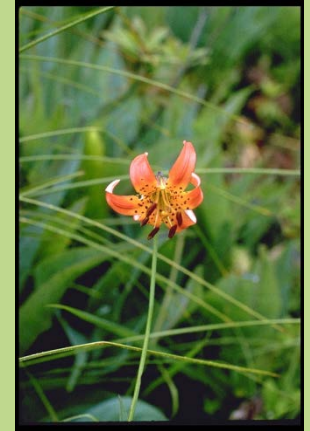
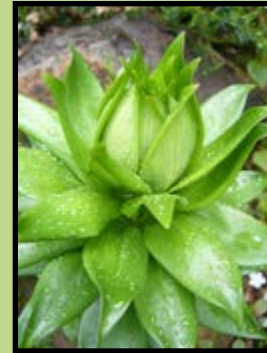


Projected future conditions & disturbance agents of North Coast forests



Photos: CAL Academy,
Cal Photos

Susan Frankel,
USDA Forest Service,
Pacific Southwest Research Station,
Albany, CA, sfrankel@fs.fed.us



Outline

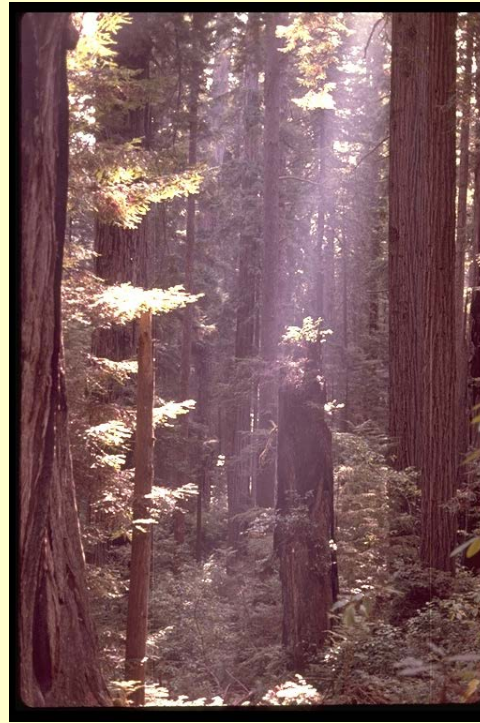
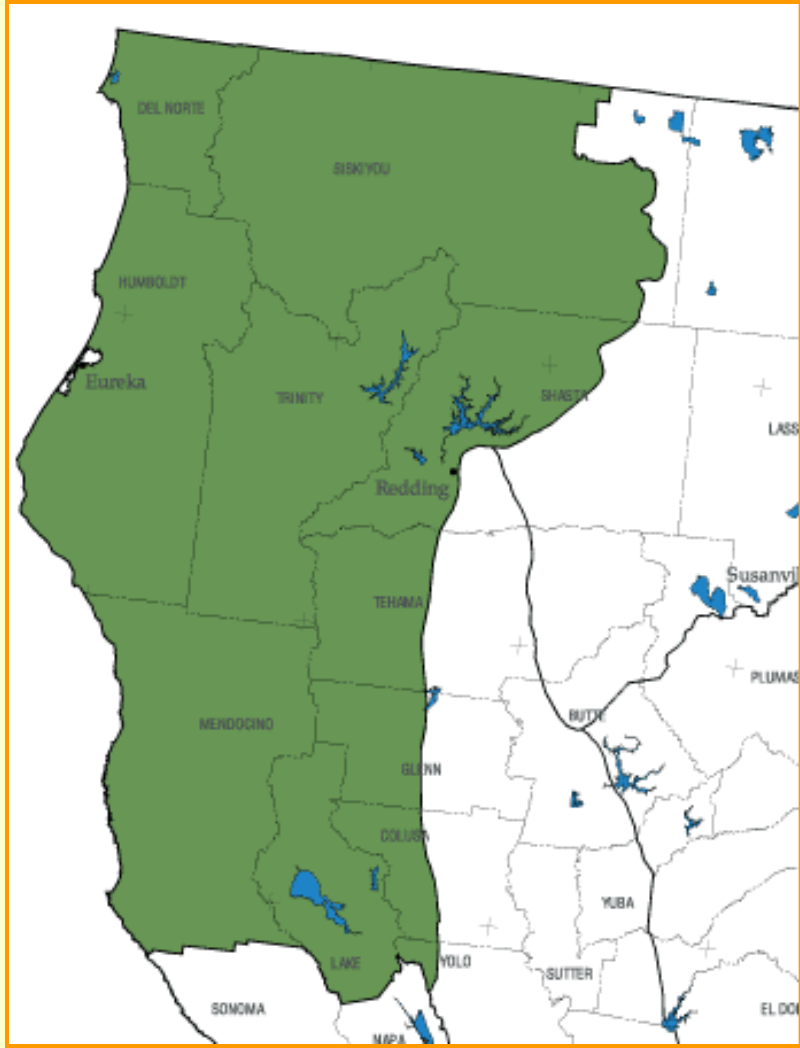
What is shaping change in North Coast forests?

What will North Coast forests be like in 2114?

Forest pests concerns on the horizon???

- Gold spotted oak borer
- Shot hole borer
- Laurel wilt
- 1000 cankers & walnut twig beetle

Klamath/North Coast Bioregion



Photos: Marc Hoshovsky;
Jo-Ann Ordano © California Academy of Sciences

Klamath/North Coast Bioregion ---- Threats

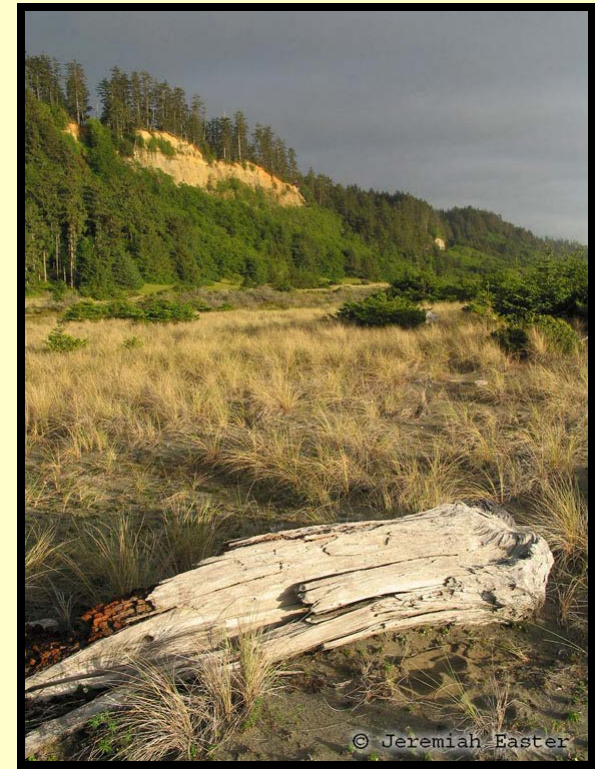
Logging – Siltation. Destabilizes slopes.

Marijuana grows – Pesticides, potential violence. Loss of habitat, tranquility, etc.

Lack of water - Klamath and Trinity river water irrigates hay

Development & people pressure - Tourists & invasive species. Wildlife poachers & vandals.

Grazing.



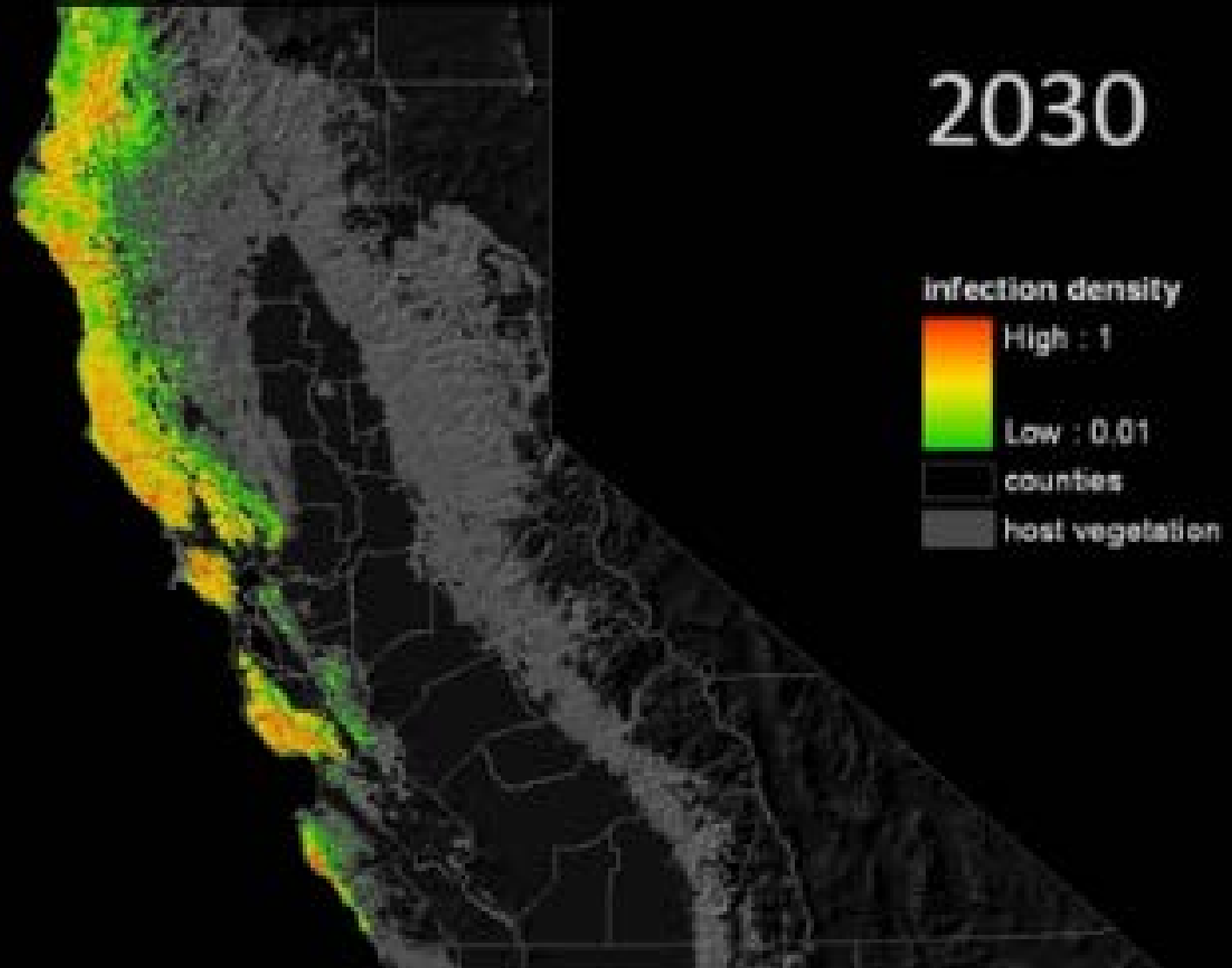
Klamath/North Coast climate projections

- Temperature. Expected increase 1.7–1.9°C by 2070
Significant increase in extreme temperature events.
- Precipitation decrease 10 – 20%. Highly uncertain!
- Snowpack – decrease by 73% (Trinity Mtns)
- Sea level rise. 11 to 72 cm by 2100.
Coastal and estuary habitats! Tidal marshes.

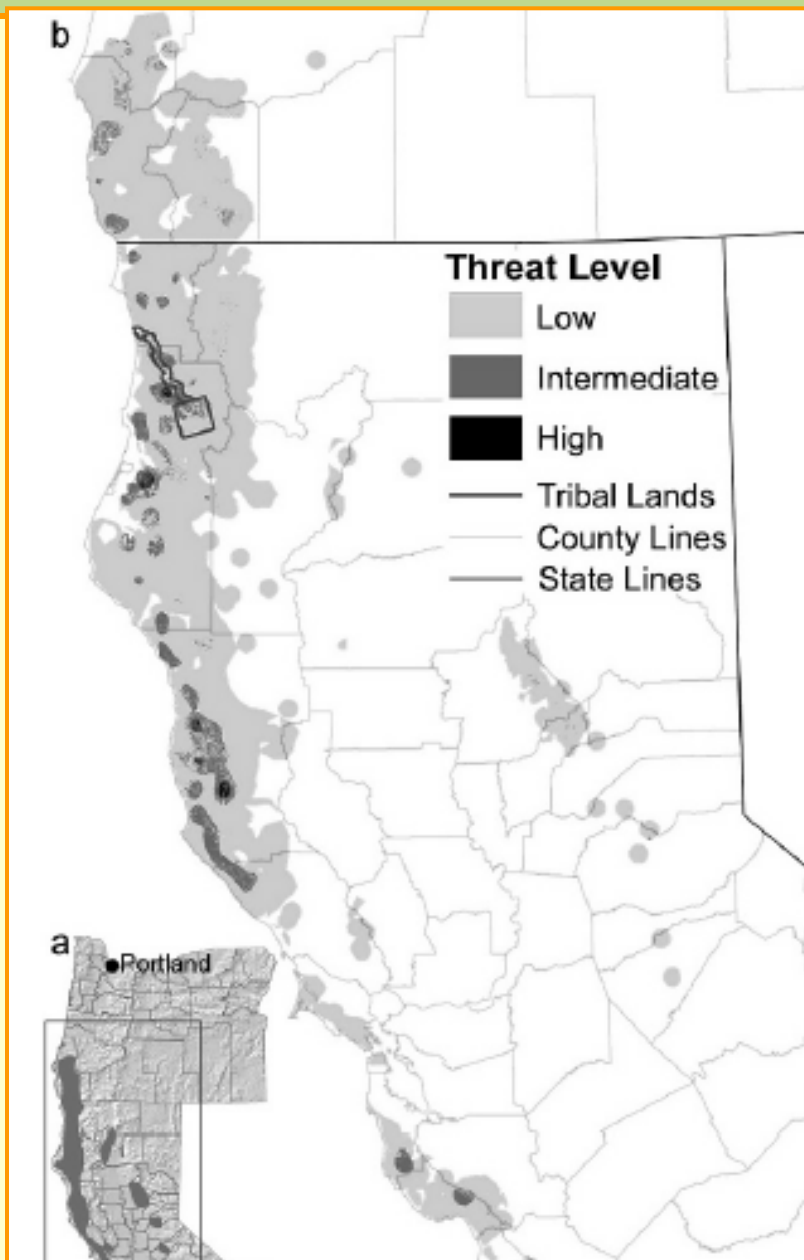
Increase in plant productivity (+water use)
may offset tidal surge.



Predicted spread of sudden oak death: early long-range spread



Ross K. Meentemeyer, Nik J. Cunliffe, Alex R. Cook, Joao A. N. Filipe, Richard D. Hunter, David M. Rizzo, and Christopher A. Gilligan 2011. Epidemiological modeling of invasion in heterogeneous landscapes: spread of sudden oak death in California (1990–2030) *Ecosphere* 2:art17



Tanoak. Interacting threats...

11,000 hectares at high risk – includes Hoopa & Yurok lands

Silviculture – herbicides, species hift from tanoak

Sudden oak death

Development

Fire – Altered regimes

Dillon, W.W., R.K. Meentemeyer, J.B. Vogler, R.C. Cobb, M.R. Metz, and D.M. Rizzo. 2013.
Range-wide risks to a foundation tree species from disturbance interactions. *Madroño* 60:139-150

Increasing stand density

Fire suppression

Altered species composition



Root disease,
Dwarf mistletoe,
Beetles

D. Conklin, USFS



Aerial Survey - 2013

Bear Damage to Douglas-fir is #1 damage agent in Del Norte & Humboldt Cos.

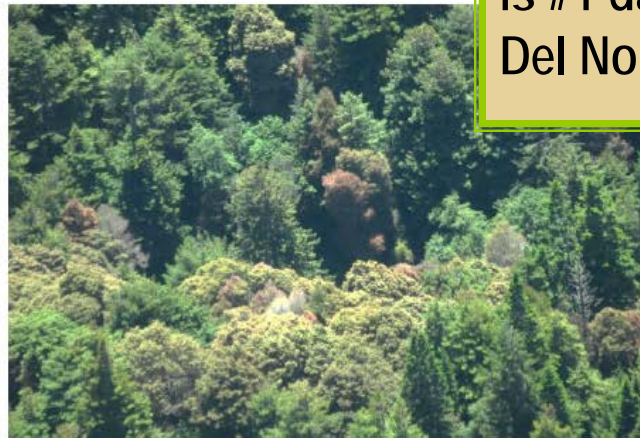
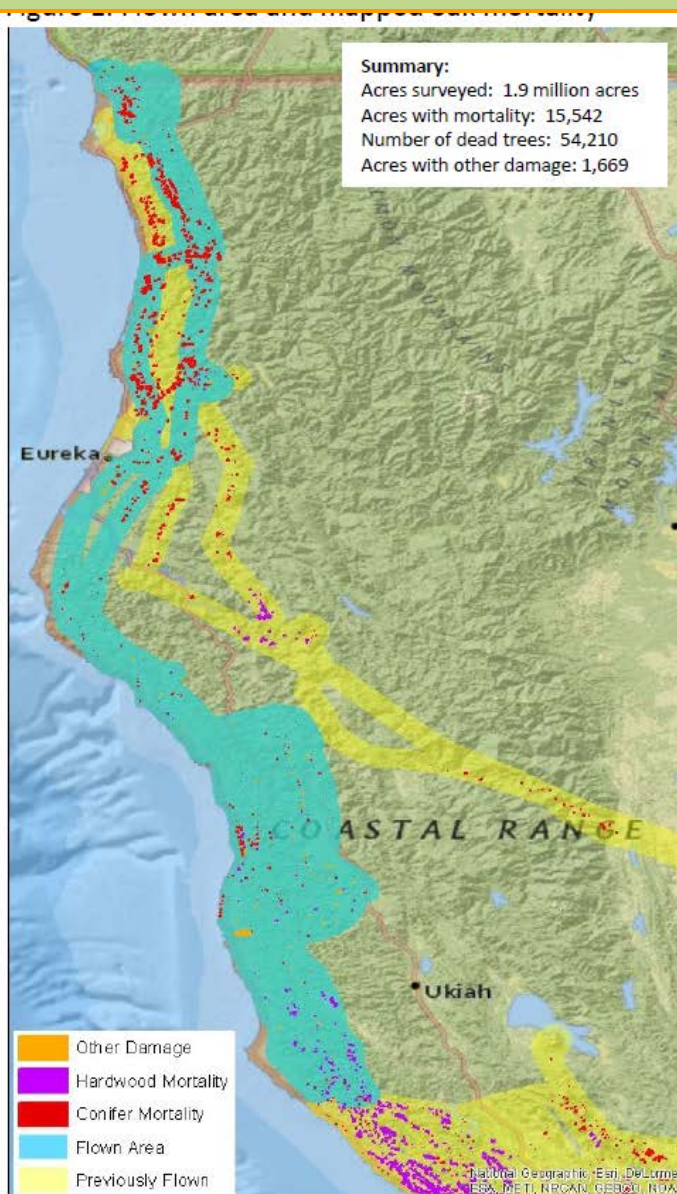


Figure 2. Dead tanoak in the North Fork of the South Fork Noyo River in Jackson State Forest.

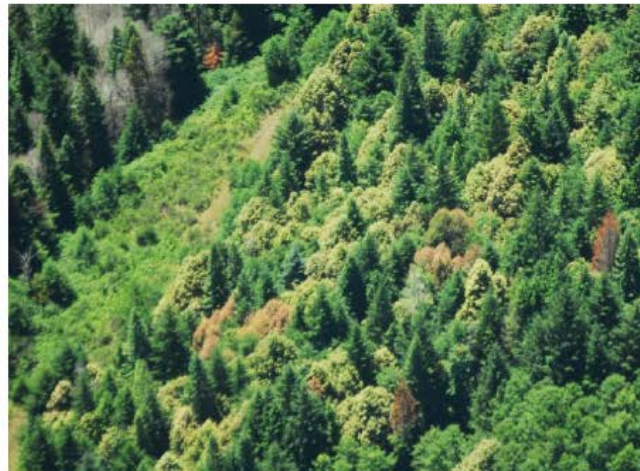


Figure 3. Dead tanoak and bear-damaged Douglas-fir in Redwood Creek in Humboldt County.

Direct questions pertaining to this report to Zachary Heath (email: zheath@fs.fed.us phone: 530-759- 1751). Report Date July 3rd 2013.

Z. Heath, USFS, FHP

Swiss Needle Cast Survey - 2013

Swiss Needle Cast not detected In Del Norte & Humboldt Cos.

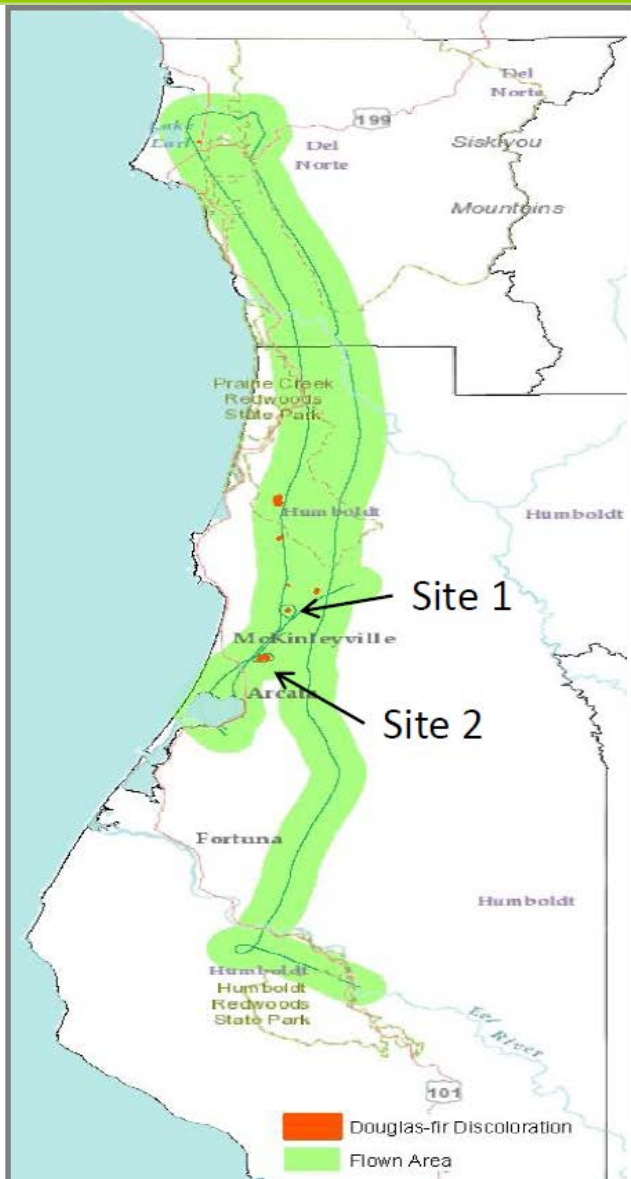


Figure 2. Site 1 on the map.

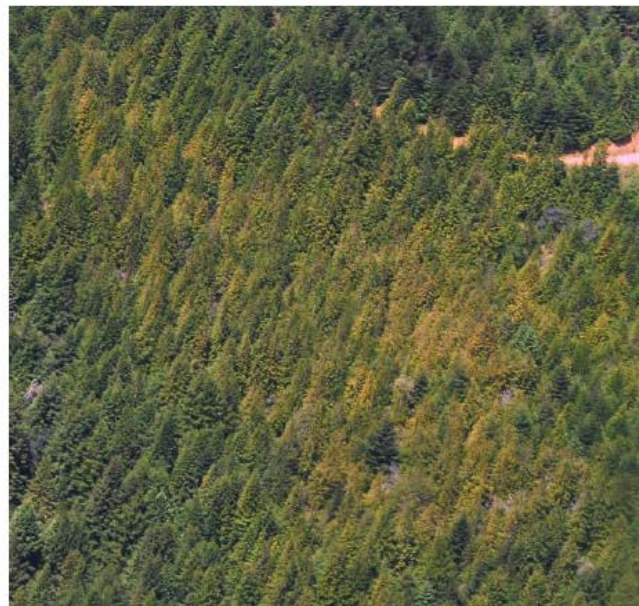
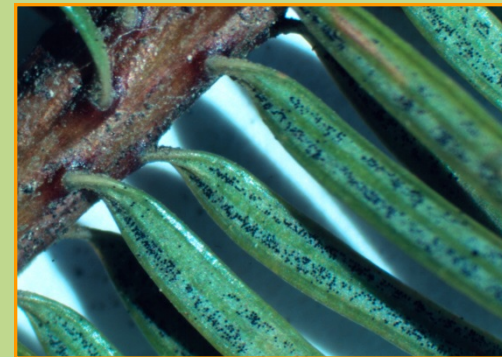
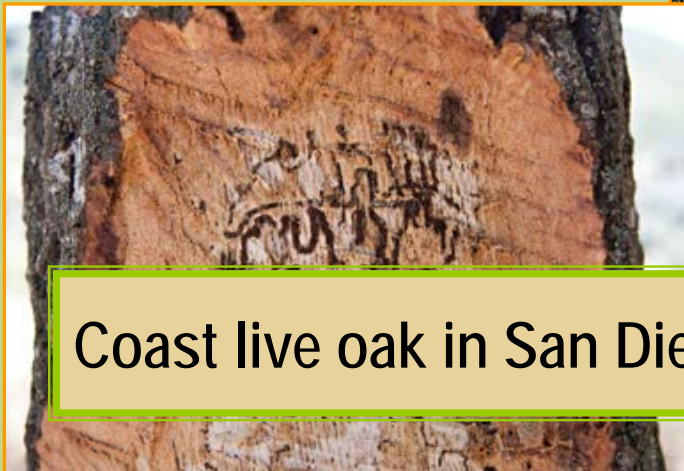


Figure 3. Site 2 on the map.



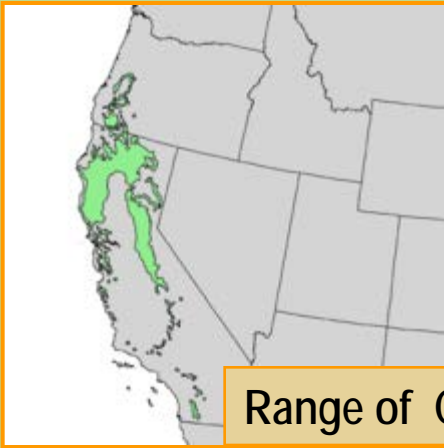
ODF photos

Gold spotted oak borer, *Agrilus auroguttatus*



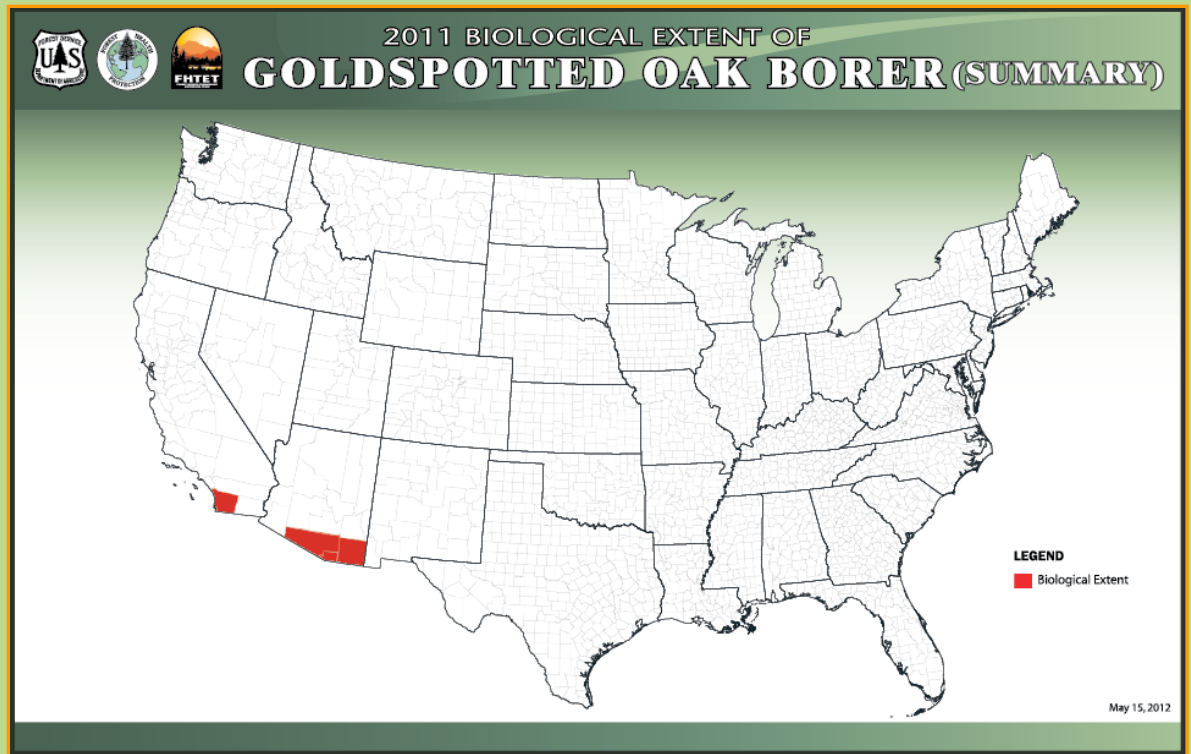
Coast live oak in San Diego Co. and CA black oak in Riverside Co.

Range of coast live oak



Range of CA black oak

Range of gold spotted oak borer?



Laurel Wilt – Threat to California Bay Laurel

Redbay ambrosia beetle,
Xyleborus glabratus

Raffaelea lauricola



Credit: UC Riverside, Center for Invasive Species Research

Thousand Cankers Disease and the Walnut Twig Beetle in California

Walnut twig beetle,
Pityophthorus juglandis
& *Geosmithia morbida*



Shot hole borer

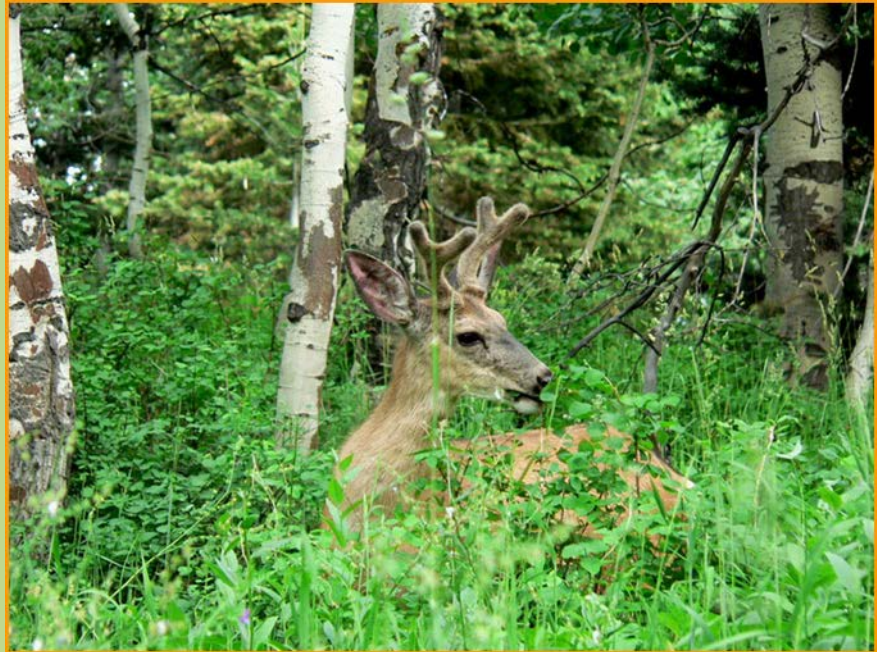


Shot Hole Borer (*Euwallacea* sp.) and Fusarium Dieback (*Fusarium* sp.)

- Los Angeles and Orange Counties
- Hosts: Coast live oak, box elder, avocado, big leaf maple, California sycamore and more



What will drive forest change?



Acknowledgements

USDA Forest Service,
Pacific Southwest Research Station



Manage water for forest health!

Mulch

Thinning and species selection

Soil conservation

Irrigation



Water for fish? Water for farms? Water for city people?

Or – water for the forest?

Photo credit : TNC

Gordon E. Grant, Christina L. Tague, and Craig D. Allen 2013. Watering the forest for the trees: an emerging priority for managing water in forest landscapes. *Frontiers in Ecology and the Environment* 11: 314–321

Photo credit : TNC

How will forests respond to climate change?

Warming will

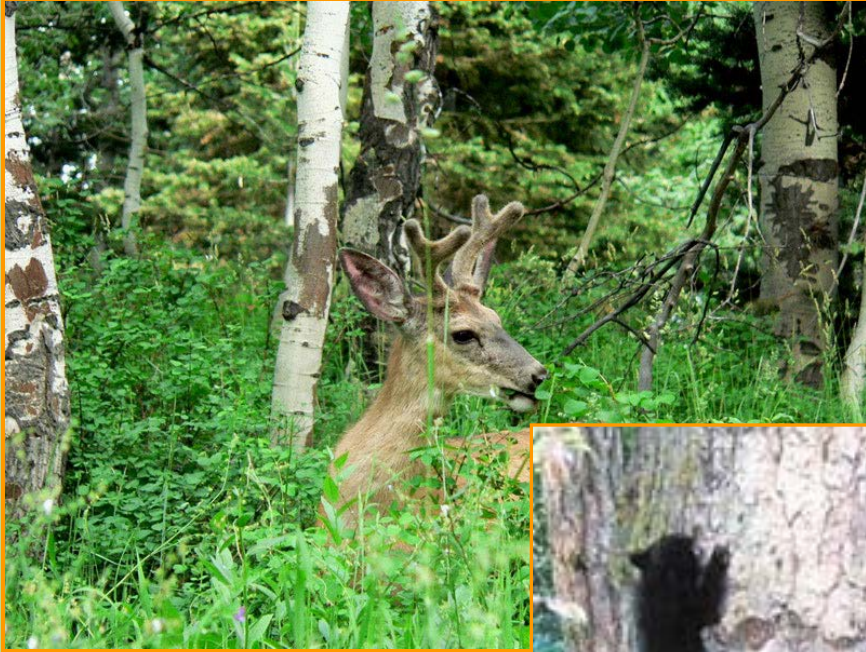
- decrease snowpack,
- cause earlier snowmelt,
- increase summer evapotranspiration,
- increase the frequency and severity of droughts,
- increase risk of frost injury
- change germination time
- change time of bud set and bud break



Photo: Craig Allen, USGS

Chumua, D.J., P.D. Anderson, G.T. Howe, C.A. Harrington, J.E. Halofsky, D.L. Peterson, D.C. Shaw, and B. St. Clair. 2011. Forest Responses to climate change in the northwestern United States: Ecophysiological foundations for adaptive management. *Forest Ecology and Management*. 261: 1121-1142

Animal Damage



Aspen Photos:
USFS



Photo: Sean Matthews



Photo: Emily Gumon



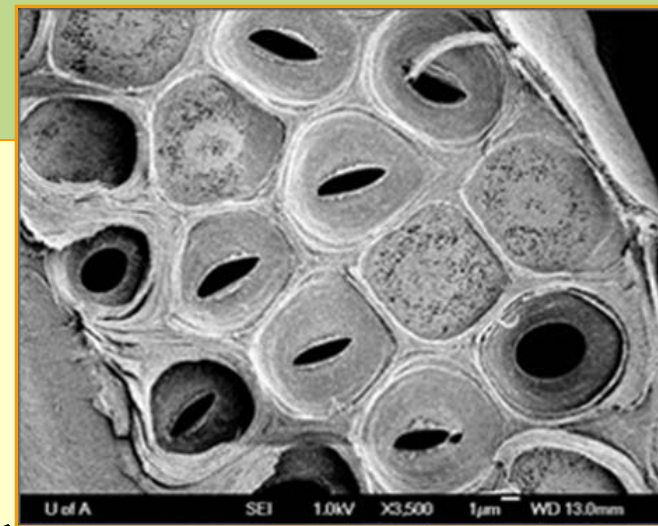
Photo: Las Pilitas Nursery

Why do trees die after drought?

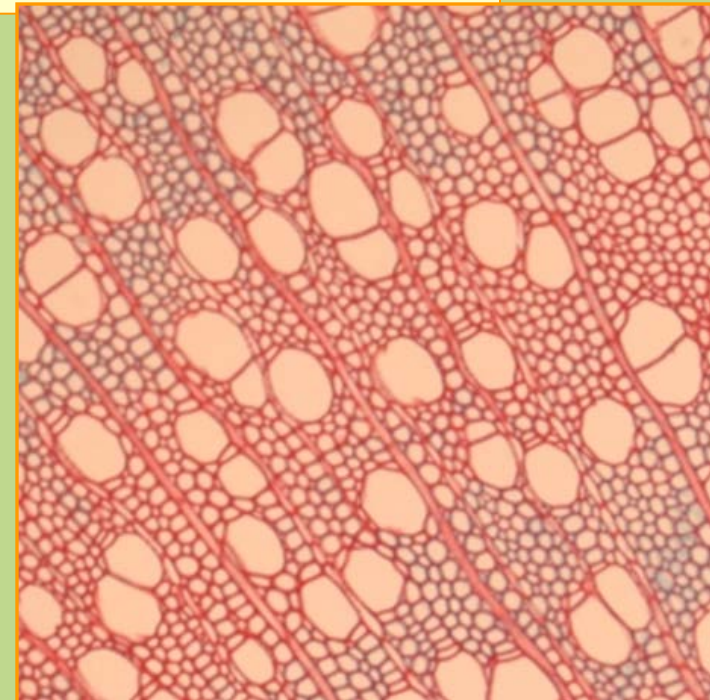
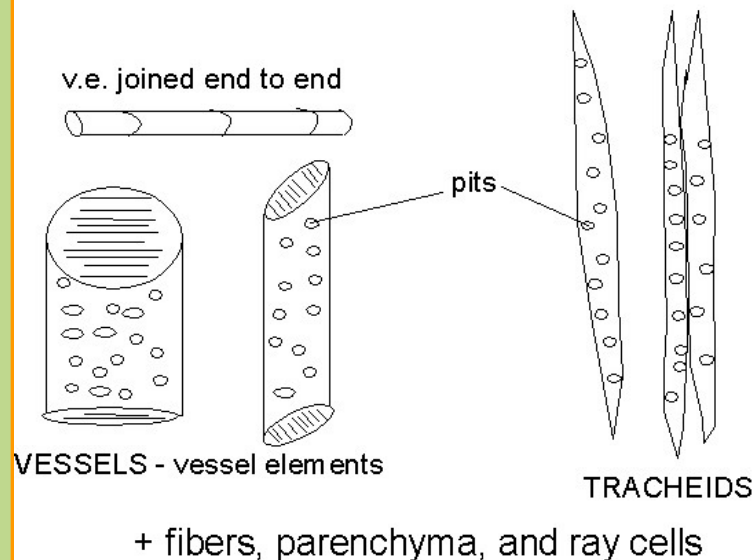
Aspen - Hydraulic damage persisted in dying trees

Deterioration- 9 years post stress.

Similar findings for pinyon (Mueller, 2005)



COMPONENTS OF XYLEM



Anderegg, W.R.L., Plavcová, L., Anderegg, L.D.L., Hacke, U.G., Berry, J.A. & Field, C.B. (2013). Drought's legacy: multiyear hydraulic deterioration underlies widespread aspen forest die-off and portends increased future risk. *Glob. Change Biol.*, 19, 1188–1196.

Photo Credit: Plavcova, Univ of Alberta & astate.edu