Western balsam bark beetle, *Dryocoetes confusus*, and subalpine-fir forests in southern B.C.

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Outline

- *Dryocoetes confusus* life history tidbits
- Ecosystems at risk – subalpine-fir succession and *D. confusus* attack patterns
- Impacts observed in past decade – baseline data???
- Climate change and possible effects on *D. confusus* and subalpine-fir

When does chronic become epidemic?

Is mortality from *D. confusus attack increasing?*

Are the periods of high in-stand mortality longer?

Subalpine fir, *Abies lasiocarpa*, is well adapted to cold, high-elevation ecosystems (±1,600 m in B.C.)

Succession is a slow process in these subalpine-fir ecosystems, with single or small groups of tree dying and falling out of the stand

Spruce or subalpine-fir will regenerate in gaps

±300 years, catastrophic fires may destroy large areas of subalpine-fir forests (*rare event*)

Dryocoetes confusus life cycle

Females construct egg galleries in phloem

Brood 1

Larvae feed in phloem

Late summer – some adults re-emerge (mostly ♀)

Overwinter as late instar larvae

Require cold snap

<u>Males</u> initiate attack in June - attracting and mating multiple females

1st year (June – September)

Brood 1

Overwinter as adults

Females within galleries continue extending galleries, expelling frass & sawdust out of nuptial chamber in spring & may lay second brood.

Summer

Brood 2

Overwinter as larvae

Larvae continue feeding; pupate; and, transform to adults

Spring-early summer

2nd year (May – September)

New adults emerge from tree, seek new host and initiate attack

Brood 1

Brood 2
Overwinter as adults

Larvae continue feeding; pupate; transform to adults

3rd year (May – September)

Brood 2

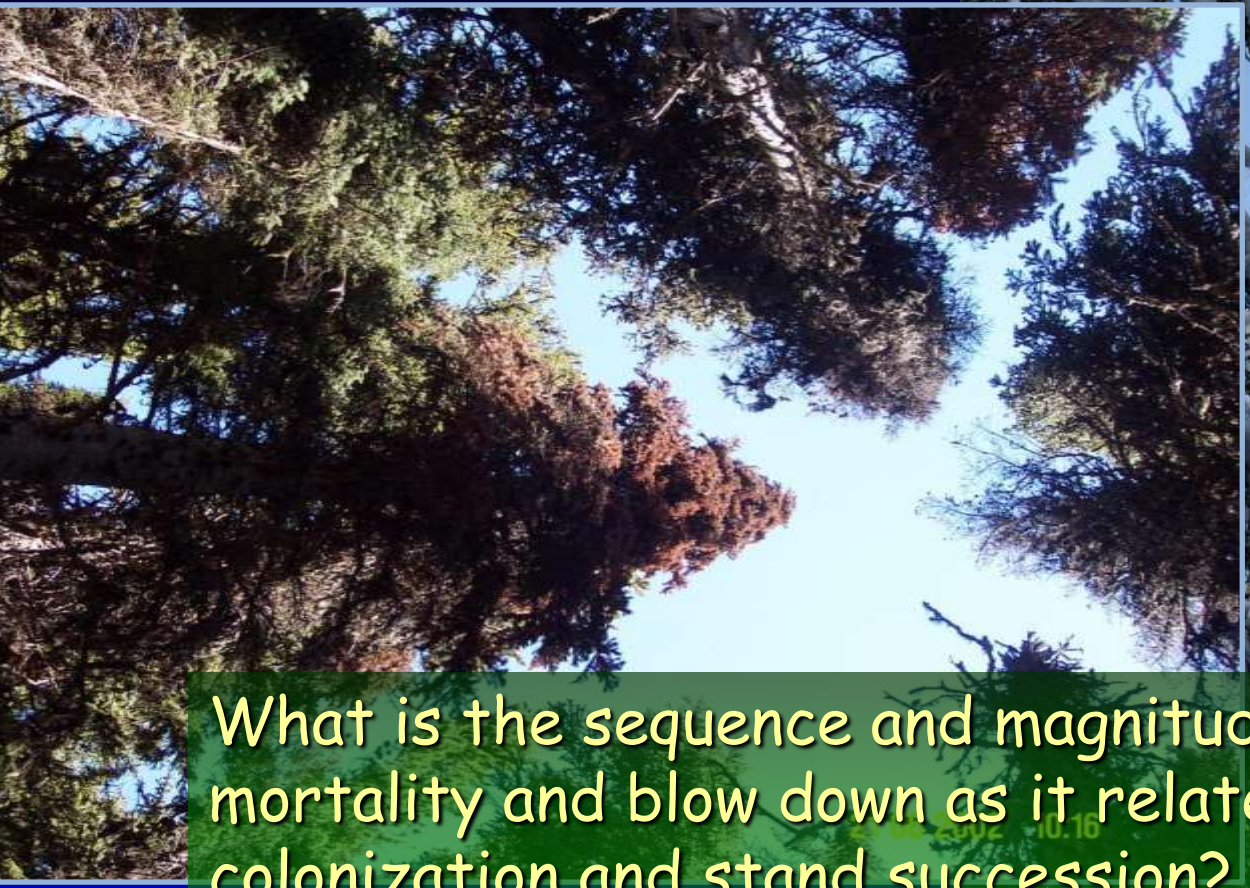
Adults emerge from tree & seek new host and mates

Trees fade to grey and loose needles over time

4th year (June)

Stand Dynamics

- some subalpine-fir die
- some subalpine-fir blow down (live & dead trees) creating gaps in the forest canopy



What is the sequence and magnitude of subalpine-fir mortality and blow down as it relates to insect colonization and stand succession?

The annual spatial signature of *Dryocoetes confusus* is typically small and disperse. This coupled with cyclical, severe pockets of attack, slowly converts old subalpine-fir stands to younger stands.

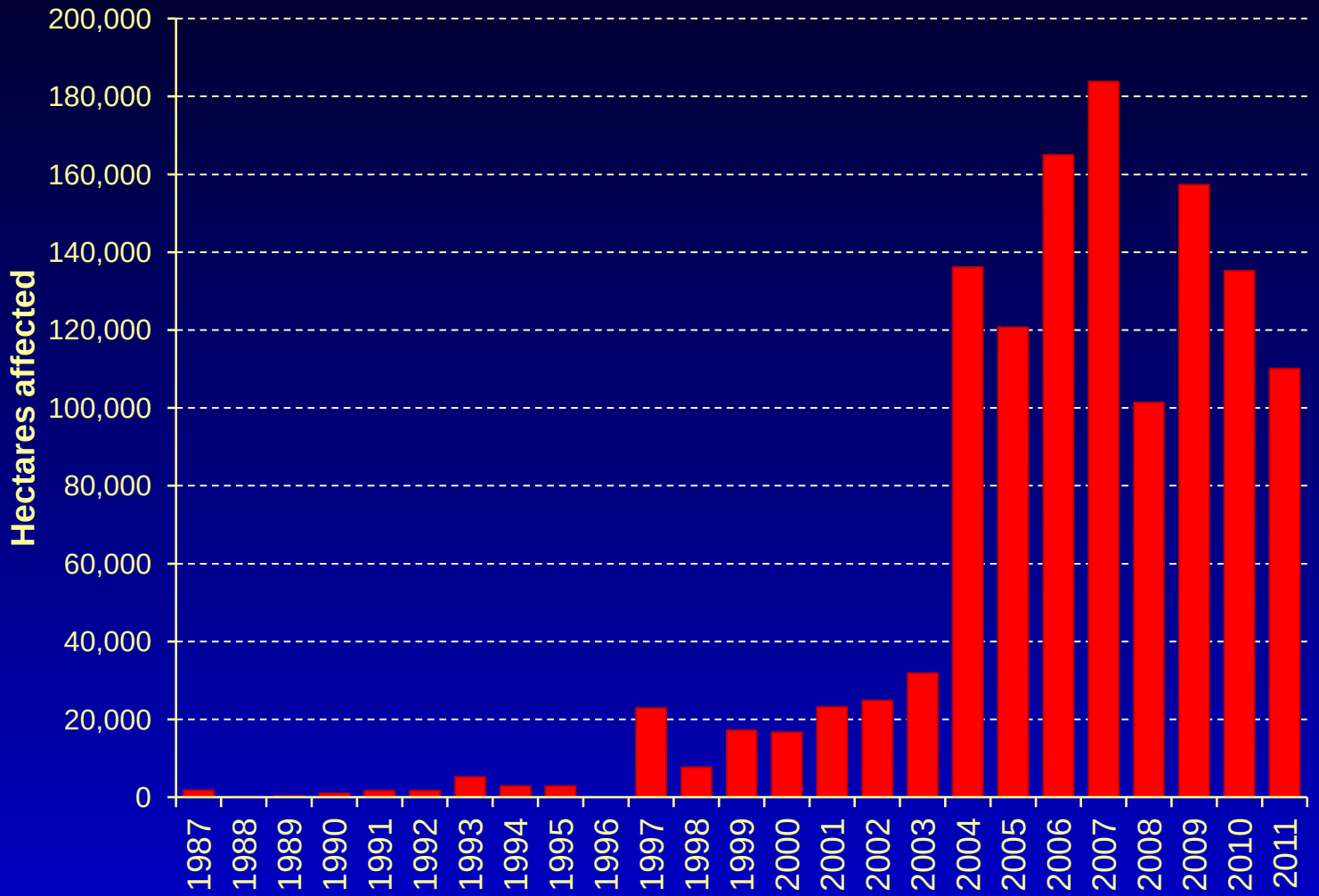
The studies I describe build upon others work:

Art Stock

Leroy Harder

Kathy Bleiker

Ha affected by western balsam bark beetle in southern B.C. (1987-2011)

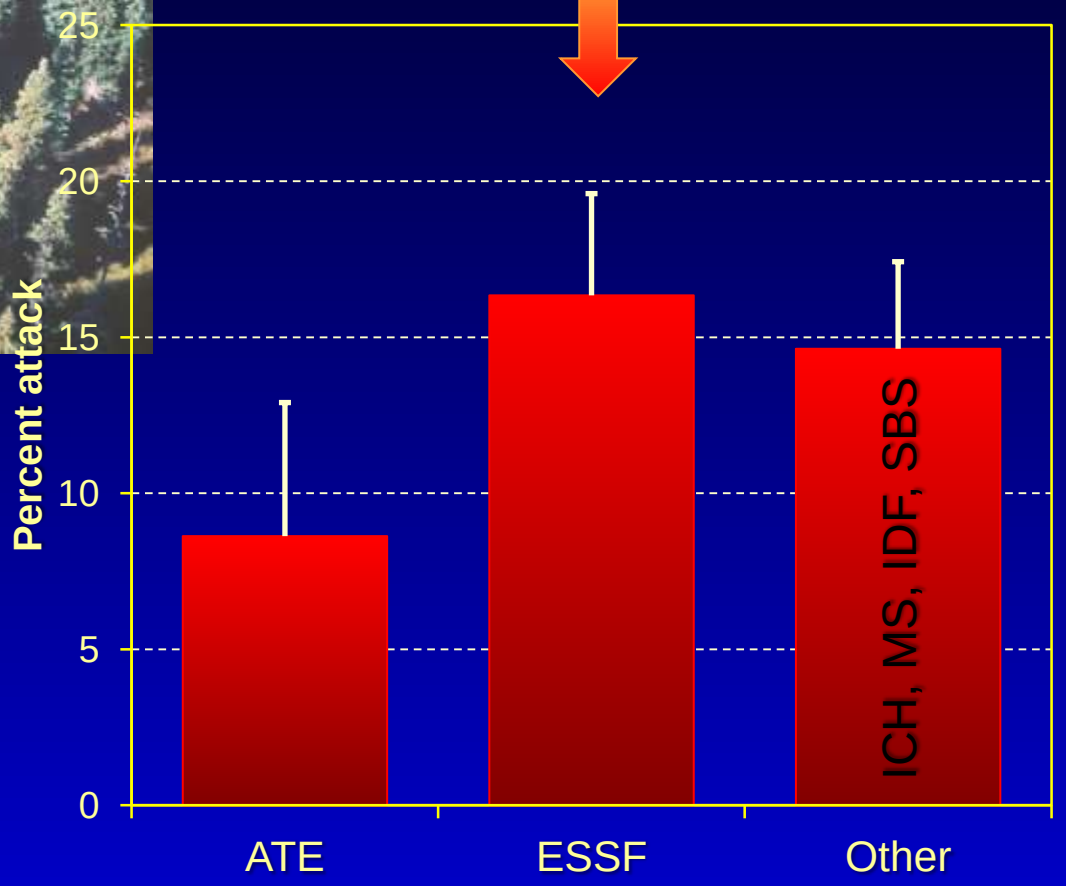


Percent attack by *Dryocoetes* (reds and greys) in all stands surveyed by air, grouped by ecosystem (± SE)

65,767 ha surveyed (805 polygons)

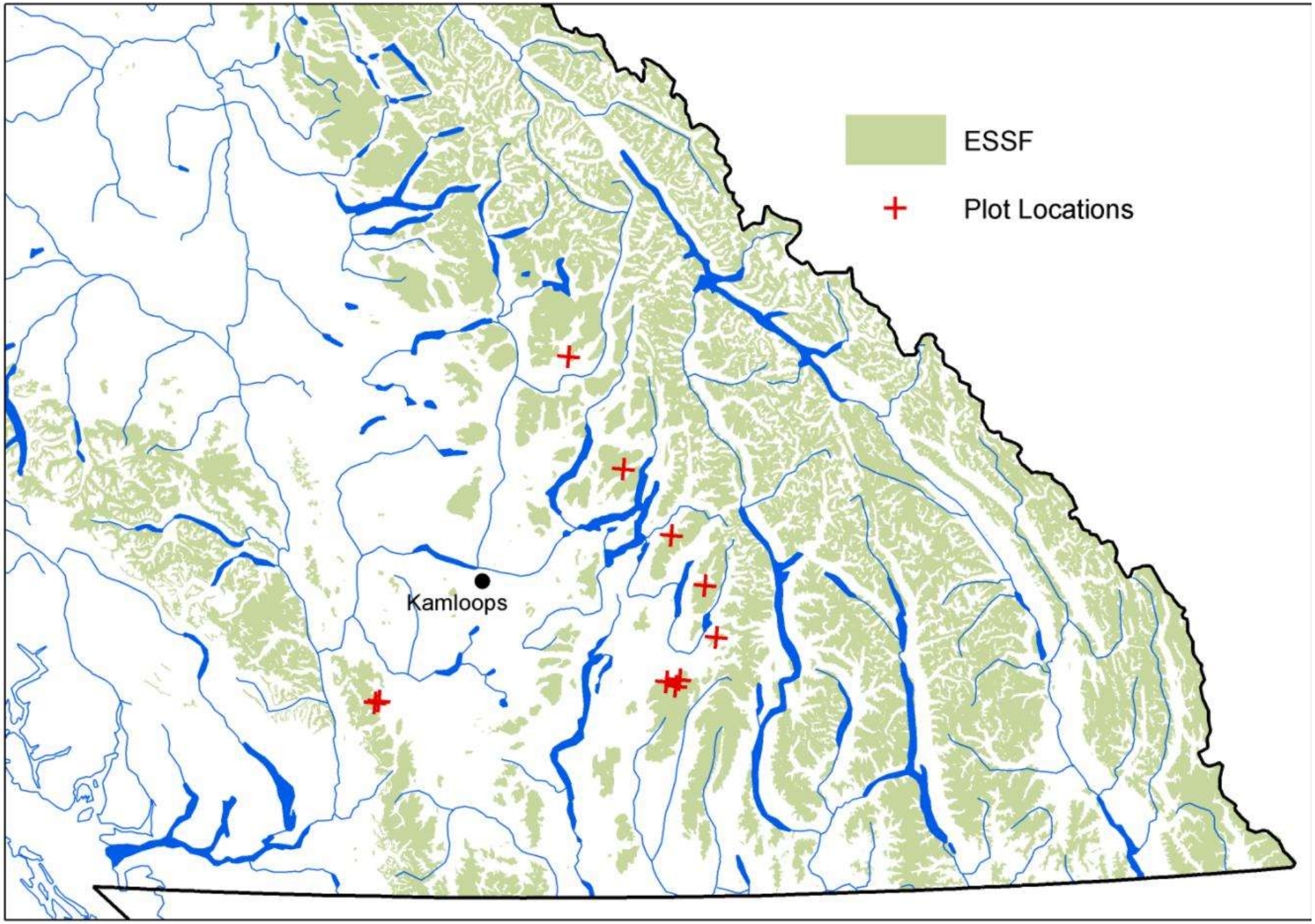
- Highest mortality (56%) observed in an ESSFwc2 polygon.
- Mortality no different among age classes 7, 8, & 9 (ANOVA, $P<0.05$),
- Age class 6 significantly lower mortality.

Highest and most consistent levels of mortality in ESSF (740 polygons surveyed)

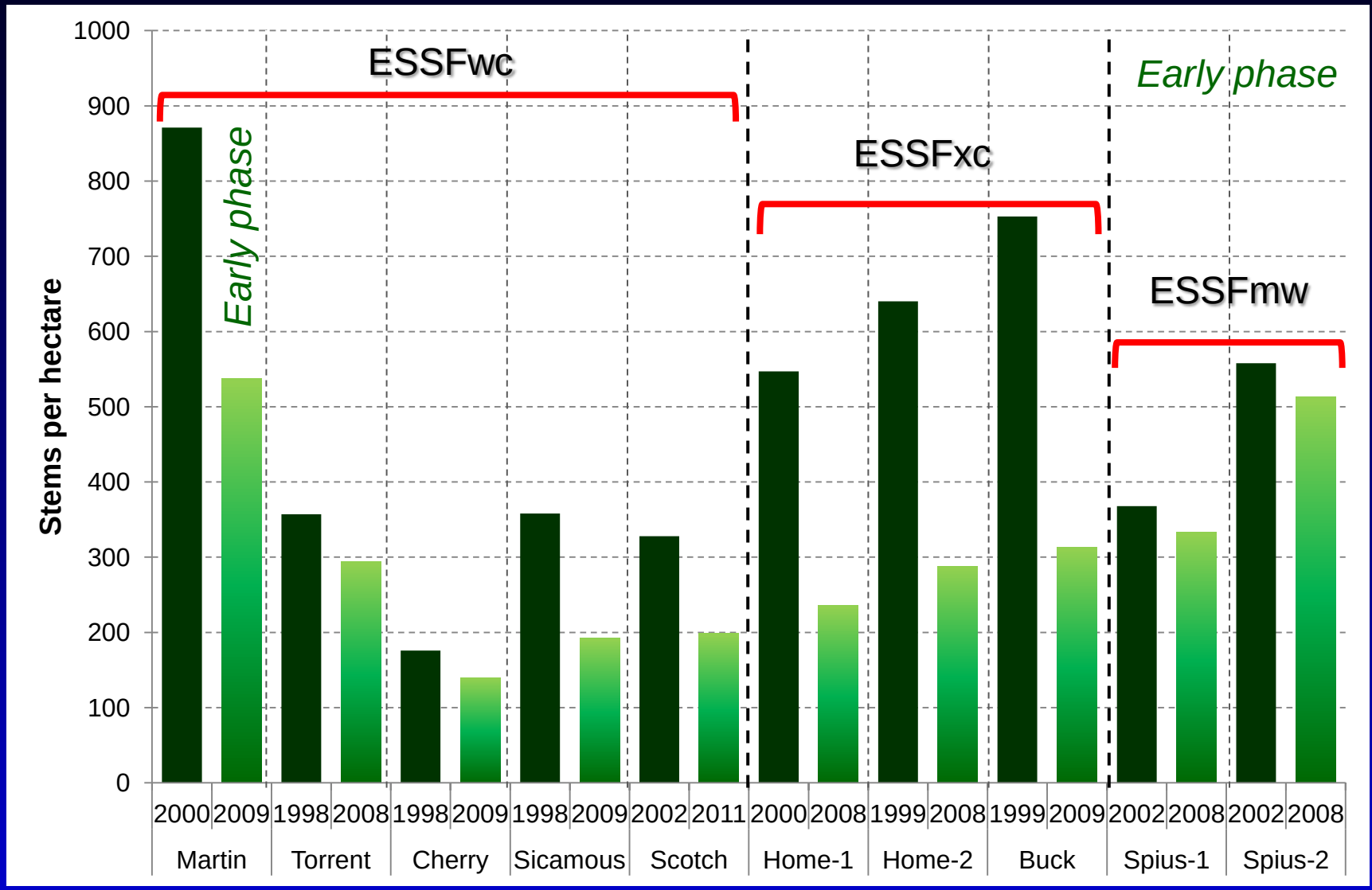


Location, ecosystem and phase of ten 1 hectare plots – established 1998-2002

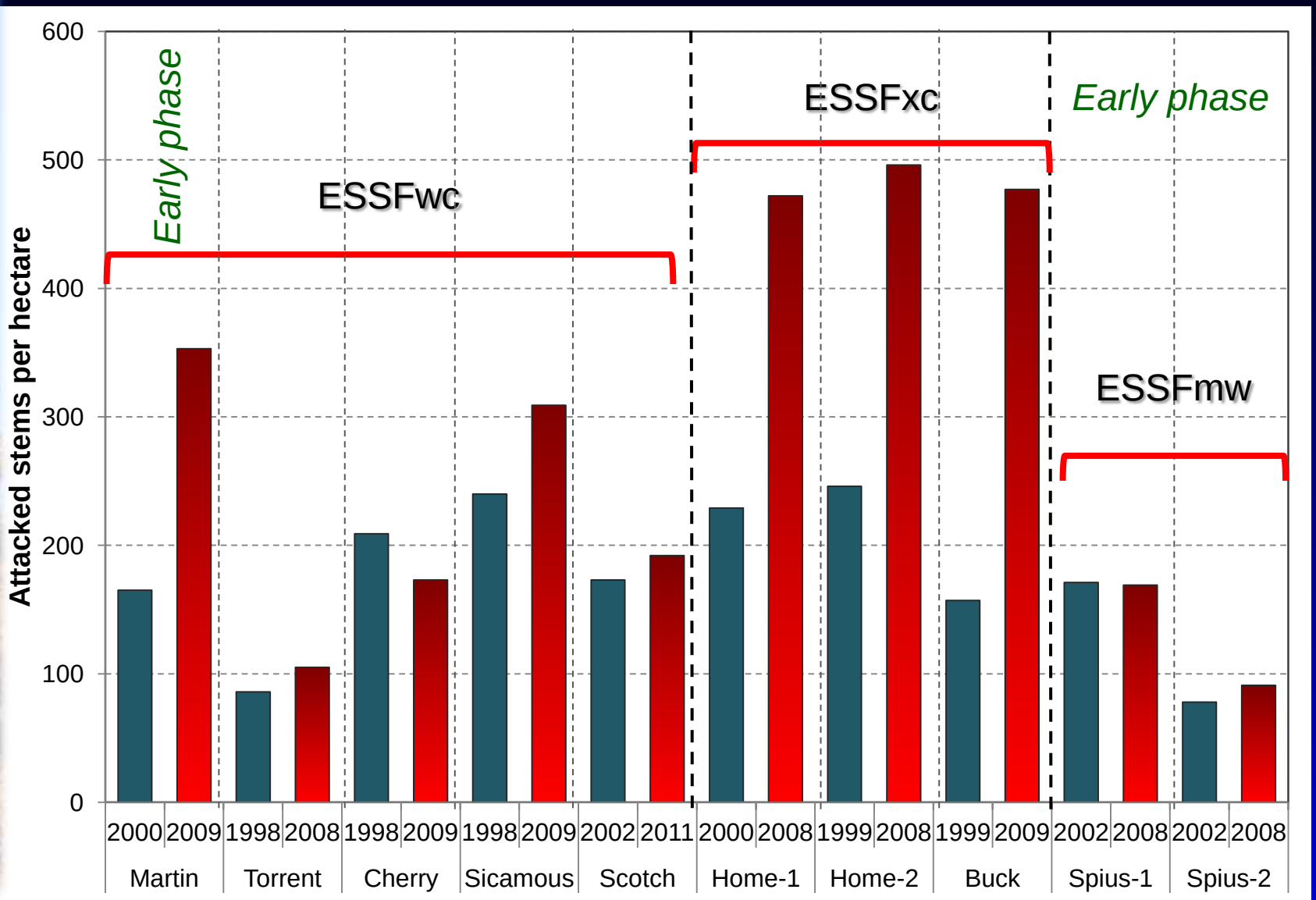
Location	BEC	Phase	Year established
Martin Cr.	ESSFwc	early	2000
Torrent Cr.	ESSFwc	mid- to late-	1998
Cherry Ridge	ESSFwc	mid- to late-	1998
Sicamous Cr.	ESSFwc	mid- to late-	1998
Scotch Creek	ESSFwc	mid- to late-	2002
Home Lk-1	ESSFxc	early to mid-	1999
Home Lk-2	ESSFxc	early to mid-	1999
Buck Mtn.	ESSFxc	early to mid-	1999
Spius Cr-1	ESSFmw	early	2002
Spius Cr-2	ESSFmw	early	2002


ESSF
Plot Locations
Kamloops

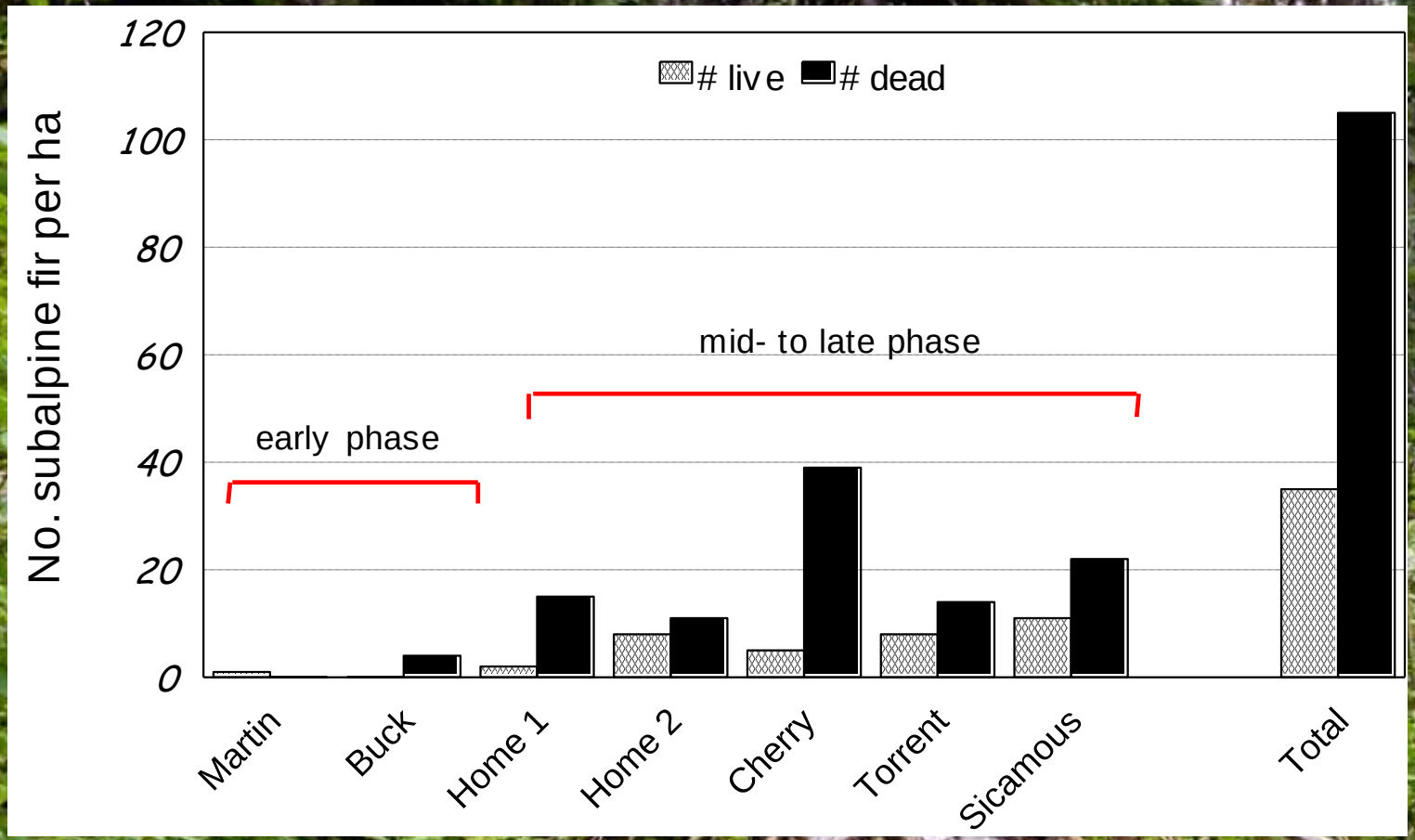
Live subalpine fir per hectare at plot establishment & final assessment in three ESSF subzones



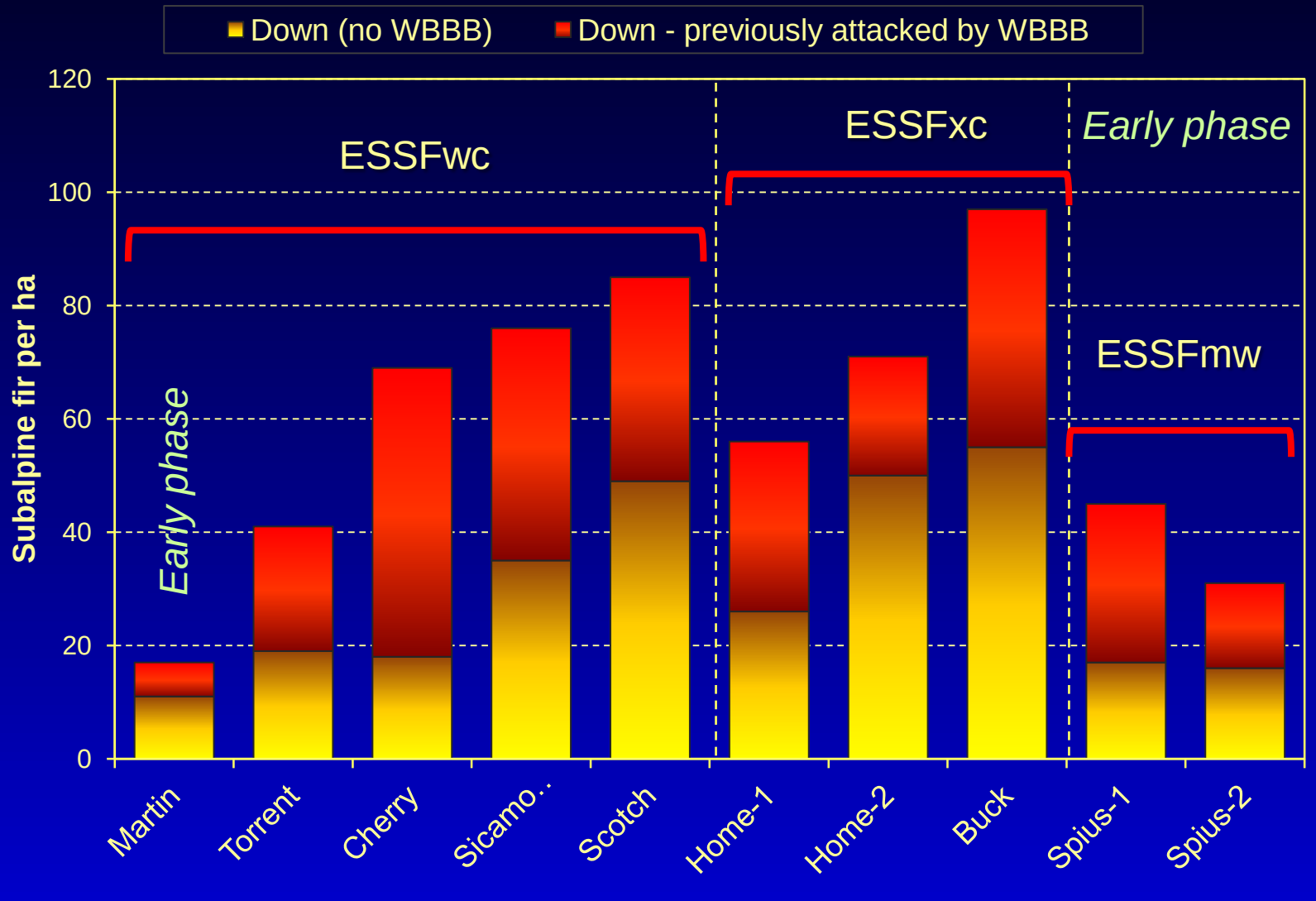
Dryocoetes-attacked subalpine-fir per hectare at plot establishment & final assessment



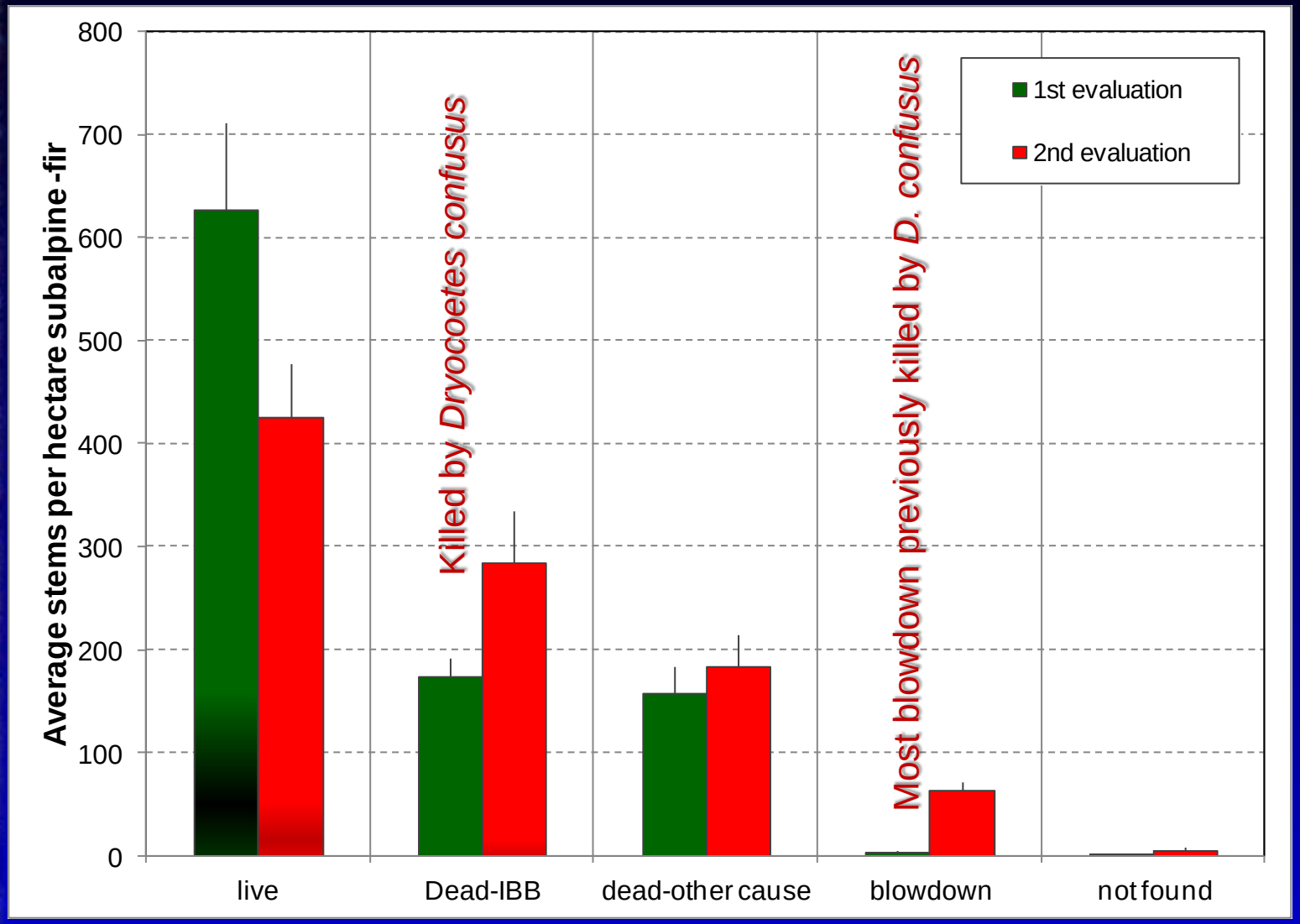
Annual blowdown rate of live and dead subalpine-fir (sph) in seven PSP's (plot establishment-2004)



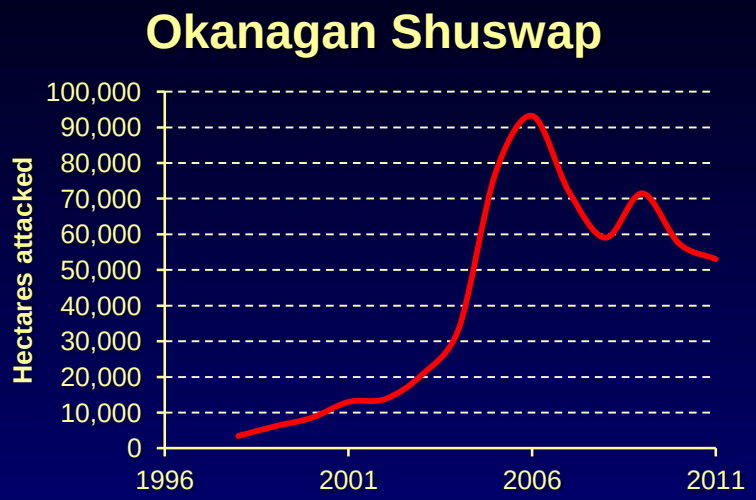
Stems per hectare of down subalpine fir (since plot establishment) noting presence/absence of *Dryocoetes attack*

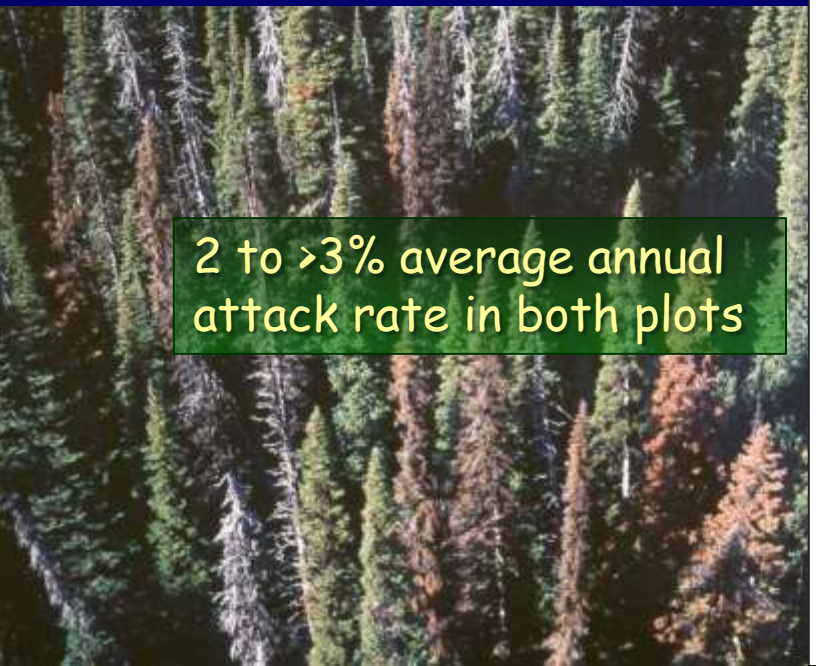


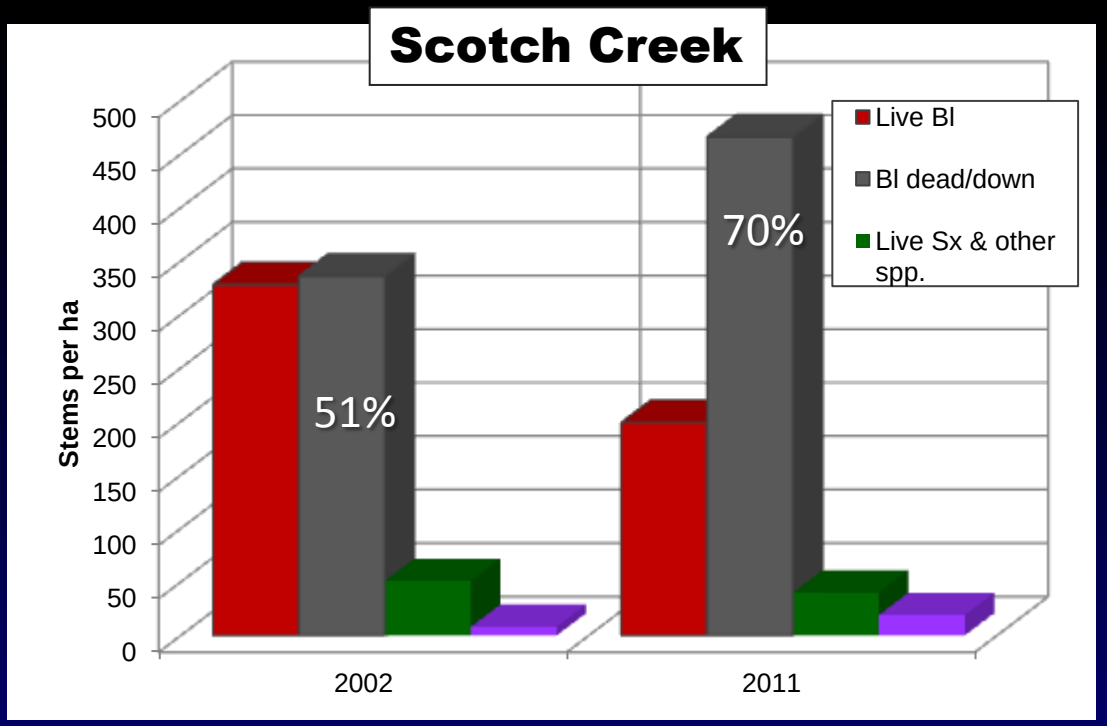
Change of sub-alpine fir status over 10 year interval (average no. subalpine-fir/ha ± SE) in 10 PSP's

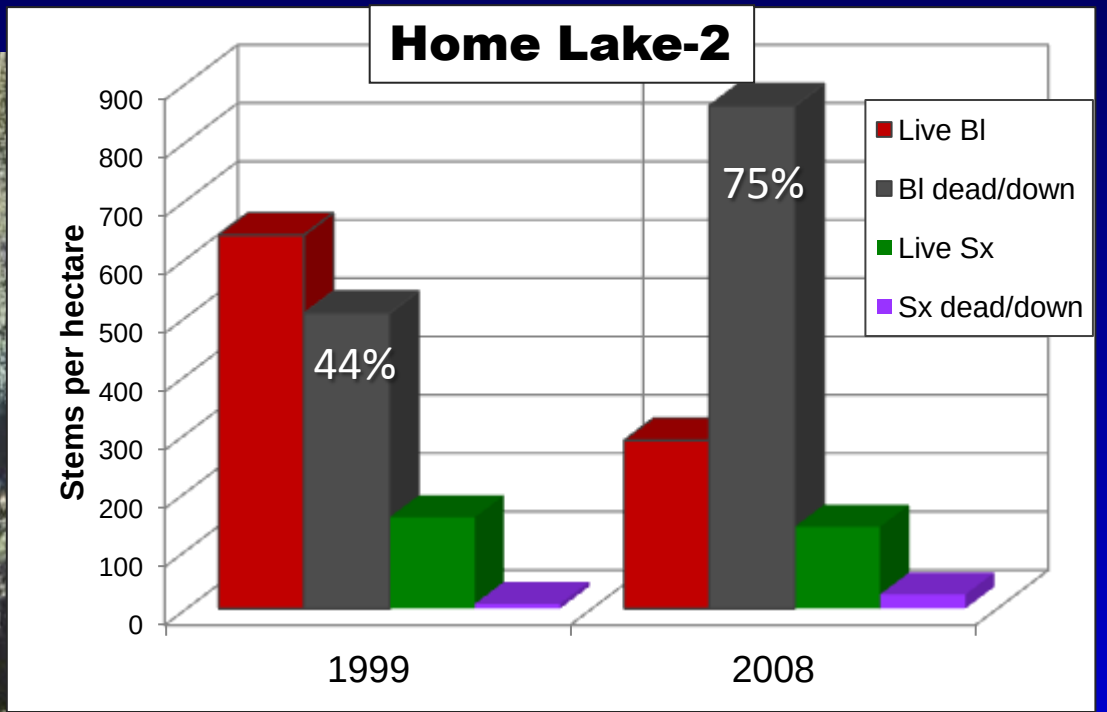


Hectares affected by *Dryocoetes* as mapped in aerial overview survey: 1996-2011









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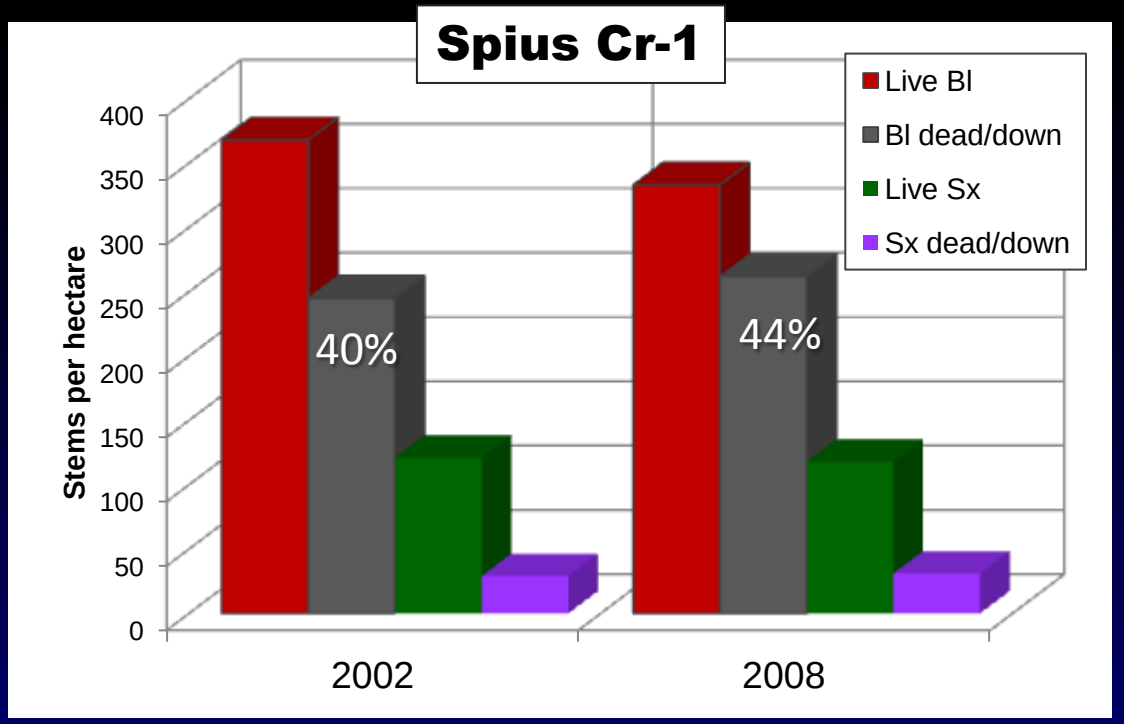
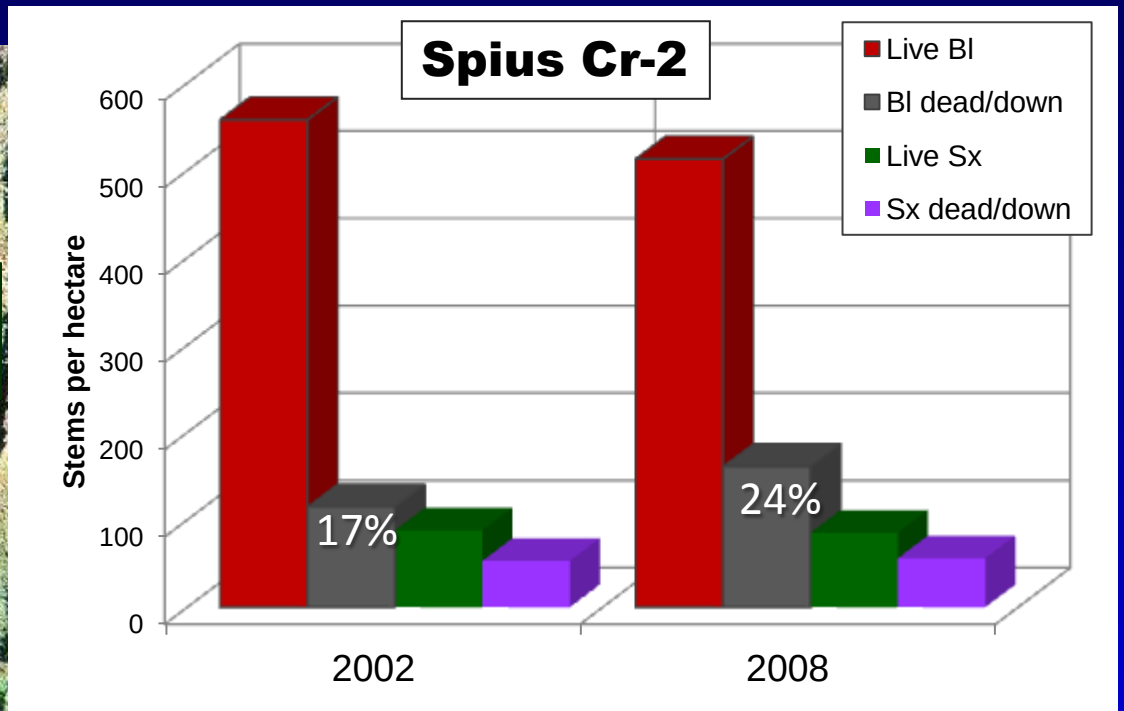
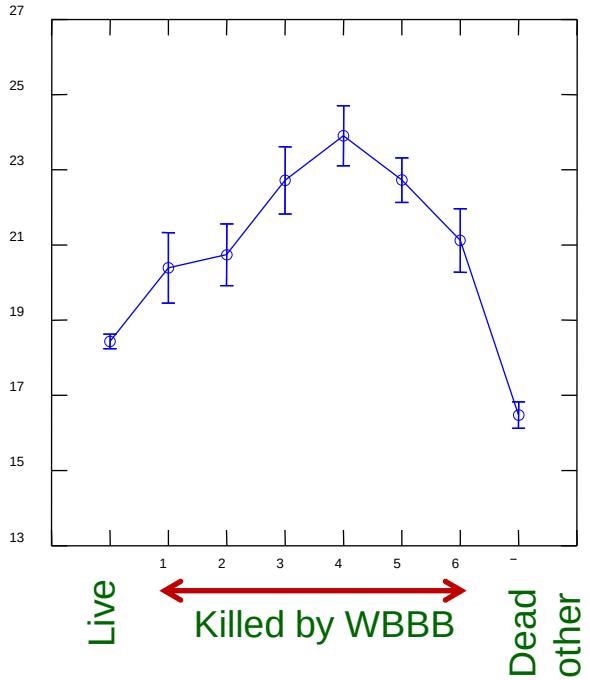


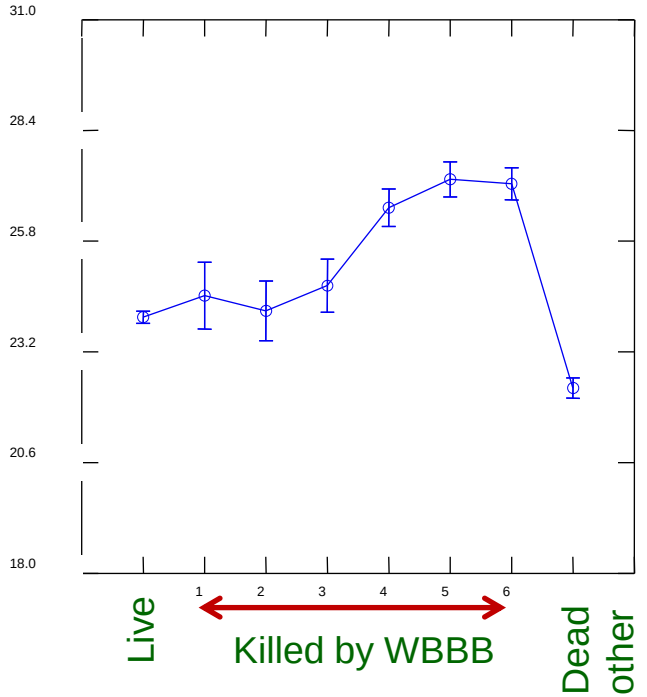


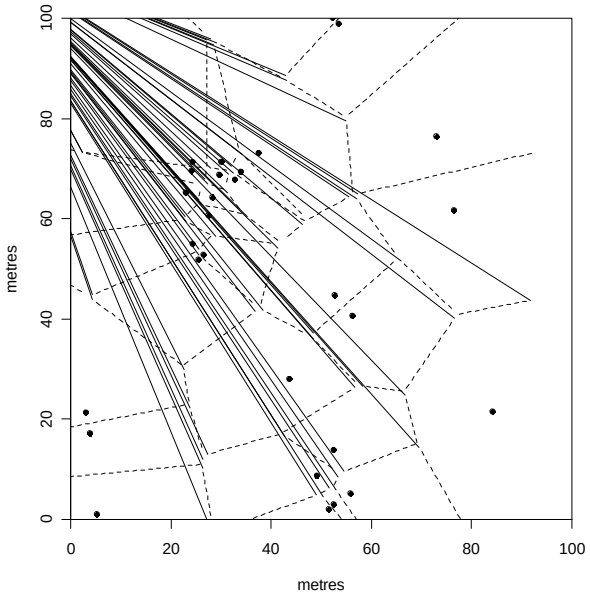
Mean diameters of subalpine-fir (from PSP's): live; attacked by *WBBB:* and, dead from other causes (2004 data).

Martin

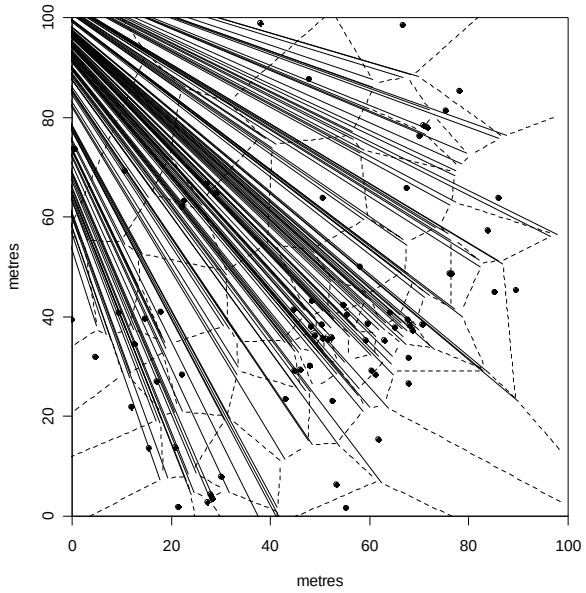


All blocks

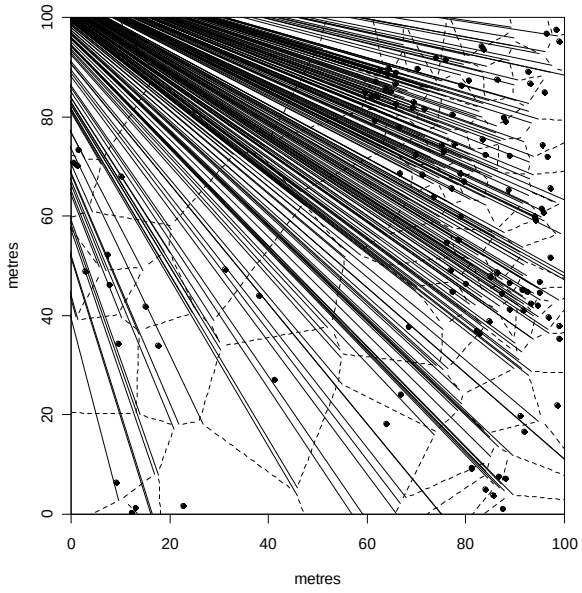




Current attack v-plot

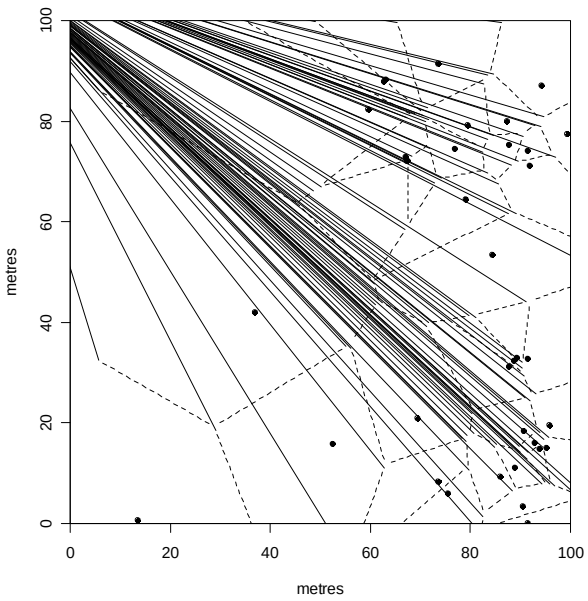


Reds v-plot

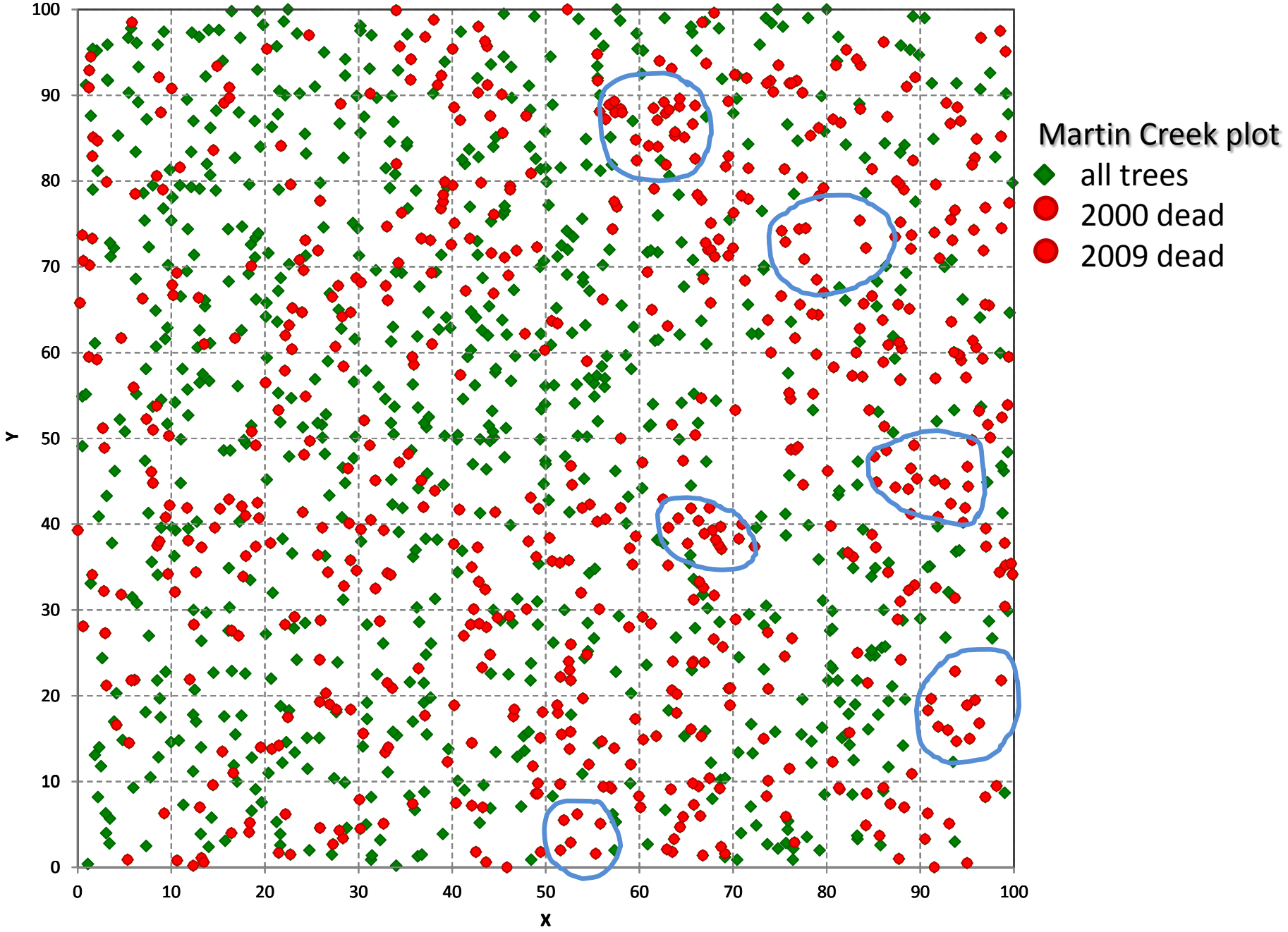


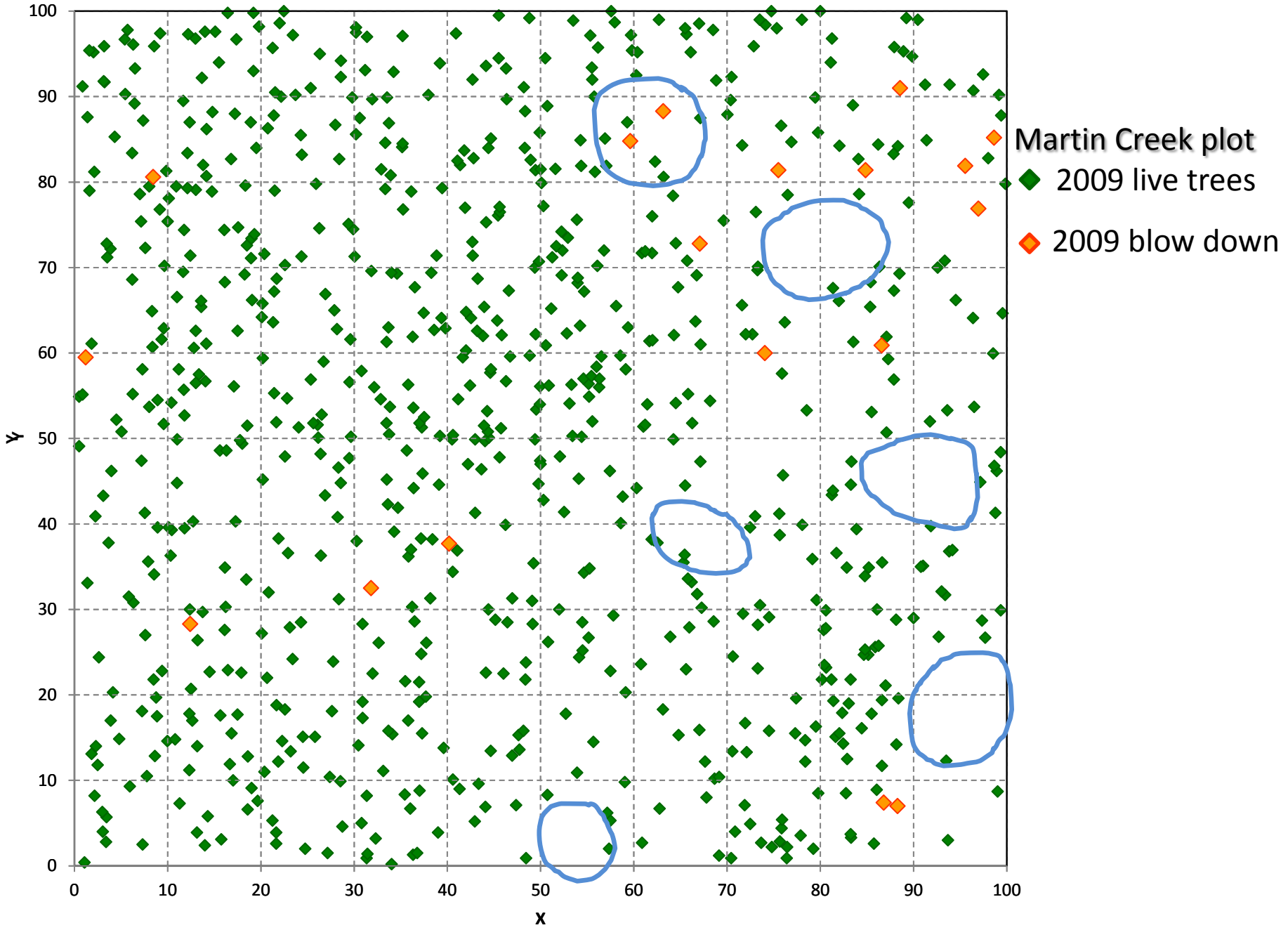
Greys v-plot

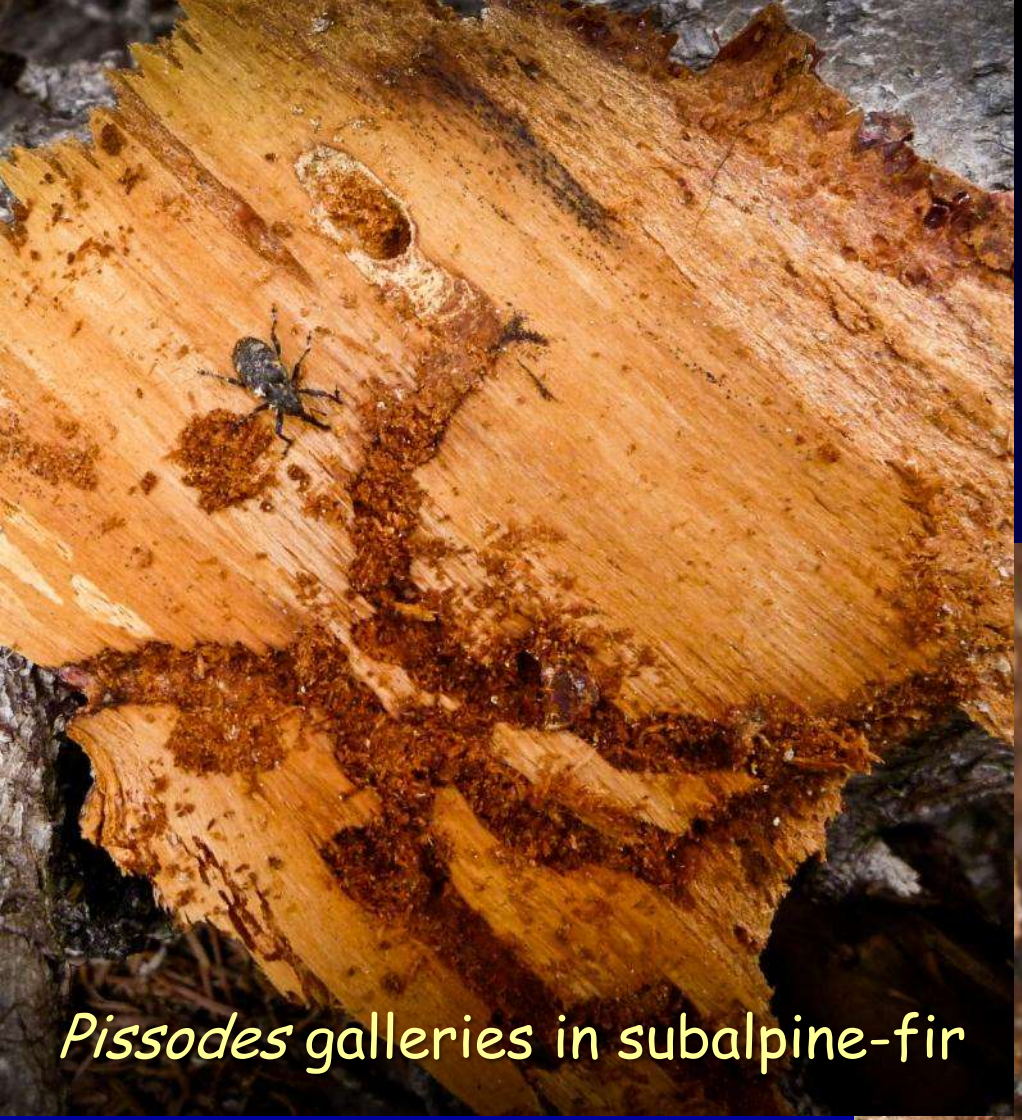
Martin Creek Plot



Snags v-plot


Martin Creek plot
all trees
2000 dead
2009 dead
Y
X
0
10
20
30
40
50
60
70
80
90
100


Martin Creek plot
2009 live trees
2009 blow down
Y
X
0
10
20
30
40
50
60
70
80
90
100



Pissodes galleries in subalpine-fir

A *Pissodes* found killing trees – alone and in combination with *Dryocoetes*

e.g. Buck Plot - 2009 assessment 32 of 298 trees killed were *Pissodes (10%)*

Pissodes adult

Summary

- Subalpine-fir stands are rapidly loosing volume and succession is being driven by *D. confusus* attack
- Stands >70 years are suitable and over a 10-20 years period undergo *select harvest* by WBBB
- Moderating climate could allow *D. confusus* and associated insects greater success as host trees become stressed
- impacts can be severe after only 10 years of *D. confusus* activity in a stand