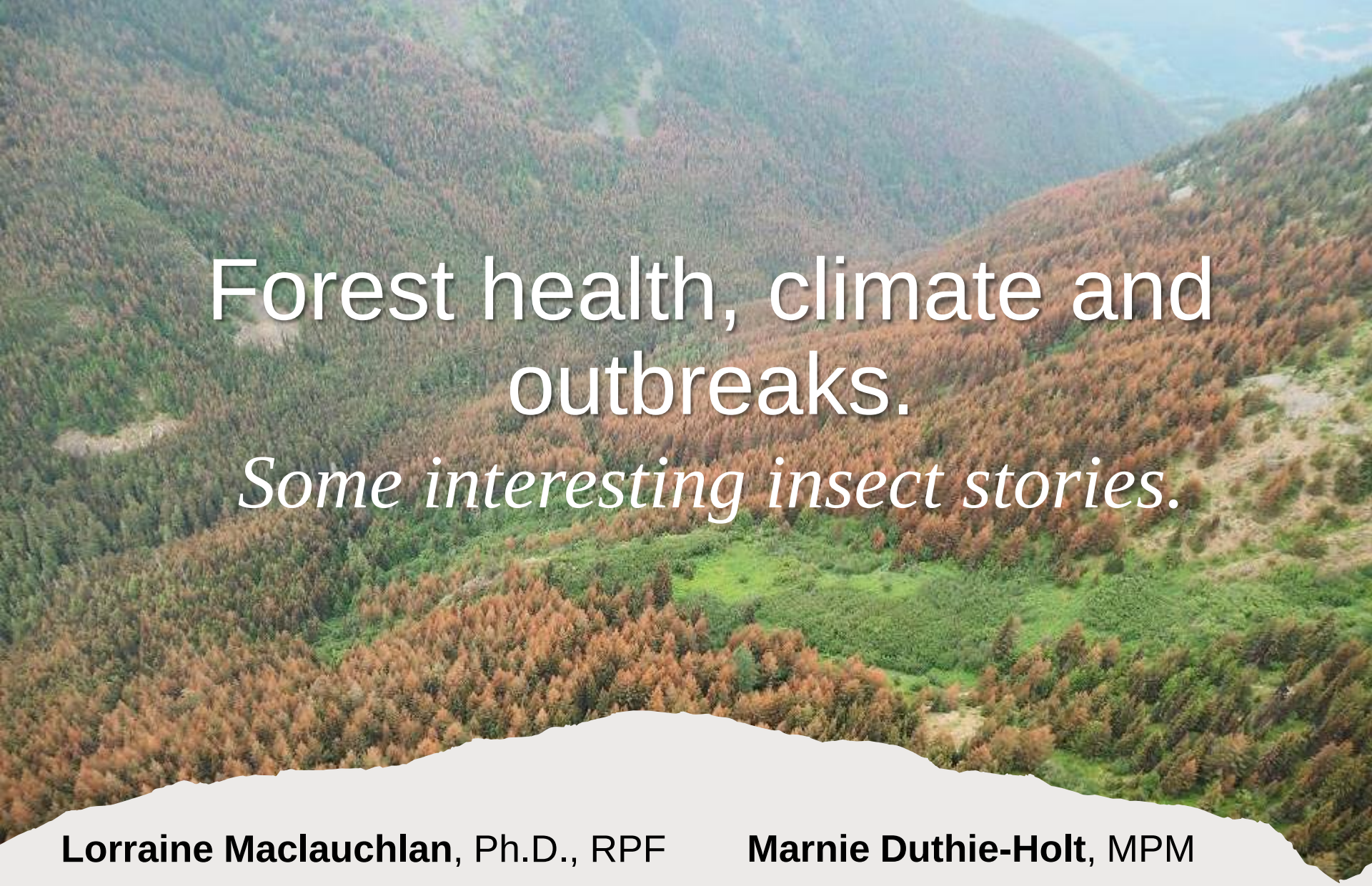


Forest health, climate and outbreaks.

Some interesting insect stories.

Lorraine Maclauchlan, Ph.D., RPF
Forest Entomologist, BC MOF
Thompson Okanagan Region

Marnie Duthie-Holt, MPM
Forest Entomologist, BC MOF
Kootenay Boundary Region

BC MOF Forest Health Team

Provincial team:

- Forest Health Officer (Babita.Bains@gov.bc.ca)
- Provincial Forest Entomologist (Kate.Mitchell@gov.bc.ca)
- A/Provincial Forest Pathologist (Calvin.Jensen@gov.bc.ca)
- Forest Health Data Scientist (Mike.Fowler@gov.bc.ca)

Specialists across six regions:

- Forest Research Entomologists
- Forest Research Pathologists
- Forest Health Technicians

District specialists

Annual Aerial Overview Surveys

- Primary source of forest health information in B.C.
- Provides current and historical records (trends, range expansion)
- Data source for management models

Taking the *pulse* of B.C.'s forests.

Detect, monitor, assess, manage, policy, research, communication.






Western spruce budworm *circa 2012*


Western spruce budworm *circa 2024*

Taking the *pulse* of B.C.'s forests.

- 60% of B.C. is forested (~55 million hectares) – *~3% defoliated by western spruce budworm in 2024*
- ~22 mill ha are public (Crown) forestlands and subject to forest management agreements (*TSA's; TFL's; Community Forests and others*)
- Since 1999, MOF has annually completed aerial overview surveys (AOS)

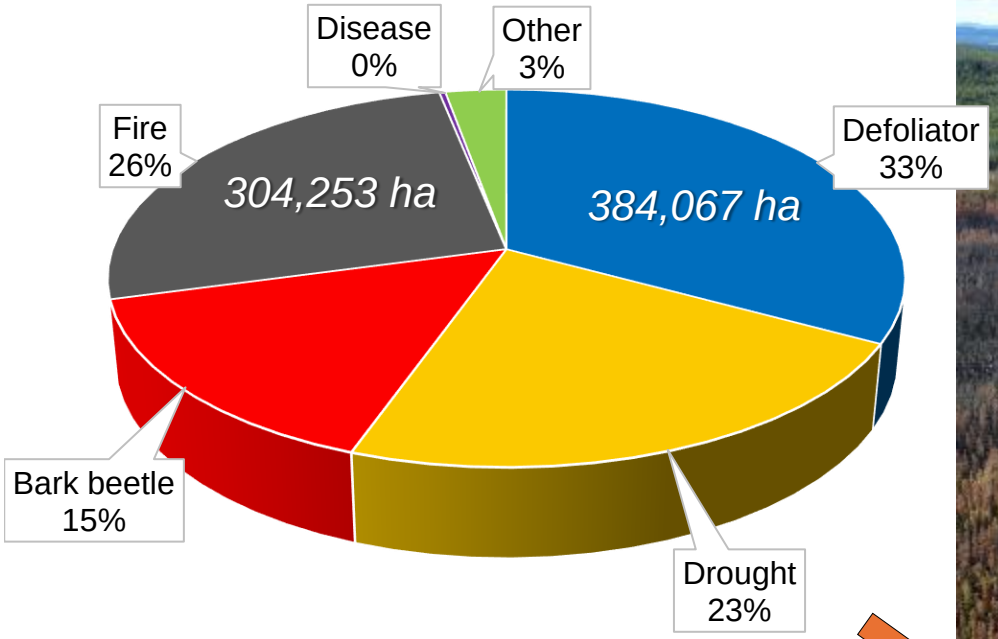
  Fixed-wing surveys

  1914 – 1999: Forest Insect and Disease Survey (FIDS) was completed by the Canadian Forest Service

- Surveying completed by certified contractors (June - October)
- 73% (68,826,034 ha) of the provincial landmass was covered in 2024 (*annual target is to cover 80%)*
- Data is course (ha impacted ≠ mortality)
- Methods, data, annual conditions reports posted on BC MOF website

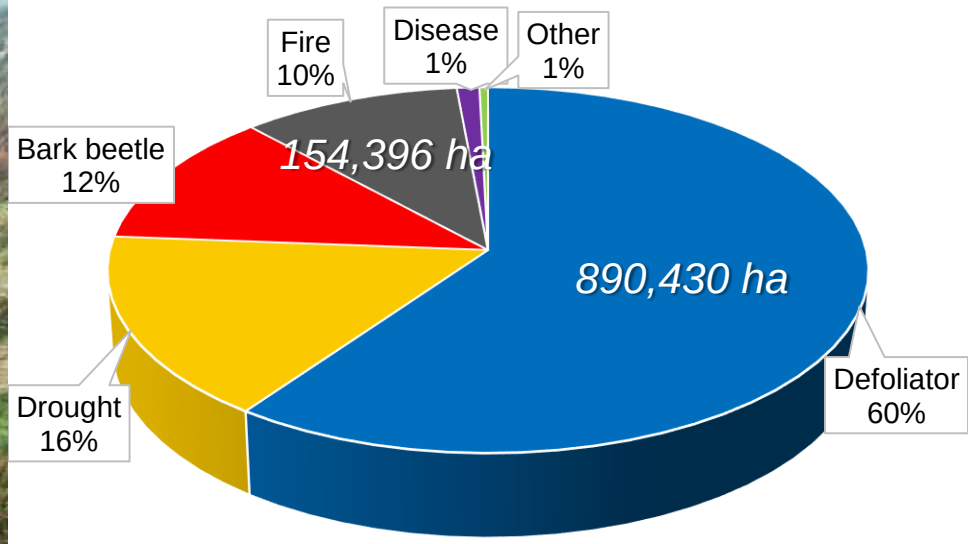
Forest Health Aerial Overview

Southern interior update


Disease
0%
Other
3%
Fire
26%
304,253 ha
384,067 ha
Defoliator
33%
Bark beetle
15%
Drought
23%

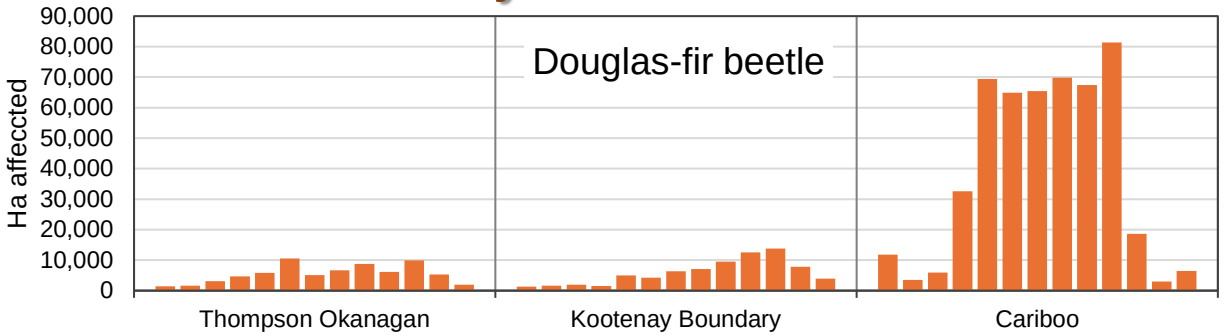

2023 damage
(6,412,705 ha)

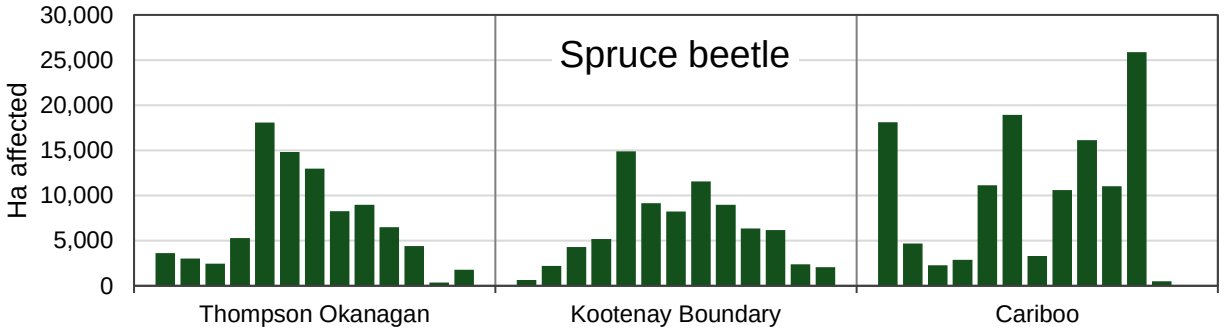

2024 damage
(4,280,764 ha)

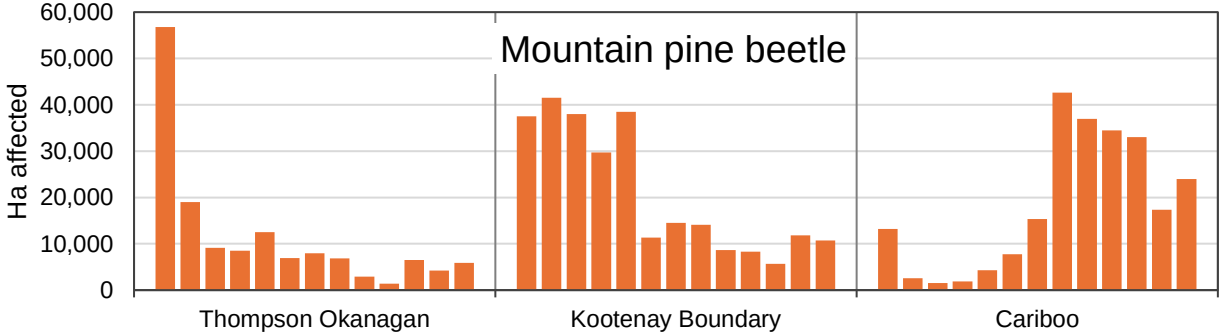

Fire
10%
Disease
1%
Other
1%
Bark beetle
12%
154,396 ha
890,430 ha
Drought
16%
Defoliator
60%

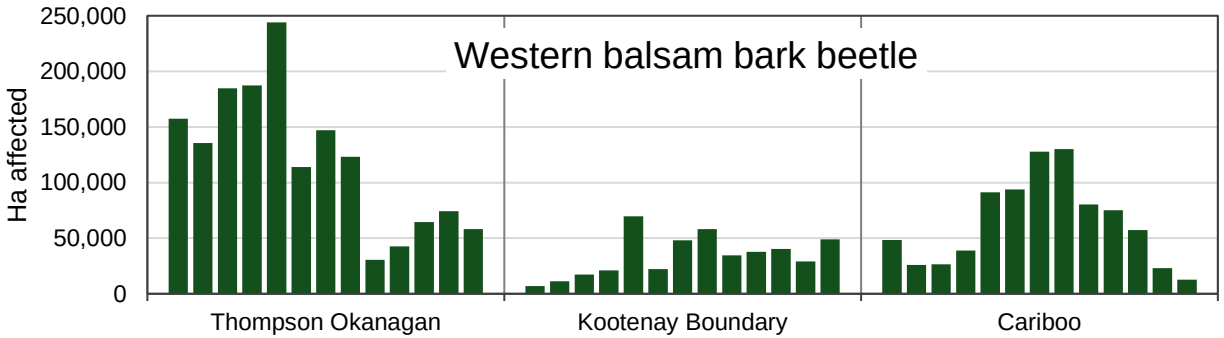
Bark beetles, woodborers, fire, drought, heat events

Ha affected by bark beetles 2012-2024

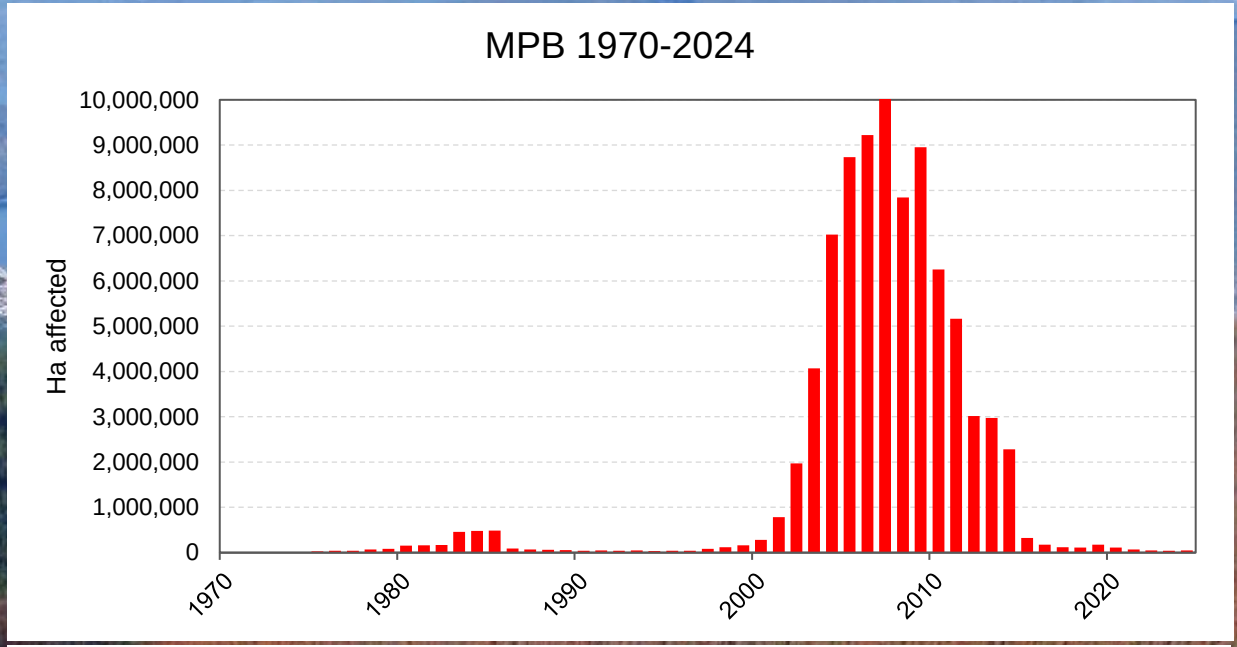


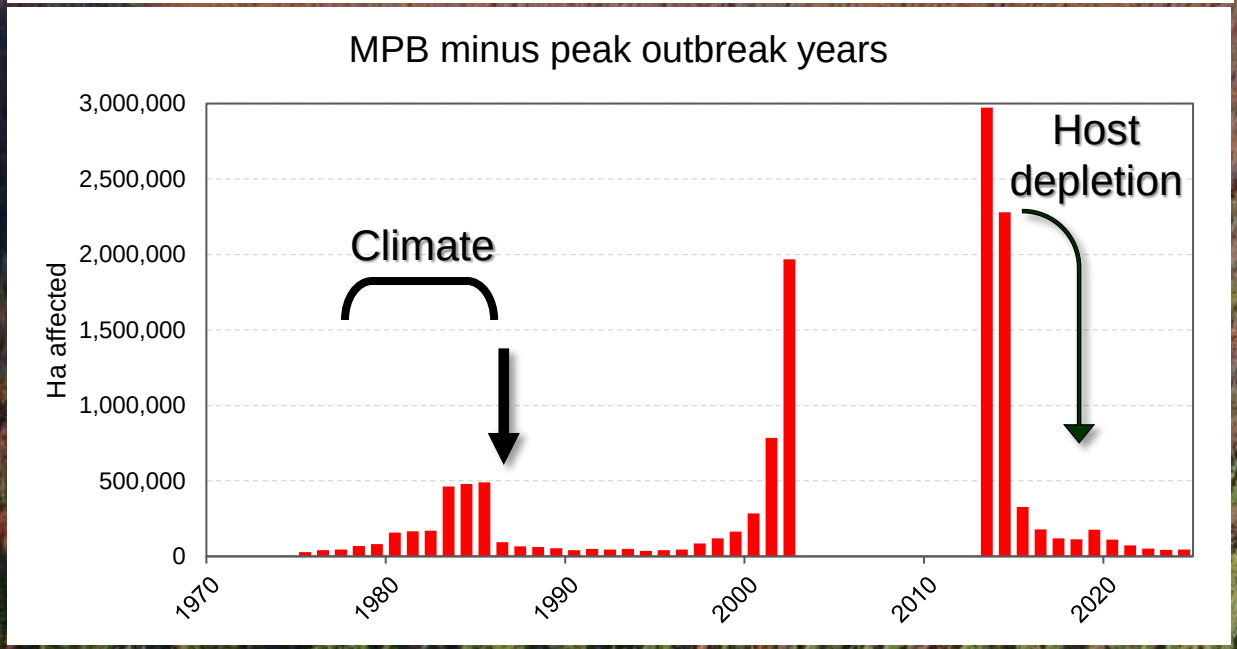




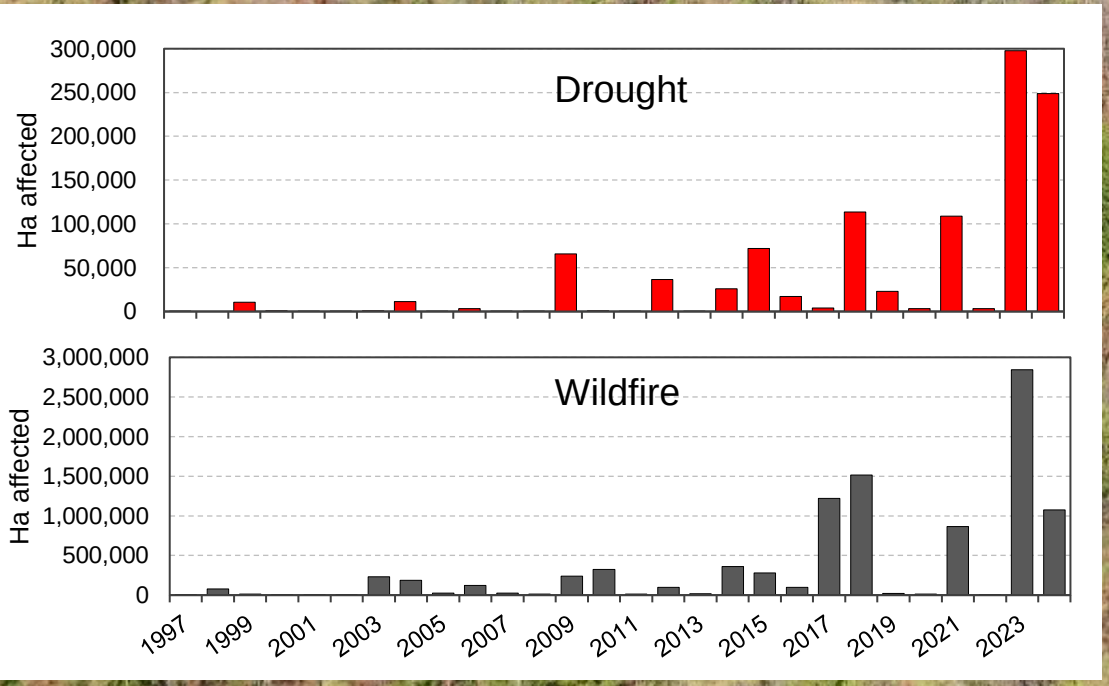


Hectares affected by mountain pine beetle in B.C. 1970-2024

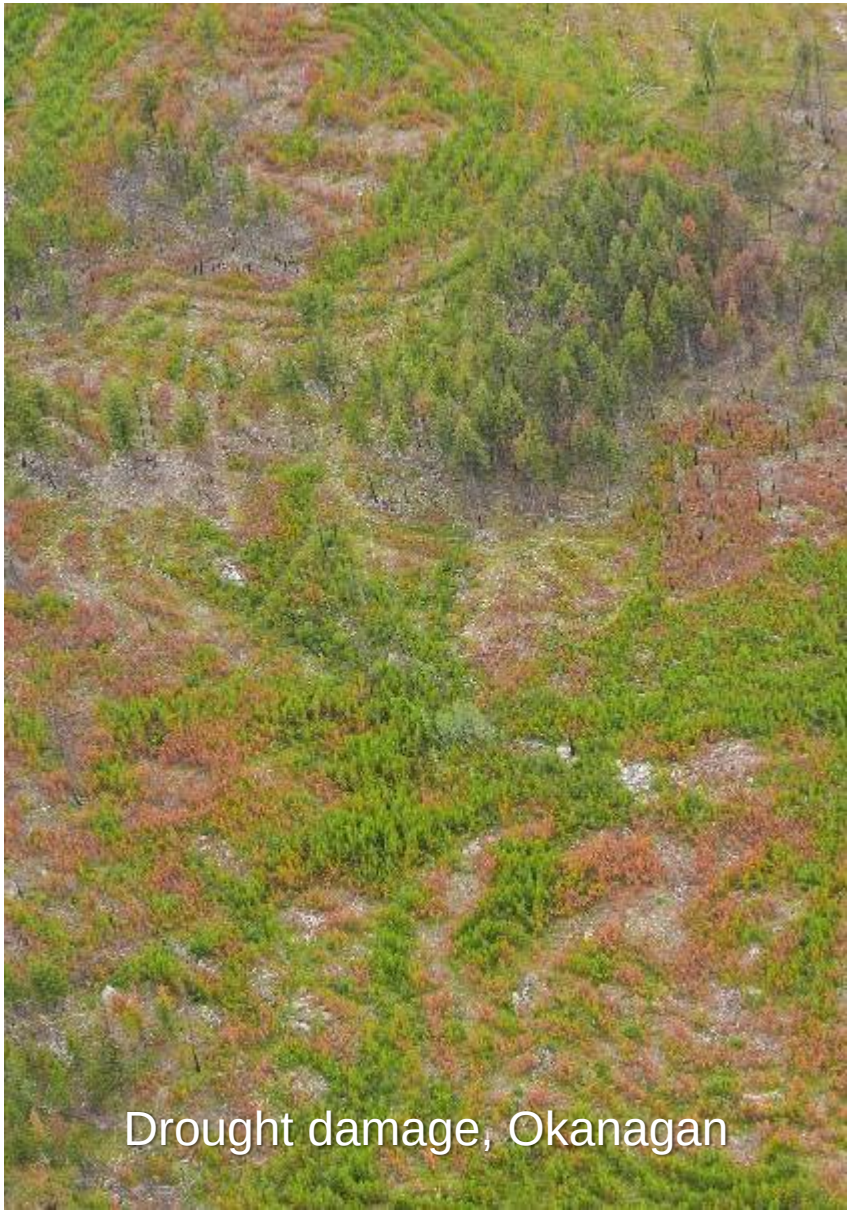




Post-fire damage, drought, secondary bark beetles.



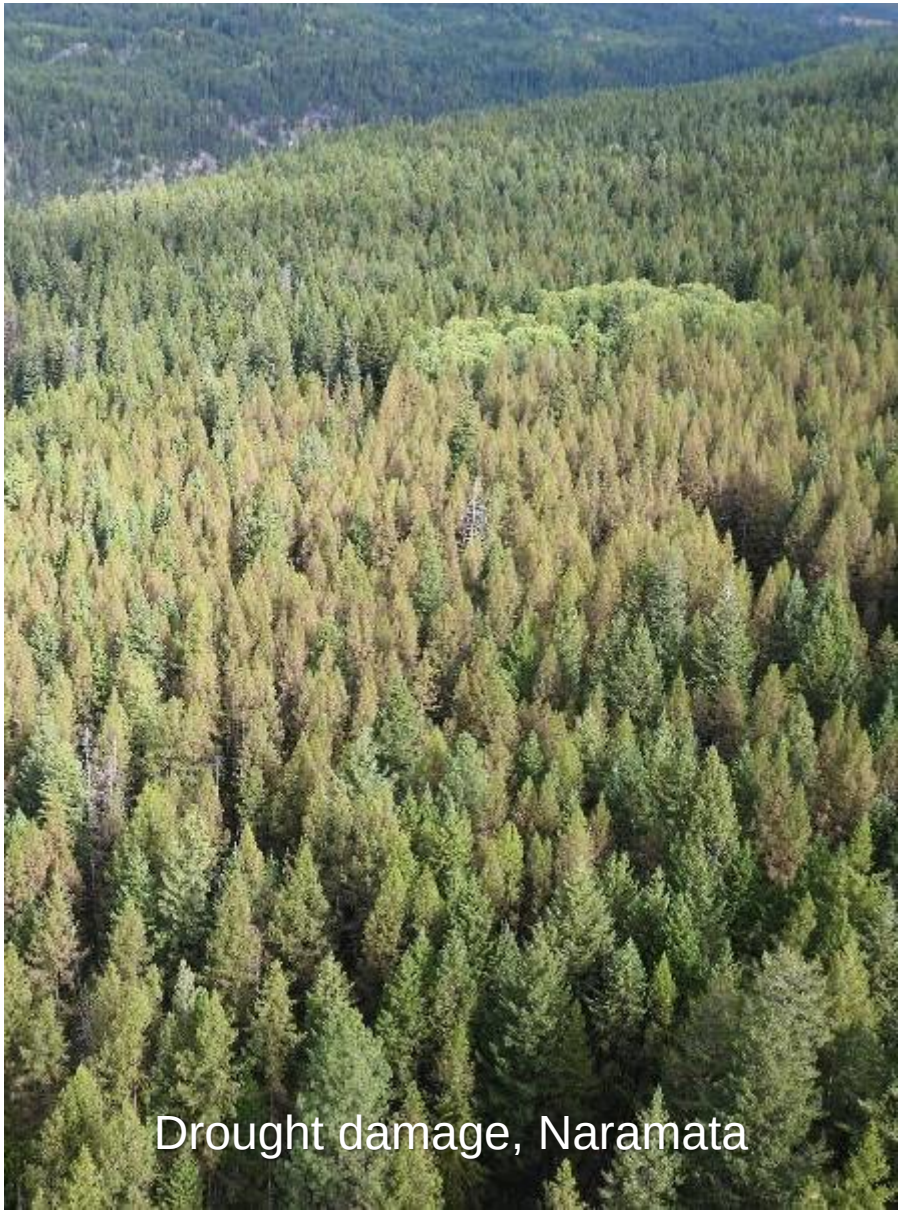
Drought damage 2017



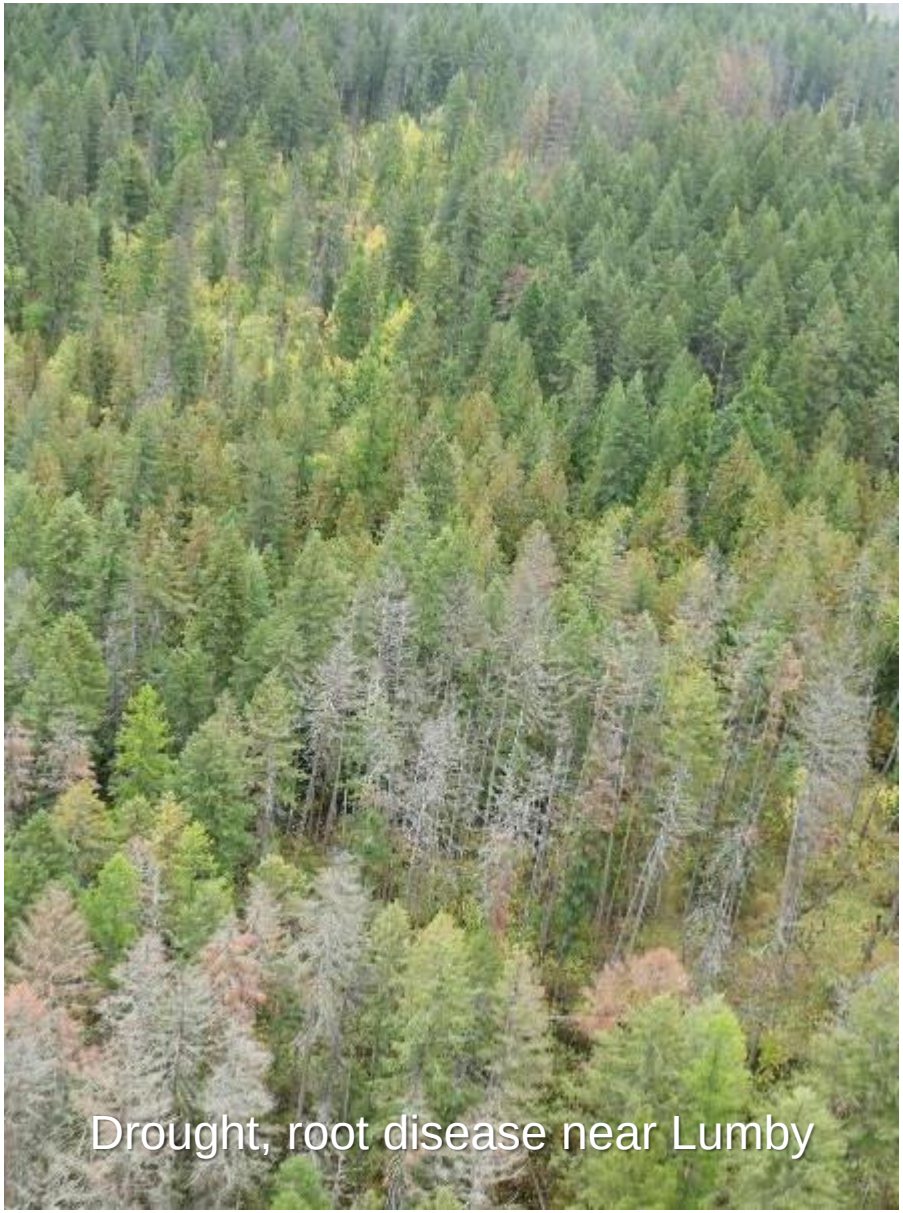
Drought damage, Okanagan

Drought damage, Sawmill Creek

Drought damage 2024



Drought damage, Naramata



Drought, root disease near Lumby

Subcortical insects

2022 - fading trees and heavy woodpecker action noticed throughout southern B.C.

Apparently ***healthy*** trees dying.

Heavy woodborer-woodpecker activity:

- within recent fires
- in green-tree reserves
- drought-affected sites

Mortality continued in 2024.

Biological and abiotic interactions of subcortical insects with fire- and drought-stressed trees.

Bark beetles & woodborers colonize fire setting

Wildfires, drought, heat dome

Many scorched & drought-stressed trees

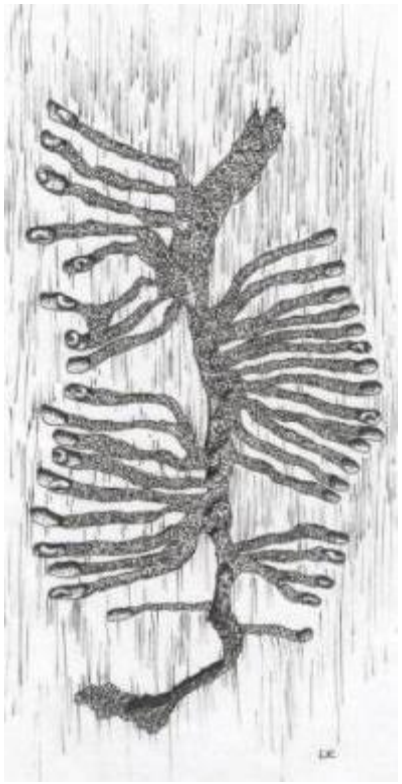
Douglas-fir beetle & woodborer attack

Bark beetles & woodborers exit fire setting

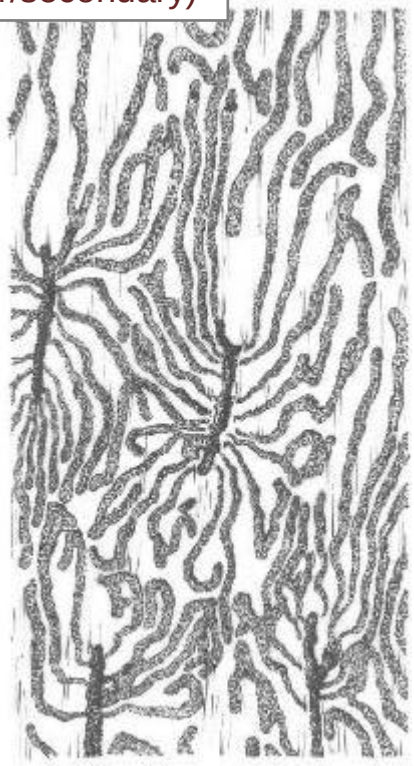
Subcortical insects colonize fire-stressed trees:

Each insect has a unique "*signature*", "*host preference*" and infestation sequence.

Douglas-fir beetle

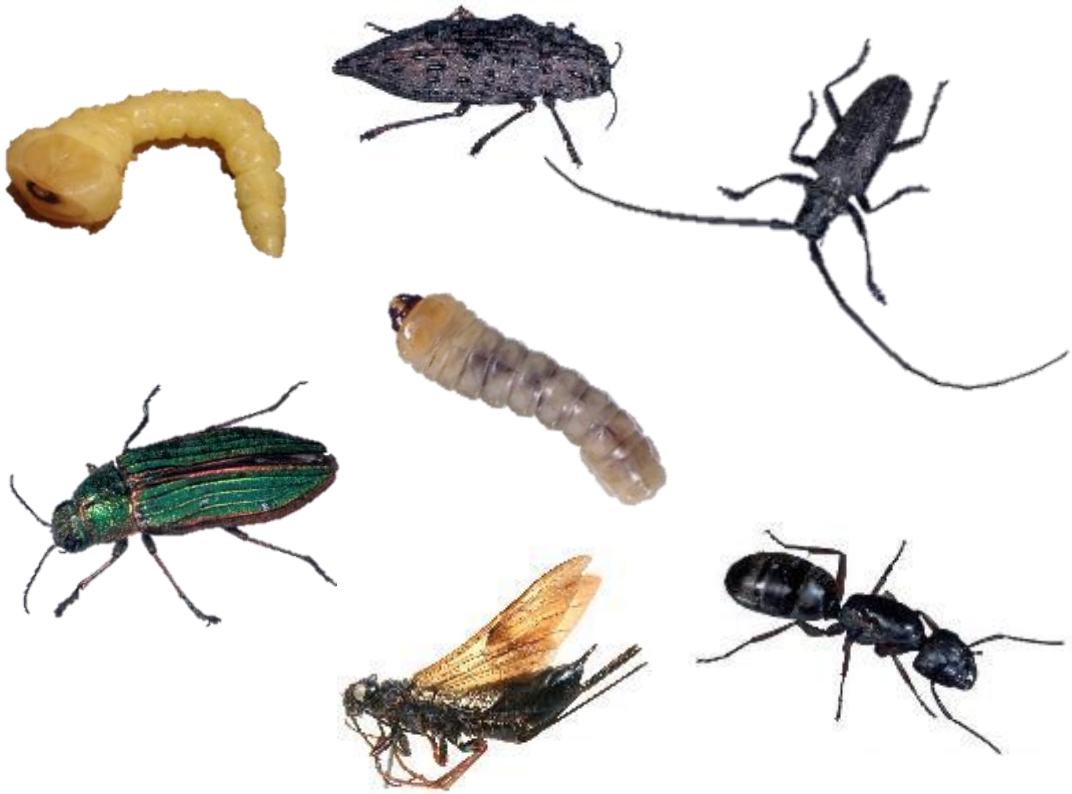


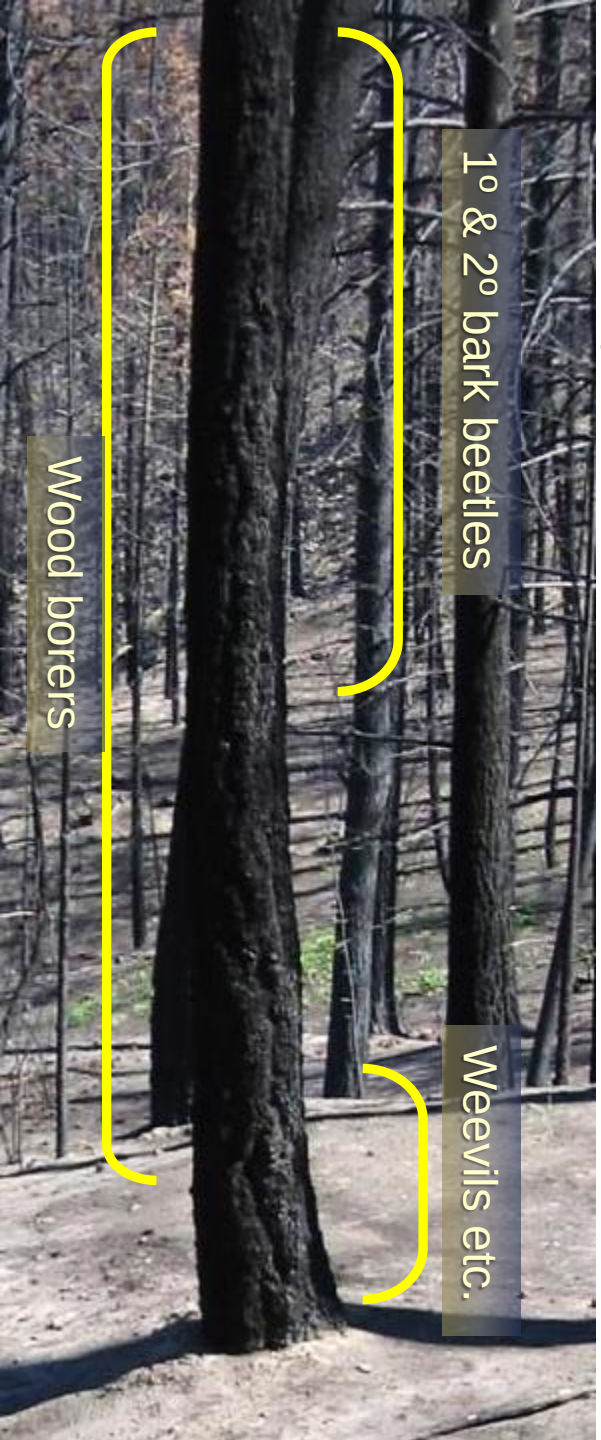
Douglas-fir pole beetle (engraver/secondary)



Subcortical insects colonize fire-stressed trees:

Decomposers / cannibalize = wood borers, wood wasps, ambrosia beetles, ants





Wood borers – immediately following fires

1º Bark Beetles – species specific & dependent upon timing of fire

2º Bark Beetles – multiple generations per year; compete for phloem

Root collar insects – red turpentine beetle, weevils, *Hylastes*

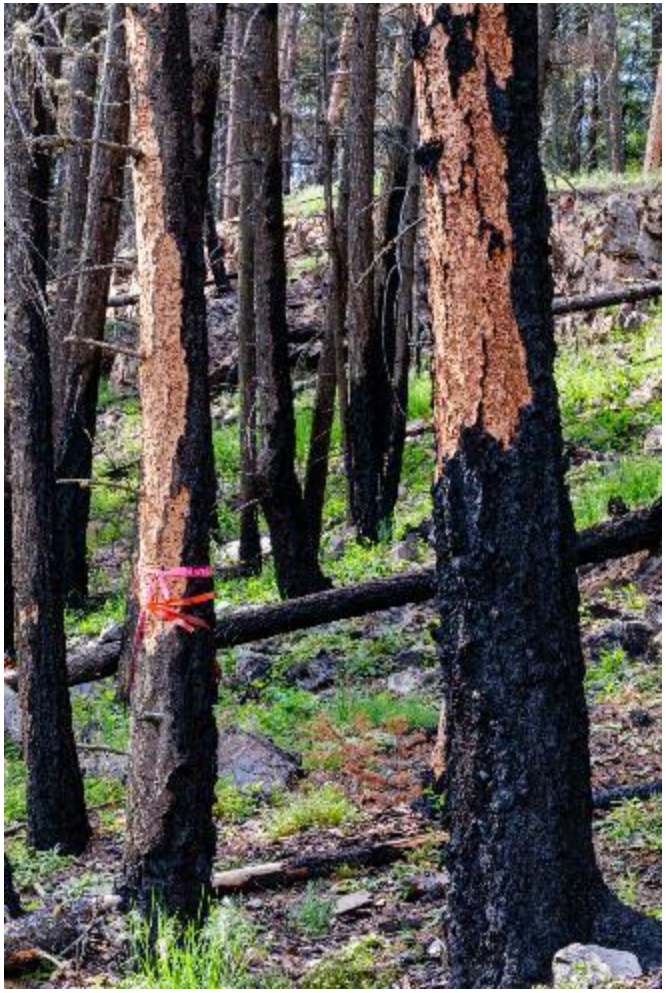
Bark beetles can be positively or negatively affected by drought or temperature extremes: dependent on intensity, duration, and tree water stress.

Increased temperatures can accelerate insect development, lessen overwinter mortality, trigger early flights.

Dendroctonus valens attack on burnt ponderosa pine

Dendroctonus valens larvae and adult

Woodborers attack fire and drought stressed trees.
Woodpeckers remove bark to feed on larvae hastening tree mortality.



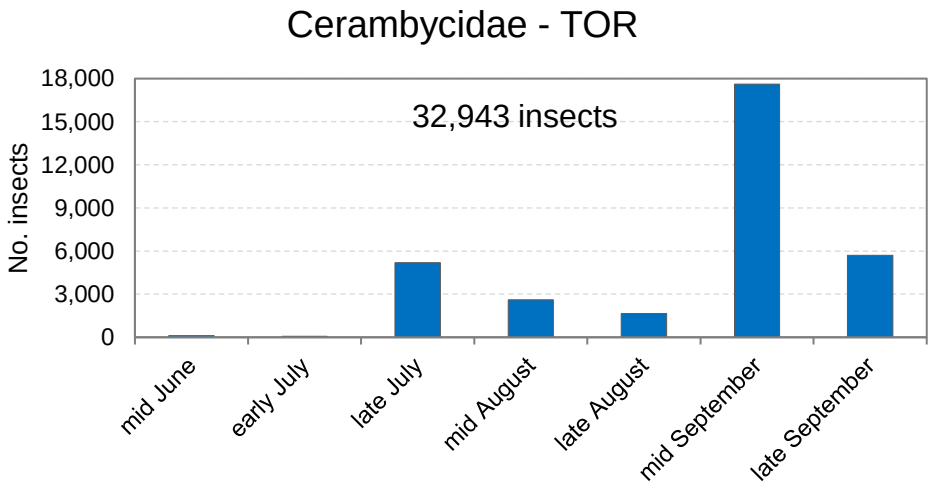
Woodpecker damage on burnt trees

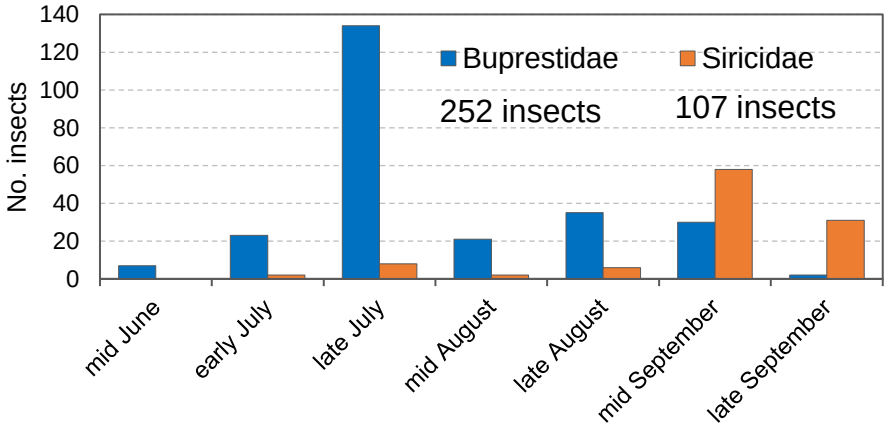
Pileated woodpecker

Hairy woodpecker

Trapping trial:

- testing 4 lure blends
- 20 sites (10 in TOR & 10 in KBR)
- 12 traps per site (240 traps)
- burnt or drought affected sites (Fd, Py, Pl)

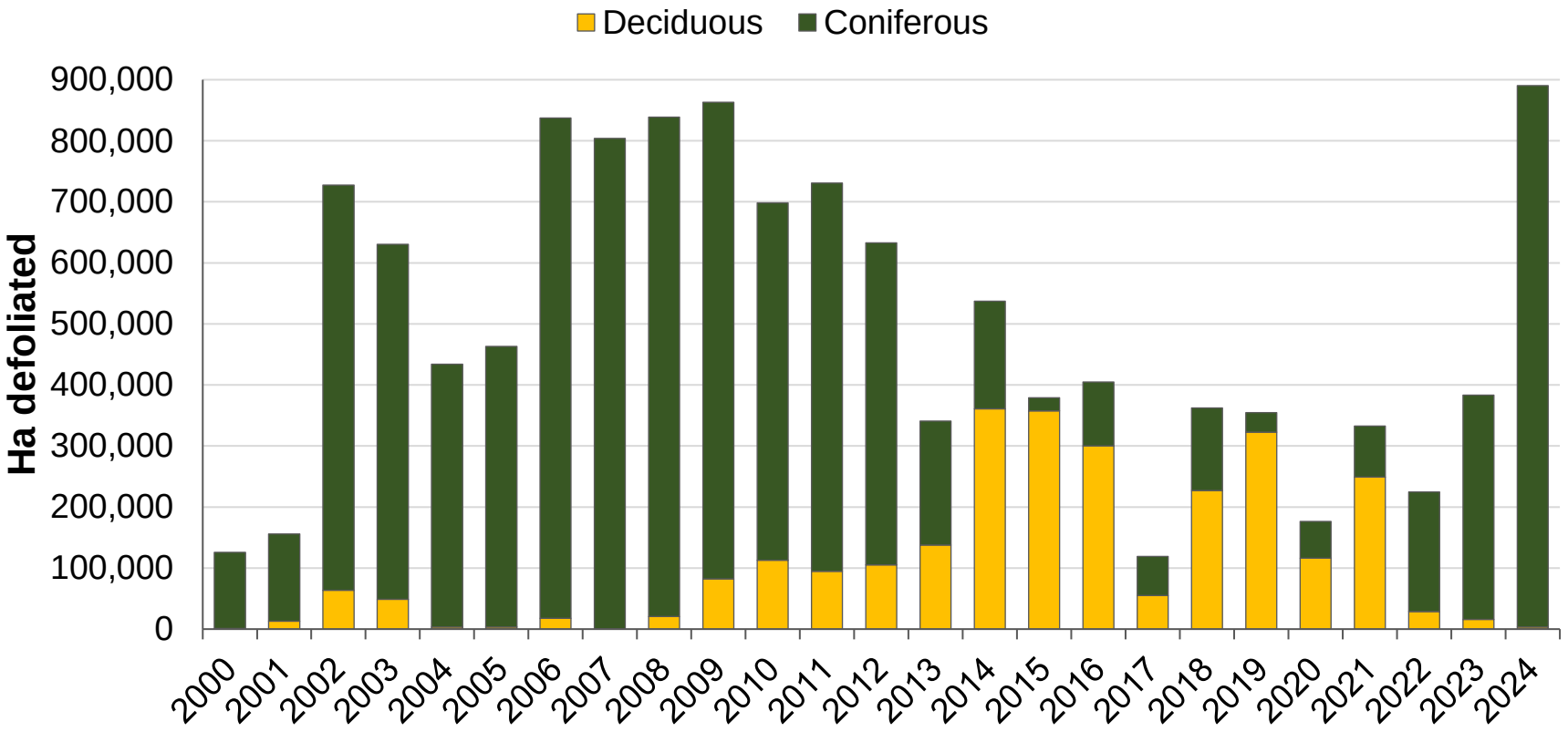




Risk of damage x fire severity

Forest health factors	Fire severity			
	Low	Moderate	Severe	Very severe
1° bark beetles	H	H	M	L
2° bark beetles	L-M	H	M	L
Woodborers	M	H	H	L
Root collar insects	L-M	M	L	L
Black army cutworm	L-M	L	H	H
Rhizina root rot	L-M	H	L	L

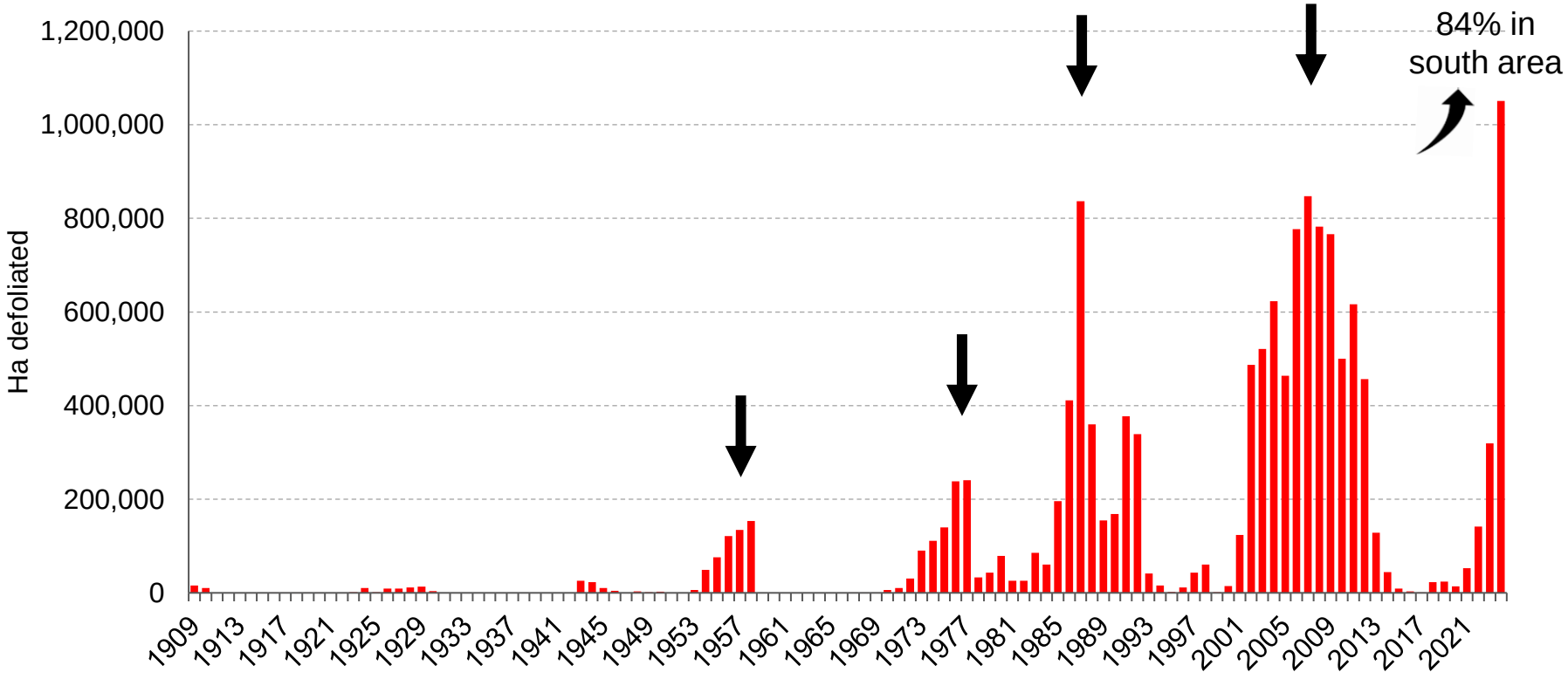
Coniferous and deciduous insect defoliation – south area

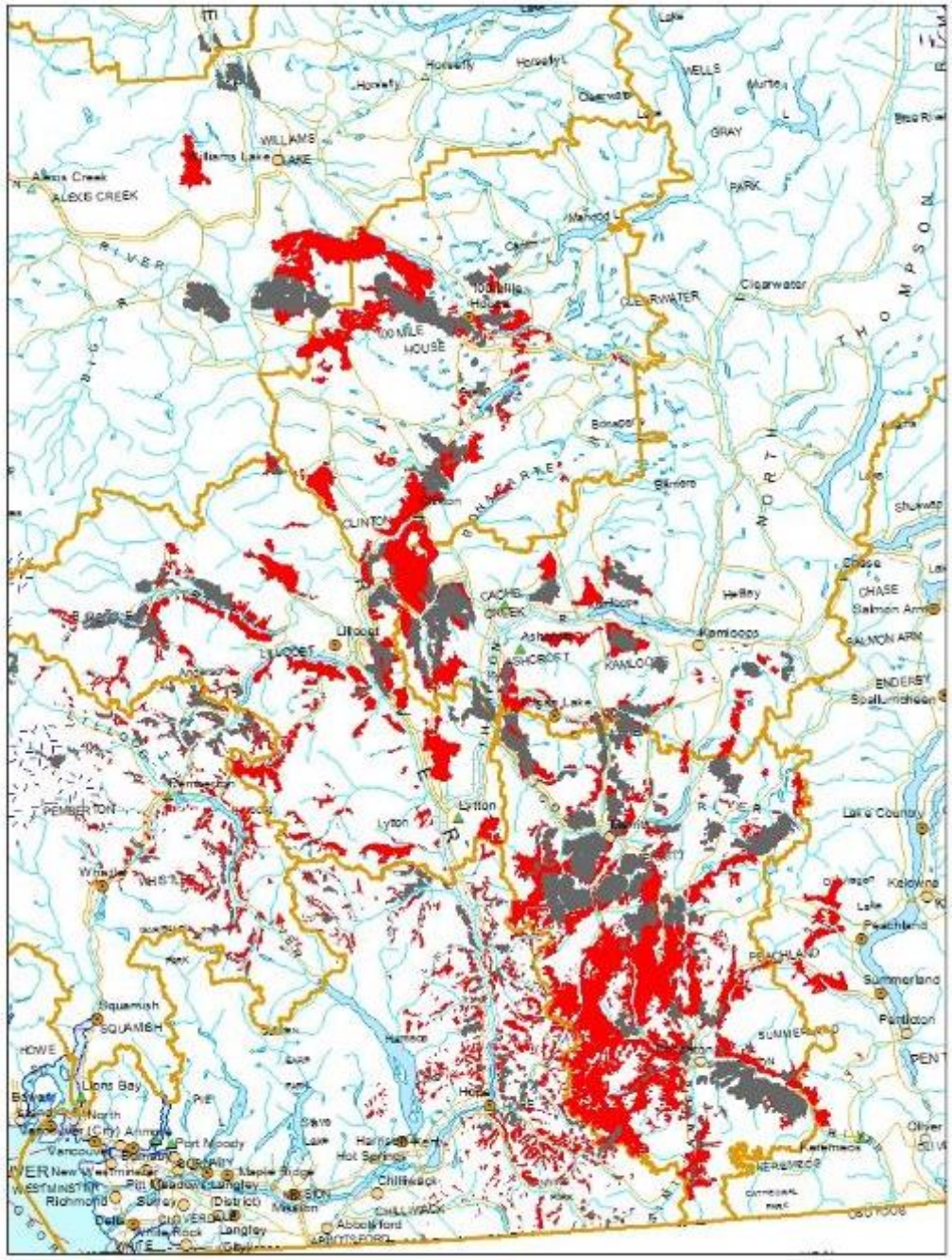


Western spruce budworm

Choristoneura freemani

Hectares defoliated by western spruce budworm in B.C. 1909-2024





Rapid population increase in the Thompson Okanagan and Coast Regions.

Slight decline in the Central Cariboo and increase in the 100 Mile House Districts, Cariboo Region.


August 14, 2024


September 18, 2024

Understanding western spruce budworm

Eggs laid on underside of needles and hatch within 10 days.

Larvae disperse for egg mass and spin hibernaculum to overwinter.

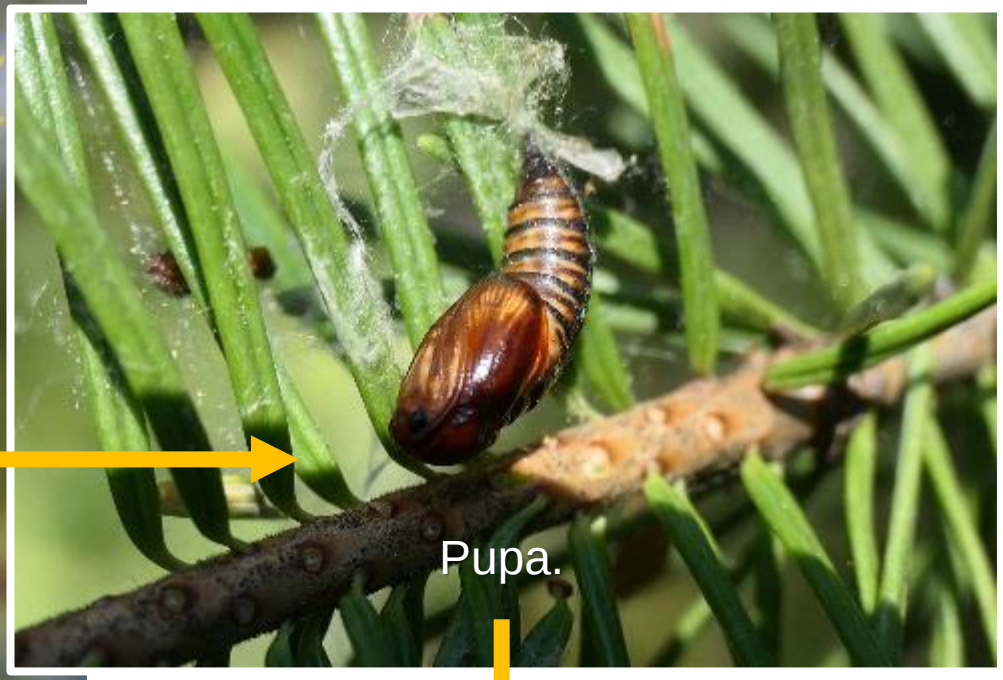
Spring larval dispersal – first mine needles until buds soften.

Larva mines bud in protective webbing

Mined bud

Larvae consume foliage (6 instars).

Larva *dangle* from foliage on silk thread when disturbed.



Pupa.

Pupal case.

Destruction of new growth.

Tree and stand defoliation.

Timing: the tricky part of a spray operation

Budmining

Larval feeding

Shoot destruction

Western spruce budworm 2024 spray program

2024 *B.t.k.* treatments

Kamloops TSA - 8,992 ha

Merritt TSA - 13,487 ha

100 Mile TSA - 15,000 ha

Total = 37,487 ha

Western spruce budworm larval density pre- and post-spray

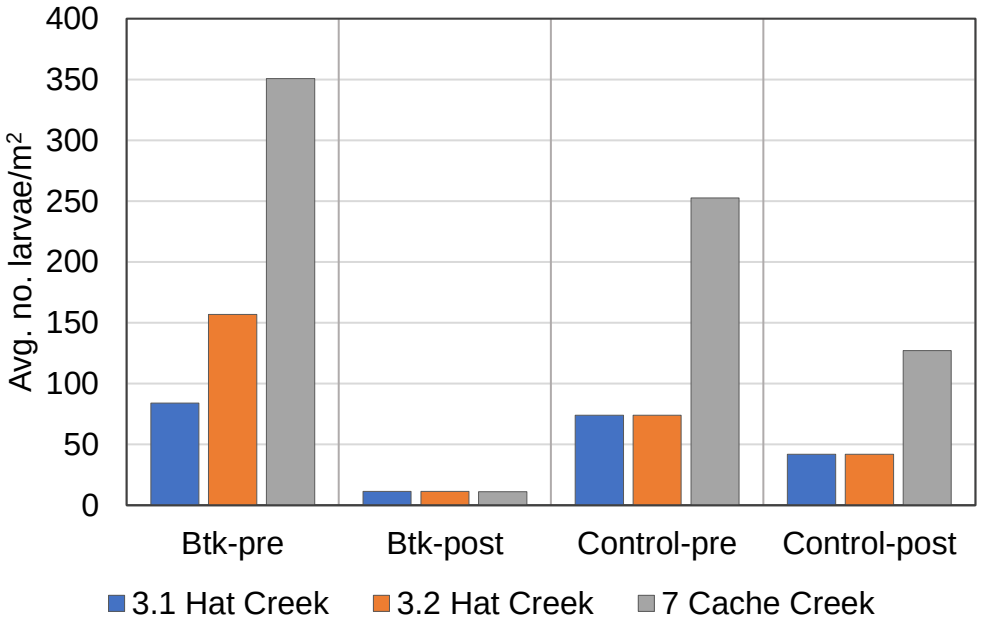
IDFxh = 6,869 ha

IDFdk = 30,307 ha

Completed spray:

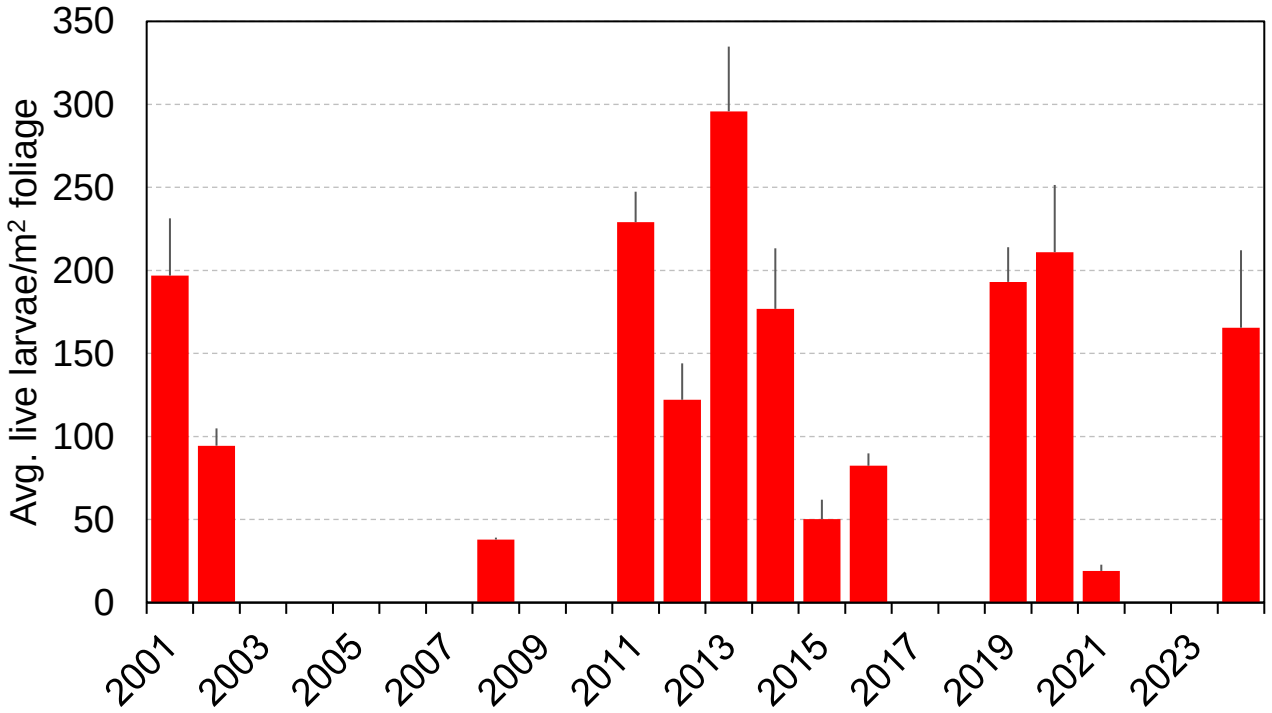
TOR **June 25 - 28, 2024**

CAR **June 29 - Jul 2, 2024**



Average number of western spruce budworm larvae/m^2 of foliage when *B.t.k*. treatments were conducted.

(avg. live larvae/m^2 ± S.E.)



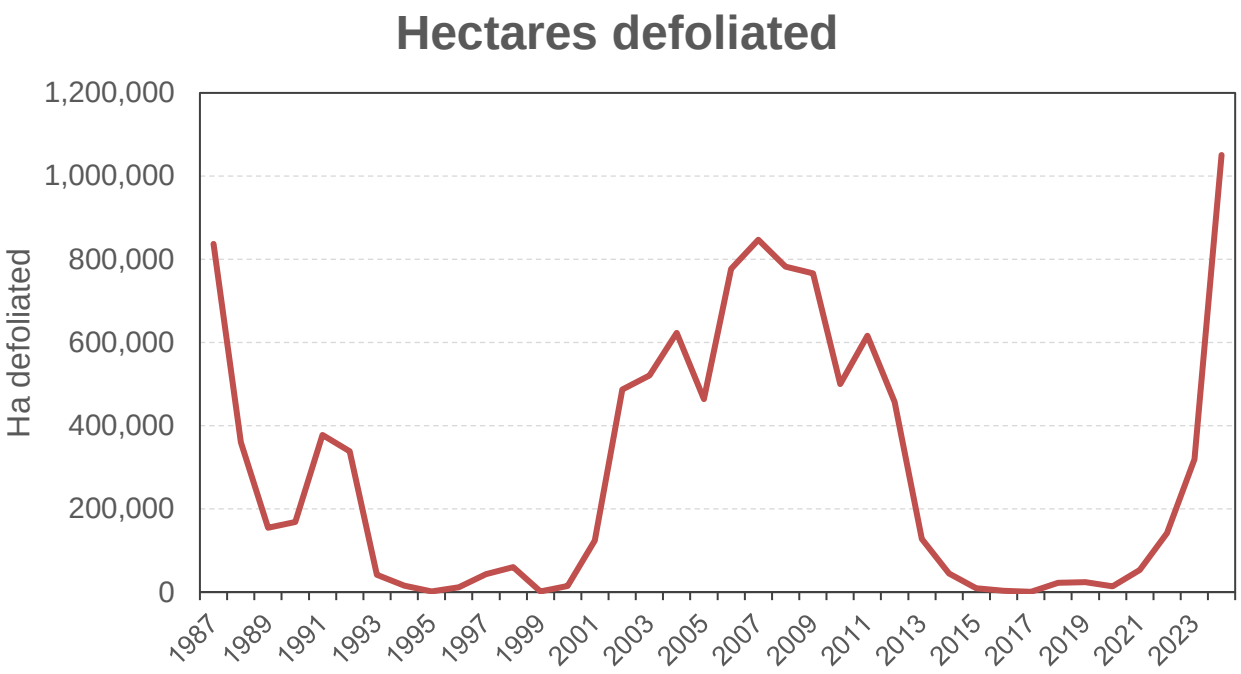
Spray efficacy

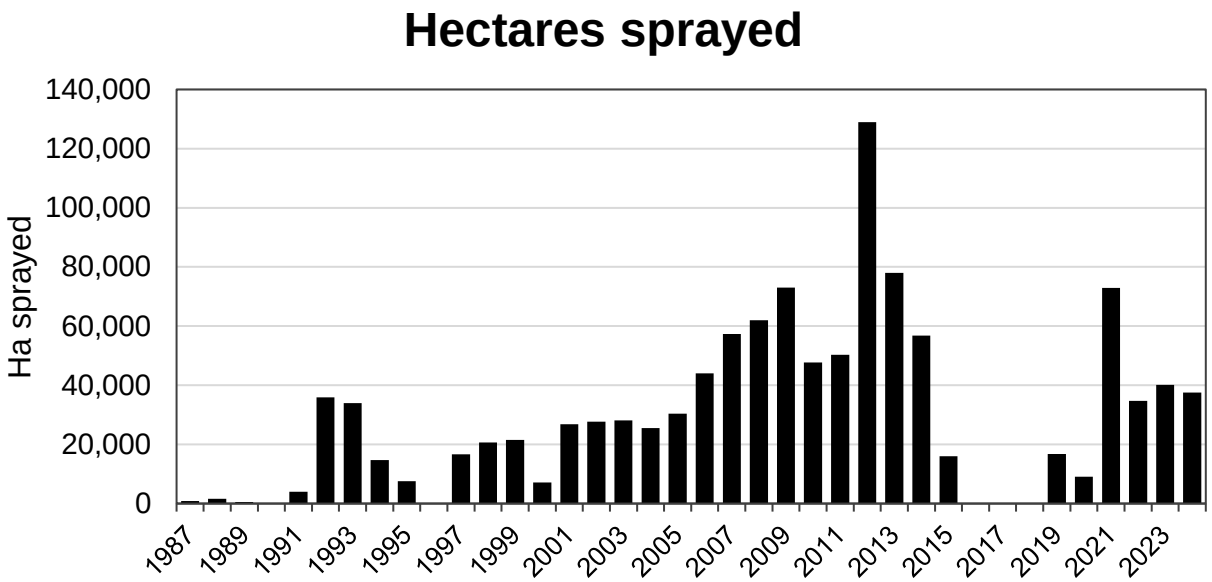
Block	Treatment	% mortality	
		Post-1	Post-2
3.1 Hat Cr NE	*B.t.k.*	86.6	94.4
3.2 Hat Cr NE	*B.t.k.*	90.9	92.1
3.0 Hat Cr NE	control	39.2	*pupated*
7.1 Cache Cr	*B.t.k.*	71.7	90.1
7.0 Cache Cr	control	42.8	64.7


Damage on lodgepole pine


Shoot damage


Defoliation on young Douglas-fir

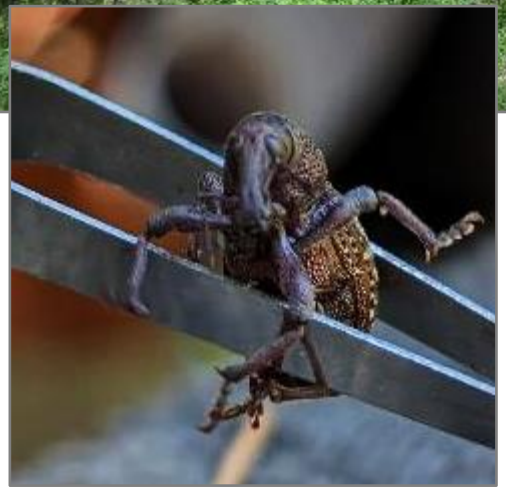

Hectares defoliated
Ha defoliated
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005
2007
2009
2011
2013
2015
2017
2019
2021
2023


Hectares sprayed
Ha sprayed
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005
2007
2009
2011
2013
2015
2017
2019
2021
2023

Defoliation predictions for 2025 based on fall egg mass sampling.

Number of sites				
Region	**Nil**	**Light**	**Moderate**	**Total # sites**
TOR	0	91	14	105
CAR	87	12	0	99
KBR	0	0	0	18
Total	**87**	**103**	**14**	**222**

Pathology, young stands



Root collar weevil &
red turpentine beetle

Comandra blister rust

Stem damage and foliar damage




Terminal weevils and pitch moths

Invasives: Dutch Elm Disease

Disease caused by by either *Ophistoma ulmi* or *Ophistoma novo-ulmi* on elm (*Ulmus* spp.) – elms are not native to B.C.

Spread through 3 species of elm bark beetles (2 are present in B.C.).

2024: confirmed detections by CFIA in the Kootenay-Boundary region.

(Calvin.Jensen@gov.bc.ca)

Whitebark Pine

Whitebark pine is a federally listed endangered species, and "Blue" listed in B.C.

- *Resistance testing ongoing since 2013; creation of two seed orchards and clone banks provide resistant seed for reforestation and climate change adaptation*

Marnie.Duthie-Holt@gov.bc.ca
Michael.Murray@gov.bc.ca

Alien

Whitebark pine – threatened

Blister rust

Pissodes striatulus

New threat!

Mountain pine beetle

Spread

Pissodes striatulus

Emerging threat to subalpine fir *and* whitebark pine.

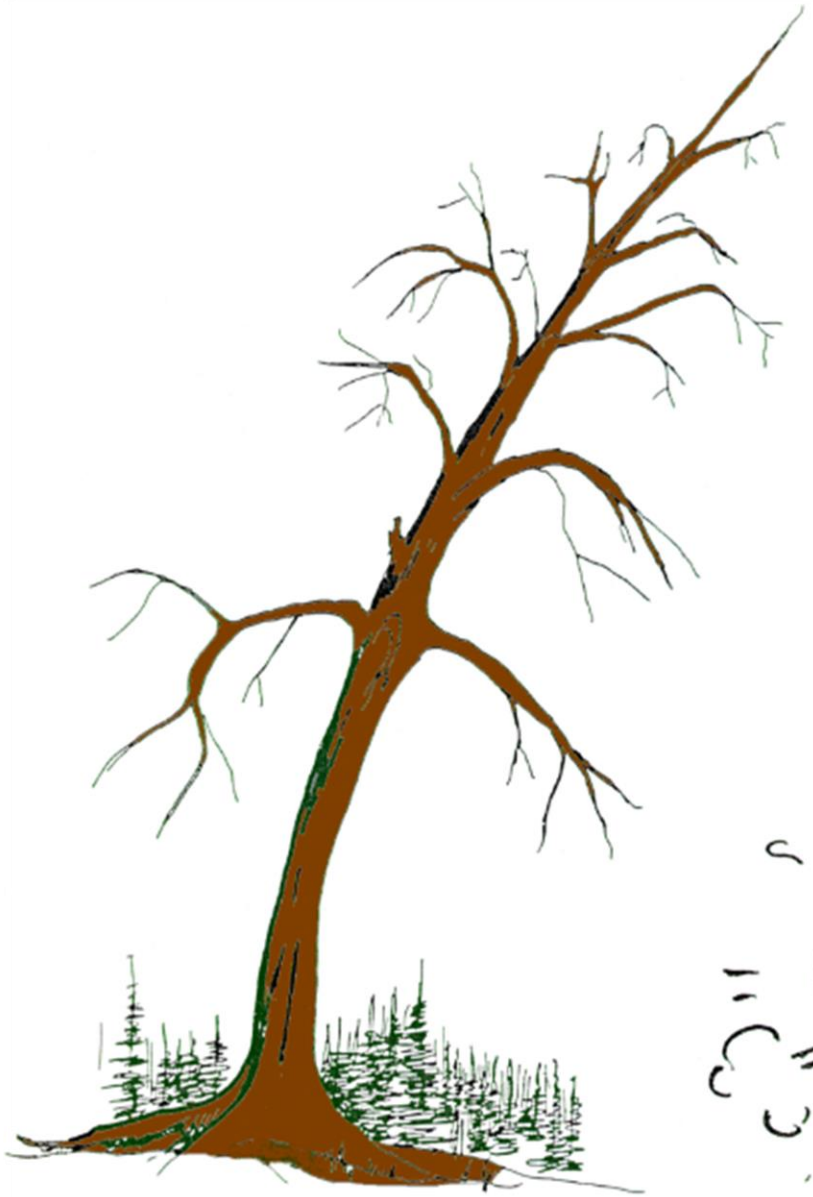
First noted while studying western balsam bark beetle.

Observed attacking and killing live, mature subalpine fir trees (1^{o} and 2^{o} invader).

Eastern Canada - infests balsam fir killed by eastern spruce budworm.

Limited information on this weevil - most likely attracted to climatically stressed trees and stands.

Maclauchlan, L.E. and Brooks, J.E. 2020. The balsam bark weevil, Pissodes striatulus (Coleoptera: Curculionidae): life history and occurrence in southern British Columbia. J. Entomol. Soc. Brit. Columbia 117:3-19.



I'll get those pesky rascals!

Questions?

RSHodgkinson