Next steps

Summary of the project to date

- "Slow the spread" (BAU) has been effective in mitigating the spread and impacts of MPB in central Alberta since 2006
- Significant improvements in BAU efficacy by:
  - Incorporation of predicted *r*-values into DSS and all aspects of prioritization
  - Increased efficiency of green attack detection/eradication
  - Increased application of Level 1 treatments

Critical aspects beyond the project scope

- Provincial-scale outcomes
- Risk to Saskatchewan, or the pine forests further east
- Impacts to values other than timber (e.g. habitat)
- Role of "net down" (e.g. landbase unavailable to MPB management)
- Potential for other approaches to MPB management

Going forward, building on success

- MPBSpread – as a foundation

Going forward. Part I.

Future work with MPBSpread should focus on **broadening the spatial scale (provincial-level, and larger), a longer temporal scale (several decades), and a broader suite of values.**

Expanding the scale of application of MPBSpread, however, introduces an additional uncertainty into the efficacy of control, the magnitude of which is largely unknown:

- A sizeable proportion of the landbase does not receive any significant beetle control because areas are inaccessible, too visually sensitive (parks, for example), or otherwise restricted (riparian, special conservation or wildlife areas, military sites).

The area subject to this net down is not trivial

FMU	Total area (ha)	Prohibited harvest	Inoperable/ isolated	Buffer	THLB[1]
A15	1,438,950	3.6%	53.8%	1.9%	21.9%
A14	1,168,279	6.6%	59.1%	1.9%	26.6%
L1	333,806	1.4%	35.5%	3.0%	36.7%
L2	300,548	2.6%	43.5%	1.5%	40.9%
L3	587,395	2.7%	50.2%	1.8%	24.0%
L11	1,047,685	1.1%	43.8%	2.3%	27.3%
S18	602,505	2.1%	47.6%	2.6%	35.3%
S17	717,719	1.5%	25.8%	1.9%	41.9%
CLAWR	1,175,350	100%	0%	0%	0%

MPBSpread will permit an evaluation of the net down effect on beetle spread.

Going forward. Part II.

A key finding from MPBSpread was the relative importance of Level 1 control in reducing beetle spread, and that increasing the area subject to Level 1 and 2 control, combined with enhanced detection and eradication, was even more useful.

Aside from being costly to implement, both strategies are oriented towards the treatment of stands that have already incurred losses from MPB (‘reactive’ control).

The Healthy Pine Strategy (HPS), along with 'regular' timber harvesting, represent 'proactive' measures – susceptible stands are removed prior to pine mortality.

These measures serve to 'beetle-proof' the landscape but the relative utility of this approach in slowing the spread of MPB is unknown, or how it could be expanded to improve overall efficacy.

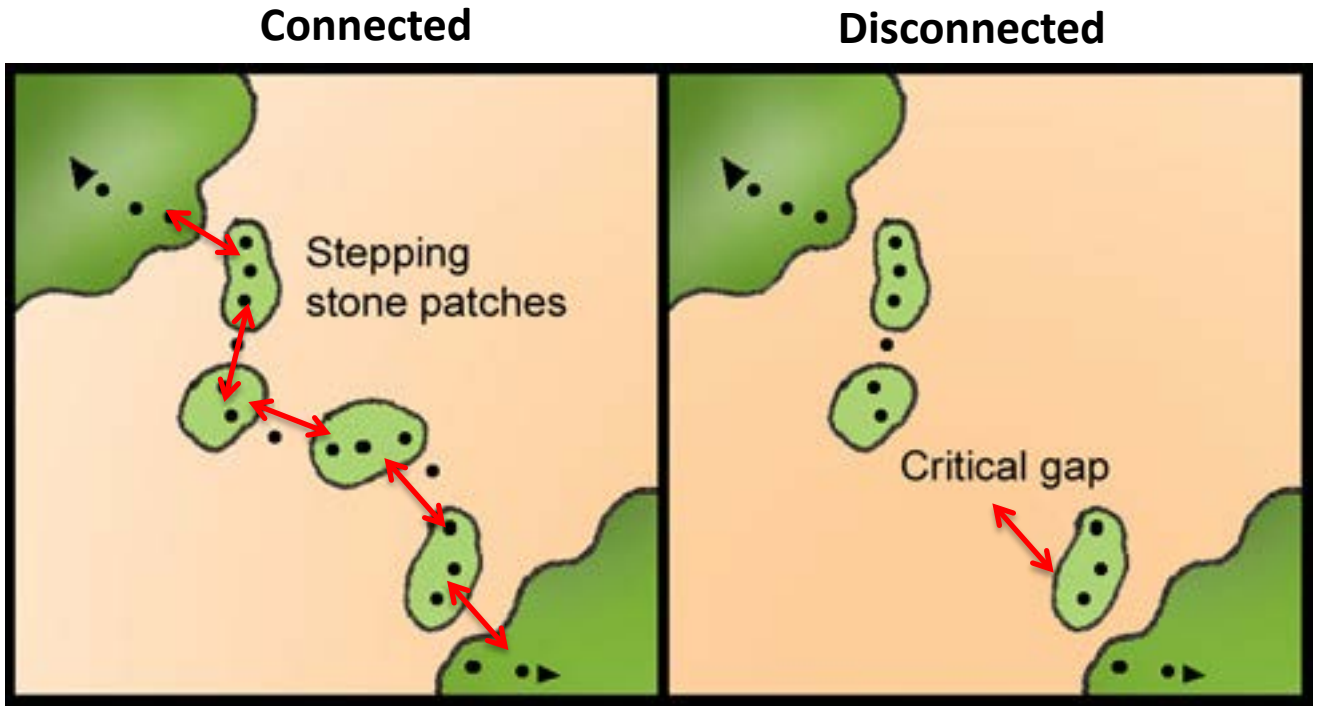
- One option we have explored combines MPBSpread with an approach that uses percolation theory to characterize the degree to which the pine landscape is 'connected' from the perspective of MPB colonization.

A different approach to implementing MPB control

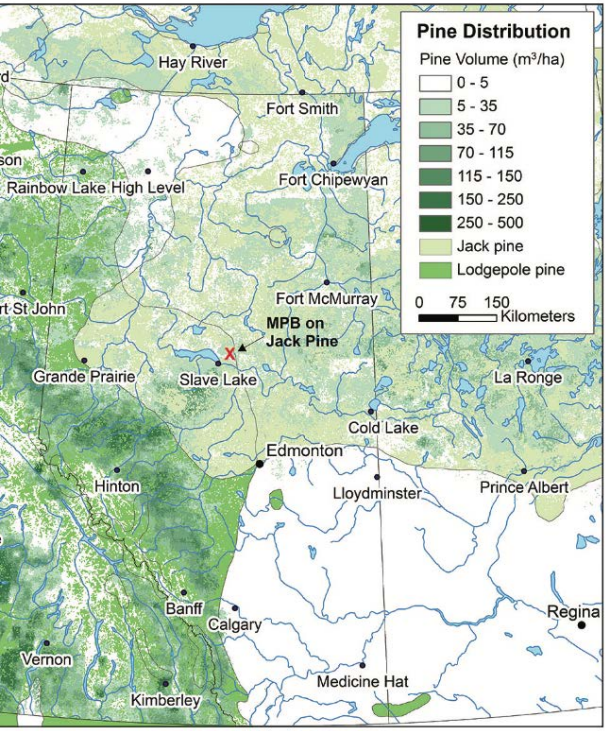
Landscape connectivity is the critical factor regulating the scale of the MPB outbreak.

Imagine an organism (say MPB) has some 'average' distance that it can disperse.

This dispersal distance can be used to characterize the connectivity of its environment in terms of its ability to move among suitable habitats that are not directly connected.



Connectedness is scale-dependent and specific to a given species



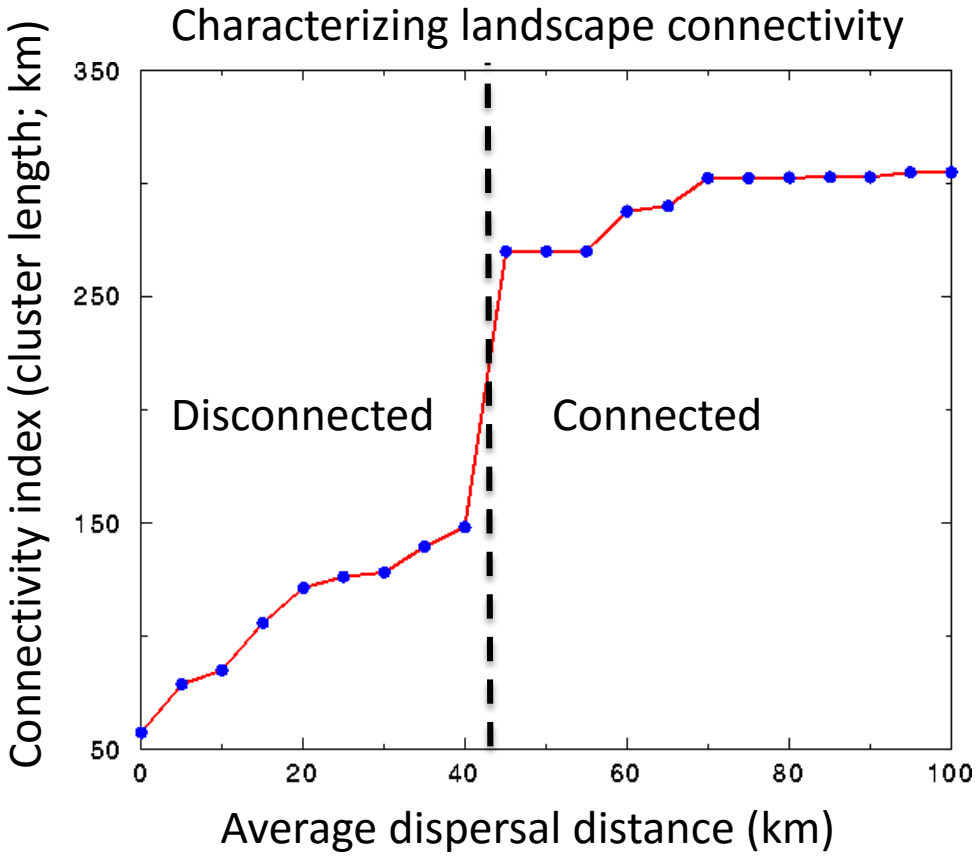
A different approach to implementing MPB control

- Percolation theory provides a useful framework for quantifying connectivity in spatially structured systems.

- A measure commonly employed to quantify connectivity is the average distance an individual must be capable of dispersing before reaching a 'barrier'.

- Note that a barrier represents a gap between habitats that is too great for an organism to cross.

Using dispersal distance to characterize connectivity of the environment based on the distribution of pine



In the case of MPB, connectivity depends on:

1. Host quality and distribution

- Characterize using percolation theory
- Proactive control tactics (HPS and harvesting) are devised

2. MPB population dynamics

- Simulated using MPBSpread
- Model is used to evaluate proactive control tactics, in conjunction with reactive measures (Levels 1 and 2).

This represents a novel approach to devising MPB control strategies

It provides a means of ‘beetle-proofing’ the landscape, which could result in:

- Lower overall pine mortality
- More effective allocation of reactive control measures
- Assessment of risk and uncertainty associated with alternative control strategies
- Reduction in the probability of continued eastward spread