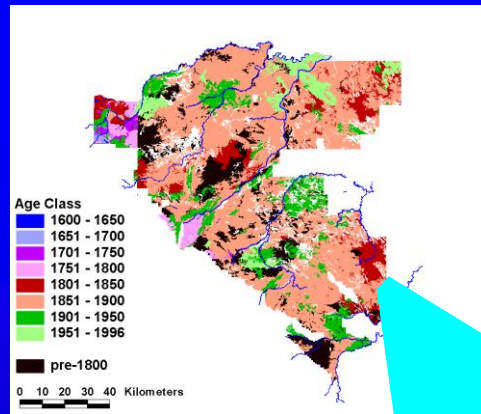




**Structural Attributes  
of Coniferous Stands  
Disturbed by Logging  
and Wildfire:**

**A Reality Check**

# Hierarchical Spatial Scales

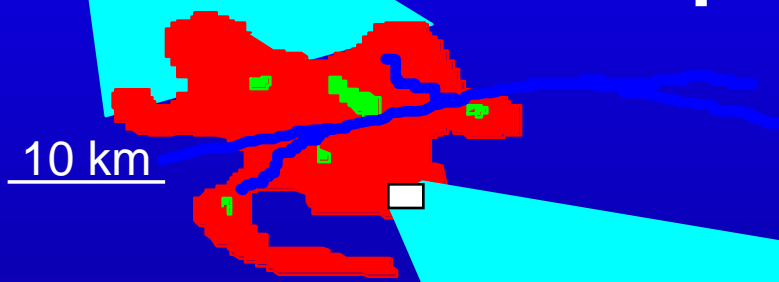


100 km

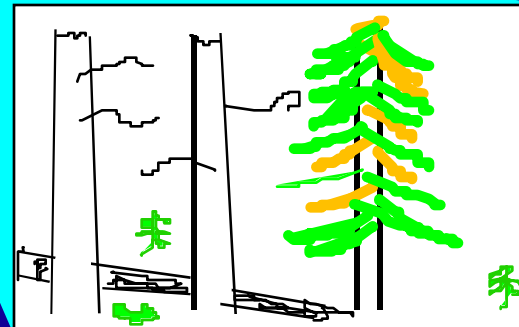
Mosaic of many wildfire patches

Within-patch structure

10 km



0.001 km



Structure within a stand

# **Wildfire and Logging in the Foothills**

- ◆ **Wildfires have occurred for many years**
- ◆ **Logging is recent, and is intended to replace wildfire on lands allocated for sustained yield of fibre**
- ◆ **Ecological effects of logging relative to fire are unclear**
- ◆ **One ecological effect:**
  - ❖ **modification of forest structure through removal of tree boles during logging**
  - ❖ **boles frequently are retained during wildfire**
    - ❖ ***major input source of down deadwood material***









# Natural Disturbance as a Template?

- ◆ **Makes several assumptions:**
  - ❖ *“human activities can approximate natural processes, at least to some degree”*
  - ❖ Alberta Forest Conservation Strategy, draft July 8, 1996
  
- ◆ **How do human activities (clearcutting) compare to natural processes (wildfire)?**

# Forest structure

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- ◆ **Live trees: density, size, species composition**
- ◆ **Dead trees: density, size, species composition**
  - ❖ **Standing dead trees (snags)**
  - ❖ **Down deadwood material**
- ◆ **Deadwood material**
  - ❖ **Involved in ecological processes such as decomposition**
  - ❖ **Structure contributes to the presence of species**
  - ❖ **deadwood material is frequently abundant in stand of pyrogenic origin**







# Forest Structure and Disturbance

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- ◆ Has rarely been estimated except immediately after disturbance
- ◆ Poor understanding of the dynamics of deadwood material in burned and logged stands, & how abundance and condition may differ through time

# Stand Structure Project

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## ◆ Primary Researchers

- ❖ Dan Farr
- ❖ Chris Spytz
- ❖ George Mercer

## ◆ Supporting Agencies

- ❖ Foothills Model Forest
- ❖ Jasper National Park
- ❖ Weldwood of Canada

## ◆ *Preliminary data, ms in prep*



# Research Objective

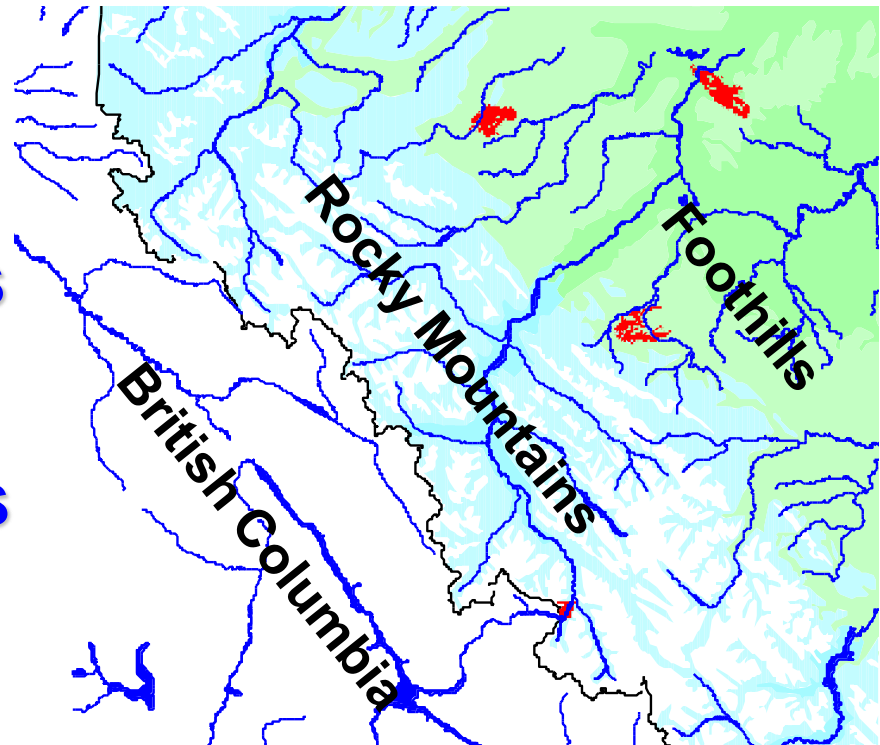
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- ◆ **Estimate and compare the range of variability in the origin, abundance and condition of deadwood material and live trees recently disturbed by wildfire and by clearcut harvesting**

# Study areas

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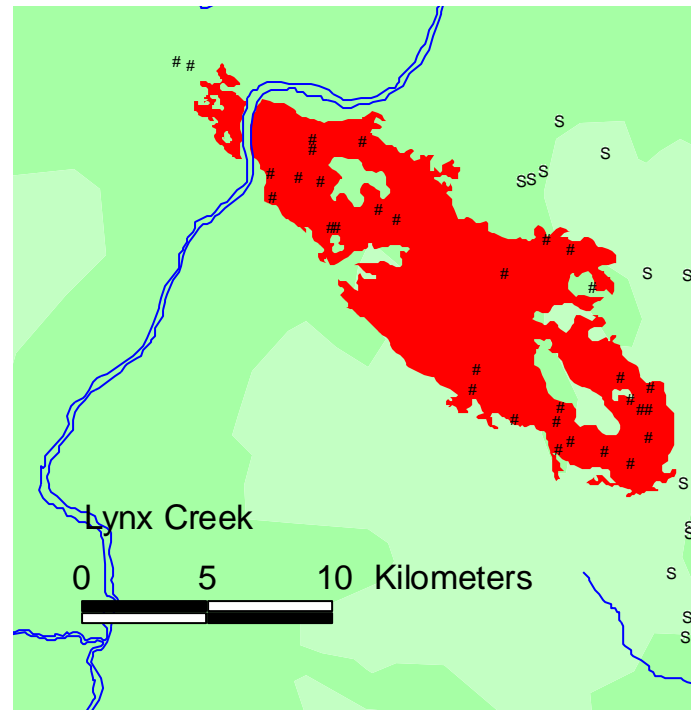
- ◆ **1 Mountain wildfire**
  - ❖ 34 yr.
- ◆ **3 Foothills wildfires**
  - ❖ 35 - 40 yr.
- ◆ **3 Foothills harvests**
  - ❖ 23 - 27 yr.



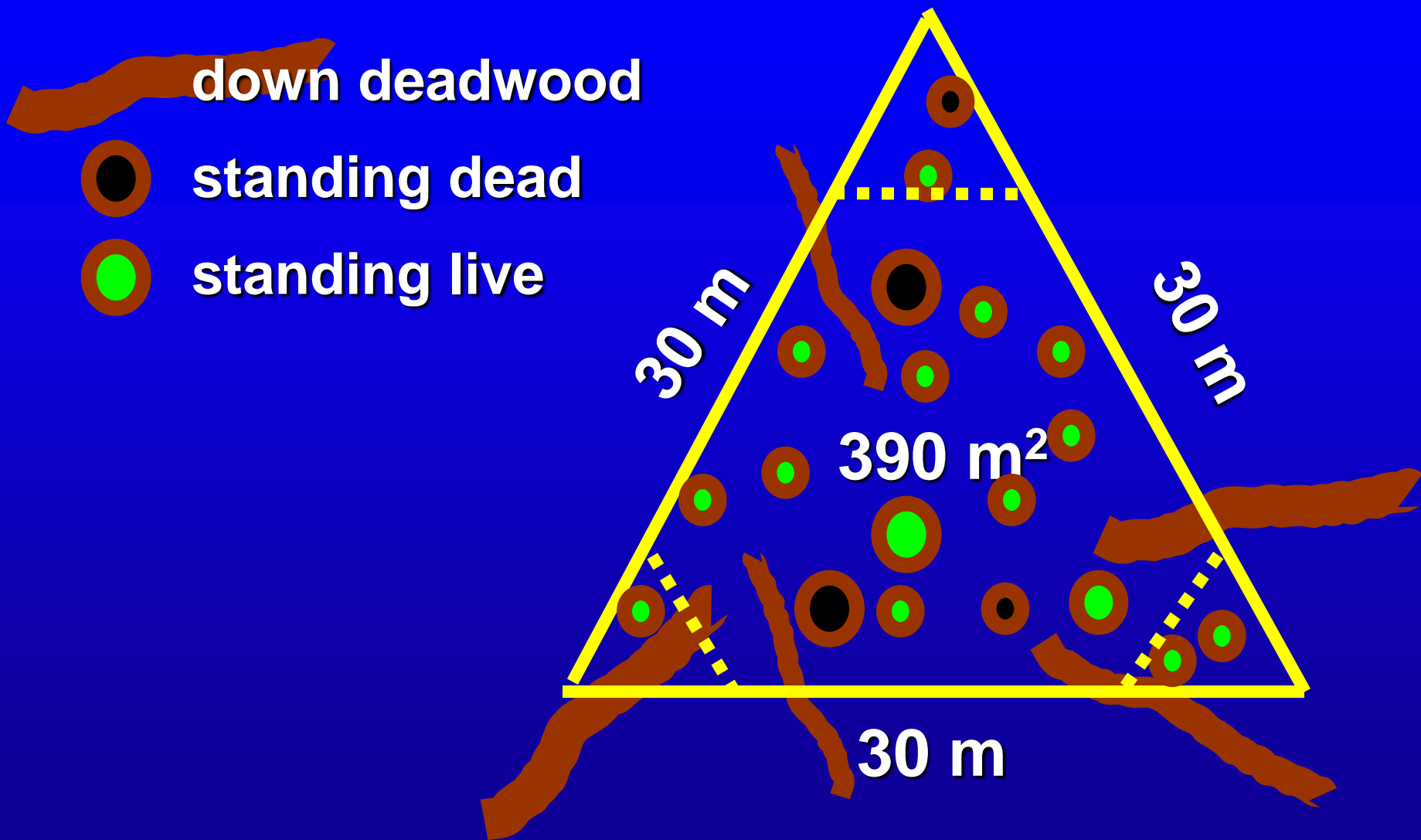


# Sample plot layout

- ◆ 30 plots per site  
(15 in Mountain burn)
- ◆ randomly located  
(almost)



# Sampling method





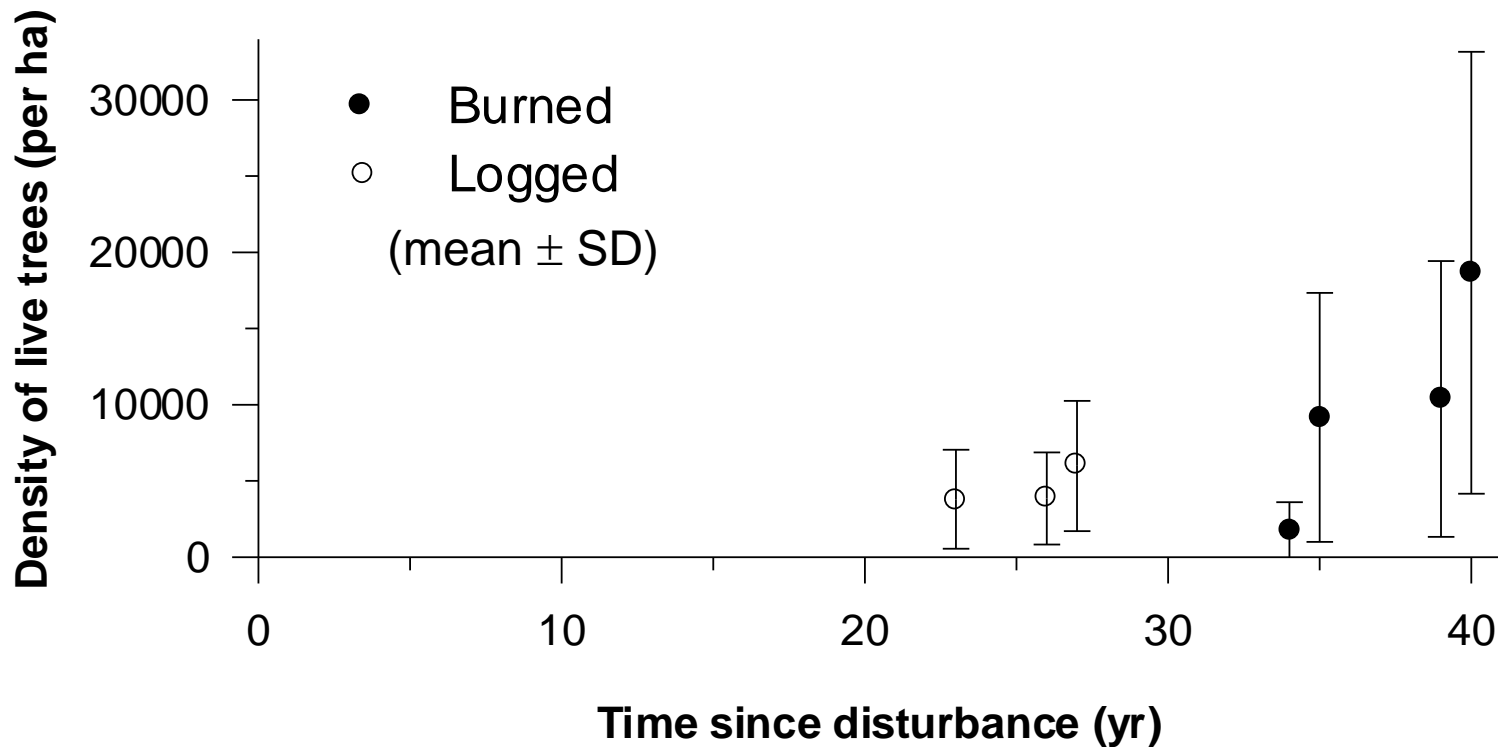


# Results

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- ◆ **Ranges of variability in burned & logged stands**
  - ❖ **Live trees, *abundance and size***
  - ❖ **Standing dead trees, *abundance & condition***
    - ❖ **Pre-disturbance & Post-disturbance**
  - ❖ **Down deadwood, *abundance & condition***
    - ❖ **Pre-disturbance & Post-disturbance**
- ◆ **Infer probable successional trajectories for deadwood in these burned and logged stands**

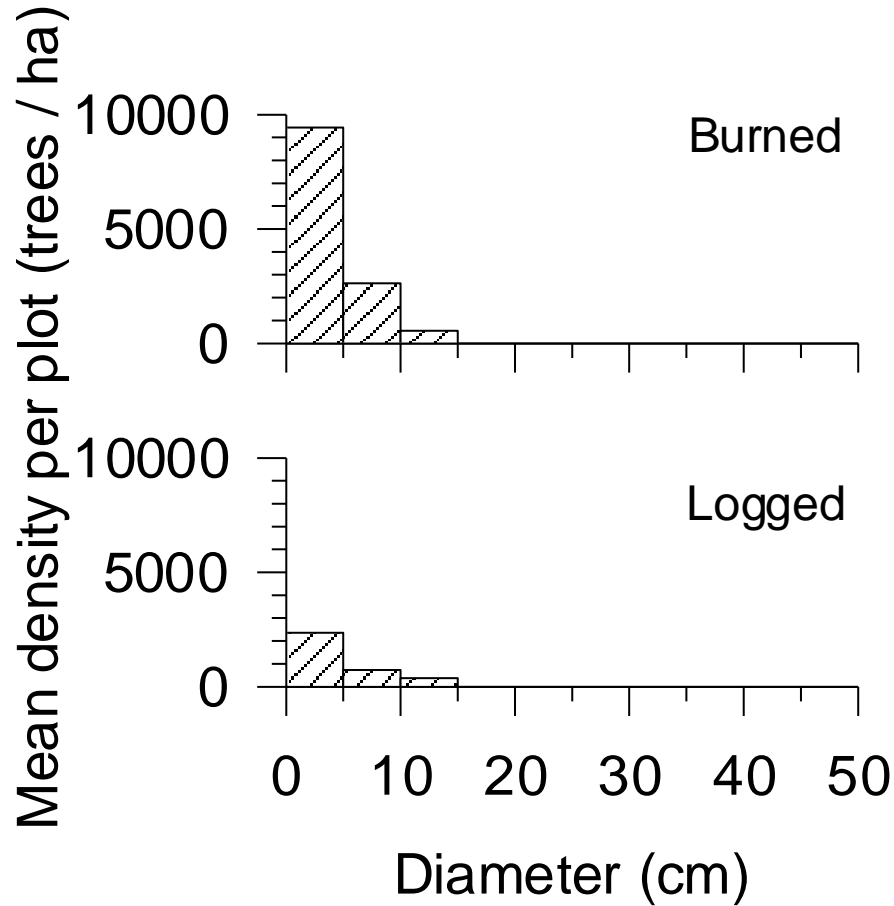
# Density of Live Trees



**Mean: Burned > Logged**  
**Variability: Burned > Logged**



# Live trees: Size Distribution



*mean of 3 sites*



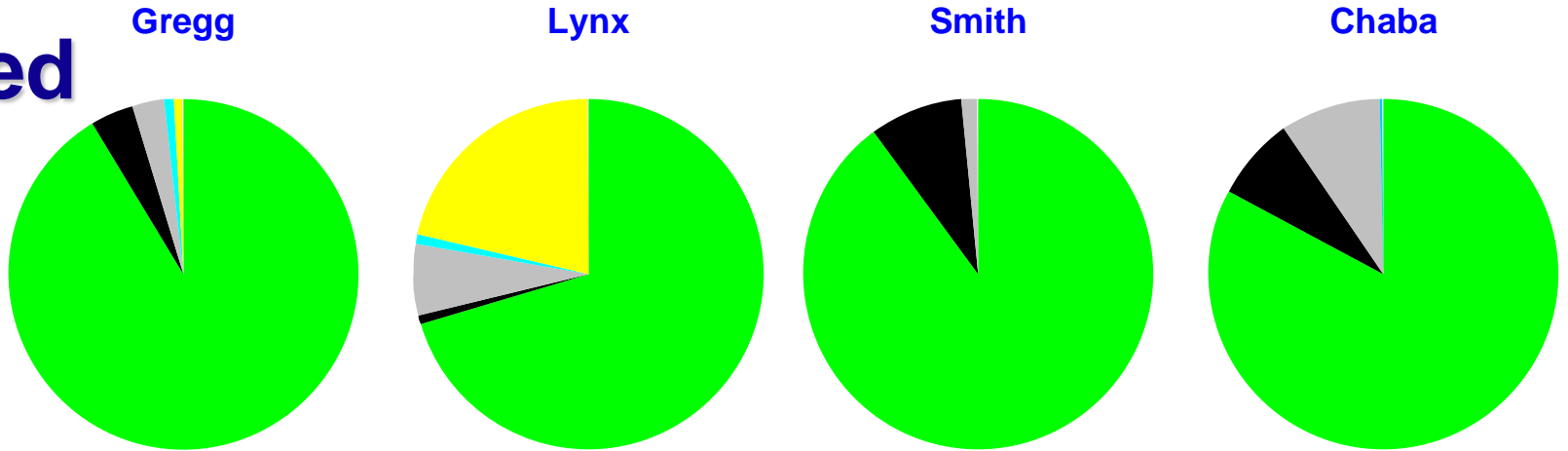




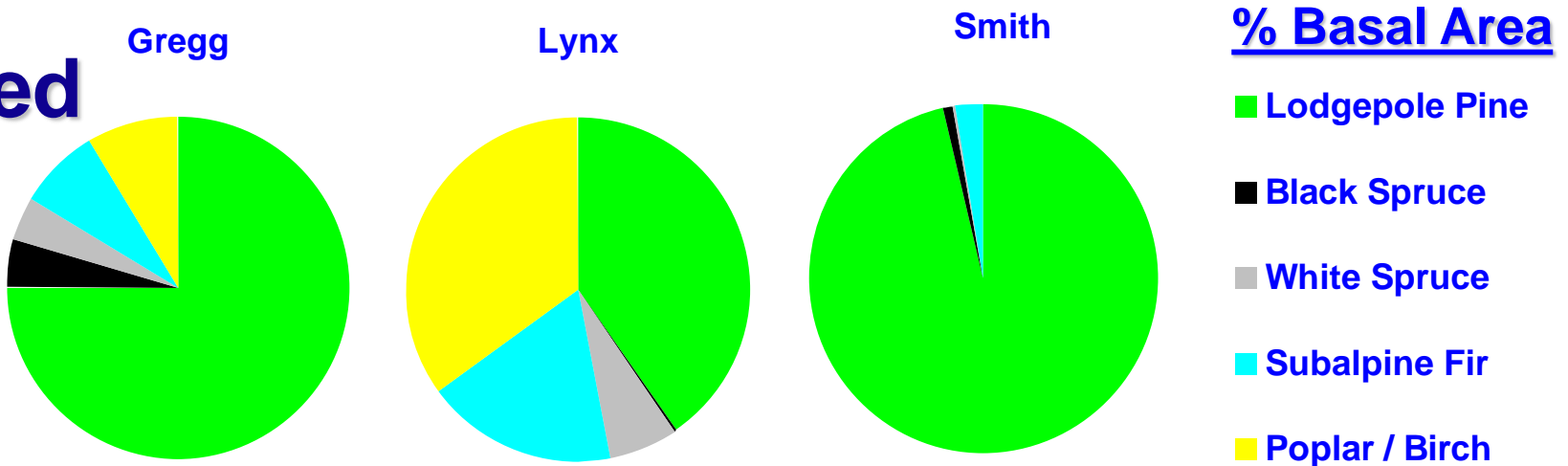


# Live Trees: Species Composition

**Burned**



**Logged**

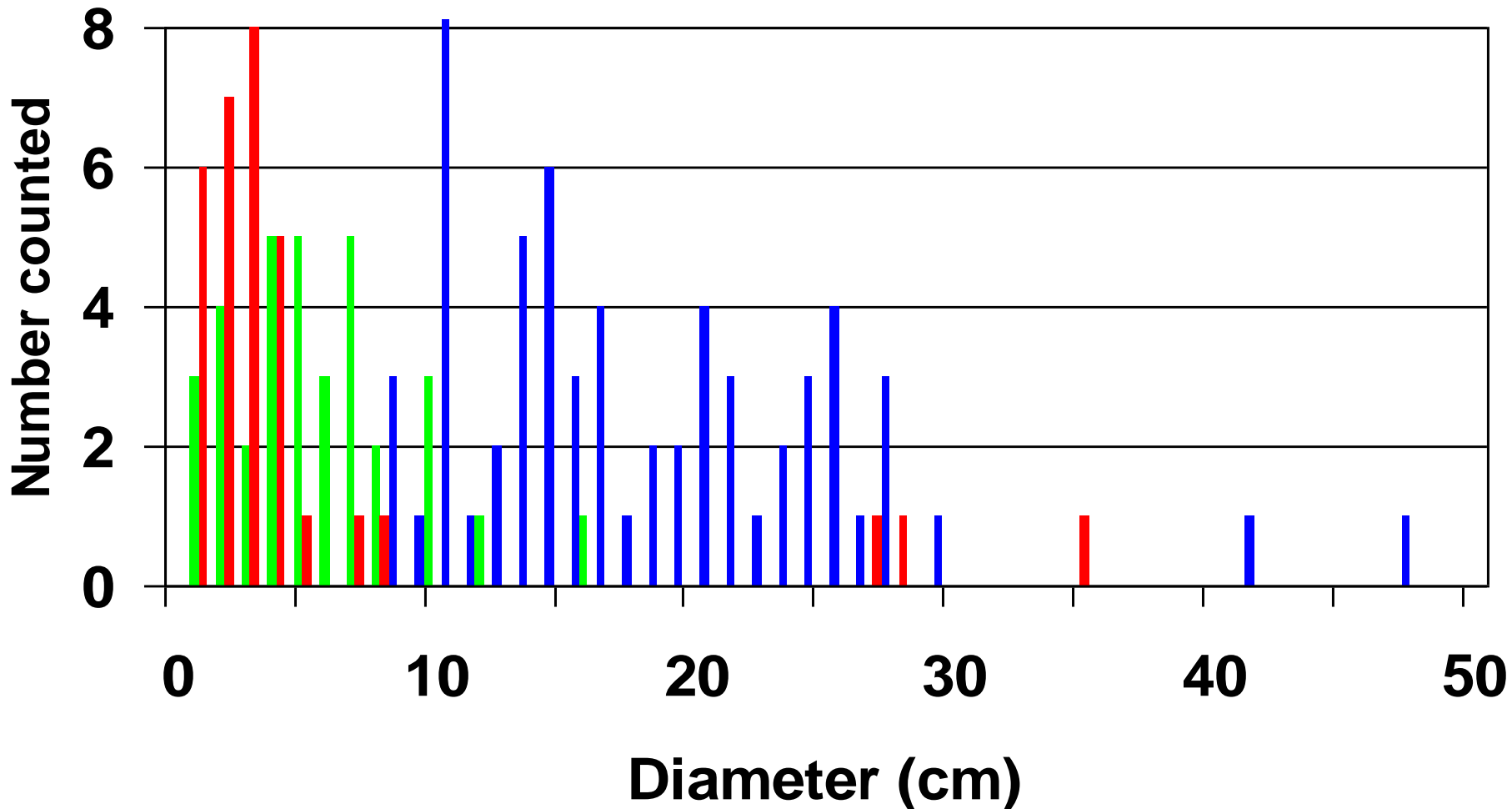


% Basal Area

- Lodgepole Pine
- Black Spruce
- White Spruce
- Subalpine Fir
- Poplar / Birch

# Distinguishing Deadwood Origin

■ Live ■ Standing Dead ■ Down Dead













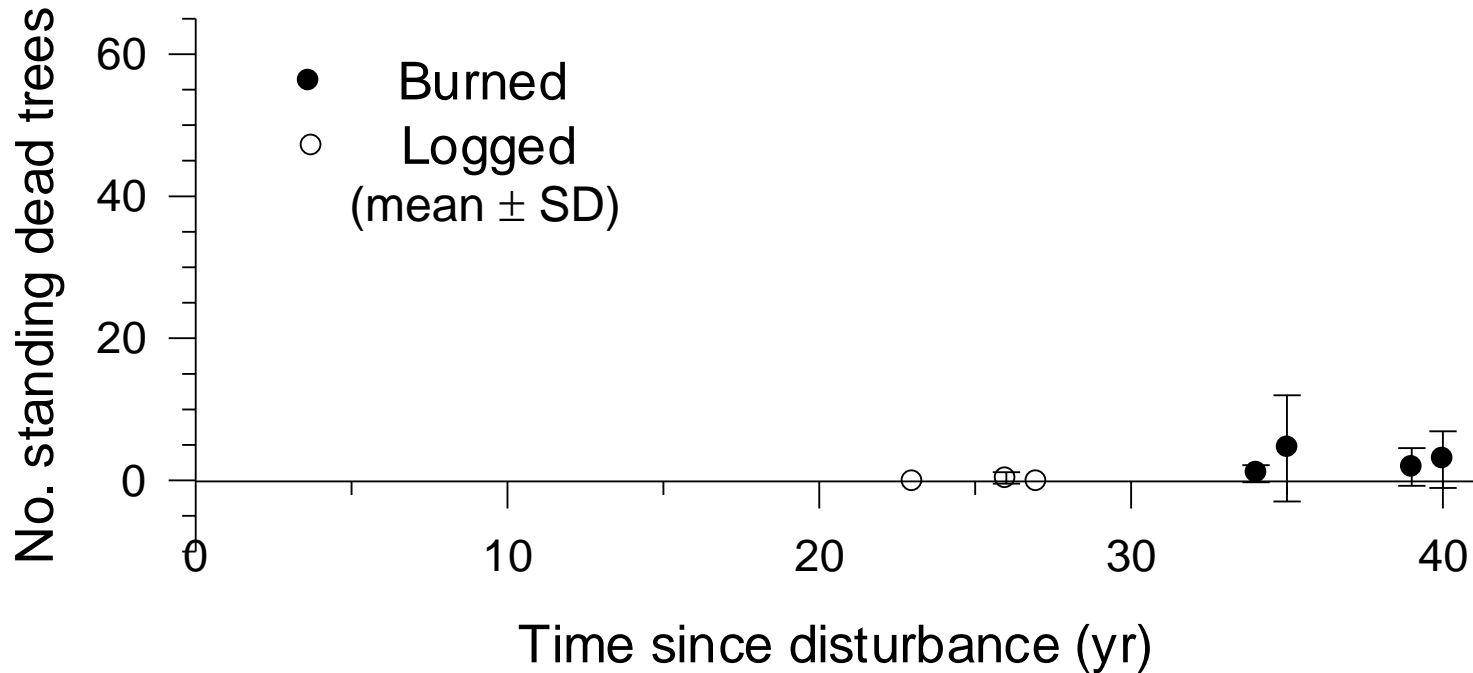


# Standing Dead Trees



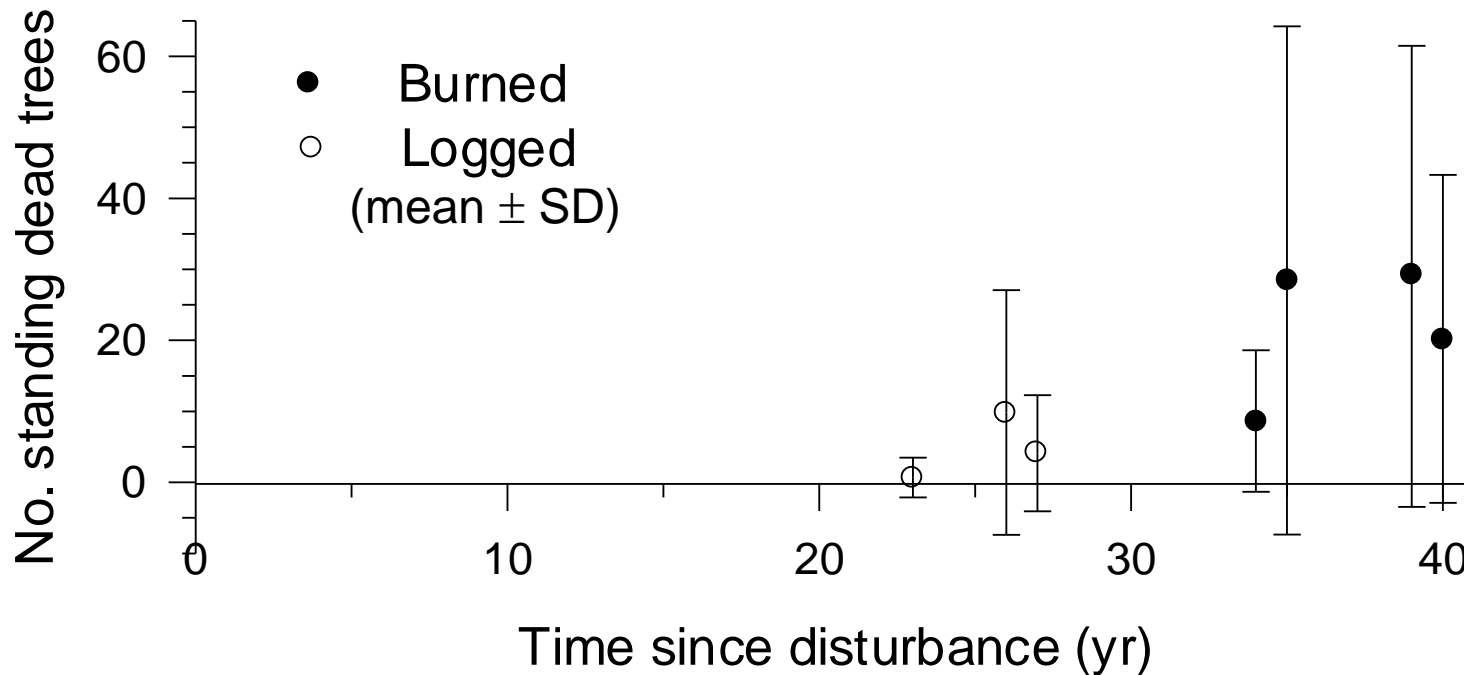


# Standing Dead Trees: Pre-disturbance



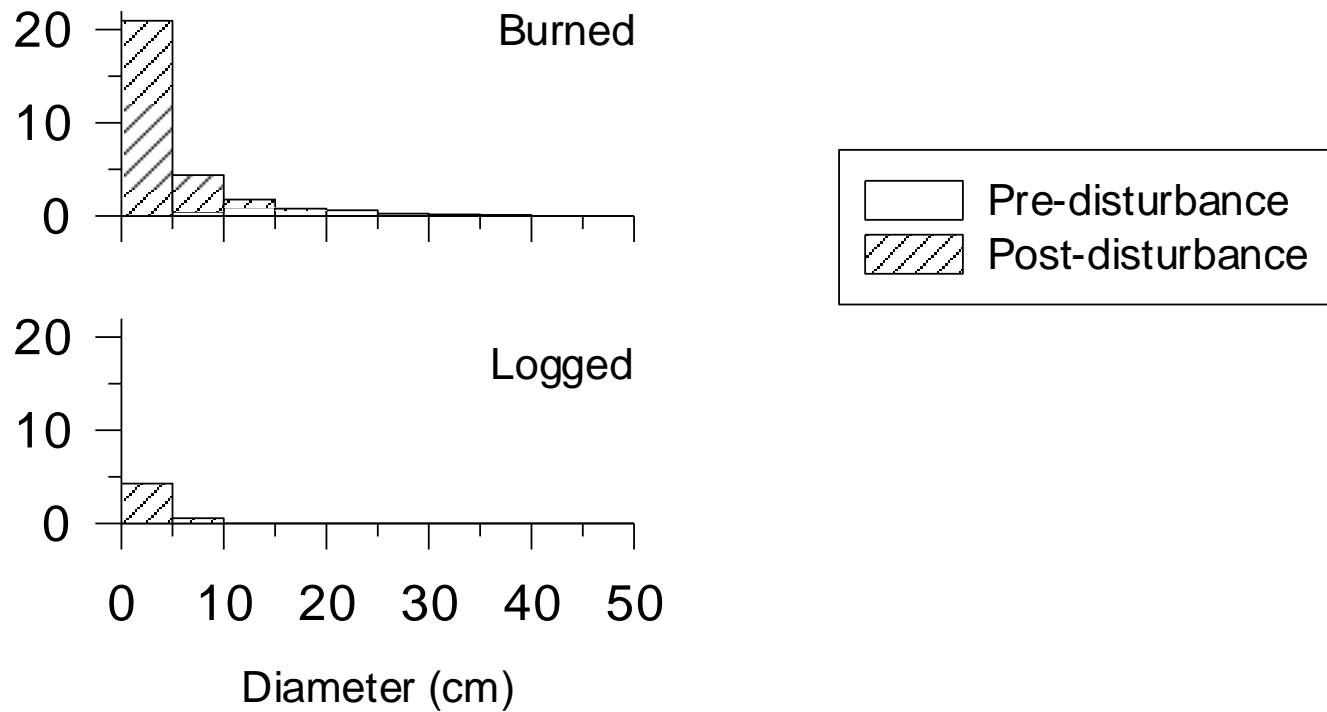
**Mean: Burned > Logged**  
**Variability: Burned > Logged**

# Standing Dead Trees: Post-disturbance



**Mean: Burned > Logged**  
**Variability: Burned > Logged**

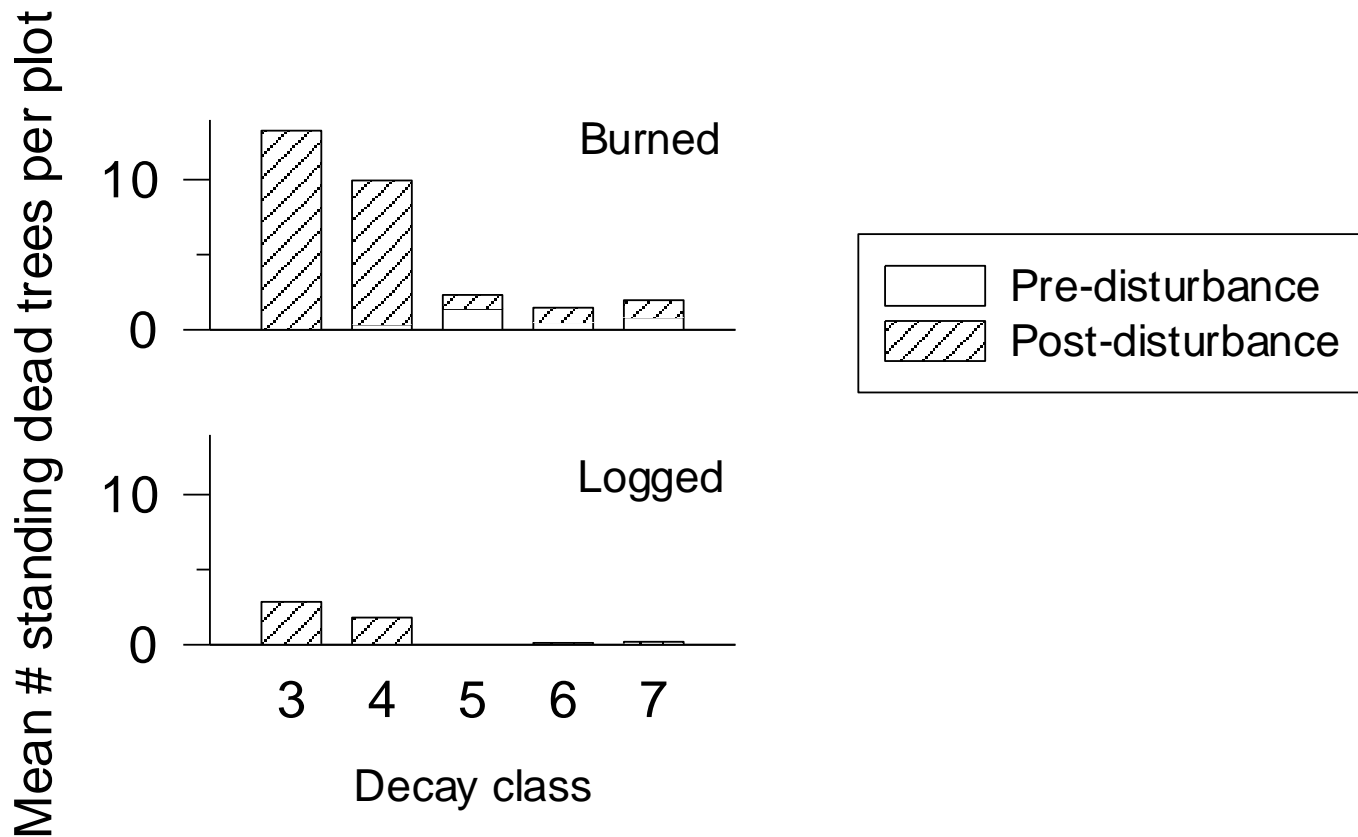
# Standing Dead Trees: Size Distribution



*mean of 3 sites*



# Standing Dead Trees: Decay Pattern



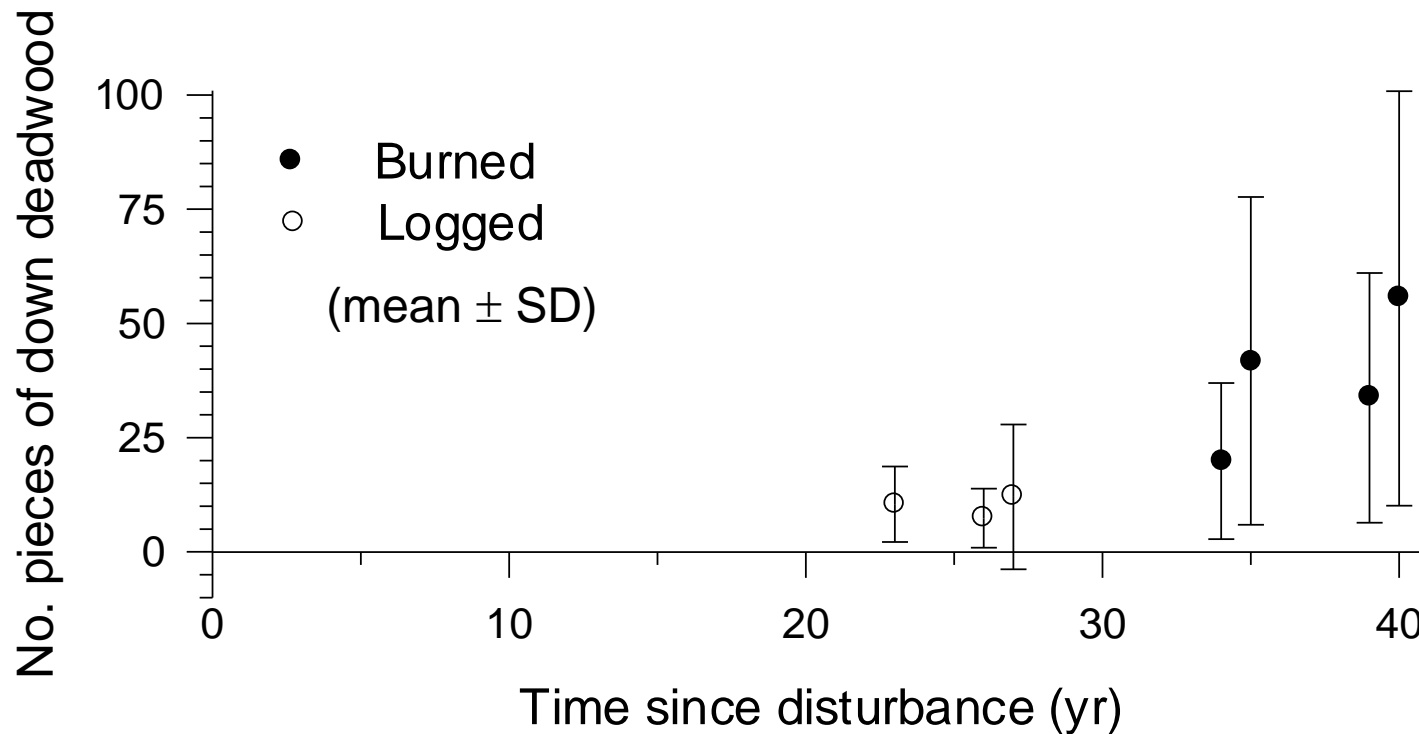
*mean of 3 sites*

# Down Deadwood Material



# Down Deadwood: Pre-disturbance

(> 7 cm diameter)

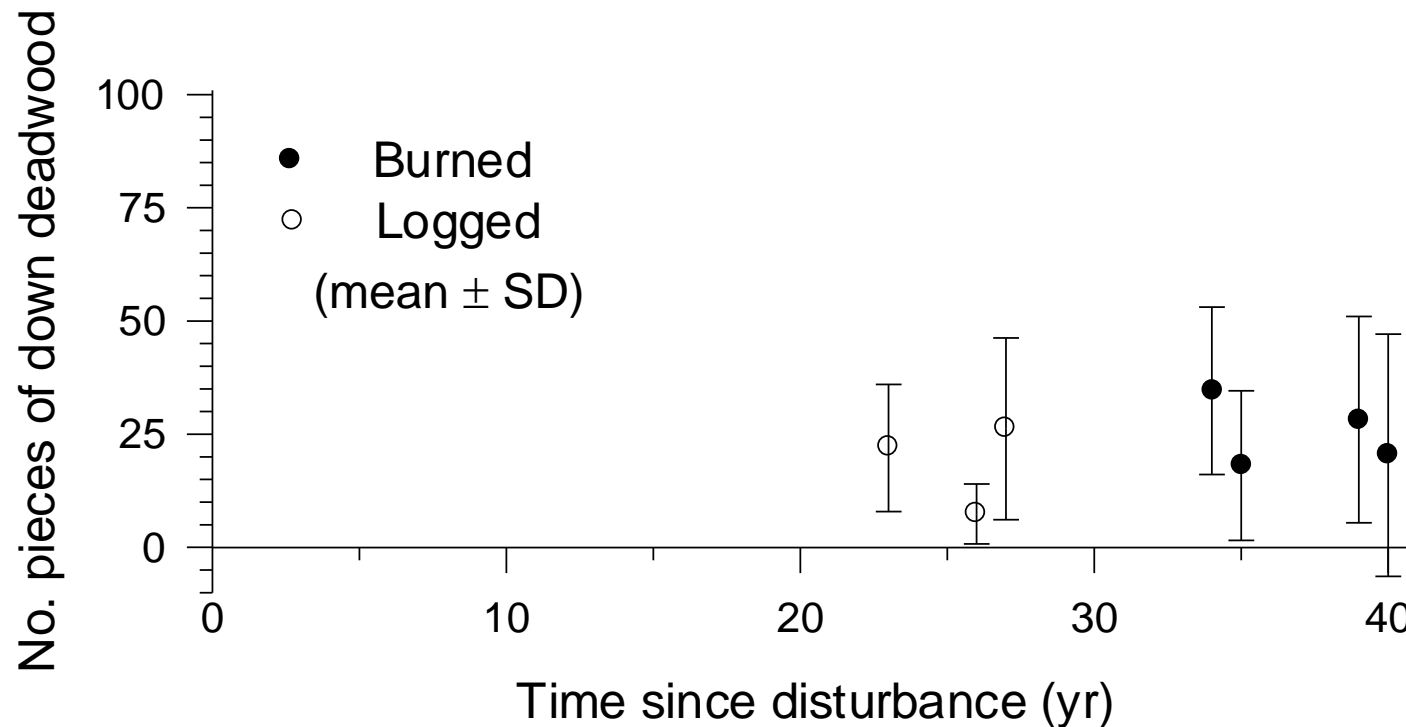


**Mean: Burned > Logged**  
**Variability: Burned > Logged**



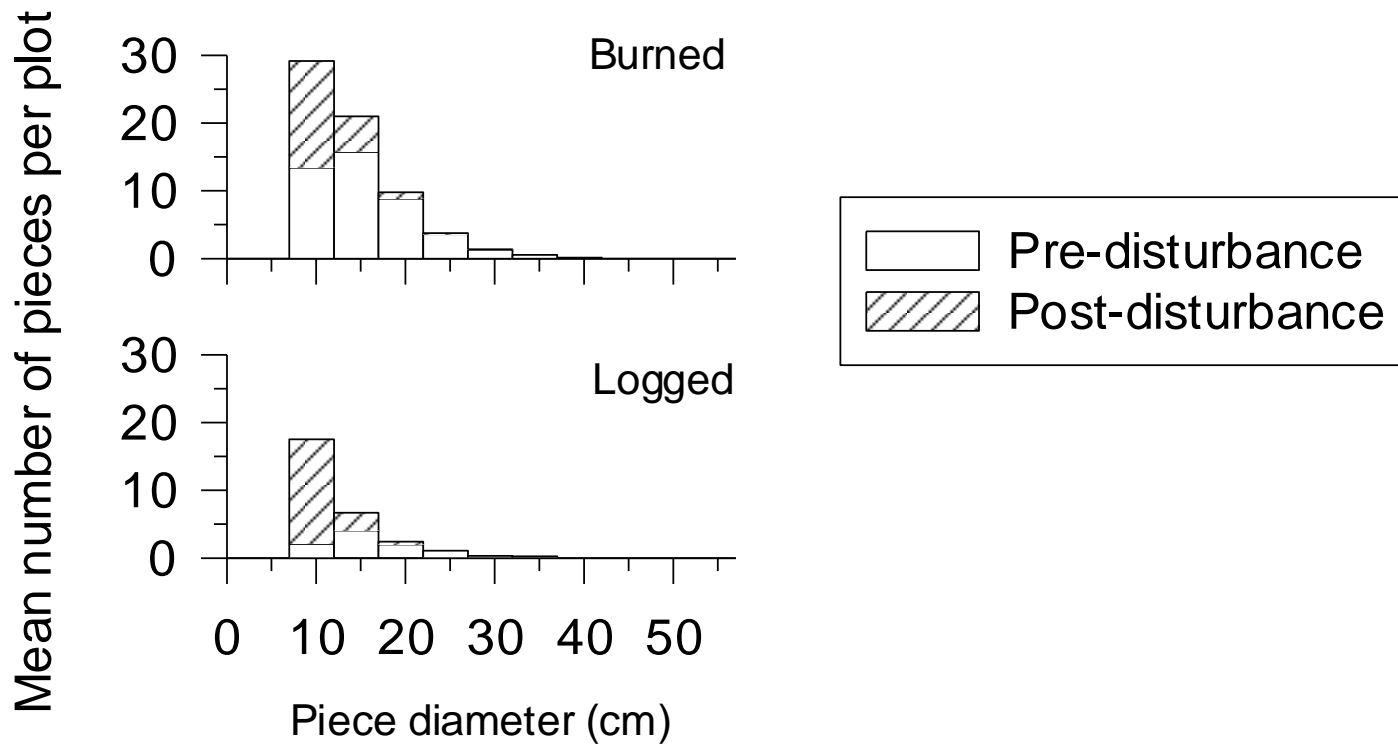
# Down Deadwood: Post-disturbance

(*> 7 cm diameter*)



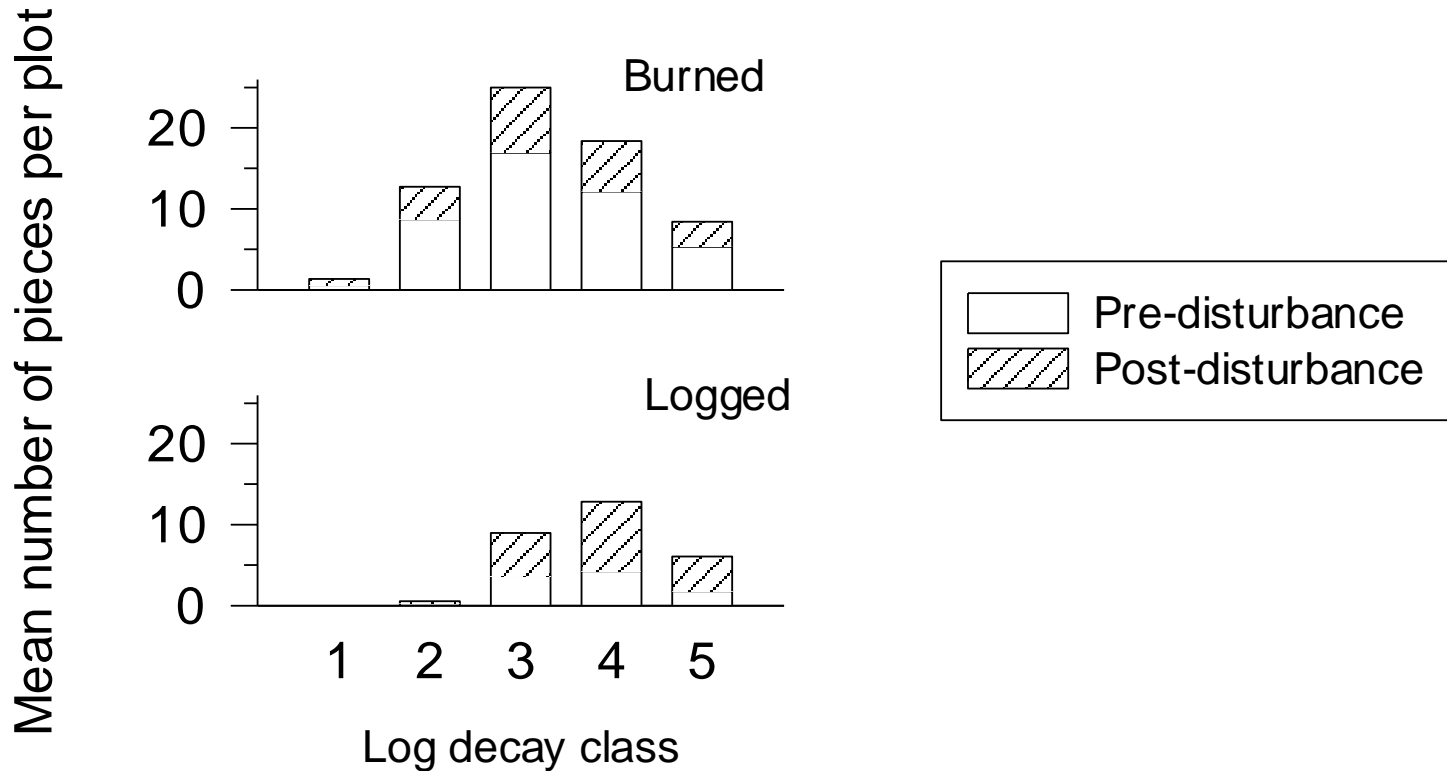
**Mean: Burned = Logged**  
**Variability: Burned = Logged**

# Down Deadwood: Size Distribution



*mean of 3 sites*

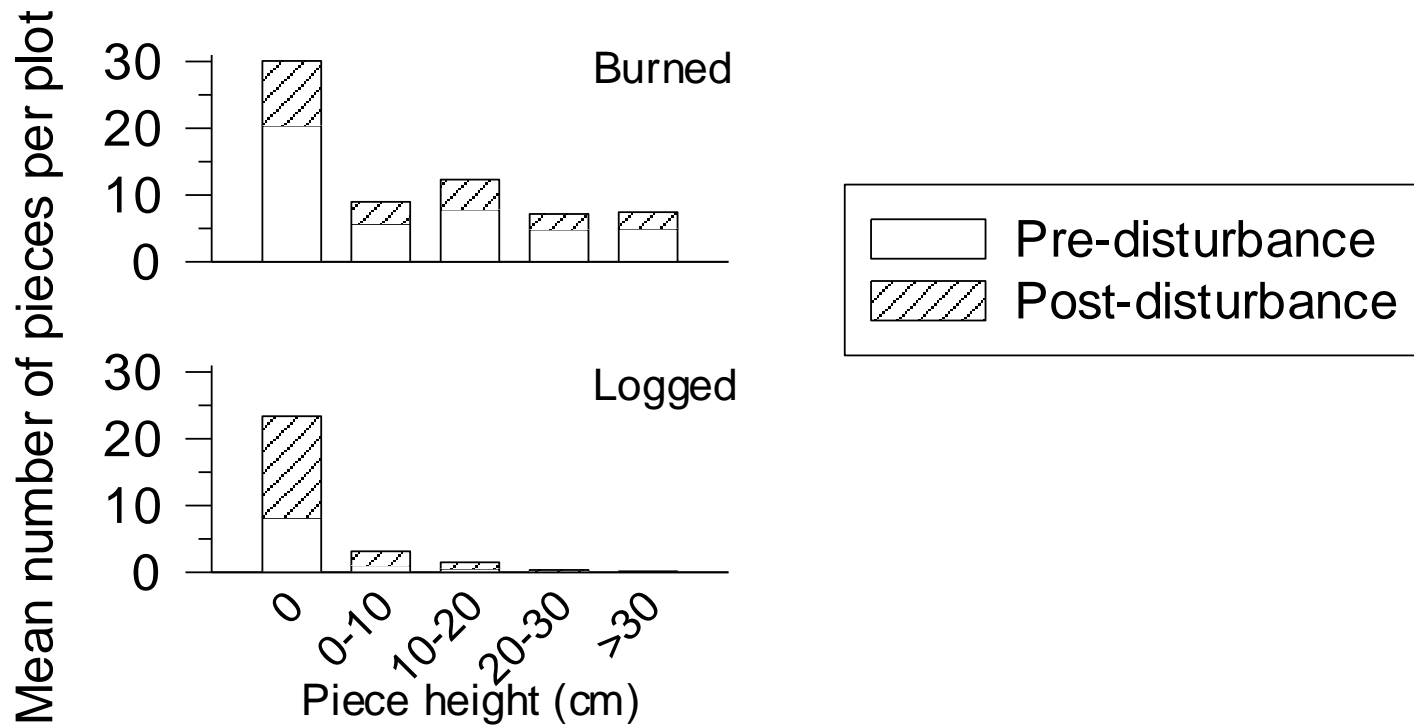
# Down Deadwood: Decay Pattern



*mean of 3 sites*



# Down Deadwood: Height above ground



*mean of 3 sites*



# Summary of Major Findings

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## ◆ Burned stands (36 - 40 yr)

- ❖ deadwood carried over from previous stand was highly variable, occasionally abundant
  - ❖ few standing dead trees
  - ❖ occasionally abundant down deadwood
    - ❖ elevation above ground may slow decay

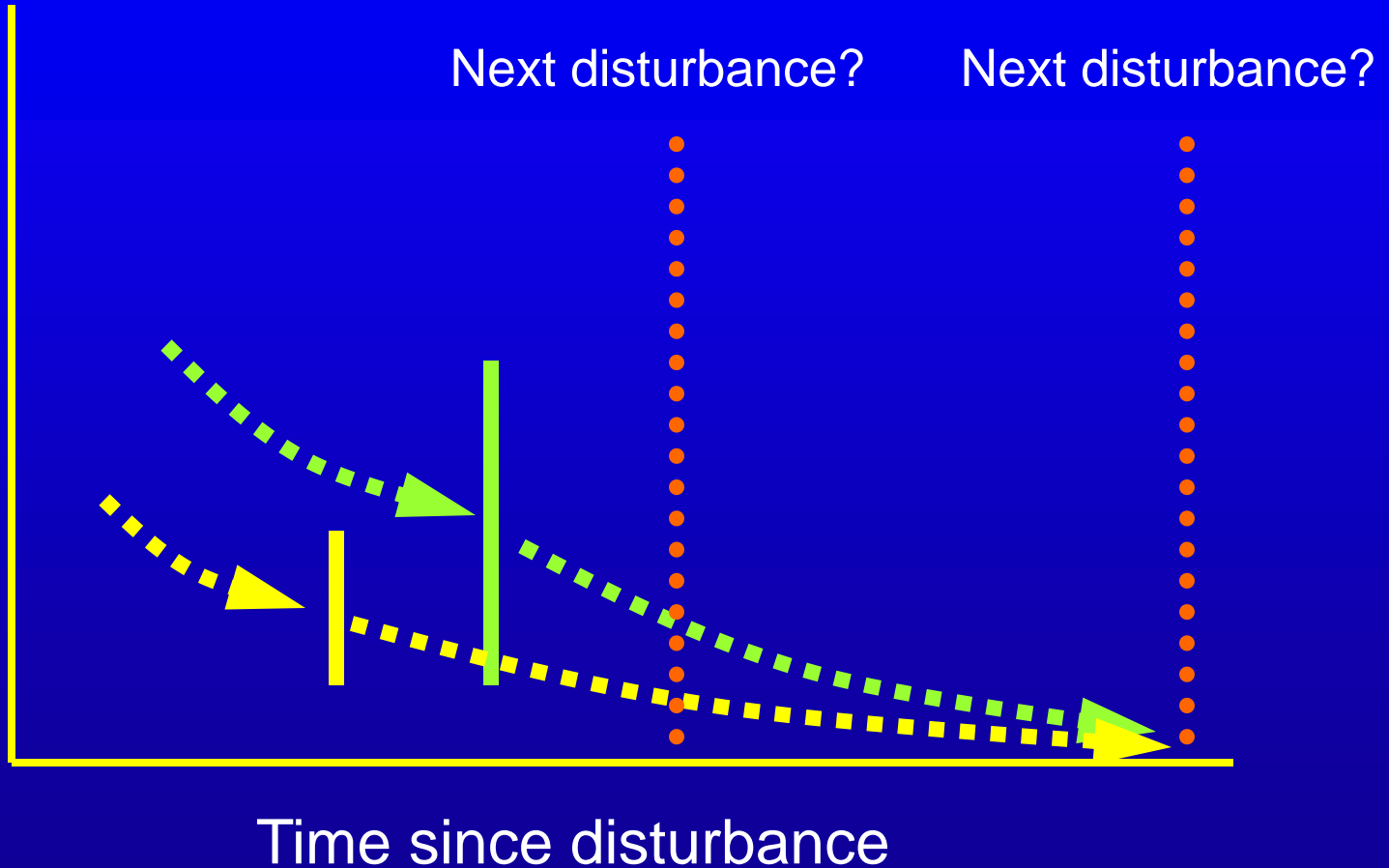
## ◆ Logged stands (23 - 27 yr)

- ❖ less (and less variable) deadwood carried over from previous stand compared to burned stands
  - ❖ very few standing dead trees
  - ❖ fewer pieces of down deadwood
    - ❖ contact with ground may accelerate decay



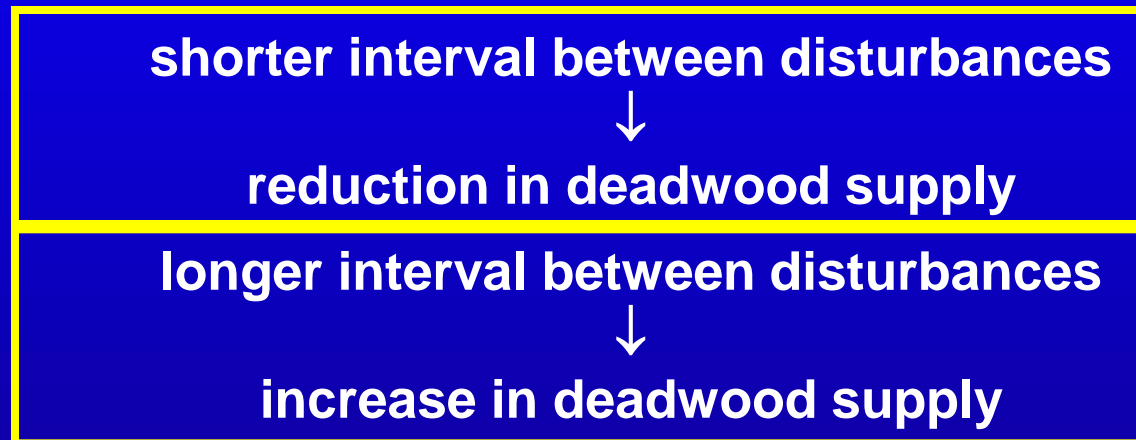
# Successional trajectory: Fire & Logging

Deadwood carried over  
from previous stand



# Successional trajectory: Fire & Logging

- ◆ Pathways for deadwood material carried over from previous stand overlap, but average amounts may differ considerably for many decades after disturbance
- ◆ Probable effects of return interval:



- ◆ Fire: Variable return interval
- ◆ Logging: Less variable return interval (?)

# Additional considerations

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- ◆ Adoption of the natural disturbance model may be more difficult at stand scales compared to landscape scales
- ◆ Construction of yield curves for some wildlife habitat variables should distinguish among origin types
  - ❖ fire vs logging
- ◆ Ecological function of future logged stands may be dissimilar to similar-aged burned stands



# Silvicultural solutions?

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- ◆ IF: An increase in the supply of deadwood material in future logged stands is a desired outcome of management,
- ◆ AND: Material retained during harvest may be standing or down,
- ◆ THEN: Retention of **standing** live and dead trees during harvest would provide a potential source of future down deadwood several decades after harvest

