Forest Health

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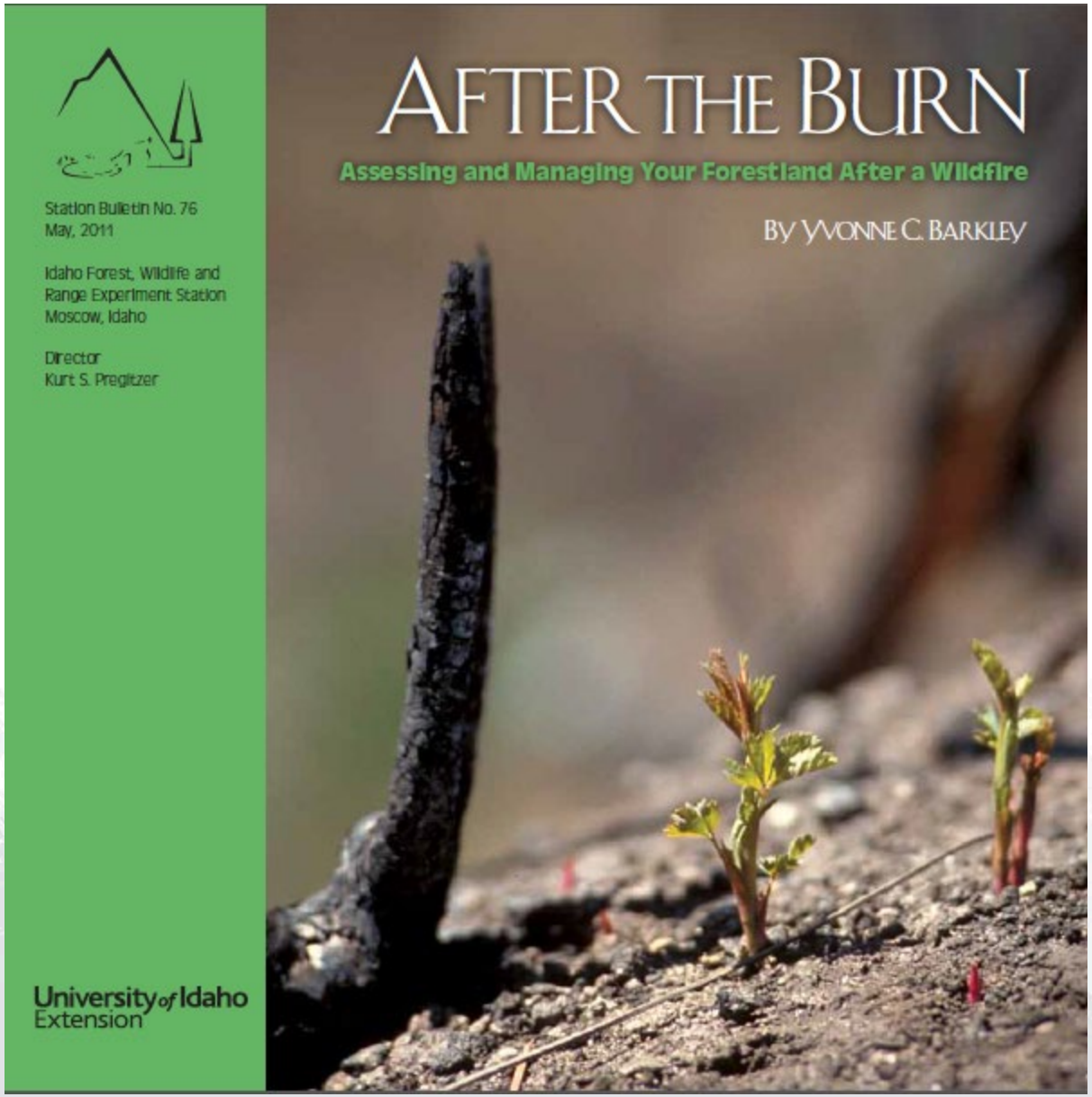
***Post-Widlfire Recovery Meeting*, Riverside, WA, September 7, 2023**



Google these 4 words:

after the burn Idaho

Table 2: Probability of fire-induced mortality for ponderosa pine.

	CROWN SCORCH VOLUME (PERCENT)									
DBH	10	20	30	40	50	60	70	80	90	100
5	49%	53%	60%	68%	78%	86%	93%	97%	99%	99%
6	42%	46%	53%	62%	72%	83%	90%	95%	98%	99%
7	36%	40%	46%	55%	67%	78%	88%	94%	98%	99%
8	30%	34%	40%	49%	61%	74%	85%	93%	97%	99%
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14	11%	12%	10%	21%	30%	43%	61%	77%	90%	96%
16	8%	9%	7%	16%	23%	35%	52%	71%	86%	94%
18	6%	7%	6%	12%	18%	29%	45%	65%	82%	93%
20	5%	5%	4%	10%	15%	24%	39%	59%	78%	91%
22	4%	4%	4%	8%	13%	21%	34%	54%	74%	89%
24	3%	4%	3%	7%	11%	18%	31%	50%	71%	87%
26	3%	3%	3%	6%	10%	16%	28%	47%	69%	86%
28	3%	3%	3%	6%	9%	15%	27%	45%	67%	85%
30	3%	3%	3%	6%	9%	15%	26%	44%	67%	85%

Sources/Notes: Table developed by David C. Powell, Forest Silviculturist, Umatilla National Forest, Pendleton, OR. These values are probabilities, expressed as a percent, of ponderosa pines of various diameters being killed by fire. They are based on an equation from Reinhardt and Ryan (1989) and a bark thickness factor from Keane et al. (1989). See Steele et al. (1996) for a description of the calculation methodology. White values on a blue background denote combinations of crown scorch and DBH with a mortality probability ≥ 50%.

Common post-fire questions:

Will trees die from fire injury?

Will there be a bark beetle outbreak?

How long will the wood be salvageable?

Crown Scorch

40% Scorch

DBH = 20”

70% Scorch

DBH = 14”

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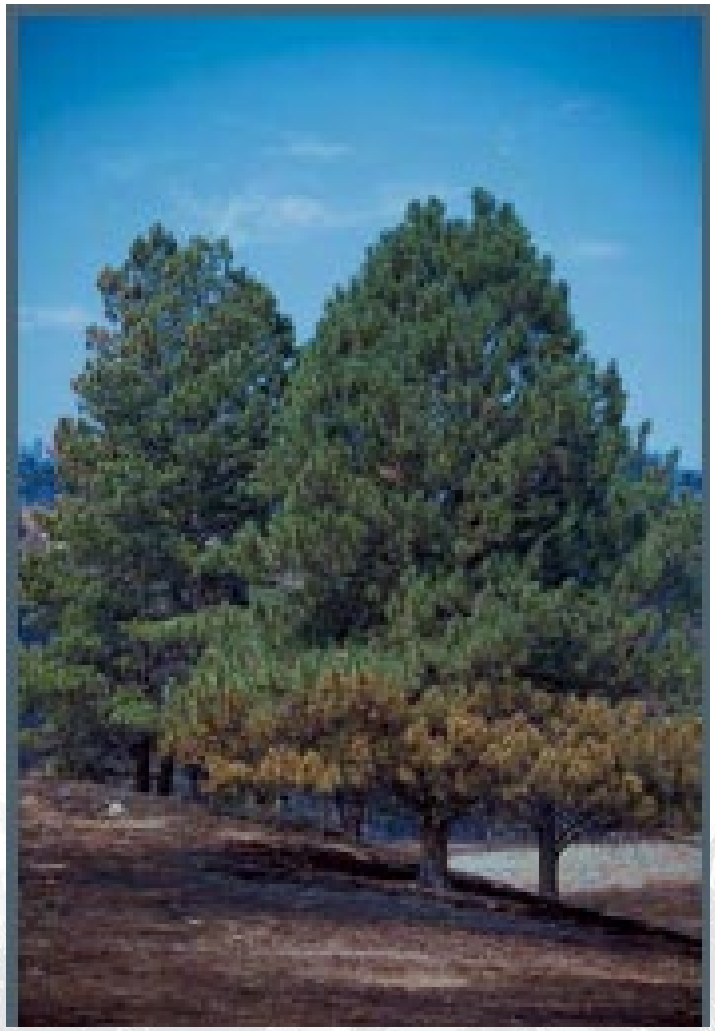
Major Factors Influencing Fire Injury

- Season wildfire occurred
- Pre-fire site quality
- Amount of woody debris

How were trees injured?

- Foliage consumption
- Needle set
- Crown scorch volume
- Stem char



Species of tree
- **Thick/thin barked**
- **Age**

Intensity

Duration

Direct/ Indirect effects (insects, disease, drought, prior health and vigor)

Sensitivity to fire injury varies by tree species and size and vigor

Thin bark ← more sensitive ← **Thick bark**

young trees, grand fir, Douglas-fir, ponderosa pine

Small buds ← more sensitive ← **Large buds**

Douglas-fir

ponderosa pine

Poor health ← more sensitive ← **Good health**

Small % live crown (desiccation vs scorch)

Small recent diameter growth

Dwarf mistletoe infected

Desiccation vs. Scorch are sometimes indistinguishable. “Consumption” = 100% kill

Fire resistant species more commonly analyzed by crown consumption

dried needles and branches

Ponderosa Pine/ Larch/ Western White Pine

Crown scorch most commonly used for analyzing Douglas-fir and other true firs

Some trees such as aspen have dormant buds and will favorably respond to fire disturbance

Needle set should be treated like consumption

- Foliage consumption

Needle Set

Crown Scorch

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Did the buds survive?

Photo: Montana State University

Douglas-fir buds (smallish) less; ponderosa pine more tolerant

Post-fire expectations

Serotiny

Soil-stored seeds

Hard seededness

Post-fire expectations

Wildlife Habitat Modifications

Invertebrates

Ken Bevis
Stewardship
Wildlife Biologist
(360) 489-4802

Post-fire expectations

Pulse – disturbances in streams
- increased stream flow
- increased temperatures
- increased nutrient and sediment transport

possibly increased large woody debris
potential for bank and channel erosion

Tend to be short duration

Water repellency and increased hydrophobia – potential for increased surface erosion and mass wasting (debris avalanches, debris flows, and torrents)

Fish come back relatively quickly so long as habitat is accessible

- Management
  - Salvage Harvest
  - Bark Beetles
  - Fungi
  - Weather Checking

- Reforestation
  - Afforestation
  - Natural Regeneration
  - Artificial Regeneration
    - Bareroot stock
    - Plug, or container grown

  - Site prep
  - Planting
  - Maintenance
    - Competing vegetation
    - Weeds

Post-fire expectations

CALL US !!

Silvicultural Contractors
Loggers
Consulting Foresters
Other

We’re from the government and we REALLY ARE here to help

Will there be a bark beetle outbreak?

Many different insect species use fire killed/injured
trees

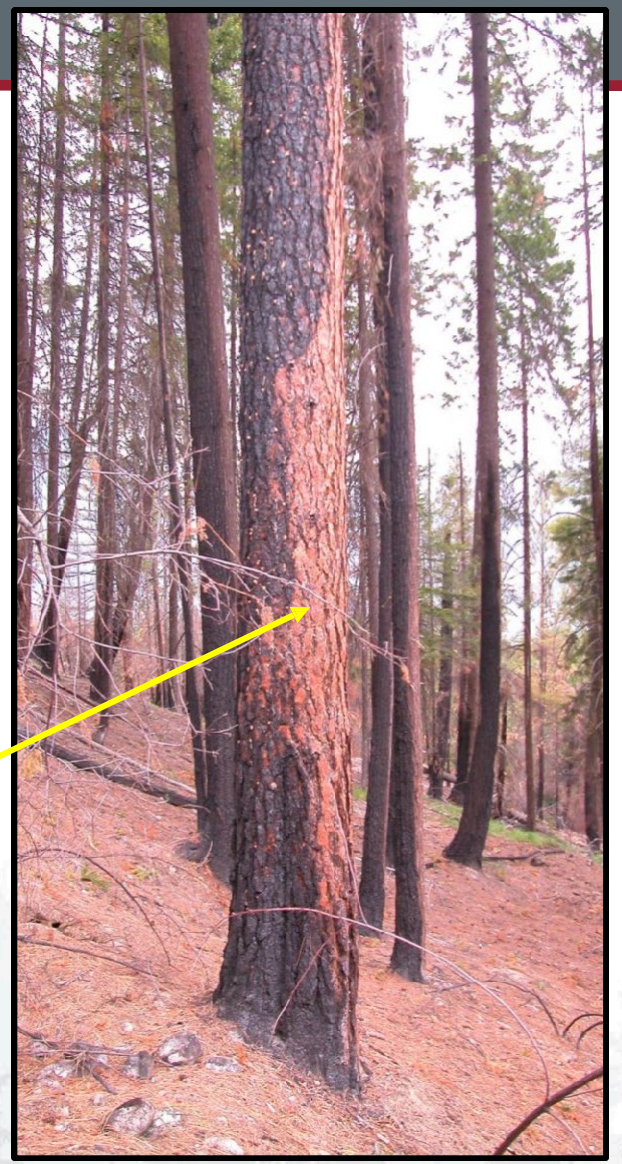
- Important ecological roles
- Biggest impacts to forest managers:
  - bark beetles killing live trees
  - associated bluestain
  - damage to wood products

Will there be a bark beetle outbreak?

- Phloem needs to be fresh (AKA not cooked dry) - limited bark char

NOT THIS

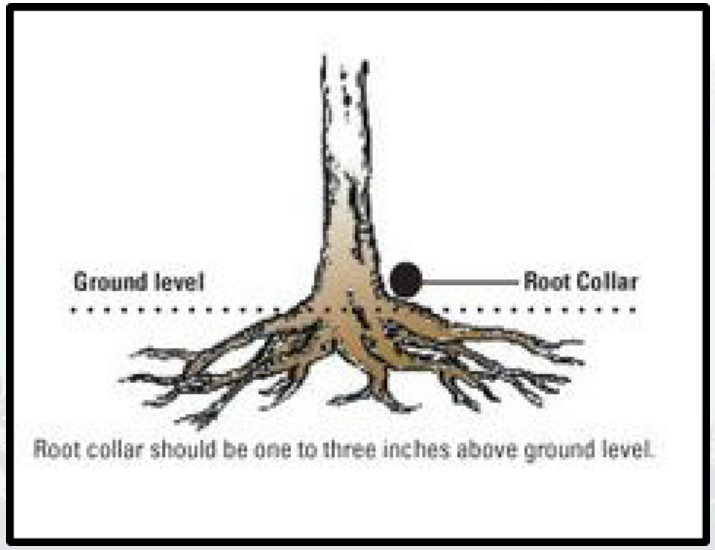
THIS



Severe Burns

- Few severely burned trees will be infested
  - unsuitable habitat

- Look for trees that have little apparent bole or crown damage, but may be completely girdled at the root collar



Moderate Burns

- Greatest risk of bark beetle infestation

Will there be a bark beetle outbreak?

- Needs to be sizable bark beetle population nearby
- Less likely after late season fires (late August and after)

- **Mountain pine beetle:**
  hosts – all pines
- **Western pine beetle:**
  host – ponderosa pine
- **Red turpentine beetle:**
  hosts – all pines
- **Fir Engraver:**
  hosts – grand fir
- **Pine engraver:**
  hosts – all pines
- **Douglas-fir beetle:**
  hosts – Douglas-fir, downed western larch

Mountain Pine Beetle

(Dendroctonus ponderosae)

- Active in >8 inch diameter lodgepole and pole sized low-vigor ponderosa
- Normally breeds in stressed, injured, diseased trees resulting in scattered mortality
- Outbreak populations kill apparently healthy trees over extensive areas

Table 6: Probability of fire-induced mortality for lodgepole pine.

	CROWN SCORCH VOLUME (PERCENT)									
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6	75%	78%	82%	87%	92%	95%	98%	99%	100%	100%
7	74%	77%	81%	86%	91%	95%	97%	99%	100%	100%
8	73%	76%	80%	86%	91%	95%	97%	99%	99%	100%
9	72%	75%	79%	85%	90%	94%	97%	99%	99%	100%
10	70%	74%	78%	84%	90%	94%	97%	99%	99%	100%
12	68%	71%	76%	82%	88%	93%	96%	98%	99%	100%
14	65%	68%	74%	80%	87%	92%	96%	98%	99%	100%
16	62%	66%	71%	78%	85%	91%	96%	98%	99%	100%
18	59%	63%	69%	76%	84%	90%	95%	98%	99%	100%
20	56%	60%	66%	74%	82%	89%	94%	97%	99%	100%
22	53%	57%	64%	72%	80%	88%	94%	97%	99%	100%
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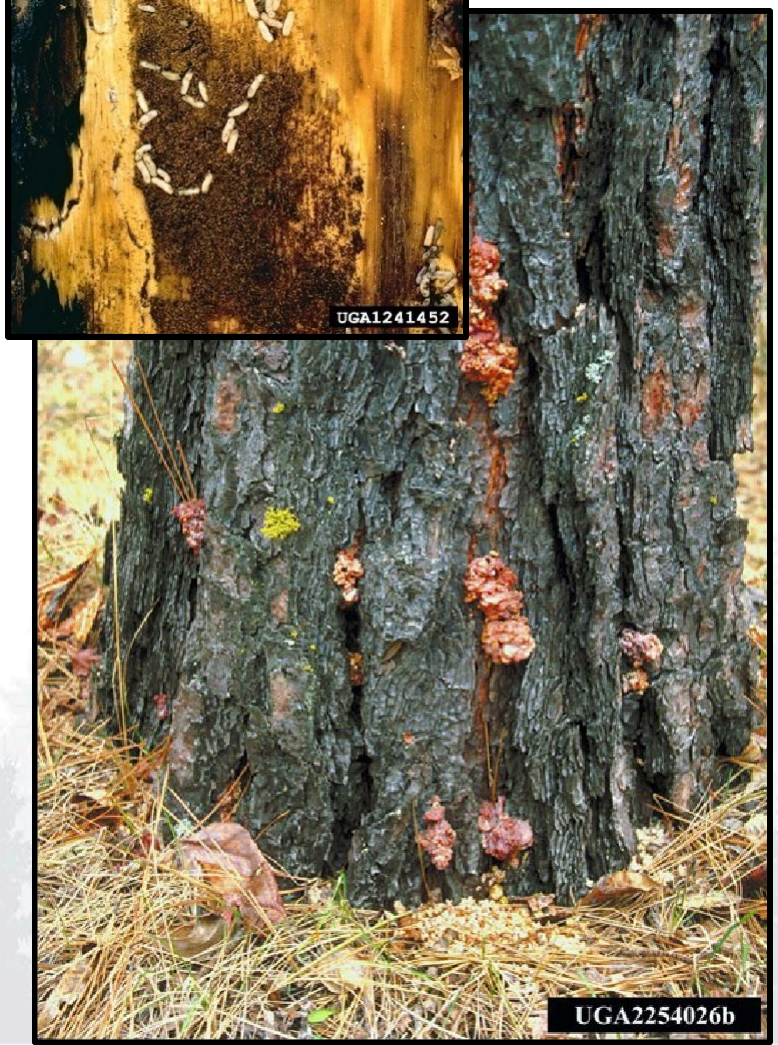
Western Pine Beetle

(Dendroctonus brevicomis)

- Prefers mature or weakened trees
- Outbreaks follow drought
- Overlapping broods, 1-2 generations per year
- Commonly group kill



Red Turpentine Beetle

(*Dendroctonus valens*)

Most pines are hosts

- Usually attack bottom 6 ft
- Common on stressed or fire scorched trees, stumps
- “Cave” larval gallery
- Forms large, ‘grainy’ pitch tubes near the base
- Considered a “secondary” bark beetle

Post-fire management of pine bark beetles

- Salvage fire damaged and infested pines before summer flight (consider season and severity of fire)
- Manage stand density to increase tree vigor
- Can use pesticides to prevent attacks on high value trees

Fir Engraver (*Scolytus ventralis*)

- Host: True fir
- Attacks weakened, dying or recently killed fir trees
- Salvage fire damage trees

Pine Engraver (*Ips pini*)

- Breed in fresh dead pine > 3 inches diameter (preferred over live trees)
- Several generations per year
- Large amounts of fire damaged trees can rapidly increase populations which can attack nearby live pine (usually small trees or tops of larger trees)

Pine Engraver Management Options

- Salvage fire damage
- Don’t leave fresh breeding material >3” diameter from Jan to July
- **Pile and burn** before flight (Mar – April)

Pine slash management options:

- Direct removal
- Chipping (remove or scatter)
- Lop and scatter in open areas – done in late summer/fall
- Don’t stack wood near live trees
- Outbreaks typically collapse after one year (high overwintering mortality, less host material)

Douglas-fir Beetle

(Dendroctonus pseudotsugae)

- **Hosts:** Douglas-fir, downed green western larch
- Breeds in felled, injured or diseased trees, resulting in widely scattered mortality
- Prefers >14 inch DBH trees
- Epidemic populations kill apparently healthy trees over extensive areas
- Commonly group kill

Post-fire Douglas-fir beetle management

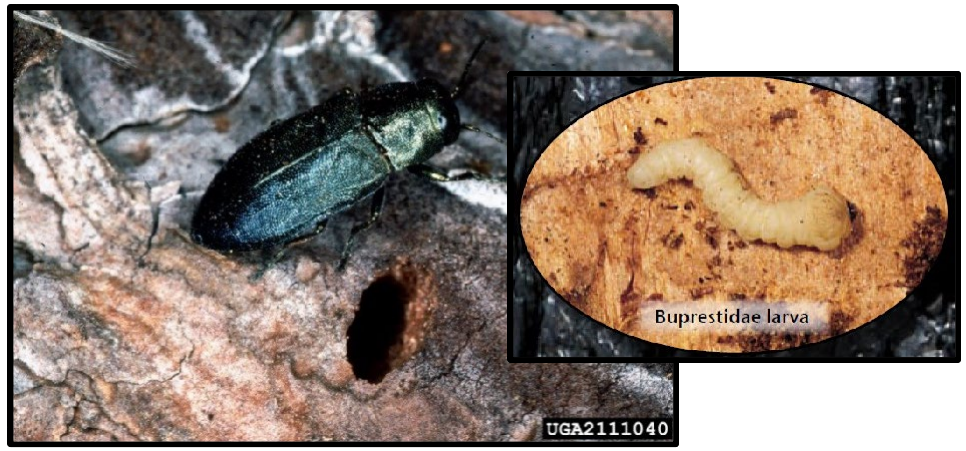
- DF less than 10” DBH is at low risk for outbreak
- After early season fire: salvage infested trees before spring flight
- After late season fire: salvage damaged trees before two springs pass

Verbenon & MCH (anti-aggregation pheromone)

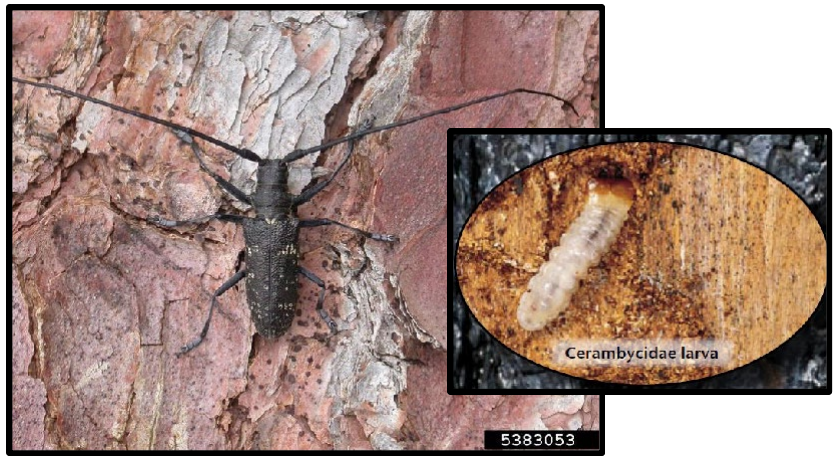
- Used to prevent Pine & Douglas-fir beetle attacks
- Best for high value stands – campgrounds, timber sale, old growth
- Can be applied by hand (bubble caps); from the air (flakes); or a goo
- Must be applied before April flight

How long will the wood be salvageable?

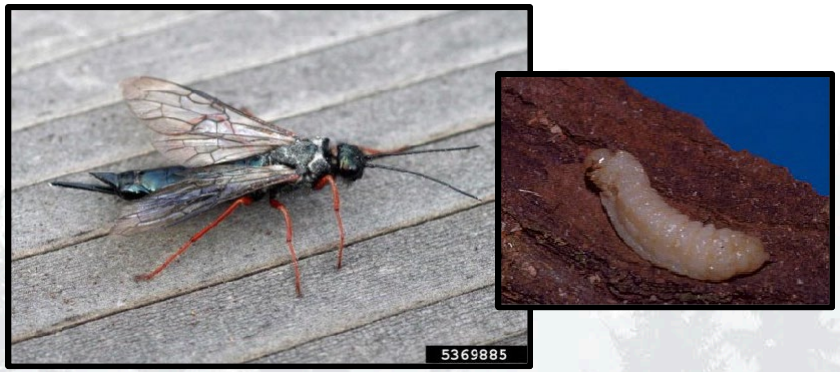
Three families of wood borers



Metallic wood borers
Flat-headed wood borers
Family Buprestidae



Long-horned wood borers
Round-headed wood borers
Family Cerambycidae



Woodwasps
Other colorful names
Family Siricidae

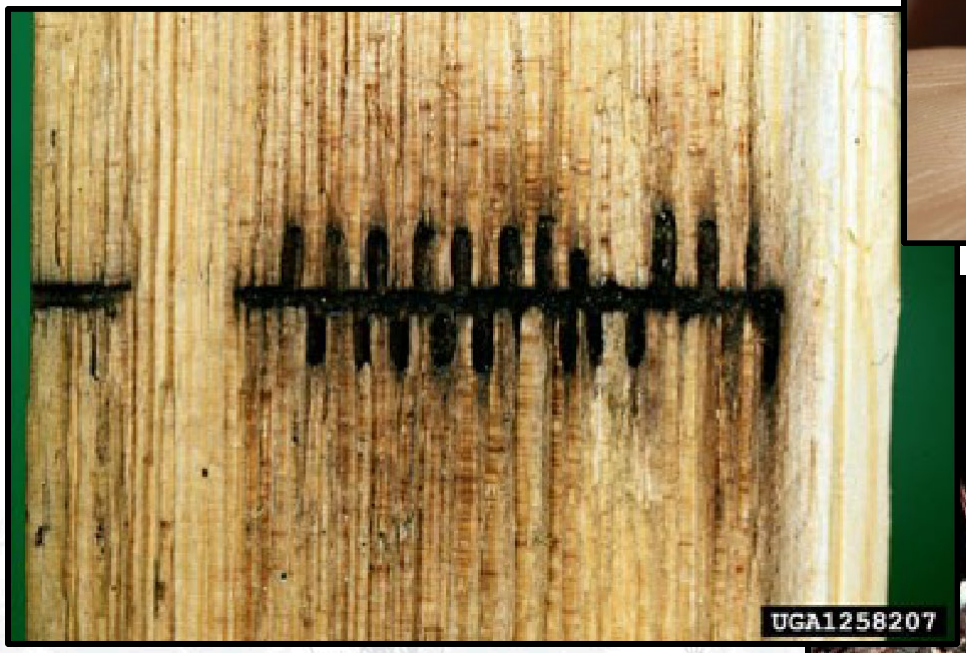
Bark beetle larva

How long will the wood be salvageable?

- Some wood borers attack before fire is out

"Fire bug"
(*Melanophila acuminata*) has infrared sensors

- Wood borers may tunnel in sapwood within a few months of fire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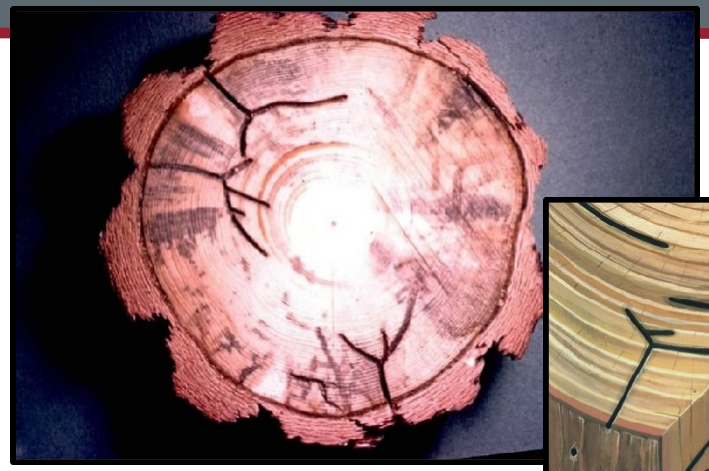
UGA1361002

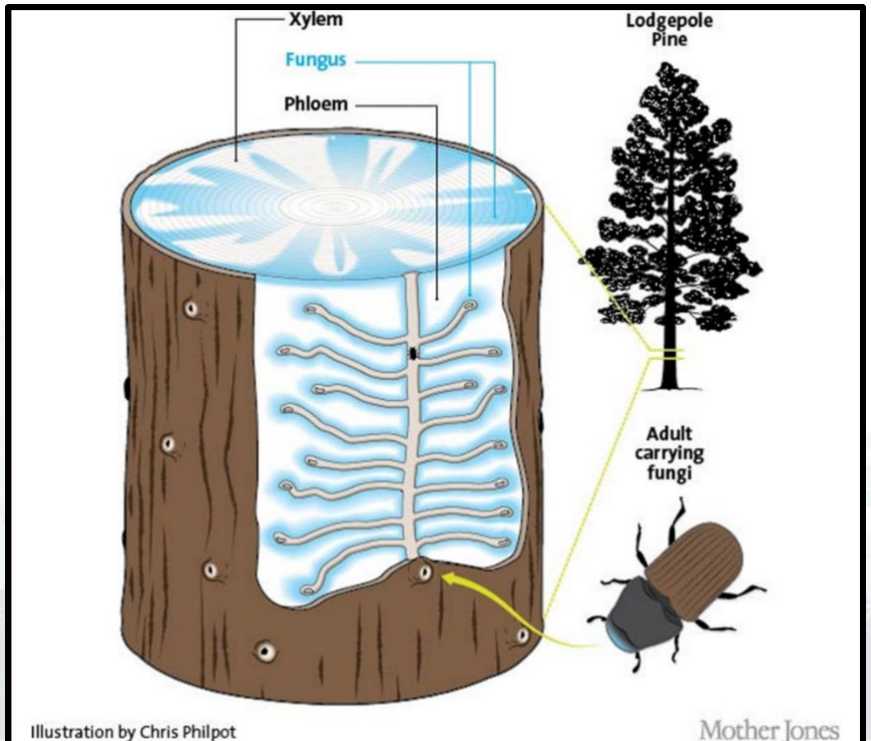
How long will the wood be salvageable?

- Ambrosia beetles can enter sapwood immediately after the fire and into the first year (don't use phloem)
- Require moisture



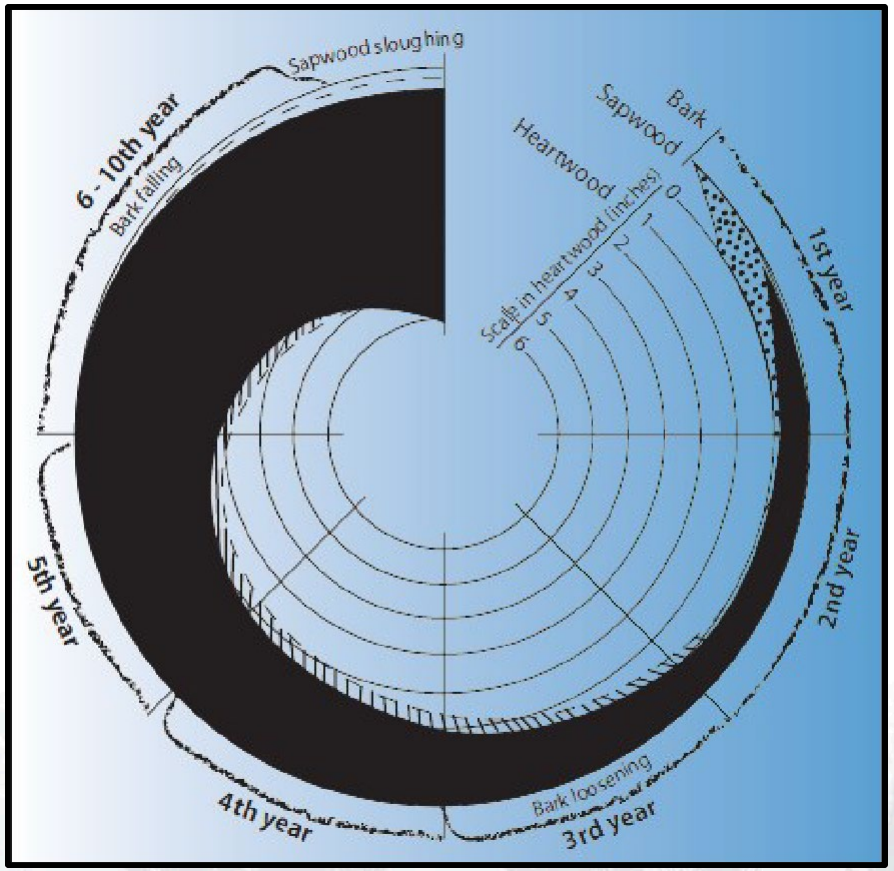
How long will the wood be salvageable?

- In trees attacked by bark beetles and/ or wood borers, bluestain can appear within weeks
- Bluestain growth slows later in season
- Bark beetles & wood borers can’t use severely burned trees, so this limits bluestain in these trees
- **Salvage appearance-grade wood within 1-2 months**



How long will the wood be salvageable?

- Decay fungi damage sapwood within 6 months and heartwood starting second year
- **Salvage for dimensional grade within 6 months**



Decay rate of fire killed Douglas-fir

Summary

- How long will the wood be salvageable?
  - Pine staining and wood boring insect activity start right away
  - Prioritize salvage for high value products
  - Manage to optimize tree vigor and meet long term objectives
  - Leave a few wildlife trees per acre!

Acknowledgements

- Melissa Fischer, Karen Ripley, Glenn Kohler, Yvonne Barkely
- Bugwood Network (www.bugwood.org)
- Forestry Images

Thank you for your attention!

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