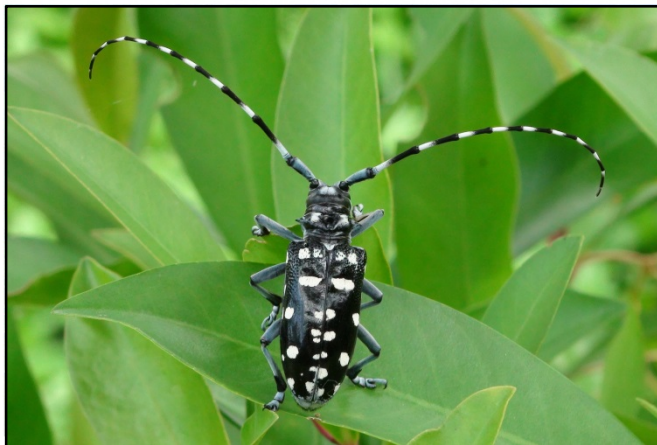
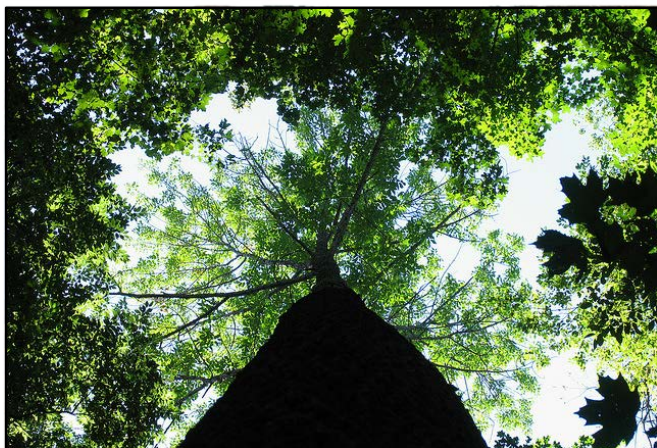


Emerging Invasive Species Threats to PNW Trees and Forests



Photos: (clockwise from top left) Joseph O'Brien, NatureServe, Andrew Koeser, David Capaert, Dennis Haugen, NatureServe

What I'll cover

- Overview of invasive species risks
- Emerald ash borer
- Asian longhorned beetle
- Gypsy moth
- Thousand Cankers
- Polyphagous shothole borer
- Take home messages

What are invasive species?

- *Non-native in origin*
- *A pest (competes with humans for resources)*
- *Tremendous negative consequences*



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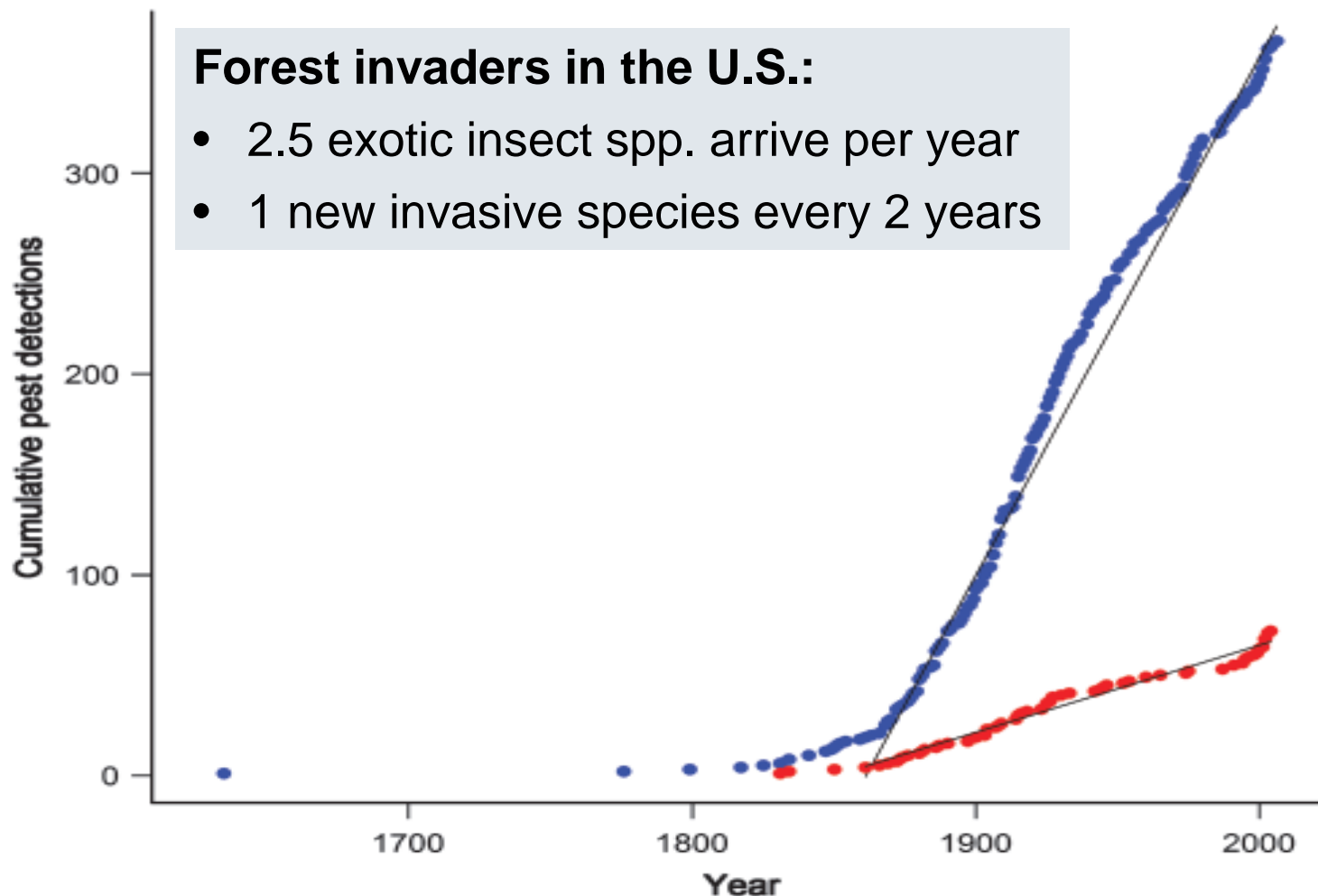
Native

Invaders

Non-native

Hypothetical community

Forest invaders are always arriving in the U.S.



Forest invaders in the U.S.:

- 2.5 exotic insect spp. arrive per year
- 1 new invasive species every 2 years

Blue = All non-native forest insects
Red = Invasive forest insects and disease

Aukema et al. 2010

Previous invaders to PNW forests



White pine blister rust

- First observed in Pacific Northwest in **1921**
- Western white pine virtually eliminated from large parts of natural range

Balsam woolly adelgid

- Introduced **1929** to west coast
- Subalpine fir mortality in 1950s-1960s
- 10-year average: **100,000 acres/year** of heavy damage in OR

Port-Orford-cedar root disease

- Introduced **1952** in Oregon
- Drastic drop in Asian export market

Sudden oak death

- Introduced **2001** in Oregon
- Kills larch and Douglas-fir in United Kingdom plantations



Photo: Beth Willhite

Consequences of invasive species



1. High costs of control, losses to industry.

- Scotch broom and Himalayan blackberry: \$80 million/year in OR, the loss of 1,700 jobs (ODA 2014)
- Asian gypsy moth potential: \$4.3 billion (USFS)
- Emerald ash borer: \$3.5 billion in costs to date, and rising (Aukema 2011)



Scotch broom invasion

2. Increased pesticide use

3. Human health concerns

- Cardiovascular disease, depression

4. Species extinctions

- Many examples from forestry



Cheatgrass-fueled fire

How forest invaders get here

- Live plant trade (~70% of species)
- Solid wood packing material (~25% of species)
 - Wood dunnage, crates, pallets, spools
 - Bracing containers, steel slabs, steel coil, rail, tile, etc.



Oregon Dept. Ag.



The situation in Oregon

Oregon's top 20 commodities: 2015

Rank	Commodity	Value - Dollar
1	Cattle & calves	914,324,000
2	Greenhouse & nursery ¹	894,833,000
3	Hay	604,062,000
4	Milk	474,486,000
5	Grass seed ²	383,972,000
6	Wheat	217,433,000
7	Potatoes	176,450,000
8	Pears	152,497,000
9	Grapes for wine	147,550,000
10	Onions	125,273,000
11	Christmas Trees ¹	123,857,000
12	Eggs	116,161,000
13	Blueberries	104,307,000
14	Hazelnuts	86,800,000
15	Cherries	68,102,000
16	Mint for oils	52,544,000

- **Nursery is #2 Ag. commodity**
- Oregon ranks 3rd in Nation
- \$900 million in sales

Oregon Dept. Ag.

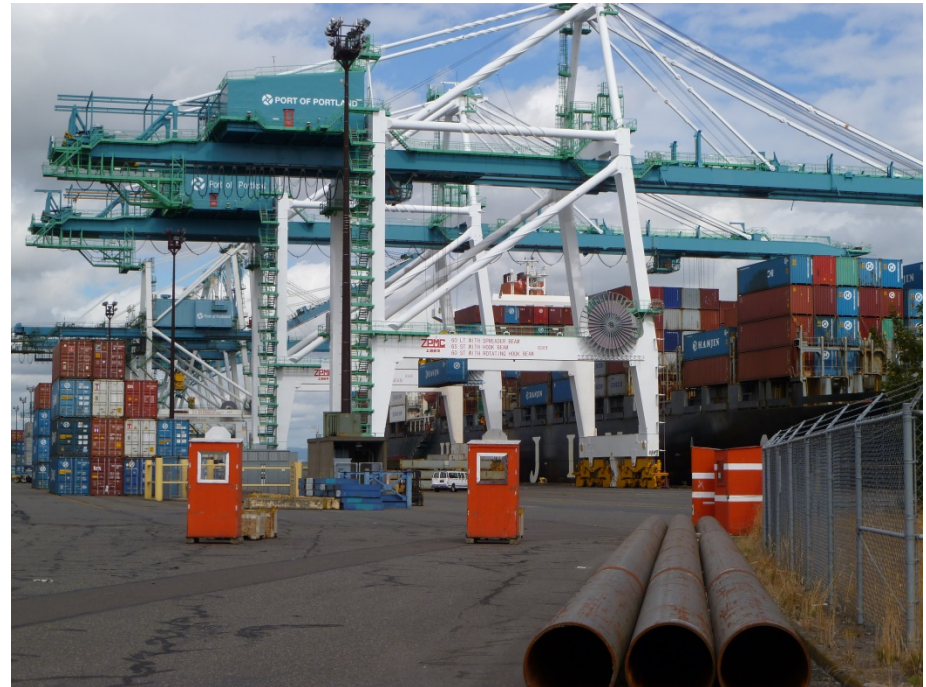


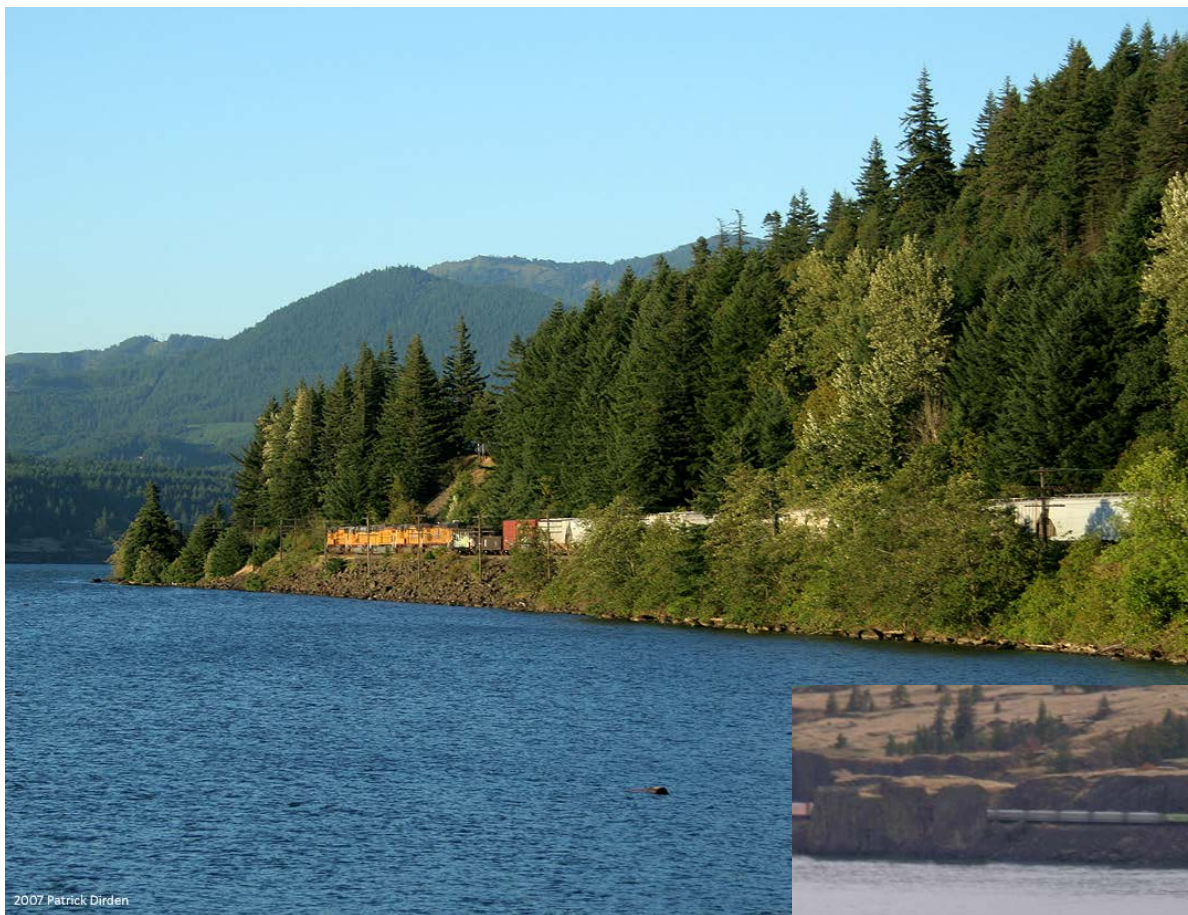
Port of Portland

- 40 million tons of cargo (\$20 billion) annually on Columbia River
- **PDX imports in 2012:** 2.8 million tons (\$200 million)

Regional Ports of Entry for Inspections

- Entry ports in Portland/ SW Washington for Dunnage
 - Terminal 6 Portland
 - Terminal 2 Portland
 - Port of Vancouver
 - Port of Kalama
 - Port of Longview
- Other inspection points:
 - PDX
 - Marine terminals
 - Bonded warehouses





2007 Patrick Dirden

*Flickr.com: Patrick Dirden,
pauljess999, gvgoebel*

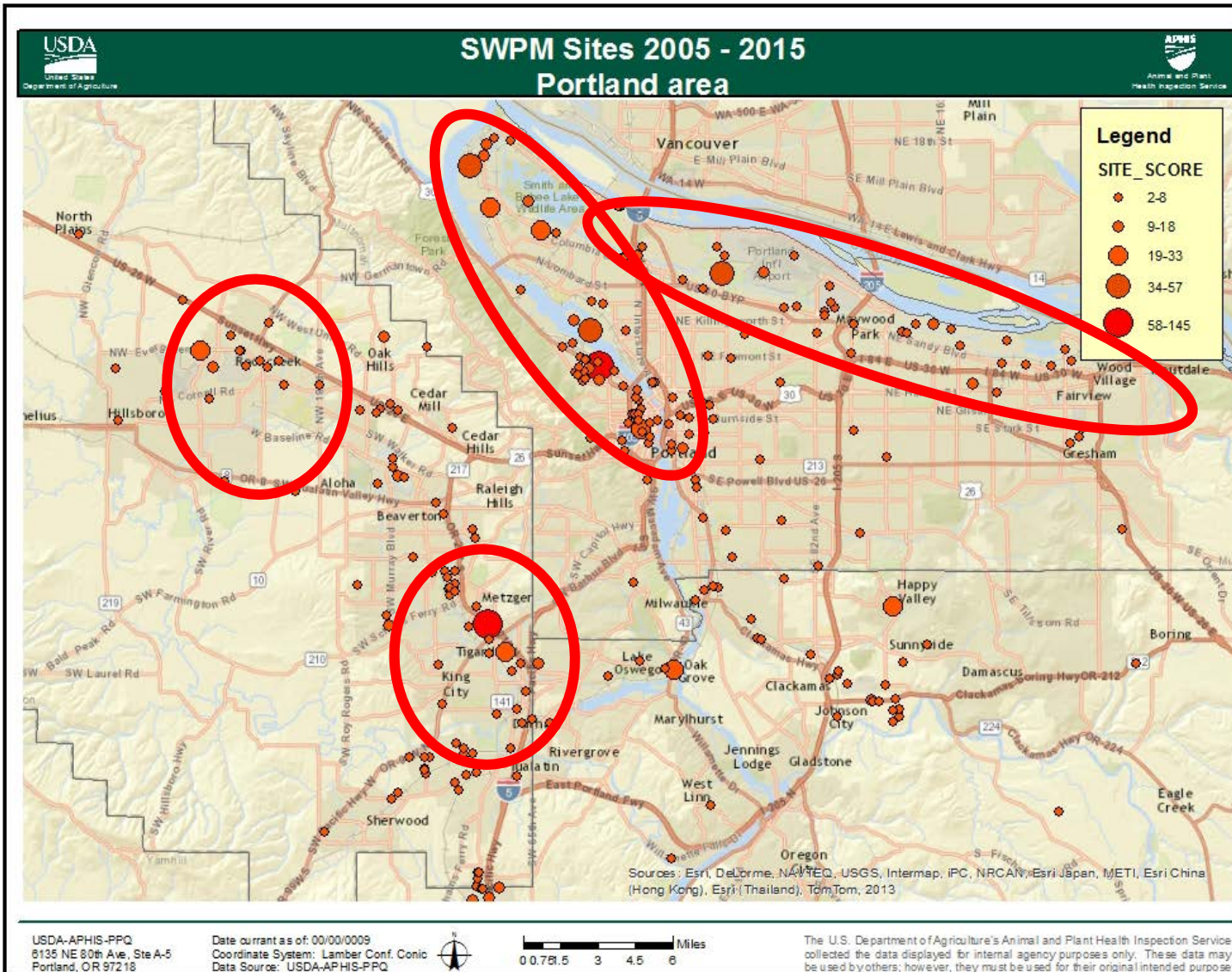


Introduction Safeguards

- Agricultural Inspectors
 - Customs and Border Control
 - USDA APHIS
 - Inspect cargo and passengers
 - Pests, noxious weeds, plant and animal diseases
- ISPM 15
 - International standard
 - Requirement to treat wood materials (pallets, crates, dunnage, etc.)
- Introductions still happen!



Wood Packing Material Risks



Domestic Spread of Invaders

- Live Plant Trade (between states)
 - Example: Sudden Oak Death
 - ODA Nursery Inspection Program
 - USDA-APHIS Interstate regulation and quarantine
- Firewood (untreated wood products)
 - 50% of untreated firewood bundles have live insects
 - Huge public outreach program- Don't Move Firewood



PNW Firewood Import Laws

- 2012 Law- Firewood sold commercially in Oregon must be:
 1. Locally harvested (Oregon, Washington, or Idaho), or
 2. Heat treated (140°F for one hour) and certified
- **Does not apply to non-commercial firewood**



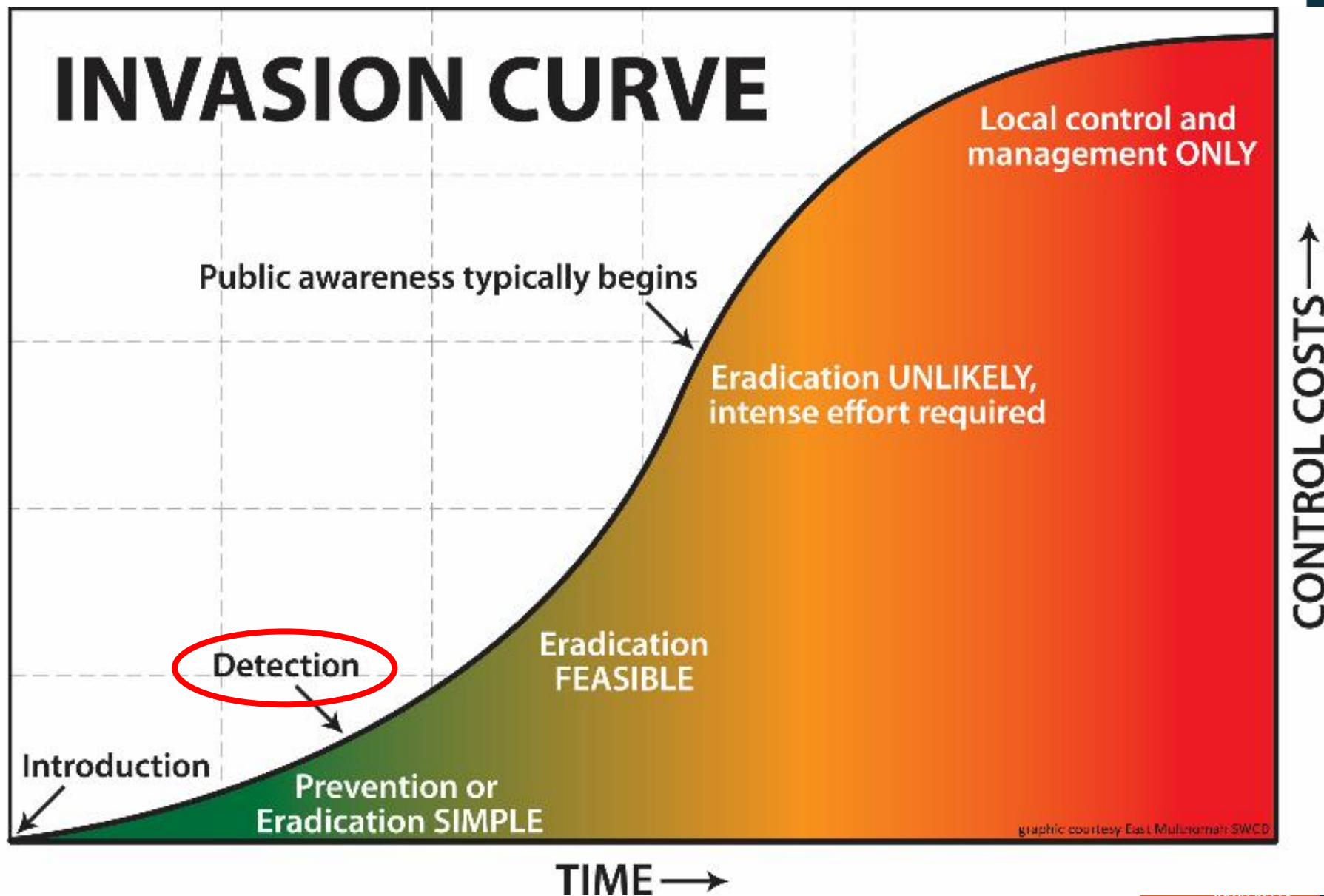
Oregon
Department
of Agriculture
635 Capitol Street N.E.
Salem, OR 97301-2532



Oregon State
UNIVERSITY

INVASION CURVE

AREA INFESTED





Gyorgy Csoka Hungary Forest Research Institute,
Bugwood.org



Steven Valley, Oregon Department of Agriculture, Bugwood.org

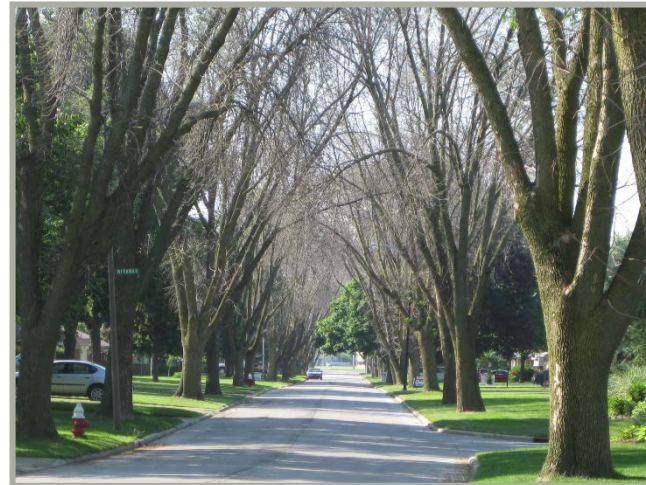
The Threats



Pests and Disease Library, Bugwood.org

Emerald Ash Borer (EAB)

- First detected in US in 2002
- Now confirmed in 30 states
- Has killed hundreds of millions of ash trees in North America
- Cost likely to exceed \$12.5 billion (costliest forest invader in U.S.)
- Quarantines



Emerald Ash Borer (EAB)

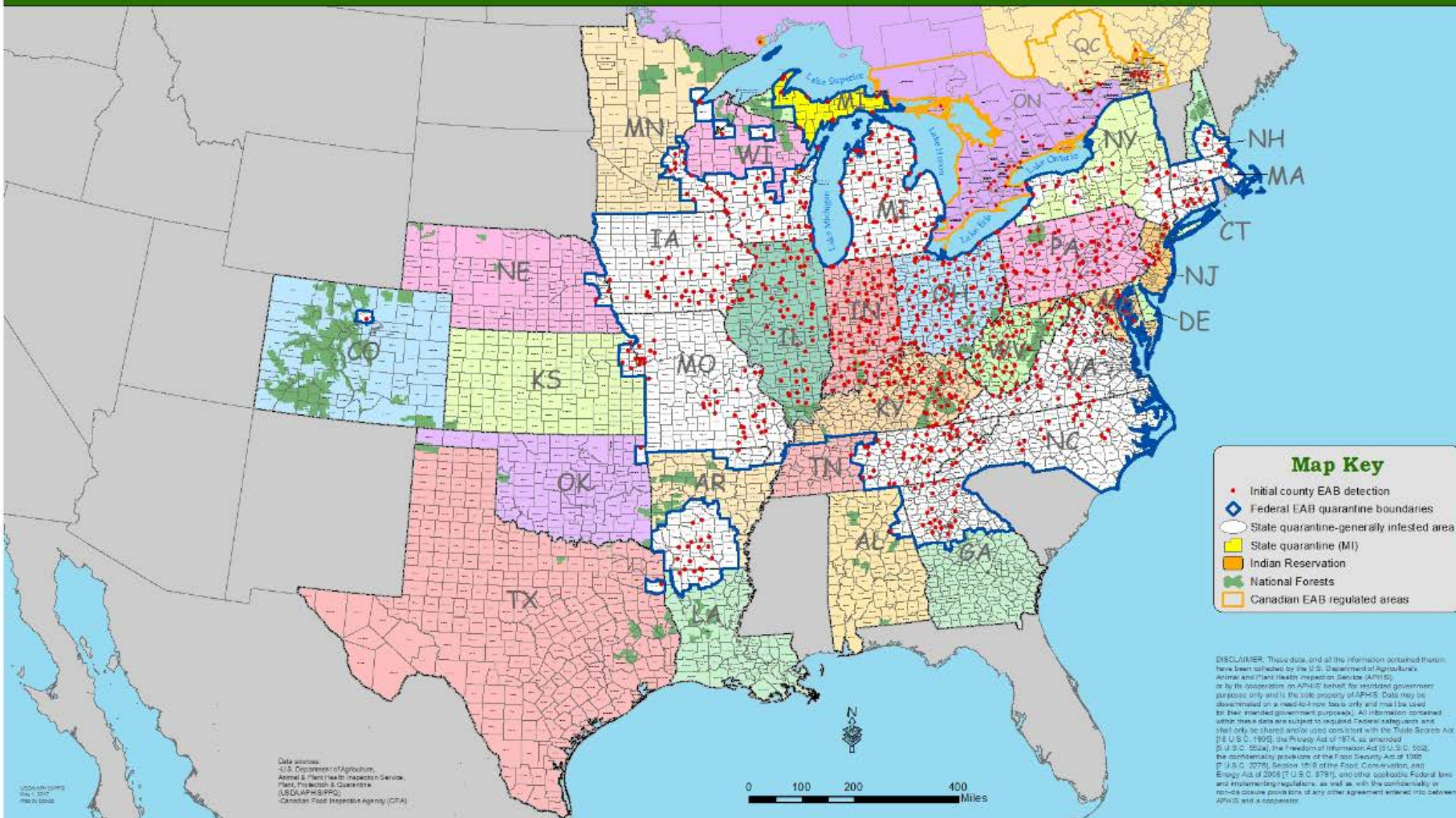


United States
Department of
Agriculture

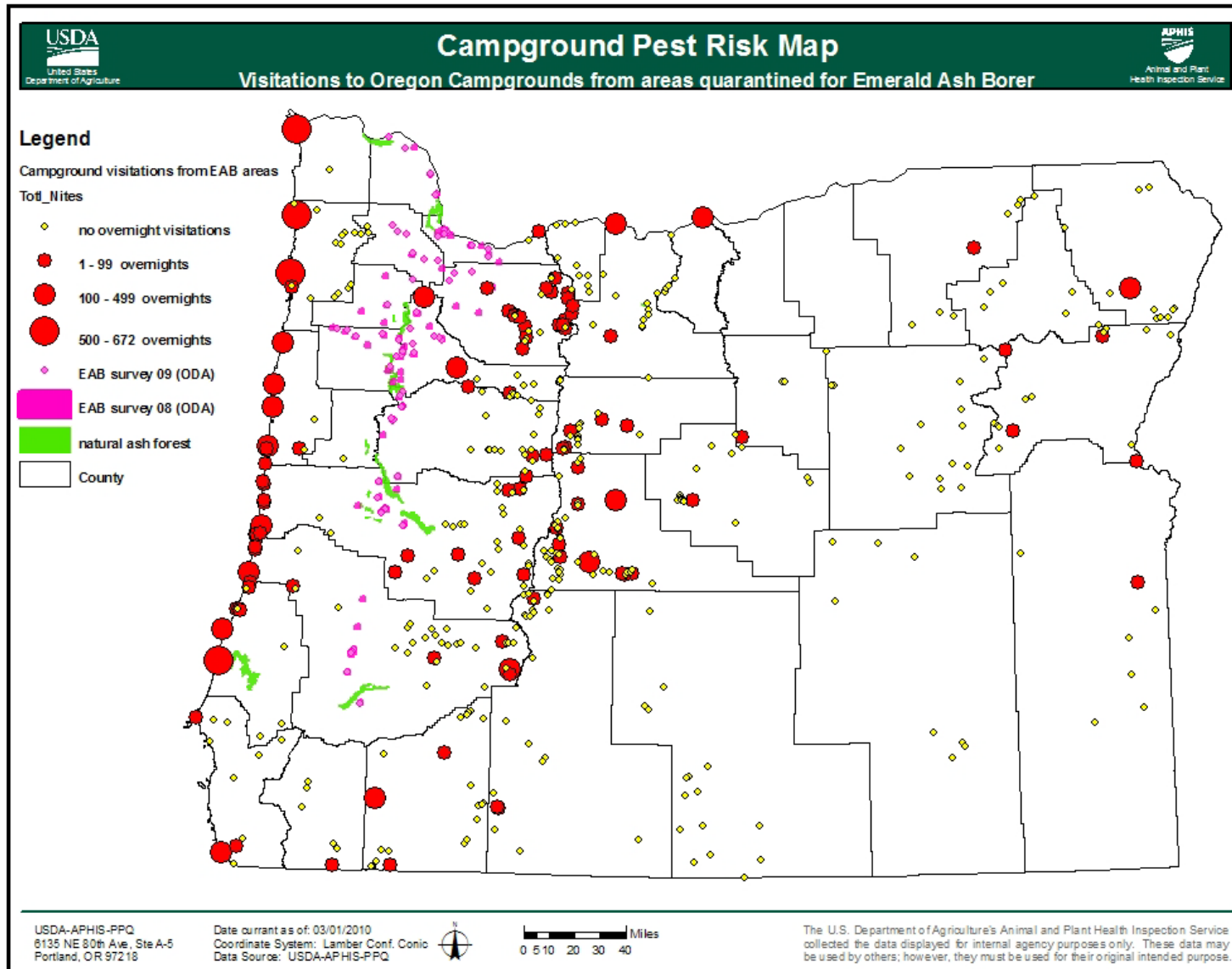
Cooperative Emerald Ash Borer Project

Initial county EAB detections in North America

May 1, 2017



The risk for EAB introduction

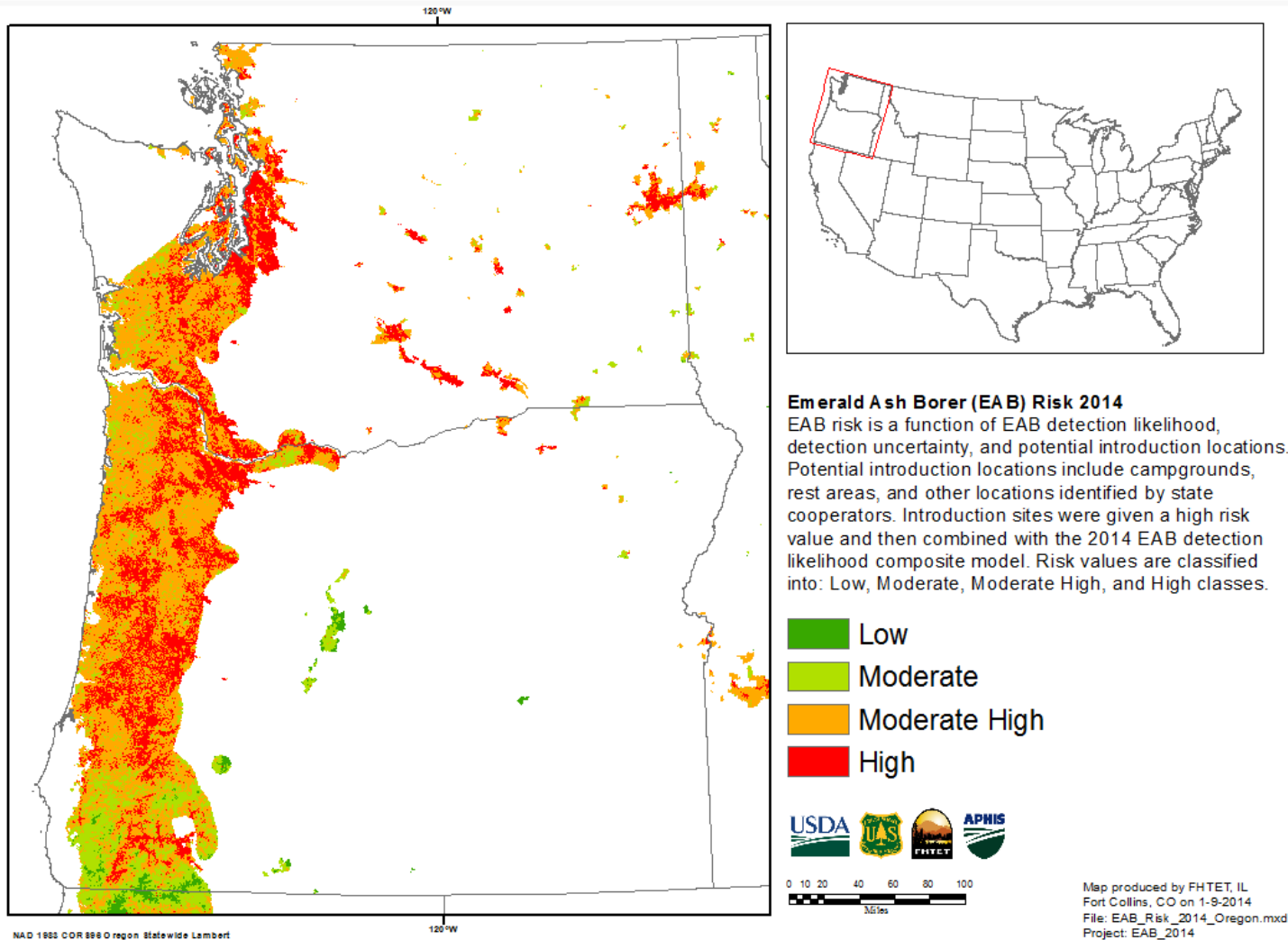


2010 data

Credit: Mark
Hitchcox,
USDA-APHIS

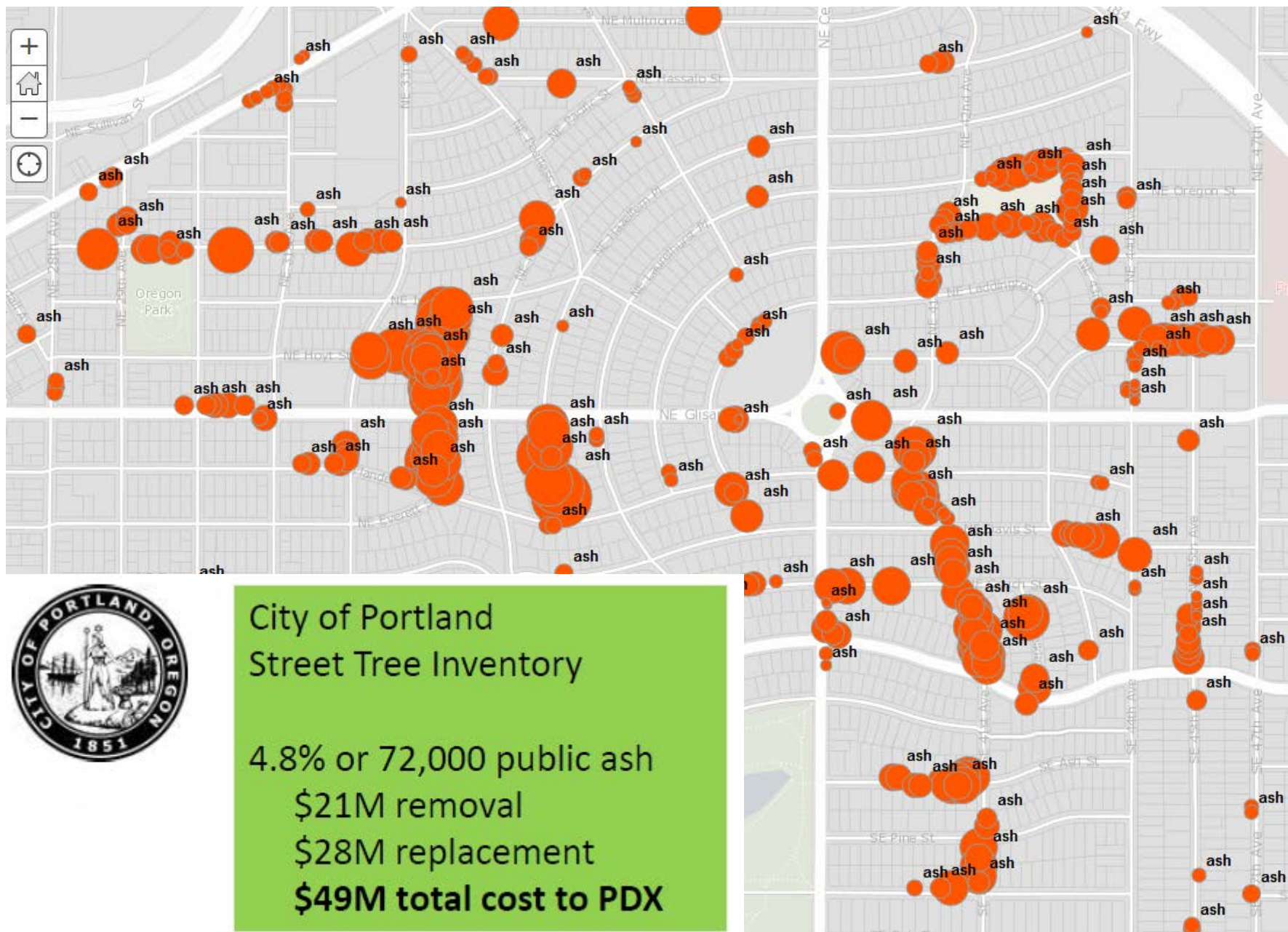
Oregon State
UNIVERSITY

The risk for EAB establishment is high





Photos: Wyatt Williams



EAB symptoms

- Crown dieback/thinning
- Epicormic shoots
- Woodpecker damage (blonding)



Amy Grotta

EAB signs

- S-shaped galleries
- D-shaped exit holes



EAB signs

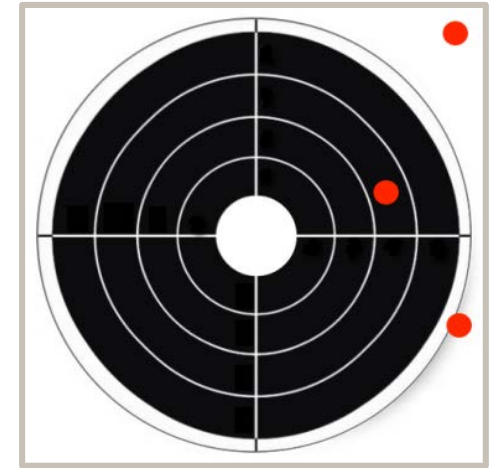
- Adults active May - July





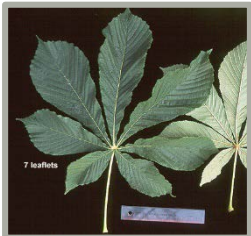
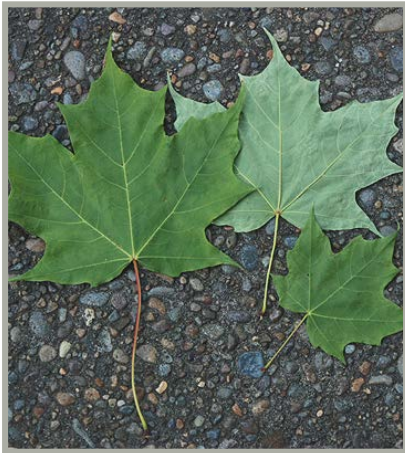
How would EAB be managed in PNW?

- Statewide response plans being developed
- Delimitation
- Traceforward/Traceback
- Control recommendations based on extent of infestation
- Treatment of high value trees (systemic insecticide)
- Removals
- Quarantine
- Biological control?



Asian longhorned beetle (ALB)

- Slow tree decline/death as larva tunnel through branches and trunks
- 3-4 years for symptoms to appear
- Many host trees in 12 genera
- Preferred hosts: maple, horsechestnut, birch, willow, elm

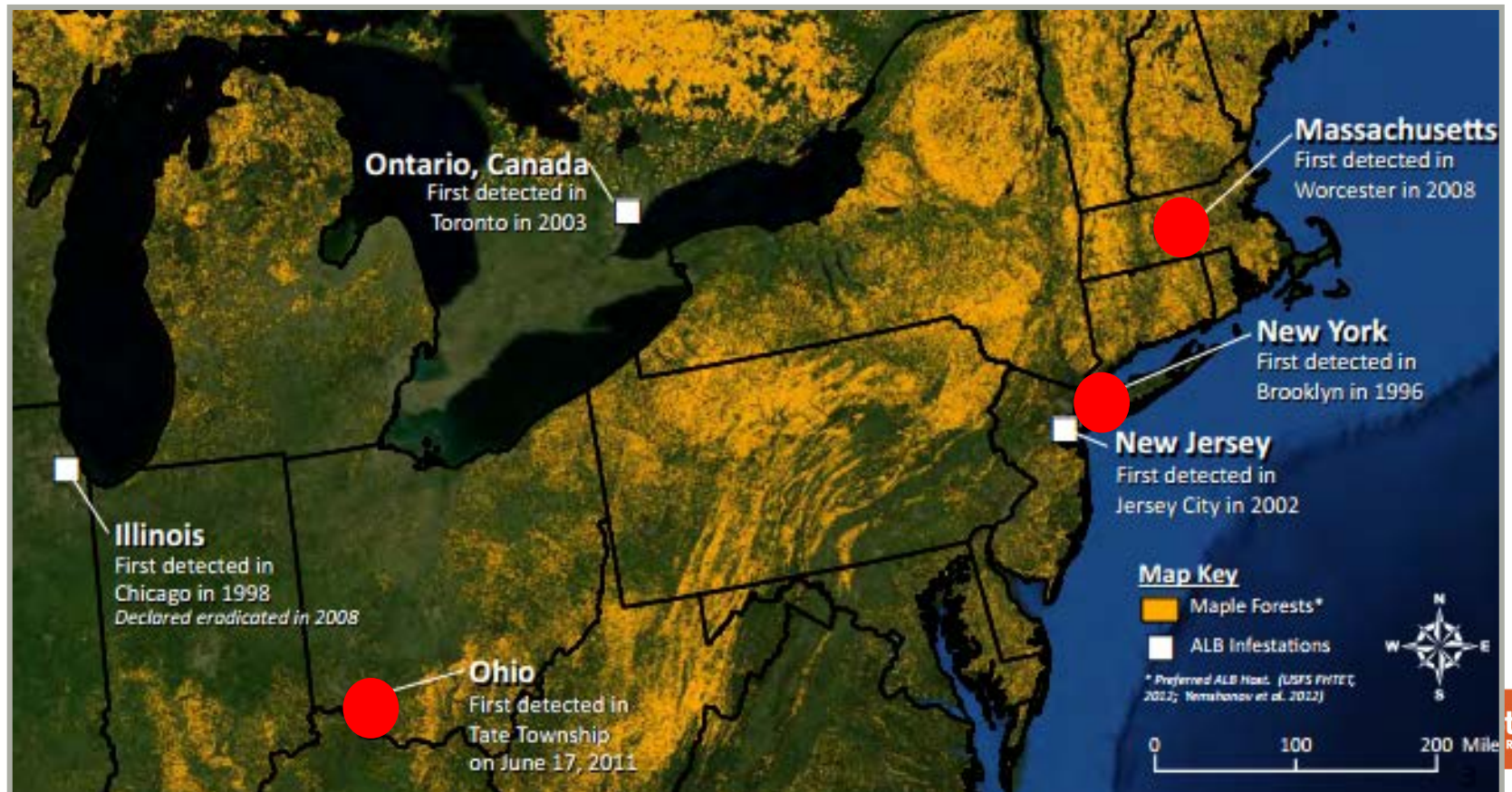


Asian longhorned beetle (ALB)

150,000 trees removed in OH, NY, MA

Millions of dollars spent on eradication and containment

Successful eradication in NJ, IL: early detection is critical!



ALB Damage

- Potential to affect 30% of urban forests in U.S.
- \$669 billion impact
- ~25% of Portland urban forest is maple



ALB



- Adults active mid to late summer
- Crown dieback, broken branches
- Round, ~1 cm exit holes
- Egg scars, frass



ALB Look-Alikes

ALB



banded alder borer



Oregon fir sawyer



Female



Male



How would ALB be managed in Pacific Northwest?

- Eradication
 - Tree removal
 - Tree surveys
- Containment (Regulation)
 - Define regulated areas
 - Safeguard known infested host material
 - Regulate movement of host materials



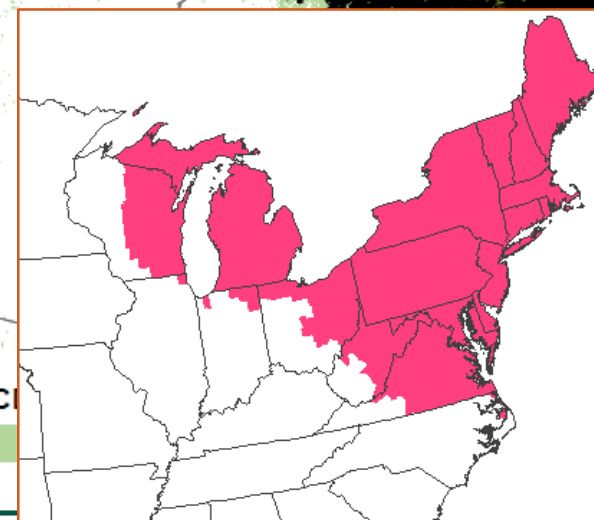
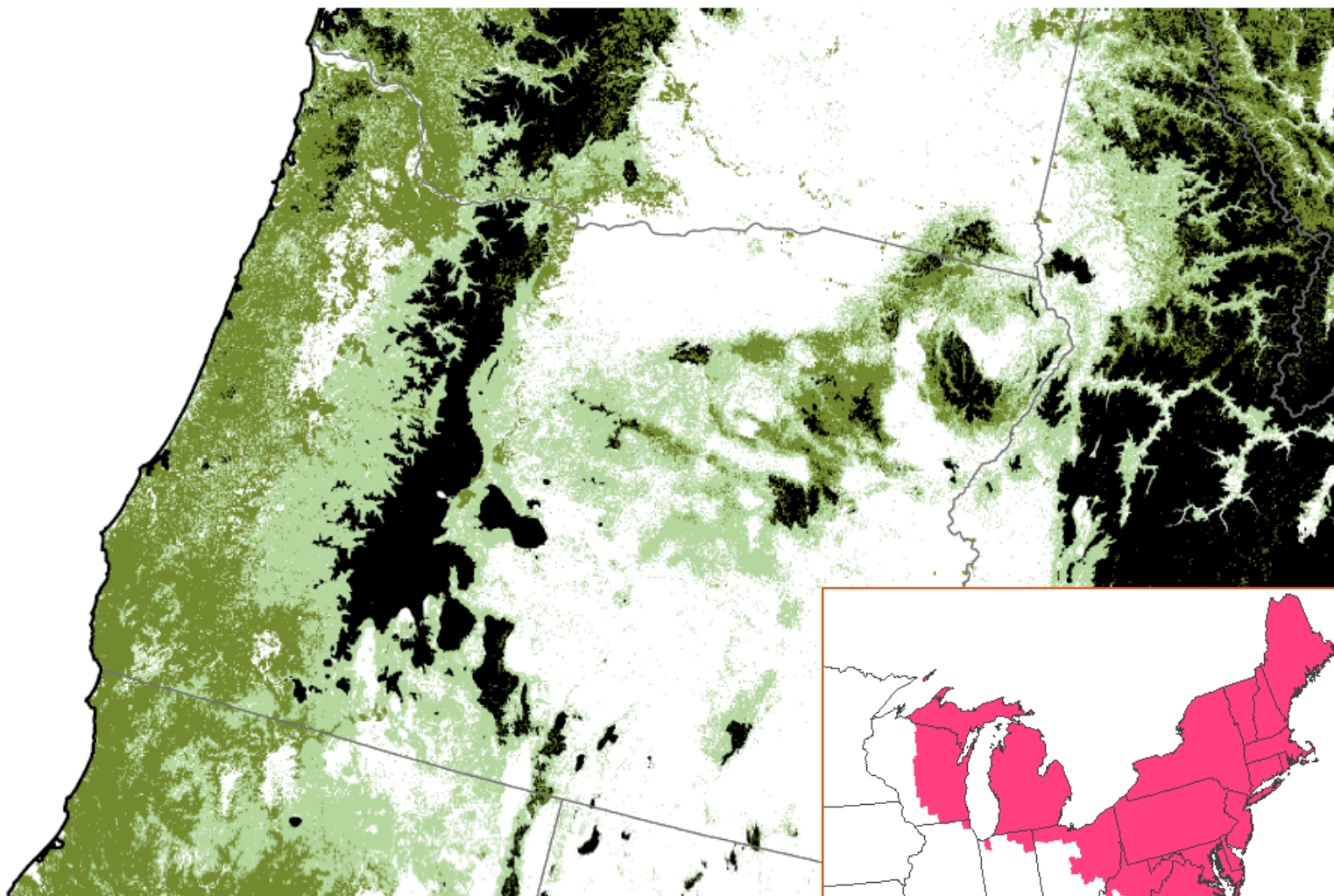
Thomas B. Denholm, New Jersey Department of Agriculture, Bugwood.org

Gypsy moth

- European & Asian subspecies
- 500+ host species, including DF
- Forest and Ag pest
- Great tools for early detection




European Gypsy Moth *Lymantria dispar dispar* Establishment Map for Oregon



Detection Likelihood


 High : 1



 Low : 0

Climate Suitability Mask

 Unsuitable



Preferred Host



NLC

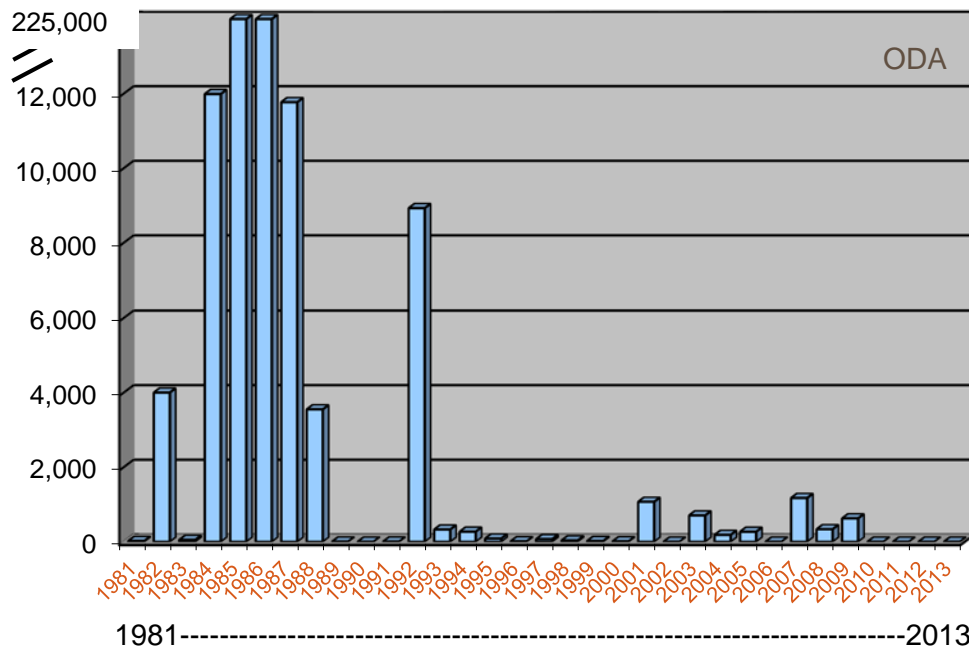




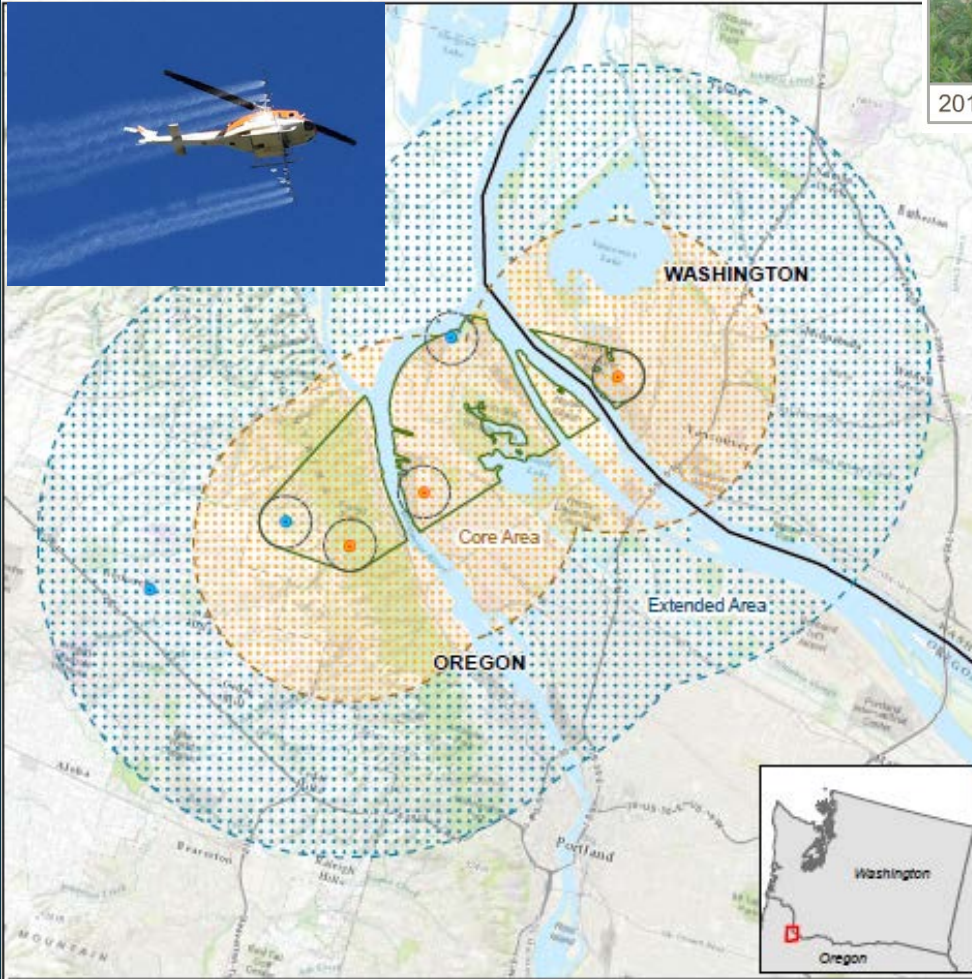
Gypsy moth

- 100% success in eradicating gypsy moth in Oregon

Historical treatments for gypsy moth in Oregon



Asian Gypsy moth



- 3 AGM trapped in PDX/VAN in 2015 (10 in WA)
- Likely result of 2014 outbreak in Russia
- 2016 eradication project on ~9,000 acres
- No AGM trapped in 2016

Thousand Canker Disease/Walnut Twig Beetle

- In Oregon since 1990's. Black Walnut most susceptible.
- Walnut twig beetle is vector for *Geosmithia* canker fungus



Jim LaBonte, ODA



Jay Pscheidt, OSU



Elizabeth Bush, bugwood.org



Mary Ann Hansen Virginia Tech, bugwood.org

Thousand Canker Disease/Walnut Twig Beetle

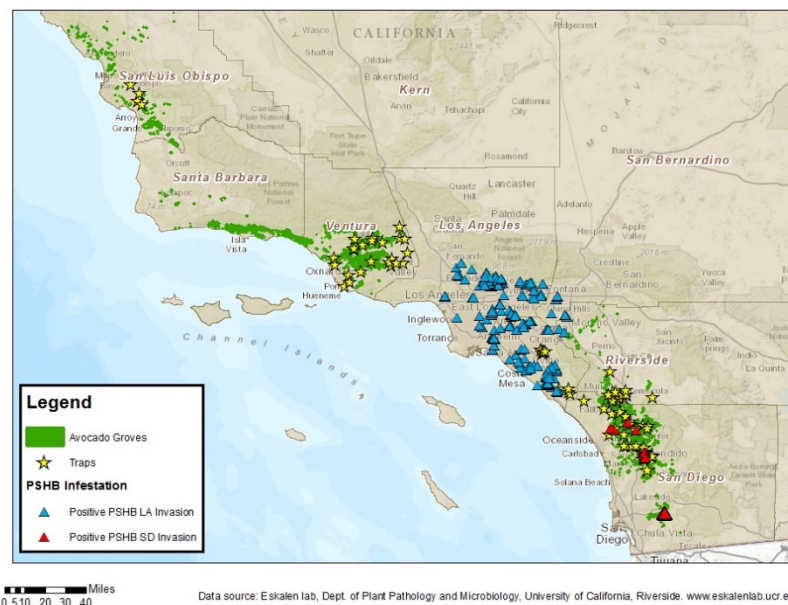


Credit: Jay Pscheidt, OSU; PNW Plant Disease Handbook

Polyphagous shot hole borer – new pest in So. California



UC RIVERSIDE Polyphagous shot hole borer / Fusarium Dieback distribution map (February 2015)



- Wide range of known hosts (including bigleaf maple, Black cottonwood, box elder, white alder, Ailanthus)
- Vector for Fusarium dieback
- Spreads via firewood

“could kill as many as 27 million trees (38% of canopy) in Los Angeles region”

Source: Univ of California Agriculture & Natural Resources: pshb.org

Polyphagous shot hole borer – new pest in So. California



- Infested material needs to be chipped, solarized, and/or kiln dried

Source: Univ of California Agriculture & Natural Resources: pshb.org

Take home messages

- We don't know what the next invasive threat will be.
- All it takes is one load of infested firewood or nursery stock
- Early detection of invaders is critical
- Be vigilant when you see pockets of tree mortality or decline
- Report suspected invaders:

oregoninvasiveshotline.org



invasivespecies.wa.gov



Thanks!

