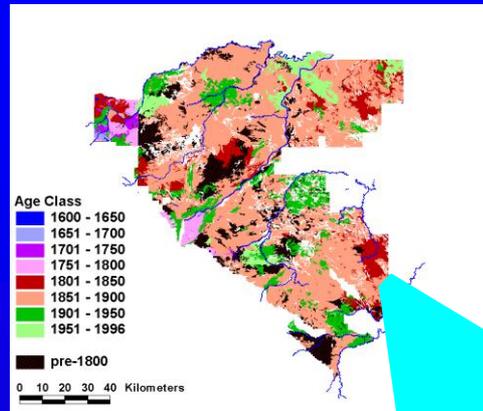


**Natural Disturbance
as a Template for
Forest Management:**

**Lessons from the
Alberta Foothills**

Patterns at Different Scales



100 km

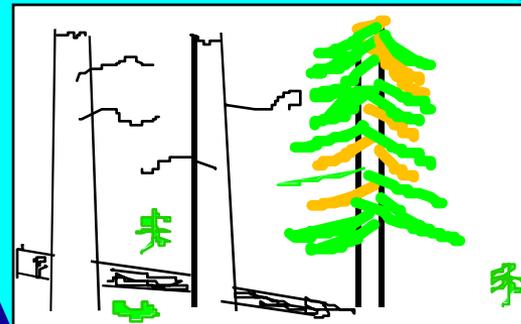
Mosaic of many wildfire patches

Within-patch structure

10 km



0.001 km



Structure within a stand

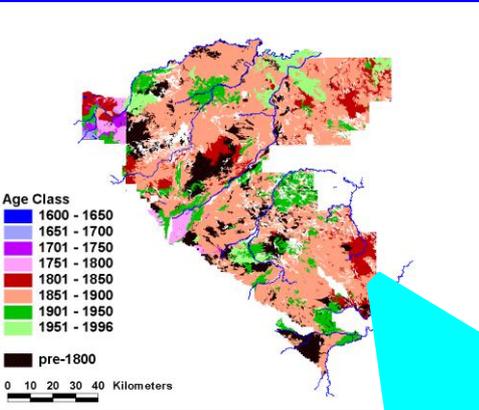
Wildfire and Logging in the Foothills

- ◆ **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, but changes in biological diversity are likely**
- ◆ **Studies of fire ecology can assist forest managers attempting to more closely approximate natural disturbance**





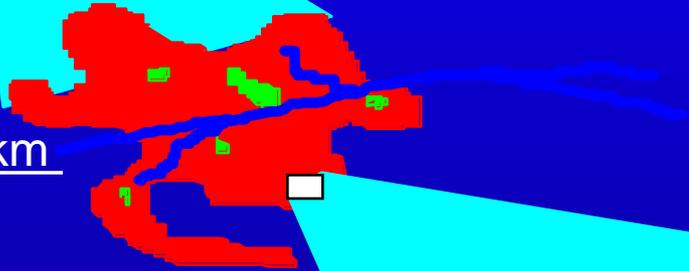
Mosaic of many wildfire patches



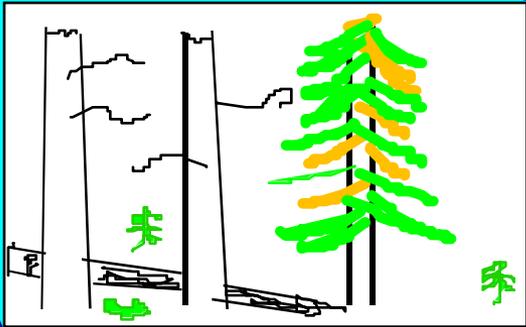
100 km

Within-patch structure

10 km



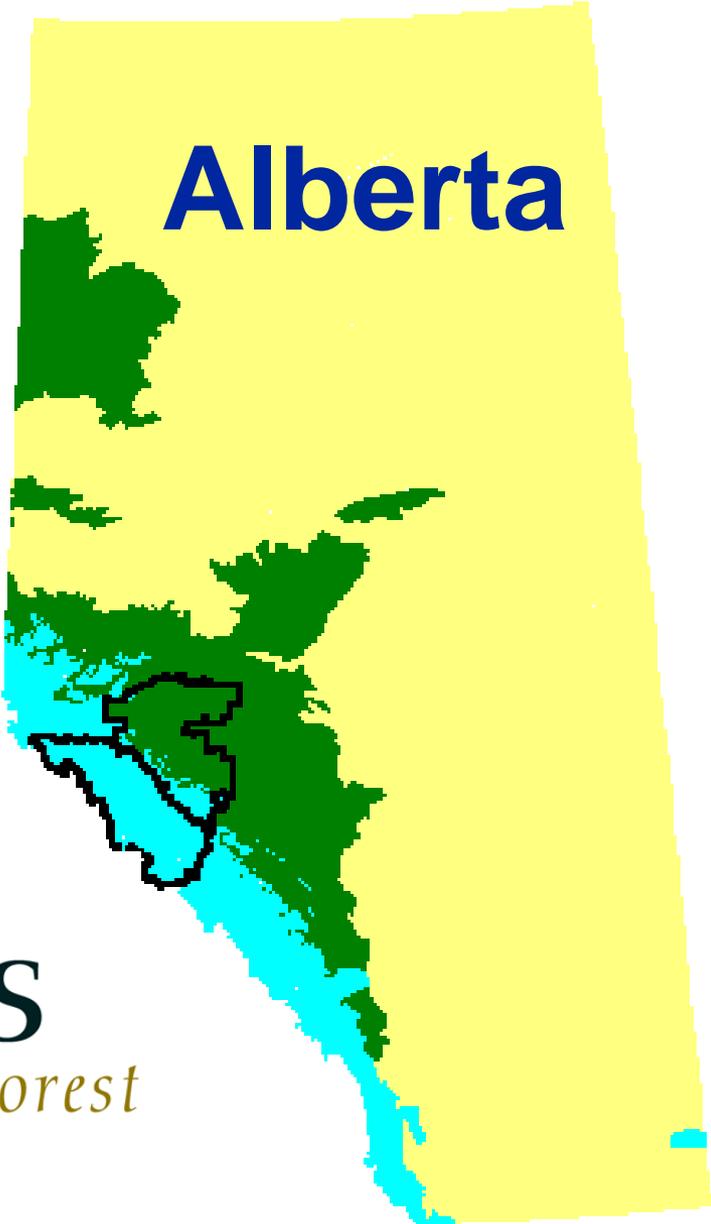
0.001 km



Structure within a stand

Landscape Disturbance

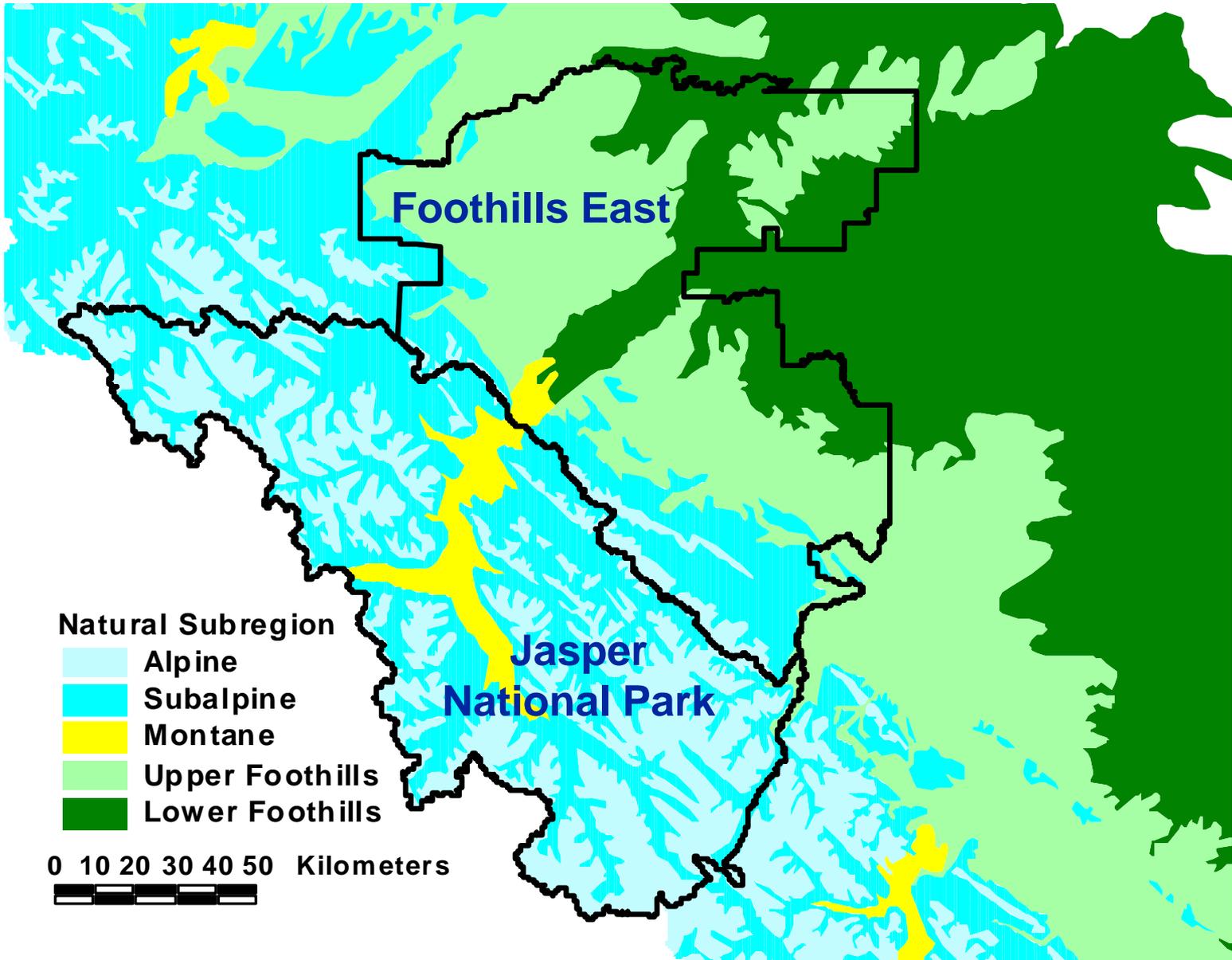
- ◆ Describe natural disturbance regime across the Foothills Model Forest, including frequency, size, and spatial arrangement of stand-replacing wildfires
 - ❖ Weldwood FMA area
 - ❖ Other Provincial lands
 - ❖ Jasper National Park



Alberta

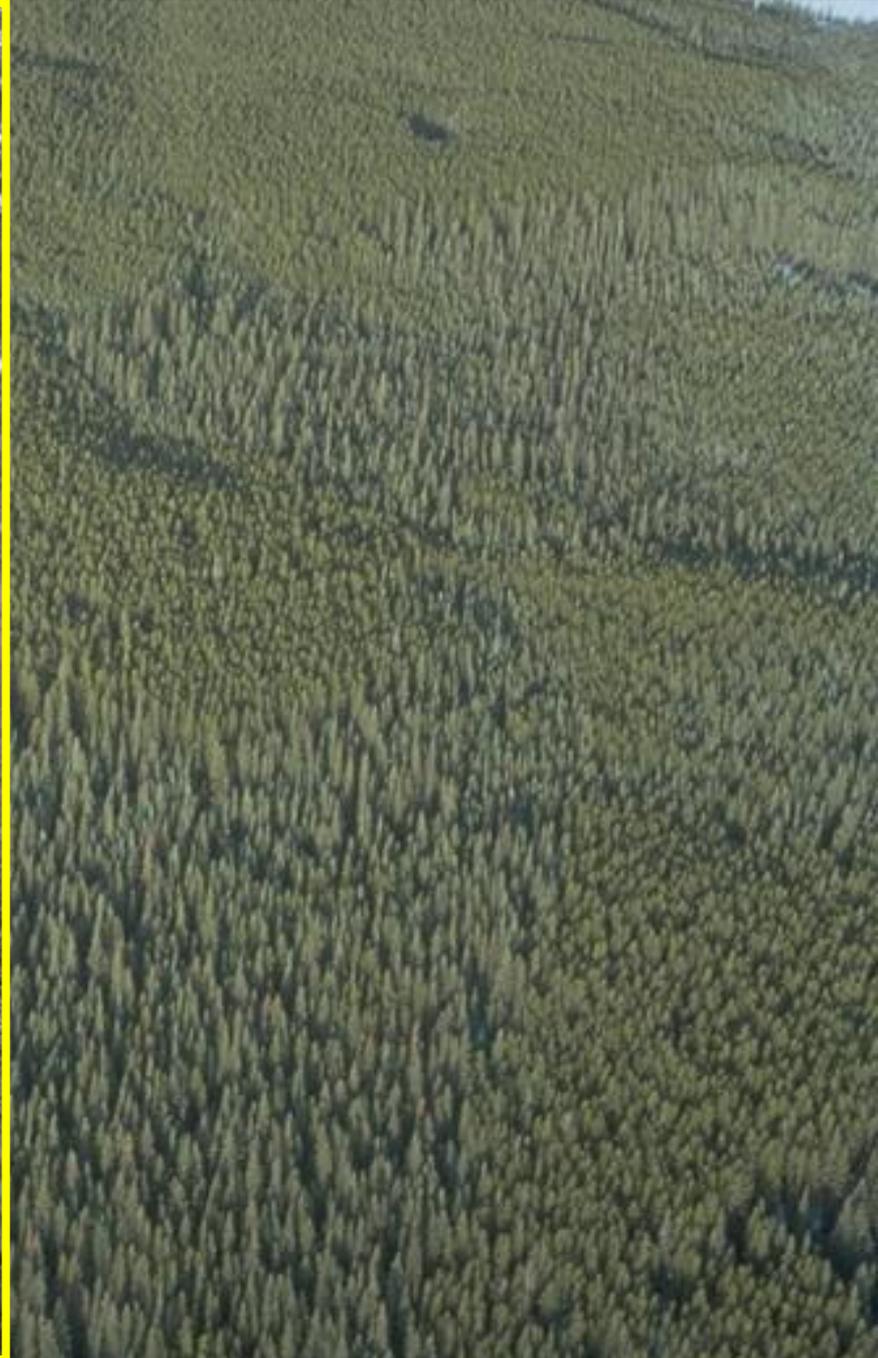


foothills
model forest
a growing understanding



Inventory: Stand Origin Map

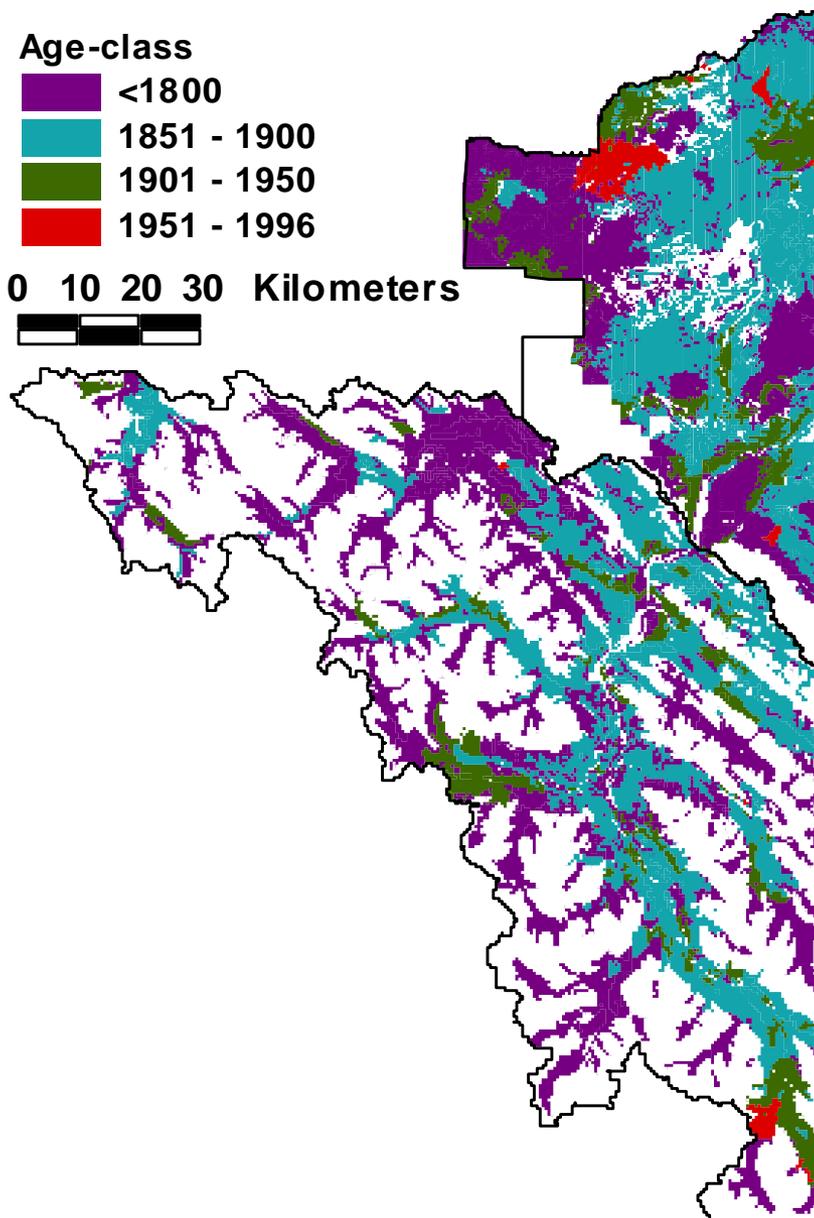
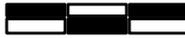
- ◆ **1:50,000 time-since-fire mapping**
 - ❖ **coarse resolution, smallest patches not mapped**
- ◆ **air photo interpretation of historical fire boundaries**
- ◆ **ground sampling for evidence to date fire events**
- ◆ **adequate for past 150 years, less confidence in age of older stands**



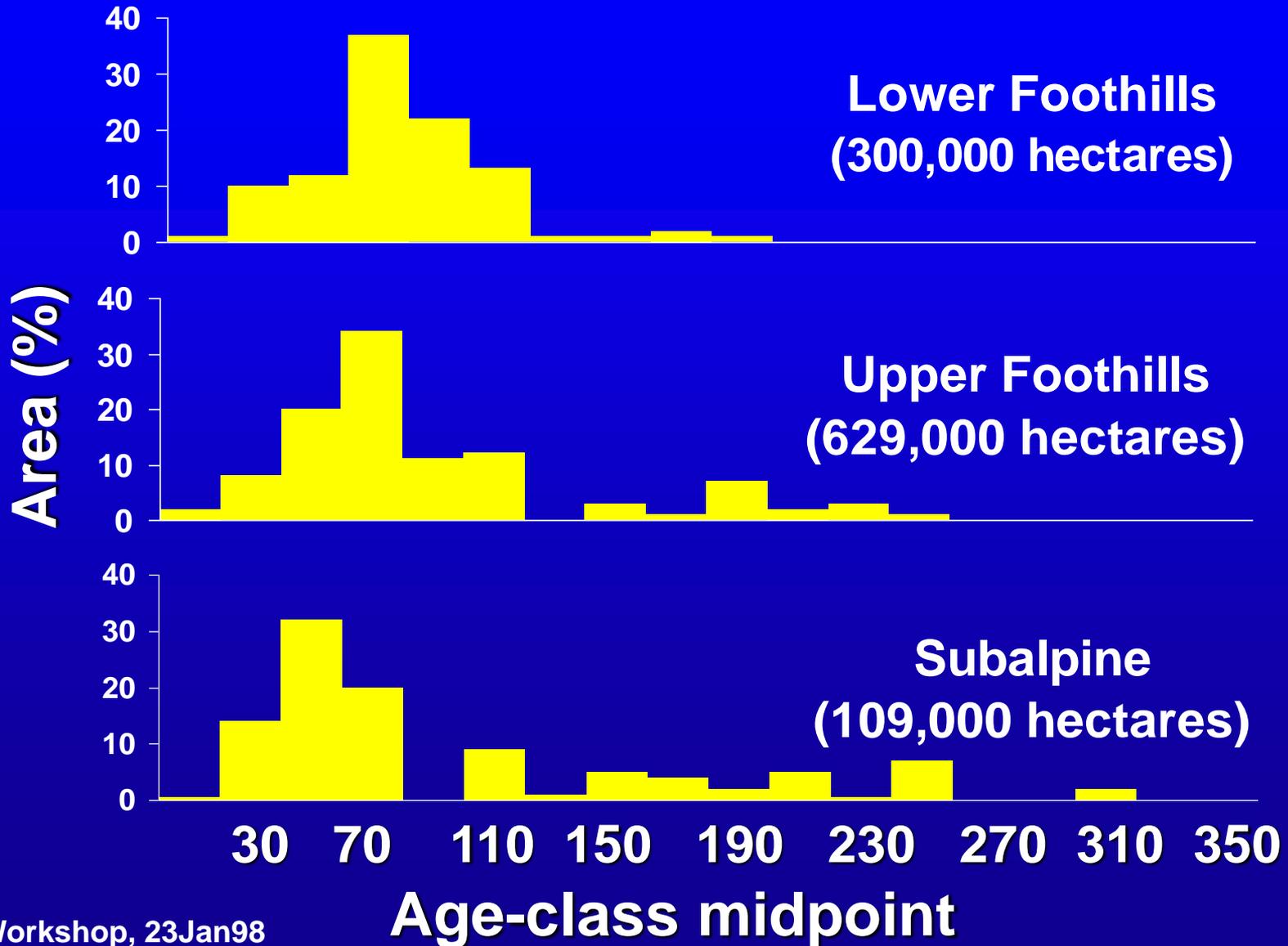
Age-class

-  <1800
-  1851 - 1900
-  1901 - 1950
-  1951 - 1996

0 10 20 30 Kilometers



Patch Age (as of 1950)

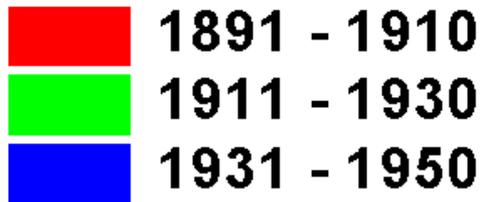


Sizes of patches created by wildfire

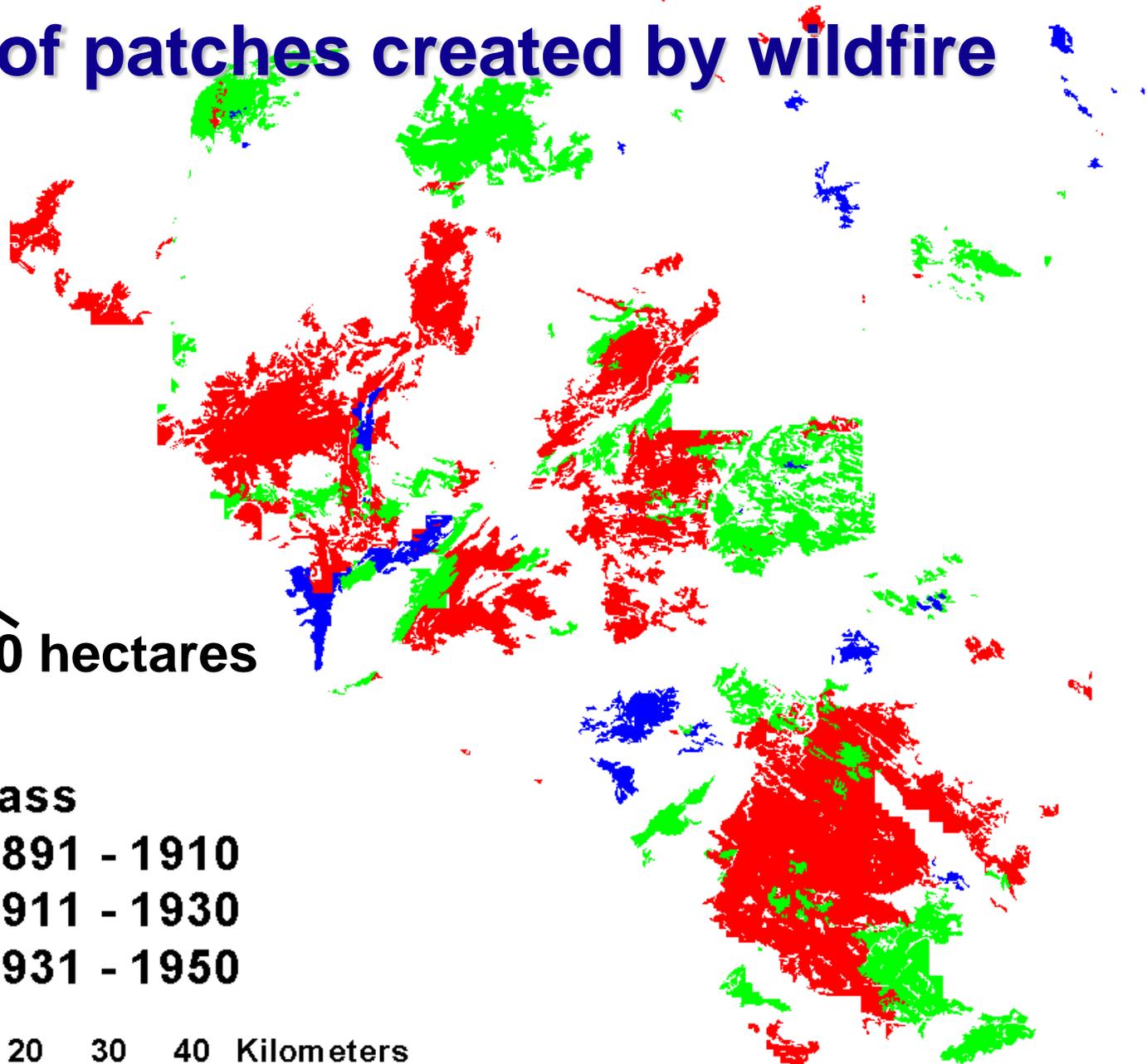


10,000 hectares

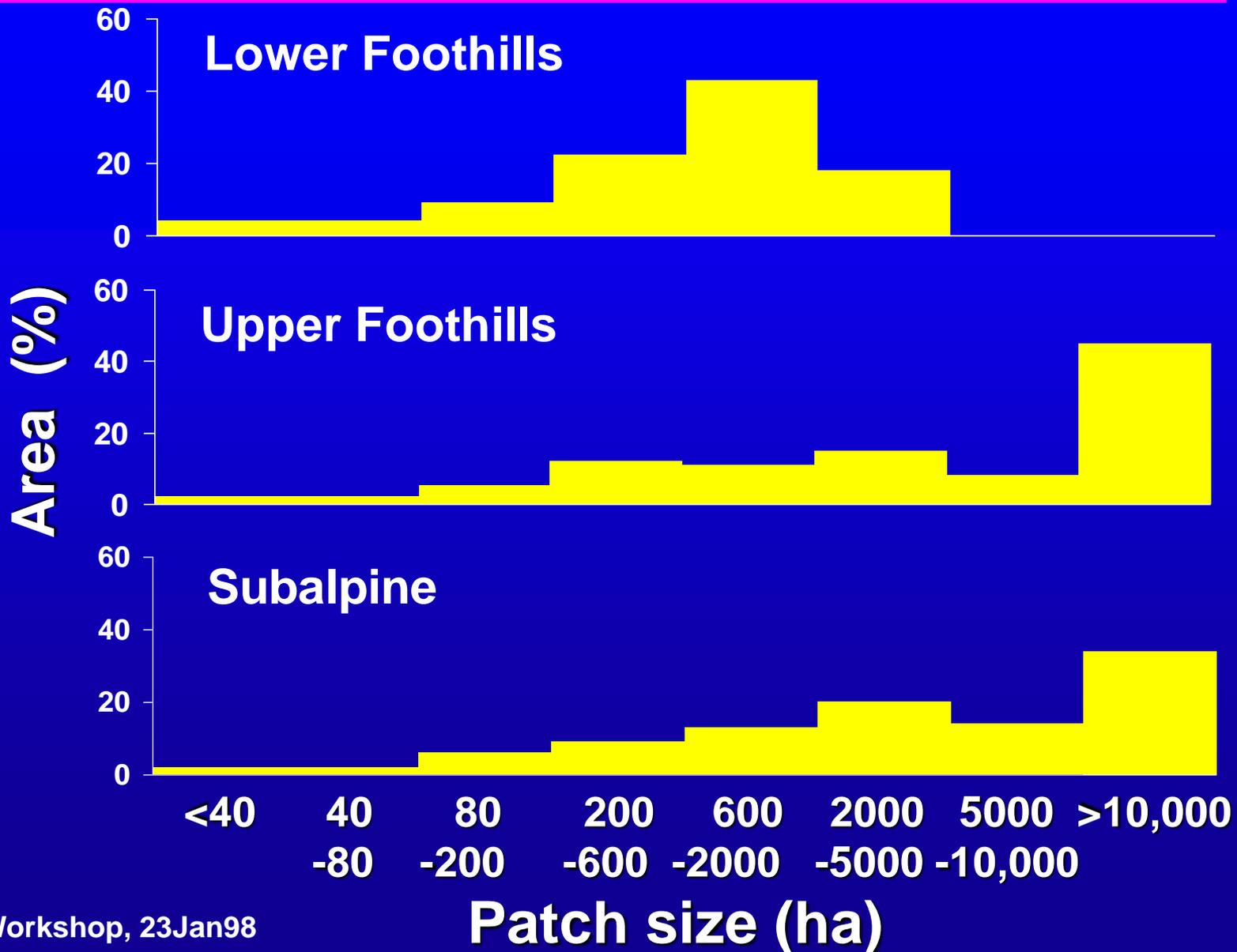
Age-class



0 10 20 30 40 Kilometers

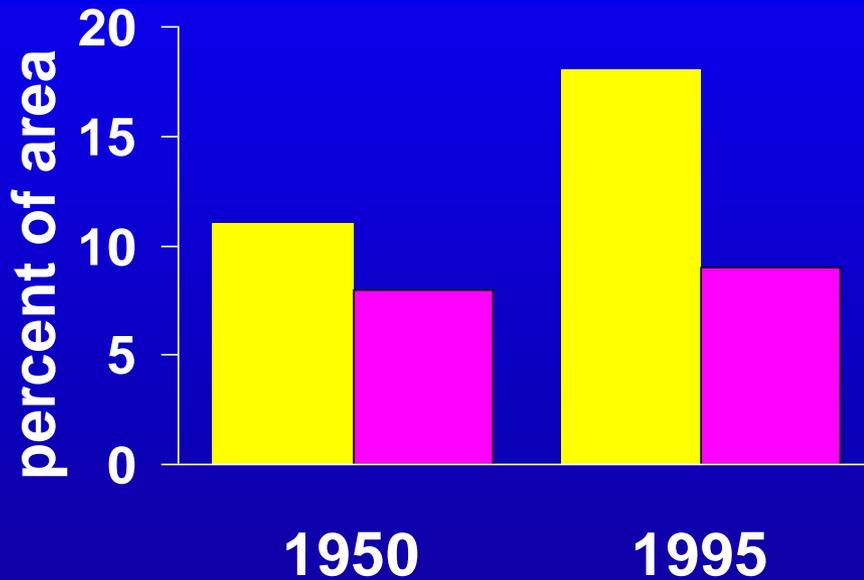


Patch size

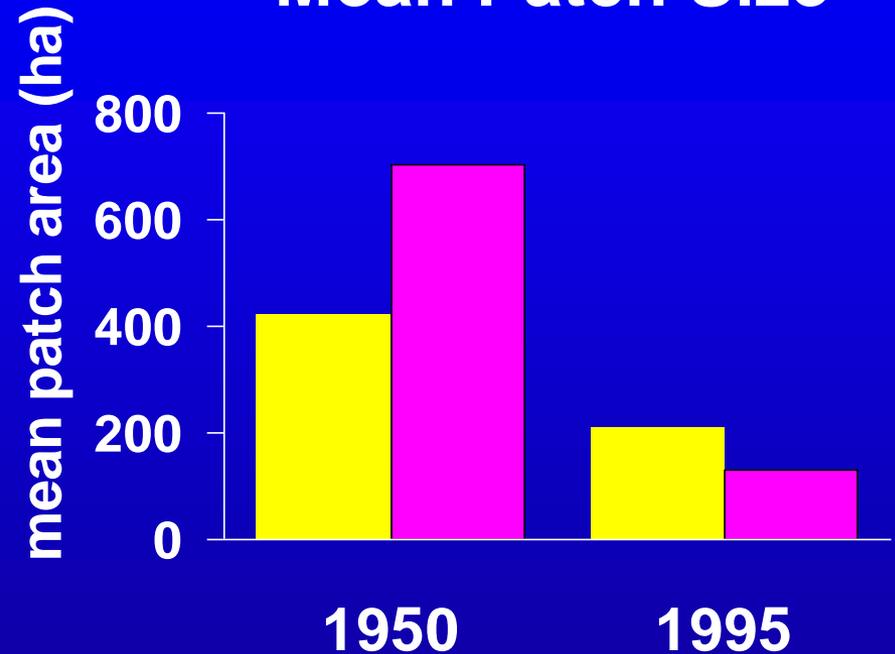


Changes in area & patch size

Total Area



Mean Patch Size



■ Young forest

■ Old forest

■ Young forest

■ Old forest

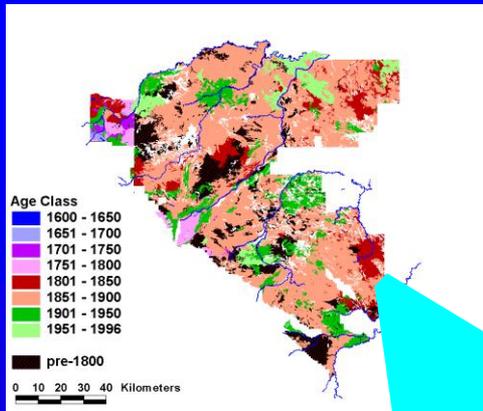
Management Implications

◆ IF

- ❖ modifications to harvest planning to more closely resemble natural disturbance is a goal of forest management

◆ THEN

- ❖ rotation lengths should be different in different natural subregions
- ❖ rotation lengths should exceed the traditional “80 - 100 years”
- ❖ harvest units should be aggregated in order to create some very large even-aged patches of forest (promoting a wide range of patch sizes)

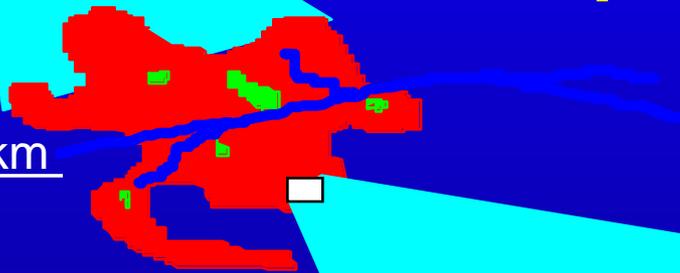


Mosaic of many wildfire patches

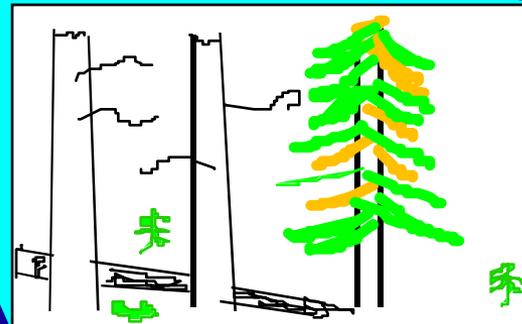
100 km

Within-patch structure

10 km



0.001 km

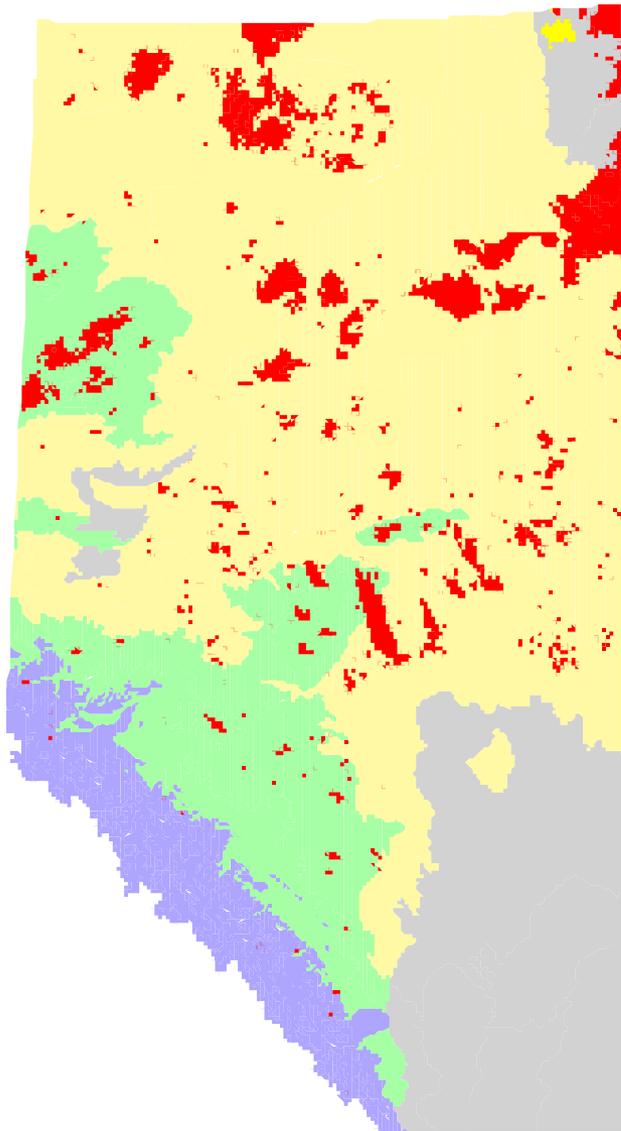


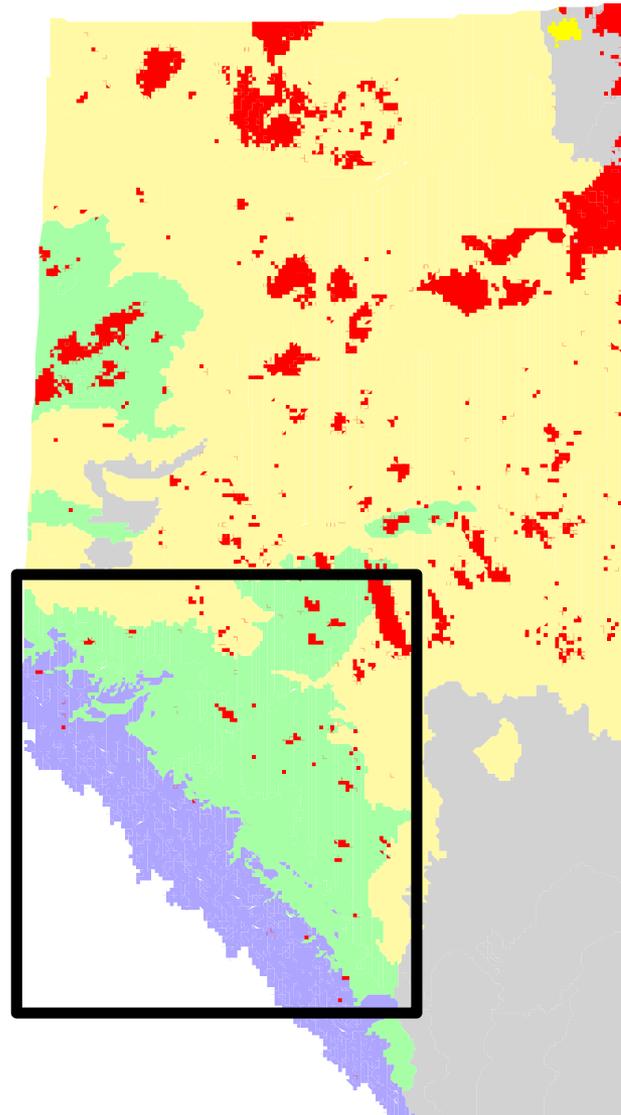
Structure within a stand

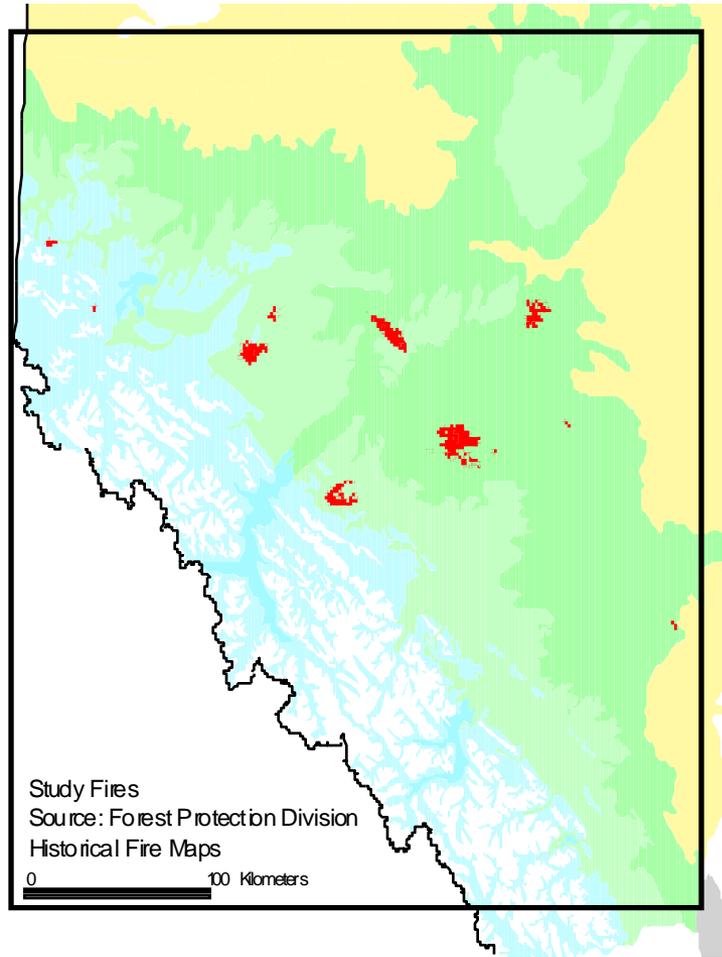
Island Remnants

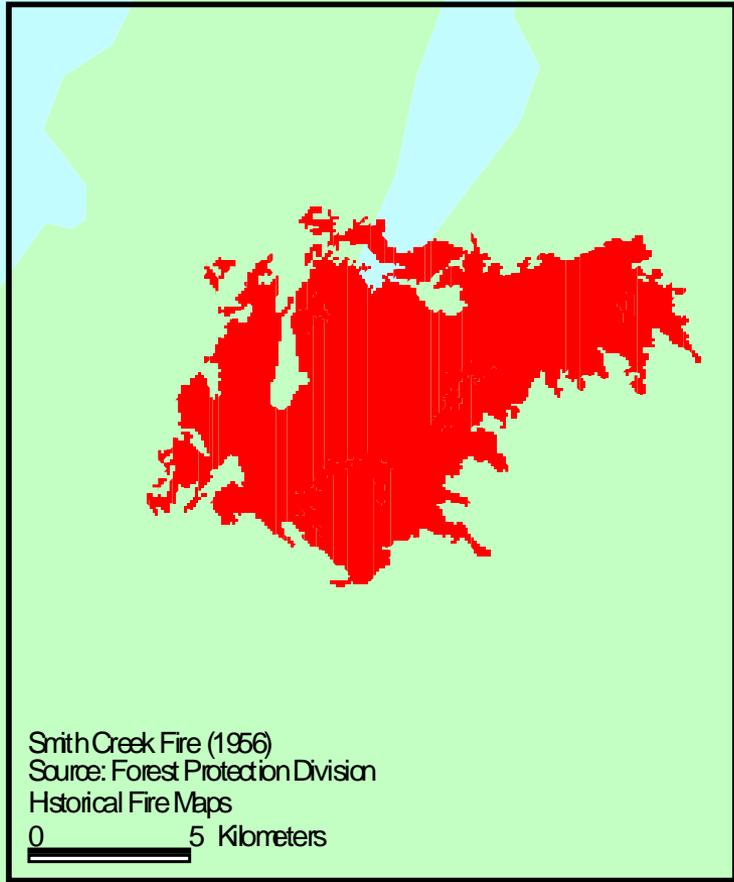




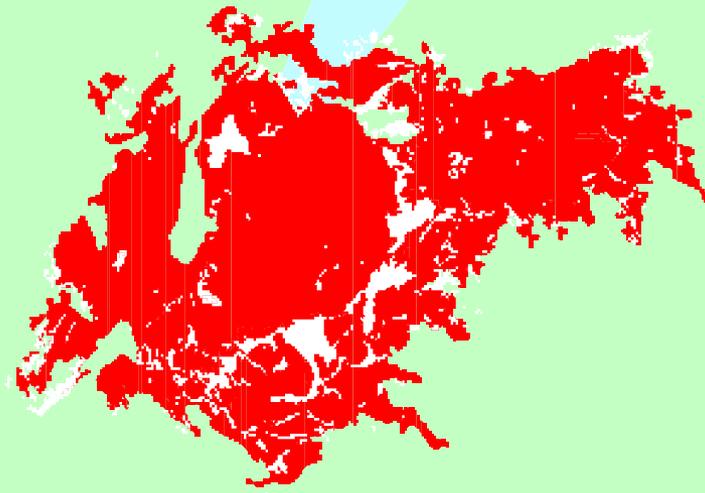








Island Remnants

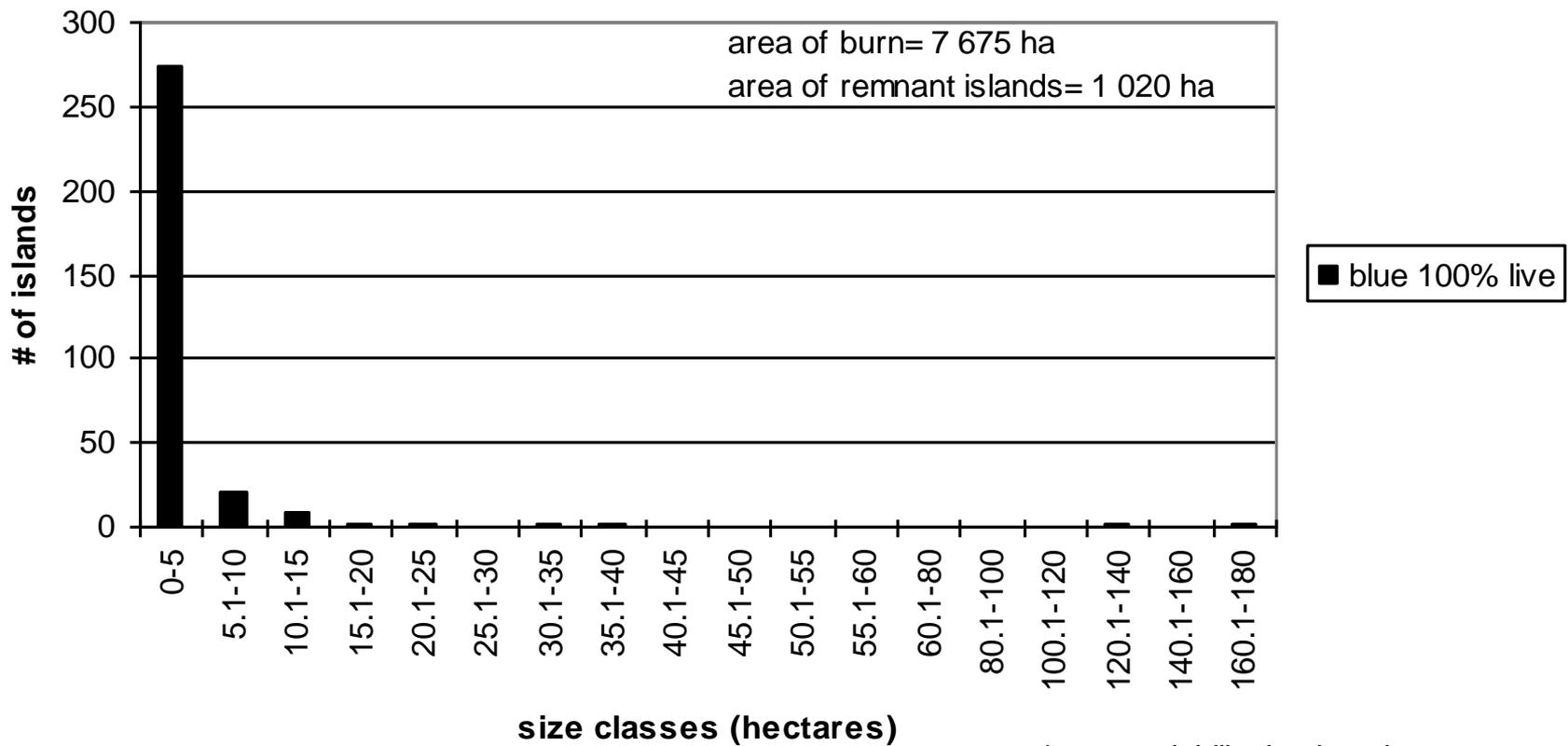


Smith Creek Fire (1956)
Source: Foothills Model Forest

0 5 Kilometers

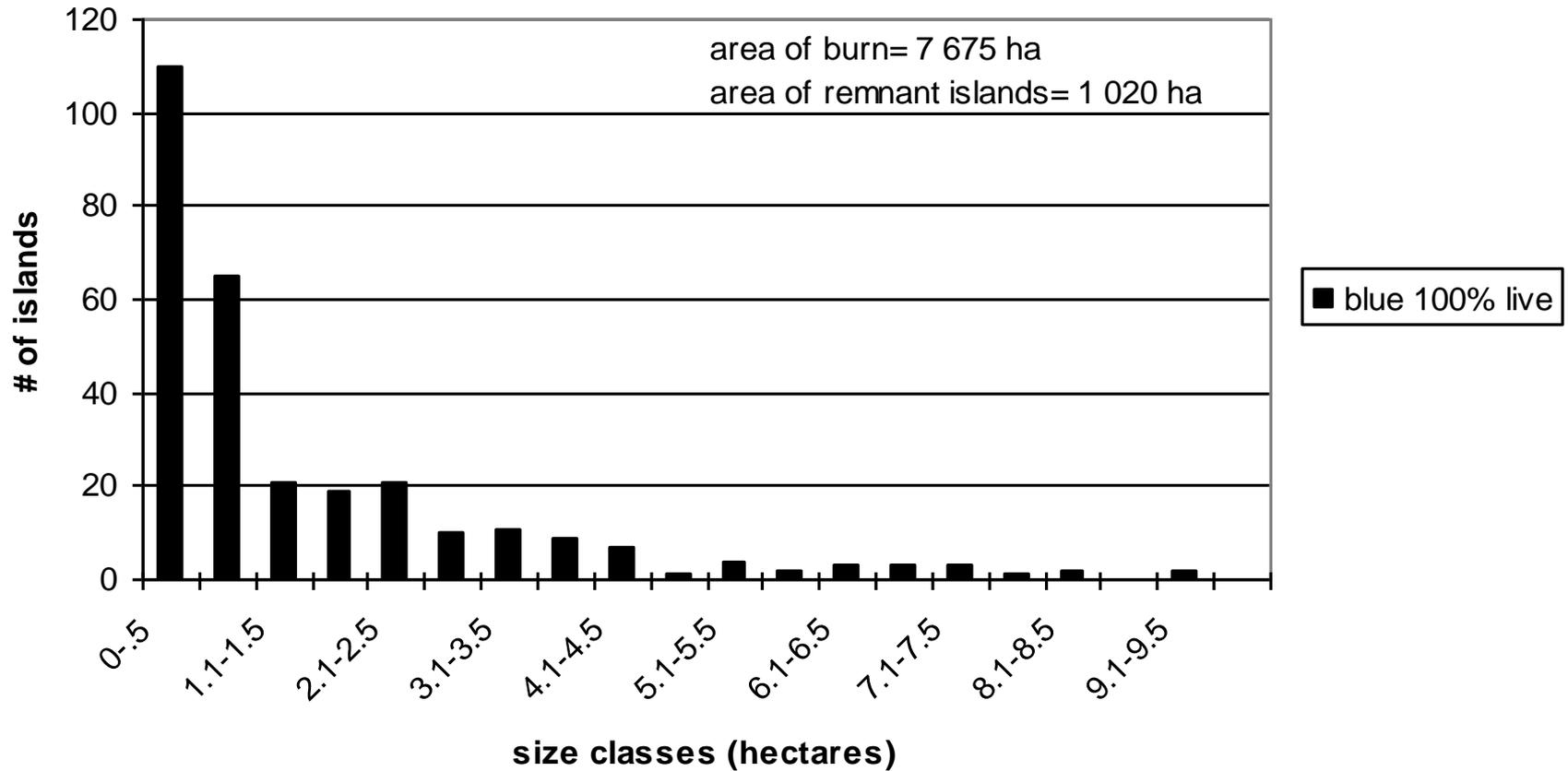
A horizontal scale bar with a black outline, divided into five equal segments. The text '0' is at the left end and '5 Kilometers' is at the right end.

**Size class distribution of remnant islands for the Smith Creek fire,
#1120, n= 310**



*note variability in size classes

Size class distribution of remnant islands, 0 to 10 ha, for the Smith Creek fire, #1120, n= 310



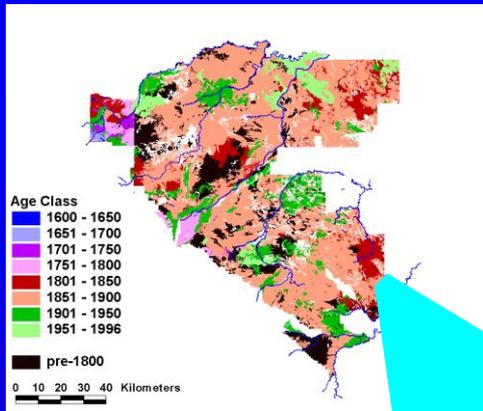
Management Implications

◆ IF

- ❖ more closely approximating the patterns of remnants created by wildfires is a goal of forest management

◆ THEN

- ❖ remnants in harvested areas should range in size and abundance
 - ❖ actual size distribution and abundance of remnants in several Foothills fires is still being determined



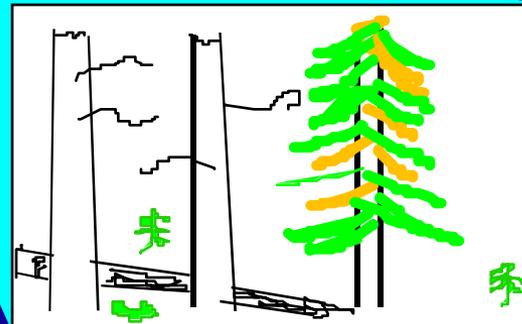
Mosaic of many wildfire patches

100 km

Within-patch structure

10 km

0.001 km



Structure
within a
stand

What is stand structure?

- ◆ **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**

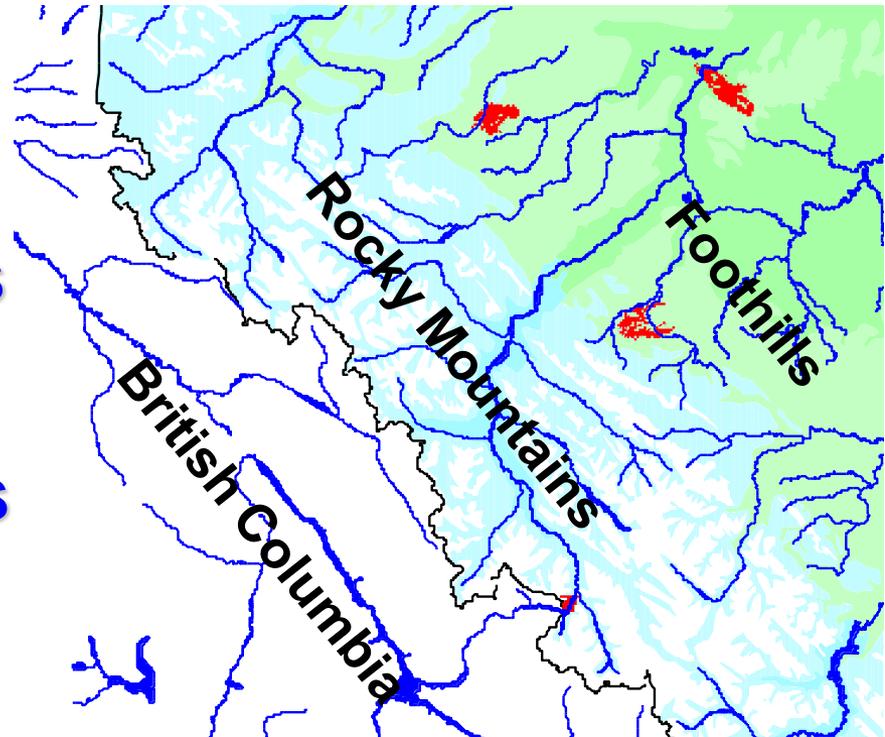


Stand Structure Project

- ◆ 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

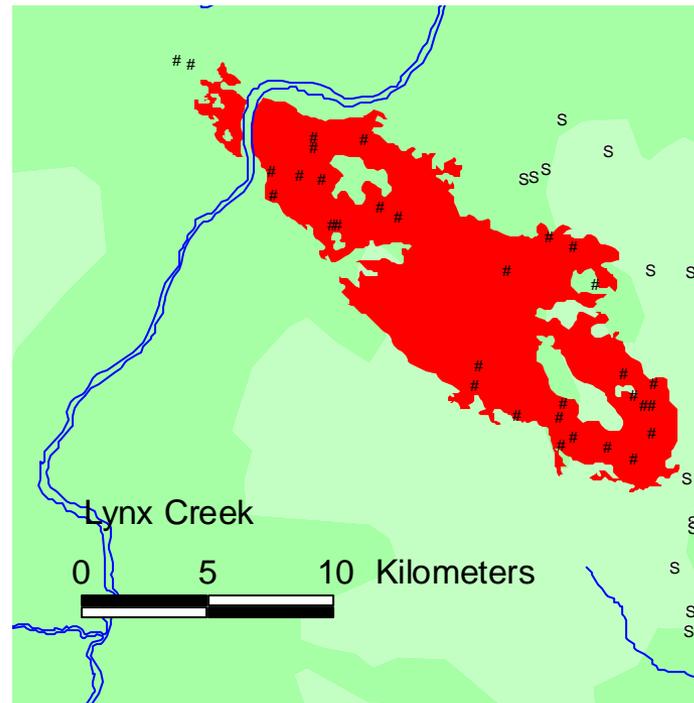
Study areas

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

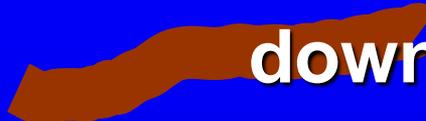


Sample plot layout

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

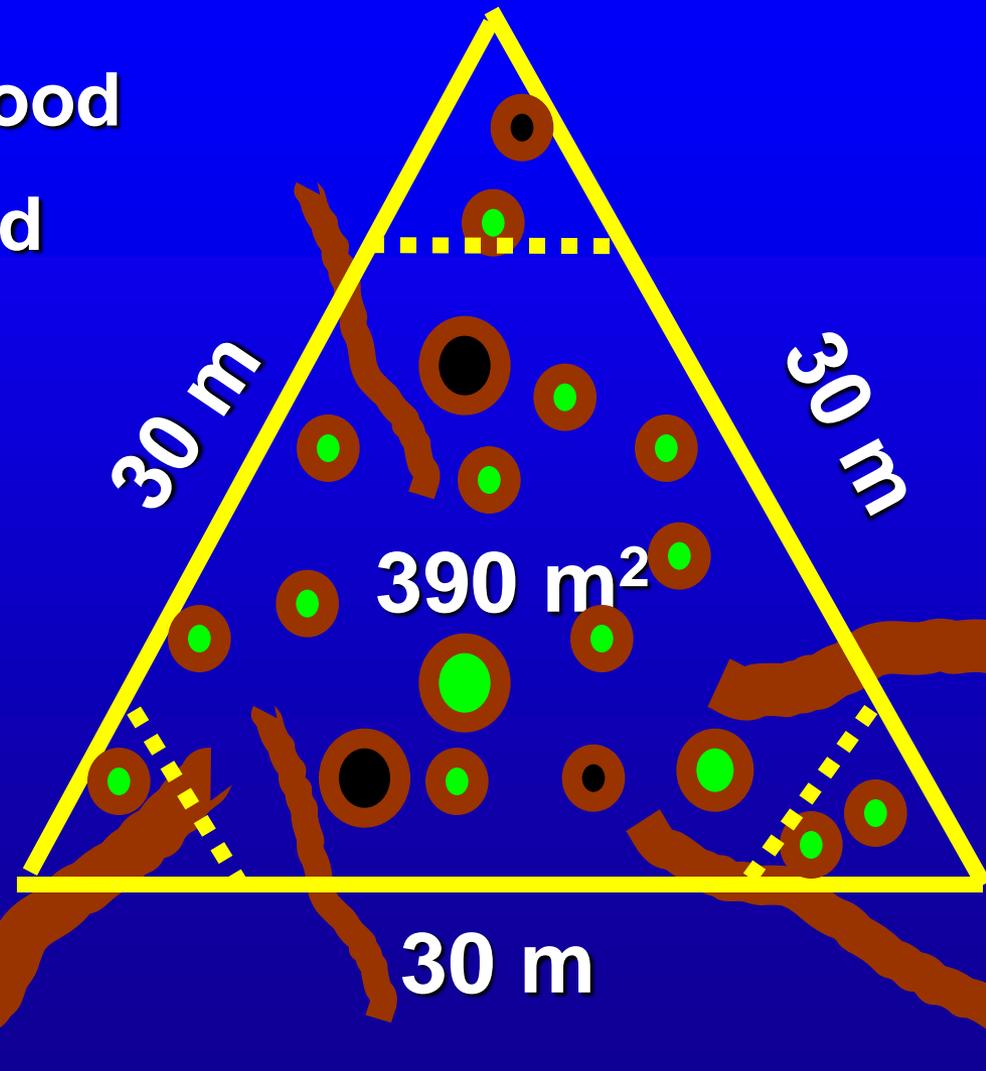


Sampling method

 down deadwood

 standing dead

 standing live



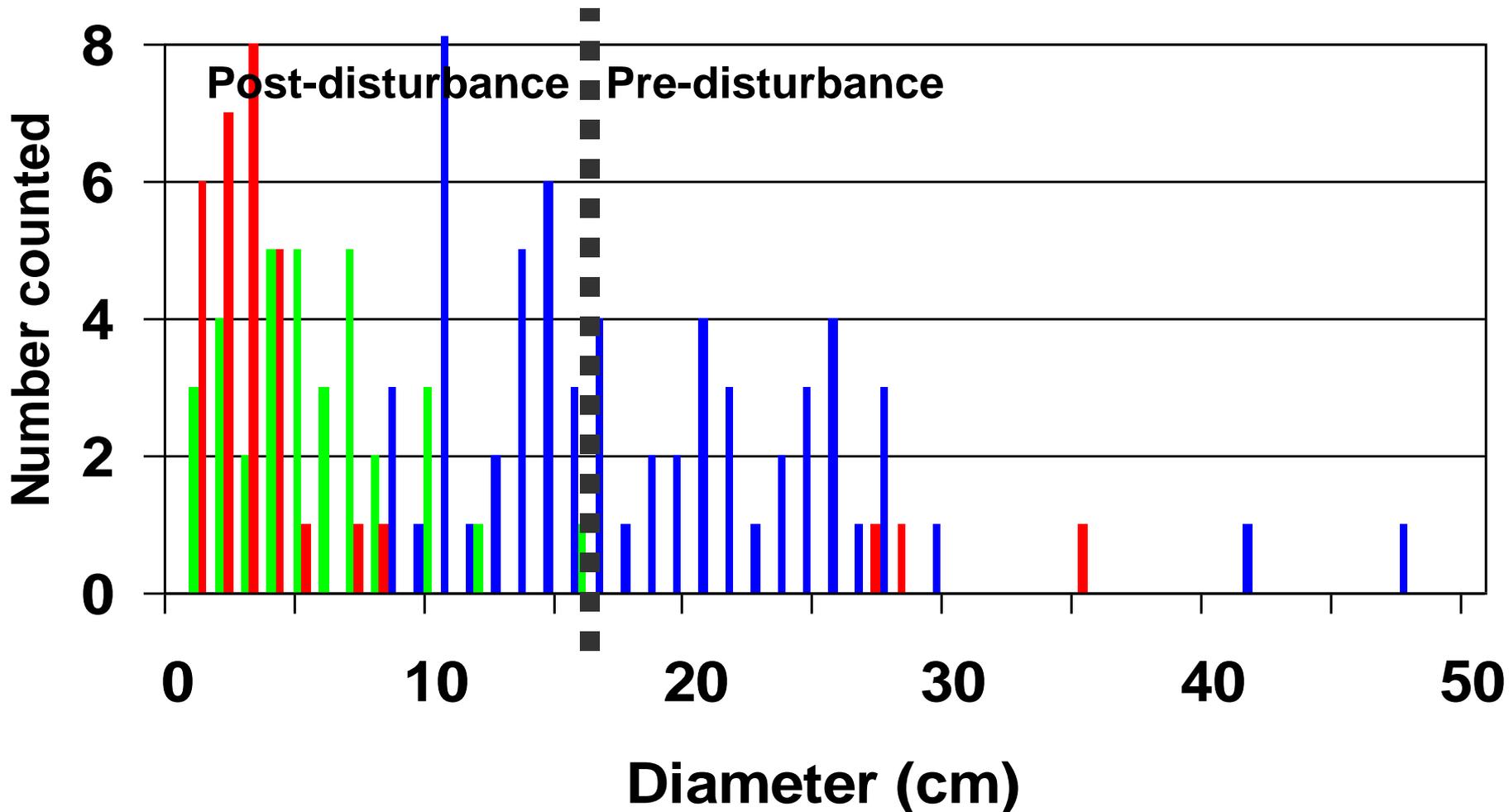






Distinguishing Deadwood Origin

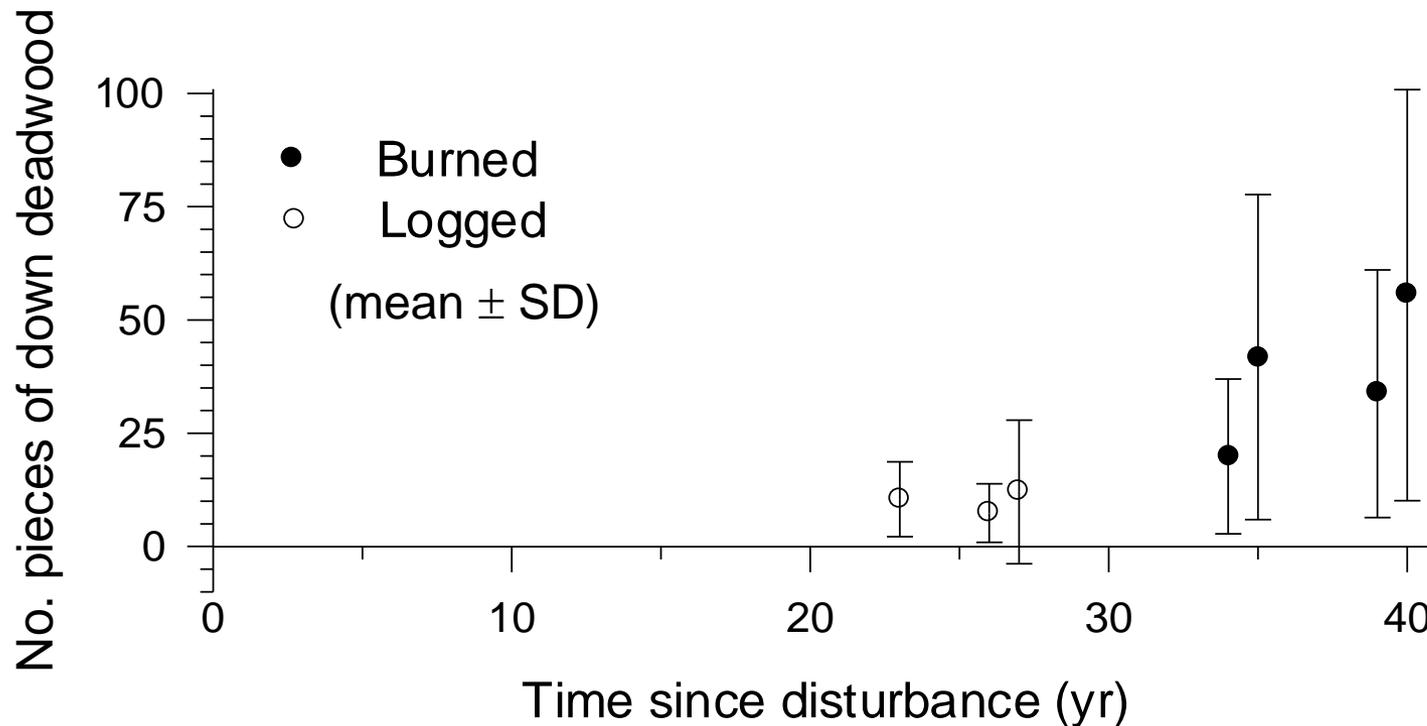
■ Live ■ Standing Dead ■ Down Dead





Down Deadwood: Pre-disturbance

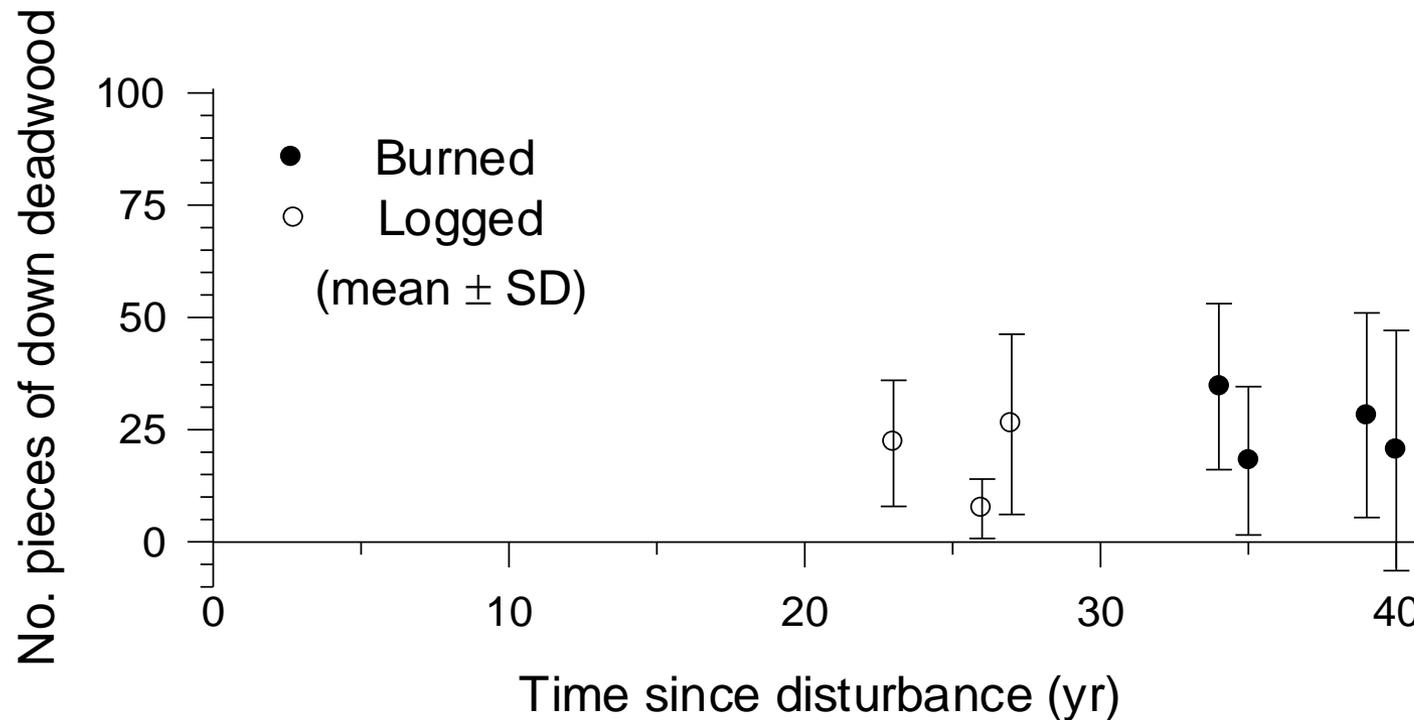
(> 7 cm diameter)



Mean: Burned > Logged
Variability: Burned > Logged

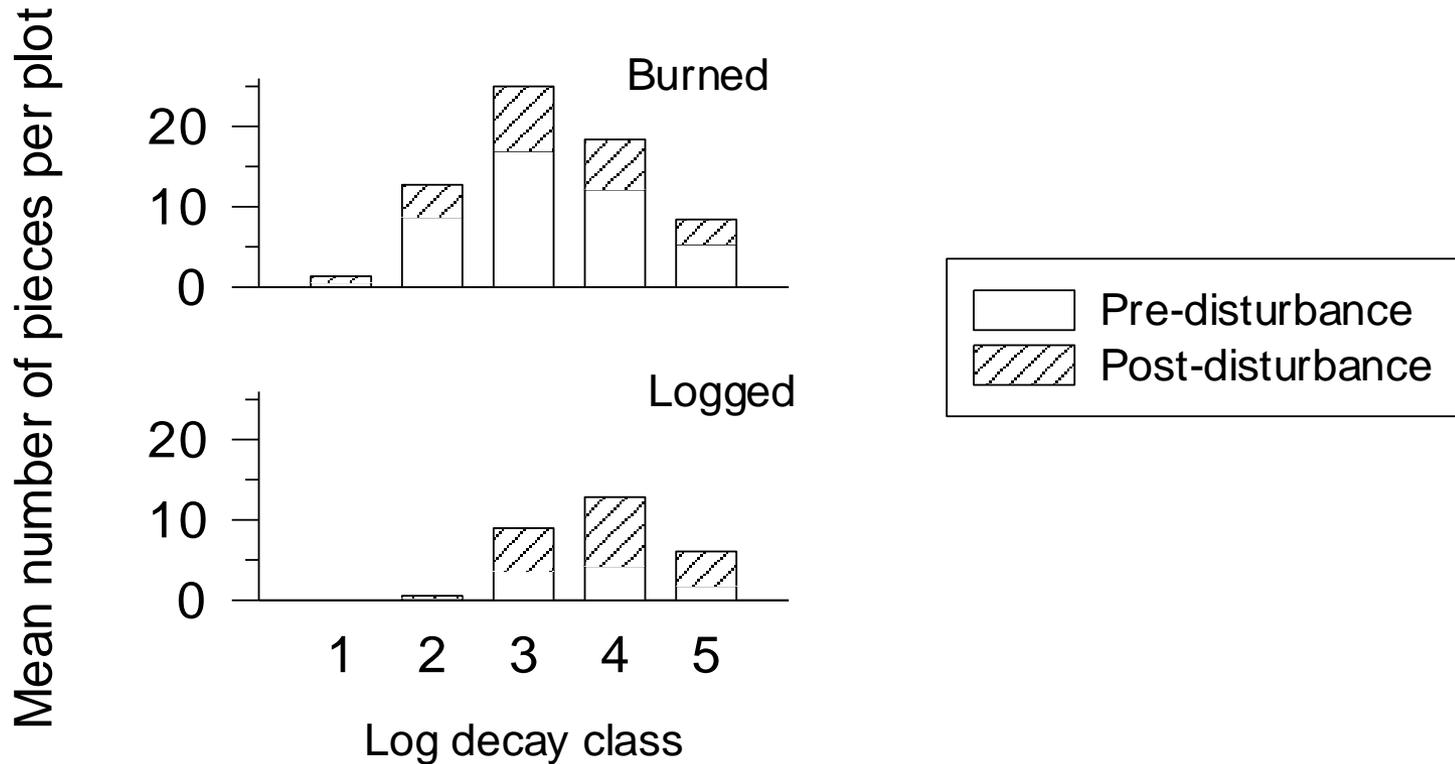
Down Deadwood: Post-disturbance

(> 7 cm diameter)



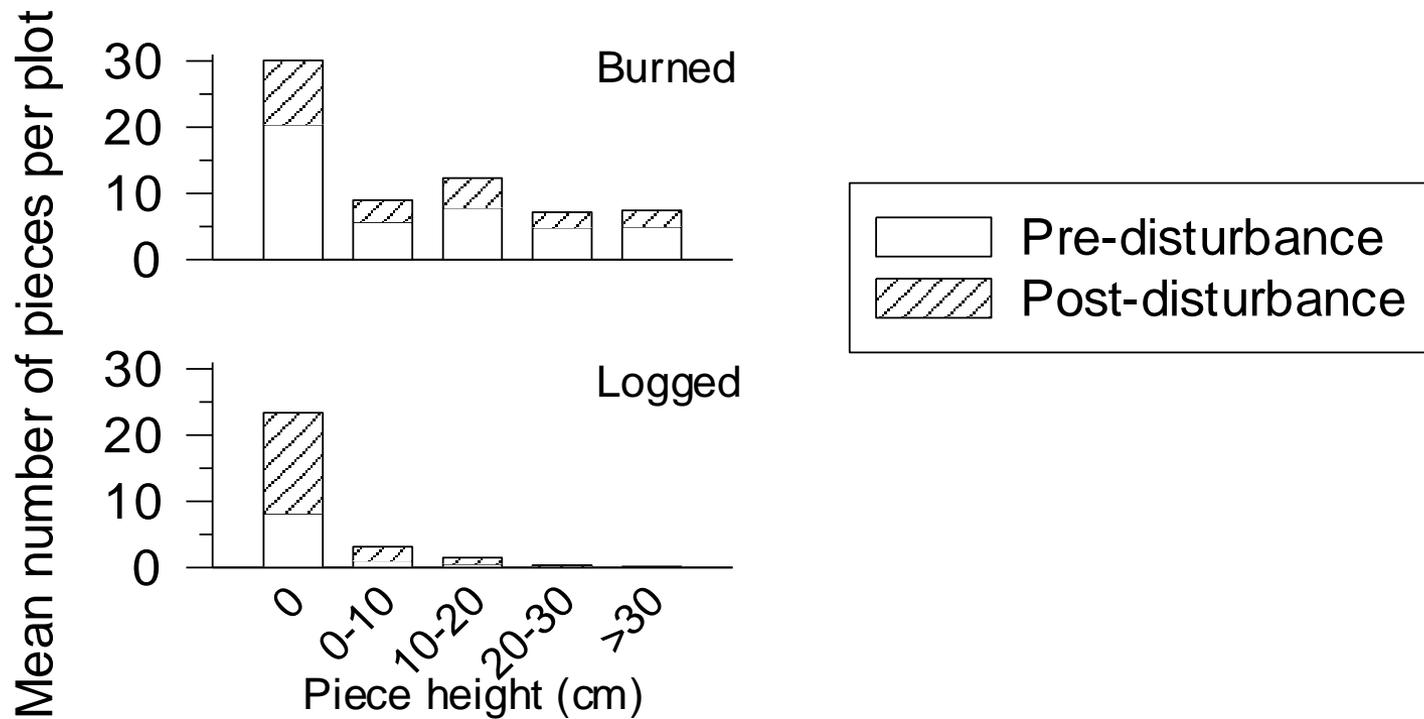
Mean: Burned = Logged
Variability: Burned = Logged

Down Deadwood: Decay Pattern



mean of 3 sites

Down Deadwood: Height above ground



mean of 3 sites



Summary of Major Findings

◆ 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

Management Implications

◆ IF

- ❖ An increase in the supply of deadwood material in future logged stands is a desired outcome of forest 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

