Exotic Woodborer Survey and Emerald Ash Borer Monitoring

cdfa CALIFORNIA DEPARTMENT OF FOOD & AGRICULTURE

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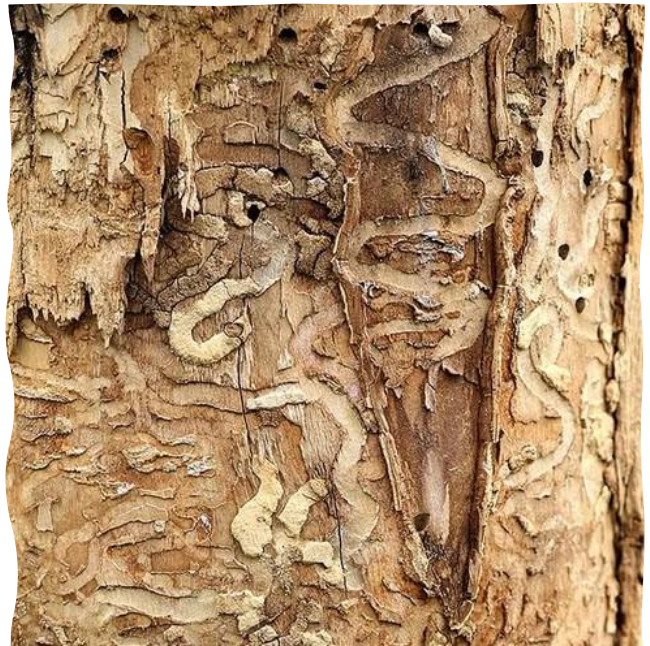
Focus Area

- **Exotic Woodborer Survey**
  Pest Detection/Emergency Project

- **Developing Action Plan, Proactive Biocontrol and Monitoring of Emerald Ash Borer (EAB) in California**



Exotic Woodborer Survey

Pest Detection/Emergency Project

Survey Targets:

Visual Survey

- **Asian longhorned beetle and Citrus longhorned beetle** *(Anoplophora glabripennis and A. chienensis)*

Trap Survey

- **Emerald ash borer** (*Agrilus planipennis*)
- **Redbay ambrosia beetle** (*Xyleborus glabratus)*
- **Black spruce beetle** (*Tetropium castaneum*)
- **Brown spruce longhorned beetle** (*Tetropium fuscum)*

Sites Selection Priority (high to low)

- PG&E woodyards, wood staging or transfer facilities, and other green waste facilities servicing large areas.
- Arboretums, gardens, or parks near other priority sites.
- Importers with pallet storage, or wood distributors.
- Campgrounds with high volume of out of state visitors.

Survey Counties FY24-25, 14 Counties:

Fresno, Madera, Merced, Tuolumne, Santa Barbara, Ventura, Los Angeles, Yolo, Sutter, Placer, Sacramento, Calaveras or Amador, San Bernardino

Survey Details:

- 2 sites/county.
- 1 trap of each type/site, 104 total traps, 30 visual surveys (ALB).
- Survey timeline: July-October 2024, April/May-June 2025, start depends on region.

Focus Area

- **Exotic Woodborer Survey**
  Pest Detection/Emergency Project

- **Proactive Biocontrol and Monitoring of Emerald Ash Borer and Developing Action Plan**

Proactive Biocontrol and Monitoring of EAB

- Develop a joint California Emerald Ash Borer Interagency Action Plan.
- EAB Monitoring.
- Increase awareness and outreach about the risks of EAB through both short term and long-term outreach efforts.

Image UGA2106098: David Cappaert, Bugwood.org

USDA United States Department of Agriculture

EAB – life cycle

1 From May to September, beetles mate and the female lays 60-90 eggs, one at a time, in crevices all over the bark of healthy ash trees.

Eggs

1/25 of an inch long

2 Eggs hatch as larvae, which tunnel through bark and into tree's cambial tissue. In winter, the larvae zig zag while feeding on cambial tissue that disrupts the tree's vascular tissue, eventually killing the tree.

Larvae

Mature larvae are about an inch long

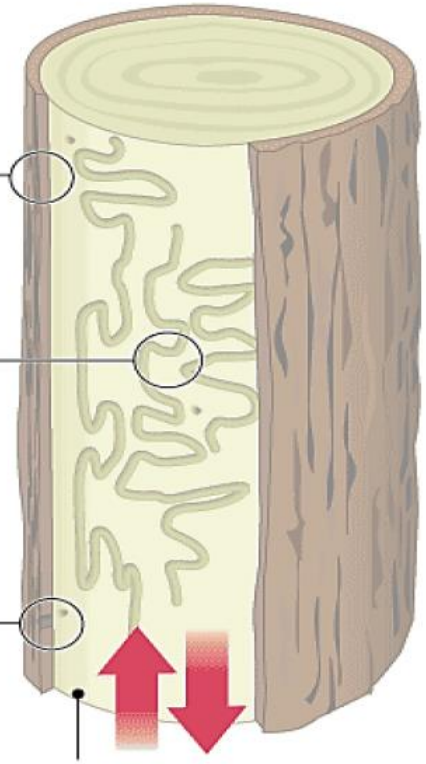
3 When warmer weather arrives (usually in April), larvae enter the pupal stage. They transform from larvae into sexually mature adults.

Pupae

4 In mid to late May, the pupae turn into beetles and emerge through holes the larva left in the bark.

Beetle

Adult beetles are 1/3 to 1/2 inches long.



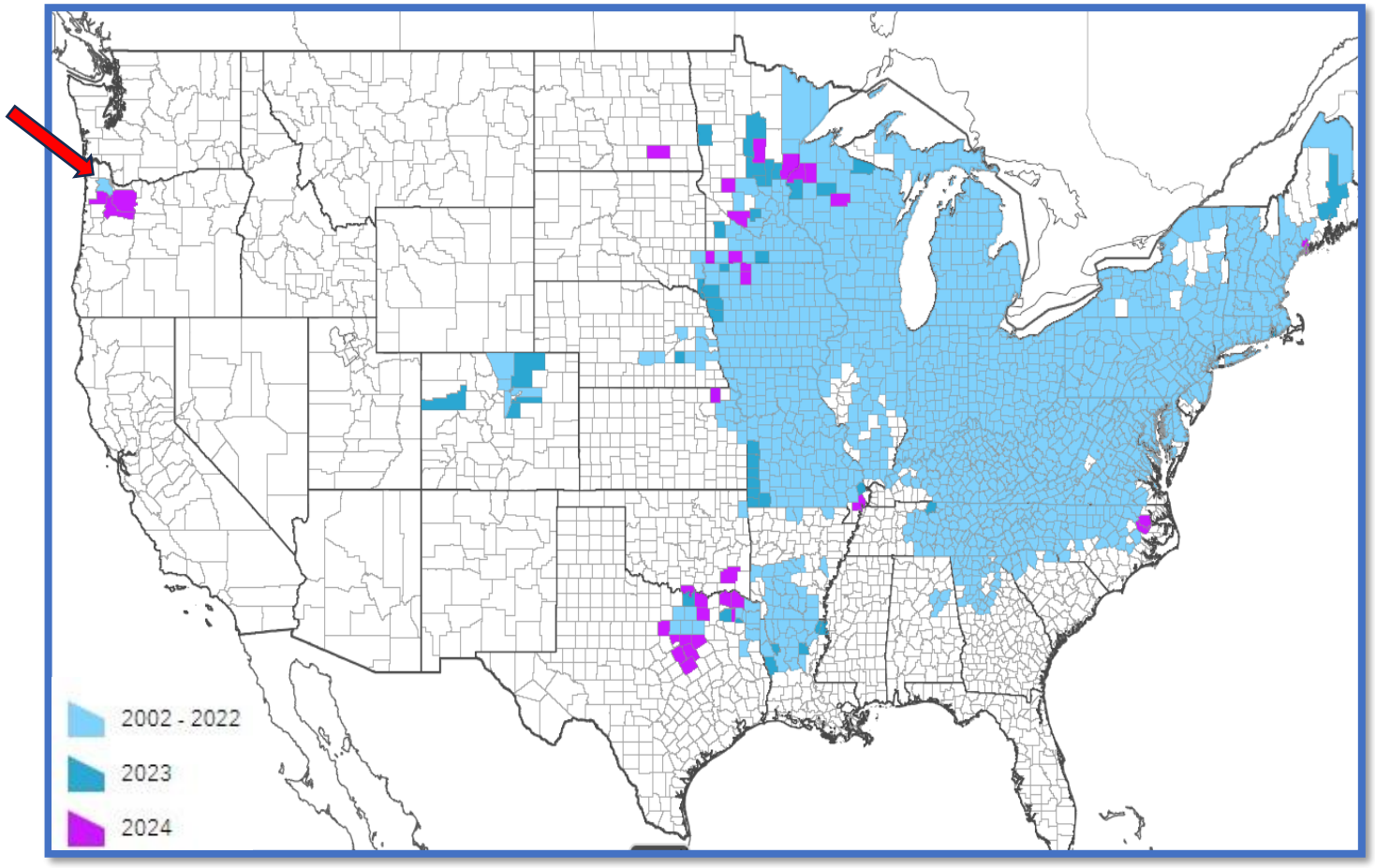
Cambial tissue: The transportation system that takes water, minerals, and nutrients throughout the tree.

5 The cycle begins again as male and females feed on leaves at the top of trees and begin mating and laying eggs for three to four weeks before dying.

Graphic Credit: Tim Summers / The Detroit News

What about EAB?

- *Agrilus planipennis* (Coleoptera: Buprestidae).
- Can attack all species of ash leading to their death in 2-5 years.
- Native to Asia, first detection in Michigan (2002).
- In 36 US states, but not present in California.
- Has already killed millions of trees in the eastern US (damage >$10 billion).



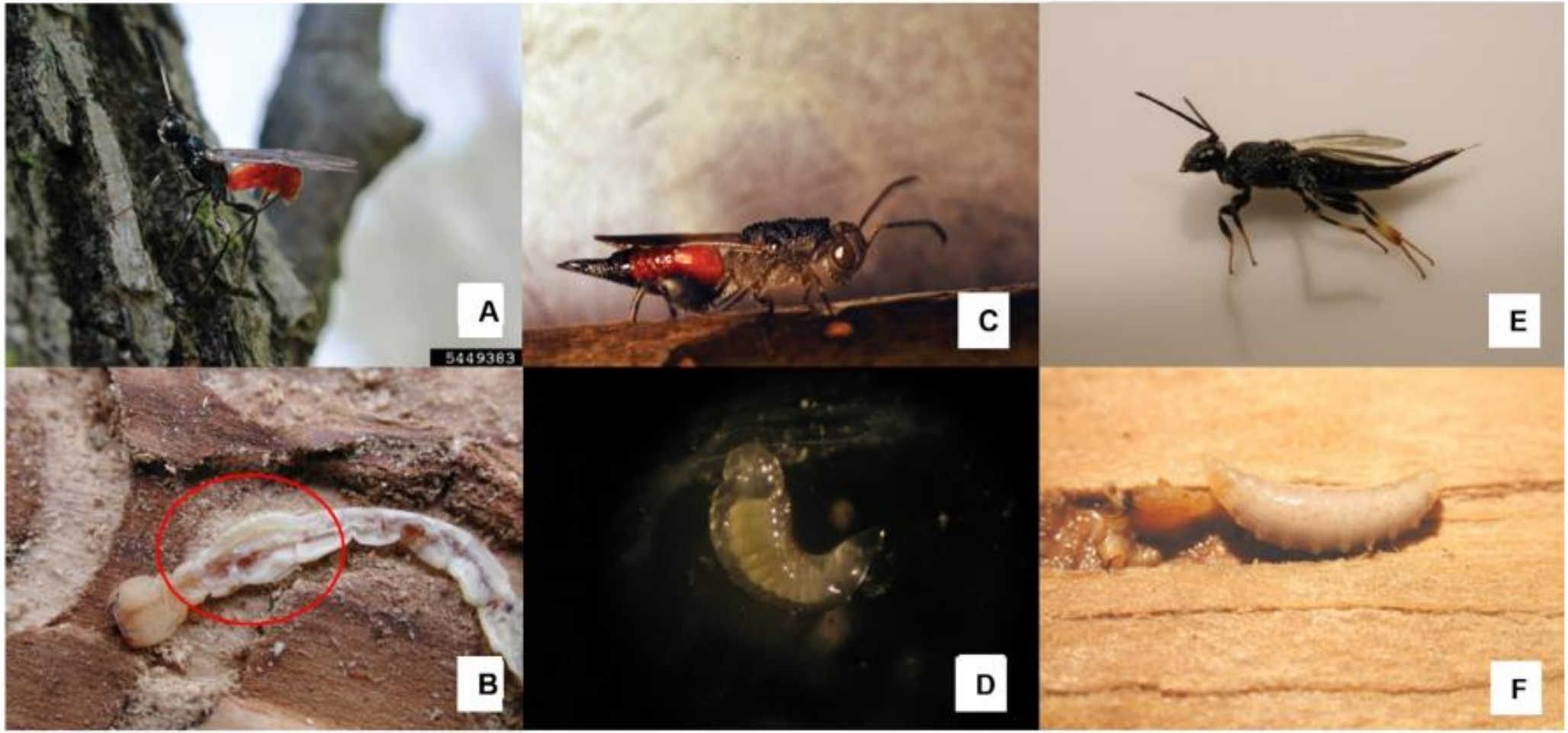
- Create a statewide EAB action plan together with our partners (US Forest Service, University of California, California Department of Forest and Fire Protection, CA County Agricultural Commissioners, and others). **Partnership**
- The California specific Interagency Action Plan will likely include procedures for detection, delimitation, treatment, quarantine, and outreach with a goal of eradication.
- A science advisory panel will be convened to fill in gaps in knowledge regarding EAB and recommendations from such advisory panels will be considered in developing this new action plan.

EAB Action Plan Development Steps

1. Identify and convene Interagency Action Plan Working Group members.
2. CDFA staff will enter into contract/grant agreement with UC IPM.
   - UC IPM will help produce, write, and oversee the development of the Action Plan in cooperation with the Action Plan Working Group
3. Produce 1st rough draft for Science Advisory Panel review. Develop list of questions for Science Advisory Panel members.
4. Convene Science Advisory Panel members.
5. Produce rough first draft for review by Action Plan Working Group members.
6. Solicit feedback on public draft.
7. Produce and publish final joint California Emerald Ash Borer Interagency Action Plan

Proactive Biocontrol and Monitoring of Emerald Ash Borer

- **Develop a joint California Emerald Ash Borer Interagency Action Plan.**
- **EAB Monitoring and proactive biocontrol**



Caption: A) Adult Atanycolus wasp inserting its eggs into an EAB larva in ash tree (photo: Houping Liu). B) A small Atanycolus larva (circled in red) feeding on an EAB larva within its gallery (photo: Deborah Miller). C) A Phasgonophora sulcata adult searching for an EAB larva in an ash log (photo: Deborah Miller). D) P. sulcata larva that has been removed from the inside of

EAB Classical Biological Control

- Four parasitoids sourced from Asia, the native range of EAB.
- Host specificity completed.
- Permitted for field release.
- Rearing and releases coordinated by USDA.

Gregarious
Larval Parasitoid
Long Ovipositor

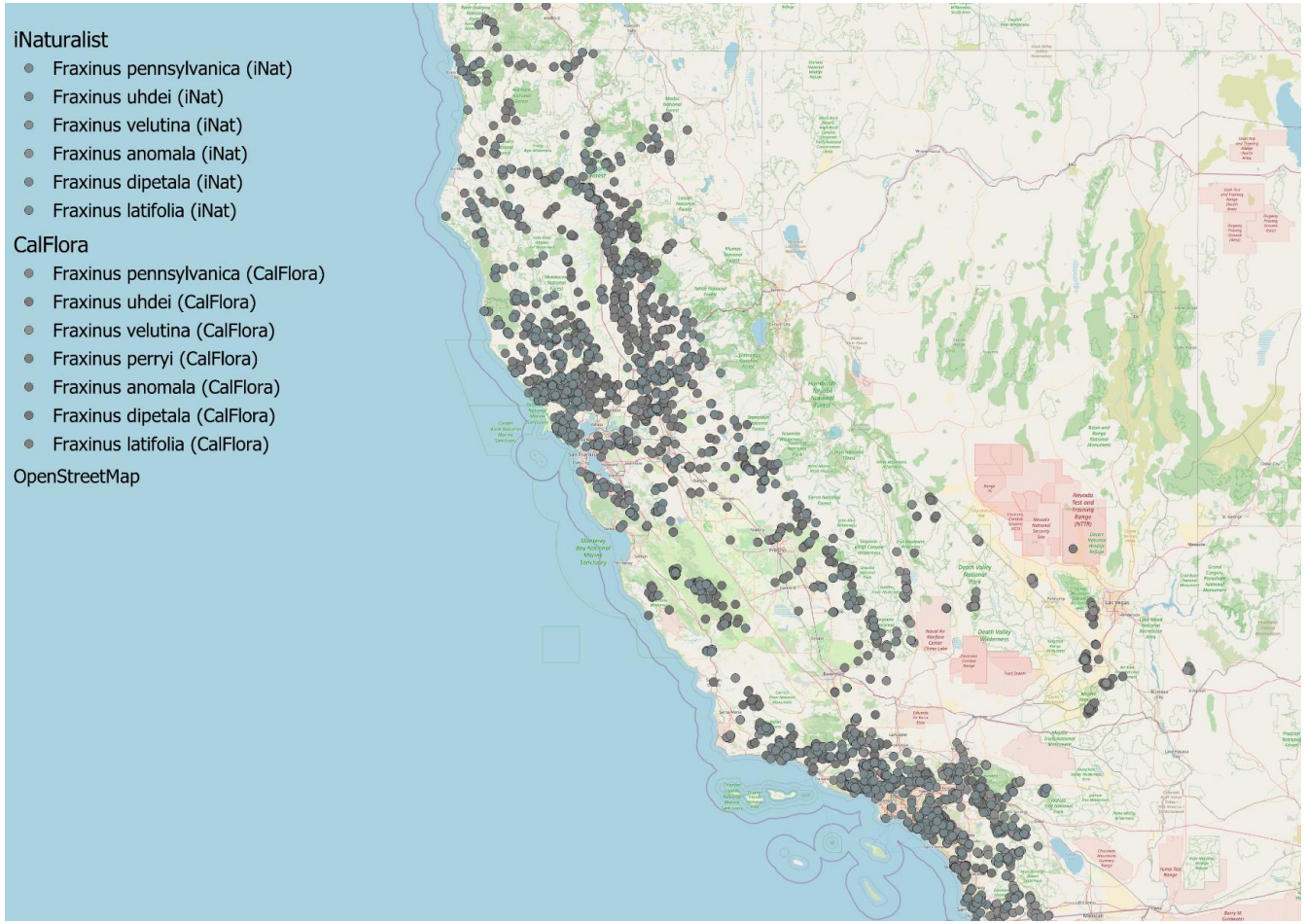
Gregarious
Larval Parasitoid
Limited recovery in northern areas

Egg Parasitoid. One egg, one parasitoid

Gregarious
Larval Parasitoid
Short Ovipositor
Most promising agent

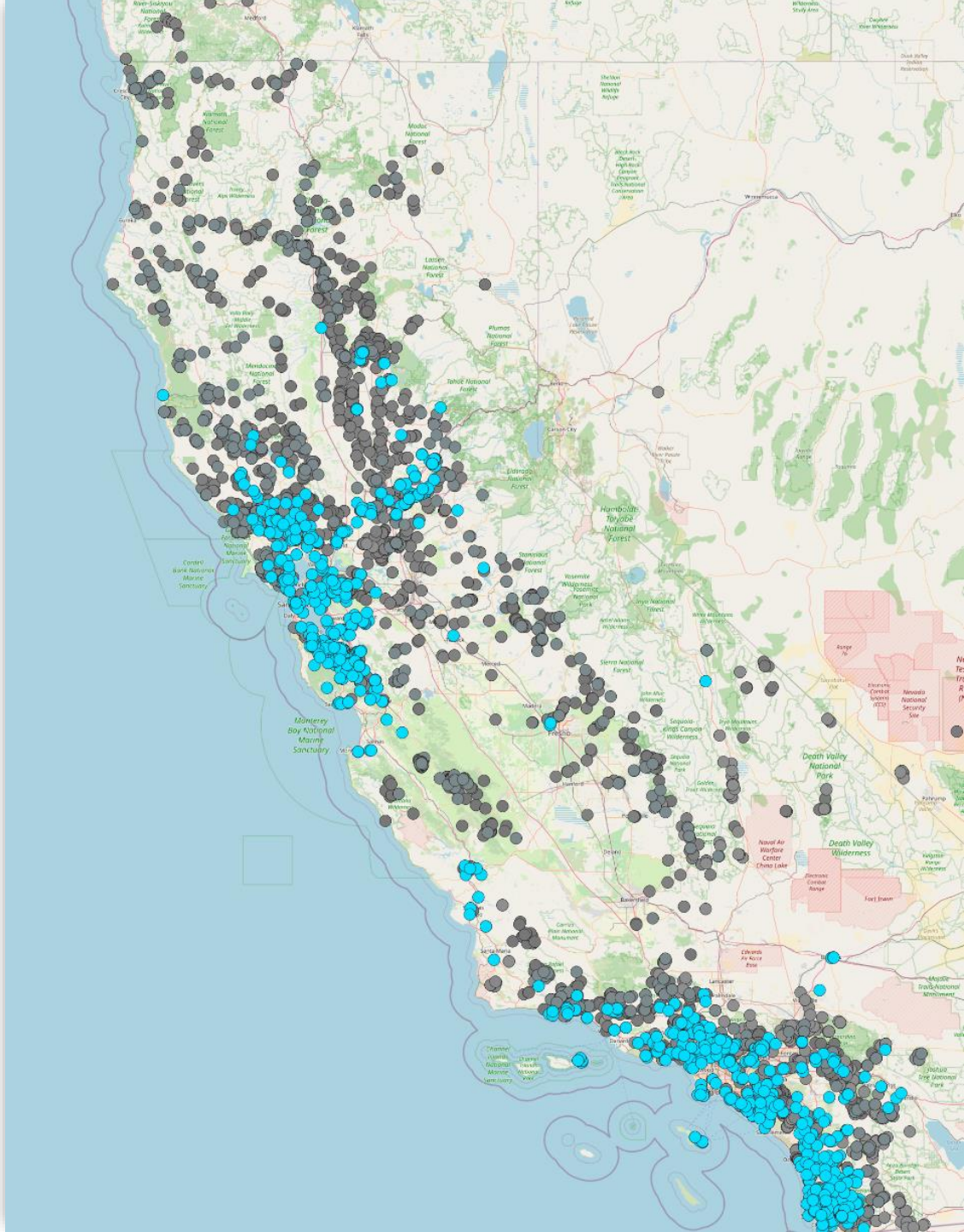
What about California?

- 16 native North American Fraxinus species (5 in CA).
- Ecological problems (stand replacement, wildlife dependency, wildfire hazard, riparian stability).
- Cost removal in urban areas, and ability to spread quickly.



What about California?

- Potential use of olive as a feeding host.
- California produces 90% of US commercial olives.



What about California?

Host Tree Surveys	Identify and characterize host tree habitat areas that would be suitable for future release (taking climate into consideration).
Native Parasitoids	Initiate potential surveys for known natural enemies of buprestid beetles in California.
Permits	Initiate paperwork to facilitate future conditional importation of EAB parasitoids in California with support from USDA.

A UC Davis Herbarium

B UC Davis Olive Collection

C

FRAXINUS ASH

Shrub or tree; gen dioecious, often bisexual (in CA). **ST**: older bark smooth or becoming furrowed, gen gray; lenticels broadly elliptic; twigs cylindric to 4-angled, glabrous to hairy; developing short-shoot spurs. **LF**: simple or gen odd-pinnate, opposite, deciduous; petioles channeled, occ winged, hairy or not; if compound, lflets (1)3–9, lanceolate to ovate or obovate, gen acute to acuminate at tip, entire or ± crenate-serrate, gen dark green adaxially, pale abaxially, thin to ± leathery in drier habitats, gen glabrous or with simple hairs abaxially or throughout, proximal opposite on rachis, stalked or not, terminal gen largest, stalk longer. **INFL**: axillary, of clusters or long-branched panicles; fls pedicelled. **FL**: unisexual or bisexual; calyx 1–2 mm, shallowly ± 4-lobed to cut, persistent on fr; petals 0, 2, or 4, free or fused to basal filaments. **STAMINATE FL**: stamens 2(3); pistil vestigial. **PISTILLATE FL**: stamens 0; style slender; ovules 2 per chamber. **FR**: achenes, winged, wings gen flat, extending to tip or base of seed-containing chamber. **SEED**: gen 1. ± 65 spp.: temp. N Am, Eurasia, trop Asia. (Latin: ancient name) [Little 1952 J Washington Acad Sci 42:369–380; Miller 1955 Cornell Univ Agric Exp Sta Mem 335:1–64] *F. uhdei* (Wenzig) Lingelsheim, Mexican ash, cult in w US; similar to *F. velutina*, with ± larger lvs and lflets, gen with stiff hairs to 0.5 mm bordering abaxial midvein and occ 2° veins abaxially (as occ in *F. velutina*), and ± larger fr, but margins tapered to near base of fr body; native n Mex to Honduras.

1. Small to large tree; lvs compound, lflets (3)4–11(14) cm; fr pedicel tip expanded; pls with either staminate or pistillate fls
2. Lflets ovate, or oblong-(ob)ovate; lateral lflets ± sessile; fr body 15–18 mm, 25–50 mm incl wing, tapered wing extending proximally to or below mid-body ..... ***F. latifolia***
2′ Lflets lanceolate to lance-ovate or lance-obovate; lateral lflets gen stalked; fr body 12–14 mm, 15–38 mm incl wing, tapered wing extending proximally to distal 1/4 of body ..... ***F. velutina***
1′ Shrub or small tree, sts many; lvs simple or compound, lflets 2–5(6) cm; fr pedicel tip ± slender; fls gen bisexual.
3. Petals gen 0; lvs simple or lflets 3(5); calyx irregularly cut; n&e DMtns ..... ***F. anomala***
3′ Petals 2, white or cream, 3.5–6.5 mm; lvs simple or lflets 3–9; calyx gen 4-toothed; CA-FP
4. Petals and filaments free exc at base; lvs, incl petioles, 7–18 cm; lflets (3)5–7(9), gen serrate-crenate ..... ***F. dipetala***
4′ Petals fused with proximal filaments for 0.5–1.5 mm at base; lvs, incl petioles, 2–5(6) cm, simple and/or lflets 3; simple lvs and/or lflets gen entire ..... ***F. parryi***

F. anomala S. Watson (p. 929) SINGLE-LEAF ASH Shrub to tree, 1.5–5 m. **ST**: many; bark gray; twigs gen 4-angled, tan; buds glandular-puberulent. **LF**: simple and/or compound; petiole 1.2–3 cm; blade narrowly ovate to ± rounded, cordate to tapered at base, acute to rounded at tip, gen crenate-serrate to ± entire, thick, glabrous, yellow-green; if compound, lflets 3–5, 2–10 cm, 1.5–6 cm wide. **INFL**: 3–9 cm; bracts glandular-puberulent. **FL**: gen bisexual; calyx 1.2–1.5 mm, irregularly cut, thin, green to ± purple; petals gen 0; anthers 1.5–2.5 mm, filaments 2–2.5 mm; stigma ≤ style. **FR**: 13–24 mm, 5–11 mm wide; body oblong-oblanceolate, broadly winged to near base; fr pedicel tip slender. 2*n*=46. Washes, rocky slopes, shrubland, pinyon/juniper woodland; 1100–2400 m. n&e DMtns; to CO, NM. Fls bisexual but only 1/2 of pls produce fr; pls rarely with petals. Source of erroneous reports of *F. dipetala* in D. Apr–May

F. dipetala Hook. & Arn. (p. 929) CALIFORNIA ASH Shrub to small tree, 1.5–3(6) m. **ST**: older st bark gray, smooth; twigs cylindric to 4-angled, gray; buds ± glandular-puberulent. **LF**: compound, 7–18 cm, 5–9(11) cm wide; petiole 2.4–4.5 cm; lflets (3)5–7(9), 2–4.5 cm, 1–2.5 cm wide, ovate to ± rounded, tapered at base, obtuse to ± rounded at tip, gen serrate-crenate, gen thin, glabrous, dark green adaxially, pale abaxially. **INFL**: 8–15 cm. **FL**: gen bisexual; calyx 1.1–2 mm, ± toothed, thin, green; petals 2, 3.5–6.5 mm, 1.3–3 mm wide, oblong-ovate, cream-white, ± cupped, narrowed and fused with filaments at base (rarely forming basal tube); anthers 2.4–4.2 mm; filaments 0.8–2.8 mm; stigmas ± < style. **FR**: 20–32 mm, 5–9 mm wide; body broadly oblanceolate, flat, broadly winged to near base; fr pedicel tip slender. 2*n*=46. Canyons, slopes, chaparral, oak/pine woodland; 100–1300 m. NCoR, CaRF, SNF, c&s SN, CW, TR, PR. Apr–Jun

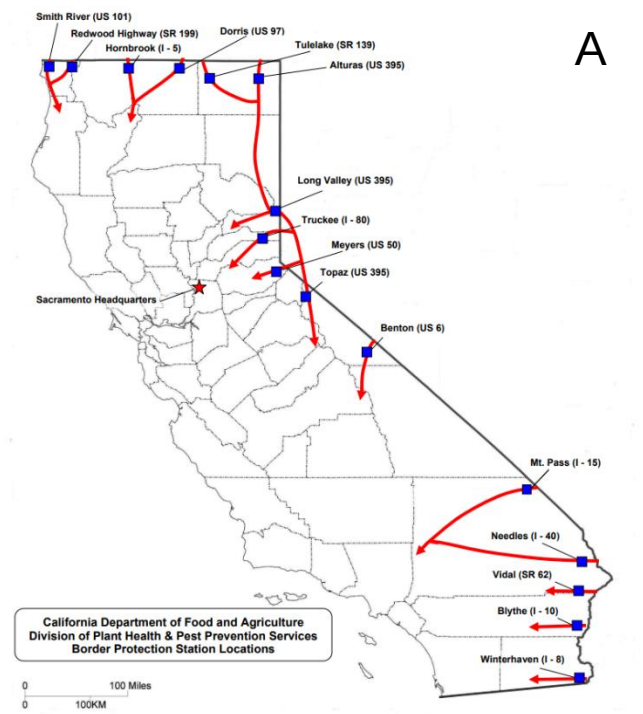
F. latifolia Benth. (p. 929) OREGON ASH Tree < 25 m, trunk < 1.5 m diam; dioecious. **ST**: bark gray-brown, furrowed; twigs cylindric, brown-gray, ± long-shaggy-hairy or glabrous. **LF**: compound, 12–33(50) cm, ± long-shaggy-hairy or glabrous; petioles 3–7(9) cm, channeled; lflets (3)5–7, 4–11(14) cm, 2.4–7.5 cm wide, ovate or oblong-(ob)ovate, broadly wedge-shaped to ± rounded at base, acuminate at tip, entire to ± serrate, lateral lflets ± sessile, terminal lflet ± larger, stalk to 10–35 mm. **FL**: petals 0. **STAMINATE FL**: calyx 0.5 mm, 4-toothed; anthers 2, 2–3.5 mm. **PISTILLATE FL**: calyx ± 1 mm, finely irregularly cut; style ± 3 mm; stigma ± 1.3 mm. **FR**: 25–50 mm, 5–9 mm wide; body 15–18 mm, ± cylindric, wing flat, extending proximally as tapering margin down 1/2–3/4 body; fr pedicel tip much expanded. 2*n*=46. Canyons, streambanks, woodland; < 1700 m. NW, CaR, SN, GV, SnFrB, MP; to BC. Pure in n CA; mostly introgressed with *F. velutina* in s CA. Mar–May

F. parryi Moran CHAPARRAL ASH Shrub to tree, 1.5–3(5) m. **ST**: older st bark gray, smooth; twigs cylindric to 4-angled; buds glandular-puberulent. **LF**: simple and/or compound, 2–5(6) cm; petiole 0.6–1.5 cm; if compound, lflets 3, 2–5(6) cm, 1.5–3.5 cm wide, ovate to rounded, 1–4 cm, 1–2.5 cm wide, broadly tapered at base, obtuse to rounded-notched at tip, gen entire, green adaxially, pale abaxially. **INFL**: 3–10 cm; bracts ± glandular-puberulent. **FL**: bisexual; calyx 1.2–2 mm, short-toothed, thin, green, persisting on fr; petals 2, 4.5–6.5 mm, 2.2–4.3 mm wide, oblong ovate, cream-white, united with filament base for 0.5–1.5 mm; anthers 2, 2.3–4 mm, free filaments 1.5–2 mm; stigma > narrow style. **FR**: 22–30 mm, 7–9 mm wide, body broadly oblong-oblanceolate, flat, broadly winged to near base; fr pedicel tip slender. Canyons, slopes, margins of mixed chaparral; 600 m. PR (s San Diego Co.); Baja CA. [*F. dipetala* var. *trifoliolata* Torr.; *F. t.* (Torr.) H. Lewis & Epling, illeg.] Feb–Mar ★

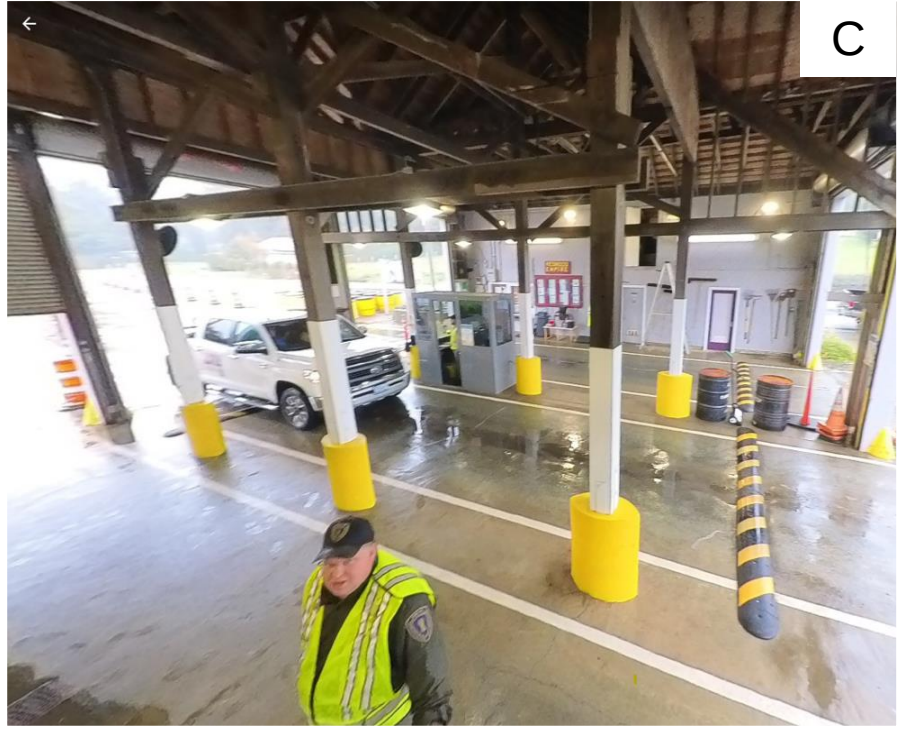
F. velutina Torr. (p. 929) VELVET ASH Tree < 15 m, trunk to 3 dm diam; dioecious. **ST**: bark gray, furrowed; twigs cylindric, gray-brown, minutely coarse-hairy to velvety or becoming glabrous. **LF**: compound, 9–20(30) cm, occ stiff-leathery, minutely coarse-hairy to velvety throughout or gen adaxially, often becoming glabrous, hairs gen erect, straight, to 0.5 mm; petiole 2–8 cm, channeled; lflets (3)5–7, 3–10 cm, 1.5–3.5 cm wide, lanceolate to lance-ovate or lance-obovate, tapered to base, long tapered at tip, entire to serrate, lateral lflets gen smaller, with stalk 4–6(10) mm, terminal lflet more tapered at base, with stalk 10–27 mm. **FL**: petals 0. **STAMINATE FL**: calyx < 1 mm, anthers 2(3), 2–3 mm. **PISTILLATE FL**: calyx 1–2 mm, green, ± unequally cut; style 0.5, stigma 2–3.5 mm. **FR**: 15–38 mm, 3–6(8) wide; body 12–14 mm, ± cylindric, wing flat, extending proximally as tapering margin onto distal 1/4 of fr body; fr pedicel tip much expanded. 2*n*=46,92. Canyons, streambanks, woodland; 200–1600 m. s SN, SCo, TR, PR, s SNE, DMoj; to sw UT, TX, n Mex. Many s CA specimens show introgression with *F. latifolia*. Mar–Apr


A
Lindgren Funnel Trap


B
Purple Prism Trap


A
Smith River (US 101)
Redwood Highway (SR 199)
Hornbrook (I - 5)
Dorris (US 97)
Tulelake (SR 139)
Alturas (US 395)
Long Valley (US 395)
Truckee (I - 80)
Meyers (US 50)
Topaz (US 395)
Sacramento Headquarters
Benton (US 6)
Mt. Pass (I - 15)
Needles (I - 40)
Vidal (SR 62)
Blythe (I - 10)
Winterhaven (I - 8)
California Department of Food and Agriculture
Division of Plant Health & Pest Prevention Services
Border Protection Station Locations
0 100 Miles
0 100KM


B
US-101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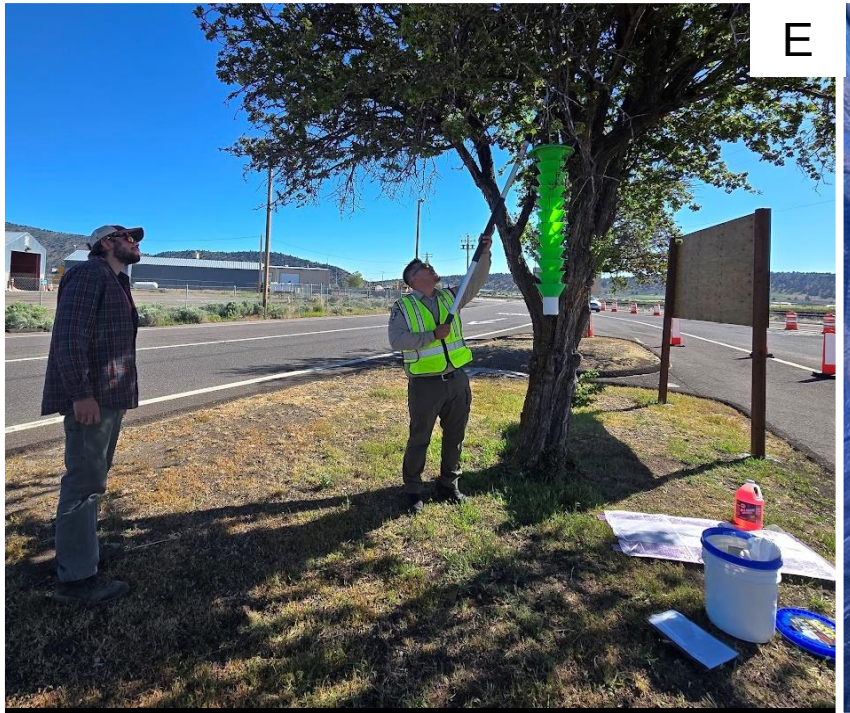
D


E


F
STOP


A

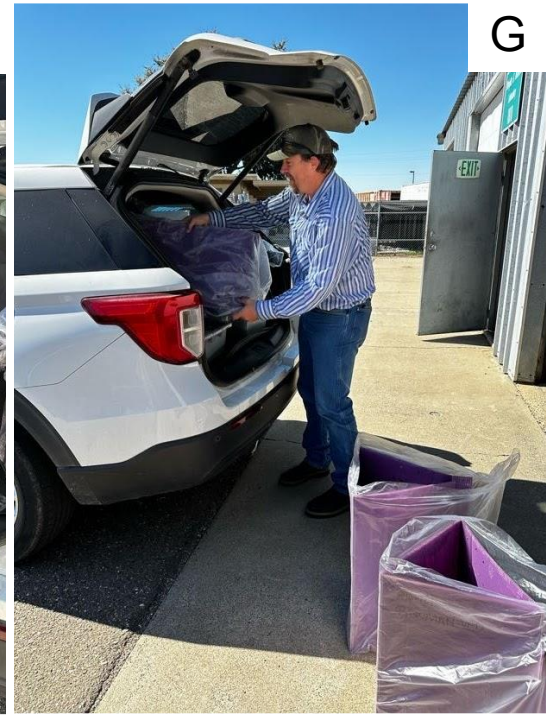

B


C


D


E


F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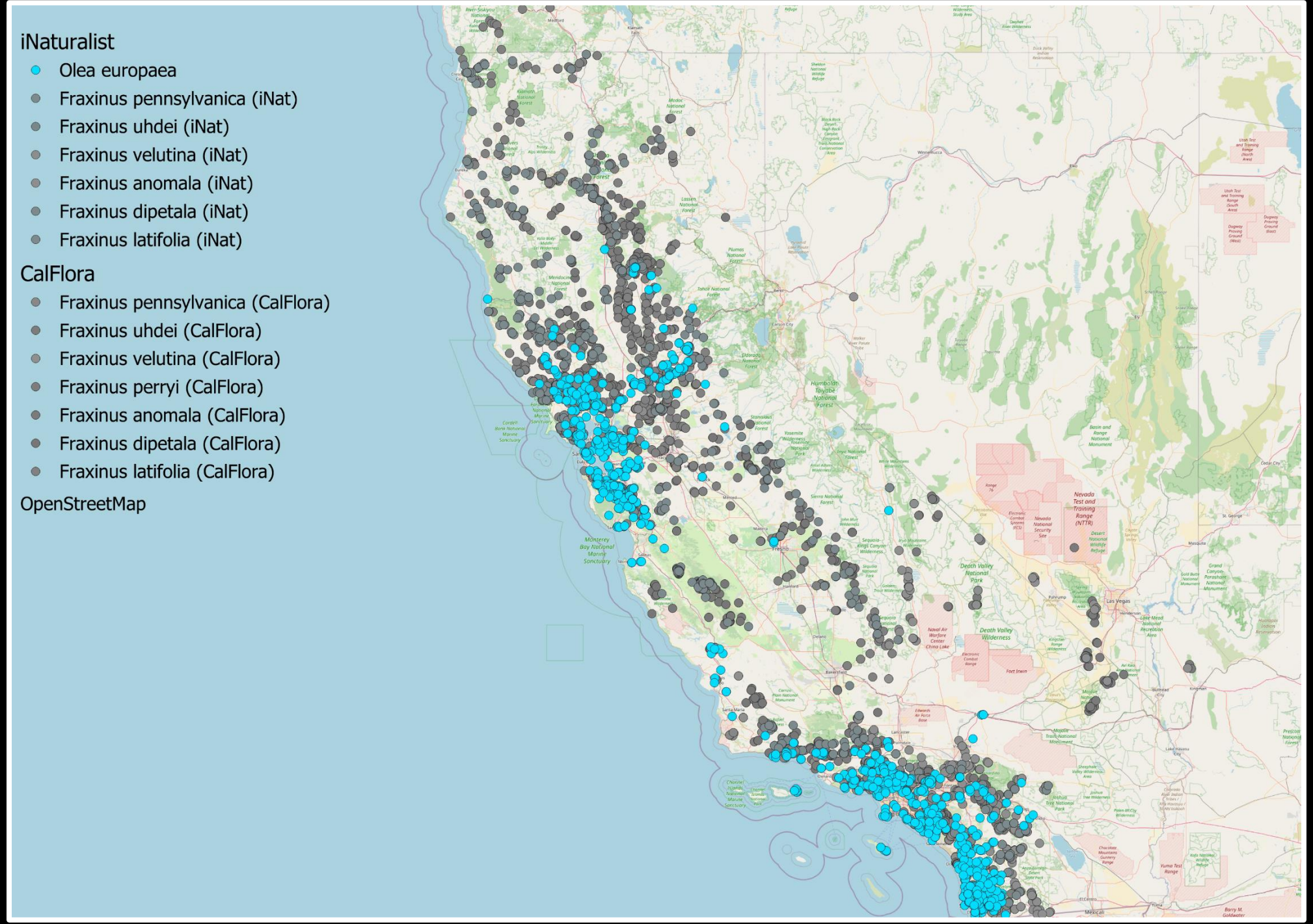
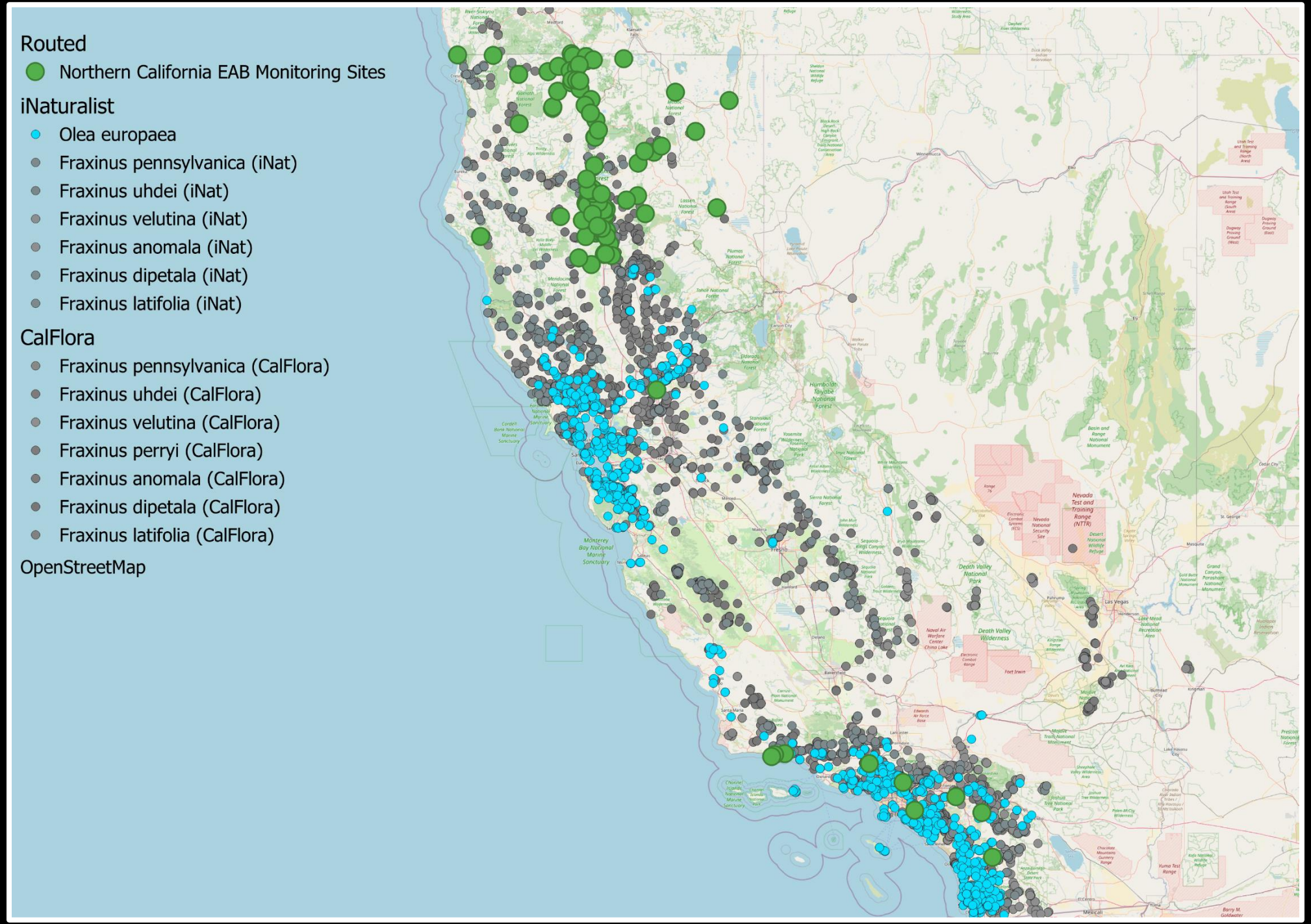

iNaturalist
Olea europaea
Fraxinus pennsylvanica (iNat)
Fraxinus uhdei (iNat)
Fraxinus velutina (iNat)
Fraxinus anomala (iNat)
Fraxinus dipetala (iNat)
Fraxinus latifolia (iNat)
CalFlora
Fraxinus pennsylvanica (CalFlora)
Fraxinus uhdei (CalFlora)
Fraxinus velutina (CalFlora)
Fraxinus perryi (CalFlora)
Fraxinus anomala (CalFlora)
Fraxinus dipetala (CalFlora)
Fraxinus latifolia (CalFlora)
OpenStreetMap


Routed
Northern California EAB Monitoring Sites
iNaturalist
Olea europaea
Fraxinus pennsylvanica (iNat)
Fraxinus uhdei (iNat)
Fraxinus velutina (iNat)
Fraxinus anomala (iNat)
Fraxinus dipetala (iNat)
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Fraxinus perryi (CalFlora)
Fraxinus anomala (CalFlora)
Fraxinus dipetala (CalFlora)
Fraxinus latifolia (CalFlora)
OpenStreetMap


A
B
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D
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G

So Far

- Exotic Wood borer survey happening in 14 counties,104 total traps, 30 visual surveys (ALB).
- Creating a joint interagency statewide EAB action plan.
- Coordinated deployment of 194 EAB traps (prism and funnel) at 109 sites across 14 CA counties for EAB Monitoring.
- Tracked servicing of traps with UCCE, UC Riverside, Cal Fire, CDFA Border Stations, and the Counties of Shasta, Siskiyou, and Tehama.
- Received and are processing 378 trap samples at CDFA. Aiming for detection of native buprestid parasitoids.

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- Chris Shogren (UCCE LA County)
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- Kyle Beucke (CDFA)
- Beth Kyre (USFS)
- Mark Hoddle (UCR)
- Tom Smith (Cal Fire)
- Curtis Ewing (Cal Fire)
- Kim Corella (Cal Fire)
- Chris Lee (Cal Fire)
- Shasta, Tehama, Siskiyou Ag Commissioners and their teams

Questions?

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