

Oaks in California: A Neglected Resource (talk prepared for the Hollister Rotary Club Feb 22, 1988)

David A. Bainbridge
Dry Lands Research Institute
University of California, Riverside
Riverside, CA 92521

Oaks in California

Oaks have been neglected as a resource in California. Hardwood trees have not been considered important and the many benefits that they can provide as commercial crops, shelter for livestock, wildlife habitat and food, and aesthetics have been ignored.

Oaks are a potential source of commercial food crops, including acorn meal and oil and oak wood is also used to culture high value shitake mushrooms. Oak hardwood is utilized on a limited basis now in California but the long-term potential of oak wood is enormous and largely untapped. Little effort has been made to develop the local oak wood industry.

Oaks also provide many benefits as shelter for livestock and valuable food and habitat for many favored game species, including deer, bear, turkeys, and many other game birds. In addition oaks provide many benefits by improving the beauty of the landscape. This can be translated directly into dollars for land developers and real estate sales.

1. Commercial Crops from Oaks

A. Acorn flour

Acorns have been used as food for thousands of years virtually everywhere oaks are found. In Europe, Asia, North Africa, the Mid-East, and North America, acorns were once a staple food. The Ch'i Min Yao Shu, a Chinese agricultural text from the sixth century recommends Mongolian oak, *Quercus mongolica*, as a nut tree. Acorns are still harvested and used in several areas of the United States, most notably Southern Arizona, Mexico, China, Korea, where acorns are listed in the agricultural statistics, and Japan. Acorns were once the staple food for most of the population of California. Acorns made up half of the diet for many of the native Californians and the annual harvest in the 1600's probably exceeded the current state sweet corn harvest of 30,000 tons. Acorn foods remain on the market not only in Korea and North Africa, but in most major American cities, at Korean food stores, and in the Southwest at some markets which serve native Americans and Mexican-Americans.

An evaluation of the acorns from all 500 species of oaks is long overdue. Although the acorns of some oaks are too small or hard to open for widespread use, there are many species that could find commercial use as food. The factors that made acorns a major food source in the past make them attractive candidates for use in the future. They are easy to collect, often ripen all at once, and are simple to process. They store well and were kept by the native Californians for several years in simple storage bins. They are relatively simple to prepare, even for the varieties that need to be leached. Although most species are bland, as are corn and wheat; some trees have good flavor and could be used in place of other nuts.

When the long-lived, deep-rooted oaks can reach sufficient water; acorn production can be high, with yields of more than 6,000 pounds per acre, although yields are commonly lower, and there is some variation from year to year. Acorn

yields can be high on hilly lands where comparable annual "grains" such as corn and wheat cause severe soil erosion, Table 1.

Table 1: Soil Erosion for Corn v/s Acorn

Land Use	Slope In%	Soil Loss Tons/Acre/yr
Continuous corn crop, Missouri	4	20
Continuous corn crop, Wisconsin	16	89
Corn, contour furrows, Iowa	10	24
Oak forest	10	0.002

The harvesting of acorns is very similar to the harvesting of other commercial nuts such as almonds or filberts. Wolf showed that it was possible to collect 50-300 lbs. of acorns per hour with very simple hand tools. My own experience has been similar. However, when harvesting a small acorn such as *Q. gambelli* in an off year it may be possible to collect only a few pounds per hour, if that. Acorns should be picked from the tree if possible or gathered the same day they fall. Native Americans would knock them off with sticks and children would climb into the trees to shake the branches. Tree shakers, as used with pecans and almonds, should work on smaller oak trees. Collected acorns should be spread out in the sun on a clean surface and dried before they are stored in a well ventilated, cool, dry area.

The composition of acorns in general are described in Table 2.

Table 2: Acorn Composition, 18 species

Component	Percent
Water	8.7-44.6
Protein	2.3-8.6
Fat	1.1-31.3
Carbohydrate*	32.7-89.7
Tannin	0.1-8.8
KCAL/lb	1200-2600

* or N free extract

The structure of acorn starch falls between that of corn and potatoes, and like them, acorns have been used to brew alcohol. Acorns are also good sources of some vitamins, with 5-54.8 mg of Vitamin C per 100 gm of raw acorn. This compares favorably with the Negev lemon, with 58.1 mg per 100 grams. Acorns are also an excellent source of Vitamin A, with 180 IU per gm in *Q. phellos*. Twenty-seven grams, or less than tenth of pound of acorns, would meet the suggested daily requirement of 5,000 IU for Vitamin A. This may prove of great benefit in poorer areas of the world where vitamin A deficiency is common.

Thorough testing may well discover other species with even higher levels of these and other vitamins and trace elements. Acorns also include many essential amino acids. When acorns are cooked with hardwood ash, to neutralize bitterness, the acorns dishes should also be a good source of calcium. The ash may also make more niacin available if the tests Ruttle conducted on corn are replicable for acorns. It is not surprising that acorn-based cultures prospered for thousands of years with this excellent food base.

B. Acorn oil

Acorns can also be processed to make acorn oil by boiling, crushing, or pressing. Acorn oil has been used as a cooking oil in Algeria and Morocco. It was used by the Indians of the eastern U.S. for cooking and as a salve for burns and injuries. Some varieties contain more than 30 percent oil, equal or greater than the best oil olives. The flavor of the oil is comparable to olive oil and the physical properties of acorn oil are also extremely close to olive oil, table 3. It is likely acorn oil could compete with olive oil in the marketplace.

Table 3: Acorn oil

Species	<i>Quercus agrifolia</i>	5 other oak species	Olive
Specific gravity	0.917	0.910	0.914-.919
Refractive index	1.470	1.463	1.466-1.468
Saponification value	192.3	191.45	187-196

The potential advantages of acorns for oil production include less risk of spoilage during harvest (the fleshy olives must be handled very carefully and processed quickly to prevent spoiling and off-flavors), ease of mechanization (olive oil production has virtually ceased in California because of high labor costs), and potential for spreading out processing over many months to better utilize equipment and labor. If this potential is realized, and it won't be until some research is completed, the California acorn oil industry could recapture some or much of the 160 million dollars now spent each year on imported olive oil. This seems to be sufficient incentive for a modest investment in testing and development work. The byproduct meal could be used for animal feed or flour.

C. Shitake mushrooms

Oak wood is the preferred medium for growing shitake mushrooms. These high value mushrooms are increasing in popularity in the U.S. One of the large Japanese food companies is reportedly developing a large scale shitake plant in Southern California. This will require large inputs of small diameter oak logs for mushroom culture.

D. Truffles

Truffles are another high value food (much like mushrooms) that grows on oak trees. Truffles, valued at up \$300 per pound, virtually all come from the oak woods of France. However, Dr. Trappe at Oregon State University is exploring the potential of commercial truffle production or harvesting wild North American truffles. These American truffles have sold for \$50 lb. This is an exciting and potentially valuable crop for California.

E. Oaks for hardwood

Cal Oak in Oroville currently produces about 5,000,000 bf of hardwoods per year, with much of it oak. Exports of oak wood to the Pacific Rim have been increasing rapidly in both value and total quantity but most of this has been for Eastern oaks. California could be doing more to capture some of these sales. Development of a tree improvement program and trials of hardwood management would be worthwhile. Although long-term investments in hardwoods have not been common in the U.S. the oak forests in France are still managed on a 120-210 year rotation. An investor with a long-term view for family wealth might do well with oak plantings. The continued destruction of tropical hardwoods is likely to result in a continuing increases in oak value.

More work is needed on harvesting existing stands for hardwood use, plantation management for hardwood, and marketing and promoting California oak, which is (for many species) sufficiently different from the Eastern Oaks to require developing a California oak identity with the major markets.

F. Oaks for fuel wood

Oak wood is primarily used for fuel in California, in 1980 almost half of the wood advertised in newspapers was oak. The annual harvest probably is over 150,000 cords with a value of about 20 million dollars. Oak wood fueled the start of the industrial revolution in England and the techniques for short-rotation coppice are well developed there. Production may be about 2 tons/acre/yr on a 30 year rotation. These methods need to be refined to fit California species, soils, and climates.

2. Shelter for Livestock

Oak trees also provide valuable shelter for livestock. Detailed economic studies of the value of a shade tree in open range have not been done but the high use and popularity of the shade for cattle and sheep suggests its importance and value. Shade reduces water use, prevents overheating, and encourages better weight gain in the hotter months. The acorns provide added food and vitamins in the fall when the quality of other feeds has declined.

Trees also provide protection in winter. Detailed studies have been done on the importance of tree shelter for sheep in New Zealand and the economic benefits were substantial. Lamb survival showed marked improvement.

3. Oaks for for Wildlife

Oaks also provide valuable feed and shelter for birds and wildlife, especially deer, bear, and wild turkeys. One of the few plantings of oaks in the western U.S. was done in Oregon to improve turkey range. Deer may rely on acorns for 90% of their food in the fall and a good acorn crop can provide the nutrition the does need for improved fawn survival.

Many birds rely on acorns for food, and even some ducks eat acorns in the Fall. Restoration of oak forests would improve habitat for many game species.

4. Oaks for beauty

Oak trees also add to the beauty of the landscape. This value can be captured in real estate transactions. A recent study showed that oaks (about 40 per acre was sufficient) could add 21-27% to the value of rural lands. In a high land value area this can amount to many thousands or tens of thousands of dollars per acre. This suggests that planting and maintaining young trees would be worthwhile. This study also discovered that very thick oak cover was less valuable than more open oak woodland. Thinning these thick oak stands may improve value and could also provide fuel wood sales.

5. Summary and Conclusion

Oaks provide many benefits for land owners. The potential market for oak products is much greater than most people realize and includes many products, such as acorn oil, acorn meal, and mushrooms that might provide very high returns. Developing these products will require an investment in research and testing.

Oak plantings can also provide many benefits in terms of real estate value, shelter and food for livestock, and food and habitat for wildlife. Restoration of oaks where they have been removed can be very worthwhile.

The University of California and the State Division of Forestry have begun work on some of these problems in their Hardwoods Programs. But the investment is much smaller than required and as yet, includes little work on the more innovative and potentially more lucrative projects involving acorns, acorn oil, truffles, and mushrooms.

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