Comparison of understory burning and mechanical site preparation to regenerate lodgepole pine stands killed by mountain pine beetle

.

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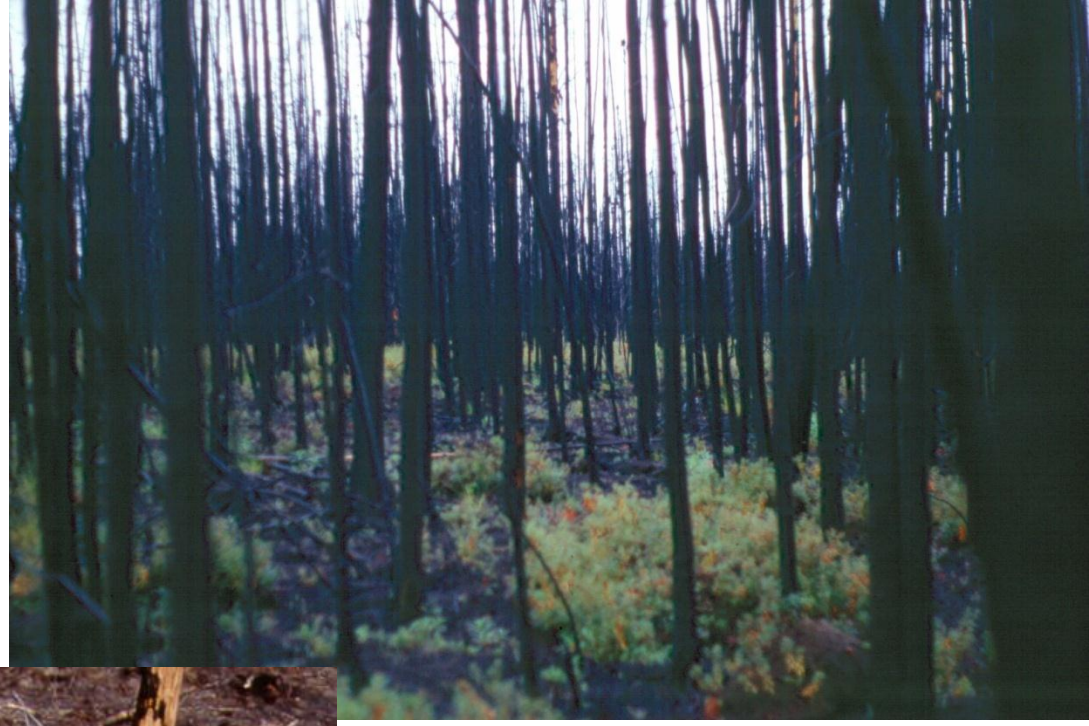
Lodgepole pine is adapted to regenerate after wildfire

Herman Stegehuis



Cone-bearing slash left after logging

Drag scarification

Cones landing on prepared seedbed

After MPB cones are left on the tree.

There is no seedbed prepared – thick litter or feathermosses
It is also quite dark for a shade intolerant tree

What happens to the seed

Closed

Partially open

Open

Seed predation

Squirrels
(Canopy and forest floor cones)

Red squirrel (*Tamiasciurus hudsonicus*)

Ground foraging rodents
(forest floor seed)

Deer mouse (*Peromyscus maniculatus*)

Squirrel seed predation

Squirrel predation persists in MPB-attacked stands resulting in a sustained reduction in the number of canopy cones.

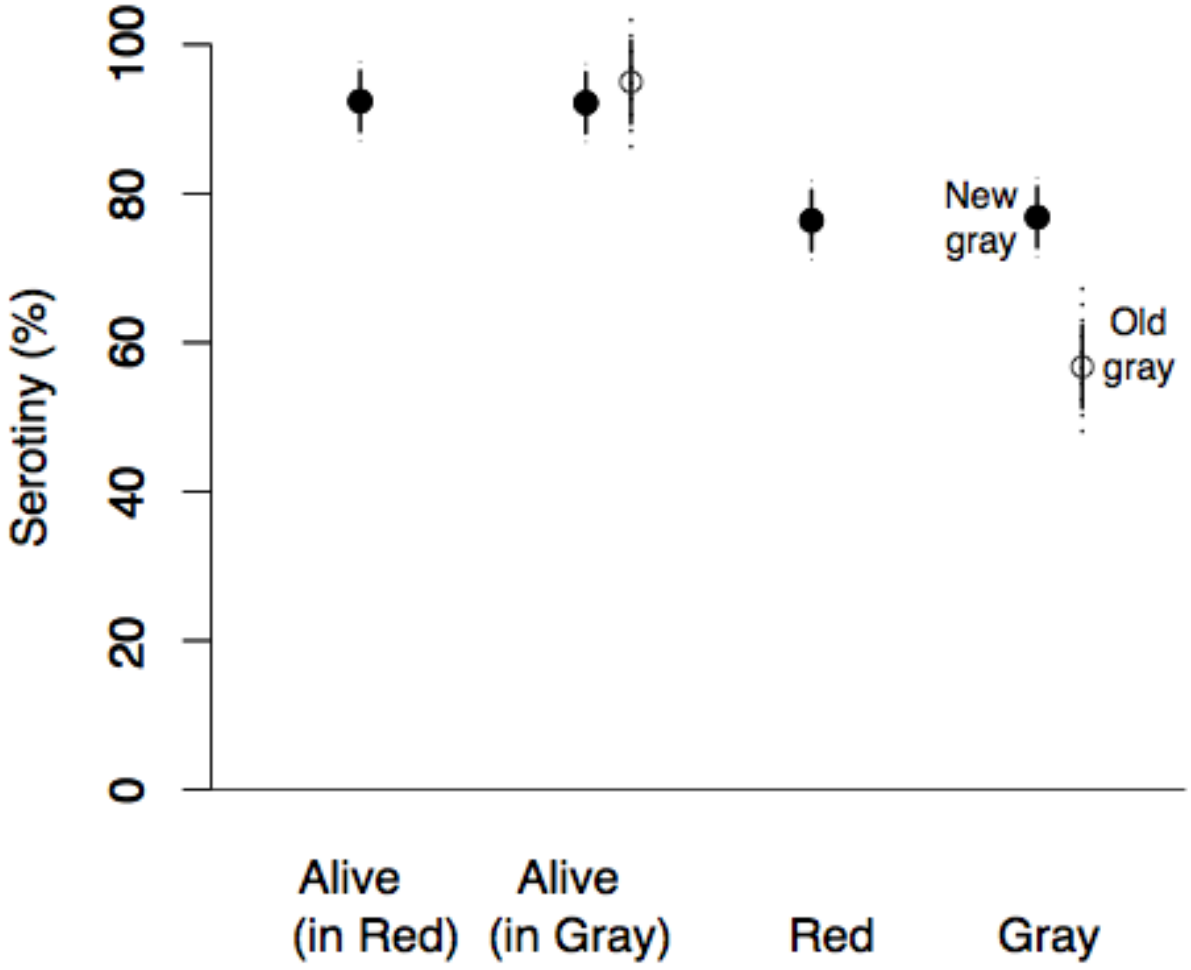
What happens to the seed

Closed

Partially open

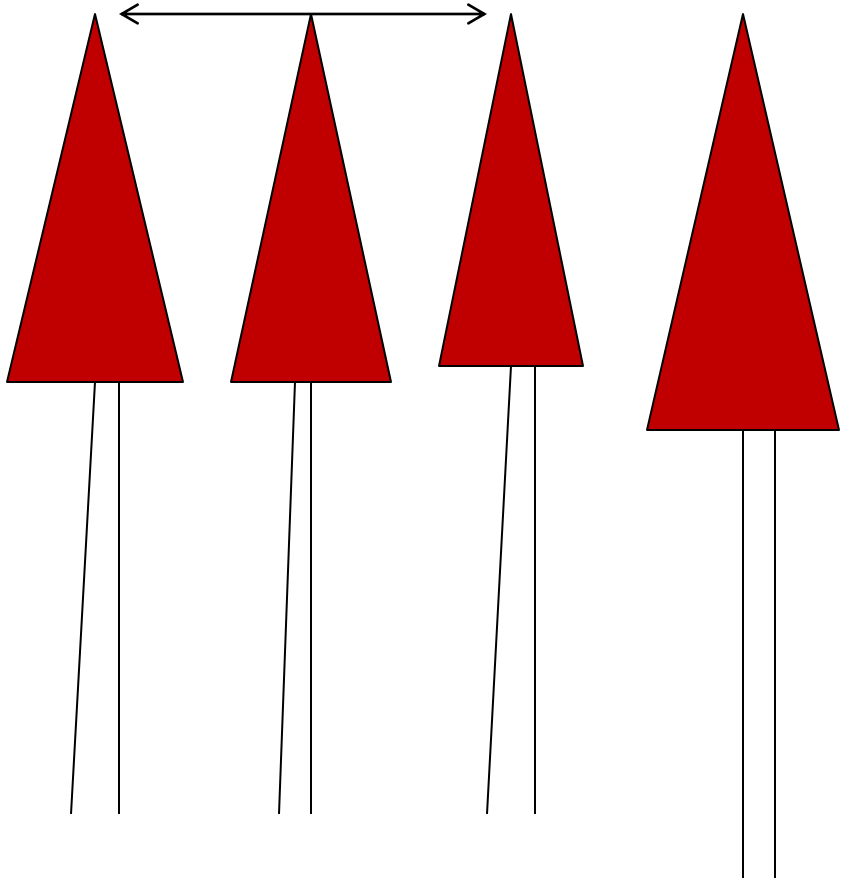
Open

Results – Canopy-cone opening (Partial loss of serotiny)



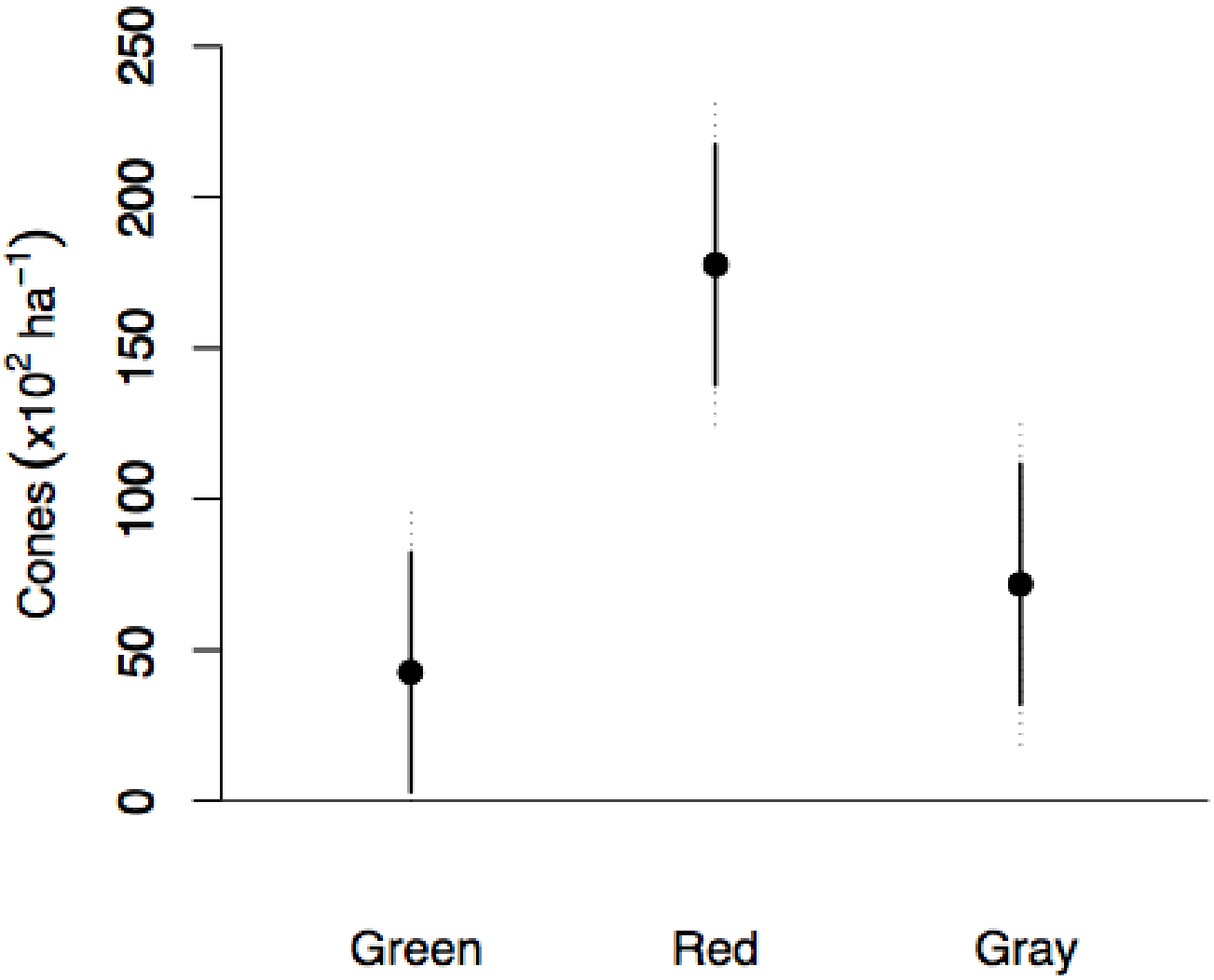
Breakage of branch/cones in the red phase

Red Phase



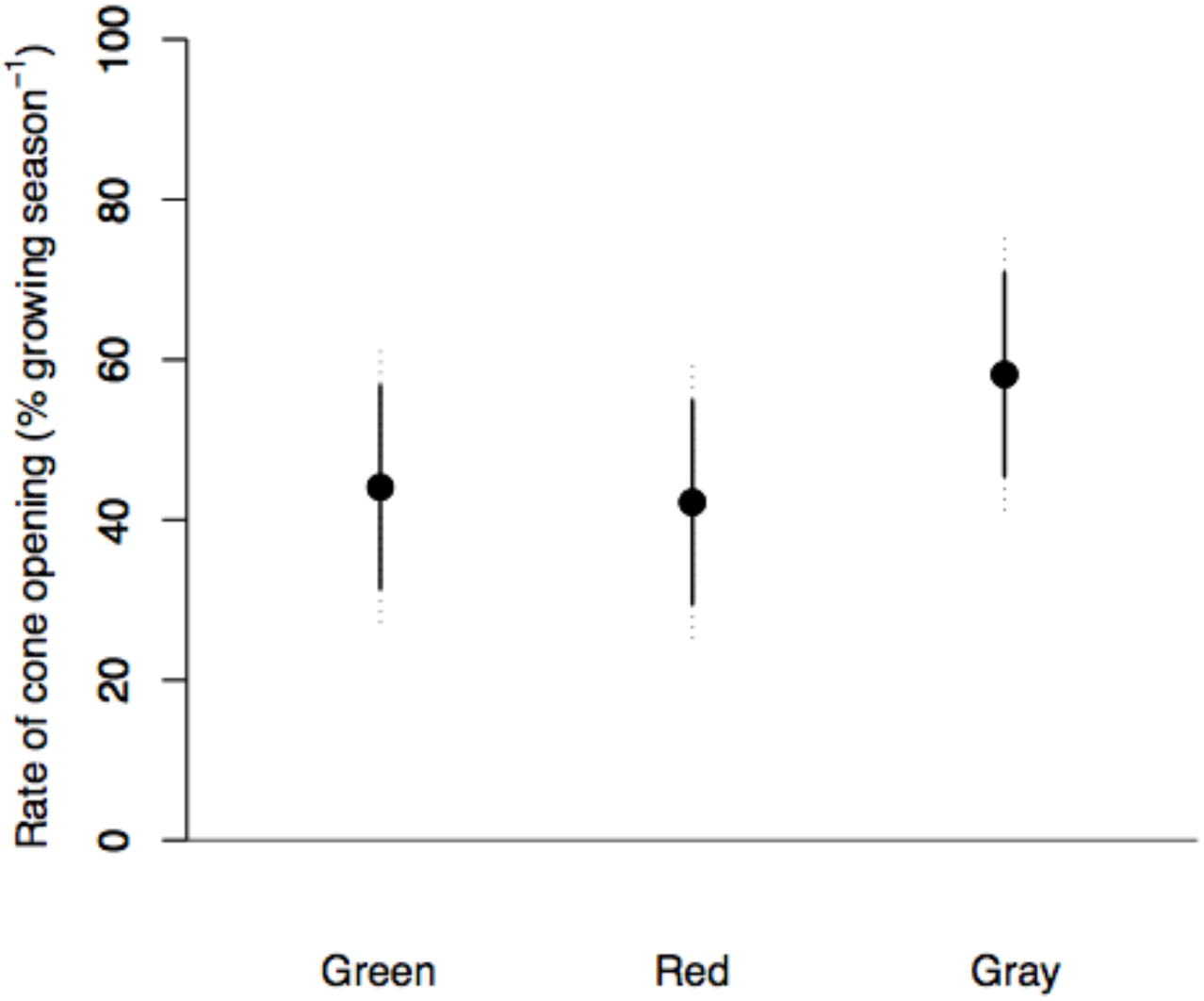
Flexible Stems and Brittle Twigs

Results – Canopy-cone drop



Results – Canopy-cone release (Crown friction)

Results – Forest floor-cone opening

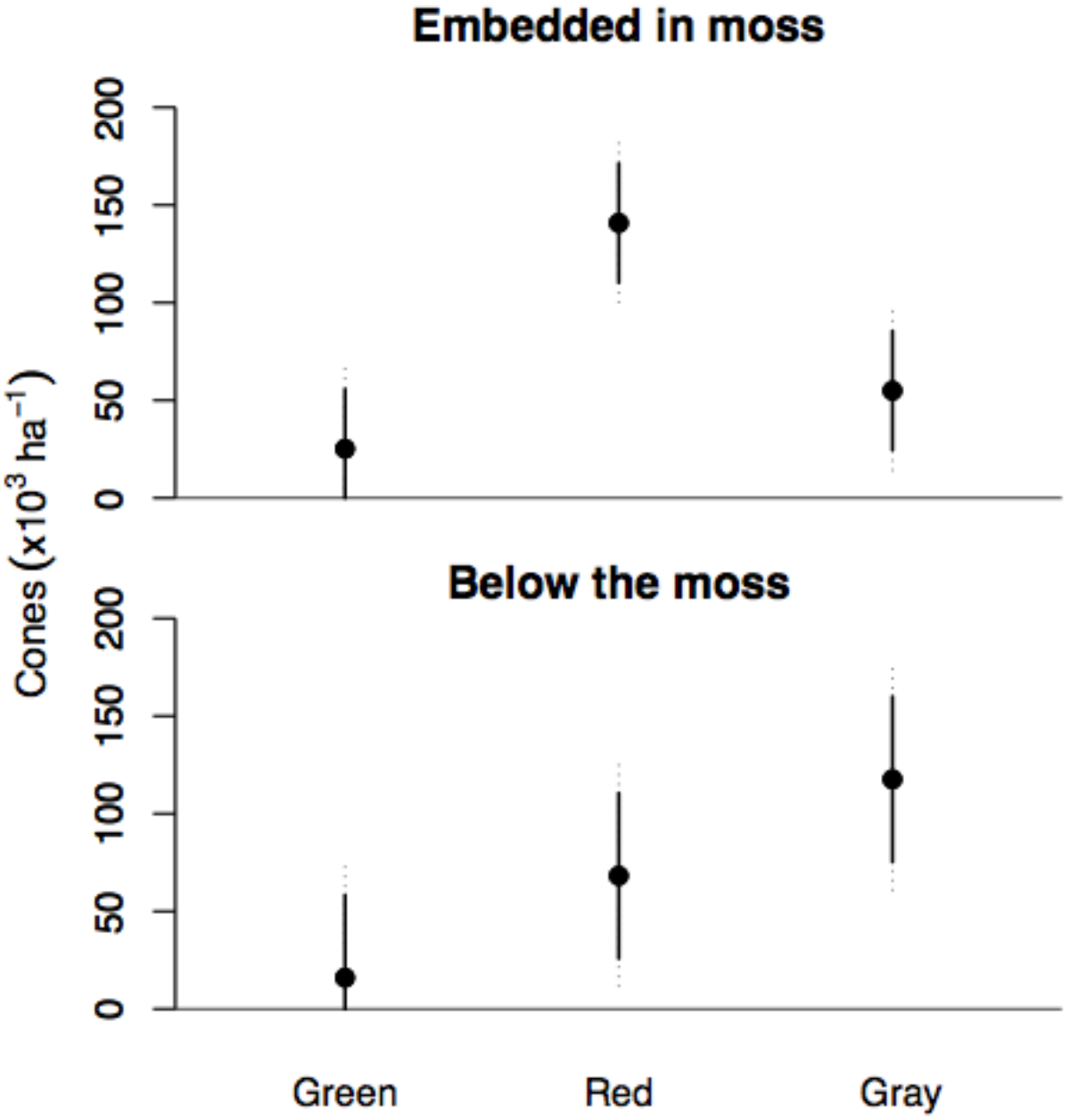


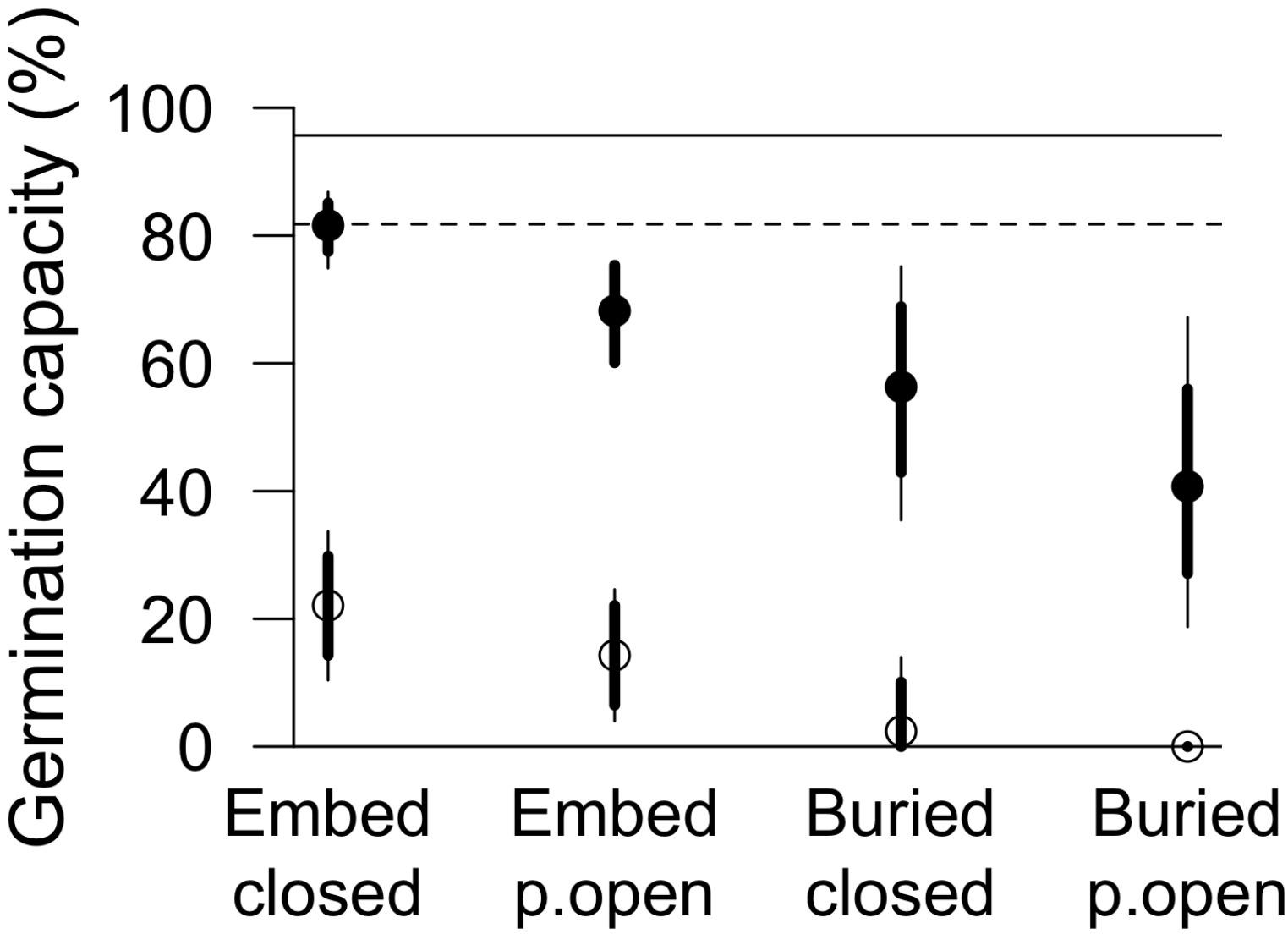
Methods - Buried cones

Embedded in moss

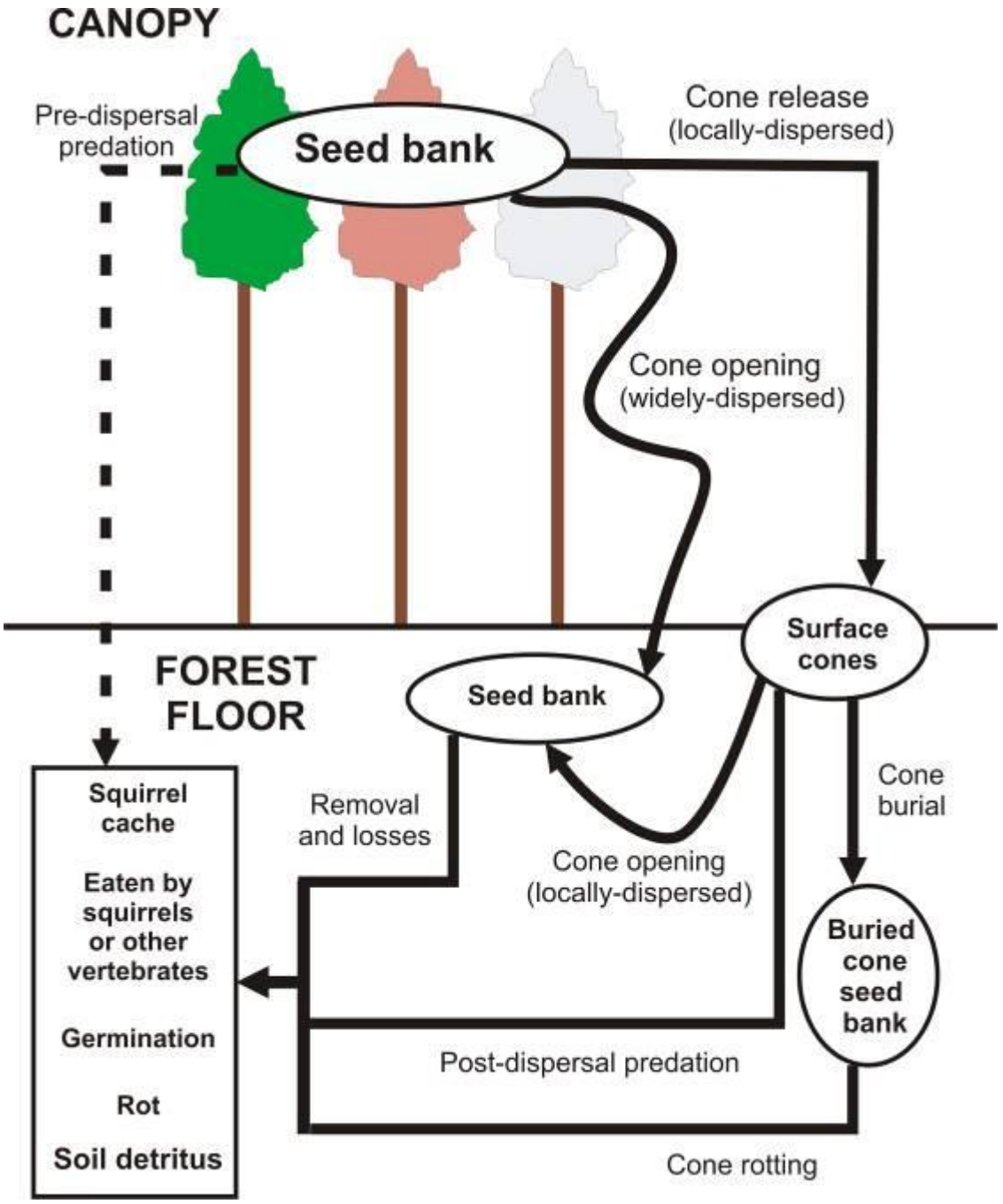
Below moss

Results – Cone burial

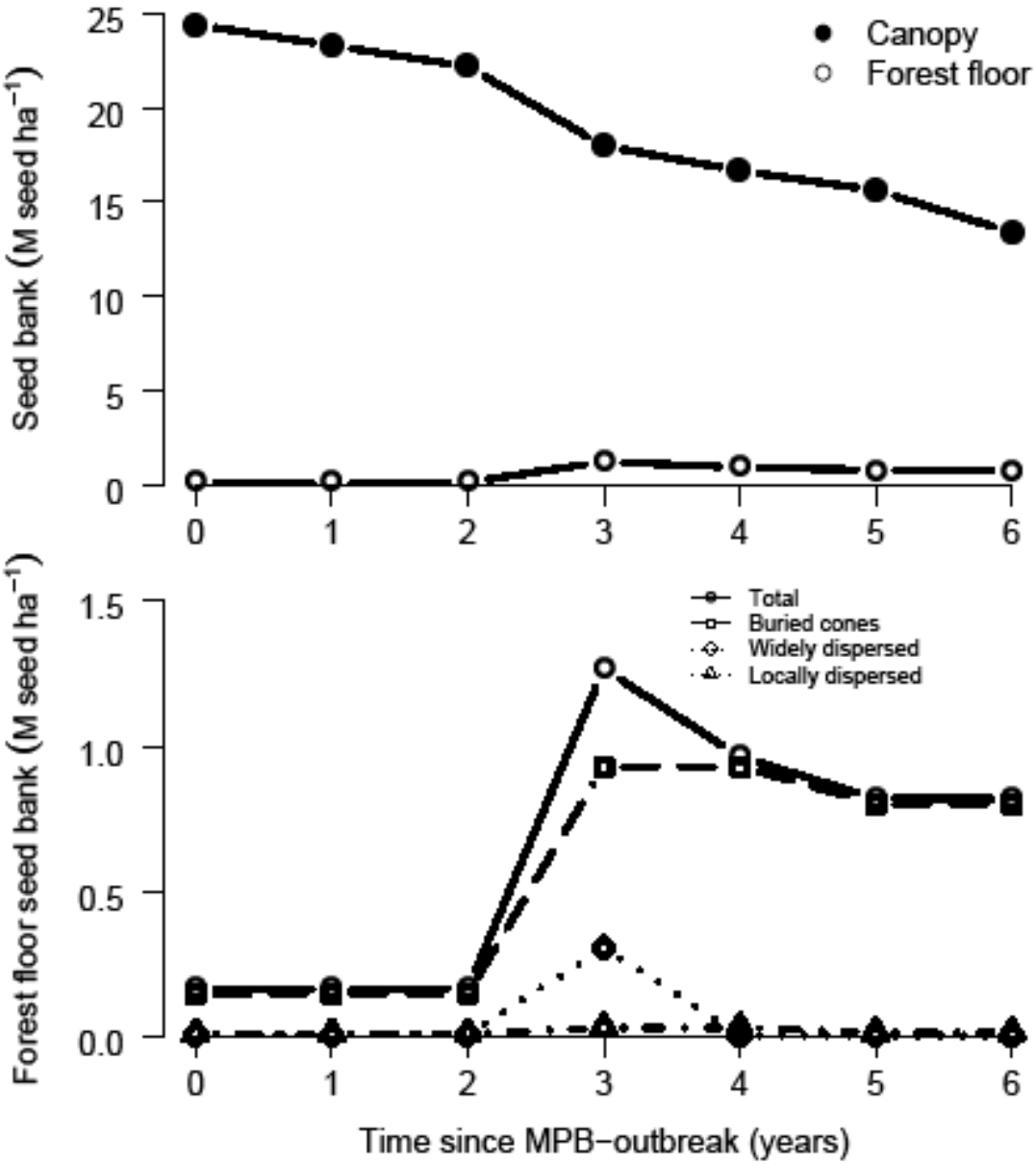



Germination capacity (%)
100
80
60
40
20
0
Embed closed
Embed p.open
Buried closed
Buried p.open

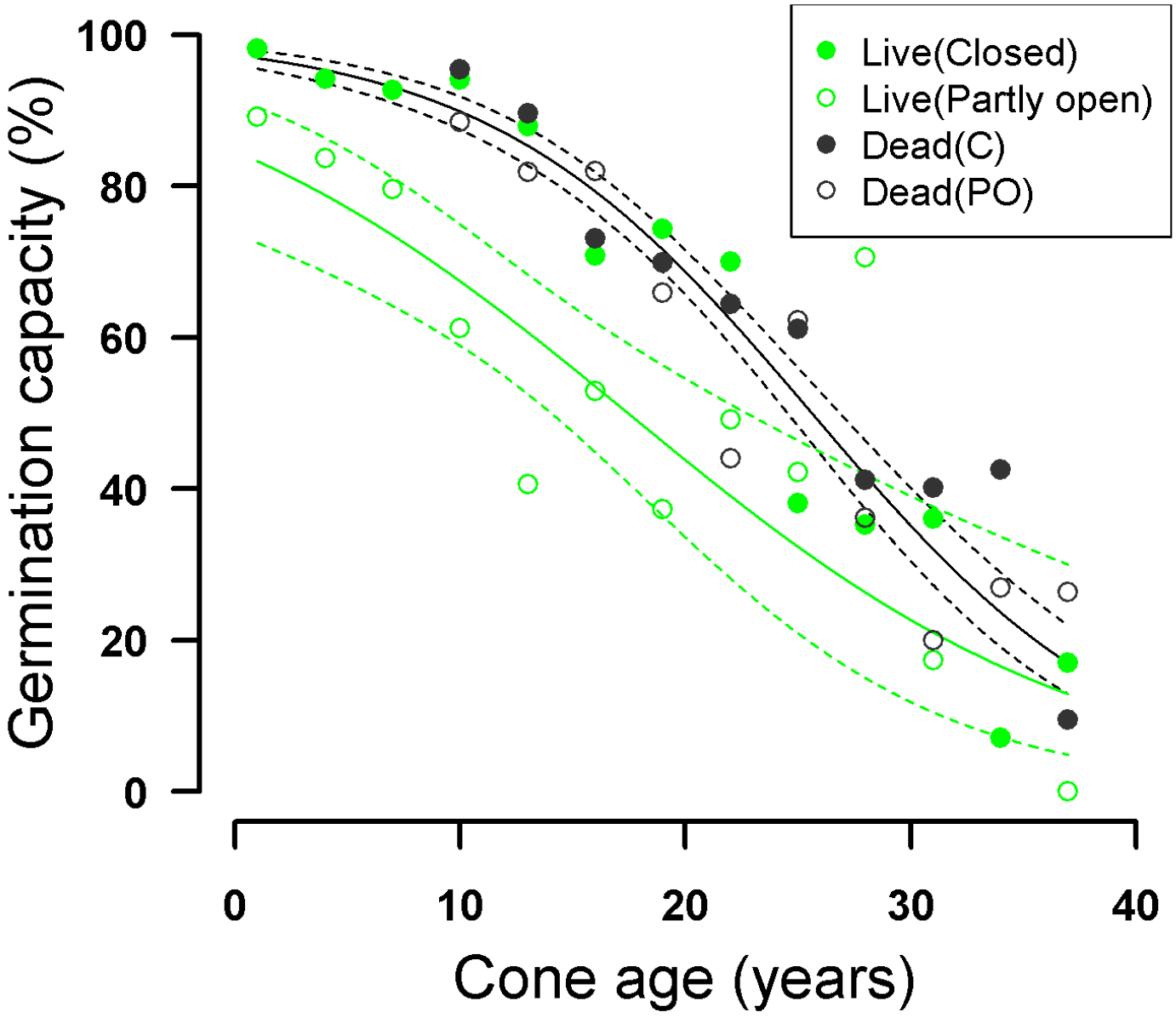
Seed banks post MPB



Results- Seed banks

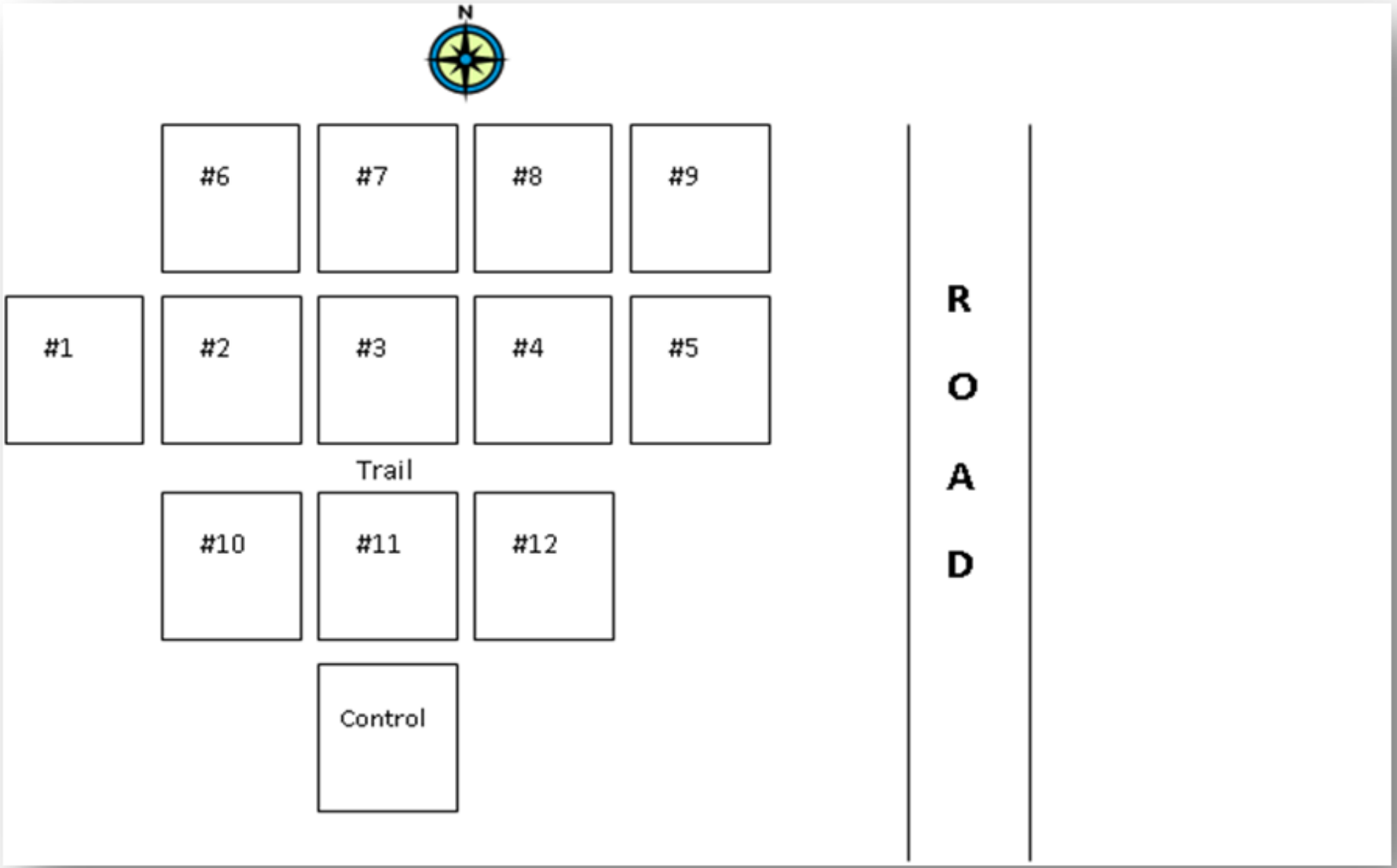


After 6 years post MPB-outbreak, 45% of the canopy seed remains while 6% are still in cones buried in the forest floor.

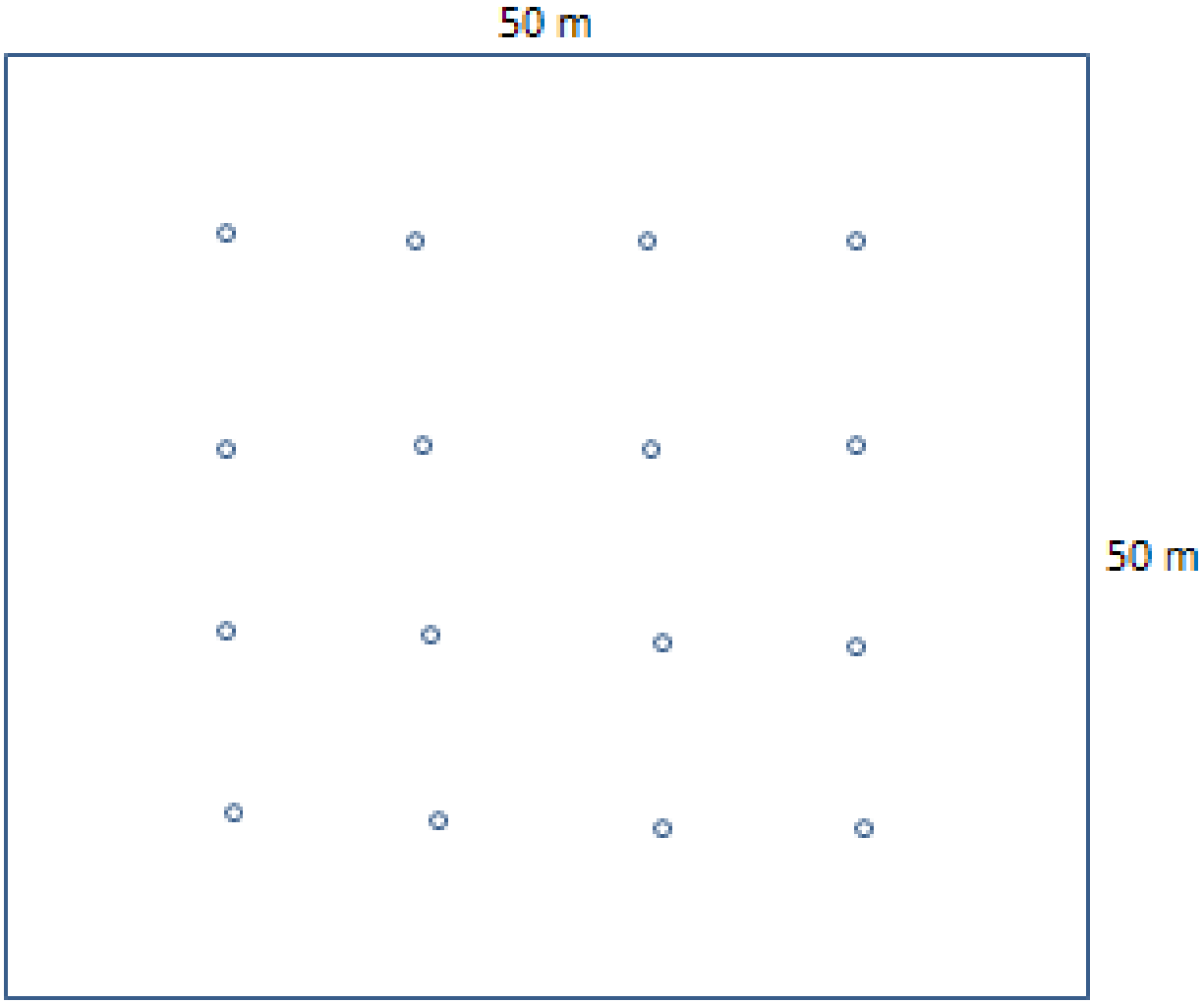

Live(Closed)
Live(Partly open)
Dead(C)
Dead(PO)
Germination capacity (%)
100
80
60
40
20
0
0
10
20
30
40
Cone age (years)

Goals

- Assess potential of fire to renew MPB sites
- Assess ability to predict the fire behaviour and link it to the FWI
- Compare fire with mechanical site preparation.


N
#6
#7
#8
#9
#1
#2
#3
#4
#5
Trail
#10
#11
#12
Control
R
O
A
D


THOMAS


50 m
50 m

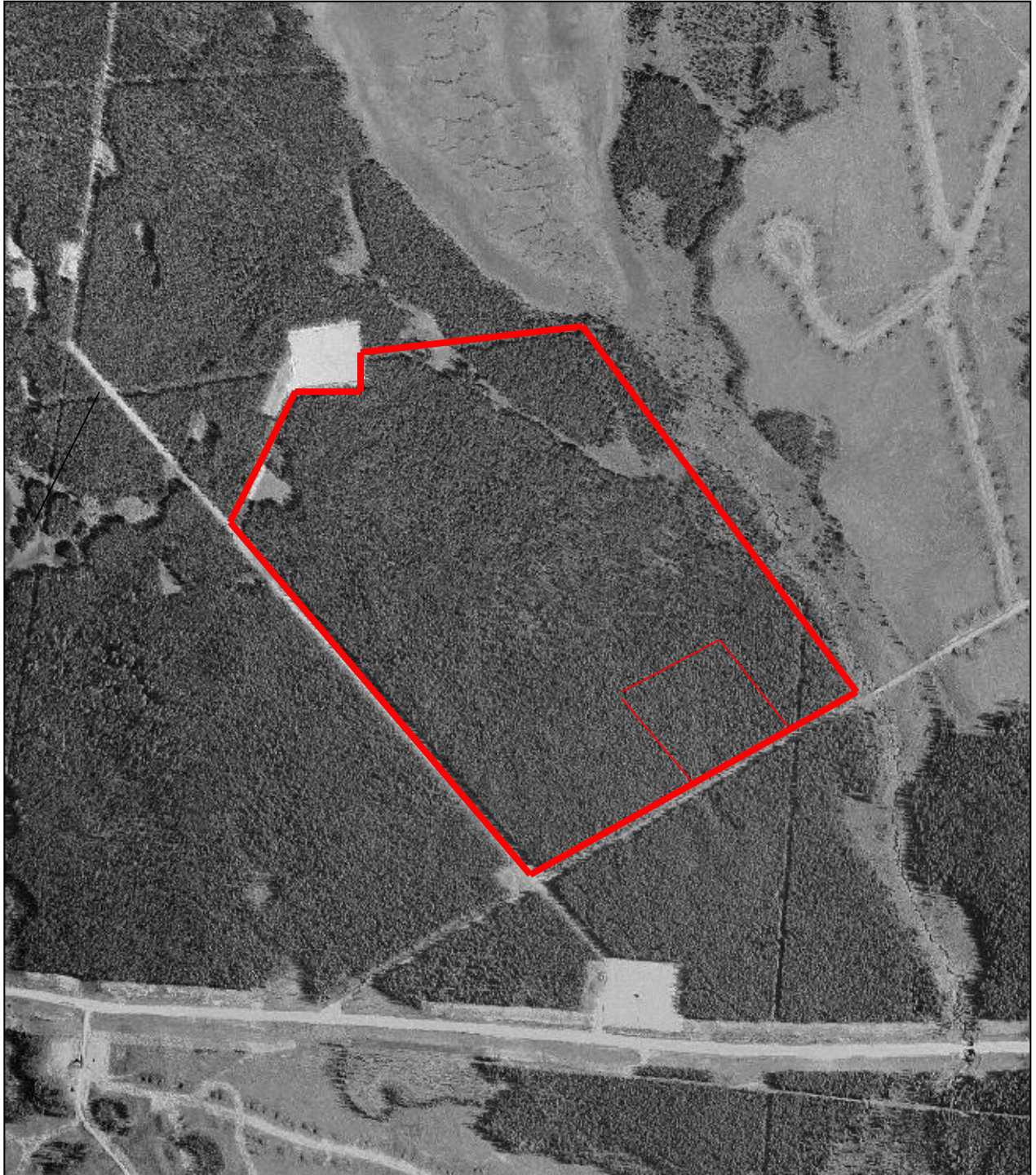
Underburning Measurements

- Temperatures in canopy.
- Duff removal and seed beds.
- Seed fall from canopy using seed traps.
- Seed viability of ground cones (surface and buried).
- Forest floor N – release of NO_3 and NH_4.

Pine measurement

- Seedling establishment (density and stocking)
- Seedling establishment of seeded plots
- Vegetation response

Horse Creek Site



ANC Rd.

- Pat Wearmouth, Forrest Barrett, Kevin Quintilio, Erin Fraser and Don Podlubny

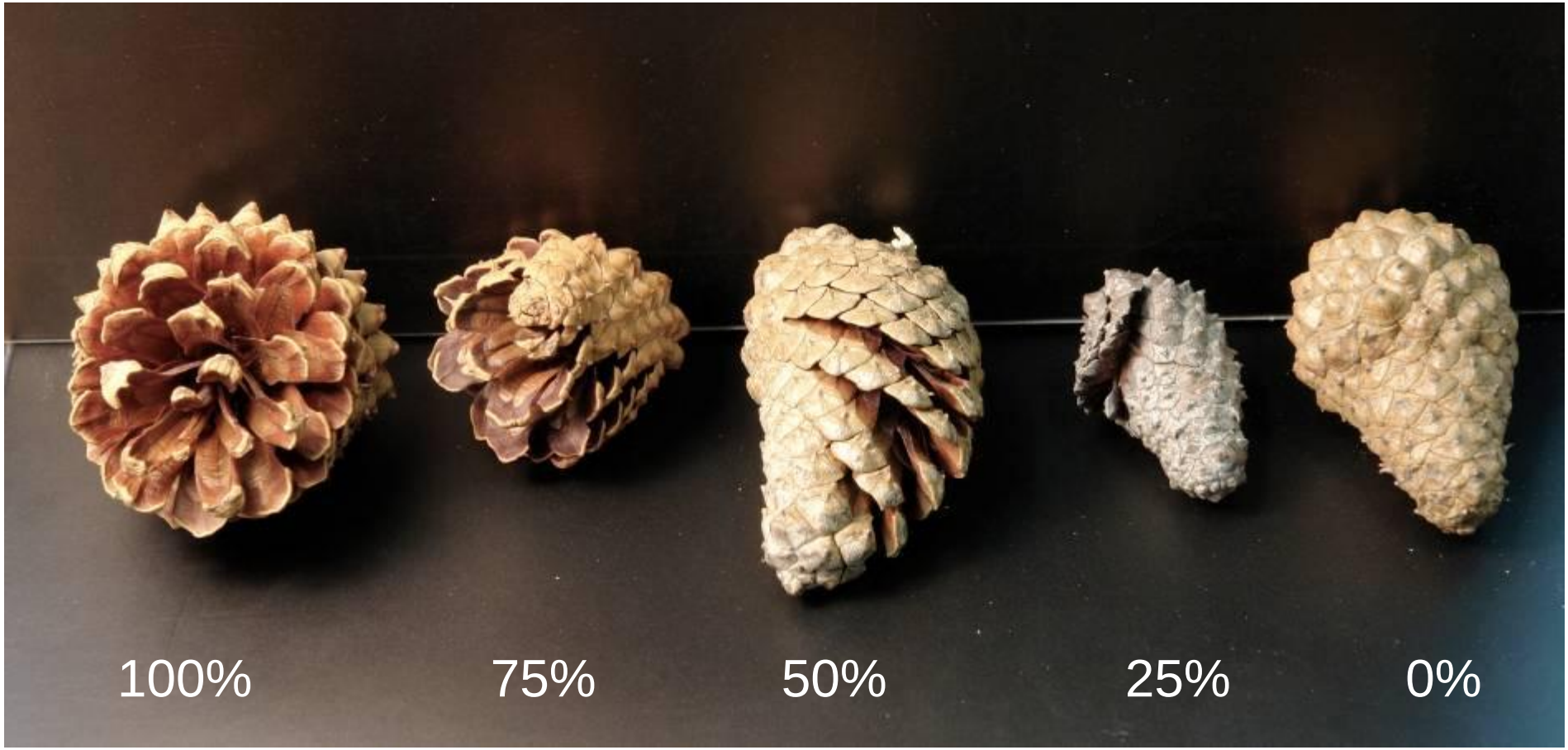
- Past research on seed was supported by West Fraser Mills, Weyerhaeuser Co. and Natural Science and Engineering Research Council of Canada (NSERC).

Government of Alberta
Sustainable Resource Development

Results – Canopy-cone opening (Partial loss of serotiny)

Canopy cones open due to partial loss of serotiny from warming and weathering.

Methods - Cone openness

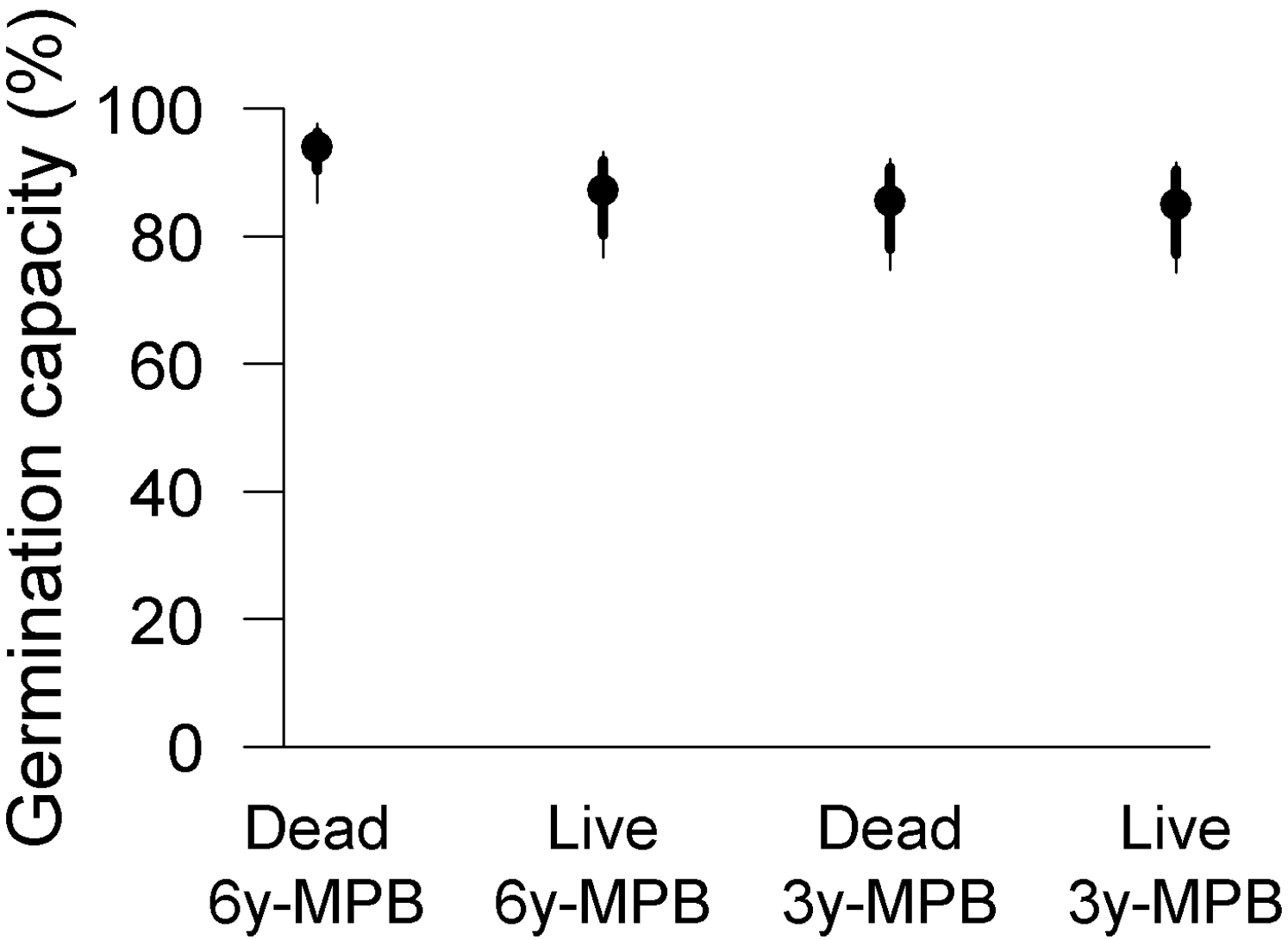


Open

Partially open

Closed

Embedded


Germination capacity (%)
100
80
60
40
20
0
Dead
6y-MPB
Live
6y-MPB
Dead
3y-MPB
Live
3y-MPB

Thank you

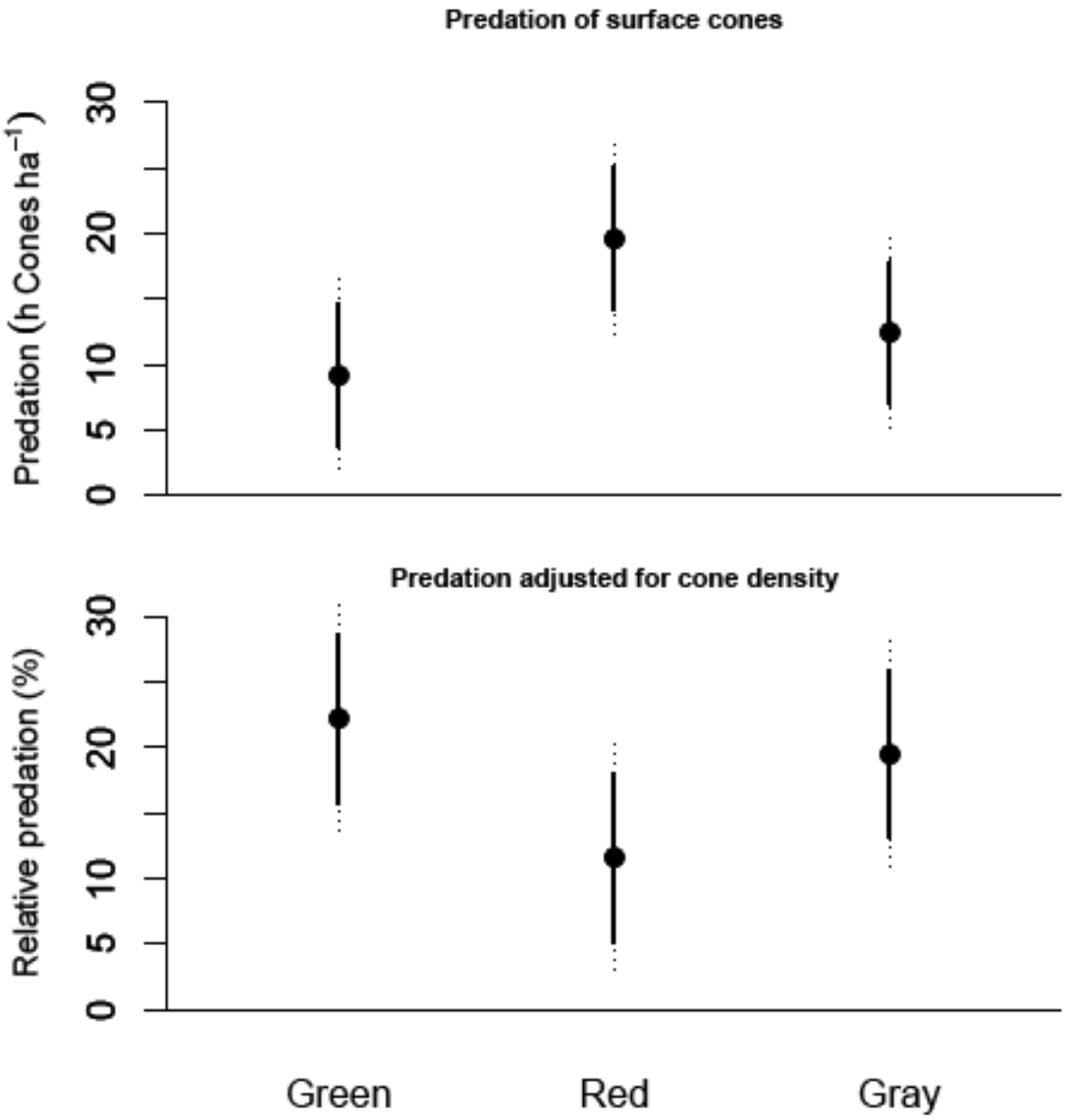
Questions…

Natural regeneration after logging

Drag scarifier

Natural regeneration after fire

Results – Squirrel predation



Results – Forest floor-cone opening

Released cones via breakage, open and release seed due to soil-surface heating.

Results – Cone burial

A forest floor-seed bank develops and maybe ecologically important if a secondary disturbance re-exposes these buried cones.

Conclusions

- The seed released accumulated to 45% of the original canopy-seed bank by year 6 after MPB outbreak.
- Branch breakage, increased cone opening, and squirrel predation.
- A small forest floor-seed bank develops due to cone burial of closed cones.