Replicating & Reintroducing Historical Tribal Ignition Patterns: Reviving the Cultural Fire Regime

- Frank K. Lake
- USDA Forest Service-PSW, Orleans/Redding, Ca.
- Fire and Fuels Program
- Traditional Ecological Knowledge and Ethnobiology

franklake@fs.fed.us
530-627-3276
Overview: Tribal Fire Use Then and Now?

- Review of historical tribal burning practices
- Review of historical data for fire frequency, seasonality and extent
- Discussion of wildland fires then and now
- Multi-step approach to tribal management & fire applications

Klamath–Siskiyou Region and Tribes

Map 1. Major Geographic Features of Southwestern Oregon and Northwestern California.

Map 2. Generalized Territories of Major Ethnographic Groups in Southwestern Oregon.

Figures/Maps: Jeff LaLande
Tribal Cultural Adaptations to Bio-physical Conditions and Ecological Processes
Whitlock et al. 2010
Paleoecological Perspectives on Fire Ecology: Revisiting the Fire Regime Concept
Indigenous/Cultural Fire Regimes

- Alternate seasons of burning for different kinds of settings.

- Frequencies w/ which fire are set and reset over varying periods of time at desired areas.

- Corresponding intensities w/ which fuels can be burned.
Indigenous/Cultural Fire Regimes

- Specific selection of sites fired and those that are not.
- A range of natural and artificial controls that humans employ in limiting the spread of fire: time of day, winds, fuels, slope, relative humidity, and natural/human fire breaks
  - Lewis 1982
- Ignition patterns to promote desired fire behavior and associated intensities.
Cultural Fire Regime and Fire Effects

Processes
- Ignition

Seasonality

Functions
- Frequency
- Intensity-Severity

Specificity

Topography
- Fuels

Fire Induced Ecological Goods and Services
First, Second and Third Order Fire Effects:

- Sequential order of fire effects on environmental conditions can be described as:
  - First order fire effects are physical
  - Second order fire effects are biological
  - Third order fire effects are socio-cultural
First, Second and Third Order Fire Effects:

Third order fire effects are socio-cultural responses to environmental conditions created by first and second order fire effects.

*See Kevin Ryan’s (USFS-RMRS) new publication on this concept.*
Indigenous land management practices on forest diversity

- Forest types and fire regime
- Composition, structure, function and productivity
- Interplay of lightning fires and indigenous burning
  - Top-lightning
  - Middle-lightning/Indian burning
  - Bottom-fire suppression

Anderson and Barbour 2002: Calif. Forests
Cultural and Natural Fire Regimes of the Klamath–Siskiyou Mountains

- Ethnographic and archaeological data about tribal burning practices and villages
- Paleoclimate and fire history data

Photo: Kroeber
Karuk Village

Figure: Briles 2005
Documented Reasons For Indian Fire Use

- Hunting
- Crop Management
- Pest Management
- Range Management
- Fireproofing
- Tree Felling/Fuel Wood
- Clearing Areas For Travel
- Clearing Riparian Areas
- Basket Materials

Indian Burning Practices:

- **Firewood:** *Lake and Zybach
  - Involves the movement of fuels to specific locations before burning, resulting in areas that contain relatively little (or stockpiled) large woody debris and designated spots of intense repeated and prolonged heat.

Hupa wood packer: Erickson 1890s. Hoopa Valley
Indian Burning Practices:

Tribal burning patches were often smaller in extent and seral stage diversity than lightning ignited burn areas.

- **Patch:**
  - A specific application of fire to fuels within a bounded area for food maintenance, utility, or travel.

Indian Burning Practices:

- **Broadcast:**
  - The practice of setting fire to the landscape for multiple purposes and with general boundaries

Bald hills: Chilula/Yurok Tribal boundary trail. Goddard 1906
Tree Felling/Fuel Wood

- Indians used fire in different ways to fell trees.
- After fire swept through chaparral or woodland areas, branches were broken off for firewood.
  - Manzanita
  - Oaks
  - Other tree and shrub species

Photo: Beckham 1996 of Tututni-Lower Rogue River area woman
Clearing Areas For Travel

- Indians used fire to clear overgrown trails for travel.
- Ignition locations and fuel breaks were located along trails.
- Access to fire affective productive areas

Traversable ridge systems, Karuk and Yurok villages, and 1909 to 2005. Lake, Werren and Crawford (UN-R)
Basket Materials

- Most of the plant materials used in basketry required fire to promote desirable plant structure or health.

Photo: NAA, Smithsonian, Bright 1978
How to determine the extent of tribal burning for culturally significant areas?

- Ethnographic Material?
- Oral History interviews?
- Archaeological data/surveys?
- GIS analysis and mapping?
- Fire history studies?
- Modeling of ignition patterns and fuel types based on intergraded data sources?

Photo: Kroeber, Univ. of Ca. Archives
Using Historical Vegetation Surveys To Examine Fire Regimes

- Wieslander VTM
  - 1930s
- Landscape vegetation diversity which reflected remnants of former mixed fire severity regimes
  - Lower to higher elevational shifts
- Vegetation-Fire severity patterns influenced tribal subsistence patterns
  - Resource abundance couple with post-fire seral stage and severity

T = Tanoak, M=Madrone, RD= Redwood, D = Douglas fir
Ran cattle on Salmon Summit trail. His family would hunt primarily deer and some bear around Le Perron Flat. He has walked many of the trails. One trail followed Rattlesnake Ridge down to Schnable’s and on the Mill Creek Gap. The trails were used as pack trails. The Forest Service maintained and improved existing trails, and packers often improved the Indian trails.
Historical photos: Aerial 1944 to 2003

Short Ranch: Boise to Red Cap Creek, NE of Orleans, Cal.
Tribal community desire to continue traditional management practices

- Culturally significant habitats
- Access and potential for management
- Contemporary management systems to achieve desired ecological conditions
Objectives and Ignition Strategies

Historical tribal fires
- Objectives: Resources, Property for Life.
  - Resource specific: Food & Materials
  - Multiple benefits: Food, Materials, Diversity
- Ignitions
  - Ridgelines/trails
  - Aspect/Slope
  - Backing/strips
    - Grass bundles
    - Pitch sticks

Contemporary Rx fires
- Objectives: Life, Property, and then Resources
  - Resource specific: Economics & WUI
  - Multiple benefits
  - Disease, pathogens and pests reduction/prevention.
- Ignitions
  - Property boundary/roads
  - Treatment history
  - Backing/strips
    - Drip torch, propane, etc.
| Region | Weather: Precipitation, Temperature, Diseases Disturbance (Fire) regime | Tribal need for acorn-Ceremonies and Meals Gathering access and locations Relationship with and Land-use history, ownership, Knowledge of suitable places Proportion to oak to other tree species, TES species-Critical habitat; Number of experienced practitioners/tribe | Snow Water Equivalent, Palmer Drought Index, Disease/Pathogen Infection rates; Tribal population consuming acorn products. Fire-Return Interval, Severity, Extent; Tribal gatherers’ opportunities Proportion of oaks burned with desirable fire effects, number of other harvestable cultural-use species, distance from road, fuel load Diameter, height, presence of pathogens/evidence of disease, acorn development or masting, proportion of good (white top) to bad (brown top/insect holes) acorns Amount of edible nut meat |
| Landscape | Competition, Community Assemblage, Wildlife use Elevation, aspect, % slope [site access], Basal area, dominate tree age, canopy cover, fuel loading [mobility], disturbance/fire history [fire exclusion, timber harvesting, thinning, burning], understory diversity | Proportion of oaks burned with desirable fire effects, number of other harvestable cultural-use species, distance from road, fuel load Diameter, height, presence of pathogens/evidence of disease, acorn development or masting, proportion of good (white top) to bad (brown top/insect holes) acorns Amount of edible nut meat |
| Habitat | | |
| Patch/Stand | Age, height, canopy volume, condition, acorn size, number of acorns | Understory conditions, topography [access], tree phenology, density of canopy and fallen acorns, acorn quality and size, other wildlife use | |
| Tree | | |
| Acorns | Size, presence of infection/infertile or mold, nut meat quality, moisture content, tannins and nutrient content | | |
The Multi-Step Approach – The next prescribed fire?

- Current condition of planning unit
  - Untreated, Thinned, Thinned and pile burned, or broadcast burned?
  - SOD-Infected or high risk areas?
- Landowner/Neighbor relations
  - Prioritized treatments
  - Size of treatment area
- Schedule of treatments
  - Workforce training & education
  - Winter Thinning/Pile burning
  - Spring or Fall prescribed fire
Effective use of landscape to reduce undesired wildfires

- Strategic treatments at various locations in the landscape. [SPLAT]
  - Land ownership
  - Elevational range
  - Slope position/Aspect
  - SOD-probable infection routes?

- Objectives of the treatments/Rx burns.
  - To protect Life, Property, (enhance?) Resources
  - Reduce non desired diseases, pathogens and pests
Oak Tree & Acorn Pest Life History

Annual Indian Burning Cycle (inner circle) Under California Black Oaks (Quercus kelloggii) Compared with Annual Life Cycle of the Oak Filbertworm (Cydia latiferreana) (outer circle)

- **Larvae complete development in acorns on the ground, emerge from acorns, and pupate in the debris beneath the tree**
  - **OCTOBER – FEBRUARY**

- **Moths emerge from pupal cases in litter beneath trees**
  - **APRIL – JUNE**

- **Indians burn duff and insect-infested acorns under black oak trees**
  - **OCTOBER – NOVEMBER**

- **Indians knock acorns or gather acorns from the ground and discard wormy ones**
  - **SEPTEMBER – NOVEMBER**

- **Eggs hatch and larvae bore into and feed on acorn embryos**
  - **AUGUST – OCTOBER**

- **Moths fly and mate**
  - **MAY – JULY**

- **Moths deposit eggs on acorns on tree**
  - **JULY – SEPTEMBER**

- **Spring Rx Fire**

- **Fall Rx Fire**

These insects infest acorns while on the tree, and the insects continue to develop as the acorns fall. In fact, insect-infested and diseased acorns tend to drop earlier than sound acorns. Eventually, the larvae exit the acorn and overwinter as pupae in the duff beneath oak trees. If you were to burn off the duff and old acorns in the fall, you would destroy most if not all of the infested acorns as well as pupae that are in the duff. This would greatly reduce the number of filbert worms and filbert weevil adults that emerge in the following year, which would reduce the level of infestation in the acorn crop. If you were to do this every year, or even every couple of years, I would think that you would end up with a pretty clean crop of acorns, with relatively low losses due to insects. However, you would have to keep burning pretty regularly, because there will commonly be a few insects that are missed by the burn, and adults could also move in from beyond the burned area.

(Ted Swiecick, pers. comm. 2004).

Source: K. Anderson, NRCS
After the smoke clears—Collecting acorns & maintaining culture

- Clearer understorey
- Reduced surface and ladder fuels
- Bad acorns burnt, good acorns easy pick’ns
Lake Property–During and After the Burn. 17 June 2013

**Question:** Did the Spring/Early Summer prescribed fire treatment achieve the objective of reducing the acorn insect pest-Filbert Weevil and Moth infestation levels?

Post burn ground surface sampling of charred acorns revealed that moths were in larvae to pupae case stage.
Lake Property Acorn Tree #4
“Spring Burn” 17 June 2013 [2pm–5pm]

Above: Pre-burn looking N/NE at Tree # 4
Right: Post-Burn, looking E/SE at Tree # 4

Research with Arielle Halpern, U.C. Berkeley and Stanford Univ. Bird Lab, NSF Exploratory grant
Environmental Diversity and Tribal Socio-Cultural Adaptive Responses

- Climate influences regional and watershed level processes
- Tribal cultures adapt to biophysical conditions and resources productivity
- Fire management is a major process and influence on biodiversity and tribal adaptive strategies
- How do pathogens [SOD] affect tribally valued habitats and resources?
- What are some applications of scientific methods, models and the utility of such data for examining various scales?
Applicable Models—What can they help us understand?

- Keyser. 2008 (Revised May 9, 2013). Klamath Mountains (NC) Variant Overview, Forest Vegetation Simulator Model [FVS]. Fire and Fuels Extension
- Includes Tree species, diameter, height, and basal area.
- Allows for evaluation of how forest composition and structure are receptive to wildland fire effects.
- Klamath Codes: 175 = LIDE3-UMCA/VAOV2, Tanoak-California laurel/California huckleberry; 483 = LIDE3-UMCA, Tanoak-California laurel; 476 = LIDE3-SESE2 Tanoak-coast redwood

- Cobb et al. 2012. Epidemiological Model-SOD-Tanoak dominated forests
  - ...populated with tanoak, bay laurel and epidemiologically unimportant species among which redwood is predominant
  - epidemiological state (Susceptible (S) or Infected (I)) and tanoak size class (i = 1,...,4),
  - Tree size and community composition affected tanoak infection and mortality rates
  - Understory tanoak, generally trees <10 cm d.b.h., had greater risk of infection compared with tanoak in the overstorey