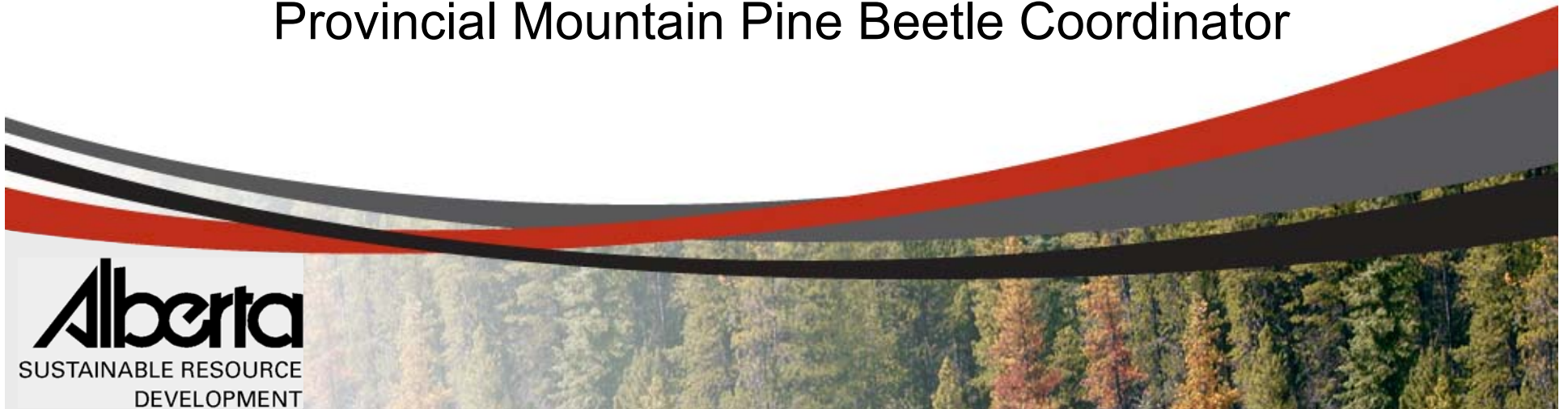


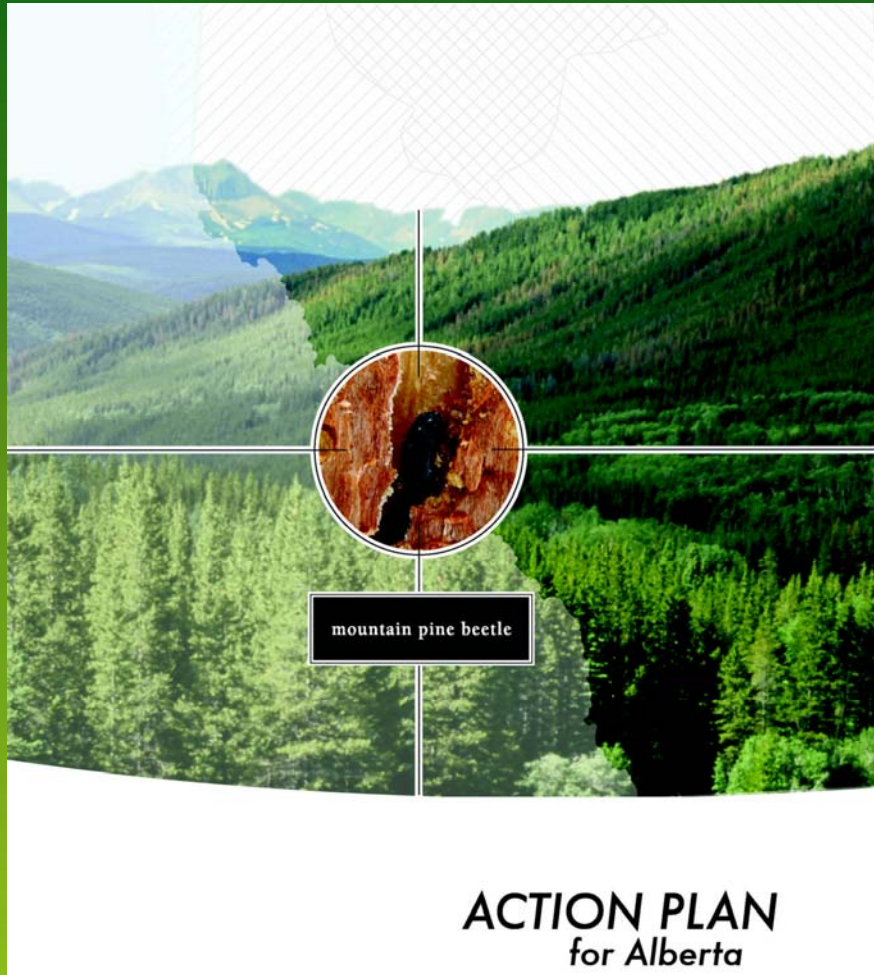
# MPB Management Tools in Alberta and Research Priorities

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Provincial Mountain Pine Beetle Coordinator



# Mountain Pine Beetle Action Plan for Alberta



## Prime Objectives

1. Prevent the spread north and south along the eastern slopes of Alberta, and
2. Prevent the spread eastward into the boreal forest of lodgepole-jack pine hybrid and jack pine forests.

# Mountain Pine Beetle Management Strategy

## Beetle Strategy

Aggressively detect, survey and control infested trees.

### Tactics

- a. Level 1 = Single Tree Treatment
- b. Level 2 = Harvest

## Healthy Pine Strategy

Pre-emptively reduce the number of highly susceptible stands.

### Tactics

- Prescribed Burns
- Harvest



# Decision Support System

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- Developed in 2007 under consultation with CFS
- Integrates beetle population parameters and forest metrics
- Sites identified during aerial surveys are ranked according to their risk of infestation **spread**
- Ensures that operational priorities are science-based and are applied systematically across the province

# Decision Support System

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Sites are ranked according to:

- MPB Management Zone
- Number of infested trees
  - Aerial surveys and Green:Red ratios
- Stand Susceptibility
- r-value
- Connectivity

# MPB Management Zones

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Define the level of management and control strategies:

- Leading edge Zone
- Holding Zone
- Salvage (limited Action) Zone

Areas are redefined every year, based on

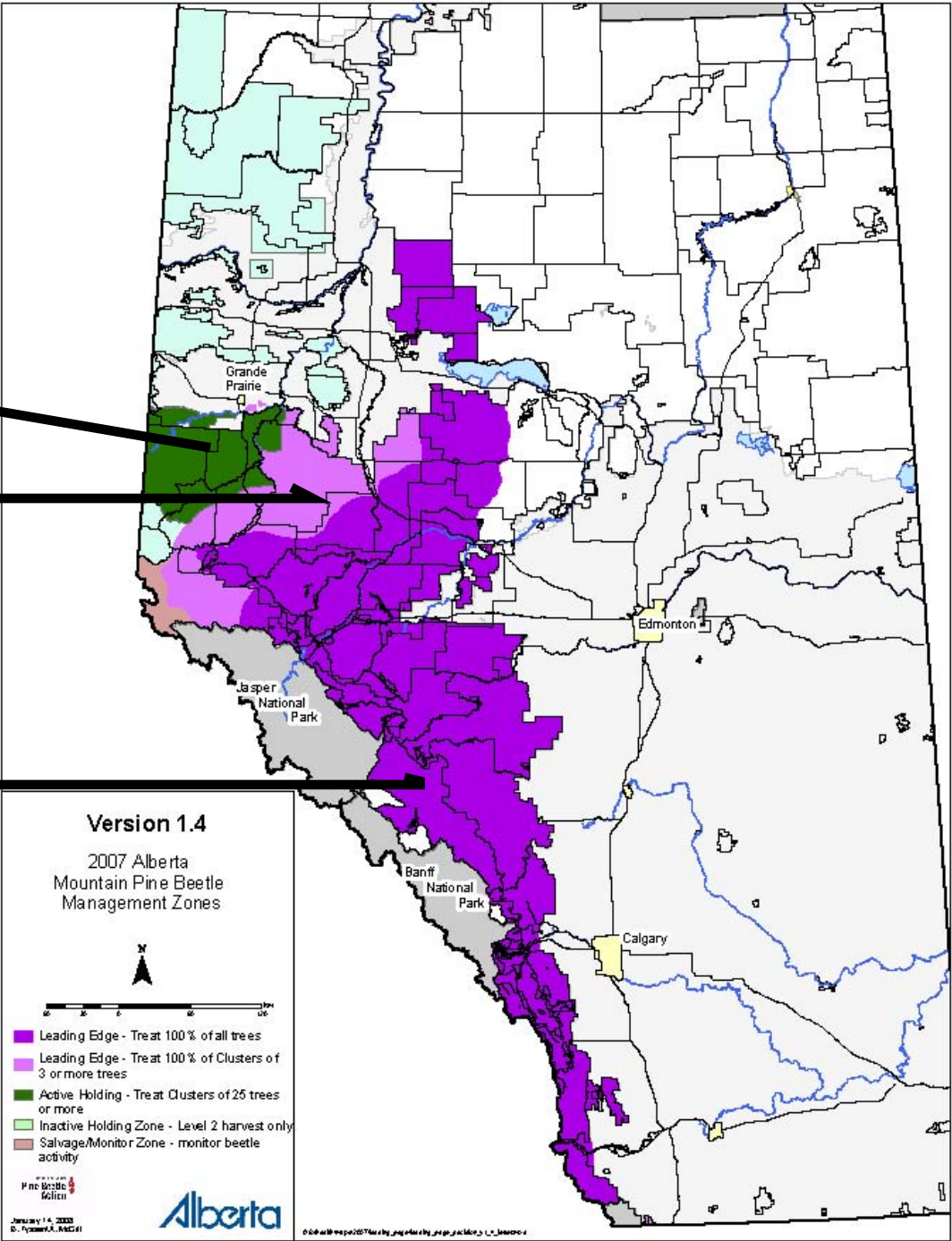
- Current status and risk of MPB spread
- Risk of MPB immigration
- Management objectives currently achievable

# Our Management Strategy

Find and control all patches of 25 trees or more

Find and control all patches of 3 trees or more

Find and control all trees



# Decision Support System

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Sites are ranked according to:

- MPB Management Zone
- Number of infested trees
  - Aerial surveys and Green:Red ratios



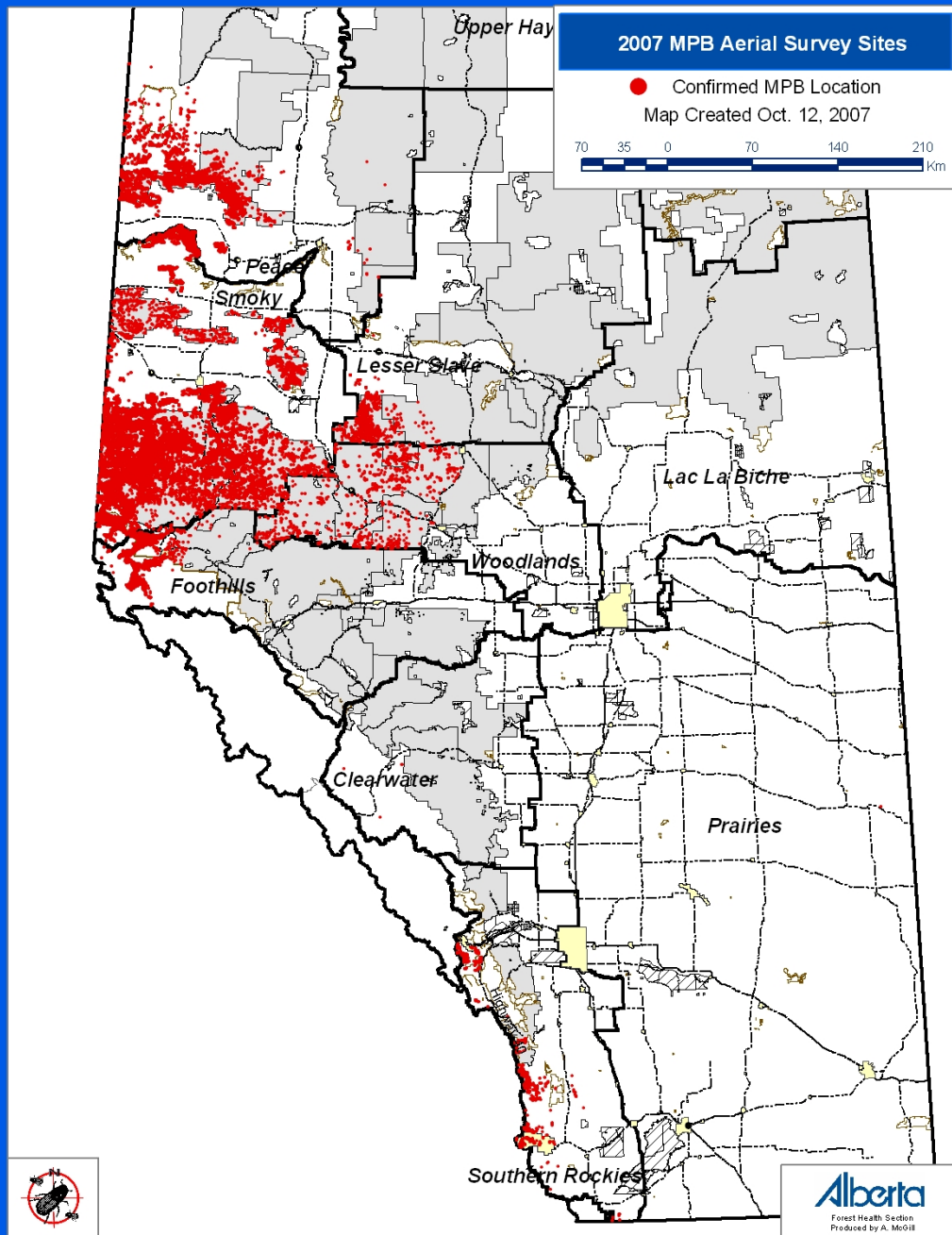
# Aerial Surveys

- Completed between August 15 and September 15
- Detailed Heli-GPS of fading trees across the Province.

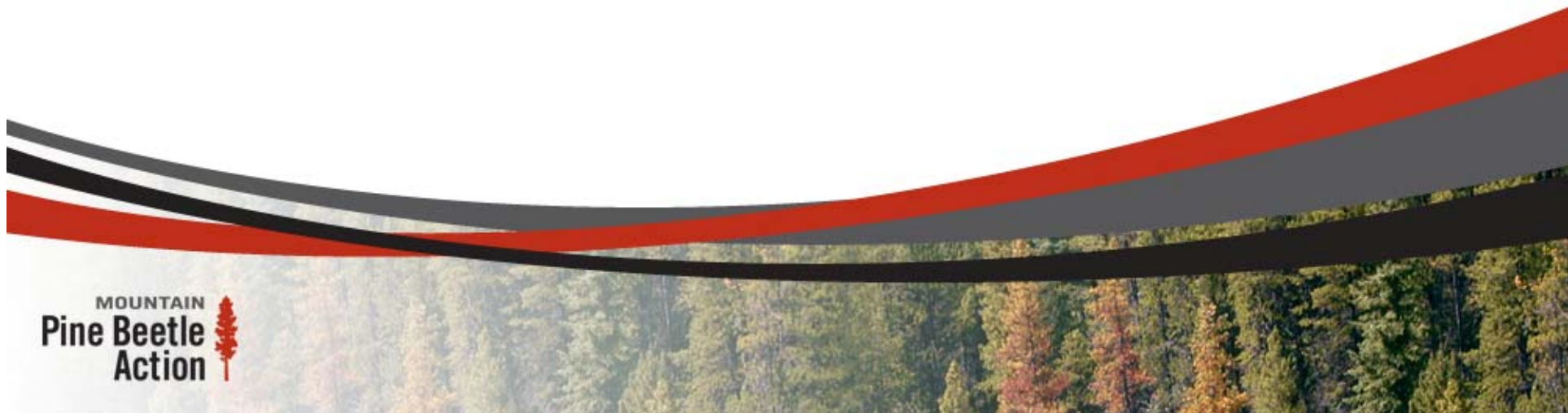




# Alberta MPB Sites

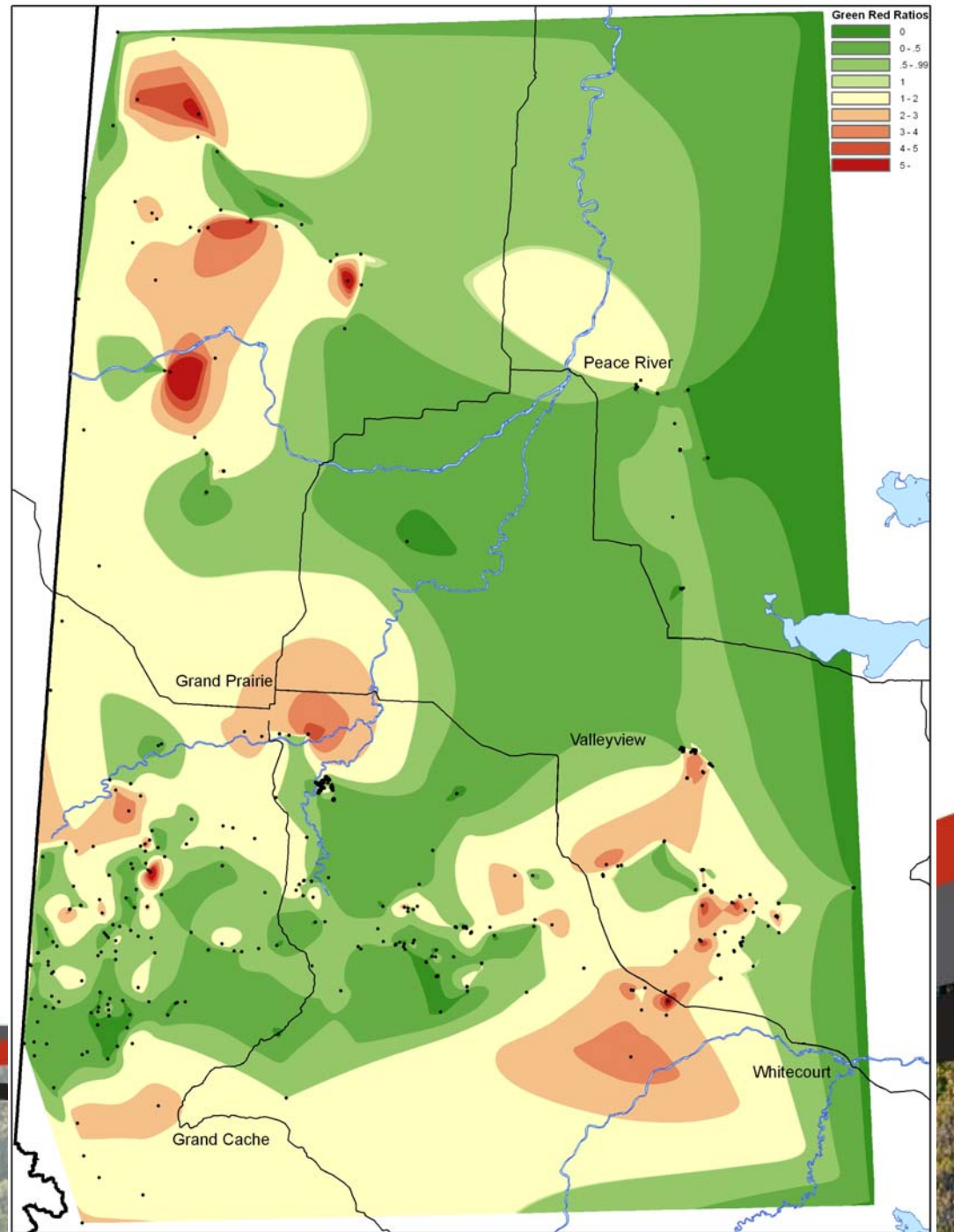


When do trees fade



# Green:Red 2007

- Collected during aerial surveys
- Multiplied with the number of red trees to estimate the number of currently infested trees at a site



# Decision Support System

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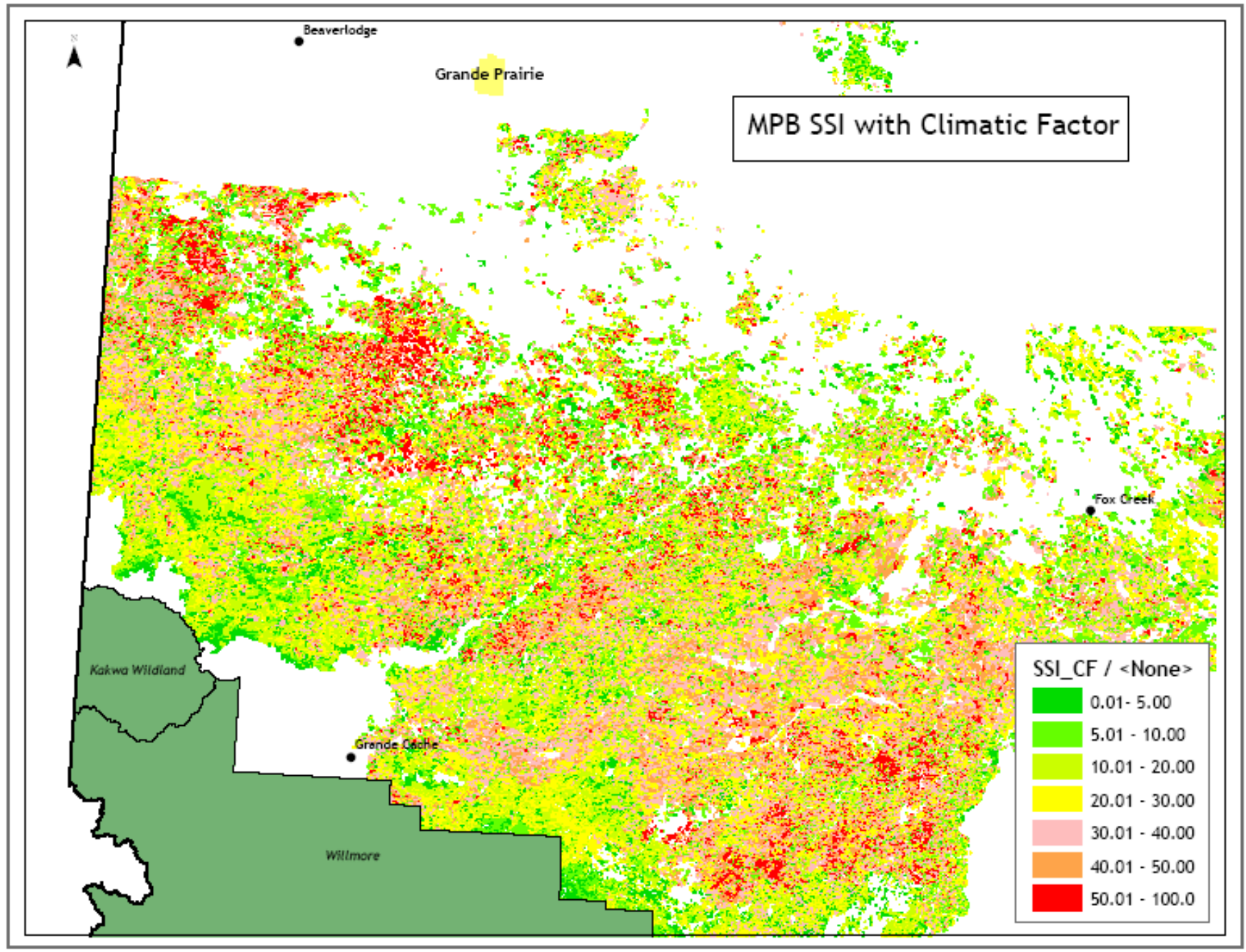
Sites are ranked according to:

- MPB Management Zone
- Number of infested trees
  - Aerial surveys and Green:Red ratios
- Stand Susceptibility

# Susceptibility

- Based on Shore & Safranyik (1992):
  - % of susceptible pine basal area ( $DBH \geq 15\text{cm}$ )
  - Age
  - Stand density
  - Location factor
- Exchanged Lat/Long for Index of Climatic Suitability (Carroll et al., 2004):

Climate data converted to monthly normals from 30-year means and extreme minima and maxima



MPB SSI with Climatic Factor

SSI_CF / <None>	Value Range
Dark Green	0.01 - 5.00
Light Green	5.01 - 10.00
Yellow-Green	10.01 - 20.00
Yellow	20.01 - 30.00
Light Orange	30.01 - 40.00
Orange	40.01 - 50.00
Red	50.01 - 100.0



## High Priority Research Areas #1

Stand susceptibility - revise ratings in relation to new climate models

# Decision Support System

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Sites are ranked according to:

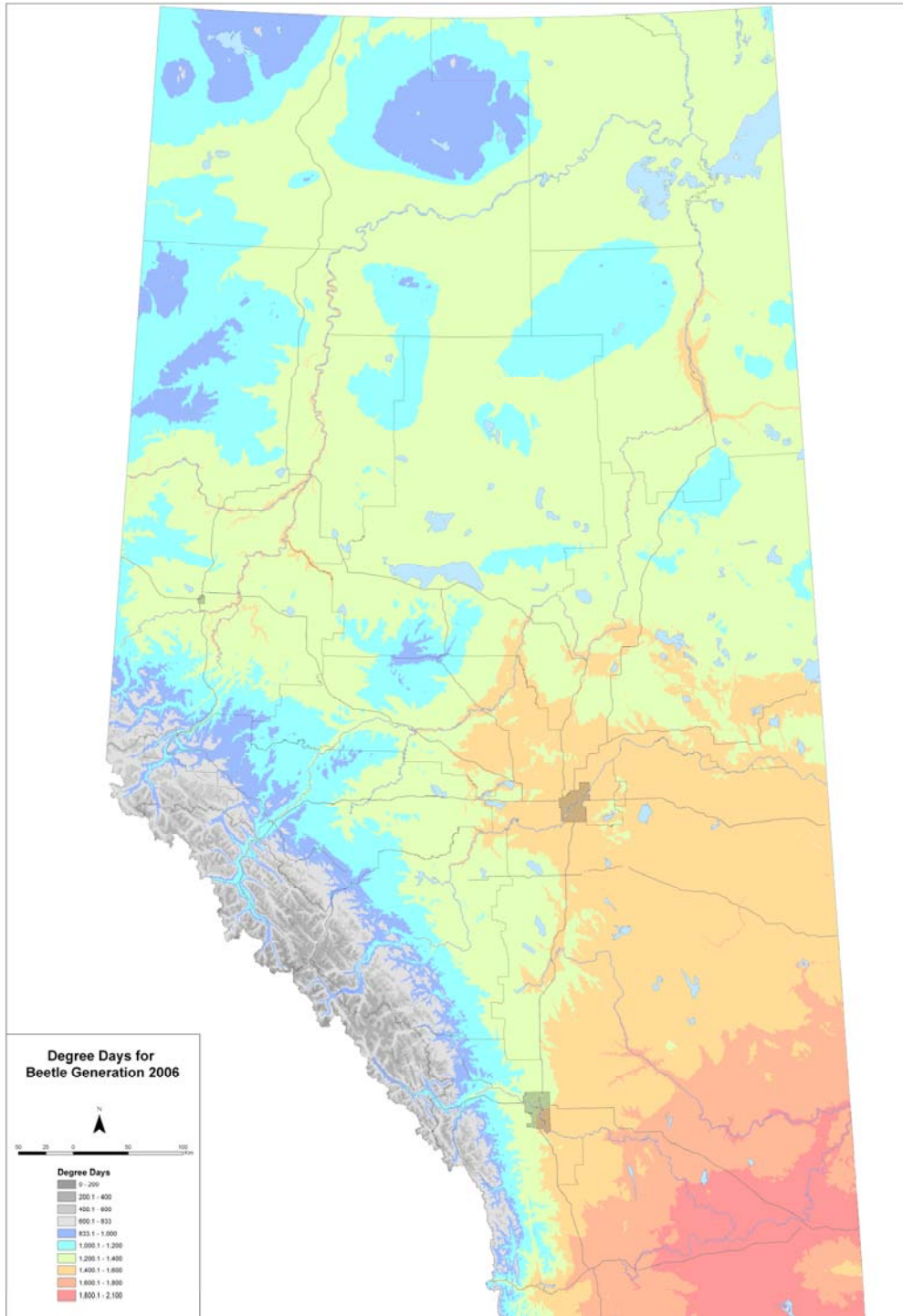
- MPB Management Zone
- Number of infested trees
  - Aerial surveys and Green:Red ratios
- Stand Susceptibility
- r-value
  - population trend
  - dependent on summer development and all mortality factors

# r-value calculations

## Lifecycle Map

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- Calculated degree-days for 1 August 2006 – July 31 2007 using BioSIM (Régnière & Saint-Amant)
- 833 degree-days above 5.5°C is the minimum required for a population to be univoltine (adapted from Reid 1962)
- Used in conjunction with a map of mean and standard deviation of degree-days for last 5 years



## r-value calculations

# Winter Mortality

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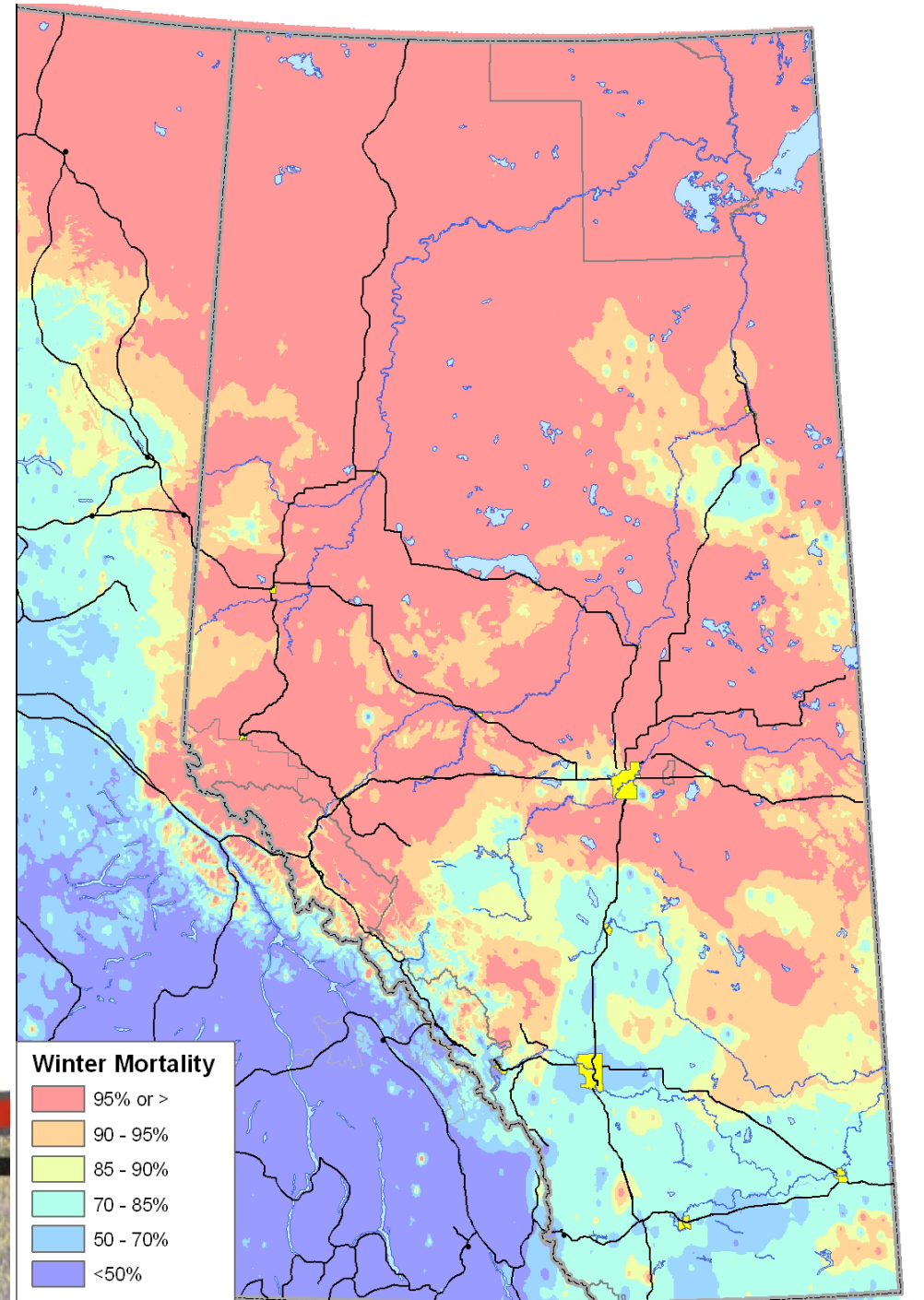
- Major determinant of r-values
- B. Cooke (CFS) tested winter-kill model (J. Régnière & B. Bentz, 2007)
- Simulates cold tolerance of MPB using daily weather data
- Captured large scale trend in 2007 survival data well
- A large amount of local variation remained unexplained

# Winter Mortality 2007 / 2008

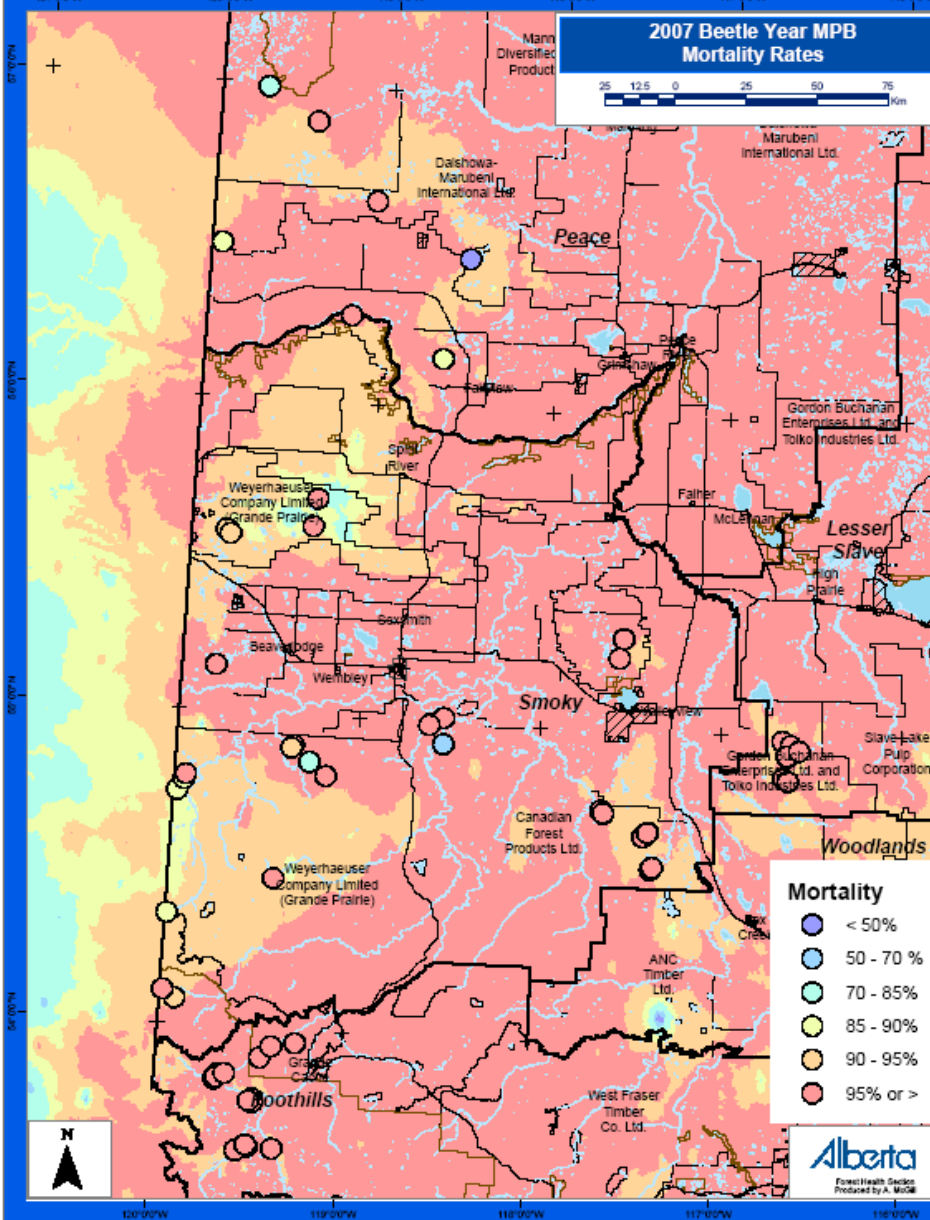
During winter 2007/2008 SRD received updated mortality maps after each cold spell

Model predicted that cold-snap end of January caused 95 -100% mortality in Northern Alberta

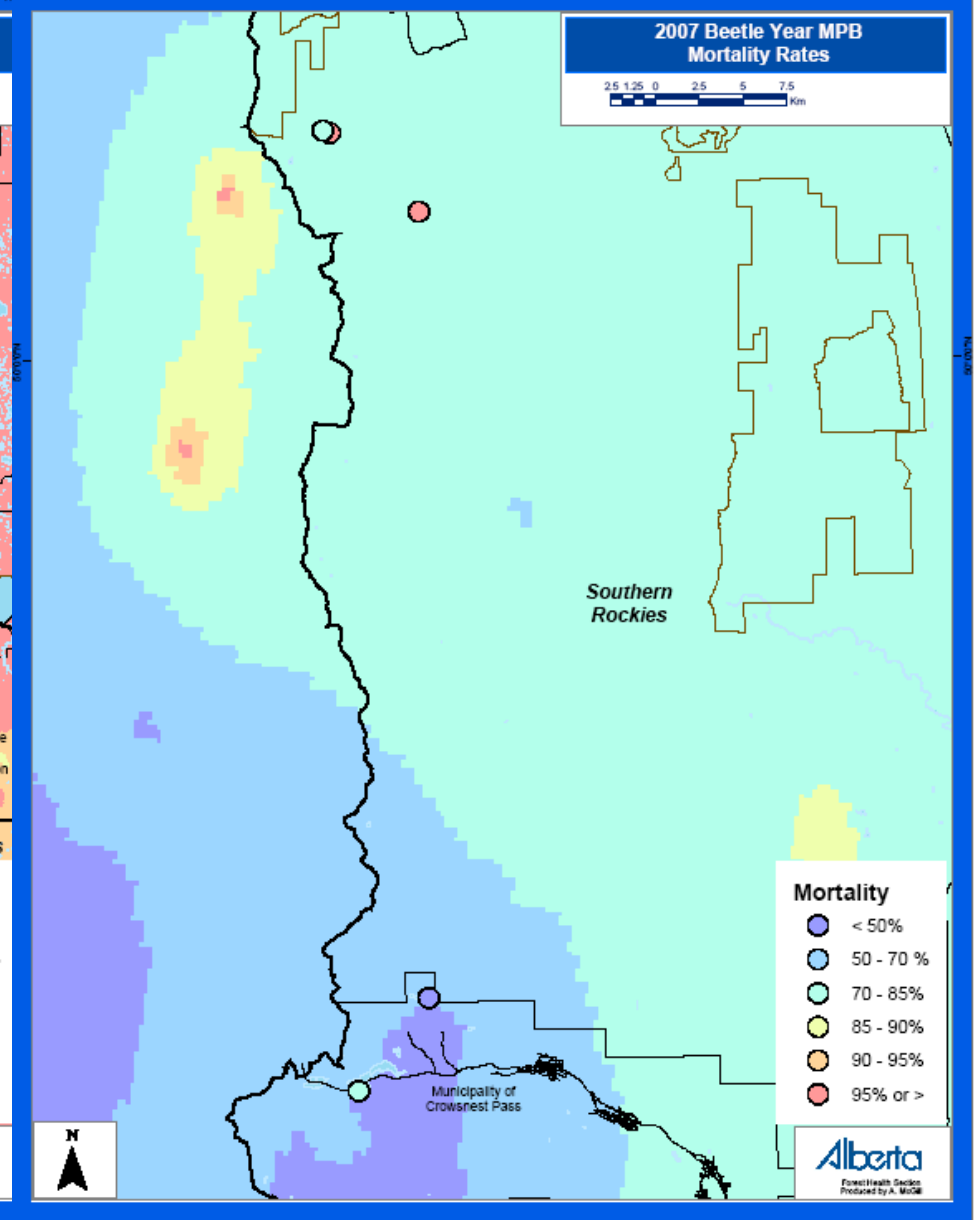
Privileged communication (Régnière, Bentz & Cooke 2007)



### Northern Alberta Winter Mortality 2007/2008



### Southern Alberta Winter Mortality 2007/2008



# Conclusions from the last 2 winters

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- The model is a very useful by geographic area but it needs to be complemented by field data for fine-tuned local operational decisions
- Due to the high amount of local variation we need to identify those areas with high survival and focus our efforts where the risk of spread remains high
- Hence, we are using the model to inform our site selection for r-value sampling in May



# r-values

Collected in May / June to  
assess population trends

$$R = \frac{\textit{larvae} + \textit{pupae} + \textit{adults}}{\textit{entrance holes}}$$

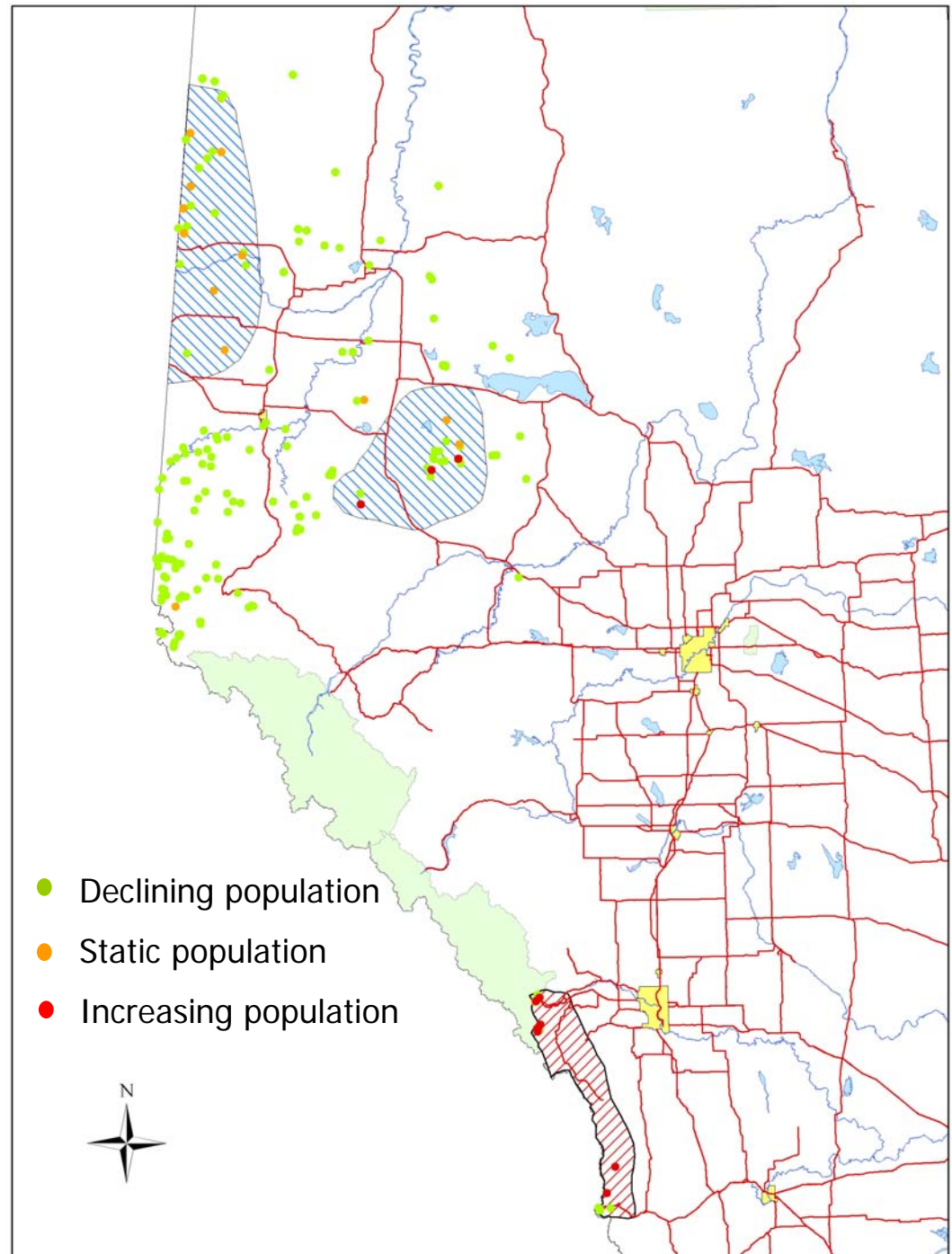
Adapted from FIDS (1970s)



# r-values 2007

Large-scale trend  
of generally high  
r-values in the  
south and low r-  
values in the north

Large amount of  
local variation



## High Priority Research Areas #2

Development of a model based on degree-days and other climatic factors to predict stage of development and flight period of MPB at a given location.

Such a model will help to prioritize infested stands for control activity and also will be useful in applying the overwintering MPB mortality model.

# Decision Support System

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Sites are ranked according to:

- MPB Management Zone
- Number of infested trees
- Stand Susceptibility
- r-value

# Decision Support System

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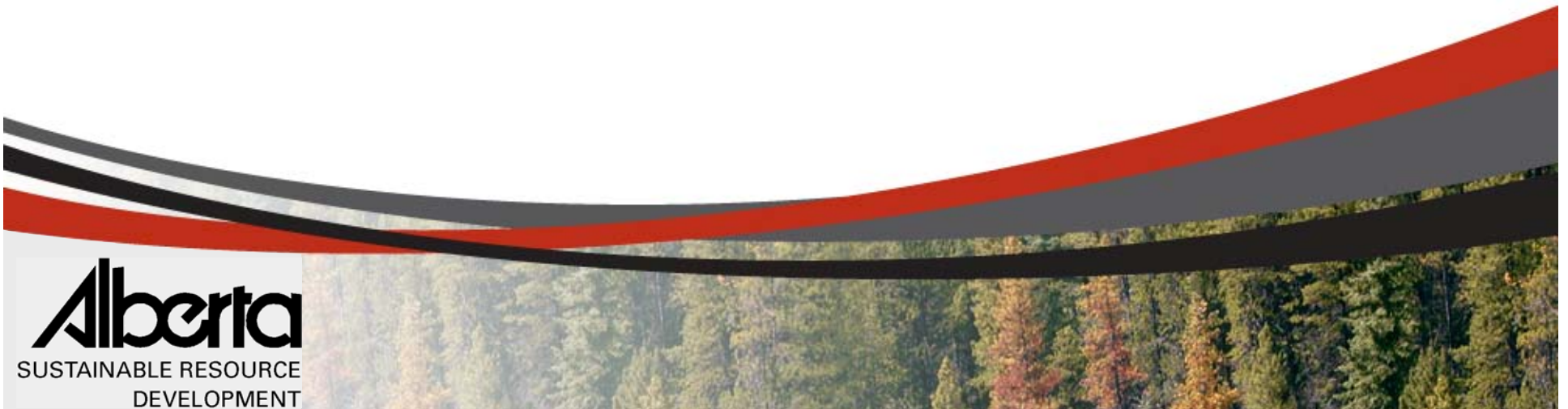
Sites are ranked according to:

- MPB Management Zone
- Number of infested trees
- Stand Susceptibility
- r-value
- **Connectivity**

# Connectivity

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- We developed a connectivity factor under consultation of various experts
- Sum of susceptible area surrounding a point, weighted by distance to the point and the susceptibility of the area
- Assumption: majority of beetles stay within five kilometers of their host trees

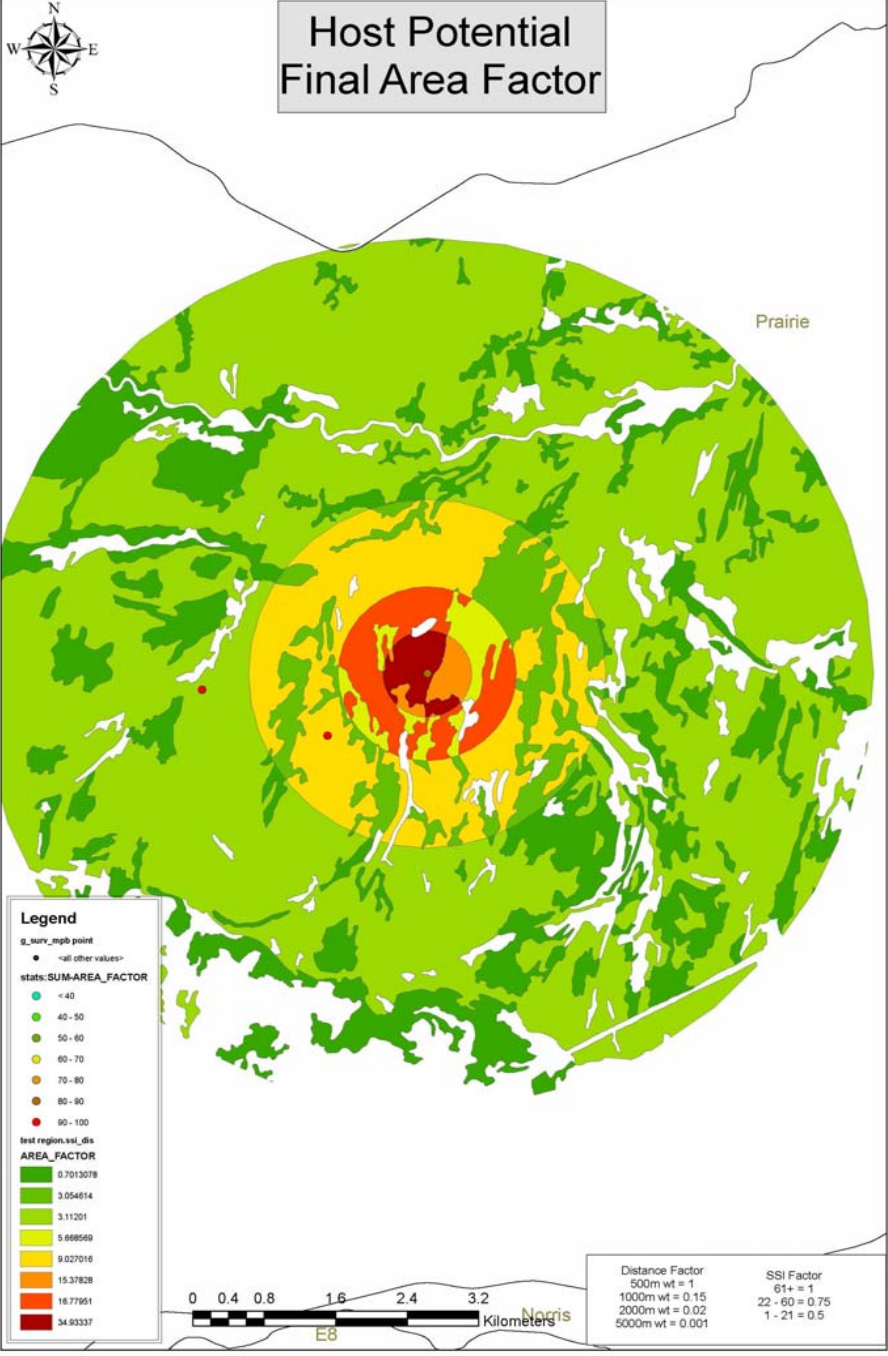


# Connectivity

Buffer Distance	Weight Factor
500m	1
1000m	0.15
2000m	0.02
5000m	0.001

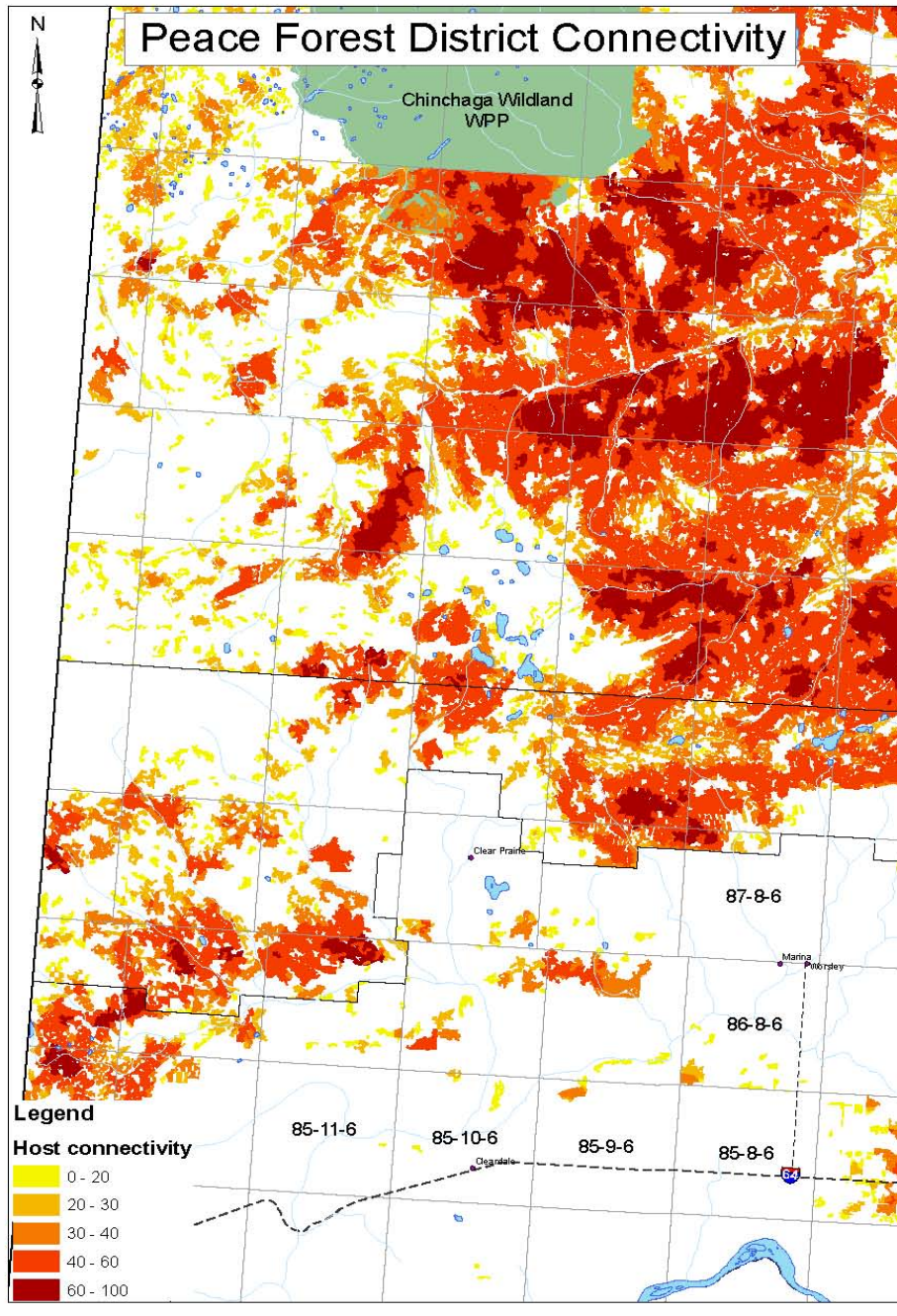
SSI	SSI Weight Factor
61 +	1
22 – 60	0.75
1-21	0.5

# Host Potential Final Area Factor





# Peace Forest District Connectivity



**MOUNTAIN**  
**Pine Beetle**  
**Action**



# Summary

## Decision Support System

- Worked well for prioritizing sites for control in 2007
- Under review with CFS for 2008

## R-values

- Geographic trend of low r-values in North and high values in South due to winter mortality
- Large amount of variation between trees and sites

# Summary Cont.

## Green:Red

- Indicate continuous immigration into AB

## Degree day map

- Delineates 2-year life cycle to areas of high elevation
- Low priority areas

## Susceptibility

- Improved by the climatic suitability factor
- Needs to consider more recent data averaged over smaller time frames

## Connectivity

- Fine-tuned Decision Support System

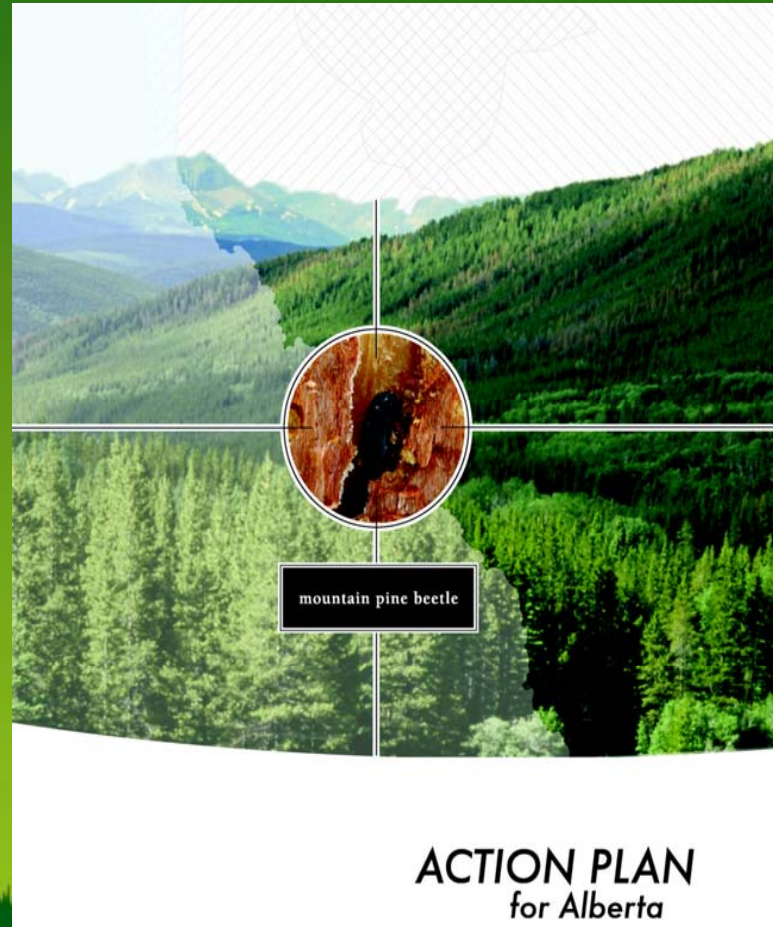
## High Priority Research Areas #3

Monitoring MPB populations - protocol to monitor MPB at low population levels

The current protocols are geared to monitoring outbreak populations. We need to have the protocols modified, if necessary, to monitor low level populations

# Healthy Pine Strategy

A long-term answer



# One Solution



## High Priority Research Areas #4

Use of prescribed fire in MPB management - effectiveness

- partially burned trees
- beetle breaks
- timing of burn
- smoke as a deterrent

## Medium Priority Research Priorities

Role of pheromones in MPB management

- potential mass trapping; use of anti-aggregation pheromones

Biology and impact of MPB in

- whitebark pine
- Limber pine

Long-range MPB dispersal

Beetle proofing through habitat manipulation



## Low Priority Research Priorities

Chemical control of MPB

MPB biology and impact on Jackpine

Genetics – resistant host clones

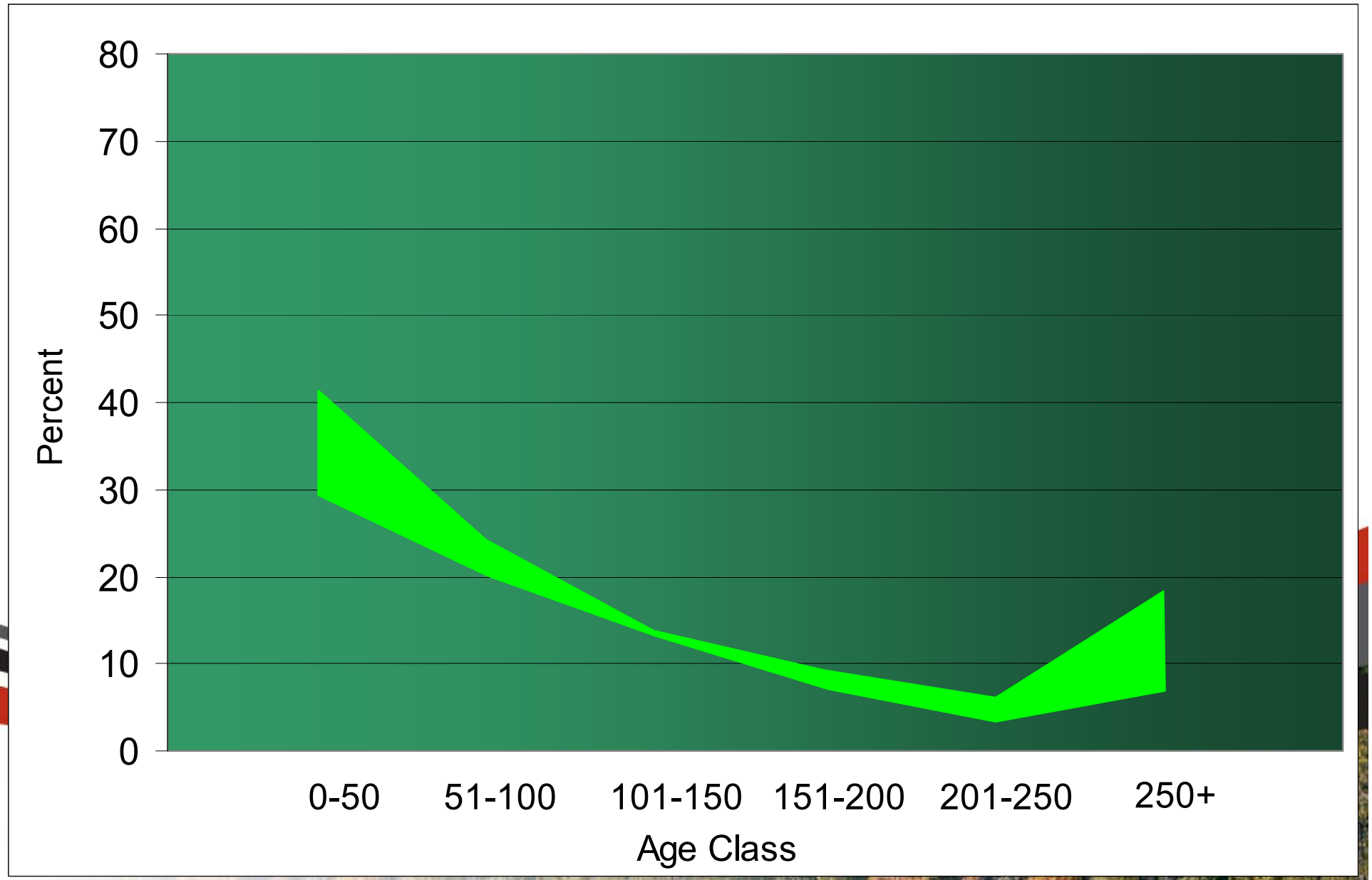
Mechanical control of beetle-infested wood

Biological control

**Thank you!**

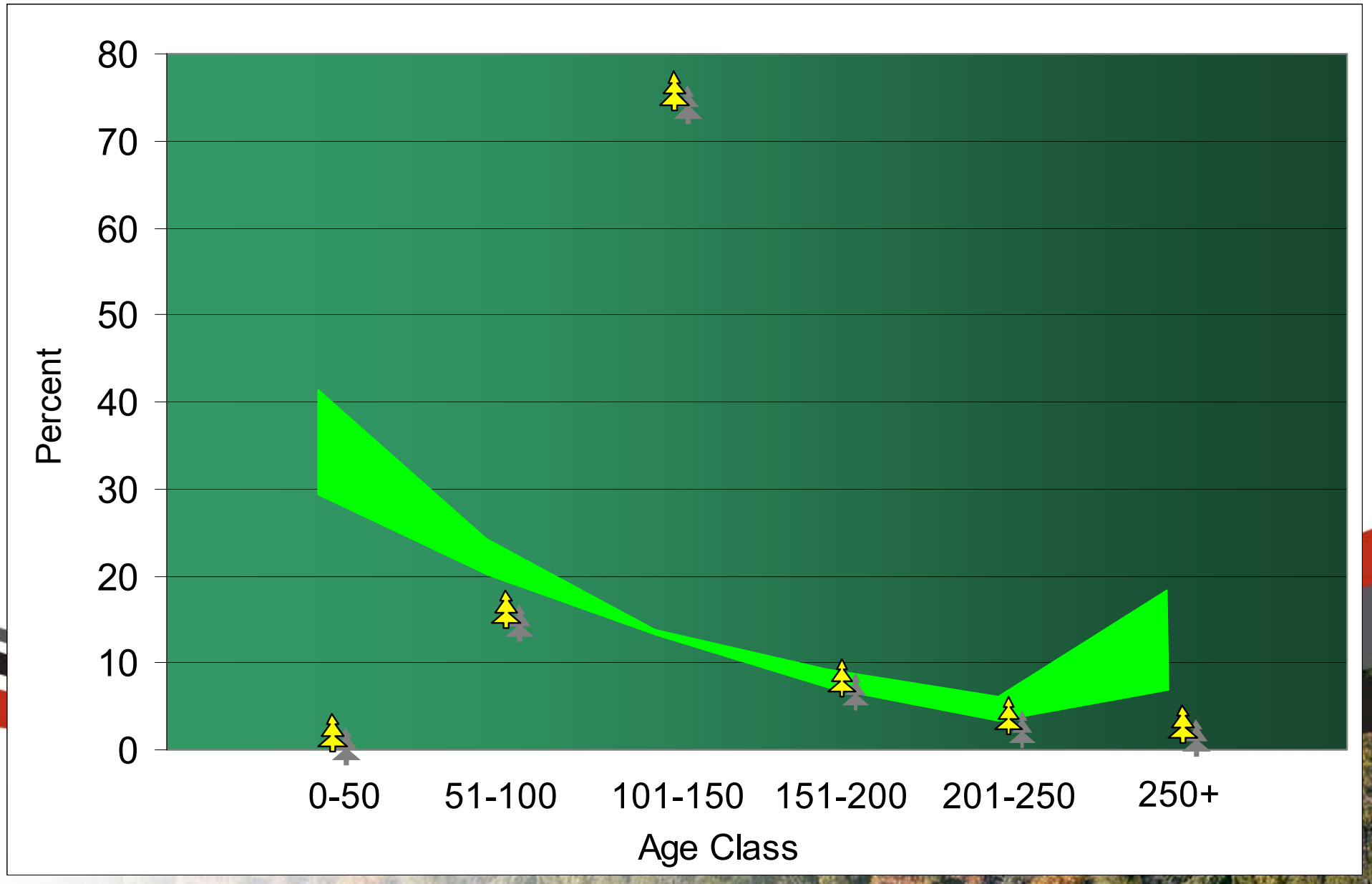


# Natural Range of Age Classes



# Natural Range of Age Classes

## With Current Age Class



# Natural Range of Age Classes

With Current Age Class

