



United States Department of Agriculture

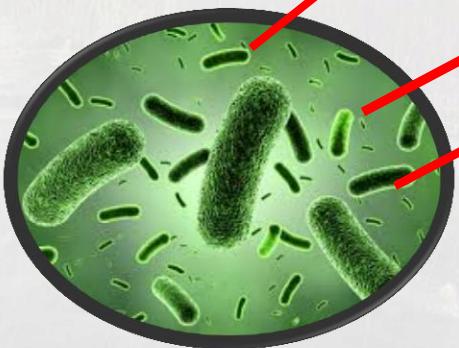
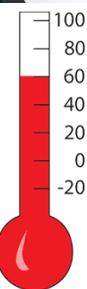
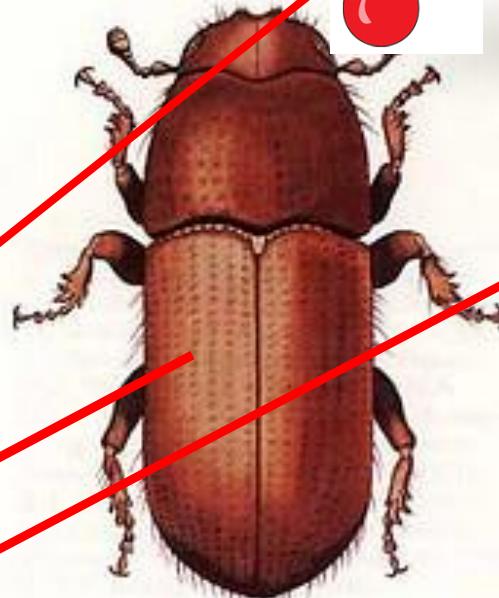
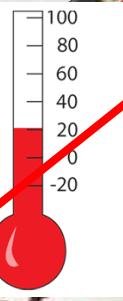
Bark beetle dynamics in the forests of the Tanana River Valley



Forest Service
Alaska Region

Stephen Burr - Entomologist
Nicholas Lisuzzo – Bio-Tech
December 16th, 2015

Bark Beetle Associates

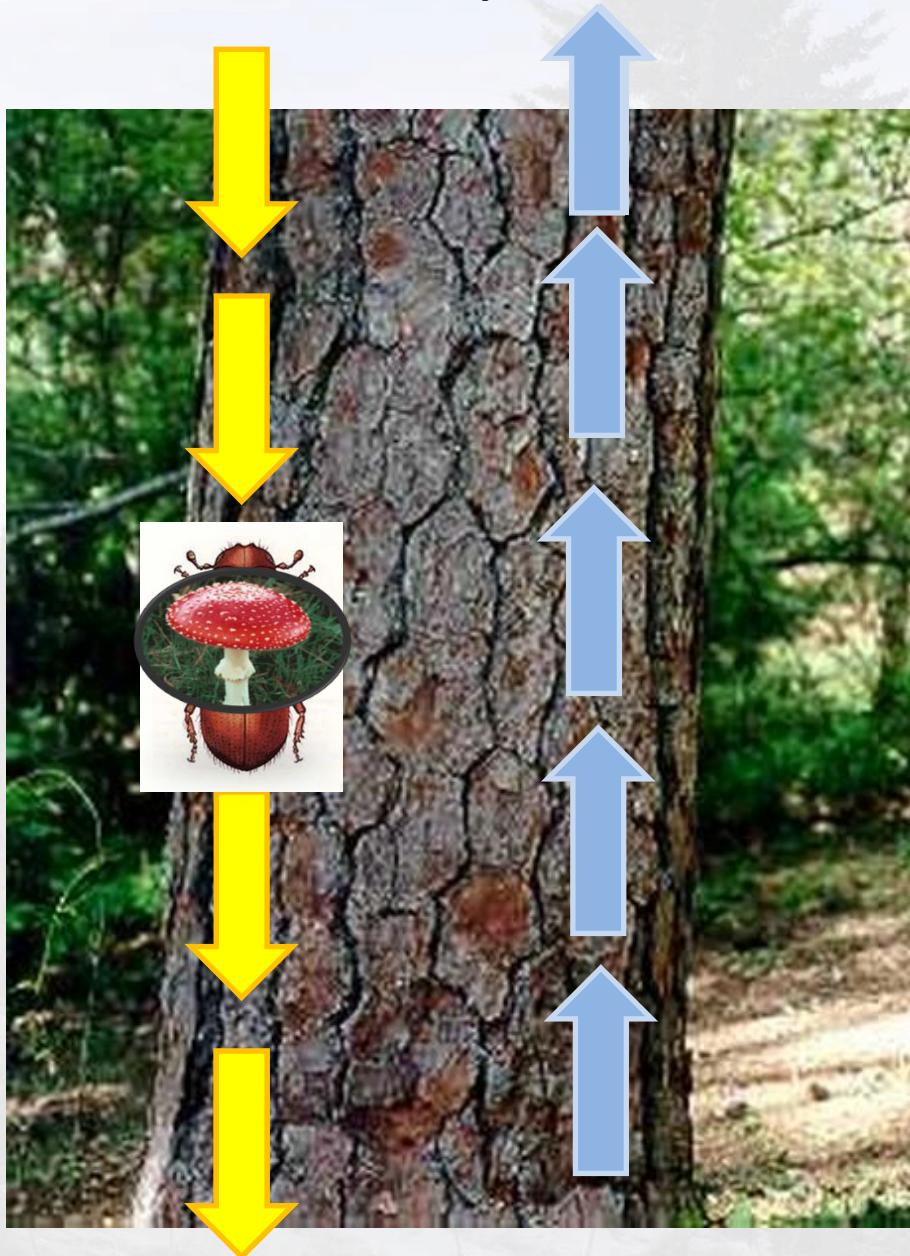


- How do beetles kill trees?
- What is the role of fungal associates in tree death?

- Carbon starvation
- Sapwood occlusion theory
- Defense depletion hypothesis
- Fungi plays NO role in tree death



Carbon Starvation & Sapwood Occlusion Theories

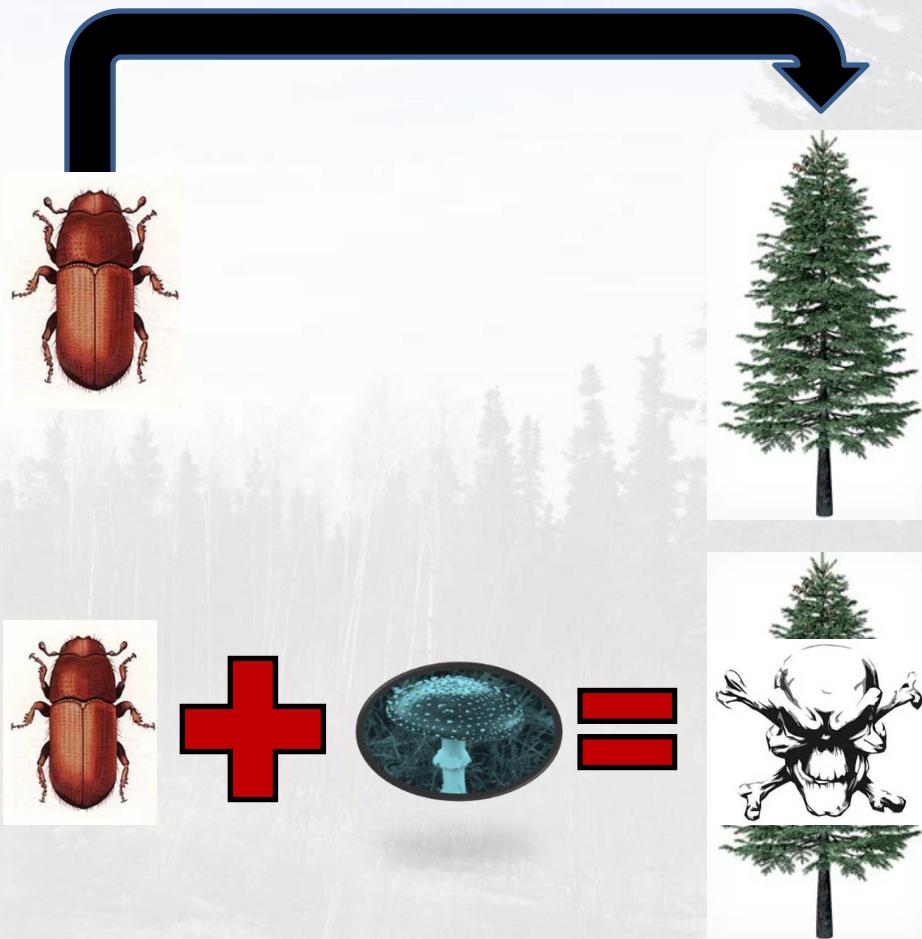


Defense Depletion Hypothesis



- Bark
- Resin ducts/resin pitch
- Sclerenchyma cells
- Calcium oxalate crystals
- Terpenes
- Phenolics
- Hypersensitive response
- Traumatic resin ducts
- Polyphenolic parenchyma cells

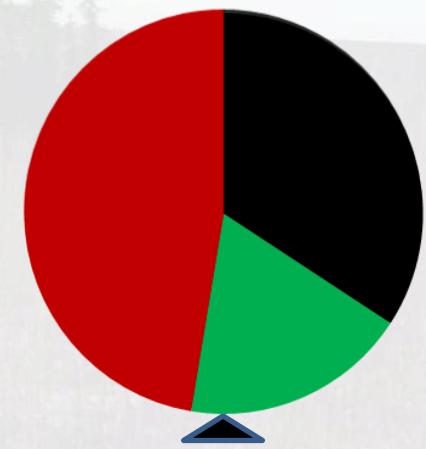
Defense Depletion Hypothesis



Tree Defenses



Point of no return



Point of no return

Sapwood Occlusion Theory

- Carbon NOT depleted
- Hydraulic failure IS taking place.
- Fungi does not appear to penetrate functional xylem
- May be a yet unknown mechanism disrupting tree water relations

Defense Depletion Hypothesis

- Fungal inoculations DO trigger tree defensive response
- Whether fungi has an additive effect on defense depletion has yet to be determined
- Fungi may metabolize defensive chemicals





55 species of bark beetle
known from Alaska.

34 species in the eastern
Interior.

3 species that are serious tree
killers.



The spruce bark beetle (*Dendroctonus rufipennis*)

- 6 million acres of mortality from 1990 to 2010.
- Outbreaks can last up to a decade or longer and can result in 50-90% mortality.
- Outbreaks are usually eruptive and dramatic in appearance.

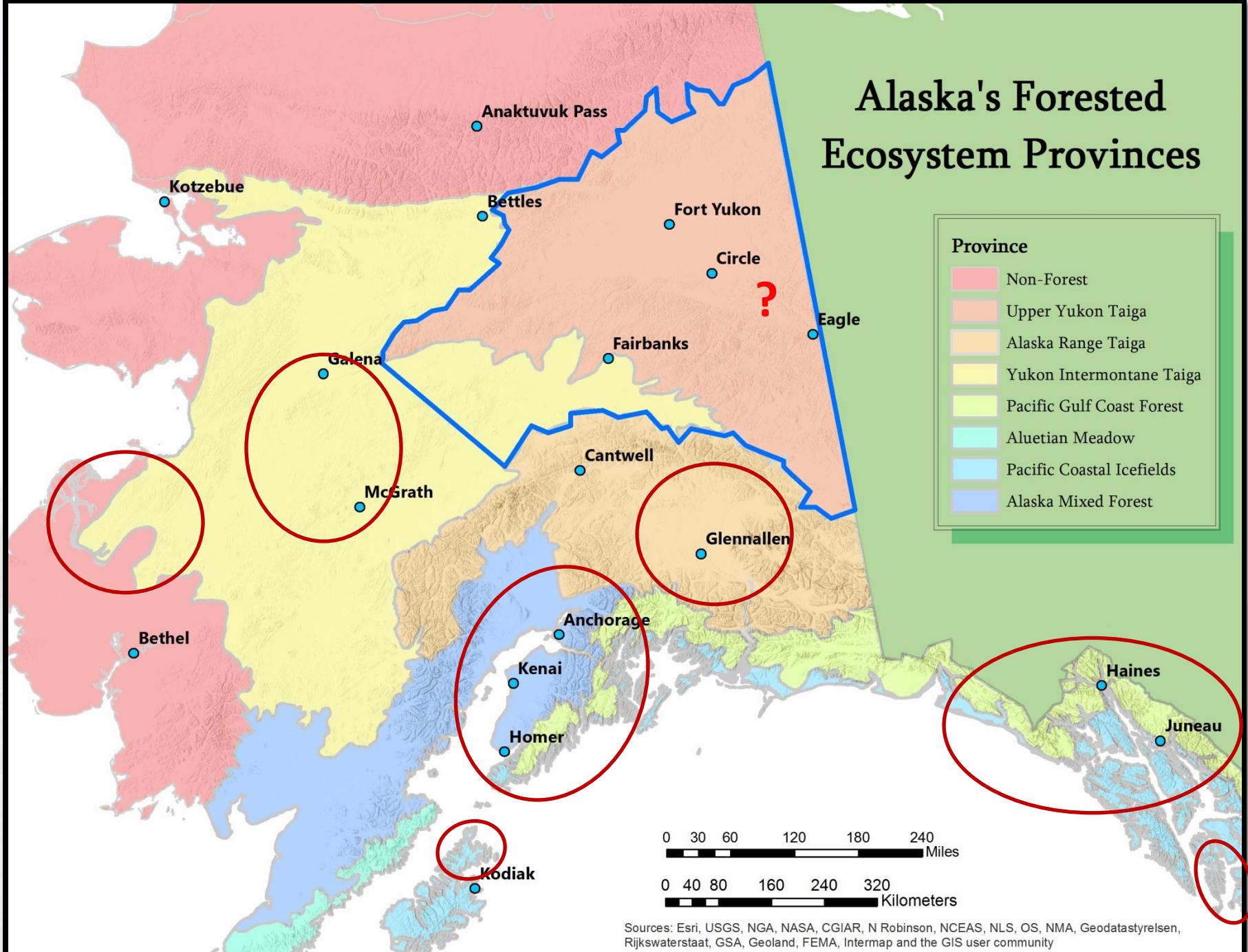


The northern spruce engraver (*Ips perturbatus*)

- 270,000 acres of mortality from 1990 to 2010.
- Outbreaks can last up to a decade or longer and have historically resulted in 5-50% mortality.
- Often scattered pockets of damage, killing the top of trees or a single side.



Alaska's Forested Ecosystem Provinces



Spruce Bark Beetle

Dispersal mostly \leq 300 m (max. 600+ m)
Mostly 2 year life cycle in Alaska, can be 1 year in warm weather
Overwinters in the stem of host material (1st year of 2) or root collar (1 year brood or 2nd year)

Needs large diameter trees (thick phloem)
Pitch-outs (i.e. unsuccessful attacks) more common

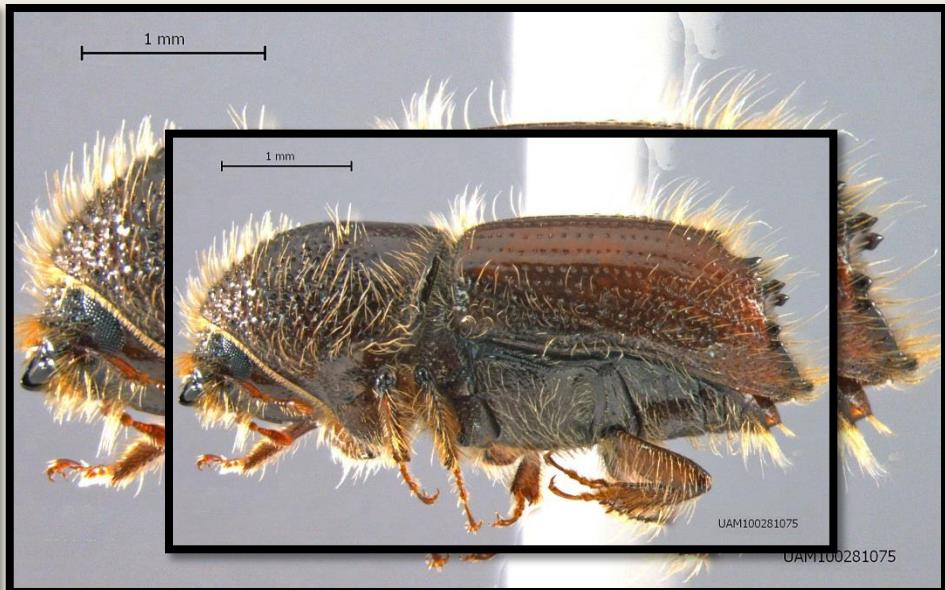


Steven Valley, Oregon Department of Agriculture, Bugwood.org

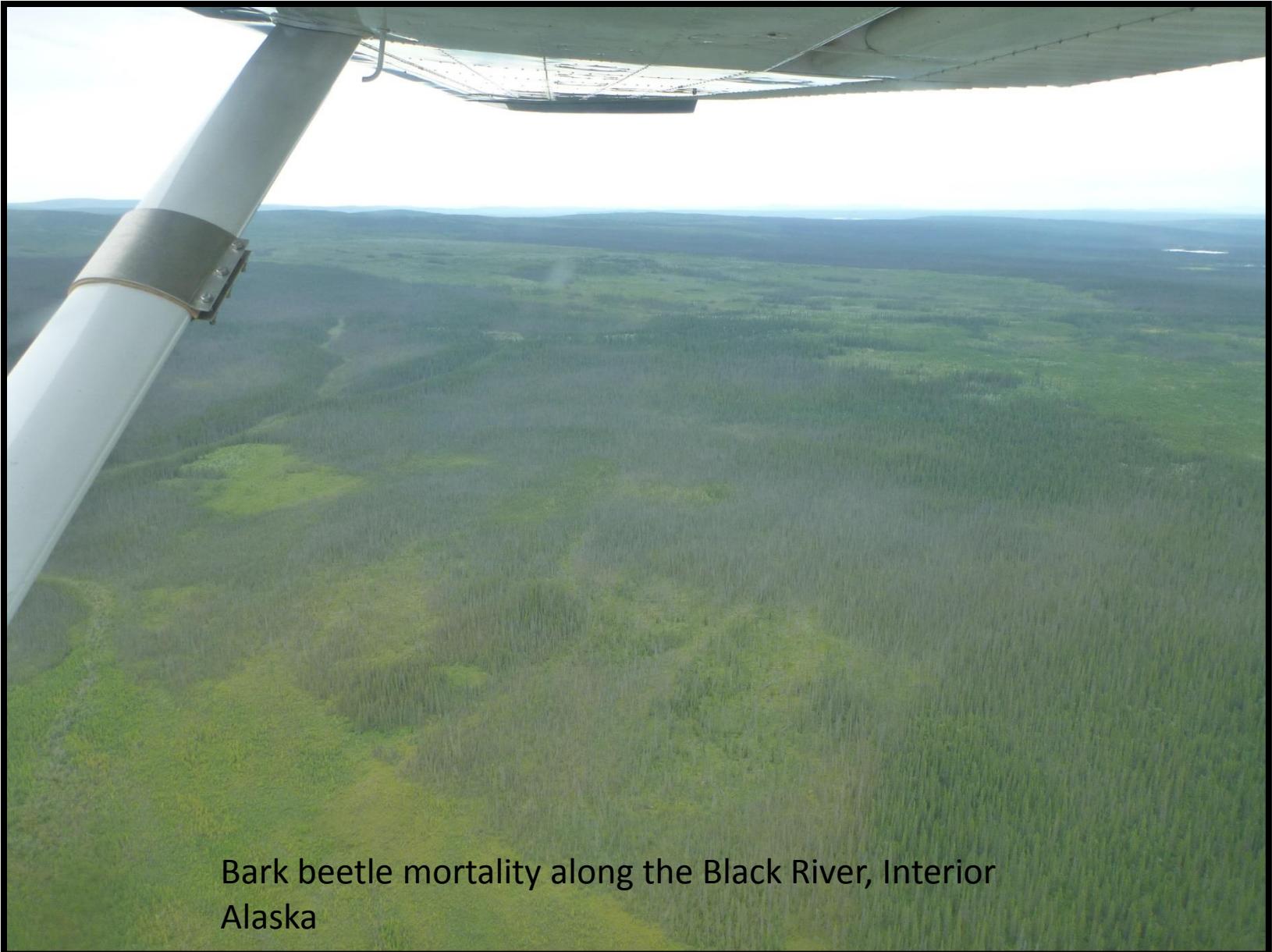
The Northern Spruce Engraver

Dispersal mostly \leq 30 m (max. 90+ m)
1 year life cycle

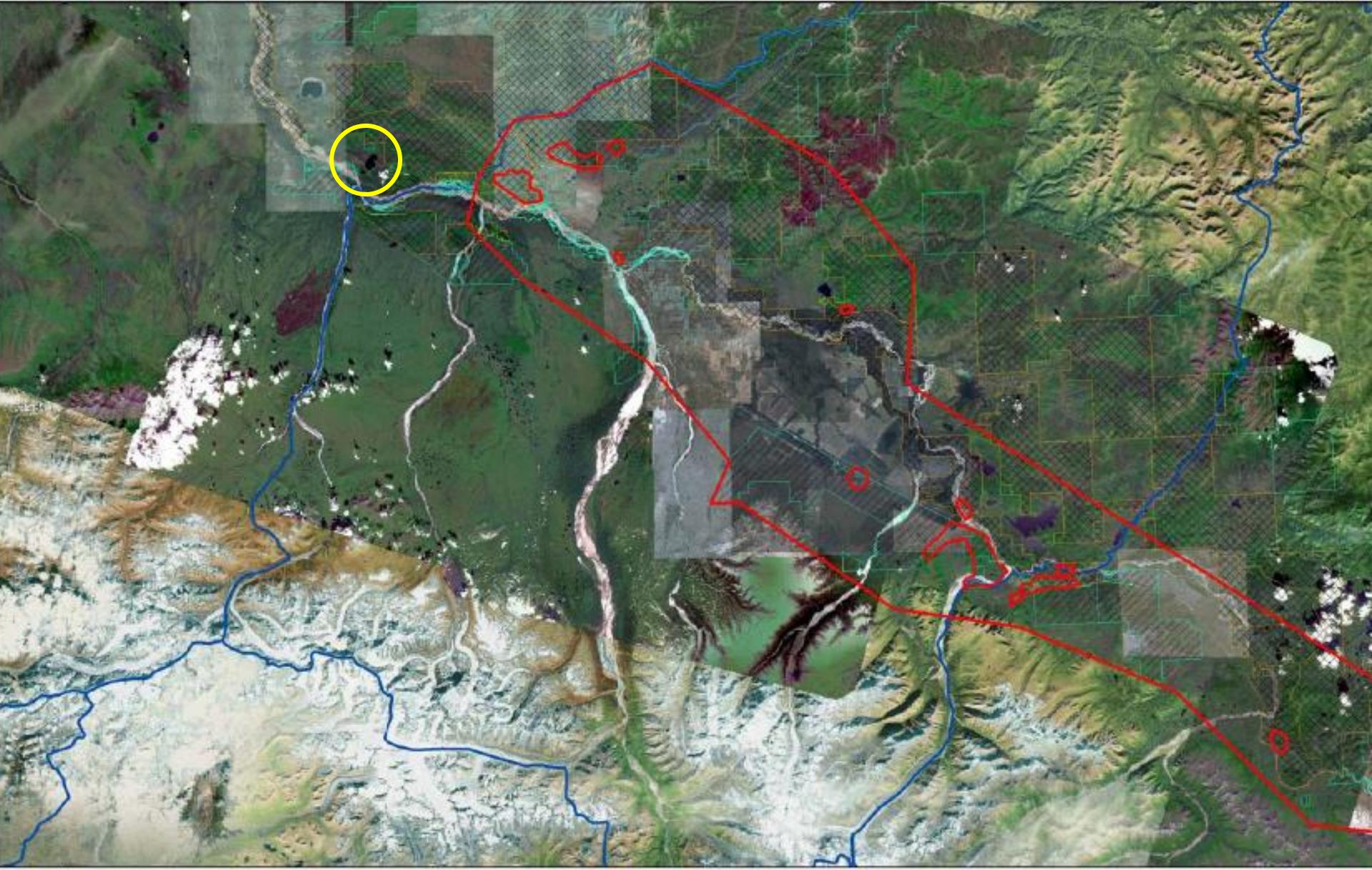
Overwinter as adults in the duff
Can breed in small trees (thinner phloem)
Pitch-outs uncommon, red boring dust common.



DS Sikes, University of Alaska Museum



Bark beetle mortality along the Black River, Interior
Alaska



Dry Creek Wind Event

- Severe Wind Throw Areas (accessible)
- ▨ GIS_FORESTRY.Tanana_Valley_SF
- ▨ GIS_FORESTRY.State_Classified_Forest_Lands



0 5 10 20 30 40 Miles





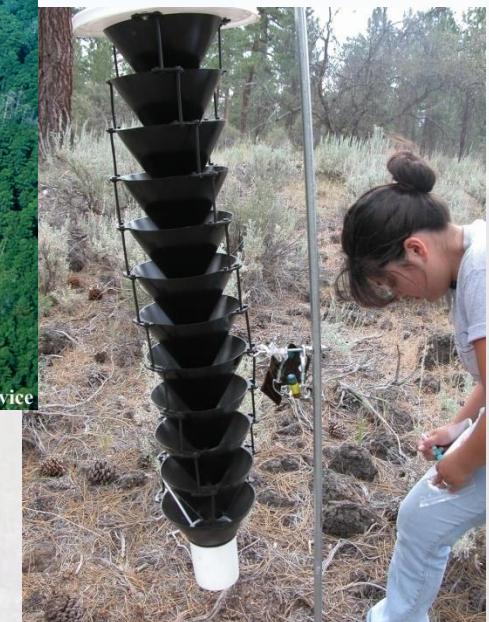
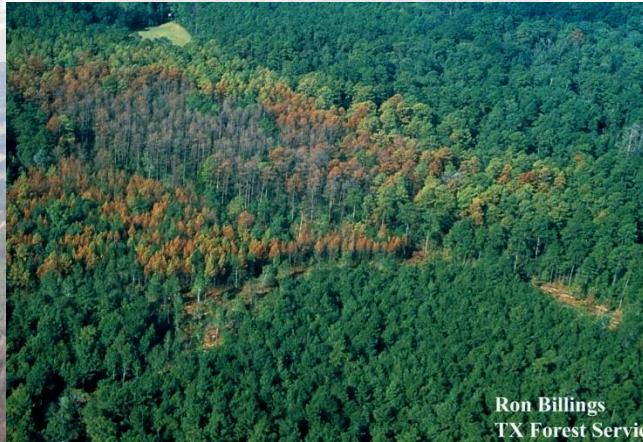
Management of bark beetles

- Prevention
- Suppression
- Restoration



How do we estimate bark beetle abundance?

- Issues of scale (number individual beetles, number of trees killed, size of an infestation, number of infestations?)



Management of bark beetles

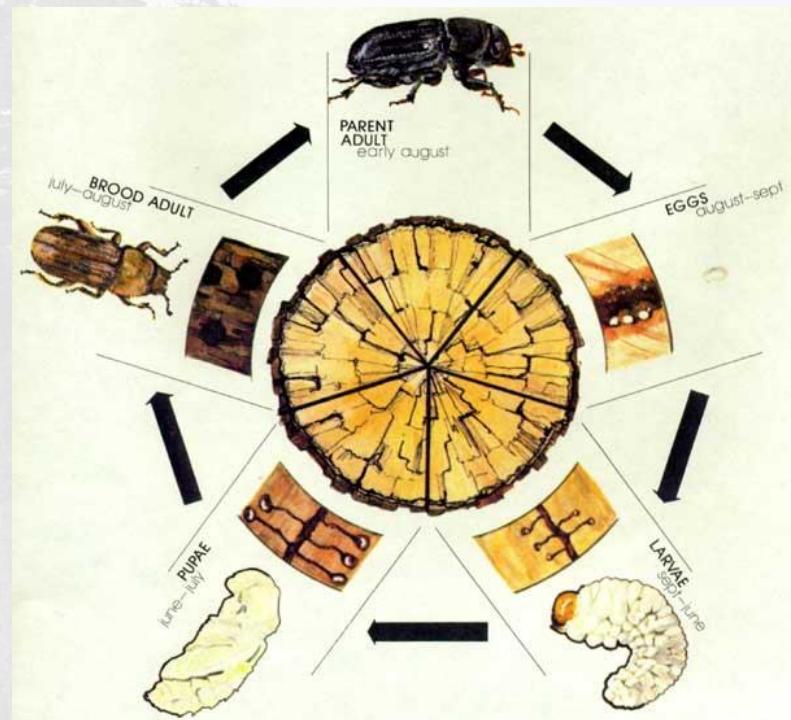
Look for “weak links” in pest life cycle

1. Find weak links in pest life cycle

2. Exploit the weak links

- Maybe linked to behavior
- Maybe linked to development

3. Break the weak links



Management of bark beetles

Thinning
Trap trees
Sanitation salvage
Pheromone-baited traps
“trap out”
Push/Pull
Prescribed fire
Biocontrol
Insecticides



Management of bark beetles

Things to keep in mind:

- Timing of harvests.
- Timely treatment of slash.
- Remove bark or dry materials as rapidly as possible.
- Slash and wounded trees actively draws beetles.



Questions?



Photo: Don Griffiths, Spencer Entomological Collection, Beaty Biodiversity Museum, UBC