Prescribed fire effects on acorn frugivores and oak cultural resource systems

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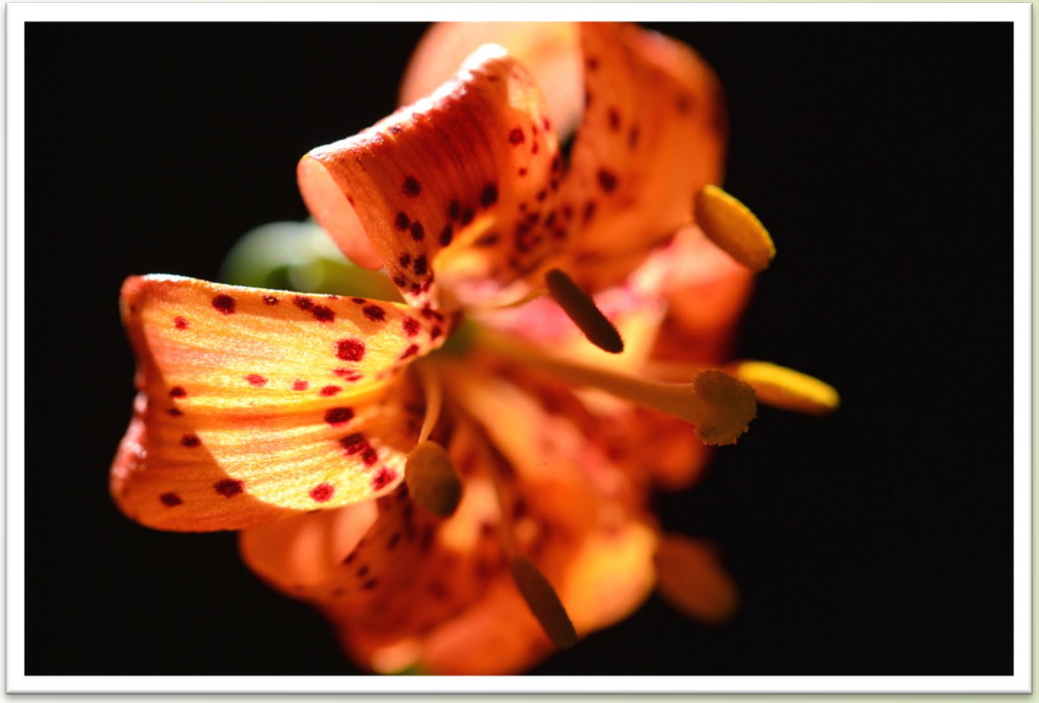
Land and People Acknowledgement

- Prior to the introduction of white settlers to the area currently known as Clark County, this land was cared for by Indigenous peoples for since time immemorial. At the time that colonization began, this area of Southwest Washington was occupied primarily by the Chinook and Cowlitz Tribes.
- Additionally, countless Tribes from across the Pacific Northwest came to this area to trade with one another by using the Columbia River and its adjoining waterways as an intricate network of trade routes.
- For millennia, their communities thrived while maintaining a balanced, sustainable relationship with the natural world. These values were passed down from generation to generation and are still practiced by Indigenous groups today, including the Cowlitz and Chinook.
- I pay my respects to the Peoples on whose ancestral land I am currently standing by supporting Indigenous-led partnerships and the making of an Indigenous vision of future a reality.

Teacher Acknowledgement

- Committee Member: Frank K. Lake
- Karuk Tribal Research Advisor: Bill Tripp
- Yurok Tribal Research Advisor: Robert McConnell Sr.
- Clarence Hostler
- Deborah Hostler
- Kathy McCovey
- Elizabeth Azzuz
- Margo Robbins



Overview

- Introduction to the tanoak acorn-fire relationship
- Prescribed fire and acorn infestation (invertebrate)
- Vertebrate acorn consumption
- Collaborative Projects:
  - The Indigenous Garden Network
  - WKRP Ikxariyatuuyship Tanoak/Black Oak Acorn Project

Not Just What, But How

- Indigenous-led research: Projects conducted at the request and with the approval of
  - Karuk Tribal Council
  - Yurok Culture Committee
  - Pikyav Field Institute, Karuk Department of Natural Resources
- Hypotheses co-developed based on Tribal researchable questions.
- Clear agreements to protect sensitive cultural information.
- Benefits agreed upon prior to project initiation and modified based on emerging needs
  - Senior authorship "…on behalf of the Karuk Tribe"
  - Educational program presented to Tribal community.
  - Paid support for Tribal community members to participate in research.

Multiple goals of a single cultural burn in a tanoak orchard

- Decrease acorn infestation (Karuk, Yurok Tribe, personal communication)
- Facilitate acorn collection (Karuk, Yurok Tribe, personal communication)
- Attract game animals for food (Karuk, Yurok Tribe, personal communication)
- Clear aboveground biomass to facilitate regeneration of plant species of cultural value (Karuk, Yurok Tribe, personal communication)
- Encourage desired functional traits in cultural plant species (Karuk, Yurok Tribe, personal communication, Lake 2007)
- Protect valued cultural landscapes/resource gathering areas from homogenously high severity fires of increasing frequencies (Norgaard 2019).
- Protect community health, wellness, and valued assets.

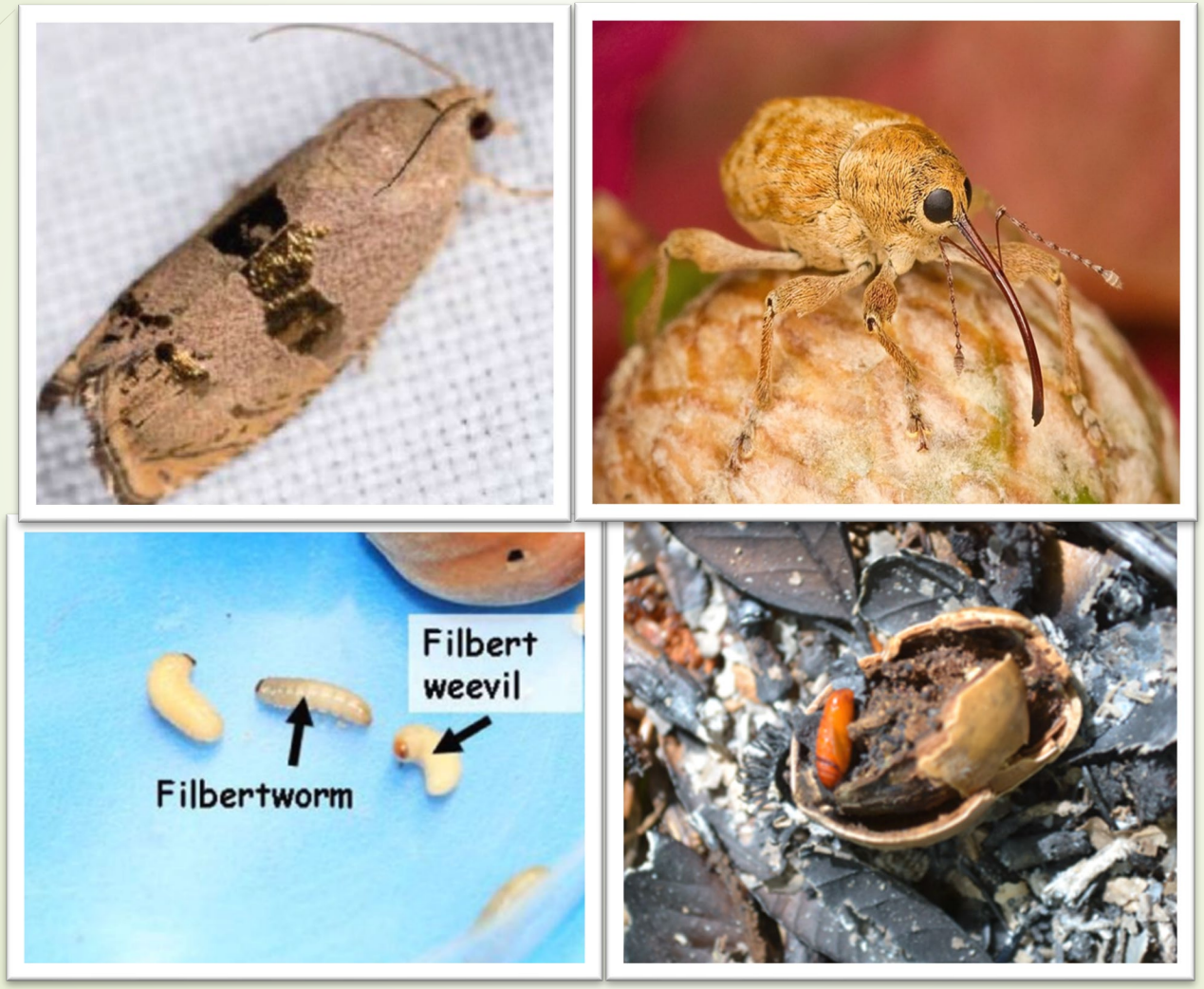
Seasonality of Cultural Burning for Acorn Management

Fall prescribed fire will reduce tanoak acorn frugivore infestation in both the year of fire and the year following fire.

Tribe	Acorn Species	Season of Burn
Yurok	Tanoak	Fall every year, Late Summer (Warburton and Endert 1966, Lewis 1973, Fryer 1995)
Maidu	Black Oak?	Fall/Winter (Duncan 2012)
Pomo		Fall (Kniffen 1939)
Tubatulabal/Kawaiisu/Yokut/Miwok		October, first chill (Anderson 2005)
North Fork Mono	Black Oak	Fall, Sept./Oct. (Anderson 2005)
Chukchansi/Choynumni	Black Oak	Late August (Anderson 2005)
Western Mono	Black Oak	Oct., Nov., Dec. (Anderson 2005)
Karuk	Tanoak, Black Oak	Fall for Tanoak (Schenk and Gifford 1952), Fall for Black Oak (Tripp, pers. comm)
Shasta	White Oak	Fall (when leaves begin to fall) (Lewis 1973).
Salinan	Oaks	Fall, when grass is dry (Anderson et al. 2012)
Eastern Miwok	Oaks	August (Levy 1978)
Tolowa	Oaks	Fall, after acorn harvest (Gould 1975)

Ter-perks: Insect Frugivores

Filbertworm: *Cydia latiferreana*, Tortricidae



Filbert Weevil: *Curculio occidentalis*, Curculionidae

Photos: Halpern 2013, Walton et. al 2007, USFS, Swiecki et al 2006

Research Questions

- **Does non-traditional late spring/early summer prescribed fire reduce the proportion of frugivore infested tanoak acorns in 1) the year of and 2) the year following fire?**
- **Do wildlife preferentially consume un-infested tanoak acorns?**
- How accurately do Indigenous tanoak acorn assessment criteria based on the external pericarp appearance predict the quality of edible cotyledon tissue within?
- Does non-traditional prescribed fire enhance both general and culturally significant plant diversity in tanoak acorn orchards.

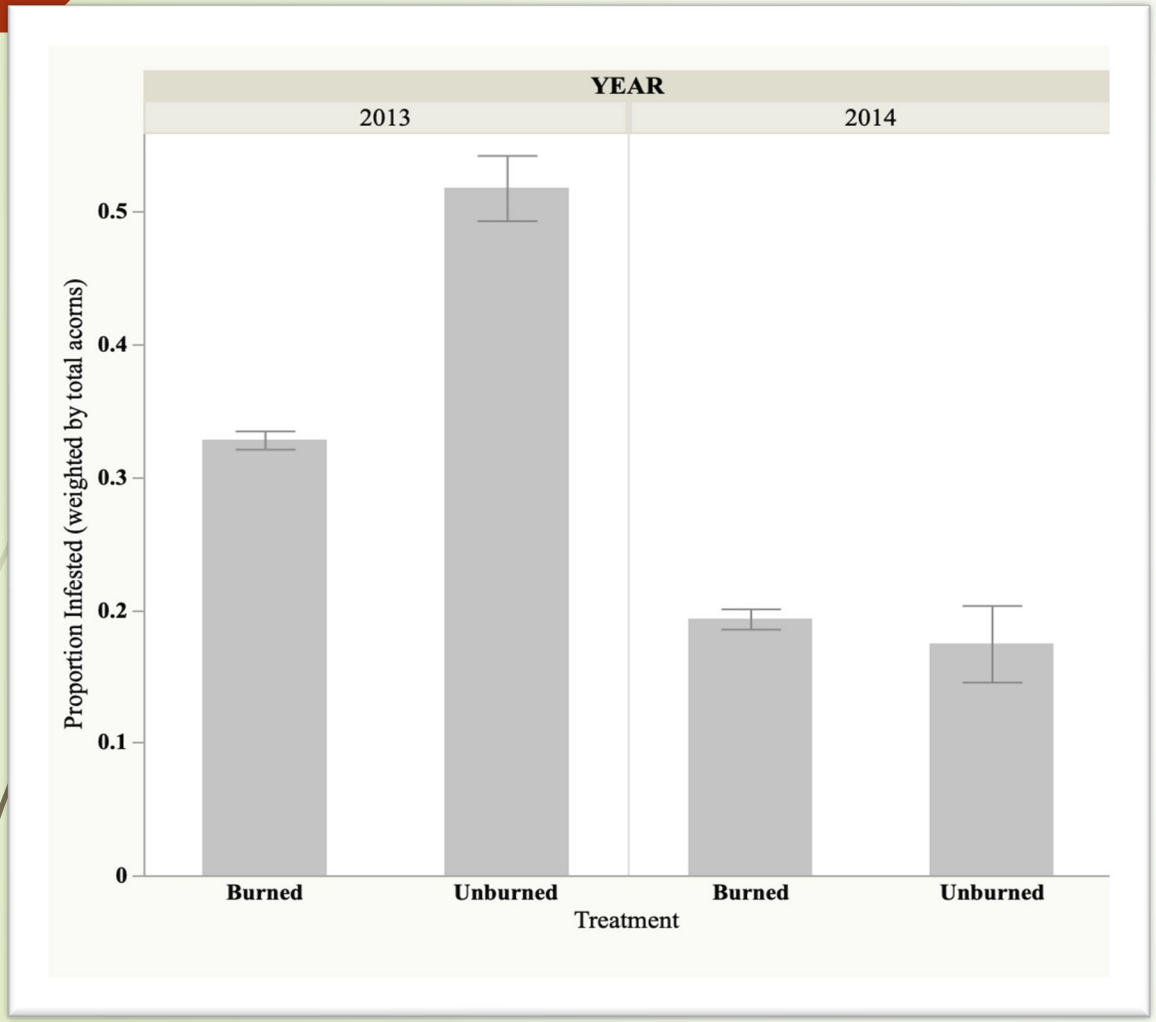
Treatment Fires

- Ignitions: Last two weeks of June
- Broadcast burns in previously burned groves
- Fireline intensity:

$$I_B = 259.833 \times L^{2.174}$$

(Alexander and Cruz 2017)

Xúntapan Infestation and Non-Traditional Prescribed Fire

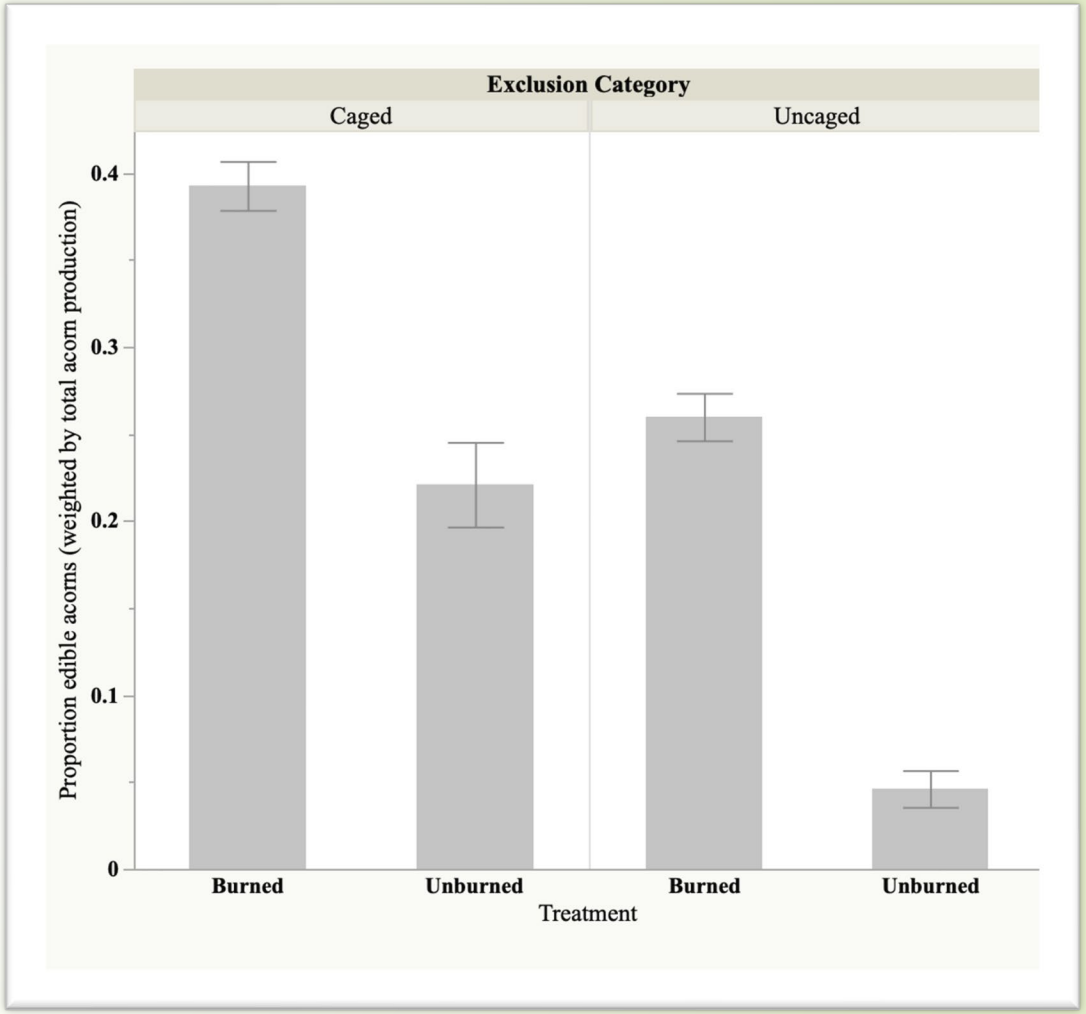


Mean (+/- 1 SE) proportion of insect-infested acorns weighted by total acorns collected in burned versus unburned plots in the year when fire was applied (2013) and one year post-fire (2014). n=3499

- Analysis
  - Binomial generalized linear mixed effect mode (GLMM)
  - Logit link function
- Fixed Effects
  - Treatment (categorical, two levels)
  - Year (categorical, two levels)
- Random Effects
  - Sites (Trees)
- Results:
  - Fire treatment reduced the proportion of infested acorns in the fire year by 36.7%, but not in the post fire year (OR:0.33, 95% CI: 0.14 – 0.79, p=0.012)

Selective Consumption by Xúntapan Co-Consumers

- Analysis
  - Binomial generalized linear mixed effect model (GLMM)
- Fixed Effects:
  - Treatment (categorical, two levels)
  - Exclusion (categorical, two levels)
- Random Effects:
  - Sites (Trees)
- Results
  - Consumption by vertebrates reduced the proportion of edible acorns in uncaged plots by ~39% (OR:0.49, 95% CI: 0.33 – 0.73, p=0.001)
  - Fire alone did not have an effect on the proportion of edible acorns available (OR: 0.77, 95% CI: 0.24 – 2.50, p=0.67)
  - The combined effect of fire and exclusion also didn't have an effect on the proportion of edible acorns (OR:0.51, 95% CI: 0.12–2.25, p=0.37)



Mean (+/- 1 SE) proportion of edible acorns weighted by total acorns collected in caged versus uncaged plots under burned and unburned treatment conditions.

Implications and Lessons Learned

- Increased availability of acorns supports connected cultural resources and kinship networks.
- **Seasonality is important**: Infestation reduction in first year only-> Implications for fire frequency and fuel availability.
  - Tribal hypothesis says that effect should last into year two if burned in the fall.
  - If burns are conducted out of season -> effect may not last as long -> more burning would be required to maintain the desired effect.
    - But will the fuel bed regenerate in time?
- Short term study.
  - Unable to track longer term effects of climate change, management activities, changing patterns of human use, etc.

Fire and First Foods: The Indigenous Garden Network

- Indigenous-led collaboration
  - Confederated Tribes of Siletz Indians
  - Confederated Tribes of Grand Ronde
  - Southern Oregon University
  - southwest Oregon partners
- Restoration of Siletz and Grand Ronde cultural resource landscapes and fire practices in southwestern Oregon ancestral territories.
  - Annual food camps centered around focal species (Black/white oak acorns and camas)
    - Cultural burn events
    - Increasing focal species availability in Tribal communities.
    - Shasta-Takelma Learning Garden
    - Tribal intergenerational research and monitoring
- College and career readiness:
  - Graduate assistantships with the M.S Environmental Education Program at Southern Oregon University.
  - Research assistantships for undergraduates/Tribal community members

WKRP Ikxariyatuuyship Project: Xuntápan and Xánthiip Focal Species

- Long term study (15-20 year) examining fire seasonality, severity, stand/tree management and tending effects on
  - Tanoak and black oak (*Quercus kelloggii,* Fagaceae)
    - acorn production
    - acorn infestation
  - plant community composition in oak groves with a focus on co-occurring plant species and functional traits of cultural value.
- Xuntápan and Xánthiip Unique Prescription Areas (UPAs) within the WKRP Ikxariyatuuyship Project Area

Many Thanks to….

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