



Invasive insect threats to Oregon trees

Emerald ash borer



Mediterranean oak borer



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ODF Forest Health: <http://tinyurl.com/ODF-ForestHealth>

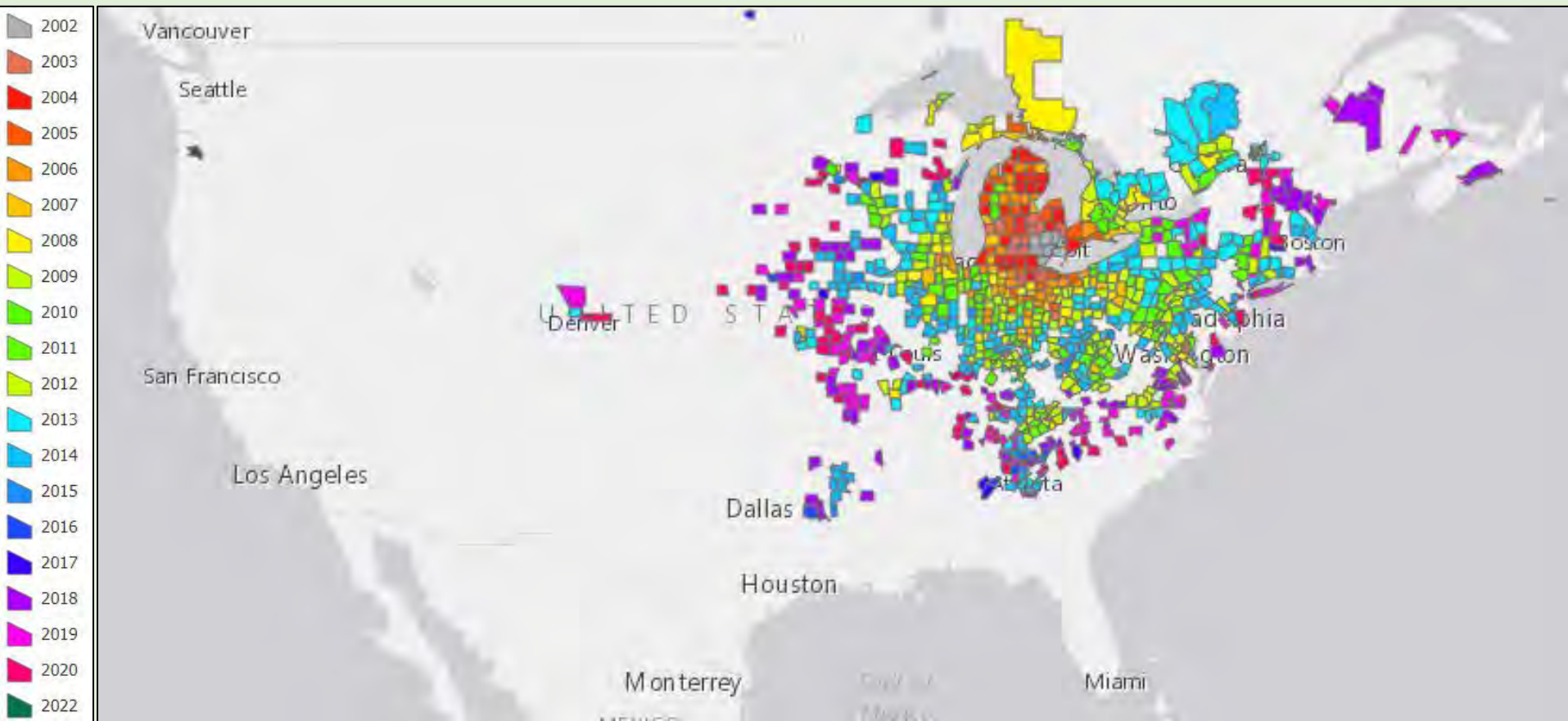


Newly introduced exotic:
Emerald ash borer (EAB)
detected in Forest Grove June 30, 2022



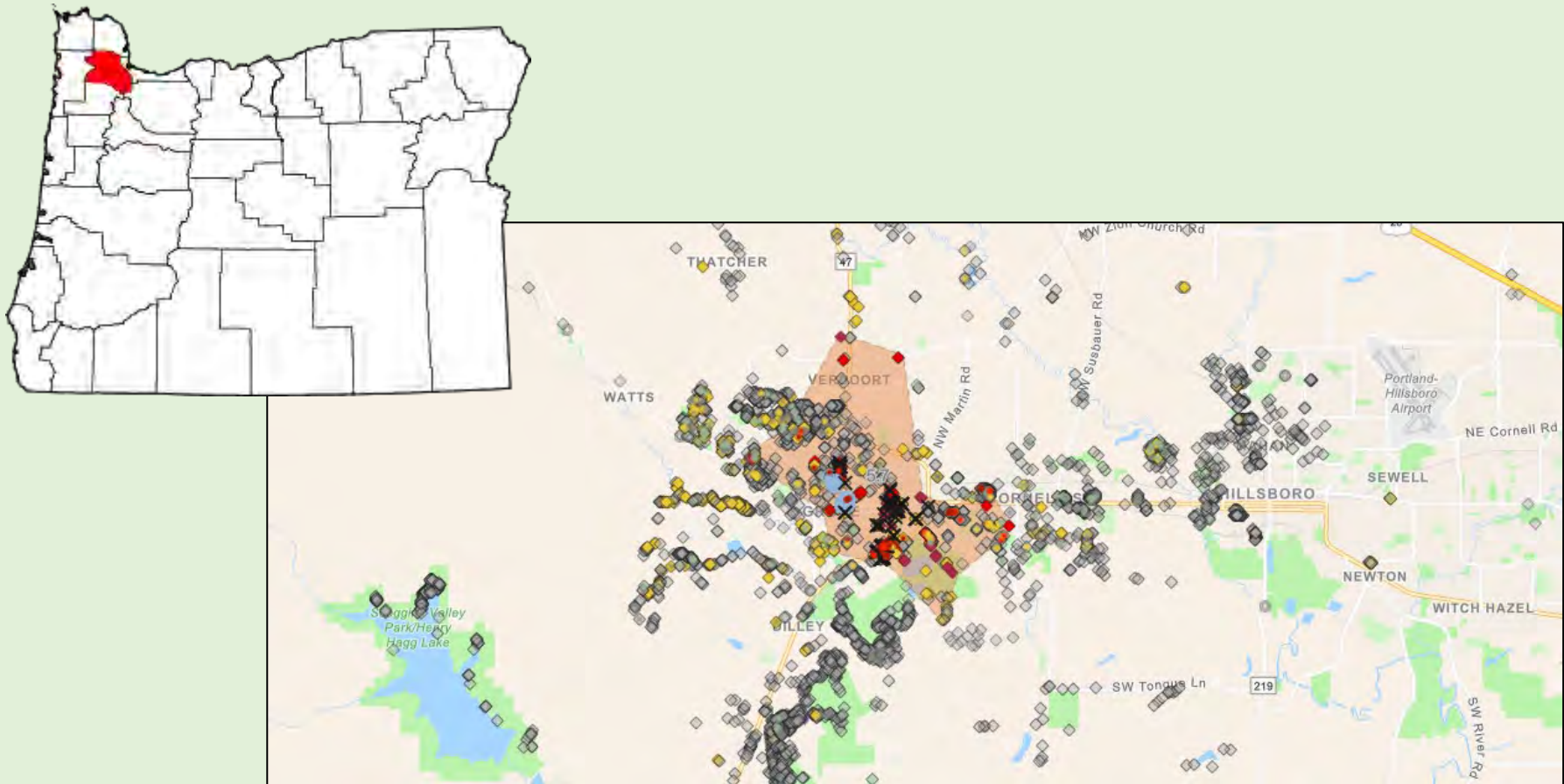
EAB presence in the U.S.

- 2002: Detected in US (Michigan)
- 2013: jumped quarantine and detected in Colorado
- 2019: Reached 33 states (as of 2023 in 36 states)
- 2022: Detected in Oregon (first detection west of Colorado)



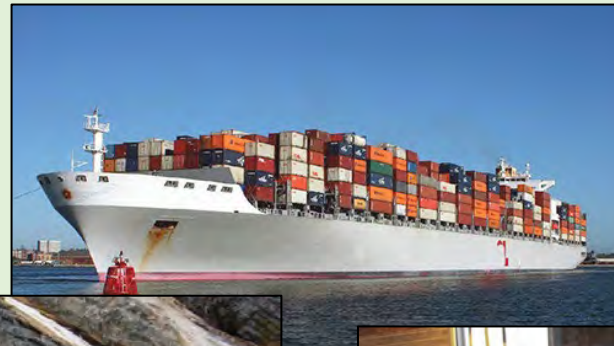
Current Distribution in Oregon

- Location(s): Washington County
- Square miles known to be infested with EAB: **10.4 sq. mi.**



Pathways

- Untreated wood imports
- Firewood (don't move >10 miles)
- Nurseries



Damage

- >95% ash mortality in some counties
- 100+ million trees killed in 30+ states since 1990s
- Never successfully eradicated
- High economic and ecological cost



TOLEDO STREET BEFORE AND AFTER EMERALD ASH BORER

BEFORE: JUNE 2006

PHOTO COURTESY OF DAN HERMS, OSU

AFTER: AUGUST 2009




Portland street tree example

- 4.8% (or 72,000) tree trees are ash
- *\$49M total cost for removal and replacement*

portland.gov

Data, Reports, and Maps

Use the map below to find out what trees are in your park or on your block, or search by address, species, or even filter for the largest tree in your neighborhood on our mobile-friendly [Tree Inventory Project Web App](#).



City of Portland, Oregon... esri

Reports

See the results from the work of over 2,000 volunteers to inventory trees across every neighborhood in the city

- [Citywide Street Tree Inventory Report](#) (5.45 Mb)
- [Park Tree Inventory Report](#)

Individual street tree reports and detailed Tree Plans for over 50 neighborhoods are also available - email treeinventory@portlandoregon.gov for information.

[Back to top](#)



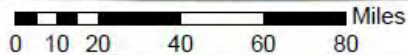
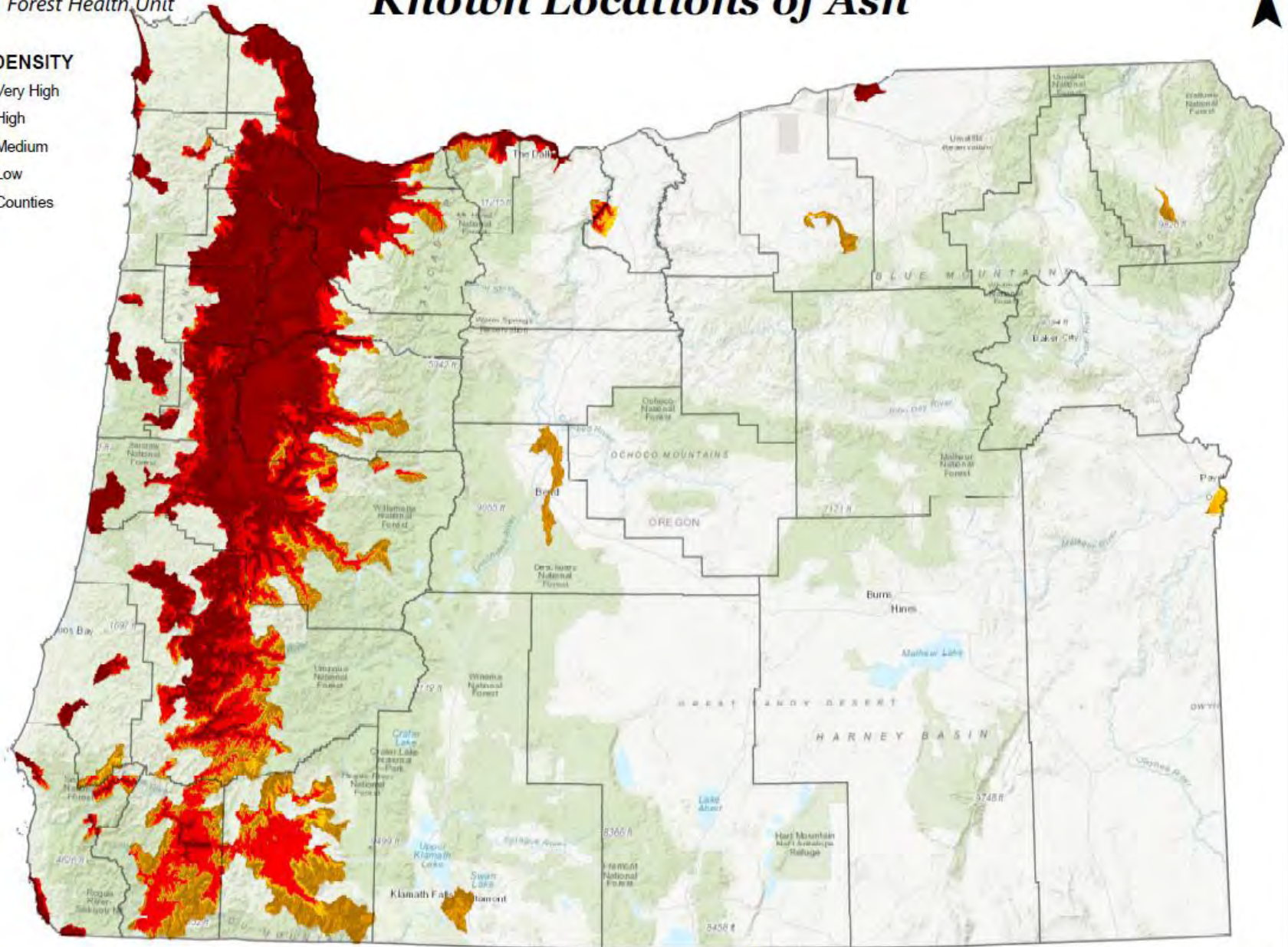


Known Locations of Ash

N

ASH DENSITY

- Very High
- High
- Medium
- Low
- Counties



Oregon ash

(*Fraxinus latifolia*)

- Oregon's only native ash tree
- Important riparian tree
- Shading, bank stabilization
- Habitat for T&E species
- Wood products
- Cultural resource

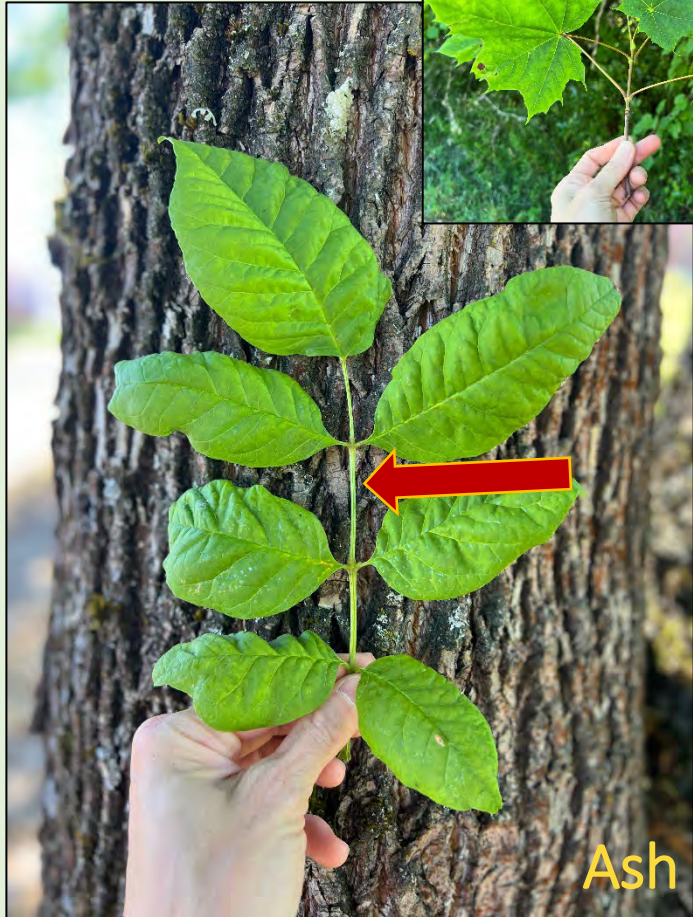


Ash islands of habitat





- 1) Multiple (instead of single) leaves attached to leaf stem
- 2) Branches opposite instead of alternating
- 3) Diamond shaped/lattice bark on older trees
- 4) Single winged seed



Mountain ash is not a true ash



EAB

(*Agrilus planipennis*)

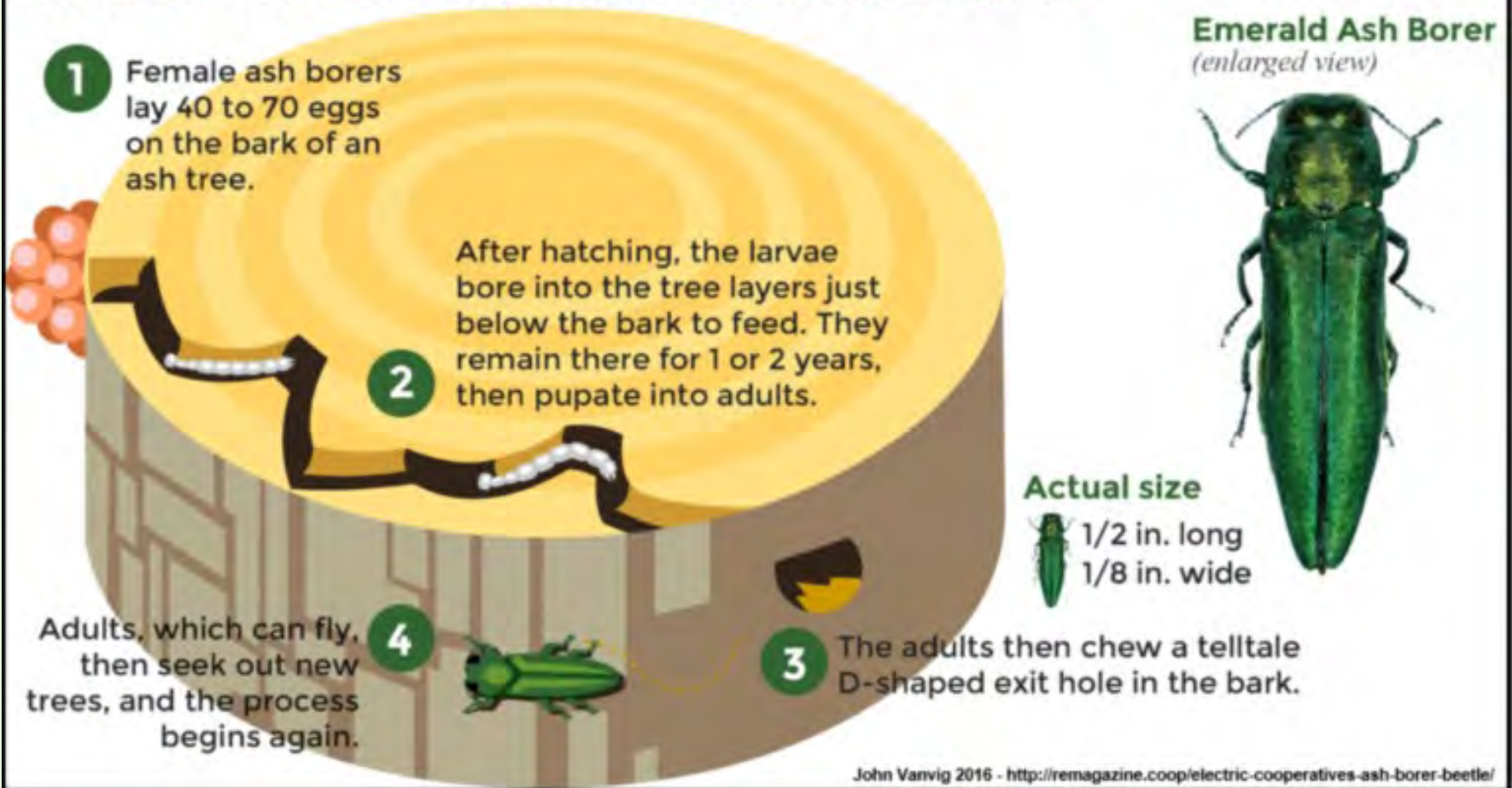


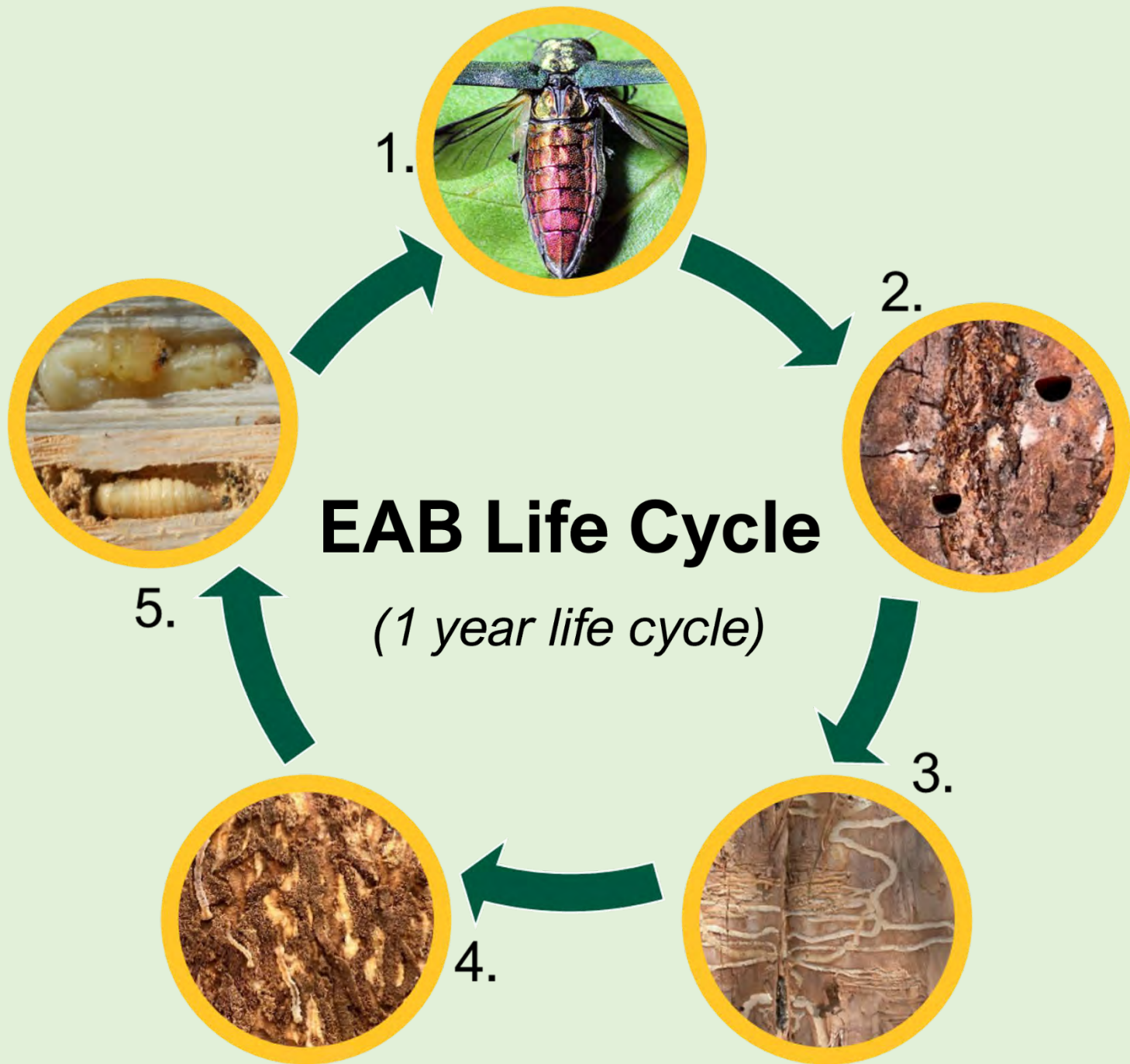
- Native to eastern Asia
- Woodboring type beetle (doesn't go deep)
- Larvae girdle trees
- Prefers ash, can also infest other members of olive family



EAB life cycle

LIFE CYCLE OF THE EMERALD ASH BORER





What does EAB look like?

- Slender, approx. ½” long
- All green
- No lines or sculpturing on “back”



Emerald Ash Borer and Oregon Look-alikes

OREGON DEPARTMENT OF AGRICULTURE

Insect Pest Prevention & Management Program
635 Capitol St, NE, Salem, OR 97301
503.986.4636 | ods.direct/EAB

1 inch
*specimens shown to scale - 2.5X life size

August 2022

- Jewel Beetle *Buprestis intricata*
- Green Bark Beetle *Ternstroemia chlorodis*
- Jewel Beetle *Buprestis langi*
- Western Cedar Borer *Trachylele blondeli*
- Salmonfly Cicada *Platypedia areolata*
- Golden Jewel Beetle *Buprestis auriventra*
- Bronze Birch Borer *Agrilus anxius*
- Green Click Beetle *Nitidulmonius resplendens*
- Longhorn Beetle *Pseudogauratina cressoni*
- Ground Beetle *Lebia viridis*
- Cuckoo Wasp *Chrysis angolaris*
- Sweat Bee *Agapostemon femoratus*
- Green Dock Beetle *Gastrophysa cyanea*
- Banana Stick Bug *Banasa dimidiata*
- Willow Gall Borer *Agrilus poltus*
- Jewel Beetle *Chrysobothris viridicyanea*
- Jewel Beetle *Chrysobothris cyanella*
- Jewel Beetle *Anthaxia prasina*
- Pale Green Weevil *Polydrusus impressifrons*
- Sharpshooter *Draeculacephala carasicornis*
- Green Blister Beetle *Lytta cyanipennis*
- Jewel Beetle *Phaenops gentilis*
- Jewel Beetle *Buprestis adjecta*
- Scarab Beetle *Dichelonyx linearis*
- Japanese Beetle *Popillia japonica*
- Jewel Beetle *Buprestis subornata*

OREGON DEPARTMENT OF AGRICULTURE

**EMERALD ASH BORER
COMMON LOOKALIKES**

WESTERN CEDAR BORER ❌

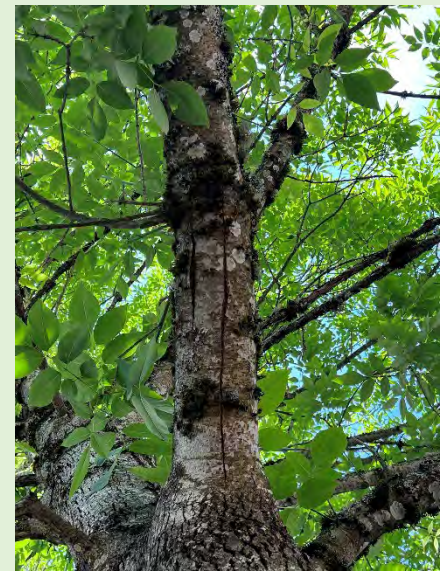
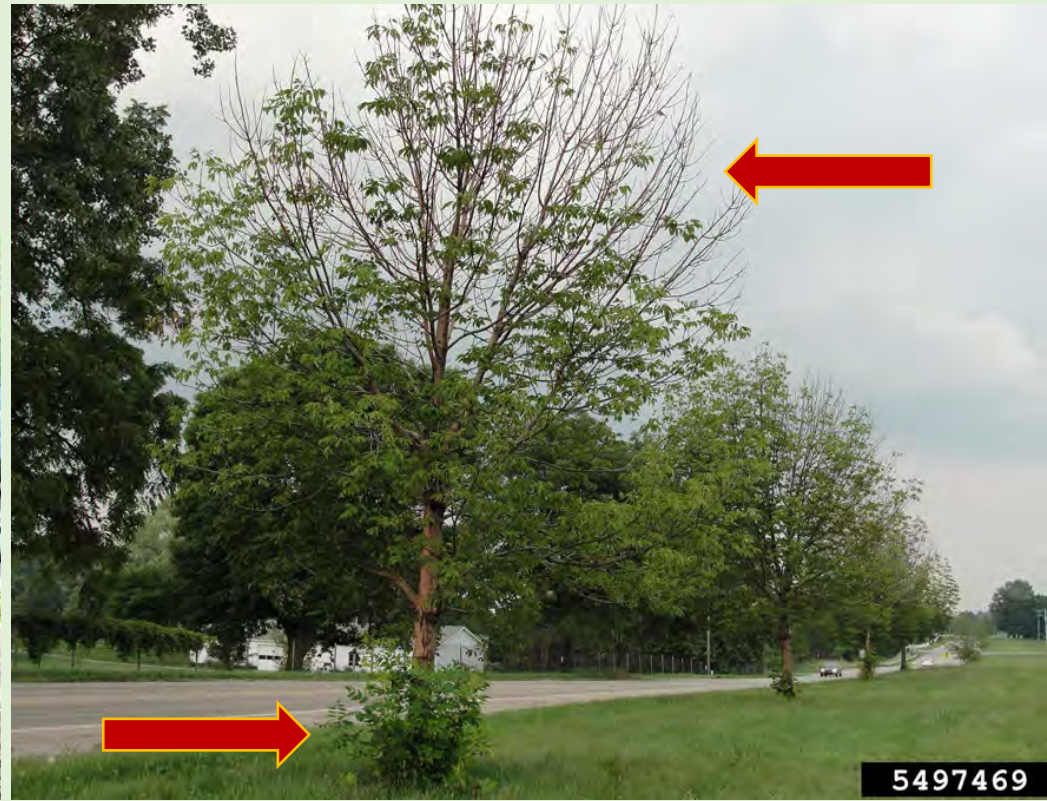
GOLDEN JEWEL BEETLE ❌

EMERALD ASH BORER ✅

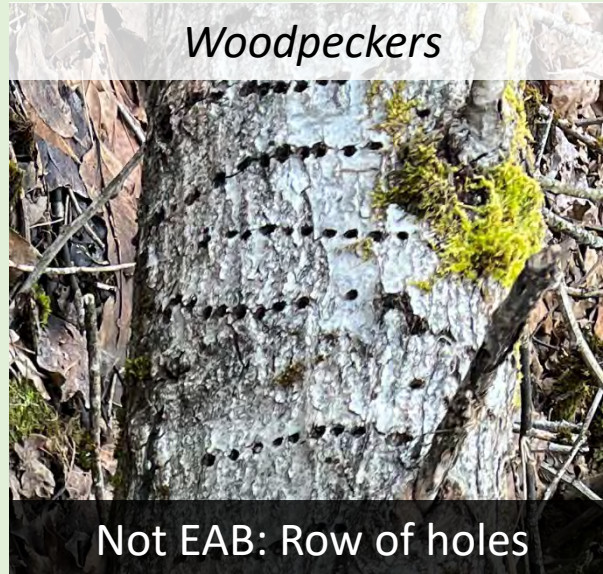
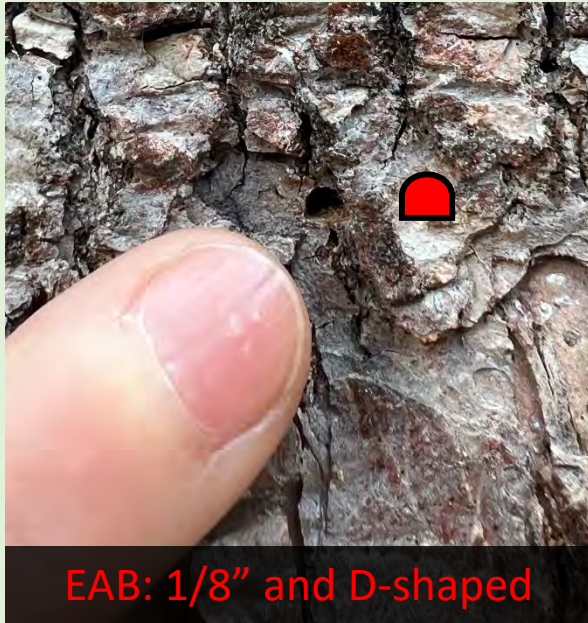
DON'T BE FOOLED!

Signs & Symptoms

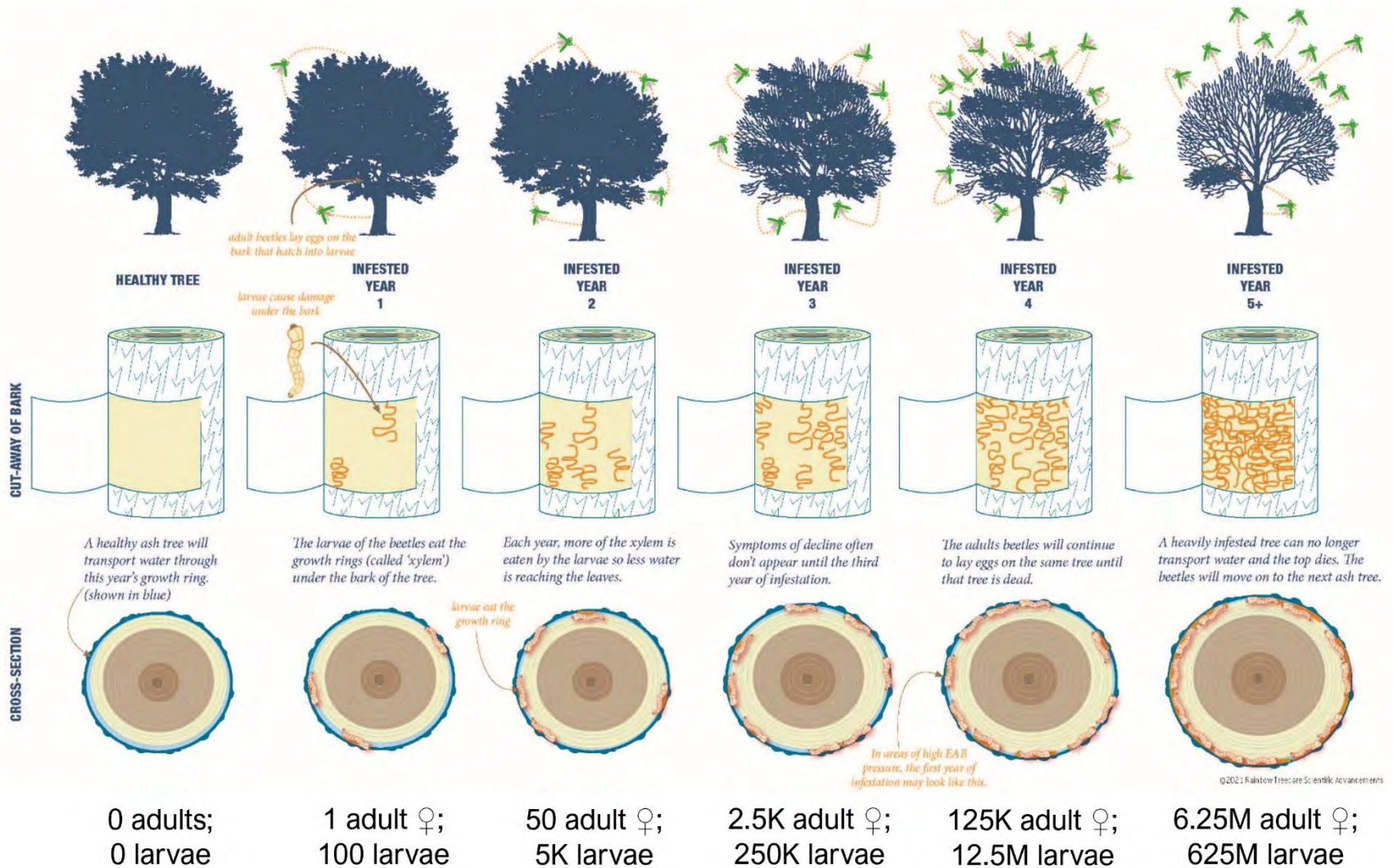
- Thinning crown or topkill
- Epicormic shoots
- Bark splits
- Woodpecker flecking
- D-shaped exit holes



ID EAB exit holes



EAB infestation progression



Prevention / Treatment

Prevention

- Take stock of ash trees and monitor health
- Healthy ash trees will die *less quickly*
- Avoid planting ash
- Systemic insecticide
- Don't move firewood more than 10 miles



Treatment

- Chip, masticate
- Kiln-dry (70 minutes at 60°C)
- Incinerate



Management recommendations: <https://extension.oregonstate.edu/forests/cutting-selling/what-do-about-emerald-ash-borer-recommendations-tree-protection-eab>

Reporting infestations

- OFPD training
- Oregon Invasives Online Hotline



Look for symptoms of damage + sign of insect

Preventative insecticides

- Current product list:

<https://www.oregon.gov/oda/shared/Documents/Publications/Publications/IPPM/Pesticides-EABList.pdf>

- Advised if canopy dieback is <30%
- Systemic emamectin benzoate at the lowest dose for 3-year protection

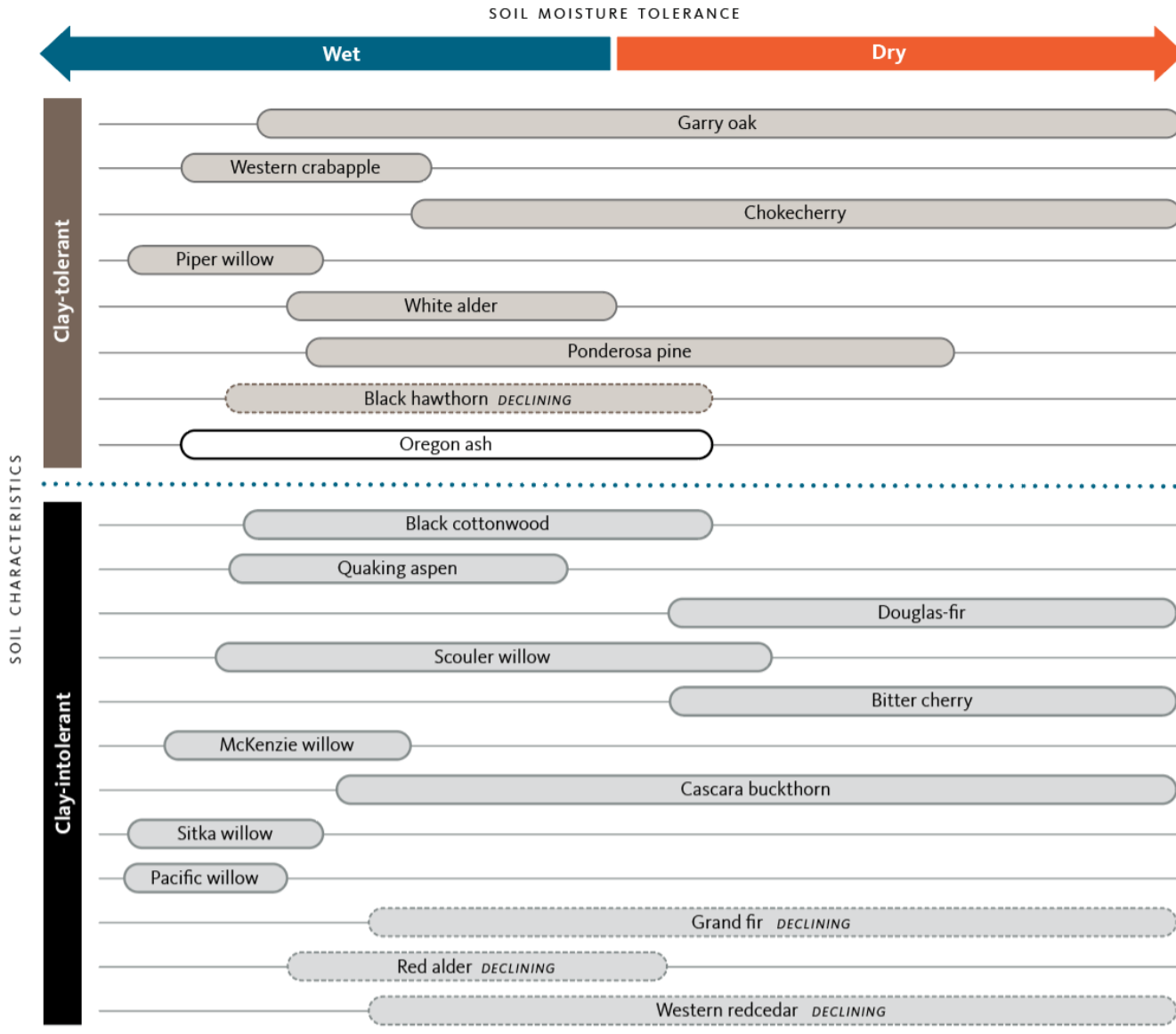
Pesticide List for Emerald Ash Borer in Oregon
Information provided by the Oregon Department of Agriculture, Sept. 14, 2022

Name	Registrant Name	EPA/State Reg. No.	Intended Use	Ingredients	Concentration	Signal Word	Restricted Use Pesticide (RUP)
13-B-4 CORRECT	BAYER ENVIRONMENTAL	432-3473	COMMERCIAL	IMIDACLOPRID	20%	CAUTION	NO
2-1-1 BROADENED SRS 12 MONTH TREE & SHRUB PROTECT & FEED CONCENTRATE	SBM LIFE SCIENCE	C92564-33	HOME	IMIDACLOPRID	1.47%	CAUTION	NO
2-1-1 BROADENED SRS 12 MONTH TREE & SHRUB PROTECT & FEED BTU GRANULES	SBM LIFE SCIENCE	C92564-39	HOME	CLOTHIANIDIN/IMIDACLOPRID	0.87% (0.74%)	CAUTION	NO
2-1-1 BROADENED SRS 12 MONTH TREE & SHRUB PROTECT & FEED BTU GRANULES	SBM LIFE SCIENCE	C92564-30	HOME	IMIDACLOPRID	1.30%	CAUTION	NO
ACE-JET	ARBORJET INC.	74579-1	COMMERCIAL	ACETAMIPRIN (ORGANOPHOSPHATE)	87.60%	CAUTION	NO
ACECAP SYSTEMIC INSECTICIDE IMPLANTS	CREATIVE SALES INC	17879-3	HOME	ACEPHATE (ORGANOPHOSPHATE)	88.90%	CAUTION	NO
ALGIFT LC G INSECTICIDE	ARYSTA LIFE SCIENCE	66330-368	COMMERCIAL	BIFENTHRIN/CLOTHIANIDIN	0.32% (0.29%)	CAUTION	NO
ARADIMECTIN	ROJAS NORTH AMERICA	15-8879	HOME	EMAMECTIN BENZOATE	4.00%	CAUTION	NO
AZAGUARO	BIOSAFE SYSTEMS	70209-17	COMMERCIAL	AZADIRACTIN	3.00%	CAUTION	NO
BALUNEL INSECTICIDE	FMC CORPORATION	279-1177	COMMERCIAL	BIFENTHRIN	23.40%	WARNING	NO
BATTALION 2EC	ATTEVO LLC	31234-104	COMMERCIAL	BIFENTHRIN	25%	WARNING	YES
BAYER X7 INSECTICIDE/FEEDTHRU	CONTOUR SOLUTIONS	5883-189	COMMERCIAL	BIFENTHRIN	25.50%	WARNING	NO
BROADENED SRS 12 MONTH TREE & SHRUB INSECT CONTROL CONCENTRATE	SBM LIFE SCIENCE	C92564-22	HOME	IMIDACLOPRID	2.94%	CAUTION	NO
BROADENED SRS 12 MONTH TREE PROTECT & FEED CONCENTRATE II	SBM LIFE SCIENCE	C92564-39	HOME	CLOTHIANIDIN/IMIDACLOPRID	0.87% (0.74%)	CAUTION	NO
BROADENED SRS 12 MONTH TREE PROTECT & FEED BTU GRANULES	SBM LIFE SCIENCE	C92564-30	HOME	IMIDACLOPRID	1.30%	CAUTION	NO
BONDE ANNUAL TREE AND SHRUB INSECT CONTROL WITH SYSTEMAX	BONDE PRODUCTS	53883-205-4	HOME	IMIDACLOPRID	1.47%	CAUTION	NO
BONDE CAPTAIN JACK'S DEADEND BREW CONCENTRATE	BONDE PRODUCTS	4-471	HOME	SPINOSAD	0.90%	NO SIGNAL WORD	NO
BONDE CAPTAIN JACK'S DEADEND BREW RTS	BONDE PRODUCTS	4-472	HOME	SPINOSAD	0.90%	NO SIGNAL WORD	NO
BONDE CAPTAIN JACK'S DEADEND BREW BTU	BONDE PRODUCTS	4-472	HOME	SPINOSAD	0.90%	NO SIGNAL WORD	NO
BONDE SYSTEMIC INSECT SPRAY WITH SYSTEMAX	BONDE PRODUCTS	53883-205-4	HOME	IMIDACLOPRID	1.47%	CAUTION	NO
BONER INSECTICIDE-MITOCIDE	ARBORSYSTEMS	69117-12	HOME	EMAMECTIN BENZOATE	4%	WARNING	NO
COMPAR-N-SAVE SYSTEMIC TREE & SHRUB INSECT DRENCH	RADAN & MASSEY	128-523-84009	HOME	IMIDACLOPRID	1.47%	CAUTION	NO
CONSERVE SC TURF & ORNAMENTAL	DOW AGROSCIENCE	142719-282	COMMERCIAL	SPINOSAD	11.60%	NO SIGNAL WORD	NO
CONSERVE SC TURF AND ORNAMENTAL	DOW AGROSCIENCE	142719-282	COMMERCIAL	SPINOSAD	11.60%	NO SIGNAL WORD	NO
CRIBBROW 2F	BAYER ENVIRONMENTAL	432-1312	COMMERCIAL	IMIDACLOPRID	21.40%	CAUTION	NO
OFF TREE CARE PRODUCTS MULTI-INSECT KILLER	ARBORSYSTEMS	69127-8	HOME	IMIDACLOPRID	5%	WARNING	NO
ENTRUST NATURALYS INSECT CONTROL	CORTIVA AGRISCIENCE	72732-282	COMMERCIAL	SPINOSAD	80%	CAUTION	NO
ENTRUST SC	CORTIVA AGRISCIENCE	72732-429	COMMERCIAL	SPINOSAD	22.50%	NO SIGNAL WORD	NO
ENTRUST SC	DOW AGROSCIENCE	142719-426	COMMERCIAL	SPINOSAD	22.50%	NO SIGNAL WORD	NO
EVERGREEN PIVETHIUM DUST	MAK	1021-1871	COMMERCIAL	PIVETHIUM	1.00%	CAUTION	NO
FEATHER HOME TREE & SHRUB SYSTEMIC INSECT	VOLUNTARY PURCHASER	155-3401	HOME	IMIDACLOPRID	1.47%	CAUTION	NO
GREEN PRO	NUFARM AMERICA	238-485	COMMERCIAL	IMIDACLOPRID	21.40%	CAUTION	NO



Native ash alternatives

Alternatives to ash by soil type and moisture tolerance



***Preventative ash removal is not suggested ***

PREPARATION

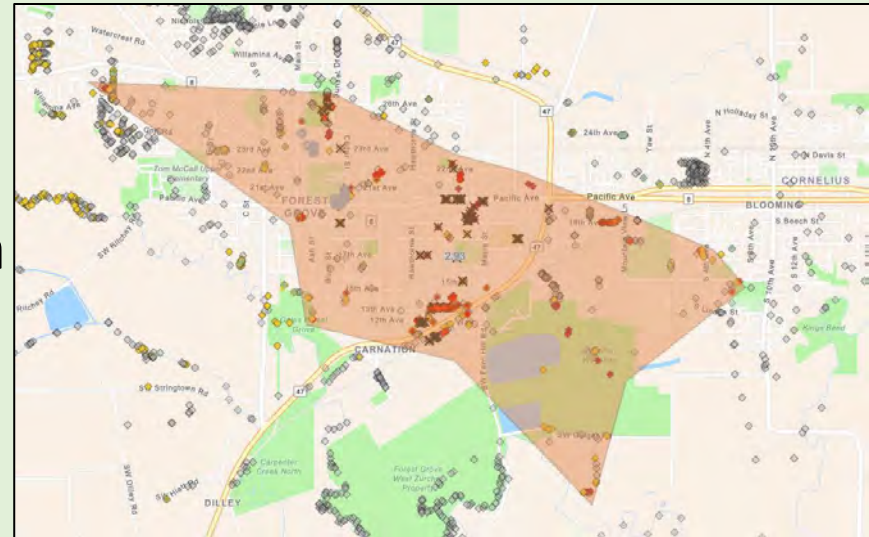


- 1) 2013-2016 statewide EAB surveys (~1,000 traps)
- 2) 2015 Oregon Forest Pest Detectors (OFPD, >500 professionals trained on EAB detection)
- 3) 2021 EAB Response Plan
- 4) 2019-2022 Ash seed collection (~1 million seeds for genetic conservation & resistance)



RESPONSE

- Temporary quarantine in Washington County
- Ongoing monitoring for new infestations
- Establishment of biocontrol starting spring 2023
- SLAM
- Task Force Subcommittees:
 1. Survey & Monitoring
 2. Wood waste & wood utilization
 3. Training & Technical assistance
 4. Integrated Pest Management
 5. Research
 6. Communication
 7. Funding



RESPONSE: Quarantine around Washington Co.

INSECT PEST ALERT TEMPORARY QUARANTINE



A temporary quarantine is now in effect. Tree materials of ash and white fringe tree, must remain within Washington County. Wood waste must be processed accordingly and disposed of to slow the spread of emerald ash borer (EAB) in Oregon.

EMERALD ASH BORER TEMPORARY QUARANTINE



WASHINGTON COUNTY, OREGON



Washington County, Oregon is now a temporary quarantine due to the presence of EAB, a destructive pest that targets ash and white fringe trees. The quarantine applies to all of Washington County, including federal, state, commercial, and private lands.

Treatments for ash & white fringe tree materials

- Debark wood and remove at least 1 inch of underlying wood.
- Grind or chip to 1 inch or less.
- Heat wood to a minimum of 170°F for at least 60 minutes.
- Bury under at least 12 inches of topsoil.
- Incinerate wood materials
- Secondary processing to produce wood by-products such as paper, fiber board, wood pellets, etc.

Regulated ash & white fringe tree materials requiring a compliance agreement to move out of Washington County:

- Logs
- Stumps
- Green lumber
- Nursery stock
- Scion wood
- Root stock
- Chips and mulch
- Roots and branches
- Firewood of any hardwood species

Regulation Exceptions

- Seeds and knives
- Finished wood products without bark, including furniture, baskets, and baseball bats.

May 1 - October 15

Avoid removing ash and white fringe trees, including branches and stumps.

October 16 - April 30

Conduct tree removal and pruning during this time period. Transport trees and parts of trees to a facility where it will be processed before May 1st.

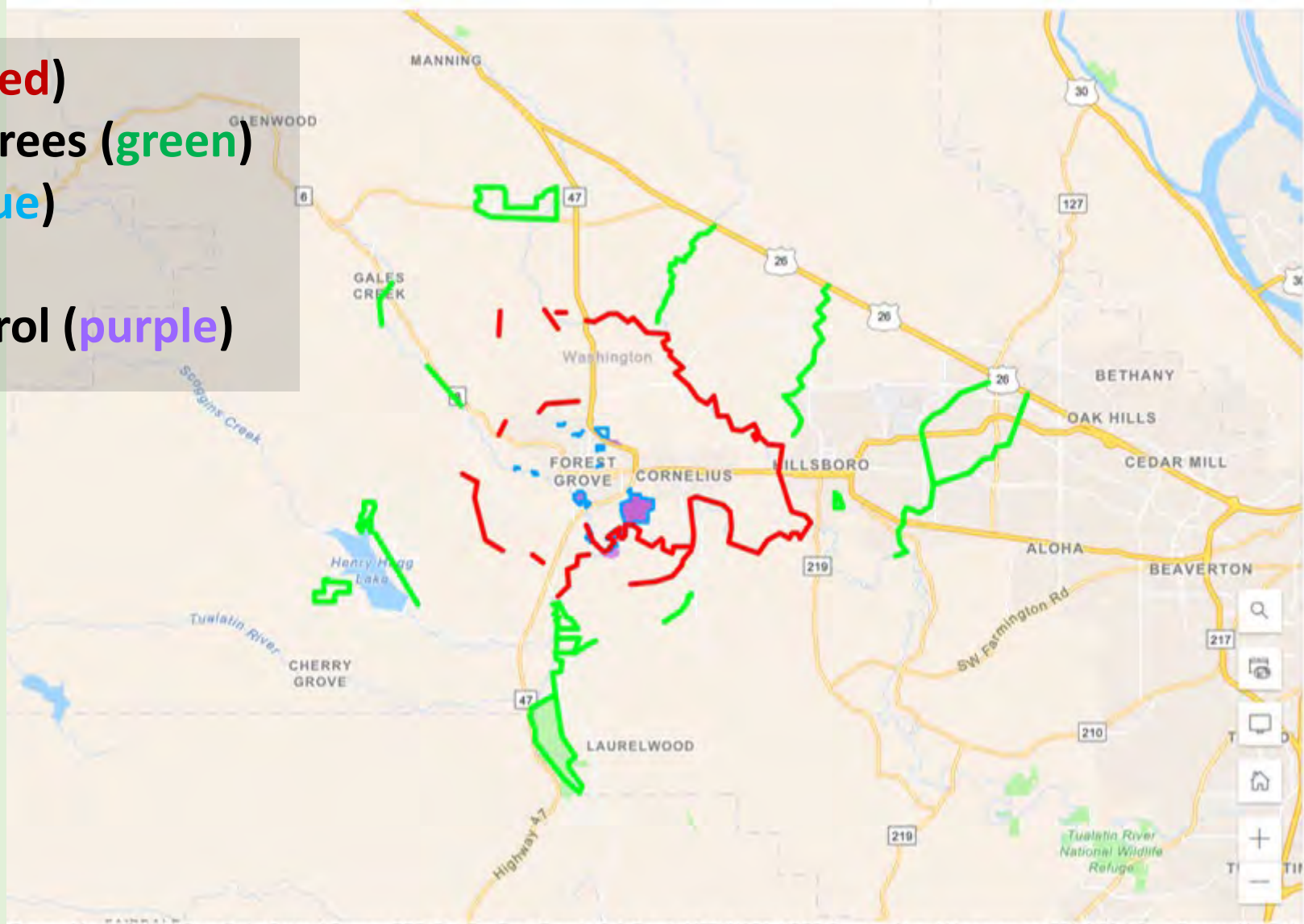
RESPONSE: SLAM (slow ash mortality)

SLAM (red)

Sentry trees (green)

Sink (blue)

Biocontrol (purple)



Summary

- Currently EAB only detected in Washington County
- Infestations can spread ~10 mi. / year
- Avoid planting ash
- Monitor ash for signs and symptoms of infestation
- Report potential infestations to online hotline (include image and location)
- Funding for underserved communities:
<https://www.oregon.gov/odf/forestbenefits/pages/urbanforests.aspx>



EAB resources



- EAB main page: <https://www.oregoninvasivespeciescouncil.org/eab>
- EAB fact sheet: <https://www.oregon.gov/odf/Documents/forestbenefits/fact-sheet-emerald-ash-borer.pdf>
- Infestation map: <https://geo.maps.arcgis.com/apps/dashboards/e6ff6b60f63b4c489cdee61315a85535>
- Report potential EAB insects or infestations (view EAB look-alikes!): <https://oregoninvasiveshotline.org/reports/create>
- Look-alikes: <https://www.oregon.gov/oda/programs/IPPM/SurveyTreatment/Documents/EABLookAlikes.pdf>
- Take stock of your ash and monitor for damage: <https://extension.oregonstate.edu/gallery/recognizing-ash-trees-oregon-washington-northern-california>
- EAB management recommendations: <https://extension.oregonstate.edu/forests/cutting-selling/what-do-about-emerald-ash-borer-recommendations-tree-protection-eab>
- Ash alternatives: <https://extension.oregonstate.edu/pub/em-9396#:~:text=often%20support%20ash,-,Well%20drained%20soils,and%20a%20number%20of%20willows>
- Insecticides: <https://www.oregon.gov/oda/shared/Documents/Publications/IPPM/Pesticides-EABList.pdf>
- EAB response plan: <https://www.oregon.gov/odf/Documents/forestbenefits/eab-readiness-and-response-plan-for-oregon.pdf>
- OFPD training: <https://extension.oregonstate.edu/ofpd>



Questions?



Newly introduced exotic:
Mediterranean oak borer (MOB)
detected in Oregon in 2018



Distribution



- Native to Europe, N. Africa, Middle East
- Detected in Napa, CA 2017 (present likely since 2010s)
- Detected in Oregon:



- 2018-2022 adults found in traps in Multnomah, Clackamas, Marion, Washington counties
- 2022 infested trees found in Clackamas and Multnomah counties
- 2023-4 Multnomah tree destroyed, ~30 infested trees found in Wilsonville

DNA analyses of current MOB populations indicate that the OR population of MOB originated in a different region than the CA population. Provenance may play a role in biology.

Pathways

- Untreated wood imports
- Firewood (don't move wood >30 miles)
- Nurseries



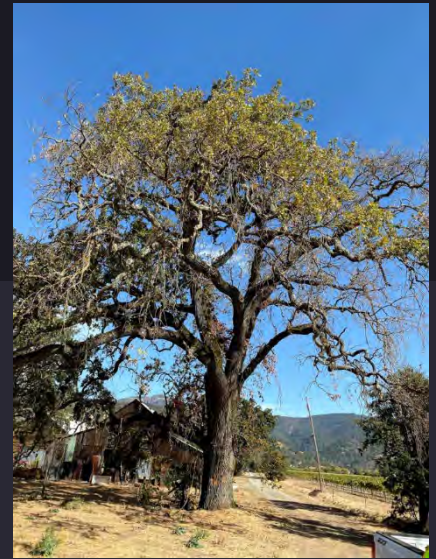
MOB biology

(*Xyleborus monographus*)

- Attacks oaks (white and red sections of *Quercus*)
- Woodboring ambrosia beetle that feeds on fungus not wood
- Vectors fungi (*Raffaella montetyi* & *Fusarium solani*) in sapwood that cause fatal oak wilt
- Females are active for most of the year (i.e., cold-tolerant)
- 2-3 generations estimated for Oregon



MOB hosts



- Native range:

Weakened oak, harvested logs, dropped limbs.

Occasionally maple, walnut, beech, elm, cherry, chestnut, hornbeam.

- California:

Mostly Valley oak (*Q. lobata*/_{white} section) but also blue (*Q. douglasii*/_{white}), CA black (*Q. kelloggii*/_{red}), Oregon white oak (*Q. garryana*/_{white})

- Oregon (to date): Oregon white oak (*Q. garryana*/_{white})

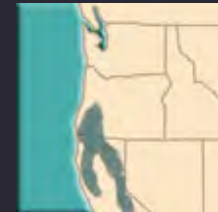
Oregon oaks



Oregon white oak
(*Quercus garryana*)
white Quercus section



California black oak
(*Q. kelloggii*)
red Quercus section



Canyon live oak
(*Q. chrysolepis*)
Intermed. Quercus section



Importance of Oregon white oak

- **White oak can live up to 500 years**
- **Primary overstory in Oregon oak savannahs**
- **Extremely drought-tolerant**
- **Important wildlife resource (nesting, overwintering, food)**
- **Wildfire tolerant (thick bark)**
- **Deciduous (escapes damage from annual defoliators)**

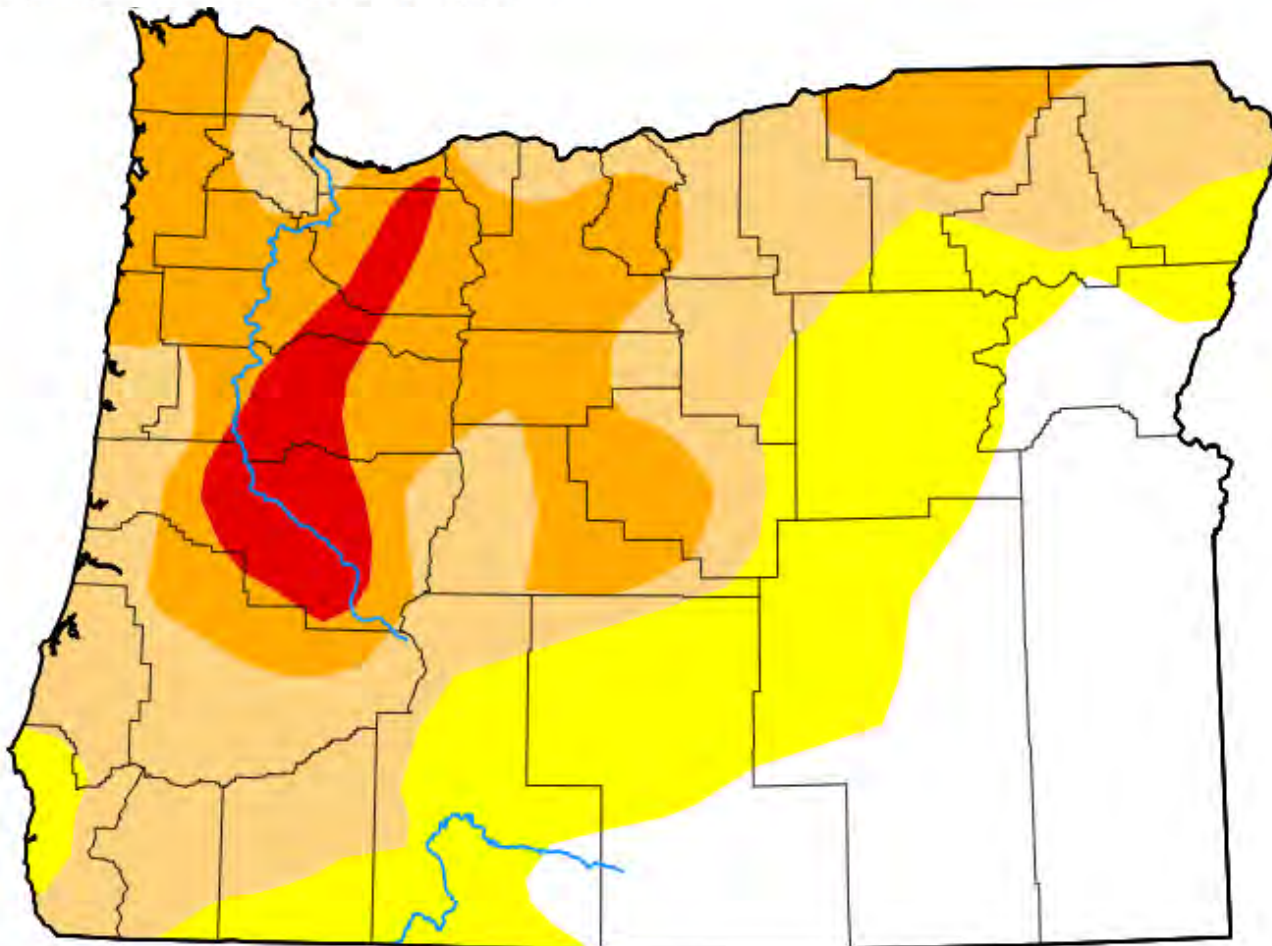
Current drought conditions

U.S. Drought Monitor

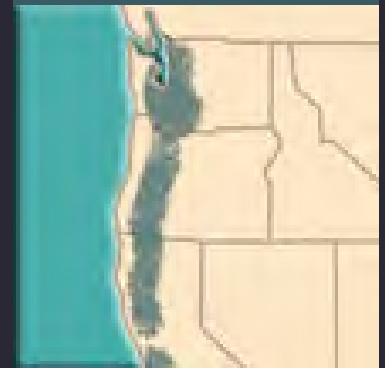
Map released: Thurs. October 5, 2023

Intensity

- None
- D0 (Abnormally Dry)
- D1 (Moderate Drought)
- D2 (Severe Drought)
- D3 (Extreme Drought)
- D4 (Exceptional Drought)
- No Data



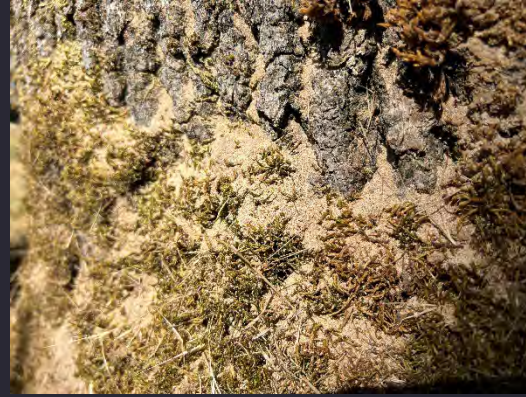
Oregon white oak range



MOB diagnosis



Dieback of a section of crown such as a whole branch



- Pale boring dust (frass)
- (1/16") tiny round holes
- Black-stained branched galleries cutting across sapwood

Non-MOB issues in oak

1. Storm breakage
2. Fungal conks
3. Oak lacebug
4. Galls + squirrels
5. Other woodboring beetles, including native ambrosias
6. Carpenterworm
7. Woodpeckers



MOB management

- Promote oak tree health

Monthly slow, deep watering during hottest summer months:

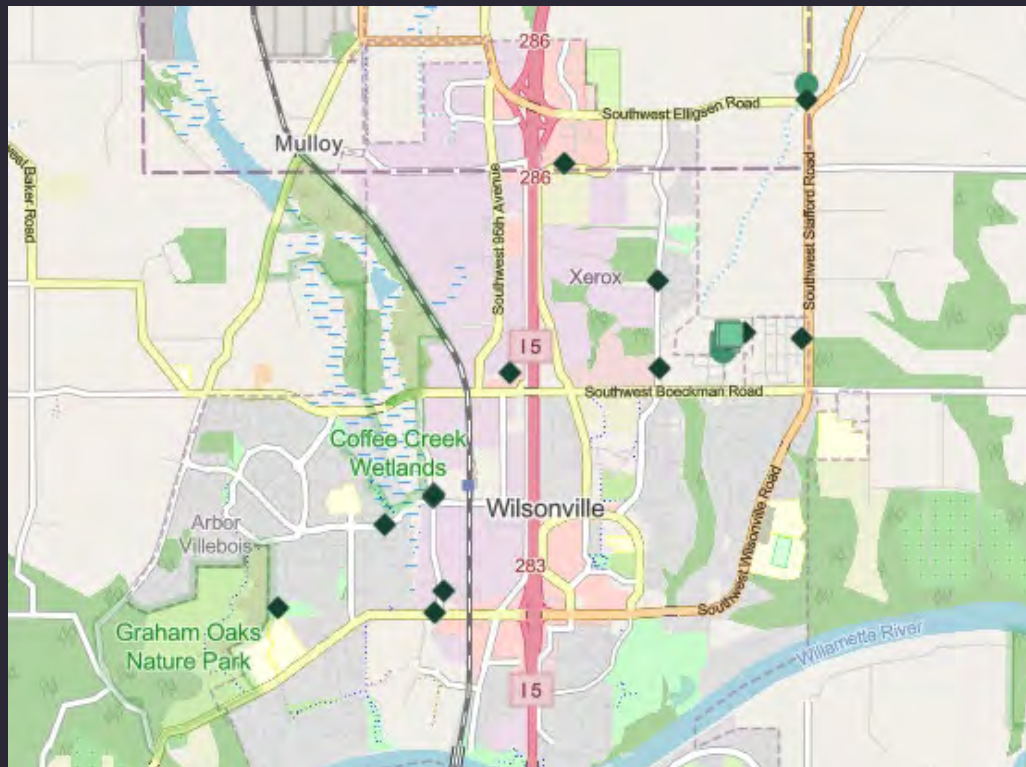
<https://www.oregon.gov/odf/Documents/forestbenefits/watering-fact-sheet.pdf>

- Preventative removal not advised
- Cut infested trees to the ground and chip/burn onsite
- Cover and transport to incinerator
- Sterilize equipment: 70% ETOH, 5% Bleach, Oxidate (hydrogen peroxide), or Lysol

...Much to be learned, more guidance to follow

Current infestation

- Current infestation in Wilsonville only (Troutdale tree was destroyed)
- ~ 30 detected infested trees



What's next?



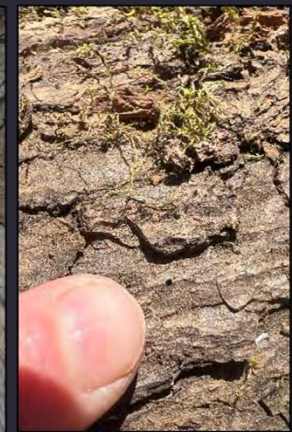
- Ongoing mapping of potentially infested trees from hotline reports, etc.
- Field trainings on diagnosing MOB infestations
- Expanded trapping to determine:
 - Distribution beyond Clackamas county
 - Potential pathways
 - Emergence timing based on temperature
- Testing management strategies:
 - Systemic insecticides
 - Repellants
 - Burial
 - Partial canopy removal
 - Pathogen spread

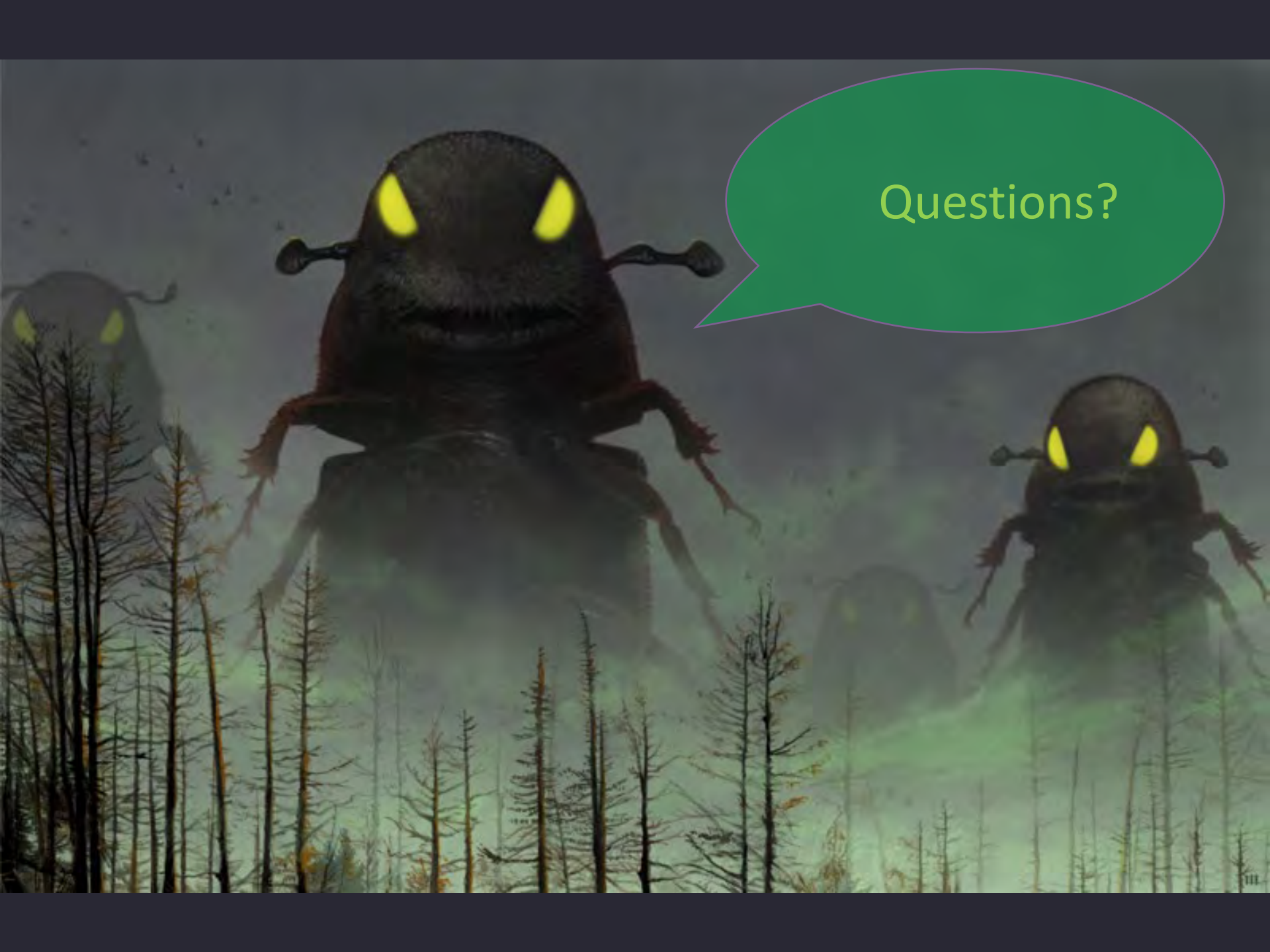


MOB resources



1. ODF factsheet: <https://tinyurl.com/MOB-oregon>
2. Other oak pests: <https://www.oregon.gov/odf/Documents/forestbenefits/oak-pests.pdf>
3. Press release: <https://www.oregon.gov/odf/forestbenefits/Documents/news-release-mediterranean-oak-borer.pdf>
4. Invasive hotline reporting: <https://oregoninvasiveshotline.org/reports/create>
5. MOB infestation map: <https://oda.fyi/MOBMap>





Questions?