

# Introduction to Citizen Science and Forest Pests

By Lauren Bell and David Dutkiewicz





# Overview

- The Invasive Species Centre
- What is EDRR?
- Resources
- Forest Pests 101
- Introduction to EDDMapS

# Invasive Species Centre

- Incorporated as a not-for-profit in 2011, the Invasive Species Centre has grown into a respected collaborator, knowledge broker, partner and leader in invasive species research and action in Ontario and beyond.

**Mission:** The Invasive Species Centre connects stakeholders, knowledge and technology to prevent and reduce the spread of invasive species that harm Canada's environment, economy and society.





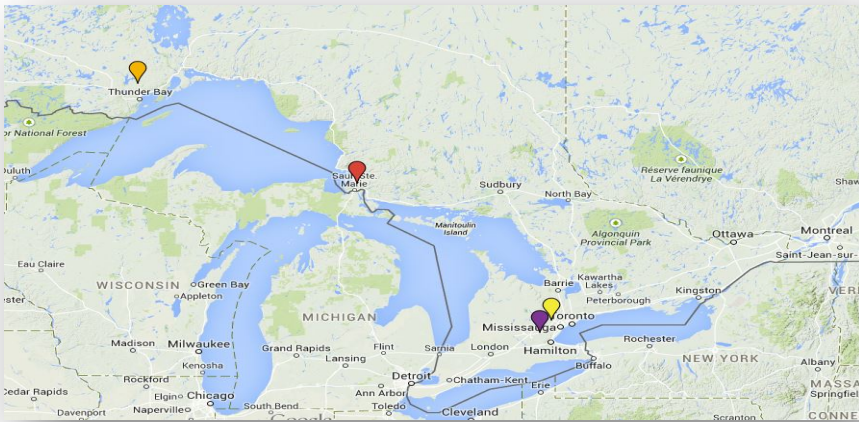
EARLY DETECTION  
& RAPID RESPONSE  
NETWORK ONTARIO

REDUCING INVASIVE SPECIES ONE COMMUNITY AT A TIME.



# EDRR Network Ontario: In a Nutshell

To create, train and equip an **EDRR network** to provide eyes on the ground to detect, track, respond to, and control invasive plants and insects in communities across Ontario.

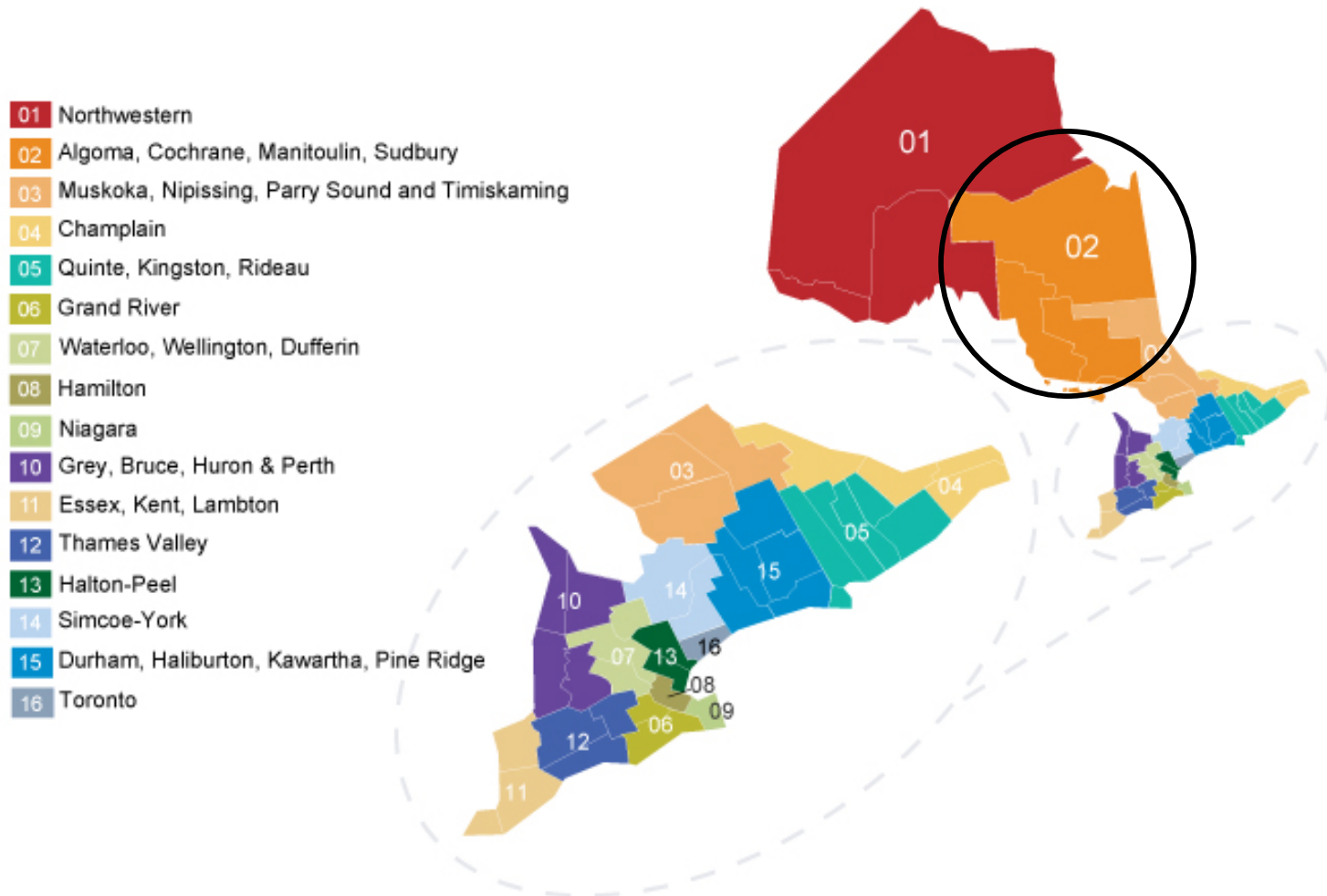


Peel ● Halton ● Sault Ste Marie ● Thunder Bay  
Sudbury & Algoma Region

- Increase awareness & knowledge of invasive species
- Support hands-on work to more rapidly detect and reduce invasive species
- Engage youth & students to foster environmental responsibility
- Facilitate community partnerships to support restoration & maintenance of local habitats and recreational spaces

**Community-level early *detection & action* as appropriate**

# EDRR Ontario Phase II: 2017-2019



Outside of the EDRR catchment? We can still provide support!



# Professional Training Workshops



## CFIA Inspection Staff Training Spring 2016

EDRR Network staff supported CFIA summer inspection staff training for GTA region held in Guelph.

- Focused on species not present in Canada/Ontario
- Informed future “watch list” development



## Lunch N' Learns Summer 2017

Sudbury and Wawa District MNRF staff trained

- Covered species encroaching these districts
- Introduced staff to species not present in Ontario
- Worked through collaborative multi-stakeholder invasion scenarios



## Professional Training Sessions Fall 2015

Workshops hosted in Halton, Peel, SSM & Tbay to present new species to local partners and professionals working in field.

- Conservation Authority staff
- Local, provincial & national ENGOS
- MNRF District staff
- Municipal staff
- Academics & Grad Students



# Student Training Workshops



## Classroom & Lab Visits 2015 - 2017

Regular guest lectures, labs and seminars at Universities across all EDRR Network Pilot Regions covering priority species.



## Envirothon Workshops Summer 2016

Delivered invasive species workshops & judging at both Provincial and North American Envirothon events on EDRR priority species.



## Invasive Species Summits Winter 2016 & 2017

Representatives from all GTA colleges & universities invited to attend peer-to-peer training session led by graduate students and industry professionals

- ~50 students attended from most GTA schools
  - McMaster
  - U of T
  - Guelph
  - Waterloo
  - Humber
  - Trent
  - Laurier
  - Sheridan





# Broader Engagement Initiatives

Trends · Change

**#PancakeDay**  
@Ptbo\_Canada, @Mike\_Lacey and 1 more  
are Tweeting about this

**#RareDiseaseDay**  
25.3K Tweets

**#werally2021**  
1,214 Tweets

**Brendan Smith**  
4,517 Tweets

**#Soufest15**

**#InvSpWk**  
@CatarauquiRCA, @KawarthaConserv and  
28 more are Tweeting about this



## Invasive Species Awareness Week Winter 2016 & 2017

EDRR resources made the #InvSpWk campaign possible in both 2016 & 2017. Reaching new audiences with priority EDRR species.

- Grew to 32 formal campaign partners
- More than 5M SM interactions, centered around Peel Region, Halton Region & GTA.

## Invasive Species Cycling Tours Summer 2015 & 2016

Reaching new audiences, and cementing partnerships with invasive species themed safe-cycling tours.

- Partnership w/ local “green-group” resulted in est. an invasive species tool-share program
- Cross promotion of all local EDRR events & increased volunteer base



## Priority Invasive Monitoring 2016 & 2017

Numerous workshops & sampling days hosted across all 4 pilot areas, hosted in collaboration with local partners.

- HWA Sampling at Lake Superior Provincial Park



# Eradication Case Study

## Garlic Mustard Eradication

Thunder Bay Region, ON

2015-2017+

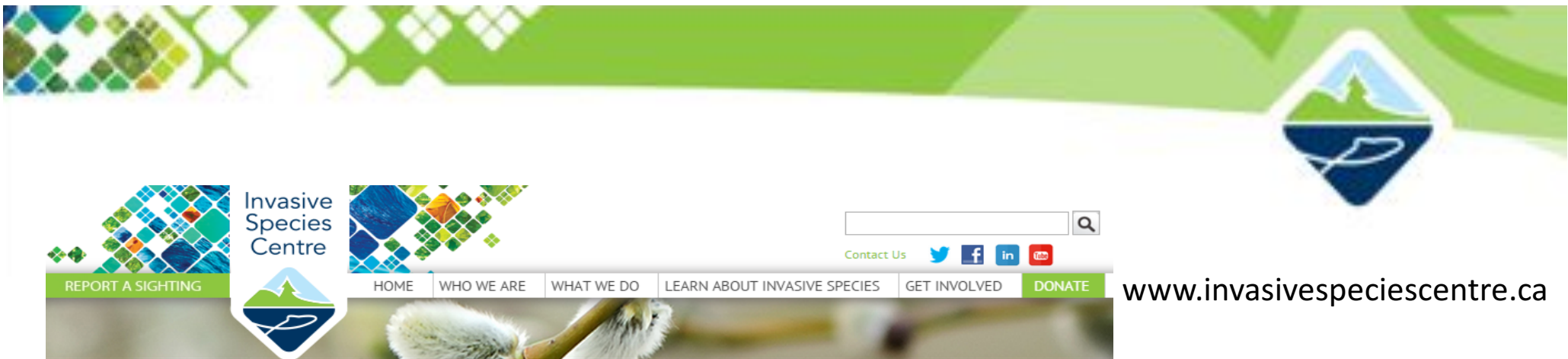
New species to an area detected, mapped and controlled through training and outreach efforts in Thunder Bay. Control continues support of local champions. Regional eradication expected.

- Garlic mustard *was* believed to be **regionally absent**
- **1<sup>st</sup> detection** made by EDRR volunteer after training
- **Delineation survey** completed by Network volunteers
- **Control efforts** completed & sustained by Network volunteers



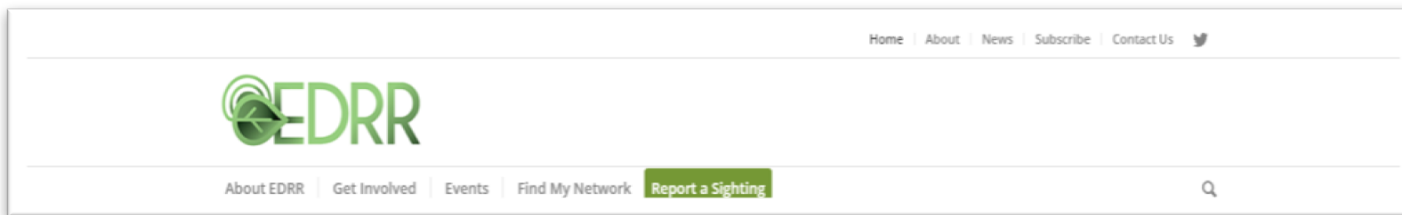
**EDRR** EARLY DETECTION  
& RAPID RESPONSE  
NETWORK ONTARIO  
**THUNDER BAY**  
**Field Naturalists**





The header features a green and blue geometric pattern on the left and a logo on the right depicting a landscape with a tree and water. The main navigation bar includes a search box, social media icons for Twitter, Facebook, LinkedIn, and YouTube, and a 'Contact Us' link. Below this is a horizontal menu with the following items: 'REPORT A SIGHTING', 'HOME', 'WHO WE ARE', 'WHAT WE DO', 'LEARN ABOUT INVASIVE SPECIES', 'GET INVOLVED', and 'DONATE'. A large banner image shows a close-up of a white, fuzzy caterpillar on a wooden stick.

[www.invasivespeciescentre.ca](http://www.invasivespeciescentre.ca)



The header features the EDRR logo in green. A navigation bar at the top right contains links for 'Home', 'About', 'News', 'Subscribe', and 'Contact Us' along with a Twitter icon. Below the logo is a horizontal menu with 'About EDRR', 'Get Involved', 'Events', 'Find My Network', and 'Report a Sighting'. A search box is located on the right side of the menu.

[www.edrrontario.ca](http://www.edrrontario.ca)



The header features a grid of nature images on the left and a search box on the right with a 'Login' link. The main navigation bar includes 'REPORT A SIGHTING', a circular logo with a beetle, and menu items: 'INTRO TO INVASIVES', 'MEET THE SPECIES', 'MANAGEMENT STRATEGIES', 'LEARN AND PARTICIPATE', and 'RESOURCES'. A large banner image shows a forest with trees and sunlight filtering through the leaves.

[www.forestinvasives.ca](http://www.forestinvasives.ca)



The header features a dark red background with a search box on the right. The main navigation bar includes 'REPORT A SIGHTING', a circular logo with a red maple leaf and a fish, and menu items: 'ASIAN CARPS', 'WHAT IS AT RISK?', 'MONITORING, PREVENTION AND RESPONSE', 'RESOURCES', and 'SPOT THE DIFFERENCE'. A large banner image shows a blue, textured background.

[www.asiancarp.ca](http://www.asiancarp.ca)



# Free Toolkit Sharing Program

- Stewardship oriented tool kits
- Housed at the Invasive Species Centre office in Sault Ste. Marie, EcoSuperior in Thunder Bay
- Currently seeking local house for kit in Sudbury
- Tools available for use to help detect and manage invasive species
- I.e.
  - Saws, shovels, gloves, tarps
  - Extractigator
  - HWA sampling kits

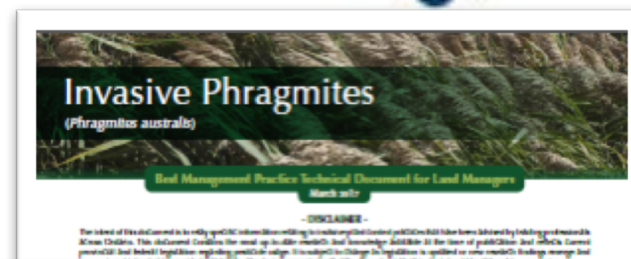
Example species include:

- Common Buckthorn
- European Common Reed
- Garlic Mustard
- Giant Hogweed
- Invasive Honeysuckle
- Japanese Knotweed
- Wild Parsnip



# New Technical Bulletins

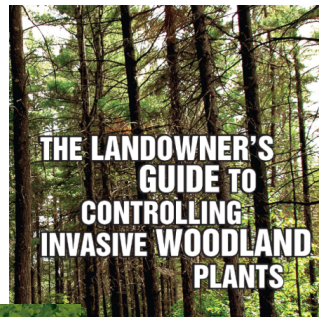
- 14 new tech bulletins
- Updated, summarized Best Management Practices for Land Managers





# Educational Resources

- Over 60 educational resources available in print version
- Over 90 available for download at [www.invadingspecies.com](http://www.invadingspecies.com)



HELP TRACK THE SPREAD OF INVASIVE PLANTS

REPORT SIGHTINGS TO [www.EDDMapS.org/Ontario](http://www.EDDMapS.org/Ontario)

INVASIVE PLANTS TO WATCH OUT FOR

EDD MapS Ontario  
Early Detection & Distribution Mapping System

Scan to visit [www.EDDMapS.org/Ontario](http://www.EDDMapS.org/Ontario)

INVADING SPECIES HOTLINE  
1-800-563-7711





## Areas for Support

- Workshops
- Materials + Tools
- Experts in the field to answer questions
- Project leads
- Access to new networks



Thunder Bay Garlic Mustard Pull 2017



REDUCING INVASIVE SPECIES ONE COMMUNITY AT A TIME.



# Invasive Forest Pests

David Dutkiewicz



# Invasive Forest Pests



- Emerald Ash Borer
  - Ash Trees
- Asian Long-horned Beetle
  - Maple Trees
- Mountain Pine Beetle
  - Pine Trees



# Emerald Ash Borer



- Description:
  - Bright green beetle
  - ~1cm in length
  - Bullet shaped
- Host:
  - Ash trees
    - **Green/Red Ash**
    - White Ash
    - **Black Ash**
    - Blue Ash
    - Pumpkin Ash

# Commonly Confused



Emerald Ash Borer

INVASIVE



Bronze Birch Borer

NATIVE



Metallic Wood Borer

NATIVE



Six-Spotted Tiger Beetle

NATIVE



Metallic Wood Borer

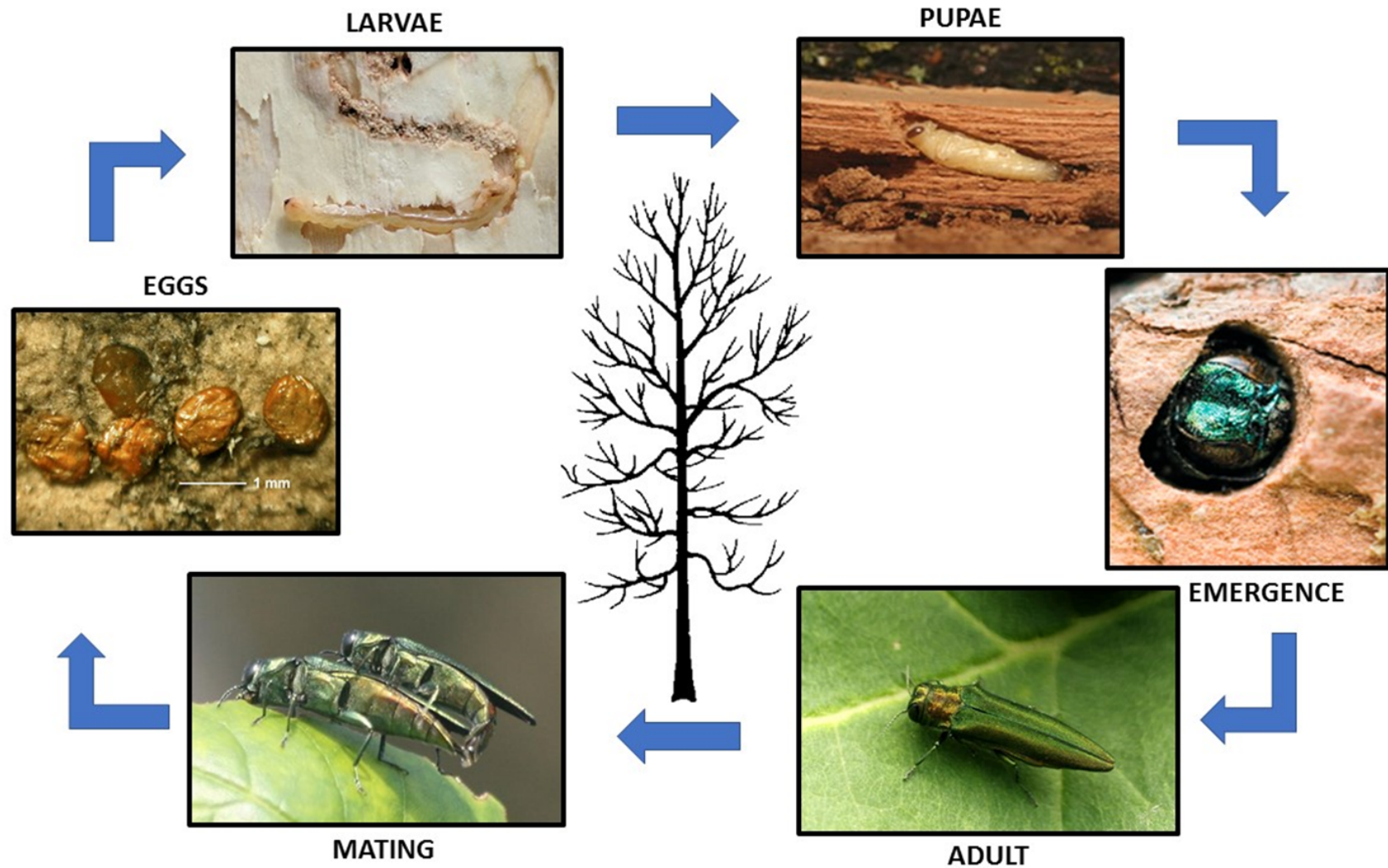
NATIVE



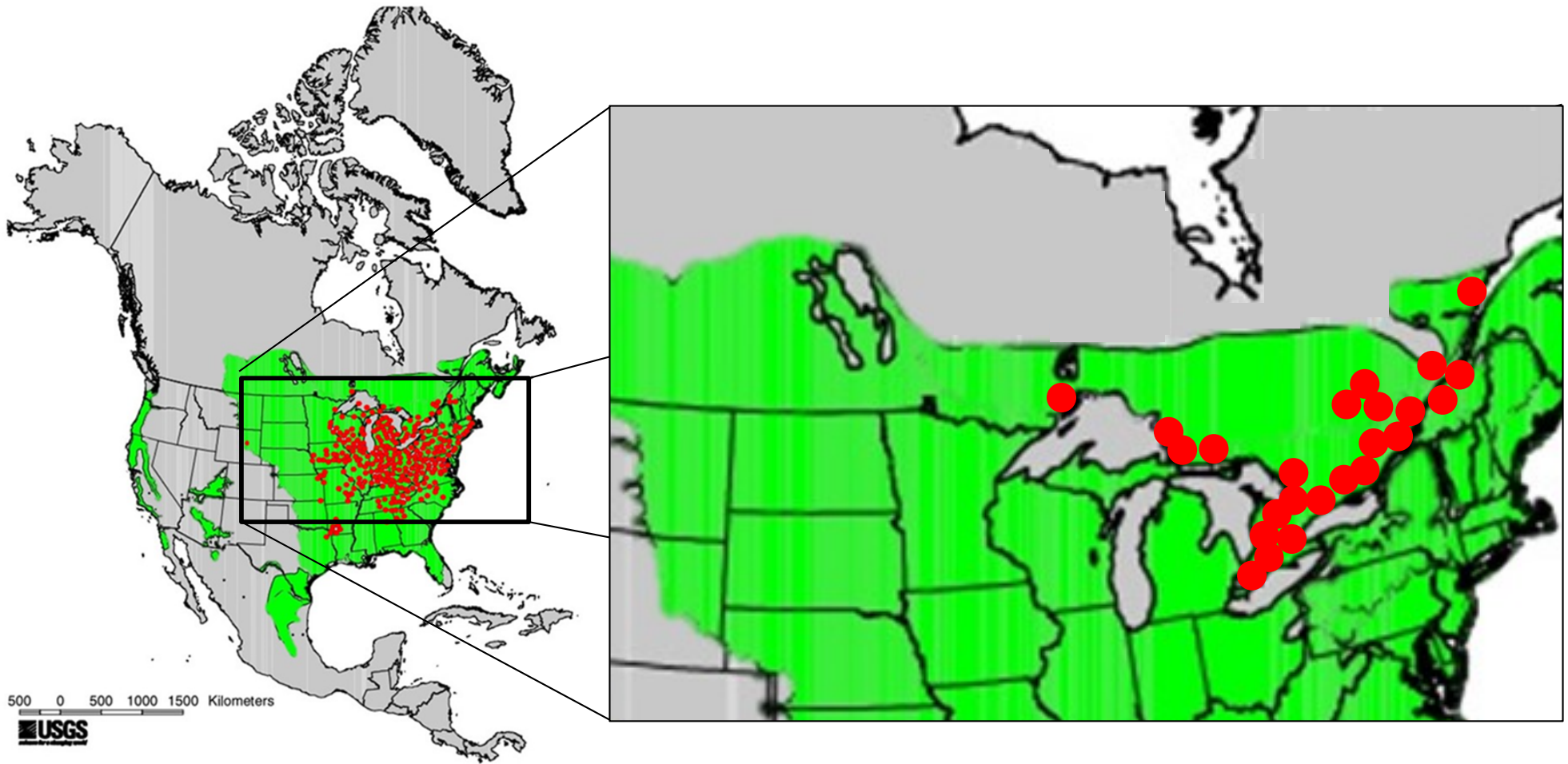
Calosoma Ground Beetle

NATIVE

# Life Cycle



# Range



# Sign's/Symptom's



- Branch Flagging – Crown dieback begins with branches losing leaves



# Sign's/Symptom's



- Epicormic Shoots
  - New shoot growth from existing branches and/or the trunk of Ash tree
- Bark Cracks and Fissures
  - EAB larvae will cause the bark to detach from the heart wood by feeding on the vascular phloem tissue
  - This cause the bark to dry and crack

# Sign's/Symptom's



- Woodpecker Feeding

- Usually found on the South side of the tree
- Easiest to see in winter
- Bark flakes off the tree
- Small feeding holes along the trunk



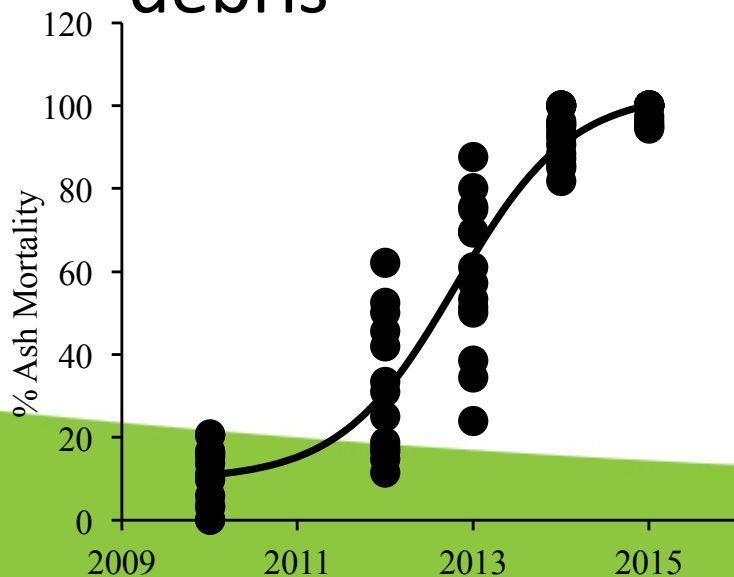
- Woodpecker feeding hole
- EAB exit hole



# Damage



- EAB kills Ash trees within 3-6 years of infestation
- Falling Ash trees are known to snap off/get snagged in non-ash trees
- Creates large amounts of woody debris



# Damage



- Allows light to penetrate the forest canopy promoting a proliferation of ground vegetation
  - Vector for introduction of invasive species
    - European Buckthorn
    - Garlic mustard

# Management



- Pesticides
  - TreeAzin<sup>®</sup> - Azadirachtin
  - Systemic injection
  - Is used every 2-3 years to prevent the development of the larvae
  - Not Host specific
  - Expensive for forestry applications



# Management



- Parasitic Wasps

- Native Parasites

- ~7 found attacking EAB
    - Parasitism rate 3.6%



- Non-Native Parasites

- *Tetrastichus planipennisi*
    - *Oobius agrili*
    - *Spathius galinae*
    - Parasitism rate ~6.6%

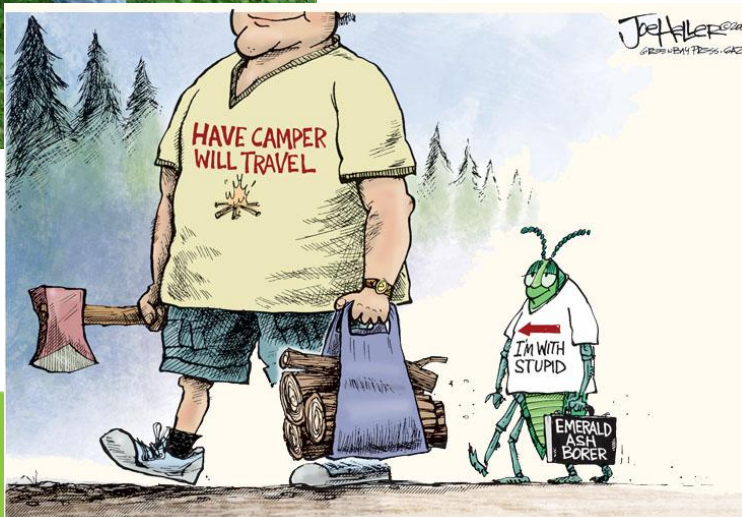




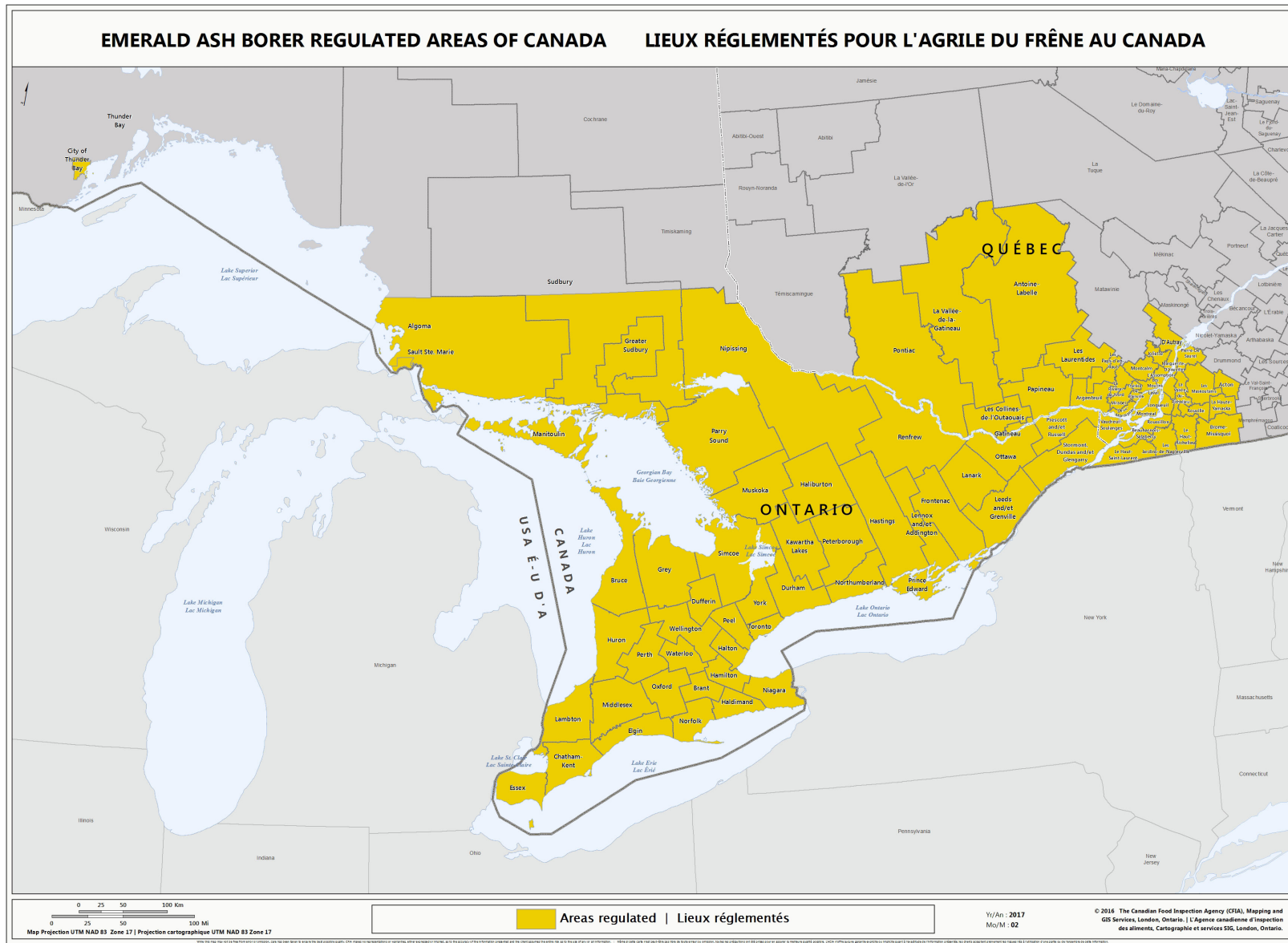
# Management



- Early Detection
  - Trapping
    - Green prism traps, host and sex pheromones
  - Branch Sampling
    - Sampling for EAB larvae
- Spread
  - EAB Quarantine Zone
    - CFIA
  - Don't Move Firewood!



# Quarantine Zone



# Asian Long-horned Beetle



- Description
  - Shiny black with white spots along its wings
  - ~19-32mm
- Host (Hardwoods)
  - Maple
  - Birch
  - Poplar
  - Willow
  - Elm
  - Horse chestnut
  - Hackberry
  - Silk Tree
  - Mountain Ash
  - Ash?
  - Basswood?

# Commonly Confused



**Asian Longhorned Beetle**

**INVASIVE**

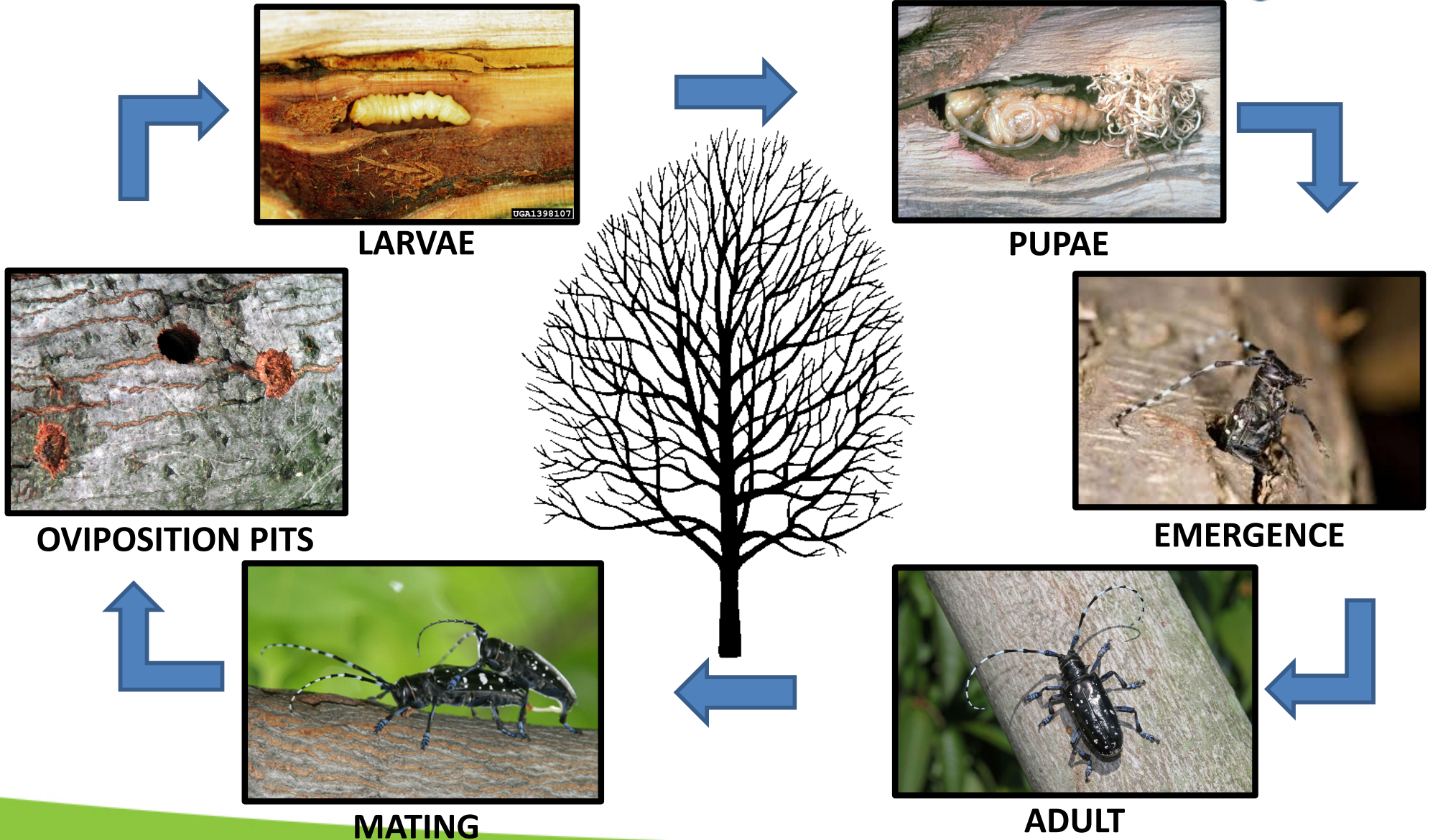


**Sawyer Beetle**

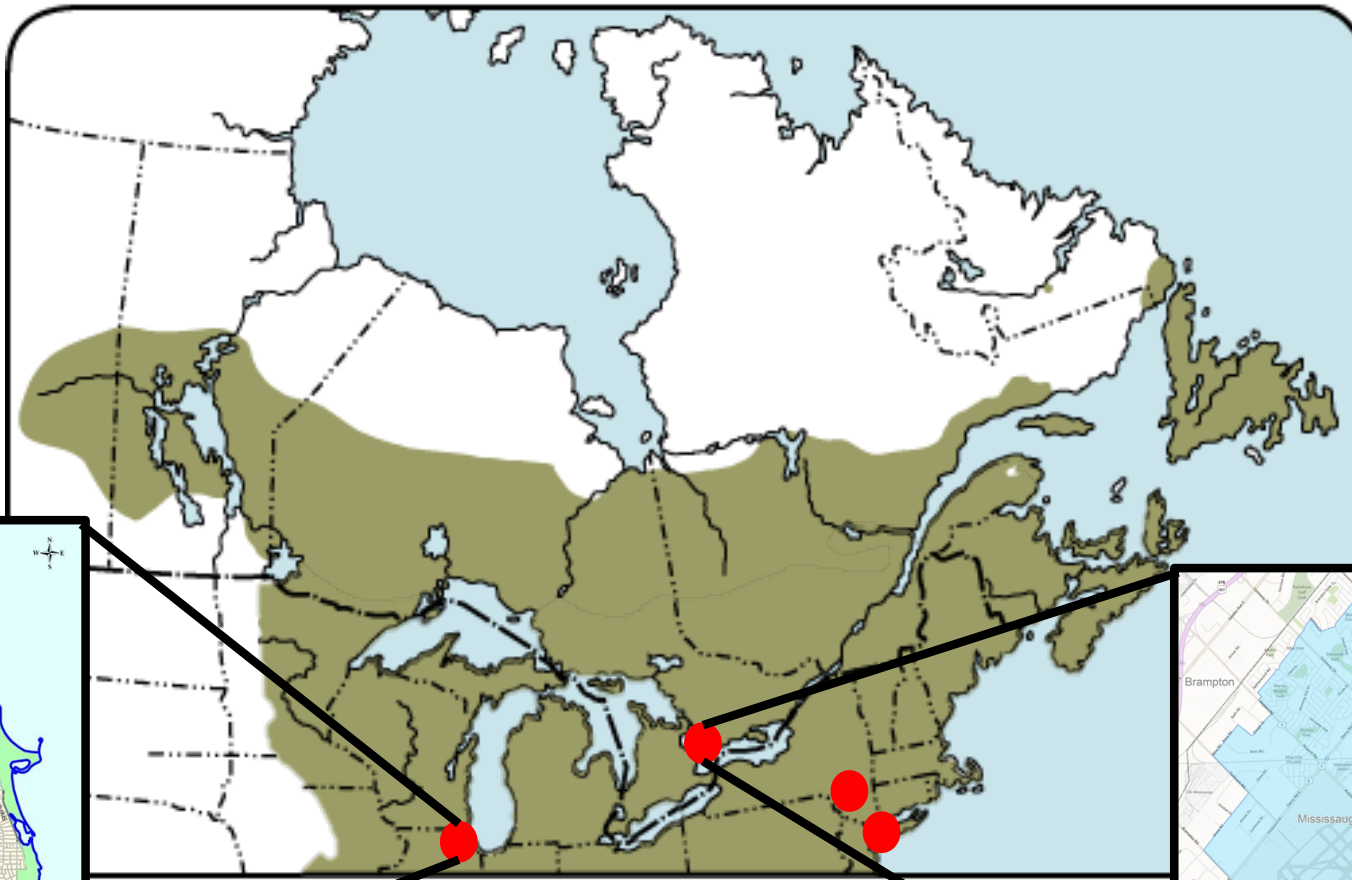
**NATIVE**



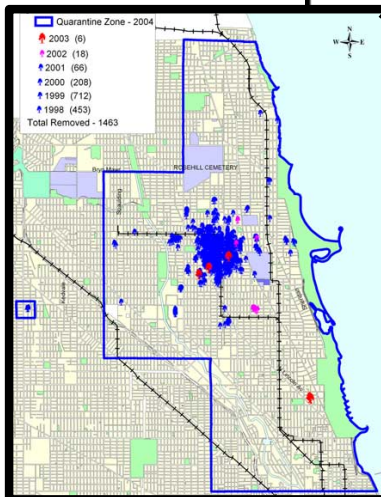
# Life Cycle



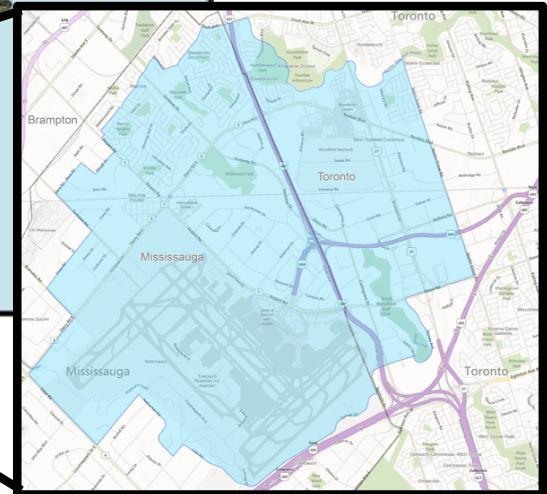
# Range



**CHICAGO**



**TORONTO**



# Sign's/Symptom's



Crown Dieback – When leaves die and are not formed because they are unable to acquire the nutrients

# Sign's/Symptom's



- Oviposition Pits
  - Small pits chewed into the bark
  - Reddish in colour at first but turn black after few hours
- Exit Holes
  - Round, fits a pencil or pen



# Sign's/Symptom's



- External Bark Cracks
  - Lifting of the bark
  - Sinking of the bark
- Adult Feeding
  - Leaves, leaf stem, twigs
  - Similar scrapped off bark



UGA1193003

# Damage



- Effects multiple different hardwood species
- Cities and Parks would be largely affected
  - Dead branched/trees
  - Forested green space
  - Hiking trails

# Damage



- Changes to the forest plant communities
- Allow invasive plant species easier access to forest ecosystems
  - European Buckthorn
  - Dog strangling vine
  - Garlic mustard



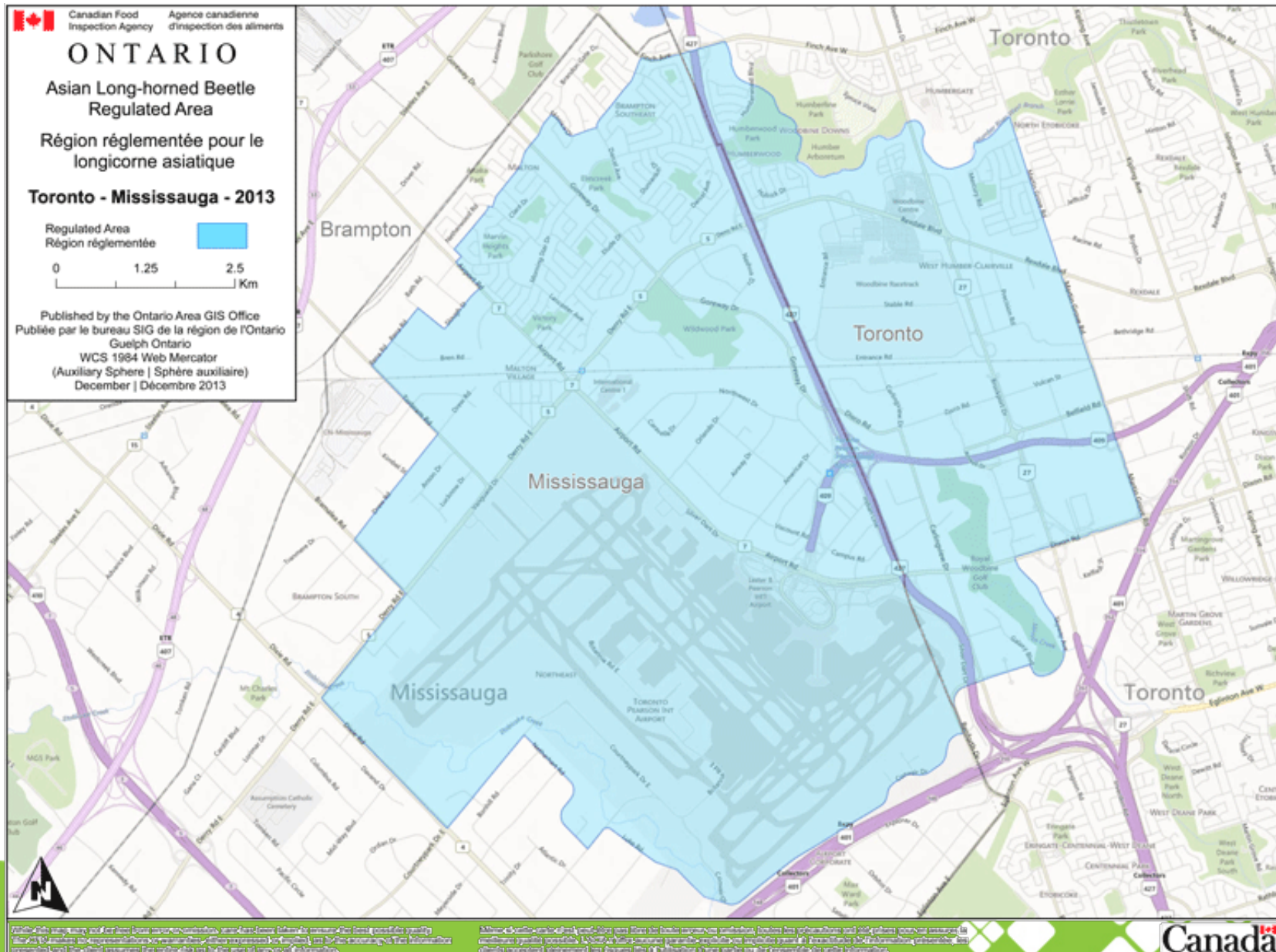
# Management



- Prevention
  - Inspection of wood material around points of entry
  - 800m diameter quarantine around infested trees
  - Inspections of trees inside/outside the quarantine zone (min 5yrs)
- Eradication
  - Chip infested trees
  - Chip high risk trees within the quarantine area
  - 2003-2007
    - 665 infested trees in Mississauga
    - 28,165 high risk trees were removed



# Quarantine Zone



# Mountain Pine Beetle



- Description
  - Small brown-black beetle, dull/mat colours
  - ~4 - 7 mm
- Host
  - All Pine trees
  - Lodgepole pine (West)
  - Jack pine (East)
  - Red pine (East)?

# Commonly Confused



Invasive  
Species  
Centre



Mountain Pine Beetle

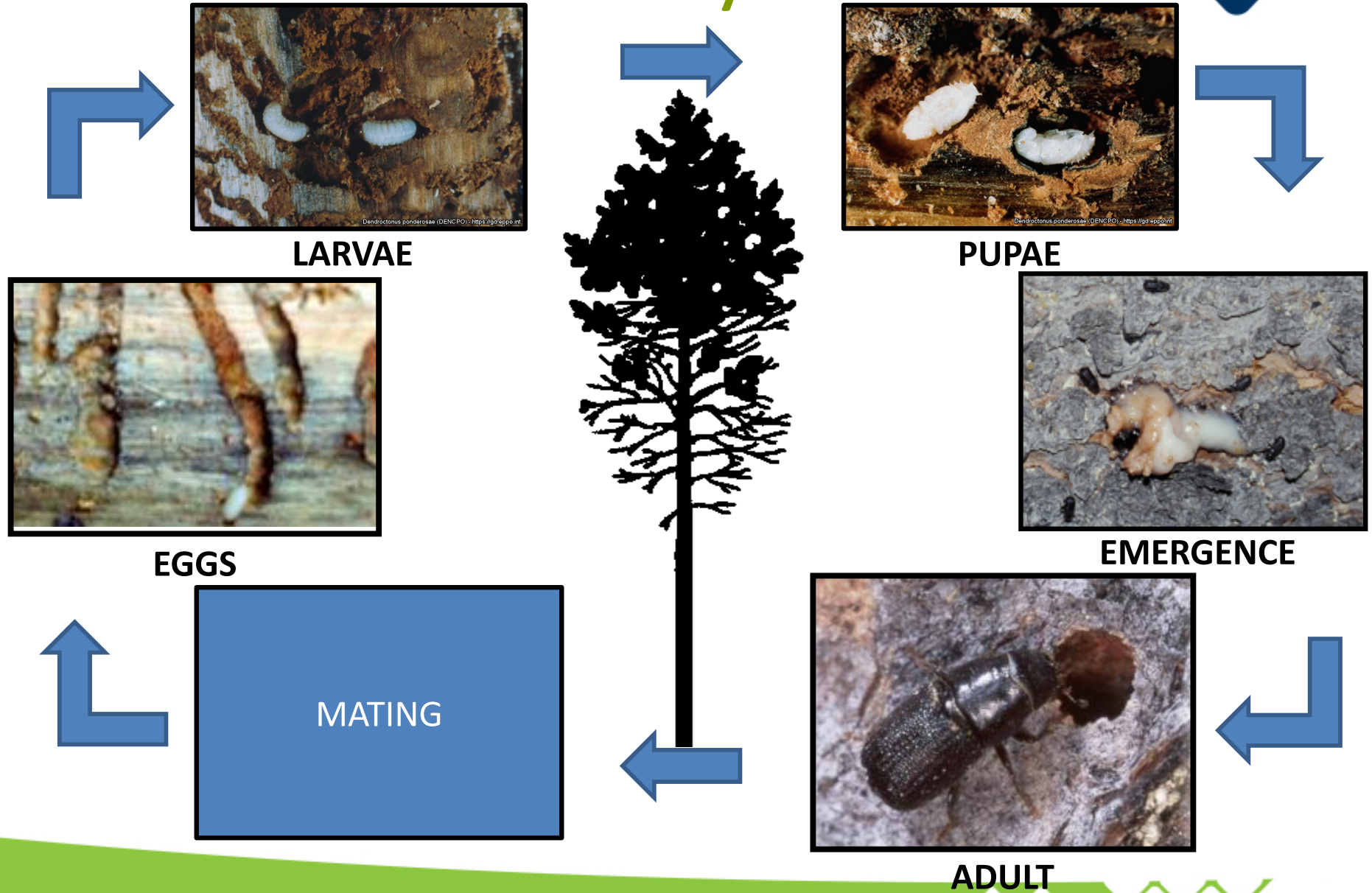
**INVASIVE**



Pine Engraver Beetle

**NATIVE**

# Life Cycle





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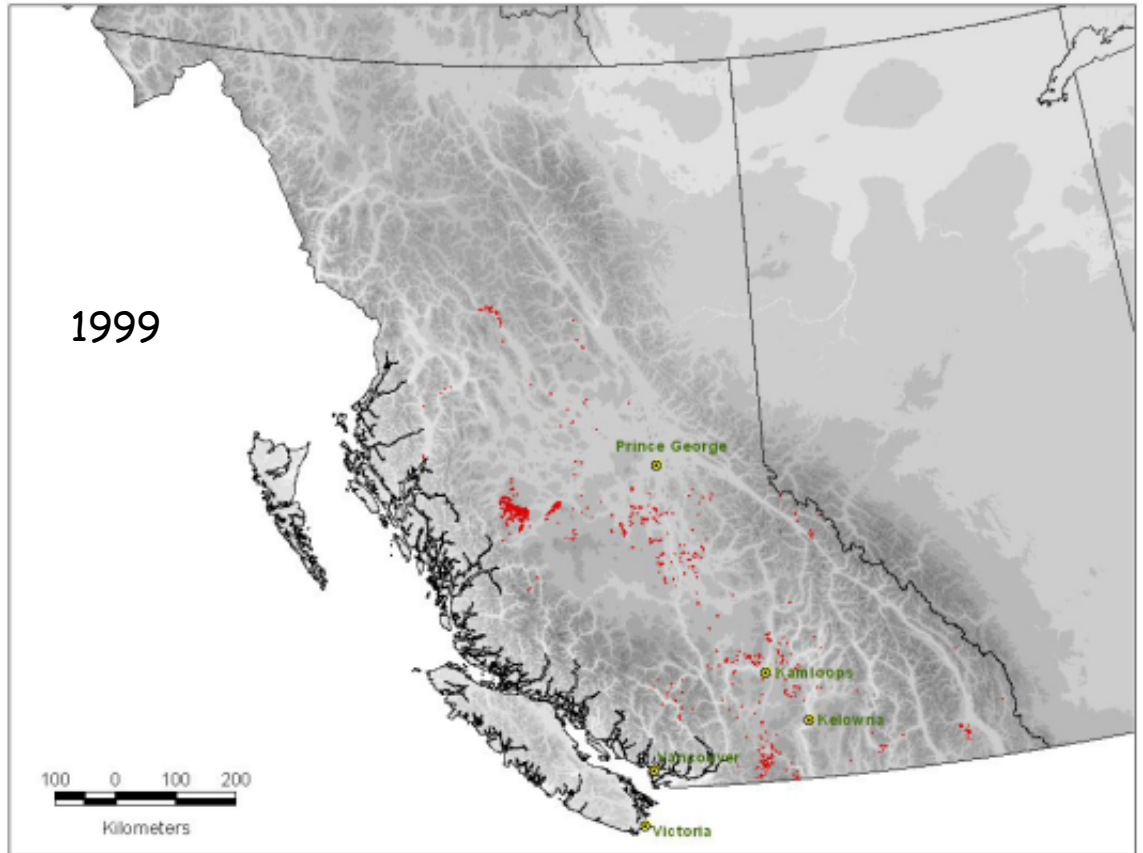
Annual area (ha x 10<sup>6</sup>) affected by MPB in BC

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1910 1930 1950 1970 1990 2010

Year

# Range



Cook & Scarr, 2017





10.0



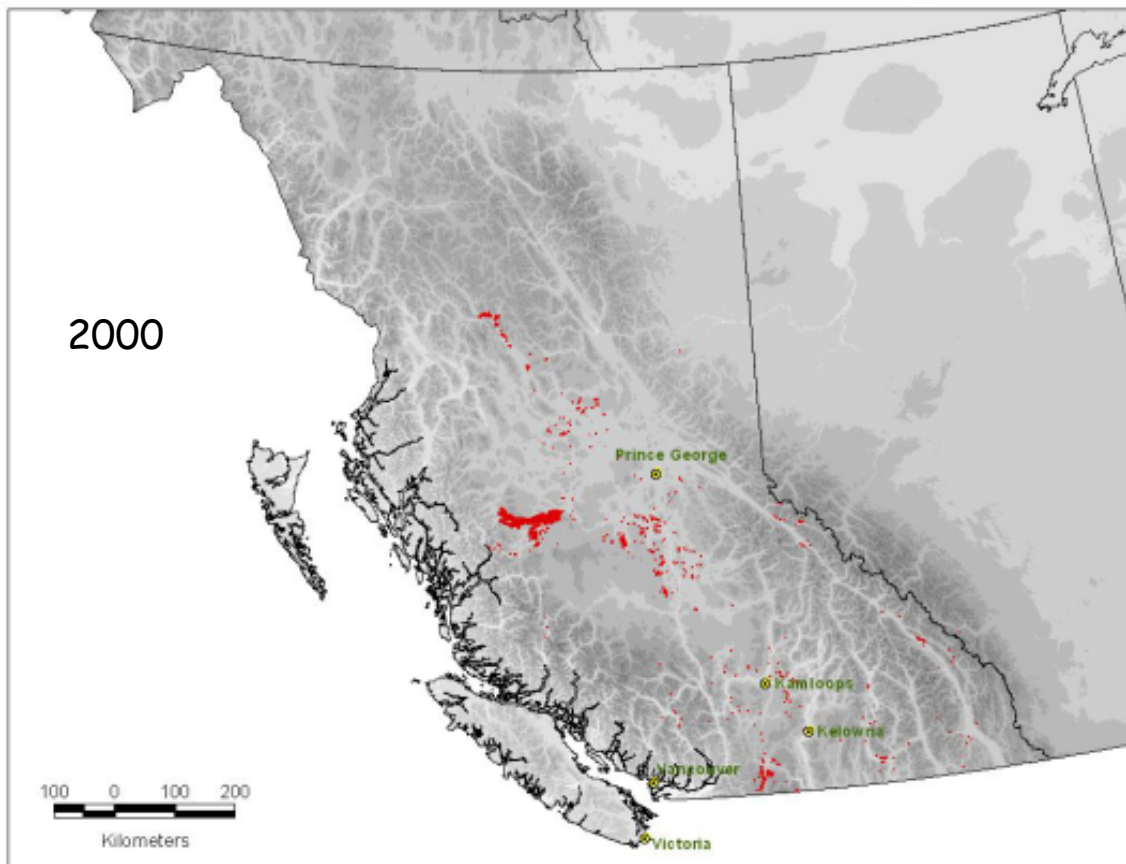
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Cook & Scarr, 2017





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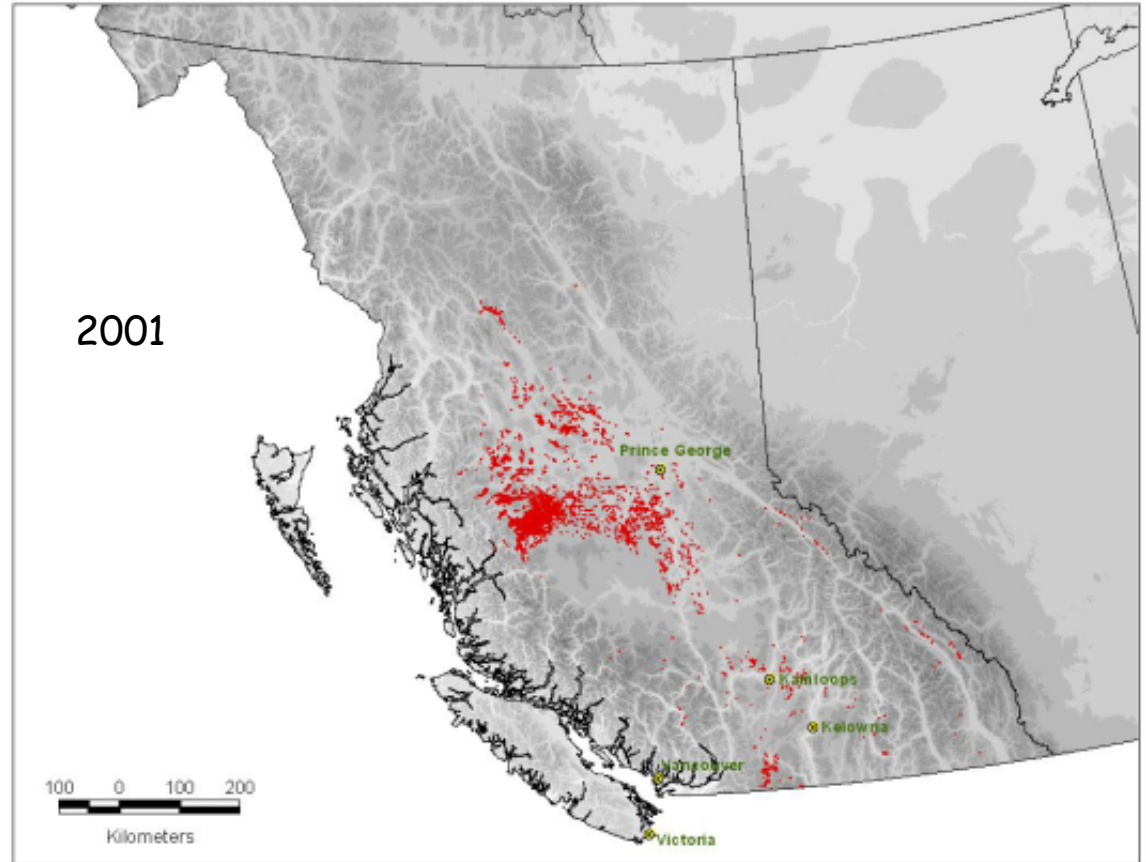
Year

2001

2000

1999

# Range



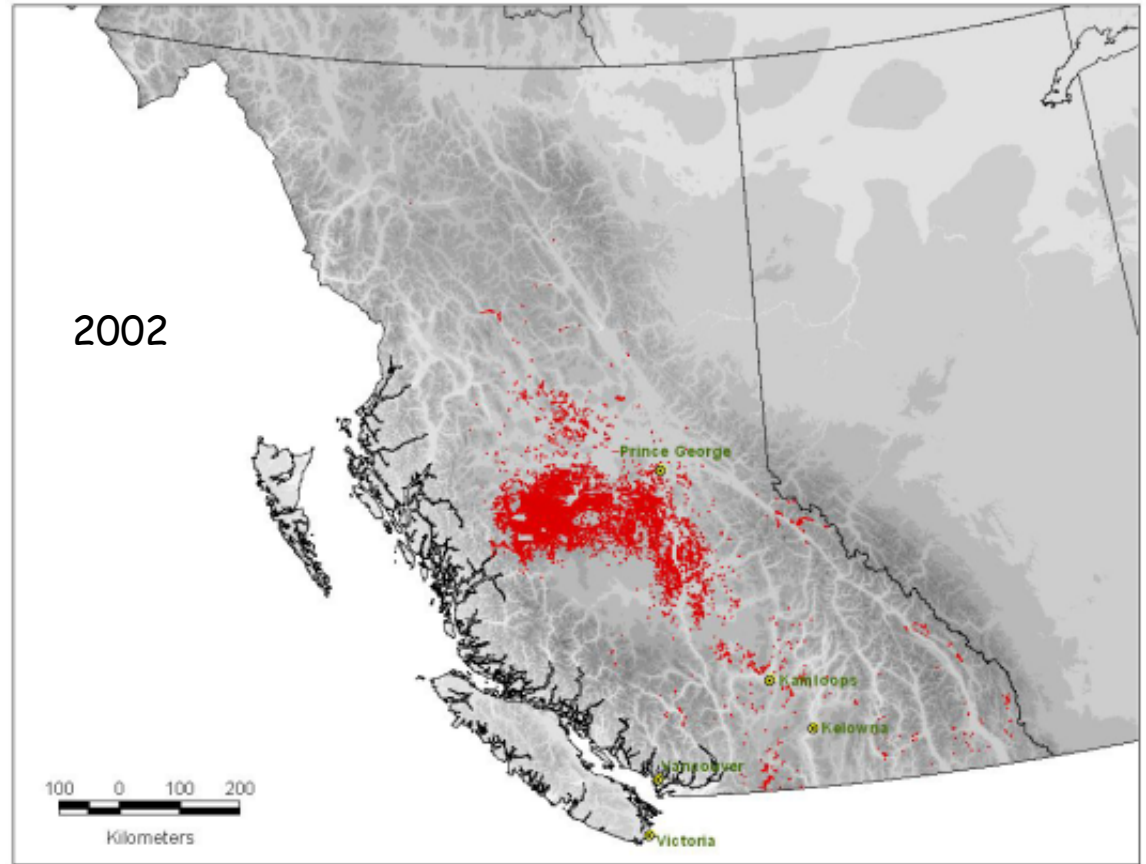
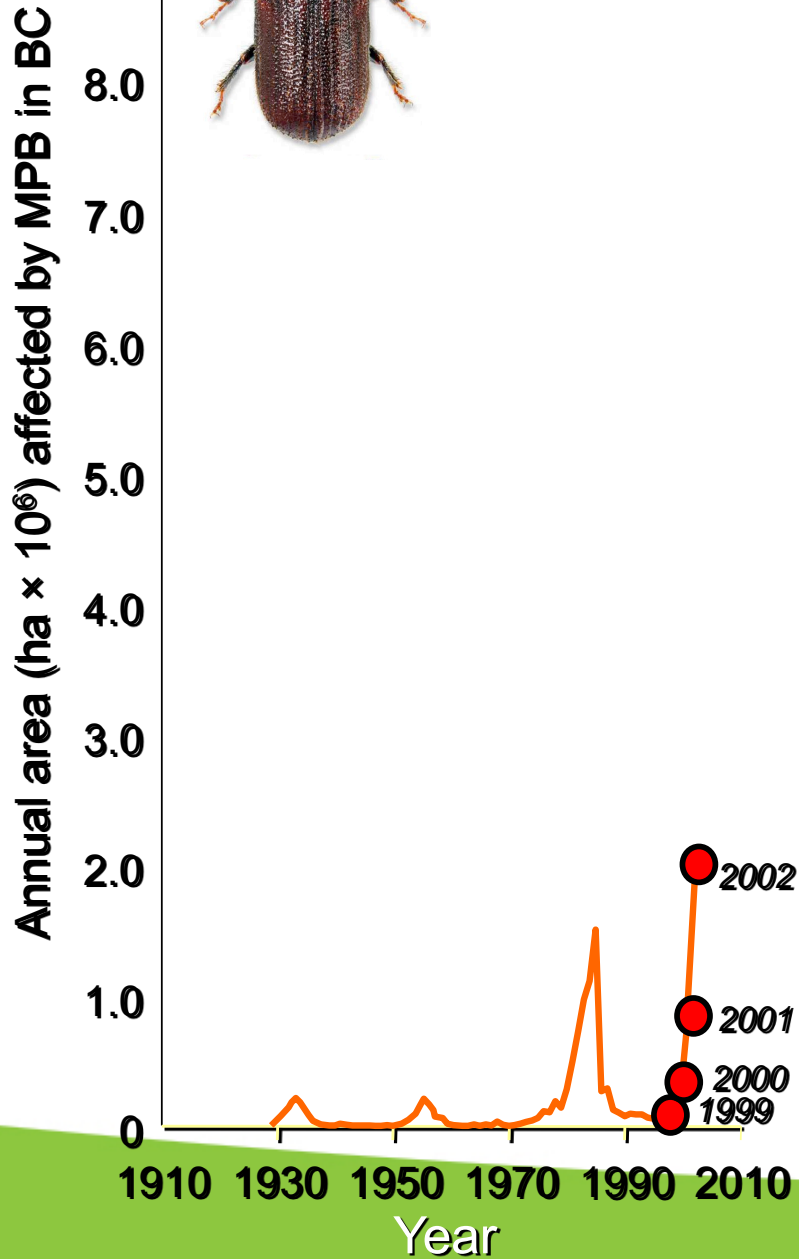
Cook & Scarr, 2017



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# Range



Cook & Scarr, 2017





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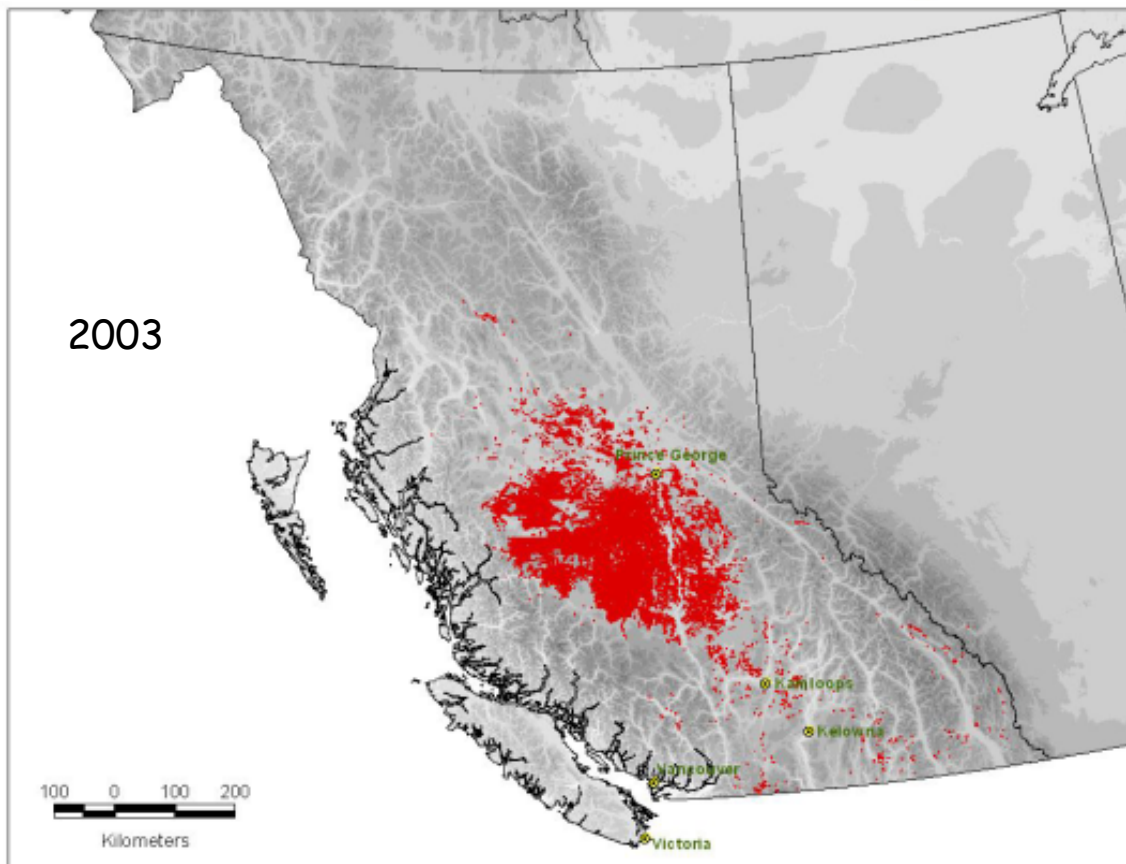
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Year

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Cook & Scarr, 2017

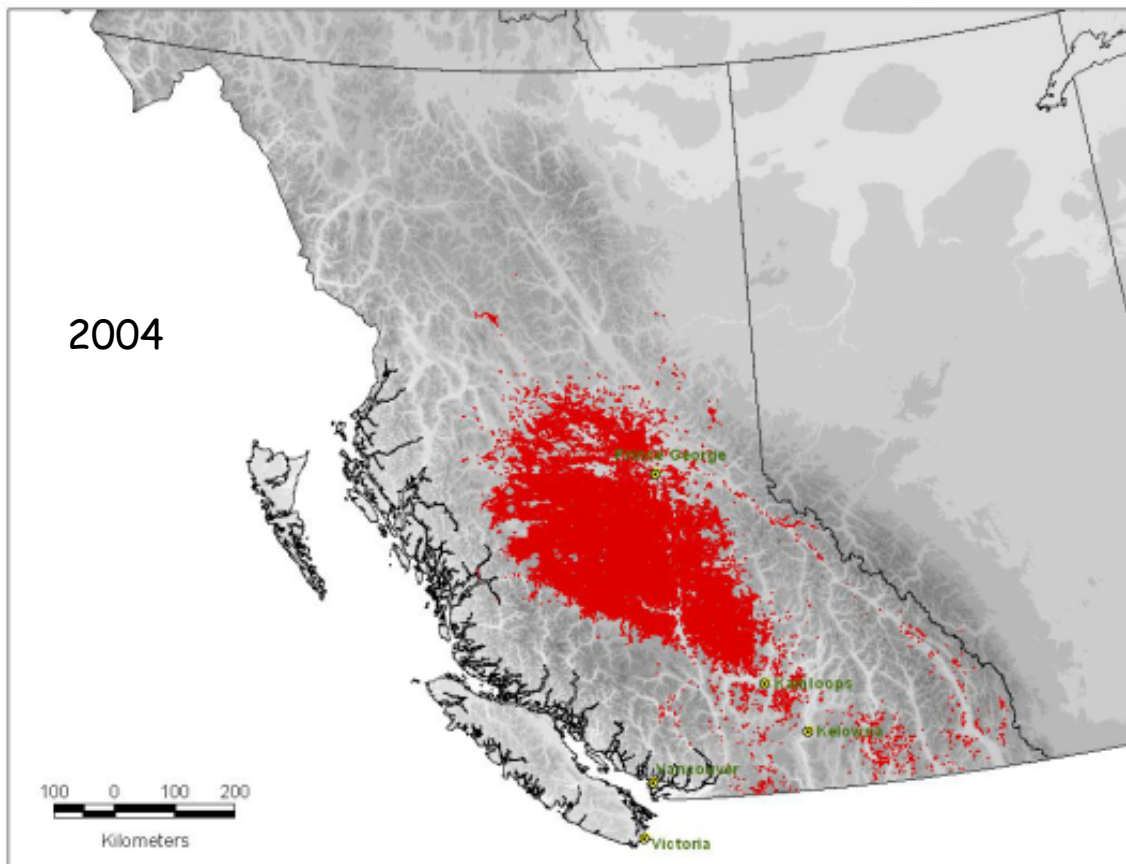
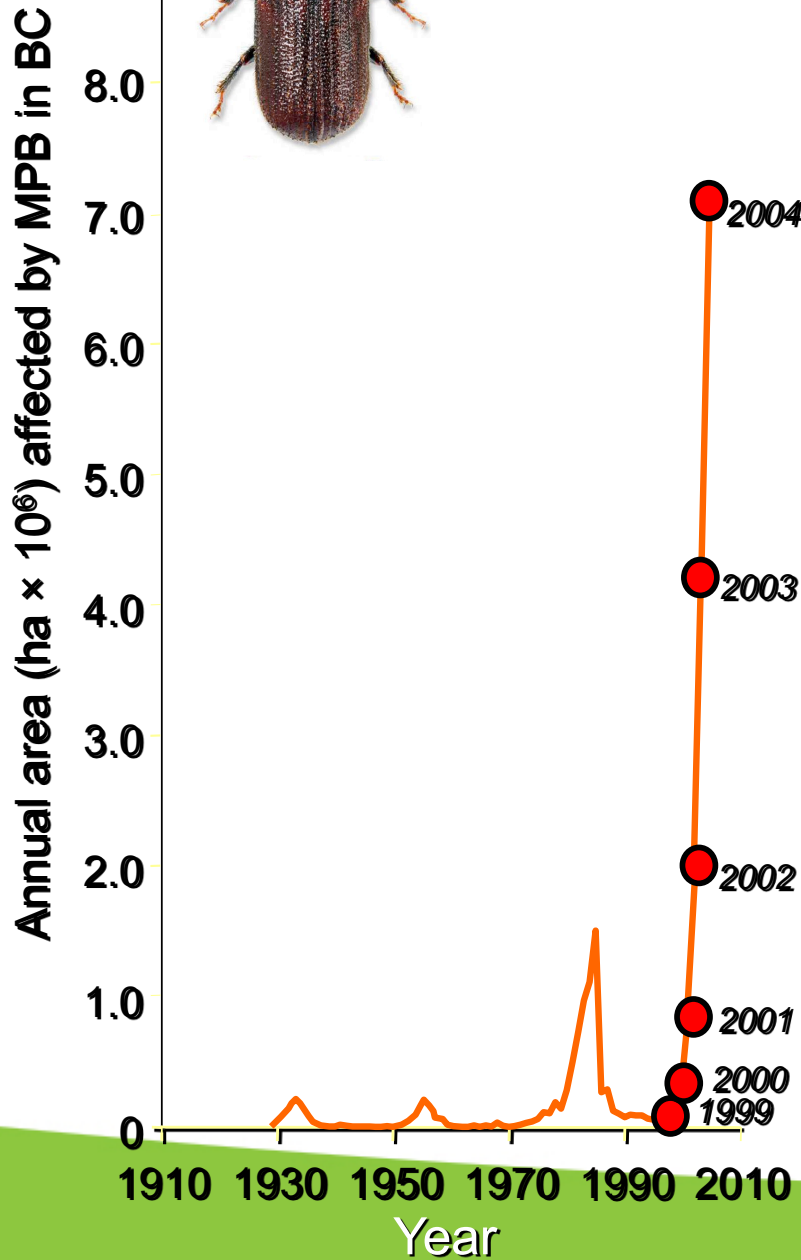




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Cook & Scarr, 2017

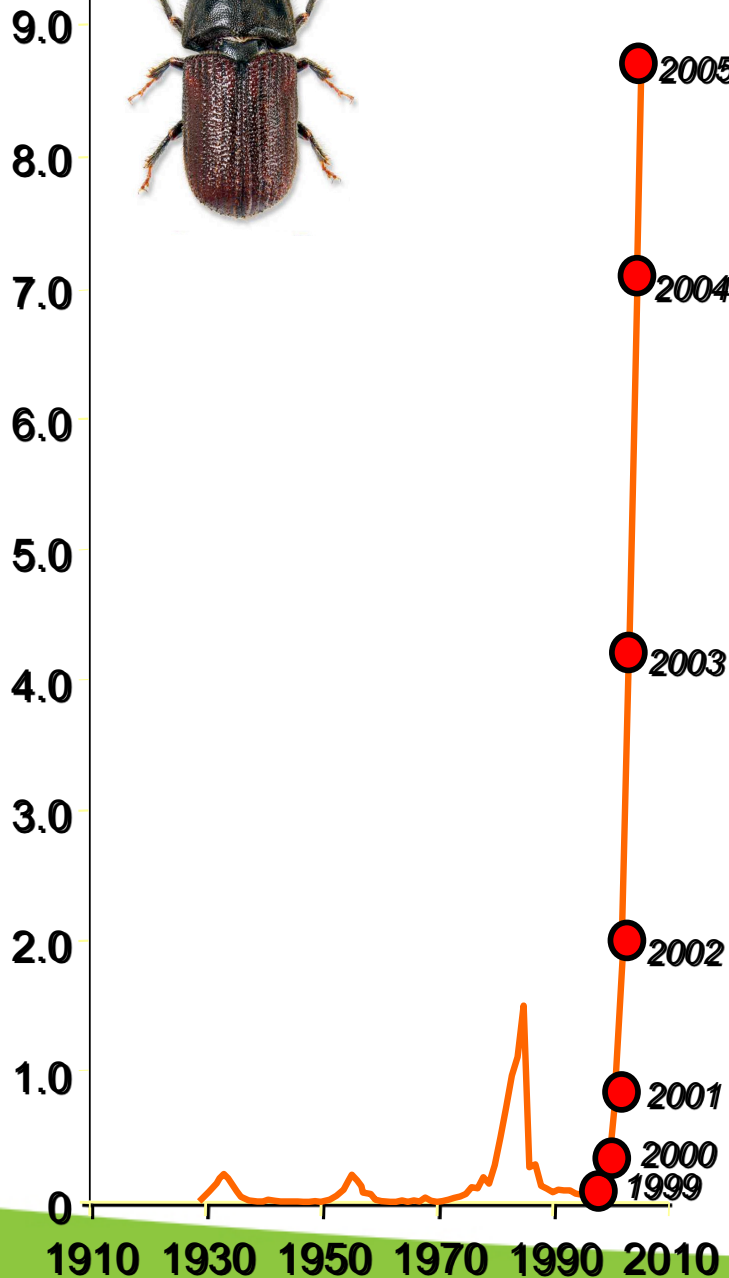




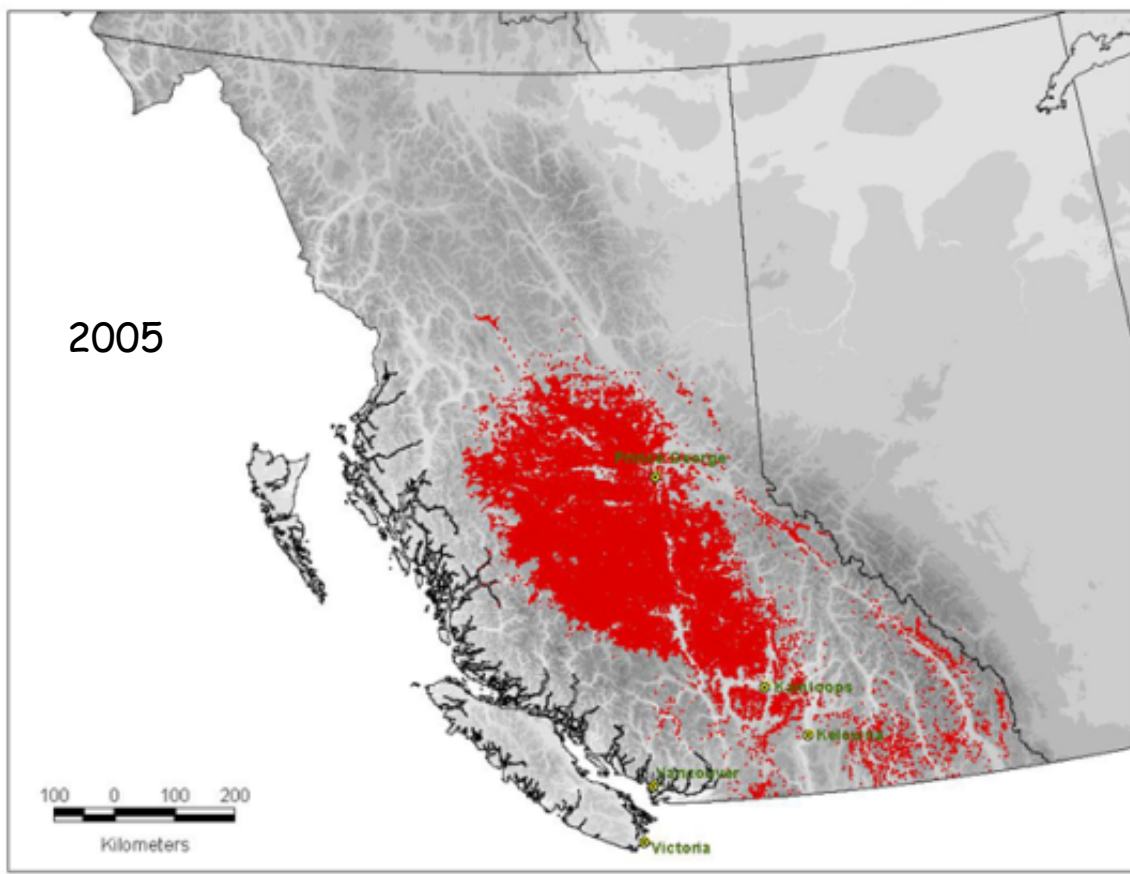
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Annual area (ha x 10<sup>6</sup>) affected by MPB in BC



# Range

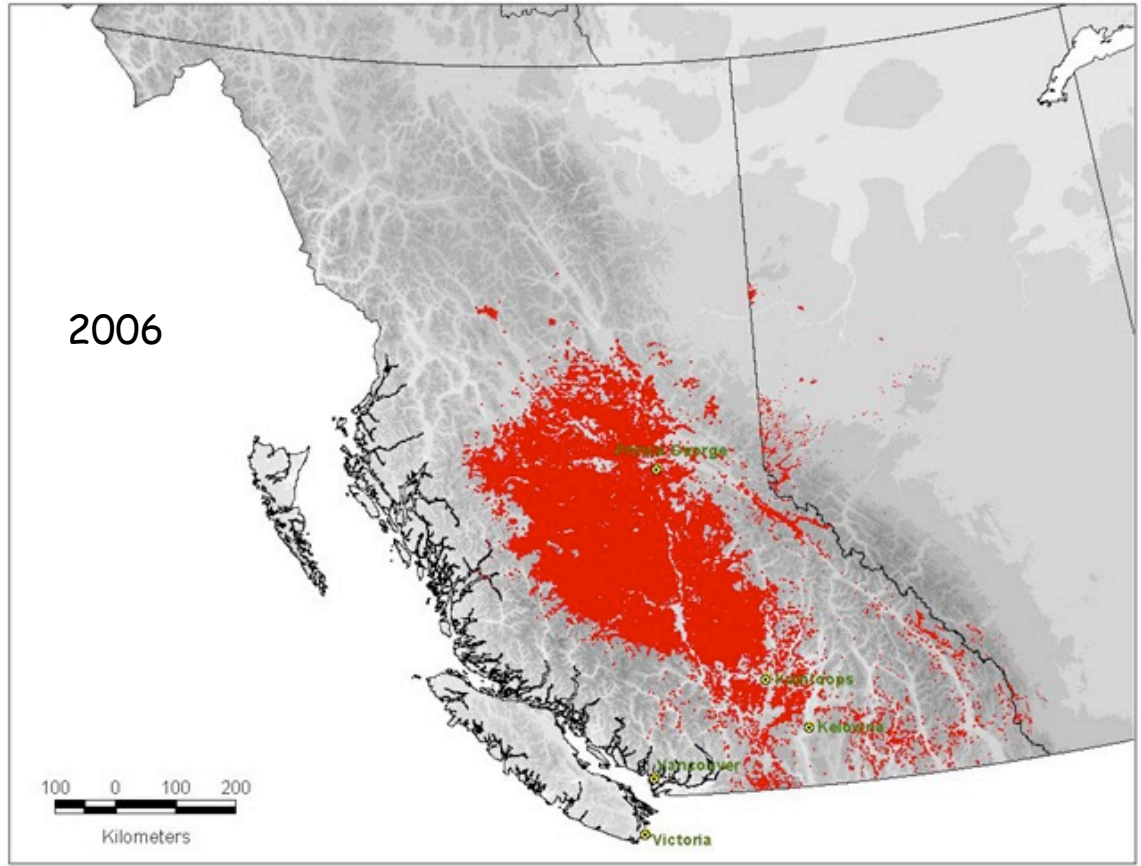
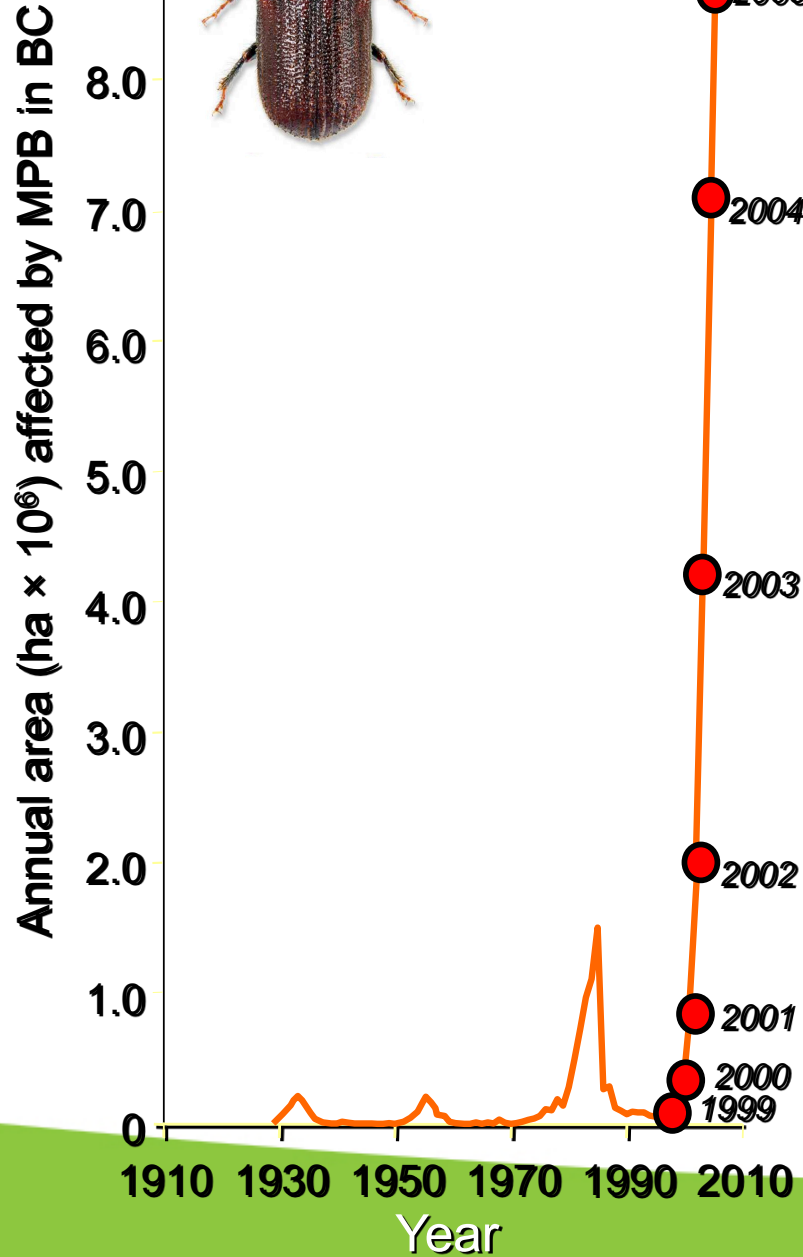


Cook & Scarr, 2017





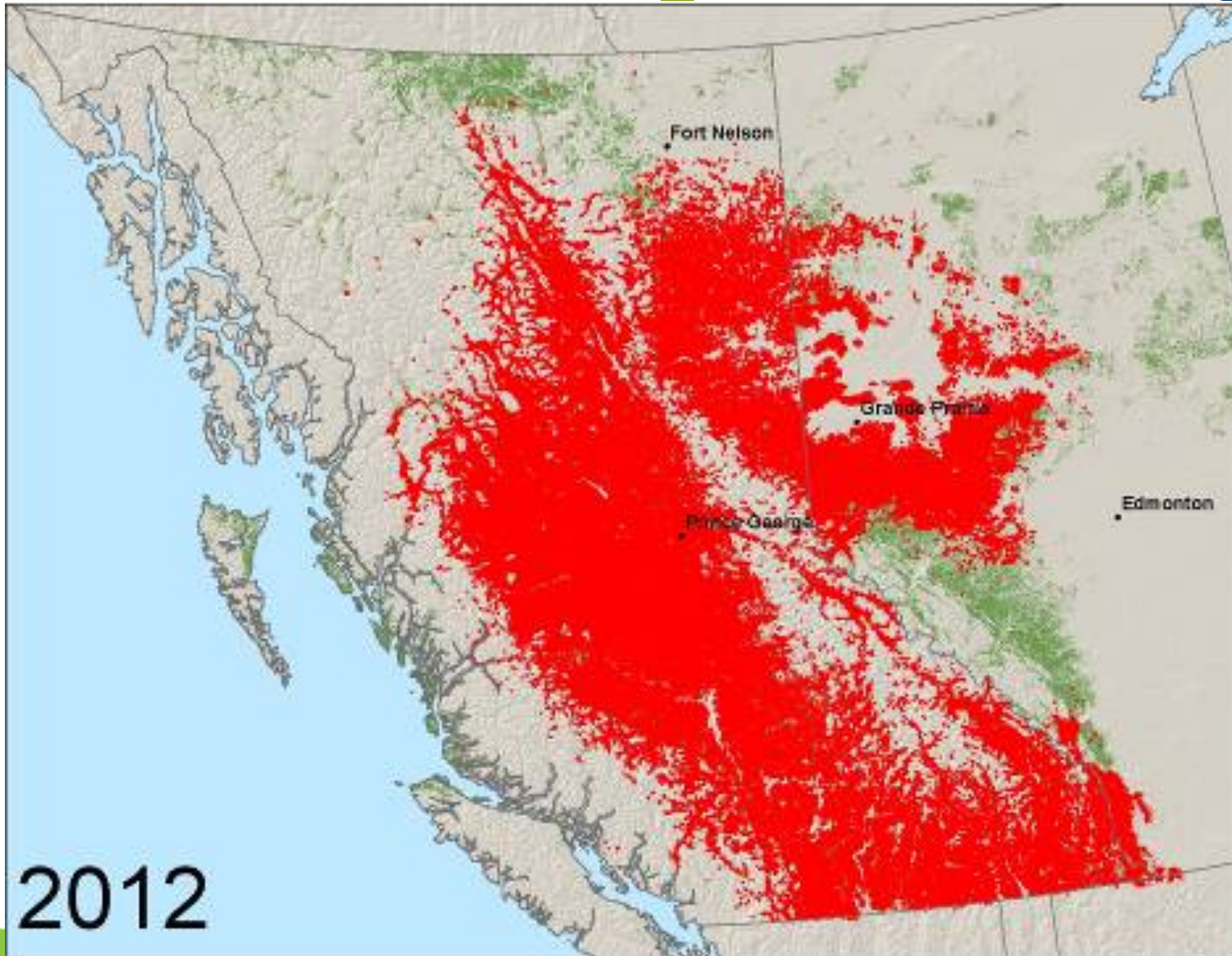
# Range



Cook & Scarr, 2017

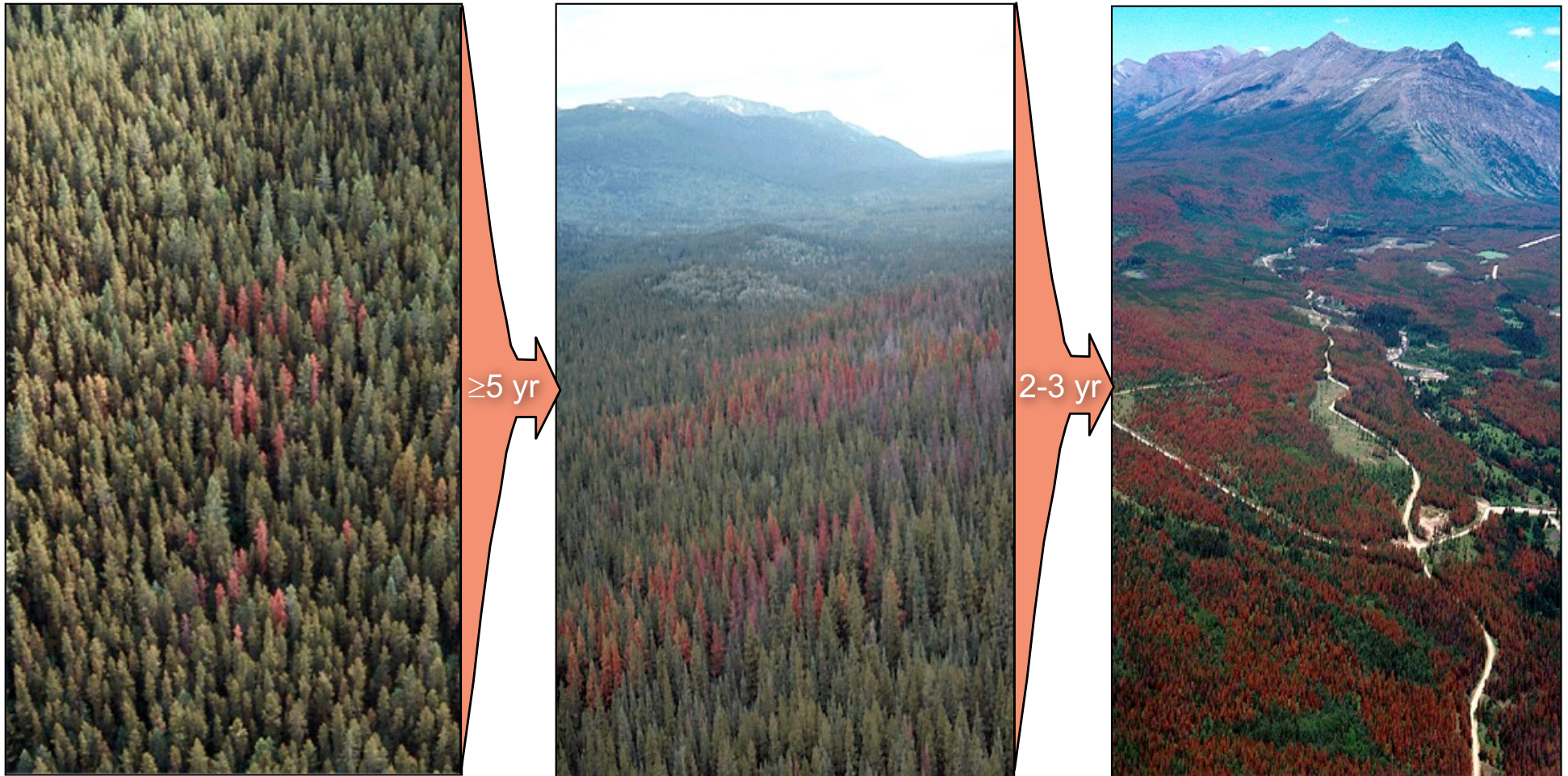


# Range



2012

# Sign's/Symptom's



→ From stand to landscape in 2 – 3 years

# Signs/Symptoms



- Tree defense
  - Pine resin will attempt to pitch the beetles out of the tree
- Blue stain fungus
- Beetle galleries



# Signs/Symptoms



- Clustering of dead trees
  - Often have red tops
  - Often needles still attacked
  - Bark flaking



# Management



- Monitoring firewood from infested locations
  - Kiln-dried 76°C min – 30min



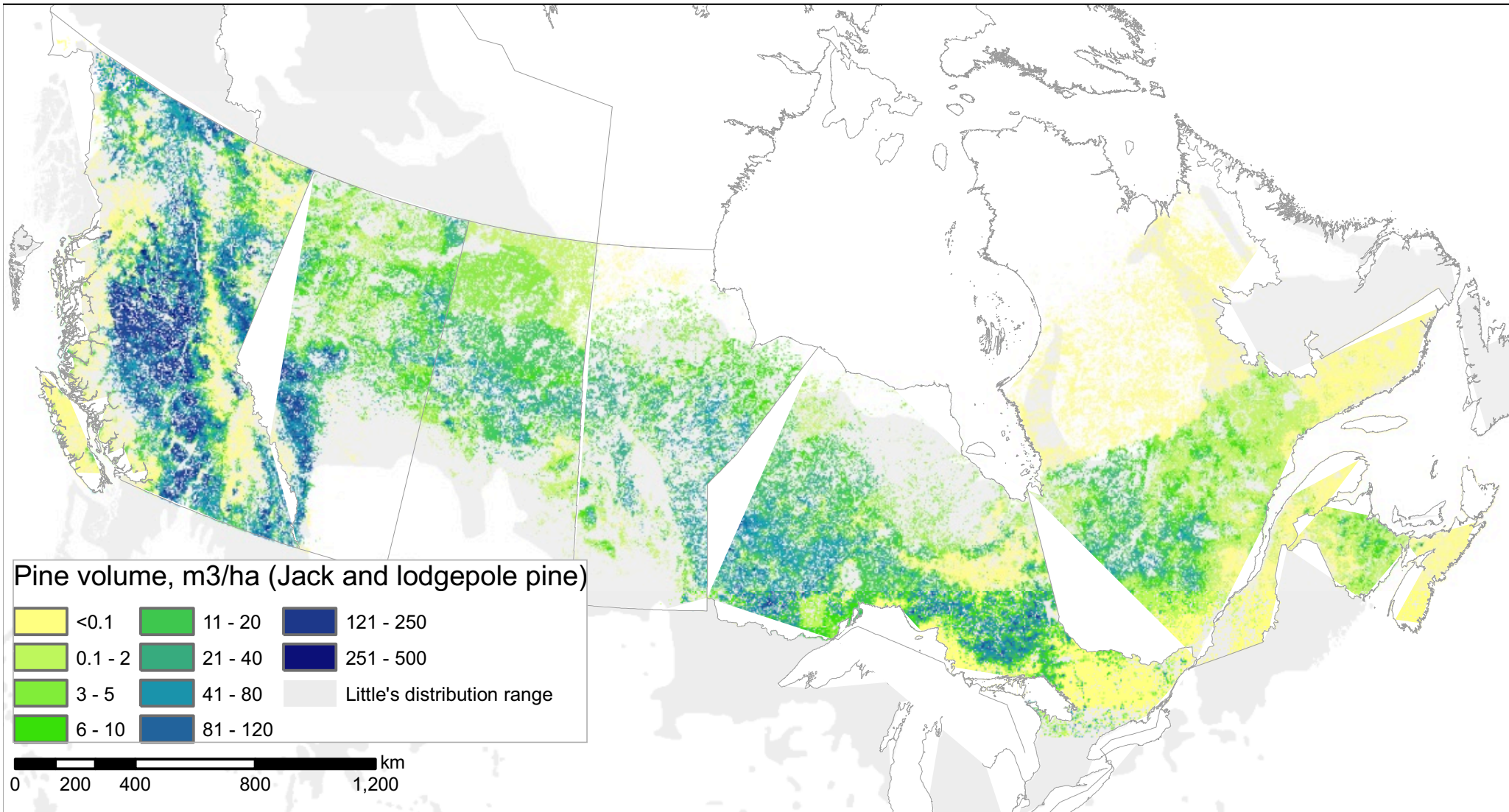
# Management



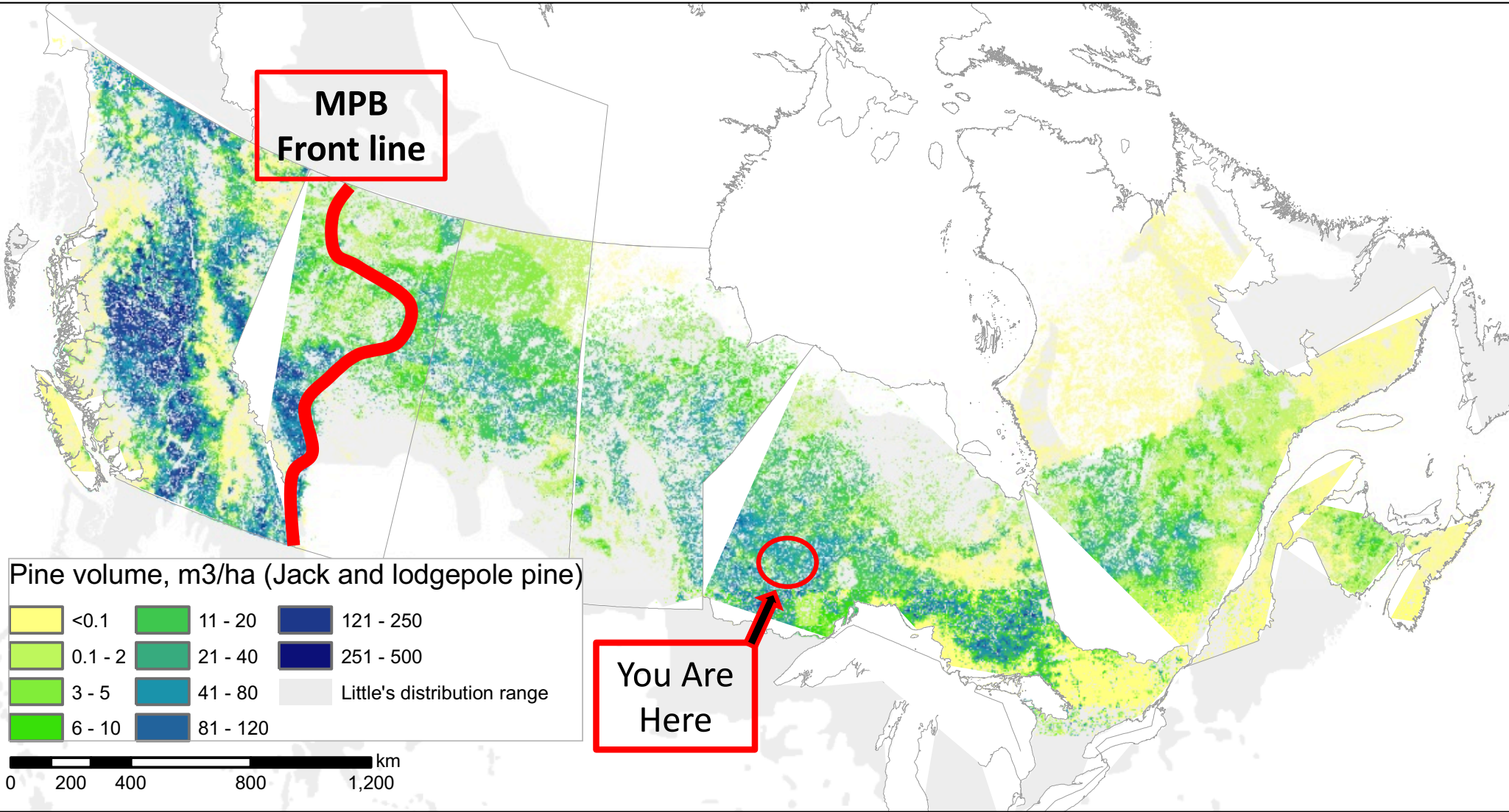
- Extensive aerial monitoring programs to map new outbreaks of MPB
- Cut down and burning of infested trees to prevent further spread



# “Quarantine Zone”



# “Quarantine Zone”





# EDDMapS Ontario

Ontario's Invading Species Awareness Program

*Spreading the word...not the species!*

**EDD** **MapS** *Ontario*

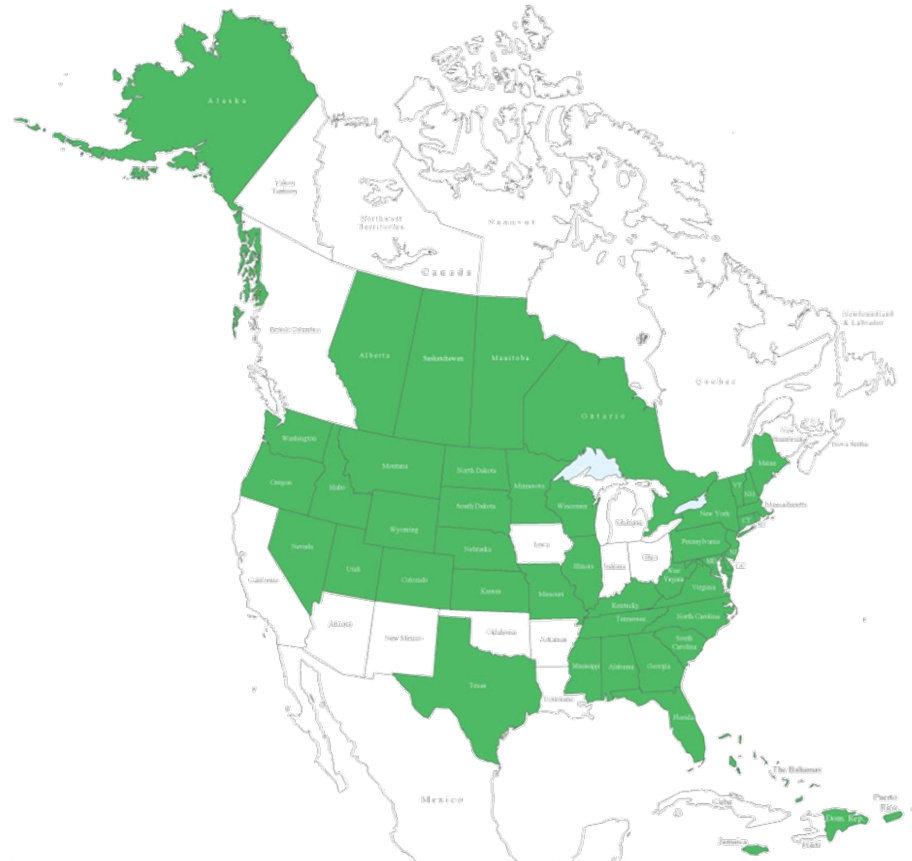
Early Detection & Distribution Mapping System



# EDDMapS Ontario



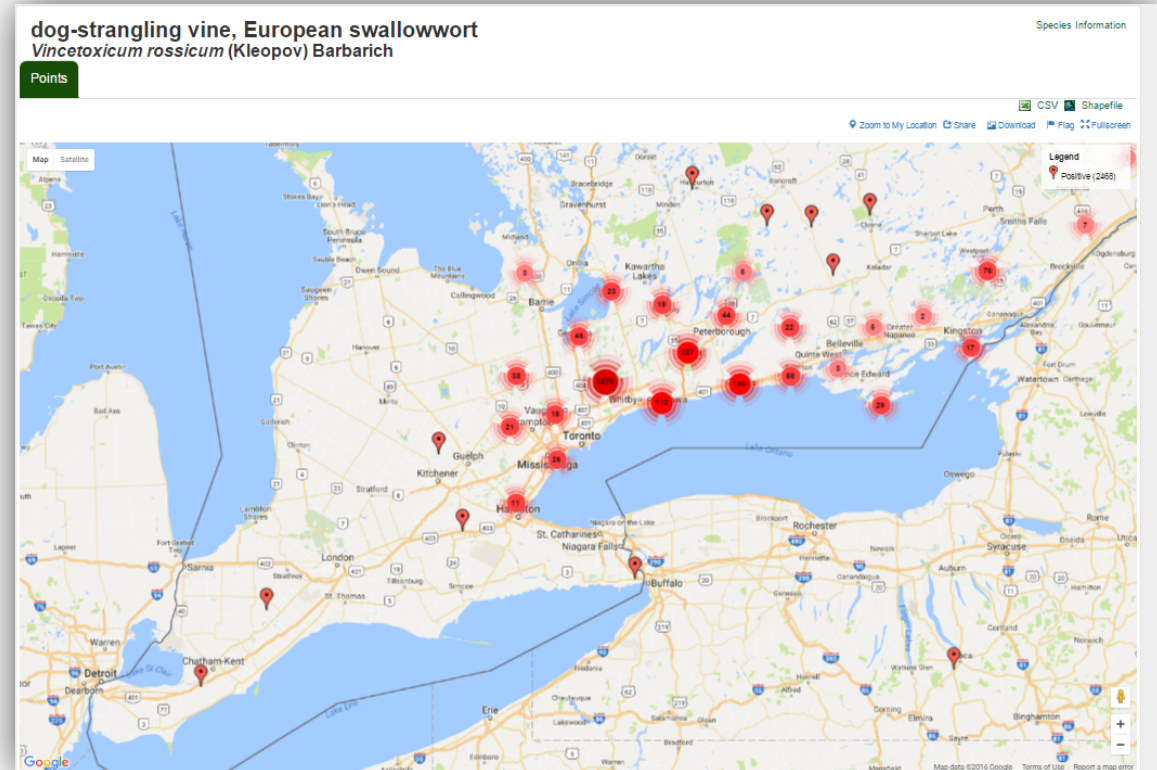
- Launched in 2005 by the Centre for Invasive Species and Ecosystem Health at the University of Georgia
- Adapted for Ontario and launched April 2014
- Combines data from other databases, organizations & volunteers
- Data will become the foundation for a better understanding of invasive species distribution around the world



# EDDMapS Ontario



- Over 35,000 Reports in the EDDMapS Ontario Database
- Easily Accessible
- Verified
- Available in Real-time



# EDDMapS Ontario



## See it, Map it

- Fast and easy – no knowledge of GIS required
- Web-based mapping of invasive species distribution to help fill gaps and identify “leading edge” ranges
- Helps Early Detection and Rapid Response with online data entry, email alerts and network of expert verifiers
- Data can be searched and downloaded





# EDDMapS Ontario



## Smartphone App

The EDDMapS Ontario app brings the power of EDDMapS to your smartphone. Now you can submit invasive species observations directly with your smartphone from the field. These reports are uploaded to EDDMapS and e-mailed directly to verifiers for review.



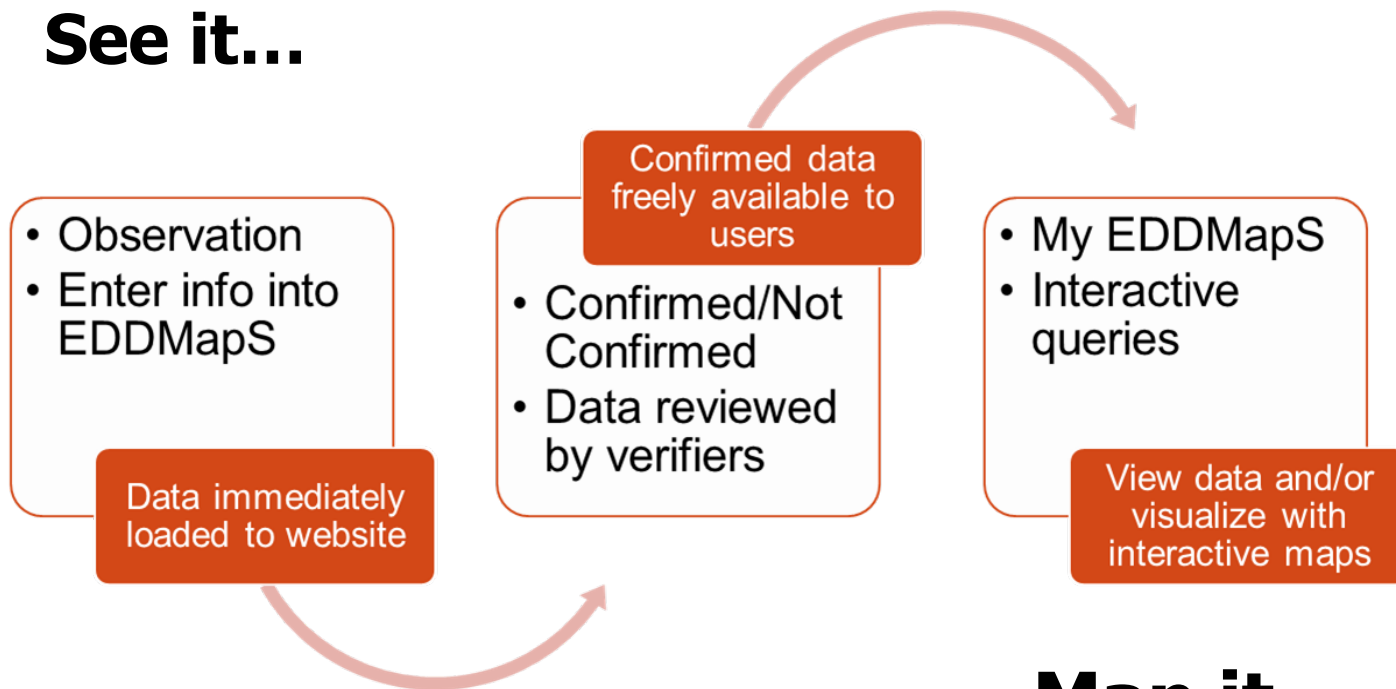
Search for **EDDMapS Ontario**

**\*Download under wifi connection\***

# EDDMapS Ontario



## See it...



## Map it...

# Verification



- Timelines for verification vary by species
- Priority is given to species of high concern or high risk
- Species categories:
  - **Priority species**
    - High risk species not currently known in Ontario
    - High risk species currently established in Ontario but reported outside their known distribution
  - **All other species**



Home

Report Sightings

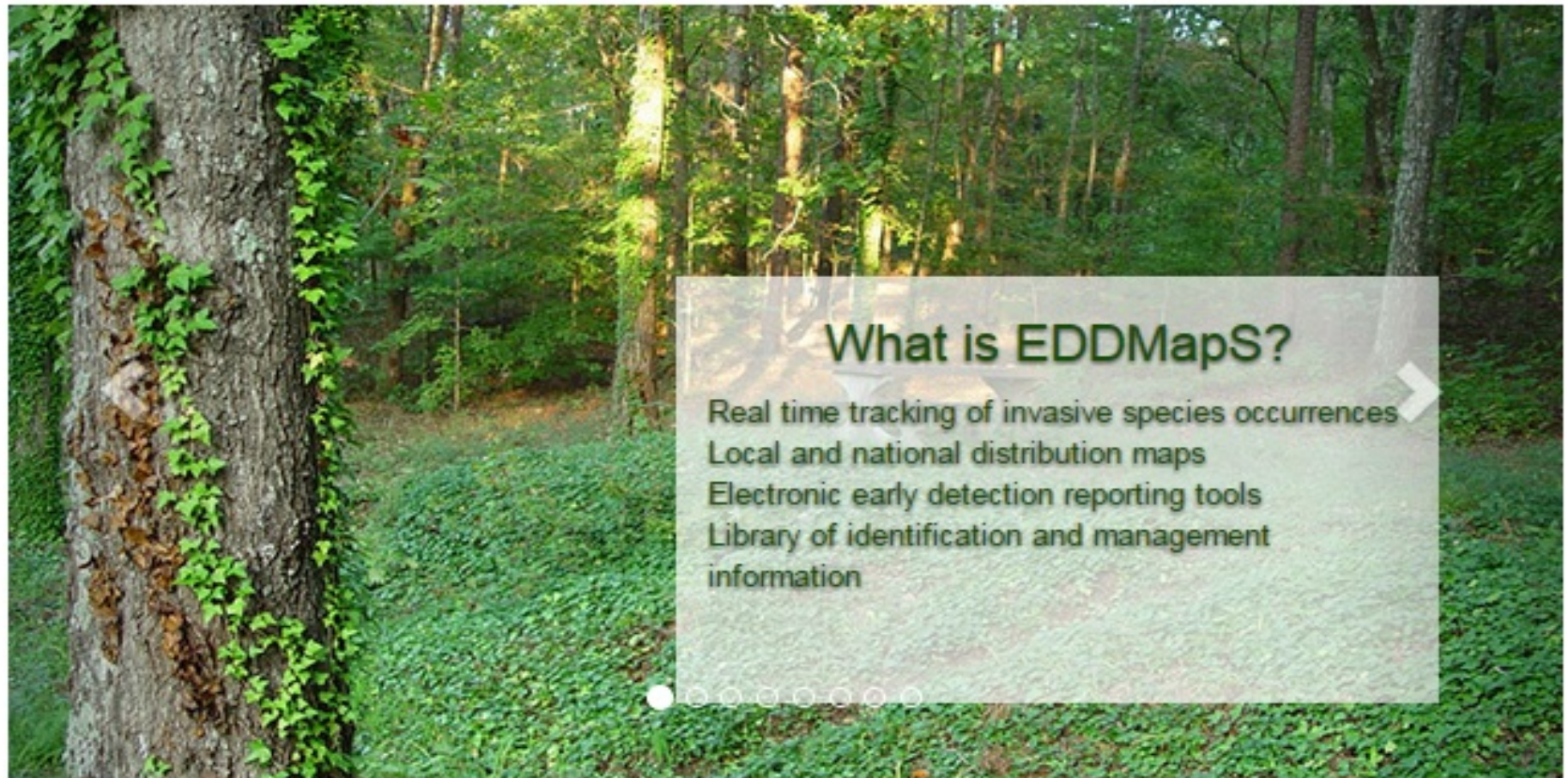
Distribution Maps

Species Information

Queries & Tools

Training

My EDDMapS



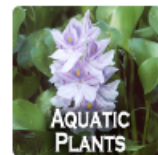


# Reporting in EDDMapS



<a href="#">Home</a>	<a href="#">Report Sightings</a>	<a href="#">Distribution Maps</a>	<a href="#">Species Information</a>	<a href="#">Queries &amp; Tools</a>	<a href="#">Training</a>	<a href="#">My EDDMapS</a>	<a href="#">About</a>	<a href="#">sign out</a>
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Click on the type of species you would like to report.



# Reporting in EDDMapS

**EDD MapS Ontario**  
Early Detection & Distribution Mapping System



## Report Page:

- Species
- Infestation
- Habitat
- Abundance
- Description
- Number of Individuals
- Location
- Image Upload
- Additional Comments

The screenshot shows the 'Report an Invasive Plant Occurrence' form on the EDD MapS Ontario website. The form is titled 'Report an Invasive Plant Occurrence' and includes a navigation bar with links for Home, Report Sightings, Distribution Maps, Species Information, Queries & Tools, Training, My EDDMapS, and About, along with a sign out button. The form fields are as follows:

- Species:** Pest (P): Search for a species (dropdown menu)
- Infestation:** Observation Date (P): 06/13/2016; Infested Area (P): Select One (dropdown menu); Habitat (P): Select One (dropdown menu); Canopy Closure (P): Select One (dropdown menu); Abundance: Select One (dropdown menu); Plant Description: Mature (radio), Immature (radio), In Flower (radio), Seeds (radio), Dormant/Dead (radio); Approximate number of individuals: (text input); Description: Adult (radio), Juvenile (radio), Unknown (radio)
- Location:** Province: Ontario (dropdown menu); Jurisdiction: (dropdown menu); Latitude (P): (text input); Longitude (P): (text input); Must be expressed in Decimal Degrees (00.XXXXX), and GARDL/NAD83/WGS84. (text input); Must be expressed in Decimal Degrees (00.XXXXX), and GARDL/NAD83/WGS84. (text input); [Helping conversion tools](#), [place marker at position](#), [clear map](#); Location Description/Nearst Address: (text input)
- Images:** For verification purposes, take at least two digital images, a close up of the species and one of the site. All photos uploaded to EDDMapS Ontario may be used by the Invasive Species Awareness Program for Educational and Promotional Purposes. Image 1: (text input); Image 2: (text input)

# Reporting in EDDMapS

## Observations:

- Standardized on-line reporting forms with custom attribute fields by taxa
- Required fields in Red
  - Observation Date
  - Habitat
  - Location
- Include any other available information

**EDD MapS Ontario**  
Early Detection & Distribution Mapping System



## Report an Invasive Plant Occurrence

Red fields are required.

### Species

Pest (?):

Search for a species

### Infestation

Observation Date (?):

06/13/2016

Info

Habitat (?):

Select One

Ca

Abundance:

Select One

Plant Description:

Mature  Immature  In Flower  Seeds  Dormant/Dead

Approximate number of individuals:

Description:  Adult  Juvenile  Unknown

### Location

Province:

Ontario

Jurisdiction:

Latitude (?):

Longitude (?):

Must be expressed in Decimal Degrees (XX.XXXX), and DATUM NAD83/WGS84.

Must be expressed in Decimal Degrees (XX.XXXX), and DATUM NAD83/WGS84.



# Reporting in EDDMapS

## Location Tools:

- Click and drag red marker to sighting location
- Select a Jurisdiction
- Red denotes required fields
- Latitude
- Longitude
- Conversions

**EDD MapS Ontario**  
Early Detection & Distribution Mapping System



### Location

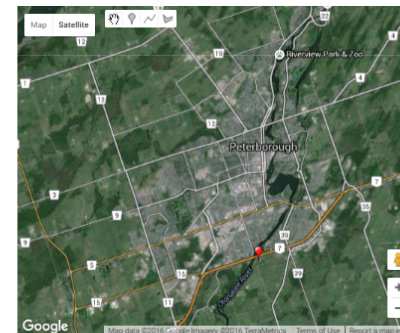
**Province:**

**Jurisdiction:**

**Latitude (?):**   
Must be expressed in Decimal Degrees (XX.XXXXX), and DATUM NAD83/WGS84.

**Longitude (?):**   
Must be expressed in Decimal Degrees (XX.XXXXX), and DATUM NAD83/WGS84.

**Location Description/Nearest Address:**



### Images

For verification purposes, take at least two digital images, a close up of the species and one of the site. All photos uploaded to EDDMapS Ontario may be used by the Invading Species Awareness Program for Educational and Promotional Purposes.

**Image 1:**

(.jpg) (Provide as much detail as possible. Do not include personal information. All information entered in this field will be displayed publicly. If the photo is not yours

**Caption:**

**Photo by:**

**Image 3:**

(.jpg) (Provide as much detail as possible. Do not include personal information. All information entered in this field will be displayed publicly. If the photo is not yours

**Image 2:**

(.jpg) (Provide as much detail as possible. Do not include personal information. All information entered in this field will be displayed publicly. If the photo is not yours

**Caption:**

**Photo by:**

**Image 4:**

(.jpg) (Provide as much detail as possible. Do not include personal information. All information entered in this field will be displayed publicly. If the photo is not yours



# Reporting in EDDMapS

EDD **MapS** Ontario  
Early Detection & Distribution Mapping System



## Images

For verification purposes, take at least two digital images, a close up of the species and one of the site. All photos uploaded to EDDMapS Ontario may be used by the Invading Species Awareness Program for Educational and Promotional Purposes.

Image 1:

 Choose file

(.jpg) (Provide as much detail as possible. Do not include personal information. All information entered in this field will be displayed publicly. If the photo is not yours

Caption:

Photo by:

Image 3:

 Choose file

(.jpg) (Provide as much detail as possible. Do not include personal information. All information entered in this field will be displayed publicly. If the photo is not yours

Image 2:

 Choose file

(.jpg) (Provide as much detail as possible. Do not include personal information. All information entered in this field will be displayed publicly. If the photo is not yours

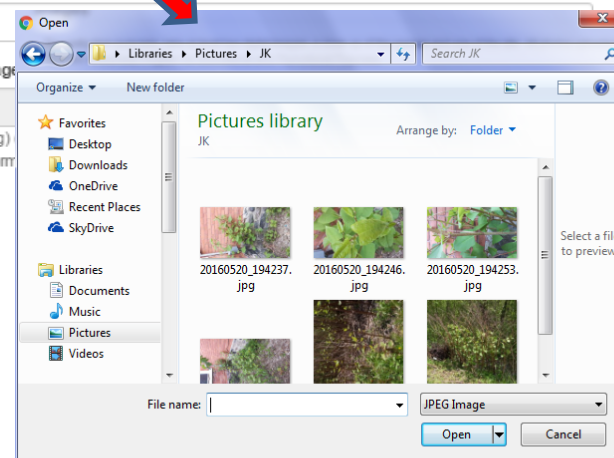
Caption:

Photo by:

Image:

 Choose file

(.jpg) inform

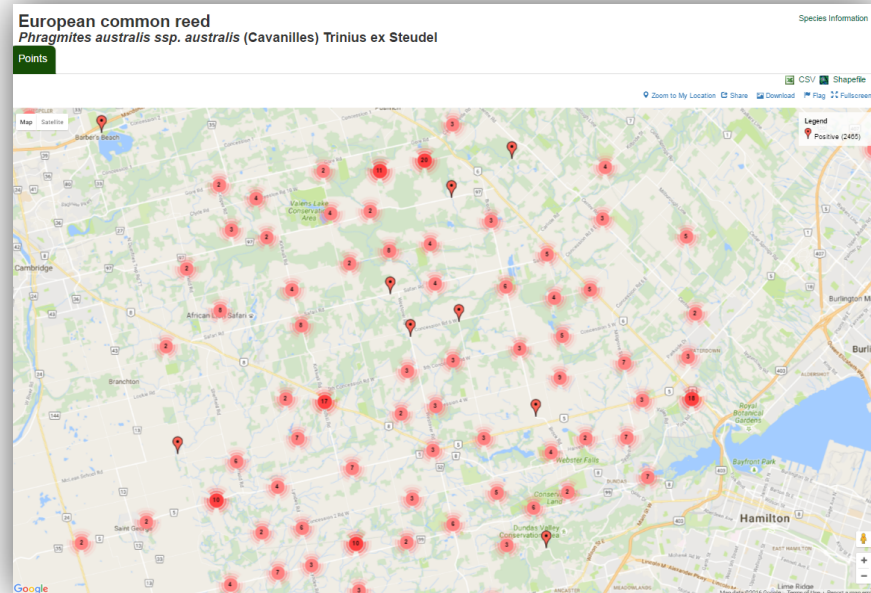




# Reporting in EDDMapS

## Reporting with EDDMapS

- Easy Field Reporting (e.g. City of Hamilton)
- Generate large quantities of data
  - Road Surveys
  - Citizen scientists



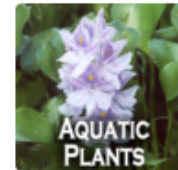




# Why include EDDMapS with management plans?

How can EDDMapS can help a municipality

- ✓ Create an Invasive Species Database (framework is already in place)
- ✓ Easy reporting and verification process (roads surveys, bulk uploads)
- ✓ Simple Field Application (smartphone/tablet or spreadsheet)
- ✓ Point, line and polygon reporting
  - Access to data from multiple sources
  - Create “Alerts” for species of concern
  - Support through ISAP Staff
  - Data Downloads
  - It’s FREE!!!





# Why include EDDMapS with management plans?

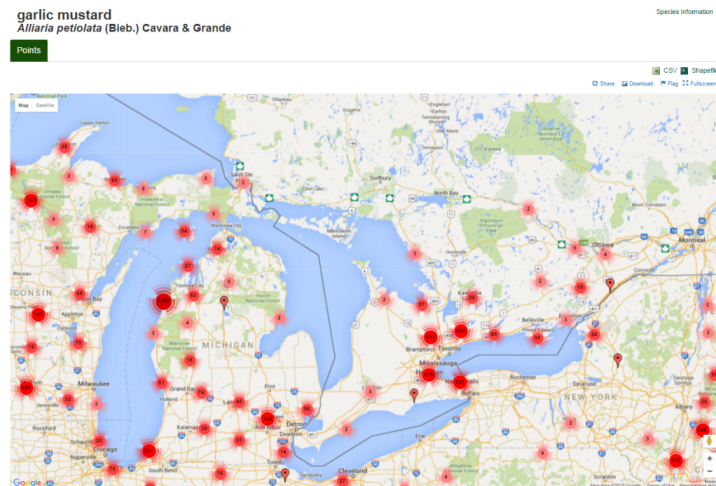
- Accessing and using the data:
  - Search existing species within their jurisdiction
  - Access mapping tools to query species by area (e.g. upper or lower tier)



Home Report Sightings Distribution Maps Species Information Queries & Tools Training My EDDMapS About sign out

### Query Species by Area

- Waterbody (lakes/rivers etc.)
- Upper Municipalities (Regional/County/District level)
- Lower Tier Municipalities (Township/City level)
- Conservation Authority Geographic Boundaries
- Provincial Parks
- Fisheries Management Zone
- MNR District Boundaries
- Conservation Areas
- Quaternary Watershed
- Tertiary Watershed
- Conservation Reserves
- First Nations Reserves
- Federal Lands





# Why include EDDMapS with management plans?

- Early Detection and Rapid Response:
  - Set up “alerts” for species of concern in their area

## Create Alerts

### Province Alert

Ontario ▼

Plants  
 Animals  
 New Only - You only get an alert the first time a plant or animal is found in a county

**Create Alert**

### Jurisdiction Alert

Ontario ▼    Select Province ▼

Plants  
 Animals  
 New Only - You only get an alert the first time a plant or animal is found in a Jurisdiction

**Create Alert**

### Species Alert

New Jurisdiction Record Only - First time the species is reported in a Jurisdiction

**Create Alert**





# Support Through ISAP

- Invading Species Hotline
  - Toll free number to the public
  - 1-800-563-7711
  - Provide information and receive reports of invasive species in the province
  - Mon-Fri 9-5





Invasive  
Species  
Centre

## Contact Us:

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