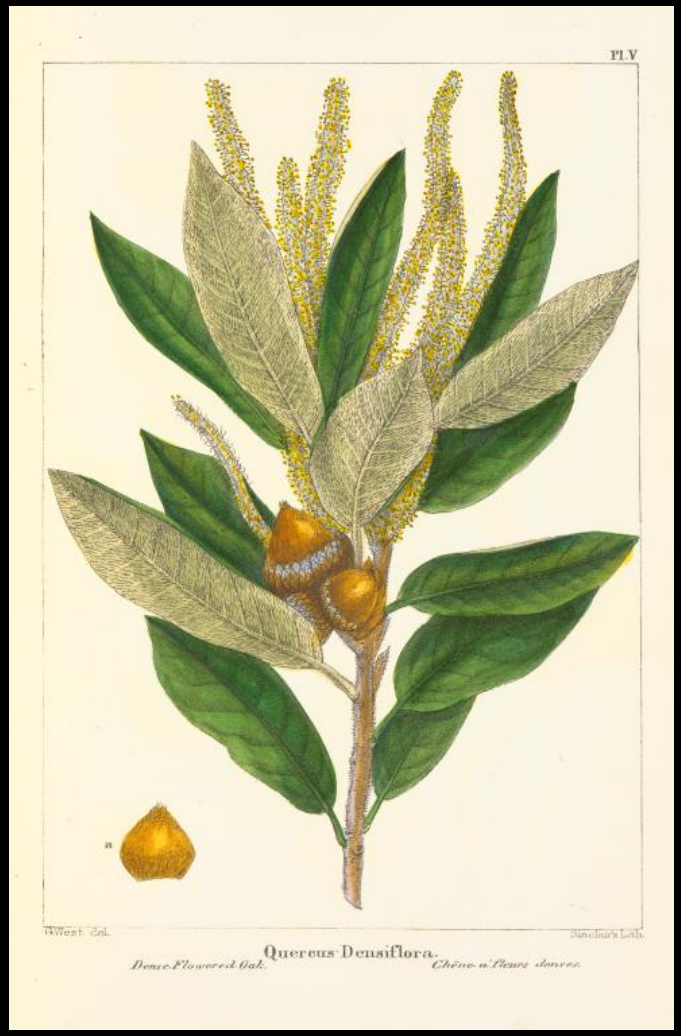
The Tanoak Tree

An Environmental History of a Pacific Coast Hardwood



This case study examines the economic, ecological, and cultural factors that have influenced the use and abuse of this magnificent tree. It puts the current sudden oak death crisis into historical context and helps us understand the failures of government regulation to prevent environmental harm caused by commerce.

From Thomas Nuttall, *The North American Sylva*, vol. 4 (1865), plate V. Lithograph by Thomas S. Sinclair, ca. 1841-1849. Hand-colored. Courtesy of New York Public Library.

Notholithocarpus densiflorus

In the Kashaya Pomo language, tanoak is called chishkale, which translates to ‘beautiful tree.’

Unknown photographer, U.S. Forest Service, 1966. Courtesy of the National Agricultural Library and USDA-NRCS PLANTS Database.

key threats to tanoak

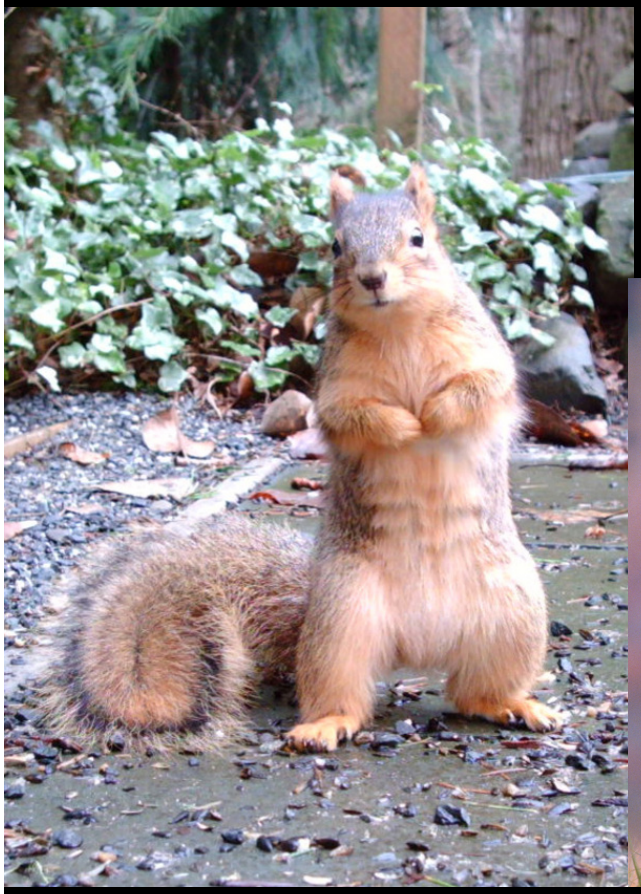
- fire suppression
- herbicide use in industrial forestry
- sudden oak death
- logging for biofuel
- climate change

Why Should We Care About Tanoak?

- climatic relict, only species in the genus
- reduces pest problems on more profitable conifers
- keystone wildlife food plant
- needed for indigenous cultural renewal
- sustainable food production
- among the most common hardwoods in California

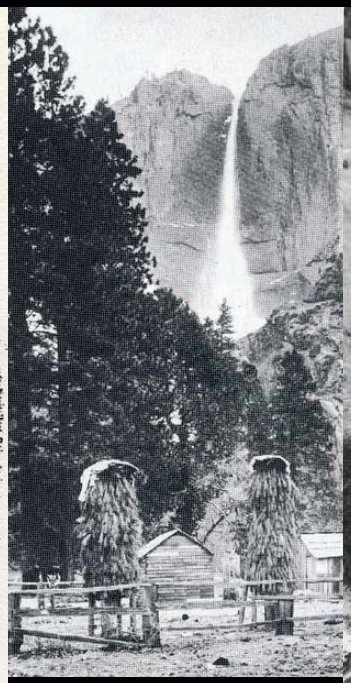
Acorn Tree

up to 1,000 lbs of acorns produced per tree



Source: U.S. Forest Service.

Indigenous Acorn Economy



On left drawing from *Hutching's California Magazine*, 1859. Courtesy of the Bancroft Library. Center photo from Bates, "Acorn Storehouses of the Yosemite Miwok." Photograph on right by Josepha Haveman. Courtesy of UC Berkeley, Hearst Museum of Anthropology.

Mrs. Freddie leaching acorn meal, Northwest California Hupa, 1901.

Photograph by Pliny E. Goddard. Courtesy of UC Berkeley, Hearst Museum of Anthropology.

Hupa, Karok, or Yurok acorn bowl, 19th - early 20th century

Courtesy of UCLA, Fowler Museum of Cultural History.

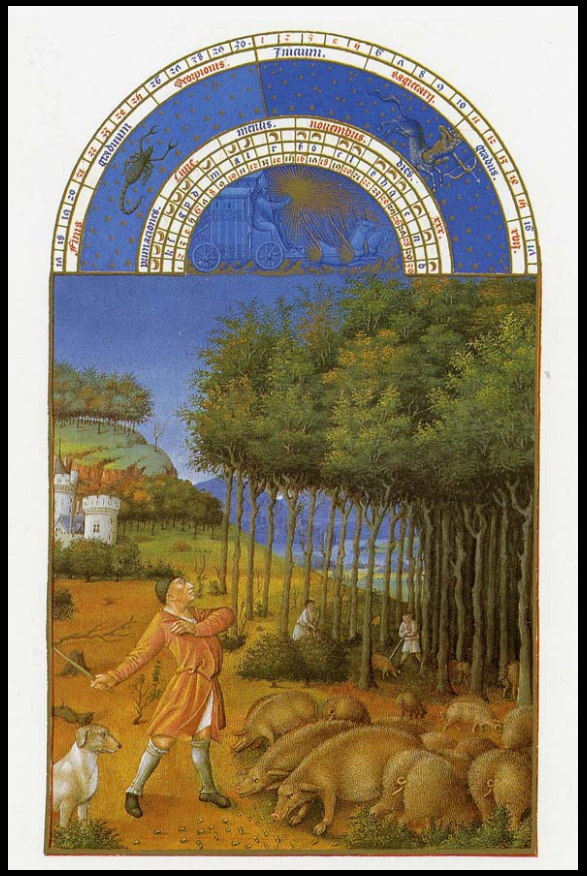
“That a food of such genuine worth should be disregarded by our people is one of many illustrations of the reluctance of the white man to avail himself of sources of subsistence long utilized by the aborigines.”

C. Hart Merriam

Former Chief of the U.S. Biological Survey, 1918

Environmental problems are "rooted in human ideas, values and beliefs."

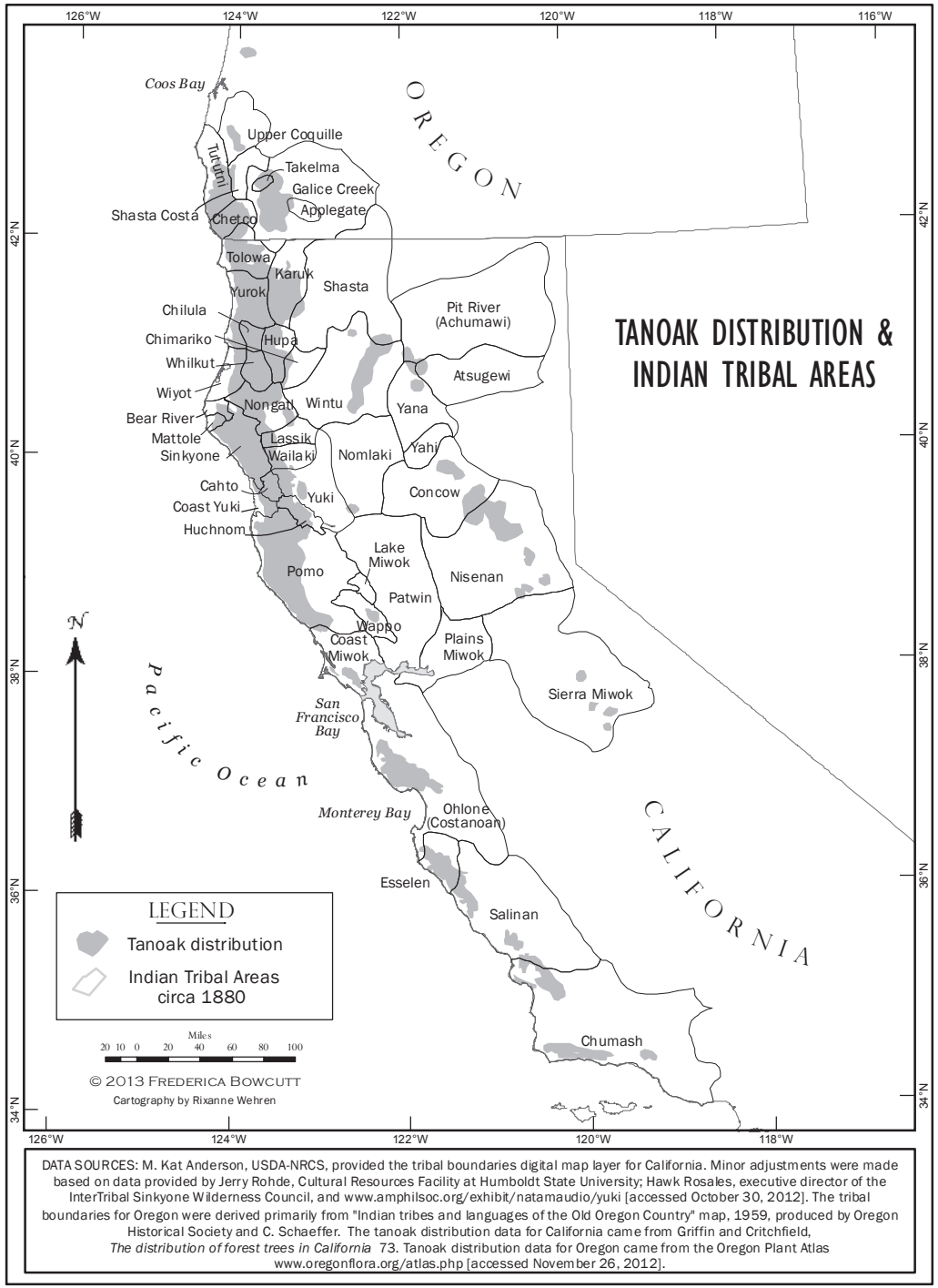
William Jordan, III, 1997



15th and 16th century prayer books from Europe that picture "primitive" pre-Christians collecting *Quercus* acorns in Europe for human food (on left) and agricultural practices (center and on right). These images illustrate cultural values about food as a reflection of relative civilized states.

Americans imported the European practices of using acorns as livestock fodder and unfenced lands as a grazing commons.

Fattening pigs on *Quercus* acorns in November before slaughtering them in December, Europe, ca. 1500. Pig herders' used the sticks in their hands to knock acorns down from the oak trees. Detail from a page in the calendar section of a prayer book, reproduced in Wieck, Voelkle, and Hearne, *The Hours of Henry VIII*, folio 6.



DATA SOURCES: M. Kat Anderson, USDA-NRCS, provided the tribal boundaries digital map layer for California. Minor adjustments were made based on data provided by Jerry Rohde, Cultural Resources Facility at Humboldt State University; Hawk Rosales, executive director of the InterTribal Sinkyone Wilderness Council, and www.amphilsoc.org/exhibit/natamaudio/yuki [accessed October 30, 2012]. The tribal boundaries for Oregon were derived primarily from "Indian tribes and languages of the Old Oregon Country" map, 1959, produced by Oregon Historical Society and C. Schaeffer. The tanoak distribution data for California came from Griffin and Critchfield, *The distribution of forest trees in California* 73. Tanoak distribution data for Oregon came from the Oregon Plant Atlas www.oregonflora.org/atlas.php [accessed November 26, 2012].

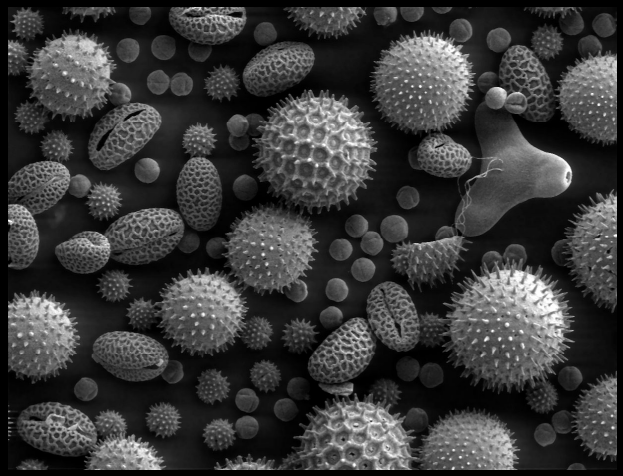
Americans Repurposed Tanoak Groves to Produce Salted Meats for Mining Camps

Humboldt Pork Packing Company alone had sold more than 400,000 pounds of pork by 1881. In neighboring Mendocino County, hog raising also became “an extensive business” by 1882 and was most profitable in well-developed tanoak groves located in valleys.

Based on their skillful use of fire as a management tool,
"some credit must be given to the native tribes as foresters."

Willis Linn Jepson
The Trees of California, 1909

Post-Glacial Climate Change



"Burning practices developed in response to climate change. Research based on microfossils shows that vegetation has shifted in relation to changing climate and fire frequency over the past fifteen thousand years. … During the early Holocene (ca. 10,900-4,500 cal yr BP), the climate shifted to "warmer-and-drier-than-present summer conditions" favoring xerophytic species such as oaks and chinquapin. Xerophytic vegetation contracted when the climate became cooler and wetter during the late Holocene period (ca. 4,500 cal yr BP–present), except where burned regularly by Native peoples."

Frederica Bowcutt, *The Tanoak Tree*, 2015

legacy tanoak

note broad canopy

"…dense growth was usually burned each year by the native tribes, making a quick hot fire sufficiently destructive to kill seedlings, although doing little injury to established or even quite young trees."

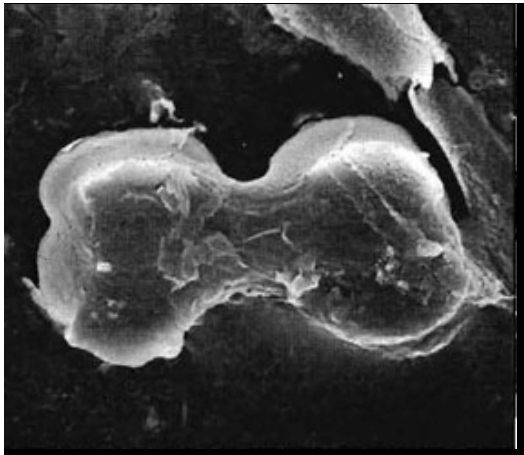
Quote & photo from
Jepson, *Silva of California*, 1910

Photograph courtesy of the National Parks Service.

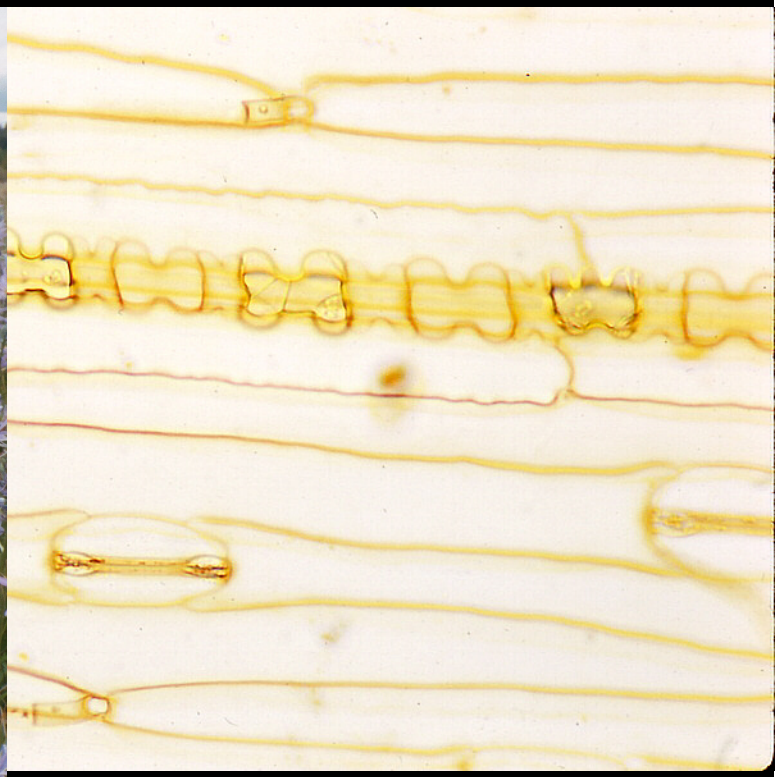
According to Mamie Offield, a Karok Indian woman, it's best to scorch tanoak each year to control diseases and pests. Offield also said that fire "leaves the ground underneath the trees bare and clean and it is easier to pick up the acorns."

"…with an increasing control of the annual fires, the forests and woods of this whole region are showing a decidedly aggressive character and are encroaching steadily upon the barren lands. There is today more wooded area in Humboldt County than when the white man came over a half-century since."

Quote & photo Jepson, *Silva of California*, 1910



phytoliths from grasses persist in the soil in areas now dominated by coniferous trees due to fire suppression

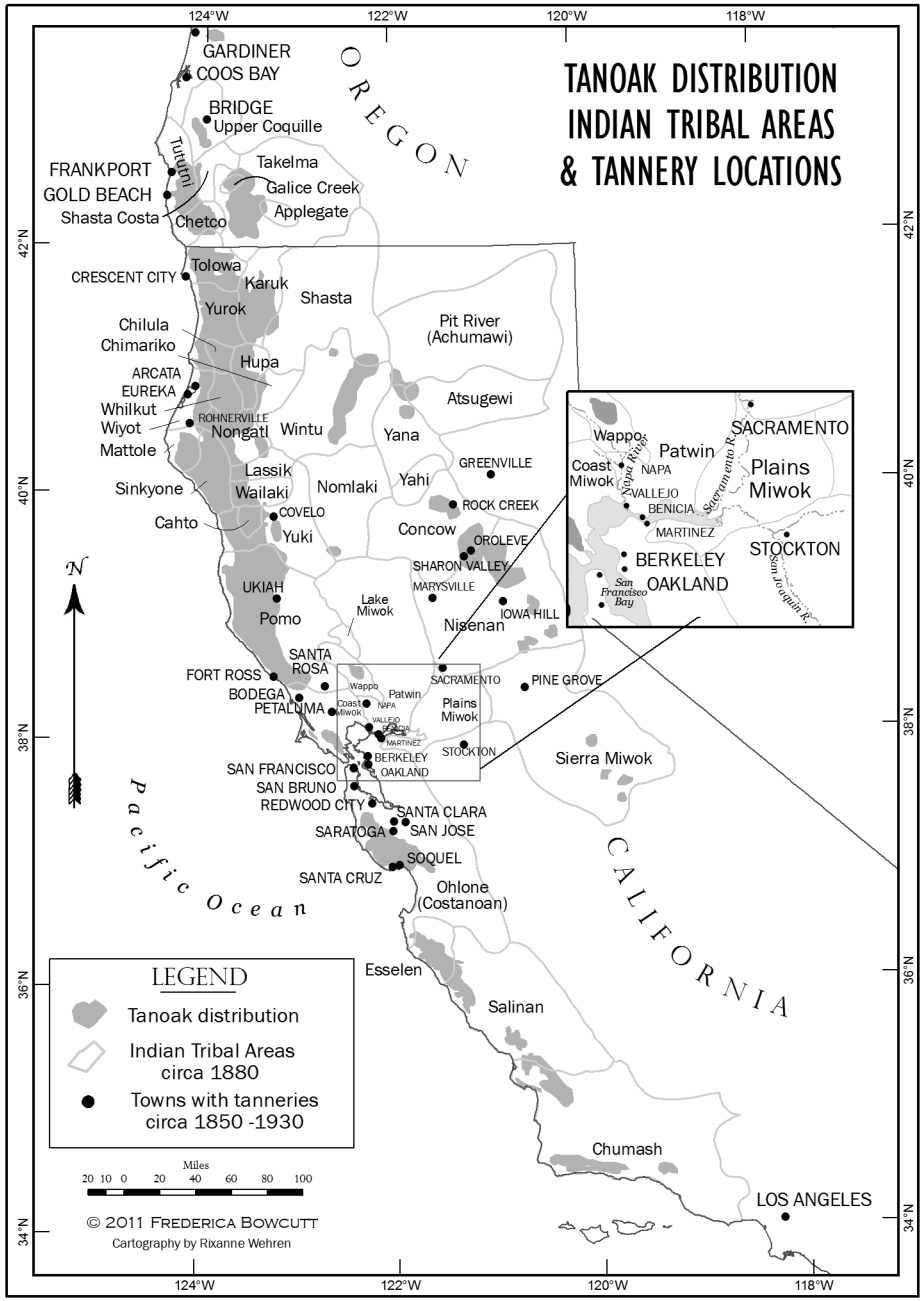


Upper left: Image of a phytolith taken with a scanning electron microscope. From http://www.texasbeyondhistory.net/varga/images/JW8-phytoliths-panicoid.jpg. Photograph on lower left of a grassland with camas by F. Bowcutt, 1995.
On right: Phytoliths in abaxial epidermis of leaf blade of the grass *Elytrophorus spicatus* from http://delta-intkey.com/grass/www/elytroph.htm

Tanbark

Tanning Industry

- hides from meat industry
- bark from tanoak
- important industry in developing areas



An American cultural landscape favoring the tanning industry was superimposed on an Indigenous cultural landscape favoring acorn production.

“100,000 trunks 10 to 100 feet long and 1/2 to 4 feet in diameter are left annually to rot on the ground” with an estimated 5% being “cut into firewood.”

Jepson, *The Trees of California*, 1909

Photograph courtesy of the University and Jepson Herbaria Archives, University of California, Berkeley.

liquidated tanbark before clearcutting with steam donkey (invented in 1881)

Photograph by Ericson. From the Ericson Collection. Unknown date. Taken in Humboldt County. Courtesy of Humboldt State University Library Special Collections in Arcata, California.

Load of bark on steep hill south of Eureka, California being pulled by a steam donkey. Date unknown.

Photograph by Ray Jerome Baker. From the Swanlund/Baker Collection.
Courtesy of Humboldt State University Library Special Collections in Arcata, California.

liquidation of the tanbark resource

Loading tanbark on to steam schooner destined for tanneries. Westport, California circa 1900.

Photograph by A. O. Carpenter.
Courtesy of the Mendocino County Historical Society, Ukiah, California.

industrial leather production in the San Francisco Bay Area

Courtesy of the University and Jepson Herbaria Archives, University of California, Berkeley.

global competition undermined tanoak conservation

Afrikaners established plantations for tanbark production from imported fast growing black wattle trees from Australia

From Howes, *Vegetable Tanning Materials*, facing title page.

Even the oldest tannery in the West turned to chromium salts and then closed altogether. In operation from 1861 to 2001, A. K. Salz Tannery depended heavily on tanoak bark for more than a century, which they used to make the tanning liquor in their Santa Cruz tanning pits pictured here in 1955.

Wood

disincentives to process hardwood from tanoak:

- requires more skilled laborers
- smaller profit margins relative to old growth conifers

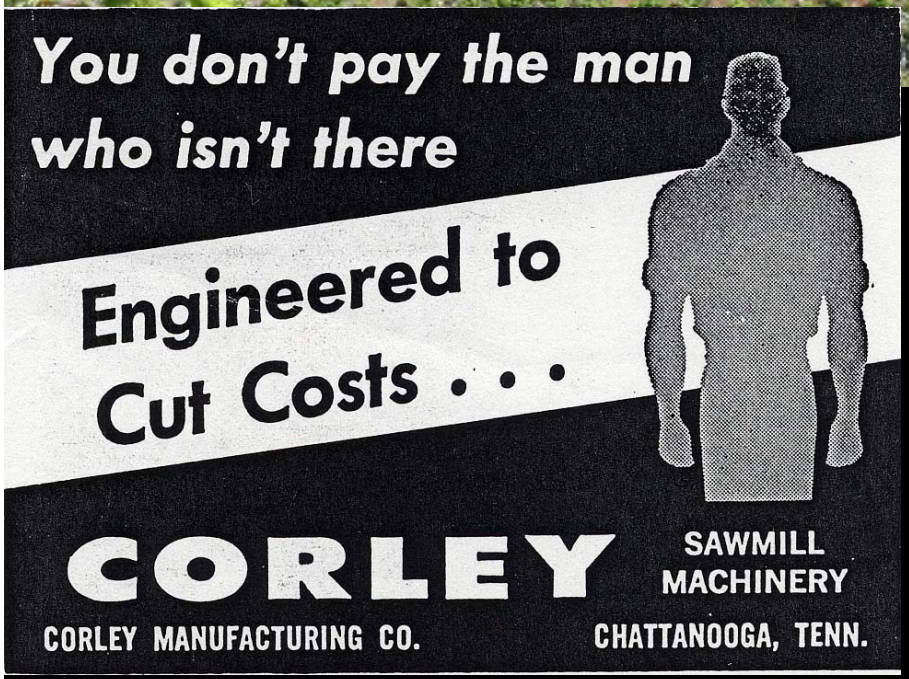
tanoak flooring on left and
tanoak rocker on right

Photographs courtesy of Ken Forden (left) and Dan Stalzer & Seth Janofsky (right).

old growth forests replaced with
even aged stands of young conifers

Photos courtesy of Fort Bragg-Mendocino Coast Historical Society Archives.

Douglas-fir plantations allowed for more mechanized production and required fire suppression on a landscape scale

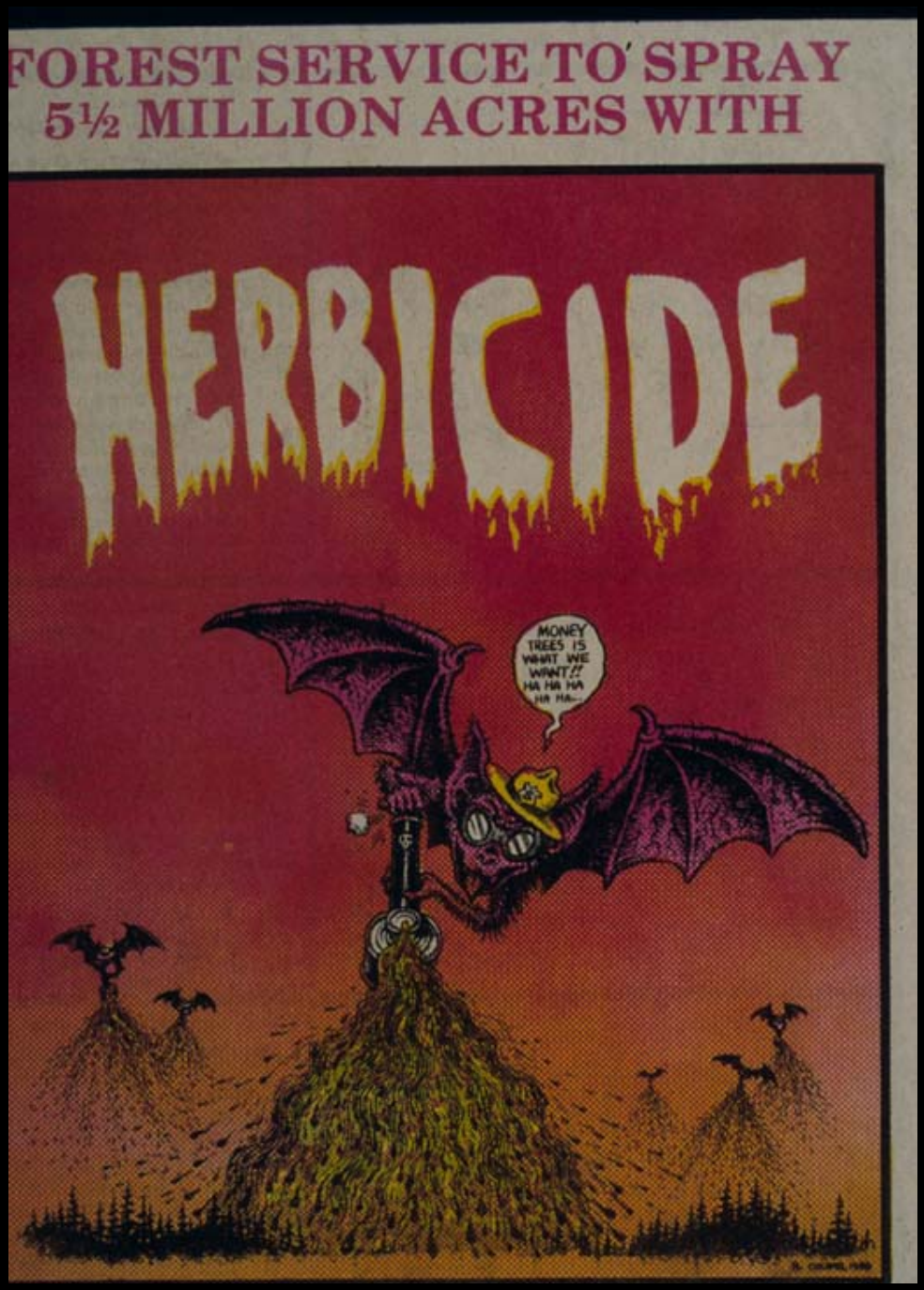


Graphics courtesy of Corley Manufacturing and the Forest History Society.

Weed

"Fairly extensive, nearly pure stands of coppice growth [*of tanoak*] appear on cut-over areas making the land unproductive from a short term economical perspective."

W. M. Harlow and E. S. Harrar
Textbook of Dendrology, 1958

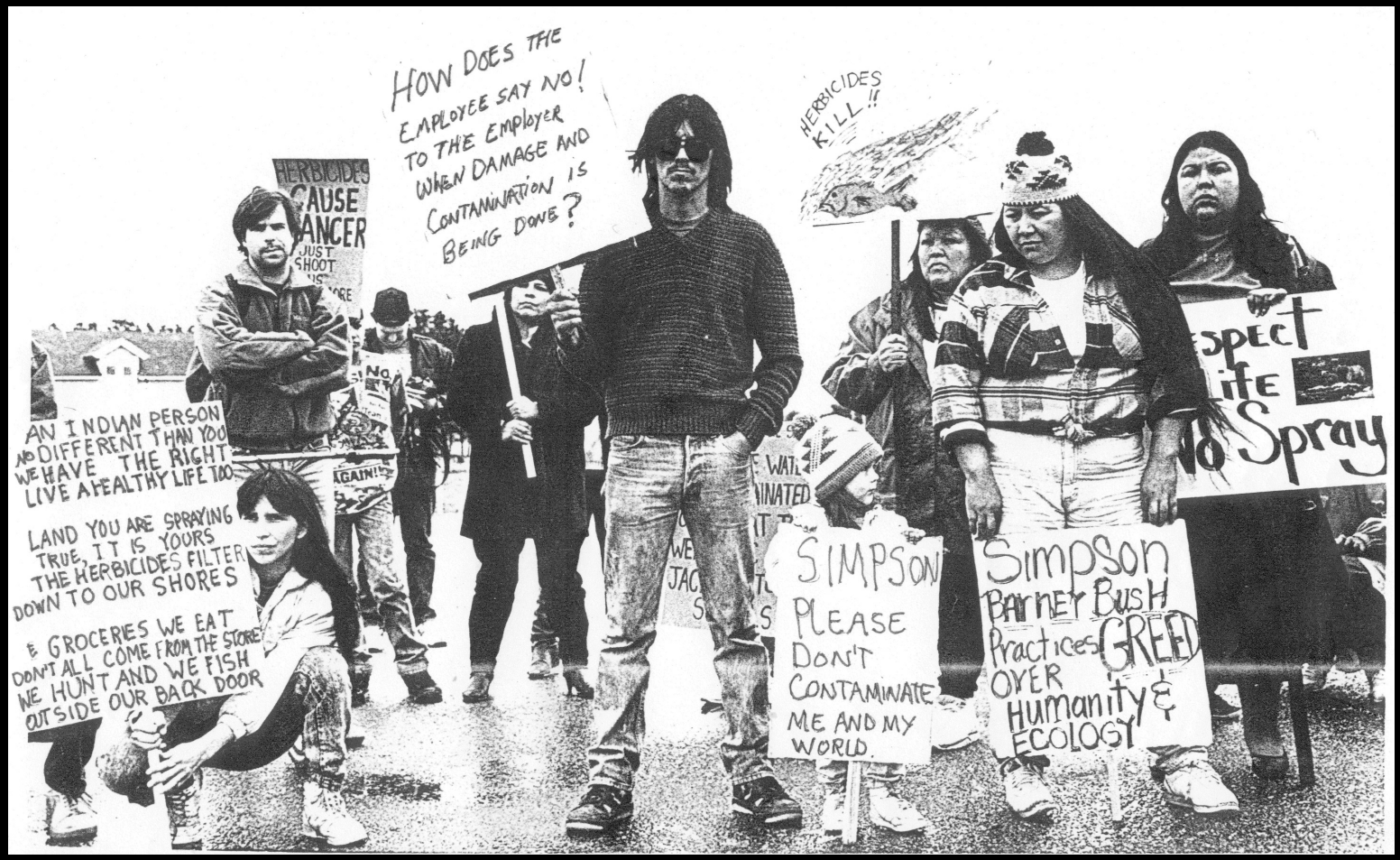


back-to-the land settlers resisted poisoning tanoak circa 1986

Forest Service bat says: "Money trees is what we want!! Ha Ha Ha Ha Ha..

Cartoon courtesy of R. Crumb

"Truth is relative to culture, that what one people takes for good, beautiful, and true may be thought as the reverse by another." —James R. Jacob, *The Scientific Revolution*, 1998



tribal action against herbicides, 1992

Photograph by Joseph Audisio. Courtesy of Californians for Alternatives to Toxics.

Photograph by F. Bowcutt, 1995

"Now we see tanoaks go down the road, all sizes and ages. The mills are just chipping it. These are acorn trees.... There are not enough for native peoples to maintain their culture."

Hawk Rosales

InterTribal Sinkyone Wilderness Council

Plague

sudden oak death

Tanoak mortality caused by *Phytophthora ramorum* can result in elevated fire hazard for years.

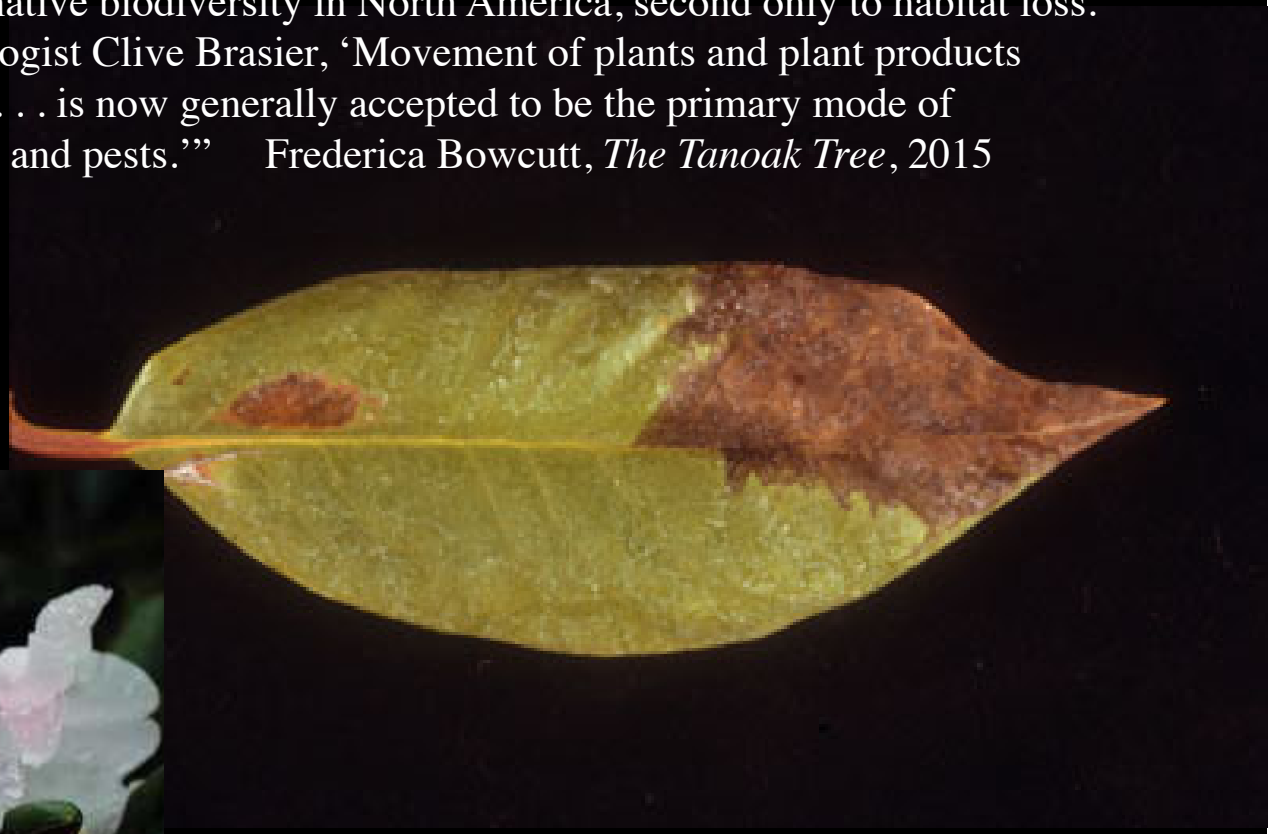
Photo on left by Everett Hansen, Oregon State University.
Photo on right by Jeffrey A. Mai. Courtesy of the U.S. Forest Service.

"We've never seen anything like this… Oak trees die, of course, but nothing to this extent. Knowing what the Dutch elm disease and chestnut blight have done to our forests—chestnuts are basically extinct—hopefully that doesn't happen with oaks."

Associate Dean of Forestry University of California at Berkeley

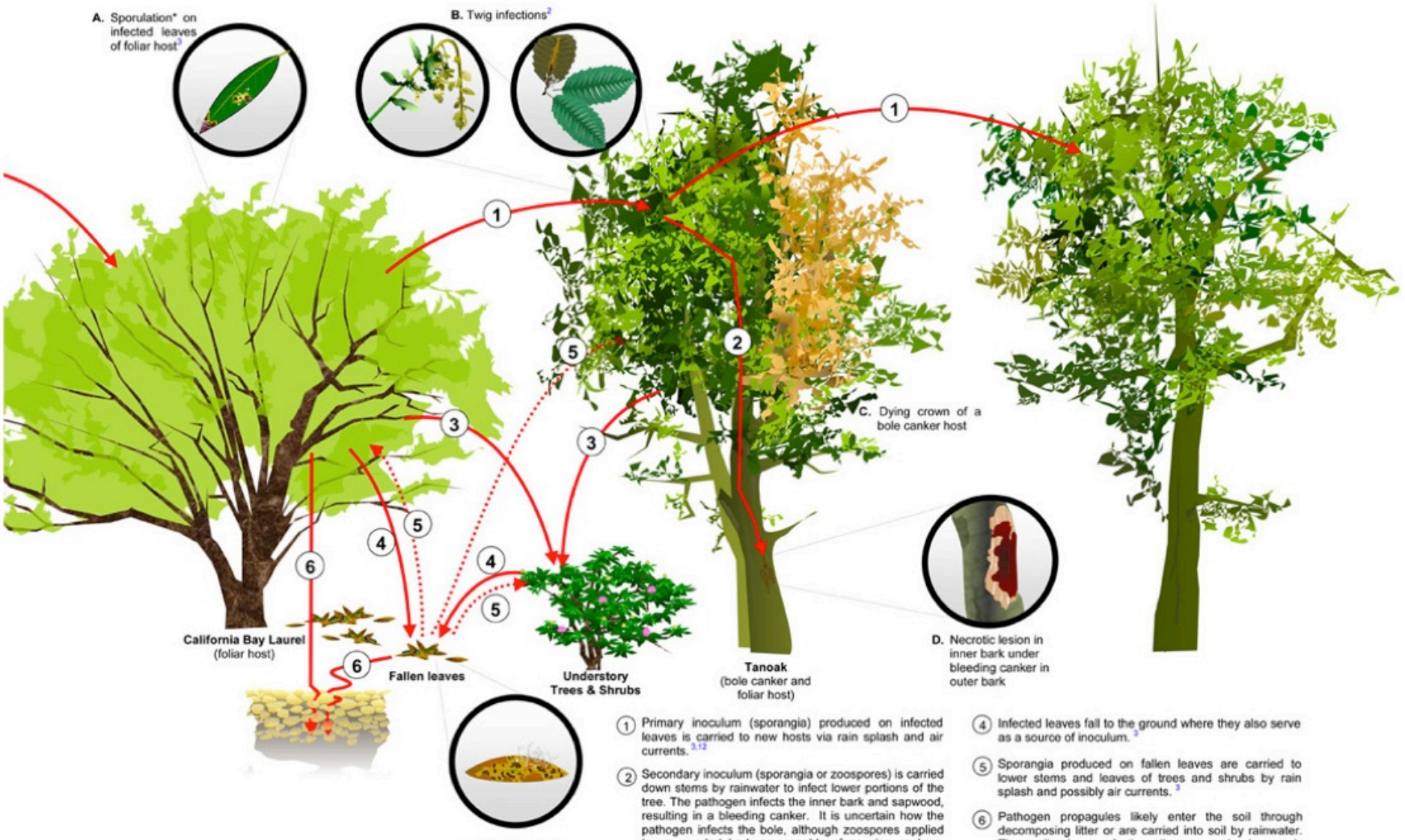
Phytophthora ramorum introduced by Nursery Trade

"… the worldwide spread of non-indigenous invasive species has accelerated and represents 'one of the greatest global threats to native biodiversity in North America, second only to habitat loss.' According to senior plant pathologist Clive Brasier, 'Movement of plants and plant products between biogeographical zones . . . is now generally accepted to be the primary mode of introduction of exotic pathogens and pests.'" Frederica Bowcutt, *The Tanoak Tree*, 2015



Foliar symptoms caused by *Phytophthora ramorum* on *Rhododendron* leaf from California. Photo courtesy of David Rizzo, University of California, Davis.

Proposed Disease Cycle for *Phytophthora ramorum* in Forests*



(1) Primary inoculum (sporangia) produced on infected leaves is carried to new hosts via rain splash and air currents.[3,12]

(2) Secondary inoculum (sporangia or zoospores) is carried down stems by rainwater to infect lower portions of the tree. The pathogen infects the inner bark and sapwood, resulting in a bleeding canker. It is uncertain how the pathogen infects the bole, although zoospores applied to unwounded bark are capable of causing cankers.[2,3,11,13]

(3) Secondary inoculum produced in the canopy is also splashed or blown onto understory tree and shrub hosts causing local intensification of disease.[3,12]

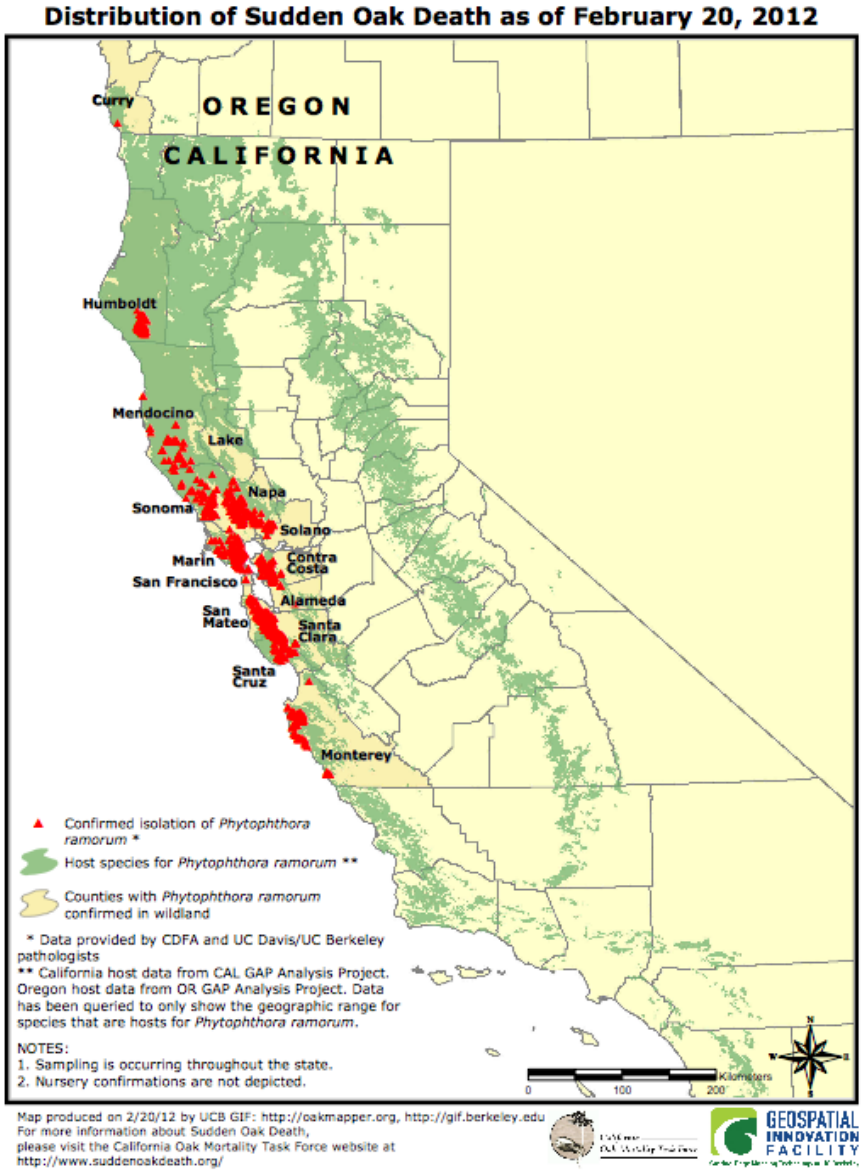
(4) Infected leaves fall to the ground where they also serve as a source of inoculum.[3]

(5) Sporangia produced on fallen leaves are carried to lower stems and leaves of trees and shrubs by rain splash and possibly air currents.[3]

(6) Pathogen propagules likely enter the soil through decomposing litter or are carried into soil by rainwater. The soil phase of the disease cycle is poorly understood, but it is clear that the pathogen can persist in soil for several months. Chlamydospores are presumed to have a role in long-term survival although the triggers for germination are not known. There is little evidence of root infection in the forest.[3,5,8,9,13]

by N. Ochiai

* not drawn to scale



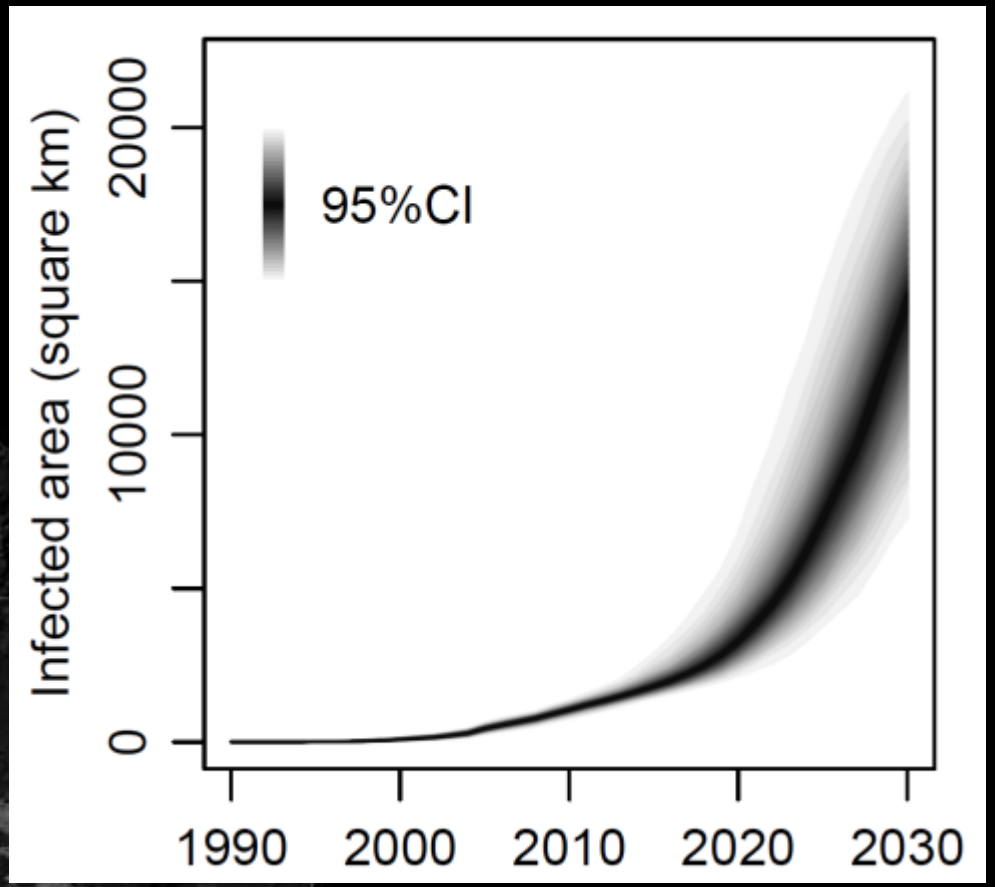
Sudden Oak Death

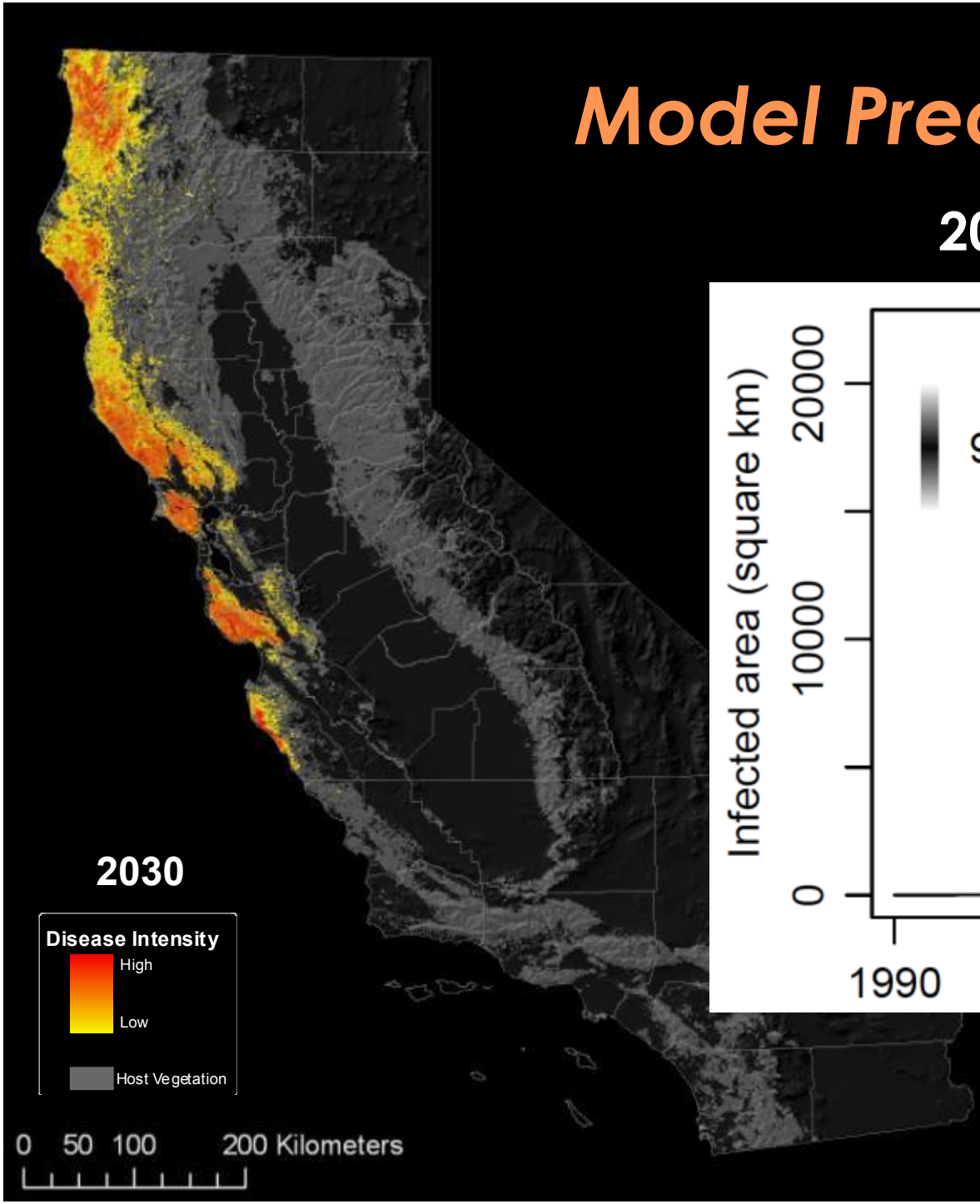
Phytophthora ramorum killed tanoaks first noticed in the mid 1990s

The pathogen spread quickly from Marin County and the Santa Cruz Mountains in large part through the horticulture trade.

Model Predictions

2030 Projections





“Current trends in global climate change indicate that ‘day-to-day weather has grown increasingly erratic and extreme,’ which ‘could have consequences for ecosystem stability and the control of pests and diseases.’ Wetter and warmer conditions will radically increase tanoak’s vulnerability to sudden oak death by favoring *P. ramorum* spore production.”

Frederica Bowcutt

The Tanoak Tree, 2015

tanoak nuts are still a traditional indigenous food

Photograph on left by Kathy McCovey, Karuk Tribal member, of tanoak acorns and California bay nuts drying, ca. 2010.

Photograph on right by Laura Lee George, Hupa Tribal member, of Jump Dance ceremonial preparation of tanoak acorns.

"… in 1984 Hoopa tribal woman Winnie Marshall warned that in the future 'everyone might have to rely on native foods' to survive."

Frederica Bowcutt

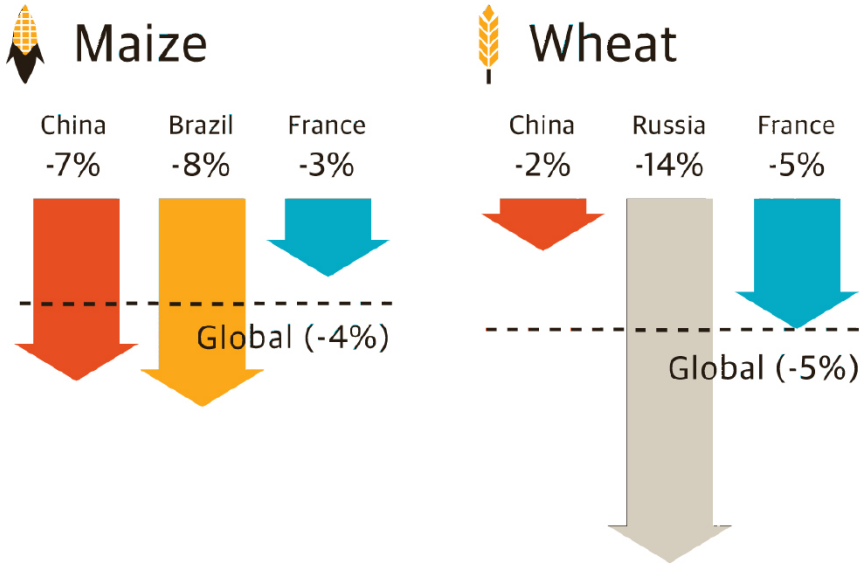
The Tanoak Tree, 2015

Climate change, food and farming: 2010s

According to the Fifth Assessment Report of the IPCC, climate change is affecting food and farming now

It is affecting crop yields

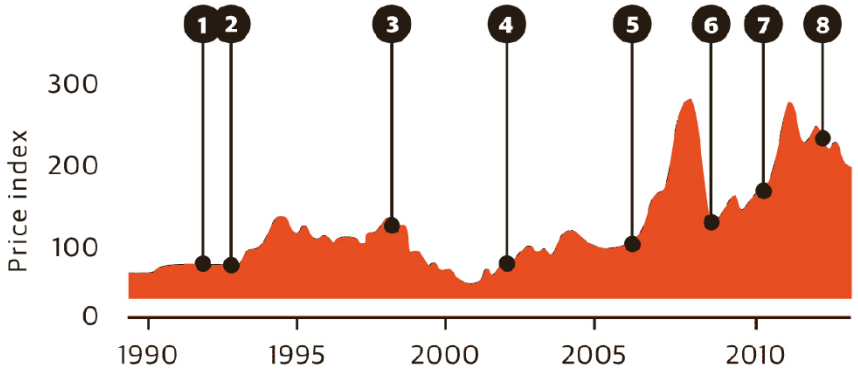
Maize and wheat yields show climate impacts



It is putting up prices

Recent price spikes for food have been linked to extreme weather events

SEASONAL CLIMATE EXTREMES AND THE FOOD PRICE INDEX



1. Australia wheat. **2.** US maize. **3.** Russia wheat. **4.** US wheat, India soy, Australia wheat. **5.** Australia wheat. **6.** Argentina maize, soy. **7.** Russia wheat. **8.** US maize.

Source: Intergovernmental Panel on Climate Change (IPCC)

Partnership

Many plants native to prairie-oak ecosystems in the West benefit from positive human disturbance that enhances biodiversity and ecosystem function.

Partnerships involving mutual aide offer hope.

Examples of collaborative responses to the current tanoak crisis include:

- Fire Safe Councils to reduce fuel loads & conifer competition
- Citizen Science guided by UCB & UCD scientists to monitor for *P. ramorum*
- Food security research by tribes with support from the University and Jepson Herbaria & funded by The National Institute of Food and Agriculture
- Tribal partnerships with USFS & NPS to do underburning in culturally significant tanoak groves

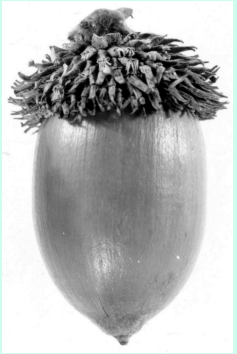
prescribed fire is a tool that can reduce risk of catastrophic wildfire and help manage the sudden oak death epidemic

Underburning in tanoak stand conducted in partnership with the Orleans-Somes Bar Fire Safe Council. Photo by and courtesy of Frank Lake.

Citizen Science & Tanoak Resistance

tribal & community-based efforts are underway to monitor the spread of *P. ramorum* & reduce its impacts in partnership with university plant pathologists

Photo by Richard Cobb of Yurok Tribe member and Yurok Tribal Forestry employee Tinman Gist researching tanoak resistance to *P. ramorum* with UC Davis plant pathologist Heather Mehl.



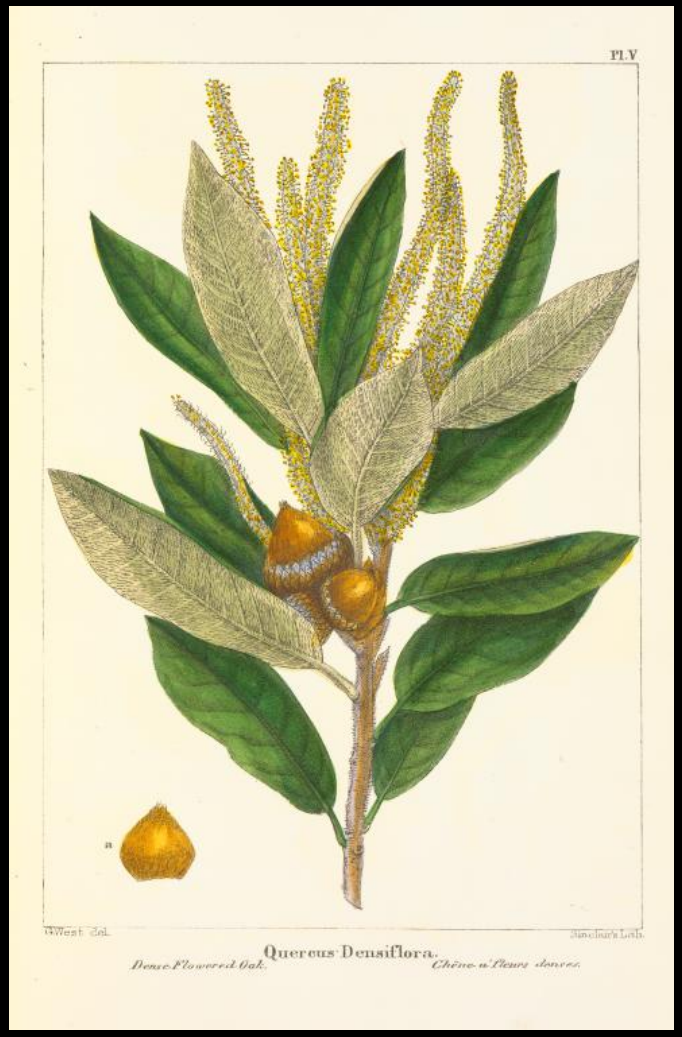
Key Points

1. Complex environmental problems need to be put in historical context.

2. Humans are not inherently bad for nature.

3. Science & technology alone cannot solve environmental problems.

4. Partnerships built on mutual aide are critical to meaningful responses.



"Ecology's most profound insights call for far-reaching modifications of long-standing social arrangements."

Garrett Hardin
Filters Against Folly, 1985

Thanks

American Society of Environmental History
Bancroft Library, University of California, Berkeley
California Botanical Society
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Common Counsel Foundation and Mesa Refuge
Fort Bragg-Mendocino Coast Historical Society
Grace Hudson Museum and Sun House
Humboldt State University Library and Special Collections
Mendocino County Historical Society
M. Kat Anderson, USDA-NRCS
Richard Cobb, University of California, Davis, Dave Rizzo's lab
Susan Frankel, Oak Mortality Task Force & US Forest Service
The Evergreen State College and my Evergreen colleagues & students
University and Jepson Herbaria Archives, University of California, Berkeley
University of California, Davis Library and Special Collections
and many others

From *Curtis's Botanical Magazine*, 1917.