

# Forest Insects & Diseases of Concern in the Pacific Northwest



Glenn Kohler – Forest Entomologist

**Forest Resilience Division**

# WA DNR Forest Health Program



Forest health issues (disease and insects) on our state, industry, and private land



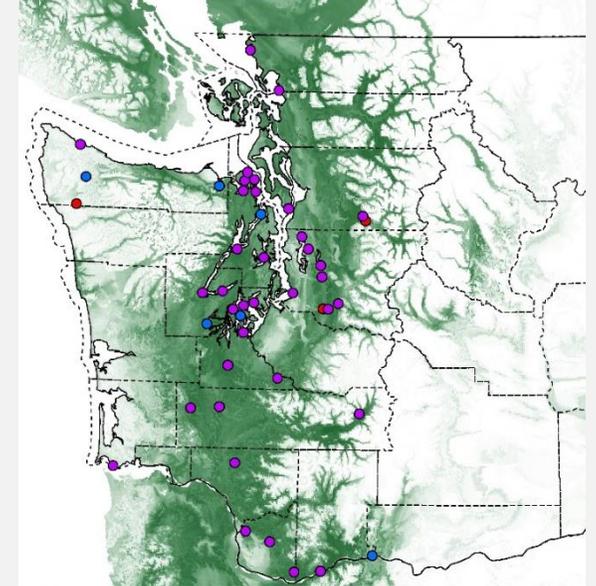
## Monitoring

(Aerial detection surveys, trapping & ground surveys)



## Technical Assistance & Outreach

(3,000+ contacts/year via email/phone assists, site visits, workshops, publications & media requests)



## Research

(examples: sooty bark disease, California five-spined Ips, white pine blister rust resistance)

# Reporting & Information



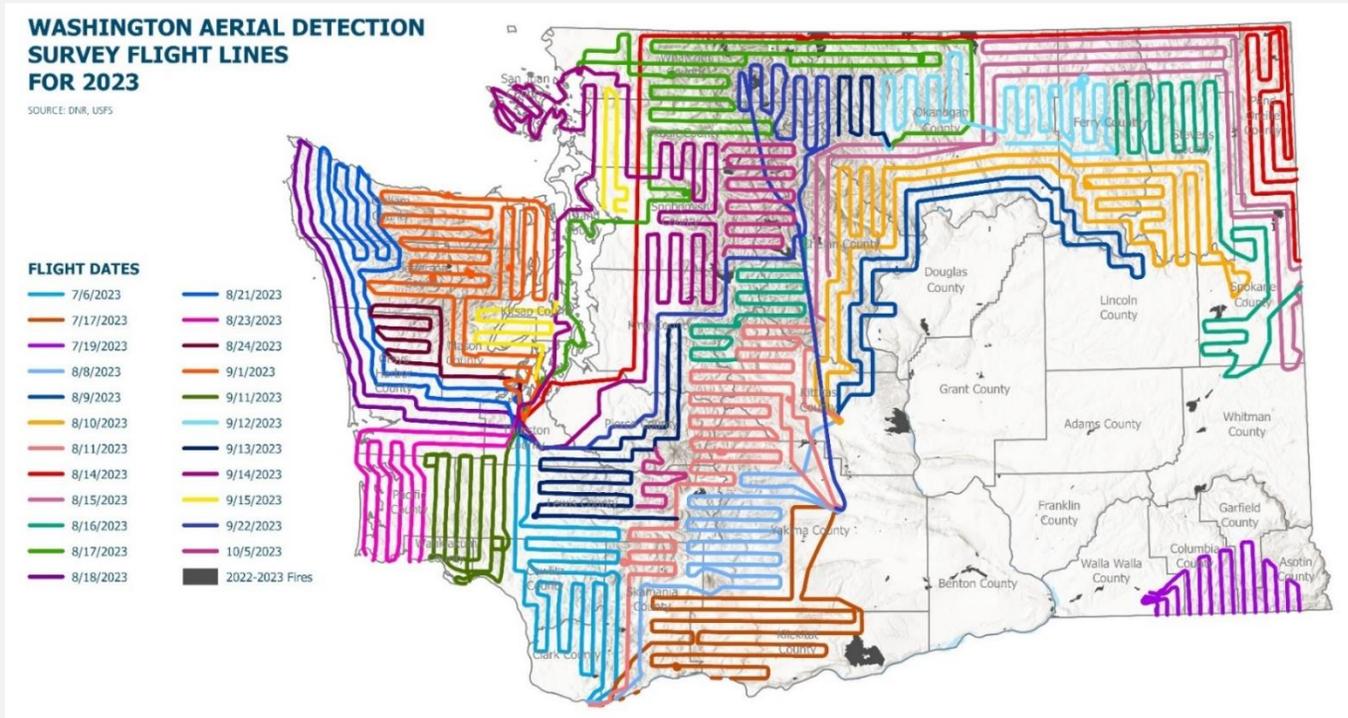
- Both states publish **annual insect & disease conditions reports** (in spring)
  - Just search: “OR/WA Forest Health Highlights”
  - Our **contact info & useful websites** are in back pages
- <https://tinyurl.com/odf-foresthealth>
- [dnr.wa.gov/foresthealth](http://dnr.wa.gov/foresthealth)
- **OSU and WSU Forestry Extension** programs are also great resources!



# Aerial Detection Survey (ADS)



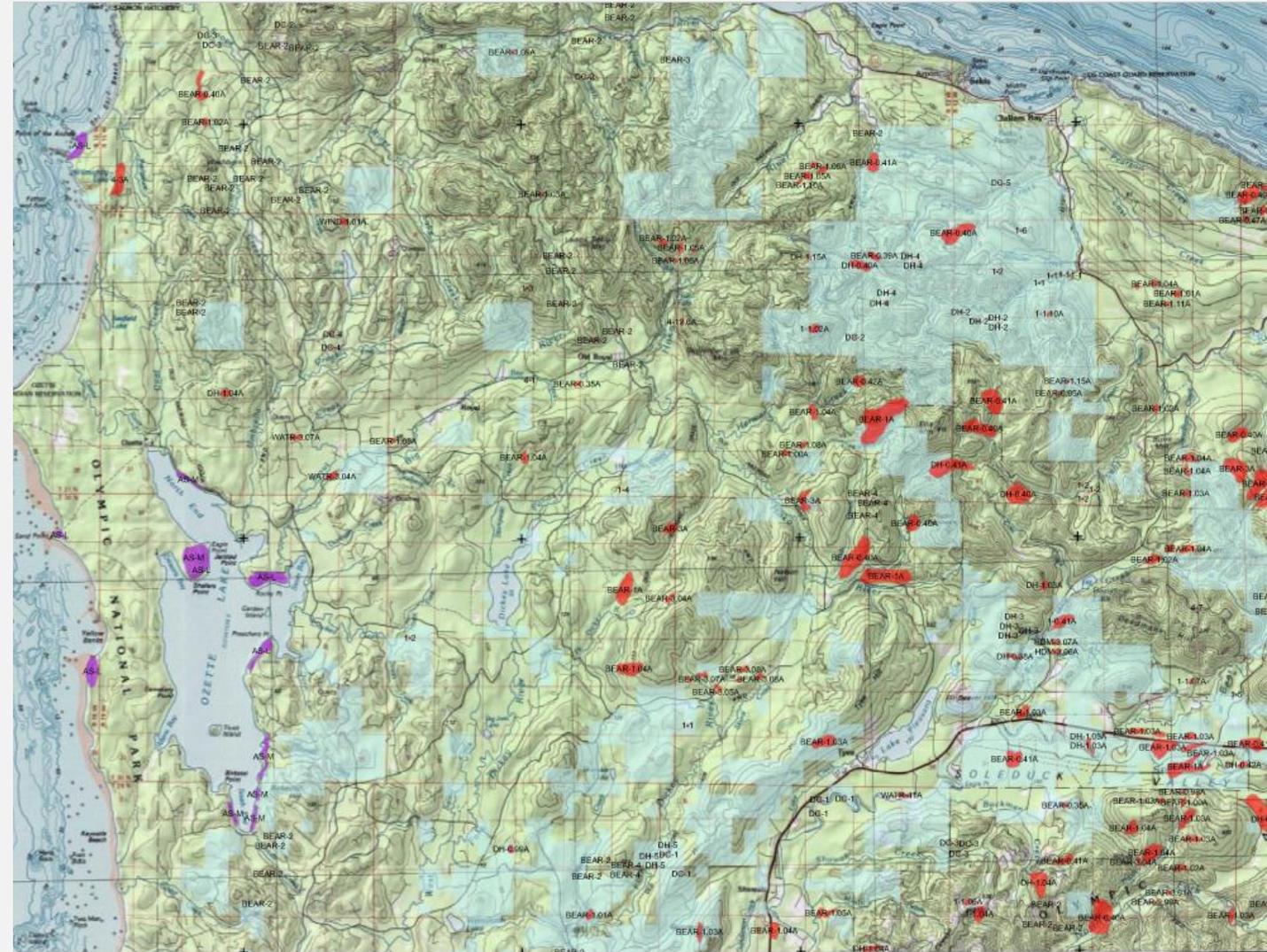
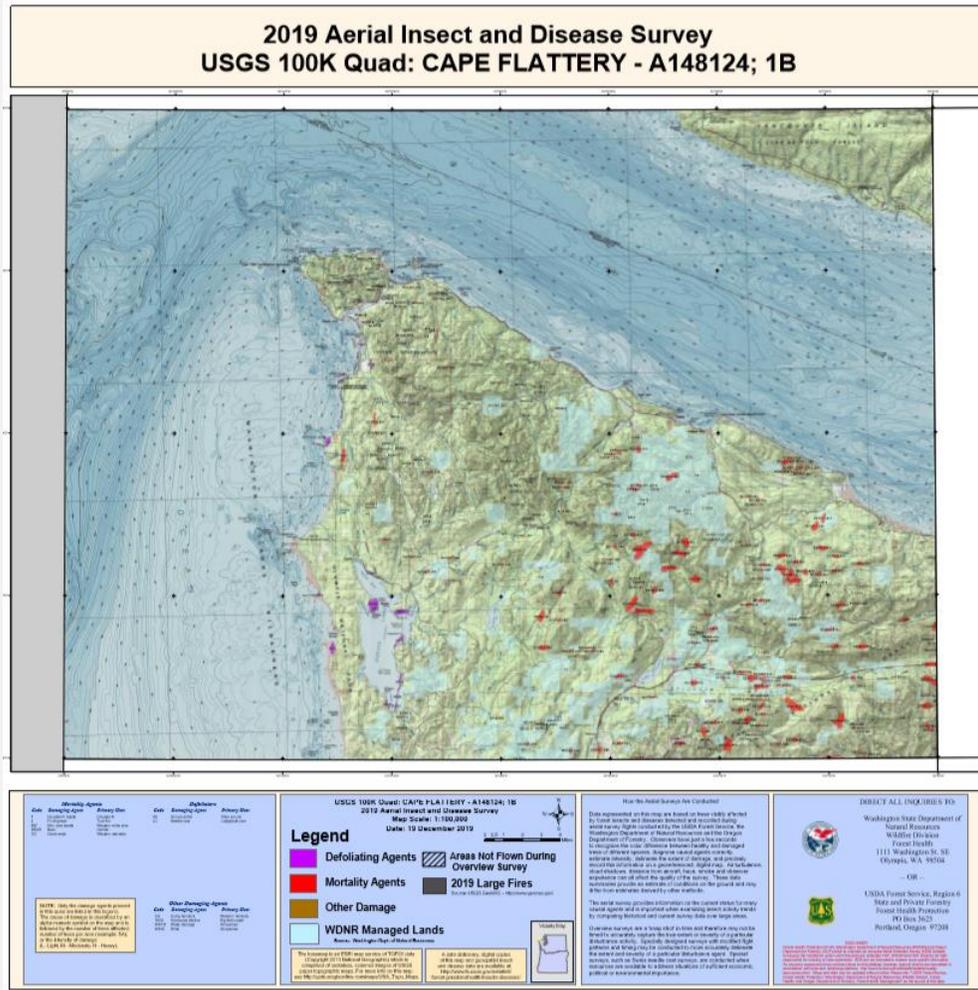
- **Annual survey** conducted by WDNR, USFS, and ODF since **1947**
- Maps recently killed or defoliated trees on forested land
- **All ownerships**
- Conditions reports rely heavily on this survey
- Maps & data are publicly available



# Aerial Detection Survey (ADS)



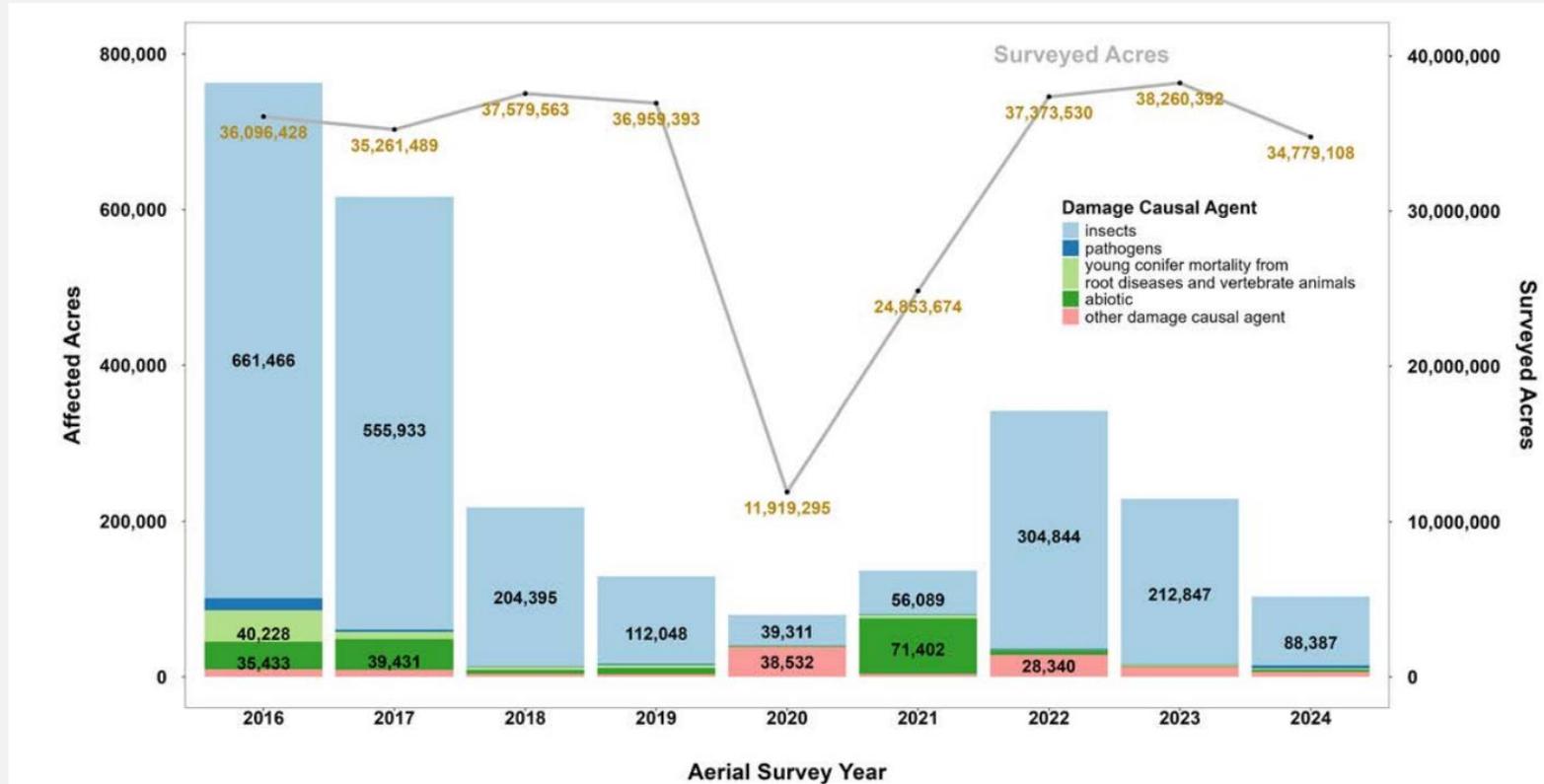
- PDF quad maps
- Georeferenced for mobile apps



# Aerial Survey Highlights

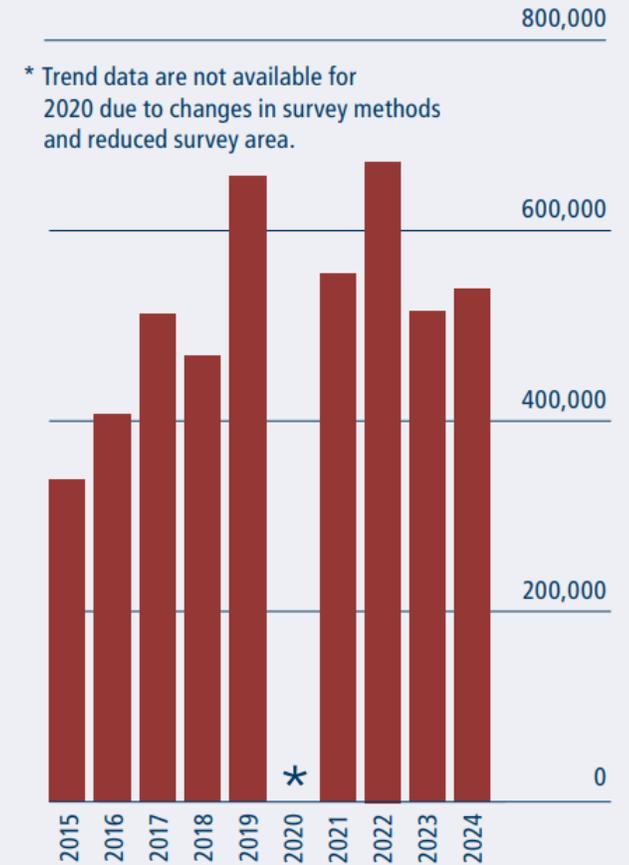


- All damage agents, statewide as of 2024



Oregon

Washington



**Figure 1.**  
**TOTAL ACRES WITH INSECT AND DISEASE DAMAGE, 2015-2024**

Recorded during annual aerial detection surveys

# Aerial Survey Highlights



- Draft **bark beetles 2025**, Washington

Code	Damage Agent	2024 acres with mortality	2025 acres with mortality*
1	Douglas-fir beetle	42,800	20,500
2	Douglas-fir engraver	12,700	4,800
3	Engelmann spruce beetle	190	0
4	Fir engraver	80,500	50,900
5	Western balsam bark beetle	12,500	11,600
6	Mountain pine beetle	83,500	29,000
7	Pine engravers ( <i>Ips spp.</i> )	1,850	1000
8	Western pine beetle	32,800	19,200
9	Silver fir beetle	2,880	3,500



Trend is down for WA, but...

\*Only 75% of the cooperative aerial detection survey was completed in 2025 due to staffing changes at the federal level|



# Aerial Survey Highlights

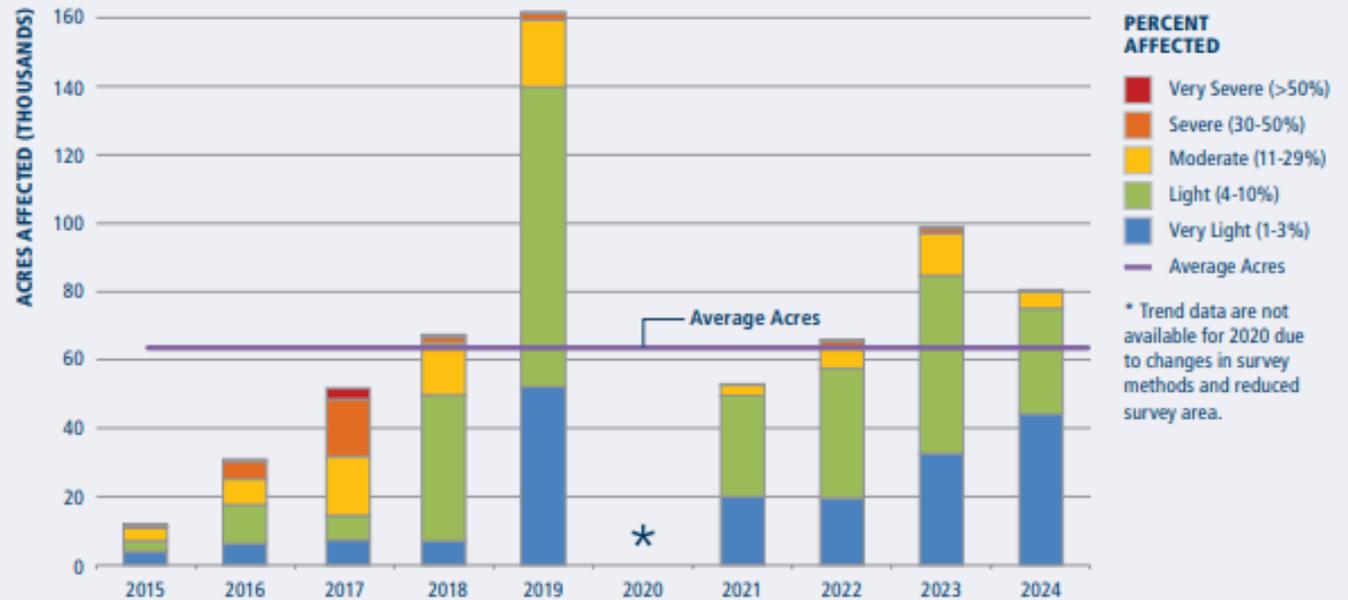


- Fir engraver – true fir mortality

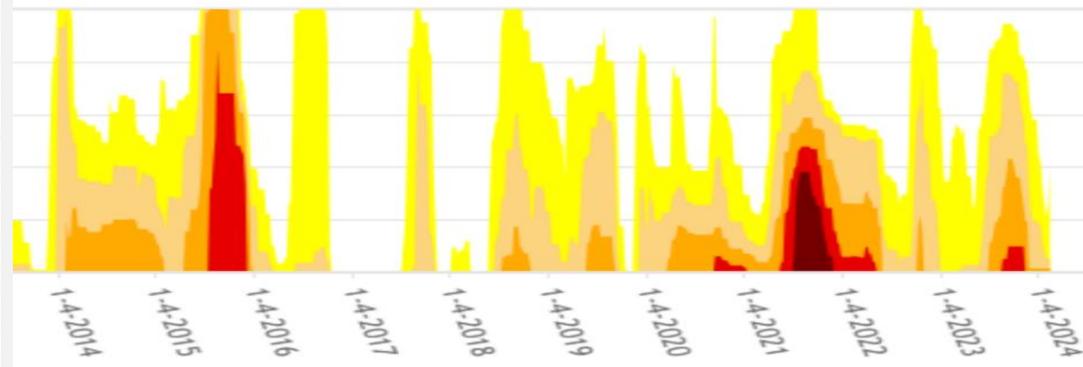


Fir engraver galleries in the Olympic National Park in 2024

**FIR ENGRAVER 10-YEAR TREND FOR TOTAL ACRES AFFECTED IN WASHINGTON** Figure 16.



Light Monitor Categories



US Drought Monitor, WA

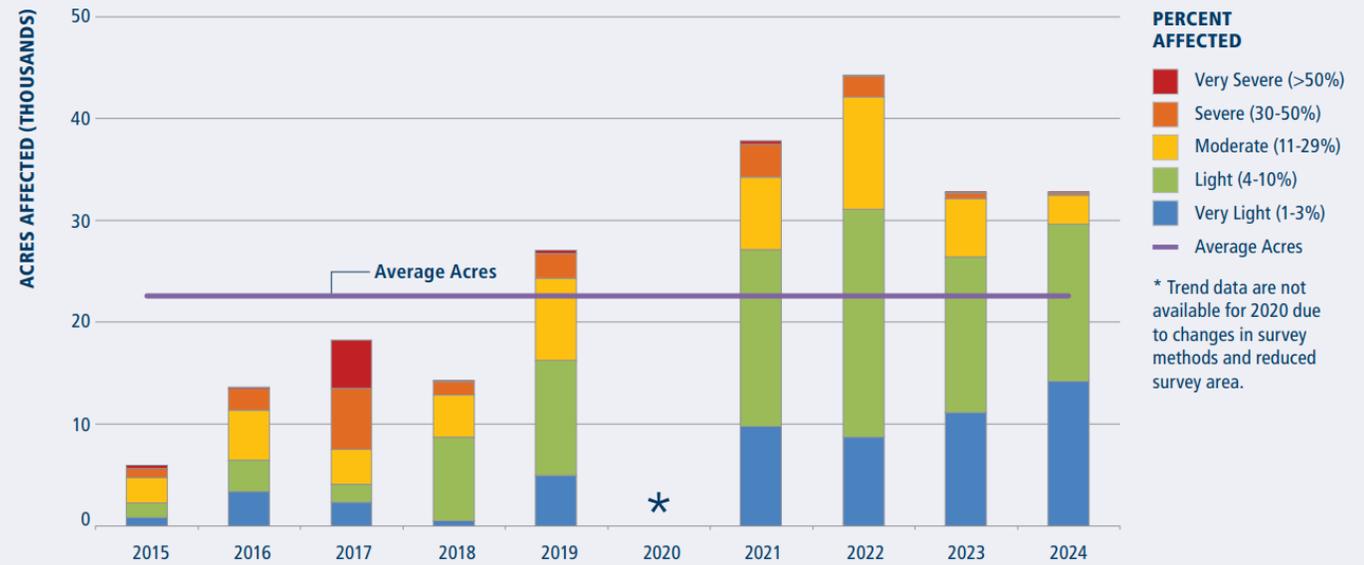
# Aerial Survey Highlights



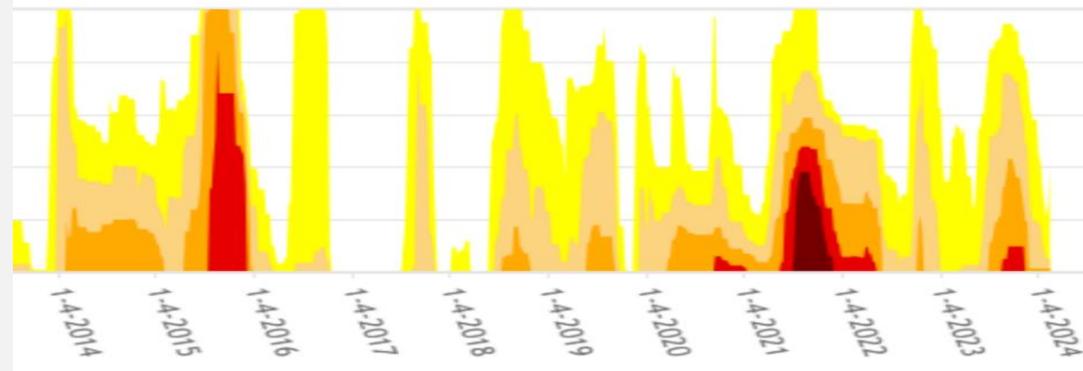
- Western pine beetle
  - Ponderosa pine only, east of Cascades



**WESTERN PINE BEETLE 10-YEAR TREND FOR TOTAL ACRES AFFECTED IN WASHINGTON** Figure 12.



Light Monitor Categories



US Drought Monitor, WA

# Aerial Survey Highlights

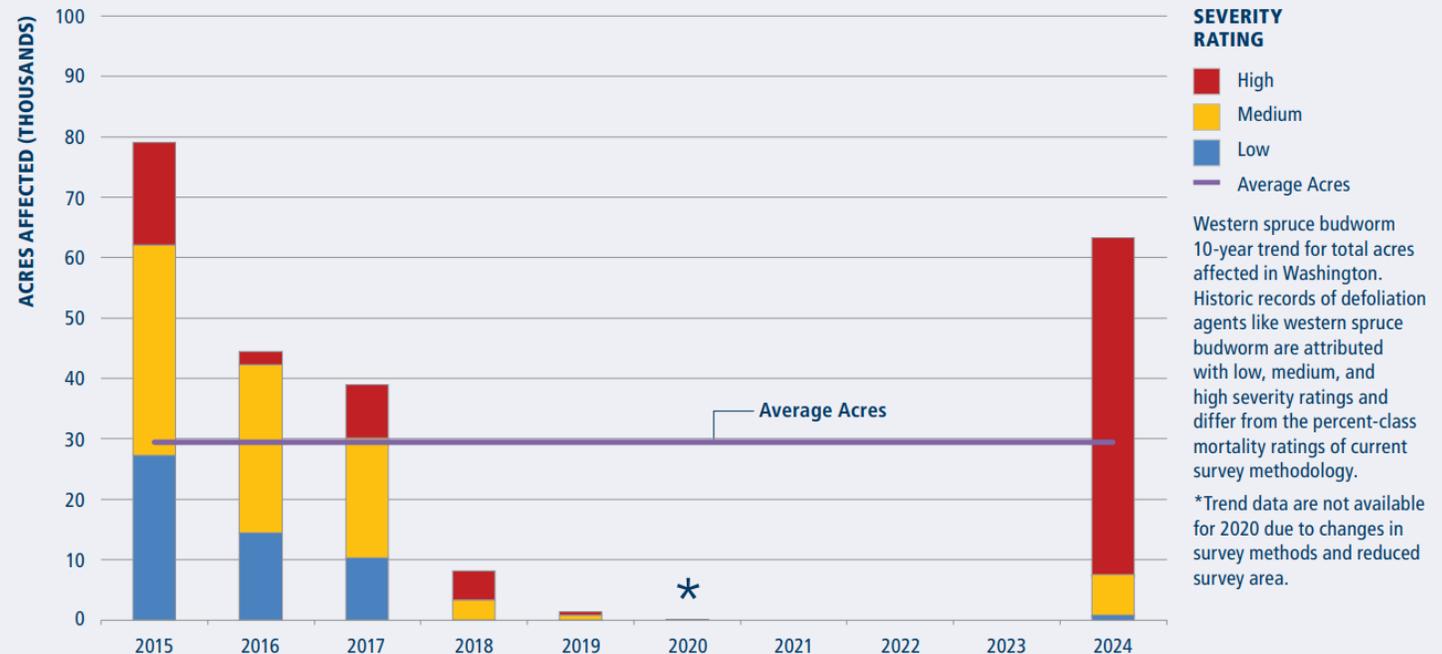


- Western spruce budworm

- **Hosts** – Douglas-fir, true firs, spruce east of Cascades (usually...)
- **Severity** – only eats new foliage, so takes 4-5 years for trees to start dying
- Outbreaks can last 10 years+



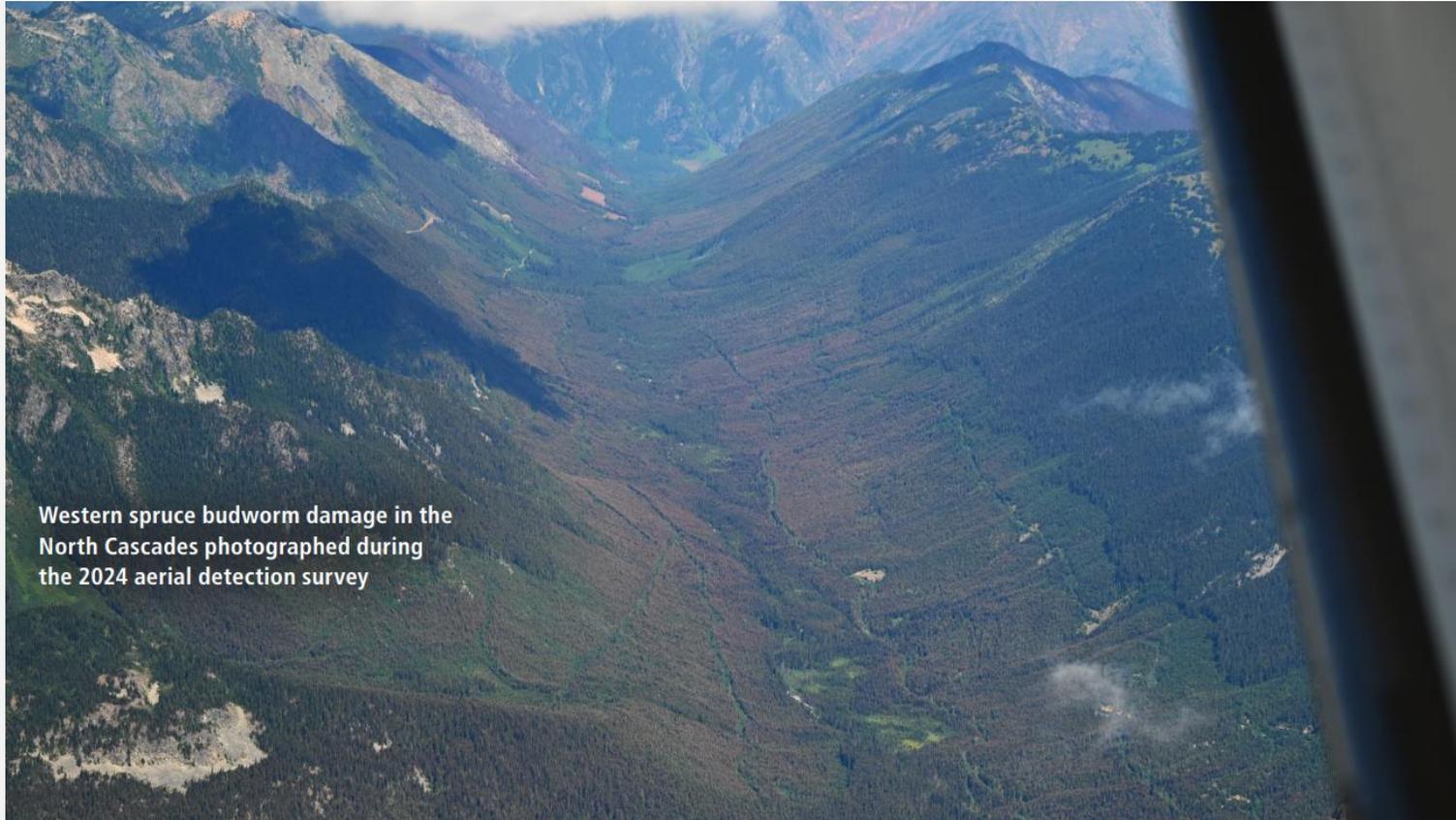
**WESTERN SPRUCE BUDWORM 10-YEAR TREND FOR TOTAL ACRES AFFECTED IN WASHINGTON** Figure 19.



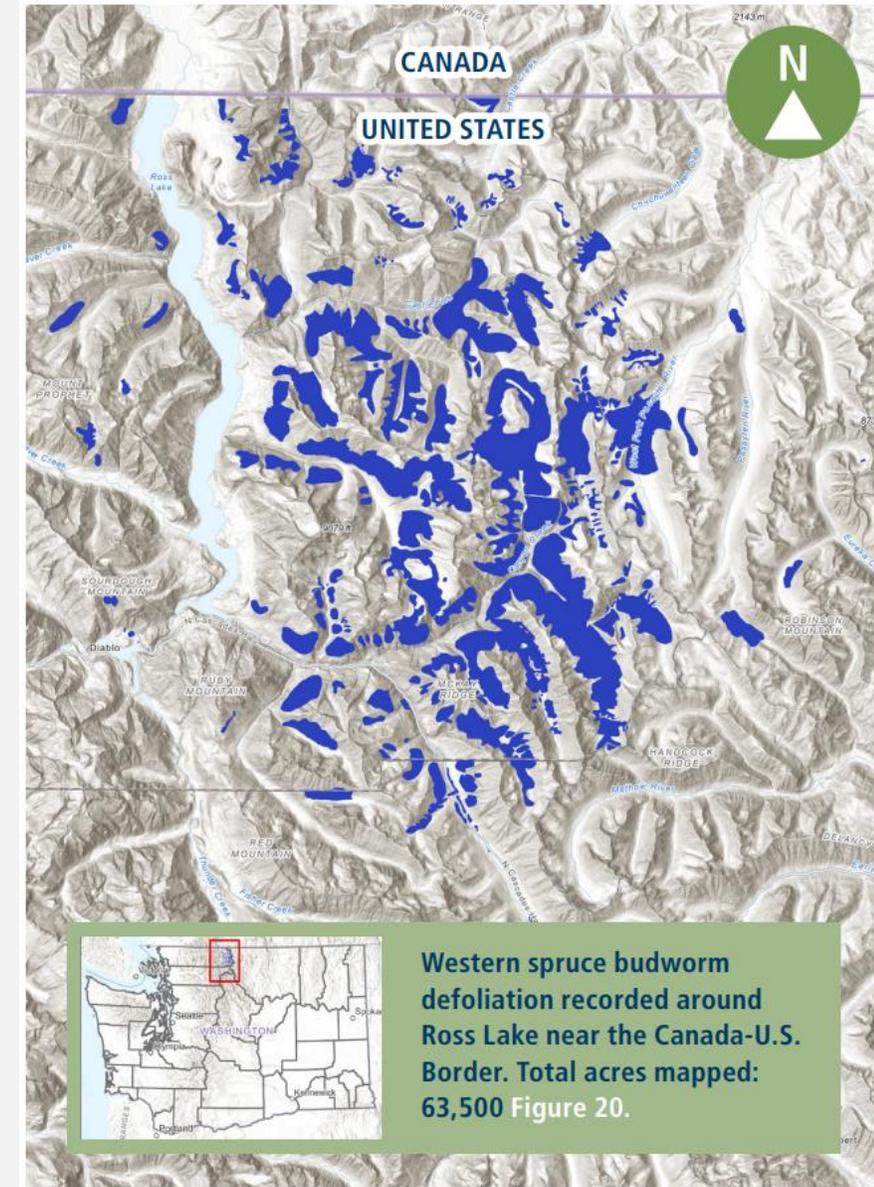
# Aerial Survey Highlights



- Western spruce budworm



**2024, WA**



# Looking Ahead



- Douglas-fir tussock moth
  - **Hosts** – Douglas-fir and true firs, east of Cascades
  - **Severity** – can feed on all age classes of foliage, so heavy defoliation **can kill trees in one season**. Outbreaks last 3-4 years.

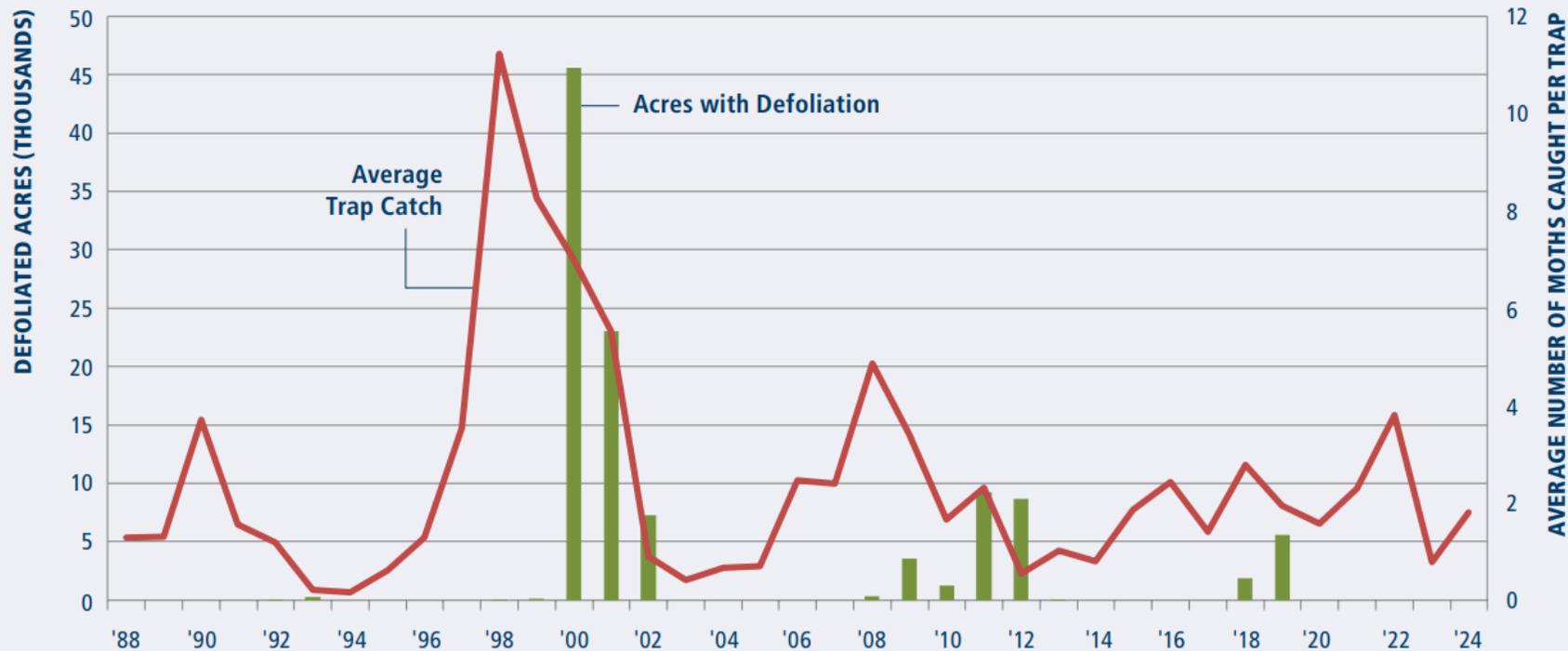


# Looking Ahead



- Douglas-fir tussock moth
  - “Early warning” pheromone trap network

**DOUGLAS-FIR TUSSOCK MOTH TRAP CATCHES AND DEFOLIATION IN WASHINGTON 1988-2024** Figure 17.



WA, through 2024

# Emerging Pest Threats



- **Mediterranean oak borer**

- **Hosts:** Cork oak in Europe; native oaks in California; Oregon white oak
- **Origin:** Europe, west Asia, north Africa
- Vectors fungi *Raffaelea montetyii* & *Fusarium solani*, causing wilt disease
- First Oregon detection in traps: 2018 near Portland, then Woodburn (2021)
- Now in 4 OR counties (22 beetles in 2022):
  - Clackamas, Marion, Multnomah, and Washington
- Smaller males rarely seen and don't fly
- 2 or more generations per year



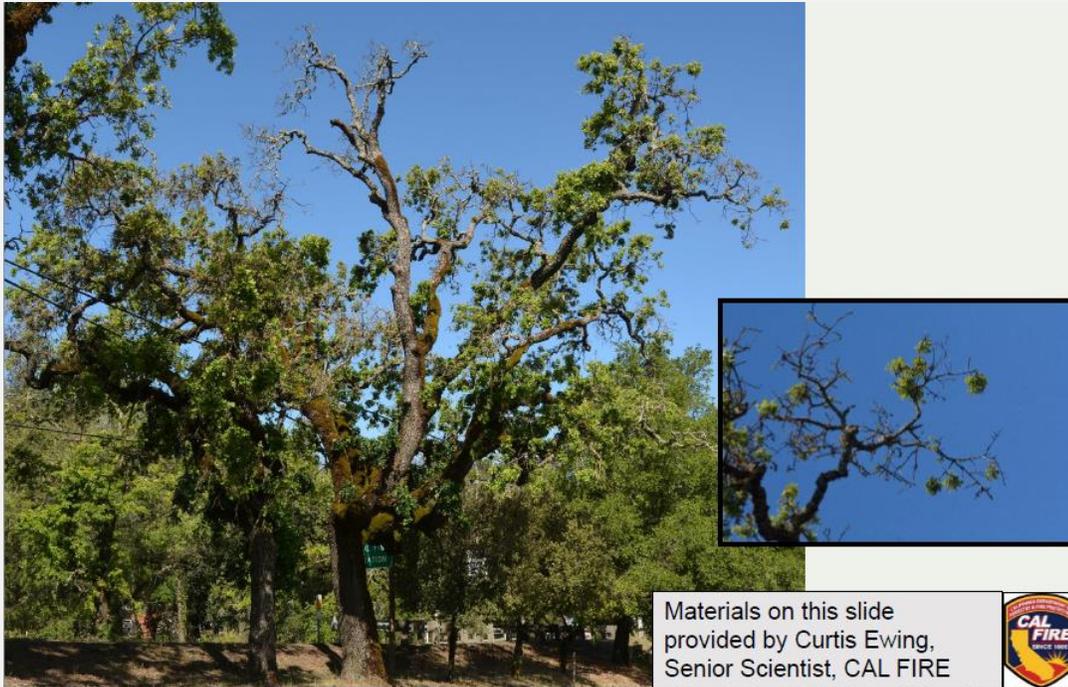
Thanks to Karen Ripley (US Forest Service) & Wyatt Williams (Oregon Dept. Forestry) for providing materials for MOB slides



# Mediterranean oak borer (MOB)



- Crown dieback symptoms (typically partial)
- Attacks start in upper branches & move downward
- May take 3-5 years to reach main stem and kill tree



Materials on this slide  
provided by Curtis Ewing,  
Senior Scientist, CAL FIRE



# Mediterranean oak borer (MOB)



- White powdery boring dust
- Black stained galleries only in sapwood (not heartwood)



Materials on this slide provided by Curtis Ewing, Senior Scientist, CAL FIRE



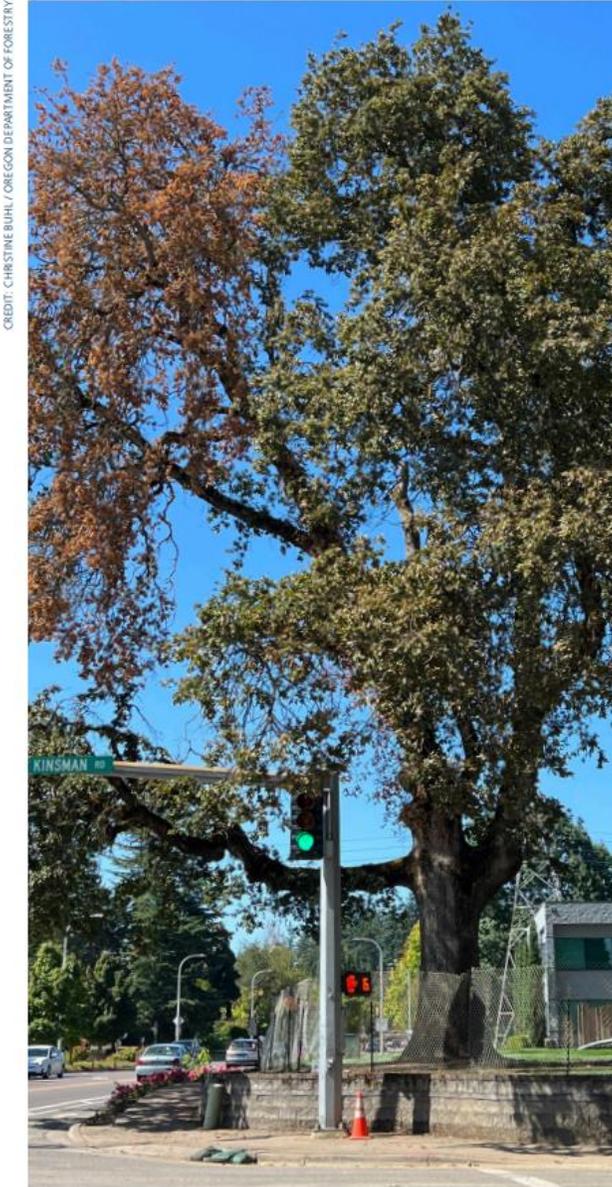
# Mediterranean oak borer (MOB)



- MOB in Oregon
  - 2023, first confirmed infestation in symptomatic Oregon white oak in Troutdale off I-84
  - In September 2023, confirmed OWO infestations in Wilsonville



**Photos:** Karen Ripley (USFS) & Christine Buhl (ODF)



CREDIT: CHRISTINE BUHL / OREGON DEPARTMENT OF FORESTRY



Observed slow progression dieback from top down

# Mediterranean oak borer (MOB)



- MOB in Oregon – learn more

## Mediterranean Oak Borer

October 2025



Crown dieback from MOB and associated fungi (Christine Buhl, ODF).

### Summary

Mediterranean oak borer (MOB, *Xyleborus monographus*) is a tiny brown woodboring insect called an “ambrosia” beetle. This beetle tunnels into many species of oaks. They have been found in Oregon infesting Oregon white oak (*Quercus garryana*). Despite being a woodboring beetle, they do not eat wood. These beetles carry fungi (such as *Raffaelea montetyi* and *Fusarium solani*) with which they inoculate their tunnels to feed their young. These fungi clog water-conducting tissues and cause a wilting disease in susceptible trees. Over several years, large numbers of adult beetles infest and reinfest the trees, often killing whole branches, large portions of the tree crown, and later whole trees.

### Current distribution

MOB is native to Europe, western Asia (Iran, Israel, Russia, and Turkey), and northern Africa (Algeria and Morocco). It has spread long distances to Korea and the United States (California and Oregon). In its native range it infests weakened or dying oak and beech tree species that are already suffering from drought, other pests, or disease. Outside of its range it

has been killing unhealthy but also seemingly healthy oaks in California and Oregon.

In California, widespread reports of dying valley oak (*Quercus lobata*) came from Napa and Sonoma counties in 2019. Large populations of MOB have likely been present there and killing trees since at least the early 2010s. MOB infestations have since spread to nearby Lake and Sacramento counties. Blue oak (*Q. douglasii*) is also a known host. In California, a single attack was found in a severely distressed California black oak (*Q. kelloggii*) and another attack in fire-damaged Oregon white oak. California officials found that MOB is already established and too widespread to be eradicated from central California.



MOB females are the size of a pencil lead. Males (inset) are slightly smaller, have a rhino horn-like structure, and are flightless (Curtis Ewing, CAL Fire).

In Oregon a single beetle was first captured in a trap in 2018 at Chinook Landing near Troutdale. Since then, adults have been found in traps in Multnomah, Clackamas, Marion, and Washington counties. In 2022, two Oregon white oak trees were found to be positive for MOB, one near Troutdale and another in Wilsonville. Since then, additional MOB-infested trees have been



## Pest to Watch: Mediterranean Oak Borer

By Kayla Seaforth, Scientific Review by Christine Buhl,  
Oregon Department of Forestry

Oak woodlands and prairie, once a defining ecosystem of the Pacific Northwest lowlands, have declined by an estimated 90% from historic land cover. Conversion for agriculture and urban development in combination with fire suppression have led to the demise of this extremely productive habitat.

The Mediterranean Oak Borer (MOB) is a species of ambrosia beetle that is native to parts of Europe, western Asia, and Northern Africa. In 2017, scientists found the first known population of the beetle

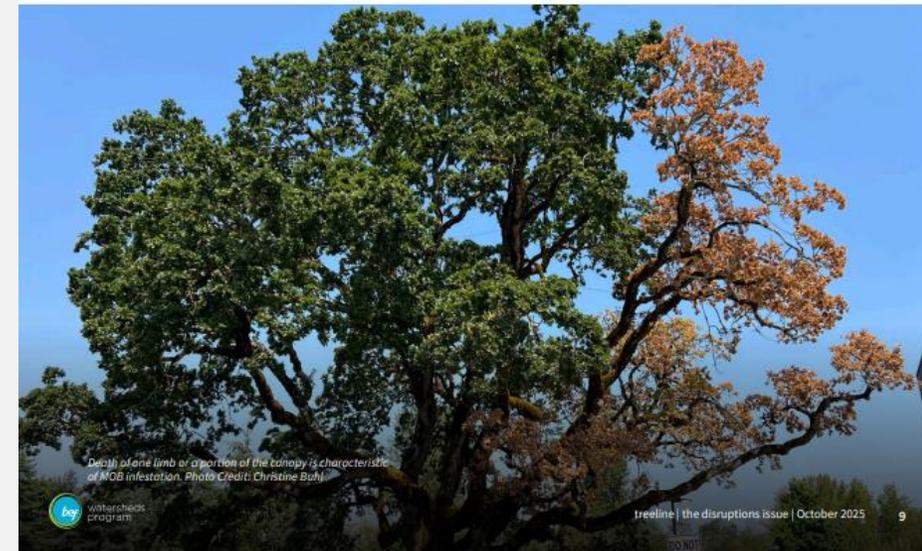
in California, and by 2019 it had spread throughout Central California and was also found in the Willamette Valley.

In its native range it infests weakened or dying oak and beech tree species that are already suffering from drought, other pests, or disease. MOB may be particularly harmful to white oaks in the United States, including Garry/Oregon white oak (*Quercus garryana*). These beetles have a symbiotic relationship with several species of fungi that can cause oak wilt. The beetles bore into the

limbs and drive their tunnels deep into the sapwood. They carry spores of fungi into trees, inoculating their galleries to provide food for their brood. Here, they lay eggs and the fungi clog the water conducting tissue within the tree, leading to wilting. This can cause the death of an entire limb and also spread throughout the whole tree.

Symptoms of MOB infestation include canopy dieback that starts as large sections of red/brown leaves on a whole branch that spread slowly throughout

<https://www.treeline-pnw.org/wp-content/uploads/2025/10/Pest-to-Watch-Mediterranean-Oak-Borer.pdf>

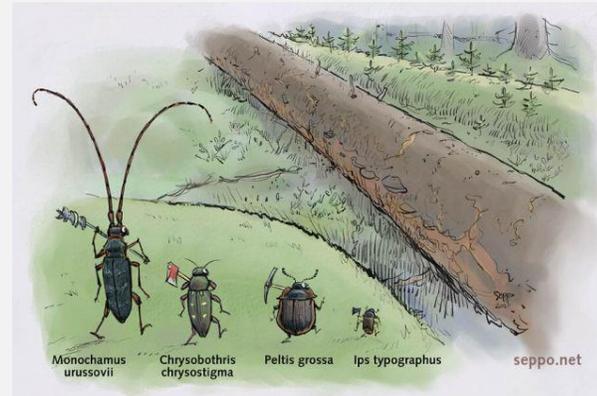


Death of one limb or a portion of the canopy is characteristic of MOB infestation. Photo Credit: Christine Buhl

# Native Insect and Pathogen Threats



- At low levels, native “pests” provide important ecosystem services



- But...**major disturbance** events (drought, windstorms, wildfire) can lead to increased levels:
  - **Outbreaks** of insects, especially tree-killing **bark beetles**
    - Example: **Douglas-fir beetle** after major wind events
  - Trees weakened/stressed by disturbance  $\uparrow$  success of pathogens
    - Example: drought events can intensify **root disease**



# Integrated Pest Management



- Landowner objectives are key
- Understand forest ecosystem processes for stand type and location
  - What is natural “background” mortality?
- Low maintenance forests are made up of **vigorous trees** that are **resilient and resistant** to pests and damage



**Adventitious root growth**



# Integrated Pest Management

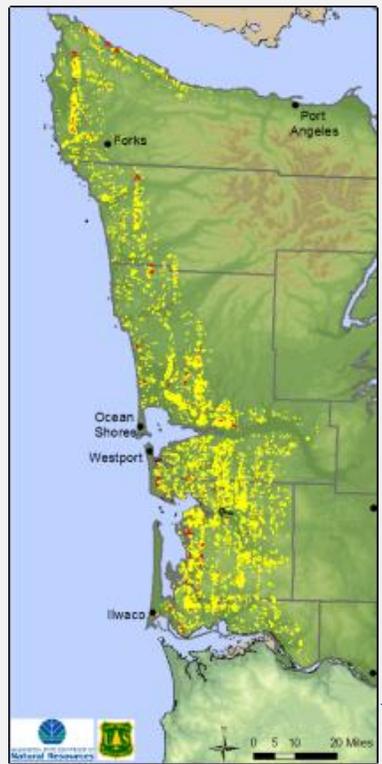
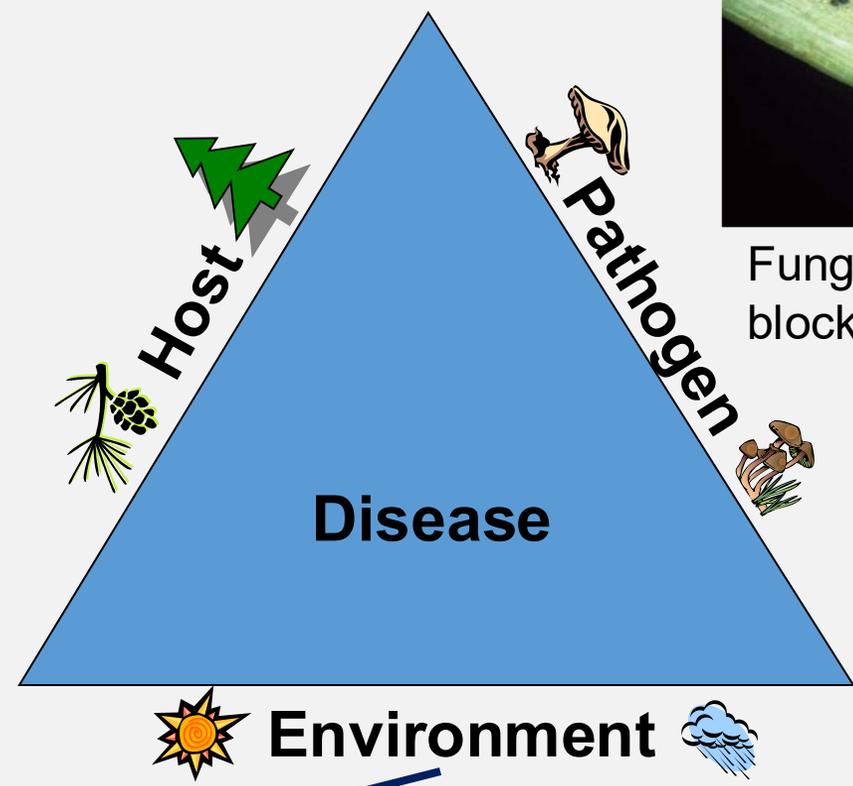
## Example: Swiss needle cast

- Host species, host condition, and environmental conditions influence ability of pathogen (or insect) to cause damage



Fungus that blocks stomates

Douglas-fir is the only host



Aerial survey for SNC damage

Fungus requires a moist climate to reach damaging levels

# Native Insect and Pathogen Threats



- **Root Diseases**

- 3 major types in western WA (Laminated RR, Armillaria, & Heterobasidion or “Annosus”)
- Kills trees slowly; can be **chronic** for decades in one site – *“diseases of the site”*
- Important **role in stand succession & complexity**
- Impacts highly variable across landscapes
- **Challenging to quantify** over large regions (rarely seen in aerial surveys)



# Root Disease Identification



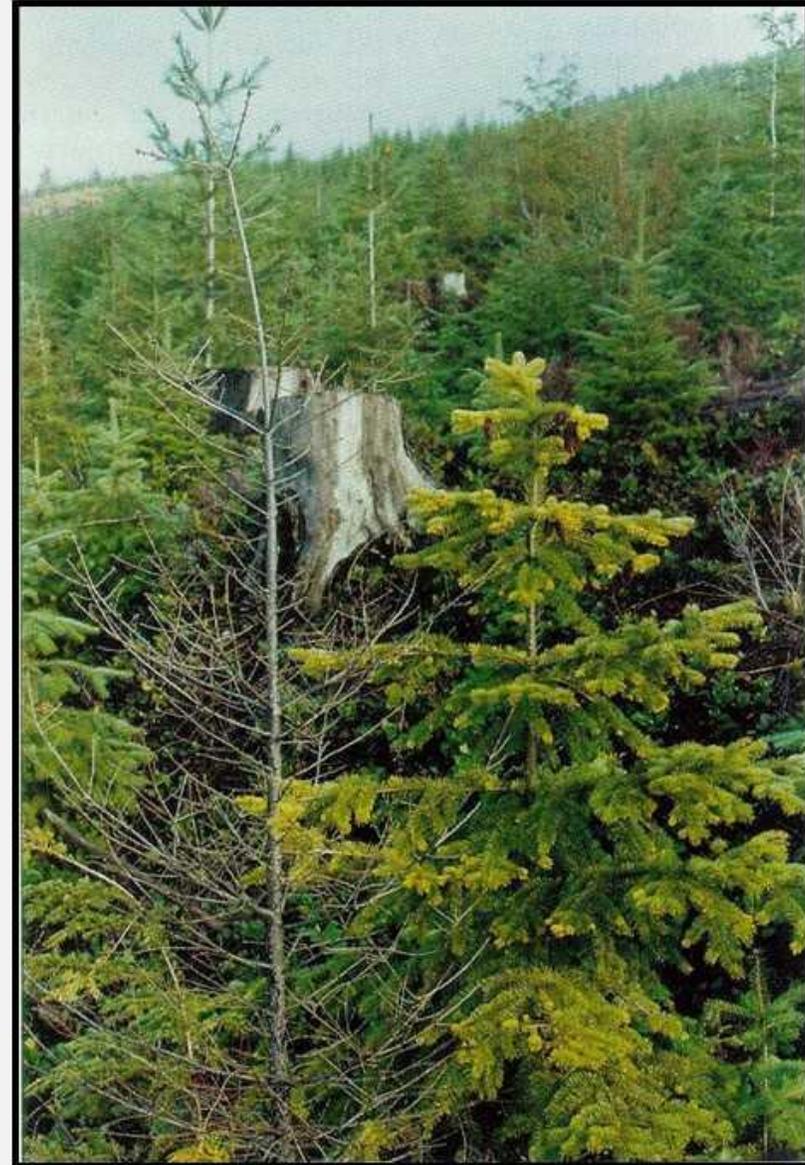
- Root disease centers are usually localized
- All sizes of susceptible trees can be affected
- Often spread by root to root contact



# Root Disease Identification



- Thinning crowns
- Stress-crop of cones
- May precede bark beetle attack
- Reduction of shoot growth
- Chlorotic (yellow) foliage



# Root Disease Identification



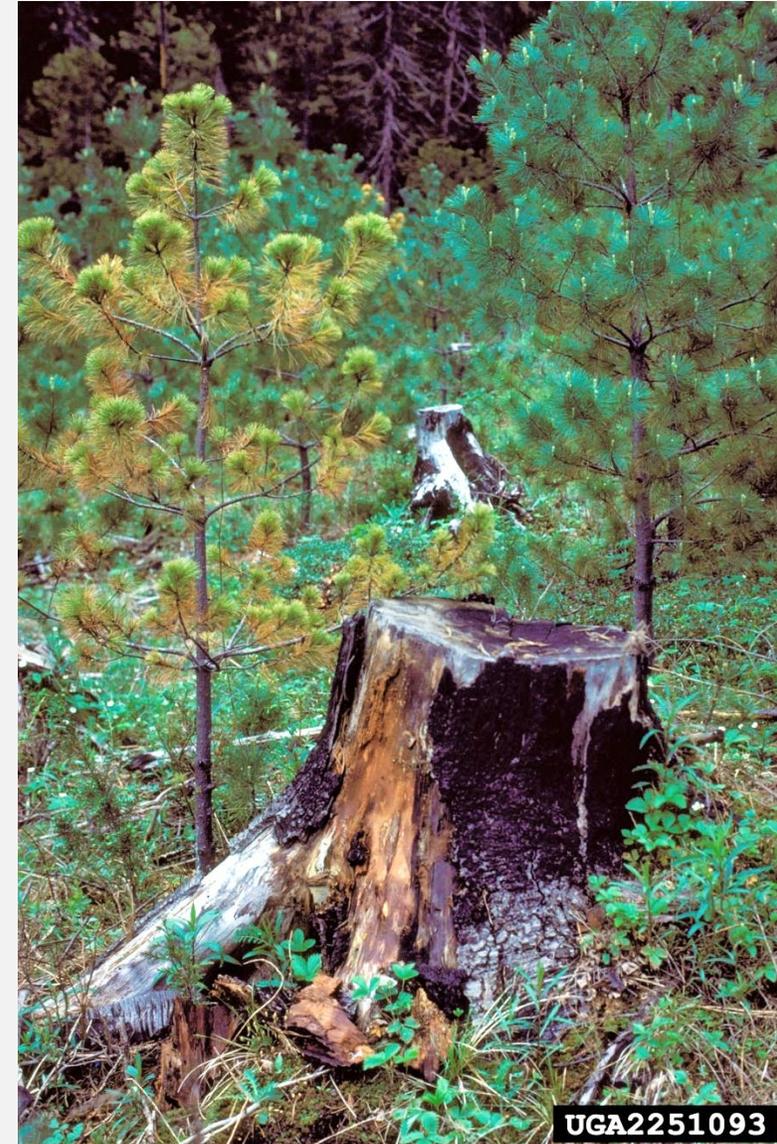
- Roots covered with fungal mycelium
- Mycelium under bark
- Highly decayed root system
- Fruiting bodies (conks) are rare



# Root Disease Management



- Get the RD species correctly identified
  - Ask for help !
- Maintain high **tree vigor**
- Species manipulation (**plant non-hosts**)
- Create buffers (fungus doesn't actively move through stumps)
- Treat cut stumps for *Heterobasidion* (annosus)
- Do nothing



# Native Insect and Pathogen Threats

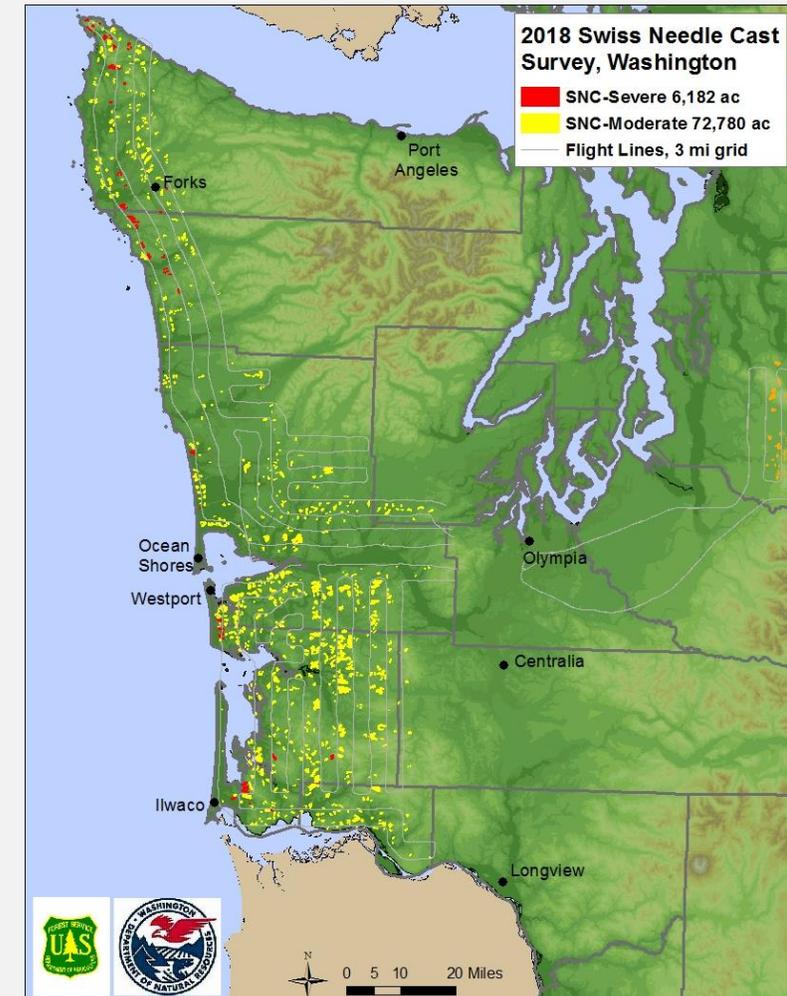


## • Foliar Diseases

- Variety of fungi cause discoloration and foliage loss
- Outbreaks often related to weather events (i.e. unseasonable precip) or off-site planting
- In **western WA**, outbreaks are short – most healthy trees recover
- Rare example of a chronic foliar disease (↑ growth loss & stress):
  - **Swiss needle cast** in Douglas-fir



Swiss needle cast - low needle retention



# Native Insect and Pathogen Threats



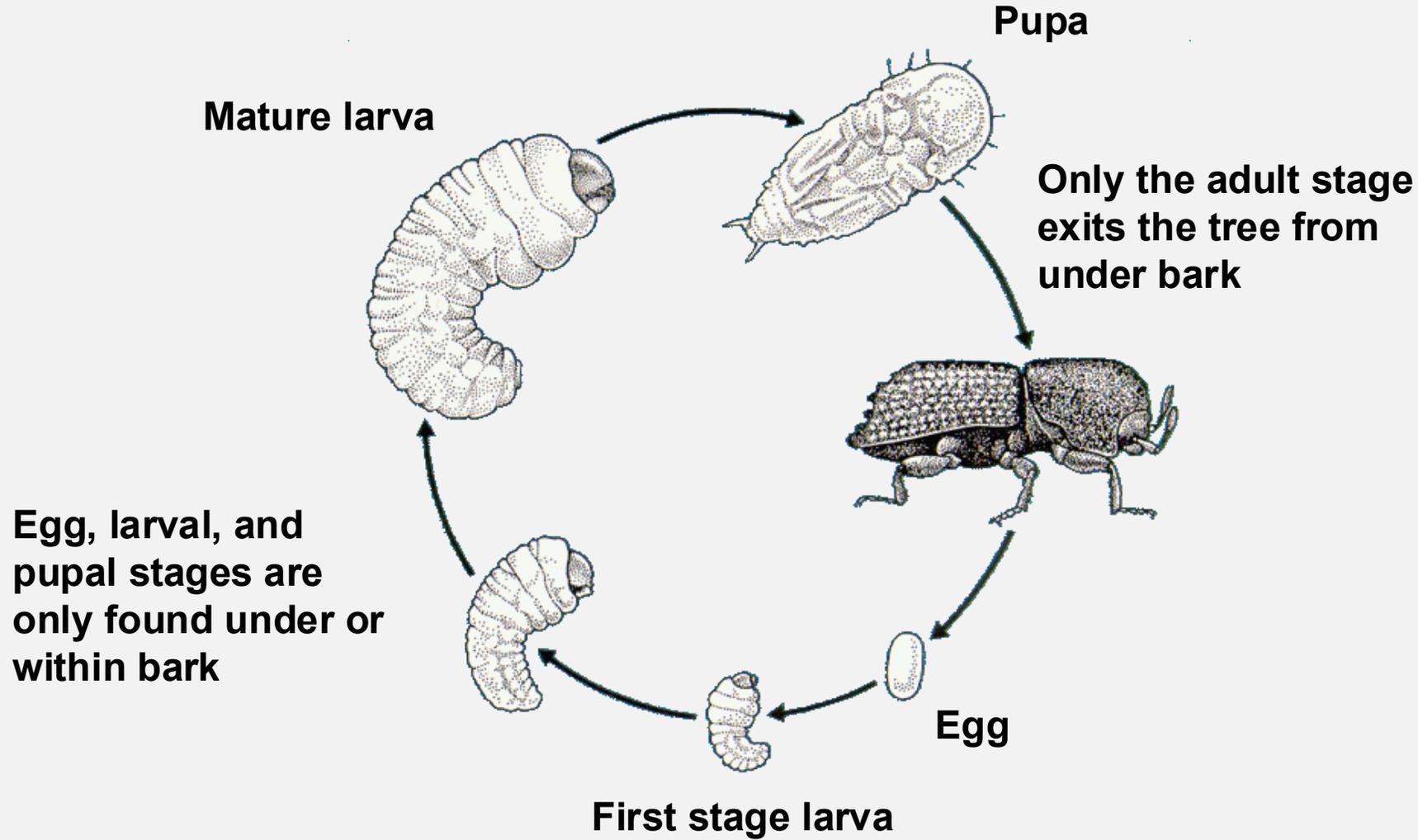
## • Bark Beetles

- Death occurs rapidly but **damage may not show until tree dries out one year later**
- Feed on inner bark (phloem), cutting off tree's food supply
- Locate and attack susceptible trees using host volatiles (like ethanol & terpenes produced by **stressed or dying trees**)
- Phloem food source is **only used by bark beetles for one season**
- Use pheromones to attract others to a tree and overwhelm defenses (**mass attack**)



**Exit holes made by new emerging adults**

# Bark Beetle Life Cycles

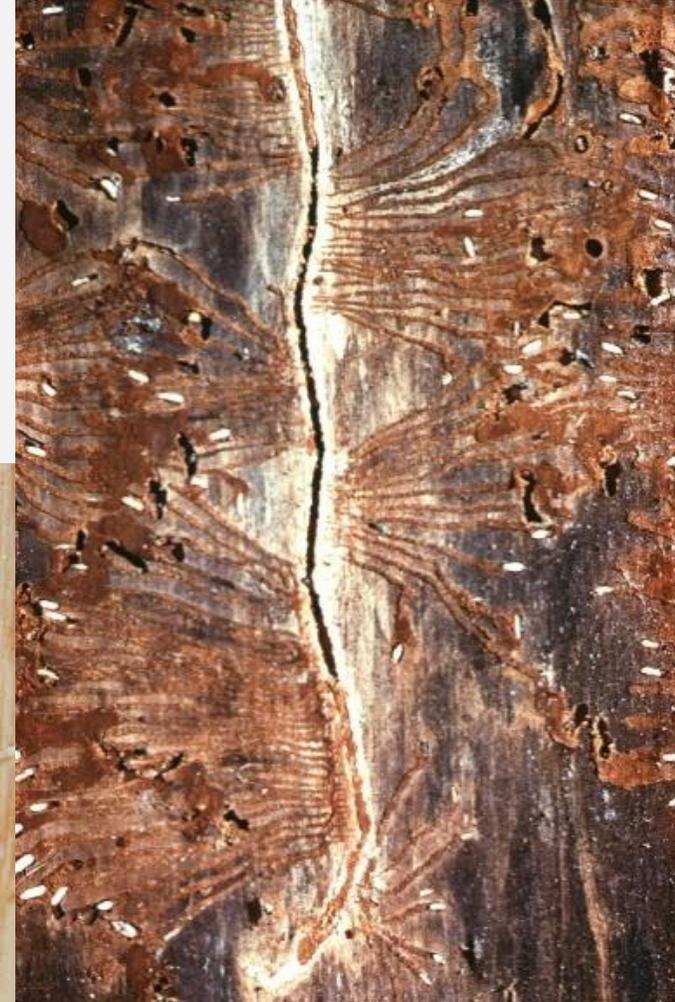


**Bark beetle eggs**

# Bark Beetle Identification



- Gallery patterns
- Frass & pitch flow
- Adults



# Bark Beetle IPM Example



- **Douglas-fir beetle**

- **Hosts:** Douglas-fir, may kill western larch
- Normally breeds in felled, injured or diseased trees, resulting in widely scattered mortality
- Epidemic populations can kill healthy trees over large areas
- Prefers >10 inch diameter trees
- Commonly group kill
- 1 year life cycle, adults **attack and lay eggs late March to June**



# Bark Beetle IPM Example



- **Douglas-fir beetle – outbreak cycle**



**Low Populations**  
Attack Scattered  
Blowdown &  
Root Disease  
Pockets

**Population Build-Up**  
Following Large  
Storm Events  
(1-2 Yr Duration)



Healthy trees can be a sink  
(beetles die trying to get in)  
leading to outbreak collapse.

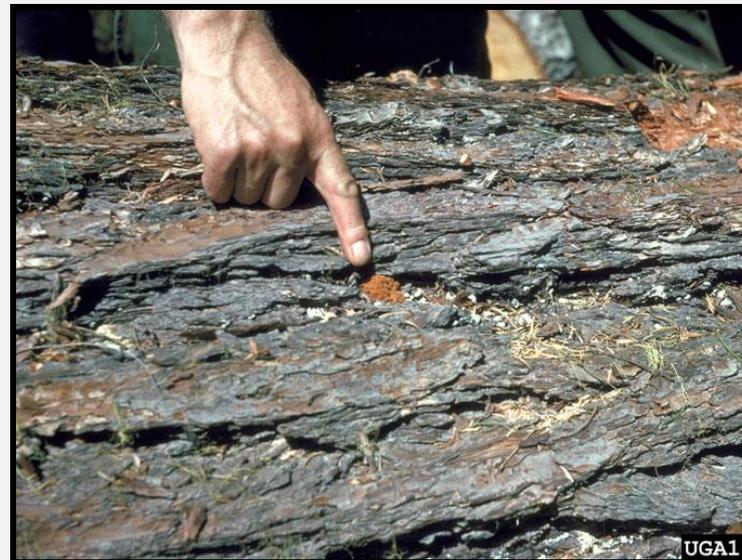
**Outbreak Levels**  
Standing Trees  
Attacked (>9")  
(1-2 Yr Duration  
west WA)



# Douglas-fir Beetle IPM



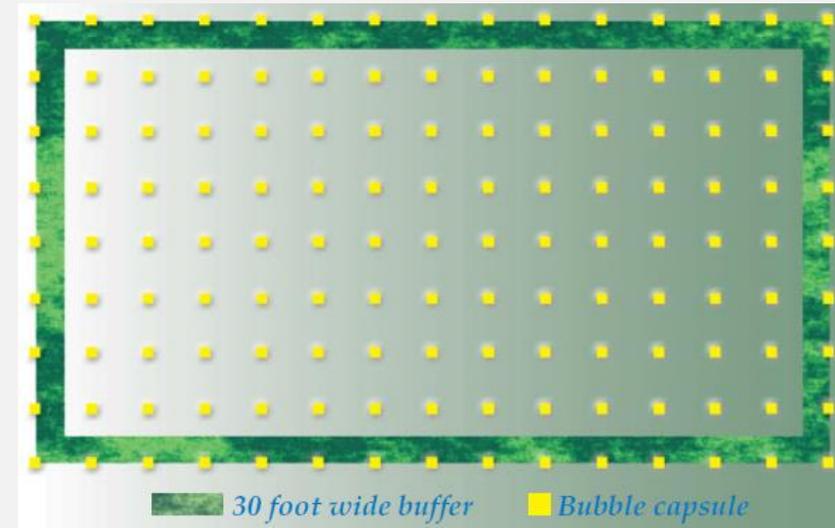
- Less than 5 **green dead** (>10" diam.) Douglas-fir per acre is **lower risk**.
- It takes about 2 downed trees to generate enough beetles to kill 1 live tree nearby
- Salvage blowdown **before two springs pass**.
- Salvage infested trees (with new boring dust) before next spring.



# Douglas-fir Beetle IPM



- Douglas-fir beetle repellent:  
**MCH** (antiaggregation pheromone)
- Effective, low impact, low-cost tool
  - Same pheromone used by beetles to reduce competition
  - Best for high value trees – yards, campgrounds, old growth
  - Cost ~ \$100/ acre, \$15 for a large DF tree
  - Bubble caps must be **applied before April flight** (ask an expert for best methods)



Apply on grid spacing for area control **or** single tree (2-4 each)



# Emerging Pest Threats



- California fivespined Ips
  - Pine engraver **bark beetle** (similar to *Ips pini*)
  - **Hosts:** Primarily ponderosa pine & other pine species
  - Historically in CA and OR
  - Low-level populations cycle in smaller diameter (>3") green branches and slash
  - Outbreaks can occur with abundant breeding material (2-3 generation/yr)
  - **Mortality often higher during droughts**



Top-kill pattern, reliably Ips-caused



*Ips paraconfusus*  
photo by Steve Valley, ODA

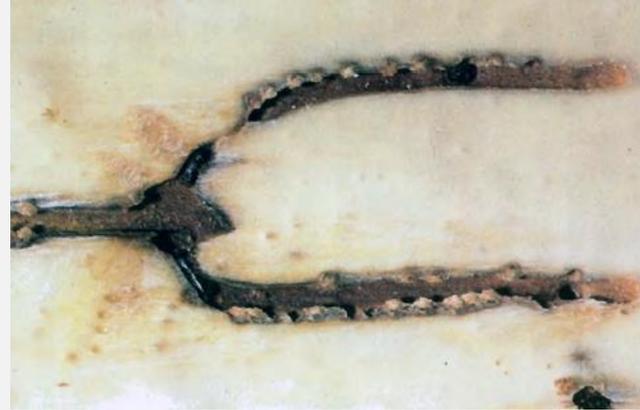


Piles of boring dust

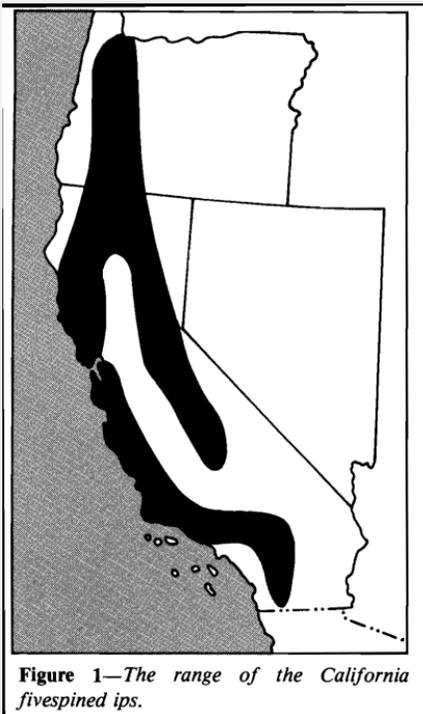
# California fivespined Ips (CFI)



- Expanded range in OR & WA
  - Starting in 2010, large outbreaks in Columbia Gorge ponderosa pine
  - First record of this species in WA

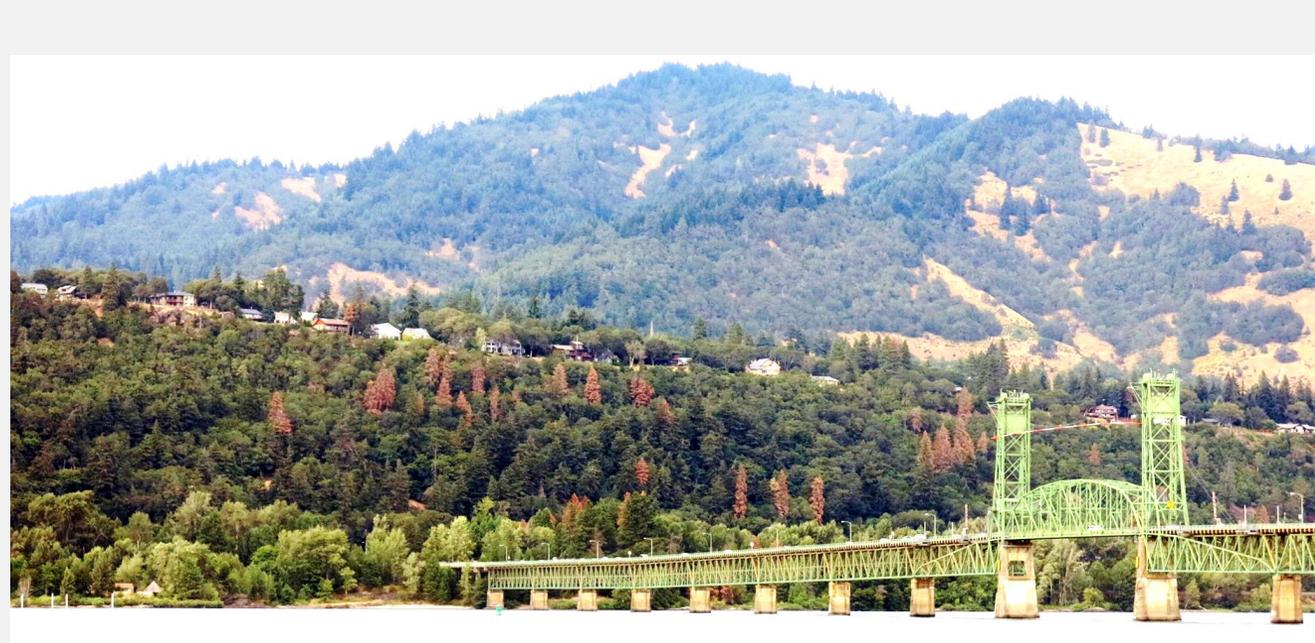


'Y'-shaped egg gallery



Range of CFI  
(Schultz &  
Bedard 1987)

Figure 1—The range of the California fivespined ips.

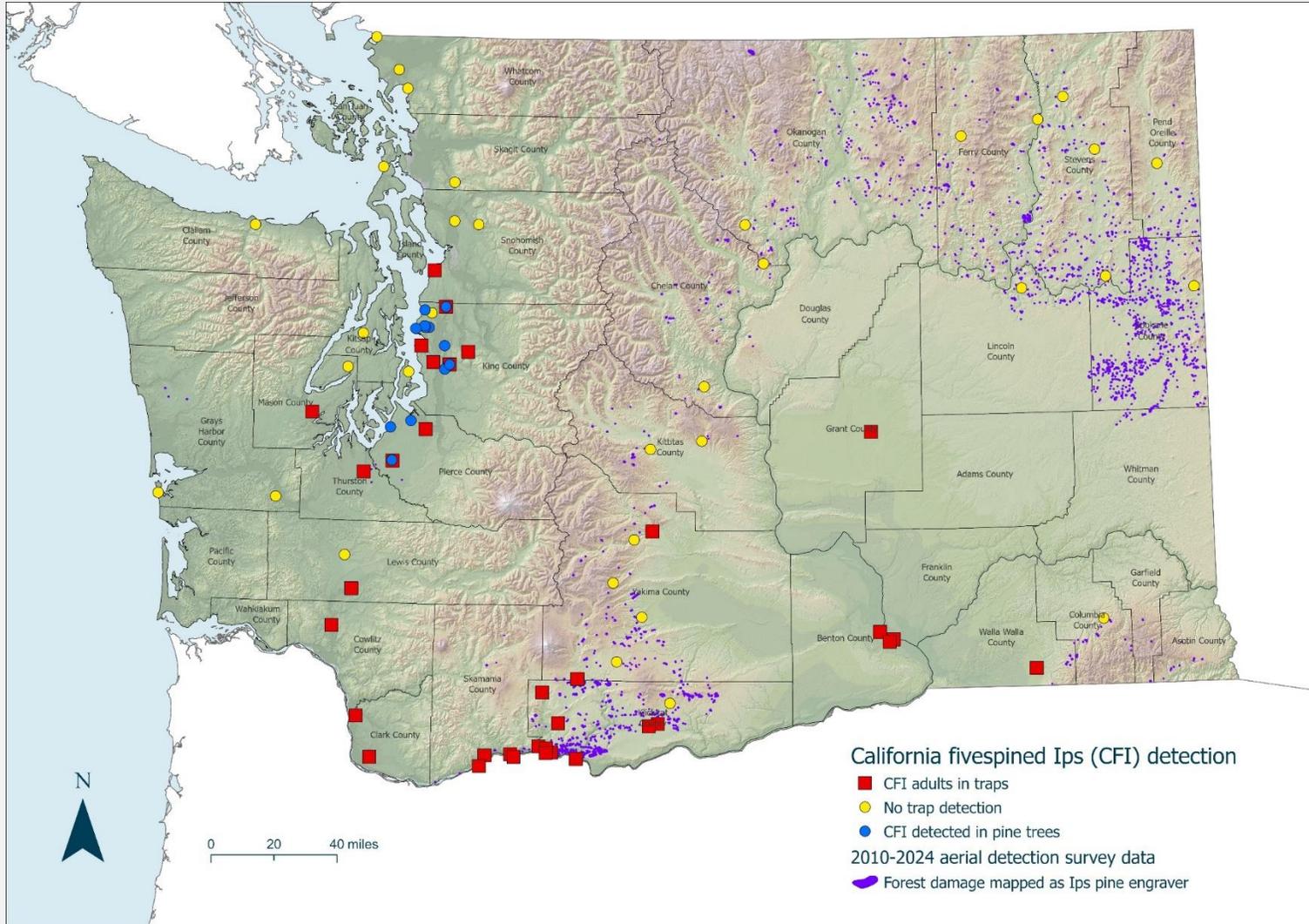


Damage from CFI near White Salmon , WA

# California fivespined Ips (CFI)



- CFI monitoring in WA (2011-2024)



- Pheromone baited funnel traps
- Found in 14 counties (red)
- Since 2022, **new outbreaks** around Puget Sound – killing wide variety of pine species (blue circles)

CFI in Austrian pines, Renton, WA 2023



# Pine Engraver Management (CFI & *Ips pini*)



- **Attack flight** period is mid-April to July
- Don't leave **fresh pine breeding material** >3" diameter from January to July
- Clean up storm or fire damage
- If slash created in "risky" months, should plan to **treat slash** (burn, lop & scatter, chip)



## Slash creation:

**'SAFE'** = Aug – Dec

**RISKY** = Jan - Jul

# Pre-disposing Factors



- **Flatheaded fir borer**, native, considered a secondary pest in WA
- Has killed large areas of Douglas-fir on dry sites in southwest OR
- Recent reports of it killing green trees in ID, southern BC, and a few in E WA
- Under **hotter and more intense droughts**, may become a wider issue for some lower elevation Douglas-fir stands



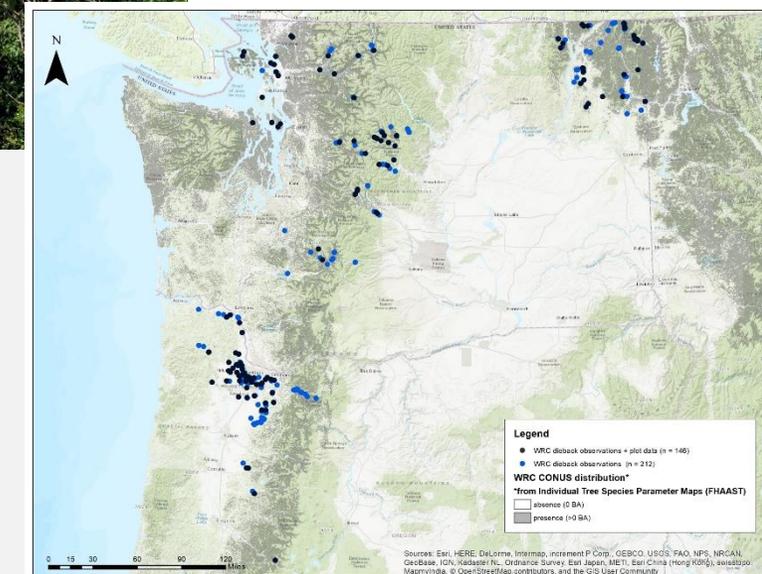
# Decline Complexes



- “It’s a complex interaction of biotic & abiotic factors”
  - *the answer when you have no idea what’s going on* 😊
- Symptoms from multiple contributing factors are sometimes called “**decline complexes**,” increasingly observed in western forests
- Underlying causes and long-term impacts are not well understood.
- A local example – **western redcedar decline**
  - Drought & heat are significant factors from research



WRC decline symptoms & survey plots



# Emerging Pest Threats



- **Sudden oak death**

- *Phytophthora ramorum*, non-native water mold
- Causes sudden oak death or ramorum blight
- Wide host range (100+ species)
- **Oregon white oak is not a host**, but many other natives are
- **Established in SW Oregon** (tan oak) – area quarantined
- Found impacting plants in nurseries and in ornamental plantings
- DNR completes an annual survey “stream baiting” waterways survey
- Oregon does aerial surveys of infested area

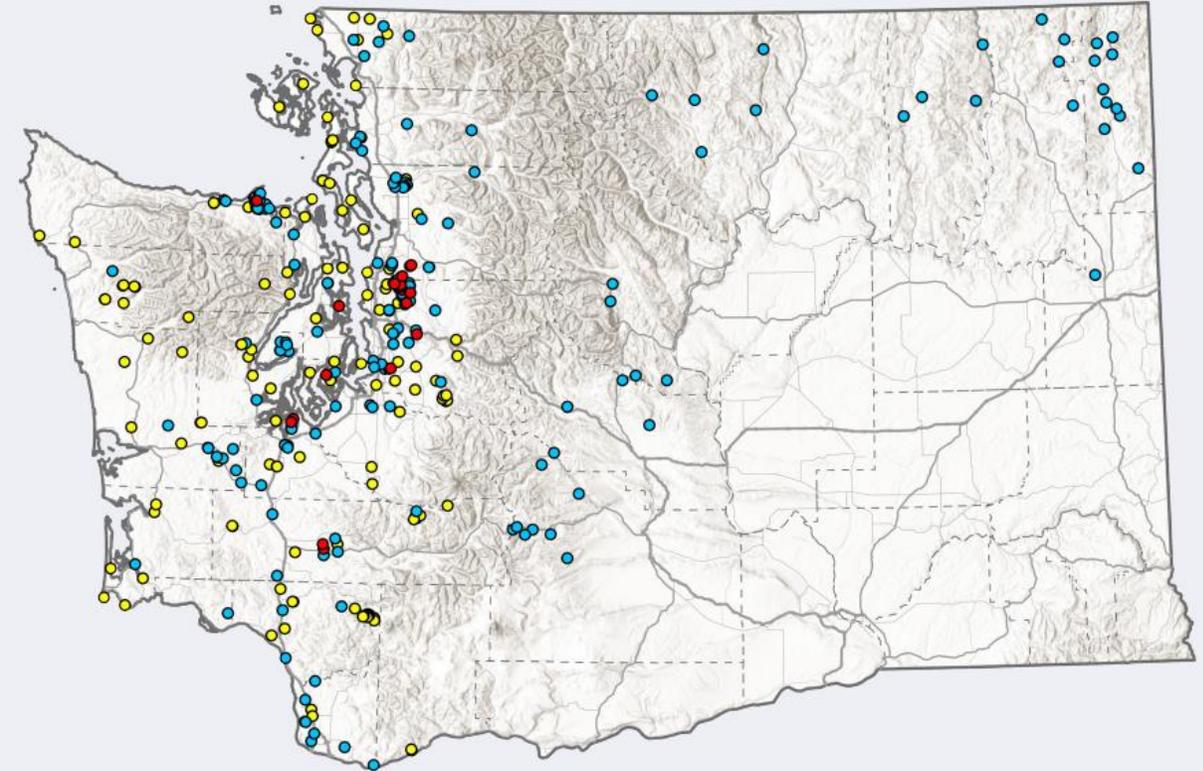
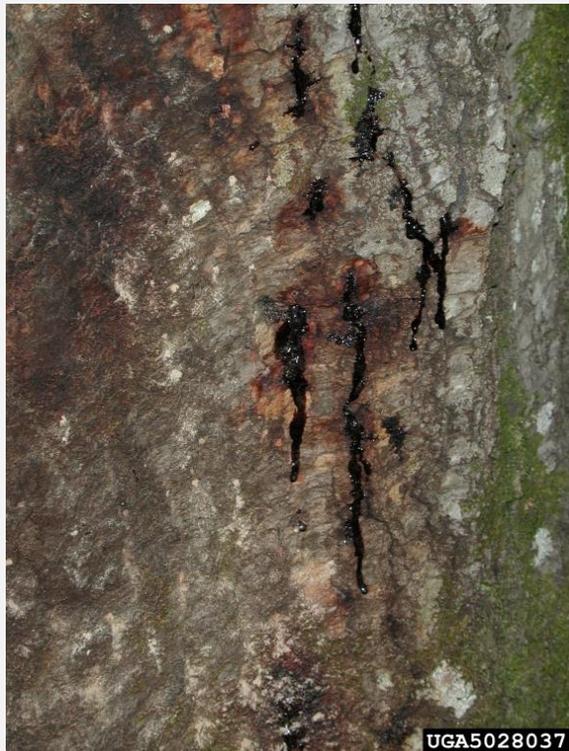


Rhododendron leaf baits in a stream, WDNR

# Sudden Oak Death (SOD)



- Stream baiting results in WA
  - No waterways tested positive in 2024
  - No indication the pathogen is leaving waterways



**No sampling locations tested positive for Pr in 2024. However, Washington's forests remain at risk for Pr spread and Pr-caused disease**

**Figure 23.**  
**DNR PHYTOPHTHORA RAMORUM MONITORING, DETECTION, AND SURVEY SITES, 2003-2024**

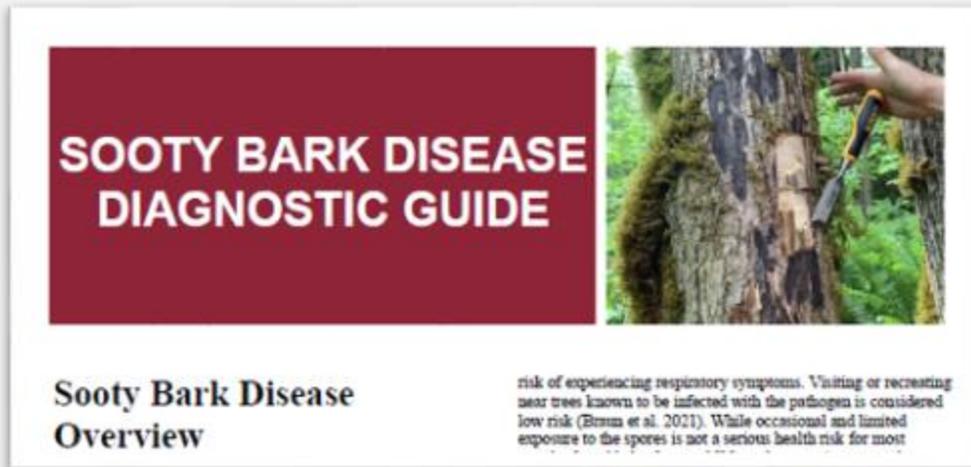
SOURCE: DNR

- KEY**
- Positive Aquatic Baiting Location
  - Negative Aquatic Baiting Location
  - Negative Wildland Survey Location

# Emerging Pest Threats



- **Sooty bark disease in maples**
  - Emerging fungus (*Cryptostroma corticale*) around Seattle
    - Unknown nativity, unknown pathogenicity
    - Is considered an invasive in Europe
  - Collaborated with WA L&I and DOH to summarize known **human health concerns** on their websites
  - Published WSU extension guide for ID:



[pubs.extension.wsu.edu/sooty-bark-disease-diagnostic-guide](https://pubs.extension.wsu.edu/sooty-bark-disease-diagnostic-guide)



# Sooty bark disease monitoring



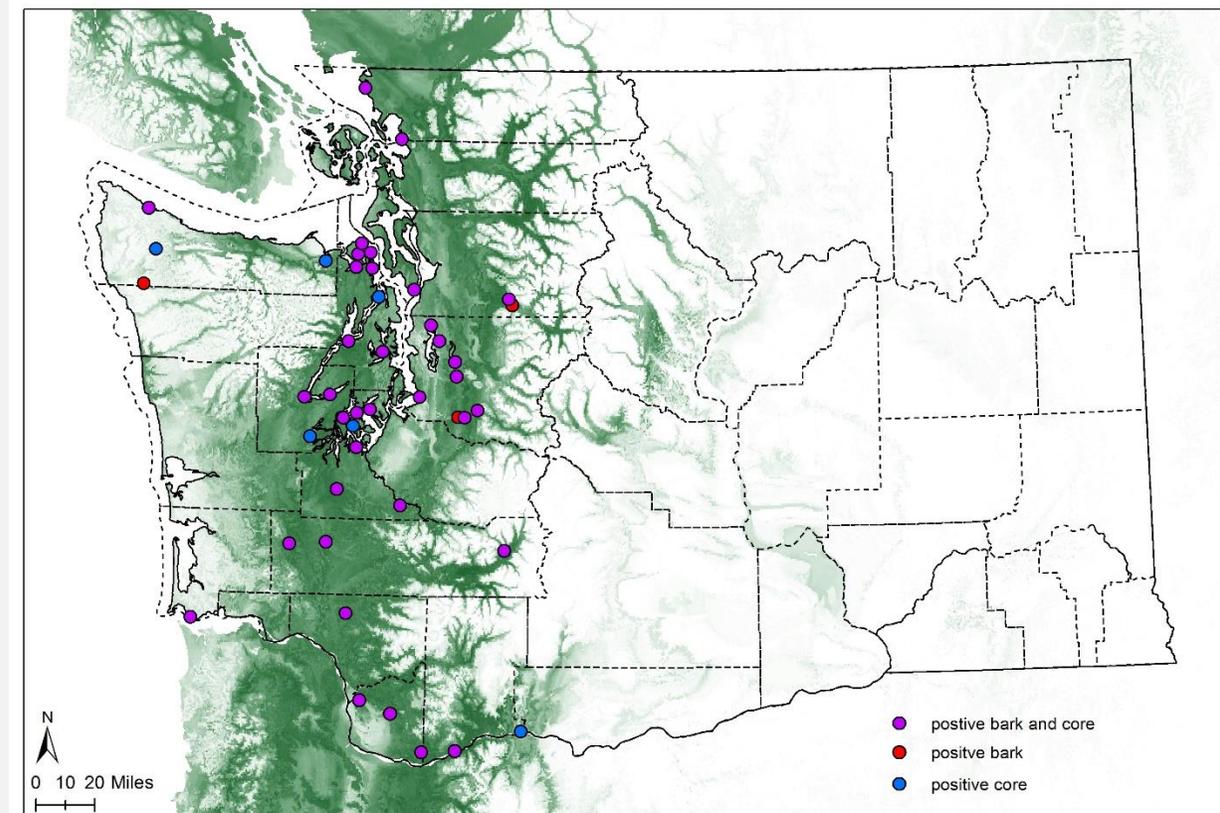
- Completed a survey in summer 2022 looking for *C. corticale* in western WA
- Confirmed presence at 45/46 sites with bigleaf maple
- Started collaborative research with WSU in 2025 – to learn more and links to drought stress



Cored asymptomatic trees for latent infections



Sampled possible fruiting bodies on symptomatic trees



All points = positive *C. corticale* site

Thank You!



Questions  
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