Invasive Shot Hole Borers

Range Management Advisory Committee

- Statutory committee advising the Board of Forestry and Fire Protection, Natural Resources Agency, CA EPA, and CDFA on issues relating to rangeland resources.

- Recent projects include
  - Prescribed herbivory for fuel reduction white paper
  - Encouraging grazing on public lands
  - Invasive pest containment

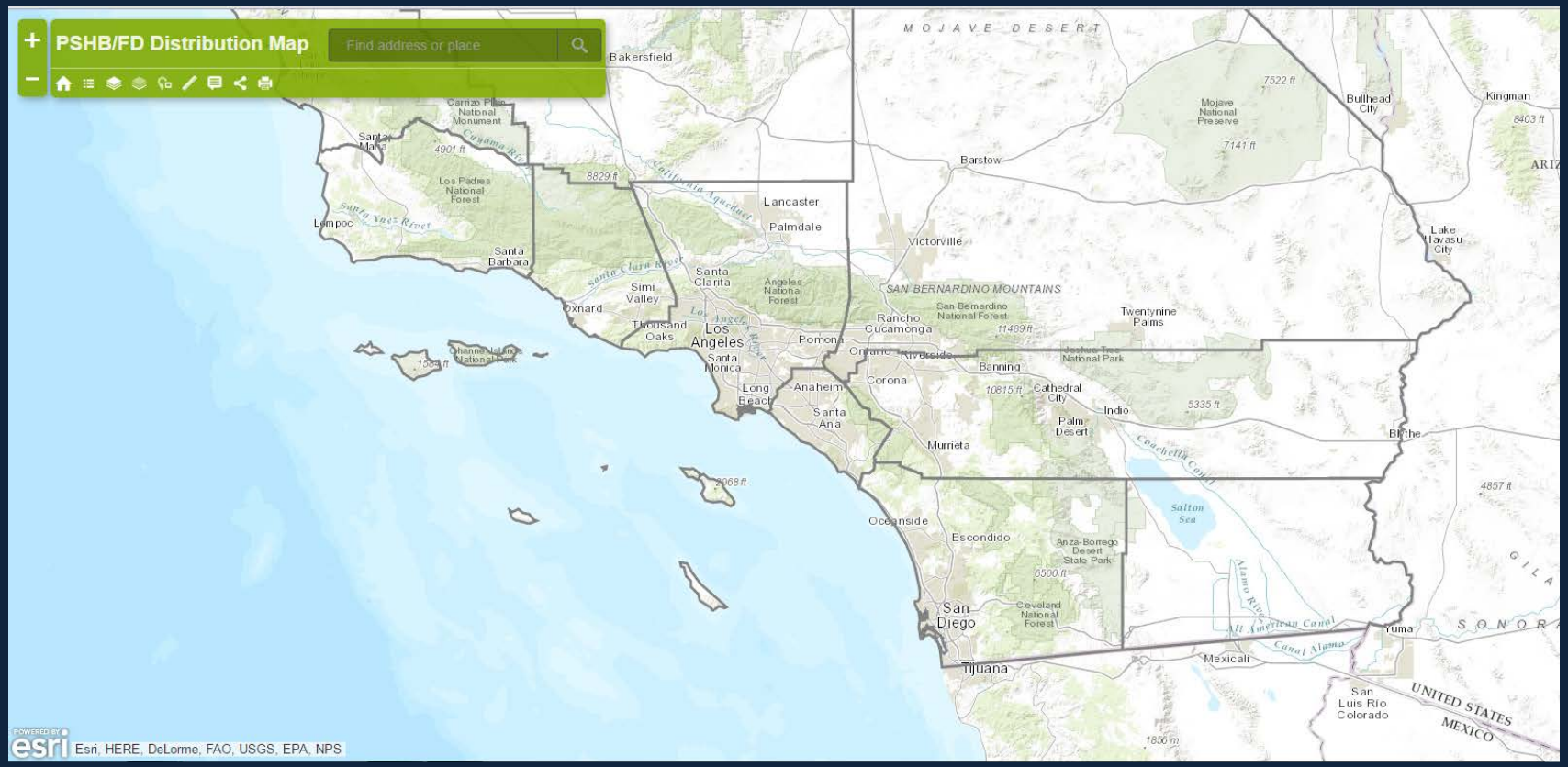
Shot Hole Borers

- The polyphagous shot hole borer (PSHB) and Kuroshio shot hole borer (KSHB) (*Euwallacea spp*.) are insects native to southeast Asia; PSHB from Vietnam and KSHB from Taiwan

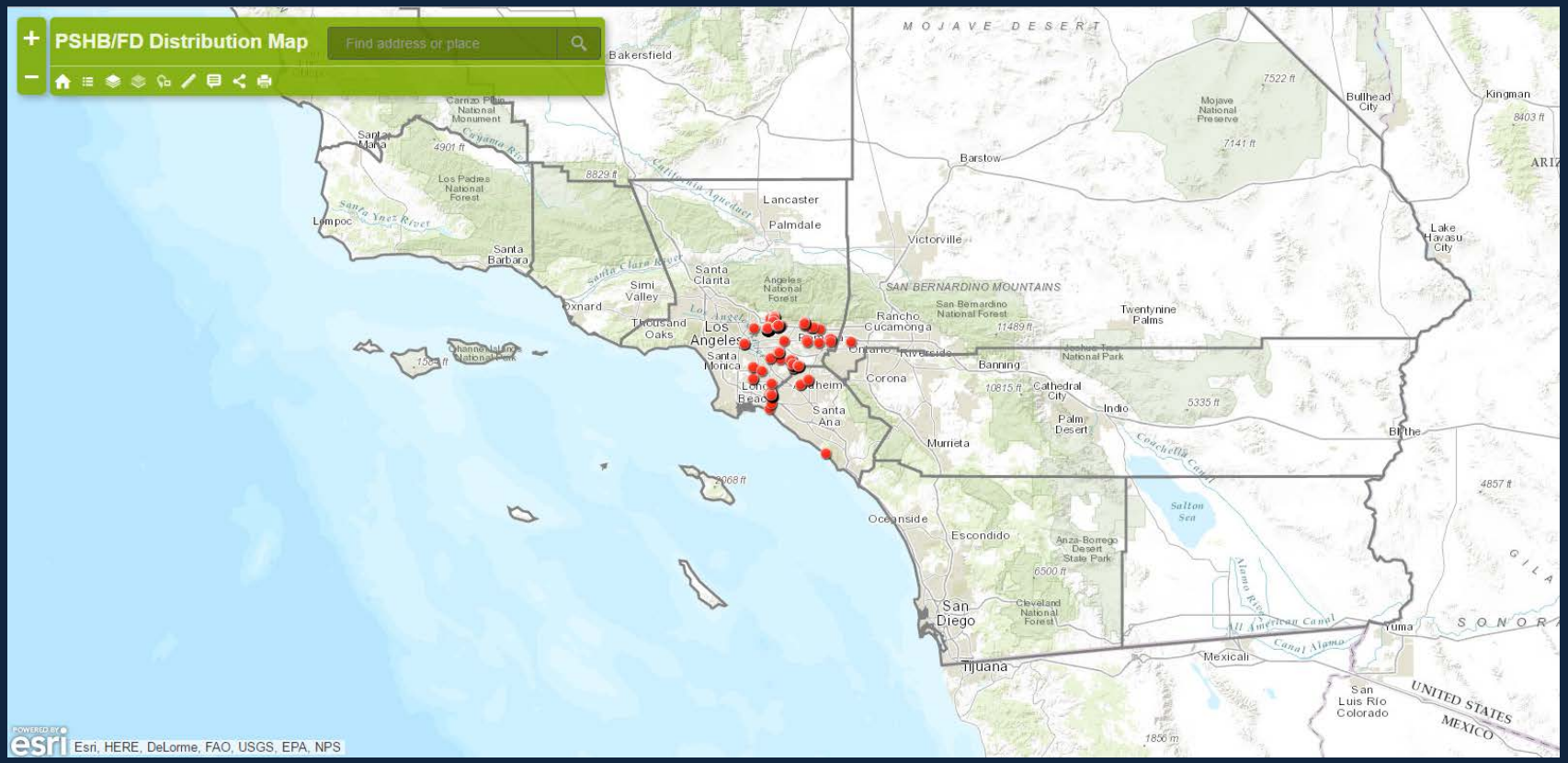
Basic Pest Biology

- Adult females are black in color and 1.8-2.5mm long. Adult males are brown and smaller. More females are produced than males.
- Mature siblings mate with each other so that females are already pregnant when they leave to start their own tunnels (galleries). Males do not fly, but stay in the host tree.
- Females carry a fungus that grows in the galleries and provides food for the beetles and larvae that is also damaging to the tree.

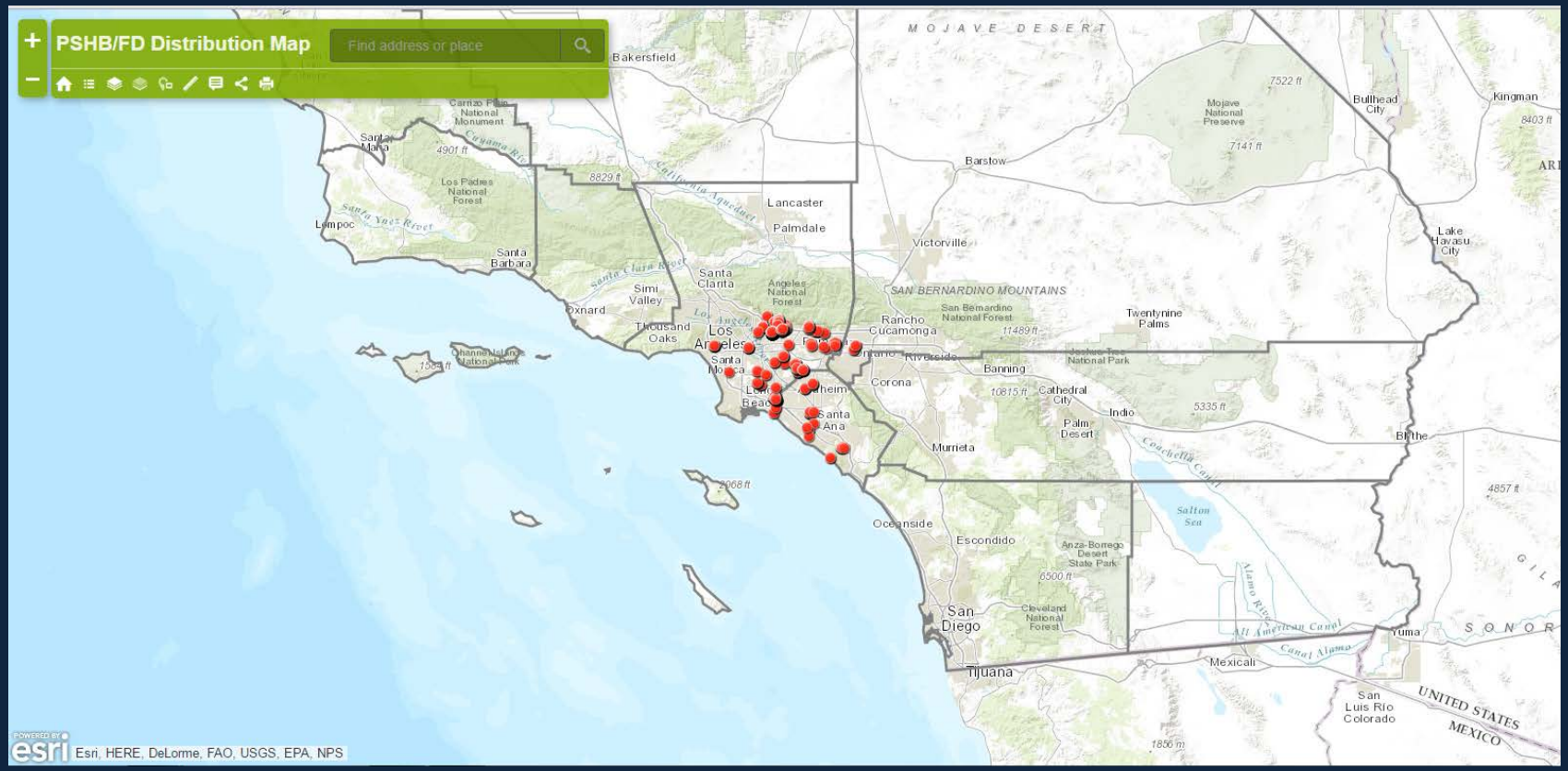
Distribution Map - 2011



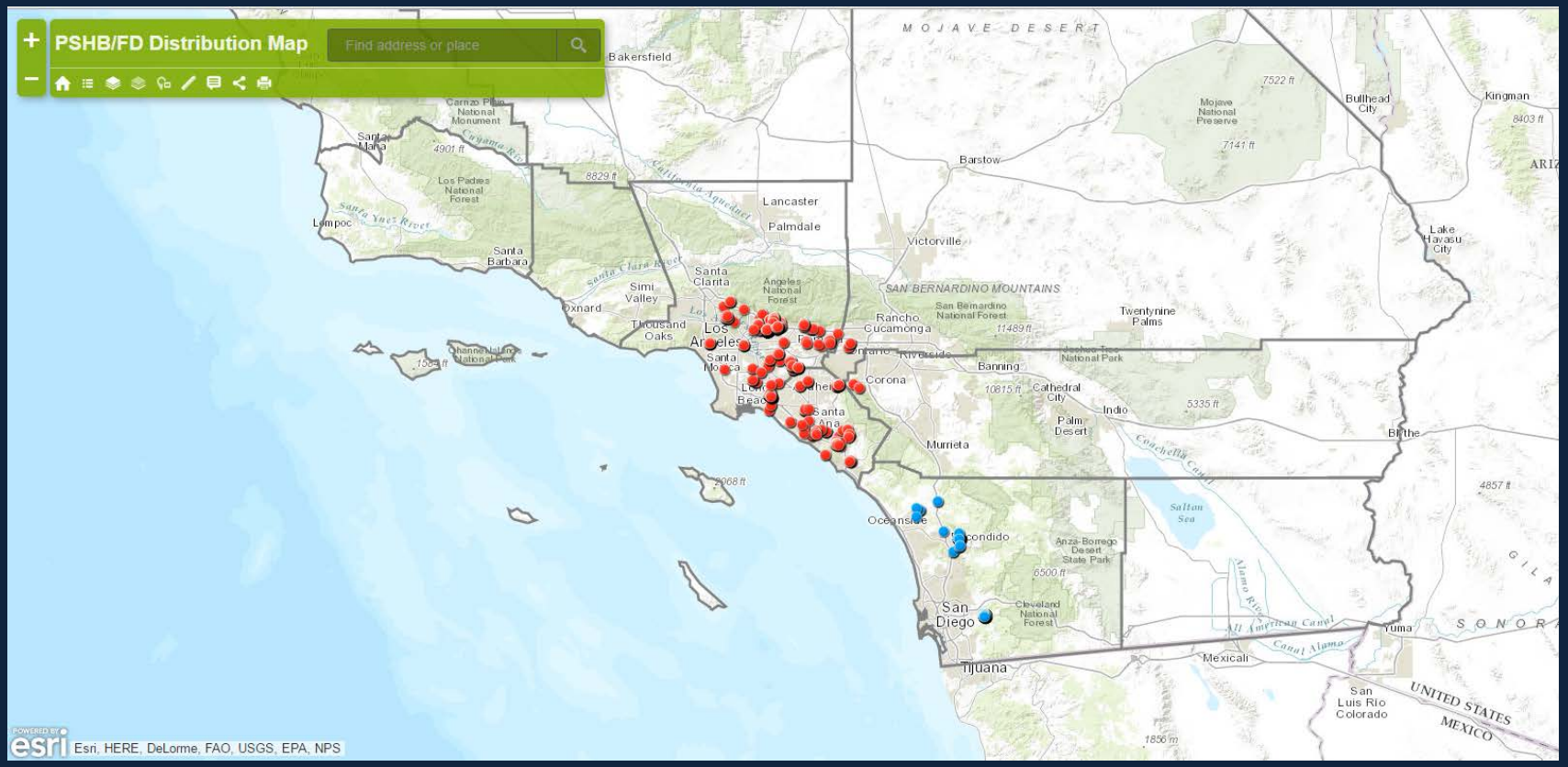
Distribution Map - 2012



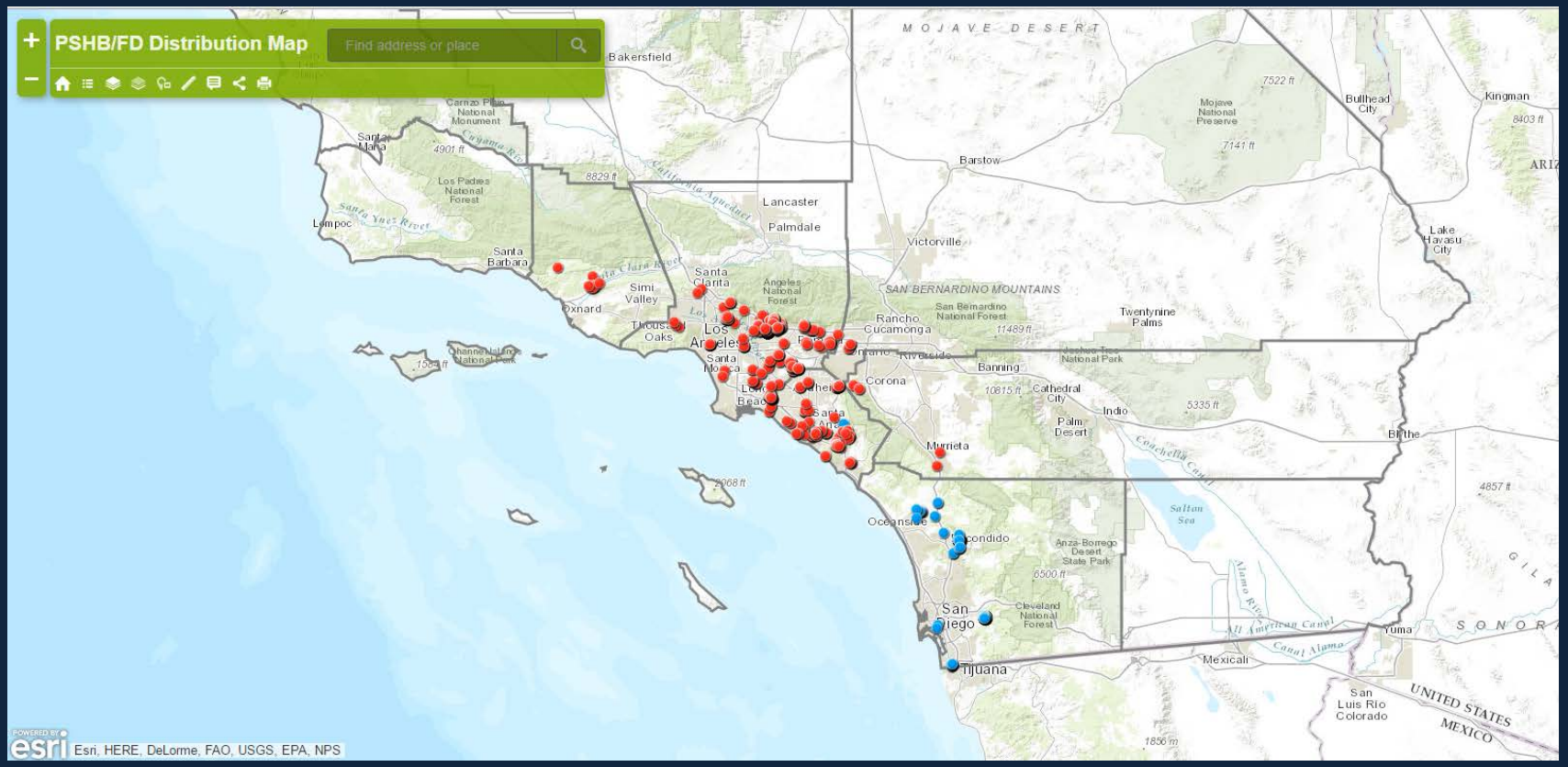
Distribution Map - 2013



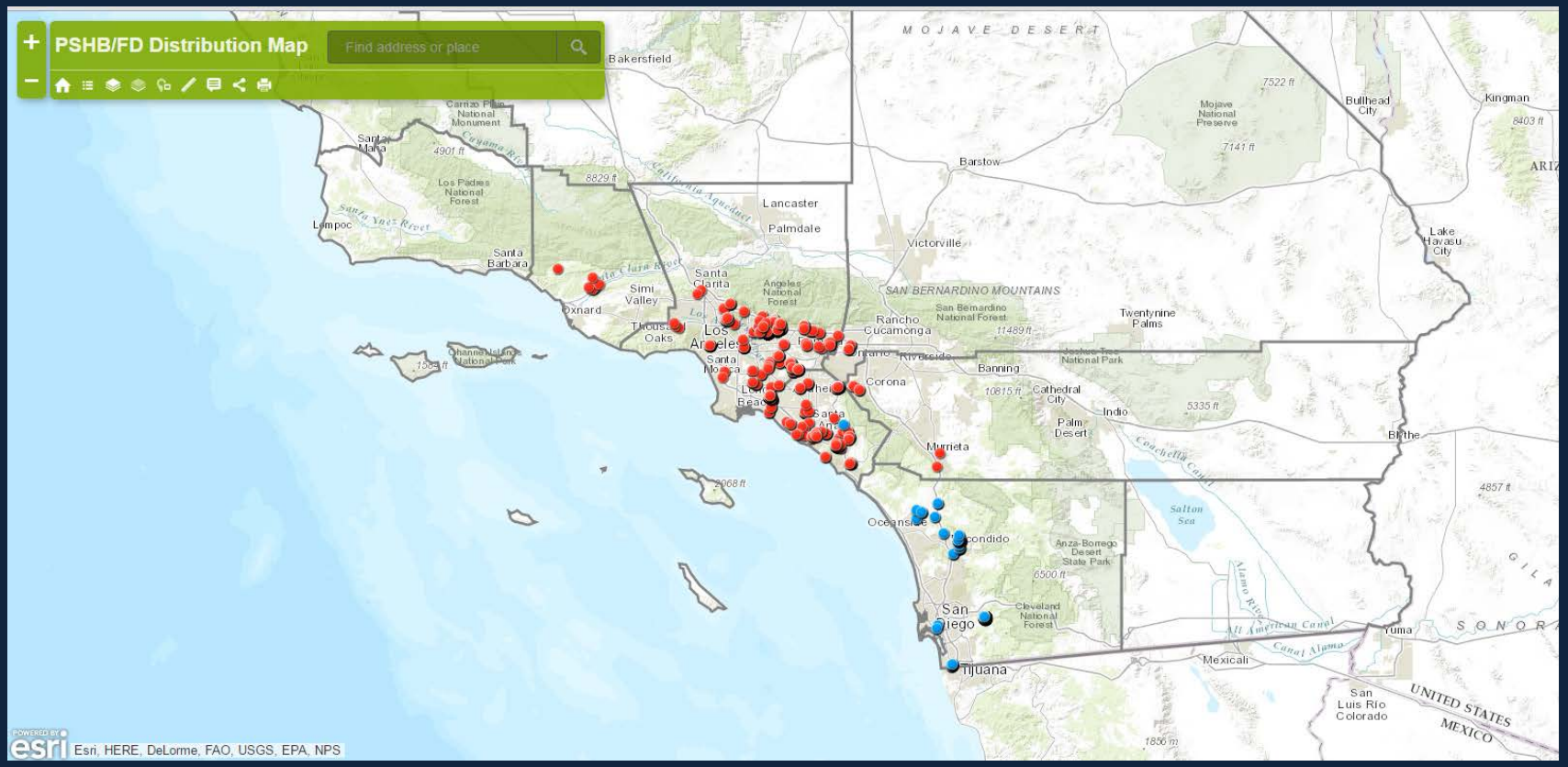
Distribution Map - 2014



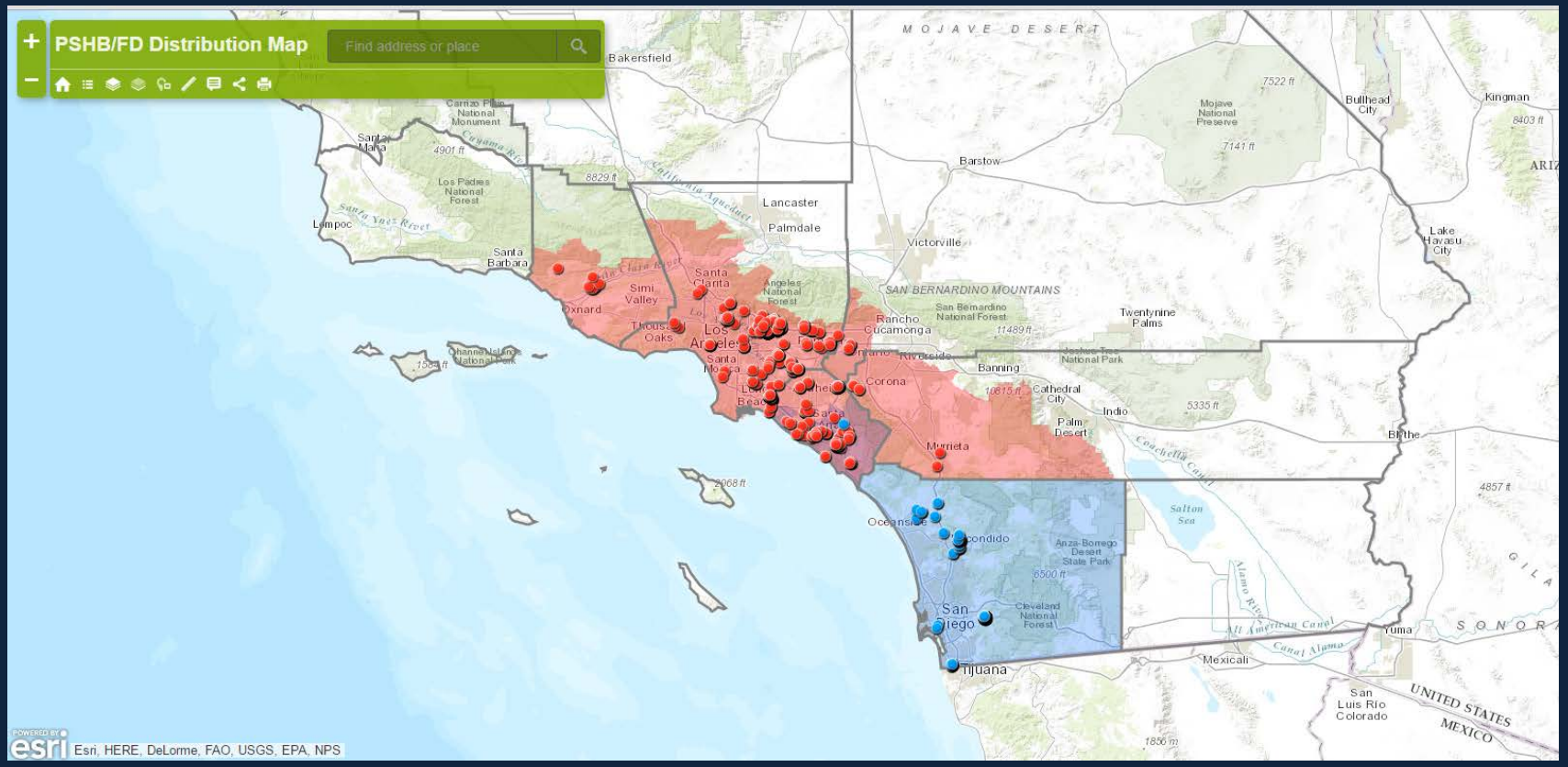
Distribution Map -2015



Distribution Map 2016



Infested Areas - 2016



Host Range

- The known host range is huge, including 207 species in 58 plant families.
- It includes 11 native species, many riparian species, urban shade trees (1/4 of all trees planted along Los Angeles streets), invasive plants (castor bean), and 13 important agricultural crops.
- Some are reproductive hosts, while some are attacked but do not support the full development of the insect and the associated fungi.

Host Range FD/PSHB

	2012	2016
Tree Species Attacked by Beetle	286	303
Tree Species Infected by Fungus	117	138
Agricultural Crops	13	13
California Native Tree Species	11	18
Number of Tree Families	62	64
Number of Reproductive Hosts	19	41

Eskalen, A., Stouthamer, R., Lynch, S.C., Rugman-Jones, P., Twizeyimana, M., Gonzalez, A., Thibault, T. 2013. Host Range of Fusarium Dieback and its Ambrosia Beetle (Coleoptera: Scolytinae) Vector in Southern California. *Plant Disease*.In 97:7, 938-951

1. Box elder (*Acer negundo*) *
2.Big leaf maple (*Acer macrophyllium*)*
3. Evergreen Maple (*Acer paxii*)
4. Trident maple (*Acer buergerianum*)
5. *Japanese maple (Acer palmatum)*
6. Castor bean (*Ricinus communis*)
7. California sycamore (Platanus racemosa) *
8. *Red willow (Salix laevigata) **
9. Avocado (*Persea americana*)
10. Mimosa (*Albizia julibrissin)*
11. English Oak (*Quercus robur*)
12. Coast live oak (Quercus agrifolia)*
13. London plane (*Platanus x acerfolia*)
14.Cottonwood (*Populus fremontii*)*
15. White Alder (*Alnus rhambifolia*)*
16.Titoki (*Alectryon excelsus*)
17. Engelmann oak (Quercus engelmannii)1*
18. Cork Oak (*Quecus suber*)
19. Valley oak (*Quercus lobata*) *
20. Coral tree (*Erythrina corallodendon)*
21. Blue palo verde (Cercidium aculeata) *
22. Palo verde (*Parkinsonia aculeata*)
23. Moreton Bay Chestnut (*Castanospermun*
24. Brea (*Cercidium sonorae*)
25. Mesquite (*Prosopis articulata*)*
26. Weeping willow (*Salix babylonica*)
27. Chinese holly (*Ilex cornuta*)
28. Camelia (*Camellia semiserrata*)
29. Acacia (*Acacia* spp.)
30. Liquidambar (*Liquidambar styraciflua*)
31. Red Flowering Gum (*Eucalyptus ficifolia*)
32. Japanese wisteria (*Wisteria floribunda*)
33.Black Cottonwood (*Populus trichocarpa*)*
34. Goodding's black willow (*Salix gooddingii*
35. Goodding's black willow (*Salix gooddingii*
36. Tree of heaven (*Alianthus altissima*)
37. Kurrajong (B*rachychiton populneus*)
38. Black mission fig (*Ficus carica*)
39. Japanese beech (Fagus crenata)
40. Shiny Xylosma (Xylosma congestum)
41. Mule Fat (Baccharis salicifolia)

Native Woodlands and Riparian Areas

- Native California Host Species include: Coast live oak and riparian species such as California sycamore, Fremont cottonwood, red willow, box elder, maples and white alder
- Urban Shade Trees include: English oak, silk tree, coral tree, Titoki tree, Liquidambar (sweetgum)

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1. California box elder (Acer negundo)
2. Coast live oak (Quercus agrifolia)
3. California Sycamore (Platanus racemosa)
4. Big leaf maple (Acer macrophyllum)
5. Red Willow (Salix laevigata)
6. Valley oak (Quercus lobata)
7. Blue palo verde (Cercidium floridum)
8. Engelmann oak (Quercus engelmannii)
9. White Alder (Alnus rhombifolia)
10. Canyon live oak (Quercus chrysolepis)
11. California bay laurel (Umbellularia californica)
12. Desert fan palm (Washingtonia filirera)
13. California buckeye (Aesculus californica)
14. Coffee berry (Ramnus californica)
15. Velvet ash (Fraxinus velutina)
16. Fremont cottonwood (Populus fremontii)
17. California ash (*Fraxinus dipetala*)
18. Gooding's black willow (*Salix gooddingii*)

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Agricultural Crops

Polyphagous Shot Hole Borer and
Fusarium Disease on Avocado

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1. Avocado (Persea americana)*
2. Persimmon (Diospyros spp.)
3. Olive (Olea europea)
4. Macadamia (Macadamia integrifolia)
5. Eastern mulberry (Broussonetia papyrifera)
6. Hazelnut (Corylus colurna)
7. Loguat (Eriobotrya japonica)
8. Peach (Prunus persica)
9. Grapevine (Vitis vinifera)
10. Citrus (Citrus cinensis)
11. Cassava (Manihot esculenta)
12. Japanese Persimmon (Diospyros lycidioides)
13. Japanese crabapple (Malus floribunda)

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Concerns

- Impacts to oak woodland and riparian areas affecting available rangeland, recreational values, and increasing fire risk in southern California

- Has infected commercial species, including avocado, almonds, walnuts, citrus, olives, impacting the agricultural economy

- Pests are rapidly moving northward to areas already stressed by drought and bark beetle, threatening even more species in central California

Current Research, Workgroups, Etc

- UC Riverside, UC Cooperative Extension
- Invasive Species Council of California
- California Invasive Species Advisory Committee
- County Agriculture Commissioners
- Gold Spotted Oak Borer Steering Committee
- California Firewood Task Force

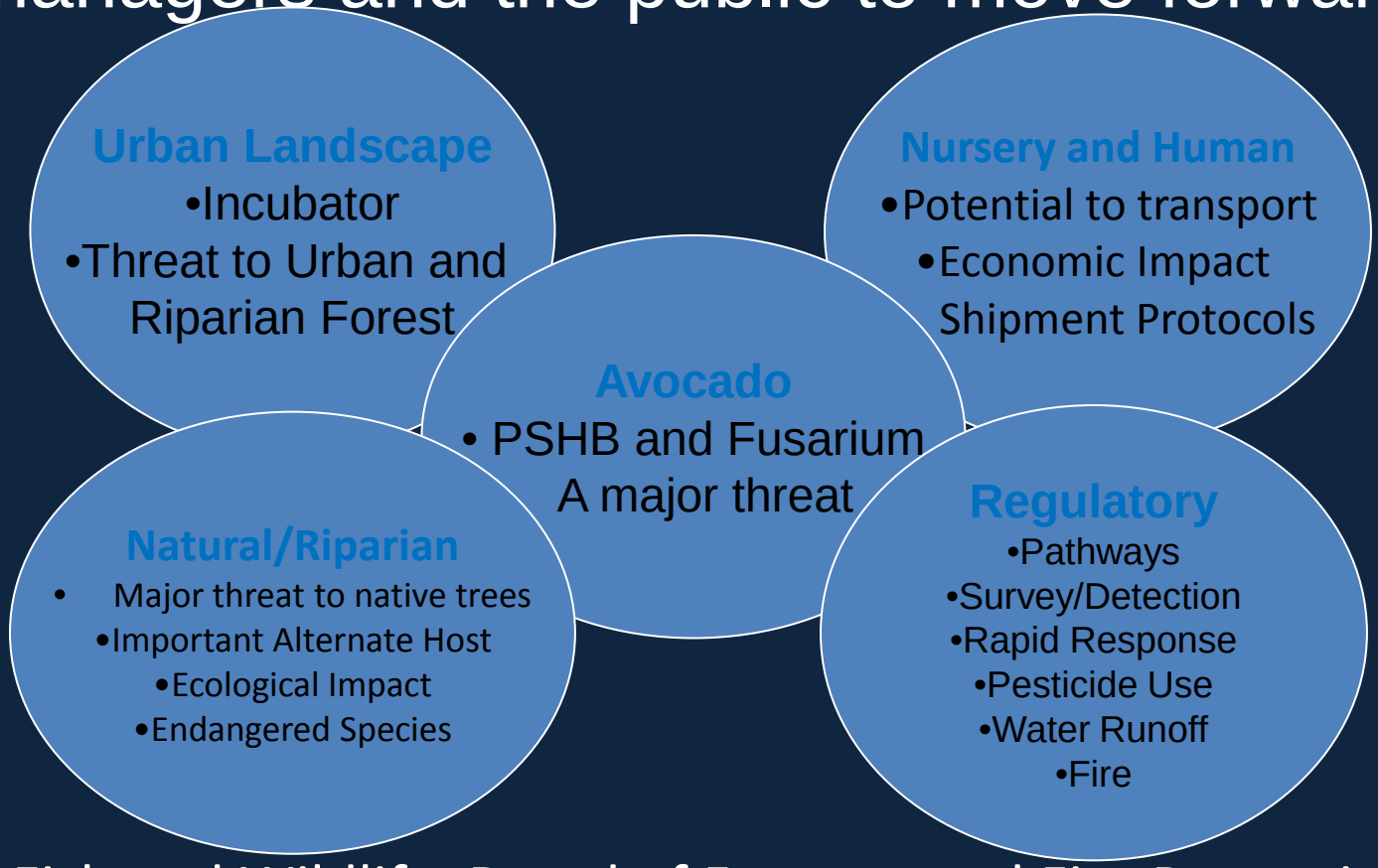
1) Quarantine Pest

- RMAC supports CDFA in requesting quarantine pest status from USDA
- Quarantine status would provide resources to:
  - Positively identify pests
  - Conduct studies on their biology
  - Develop better traps, lures and detection methods
  - Develop and communicate Best Management Practices
  - Form Rapid Response Teams

2) Coordinate Efforts

- Lots of small groups are working on this issues; RMAC encourages CDFA to take up the leadership mantle and connect policymakers, academics, and program implementation staff who are already talking in their smaller groups
- Coordination of these efforts will lead to effective programs

We need a strong coalition of local, state and federal public agencies, NGOs, land managers and the public to move forward



CAL FIRE, Fish and Wildlife, Board of Forestry and Fire Protection, USDA Forest Service, CA State Parks, Public Agencies, NGOs, Land Managers, CDPR, Assembly Ag/Natural Resources, Audubon, University of California ANR, NRCS, RCDs, and…

3) Governor’s Office Funding

- Request inclusion of these pests in tree mortality and forest health funding
- Expand the scope of the Tree Mortality Task Force, or authorize a similar organization, to address impacts of these pests

Kuroshio Shot-Hole Borer/Fusarium Dieback Impact on Riparian Habitat in the The Tijuana River Valley

140,000 willow trees severely damaged

The forest at Dairy Mart Bridge before the beetle attack (May 2015).

The forest at Dairy Mart Bridge after the beetle attack (February 2016).

Photos by John Bolund

pshb.org

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