Plant of the Year

California Buckeye (*Aesculus californica* (Spach) Nutt.)

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California buckeye (*Aesculus californica*) bears multi-flowered spikes that measure 2½ inches across and 6 to 9 inches in length. Photo by Cindy Roché.

California buckeye (*Aesculus californica*) is apparently quite rare in Oregon, known only in the hills near Gold Hill in Jackson County. The largest population is on Hidden Valley Ranch where a proposed subdivision development threatens its habitat (Mann 2005).

California buckeye was discovered in the early 1800s in California and described by Edouard Spach in 1834 (Little 1979, Hickman 1993). He named it *Calothyrsus californica* (*calo* = beautiful, *thyrse* = cluster), and indeed it has a strikingly beautiful flower cluster, not to be confused with any other Western native species. However, four years later, Harvard botanist and ornithologist Thomas Nuttall reclassified the species, placing it in the genus *Aesculus*. The name *Calothyrsus* seems more appropriate, as *Aesculus* is an ancient Latin name of a European oak or other mast-bearing tree, neither of which applies to the spreading, round-crown, palmate-leaf buckeye.

Recently, *Aesculus* was reclassified from Hippocastanaceae to the family Sapindaceae in subfamily Hippocastanoideae (Thorne 2000, and R. Thorne, pers. comm.). It is closely related to the subfamily Aceroideae (maples). The genus *Aesculus* comprises seven species in North America, one in southeastern Europe, and five in India and eastern Asia. The genus *Billia* (an evergreen buckeye) has two species that range from southern Mexico to tropical South America (Mabberley 1993). California buckeye is one of two species of buckeye in western North America. The other is Parry buckeye (*A. parryi*), which grows in Baja California Norte in Mexico.

A small tree, California buckeye is recognized by its smooth, light gray bark, palmately compound leaves, and showy spikes of pinkish white flowers. It is one of the earliest trees to flush vibrant green leaves in spring, but tardily reluctant to flower, perhaps to miss late frosts. Flowers open in late May. It is so adapted to drought that it shuts down leaf activity in late summer and carries on photosynthesis in the bark and fruit pods. In late fall, the large seeds are slowly released from the 2- to 4-inch long pear-shaped pods that split as three-piece valves. The wood is very close-grained, light ivory in color and lightweight. It is highly resistant to decay, but vulnerable to wood borers (Peattie 1953).

California buckeye is often a multiple-trunked, round-domed small tree that adds character to a landscape. The largest tree I have

Poisonous to European honeybees, California buckeye flowers are a favorite of pale swallowtail butterflies. Photo by Bob Korfhage.

measured was 16 feet in circumference and only 28 feet tall; it grows in central California about two miles inland on the main highway to Carmel. At five feet in diameter, it also has the largest bole reported for the species (American Forests, National Champion trees). I can only guess its age (ancient!); its stature is a stubby trunk with gnarled branches, and a gash on its trunk from a bulldozer—one tough tree!

All parts of California buckeye are toxic to humans and livestock. Poisoning is from glycosidal compounds that are present in all plant parts. Humans have been poisoned by honey made from the flowers (USDA Forest Service 1974). The flowers are toxic to European honeybees (*Apis mellifera*); however, native pollinators relish the collection of nectar without side effects. The adult pale swallowtail butterfly (*Papilio eurymedon*) appears particularly fond of this plant.

Discovery in Oregon

California buckeye was not known in Oregon until I discovered it in 1970. I encountered it just after I purchased some property south of Foley Lane near Gold Hill in Jackson County. My neighbor, Ray Mitchell, had started a firewood business on his 200 acres. Long woodpiles were stacked on both sides of the access road leading to my property. I noticed that some of the cordwood had an unusual smooth gray bark, unlike the common oak, madrone, and manzanita that made up the bulk of the firewood. I asked where these trees with gray bark had been harvested, and Ray responded that they were "wild pears" and that the trees were all dying because of lack of rainfall. When I saw them in late summer I realized that, despite the pear-shaped fruit and dull brown leaves, these were not pears, but horse chestnuts, and they were not dying. In response to summer drought, California buckeye leaves turn brown, continuing to hang dormant on the trees until autumn.

Ray and I finally visited his wood cutting site in 1992 and sawed a "cookie" (round cross-section) from a California buckeye stump. I sanded and polished the disk to a satin smooth finish and counted the rings. The radius was 6.5 inches; with the ring count indicating 142 years, I calculated that the tree was a seedling in 1850! This specimen was not the largest stump we found, but it yielded the most complete cross-section for counting the growth rings. Larger stumps, up to 23.5 inches in diameter, were encountered, but hollow centers and borer damage limited their usefulness for accurate ring counts. The largest live trees reached 30 feet in height, and we estimated their ages between 250 and 280 years, which equated to seedlings in the early 1700s (before Anglo-European presence). Ray's misunderstanding of these trees as dying "wild pears" led to the cutting of the entire stand at the woodcutting site. However, the buckeyes and the madrones all resprouted and grew into multi-trunked trees. All of the old growth trees were harvested for firewood, but recruitment of replacements is good on the site, with seedlings in addition to the resprouted adults.

Tracing the origin of California buckeye in Oregon

The obvious question is how did this disjunct population of California buckeye become established in Jackson County, Oregon? In California, there is ample evidence that native tribes utilized the seeds to stupefy fish and to grind the fruits into a nutritious flour (after leaching out the toxins with boiling water). However, the suggestion that Native Americans introduced California buckeye in Oregon lacks supporting evidence. No campsites have been located in the hills where buckeye is found; most aboriginal campsites exhibit a valley or riparian settlement pattern. There is a large gap in the buckeye distribution, with no populations present between northern Siskiyou County,

Pear-shaped fruits measuring 2 to 4 inches long are produced in autumn. Photo by Cindy Roché.

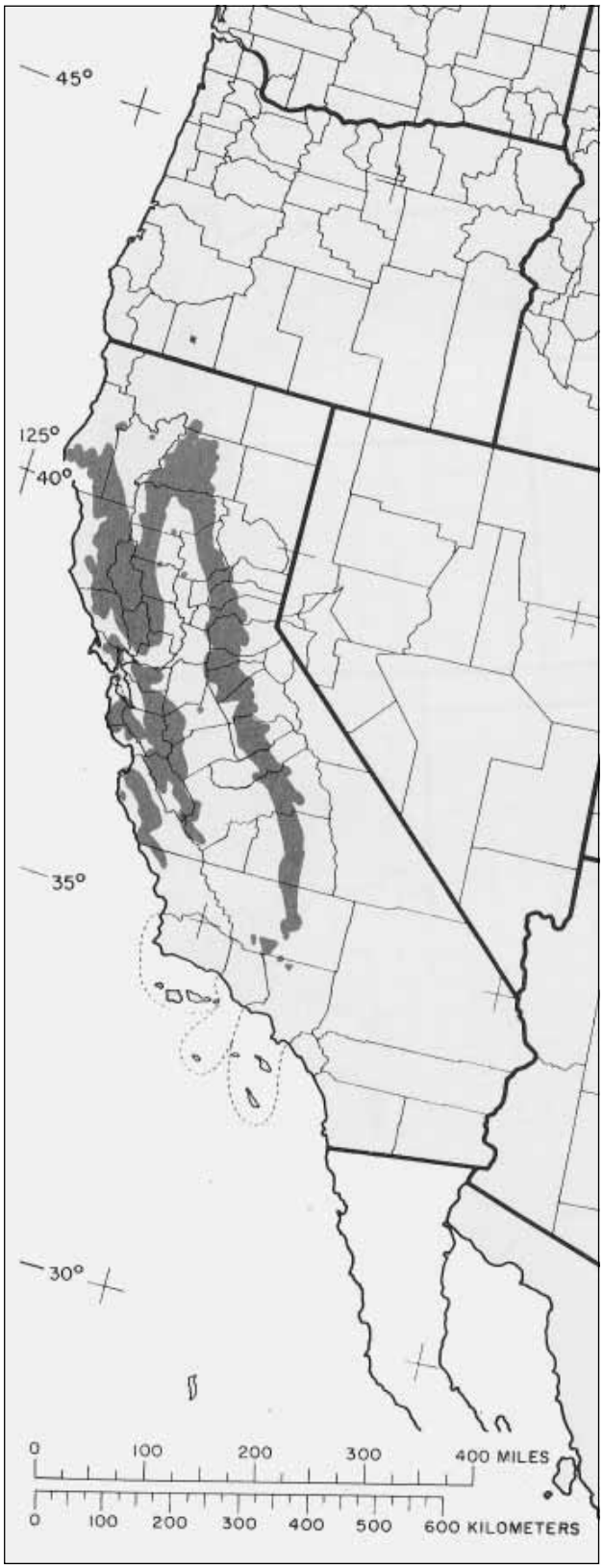
California, and southern Jackson County, Oregon, despite the presence of Native American sites and abundant habitat.

In the sections to follow I investigate probable origins of California buckeye in Oregon, using evidence from the fields of geology, paleobotany, ecology, meteorology, and soil science.

Paleofloristic Clues

Oregon's fossil records indicate the presence of California buckeye's ancestors and associates some 20 to 30 million years ago. In an extensive study of the petrified forest of Sweet Home in Linn County, Irene Gregory (1968) catalogued 54 different fossil woods, including buckeye. In the Rogue Valley of Jackson County (due south of Linn County), two species associated with buckeye, false indigo (*Amorpha californica*) and redbud (*Cercis occidentalis*), are represented in the fossil leaf flora dating from the Miocene period (collections in the Crater Rock Museum: redbud in the Conde Creek Formation (Neilson collection) and Roxy Ann Formation (Callahan collection with seeds and pods in addition to the leaves). Orr and Orr (1999) reported this same flora extending north to The Dalles and along the Columbia river during the Miocene. The Dalles flora included *Cercis 'occidentalis,' Amorpha 'fruticosa'* and *Ulmus*. *Amorpha* has since re-naturalized along the Columbia River (Glad and Halse 1993) and *Ulmus* became extinct. [Single quotes are used around names of plants when fossil material is indistinguishable from modern plants.]

At the Crater Rock Museum in Central Point, Doug Foster and I have been researching and reconstructing the paleofloras of Jackson County, using the museum's extensive petrified wood collection along with leaf and seed impressions. Three distinct periods of preservation include the Miocene (5 to 25 million years ago), the Oligocene (25 to 35 million years ago), and the Eocene (35 to 55 million years ago). California buckeye petrified wood is linked to the Miocene by the Trout Creek Formation in Malheur and Harney counties (Rice Museum petrified wood specimen #M4237) and the Cove Creek Oligocene Bridge Creek Flora in Wheeler and Grant counties (Manchester and Meyer 1997). The Miocene exhibited a much more diverse flora than is known today, containing many more representatives from the California Floristic Province than does the present flora. Southern taxa present in both extant and fossil floras include northern California black walnut (*Juglans californica* var. *hindsii*), false indigo (*Amorpha*), and redbud (*Cercis*), although they are rare in the Rogue Valley today. Also represented the Rogue Valley Paleoflora are redwood (*Sequoia*), dawn redwood (*Metasequoia*), California bay laurel (*Umbellularia*), Western sycamore (*Platanus 'racemosa'*) and interior live oak (*Quercus 'wislizeni'*) are well represented as petrified wood as well as leaf and seed impressions. The estimate of 20 to 30 million years ago needs some refinement because the fossil floras of Jackson County are dated by comparison with similar floras. Radiometric dating, which gives a more accurate timescale, has not been done on many of the County's fossil strata.



Native distribution of California buckeye. Map adapted from Little (1976).

The late Miocene conifer forest of the Columbia Plateau-Cascade region has also been highly modified since 10 million years ago. Perhaps the area floristically most related to this vegetation is the Oregon part of the Klamath Range and adjacent areas (also known as the Siskiyou Mountains). In this region, most of the late Miocene conifer species have survived, including some of the associated ligneous dicotyledons (Wolfe 1969). Thus, the Klamath Mountains became a refugia for many species that perished elsewhere; it is possible that California buckeye is a Tertiary relict.

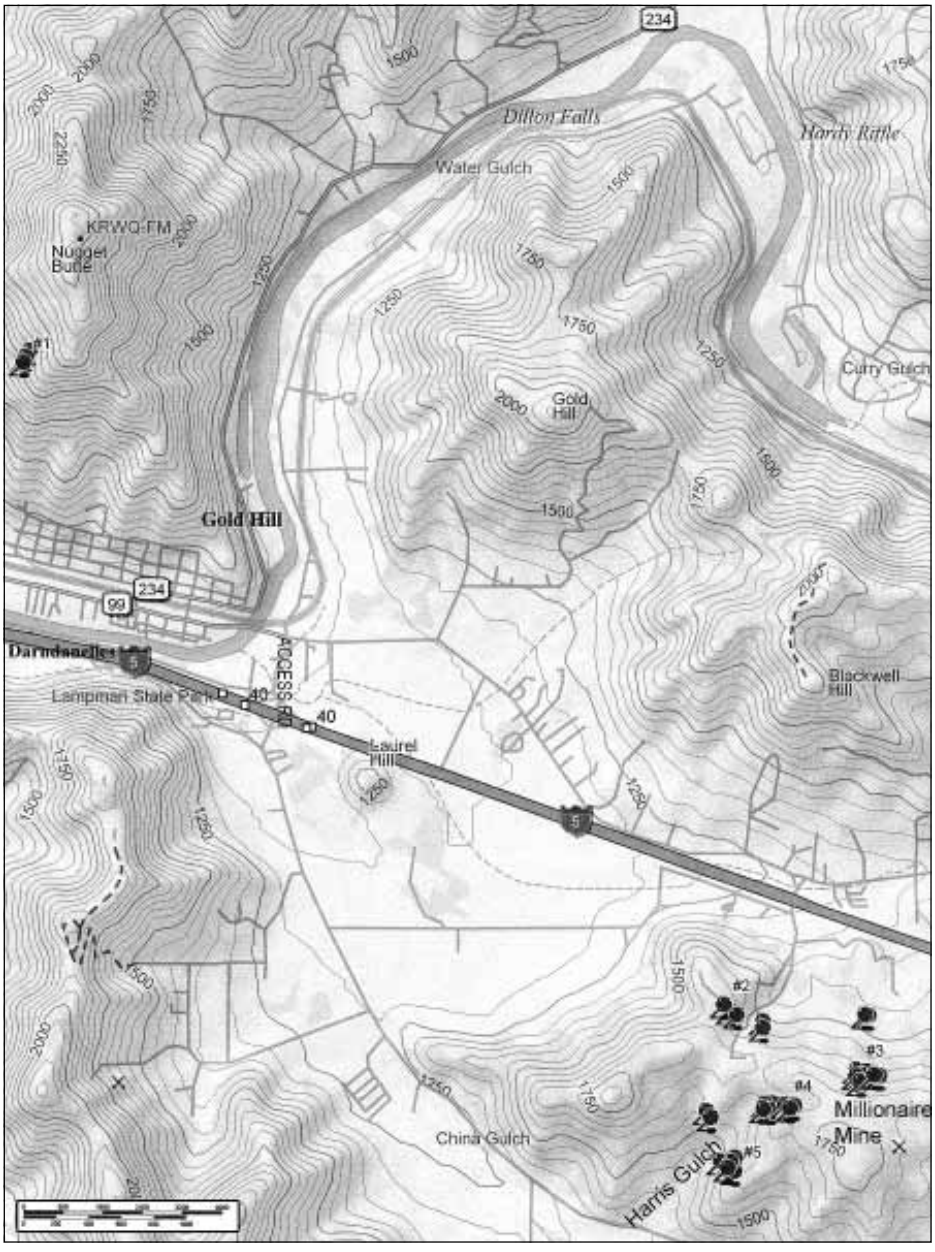
Near the end of the Miocene the climate began to fluctuate, becoming colder in the Pliocene to early Pleistocene. About 10 to

2 or 3 million years ago the flora became depauperate compared to the warmer Miocene. The Northwest flora still contained some broad-leaf deciduous elements, including *Aesculus*. By the early Pleistocene, however, ancient broad-leaf species were almost extinct in the Northwest (Wolfe 1969). The onset of a definite summer dry climate with colder winter temperatures in the Pacific Northwest would account for the extinction of many lineages about 1.8 million years ago (Bishop 2003). This cooling event plunged the planet into a series of ice ages that lasted until about 10,000 years ago, decimating most of the tender plants and creating the modern flora we know today. Fan palms (*Sabalites*), avocado (*Persea*), dawn redwood (*Metasequoia*), euptelea (*Euptelea*), sweetgum (*Liquidambar*), hickory (*Carya*), bald cypress (*Taxodium*), and hophornbeam (*Ostrya*) all perished during the series of Pleistocene glacial events.

The close of the Pleistocene led to a series of warming periods collectively known as the Holocene. This warming trend enabled plants to migrate northward while higher temperatures diminished elevation barriers. California buckeye may have migrated north with its associates of the chaparral community about 8,000 to 5,000 years ago, the warmest part of the Holocene (Hansen 1955). The gap from the uppermost Sacramento River (California buckeye's northernmost California station) to Oregon is relatively small (John Sawyer, pers. comm.). Daubenmire (1969) links the two categories of chaparral vegetation (scrub and woodland) extending from the margin of the great valley in California in fragmentary fashion into southern Oregon (principally the upper Rogue River valley, but with a trace of chaparral as far north to the Umpqua River valley). Wedgeleaf ceanothus (*Ceanothus cuneatus*) extends north to the southern Willamette Valley. Chaparral in southwestern Oregon is floristically closely related to that of California, with many species common to both areas or represented by closely related species or subspecies. The distribution of California buckeye is closely tied to chaparral that has its northernmost North American outpost in the Rogue Valley (Detling 1961). After the California chaparral communities crossed the altitude and ecological barriers of the Siskiyou Summit, cooler and moister conditions returned about 2,500 years ago that favor conifer, madrone and oak woodland, keeping the chaparral mosaic in check. Today the chaparral communities are limited to the lower Rogue Valley and adjacent foothills on poor soils.

Associates from the California Floristic Province

Perhaps the best evidence supporting the premise that California buckeye is a relict species in Oregon is the local assemblage of other species also at the northern limits of their ranges. In Harris Gulch, California buckeye shares habitat with fourteen species representing the California floristic province, including *Calycanthus occidentalis*, *Amorpha californica*, *Cercis occidentalis*, and *Cornus sessilis*. The drier uplands support the largest population of *Pinus sabiniana* in southwest Oregon. Although not found in the same habitat as the buckeye, other California species in the vicinity include *Fritillaria eastwoodiae, Odontostomum hartwegii*, *Triteleia ixioides* ssp. *scabra*, *Allium sanbornii*, *Ptelea crenulata*, *Styrax officinalis* var. *redivivus, Chlorogalum angustifolium*, *Brodiaea californica* var. *californica*, *Brodiaea minor*, and *Dichelostemma volubile.* The northern-most populations of each of these taxa in California are



California buckeye sites in Oregon. Map prepared by Frank Callahan and Bob Korfhage.

in Shasta County, except for gray pine, which is represented by a single population on Cottonwood Mountain, just north of the Klamath River in Siskiyou County, and California false indigo, which extends as far north as southern Siskiyou and Modoc counties.

Mediterranean Climate

The climate in the Rogue Valley with its hot, dry summers and mild winters that lack severe low temperatures is classified as Zone 7, Gray Pine Belt (Brenzel 2001). The namesake indicator tree in this climatic zone, the native gray pine, occurs as a sparse population on the low ridges and valleys near Gold Hill. Oliver Matthews, an ardent tree explorer and contemporary of Morton Peck, was probably the first to document *Pinus sabiniana* at Rock Point near Gold Hill. (Peck (1961) erroneously listed this site as Josephine County). Gray pine is currently known from Jackson and Josephine counties.

Microclimate and Foothills Distributions

That the foothills are cooler in summer and warmer in winter than the valley bottoms explains differences in species distribution. California buckeye is almost exclusively a foothills species in California; there are no significant populations in the flat Sacramento or San Joaquin Valley basins (Griffin and Critchfield 1972, Little 1976, McMinn 1974). In the California cismontane region, it is also strictly confined to the Sierra Nevada foothills. This foothill distribution holds true in the Rogue and Bear Creek valleys in Oregon, as well, occurring in a band between 1300 and 1700 feet elevation. Distribution appears related to cold hardiness, and is most easily described by elevation limits. In southern Siskiyou County, California buckeye grows on sites below 3,000 feet elevation, while in the southern portion of its range, especially south of Bakersfield, it is found to 5,000 feet. At the western edge of its distribution, it grows in protected ravines and sheltered coastal bluffs. In the inner Coast Ranges, it is found in open grassland and broken woodlands.

The foothills distribution pattern is not unique to the California buckeye; a number of foothill species are absent from the Bear Creek valley floor (e.g., *Garrya fremontii*, *Viburnum ellipticum, Acer circinatum, Pinus attenuata, Rhamnus crocea, Cercis occidentalis, Ptelea crenulata, Styrax officinalis* var. *redivivus, Calycanthus occidentalis*, *Cornus nuttallii* and *C. sessilis*). Differences between foothill and basin floras are easily explained by microclimatic conditions: in summer, the basins are hot thermal troughs and in winter, they serve as cold air basins. Under these seasonal temperature extremes in the valley basins, sensitive species tend to be killed by drought in summer or by freezing temperatures during winter. For example, wedgeleaf ceanothus thrives on thermal slopes and in basins. In contrast, deerbrush (*Ceanothus integerrimus*) appears less tolerant of high summer temperatures, and its distribution is limited to the foothills. Precipitation is also an important difference between foothill and basin habitats. For example, total precipitation for the 2003 water year at the Medford airport (valley location) was 23.2 inches. In contrast, at the California buckeye (foothill) sites the 2003 water year measured 34.7 inches, a difference of 11.5 inches! Clearly, the foothill sites are considerably more mesic.

California buckeye seeds are a shiny mahogany brown. Photo by Cindy Roché.

However, a few old California buckeye trees in cultivation can be used to gauge its performance and hardiness on the valley floor. Here it thrives in cultivation and, with summer irrigation, its leaves remain green until late fall. (This appears to be the signature of a relict species that prospered in a past climatic regime of moist summer climate.) In the wild, it is damaged both by drought and subzero temperatures. Its reaction to both extremes is to die back and produce basal sprouts to reduce mass and ensure its perpetuity.

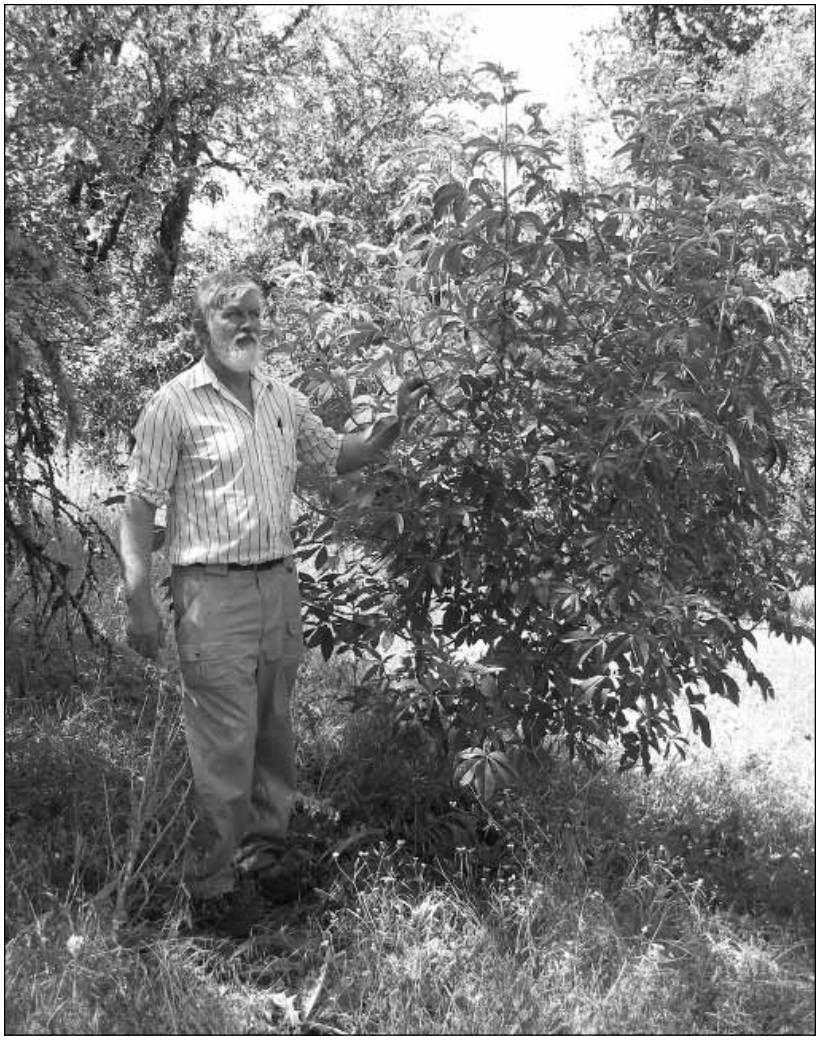
Sean Hogan reports a large California buckeye in Portland that measures over three feet in diameter on N. Boston Avenue, near Portland Street; it may be the largest individual in Oregon. In cultivation, it is an adaptable tree with pleasing stature, and unusual foliage, flowers and fruits. It has not been popular in cultivation and few nurseries stock it, but Oregon residents in areas of mild winters looking for something different could consider planting a California buckeye[1]. Be sure to plant seeds where you want the tree because they germinate with an aggressive taproot and resent transplanting.

Geology and Soils

The high diversity of plant species concentrated near Gold Hill seems to be related to complex geologic conditions that interplay on these sites. The sites range only about 1,000 feet in elevation (from slightly more than 1,000 feet at the Rogue River to the top of Gold Hill (a pyroxenite dome) at 2,158 feet and Blackwell Hill (a granodiorite pluton) at 2,142 feet. Soil parent materials derive from a complex of metavolcanics, metasediments (including limestone), and metaultramafics in linear intrusive bands, punctuated by granodioritic intrusives with accompanying quartz fault bands. The primary soils of the buckeye sites are

[1] Seeds available from Callahan Seeds, P.O. Box 5531, Central Point, OR 97502.

Vannoy silt loams, which are amenable to tilling during summer drought. Soil depth varies from rock outcrop to 10 feet, yielding plant communities that range from lichens and mosses to dense forests. California buckeye prefers a north-facing, mesic, open site and is seldom found in the Pacific madrone woodland. It shares habitat with Oregon white and California black oaks (*Quercus garryana, Q. kelloggii*), plume tree (*Cercocarpus betuloides* var. *macrourus*), gray, ponderosa and sugar pine (*Pinus sabiniana, P. ponderosa*, *P. lambertiana*), and Douglas fir (*Pseudotsuga menziesii*). Shrubs include whiteleaf manzanita (*Arctostaphylos viscida*), which grows to small tree stature, deer brush, wedgeleaf ceanothus, and Fremont's silk tassel (*Garrya fremontii*). Also of interest is a distinct population of Ida May brodiaea (*Dichelostemma idamaia*).



Author with resprouted California buckeye tree. Photo by Cindy Roché.

Human History

Why, if California buckeye has been in southern Oregon for 20 million years, was it not discovered until 1970? The site of Oregon's California buckeye populations was not a benign region for botanical explorers, for a variety of reasons. The word poison oak was always spoken with exclamation in these hills – best crop in the county, as old-timers would put it! Another word was gold – mining claims were fiercely protected and anyone viewed as a potential claim-jumper could meet harsh treatment. Moonshiners stationed themselves in hidden canyons to thwart discovery from revenuers, where they burnt the smokeless moonshine wood (manzanita) and sold whiskey to miners and other local contacts. Poachers hunted meat (rabbit and deer) for themselves and the miners. The Millionaire Mine with the Johnson shaft was the largest mine operation and provided jobs for about a dozen families. The operation was shut down after the paymaster absconded with the payroll, fleeing to Seattle, favoring a number of brothels on his way, before he was caught and later hanged. The Millionaire Mine never reopened (John Mardon, pers. comm.). Its historical signature includes large tailing piles, a few naturalized plants (*Iris, Vinca major*), and the cabins composting to the soil. Things remained quiet from the late 1930s through the early 1970s when some of the land was sold and firewood cutting began. Major logging of the hills from the 1970's until the late 1990's removed most of the conifers over 14 inches in diameter, leaving few remaining trees. Douglas fir survived only in hidden canyons. Gone were the few stands of gray pine on the ridgetops and sugar pine in the protected drainages. Incense cedar was rare and occurred only on the ultramafic barrens. Since then, conifer reproduction has been slow because most of the adult seed trees were removed. Pacific madrone and California buckeye have recovered by stump sprouting. Whiteleaf manzanita lacks this trait, and its seedbank in the soil awaits the next fire to produce seedlings. The last major fire was in 1927.

All the exploitation of former years was eclipsed by the abuse that occurred in 2004. A neighbor purchased a total of 100 acres of the old Mitchell Ranch and introduced cattle. The cattle created a virtual desert within one year! The property was so overgrazed that the *Cercocarpus* are all girdled and dying. Yellow starthistle (*Centaurea solstitialis*) has invaded; other noxious weeds and exotic grasses were brought in with contaminated hay.

Conservation Needs

In the 166 years since its entry into the botanical records, California buckeye has disappeared across much of its range. It is defenseless against the onslaught of human trespass that converts its foothills habitat into subdivisions and vineyards. In particular, the California wine industry is fueling mass destruction of native plants in the chaparral types. It is fortunate that buckeye readily resprouts; otherwise it might have been doomed in Oregon by firewood cutting. Sound land-use zoning laws could have prevented the recent grazing damage. Jackson County has a long history of county commissioners who favored cattle and timber interests; this has severely compromised any protection or conservation of special ecosystems. Jackson County lists most rural properties under exclusive farm use (EFU) or small woodlot. A zoning of open space or watershed offers better protection against activities that threaten buckeye habitat, e.g., livestock

grazing, subdivision, land clearing and housing developments. A recent ownership change of Hidden Valley Ranch, which supports the largest populations of California buckeye, is not good news for this species. A development consortium unveiled plans for a major subdivision with 300 homes in private settings, termed the Millionaire Estates (Mann 2005). The planned development is a destination resort for the rich and famous, complete with private golf course, horse stables and equestrian trails, swimming pools, tennis courts, car museum and other amenities.

The bottom line is that there is no protection for any of these special ecosystems unless the public is made aware of them, and specific action taken to implement conservation measures protecting them. It was fortunate that this ecosystem was in a botanist's backyard or it might have been missed. What's in your backyard?

Acknowledgments

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Frank Callahan, a member of the Siskiyou Chapter of NPSO, has reported over two dozen range extensions of California plants in Oregon. He has botanized extensively in Mexico. A writer and photographer, he wrote the *Calochortus* chapter for *Bulbs of North America* published by Timber Press, furnishing some of the photographs. He described two new species of *Calochortus*, *C. syntrophus* and *C. coxii*, published in *Herbertia* and *Phytologia*, respectively, and is presently working on two additional new species. He is a leading nominator of National Champion Trees, having reported the largest individual for the species in more than 60 species. He filmed botanical documentaries with Martha Stewart (Martha Stewart Living), Ed Bagley Jr. (Big Foot County), and "American Forest–National Champion Trees" for PBS. He works as a private consultant field botanist for the Forest Service and BLM and manages a business, Callahan Seeds, which markets tree and shrub seeds globally. He is also the current president of Crater Rock Museum in Central Point, Oregon.
