

The Dynamics of In-Stream Large Woody Debris

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Research Goals

- I) Understand LWD dynamics
- II) Links between riparian forests and LWD

Questions

- 1) Time since death of LWD ?
- 2) Rates of decay?
- 3) Processes determining recruitment ?

- **small, headwater streams**
- **width <3.5m, no transport**
- **mature riparian forests**
- **5 pine-dominated sites**
- **5 spruce-dominated sites**

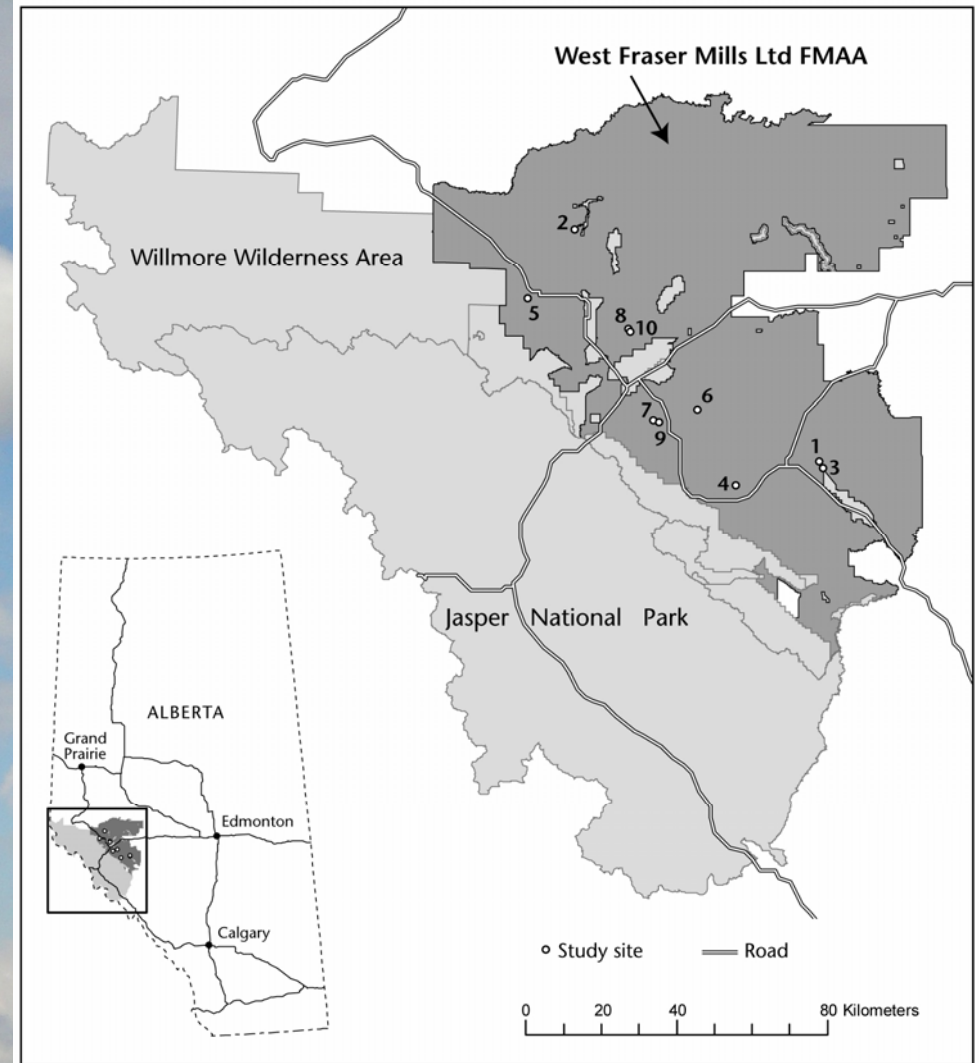
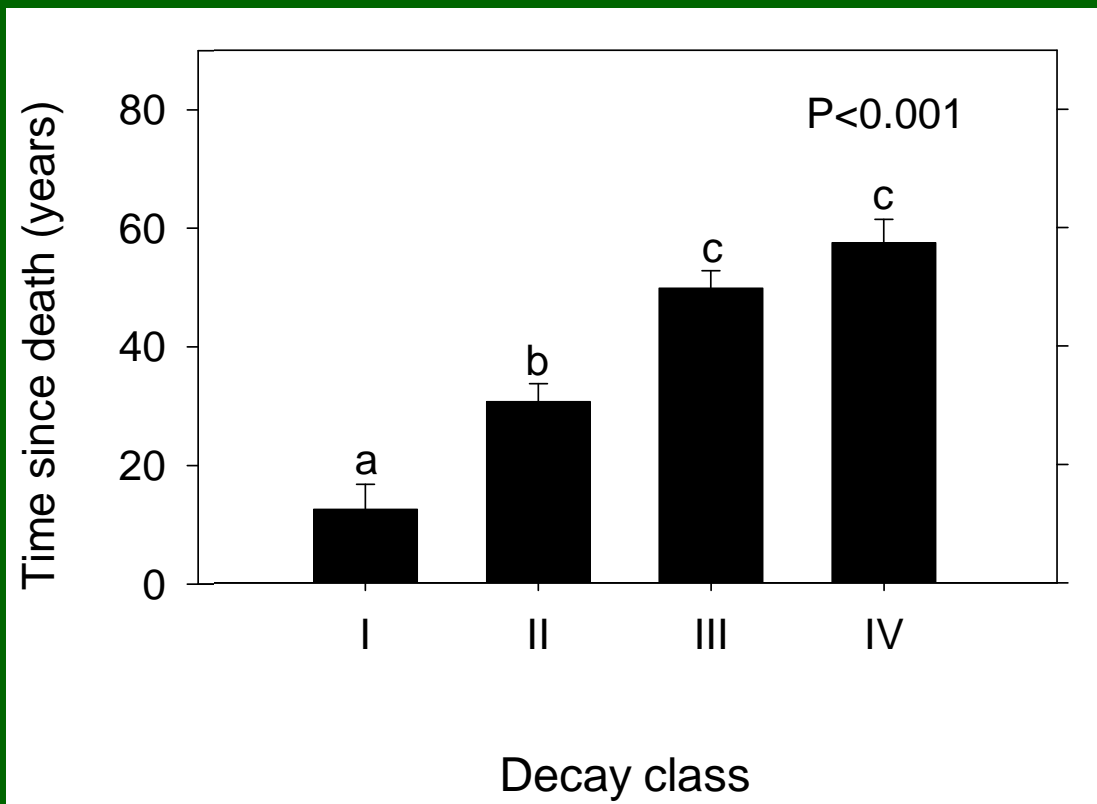


Photo: Sonya Powell



LWD Time Since Death:

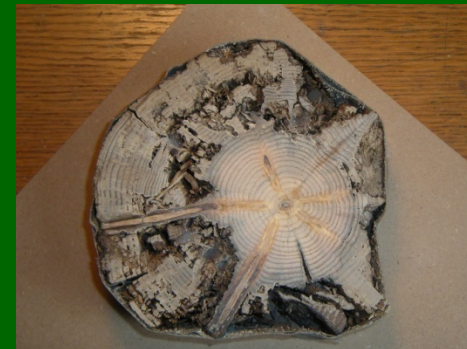
- **2 to 143 years (n = 186 logs)**
- **pine \leq 86 years (n = 113)**
- **spruce \leq 143 years (n = 73)**



DC I - 1997



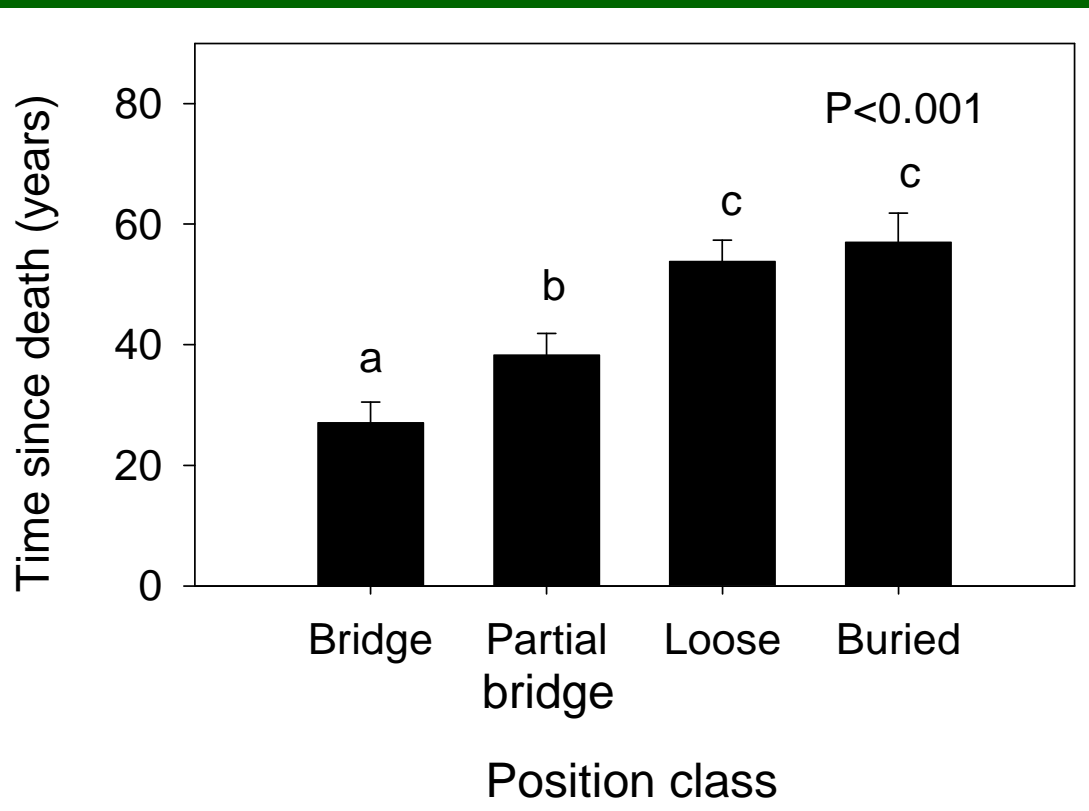
DC II - 1968



DC III - 1951



DC IV - 1943



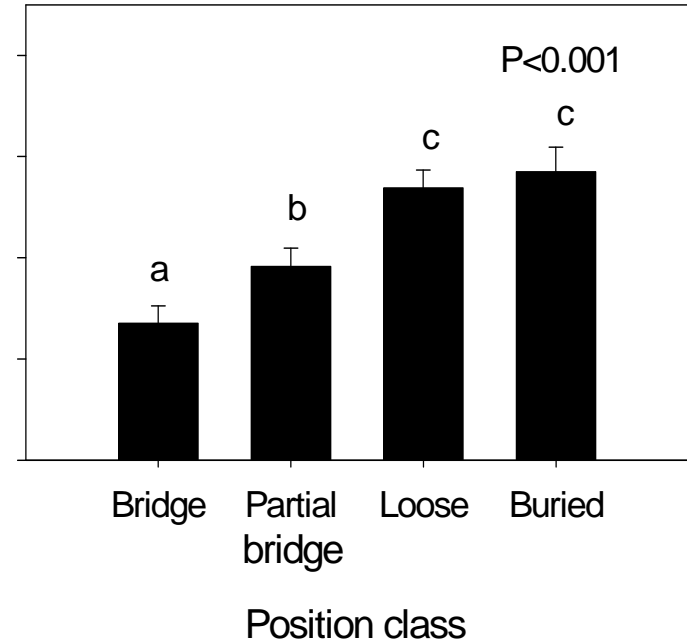
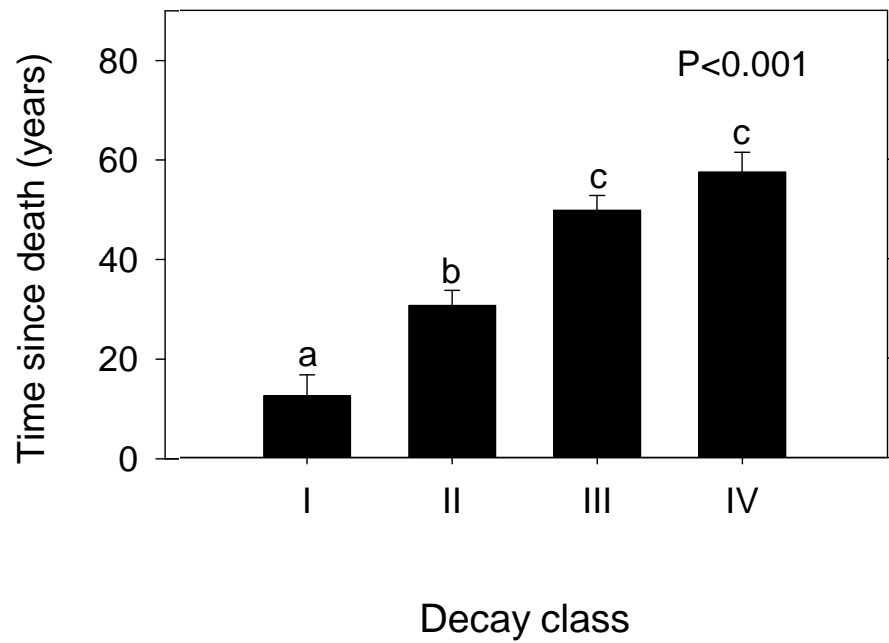
bridge



partial bridge



buried



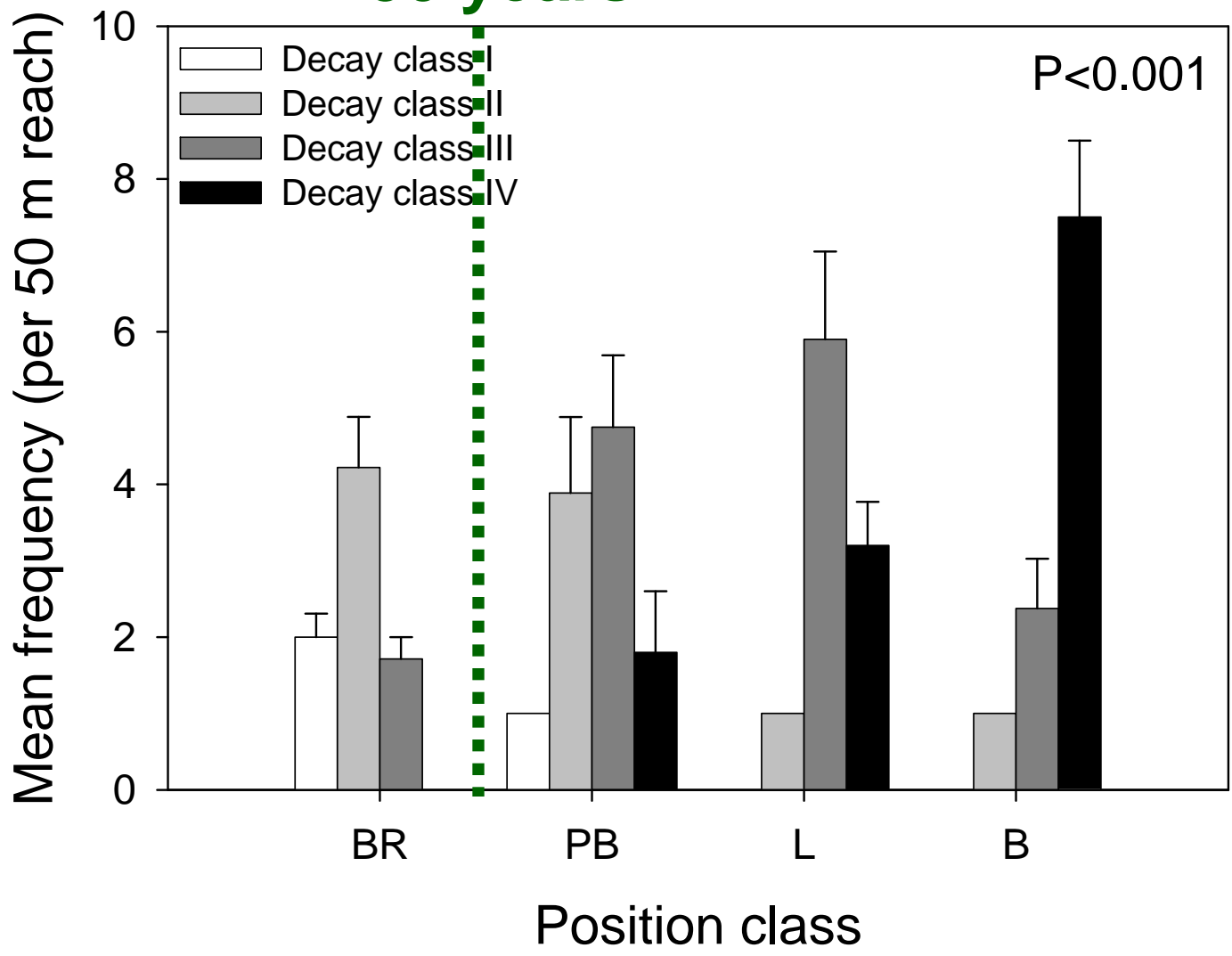
Young LWD
bridge
decay I & II
perpendicular

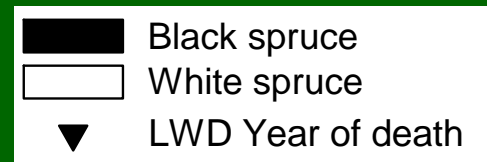
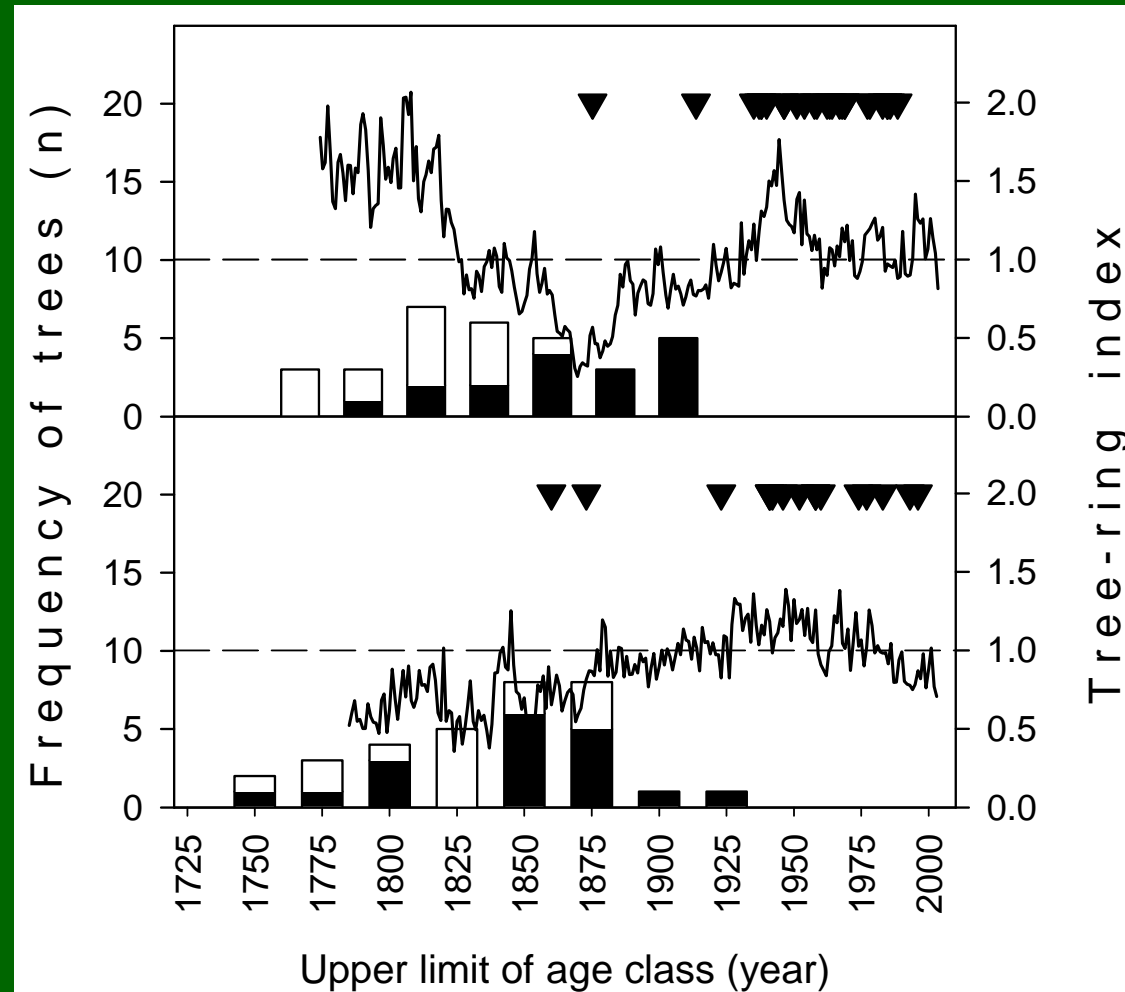


Old LWD
loose & buried
decay III & IV
angled & parallel



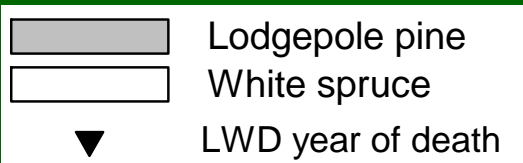
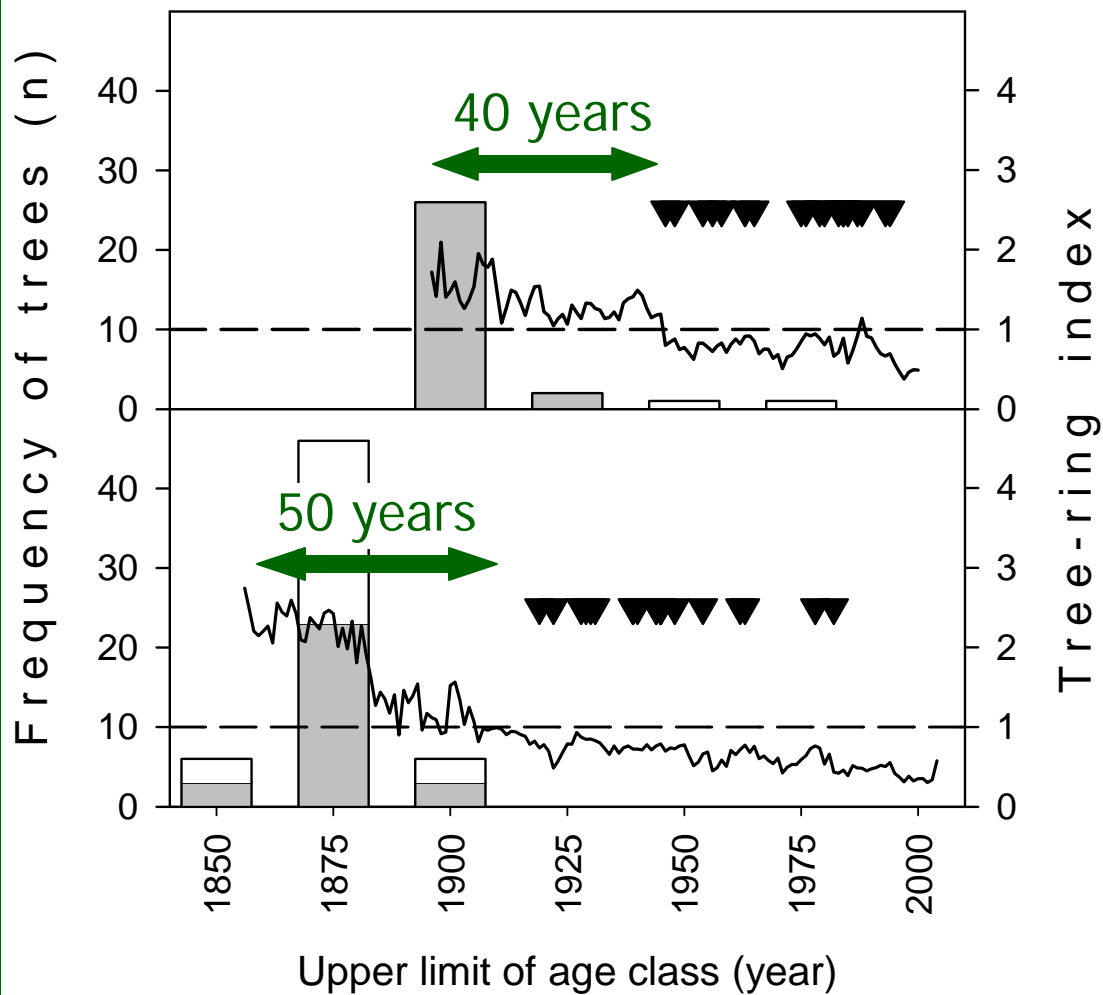
30 years





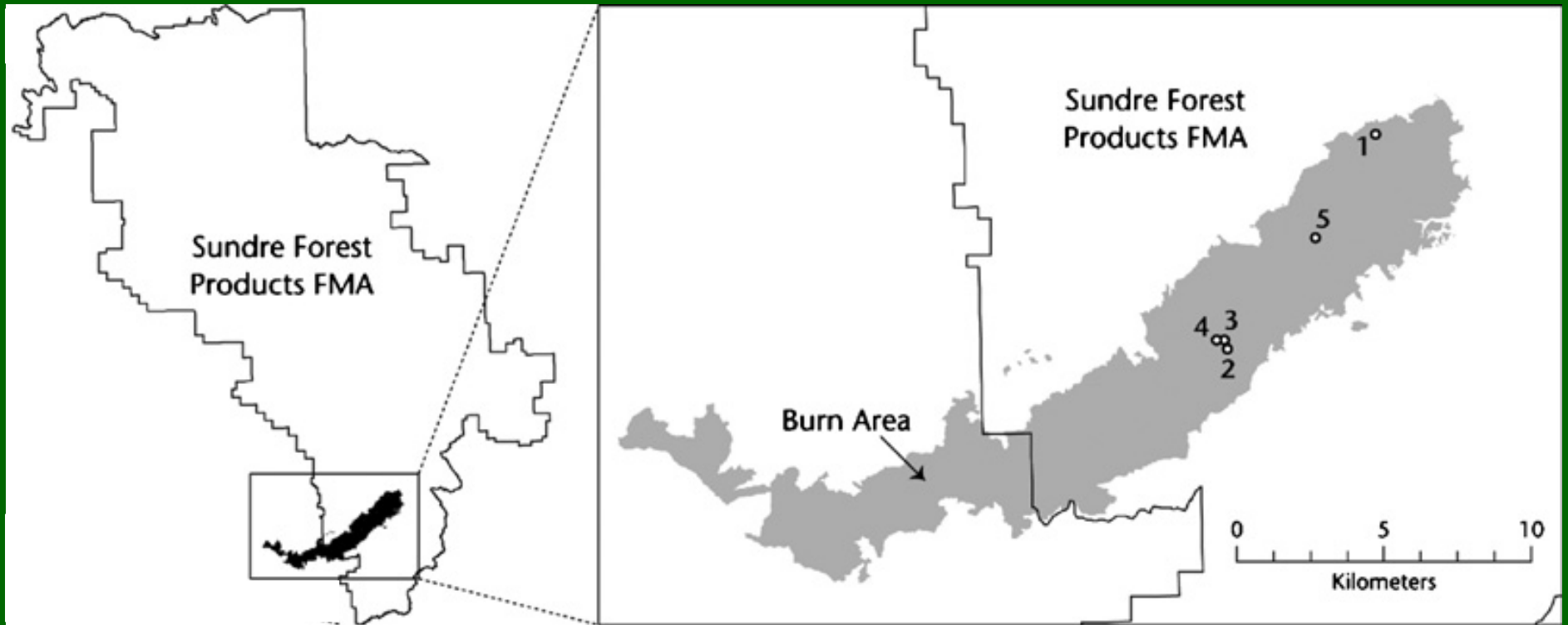
White & Black Spruce

uneven-aged,
 variable rates of
 initial growth,
 tree death
 relatively
 continuous
 in 20th C



Lodgepole Pine
 post-fire,
 even-aged,
 fast initial growth,
 tree deaths after
 crown closure,
 no LWD predated
 the fire

**What happens during the
 first 50 years after fire?**



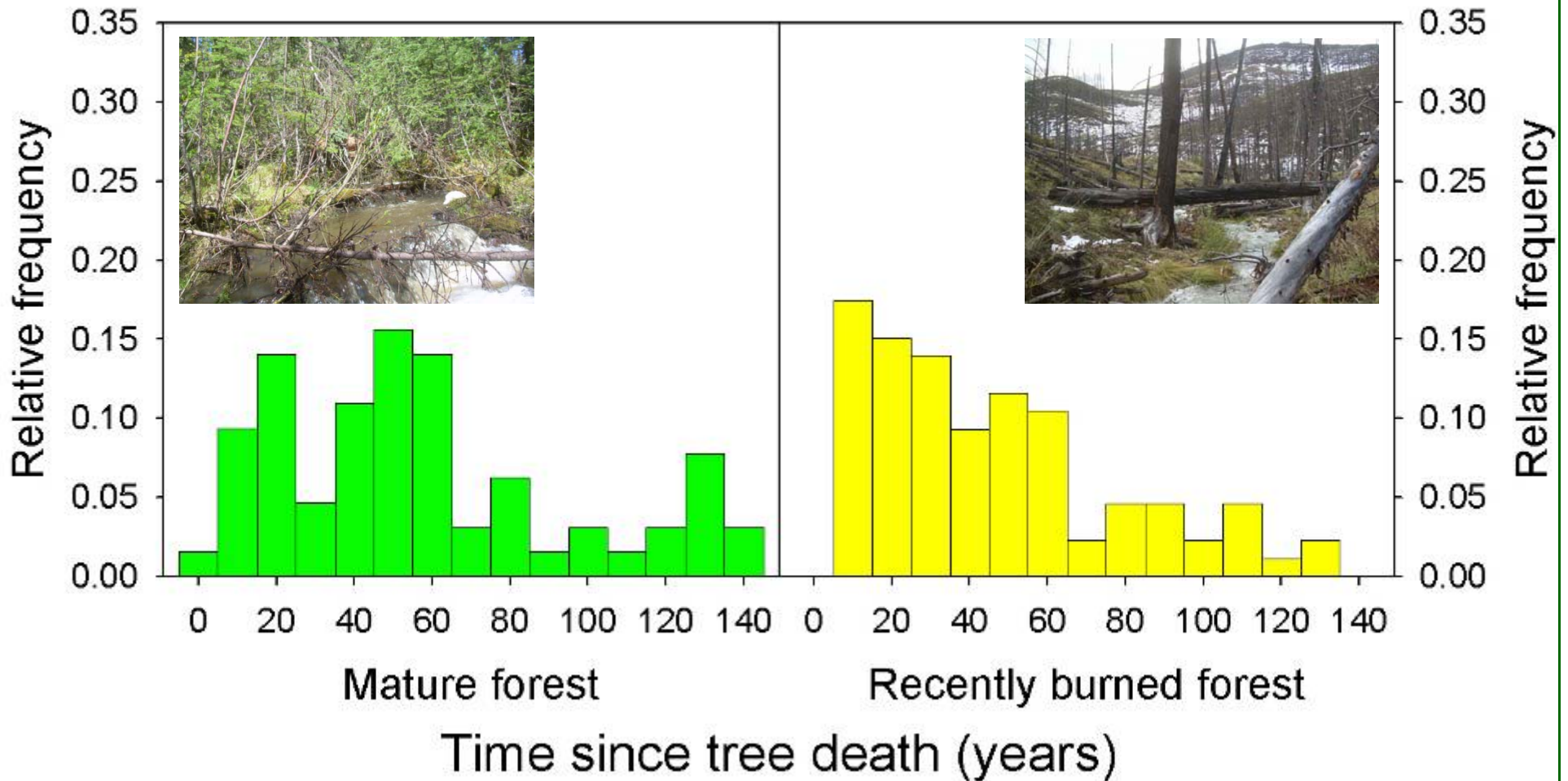
2001 Dogrib Fire

- 5 headwater streams
- white-spruce dominated
- not salvaged
- regenerating to pine



Frequency distribution of LWD

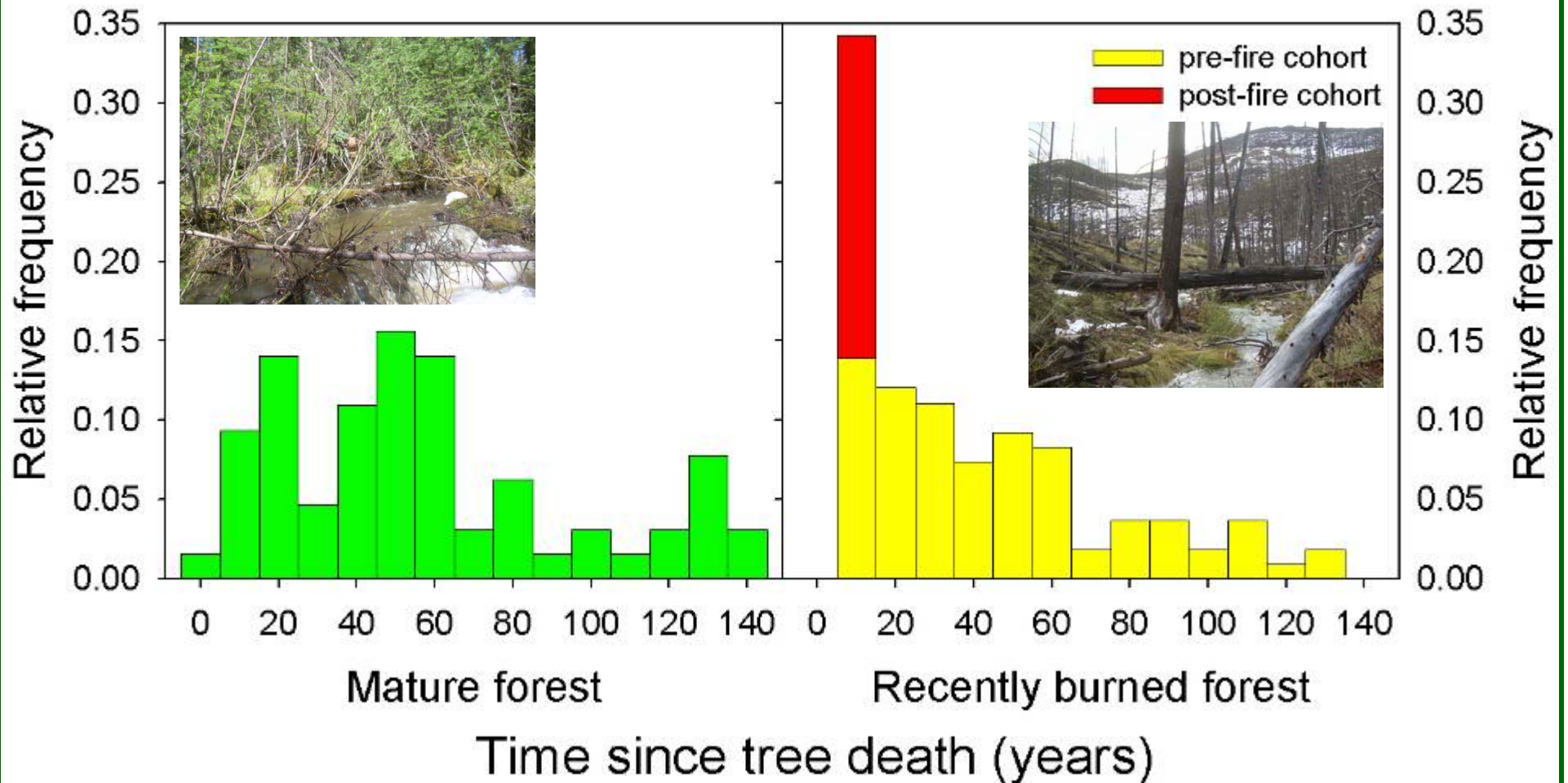
Mature spruce LWD vs Pre-fire spruce LWD



Similar frequency distributions

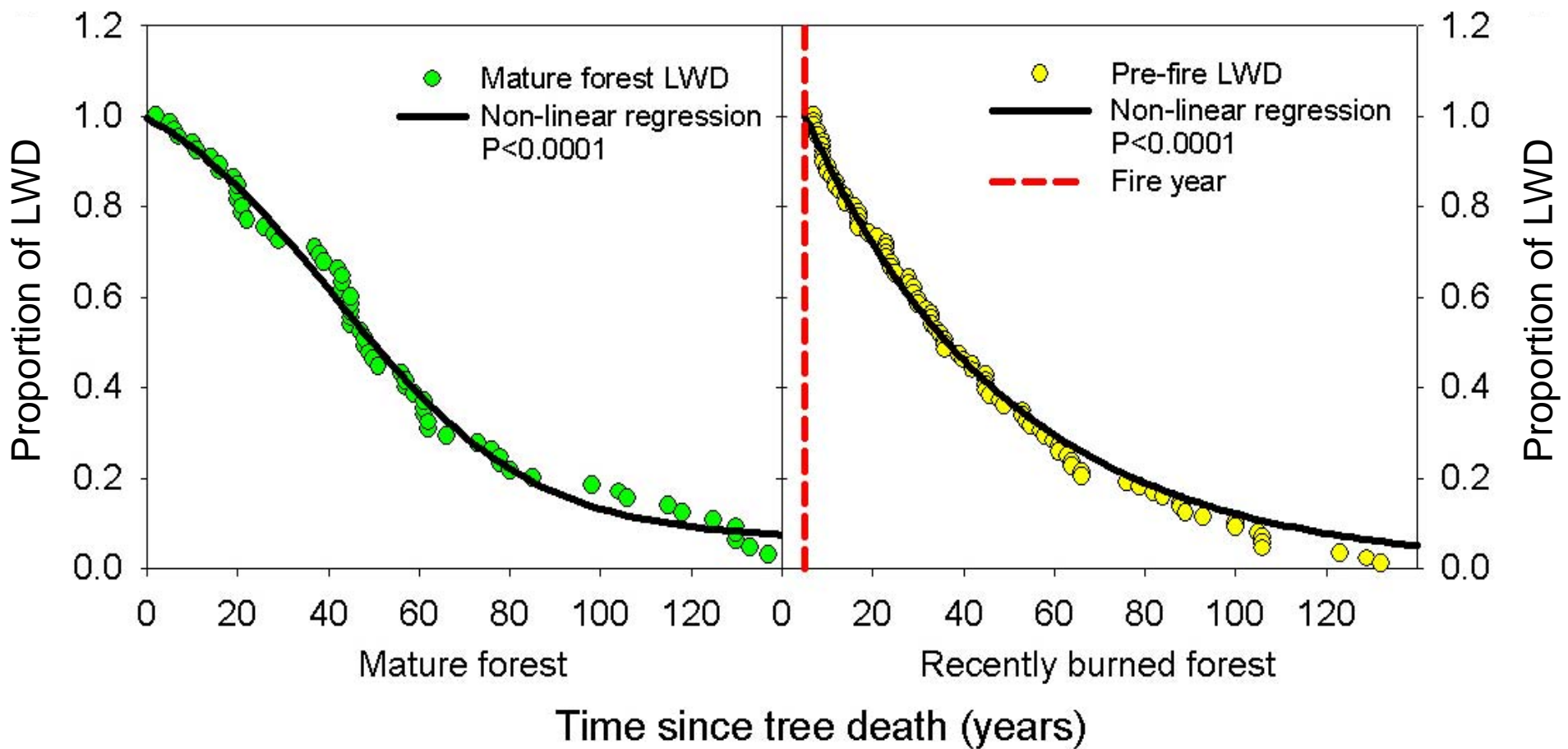
Frequency distribution of LWD

Mature LWD vs **Pre-fire LWD** + **Post-fire recruits**

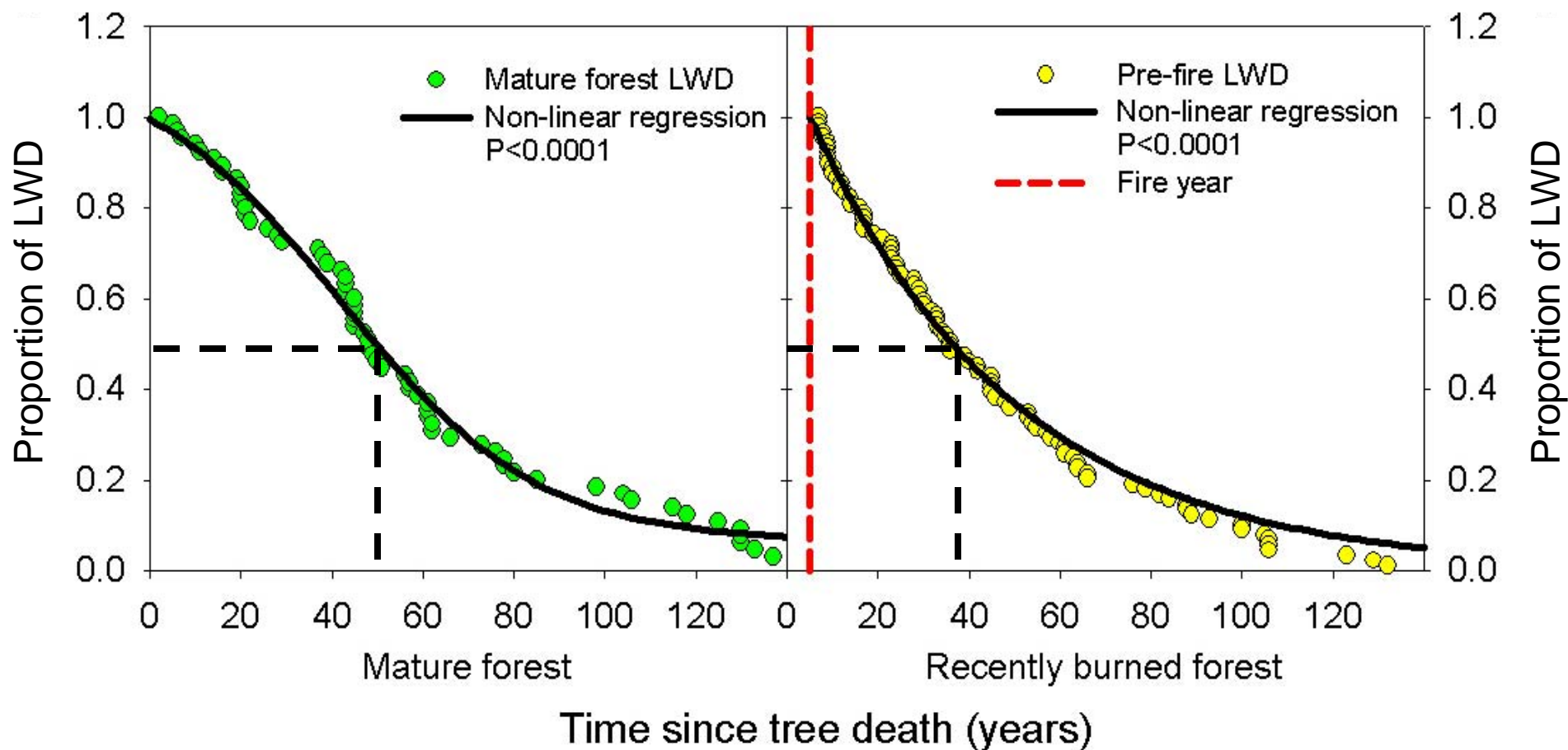


Large pulse in recruitment following fire

LWD Depletion Rates: Mature spruce LWD vs Pre-fire spruce LWD



LWD Depletion Rates: Mature spruce LWD vs Pre-fire LWD

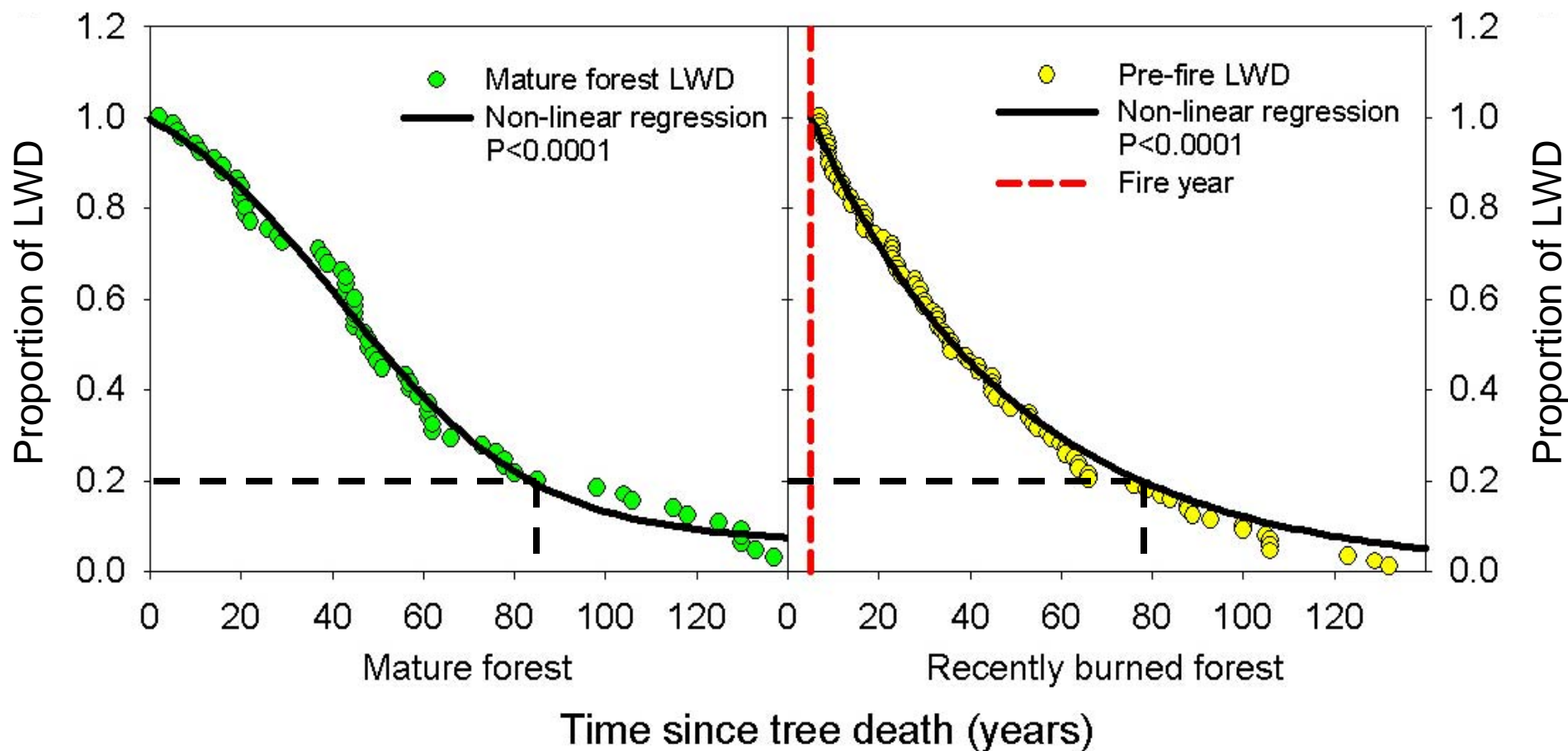


If no additional LWD input:

50% reduction of LWD in 50 years

50% reduction of LWD in 39 years

LWD Depletion Rates: Mature spruce LWD vs Pre-fire LWD



If no additional LWD input:

80% reduction of LWD in 83 years

80% reduction of LWD in 79 years

Future LWD Dynamics

- Mature forests have ~continual long term supply of LWD due to stand dynamics
- Burned forests have pulse of LWD from fire
 - Size of and duration of pulse?
 - Lag before LWD affects stream function?
 - Lag before new forest contributes new LWD?



Snag fall rates?

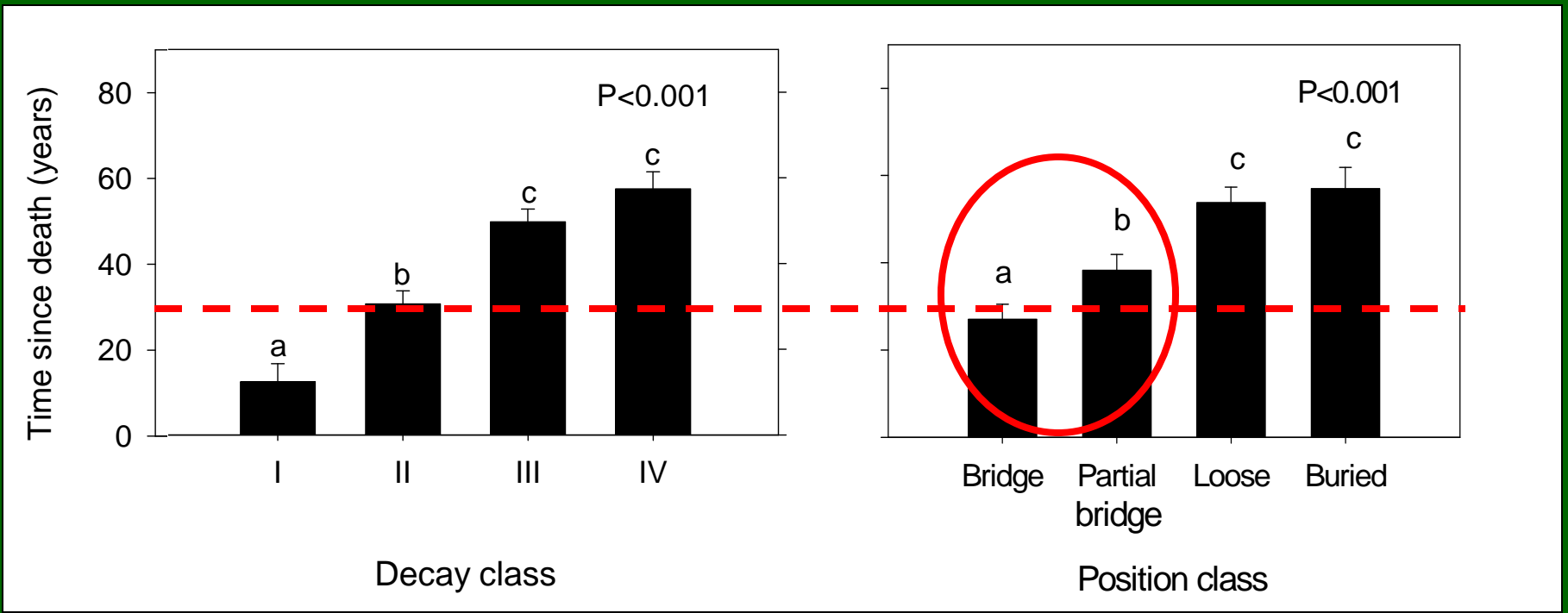


5 years post fire

Lag between fall and function?



5 years post fire



Young LWD
nominal
function



LWD
increasing
function

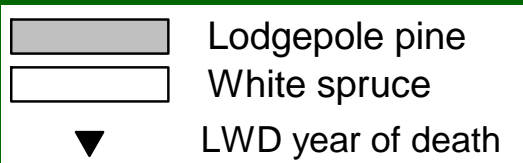
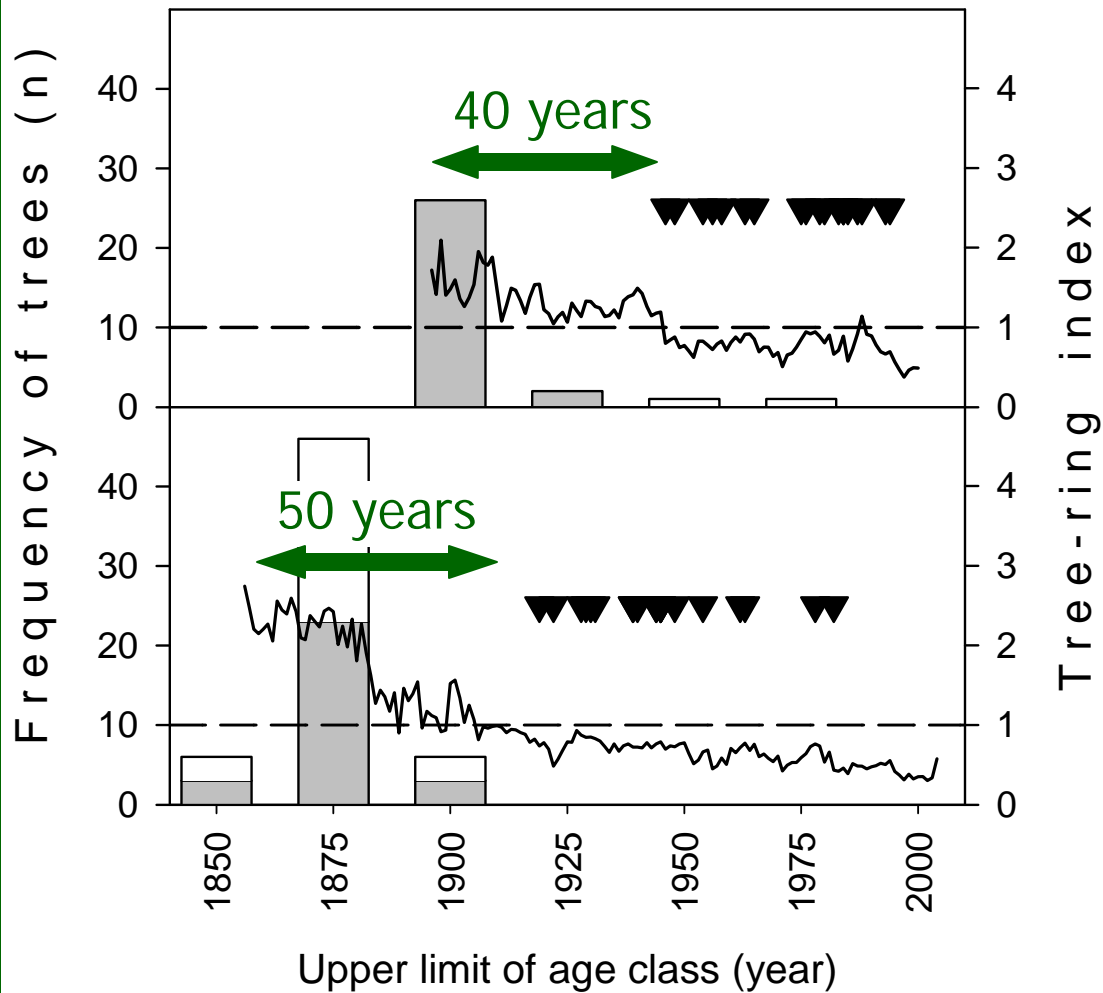


Old LWD
multi-
functional



How long before new forest will contribute new LWD?





Lodgepole Pine

**post-fire,
even-aged,
fast initial growth,
tree deaths after
crown closure**

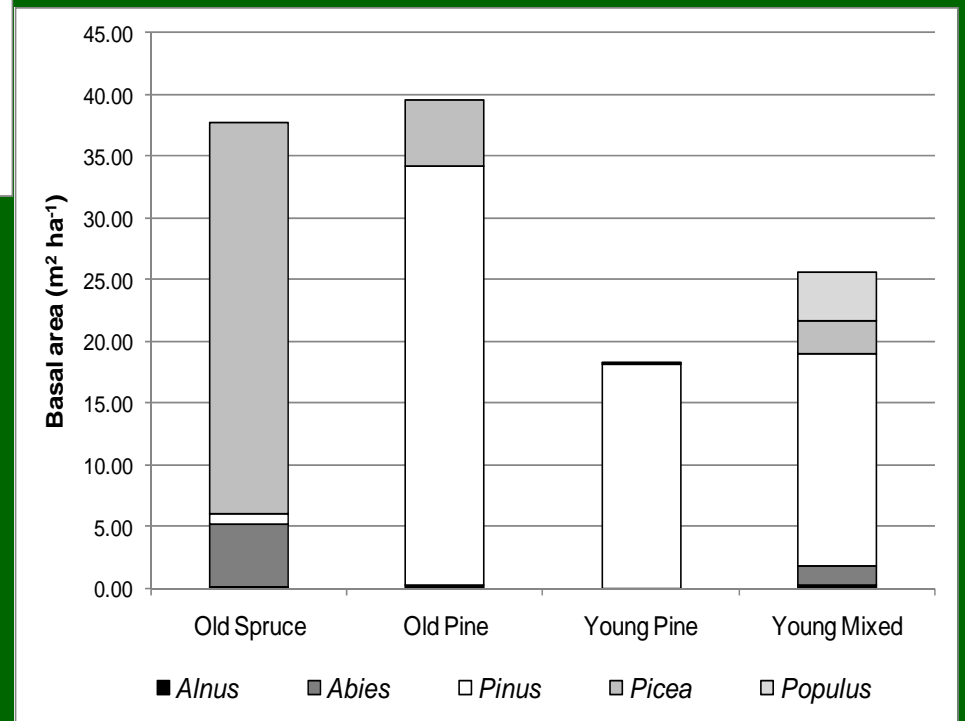
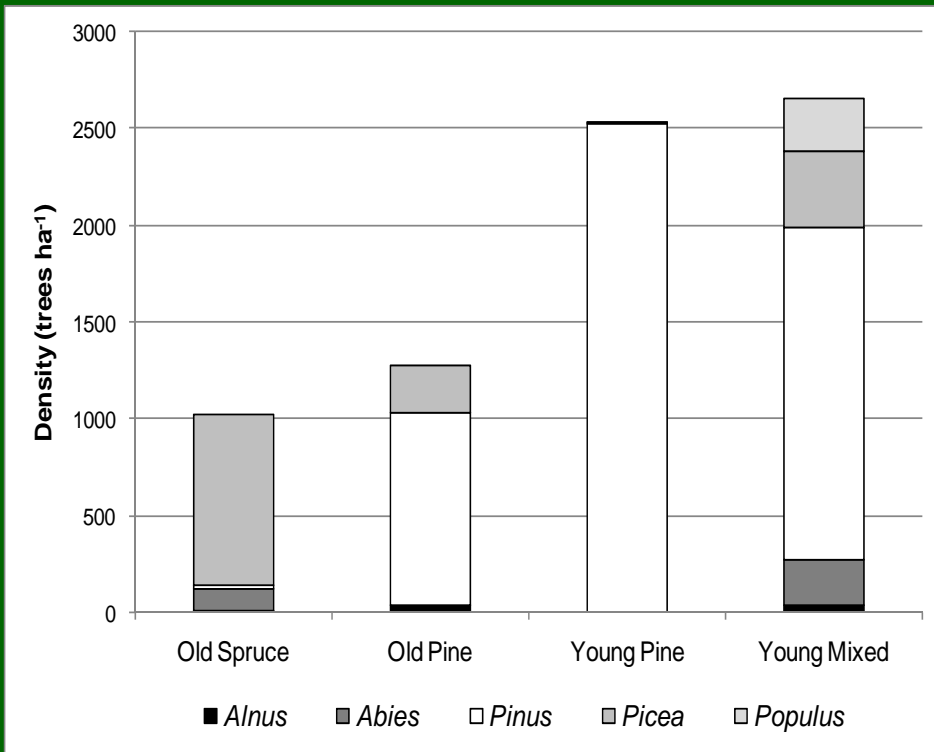
Implications of the Dogrib Study

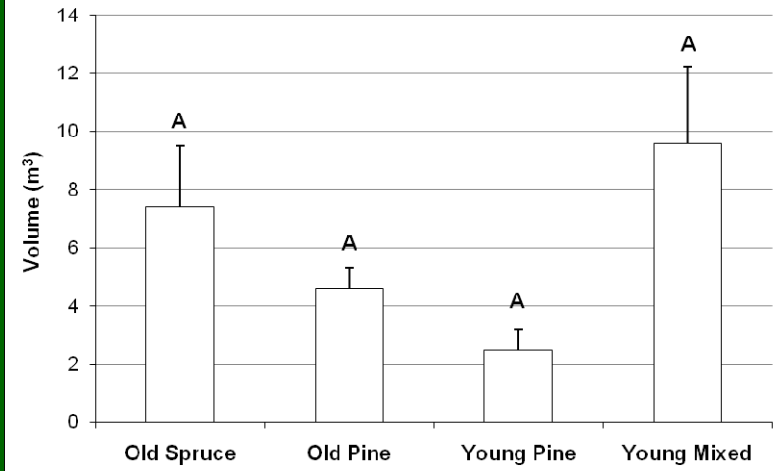
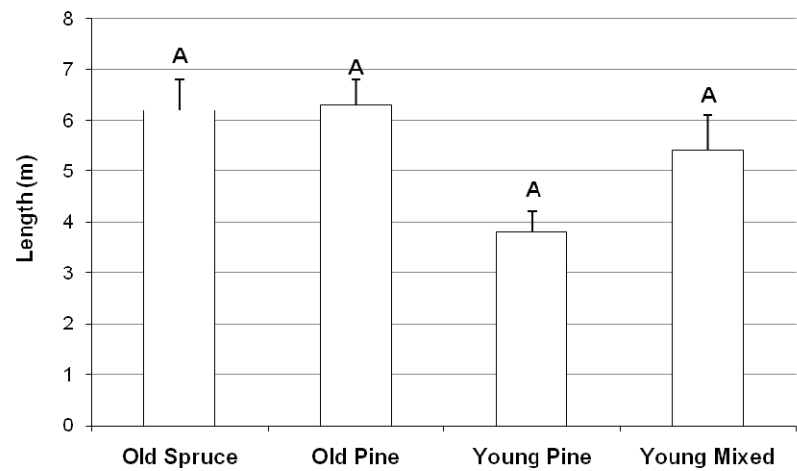
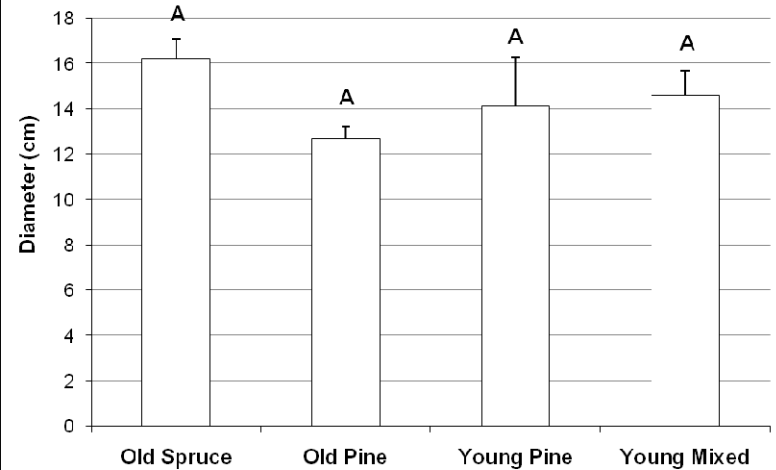
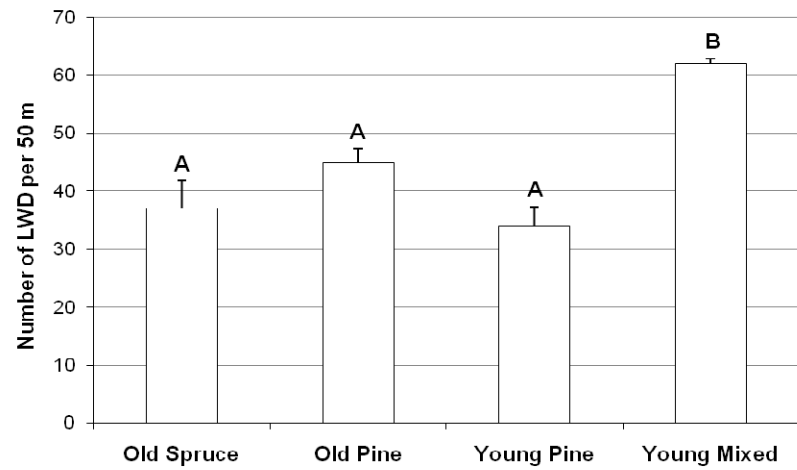
- 70-80-yr lag: fire to new functional LWD
- snags surrounding headwater streams provide a source for LWD recruitment
- retain post-fire buffer zones of snags especially in riparian forests that
 - are susceptible to seasonal floods and erosion
 - provide habitat for threatened, rare or endangered species

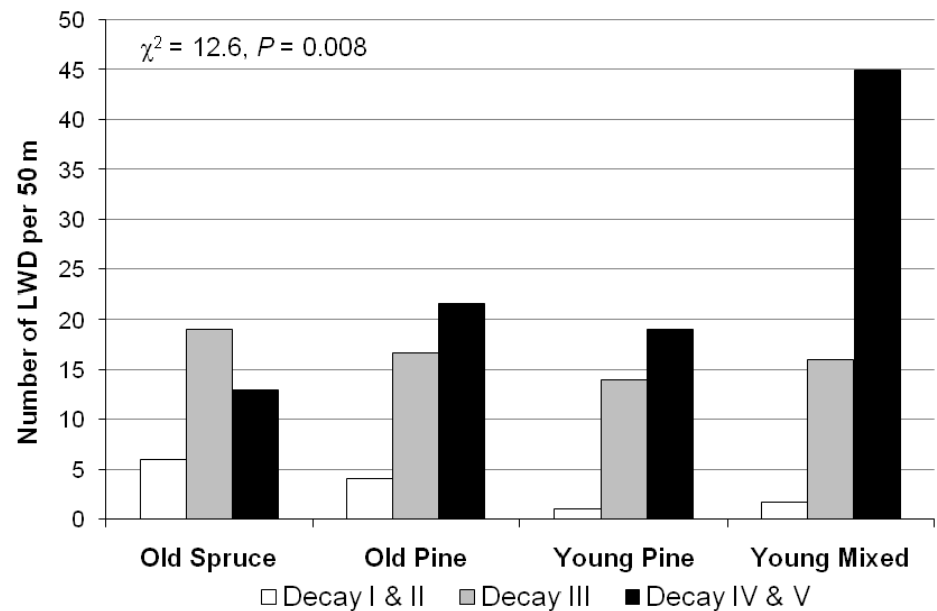
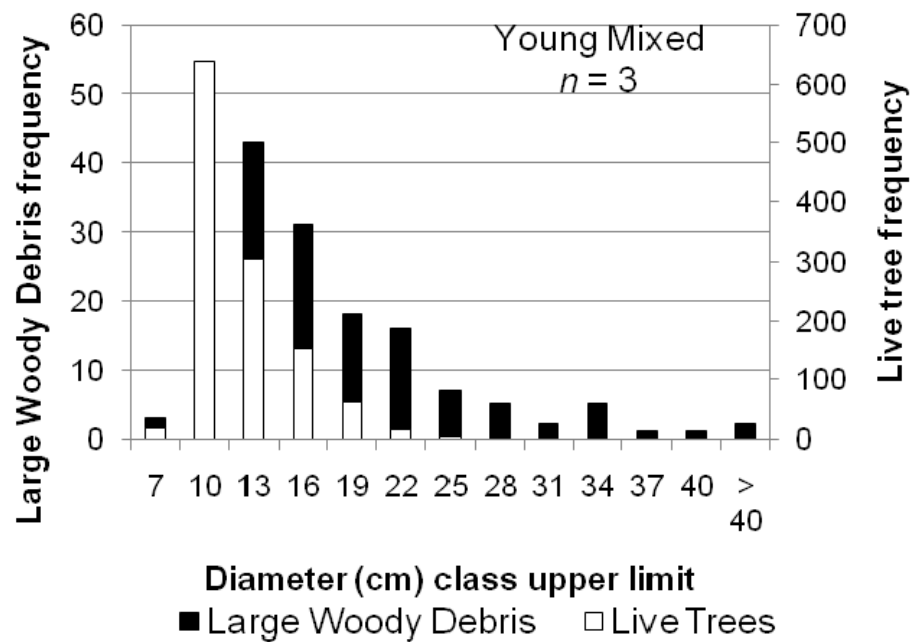
Chronosequence Study

- Comparison of LWD in riparian forests of different ages and composition
 - ~50 year-old pine (n = 4)
 - ~50 year-old mixed species (n = 3)
 - ~100 year-old pine (n = 3)
 - >150 year-old spruce (n = 3)









Chronosequence Study

- LWD time since death and depletion rates
- Does LWD in young forests decay at the same rate as LWD in mature forest?

Conclusions

- **LWD persists decades to centuries**
- **LWD position relates to decay and determines in-stream function with time**
- **LWD recruitment depends on disturbance and stand dynamics**
- **Changes to LWD abundance have long-term implications for stream function**

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