Playing with fire: the effect of prescribed burns on mountain pine beetle populations

Crisia Tabacaru, provisional Ph.D. candidate

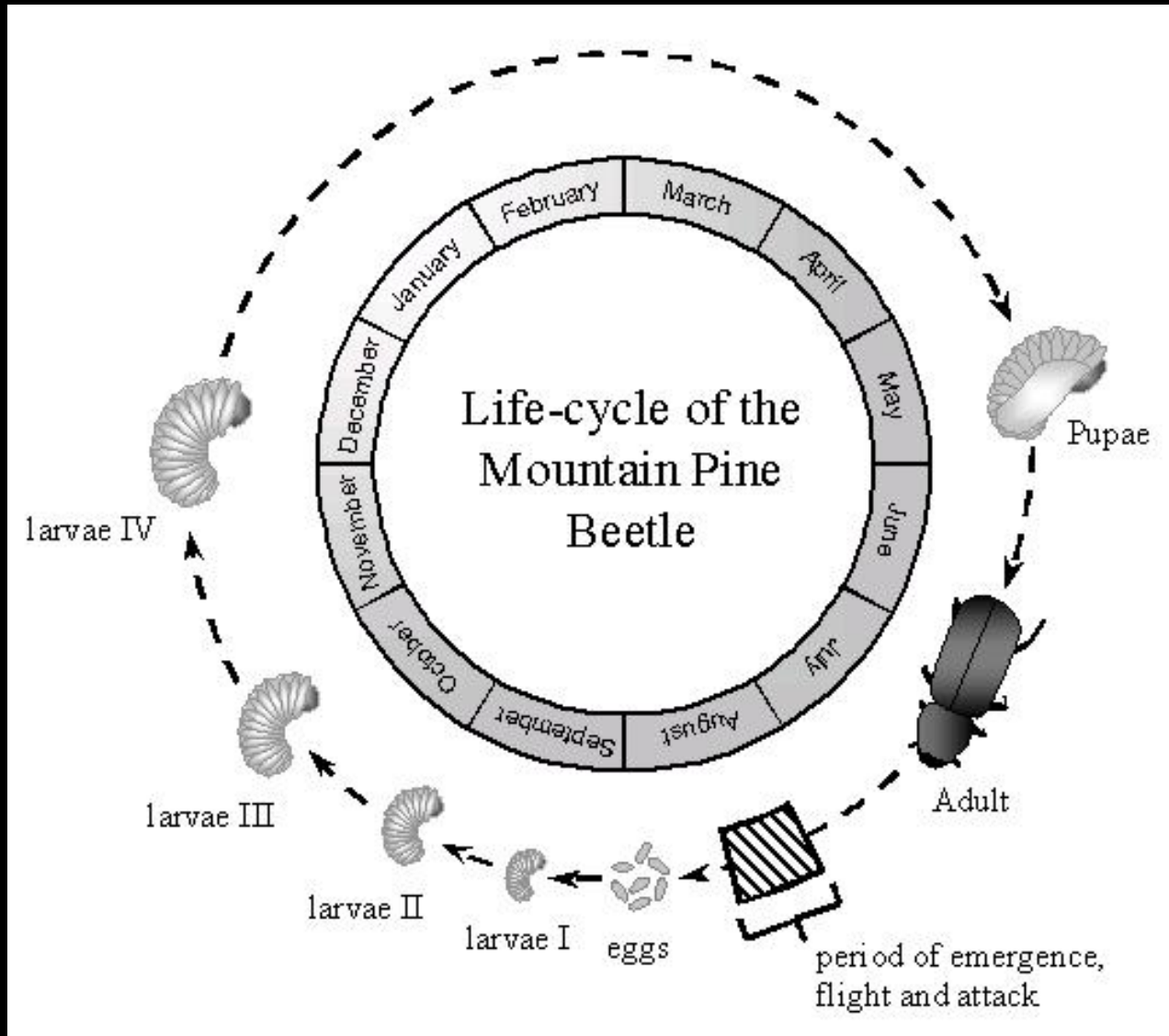Nadir Erbilgin, Jane Park, Dan Perrakis

Mountain Pine Beetle (MPB) (*Dendroctonus ponderosae)*

denimpine.com/documents/45.html

• most destructive insect pest in western Canada—attacks mostly lodgepole pine

• larvae feed on phloem and a combination of girdling and blue-stain fungi kill the tree

MPB Lifecycle

Life-cycle of the Mountain Pine Beetle

Management Options

Logging/Fire

- cut/burn affected trees to salvage the wood

- cut/burn unaffected trees to create boundaries

- cut/burn unaffected trees to heterogenize the landscape

Advantages to Using Fire

- can kill MPB in affected trees more efficiently

- can mimic a natural disturbance

BUT…

- Fire may leave partially burned—and therefore stressed—trees in its wake

- These trees may be attractive to bark beetles if defenses are compromised

Main Objective

To determine whether burned lodgepole pine stands become sinks or sources for MPB populations…

by testing the following specific objectives:

Objectives

1. To determine MPB population densities in each burned and unburned site before burning and three years after and relate prior MPB population densities to the subsequent beetle colonization of burned and unburned sites

Objectives

2. To compare MPB reproductive success and offspring quality between burned and unburned sites

Objectives

3. To describe MPB colonization as it relates to fire injury at the individual tree level

Objectives

4. To identify and describe the community of insect and nemic natural enemies and competitors of MPB present in burned and neighbouring unburned sites and to evaluate their responses to prescribed fire

Objectives

5. To relate colonization rates of MPB to densities of competitors, natural enemies, and burn intensity at the individual tree level

www.pbase.com/terrythormin/image/64519820

bugguide.net/node/view/111124/bgimag

www.uga.edu/.../parasites_in_monarchs/index.html

Methods

3 + 200m transects in each site with 14 5x5m plots per transect

Methods

Spring visits (target attacks from previous year):

- Percentage of killed trees relative to distance from burn

- Each tree:
- Number of entrance holes
- Number and length of maternal galleries
- Number of larval galleries
- Measure indices of fire severity/intensity
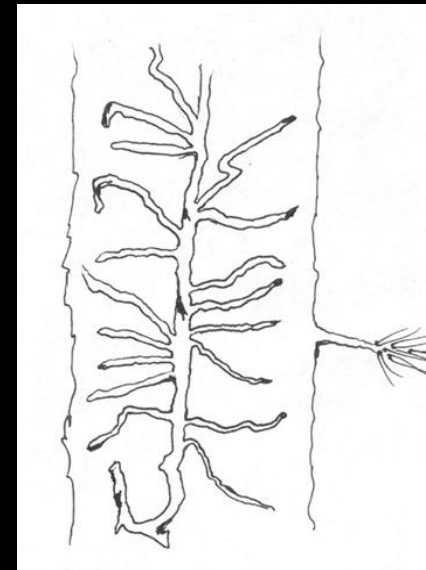
Burn severity/intensity indices

1. Ground char
2. Bole char severity
3. Percentage of the bole circumference charred
4. Percentage of crown scorch

Methods

Spring visits (target attacks from previous year):

- Collect adults for parasite and offspring quality analysis: dry weight, pronotum size, lipid levels
- Set up traps
- Cut trees to outfit up bolts of various
  sizes with emergence traps

Methods

Fall visits (target current year attacks):

- Number of pitch tubes

- Boring dust

- Number of entrance holes

- Collect specimens from traps

- Cut trees to determine status of population

Status of the Population

- 30 cm logs every 2 meters along the infested portion

- count entrance holes from the previous fall and exit holes from the current spring

- <u># emerging beetles</u>

  # attacking beetles

  – if the ratio > 1, the population is growing, if the ratio = 1 the population is stable, and if the ratio is < 1 the population is decreasing

Trapping

- Passive flight intercept traps
- Landing rate traps
- Emergence traps

plexiglass →

collection jar →
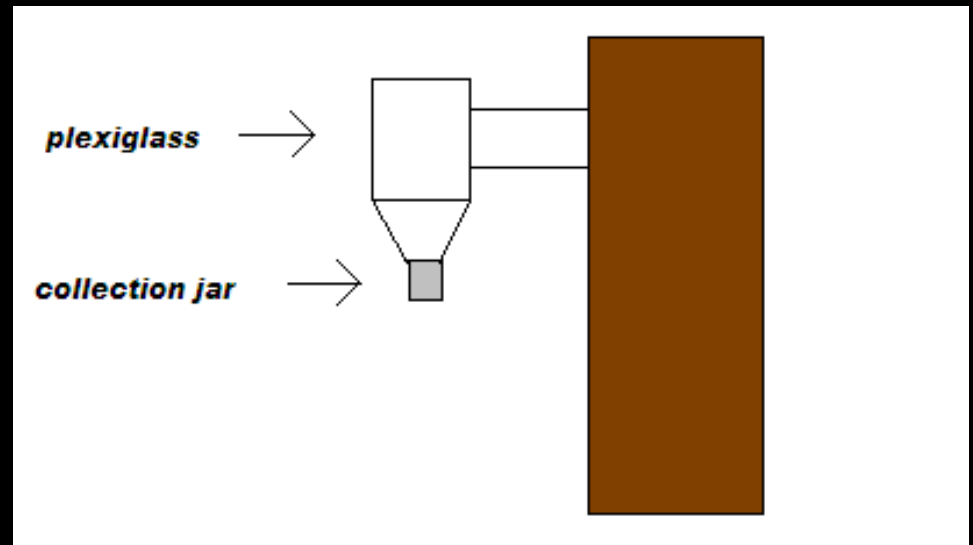
Output

We will contribute to predicting if prescribed fires increase pine susceptibility to successful MPB attack and contribute to population growth in both burned and adjacent unburned stands.

Increase Pine Susceptibility

- Trees are burned in ways that may be differentially attractive to MPB

  - Slightly-moderately burned trees may serve as an epicentre for MPB attacks

  - Severely burned trees may not be targeted by MPB

Contribute to Population Growth

- If MPB are preferentially attracted to burned trees and reproduction is as successful or more so than in unburned trees

  – Increased MPB population is imminent

  – Trees in adjacent unburned stands may be targeted when MPB population increases

- If MPB are NOT successful in locating and colonizing partially burned trees

  – Burning removes potentially susceptible host trees from the landscape and creates a short-term sink for MPB

Output

Contribution to predicting if prescribed fires increase pine susceptibility to successful MPB attack and contribute to population growth in both burned and adjacent unburned stands.

This project will provide recommendations for forest managers to help evaluate potential risks associated with prescribed fire.

Potential Risks

When prescribing a fire forest managers may have to take into account:

- MPB density in and around the area

- that additional post-fire control strategies, should be considered (removal of trees with certain characteristics, such as age, height, bark thickness)

Collaborations and Funding

Thank you!