

## Ecological Evidence of Intensive Cultivation of Oaks by California Indians: Implications for the Treatment of Sudden Oak Death

Lee Klinger, Independent Scientist, 10 Elm Ct., San Anselmo, CA 94960; 415-457-2469; lee@luminousproject.org

The native oaks of California are remarkable for being among the oldest and largest oak trees in the U.S. Besides their great age and size, these trees possess various idiosyncrasies in their arrangements and shapes that appear to defy basic principles of ecology and population biology. When taken together, these and other associated patterns present an anomalous situation that cannot be explained using our current scientific understanding of old-growth forests. In this paper I describe several abnormal features of California oaks recorded during ecological surveys in the Coast Range and the Sierra Nevada foothills in 1997 and 2003. These features are all plainly visible, expressed as gross variations in the character of the oaks and the surrounding soils. In the search for a plausible and parsimonious explanation of these anomalies, I am drawn by previous experiences to consider the wisdom and practices of the native people.

In the oak savannas of California the various species of native oaks occur as individual large trees or in clusters of a few, with broad canopies and thick trunks that indicate the trees are many centuries old. Most have trunks that branch oddly into multiple large boles. Numerous trunks have unusually bent and trailing forms. Open grasslands adjacent to the oaks are in certain places distinctly terraced, especially on steeper slopes and in draws. Young trees are notably few or absent in oak savannas. The predominance of old oaks and a lack of regeneration means that the population of oaks in these savannas is not sustainable, nor has it been sustainable for several hundred years. In recent years elevated levels of dieback have occurred among the older oaks. This mortality is sometimes (though not always) associated with the Sudden Oak Death (SOD) pathogen (*Phytophthora ramorum*).

Within the oak savannas that exhibit some regeneration, there is seen a cohort-related dimorphism in the growth forms of the old (bent and branched) vs. young (straight and unbranched) oaks. Seen also is a similar dimorphism occurring within individual old oaks which exhibit two developmental phases, an earlier bent-and-branched phase and a more recent straight-and-unbranched phase. Along with these peculiar dimorphisms we find other phenomena, like oddly-placed fire scars, scatterings of seashell and bone fragments under the oaks, and, on the trunks of certain oaks, lime-rich crusts which cover the bark.

In the search for an explanation, it is first apparent that natural forces cannot readily account for these unusual features. It appears more reasonable that the shell fragments and the strange forms of oaks (and other trees) are the result of plant husbandry practices by the local Indians who formerly occupied these areas. The trailing, bent, and many-boled forms of the old oaks are quite likely the result of coppicing, pruning, and training by native people mainly for the purposes of maximizing the size of the tree canopy and, thus, the production of acorns for food. The low, lateral-tending branches also would have greatly facilitated the gathering of the acorns. Oak trees established since white settlement were not traditionally tended and so have taken on normal, more upright and unbranched growth forms. It is well known that local people regularly burned the land to improve its fertility, and new archeological evidence indicates that large quantities of seashells, bones, ashes, and mineral-rich rocks were stockpiled in huge middens in order to make mineral fertilizers.

Thus, it is apparent to this author that the California Indians were not simple hunter-gatherers, but instead were sophisticated farmers who practiced a sustainable kind of agriculture that involved the careful cultivation of oaks and other food-bearing trees in vast orchards. Today this ancient wisdom casts light on a promising treatment for SOD simply by ameliorating acidity and improving mineral nutrition which makes trees healthy and able to resist attacks by pests and diseases. The many ancient oaks that still thrive in our landscape stand as testimonials to the long-term efficacy of this treatment in keeping the SOD pathogen and other pests and diseases under control.