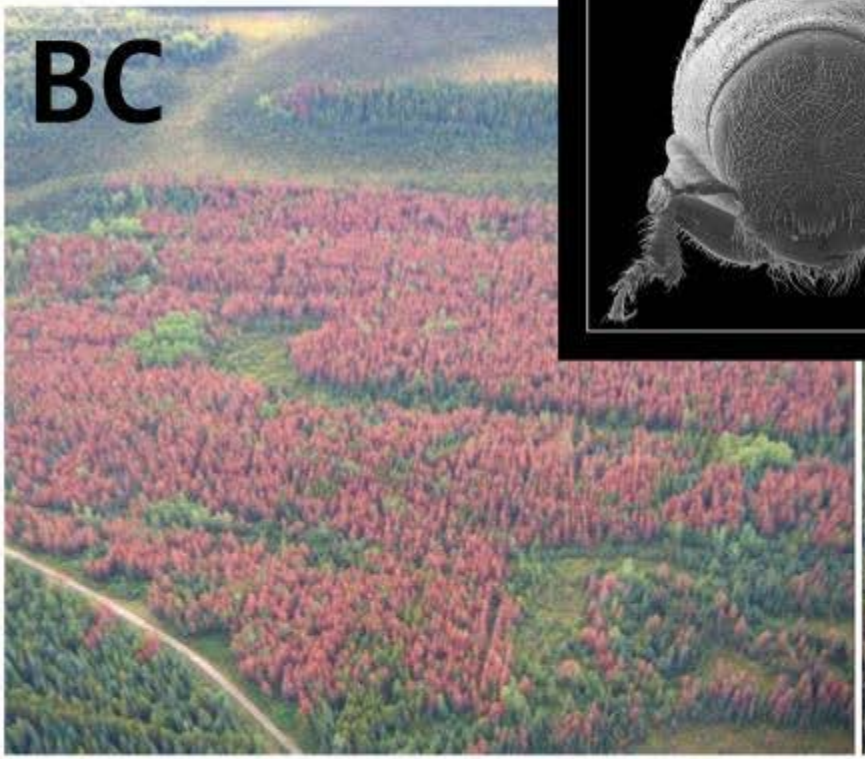
Mountain pine beetle spread to eastern Canada: what's the real risk?



Barry J. Cooke, MNRF
Allan Carroll, UBC

Thunder Bay, March 22, 2017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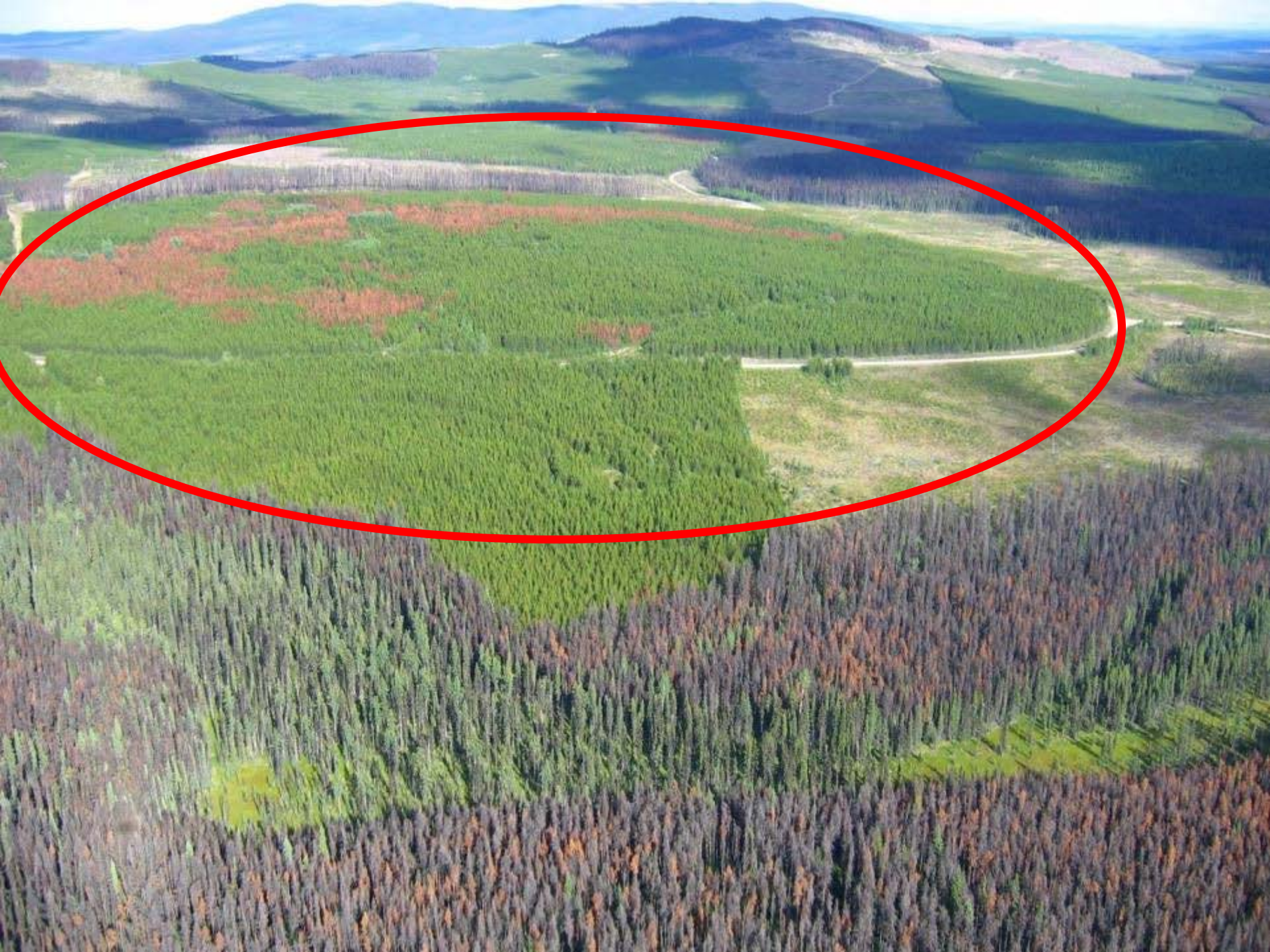
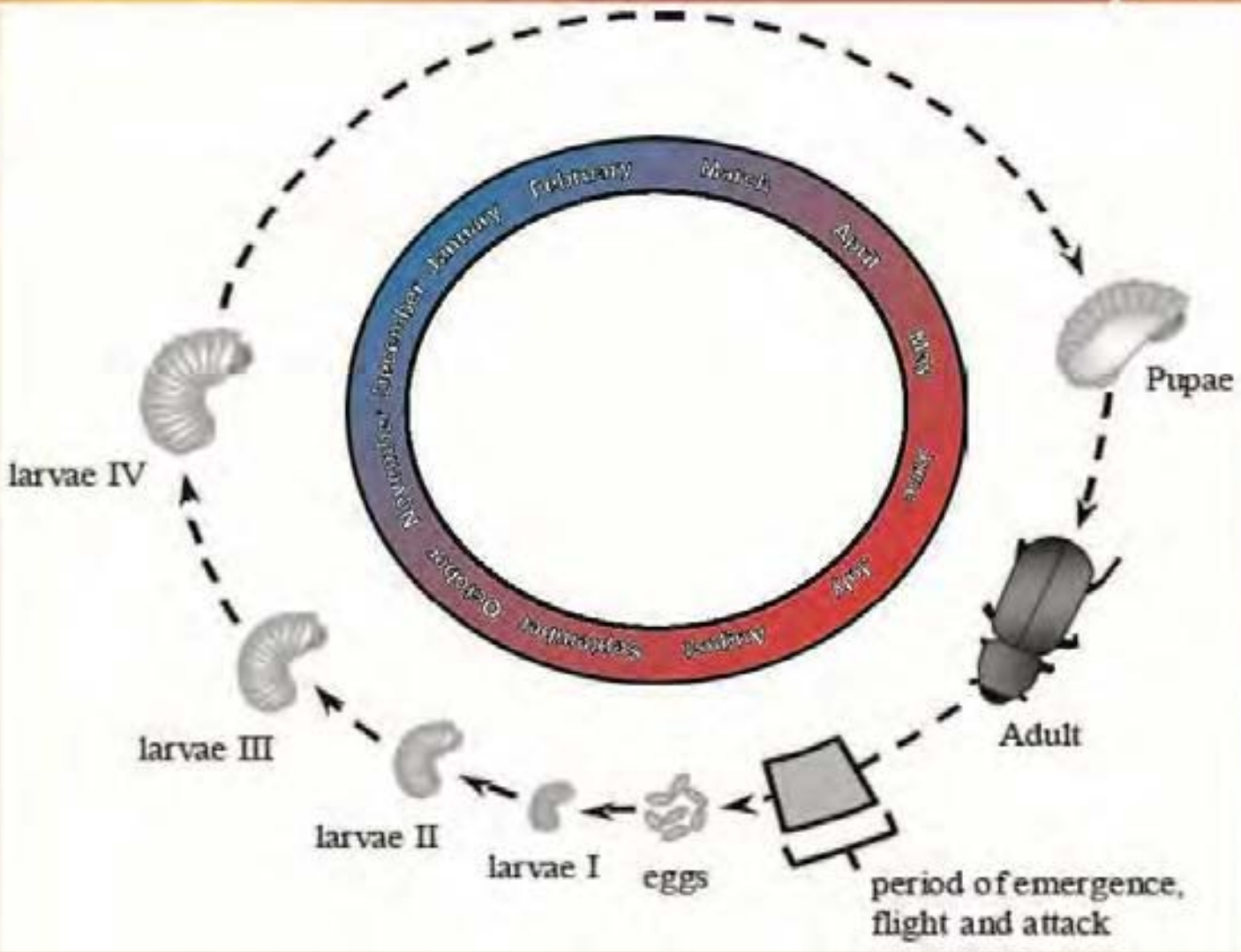
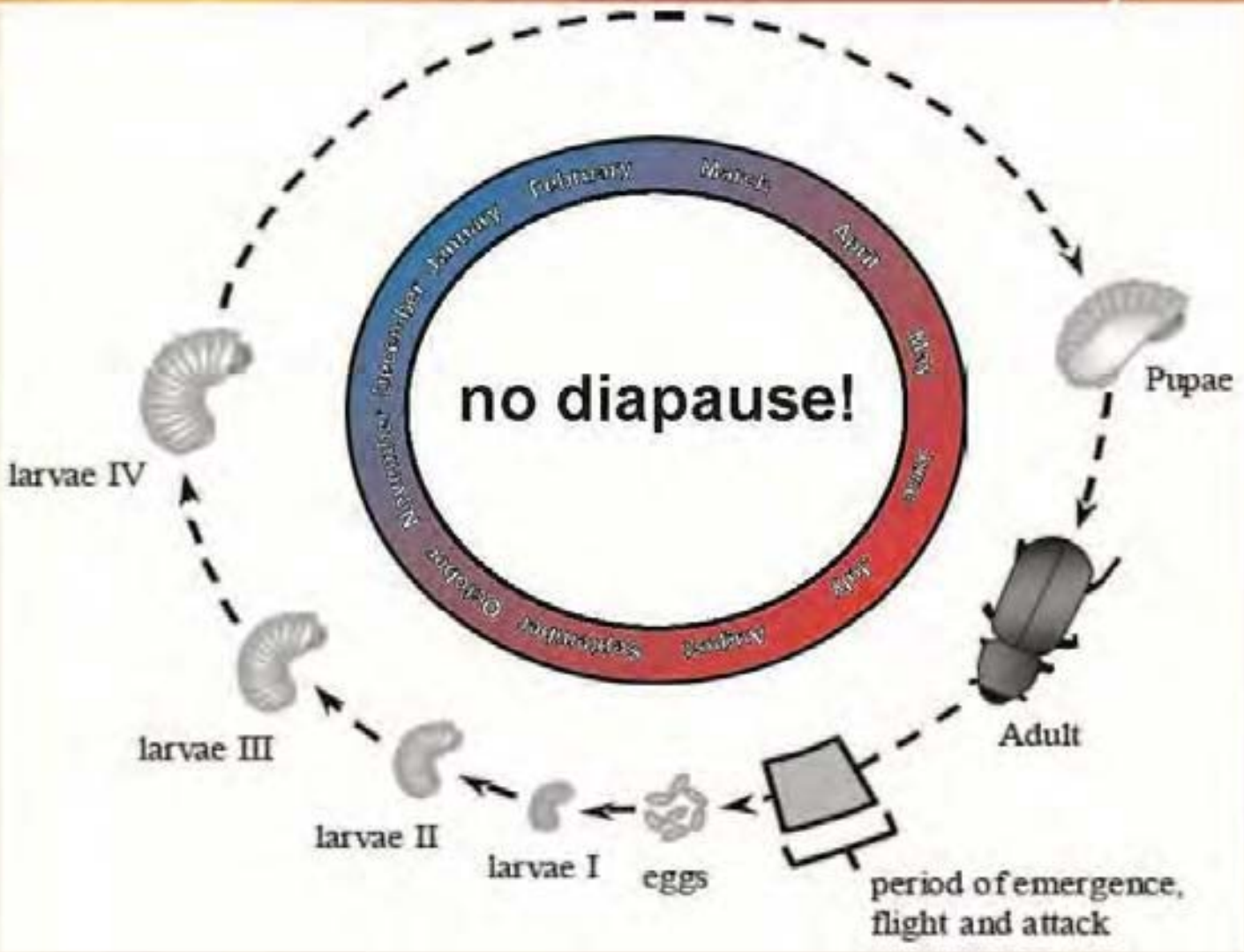



HUSQVARNA

MPB life cycle



MPB life cycle



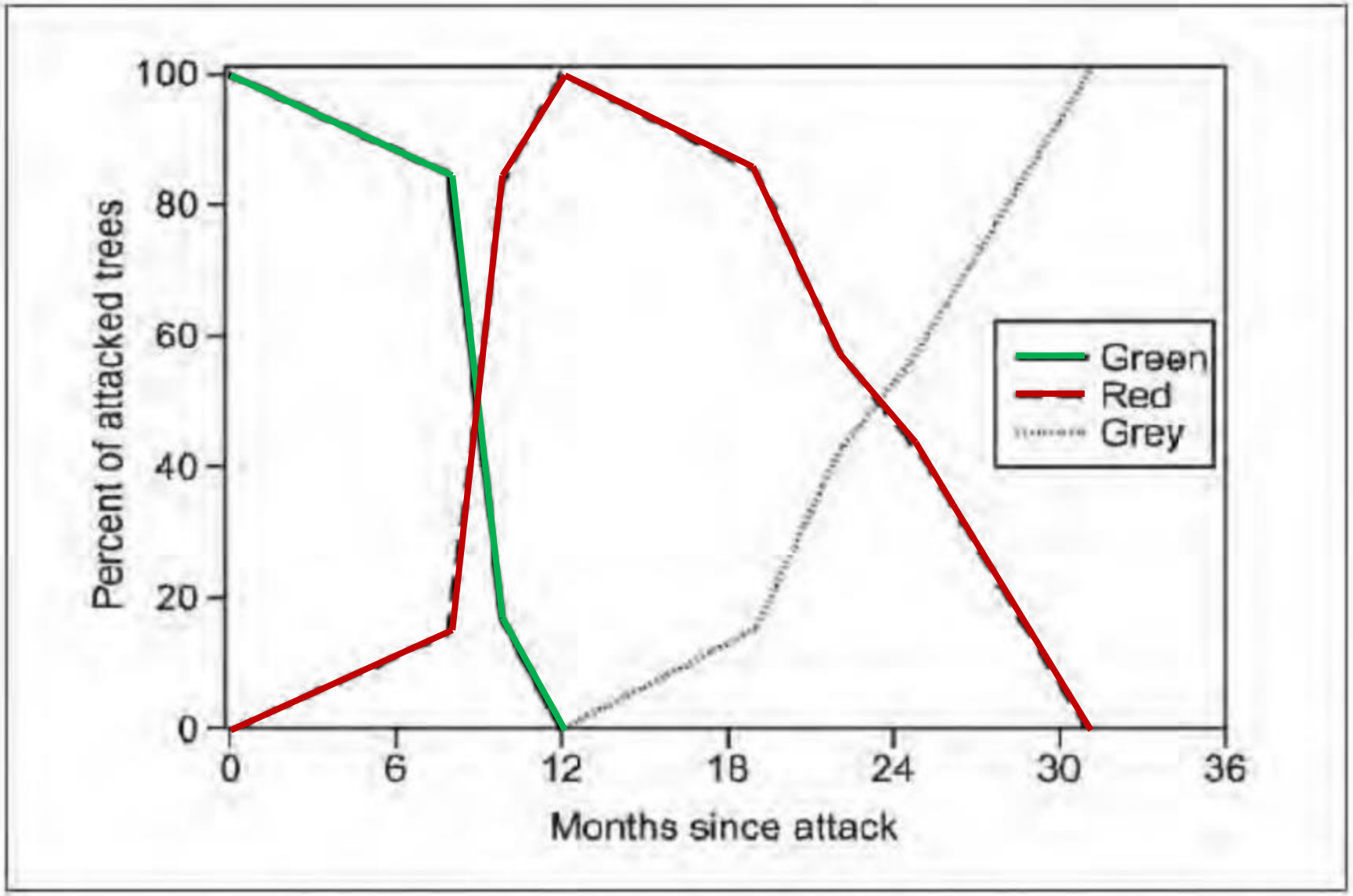
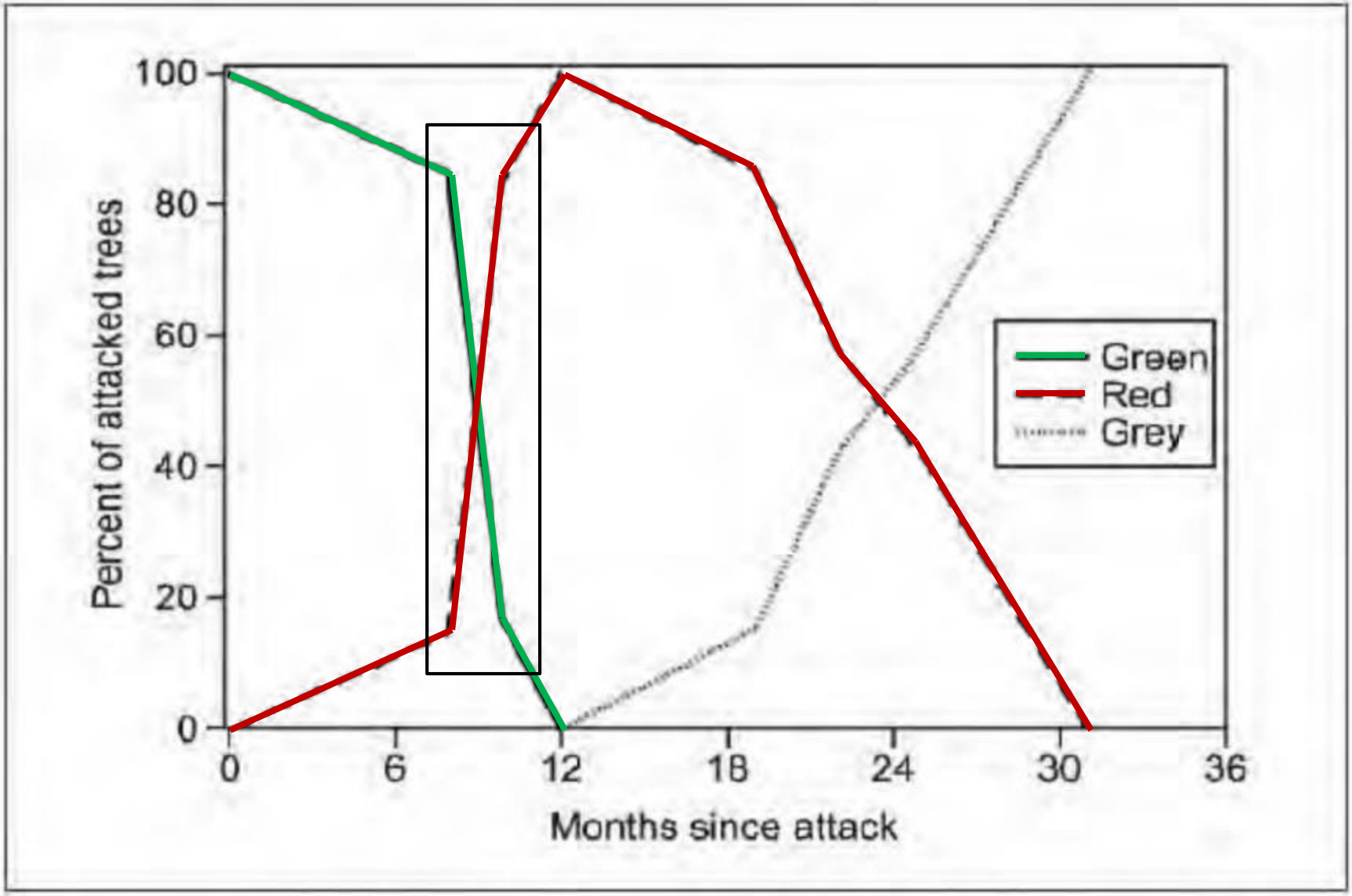


Fig. 1. Variability in fading rate of foliage within a sample lodgepole pine stand (Fountain Valley Site 2, Kamloops Forest District, between 1962 and 1965) post-mass-attack. This example stand was composed of 15 attacked trees.



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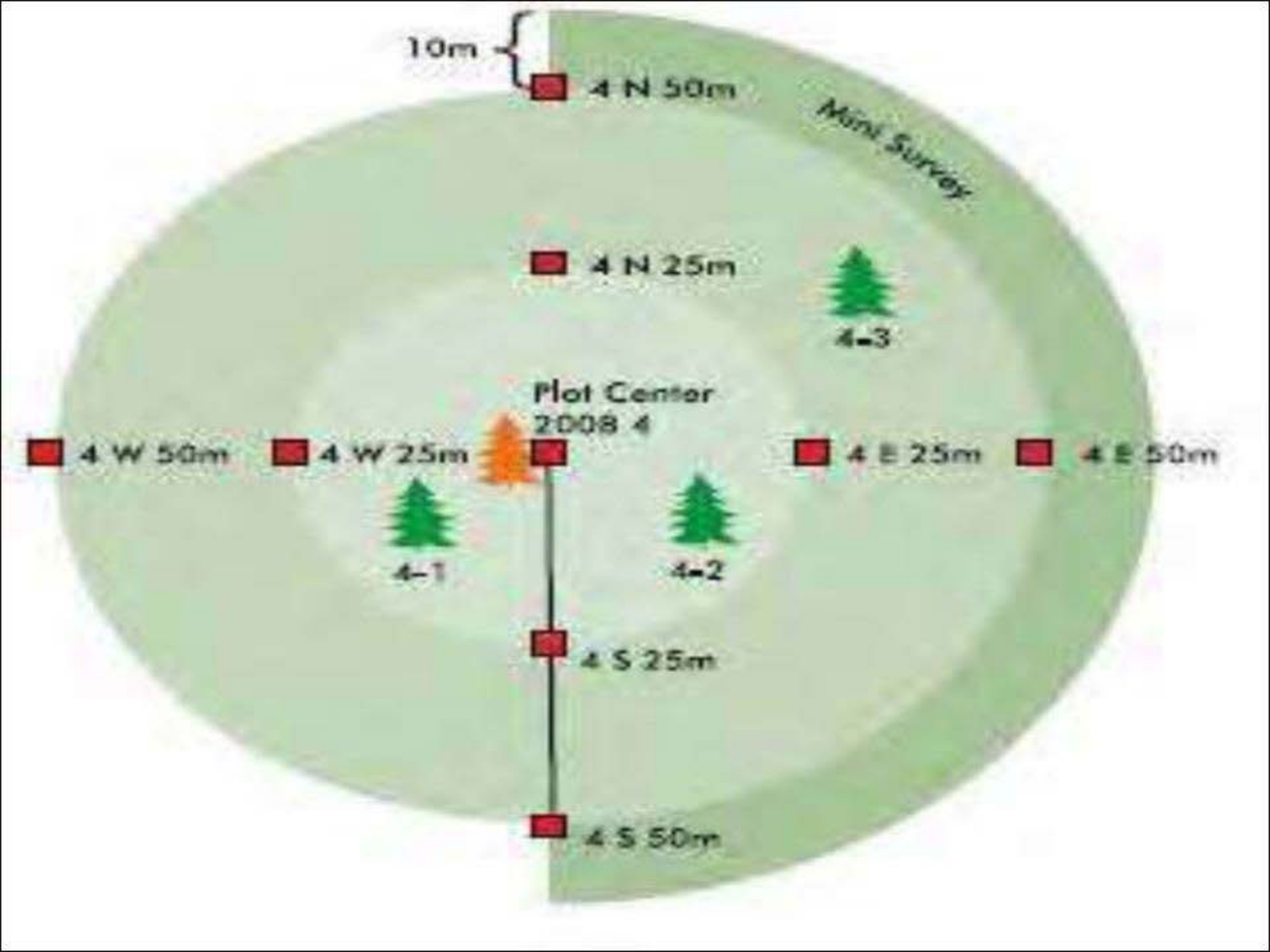
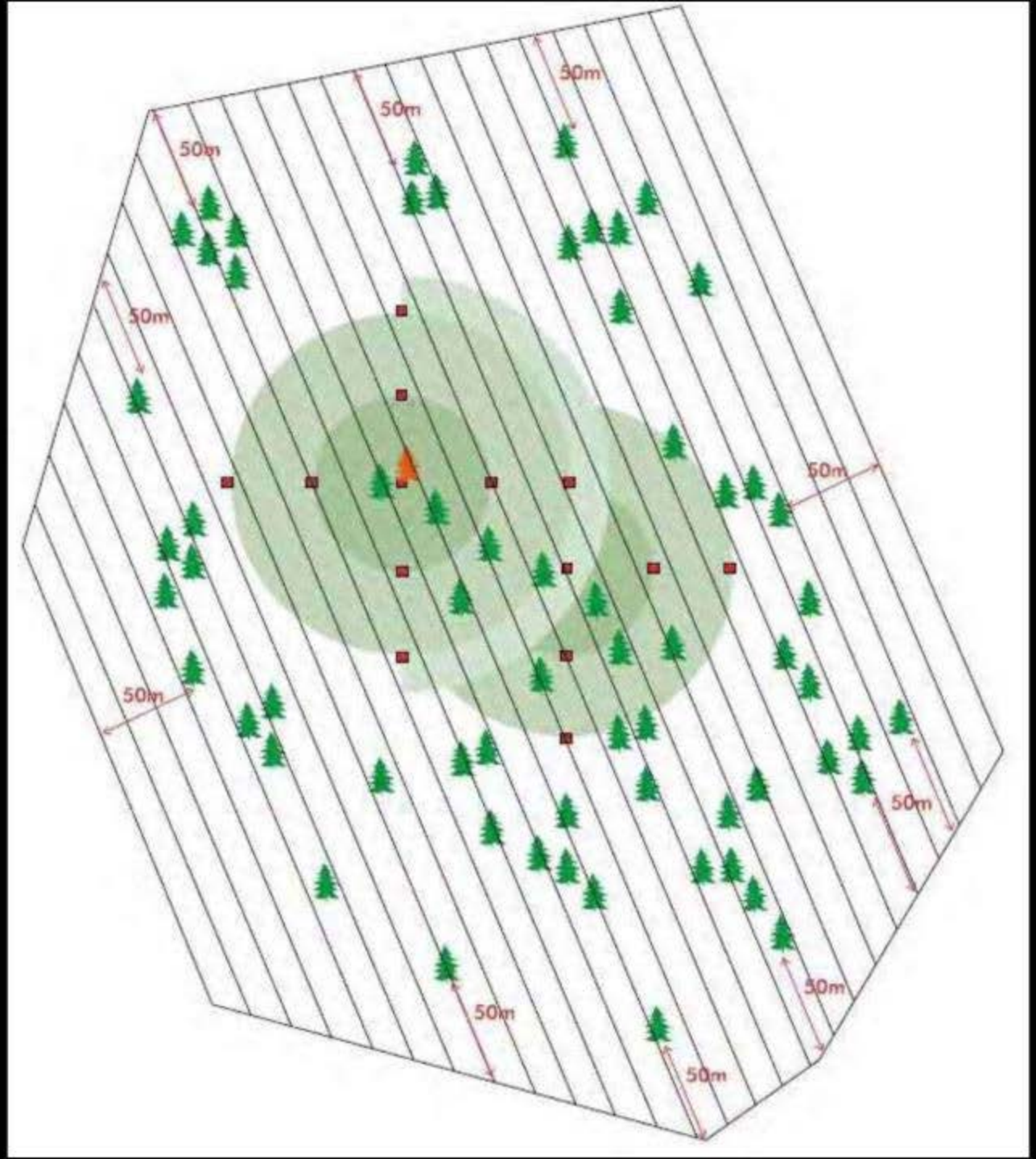

10m
4 N 50m
Mini Survey
4 N 25m
4-3
Plot Center
2008 4
4 W 50m
4 W 25m
4 E 25m
4 E 50m
4-1
4-2
4 S 25m
4 S 50m


50m
50m
50m
50m
50m
50m
50m
50m
50m
50m
50m


S. Bourassa

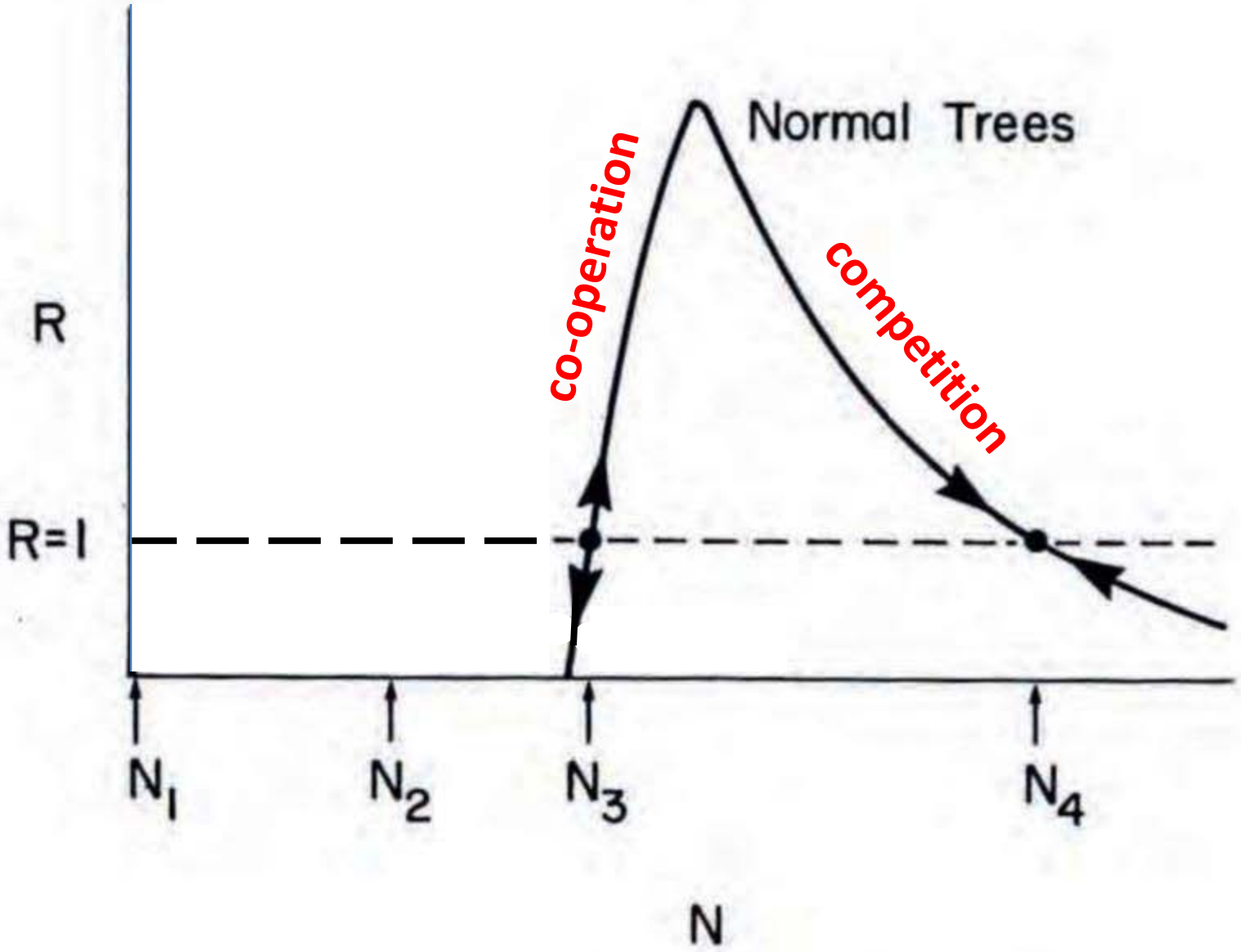
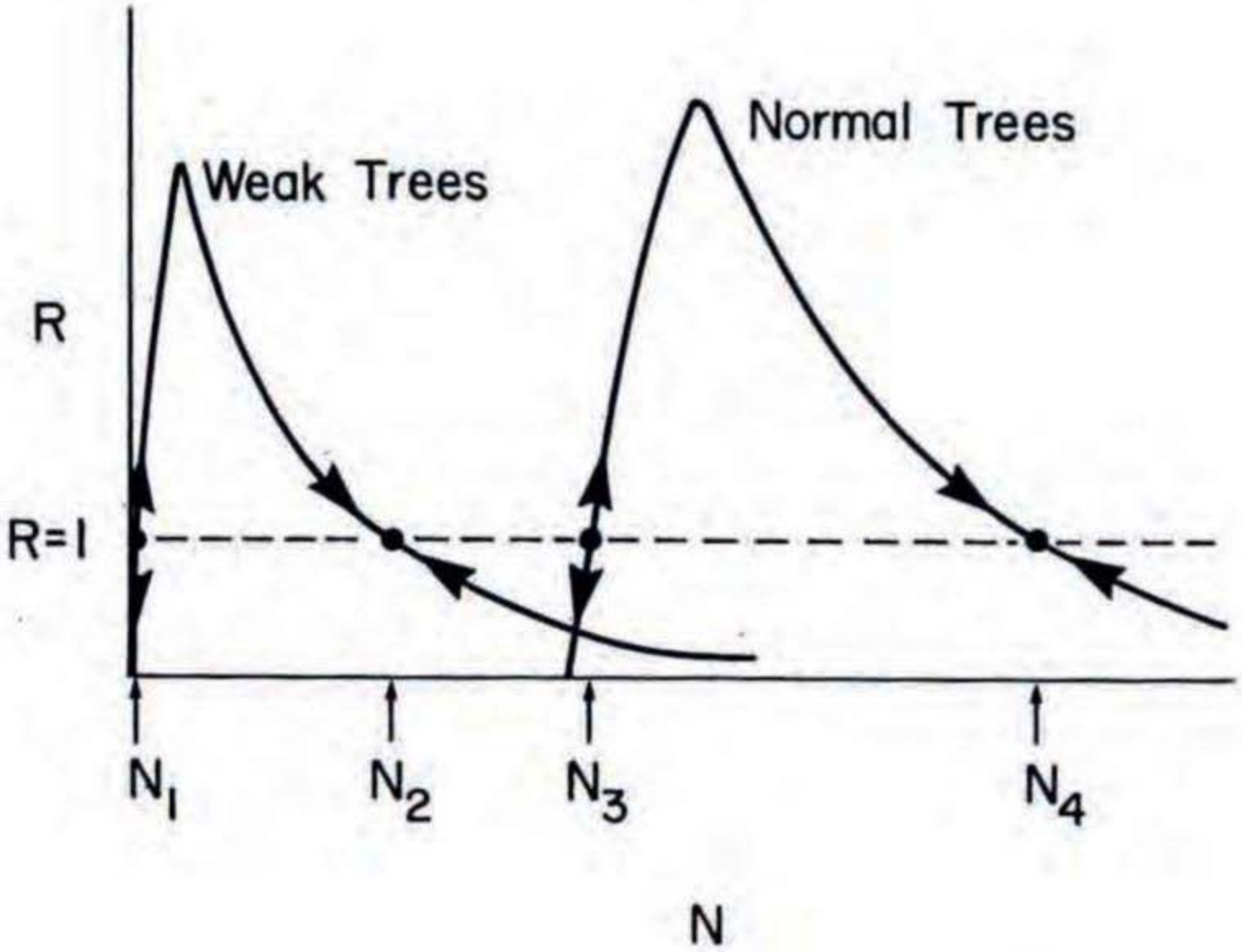


Fig. 3: Replacement curves for endemic and epidemic beetle populations, where reproduction in the normal healthy trees is only possible when beetles attain sufficient numbers.



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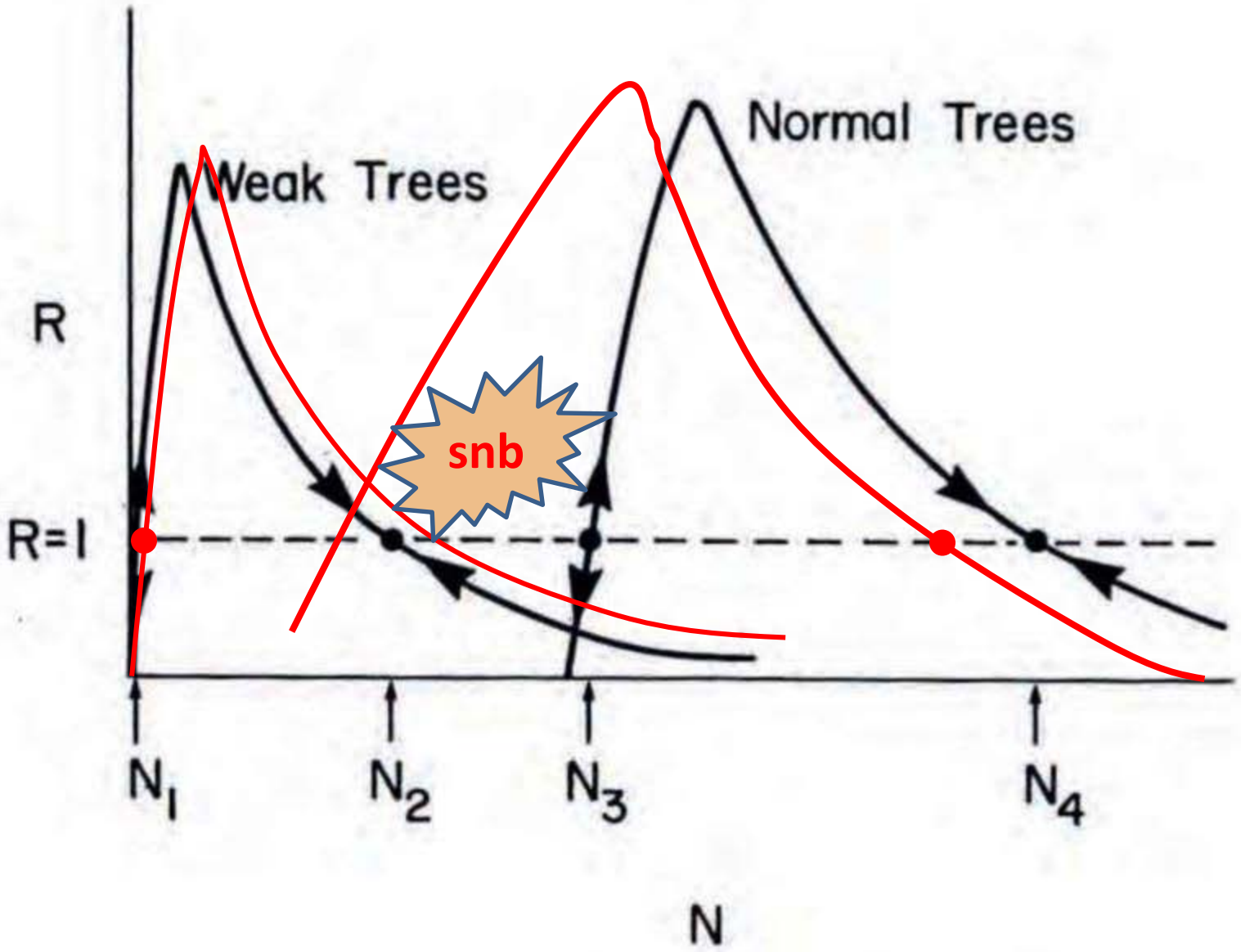

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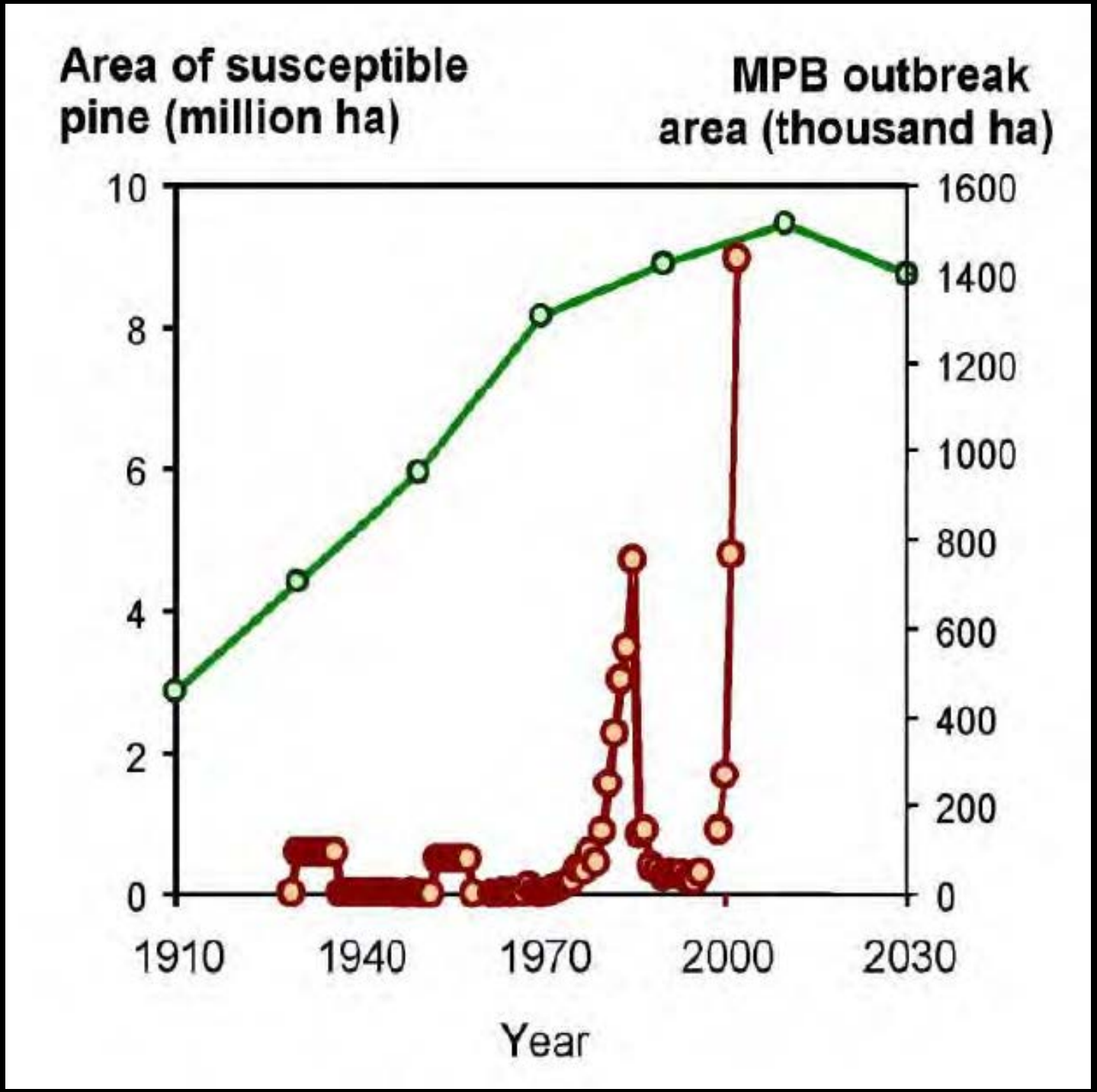
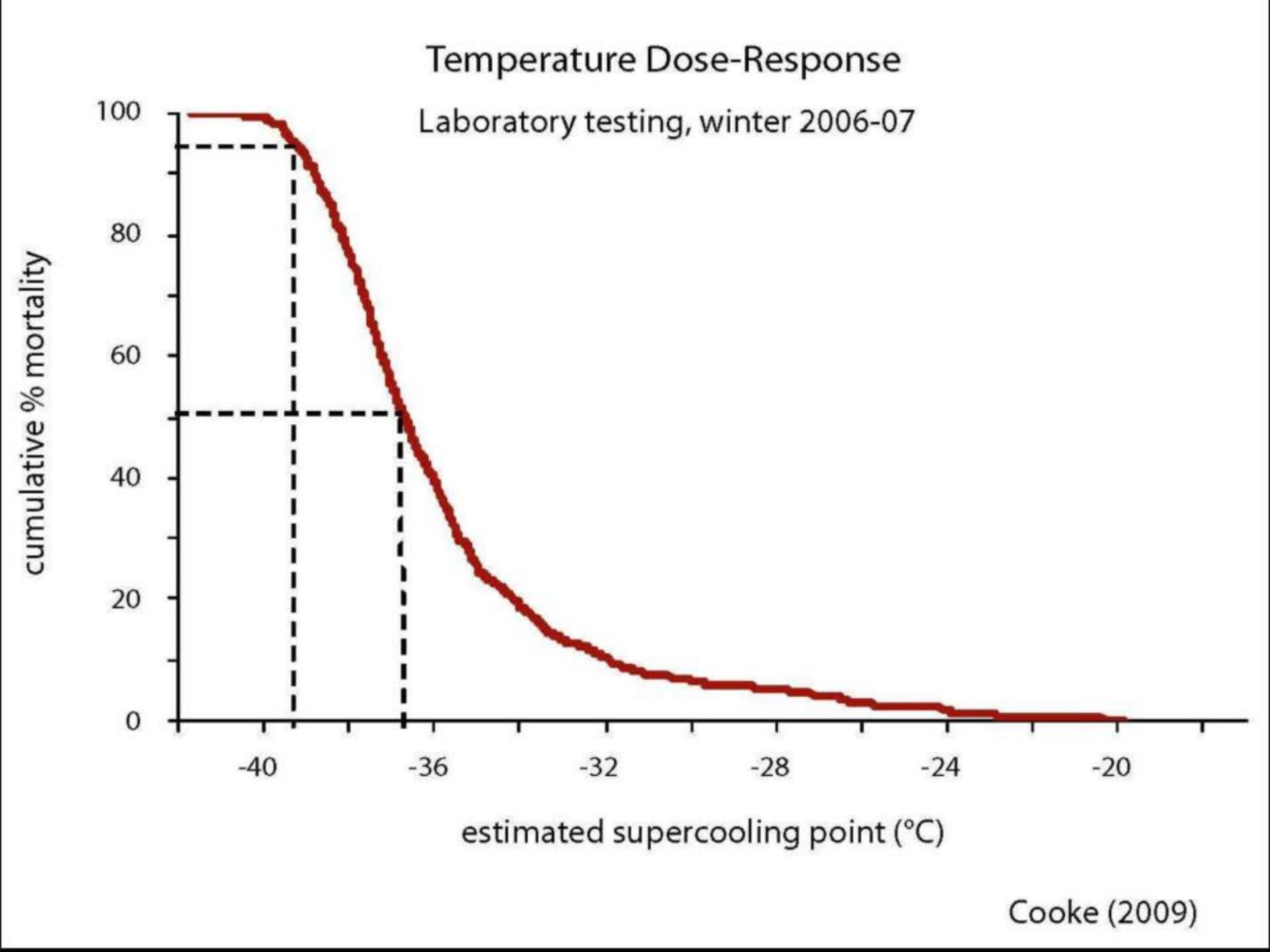

Area of susceptible pine (million ha)
MPB outbreak area (thousand ha)
10
8
6
4
2
0
1600
1400
1200
1000
800
600
400
200
0
1910
1940
1970
2000
2030
Year


Temperature Dose-Response
Laboratory testing, winter 2006-07
cumulative % mortality
100
80
60
40
20
0
-40
-36
-32
-28
-24
-20
estimated supercooling point (°C)
Cooke (2009)

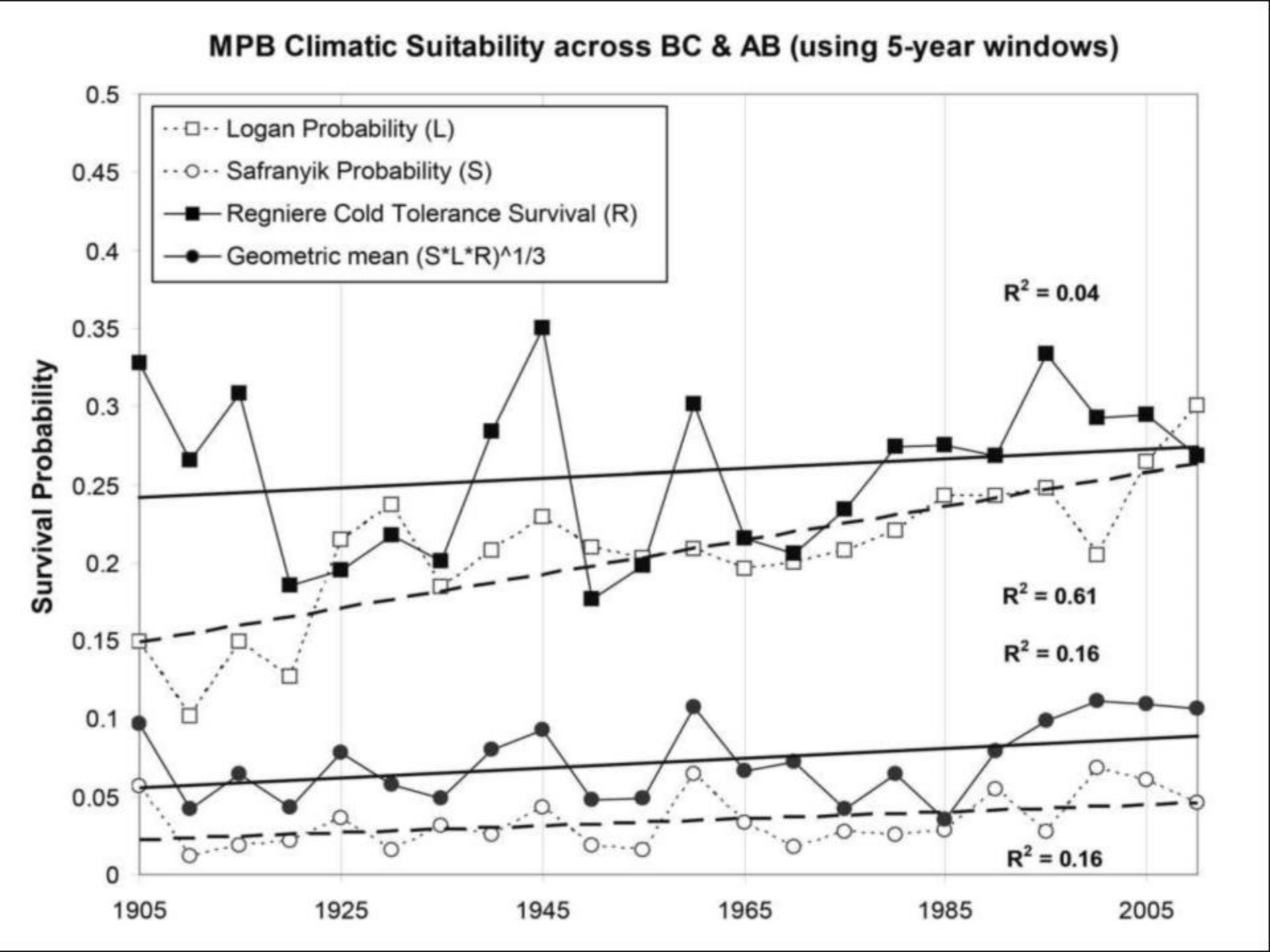

MPB Climatic Suitability across BC & AB (using 5-year windows)
Logan Probability (L)
Safranyik Probability (S)
Regniere Cold Tolerance Survival (R)
Geometric mean (S*L*R)^1/3
Survival Probability
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
1905
1925
1945
1965
1985
2005
R2 = 0.04
R2 = 0.61
R2 = 0.16
R2 = 0.16

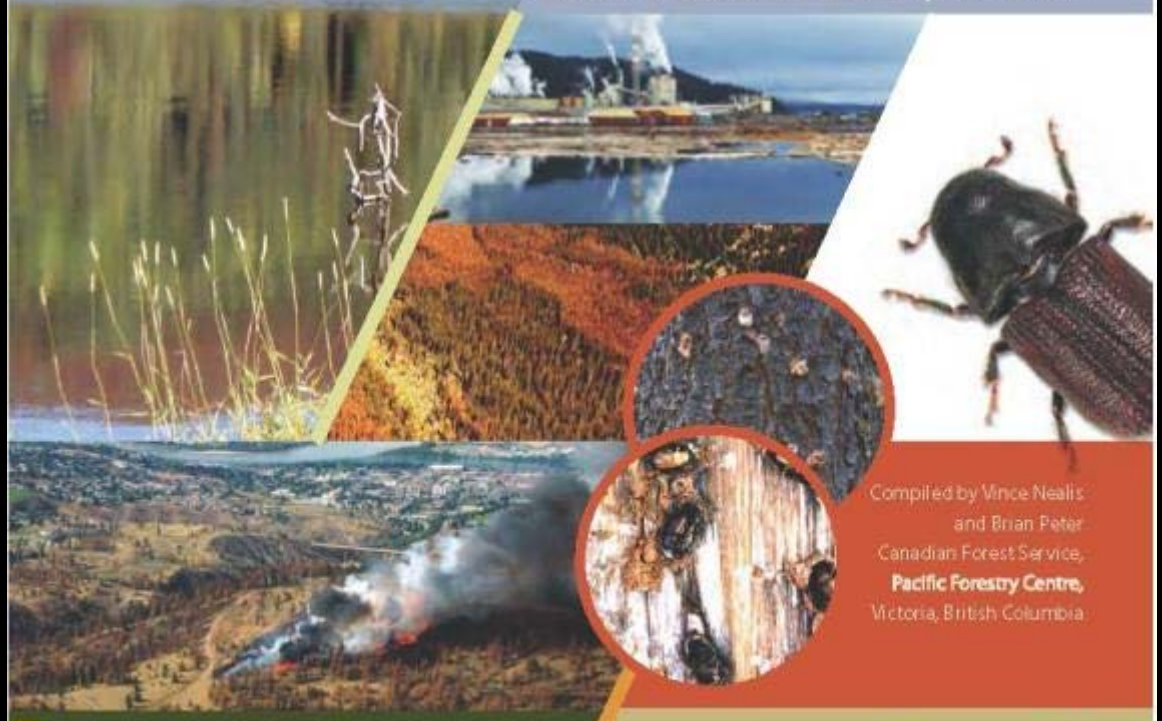
Table 1. Recent papers linking MPB outbreaks to warming climate

Study	Location	Years
Logan and Powell 2001	Idaho	1930s
	Alberta	1990s
Logan and Powell 2004	Sawtooth Valley, Idaho	1989-2001
Carroll et al. 2004	British Columbia	1959-1996
Taylor et al. 2006	British Columbia and Alberta	1959-1996
Régnière and Bentz, 2007	Utah and Wyoming	1992-1995
Zhu et al. 2008	Tweedsmuir region (BC)	1972-1984
Kurz et al. 2008	British Columbia	1959-2002
Raffa et al. 2008	Range-wide North America	1980-2005
Macias Faurias and Johnson 2009	British Columbia	1959-2002
Powell and Bentz 2009	Sawtooth Valley, Idaho	1989-2004
Trczinski and Reid 2009	Kootenay Valley, BC	1933-1943
Bentz et al 2010	Range-wide North America	NA
Safranyik et al. 2010	Range-wide North America	NA
Sambaraju et al. 2011	British Columbia and Alberta	1992-2007
Preisler et al. 2012	Washington & Oregon	1980-2006

Natural Resources Canada | Ressources naturelles Canada

Canadian Forest Service
Pacific Forestry Centre
Information Report
BC-X-417

Risk assessment of the threat of mountain pine beetle to Canada's boreal and eastern pine forests



Compiled by Vince Nealis and Brian Peter
Canadian Forest Service,
Pacific Forestry Centre,
Victoria, British Columbia

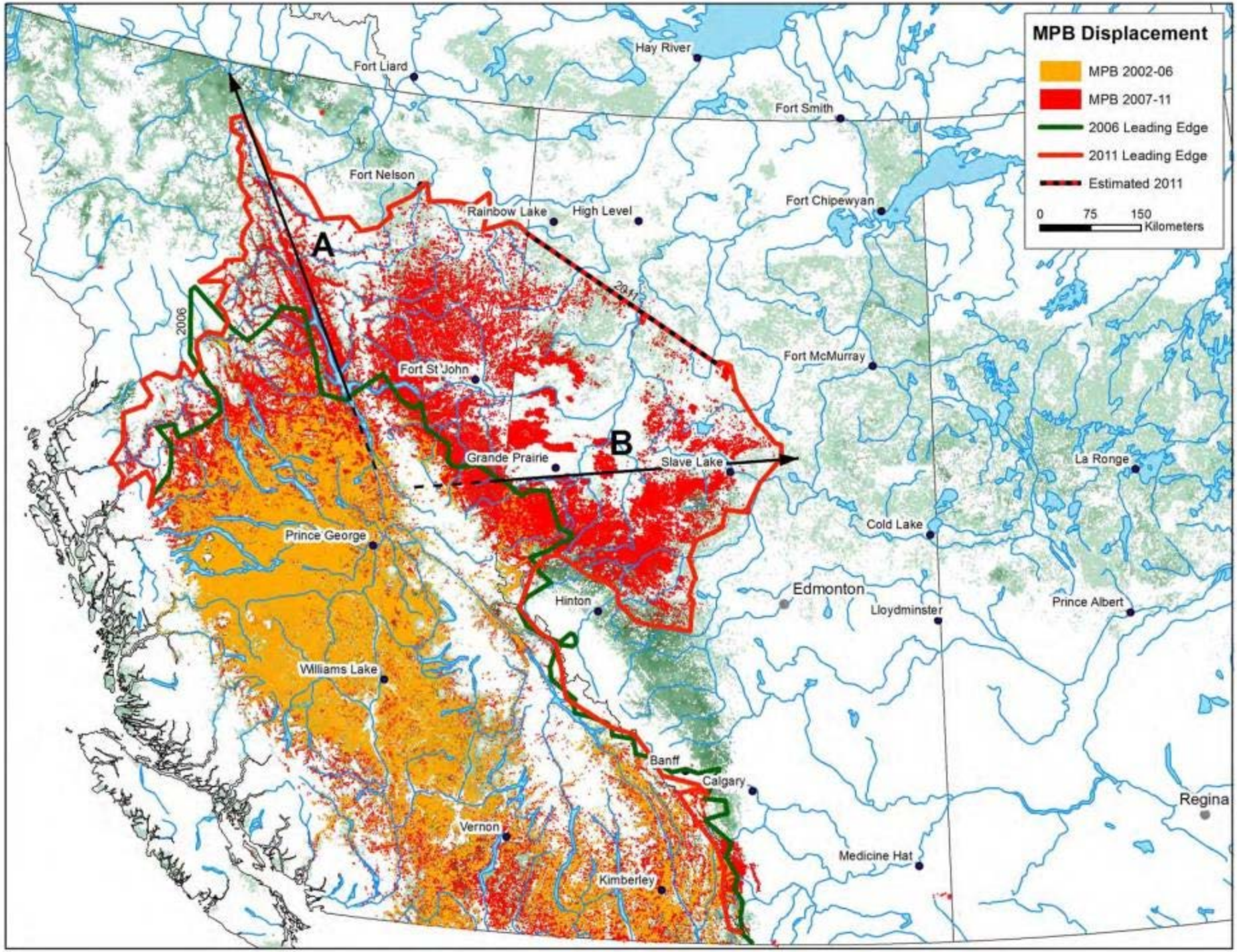
forest. forward.
moving beyond the pine beetle

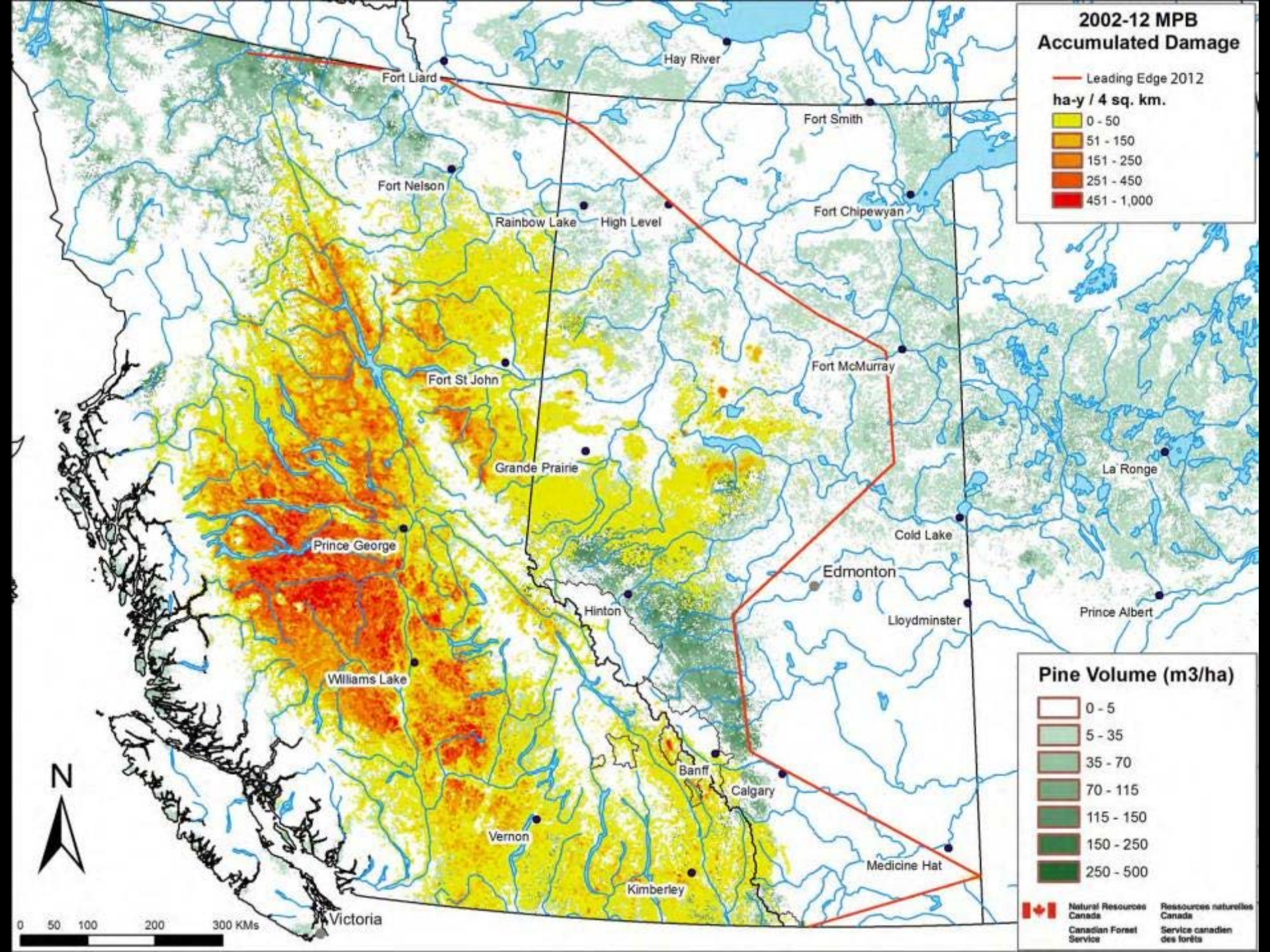
Canada

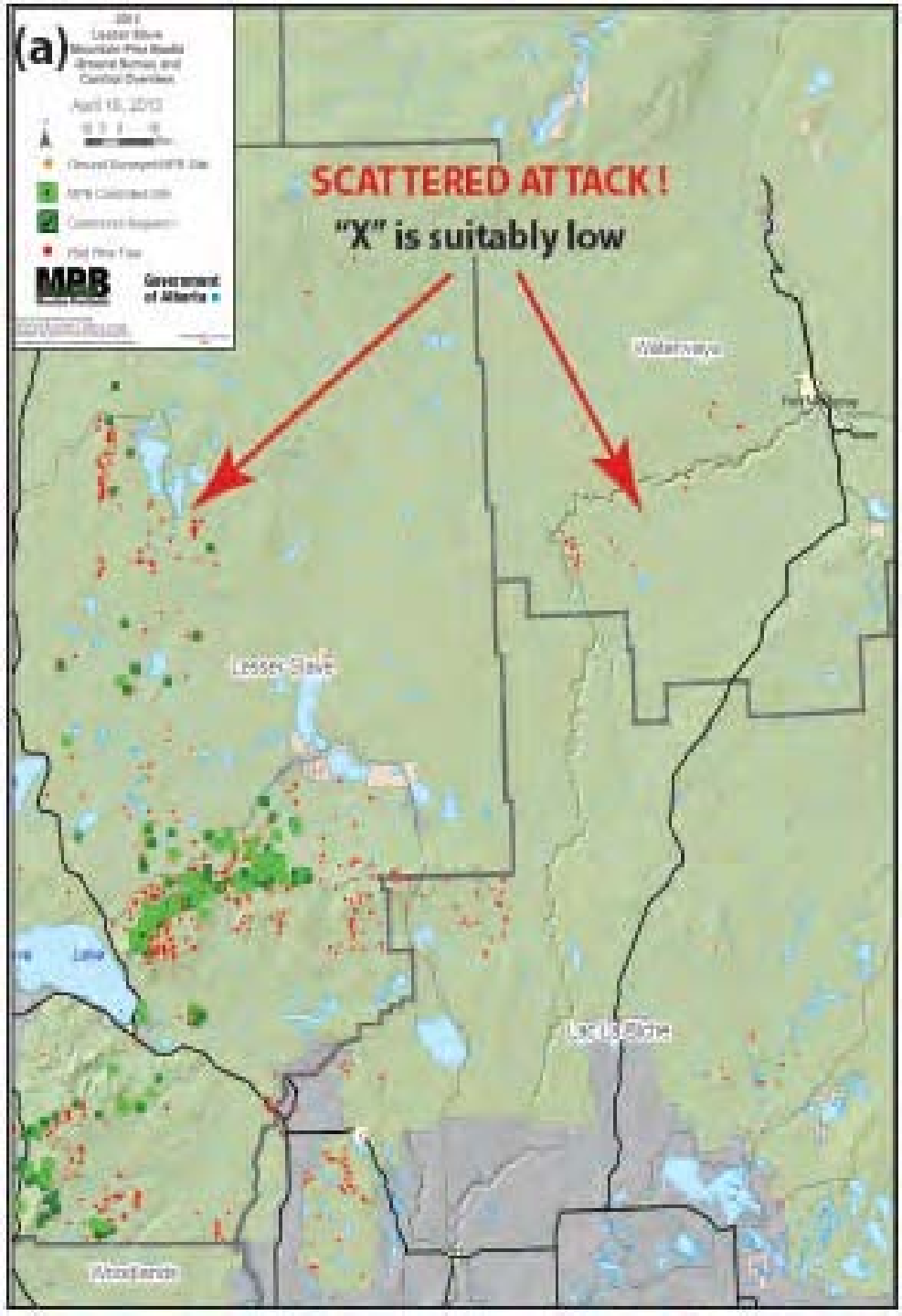

3D GPS Location
18-SEP-12 02:17:32PM
N 60°00.889'
W119°56.842'
GARMIN

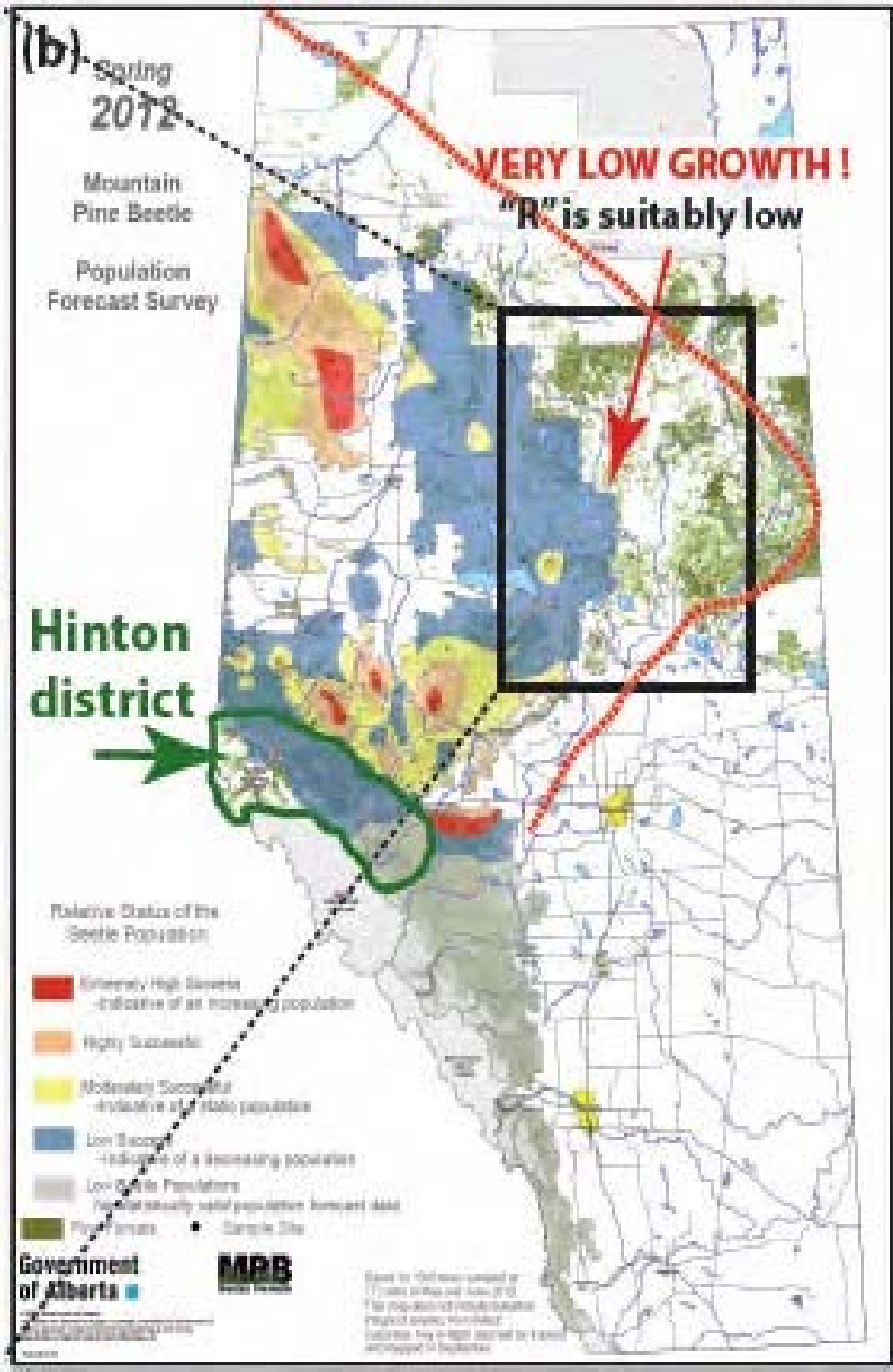
Canadian Council of Forest Ministers
Conseil canadien des ministres des forêts

Risk assessment of the threat of mountain pine beetle *to Canada's boreal and eastern pine forests*

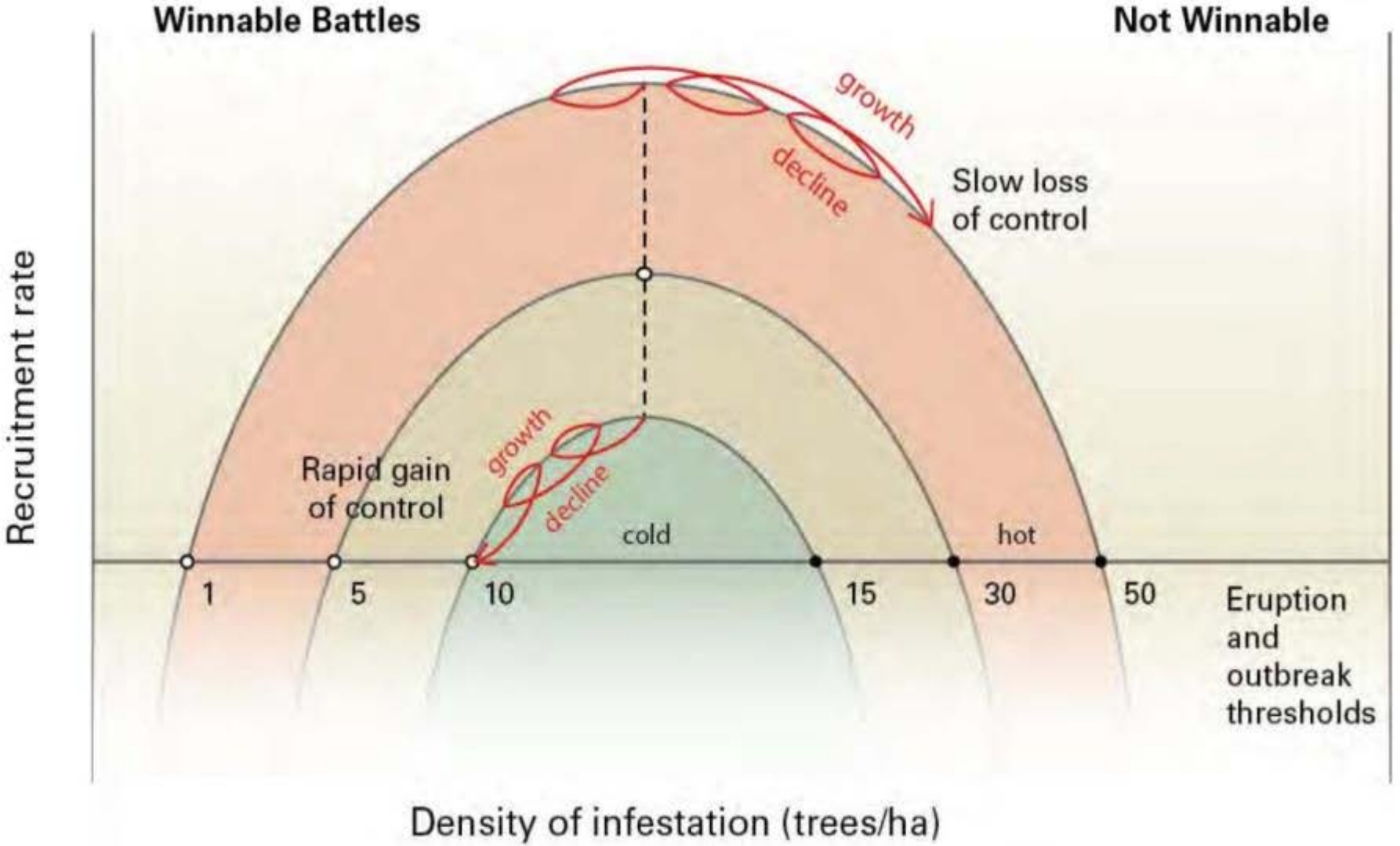

MPB Displacement
MPB 2002-06
MPB 2007-11
2006 Leading Edge
2011 Leading Edge
Estimated 2011
0 75 150
Kilometers
Hay River
Fort Liard
Fort Smith
Fort Nelson
Rainbow Lake
High Level
Fort Chipewyan
A
2006
2011
Fort St John
Fort McMurray
B
Grande Prairie
Slave Lake
La Ronge
Cold Lake
Prince George
Edmonton
Hinton
Lloydminster
Prince Albert
Williams Lake
Banff
Calgary
Regina
Vernon
Medicine Hat
Kimberley


2002-12 MPB
Accumulated Damage
Leading Edge 2012
ha-y / 4 sq. km.
0 - 50
51 - 150
151 - 250
251 - 450
451 - 1,000
Pine Volume (m3/ha)
0 - 5
5 - 35
35 - 70
70 - 115
115 - 150
150 - 250
250 - 500
Natural Resources Canada
Canadian Forest Service
Ressources naturelles Canada
Service canadien des forêts
Fort Liard
Hay River
Fort Smith
Fort Nelson
Rainbow Lake
High Level
Fort Chipewyan
Fort St John
Fort McMurray
Grande Prairie
La Ronge
Prince George
Cold Lake
Edmonton
Hinton
Lloydminster
Prince Albert
Williams Lake
Banff
Calgary
Vernon
Medicine Hat
Kimberley
Victoria
N
0 50 100 200 300 KMs

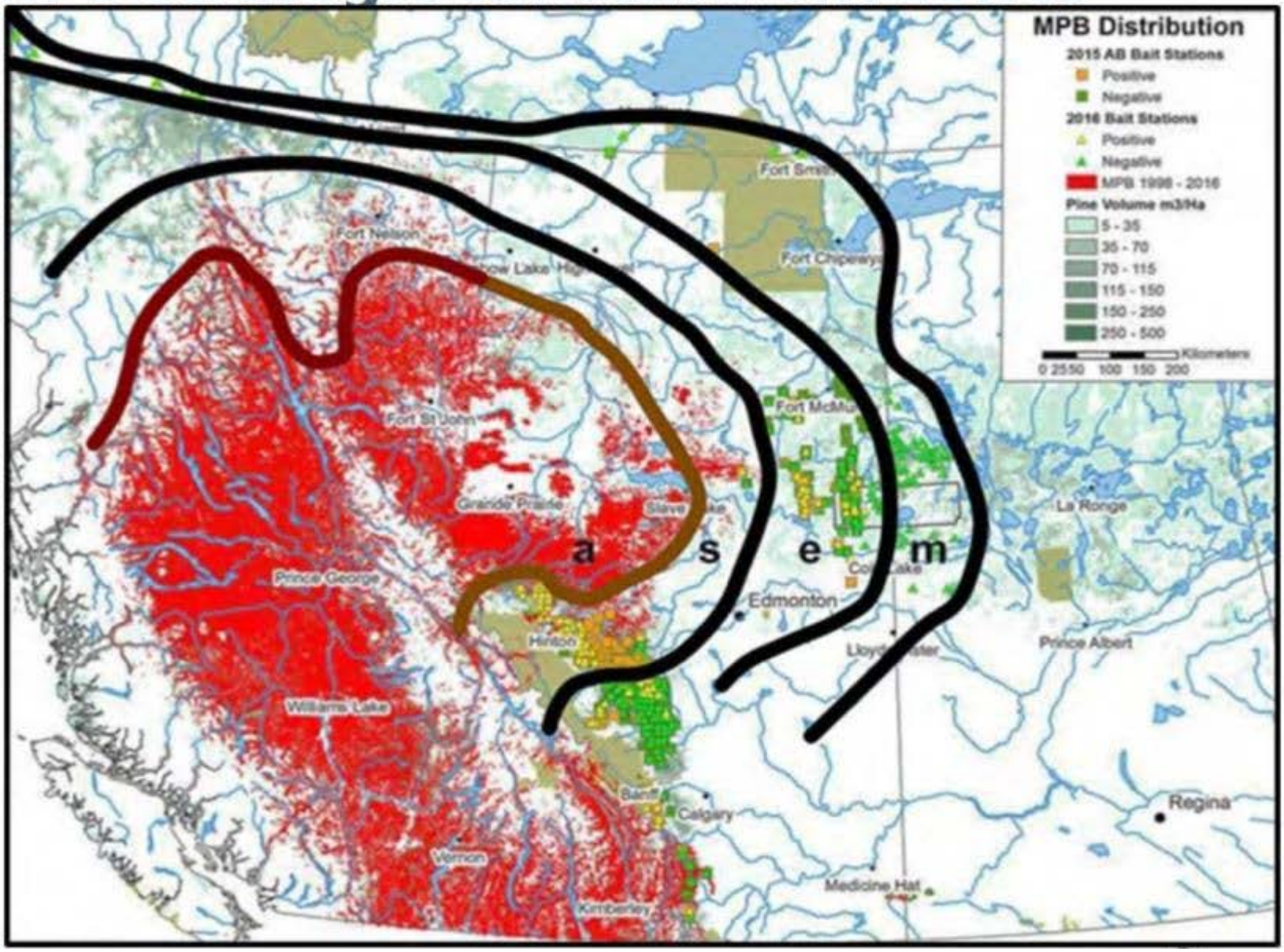

(a)
SCATTERED ATTACK !
"X" is suitably low
Waterways
Lesser Slave
Lake
Lac La Biche
Athabasca
MPB
Government of Alberta

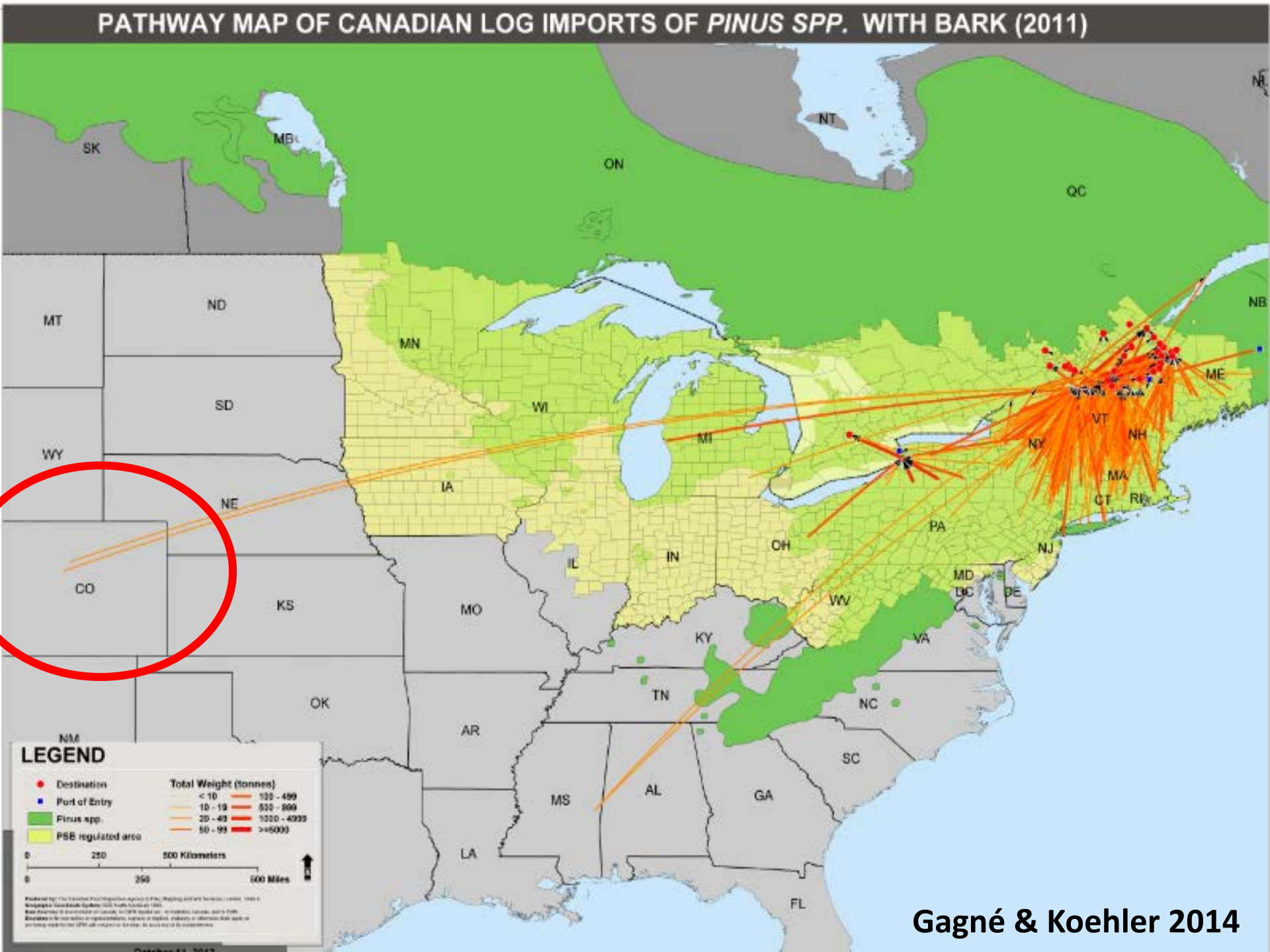

(b)
Spring
2012
Mountain
Pine Beetle
Population
Forecast Survey
VERY LOW GROWTH !
"R" is suitably low
Hinton
district
Relative Status of the
Beetle Population
Government
of Alberta
MPB

MPB strategic control



MPB strategic containment zones




PATHWAY MAP OF CANADIAN LOG IMPORTS OF *PINUS SPP.* WITH BARK (2011)
SK
MB
ON
NT
QC
NL
NB
MT
ND
MN
SD
WY
WI
MI
NE
IA
IL
IN
OH
PA
NY
VT
NH
ME
MA
CT
RI
NJ
MD
DC
DE
WV
VA
CO
KS
MO
KY
TN
NC
SC
OK
AR
MS
AL
GA
LA
FL
NM
LEGEND
Destination
Port of Entry
Pinus spp.
PSB regulated area
Total Weight (tonnes)
< 10
10 - 19
20 - 49
50 - 99
100 - 499
500 - 999
1000 - 4999
>=5000
0
250
500 Kilometers
0
250
500 Miles
Gagné & Koehler 2014