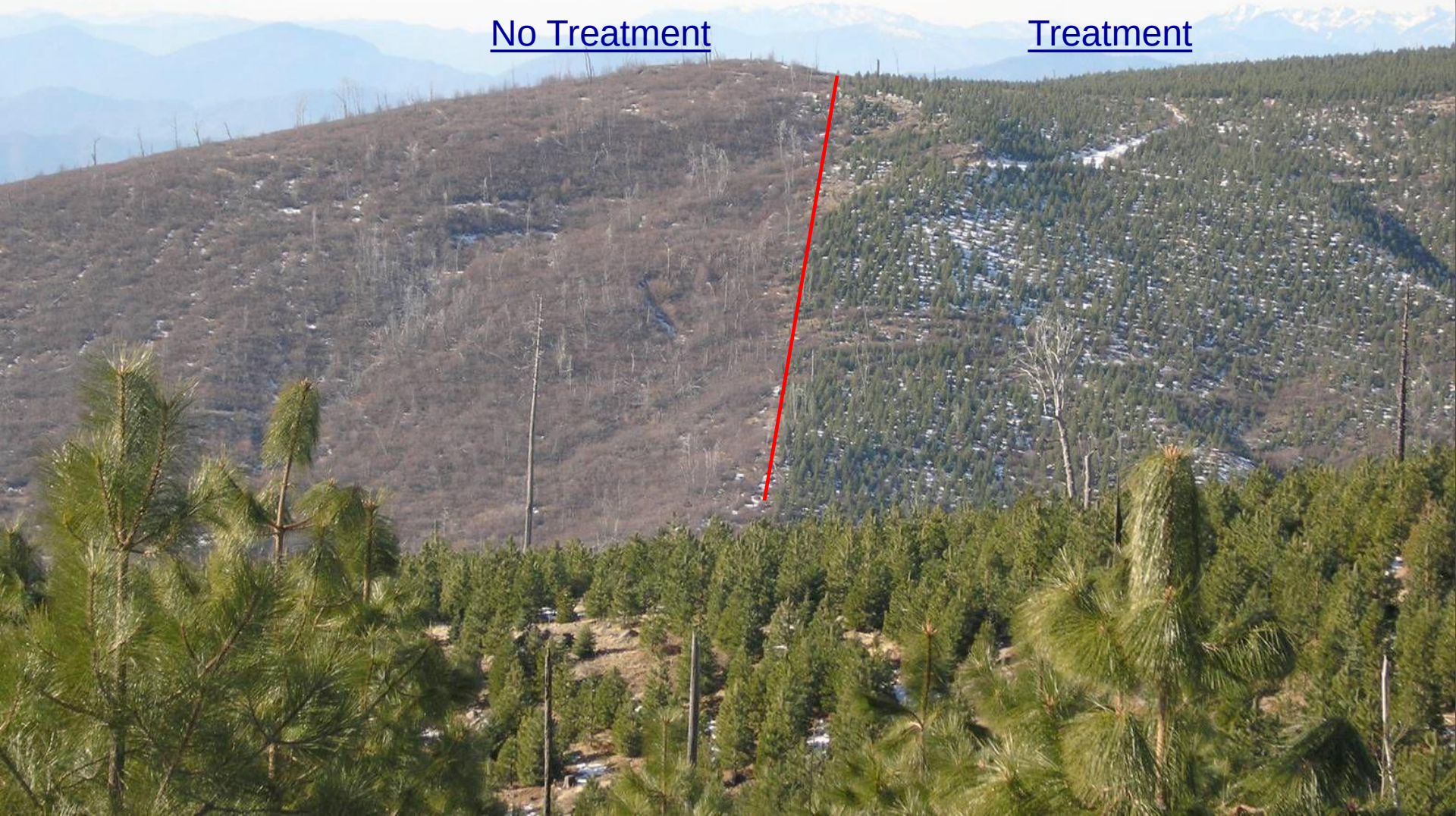
- Erosion control?
- Improve road system?
- Remove trees?
- Replant?
- All depends on how your property burned, the risks, and what your long-term ownership objectives are

Action	Objective	Methods	Pros	Cons
Erosion control	Protect water quality and site productivity	Mulching with straw/wood chip	Effective at 60% ground cover	Expense: $250-$930/acre (helimulch), $500-$1200/acre hand
		Contour felling	Effective if done correctly	Expense: $420-$1,200/ acre requires expertise
		Straw/fiber wattles/rolls	Moderately effective with large rainfall events	Expense: $1,100-$4,000/ acre requires expertise
		Silt fence	Effective when properly installed, must be cleaned out to maintain	$50/role + labor = @ $200/fence
		Seeding	Often not effective	$20-$170/acre
Remove dead trees	Produce wood products/ Recover costs	Mechanical harvesting methods	Can offset treatment costs	Will require paperwork
	Reduce future fuels		Effective when done quickly	When delayed can interfere with regeneration
			Removes largest fuels	May create smaller fuels
	Improve worker safety		Removes danger to planters /firefighters	Reduces snag habitat
				Road construction impacts

Action	Objective	Methods	Pros	Cons
Replant	Accelerate growth of forest	Bare root and contain planting	Establishes trees more quickly (30-50 years) Restores carbon sequestration potential Control species and genotype of future forest	Expense: $500-$1,000/acre Reduces future shrub habitat Requires on-going maintenance Past performance may not be a predictor of future success
Vegetation control	Control non-natives Reduce competition to conifers	Herbicide Herbicide/ hand grubbing	Mixed results Effective	Expense: Requires licensed applicator Hand grubbing very labor intensive – not for large areas
Road system upgrades	Maintain road system Protect water quality	Maintain/ clean culverts Upgrade road/ armor / sediment traps	Effective, only needs to be done a few winters Effective with long lasting benefits	Requires time and vigilance Expense

1992 Fountain Fire
Shasta Co., CA
Right - 10 years after reforestation

Left – no reforestation



Treatment included salvage tree harvesting immediately after fire, planting and brush control with herbicides

Figure 4. (Upper panels) plantation at the age of 0 years (1995), 7 years (2002), and 12 years (2007). (Photographs taken by Ted Silbersteins.) (Lower panel) A contrast of planted plantation and nonplanted ground on December of 2007. (Photograph taken by Jianwei Zhang.)

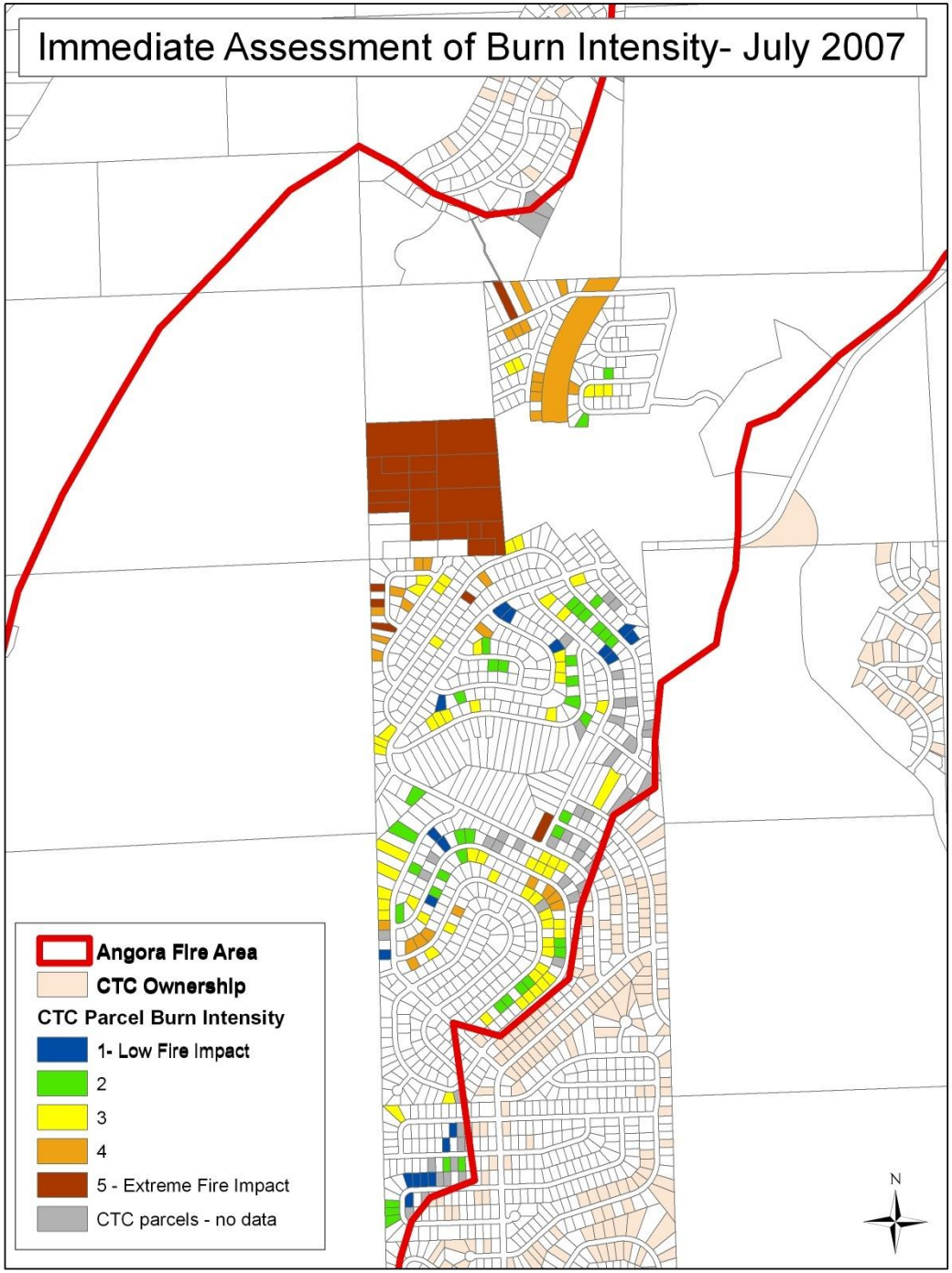
Fountain Fire. See Zhang et al. Journal of Forestry (2008)

Time to tree decay

Years after tree death	White fir	Ponderosa/ Jeffrey pine	Sugar pine	Douglas-fir
1	10-20% volume decayed	25% of sapwood bluestained	Extensive bluestain in sapwood	Minimal decay, some cracks in heartwood
2	50% volume decayed	All wood bluestained, 50% of sapwood decayed	75% sapwood decayed	25-50% sapwood decayed
3	100% volume decayed	All sapwood and some heartwood decayed	All sapwood and some heartwood decayed	All sapwood and 1” heartwood decayed
4	--	70% of volume decayed	50% volume decayed	2” heartwood decayed
5	--	90% volume decayed	50% volume decayed	3” heartwood decayed

The Angora Fire

- Burned 3,100 acres June 24 -July 2, 2007
- California Tahoe Conservancy owns and manages 90 acres in burn area.
- 40 acres in larger parcels that experienced high severity fire - nearly 100% of trees were killed


Immediate Assessment of Burn Intensity- July 2007
Angora Fire Area
CTC Ownership
CTC Parcel Burn Intensity
1- Low Fire Impact
2
3
4
5 - Extreme Fire Impact
CTC parcels - no data
N

Tahoe Conservancy Treatment Goals

- Treatment goals for these areas
  - to re-establish a native forest quickly
  - to reduce hazards posed by dead trees and fuel accumulation
- Reduce risk of soil erosion and sedimentation to Lake Tahoe
- Proximity to neighborhood encouraged active approach

Treatments

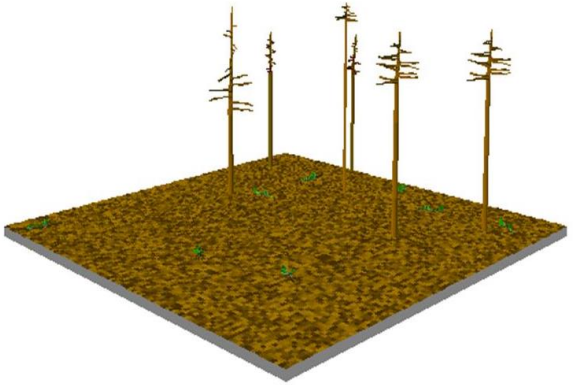
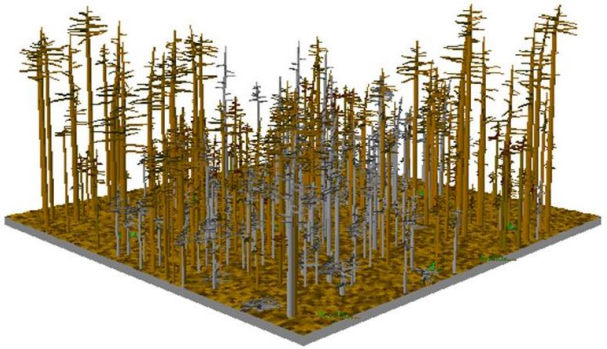
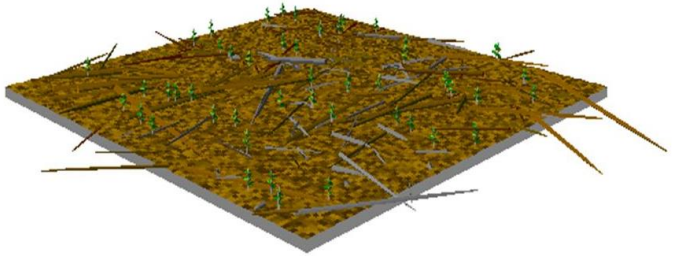
- Removed dead and dying trees
- Marketable lumber to SPI mill in Camino.
- Slash was masticated and left to provide cover
- Tree removal completed by Oct 2007
- Replanting October 2007 -2011

Forest Stand Development

- A new forest established on Conservancy lands - 130 planted tree seedlings per acre.
- Very few mature trees survived the fire in the studied area and so there is little natural tree seed source or seedlings.

Forest Growth Modeling

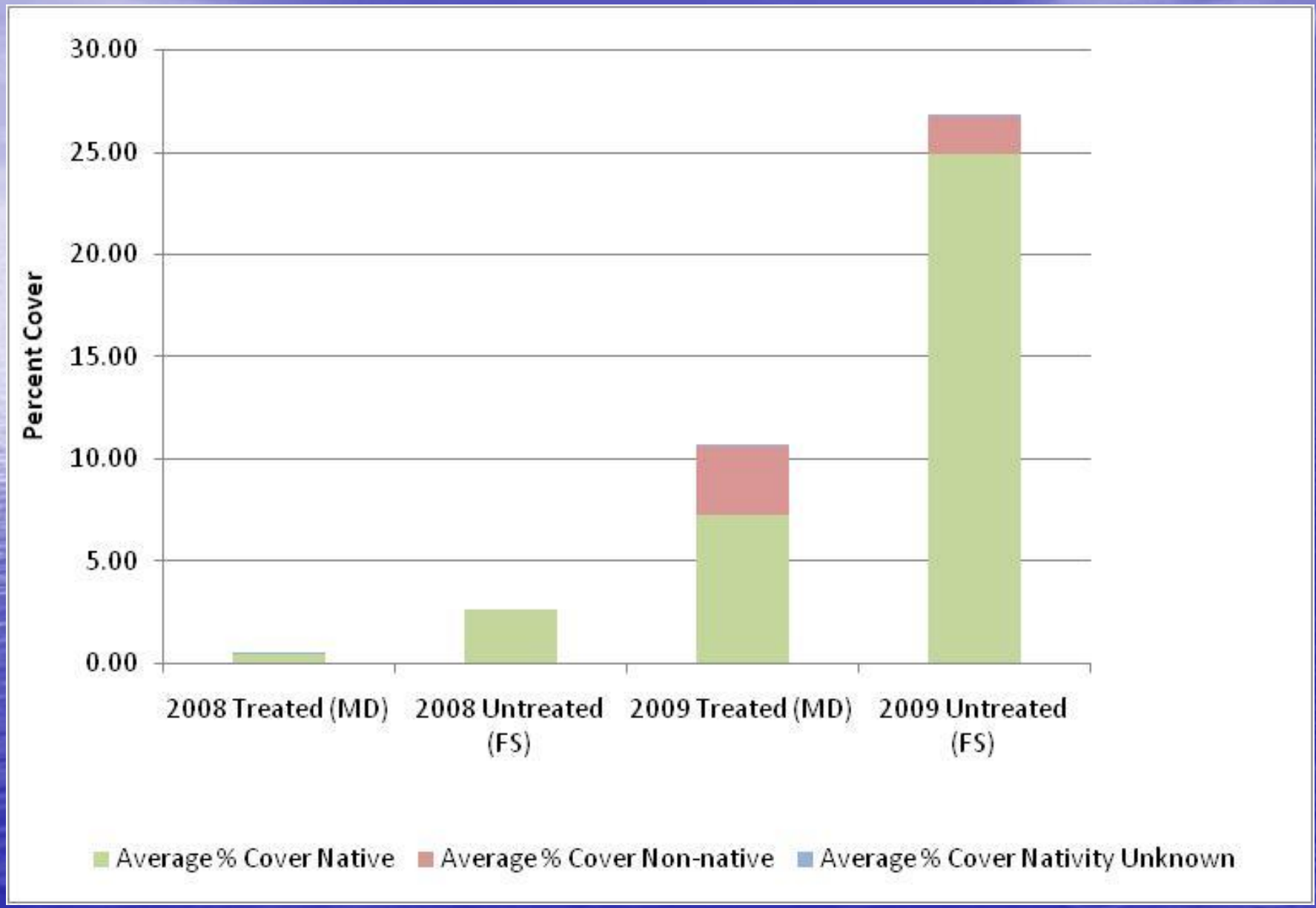
Forest Vegetation Simulator (FVS) -we estimate that the treatment accelerated the development of a new forest by about 60 years.

	Treated Site	Untreated Site
2007 (Inventory conditions following treatment)		
2067 (Natural seedling regeneration begins)		

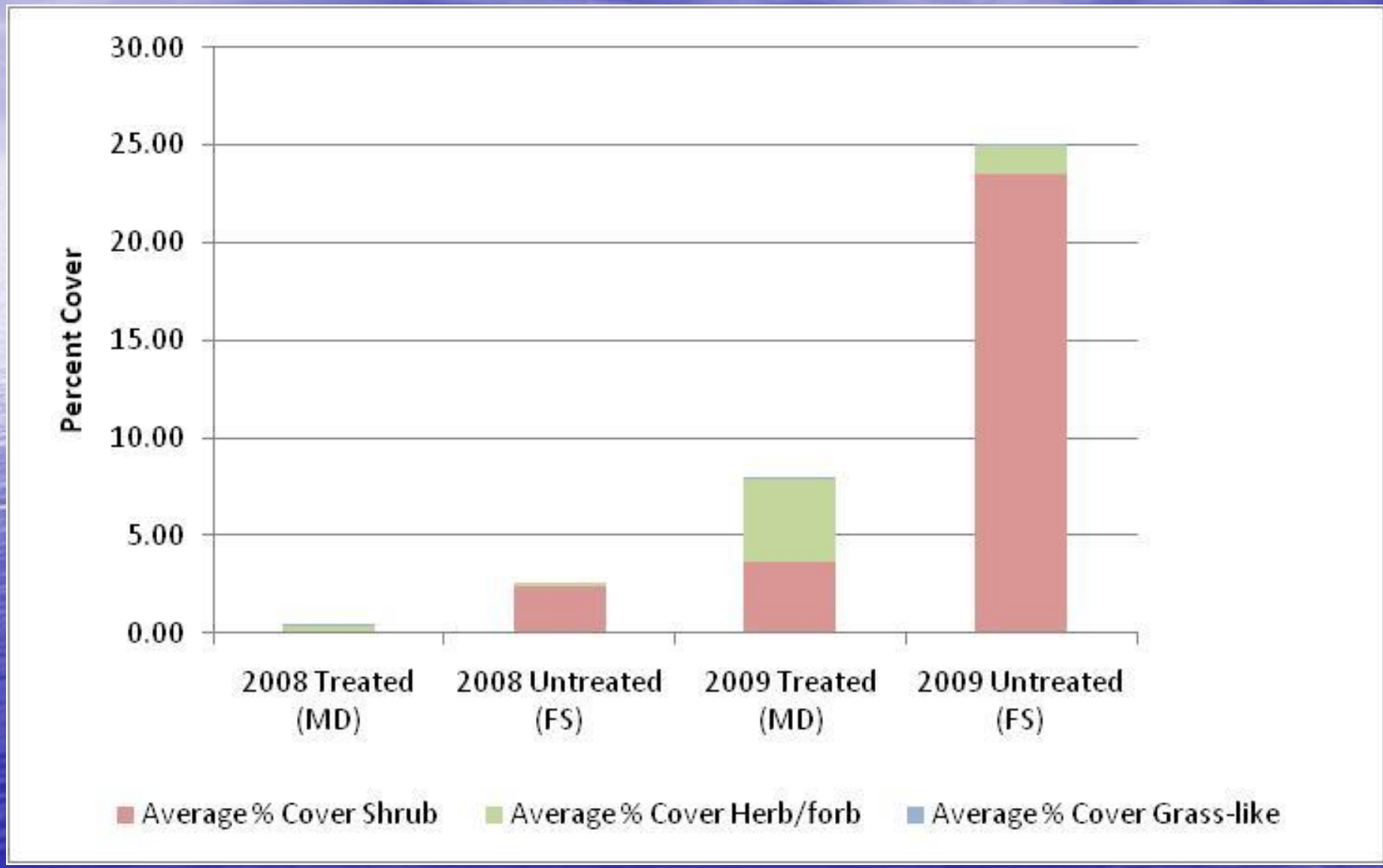
Native Vegetation Recovery

- Growth of native vegetation greater in untreated areas than treated area.
  - 55% no treatment (2010), vs 30% in treated area
  - Greater cover in untreated area mostly shrubs
  - Wood mulch suppresses brush and favor conifers.
- Treated area had more native species return (22) compared with the untreated site (18).

Native Species Cover: Treated Versus Untreated Site



Cover by Life Form: Treated Versus Untreated Site



Untreated

Masticated (light cover)

Masticated (heavy cover)

2007 Pre-treatment

2009 Post-treatment

Fuels and Fire Hazard

- Masticated material forms a layer of surface fuel that carries some wildfire risk.
  - Mastication more than tripled the amount of woody mulch material on the treated site.
  - 86 tons /acre in the treated area, nearly nine times greater than on the untreated site much in smallest, most ignitable size.
- Risk is hard to quantify and will change over time.

Soil Quality & Erosion

- **Soil Quality**:
- No detectable increase in soil compaction was created by tree harvesting operations.

Treatments - Channel

Coir logs, contour logs

- Erosion control measures were effective though winters were mild (no rain, only snow)
- Channel on site has remained stable

Channel changes

September 2007

September 2008

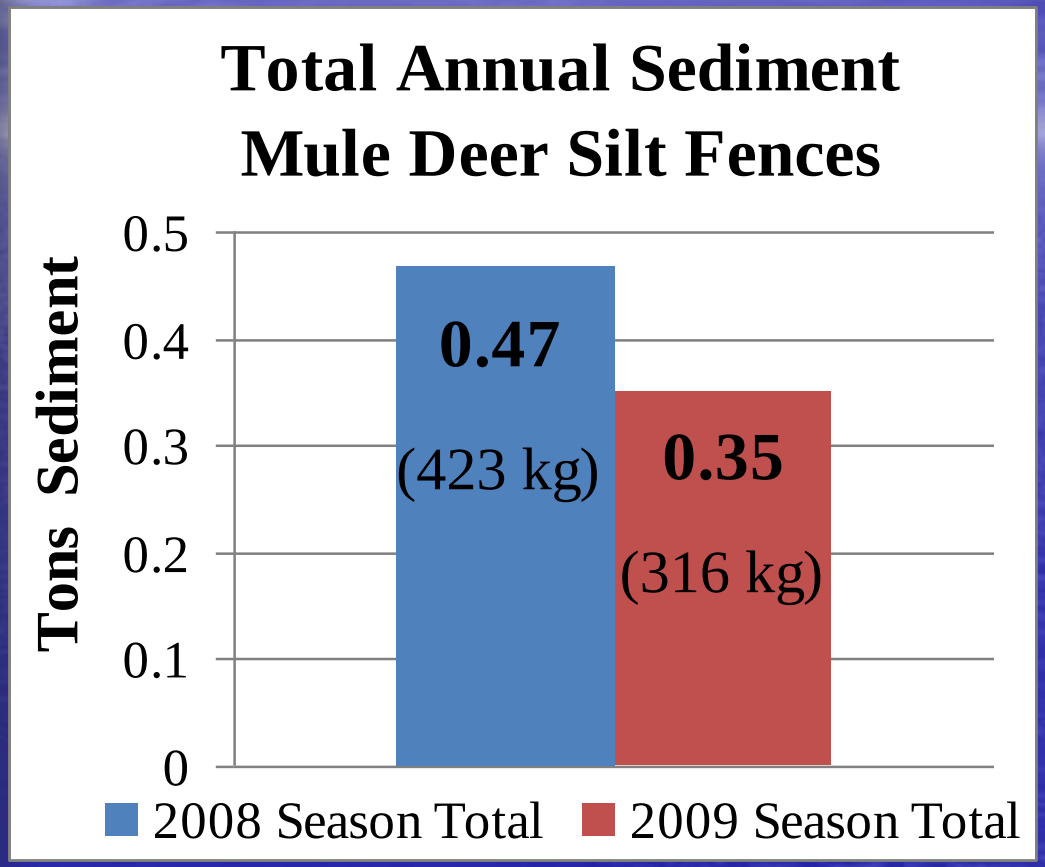
November 2007

December 2008

May 2008

July 2009

Soil Erosion - slope



Monitoring silt fences collected half a ton of sediment the first winter and another third of a ton the second winter - 0.02 tons /acre for the first two years – extremely low

Post-fire treatments depend on goals and risks

1) First survey your property to identify issues:
   - Patches of high severity fire
   - Undersized/plugged culverts
   - Exotic weed invasions
2) Define your goals
   - Research treatment options and costs
   - Refine your goals
3) Contact a professional
   - Develop a plan

Thank you!

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