

# Soil heating during burning of forest slash piles

*Matt Busse, Ken Hubbert,  
Steve Overby, Carol Shestak*



**What conditions might lead to detrimental changes in soils?**



# Do pile burns act as short-term “hotspots” for nutrient release?



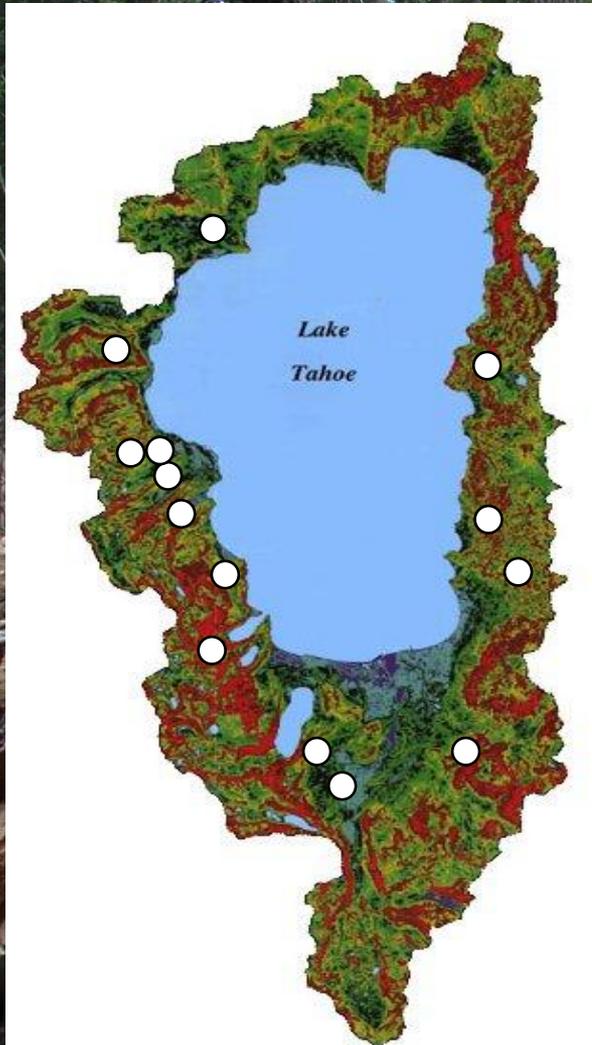


***Soil heating***

***Post-burn soil quality***

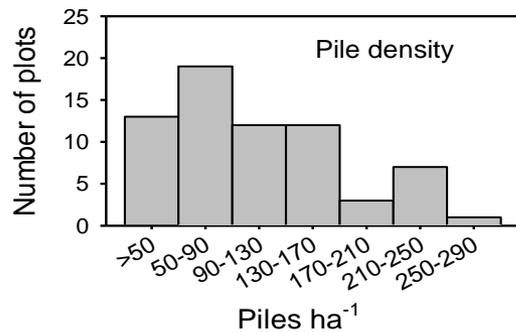
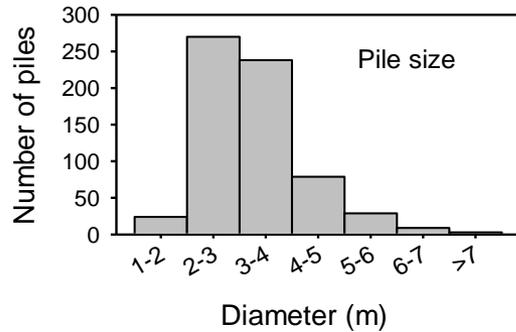
***Tahoe Basin inventory***

# Step 1: Assess the range of pile conditions in the Tahoe Basin



- ✓ 75 inventory plots
- ✓ Pile size
- ✓ Fuel composition
- ✓ Pile density (#/acre)
- ✓ Ground cover
- ✓ Thinning intensity

# Inventory of current conditions



- **Wide variety of pile sizes and densities**
- **Average diameter = 10 ft**
- **Large piles not uncommon**
- **Everything from small slash to large wood piles**

# How much ground is covered by piles within a unit?



3% cover



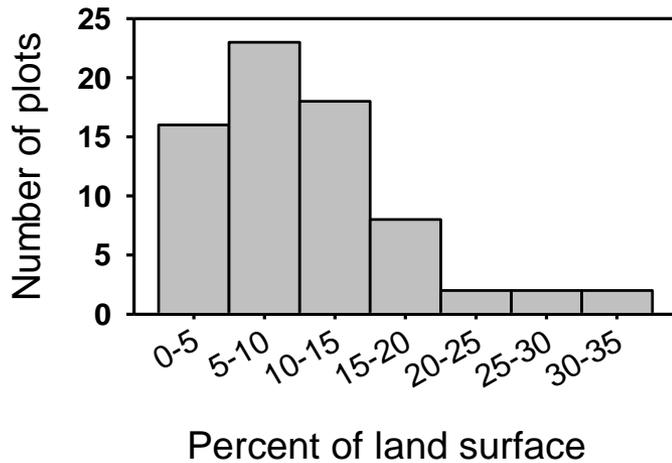
10% cover



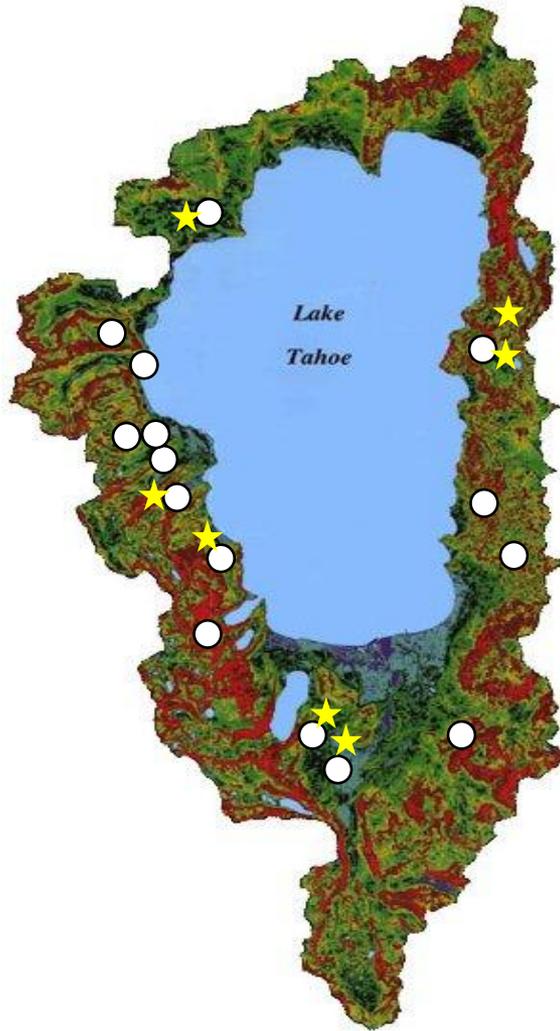
20% cover



30% cover



- Average cover = 11%
- One-fifth of the plots exceeded 15% cover
- Ground cover =  $3.75 + 0.223(\text{stump BA})$



# Soil Quality Study

## ★ Intensive plots (29 piles)

- ✓ Soil heating
- ✓ Soil and water chemistry
- ✓ Water repellency
- ✓ Soil physical properties
- ✓ Riparian and upland soils



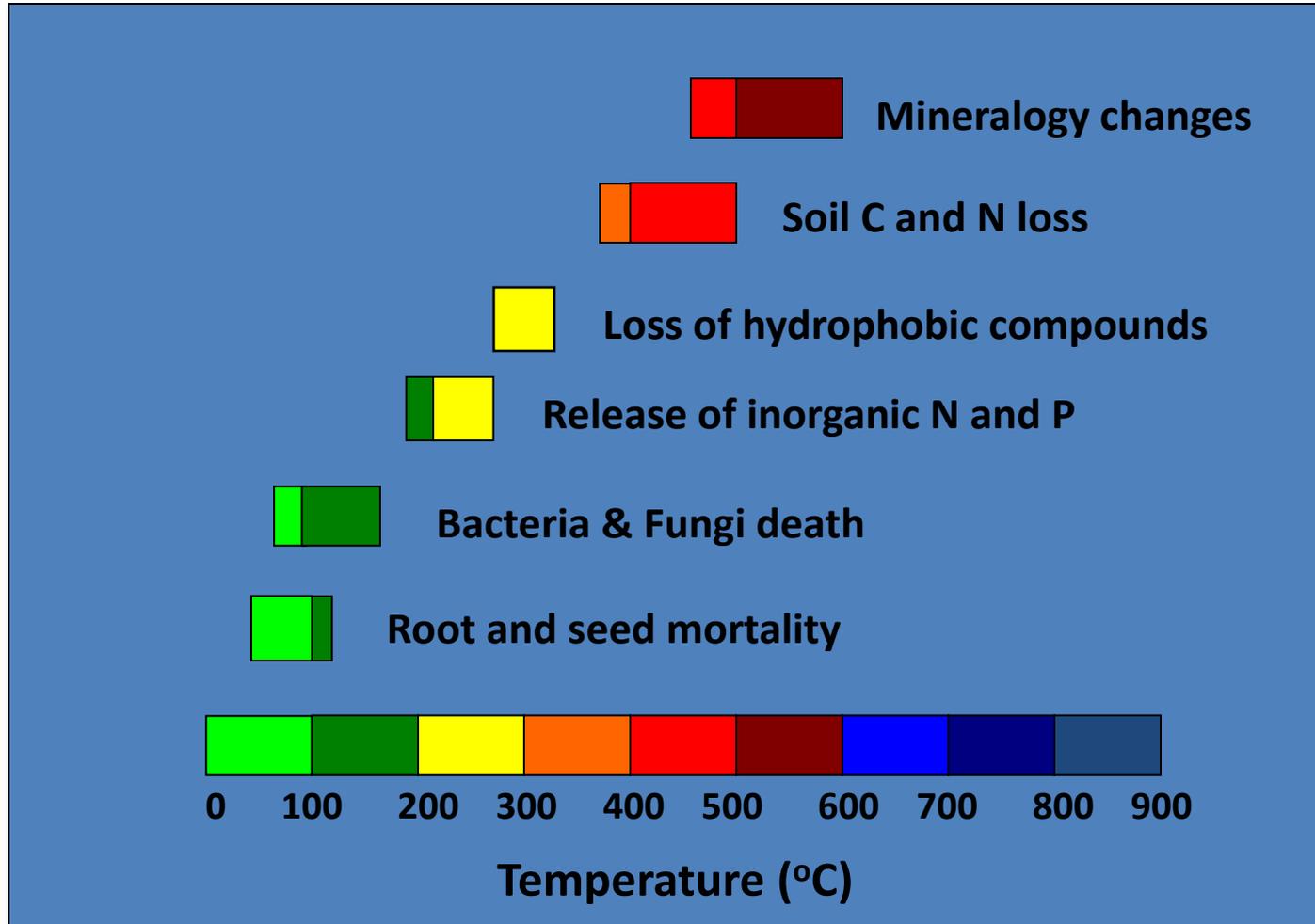
Each pile was measured for

- pile size
- fuel mass by size class

**Measure heat pulse at 0, 5, 10, 30, 50 cm soil depths beneath pile center**



# What's the big deal about soil heating?

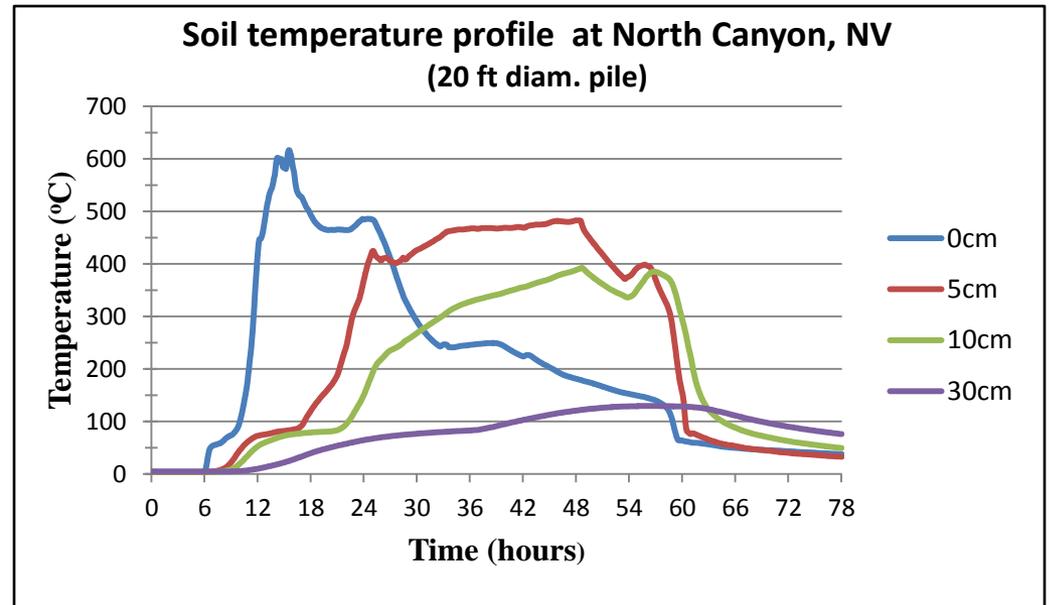


***So how hot does the soil get?***



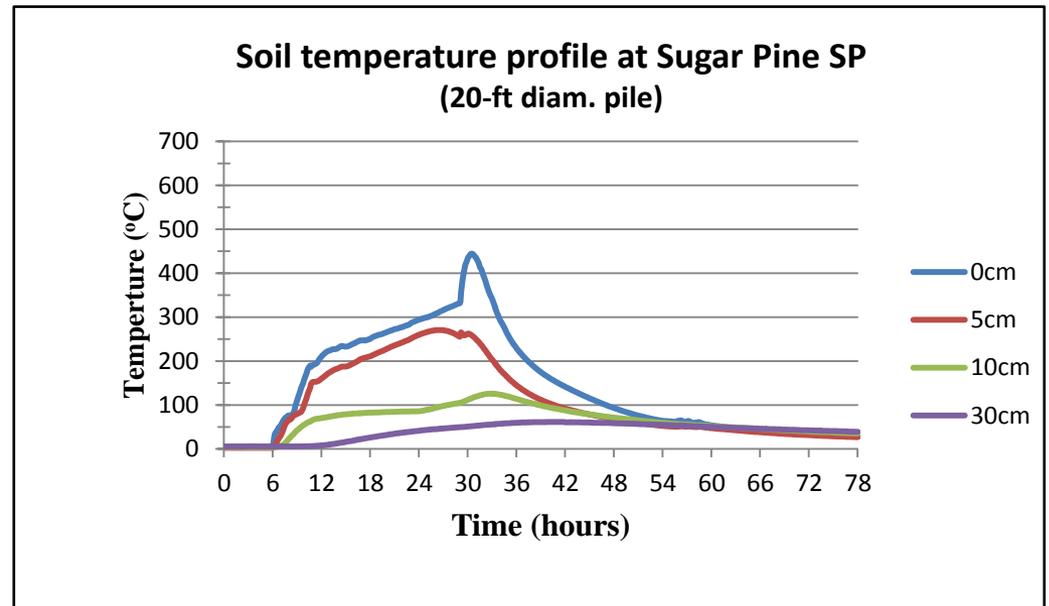
## Pile type I

- Dominated by bolewood
- Upper North Canyon



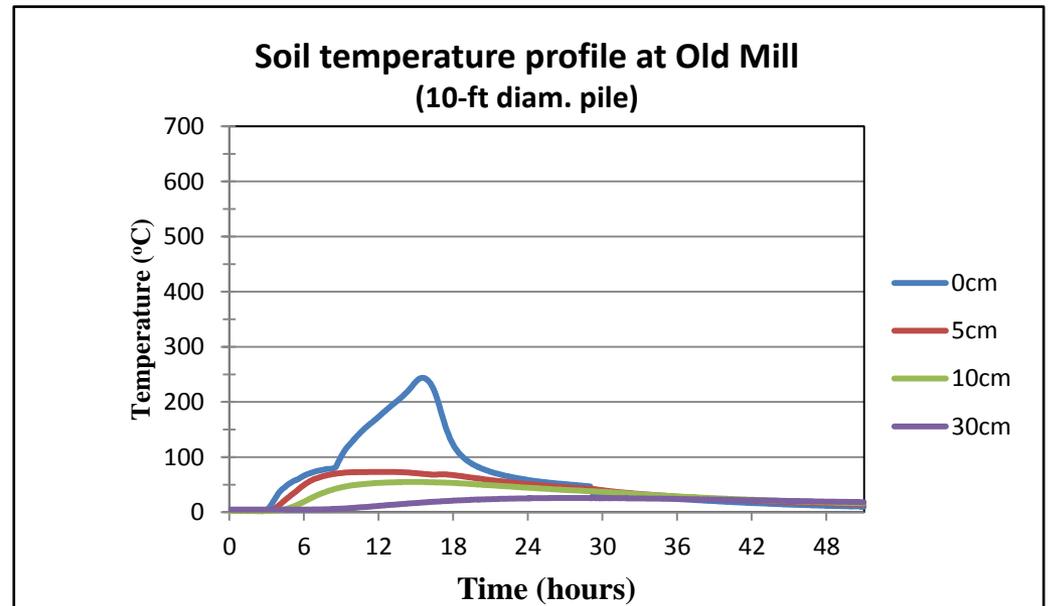
## Pile type 2

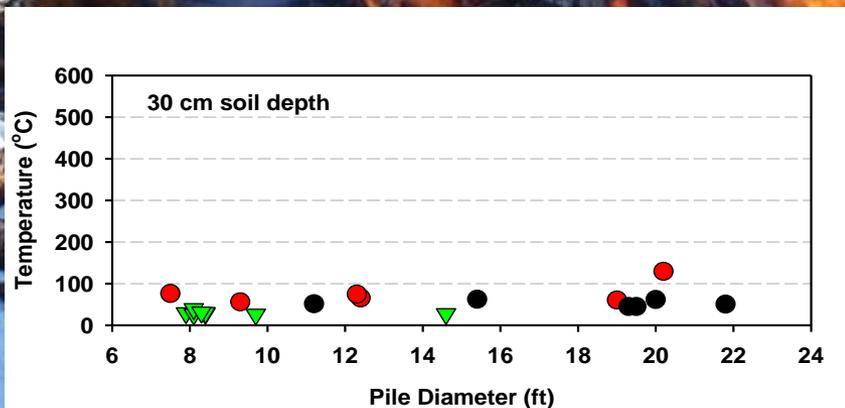
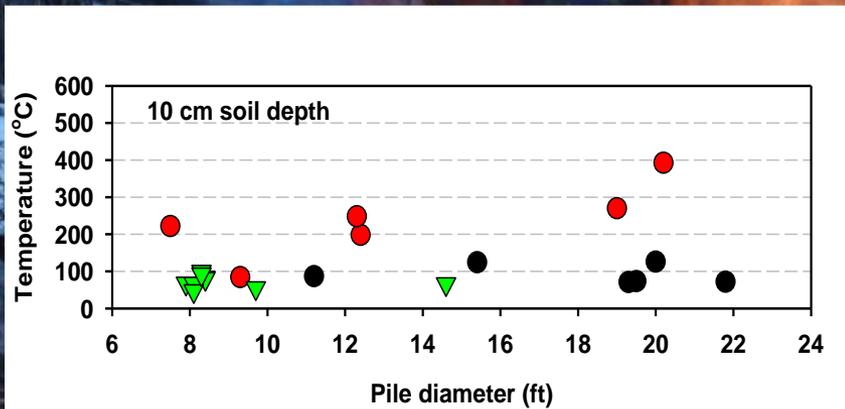
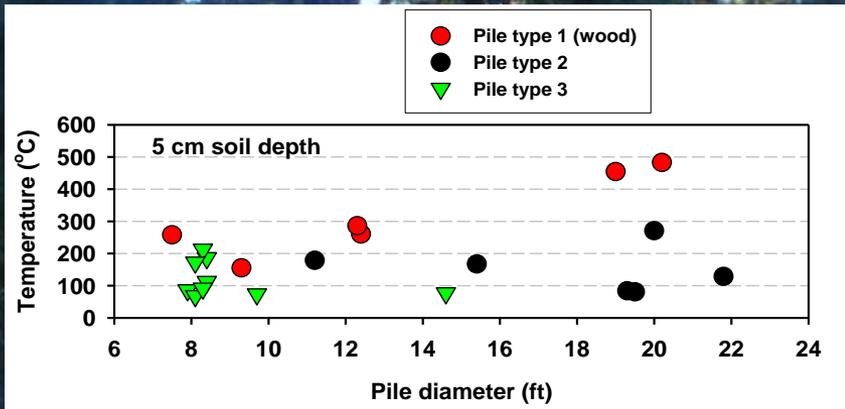
- Mix of all fuel sizes
- Bliss SP; Sugar Pine SP



## Pile type 3

- Small diameter slash
- Old Mill

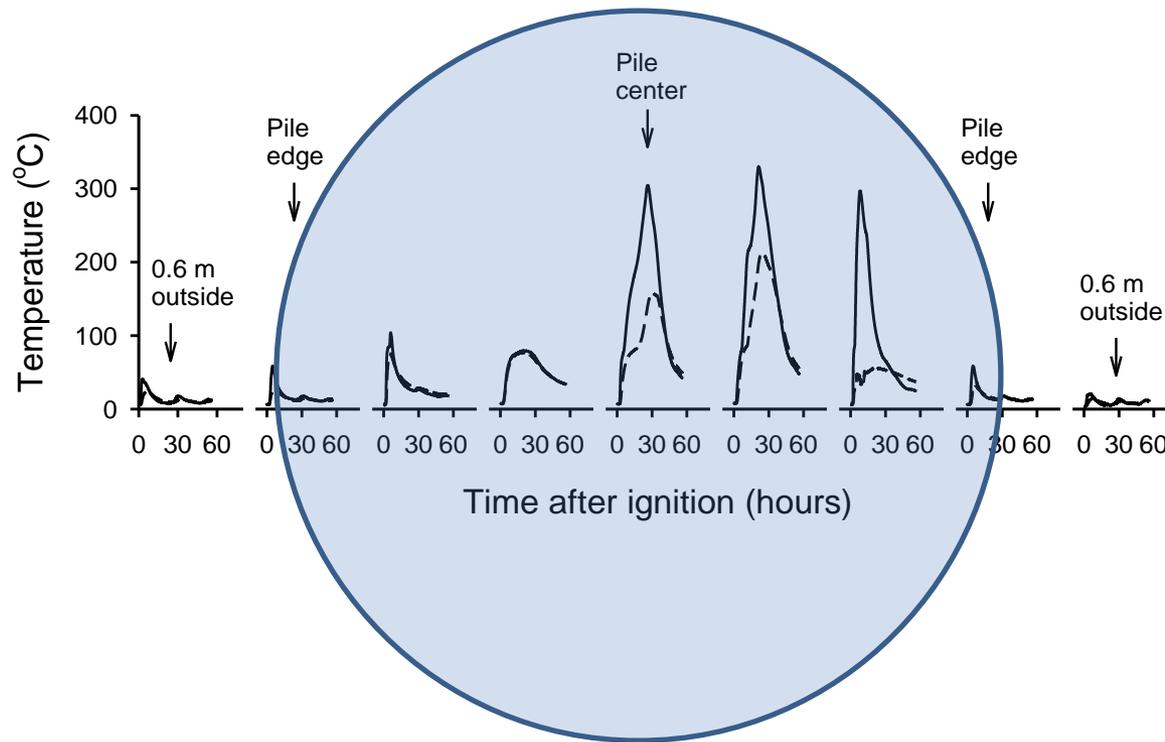




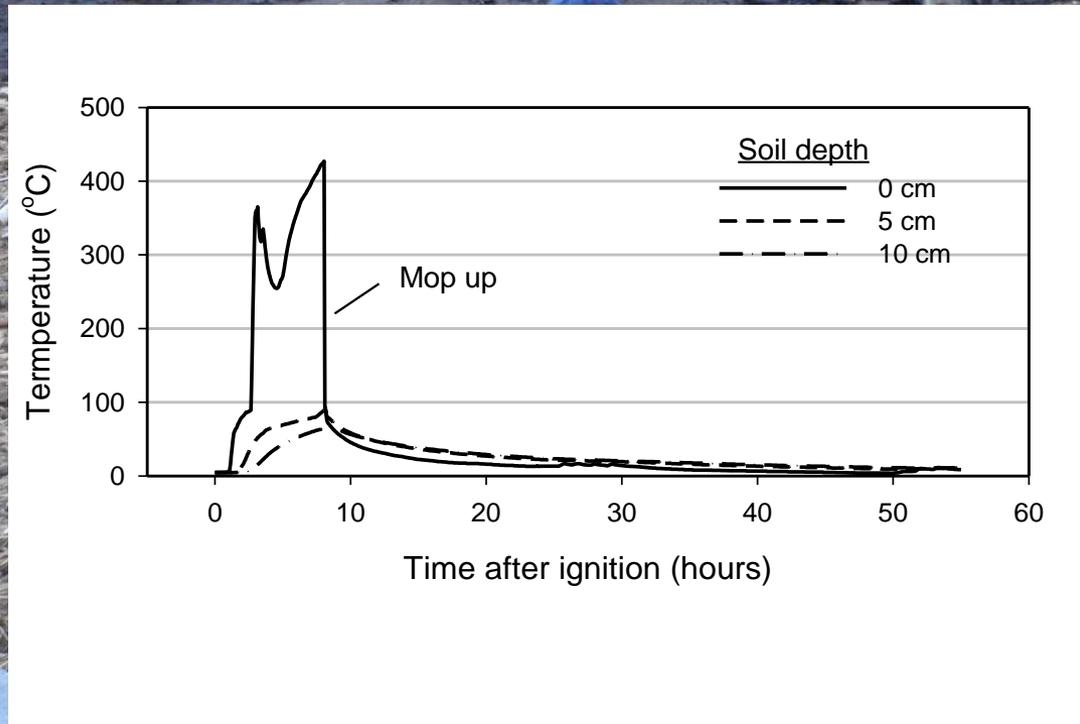
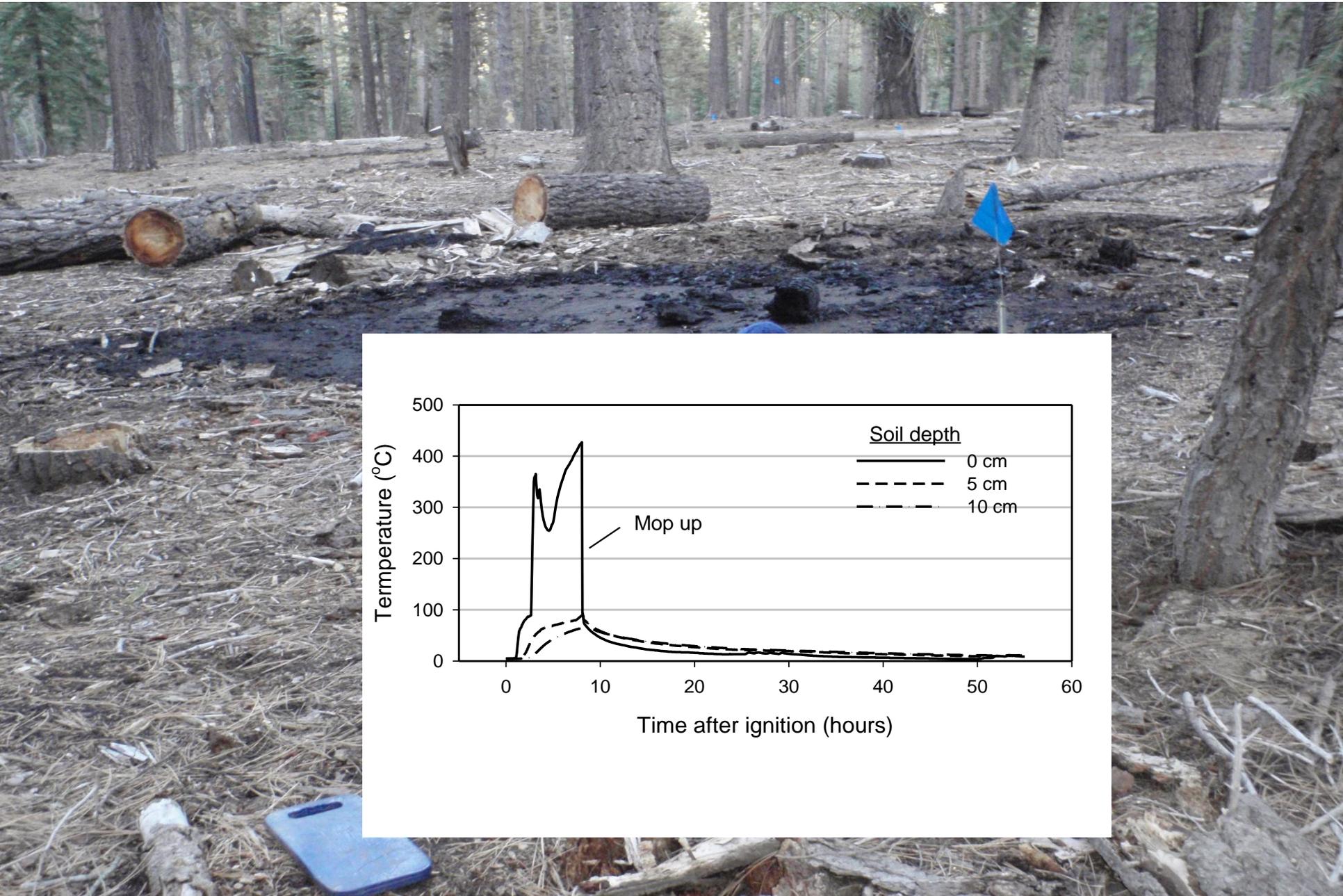
# How much spatial variability in heating is found beneath piles?



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# What about mopping up?



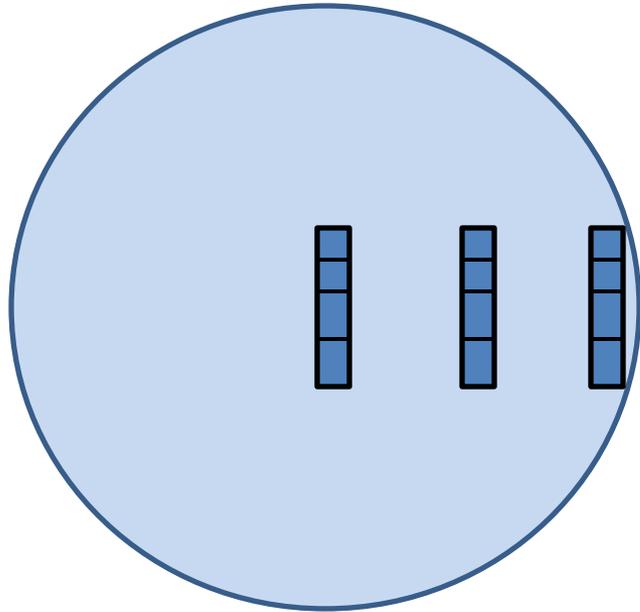
# Soil Heating Summary

- **Moderate to severe heating was found in the surface 10 cm beneath piles**
- **Fuel composition was the driving force**
- **Pile size was important only for wood-dominated piles**
- **Spatial variability was high - about one-half of the pile area reaches maximum heating**



# Post-burn soil quality





Water quality  
NO<sub>3</sub>, PO<sub>4</sub>  
Surface and subsurface  
Downslope

Soil effects  
Nitrate  
Ammonium  
Total C, N, P  
N mineralization  
Nitrification  
Nutrients  
pH  
Fungi, bacteria  
Microbial biomass  
Respiration  
PLFA community structure  
Water infiltration  
Water repellency  
Bulk density  
Plant recovery  
  
Repeated sampling

# Post-burn soil quality (0-5 cm)



## Soil C (24 months)



## Post-burn soil quality (0-5 cm)



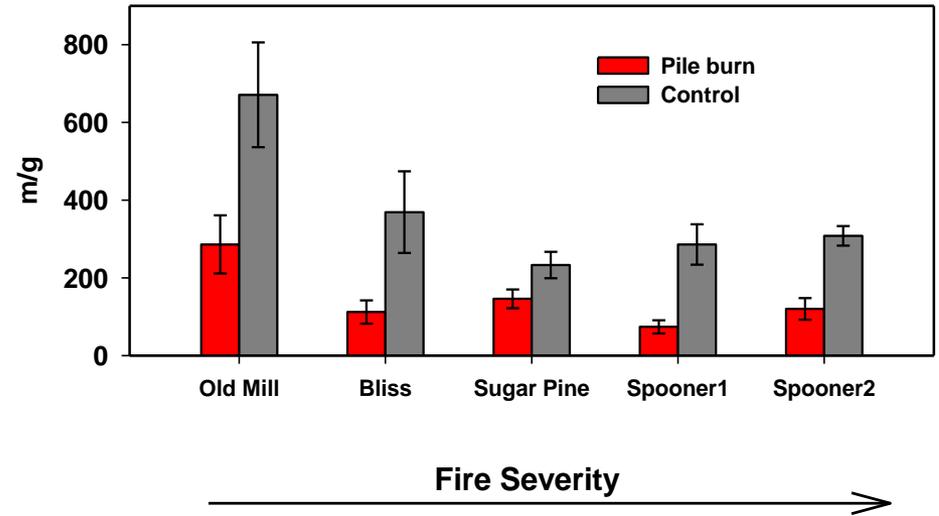
## Soil N (24 months)



## Post-burn soil quality (0-5 cm)



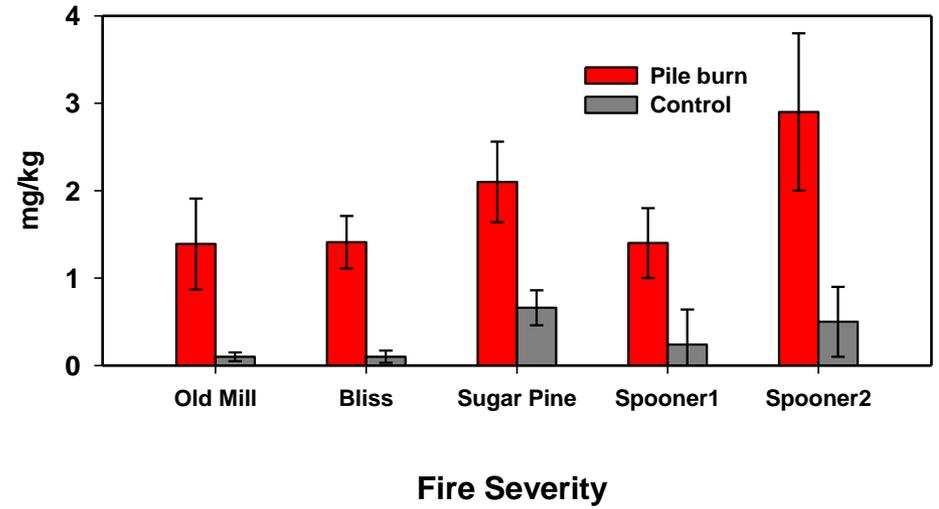
## Fungal hyphae (24 months)



## Post-burn soil quality (0-5 cm)



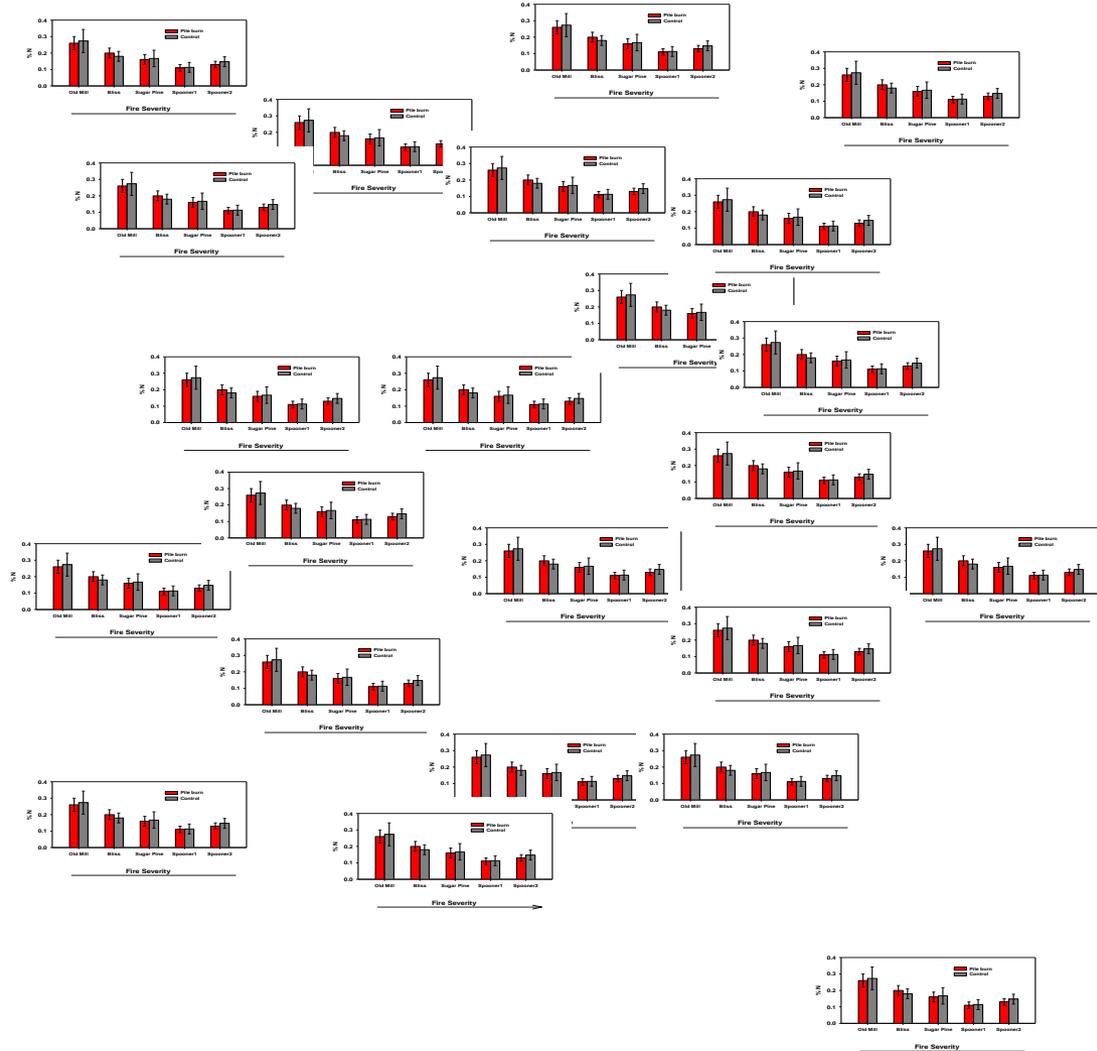
## Soil solution $\text{NO}_3$ (24 months)



# Post-burn soil quality (0-5 cm)



# Multivariate analyses



## Post-burn soil quality (0-5 cm)



<u>Soil effects</u>	<u>Percent of unburned control</u>
Nitrate	515%
Nitrification	190%
Ammonium	90%
N mineralization	97%
Total C	92%
Total N	98%
Total P	114%
pH	103%
Fungi hyphae	42%
Bacteria biomass	35%
Microbial biomass (SIR)	87%
Respiration	109%
PLFA community structure	
Water infiltration	20%
Water repellency	200%
Bulk density	107%

**Burning of hand piles will not result in extreme or extensive soil heating except when:**

- **piles are dominated by large wood**
- **piles occupy a high percentage of the ground surface**

**Expect short-term changes in certain soil properties. Are they a problem?**

