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SOUTHWESTERN TREES

A Guide to the Native Species of New Mexico and Arizona

U.S. DEPT. OF AGRICULTURE
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Forest Service

SOUTHWESTERN TREES

A Guide to the Native Species of New Mexico and Arizona

By

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FOREST SERVICE



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SOUTHWESTERN TREES

A Guide to the Native Species of New Mexico and Arizona

INTRODUCTION

The Southwest, where the low, hot, barren Mexican deserts meet the lofty, cool, forested Rocky Mountains in New Mexico and Arizona, has an unsuspected richness of native trees. The deserts are not really treeless but contain here and there, scattered along the drainages and rocky slopes, strange spiny dwarf trees, such as yuccas, paloverdes, and cacti, found nowhere else in the United States. On foothills and mesas are broad zones of orchardlike woodlands of pinyons, junipers, and evergreen oaks. At higher elevations are mountain ranges and high plateaus, clothed with valuable forests of tall pines, spruces, and firs. Within these extensive timberlands of New Mexico and Arizona are located thirteen national forests and the largest area of continuous virgin ponderosa pine forests in the West.

Though most States have illustrated popular handbooks of their native trees, New Mexico and Arizona have not been so fortunate. Wootton's *Trees and Shrubs of New Mexico*, published in 1913 and illustrated with habit photographs of the most important species, has long been unavailable. The excellent *Manual of Southwestern Desert Trees and Shrubs*, by Benson and Darrow, published in 1945 but now out of print, contains drawings or photographs of nearly all the desert trees in New Mexico and Arizona but omits the timber species of the mountains.

A nontechnical, fully illustrated guide to southwestern trees without the numerous shrubs is needed. It should be useful particularly in connection with the national survey of forest resources being conducted by the Forest Service. Moreover, as the forests of New Mexico and Arizona are largely in national forests and as these States do not maintain separate forestry organizations, it seems logical that the Forest Service, United States Department of Agriculture, issue this publication.

The purpose of this handbook is to present nontechnical descriptions and drawings of the native and naturalized tree species of New Mexico and Arizona, the fourth and fifth largest States in the United States. The term Southwest, as used here, refers to these two States, which comprise the geographical area served by the Southwestern Region of the Forest Service. However, this handbook includes nearly all the tree species in portions of bordering States having similar vegetation and should be useful in the Trans-

Pecos region of southwestern Texas, Colorado, Utah, Nevada except the western border, southeastern California, and areas along the northern boundary of Mexico.

An attempt is made here to answer the question, "What tree is that?" Technical botanical terms have been omitted as far as possible in order to make this publication useful to all who want to become better acquainted with the native trees. Many cultivated and ornamental trees will be found here, although trees from foreign lands have not been included. It is hoped that tourists and visitors to the Southwest, as well as residents, may find this guide of interest.

Naturally the division between trees and shrubs is gradual, especially in the desert, and the number of species recognized as trees depends upon the definition accepted. Trees are considered here as woody plants having one well-defined perennial stem or trunk at least 2 inches in diameter at breast height, a height of at least 10 feet, and a somewhat definitely formed crown of foliage. Several shrubby species, only rarely becoming trees, are included. About 10 additional species of large shrubs reported to reach tree size in the Southwest have been omitted because information about them is inadequate. Species sometimes becoming trees in other States but only shrubby in the Southwest have been excluded.

In this handbook are descriptions and drawings of 132 species of native trees of New Mexico and Arizona and 3 naturalized species, together with notes on several other species and important botanical varieties, and drawings of 2 varieties. Both common and scientific names approved by the Forest Service, as well as other names and botanical synonyms in use, are listed. The sizes refer to trees growing in the Southwest, and trunk diameters are measured at breast height (4½ feet). Notes on abundance, habitat, vegetation zone, altitudinal limits, geographical distribution within New Mexico and Arizona, general range, uses, and other matters of interest are given for each species. The illustrations show leaves and fruits and in some cases other details or, for a few species such as yuccas and large cacti, habit sketches. Scales of all drawings, mostly reduced from natural size, are indicated.

Of these tree species 99 are found in New Mexico and 126 in Arizona, while 90, or two-thirds of the total, occur in both States. These southwestern trees are classified into 60 genera and 32 plant families, but 14 families are represented by only a single tree species each. Families with greatest numbers of tree species in New Mexico and Arizona are: pine family, 18 species; willow family, 17; legume family, 15; rose family, 13; and beech family (the oaks), 12. The largest tree genera here are: oaks (*Quercus*) and willows (*Salix*), 12 species each; pines (*Pinus*), 8 species; yuccas (*Yucca*), cottonwoods (*Populus*), and ashes (*Fraxinus*), 5 species each; and junipers (*Juniperus*), cherries (*Prunus*), and chollas (*Opuntia*), 4 species each.

According to geographic distribution, southwestern trees may be arranged in several groups. Most coniferous and other trees of the high mountain forests, such as ponderosa pine, Douglas-fir, and aspen, are widespread in the Rocky Mountains and extend southward to the Southwest. Another and more prominent group of

desert trees and others, chiefly of lower elevations, is southwestern and Mexican, from southwestern Texas and northern Mexico northward into southern New Mexico and central Arizona or beyond to southwestern Utah, southern Nevada, and southeastern California. Gray oak, catclaw acacia, and desertwillow are illustrations. An interesting division includes the trees of the Mexican border region which barely reach mountains in the extreme southwestern corner of New Mexico (Hidalgo County) and the southeastern corner of Arizona (Cochise, Santa Cruz, and Pima Counties). Examples are Apache pine, Mexican blue oak, and Arizona madrone.

A very small group of trees of the short-grass plains, such as plains cottonwood and little walnut, enter eastern New Mexico from the east. A few shrubby tree species of the California chaparral, such as sugar sumac, hollyleaf buckthorn, and California fremotia, are present also in the chaparral zone of central Arizona. Some trees of middle elevations, such as pinyon, one-seed juniper, and velvet ash, have their ranges centering in these two States.

Desert trees chiefly are limited to one or more of the four southwestern desert regions characterized by creosotebush and mesquite: (1) The Chihuahuan desert in southern New Mexico, mostly in Tularosa Basin and Rio Grande basin (Torrey yucca); (2) the Arizona desert of southern and central Arizona (saguaro); (3) the Colorado desert of southwestern Arizona (smokethorn); and (4) the Mojave desert of northwestern Arizona (Joshua-tree).

Trees definitely established as naturalized in New Mexico and Arizona are limited to three hardy shrubby species, French tamarisk, tree tobacco, and castor-bean. Two others, American plum and Jerusalem-thorn, are commoner as escapes than native. Several species are noteworthy for their great rarity or very local distribution in the Southwest; for example, bristlecone pine, California washingtonia, Knowlton hophornbeam, chinquapin oak, California redbud, California fremontia, and Gregg ash.

Two tree species Lowell ash and Kearney sumac are confined to Arizona, so far as known, although the latter may be expected to occur also across the Mexican boundary. The following nine species, mostly of the desert zone, are found in the United States only in Arizona but are native also in northern Mexico: Toumey oak, littleleaf lysiloma, fragrant bursera, jumping-bean sapium, bitter condalia, organpipe cactus, senita, staghorn cholla, and desert-olive forestiera.

Several publications have been especially helpful in the preparation of this handbook. These are included in the Selected References, which may be consulted for further information about the trees of New Mexico and Arizona. Sargent's Manual of the Trees of North America, the standard work describing and illustrating the trees of the United States, is a valuable reference containing nearly all the native southwestern trees. The distribution notes of this handbook have been compiled chiefly from Wootton and Standley's Flora of New Mexico, Kearney and Peebles' Flowering Plants and Ferns of Arizona, and Benson and Darrow's Manual of Southwestern Desert Trees and Shrubs. However, a few range extensions have been added here.

Specimens of southwestern trees in the Forest Service Herbarium and United States National Museum, both in Washington, D. C., have been examined. Grateful acknowledgment is due the latter for the loan of many specimens for preparation of illustrations.

The drawings in this handbook have been made by Miss Leta Hughey, scientific illustrator (botany), of the Forest Service. Various persons, particularly Forest Service personnel and botanists in New Mexico and Arizona, have reviewed the preliminary draft of the manuscript and have contributed useful notes and suggestions as well as records of additional tree species and localities. Leslie N. Goodding has supplied information on several usually shrubby species rarely reaching tree size, which have been included here as trees. Carleton R. Ball has reviewed the manuscript on the willows (genus *Salix*) and has made many constructive suggestions on the treatment of this difficult group. A list of the trees of Lukachukai Mountains in Apache County, northeastern Arizona, has been furnished by George J. Goodman. The author was in research work with the Forest Service in Arizona and New Mexico for eight years.

The Forest Service will welcome further information about southwestern trees, including corrections and suggestions, additional tree species, range extensions, etc. (Address Chief, Forest Service, Washington 25, D. C.) Records of giant individual trees of each species, including their location, height, diameter at breast height, and crown spread will be of interest. Similar information is desired about exceptional individuals reaching tree size in species hitherto known only as shrubs or reported to become trees. Also, notes on establishment of planted trees as naturalized are worthy of record.

The Regional Office of the Forest Service for the Southwestern Region, comprising the 13 national forests of New Mexico and Arizona, is located at Albuquerque, N. Mex. (Post Office Building). Inquiries and requests for publications about the forests of these two States should be addressed to that office. The Forest Service maintains in the same region a research organization conducting forestry, range, and watershed investigations, the Southwestern Forest and Range Experiment Station, with headquarters at Tucson, Ariz.

VEGETATION OF NEW MEXICO AND ARIZONA

Most species of southwestern trees have a geographic and altitudinal distribution which follows closely the extent of one or more zones or types of natural vegetation. Therefore, a summary of the vegetation with maps may assist identification and further study of these trees.

The distribution of plant life, or vegetation, over the earth's surface is dependent upon the interaction of various external factors, such as climate (temperature and rainfall), topography and soil, other living things including man, and fire. Forests occur where there is a long, warm, moist growing season and where the soil is moist throughout the year. Grasslands are found generally where

most of the rainfall is in the growing season and where low moisture or a dry season prevents tree growth. Deserts, with their sparse vegetation, are warm or hot regions where moisture is insufficient to support dense growths of trees or grass.

Within the broad climatic zones (tropical, temperate, and frigid), topography is important. A difference in elevation (altitude) of 1,000 feet affects climate and distribution of plant and animal life in about the same way as a distance north or south (latitude) of 300 miles at sea level. Thus, the summit of a mountain peak a mile above its base may have vegetation like that at low levels about 1,600 miles northward.

In the Southwest variations in climate and topography are extreme. Elevations in New Mexico range from 2,876 feet above sea level where the Pecos River leaves the southern border in the desert zone to 13,306 feet on the cold, barren, alpine summit of North Truchas Peak in the Sangre de Cristo Range. The southwestern corner of Arizona, elevation only 100 feet, has subtropical desert plant life, while San Francisco Mountain, elevation 12,655 feet, has a timber line and tundra vegetation.

The principal types of natural vegetation in New Mexico and Arizona are summarized in table 1. Merriam's Life Zones, which were formulated in a study of the San Francisco Mountain area in northern Arizona in 1889, are listed in parentheses because of their wide use. For each type the characteristic plants, approximate elevation limits, annual precipitation, and main areas are stated. Further descriptions of the vegetation may be found in several of the references listed, such as Bailey, Benson and Darrow, Kearney and Peebles, Nichol, and Pearson.

The vegetation map of Arizona (fig. 1) is taken from A. A. Nichol (Ariz. Univ. Agr. Expt. Sta. Tech. Bul. 68. 1937) and was prepared at the University of Arizona with the cooperation of the Forest Service and Soil Conservation Service. The vegetation map of New Mexico (fig. 2), is from Byron Hunter, P. W. Cockerill, and H. B. Pingrey (N. Mex. Agr. Expt. Sta. Bul. 261, fig. 6. 1939), and is based largely on Forest Service data. It was prepared by Kenneth W. Parker, and has been supplied by the Bureau of Agricultural Economics of the United States Department of Agriculture.

A representative southwestern mountain peak may have the following zones or belts of vegetation on its slopes: Grassland, pinyon-juniper woodland, ponderosa pine forest, Douglas-fir forest, spruce-fir forest, and alpine tundra. These zones, of course, are not sharply limited but blend into one another. Rainfall generally increases with elevation. Vast plains lack water and are treeless, while the higher mountains rising upward from grassland or desert have a lower timber line and are forested above.

The elevation of the different zones naturally increases slightly from the northern to southern parts of these large States. On a mountain the lower zones extend highest on the relatively warmer and drier southern and southwestern exposures, while the higher zones project lowest on northern and northeastern slopes and in cool, shaded canyons. Zones are lower where rainfall is high and rise on plateaus or similar broad uplands.

TABLE 1.—*Principal vegetation types in New Mexico and Arizona*

| Name of vegetation type | Characteristic plants | Elevation (feet) | Annual rainfall (inches) | Location in New Mexico | Location in Arizona |
|---|--|---------------------|--------------------------------|---|---|
| Alpine tundra (Arctic-Alpine Life Zone). | Mountain avens, alpine sedges, alpine grasses. | 11,500–13,306 | 30–35 | Above timber line of summits of Sangre de Cristo Range and Jemez Mountains in northern part. | Above timber line on summit of San Francisco Mountain. |
| Spruce-fir forest (sub-alpine forest, Hudsonian and Canadian Life Zones). | Engelmann spruce, alpine fir, corkbark fir. | 8,500–12,000 | 30–35 | High mountains, especially Sangre de Cristo Range, Jemez, Sacramento, and Mogollon Mountains. | High mountains, especially White Mountains, San Francisco Mountain, and Kaibab Plateau. |
| Douglas-fir forest (montane forest, Canadian Life Zone). | Douglas-fir, white fir, quaking aspen, limber pine. | 8,000–9,500 | 25–30 | High mountains in western two-thirds. | High mountains in eastern and northern parts. |
| Ponderosa pine forest (Transition Life Zone). | Ponderosa pine, Arizona pine. | 5,500–8,500 | 19–25 | Mountains in western two-thirds and northeastern corner. | Mountains and plateaus in northeastern half. |
| Pinyon-juniper woodland (Upper Sonoran Life Zone). | Pinyon, Utah juniper, one-seed juniper, alligator juniper, Rocky Mountain juniper. | 4,500–7,500 | 12–20 | Plateaus, foothills, and mountains except eastern quarter. | Plateaus and mountains in northeastern half. |
| Oak woodland (Upper Sonoran Life Zone). | Emory oak, gray oak, Mexican blue oak, Arizona white oak. | 4,500–6,000 | 12–20 | Foothills and mountains in southern quarter. | Foothills and mountains in southeastern and central parts. |
| Chaparral (Upper Sonoran Life Zone). | Shrub live oak, manzanitas, sumacs, cliff-rose, ceanothuses. | 4,000–5,500 | 13–25 | None | Mountains in central part. |

| | | | | | |
|---|---|-------------|-------|---|---|
| Oak brush (shinnery, Upper Sonoran Life Zone). | Havard oak..... | 3,600-4,800 | 13-18 | Southeastern corner | None. |
| Short grass (plains grassland, Upper Sonoran Life Zone). | Blue grama, hairy grama, galleta, buffalograss. | 4,500-6,500 | 9-20 | Plains, mostly in eastern, central, and northern parts. | Plains and plateaus in northern part. |
| Desert grass (semidesert grassland, Lower Sonoran Life Zone). | Black grama, tobosa, dropseeds. | 3,000-5,000 | 9-18 | Plains in southwestern half. | Plains in southeastern part. |
| Sagebrush (northern desert, Upper Sonoran Life Zone). | Big sagebrush, blackbrush. | 2,500-6,000 | 7-17 | Scattered near northern border. | Plateaus of northern quarter. |
| Desert (semidesert shrub, Lower Sonoran Life Zone). | Creosotebush, mesquite, tarbush, catclaw acacia, paloverdes, bur-sages, cacti, desert saltbush. | 100-4,500 | 3-15 | Plains and valleys of southern third. | Southwestern half and bottom of Grand Canyon. |

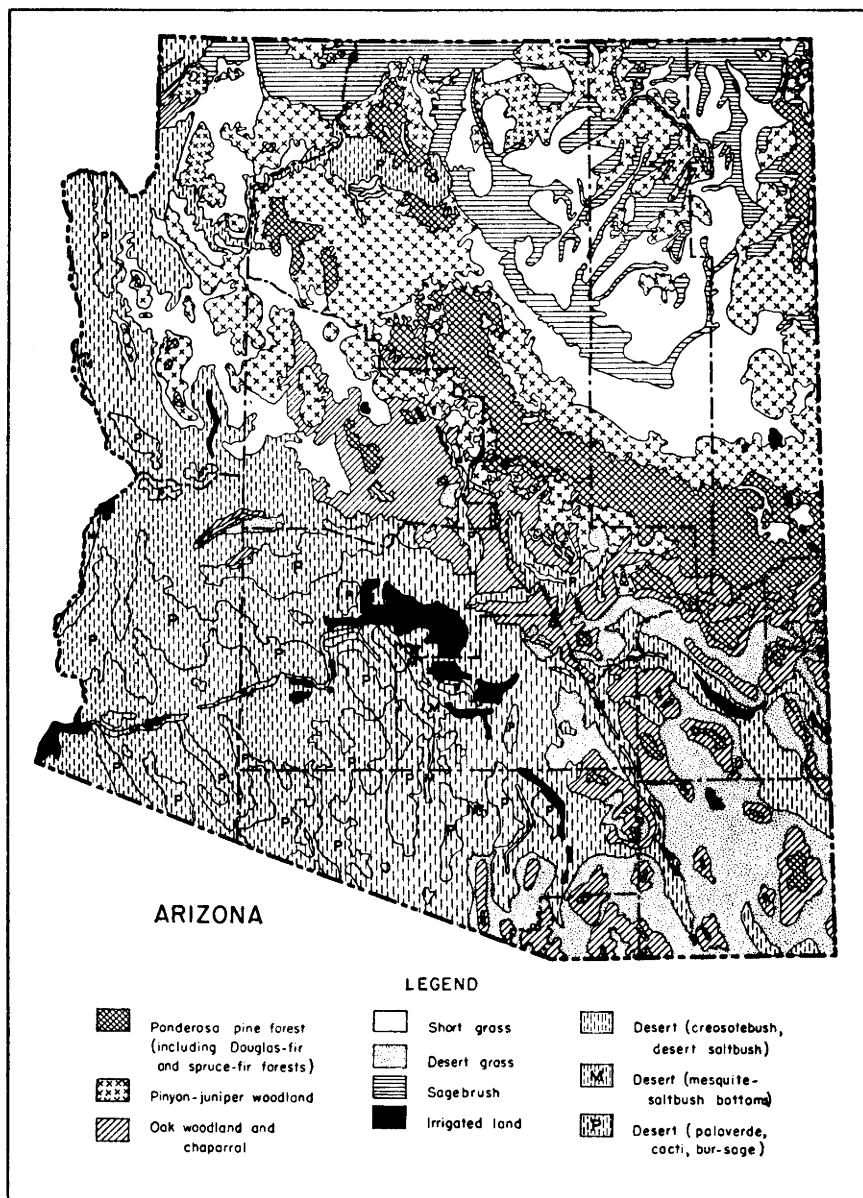


Figure 1.—Principal vegetation types in Arizona.

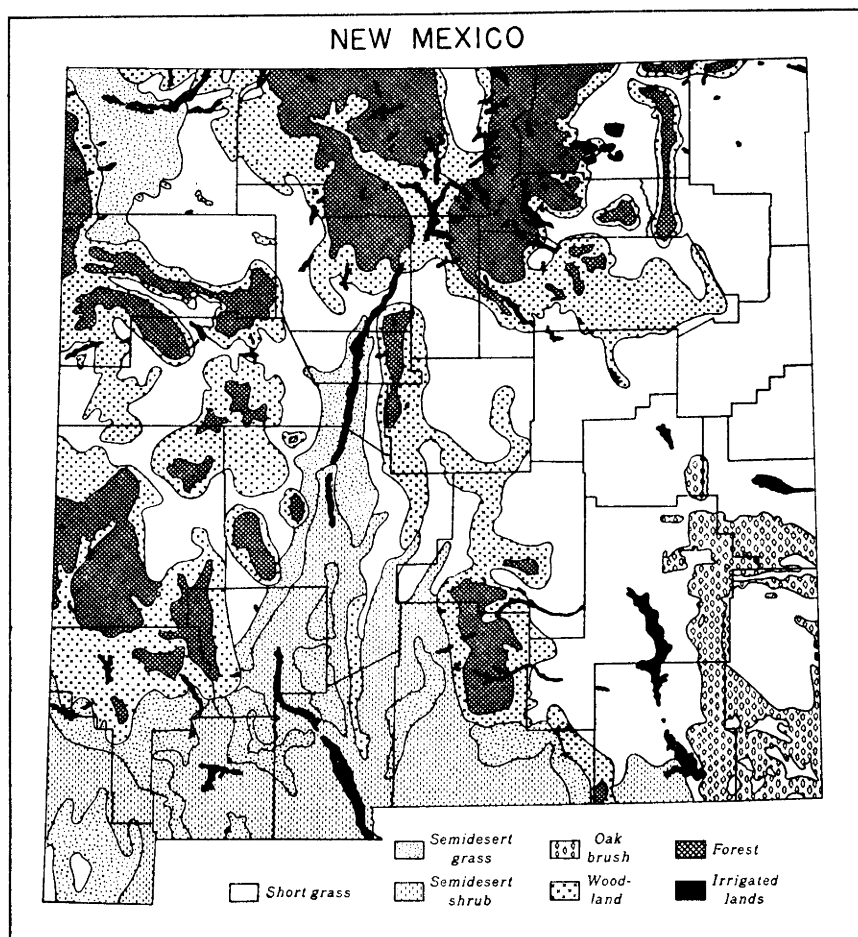


Figure 2.—Principal vegetation types in New Mexico.

FORESTS OF NEW MEXICO AND ARIZONA

Most of the trees of New Mexico and Arizona are found within the vegetation types of forest and woodland, though smaller numbers of trees representing many species are scattered in other types or along streams. The woodlands, both pinyon-juniper and oak, contain small trees usually not of commercial value for lumber, while the coniferous forest types of ponderosa pine, Douglas-fir, and spruce and fir at higher elevations constitute the saw-timber area, with large trees suitable for logging operations.

Forests and woodlands combined cover about 25.7 percent of the area of New Mexico and 26.8 percent of Arizona, or more than one-fourth of each State. Saw-timber forests alone occupy about 7.8 percent of New Mexico and 6.5 percent of Arizona. A considerable part of the saw-timber area, however, is noncommercial, that is, too inaccessible or too scattered for logging or has been withdrawn

for other purposes. The volume of commercial saw timber in New Mexico is estimated at 8,471,000,000 board feet and in Arizona, 16,270,000,000 board feet.

Four coniferous species, or softwoods, together account for 98 percent of the total saw timber in New Mexico and Arizona. Ponderosa pine makes up 82 percent; Douglas-fir, 10 percent; white fir, 3 percent; and Engelmann spruce, 3 percent. Limber pine, alpine fir (including corkbark fir), and other species have small quantities of saw timber.

The forested areas of New Mexico and Arizona are valuable in many ways. Besides providing saw timber, fence posts, fuel, and other wood products, they support large numbers of livestock, game, and wildlife. They yield minerals and also supply the water which makes agriculture and settlements possible in the drier lowlands. The plant cover on mountain slopes regulates stream flow, prevents disastrous floods, and reduces the silting of reservoirs. The undisturbed forest areas with their great scenic beauty attract numerous visitors to the Southwest on outings and vacations in both summer and winter and have an inestimable value for recreation.

HOW TO USE THIS HANDBOOK

It is easy to identify most of the native trees of your locality by reference to the drawings, descriptions, and distribution notes. If you know a common name, just consult the index for page numbers and then match your tree or specimen with the illustrations and text. If your specimen is a pine, it may be necessary to look at the drawings of all eight species of pines to find the complete name, for example. Identification is quicker and more certain if fruits or flowers, as well as leaves, are present.

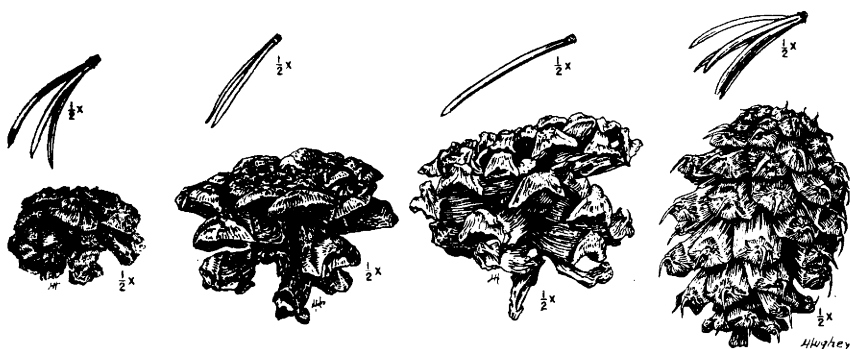
Many southwestern trees can be identified almost as easily in winter as in summer. Some, such as conifers, yuccas, and most oaks, are evergreen and bear leaves at all times. Others, including cacti, paloverdes, and certain other spiny desert species, are leafless most of the year. When a broadleaf tree is to be identified in leafless, winter condition, a search frequently will reveal a few old fruits still attached on the twigs and old leaves and fruits on the ground underneath.

Pine Family (Pinaceae)

MEXICAN PINYON (*Pinus cembroides* Zucc.)

Also called nut pine, pinyon pine, Mexican pinyon pine.

Description: Small, needle-leaf evergreen tree 15 to 30 feet or more in height, with trunk $1\frac{1}{2}$ feet or more in diameter and with compact, rounded, spreading crown. **Needles** 3 in a bundle, 1 to $1\frac{3}{4}$ inches long, slender, dark blue green. **Cones** egg-shaped, 1 to $1\frac{1}{2}$ inches long, light brown, with thick blunt scales and hard-shelled, brown seeds $\frac{3}{8}$ inch long, oily and edible and known as pinyon nuts. **Bark** deeply furrowed into scaly ridges, reddish brown or blackish, on large trunks with flattened plates. **Wood** soft, heavy, resinous, yellow.



Mexican pinyon.

Pinyon.

Singleleaf pinyon.

Bristlecone pine.

Distribution: Characteristic and common tree of the pinyon-juniper woodland, associated with junipers and oaks, 5,000 to 7,500 feet elevation, in mountains along the Mexican border. New Mexico: mountains of southwestern corner in Hidalgo and Grant Counties. Arizona: mountains of southeastern part, from Cochise and Greenlee Counties west to Pima and Santa Cruz Counties. Also in northern and central Mexico.

Mexican pinyon differs from the common pinyon in its thinner needles in 3's which (in the form present in the United States) lack the whitish lines on the outer surface, in its smaller cones with smaller, hard-shelled seeds or nuts, and in its more southern, limited range along the Mexican border. Though they are extensively gathered and eaten in Mexico, Mexican pinyon nuts are of no economic importance in the United States. The small seeds are seldom produced in quantity and are too hard to be cracked with the teeth. The pitchy wood is suitable for fuel.

PINYON (*Pinus edulis* Engelm.)

Also called nut pine, pinyon pine, Colorado pinyon pine. Botanical synonym: *P. cembroides* var. *edulis* (Engelm.) Voss.

Description: Small, bushy, needle-leaf evergreen tree 15 to 35 feet tall, with short trunk 1 to 2 feet or more in diameter, and with compact, rounded, spreading crown. **Needles** 2 (sometimes 3 or 1) in a bundle, 1 to 2 inches long, stout, yellow green. **Cones** egg-shaped, 1½ to 2 inches long, light brown, with thick blunt scales and large brown seeds ½ inch long, oily and edible and known as pinyon nuts or piñones. **Bark** furrowed into scaly ridges, gray to reddish brown. **Wood** soft, heavy, resinous, yellow.

Distribution: The abundant and characteristic tree of the pinyon-juniper woodland zone, growing in pure stands or with junipers on dry rocky foothills, mesas, plateaus, and lower mountain slopes between the deserts and forests, mostly from 5,000 to 7,000 feet elevation, widely distributed. New Mexico: northeastern corner and western two-thirds. Arizona: mountains and plateaus of northeastern third, from Greenlee County and northeastern corner west to Kaibab Plateau and Hualpai Mountains and south to

Yavapai and Gila Counties. Southwestern Texas, extreme northwestern Oklahoma, and Colorado, west to southwestern Wyoming, Utah, Arizona, and southeastern California. Also in northern Mexico.

Pinyon, the State tree of New Mexico, is one of the most abundant and most widely distributed tree species in the Southwest. It grows in pure stands or with one or more of four kinds of junipers and covers vast areas. On the south rim at Grand Canyon National Park it is the commonest tree species. A form with the needles single as in singleleaf pinyon but relatively more slender and shorter occurs in central Arizona along the lower limit of the woodland zone north to Grand Canyon. Pinyon is one of the most drought-resistant and slowly growing species of pines, requiring only 12 to 18 inches of rainfall a year. Because of the scarcity of moisture, these dwarf trees do not form dense forests but grow scattered in open woodlands resembling old orchards.

The familiar seeds, known as pinyon nuts, piñones, and Indian nuts, are a wild, commercial nut crop, delicious raw or roasted and also sold shelled and in candies. Pinyon ranks first among the native nut trees of the United States not also under cultivation. Every autumn Navajo Indians, Spanish-Americans, and others harvest more than a million pounds of pinyon nuts, which are shipped to New York City and other eastern markets. Thus pinyon nuts furnish supplementary income to persons living near the woodlands as well as food to city dwellers. The pitchy wood is good for fuel and is used locally for mine timbers and fence posts but is not durable unless treated. Pinyons are sometimes planted as ornamentals within their range, where they are hardy but of very slow growth unless irrigated.

SINGLELEAF PINYON (*Pinus monophylla* Torr. & Frém.)

Also called nut pine, singleleaf pinyon pine. Botanical synonym: *P. cembroides* var. *monophylla* (Torr. & Frém.) Voss.

Description: Small, spreading, needle-leaf evergreen tree 15 to 30 feet or more in height, with trunk 1 foot or more in diameter. **Needles** 1 in a sheath, 1 to 2 inches long, stout and stiff, gray green. **Cones** egg-shaped, 2 to 3 inches long, light brown, with thick blunt scales and large, thin-shelled, brown seeds $\frac{3}{4}$ inch long, edible and known as pinyon nuts and pine nuts. **Bark** furrowed into scaly ridges, dark brown. **Wood** soft, heavy, yellowish brown.

Distribution: Local in pinyon-juniper woodland with Utah juniper, 4,500 to 6,500 feet elevation, in mountains of northwestern corner of Arizona; not in New Mexico. Arizona: Virgin Mountains (northwestern Mohave County) and perhaps elsewhere in extreme northwestern corner of State. Also in western Utah, southern Idaho, Nevada, California, and Lower California, Mexico.

Singleleaf pinyon, the State tree of Nevada, is a characteristic tree of the pinyon-juniper woodland in the Great Basin region, replacing the species of pinyon in the Southwest. The pinyon of central Arizona with needles single, though usually called single-

leaf pinyon, is more properly placed as a form of the common 2-needle pinyon (*Pinus edulis*), according to the seeds and other characteristics.

The nuts of singleleaf pinyon, which are gathered by Indians and sold locally on a small scale, differ from the common pinyon nuts of the Southwest in being larger, thinner shelled, and mealy rather than oily in flavor. The wood is used for fuel.

BRISTLECONE PINE (*Pinus aristata* Engelm.)

Also called foxtail pine.

Description: Small needle-leaf evergreen tree 40 feet or less in height and up to $2\frac{1}{2}$ feet in trunk diameter, with broad, irregular crown and spreading branches, or a low bushy shrub at the timber line. **Needles** numerous and densely crowded, 5 in a bundle, 1 to $1\frac{1}{2}$ inches long, stout, dark green, curved and pressed against the twig and not spreading out, remaining attached 10 to 15 years and forming brushlike or "foxtail" masses along the ends of the branches. **Cones** $2\frac{1}{2}$ to 4 inches long, dark purplish brown, each scale with a slender prickle nearly $\frac{1}{4}$ inch long. **Bark** on small trunks and branches smooth and whitish, on larger trunks becoming irregularly fissured, scaly, and reddish brown. **Wood** soft, moderately heavy, brownish red.

Distribution: Very local and widely scattered, in open grassy stands or in spruce-fir forest up to timber line, 9,700 to 11,500 feet elevation, on the highest mountains of northern New Mexico and Arizona. New Mexico: highest peaks of Sangre de Cristo Range. Arizona: only on San Francisco Mountain near Flagstaff. Also on high peaks in Colorado, Utah, Nevada, and California.

Bristlecone pine, named from the prickles on the cones, has an unusual, scattered distribution on widely separated high peaks in six States. As the trees are small, uncommon, and not accessible, the wood is seldom used.

LIMBER PINE (*Pinus flexilis* James)

Also called Rocky Mountain white pine, white pine. Variety: *P. flexilis* var. *reflexa* Engelm. (also called border limber pine, Mexican white pine; botanical synonym, *P. strobiformis* auth.).

Description: Medium-sized, needle-leaved evergreen tree 50 to 80 feet tall and 3 feet or more in trunk diameter, with broad rounded crown. **Needles** 5 in a bundle, 2 to $3\frac{1}{2}$ inches long, slender, blue green. **Cones** short-stalked, hanging down, 4 to 8 inches long, yellow brown, with thick rounded scales bearing seeds $\frac{3}{8}$ to $\frac{1}{2}$ inch long. **Bark** on small trunks smooth and whitish gray, on larger trunks becoming deeply furrowed and dark brown or gray. **Wood** soft, lightweight, pale yellow.

Distribution: Not common but widely distributed in high mountains of Douglas-fir and spruce-fir forests, or less frequently ponderosa pine forest, usually between 7,000 and 10,000 feet elevation; with a variety in pine forest as low as 6,500 feet elevation in the Mexican border region. New Mexico: high mountains of western two-thirds. Arizona: high mountains of eastern half, west to

Navajo Mountain and San Francisco Mountain and south to Santa Rita Mountains and Chiricahua Mountains. Widely distributed in Rocky Mountain region from southwestern Texas to Black Hills of South Dakota and Montana, west to southern Alberta and southern British Columbia, and south to California, Arizona, and northern Mexico.

The variety (var. *reflexa*) found at lower elevations in the southwestern corner of New Mexico, southeastern Arizona, and northern Mexico, differs from the typical form in larger size, better developed trunk, absence of whitish lines on outer surface of needles, and the cone scales with narrow tips curved back.

The wood of limber pine is used for lumber (mostly for rough construction and occasionally for boxes), mine timbers, railroad ties, poles, and fuel. However, in the Southwest the limited supply furnishes only a small amount of lumber and often is cut along with ponderosa pine. The seeds are edible, though smaller and thicker shelled than pinyon nuts.

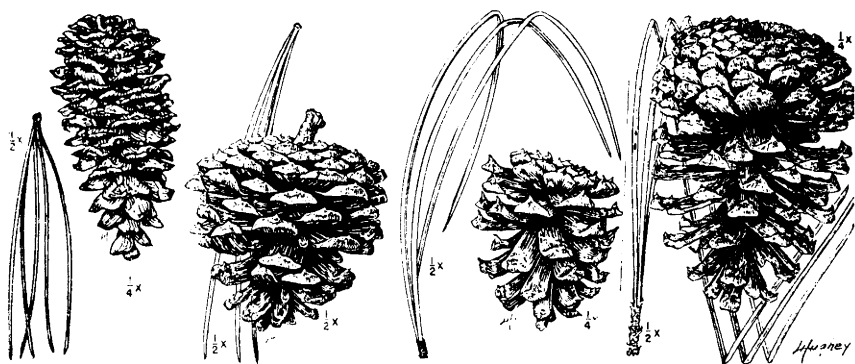
CHIHUAHUA PINE (*Pinus leiophylla* Schiede & Deppe var. *chihuahuana* (Engelm.) Shaw)

Botanical synonym: *P. chihuahuana* Engelm.

Description: Small to medium-sized tree 30 to 80 feet tall and 1 to 2 feet in trunk diameter, with open, spreading crown. Small, short twigs usually present along the trunk. Needles 3 in a bundle, 2½ to 4½ inches long, slender, pale blue green, with the sheath at base soon shedding. Cones distinctly stalked and spreading, egg-shaped, 1½ to 3 inches long, light brown and shiny, the scales with short, shedding prickles, maturing and opening in 3 years but remaining attached several years. Bark very thick (2 inches or more), with deep furrows and broad ridges, dark brown or nearly black. Wood hard, orange.

Distribution: Common or scattered in pine forest, associated with Arizona pine and Apache pine, 5,000 to 7,800 feet elevation, in mountains along the Mexican border. New Mexico: mountains of extreme southwestern corner, Animas and San Luis Mountains in Hidalgo County. Arizona: mountains of southeastern corner north to southern Navajo County and west to Pinal Mountains in Gila County and Santa Catalina and Santa Rita Mountains in eastern Pima County. Also in Mexico.

Chihuahua pine is a northern variety of a widely distributed Mexican species, the typical form having 5 needles in a bundle. This species is easily recognized by the many old, open, stalked cones remaining attached in the branches, by the trunk with very thick bark and often bearing scattered leafy twigs, and by the absence of sheaths at base of needles except when young. This is the only pine native in the United States which requires 3 years instead of 2 to mature its cones. The three stages of developing cones usually can be found. Chihuahua pine is one of the few kinds of pine which will sprout from cut stumps. Because of the small size and limited distribution, Chihuahua pine is of minor importance for lumber.



Limber pine.

Chihuahua pine.

Ponderosa pine.

Apache pine.

PONDEROSA PINE (*Pinus ponderosa* Laws.)

Also called western yellow pine, yellow pine. Varieties: Arizona pine (*P. ponderosa* var. *arizonica* (Engelm.) Shaw; also called Arizona ponderosa pine, Arizona yellow pine; botanical synonym, *P. arizonica* Engelm.). *P. ponderosa* var. *scopulorum* Engelm. (also called Rocky Mountain ponderosa pine; botanical synonym, *P. brachyptera* Engelm.).

Description: Large, needle-leaved evergreen tree 80 to 125 feet tall with a straight trunk 2 to 3 feet in diameter, or sometimes 150 feet tall and 3½ feet in diameter or larger. Crown narrow and open, with spreading branches. **Needles** usually 3 in a bundle or occasionally 2 (mostly 5 in the variety Arizona pine), 4 to 7 inches long, stout, dark green. **Cones** 3 to 5 inches long (2½ to 3 inches in Arizona pine), light reddish brown, with prickly scales, leaving several scales on the twig when shedding. **Bark** on small trunks less than 1 foot in diameter (known as "blackjacks") blackish and furrowed into ridges, on larger trunks becoming yellow brown and irregularly fissured into large, flat, scaly plates. **Wood** hard, yellowish with whitish sapwood.

Distribution: The commonest forest tree in the Southwest and the characteristic species of the ponderosa pine forest on the mountains and higher plateaus, in pure stands or associated with Douglas-fir, Gambel oak, limber pine, or pinyon, usually between 5,500 and 8,500 feet in elevation but sometimes beyond these limits, widely distributed. New Mexico: common at suitable elevations in mountains of western two-thirds from Guadalupe Mountains north and west and to northeastern corner. Arizona: high mountains and plateaus in northeastern half, west to Kaibab Plateau and Hualpai Mountains. Range very extensive in Rocky Mountains and Pacific coast mountains, from southwestern Texas north in foothills to western Nebraska, western North Dakota, and Montana, west to British Columbia, and south to California and Arizona. Also in northern Mexico.

Ponderosa pine has one of the greatest ranges of all the trees in the western mountains and includes minor geographic variations which intergrade. The Rocky Mountain variety, which is

present over New Mexico, has shorter needles of both 3 and 2 in a bundle and has smaller cones. More distinct is Arizona pine, a variety with 5 slender needles in a bundle and with small cones, distributed in mountains along the Mexican border in the extreme southwestern corner of New Mexico (Hidalgo County), southeastern Arizona (Cochise, Santa Cruz, and Pima Counties), and northern Mexico. The typical variety with needles in clusters of 3 occurs northward over Arizona but occasionally is found southward with Arizona pine.

In many places this species grows in pure stands. The vast forest on the Mogollon Plateau in central Arizona extending into western New Mexico, about 300 miles long, is the largest continuous virgin forest of ponderosa pine anywhere in the West.

Ponderosa pine not only is the most valuable saw-timber tree species of New Mexico and Arizona but is the most important western pine and is second only to Douglas-fir in total stand among all the different tree species of the United States. Most of the lumber produced in the Southwest is from ponderosa pine. The lumber has many uses, such as building and other construction, boxes and crates, and millwork; also caskets, furniture, and toys. Other products are piling, poles, fence posts, mine timbers, veneer, railroad ties, and fuel. The trees are planted also in shelter belts and for ornament. Indians stripped and ate the inner bark of this and other conifers. Montana has ponderosa pine as its State tree.

APACHE PINE (*Pinus latifolia* Sarg.)

Also called Arizona longleaf pine. Botanical synonym: *P. apachea* Lemm.

Description: Medium-sized, needle-leaved evergreen tree 50 to 70 feet tall and 2 feet or more in trunk diameter, with open, rounded crown and with few large branches. **Twigs** relatively few, stout. **Needles** 3 (sometimes 4) in a bundle, 8 to 12 inches long (to 15 inches in seedlings), stout, dark green. **Cones** 4 to 5½ inches long, light brown, with prickly scales, leaving several scales on the twig when shedding. **Bark** deeply furrowed, dark brown. **Wood** hard and heavy, yellowish.

Distribution: Uncommon and scattered in pine forest, with Arizona pine, Chihuahua pine, silverleaf oak, and Arizona oak, 5,000 to 8,200 feet elevation, in mountains along the Mexican border. New Mexico: mountains of extreme southwestern corner. Arizona: mountains of southeastern corner, Chiricahua, Huachuca, and Dragoon Mountains in Cochise County and Santa Rita Mountains in eastern Pima County. Also in adjacent Mexico.

Apache pine is a distinctive species with a rather restricted range. The seedlings pass through a grasslike stage, reminiscent of longleaf pine (*P. palustris* Mill.) of the Southeast; they, with the very long-needled saplings, are wholly unlike those of any other western pine. Mature trees, however, are more like the closely related ponderosa pines, differing chiefly in the fewer and stouter twigs with longer needles and the slightly larger cones. The wood is similar to that of ponderosa pine but not much used because of the limited supply.

ENGELMANN SPRUCE (*Picea engelmanni* Parry)

Also called white spruce, mountain spruce, silver spruce.

Description: Large, needle-leaved evergreen tree to 80 feet or more in height, with straight trunk to 3 feet or more in diameter, and with narrow, pointed conical crown and horizontal or slightly drooping branches extending nearly to ground; or at timber line dwarfed and bushy. **Twigs** roughened by peglike bases of fallen needles; twigs and leaf bases usually hairy. **Needles** 4-angled, $\frac{5}{8}$ to $1\frac{1}{4}$ inches long, pointed but not stiff, dark or pale blue green, with disagreeable odor when crushed. **Cones** $1\frac{1}{2}$ to $2\frac{1}{2}$ inches long, light brown, with papery scales more or less rounded and distinctly thinner at apex. **Bark** thin, with loosely attached scales or flakes, grayish or purplish brown. **Wood** soft, lightweight, light yellow to reddish brown.

Distribution: A common and characteristic tree of the spruce-fir forest up to the timber line, often growing crowded in dense stands, pure or mixed with alpine fir, Douglas-fir, white fir, and blue spruce, usually between 9,000 feet and the timber line up to 12,000 feet elevation but occasionally as low as 8,000 feet, in higher mountains. New Mexico: higher mountains in western two-thirds, from Sacramento Mountains and Sangre de Cristo Range westward. Arizona: higher mountains of northeastern half, from Chiricahua, Santa Catalina, Pinaleno, and White Mountains northwest to San Francisco Mountain and Kaibab Plateau. Rocky Mountain and Pacific Coast regions from New Mexico to Montana, Alberta, and British Columbia, and south to northern California and Arizona.

Engelmann spruce is an important tree species at higher elevations in mountains of the Southwest, though limited in area and accessibility. The lumber is used for building construction and boxes, and the wood is also a source of mine timbers, railroad ties, and poles. The trees are desirable ornamentals in cool moist climates. This species honors George Engelmann (1809-84), German-American physician and botanist of St. Louis, an authority on conifers, yuccas, cacti, and other plant groups.

BLUE SPRUCE (*Picea pungens* Engelm.)

Also called Colorado blue spruce, Colorado spruce, silver spruce. Botanical synonym: *P. parryana* (André) Sarg.

Description: Large, needle-leaved evergreen tree up to 80 feet tall and 2 feet in trunk diameter or larger, with conical crown of bluish foliage, at least on young trees and parts. **Twigs** roughened by peglike bases of fallen needles; twigs and leaf bases usually not hairy. **Needles** 4-angled, $\frac{3}{4}$ to $1\frac{1}{8}$ inches long, stiff and spine-pointed, dull blue green or silvery blue or becoming darker on older parts. **Cones** $2\frac{1}{2}$ to 4 inches long, light brown, with scales more or less straight across apex and not thinner. **Bark** rough and thick, furrowed into scaly ridges, gray or brown. **Wood** soft, lightweight, brownish or whitish.

Distribution: Uncommon in spruce-fir forest and Douglas-fir forest, but sometimes in dense stands, 7,000 to 11,000 feet eleva-

tion, in higher mountains. New Mexico: higher mountains in western two-thirds, Sacramento Mountains and Sangre de Cristo Range westward. Arizona: local at high elevations in eastern and northern parts, White Mountains and Lukachukai Mountains in Apache County and Kaibab Plateau in Coconino County. Rocky Mountain region from New Mexico to Wyoming and southeastern Idaho, and south to Arizona.

Blue spruce is less common than Engelmann spruce and less widely distributed, often occurring at slightly lower levels. The lumber of both species is cut and marketed together. The trees are extensively planted for ornament because of the bluish, often silvery, foliage and are used also in shelter belts. Blue spruce is the State tree of both Colorado and Utah.

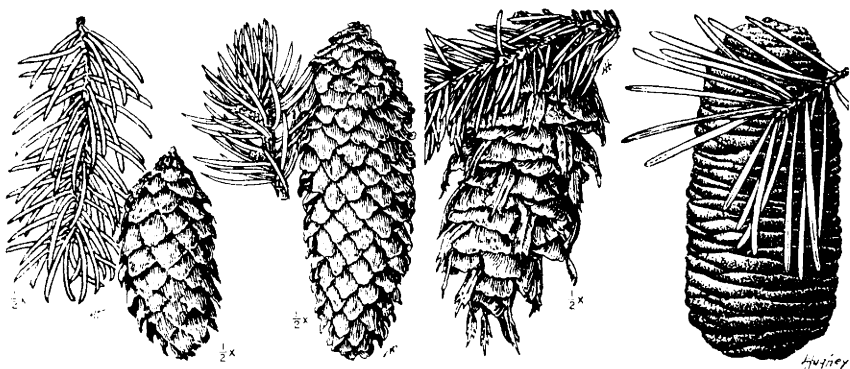
DOUGLAS-FIR (*Pseudotsuga taxifolia* (Poir.) Britton)

Also called Douglas-spruce, red fir, yellow fir, common Douglas-fir, Oregon pine (lumber). Botanical synonyms: *P. douglasii* (Sabin) Carr., *P. mucronata* (Raf.) Sudw. Variety: *P. taxifolia* var. *glauca* (Mayr) Sudw. (also called blue Douglas-fir).

Description: The largest native tree of New Mexico and Arizona, needle-leaved evergreen tree becoming 100 to 150 feet (or 190 feet) in height, with straight trunk 3 to 6 feet or more in diameter, with open, broadly conical crown and drooping lower branches. **Twigs** slightly roughened by bases of fallen needles. **Needles** spreading on all sides of twigs or sometimes in 2 rows, short-stalked, flat, $\frac{3}{4}$ to $1\frac{1}{8}$ inch long, rounded at apex, dark blue green. **Cones** $1\frac{3}{4}$ to $2\frac{3}{4}$ inches long, reddish brown, with thin, rounded scales and long, distinctive 3-pointed bracts projecting beyond the scales. **Bark** rough and very thick, deeply furrowed into broad ridges, sometimes very corky, dark reddish brown or gray. **Wood** soft, lightweight, yellowish with whitish sapwood.

Distribution: Common as the characteristic tree in the Douglas-fir forest but also occurring in the ponderosa pine forest and spruce-fir forest, 6,500 to 10,000 feet elevation, or as low as 5,200 feet in canyons, widely distributed in higher mountains. New Mexico: higher mountains in western two-thirds, from Guadalupe Mountains, Sacramento Mountains, and Sangre de Cristo Range westward. Arizona: higher mountains of northeastern half, west to Santa Rita and Santa Catalina Mountains, Hualpai Mountains, and Kaibab Plateau. Widely distributed in Rocky Mountain and Pacific Coast regions from southwestern Texas to Montana, Alberta, and British Columbia, and south to California and Arizona. Also in northern Mexico.

Douglas-fir grows in pure stands or mixed with species of the next lower and higher forest zones of the mountains. The Rocky Mountain trees are placed in a separate botanical variety (*P. taxifolia* var. *glauca* (Mayr) Sudw.), which differs from the typical variety in the Pacific Coast region chiefly in slower growth, more compact habit, shorter and paler blue-green leaves, and smaller cones.



Engelmann spruce.

Blue spruce.

Douglas-fir.

White fir.

The most important timber tree species of the United States, Douglas-fir ranks first in total stand, lumber production, and production of veneer for plywood. In the Southwest this species is confined to limited areas in the higher mountains but ranks second to ponderosa pine as saw timber. Douglas-fir is cut for its high quality lumber in localities where it is sufficiently abundant, chiefly in northern New Mexico and in the Sacramento Mountains. The wood is used also for rough construction, telephone poles, and railroad ties. Douglas-fir is planted also for shade, ornament, and shelter belts and is used for Christmas trees. It is the State tree of Oregon.

This species bears the name of David Douglas (1798-1834), Scotch botanical explorer, who discovered and introduced to horticulture many species of trees and other plants of the Pacific Northwest.

WHITE FIR (*Abies concolor* (Gord. & Glend.) Hoopes)

Also called balsam fir, silver fir, white balsam.

Description: Large, needle-leaved evergreen tree to 150 feet in height and $3\frac{1}{2}$ feet in trunk diameter, with pointed conical crown becoming irregular in age. **Needles** spreading and curved upward, flat, $1\frac{1}{2}$ to $2\frac{1}{2}$ inches long, usually blunt, pale blue green or silvery. **Cones** in top of tree, upright, 3 to 5 inches long, usually grayish green, with scales falling apart at maturity. **Bark** on small trunks smoothish, gray, becoming very thick, hard, and deeply furrowed into scaly ridges. **Wood** soft, very lightweight, whitish or light brown.

Distribution: Common in ponderosa pine, Douglas-fir, and spruce-fir forests, 5,500 to 10,000 feet, in high mountains. New Mexico: high mountains of western two-thirds and northeastern part from Sacramento Mountains and Mogollon Mountains northward. Arizona: high mountains of northeastern half, west to Santa Catalina Mountains, Hualpai Mountains, and Grand Canyon. Widely distributed in Rocky Mountain and Pacific Coast regions from New Mexico to Wyoming, west to Oregon, and south to California and Arizona. Also in Lower California, Mexico.

White fir is associated with other coniferous species in forests at high elevations. Limited quantities of white fir are cut for lumber in the Southwest, often sold with lumber of other species. The trees are suitable as ornamentals and shade trees.

ALPINE FIR (*Abies lasiocarpa* (Hook.) Nutt.)

Also called white balsam, white fir (lumber). Variety: Corkbark fir (*A. lasiocarpa* var. *arizonica* (Merriam) Lemm.; also called Arizona fir; botanical synonym, *A. arizonica* Merriam).

Description: Large, needle-leaved evergreen tree to 90 feet tall and 3 feet in trunk diameter, or larger; but dwarfed and shrubby at timber line. Crown long, narrow, and sharp-pointed, with branches extending nearly to base of tree. Needles spreading or sometimes in 2 rows, flat, 1 to $1\frac{3}{4}$ inches long, blunt, or on uppermost branches pointed and shorter, dark blue green. Cones in top of tree, upright, $2\frac{1}{2}$ to 4 inches long, dark purple, finely hairy, with scales falling apart at maturity. Bark becoming fissured and scaly, gray; in the variety corkbark fir, bark soft, spongy or corky, smoothish, thin, creamy white. Wood soft, lightweight, light brown.

Distribution: Characteristic, usually common tree of spruce-fir forest up to timber line, growing with Engelmann spruce, 8,000 to 12,000 feet elevation, in higher mountains. New Mexico: higher mountains of northern and western parts, from Sangre de Cristo Range, Sandia Mountains, and Mogollon Mountains westward. Arizona: higher mountains of eastern and northern parts, from Pinaleno Mountains, Santa Catalina Mountains, White Mountains, and Navajo Mountain, west to Kaibab Plateau and San Francisco Mountain. Widely distributed in Rocky Mountain region from New Mexico north to Montana, Alberta, British Columbia, Yukon, and Alaska, and south to Oregon, Nevada, and Arizona.

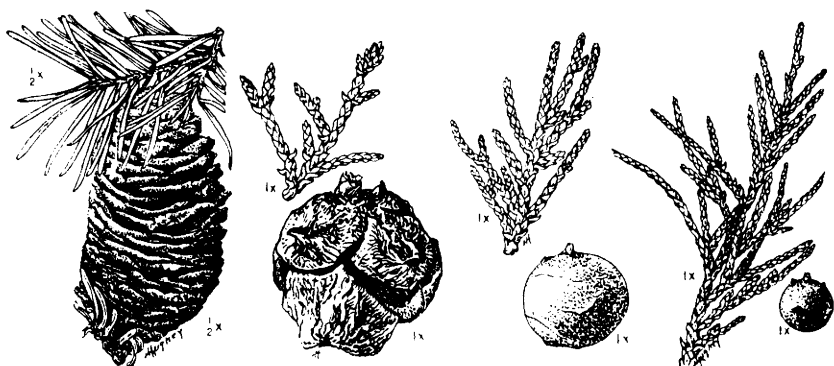
Corkbark fir, a variety readily distinguished by its peculiar whitish corky bark, occurs on San Francisco Mountain, Ariz., where it was first discovered, on Lukachukai Mountains in northeastern Apache County, and on scattered mountains in southwestern, western, and northern New Mexico and southwestern Colorado. Because of its attractive, showy bark, it is highly valued as an ornamental tree.

In the Southwest, alpine fir, including corkbark fir, is too restricted to be of much importance for lumber, though some is cut in the White Mountains of eastern Arizona and elsewhere. This species is suitable for ornamentals and Christmas trees.

ARIZONA CYPRESS (*Cupressus arizonica* Greene)

Also called rough-bark Arizona cypress, smooth cypress, smooth Arizona cypress. Botanical synonyms: *C. glabra* Sudw., *C. arizonica* var. *bonita* Lemm.

Description: Medium-sized, scale-leaved evergreen tree usually about 30 feet tall, with straight trunk $1\frac{1}{2}$ feet in diameter, up to 75 feet in height and 3 feet in diameter (maximum about 90 feet tall and $5\frac{1}{2}$ feet in diameter). Crown conical or rounded. Twigs



Alpine fir.

Arizona cypress. Alligator juniper. Rocky Mountain juniper.

numerous, stout, 4-angled, branching nearly at right angles in all directions. Leaves scalelike, $\frac{1}{16}$ long, pale blue green. Cones short-stalked, $\frac{3}{4}$ to 1 inch in diameter, hard and woody, gray, with flattened scales bearing a point in center, remaining attached several years. Bark variable, on small trunks smoothish and shedding in thin scales to expose dark red inner bark; the form in central Arizona retaining this smoothish red bark on most larger trunks; or bark on larger trunks becoming rough and thick, furrowed and fibrous, or checkered, gray or blackish. Wood moderately soft and lightweight, light brown.

Distribution: Very scattered and local, forming groves in canyons and mountains of oak woodland, with evergreen oaks or junipers, 3,500 to 7,200 feet elevation, mountains of Mexican border region and in central Arizona. New Mexico: San Luis and San Francisco Mountains in southwestern corner. Arizona: mountains and canyons of southeastern and central parts from Chiricahua Mountains and Greenlee County west to Dragoon Mountains and Santa Catalina Mountains and northwest to Mazatzal Mountains and Oak Creek Canyon. Also in Chisos Mountains of southwestern Texas and in northern Mexico.

The form of Arizona cypress in central Arizona is regarded by some botanists as a separate variety or species, smooth cypress (*C. glabra* Sudw.). It is distinguished by the smoothish outer bark shedding or peeling and exposing the dark red inner bark, though the largest trees have thick, furrowed, gray bark. This form is widely cultivated in warm, dry regions as a symmetrical ornamental evergreen with bluish-green foliage and is planted also in shelter belts. It is also grown for Christmas trees in the South. The wood of Arizona cypress is used for fence posts but is too scarce to be lumbered.

The cypresses (genus *Cupressus*), though widely distributed in the Old World, are found in the New World only in southwestern and western United States from Texas to California and Oregon and from Mexico south to Costa Rica. The native species (about 8) in the United States all are of restricted and scattered distribution, suggesting that they may be of great antiquity and

relics of former widespread occurrence. The best groves should be preserved in their natural condition before the larger trees are cut. Some fine specimens of Arizona cypress are already under protection in the Chiricahua National Monument, in southeastern Arizona.

ALLIGATOR JUNIPER (*Juniperus deppeana* Steud.)

Also called western juniper (lumber). Botanical synonyms: *J. pachyphloea* Torr.; *J. deppeana* var. *pachyphloea* (Torr.) Martinez.

Description: Medium-sized, scale-leaved evergreen tree usually 20 to 40 feet tall with a large, short trunk 2 to 3 feet in diameter, reaching a maximum height of 65 feet and a trunk diameter of 7 feet. Crown rounded and spreading or in age irregular and partly dead. Leafy twigs $\frac{1}{16}$ to $\frac{1}{32}$ inch in diameter. Older twigs reddish brown and nearly smooth, peeling off. Leaves scalelike, $\frac{1}{16}$ long, blue green, glandular, mostly with a whitish resin drop or gland, or on leading twigs needlelike, up to $\frac{1}{4}$ inch long, pale or whitish. "Berry" $\frac{1}{2}$ inch in diameter, bluish or brownish, covered with a bloom, hard and mealy, 3- or 4-seeded, maturing the second year. Bark thick and rough, deeply furrowed into checkered or square plates, gray or blackish, suggesting the back of an alligator. Wood soft, lightweight, light red with narrow whitish sapwood.

Distribution: Common but usually scattered on hillsides and mountains in oak woodland, pinyon-juniper woodland, and lower part of ponderosa pine forest, 4,500 to 8,000 feet elevation. New Mexico: mountains in southern and western parts, from Guadalupe Mountains and Capitan Mountains west to Black Range and north to Mount Taylor and Zuni Mountains. Arizona: mountains of southeastern and central parts, west to Flagstaff and to Baboquivari Mountains. Also in southwestern Texas and northern and central Mexico.

Alligator juniper, the largest juniper in New Mexico and Arizona, is usually scattered rather than in pure stands. The trees attain a great age and develop very large trunks. With some weathered dead limbs attached and with dead strips vertically ascending the trunk and branches, older trees have a grotesque appearance. Sprouts often are formed at the base of stumps. The wood is used for fuel and fence posts. Juniper seeds are widely spread by birds and wild mammals which eat the "berries."

ROCKY MOUNTAIN JUNIPER (*Juniperus scopulorum* Sarg.)

Also called western juniper (lumber), Rocky Mountain redcedar.

Description: Small to medium-sized, scale-leaved evergreen tree 20 to 50 feet tall, with straight trunk up to $1\frac{1}{2}$ feet in diameter, with narrow and pointed open, conical crown, and with slender branches often drooping at the ends. Leafy twigs slender, about $\frac{1}{32}$ inch in diameter. Leaves scalelike, $\frac{1}{16}$ inch long, usually gray green, or on leading shoots needlelike, up to $\frac{1}{4}$ inch long. "Berry" $\frac{1}{4}$ inch in diameter, bright blue, covered with a bloom, juicy, usually 2-seeded, maturing the second year. Bark thin, fibrous and

shreddy, dark reddish brown or gray. **Wood** soft, lightweight, deep red with thick whitish sapwood.

Distribution: Scattered in mountains and canyons of pinyon-juniper woodland and lower part of ponderosa pine forest, 5,000 to 9,000 feet elevation. New Mexico: mountains of northern and central parts south to White Mountains and Mogollon Mountains. Arizona: mountains and plateaus of eastern and northern parts, from White Mountains and Lukachukai Mountains west through Mogollon Plateau to Coconino Plateau, Grand Canyon, and Kaibab Plateau. Widely distributed in Rocky Mountain region from New Mexico north to western North Dakota, west to Montana, Alberta, and British Columbia, and south to Washington, Nevada, and Arizona.

Rocky Mountain juniper, a slender tree with grayish green foliage, is graceful and highly ornamental. The form with drooping twigs is called "weeping juniper." The trees grow faster than other southwestern junipers and are planted in shelter belts and as ornamentals. The wood is used for fence posts, fuel, and lumber and is suitable for cedar chests.

ONE-SEED JUNIPER (*Juniperus monosperma* (Engelm.) Sarg.)

Botanical synonym: *J. gymnocarpa* (Lemm.) Cory.

Description: Much-branched, spreading, often scraggy, scale-leaved evergreen shrub or small tree 10 to 25 feet tall, with several curved branches from the ground, usually without a single upright trunk but sometimes with a trunk to 1½ feet in diameter. Leafy **twigs** stout, about ¼ inch or less in diameter. **Leaves** scale-like, ¼ inch or more in length, yellow green. Pollen and seeds borne on different trees (dioecious). "**Berry**" ¼ inch in diameter, dark blue, covered with a bloom, juicy, 1-seeded, maturing in one year. **Bark** fibrous and shreddy, gray. **Wood** soft, lightweight, light reddish brown with whitish sapwood.

Distribution: Common and widespread on plains, plateaus, and foothills in pinyon-juniper woodland, growing with pinyon and Utah juniper, or sometimes in upper part of desert and desert grassland, 3,000 to 7,000 feet elevation, widely distributed. New Mexico: almost throughout. Arizona: widespread but absent from northeastern, southwestern, and extreme western parts. Western Texas and extreme western Oklahoma, west to Colorado and Nevada, and south to Arizona and northern Mexico.

One-seed juniper is the commonest juniper in New Mexico but not as abundant in Arizona as Utah juniper. The wood is much used for fence posts and fuel.

These two similar species occasionally grow together but can usually be distinguished by the following differences: Utah juniper is larger, with a definite trunk, while one-seed juniper is smaller and usually shrubby, with several branches from the ground. The former has larger, mealy, 1- or 2-seeded "berries" borne on the same trees as the pollen (monoecious), while one-seed juniper has smaller, juicy, 1-seeded "berries" on the female trees and pollen on male trees (dioecious).

UTAH JUNIPER (*Juniperus osteosperma* (Torr.) Little)

Also called western juniper (lumber). Botanical synonyms: *J. utahensis* (Engelm.) Lemm.; *J. megalocharpa* Sudw.

Description: Small, scale-leaved evergreen tree 15 to 40 feet tall, usually with definite upright trunk 1 to 3 feet or more in diameter, branching usually several feet above the ground to form a broad, rounded or conical, open crown. Leafy twigs stout, about $\frac{1}{16}$ inch or less in diameter. Leaves scalelike, about $\frac{1}{16}$ inch long, yellow-green. "Berry" $\frac{1}{4}$ to $\frac{5}{8}$ inch in diameter, brownish, covered with a bloom, mealy, 1- or 2-seeded. Bark fibrous and shreddy in long strips, gray. Wood soft, lightweight, light brown with thick whitish sapwood.

Distribution: Common to abundant on dry plains, plateaus, hills, and mountains in pinyon-juniper woodland, often in pure stands or with pinyon, 3,000 to 7,500 feet elevation, widespread in Arizona. New Mexico: limited to western border from Mogollon Mountains north to Tunitcha Mountains and Aztec. Arizona: widespread across central and northern parts from Gila River northward. Range chiefly in Great Basin region, from western New Mexico north to southwestern Wyoming, west to southern Idaho and Nevada, and south to southeastern California and Arizona.

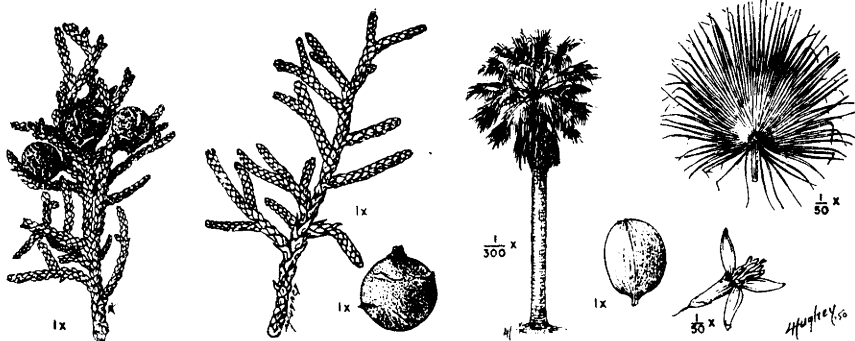
Utah juniper is the commonest juniper in Arizona but in New Mexico is of restricted occurrence. In various places it occupies pure stands, especially westward and at elevations below the limits of pinyon. Within the past 75 years junipers have increased, thickened, and spread onto adjacent short grass and desert grassland vegetation in the Southwest. This change is considered undesirable on lands used for grazing. The durable wood is valuable for fence posts and is used also for fuel. The large, mealy "berries" are eaten by wildlife and formerly also by the Indians.

Common juniper (*Juniperus communis* L.; botanical synonym, *J. sibirica* Burgsd.), the only other conifer native in New Mexico and Arizona, is a spreading or nearly prostrate shrub less than 3 feet tall, rarely becoming a small tree in northeastern United States. The awllike evergreen leaves are in groups of 3, $\frac{3}{8}$ to $\frac{1}{2}$ inch long, sharp and prickly, whitish and grooved above, shiny yellow green beneath. This shrub is scattered in the spruce-fir forest up to the timber line, 8,000 to 11,500 feet elevation, in higher mountains of northern New Mexico from Sandia Mountains and Sangre de Cristo Range westward and in northeastern Arizona from White Mountains and Lukachukai Mountains to Kaibab Plateau. Widely distributed, with varieties, across North America, Europe, and Asia.

Palm Family (Palmae)**CALIFORNIA WASHINGTONIA (*Washingtonia filifera* (Linden) H. Wendl.)**

Also called California-palm, California washington-palm, desert-palm, California fan-palm. Botanical synonym: *W. filamentosa* Kuntze.

Description: Medium-sized to tall evergreen palm tree 20 to 60



One-seed juniper.

Utah juniper.

California washingtonia.

feet or more in height, with thick, columnar, unbranched trunk 2 to 3 feet or more in diameter and with rounded crown of erect and spreading leaves and old dead leaves hanging down against trunk in a thick thatch. **Leafstalks** 4 to 6 feet long, stout, with hooked spines along edges, becoming smaller or entirely absent above. **Leaf blades** fanlike, very large, 6 feet or more in diameter, gray green, the outer part split into many narrow, folded, leathery segments with edges frayed into many threadlike fibers. **Flower** clusters large and branched, 10 to 12 feet long, drooping, bearing numerous small flowers $\frac{3}{8}$ inch long, white, slightly fragrant. **Berry** nearly $\frac{1}{2}$ inch long, black, with thin edible flesh and 1 large seed. **Trunk** rough and checkered, with vertical cracks more prominent than the horizontal lines, grayish brown, in upper part covered by mass of dead leaves. **Wood** without annual rings, soft and lightweight, yellowish.

Distribution: Rare and local in canyons of desert mountains, in Arizona only from one locality, Kofa Mountains, about 2,500 feet elevation, in southwestern part; not in New Mexico. Arizona: known only from about 100 wild trees in Palm Canyon and other deep, narrow canyons of Kofa Mountains, about 25 miles southeast of Quartzsite, Yuma County. Also in southeastern California, such as Palm Canyon near Palm Springs and Thousand Palms Canyon near Indio, and in northern Lower California, Mexico.

California washingtonias are commonly planted as ornamentals in southern Arizona but were not known to be native in the State until discovered in the Kofa (or S. H.) Mountains in 1923. From the Quartzsite-Yuma highway about 17 miles south of Quartzsite a very rocky road or trail extends eastward about 8 miles to the foot of the mountains. A hike of $1\frac{1}{2}$ to 2 miles up Palm Canyon leads to these beautiful palms.

In southeastern California, where this species is more common, the fruits were gathered and eaten by Indians. A related species from Lower California, Mexican washingtonia (*W. robusta* H. Wendl.), distinguished by more slender and taller trunks about 1 foot in diameter above the wider base, is also frequent in cultiva-

tion. Both species are widely planted in subtropical portions of the United States and in other parts of the world. *Washingtonia* is dedicated to President George Washington (1732-99).

Lily Family (Liliaceae)

SOAPTREE YUCCA (*Yucca elata* Engelm.)

Also called palmilla, soapweed. Botanical synonym: *Y. verdien-sis* McKelvey.

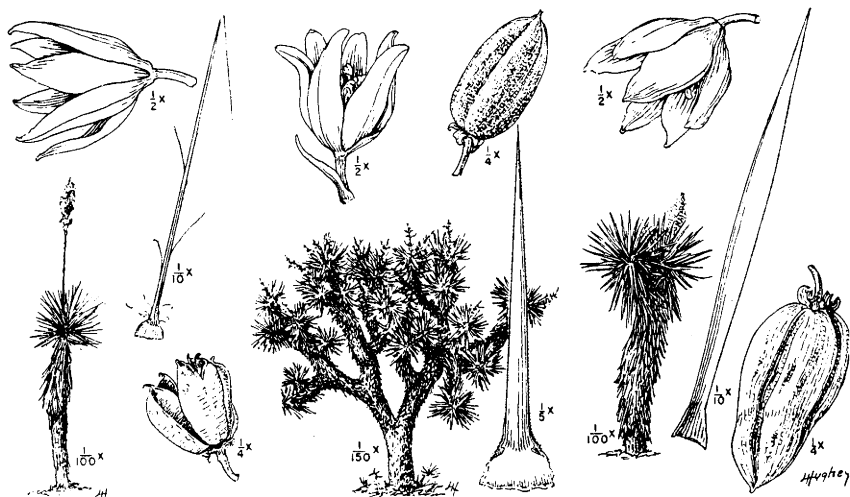
Description: Narrow-leaved evergreen, palmlike shrub or small tree, usually 3 to 6 feet tall and infrequently 10 to 15 feet or rarely 25 feet or more in height, with trunk 6 to 9 inches in diameter, unbranched or with few branches, bearing at the top a cluster of spreading grasslike leaves. **Leaves** numerous, very long and narrow, 1 to 2½ feet long, ¼ to ⅜ inch wide, leathery and flexible, yellow green, ending in a sharp spine, with threads along the edges. **Flower stalk** large, upright in top of plant, 3 to 6 feet or more in length, much branched in upper half, resembling a candelabra. **Flowers** numerous in large clusters, 1½ to 2 inches long, whitish, in late June and early July. **Seed capsules** cylindrical, dry, about 2 inches long, light brown, splitting open in 3 parts to release the many thin black seeds and remaining attached through the winter. **Trunk** bare in lower part, slightly furrowed and gray, in upper part covered by old dead leaves. **Wood** soft and spongy, lightweight, light brown.

Distribution: Common on sandy plains, mesas, and washes, desert grassland and desert, often forming pure stands as the only conspicuous woody species with the grasses, 1,500 to 6,000 feet elevation, widely distributed. New Mexico: southern part from Tularosa Basin westward, north in Rio Grande drainage nearly to Albuquerque and north to Gila River drainage. Arizona: southern and central parts north to Salt River drainage in Gila County and Verde River drainage in Yavapai and southern Coconino Counties and west to Salome (Yuma County). Also in southwestern Texas and northern Mexico.

Soaptree yucca is very common and conspicuous on large areas of desert grassland in southern New Mexico, while related, trunkless species are characteristic of the short-grass plains in other parts of the State. Some very large soaptree yuccas up to 26 feet or more in height are preserved at Jornada Experimental Range, maintained by the Forest Service, in northern Dona Ana County, New Mexico. *Yucca* is the State flower of New Mexico.

Height growth in soaptree yucca is extremely slow, about 1 inch a year. Thus the tallest plants are 200 to 300 years old. When the long, slender or branched trunks lose balance and fall over, they may continue to grow for a time, but sprouts at their bases eventually replace them.

The name soapweed refers to the soapy material in the roots and trunks, which has been used as a substitute for soap. The leaves were employed by the Indians in making baskets and are a possible emergency source of coarse fiber. In drought periods the chopped



Soap-tree yucca.

Joshua-tree.

Schott's yucca.

stems have served as emergency food for cattle. On the ranges cattle relish the young flower stalks. Indians ate the flowers also. Small plants can be grown as ornamentals if carefully transplanted with sufficient roots. This species is planted along highways also.

JOSHUA-TREE (*Yucca brevifolia* Engelm.)

Also called Joshua-tree yucca. Botanical synonym: *Y. brevifolia* var. *jaegeriana* McKelvey.

Description: Picturesque or grotesque, narrow-leaved evergreen, small or medium-sized tree 15 to 30 feet (rarely 40 feet or more) in height, with short stout trunk 1 to 3 feet or more in diameter, with open broad crown of many stout, widely spreading or sometimes drooping branches forking at intervals of 2 to 3 feet, bearing at the ends clusters of spreading, grasslike leaves. **Leaves** many, long and narrow, 8 to 14 inches long (or as short as 4 inches in a form), $\frac{1}{4}$ to $\frac{1}{2}$ inch wide, stiff, flattened but keeled on outer surface, smooth or slightly rough, blue-green, ending in a short, sharp spine, the edges yellowish and bearing many minute sharp teeth. **Flower stalks** at ends of branches, 1 to $1\frac{1}{2}$ feet long, much branched and bearing flowers nearly to base. **Flowers** many, crowded in clusters, $1\frac{1}{2}$ to $2\frac{1}{2}$ inches long, greenish yellow, with unpleasant odor, from March to May. **Fruit** egg-shaped, $2\frac{1}{2}$ to 4 inches long and about 2 inches in diameter, green but becoming brown, fleshy, not splitting open, falling soon after maturity. Branches and small trunks covered with dead stiff leaves pressed downward; larger trunks corky, rough, deeply furrowed and cracked into plates, brown or gray. **Wood** lightweight, soft, spongy and pliable, light brown or whitish.

Distribution: The characteristic tree scattered or in "forests," on desert plains in the Mohave desert, 2,000 to 3,500 feet elevation, in northwestern Arizona; not in New Mexico. Arizona: north-

western part, in southwestern corner of Yavapai County, northern border of Yuma County, and southern and western Mohave County. Also in extreme southwestern corner of Utah, southern Nevada, and southern California.

Joshua-tree is the outstanding plant of the Mohave desert, which is located mostly in California and Nevada, and like the saguaro of southern and central Arizona has become a familiar symbol of deserts. Ranges of the two monarchs of the desert meet in Arizona at a few places near Bill Williams River in southern Mohave County. The Mormon pioneers a century ago gave to this species the name of Joshua, a leader of a desert people pointing the way to a new Promised Land or perhaps praying with uplifted arms.

These weirdly forking plants appear as if survivors of a primitive age. They probably are among the oldest living things in the desert, though not forming annual rings of wood by which age could be counted. Large trees perhaps are 200 to 300 years old, or older. A California giant more than 60 feet tall but no longer living was estimated to be 1,000 years old.

Extensive stands of Joshua-trees are preserved in the Joshua Tree National Monument of 1,289 square miles in southeastern California, with headquarters at Twentynine Palms. In Arizona, one of the most accessible localities is a large "forest" in southwestern Yavapai County westward along a road about 12 miles west of Congress Junction, which is on the highway between Phoenix and Prescott. Part of this area should be preserved as a State park.

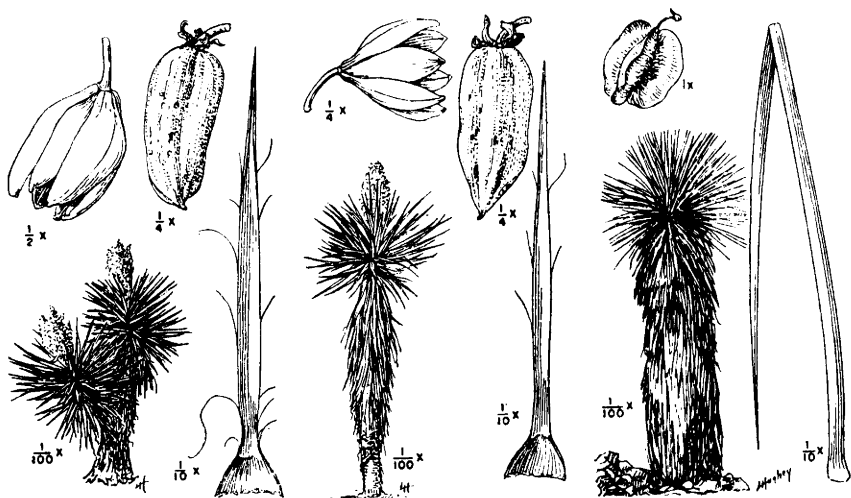
A smaller, more compact form usually only 9 to 12 feet tall and with shorter leaves mostly 4 inches long is found in the vicinity of Virgin River valley, Mohave County, in the extreme northwestern corner of Arizona, and westward in a smaller range than the typical form.

The spongy, fibrous wood has been used in manufacture of paper, for surgeons' splints, wrapping material and boxes, and novelties. However, if harvested extensively, these scattered, slowly growing desert giants would be decreased greatly in numbers.

SCHOTTS YUCCA (*Yucca schottii* Engelm.)

Also called mountain yucca, hoary yucca, Spanish bayonet, Spanish dagger.

Description: Narrow-leaved evergreen shrub or small tree 5 to 18 feet tall, with usually 2 or 3 trunks from base, the trunks unbranched or with 1 or 2 branches, often leaning slightly, bearing at the top a cluster of spreading bayonetlike leaves. **Leaves** many, very long and narrow, $1\frac{1}{2}$ to $2\frac{1}{2}$ feet or more in length, 1 to 2 inches wide, flat, leathery and flexible, blue-green, ending in a very short, sharp spine, the edges reddish and without teeth or threads. **Flower stalk** upright, 1 to $2\frac{1}{2}$ feet long, finely hairy, much branched and bearing flowers almost to base. **Flowers** many in large clusters, 1 to $1\frac{1}{2}$ inches long, white, from April to August. **Fruit** bananalike, 4 to 5 inches long and $1\frac{1}{2}$ to 2 inches in diameter, green, fleshy, not splitting open, falling before winter. **Trunk**



Mohave yucca.

Torrey yucca.

Bigelow nolina.

mostly covered with dead leaves, at base rough and scaly, with many horizontal leaf scars, reddish brown or gray.

Distribution: Slopes and canyons in oak woodland and rare in upper desert grassland, extending to a higher elevation than the other tree yuccas, 4,000 to 7,000 feet elevation, mountains along the Mexican border. New Mexico: mountains of extreme southwestern corner in southern Hidalgo County. Arizona: mountains of southeastern part, from Cochise and Greenlee Counties west to Santa Catalina Mountains in Pima and Pinal Counties and to Santa Cruz County. Also in Sonora, Mexico.

Schotts yucca is an attractive ornamental in cultivation. It was discovered by Arthur C. V. Schott (1814-75), German-American naturalist, who made large plant collections with the United States-Mexican Boundary Survey in the early 1850's.

MOHAVE YUCCA (*Yucca mohavensis* Sarg.)

Also called Spanish dagger. Botanical synonym: *Y. schidigera* Roehl.

Description: Narrow-leaved evergreen shrub or small tree 5 to 16 feet tall and 6 to 10 inches in trunk diameter, usually with few branches or unbranched, bearing at the top a cluster of widely spreading daggerlike leaves. **Leaves** many, very long and narrow, $1\frac{1}{2}$ to 2 feet (or sometimes 4 feet or more) in length, $\frac{3}{4}$ to $1\frac{1}{2}$ inches wide, stiff and stout, concave, broadest at the middle, yellow green, ending in a short, sharp spine, with many coarse threads along the edges. **Flower stalk** upright, $1\frac{1}{2}$ to $2\frac{1}{2}$ feet or more in length, projecting only slightly beyond the longest leaves, branched and bearing flowers almost to base. **Flowers** numerous, crowded in large clusters, $1\frac{1}{4}$ to 2 inches long, whitish or cream-colored and often purple-tinged, in March and April. **Fruit** 2 to 3

inches long and 1 to 1½ inches in diameter, fleshy, sweetish, and edible, not splitting open, falling before winter. **Trunk** covered with dead leaves or sometimes bare at base, furrowed and gray brown. **Wood** soft and spongy, lightweight, light brown.

Distribution: Rocky slopes and plains in desert, 1,000 to 3,500 feet elevation, northwestern Arizona; not in New Mexico. Arizona: northwestern part in Mohave desert west of Kingman, western Mohave County. Also in southern Nevada, southern California, and northern Lower California, Mexico.

TORREY YUCCA (*Yucca torreyi* Shafer)

Also called palma, Spanish bayonet, Spanish dagger. Botanical synonyms: *Y. baccata* Torr. var. *macrocarpa* Torr.; *Y. macrocarpa* (Torr.) Merriam, not Engelm.

Description: Narrow-leaved evergreen shrub or small tree 3 to 16 feet tall, with trunk usually single and usually unbranched, 6 to 8 inches in diameter, bearing at the top a cluster of spreading daggerlike leaves. **Leaves** many, very long and narrow, 2 to 3 feet or more in length, 1¼ to 2 inches wide, stiff and stout, concave, yellow green, ending in a short, sharp spine, with many whitish threads along the edges. **Flower stalk** upright, 3 to 4 feet, much branched and bearing flowers nearly to base. **Flowers** many in large clusters, large, 3 to 4 inches long, bell-shaped, cream-colored, in April or March. **Fruit** bananalike, 4 to 5½ inches long and 1¼ to 2 inches in diameter, fleshy, not splitting open, falling before winter. **Trunk** covered with living and dead leaves usually to base, or scaly and dark brown at base.

Distribution: Scattered on mesas, plains, and foothills in desert and desert grassland, 3,700 to 5,000 feet elevation, in a limited area of southeastern New Mexico; not in Arizona. New Mexico: southeastern part, from Texas boundary north to Carlsbad Caverns National Park in Eddy County and to Guadalupe Mountains and Tularosa in Otero County; also north from El Paso, Texas, to Las Cruces and vicinity in Dona Ana County, New Mexico. Also in southwestern Texas and Chihuahua, Mexico.

Though Torrey yucca is of restricted occurrence, a closely related, trunkless species, datil yucca (*Yucca baccata* Torr.) is common and widespread over most of New Mexico and Arizona. The large, fleshy, bananalike fruits of both species are eaten by the Indians fresh, roasted, or dried, while the leaves were used in basket making. Torrey yucca is easily transplanted and grown for ornament and has been used in landscaping along highways. It honors John Torrey (1796–1873), American botanist and chemist of Columbia University, who named many new species of plants from the Southwest.

BIGELOW NOLINA (*Nolina bigelovii* (Torr.) S. Wats.)

Variety: Parry nolina (*Nolina bigelovii* var. *parryi* (S. Wats.) L. Benson; botanical synonym, *N. parryi* S. Wats.).

Description: Narrow-leaved evergreen shrub or rarely small tree 4 to 16 feet tall, resembling yucca, with massive, unbranched

trunk 2 to 3 feet in diameter, bearing at the top a dense cluster of stiff, spreading, grasslike leaves and below mostly covered with old dead leaves. **Leaves** numerous, very long and narrow, 2 to 4½ feet long and ⅜ to ¾ inch wide, grasslike, stiff and leathery, with edges slightly rough (edges saw-toothed in the variety), separating into long fibers, in age straw-colored and hanging down against the trunk. **Flower stalk** upright, large, 3 to 8 feet or more in length, the upper half or two-thirds much branched and bearing very many small flowers ⅛ inch or more in length, white with greenish tinge, in June and July. **Seed capsule** about ½ inch in diameter, thin and membranous, 3-winged, with few seeds.

Distribution: Rocky hillsides and canyons in desert, 500 to 3,500 feet elevation; not in New Mexico. **Arizona:** western part, in Yuma, Mohave, and western Yavapai Counties and Grand Canyon, Cocino County. Also in southeastern California and in Baja California and Sonora, Mexico.

The variety *Parry nolina*, with leaf edges saw-toothed and with slightly larger flowers and fruits than the typical variety, occurs in Arizona as a shrub near Kingman and southward in Mohave County and is the common type in California.

Bigelow nolina is described in manuals as a shrub and until recent years was not known to reach tree size. However, Leslie N. Goodding has discovered in Tinajas Altas Mountains of Yuma County, southwestern Arizona, small trees of this species up to 15 feet in height and 3 feet in trunk diameter. Numbers of these oddly shaped desert trees with about the same maximum size are under protection in Joshua Tree National Monument, southeastern California. The large flower stalks with beautiful white flower clusters are visible from a distance as landmarks in the desert. This species is named for John M. Bigelow (1804–78), surgeon and botanist, who made large plant collections in the Southwest on Government surveys from 1850 to 1854.

Willow Family (Salicaceae)

NARROWLEAF COTTONWOOD (*Populus angustifolia* James)

Also called narrowleaf poplar, black cottonwood, mountain cottonwood.

Description: Medium-sized tree to 50 feet in height and 1½ feet in trunk diameter, with narrow crown and slender, erect branches. **Leaves** lance-shaped, usually 2 to 3 inches long or up to 6 inches on vigorous shoots, narrow and usually less than 1 inch wide, tapering and long-pointed, finely saw-toothed, thin but firm, not hairy, bright yellow-green above, paler beneath. **Flowers** of this genus male and female on different trees (dioecious), in long, narrow catkins, in early spring. **Seed capsules** in catkins 2½ to 4 inches long, with many cottony seeds. **Bark** smooth, light yellow-green, on large trunks becoming fissured and light gray brown. **Wood** lightweight, light brown with whitish sapwood.

Distribution: Common to abundant along streams in mountains, growing with willows and alders, ponderosa pine forest and pinyon-

juniper woodland zones, 5,000 to 7,000 feet elevation, widely distributed. New Mexico: mountains of southern, central, and northern parts, from White Mountains, Organ Mountains, Black Range and Mogollon Mountains northward; also common in San Juan valley, San Juan County. Arizona: mountains of eastern and central parts, west to Pima, Yavapai, and Coconino Counties. Widely distributed in Rocky Mountain region from southwestern Texas north to Black Hills of South Dakota, Montana, and Alberta, west to Washington, and south to Nevada and Arizona. Also in Chihuahua, Mexico.

Narrowleaf cottonwood, easily distinguished by its willowlike leaves, is planted as a shade tree in many places and is suitable for erosion control.

Lanceleaf cottonwood (\times *Populus acuminata* Rydb.), formerly thought to be a distinct species, is considered by Ernest Rouleau to be a hybrid of narrowleaf cottonwood with plains cottonwood (*Populus sargentii* Dode). This hybrid differs from narrowleaf cottonwood in its slightly broader, coarsely toothed, ovate leaves with longer leafstalks. It has been reported from various parts of New Mexico and Arizona but probably is uncommon in the Southwest and restricted to areas where the two parents meet, such as northeastern New Mexico. Some trees referred to as lanceleaf cottonwood may represent hybrids of narrowleaf cottonwood with other species having broad leaves.

QUAKING ASPEN (*Populus tremuloides* Michx.)

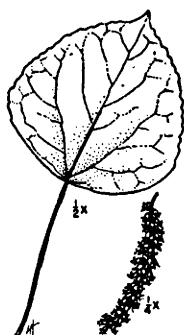
Also called aspen, golden aspen, quaking asp, trembling poplar. Botanical synonyms: *P. tremuloides* var. *aurea* (Tidestr.) Daniels, *P. aurea* Tidestr.

Description: Small to medium-sized tree usually less than 40 feet in height and 1 foot in trunk diameter, rarely 80 feet tall and 2½ feet in diameter, with slender, rounded crown of thin foliage. **Leafstalks** 1¼ to 3 inches long, slender, and flattened. **Leaf blades** nearly round, 1¼ to 3 inches long, short-pointed, rounded at base, finely saw-toothed, shiny green above, dull green beneath, turning golden or orange in autumn before falling. **Seed capsules** in catkins, with many cottony seeds. **Bark** smooth, thin, whitish or yellowish, on very large trunks becoming thick, furrowed, and dark gray. **Wood** soft and brittle, lightweight, light brown with very thick whitish sapwood.

Distribution: Common and widely distributed in upper part of ponderosa pine forest, Douglas-fir forest, and spruce-fir forest in high mountains and plateaus, on cool, shaded mountain slopes, in canyons, and along streams, often forming pure stands or groves, 6,500 to 10,000 feet elevation. New Mexico: western two-thirds, on all the higher mountains. Arizona: high mountains and plateaus in northeastern half, from Chiricahua Mountains west to Pima and Mohave Counties and Kaibab Plateau. Range very broad, one of the most extensive of all native North American trees, from Labrador across Canada to Alaska, in northeastern United States south to West Virginia and Missouri, and south in Rocky Moun-



Narrowleaf
cottonwood.



Quaking aspen.



Fremont cottonwood.



Rio Grande
cottonwood.

tains and mountains of Pacific coast region to California, Arizona, southwestern Texas, and northern Mexico.

Quaking aspen is so named because the slender, flattened leafstalks enable the leaves to tremble in the slightest breeze. The soft smooth whitish bark, which is favored by persons carving initials on trees, makes identification easy. The form in western United States, characterized largely by the deeper, golden color of autumn foliage, is considered by some botanists as varietally distinct.

Aspens are pioneer trees on burned areas, forming thickets of short-lived trees afterwards replaced by conifers. Propagation is chiefly from root sprouts. The wood has been used in the Southwest in manufacture of excelsior and elsewhere also for pulpwood, boxes and crates, food containers, and matches. Domestic livestock and deer browse the foliage within reach.

FREMONT COTTONWOOD (*Populus fremontii* S. Wats.)

Also called Fremont poplar, alamo.

Description: Large tree 50 to 100 feet tall, with trunk 2 to 4 feet or more in diameter, often leaning, and with broad, flat, open crown of large branches. **Leafstalks** long slender, flattened. **Leaf blades** broadly triangular, 2 to 2¾ inches long and 2¼ to 3 inches wide, short-pointed, nearly straight across base, coarsely and irregularly saw-toothed, thick and leathery, usually not hairy, shiny yellow green, turning yellow in autumn. **Seed capsules** in catkins 4 to 5 inches long, with the stalks less than ¼ inch long, the egg-shaped capsules ¼ to ½ inch long, with many cottony seeds. **Bark** gray or brown, thick, rough and deeply furrowed. **Wood** light brown with whitish sapwood, soft, lightweight, brittle.

Distribution: Common along streams and in moist soils of desert, desert grassland, and woodland zones, often associated with Arizona sycamore, willows, and alders, 150 to 6,000 feet elevation. New Mexico: southwestern part, in Gila River drainage. Arizona: along streams almost throughout, except in northeastern part and at high elevations. Southwestern New Mexico northwest to southwestern Utah, Nevada, and California, south to Arizona and northern Mexico.

This species, the cottonwood of the desert zone in Arizona, is planted extensively as a shade tree and along irrigation ditches. Like other cottonwoods, it is easily propagated from cuttings and rapidly growing but short-lived. The wood is used as fuel and for temporary fence posts but is not durable. Fremont cottonwood is common at Grand Canyon, where it is the only large tree in the lower depths and where its green coloring is visible to visitors on the rims above.

RIO GRANDE COTTONWOOD (*Populus wislizeni* (S. Wats.) Sarg.)

Also called Wislizenus cottonwood, valley cottonwood, Rio Grande poplar, alamo. Botanical synonym: *P. fremontii* S. Wats. var. *wislizeni* S. Wats.

Description: Large tree 40 to 100 feet tall and 2 to 4 feet or more in trunk diameter, with flat, widely spreading crown of large branches. **Leafstalks** long, slender, flattened. **Leaf blades** broadly triangular, 2 to 2½ inches long and about 3 inches wide or sometimes larger, abruptly short-pointed, straight across base, coarsely and irregularly saw-toothed, thick and leathery, shiny yellow green, turning yellow in autumn. **Seed capsules** in catkins 3½ to 5 inches long, the long stalks ½ to ¾ inch long and longer than the narrow capsules, with many cottony seeds. **Bark** thick, deeply furrowed into broad flat ridges, light gray. **Wood** soft, lightweight, brittle, yellowish brown with whitish sapwood.

Distribution: Common along the larger streams in desert, desert grassland, and woodland zones, 3,800 to 6,000 feet elevation; not in Arizona. New Mexico: western half, from Tularosa Basin north and west, chiefly in Rio Grande drainage northward across the State and in San Juan drainage in northwestern corner, forming extensive woodlands or "bosques" on the broad, sandy flood plains of these two rivers. From southwestern Texas northwest across New Mexico to Colorado and in northern Mexico.

Rio Grande cottonwood, as its name suggests, is the "valley cottonwood" of New Mexico and one of the most common shade trees in the State and is widely planted along irrigation ditches. The wood is used for fuel, temporary fence posts, and rafters of buildings.

PLAINS COTTONWOOD (*Populus sargentii* Dode)

Also called plains poplar.

Description: Large tree 60 feet or more in height and 2 to 4 feet or more in trunk diameter, with broad open crown of large branches. **Leafstalks** long, slender, flattened. **Leaf blades** ovate, 3 to 4 inches long and broad, long-pointed, coarsely saw-toothed with curved teeth, light green, shiny. **Seed capsules** in catkins 4 to 8 inches long, very short-stalked, with many cottony seeds. **Bark** thick, deeply furrowed into broad flat ridges, light gray. **Wood** soft, lightweight, brown with whitish sapwood.

Distribution: Along streams in short grass plains, 4,000 to 6,000 feet elevation; not in Arizona. New Mexico: plains in northeastern



Plains cottonwood.

Pacific willow.

Whiplash willow.

Red willow.

part. Great Plains region, from northwestern Texas north to central Kansas, North Dakota, and Saskatchewan, west to Alberta and Montana, and south to eastern Colorado and northeastern New Mexico.

PACIFIC WILLOW (*Salix lasiandra* Benth.)

Also called western black willow, yellow willow.

Description: Shrub or small tree, rarely to 40 feet or more in height. Twigs relatively stout, purple or reddish brown or in early spring bright yellow, hairy when young but becoming hairless and shiny. Leaves lance-shaped, 2 to 5 inches long and $\frac{1}{2}$ to 1 inch wide, long-pointed, mostly rounded at base, edges finely saw-toothed with yellowish gland-tipped teeth, thick and slightly leathery, dark green and very shiny above, paler or whitish beneath, hairless. Flowers of this and other willows male and female on different trees (dioecious), in long, narrow, upright, greenish catkins, in early spring. Catkins on leafy stalks, 2 to 4 inches long at maturity. Seed capsules hairless, with many cottony seeds. Bark fissured, dark brown. Wood brittle, pale brown.

Distribution: Shrubby willow forming clumps along mountain streams in ponderosa pine forest, 5,000 to 7,500 feet elevation. New Mexico: common in mountains of western and northern parts from Mogollon Mountains northward to Sangre de Cristo Range. Arizona: eastern part in White Mountains and Tonto Basin (Gila County). New Mexico north to Wyoming, Saskatchewan, Yukon, and Alaska, and south to southern California and Arizona.

Whiplash willow (*Salix caudata* (Nutt.) Heller var. *bryantiana* Ball & Bracelin) is related to Pacific willow, but this variety is distinguished by the bright yellow or orange twigs always hairless and by the very long-pointed, lance-shaped leaves green on both sides. It is a tall bushy shrub which may not reach tree size in the Southwest, where it apparently is uncommon in ponderosa pine forest of northern New Mexico south to Santa Fe. Reported from eastern Arizona at Springerville (Apache County). This species is distributed from New Mexico north to southern Alberta, west to southern British Columbia, and south to California and Arizona.

RED WILLOW (*Salix laevigata* Bebb)

Also called polished willow.

Description: Small or medium-sized tree to 40 feet in height and 2 feet in trunk diameter. **Twigs** yellow to reddish brown. **Leaves** lance-shaped or oblong lance-shaped, 2 to 6 inches long and $\frac{3}{4}$ to $1\frac{1}{2}$ inches wide, short-pointed, edges slightly turned under and obscurely saw-toothed, without hairs at maturity, dark green and shiny above, paler beneath. **Catkins** 2 to 4 inches long on leafy twigs in March. **Seed capsules** long-stalked, hairless with many cottony seeds. **Bark** furrowed into irregular scaly ridges, dark brown. **Wood** soft, lightweight, brittle, light reddish brown with whitish sapwood.

Distribution: Uncommon along streams in oak woodland and pinyon-juniper woodland and sometimes desert zone, 1,800 to 5,000 feet elevation; not in New Mexico. Arizona: scattered over the State from Huachuca Mountains and Pinal Mountains northwest to Prescott, Grand Canyon, and Beaver Dam in northwestern Mohave County. Arizona and southern Utah, west to northern California, and south to Lower California, Mexico.

BONPLAND WILLOW (*Salix bonplandiana* H. B. K.)

Also called Toumey willow. Botanical synonym: *S. bonplandiana* var. *toumeyii* (Britton) Schneid.

Description: Small or medium-sized tree 20 to 50 feet in height and 1 to 3 feet in trunk diameter, with broad, rounded crown. **Twigs** slender, red or purple, hairless. **Leaves** narrowly lance-shaped, 4 to 6 inches long and $\frac{1}{2}$ to $\frac{3}{4}$ inch wide, long-pointed, broadest near middle and tapering to base, edges inconspicuously fine-toothed or without teeth, green and shiny above, whitish beneath, without hairs at maturity, shedding irregularly in winter. **Catkins** leafy-stalked, about $1\frac{1}{2}$ inches long. **Seed capsules** reddish yellow, hairless, with many cottony seeds. **Bark** rough and fissured or checkered, dark gray or nearly black.

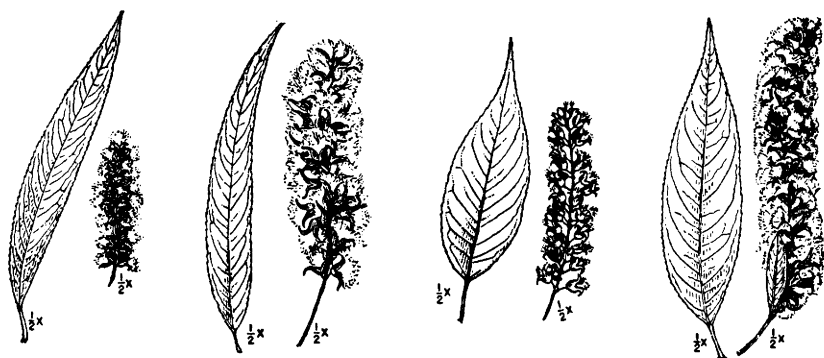
Distribution: Along streams in upper desert, desert grassland, and oak woodland, 2,500 to 5,000 feet elevation, chiefly near Mexican border. New Mexico: extreme southwestern corner, in southern Hidalgo County. Arizona: common in southeastern and central parts, from Cochise and Greenlee Counties west and northwest to Santa Cruz, Pima, Gila, and Yavapai Counties. Also south through Mexico to Guatemala.

Bonpland willow is one of the common tree willows in southeastern Arizona. It was named for Aimée Bonpland (1773–1858), of France and afterwards South America, who made large botanical collections on an expedition with Alexander von Humboldt from 1799 to 1804 to various Spanish colonies in the New World.

GOODDING WILLOW (*Salix gooddingi* Ball)

Also called Dudley willow, western black willow. Botanical synonym: *S. nigra* Marsh. var. *vallicola* Dudley.

Description: Medium-sized tree 20 to 50 feet in height and 2 to 3 feet in trunk diameter, with broad rounded crown. **Twigs** yellowish,



Bonpland willow. Goodding willow. Peachleaf willow. Wright willow.

often slightly hairy. Leaves narrowly lance-shaped and often slightly curved, 2 to 4 (to 6) inches long and $\frac{1}{4}$ to $\frac{3}{4}$ inches wide, long-pointed, broadest at base, finely saw-toothed, green or yellowish green on both sides, usually hairless at maturity. Catkins 2 to $3\frac{1}{2}$ inches long on leafy twigs, in March. Seed capsules not crowded, usually hairless, with many cottony seeds. Bark thick, rough, deeply furrowed with narrow ridges, gray.

Distribution: Common along streams in the desert, desert grassland, and oak woodland, 150 to 5,000 feet elevation. New Mexico: southern part, from Eddy and Chaves Counties westward, north along Rio Grande drainage to Bernalillo in central part and in Gila River drainage. Arizona: widely distributed, especially in southern and central parts and along Colorado River to Grand Canyon in northern part; forming dense forests with Fremont cottonwood on flood plains of lower Colorado and Gila Rivers in southwestern part. West central Texas northwest across New Mexico and Arizona to southern Utah, southern Nevada, and northern California, and south to northern Mexico.

Goodding willow, the largest willow in Arizona, is important for stream-bank protection because of its deep root system. It honors Leslie N. Goodding, botanist of the United States Department of Agriculture, who has made extensive plant collections and many interesting botanical discoveries in the Southwest.

PEACHLEAF WILLOW (*Salix amygdaloides* Anderss.)

Also called peach willow, almond willow. Variety: Wright willow (*S. amygdaloides* var. *wrightii* (Anderss.) Schneid.; also called Wright peachleaf willow, southwestern peach willow; botanical synonym, *S. wrightii* Anderss.).

Description: Small tree to 30 feet tall and 1 foot or more in trunk diameter, with spreading crown. Twigs slender, often slightly drooping at tip, yellowish or older twigs gray, hairless. Leaves lance-shaped, 2 to 4 (to $7\frac{1}{2}$) inches long and $\frac{5}{8}$ to $1\frac{1}{4}$ (to $1\frac{3}{4}$) inches wide, long-pointed at apex, short-pointed or rounded at base, hairless at maturity, yellow green above but whitish to white beneath; leaves in the variety Wright willow (var. *wrightii*) very narrowly lance-shaped, $2\frac{1}{2}$ to 3 (to 4) inches long and less than $\frac{3}{8}$ inch

(rarely $\frac{1}{2}$ inch) wide, long-pointed at apex and sharply short-pointed at base. **Catkins** 2 to 3 inches long on leafy twigs. **Seed capsules** long-stalked, hairless, with many cottony seeds. **Bark** rough and furrowed, gray or brown.

Distribution: Along streams in short grass, desert, desert grassland, and pinyon-juniper woodland, 3,000 to 7,000 feet elevation. New Mexico: the typical form is common in northern half, extending down Pecos River and Rio Grande drainages to southern border; the variety Wright willow in Curry County on eastern border and on Rio Grande drainage in Dona Ana County at southern border. Arizona: apparently rare in eastern part, the typical form collected in Tunitcha Mountains (Apache County) and Rincon Mountains (Pima County). Peachleaf willow, including the variety, is widely distributed from southeastern Quebec and New York, west to southeastern British Columbia and Washington, and south to Arizona, western Texas, and northern Mexico. Wright willow is restricted to western and southwestern Texas, New Mexico, and adjacent northern Mexico.

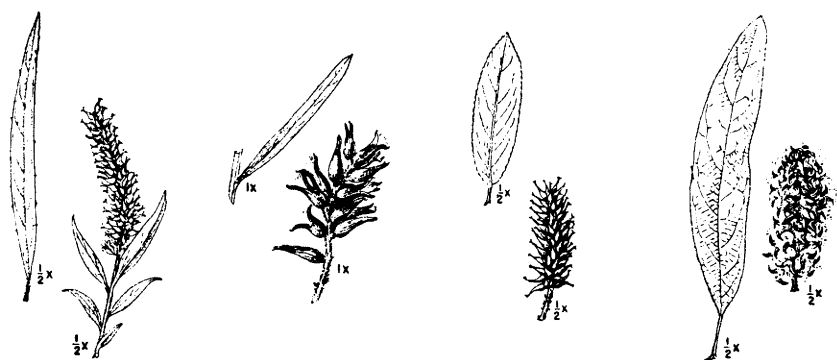
Wright willow (*Salix amygdaloides* var. *wrightii* (Anderss.) Schneid.) is a doubtfully distinct southwestern variety of peachleaf willow, differing from the widespread typical form in its narrower leaves with bases sharply short-pointed (rather than rounded in part) and in slightly shorter leafstalks.

COYOTE WILLOW (*Salix exigua* Nutt.)

Also called sandbar willow, acequia willow, basket willow. Includes two southwestern varieties: *S. exigua* var. *stenophylla* (Rydb.) Schneid. and *S. exigua* var. *nevadensis* (S. Wats.) Schneid.

Description: Usually a shrub 6 to 15 feet tall with clustered stems or rarely treelike, forming thickets. Twigs yellowish and more or less silvery- or gray-hairy. **Leaves** almost stalkless, very narrow, linear or narrowly lance-shaped, $1\frac{1}{2}$ to 3 (or 4) inches long and $\frac{1}{8}$ to $\frac{1}{4}$ (or $\frac{3}{8}$) inch wide, short-pointed at both ends, without teeth or with few minute teeth, densely silvery-hairy or silky on both sides (var. *stenophylla*), or silvery-hairy while unfolding but soon becoming nearly hairless and yellow green (var. *nevadensis*), or gray-green and more or less densely gray-hairy on both sides (typical form). **Catkins** on leafy twigs, 1 to 2 inches long. **Seed capsules** hairless or nearly so, with many cottony seeds. **Bark** smooth or becoming rough and fissured at base of large trunks, gray. **Wood** soft, lightweight, light brown.

Distribution: Common in moist sandy soil along streams in the desert, desert grassland, pinyon-juniper and oak woodlands, and lower ponderosa pine forest, forming dense thickets on sand bars, shores, and washes, from slightly above sea level to 7,000 feet elevation, widely distributed. New Mexico: lower mountains nearly throughout western two-thirds but absent from plains of eastern part; abundant along Rio Grande. Arizona: almost throughout. This species with its varieties is widely distributed in the Rocky Mountain, Great Basin, and desert regions of the West, from



Coyote willow.

Yewleaf willow.

Yellow willow.

Arroyo willow.

southwestern Texas north to South Dakota and Alberta, west to British Columbia, and south to California, Arizona, and Mexico.

Coyote willow is the common, thicket-forming shrubby willow in the Southwest. In New Mexico and Arizona the characteristic variety of this very widespread and variable species has silvery-hairy leaves and twigs (var. *stenophylla*). The variety with yellow-green leaves nearly hairless at maturity (var. *nevadensis*) is found in northern New Mexico and nearly throughout Arizona, while the typical form with less narrow gray-hairy leaves to $\frac{3}{8}$ inch or more in width is rare in this region and more common northward.

This species is drought-resistant and especially suitable for planting on stream bottoms to prevent surface erosion. The foliage is excellent browse. The twigs and bark have been used in basket making by Indians and others, as the local name basket willow suggests. However, this is not one of the important basket willows of commerce.

Sandbar willow (*Salix interior* Rowlee), a closely related species, is represented by a shrubby variety (var. *angustissima* (Anderss.) Dayton) at the southeastern border of New Mexico. This variety is distinguished from coyote willow by the narrow leaves with edges sharply fine-toothed, silvery-silky on both sides when young but becoming nearly hairless except for hairs remaining on midrib beneath. This widely ranging species extends from Virginia and southern Canada west to Alaska and south in Great Plains to Texas and adjacent Mexico.

YEWLEAF WILLOW (*Salix taxifolia* H. B. K.)

Also called yew willow.

Description: Large shrub or small to medium-sized tree 20 to 40 feet tall, with a trunk up to 2 feet in diameter and with a dense, compact, rounded crown. **Twigs** much branched, slender, densely white- or silvery-hairy the first year, afterwards gray. **Leaves** very small and densely crowded, very narrow, yewlike, almost stalkless, $\frac{1}{2}$ to $1\frac{1}{4}$ inches long and about $\frac{1}{8}$ inch wide, short-pointed, the edges usually without teeth, densely silvery-hairy when young and becoming gray-hairy. **Catkins** at the end of

short leafy twigs, very short, about $\frac{1}{2}$ inch long, in March and sometimes again in autumn. **Seed capsules** stalkless, hairy, with many cottony seeds. **Bark** rough and fissured, light gray-brown.

Distribution: Infrequent along streams and washes in foothills and mountains, oak woodland and rarely in desert and desert grassland, 3,500 to 6,000 feet elevation, limited to Mexican border region. New Mexico: extreme southwestern corner, in southern Hidalgo County. Arizona: southeastern part, in Cochise, Santa Cruz, and eastern Pima Counties. Also in southwestern Texas and in Mexico.

Yewleaf willow is a good soil binder, fairly drought-resistant, and excellent browse for livestock but grows slowly. It should make an attractive ornamental.

YELLOW WILLOW (*Salix lutea* Nutt.)

Description: Usually a shrub with clustered stems and perhaps not a tree in the Southwest. **Twigs** yellow and hairless. **Leaves** lance-shaped or broadly so, 1 to 3 inches long, short-pointed, rounded at base, edges finely saw-toothed, thin, generally light green above, paler and whitish beneath, hairless or nearly so. **Catkins** almost stalkless. **Seed capsules** hairless, with many cottony seeds.

Distribution: Uncommon along mountain streams in woodland and ponderosa pine forest, 3,800 to 6,500 feet elevation. New Mexico: White Mountains and northern part of State. Arizona: northeastern part from Apache County to Coconino and Yavapai Counties. New Mexico north to Saskatchewan, west to British Columbia and south to California and Arizona.

Strapleaf willow (*Salix ligulifolia* (Ball) Ball; botanical synonym, *S. lutea* var. *ligulifolia* Ball), a shrub with clustered stems 3 to 10 feet tall is related to yellow willow and more common in the Southwest. From the latter, strapleaf willow is distinguished by the twigs brown to dark brown and often more or less hairy and by the narrower, strap-shaped or narrowly lance-shaped leaves 2 to 4 inches long, dark green above. It is distributed in the ponderosa pine forest at elevations of 5,000 to 7,000 feet, in New Mexico in mountains of northeast corner and western two-thirds south to White Mountains and Mogollon Mountains and in eastern Arizona west to Flagstaff. Also from New Mexico north to Black Hills and Wyoming and west to California.

ARROYO WILLOW (*Salix lasiolepis* Benth.)

Also called white willow.

Description: Usually a shrub with clustered stems but sometimes a small tree to 30 feet in height, with slender erect branches forming a narrow, irregular crown. **Twigs** yellow to brown, finely hairy when young. **Leaves** very narrow, linear to narrowly oblanceolate, $2\frac{1}{2}$ to 4 (to 6) inches long and $\frac{3}{8}$ to $\frac{3}{4}$ inch wide, short-pointed, edges without teeth or slightly wavy with a few inconspicuous teeth, thick and leathery, dark green above, beneath paler or whitish, becoming nearly hairless. **Catkins** almost stalkless, about $2\frac{1}{2}$ inches long, densely hairy, in March. **Seed capsules**

crowded, dark green, hairless, with many cottony seeds. **Bark** smooth, gray brown, on larger trunks becoming rough, fissured into broad ridges, and darker. **Wood** soft, lightweight, brittle, light brown with thick whitish sapwood.

Distribution: Along streams in mountains often with Arizona alder and Arizona sycamore, 6,000 to 7,500 feet elevation. New Mexico: mountains of southwestern part from Organ Mountains to Mogollon Mountains. Arizona: mountains of eastern part from Cochise and Pima Counties to Apache and Coconino Counties. Southwestern Texas to Arizona, north to Idaho and Washington, and south to California. Also in northern Mexico.

SCOULER WILLOW (*Salix scouleriana* Barratt)

Also called mountain willow, black willow, fire willow.

Description: Large shrub or rarely a small tree to 4 inches in trunk diameter, with compact rounded crown. **Twigs** stoutish, yellow and densely hairy when young. **Leaves** obovate or elliptical, $1\frac{1}{2}$ to 4 inches long and $\frac{1}{2}$ to $1\frac{1}{2}$ inches wide, rounded or short-pointed at apex, tapering toward base, edges without teeth or slightly wavy, thick and firm, yellow-green and nearly hairless above, beneath whitish and more or less white- or gray-hairy or furry, or becoming rusty hairy in age. **Catkins** stalkless or nearly so, at maturity 1 to 2 inches long, stout and dense. **Seed capsules** long, slender, gray-woolly, with many cottony seeds. **Bark** thin, divided into broad flat ridges, dark brown. **Wood** soft, lightweight, light brown tinged with red and with thick whitish sapwood.

Distribution: Local and uncommon along streams in high mountains, ponderosa pine and Douglas-fir forests, 8,000 to 10,000 feet elevation. New Mexico: high mountains of western two-thirds and northeast corner, from Sacramento Mountains, Black Range, and Mogollon Mountains northward. Arizona: known from Santa Catalina, White, Lukachukai, and San Francisco Mountains and Grand Canyon. Widely distributed in western North America, especially in mountains, from New Mexico north to Black Hills, Montana, Saskatchewan, Yukon, and Alaska, and south to California and Arizona.

Scouler willow is called fire willow because it rapidly occupies burned areas in the forests. Unlike most willows, it can grow in the shade of larger trees. This is an important browse species for sheep and cattle where sufficiently common. In the Pacific States it has been planted occasionally for shade and ornament. Scouler willow is named for its discoverer, John Scouler (1804-71), Scotch naturalist who made a voyage to northwestern America in 1825.

BEBB WILLOW (*Salix bebbiana* Sarg.)

Also called beaked willow. Botanical synonym: *S. rostrata* Richards., not Thuill.

Description: Usually a much-branched shrub or a small bushy tree to 15 feet in height, forming clumps or growing singly. **Twigs** slender, branching at wide angles, yellowish to brown, gray-hairy when young but afterward hairless. **Leaves** elliptical, oblong, or reverse lance-shaped, usually small, 1 to $3\frac{1}{2}$ inches long and $\frac{3}{8}$ to

1 inch wide, pointed at both ends or broad at base, edges without teeth or somewhat wavy, thick and firm, dull green above, whitish and roughly net-veined beneath, more or less whitish hairy on both sides but becoming less hairy with age. **Catkins** on short leafy twigs, at maturity 1 to 3 inches long and loose. **Seed capsules** long-stalked, long, very slender, and hairy, with many cottony seeds. **Bark** thin and slightly fissured, reddish. **Wood** lightweight, brittle.

Distribution: Moist soils, chiefly along mountain streams in ponderosa pine, Douglas-fir, and spruce-fir forests, 8,500 to 11,000 feet elevation. New Mexico: high mountains of western two-thirds and northeast corner, from White and Mogollon Mountains northward. Arizona: high mountains and plateaus of eastern and northern parts, from White Mountains northwest to San Francisco Mountain and Grand Canyon. Widely distributed from Newfoundland and Labrador across Canada to Alaska, south in mountains of western United States to California, Arizona, and New Mexico and south in northeastern States to Nebraska and New Jersey.

Bebb willow has been suggested for stream planting at high altitudes. In other regions, where the trees become larger, the wood has been used for baseball bats, charcoal, and gunpowder. The twigs have been employed in making furniture and baskets. This species honors Michael S. Bebb (1833-95), American specialist on willows.

Walnut Family (Juglandaceae)

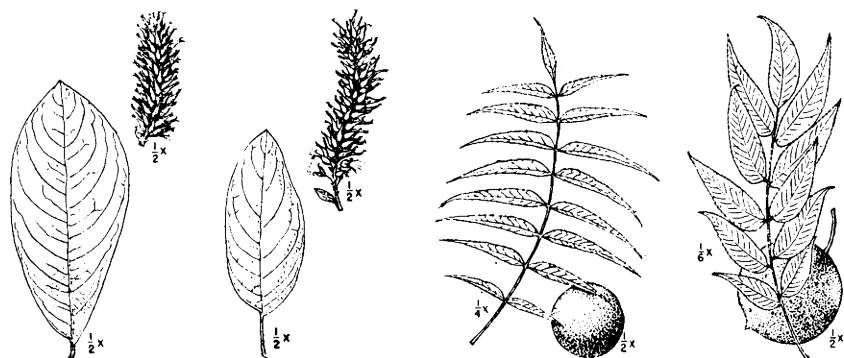
LITTLE WALNUT (*Juglans microcarpa* Berland.)

Also called Texas black walnut, nogal. Botanical synonym: *J. rupestris* Engelm.

Description: Large branching shrub or small tree 10 to 20 feet tall and $\frac{1}{2}$ to $1\frac{1}{2}$ feet in trunk diameter, usually branching at or near ground, with broad rounded crown. **Twigs** reddish brown, densely hairy when young, becoming ashy gray. **Leaves** pinnately compound, 8 to 13 inches long, with characteristic walnut odor. **Leaflets** usually 17 to 23 (sometimes as few as 13), narrowly lance-shaped, 2 to 3 inches long and about $\frac{1}{2}$ inch wide, long-pointed, usually slightly curved, edges finely saw-toothed or almost without teeth, thin, becoming hairless or nearly so, yellow green. **Flowers** of this and the next species greenish, male in narrow hanging clusters and female few together, in spring. Walnut **fruit** spherical, $\frac{1}{2}$ to $\frac{3}{4}$ inch in diameter, with thin, hairy, brown husk, thick hard shell, and small edible kernel. **Wood** hard, heavy, chocolate brown with thick whitish sapwood.

Distribution: Scattered along streams in plains and foothills desert zone, 3,000 to 4,000 feet elevation; not in Arizona. New Mexico: southeastern part, common along Pecos River and tributaries west to Guadalupe and Sacramento Mountains. Southern and western Texas to western Oklahoma, southeastern New Mexico, and northern Mexico.

This species has the smallest nuts of all the walnuts, suggesting marbles in size.



Scouler willow.

Bebb willow.

Little walnut.

Arizona walnut.

ARIZONA WALNUT (*Juglans major* (Torr.) Heller)

Also called Arizona black walnut, nogal. Botanical synonym: *J. rupestris* Engelm. var. *major* Torr.

Description: Small to medium-sized tree 30 to 50 feet tall and 1 to 2 feet (rarely 4 feet) in trunk diameter, with rounded crown of widely spreading branches. **Twigs** reddish brown, densely hairy when young, becoming ashy gray. **Leaves** pinnately compound, 7 to 14 inches long, with characteristic strong walnut odor. **Leaflets** usually 9 to 13 (rarely to 19), lance-shaped or broadly lance-shaped, 2 to 4 inches long and $\frac{1}{4}$ to $1\frac{1}{2}$ inches wide, long-pointed, often slightly curved, edges coarsely saw-toothed, thin, scurfy-hairy when young but becoming hairless or nearly so, yellow green. **Walnut fruit** almost spherical, 1 to $1\frac{1}{2}$ inches in diameter, with thin, densely hairy, brown husk, thick hard shell, and small edible kernel. **Bark** on small trunks smoothish and fissured, on large trunks thick, deeply furrowed and ridged, grayish brown. **Wood** hard, heavy, chocolate brown with thick whitish sapwood.

Distribution: Scattered along streams and canyons, mostly in mountains, in upper part of desert, desert grassland, and oak woodland zones, often with Fremont cottonwood, Arizona sycamore, Arizona alder, and willows, 3,500 to 7,000 feet elevation. New Mexico: mountains of southwestern quarter from Black Range and Magdalena Mountains westward. Arizona: widely distributed in mountains of southeastern and central parts west to Baboquivari Mountains and northwest below Mogollon Rim to southern Coconino County, Yavapai County, and Hualpai Mountains; Havasu Canyon at Grand Canyon. Also in northern Mexico.

The small, thick-shelled walnuts, known in Spanish as nogales, are often gathered and eaten by the local residents. The trees are planted for shade. Enlarged burls and stumps at the base of some tree trunks are prized for the beautiful patterns of their wood and are manufactured into table tops and veneer. The wood is suitable for the same uses as black walnut, such as furniture, cabinets, and gunstocks, and has been cut in small quantities for cabinetmaking. However, the supply is limited, scattered, and not easily accessible, and the trees generally are small. The wood is durable and is used locally for fence posts.

Birch Family (Betulaceae)

KNOWLTON HOPHORNBEAM (*Ostrya knowltoni* Cov.)

Also called western hophornbeam. Botanical synonym: *O. baileyi* Rose (also called Bailey hophornbeam).

Description: Shrub or small slender tree 10 to 40 feet tall and 6 inches in trunk diameter. Young twigs brown, hairy and with glandular hairs. Leaves elliptic to ovate, 1 to 2½ inches long, short-pointed or rounded at apex, usually rounded or slightly heart-shaped at base, edges sharply and doubly saw-toothed, dark yellow green and slightly hairy above, paler and soft hairy beneath. Male and female flowers in catkins in April. Fruit conelike, 1 to 1½ inches long and ¾ inch broad, of baglike, papery bracts, each enclosing a nutlet ¼ inch long. Bark thin, fissured and peeling off in long flakes, gray. Wood hard, light reddish brown.

Distribution: Very local in moist canyons, oak woodland, pinyon-juniper woodland, and lower ponderosa pine forest zones, 4,200 to 7,000 feet elevation. New Mexico: known only from Guadalupe and Sacramento Mountains in southeastern part. Arizona: known only from Coconino County in northern part at Oak Creek Canyon and at Grand Canyon, where it is common below both rims. Also in southwestern Texas and southeastern Utah.

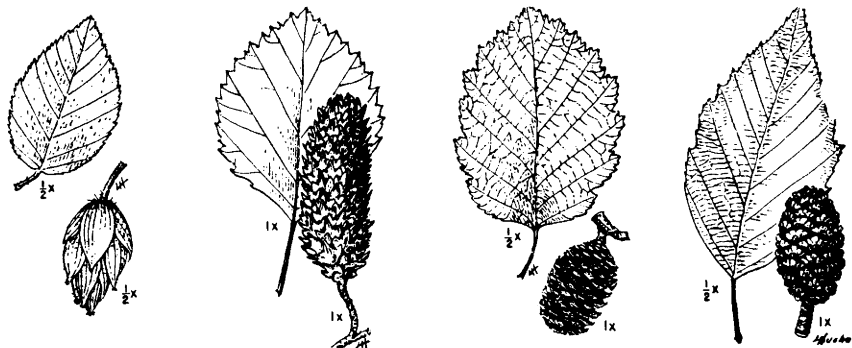
As the common name suggests, the bladderly fruit resembles that of hops. Knowlton hophornbeam is the only representative of its genus in western United States but another species, eastern hophornbeam (*Ostrya virginiana* (Mill.) K. Koch), is widely distributed in the eastern half of the country. The plants of southeastern New Mexico and adjacent Texas are slightly intermediate between the eastern and western species and have been considered also as distinct. Frank H. Knowlton (1869–1926), American botanist and paleobotanist of the United States Geological Survey, discovered this species at Grand Canyon in 1889.

WATER BIRCH (*Betula occidentalis* Hook.)

Also called red birch, black birch. Botanical synonym: *B. fontinalis* Sarg.

Description: Small tree or large shrub to 25 feet in height and 8 inches in trunk diameter, with finely branched, spreading, open crown. Twigs often drooping, slender, covered with resinous glands, light green when young but becoming dark red brown. Leaves ovate, 1 to 2 inches long, short- or long-pointed, usually rounded at base, sharply and often doubly saw-toothed, thin, dark green above, beneath pale yellow green and shiny and covered with resin dots. Male and female flowers in catkins in early spring. Fruit of erect or hanging cylindrical cones 1 to 1¼ inches long and ½ thick, slightly hairy, with many small winged nutlets. Bark smooth, shiny, copper colored, with conspicuous pale brown horizontal lines (lenticels). Wood soft, light brown.

Distribution: Along streams in mountains, often forming thickets, pinyon-juniper woodland and ponderosa pine forest zones, 5,000 to 8,000 feet elevation. New Mexico: mountains of northwestern



Knowlton hophornbeam. Water birch. Thinleaf alder. Arizona alder.

part. Arizona: northeastern part, from Lukachukai and Tunitcha Mountains (Apache County) west to Kaibab Plateau. New Mexico north to Black Hills and Saskatchewan, west to British Columbia, and south to northern California and Arizona.

Water birch is the only native birch in the Southwest.

THINLEAF ALDER (*Alnus tenuifolia* Nutt.)

Also called mountain alder.

Description: Large shrub or small tree to 30 feet tall, with usually several trunks up to 6 inches or more in diameter spreading from the base, and with rounded crown. **Leaves** ovate or oblong, 2 to 4 inches long, short-pointed at apex, rounded, straight, or slightly heart-shaped at base, edges doubly saw-toothed and slightly lobed, thin, dark green and hairless above, beneath pale yellow green and hairless or slightly hairy. **Male and female flowers** in catkins in early spring. **Fruit** of cones $\frac{3}{8}$ to $\frac{1}{2}$ inch long, with hard black scales and many small nutlets, remaining on tree in winter. **Bark** on small trunks, thin and grayish but becoming scaly and reddish brown. **Wood** light brown.

Distribution: Along streams and canyons mostly in mountains, often forming thickets on stream banks, ponderosa pine forest, 7,000 to 9,000 feet elevation. New Mexico: mountains across northern part of State. Arizona: uncommon in eastern part in Pinaleno, White, and Tunitcha Mountains and Clear Creek Canyon (Coconino County). Widely distributed in western North America from New Mexico north to Saskatchewan, Yukon, and Alaska, south to southern California, Arizona, and northern Mexico.

The Navajos made a red dye for wool from the powdered bark of this species, together with ashes of one-seed juniper and a decoction of mountain-mahogany.

ARIZONA ALDER (*Alnus oblongifolia* Torr.)

Also called New Mexican alder.

Description: Medium-sized to large tree to 60 or 80 feet in height, with tall straight trunk 2 to 3 feet in diameter, and with open, rounded crown. **Leaves** elliptic, 2 to 3 inches long, short-

pointed at apex, gradually narrowed at base, edges sharply and usually doubly saw-toothed, thin, dark green and almost hairless above, beneath paler and slightly hairy. Male and female flowers in catkins in March. Fruit of cones about $\frac{1}{2}$ inch long, with hard, black scales and many small nutlets, remaining on tree in winter. Bark smooth, thin, dark gray, on large trunks fissured and scaly. Wood soft, lightweight, whitish when cut but turning to light reddish brown.

Distribution: Along canyons and streams mostly in mountains, oak woodland and ponderosa pine forest, 4,500 to 7,500 feet elevation. New Mexico: mountains of southwestern part from Black Range and Magdalena Mountains west to Mogollon Mountains. Arizona: common and widely distributed in mountains of southeastern and central parts west to Pima County and northwest to Oak Creek Canyon in Coconino County. Also in northern Mexico.

Beech Family (Fagaceae)

NETLEAF OAK (*Quercus reticulata* Humb. & Bonpl.)

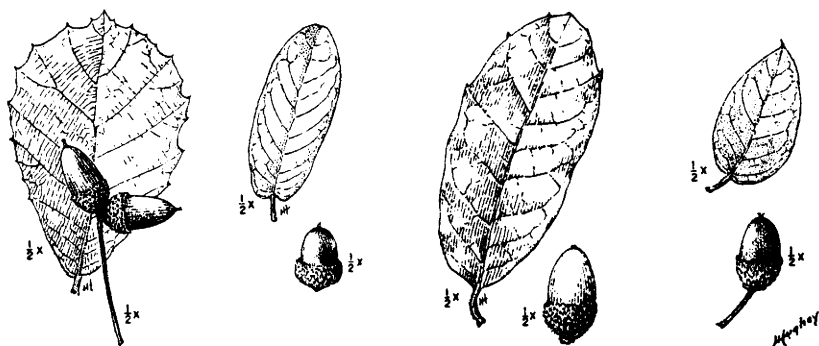
Botanical synonym: *Q. diversicolor* Trel.

Description: Small to medium-sized evergreen tree to 40 feet tall, with broad rounded crown, or a shrub as low as 6 feet in height. Leaves broadly obovate, varying in form and size, 1 to 4 inches long, rounded at apex and slightly heart-shaped at base, edges with several small spiny teeth especially toward apex, thick and stiff, above dark green and slightly hairy and with veins sunken, beneath paler and yellow hairy and with a network of raised veins. Flowers of this and other oaks male in narrow hanging clusters and female 1 or few in leaf axils, in spring. Acorns 2 or 3 together on long stalk 1 to 4 inches long, $\frac{1}{2}$ inch long, oblong, one-fourth enclosed by the shallow cup. Bark fissured and flaky, gray. Wood hard, light brown.

Distribution: Uncommon in mountains and canyons, oak woodland zone, 4,000 to 8,000 feet elevation, in Mexican border region. New Mexico: mountains of southwestern corner in Luna, Hidalgo, and Grant Counties north to Mogollon Mountains. Arizona: southeastern part in Cochise, Graham, and Pima Counties; also in southern Coconino County. Southwestern Texas to Arizona and northern Mexico.

MEXICAN BLUE OAK (*Quercus oblongifolia* Torr.)

Description: Small evergreen tree to 25 feet tall, with trunk up to $1\frac{1}{2}$ feet in diameter and with spreading, rounded crown, or a shrub at higher elevations. Leaves oblong, 1 to 2 inches long, rounded at both ends or heart-shaped at base, edges without teeth (rarely toothed), thin and firm, at maturity without hairs, blue-green and covered with a bloom above, paler beneath. Acorn $\frac{1}{2}$ to $\frac{3}{4}$ inch long, rounded, one-third enclosed by the cup. Bark fissured



Nettleleaf oak.

Mexican blue oak.

Arizona white oak.

Gray oak.

into small, squarish plates, gray. **Wood** hard, very heavy, brittle, dark brown.

Distribution: Common and characteristic small tree of oak woodland in foothills and mountains and sometimes in canyons at upper edge of desert and desert grassland, 4,500 to 6,000 feet elevation, in Mexican border region. New Mexico: mountains of extreme southwestern corner in southern Hidalgo County. Arizona: foothills and mountains in southeastern part (Cochise, Santa Cruz, and Pima Counties) and in Mohave County. Also in northern Mexico (Chihuahua and Sonora).

Mexican blue oak, which forms open woodlands of small spreading trees along the Mexican border, is readily distinguished by the small, blue-green, oblong, toothless and hairless leaves.

ARIZONA WHITE OAK (*Quercus arizonica* Sarg.)

Also called Arizona oak.

Description: Medium-sized evergreen tree 30 to 60 feet or more in height and 2 to 3 feet in trunk diameter, with irregular spreading crown of stout branches. **Leaves** obovate or oblong, 1 to 3 inches long, short-pointed or rounded at apex, heart-shaped or rounded at base, edges slightly wavy-lobed and toothed toward apex, thick and stiff, above dull blue-green and nearly hairless and with veins sunken, beneath paler and densely hairy and with prominent raised veins, shedding gradually in spring as the new leaves unfold. **Acorn** $\frac{3}{4}$ to 1 inch long, with shallow cup. **Bark** fissured into thick plates, light gray or whitish. **Wood** hard, heavy, dark brown.

Distribution: Common and characteristic tree of the oak woodland, in foothills, mountains, and canyons, 5,000 to 7,600 feet elevation. New Mexico: mountains in southern part, from White, Capitan, and Organ Mountains westward to Mogollon Mountains and southwest corner. Arizona: mountains in southeastern and central parts, west to Santa Cruz and Pima Counties and northwest to Gila and Yavapai Counties. Also in northern Mexico (Chihuahua and Sonora).

Arizona white oak is probably the largest of the southwestern oaks, reaching its greatest size in canyons and other moist sites.

GRAY OAK (*Quercus grisea* Liebm.)

Description: Small, low scrubby evergreen tree or shrub, or in favorable locations a medium-sized tree to 65 feet in height. **Leaves** elliptic to ovate, $\frac{3}{4}$ to 2 inches long, blunt or short-pointed at apex, rounded or slightly heart-shaped at base, edges without teeth or with a few teeth toward apex, thin and firm, gray green or blue green, shiny and sparsely hairy above, beneath densely hairy. **Acorn** $\frac{1}{2}$ inch long, rounded, one-third enclosed by the deep cup. **Bark** fissured into shaggy plates, light gray. **Wood** hard, heavy, brown.

Distribution: Dry rocky mountain slopes and foothills and in canyons, oak woodland and pinyon-juniper woodland, 5,000 to 7,000 feet elevation. New Mexico: common in mountains of southern and central parts, from Guadalupe, White, and Sandia Mountains and Santa Rosa westward. Arizona: uncommon in mountains of southeastern and central parts, west from Cochise County and White Mountains to Gila County and Oak Creek Canyon (Coconino County). Southwestern Texas to Arizona and also in northern Mexico (Chihuahua and Coahuila).

Gray oak, usually a low, scrub oak, is common in the oak woodland of New Mexico and infrequent westward in Arizona. As this species intergrades both with Arizona white oak and shrub live oak, some forms are not readily distinguished.

TOUMEY OAK (*Quercus toumeyi* Sarg.)

Description: Evergreen shrub 3 to 6 feet tall or small tree to 33 feet in height and 8 inches in trunk diameter. **Leaves** numerous and crowded, very small, elliptic or oval, $\frac{1}{2}$ to $\frac{3}{4}$ inch long, sharp-pointed, edges without teeth or infrequently with a few short teeth, shiny yellow-green above, slightly hairy beneath, shedding in spring as new leaves appear. **Acorn** $\frac{1}{2}$ to $\frac{5}{8}$ inch long, with shallow cup. **Bark** thin, scaly or flaky, dark brown. **Wood** light brown.

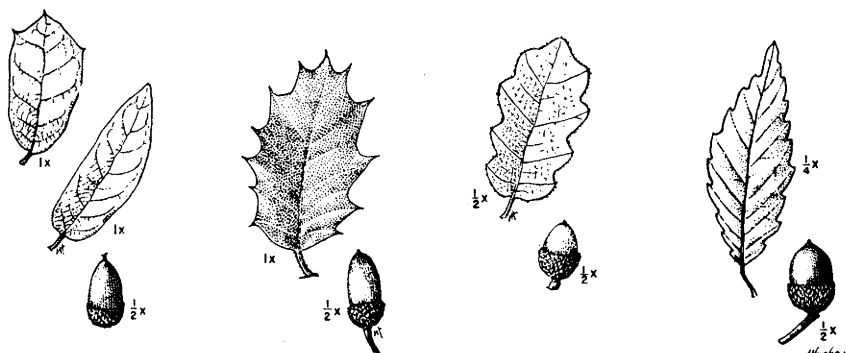
Distribution: Local and restricted on hillsides and mountains in oak woodland, 4,000 to 7,000 feet elevation, Mexican border region; not in New Mexico. Arizona: southeastern part, in Cochise, Greenlee, and Santa Cruz Counties. Also in adjacent Sonora, Mexico.

Toumey oak has a restricted distribution, so far as known. It was discovered in the Mule Mountains of Cochise County in 1899 by James W. Toumey (1865-1932), then botanist at the University of Arizona and afterwards dean of the Yale University School of Forestry. Shrubs of this species may be seen in Texas Canyon along the highway east of Benson in Cochise County.

SHRUB LIVE OAK (*Quercus turbinella* Greene)

Also called scrub oak, California scrub oak, turbinella oak. Botanical synonyms: *Q. dumosa* Nutt. var. *turbinella* (Greene) Jepson, *Q. subturbinella* Trel.

Description: Evergreen, much-branched shrub usually less than 8 feet tall or rarely a small tree to 15 feet in height with open, widely spreading crown. **Leaves** small, elliptic or oblong, $\frac{1}{2}$ to $1\frac{1}{4}$



Toumey oak.

Shrub live oak.

Wavyleaf oak.

Chinquapin oak.

inch long, short-pointed, edges with many small spinelike teeth, thick and stiff, above blue-green with a bloom and nearly hairless, beneath yellowish green and finely hairy. **Acorn** $\frac{3}{4}$ inch long, narrow and pointed, with shallow cup. **Bark** fissured and scaly, gray. **Wood** hard, brittle, brown with tan or yellowish sapwood.

Distribution: Abundant as the characteristic species of the chaparral in Arizona, forming dense thickets and covering hill-sides, and also in oak woodland, pinyon-juniper woodland, lower ponderosa pine forest, and sometimes upper edge of desert, 4,500 to 8,000 feet elevation. New Mexico: mountains of southwestern part, from Magdalena Mountains westward. Arizona: widely distributed and nearly throughout, but most common in the chaparral vegetation of the central part, chiefly in Gila, eastern Maricopa, and Yavapai Counties. New Mexico and Colorado, west to southern Utah, southern Nevada, and southeastern California, and south to northern Mexico.

Though generally a shrub in the evergreen shrubby or chaparral vegetation, this species rarely becomes a small tree at Grand Canyon and elsewhere. Shrub live oak and other southwestern oaks provide browse for goats, sheep, and cattle.

WAVYLEAF OAK (*Quercus undulata* Torr.)

Also called Rocky Mountain shin oak, scrub oak, shinnery.

Description: Usually a low evergreen shrub 1 to 6 feet in height but sometimes becoming a small tree to 15 feet tall and 4 inches or more in trunk diameter. **Leaves** small, varying in shape, elliptical or oblong, 1 to $2\frac{1}{2}$ inches long, usually flat or wavy margined, shallowly or wavy lobed or toothed, thick and firm, gray-green, densely hairy beneath and slightly rough. **Acorn** $\frac{3}{8}$ to $\frac{7}{8}$ inch long, oblong, rounded at tip, with deep cup nearly half the length. **Bark** very scaly, light gray.

Distribution: Dry mountain slopes and canyons, forming dense brush, pinyon-juniper woodland, oak woodland, and ponderosa pine forest zones, commonly at 5,000 to 7,000 feet elevation but sometimes to 4,000 and 9,000 or 10,000 feet. New Mexico: widely distributed in foothills and mountains over the State, from Guadalupe

and Organ Mountains northward; common across northern part to northeastern corner. Arizona: mountains in southeastern corner (Cochise County) and in northern part (Navajo, Coconino, and Mohave Counties). Southwestern Texas and New Mexico to Colorado, west to southern Utah and Nevada, and south to Arizona and northern Mexico.

Wavyleaf oak is usually a low, carpet-forming shrub occupying large areas of foothills and spreading by sprouts from underground branches. However, in moist protected places at lower elevations, such as in Grand Canyon, it becomes a low tree. It is often common on burned areas.

CHINQUAPIN OAK (*Quercus muehlenbergii* Engelm.)

Description: Small tree to 25 feet in height (in eastern United States a large tree). Leaves oblong or broadly lance-shaped, 3 to 6 inches long, short- or long-pointed, usually rounded at base, edges wavy with coarse, slightly curved teeth, dark or yellowish green above, paler and finely hairy beneath. Acorn $\frac{1}{2}$ to $\frac{3}{4}$ inch long, rounded, half enclosed by the deep cup. Bark thin, fissured, and flaky, light gray. Wood heavy and hard.

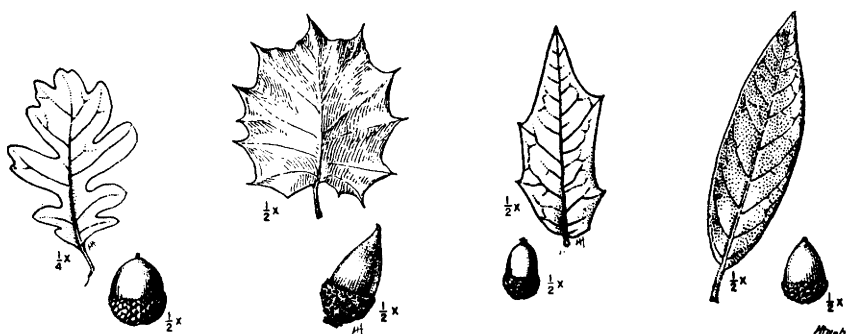
Distribution: Very rare and local in mountain canyons of pinyon-juniper woodland, about 7,000 feet elevation, in mountains bordering the plains in eastern New Mexico; not in Arizona. New Mexico: known from two places in the vicinity of Capitan Mountains (Lincoln County); reported from Coyote Creek near Guadalupita (Mora County); and collected in Guadalupe Mountains of southwestern Texas near New Mexico border and on other mountains in southwestern Texas. Also widely distributed in eastern United States from northwestern Florida north to Vermont and southern Ontario, west to Wisconsin and Iowa, and south to Texas. A variety extends south from Texas into northern Mexico.

Chinquapin oak is too rare in New Mexico to be important but is noteworthy because of its unusual distribution. These isolated Rocky Mountain localities are some distance westward of the limits of continuous distribution of this species in western Oklahoma and central Texas.

GAMBEL OAK (*Quercus gambelii* Nutt.)

Also called Utah white oak, Rocky Mountain white oak. Botanical synonyms: *Q. gunnisonii* (Torr.) Rydb., *Q. leptophylla* Rydb., *Q. novomexicana* (A. DC.) Rydb., *Q. submollis* Rydb., *Q. utahensis* (A. DC.) Rydb.

Description: Small to medium-sized tree 20 to 70 feet tall with trunk 2 to 4 feet in diameter and with rounded crown, or a shrub as low as 6 feet in height and growing in thickets. Leaves oblong, 2 to 7 inches long, deeply 7- to 11-lobed halfway or more to middle, edges without teeth, dark green above, light green and soft-hairy beneath, varying greatly in size, lobing, and hairiness, turning yellow and reddish in autumn before shedding. Acorn $\frac{3}{8}$ to $\frac{3}{4}$ inch long, broad and rounded, with deep cup. Bark rough, thick, deeply furrowed or scaly, gray. Wood hard, heavy, light brown.



Gambel oak.

Palmer oak.

Emory oak.

Silverleaf oak.

Distribution: Common and widespread in mountains and plateaus in ponderosa pine forest, 5,000 to 8,000 feet elevation. New Mexico: widely distributed in mountains of western two-thirds and northeastern corner, from Sacramento and Organ Mountains, Black Range, and Mogollon Mountains northward. Arizona: mountains and plateaus of northeastern half, from Chiricahua Mountains to Kaibab Plateau. Southwestern Texas north to Colorado, west to southwestern Wyoming, Utah, and southern Nevada, and south to Arizona and northern Mexico (Chihuahua and Coahuila).

Gambel oak is easily recognized by the deeply lobed leaves, which are larger than those of other southwestern oaks and which are shed in autumn. This is the only common tree oak in the northern parts of New Mexico and Arizona. The wood is used for fence posts and fuel. This familiar southwestern oak and the equally familiar Gambel quail commemorate William Gambel, a physician, ornithologist, and botanist of Philadelphia, who "passed through Santa Fe, N. Mex., in 1841 on his way to California" and discovered about a hundred new species of plants on the expedition.

PALMER OAK (*Quercus chrysolepis* Liebm. var. *palmeri* (Engelm.) Sarg.)

Also called canyon live oak. Botanical synonyms: *Q. palmeri* Engelm., *Q. wilcoxii* Rydb.

Description: Evergreen shrub or small tree usually 6 to 25 feet tall and up to 6 inches in trunk diameter, with dense, bushy, broad crown of many stiff branches and spiny-toothed leaves. **Leaves** elliptic to ovate, $\frac{3}{4}$ to 2 inches long, short-pointed, edges crisp and spiny toothed, stiff and very leathery, shiny yellow-green above, beneath slightly yellowish and resinous hairy but becoming whitish. **Acorn** $\frac{5}{8}$ to $1\frac{1}{2}$ inches long, broad or narrow, maturing in 2 years; the cup large, spreading, and loosely fitting the acorn, finely hairy inside and covered with fine coat of golden hairs. **Bark** fissured into narrow scales and flakes, gray or brown. **Wood** hard, heavy, light brown.

Distribution: Canyons and mountainsides, often forming thickets, oak woodland, elevation 3,500 to 7,000 feet. New Mexico:

mountains in southwestern corner (Hidalgo and Grant Counties). Arizona: mountains of southeastern and central parts, from Cochise and Greenlee Counties west to Pima County and northwest below Mogollon Rim to southern Coconino County (Oak Creek Canyon) and Yavapai County and west to Hualpai Mountains; also at Bright Angel Canyon near Grand Canyon. This variety also in southwestern Utah, southern Nevada, southern California, and south to northwestern Mexico (Sonora and Lower California). Canyon live oak, the typical form of this species, is found in California, southwestern Oregon, and Lower California, Mexico.

Palmer oak has spiny evergreen leaves resembling those of holly and is attractive in winter. It honors Edward Palmer (1831-1911), American botanical collector who obtained numerous specimens in Mexico and southwestern United States during many years of exploration.

EMORY OAK (*Quercus emoryi* Torr.)

Also called black oak, blackjack oak, bellota.

Description: Medium-sized evergreen tree to 50 feet in height and $2\frac{1}{2}$ feet in trunk diameter. Leaves broadly lance-shaped, 1 to $2\frac{1}{2}$ inches long, with a short spiny point and a few short spiny teeth, thick, stiff, leathery, flat, shiny yellowish green on both sides, nearly hairless, shedding gradually in spring as the new leaves unfold. Acorn $\frac{1}{2}$ to $\frac{3}{4}$ inch long, rounded, one-third or more enclosed by the cup, sweetish and edible. Bark thick, divided into thick plates, black. Wood hard and heavy, dark brown with thick lighter sapwood.

Distribution: The most abundant and most characteristic tree of the oak woodland in the Mexican border region, in foothills, mountains, and canyons and sometimes also in canyons at upper edge of desert and desert grassland, 4,000 to 7,000 feet (rarely 8,000 feet) elevation. New Mexico: mountains of southwestern corner, from Black Range southwestward. Arizona: mountains of southeastern and central parts, west to Santa Cruz and Pima Counties and northwest below Mogollon Rim to Gila County, southern Coconino County (Oak Creek Canyon), and Yavapai County. Also in southwestern Texas and northern Mexico.

Emory oak is named from Lt. Col. W. H. Emory (1811-87), leader of a military expedition in the Southwest in 1846-47, during the Mexican War, who first collected specimens of this species at Pigeon Creek (Las Palomas), within the present Sierra County, N. Mex. In moist places, especially in canyons, Emory oak forms fairly dense forests. It is one of the most important sources of firewood in southern Arizona. The acorns, known in Spanish as bellotas, are nearly free from tannin with its bitter taste and are gathered and eaten locally by Indians and Mexicans.

SILVERLEAF OAK (*Quercus hypoleucoides* A. Camus)

Also called whiteleaf oak. Botanical synonym: *Q. hypoleuca* Engelm., not Miq.

Description: Small to medium-sized evergreen tree to 30 feet to 65 feet in height and $1\frac{1}{2}$ to $2\frac{1}{2}$ feet in trunk diameter, with a

rounded spreading crown, or sometimes a clump-forming shrub 6 feet tall. **Leaves** lance-shaped, 2 to 4 inches long and $\frac{1}{2}$ to 1 inch wide, sharp-pointed, narrowed at base, edges rolled under and usually without teeth or with a few small spiny teeth, very thick and leathery, shiny yellow-green above, beneath densely white-woolly. **Acorn** $\frac{1}{2}$ to $\frac{5}{8}$ inch long, pointed, one-third enclosed in a thick cup hairy inside, maturing in 2 years. **Bark** deeply furrowed into ridges and plates, blackish. **Wood** hard, heavy, dark brown.

Distribution: More or less common in mountain slopes and canyons of oak woodland, 5,000 to 7,000 feet elevation, in Mexican border region. New Mexico: mountains of southwestern part north to Black Range and Mogollon Mountains. Arizona: mountains of southeastern part west to Santa Cruz, Pima, and Graham Counties. Southwestern Texas to southeastern Arizona and in northern Mexico.

Silverleaf oak with its leaves so distinct from those of most oaks should be suitable for cultivation as an ornamental tree.

Elm Family (Ulmaceae)

NETLEAF HACKBERRY (*Celtis reticulata* Torr.)

Also called paloblanco, western hackberry. Botanical synonym: *C. laevigata* Willd. var. *reticulata* (Torr.) L. Benson.

Description: Large shrub or small tree to 30 feet tall and 1 foot or more in trunk diameter, with spreading crown. **Leaves** in 2 rows, very variable, mostly ovate, 1 to $2\frac{1}{2}$ inches long, one-sided, short- or long-pointed, base rounded or slightly heart-shaped and with 3 main veins, edges without teeth or sometimes coarsely saw-toothed, usually thick, dark green and rough above, beneath yellow-green, strongly veined, and slightly hairy, shedding in autumn or winter. **Flowers** small, greenish, in March and April. **Fruit** $\frac{1}{4}$ to $\frac{3}{8}$ inch in diameter, orange-red, dry and sweet, 1-seeded. **Bark** smoothish or becoming rough and fissured, with large corky warts, gray. **Wood** light brown.

Distribution: Usually along streams, canyons, and washes, in moist soil, plains grassland, upper desert, desert grassland, and oak woodland zones, 2,500 to 6,000 feet elevation, widely distributed. New Mexico: plains of eastern part from Union County south and southwest; mountains across southern part, north along Rio Grande drainage to Sandia Mountains, and in Gila River drainage. Arizona: mountains and streams of southeastern and central parts south of Mogollon Rim, northwest to Yavapai and Mohave Counties; also along Colorado River and tributaries across northern part. Southern and central Texas and Oklahoma, west to Colorado, Arizona, and California. Also in northern Mexico.

The wood is used for fuel and fence posts, and the sweetish fruits are eaten by wildlife and can be nibbled. Many leaves have rounded, swollen galls caused by insects, while the branches often have witches' broom galls.

Mulberry Family (Moraceae)

TEXAS MULBERRY (*Morus microphylla* Buckl.)

Also called Mexican mulberry and mountain mulberry.

Description: Small scrubby tree or large shrub to 20 feet tall and 6 inches in trunk diameter, often growing in dense clumps. **Leaves** in 2 rows, variable in shape, ovate and often 3- to 5-lobed, 1 to 2 inches long, short-pointed, base rounded or heart-shaped and with 3 main veins, edges coarsely saw-toothed, dark green and rough above, beneath paler and usually hairy. Male and female **flowers** in dark green catkins on different trees (dioecious), appearing with the leaves in April. Mulberry fruit on oblong cluster about $\frac{1}{2}$ inch long, turning from red to purple or black, juicy and acid, edible. **Bark** smoothish, light gray, becoming fissured and scaly. **Wood** hard, heavy, dark orange or brown.

Distribution: Common, usually along streams, canyons, washes, or rocky slopes below cliffs, in foothills and mountains, woodland and upper desert zones, 2,000 to 6,000 feet elevation, widely distributed. New Mexico: foothills and mountains across southern part, north to White Mountains and Black Range. Arizona: mountains in southern and central parts west to Santa Cruz and Pima Counties and Kofa Mountains (Yuma County) and north to Yavapai County. Central Texas west to Arizona and south to northern Mexico.

The small mulberry fruits are eaten by Indians and by wildlife. This species is established at Grand Canyon, where the Havasupai Indians cultivate the trees for the fruits.

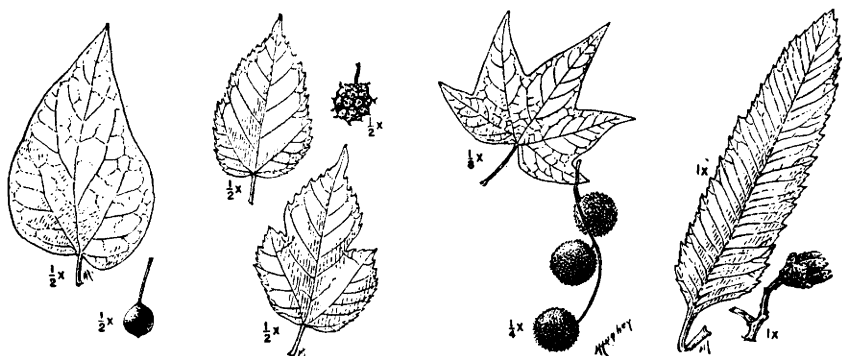
Sycamore Family (Platanaceae)

ARIZONA SYCAMORE (*Platanus wrightii* S. Wats.)

Also called Arizona planetree. Botanical synonym: *P. racemosa* Nutt. var. *wrightii* (S. Wats.) L. Benson.

Description: Large tree 40 to 80 feet in height, with large trunk to 4 feet or more in diameter and with large spreading branches and broad open crown. **Leafstalks** $1\frac{1}{2}$ to 3 inches long, stout, the enlarged base enclosing the bud. **Leaves** slightly star-shaped, large, 6 to 10 inches long and wide, heart-shaped at base, deeply divided into usually 5 or 3 (or 7) narrow, long-pointed lobes, the edges mostly without teeth, thin and firm, light green and hairless above, beneath pale and hairy. **Flowers** male and female, in clusters of usually 2 to 4 balls, in March and April. **Fruit** of 2 to 4 stalked balls $\frac{3}{4}$ to 1 inch in diameter, along a stalk 6 to 8 inches long. **Bark** of branches smooth, thin, whitish; bark of largest branches and trunk smoothish and peeling off in brownish flakes, on large trunks becoming thick, dark gray, and deeply and irregularly divided into thick plates. **Wood** light brown.

Distribution: Common along streams and rocky canyons in foothills and mountains, upper desert, desert grassland, and oak woodland zones, 2,000 to 6,000 feet elevation. New Mexico: south-



Nettleleaf hackberry. Texas mulberry. Arizona sycamore. Torrey vauquelinia.

western corner, from Black Range and Mogollon Mountains southwestward. Arizona: southeastern and central parts, west to Santa Cruz and Pima Counties and northwest in central part to Mogollon Rim, southern Coconino County, Yavapai County, and southeastern Mohave County. Also local in southeastern California and in Sonora and Chihuahua, northern Mexico.

Arizona sycamore, one of the largest and handsomest deciduous tree species in Arizona, is valuable in preventing erosion along stream banks.

Rose Family (Rosaceae)

TORREY VAUQUELINIA (*Vauquelinia californica* (Torr.) Sarg.)

Also called Arizona rosewood.

Description: Evergreen small tree 10 to 30 feet tall, with trunk $\frac{1}{2}$ to $1\frac{1}{2}$ feet in diameter, with stiff twisted branches and slender twigs, or a low, much-branched shrub. **Leaves** narrowly lance-shaped, $1\frac{1}{2}$ to 4 inches long and $\frac{1}{4}$ to $\frac{5}{8}$ inch wide, long-pointed, edges saw-toothed, leathery, bright yellow-green, finely hairy beneath. **Flowers** many in dense clusters 2 to 3 inches across, small, $\frac{3}{8}$ inch across, white, in May and June. **Fruit** a hard capsule $\frac{1}{4}$ inch long, hairy, splitting into 5 2-seeded parts, remaining attached during winter. **Bark** thin, broken into small square scales or shaggy, dark red brown. **Wood** hard, very heavy, dark brown streaked with red.

Distribution: Canyons and mountains in upper desert and lower oak woodland, 2,500 to 5,000 feet elevation, Mexican border region. New Mexico: known only from Guadalupe Canyon (Hidalgo County) in southwestern corner. Arizona: scattered on mountains of southeastern part from Guadalupe and Whetstone Mountains (Cochise County) west to Ajo Mountains (Pima County) and north to Superstition Mountains and Sierra Estrella (Maricopa County). Also in southwestern Texas and northwestern Mexico (Sonora and Lower California).

The hard, heavy wood is beautiful and suggested the name

Arizona rosewood. However, commercial use has been limited by the small size and scarcity of the trees and their slow growth. Vauquelinia honors the French chemist Louis Nicholas Vauquelin (1763-1829).

UTAH SERVICEBERRY (*Amelanchier utahensis* Koehne)

Botanical synonyms: *A. australis* Standl., *A. bakeri* Greene, *A. crenata* Greene, *A. goldmanii* Woot. & Standl., *A. mormonica* Schneid., *A. oreophila* A. Nels., *A. rubescens* Greene.

Description: Shrub or small tree 5 to 16 feet tall, much-branched and often forming clumps. **Leaves** very variable, nearly round to elliptic, small, $\frac{1}{2}$ to $1\frac{1}{4}$ inches long, rounded at apex and base, edges coarsely and often sharply toothed above middle, slightly leathery at maturity, grayish green, finely hairy on both sides. **Flowers** 3 to 6 in cluster, about $\frac{1}{2}$ inch long, with 5 white petals, from April to June. **Fruit** $\frac{1}{4}$ to $\frac{3}{8}$ inch in diameter, resembling a small apple, bluish black, juicy and sweet, or often pale brown, dry and mealy. **Bark** smooth, ashy gray.

Distribution: Scattered in canyons, rocky slopes, foothills, and mountains in pinyon-juniper woodland and ponderosa pine forest and sometimes also in upper desert, 2,000 to 8,500 feet elevation. New Mexico: widely distributed in mountains over the State, except along eastern and southern borders, from San Andres Mountains (Dona Ana County) and Sandia and Las Vegas Mountains westward. Arizona: mountains and canyons of central and northern parts, from southern Apache County west to Gila and Yavapai Counties and northward; common at Grand Canyon. Widely distributed from southwestern Texas north to Wyoming and southern Montana, west to Oregon, and south to California and Lower California, Mexico.

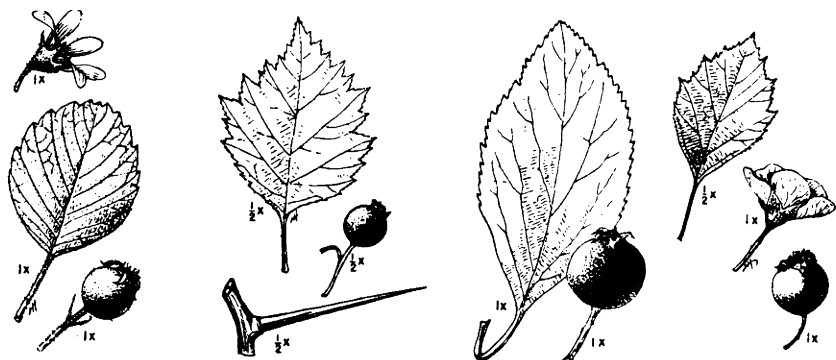
The fruits are eaten by wildlife and were consumed by the Indians fresh or dried, though in arid localities the fruits may remain dry and insipid and not become juicy. The foliage is good to excellent browse for sheep and cattle.

FIREBERRY HAWTHORN (*Crataegus chrysocarpa* Ashe)

Botanical synonym: *C. rotundifolia* Moench, not Lam.

Description: Spiny shrub or small tree with rounded crown. **Twigs** hairy when young, with many spines $\frac{3}{4}$ to $2\frac{1}{2}$ inches long. **Leaves** broadly ovate or nearly round, $1\frac{1}{4}$ to 2 inches long, short-pointed, broadly wedge-shaped at base, slightly 7- or 9-lobed, coarsely and doubly saw-toothed, firm, dark green above and paler beneath, loosely hairy on both sides. **Flowers** in clusters, white, $\frac{3}{4}$ inch or less across. **Fruit** about $\frac{3}{8}$ inch in diameter, orange or red, resembling a small apple, with thin flesh and bony nutlets.

Distribution: Recorded from New Mexico; not in Arizona. Widely distributed from Nova Scotia and New Brunswick west to Saskatchewan and North Dakota, south to Nebraska, Colorado, and New Mexico, and in eastern United States south to Michigan and North Carolina.



Utah serviceberry. Fireberry hawthorn. River hawthorn. Cerro hawthorn.

RIVER HAWTHORN (*Crataegus rivularis* Nutt.)

Also called black haw.

Description: Spiny shrub or small tree to 20 feet tall, with open crown, often forming clumps. **Twigs** more or less zigzag, shiny reddish brown, often with a few straight, slender, sharp spines 1 inch or less in length. **Leaves** elliptic, about 2 inches long and less than 1 inch wide, mostly short-pointed, tapering at base, finely saw-toothed but not lobed, thin, without hairs at maturity, blue-green above, pale yellow-green beneath. **Flowers** several in cluster, $\frac{1}{2}$ inch across, white. **Fruit** $\frac{3}{8}$ to $\frac{1}{2}$ inch in diameter, dark red but turning black, shiny, resembling a small apple, with thin mealy flesh and 3 to 5 large bony nutlets.

Distribution: Local and scattered along streams and canyons in mountains, pinyon-juniper woodland and ponderosa pine forest zones, 5,000 to 6,000 feet elevation. New Mexico: northern part; also collected at Upper Negrito Creek (Catron County). Arizona: collected at Clear Creek Canyon southeast of Winslow (Navajo County). New Mexico north to Wyoming, west to Idaho and Nevada, and south to Arizona.

CERRO HAWTHORN (*Crataegus erythropoda* Ashe)

Also called manzana de puya larga. Botanical synonym: *C. cerronis* A. Nels.

Description: Spiny shrub or small tree to 15 feet in height. **Twigs** more or less zigzag, with many stout sharp purplish spines $\frac{3}{4}$ to 2 inches long, without hairs, purplish. **Leaves** ovate, 1 to $2\frac{1}{2}$ inches long, less than twice as long as wide, short-pointed, wedge-shaped at base, often shallowly 3- to 7-lobed, coarsely saw-toothed, bright green and without hairs. **Flowers** in clusters 1 to $2\frac{1}{2}$ inches broad, white. **Fruit** about $\frac{3}{8}$ inch in diameter, orange-red, resembling a small apple, with thin flesh and large bony nutlets.

Distribution: Uncommon along streams and canyons, pinyon-juniper woodland and ponderosa pine forest, 5,400 to 8,000 feet elevation. New Mexico: mountains in northern part from Colfax County south to Sandia Mountains. Arizona: uncommon and local,

collected in White Mountains (Apache County) and Oak Creek Canyon (Coconino County). New Mexico north to Wyoming, west to Washington, and south to Arizona.

Another species of hawthorn (*Crataegus wootoniana* Eggleston), described as a shrub 10 feet or less in height, occurs in the White Mountains and Mogollon Mountains of southern and southwestern New Mexico. It has broadly ovate, saw-toothed leaves with 3 or 4 pairs of broad lobes.

CLIFFROSE (*Cowania stansburiana* Torr.)

Also called quinine-bush. Botanical synonym: *C. mexicana* D. Don var. *stansburiana* (Torr.) Jeps.

Description: Small-leaved evergreen, spreading shrub 3 to 6 feet tall or sometimes becoming a small scrubby tree to 25 feet in height and 6 inches in trunk diameter, with irregular open crown of stiff erect branches. **Twigs** hairy, glandular, and reddish brown the first year, becoming hairless and gray. **Leaves** crowded and small, $\frac{1}{4}$ to $\frac{5}{8}$ inch long, wedge-shaped, divided into 3 to 7 narrow lobes, thick and leathery with edges rolled under, with white sticky resinous dots, above dark green and loosely hairy or almost hairless, beneath densely white-woolly, bitter. **Flowers** many but borne singly, large, $\frac{3}{4}$ to 1 inch across, whitish or pale yellow, fragrant, March to September. **Fruits** 5 to 10 clustered from a flower, $\frac{1}{4}$ inch long, each with long feathery or plummy, whitish tail (style) $1\frac{1}{4}$ to 2 inches long. **Bark** shreddy, splitting into long narrow strips, reddish, brown, or gray. **Wood** brown, with thin whitish sapwood.

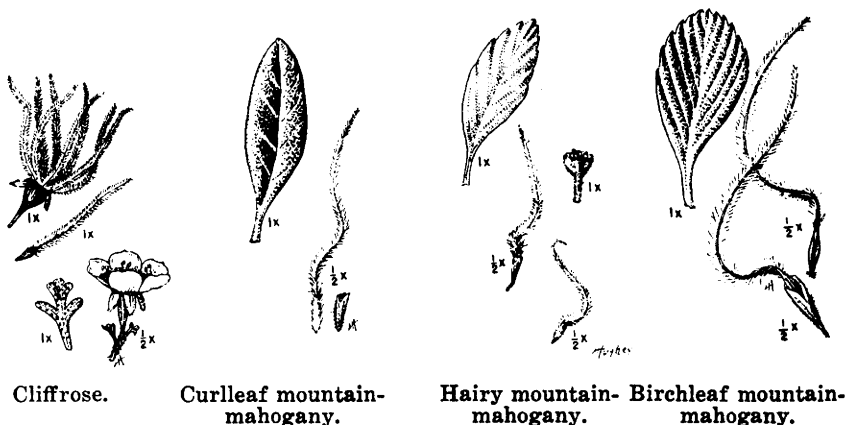
Distribution: Common on dry rocky hills and plateaus, especially on limestone, in upper desert, desert grassland, oak woodland, and pinyon-juniper woodland zones, 3,500 to 8,000 feet elevation. New Mexico: western part, west of Rio Grande, from Black Range westward and northwest to San Juan River drainage. Arizona: widely distributed across central and northern parts and also in mountains of southeastern part, from mountains of Cochise and Santa Cruz Counties north to northern border of State and west to Hualpai Mountains. Western New Mexico north to southern Colorado, west to northern Utah, Nevada, and eastern California, and south across Arizona to northern Mexico (Sonora and Chihuahua).

Cliffrose is an important browse plant for deer, cattle, and sheep. Covered with whitish flowers, it is beautiful when in full bloom and should be an attractive ornamental. It is planted also for erosion control.

CURLLEAF MOUNTAIN-MAHOGANY (*Cercocarpus ledifolius* Nutt.)

Botanical synonym: *C. ledifolius* var. *intercedens* C. K. Schneid.

Description: Evergreen spreading shrub or small tree to 15 or sometimes 20 feet tall and $\frac{1}{2}$ to 2 feet in trunk diameter, with compact rounded crown of widely spreading branches and many stiff twigs. **Leaves** usually clustered, narrowly lance-shaped or elliptic,



Cliffrose.

Curleaf mountain-mahogany.

Hairy mountain-mahogany.

Birchleaf mountain-mahogany.

$\frac{1}{2}$ to $1\frac{1}{4}$ inches long and less than $\frac{3}{8}$ inch wide, short-pointed at both ends, edges without teeth and rolled under, thick and leathery, shiny dark green above, pale and finely hairy beneath, resinous and slightly aromatic. **Flowers** single in leaf axils, $\frac{5}{8}$ inch long, yellowish, in April. **Fruit** $\frac{1}{4}$ inch long, hairy, with a twisted hairy tail (style) $1\frac{1}{2}$ to 3 inches long. **Bark** thick, furrowed and scaly, reddish brown. **Wood** very hard, heavy, red or dark brown with thin yellow sapwood.

Distribution: Common locally on both rims of Grand Canyon, northern Arizona, in ponderosa pine forest zone, about 7,000 feet elevation; not in New Mexico. **Arizona:** known only from Grand Canyon. **Southwestern Colorado** north to Montana, west to Washington, and south to southern California and northern Arizona.

HAIRY MOUNTAIN-MAHOGANY (*Cercocarpus breviflorus* A. Gray)

Also called Wright mountain-mahogany. **Botanical synonyms:** *C. paucidentatus* (S. Wats.) Britton, *C. montanus* Raf. var. *paucidentatus* (S. Wats.) F. L. Martin.

Description: Evergreen shrub or small tree to 15 feet or more in height and 5 inches in trunk diameter, with open crown of widely spreading branches and long slender twigs. **Leaves** obovate or reverse lance-shaped, $\frac{3}{8}$ to 1 inch long and $\frac{1}{4}$ to $\frac{1}{2}$ inch wide, rounded or short-pointed at apex and tapering from above middle to base, edges turned under and usually with a few rounded teeth near apex, thick, dark green and hairless or slightly hairy above, pale and finely hairy beneath. **Flowers** 1 to 3 in leaf axils, about $\frac{1}{2}$ inch long, yellowish, March to November. **Fruit** $\frac{1}{4}$ inch long, red-brown, hairy, with a twisted white-hairy tail (style) 1 to $1\frac{1}{2}$ inches long. **Bark** thin, smoothish, becoming fissured and scaly, gray or red-brown. **Wood** hard, light brown with light yellow sapwood.

Distribution: Common on dry slopes and mountainsides, chaparral and oak woodland, 5,000 to 8,000 feet elevation. **New Mexico:**

mountains of southern and central parts, from Guadalupe Mountains north to Capitan Mountains and Santa Fe County and west to Black Range and San Luis Mountains. Arizona: mountains of southeastern and central parts, from Cochise County to southern Apache County and west to southern Coconino, Yavapai, and Pima Counties. Southwestern Texas to central Arizona, south to northern Mexico.

This species and birchleaf mountain-mahogany are important browse plants for livestock.

BIRCHLEAF MOUNTAIN-MAHOGANY (*Cercocarpus betuloides* Nutt.)

Botanical synonym: *C. montanus* Raf. var. *glaber* (S. Wats.) F. L. Martin.

Description: Evergreen large spreading shrub or small tree to 20 feet in height with a single trunk to 6 inches in diameter and spreading crown. Leaves obovate to oval, 1 to 1¼ inches long and ⅜ to ½ inch wide, rounded at apex and wedge-shaped at base, finely toothed above middle, slightly thick, dark green above, pale green or grayish and slightly hairy beneath. Flowers 1 to 3 in leaf axils, about ½ inch long, yellowish, March to July. Fruit hairy, with a twisted hairy tail (style) 2 to 3 inches long. Bark of thin scales, smoothish.

Distribution: Chaparral zone of mountains in Arizona, 3,500 to 6,500 feet elevation; not in New Mexico. Arizona: mountains, chiefly across the central part, from Cochise County (Winchester Mountains) to southern Apache County and west to Gila, Coconino (Grand Canyon), Mohave (Hualpai Mountains), and Yuma (Harqua Hala Mountains) Counties. Also in Oregon, California, and Lower California, Mexico.

BITTER CHERRY (*Prunus emarginata* (Dougl.) D. Dietr.)

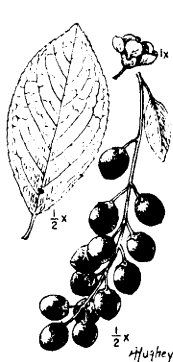
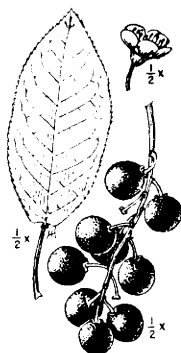
Also called wild cherry. Includes the variety *P. emarginata* var. *crenulata* (Greene) Kearney & Peebles (botanical synonym, *Cerasus crenulata* Greene).

Description: Small tree or shrub to 13 feet or more in height, with slender upright branches. Twigs red, slender, hairy when young. Leaves varying in shape, oval or elliptic to reverse lance-shaped, 1 to 2 inches long, rounded or short-pointed at apex, edges minutely saw-toothed with blunt gland-tipped teeth, dark green above, pale and sometimes hairy beneath, very bitter. Flowers few in short clusters 1 to 1½ inches long, ⅜ to ½ inch across, white, April to June. Fruit a red cherry about ⅜ inch in diameter, juicy, acid and bitter, with a large stone. Bark smooth, purplish or reddish brown, very bitter. Wood soft and brittle, brown streaked with green.

Distribution: Mountains in ponderosa pine forest, 5,000 to 9,000 feet elevation. New Mexico: mountains of southwestern part, Black Range and Mogollon Mountains. Arizona: mountains of southeastern and central parts, from Cochise County west to Pima County



Bitter cherry. Common chokecherry.

Southwestern
chokecherry.

American plum.

and northwest to Coconino County and Hualpai Mountains. New Mexico north to British Columbia, south to southern California and Arizona.

COMMON CHOKECHERRY (*Prunus virginiana* L.)

Also called wild cherry. Includes two varieties in the Southwest, not distinguished here: black chokecherry (*P. virginiana* var. *melanocarpa* (A. Nels.) Sarg.; also called black western chokecherry) and western chokecherry (*P. virginiana* var. *demissa* (Nutt.) Torr.). Botanical synonym: *Padus valida* Woot. & Standl.

Description: Shrub or small tree to 25 feet in height, with a trunk 6 inches or more in diameter, often forming dense thickets. **Leaves** varying in shape and hairiness, oval to obovate, 2 to 4 inches long, abruptly short-pointed at apex, rounded or heart-shaped at base, edges sharply saw-toothed, thick, above shiny dark green, beneath light green and without hairs or slightly hairy. **Flowers** many in clusters 3 to 6 inches long, small, $\frac{3}{8}$ to $\frac{1}{2}$ inch across, white, in April and May. **Fruit** a chokecherry $\frac{1}{4}$ to $\frac{3}{8}$ inch in diameter, at maturity dark red or nearly black, shiny, juicy and astringent, with a large stone. **Bark** smooth and brown or gray on small trunks, becoming fissured and scaly. **Wood** hard and heavy, light brown.

Distribution: Widely distributed, especially along streams in mountains, ponderosa pine forest, 4,500 to 8,000 feet elevation. New Mexico: mountains of western two-thirds and northeastern corner, from Sacramento Mountains north to Las Vegas and Raton Mountains and westward. Arizona: mountains and plateaus of northeastern third, from Greenlee County north to Lukachukai Mountains (Apache County) and west to Gila County and north rim of Grand Canyon. This species including varieties has a very broad range from New Foundland and Quebec west to British Columbia and south to California, Texas, and Georgia.

Chokecherries are eaten by wildlife and are sometimes used in making preserves and jelly. However, as the common name suggests, they are astringent when raw.

SOUTHWESTERN CHOKECHERRY (*Prunus virens* (Woot. & Standl.) Shreve)

Also called Gila chokecherry, Chisos wild cherry. Botanical synonyms: *P. rufula* Woot. & Standl., *P. virens* var. *rufula* (Woot. & Standl.) Sarg.

Description: Small to medium-sized tree to 40 feet in height and 2 feet in trunk diameter, with spreading crown, or a large shrub. **Leaves** elliptic, $1\frac{1}{2}$ to 2 inches long, short-pointed at apex and base, edges finely saw-toothed, shiny light green above, beneath paler and without hairs or with rusty brown hairs along midrib. **Flowers** many in clusters 3 to 6 inches long, small, $\frac{1}{4}$ inch across, white, in April and May. **Fruit** a chokecherry about $\frac{3}{8}$ inch in diameter, with calyx remaining attached at base, purplish black and shiny, juicy but astringent, with a large stone. **Bark** fissured into thin flat plates, gray, on larger trunks rough and scaly, black.

Distribution: Common, usually along streams and in canyons, mountains in oak woodland zone, 4,500 to 7,500 feet elevation. New Mexico: mountains of southern part, from Sacramento and White Mountains west to Black Range and Mogollon Mountains and southward. Arizona: mountains of southeastern and central parts, from Cochise to southern Apache County, west to Santa Cruz County and northwest below Mogollon Rim to Oak Creek Canyon (Coconino County) and Mohave County. Southwestern Texas west to Arizona and south to northern Mexico.

AMERICAN PLUM (*Prunus americana* Marsh.)

Also called wild plum.

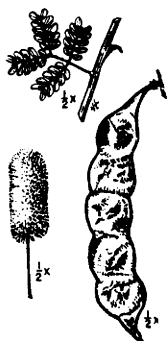
Description: Shrub or small tree to 10 feet or more in height, sometimes slightly spiny, often forming dense thickets. **Twigs** stout and stiff, widely spreading, the short lateral twigs often ending in spines. **Leaves** oval, 2 to 4 inches long, long-pointed, narrowed at base, sharply saw-toothed, thick and firm, appearing slightly wrinkled, dark green above and paler beneath, hairless or nearly so. **Flowers** 2 to 5 in a cluster, $\frac{3}{4}$ to 1 inch across, white, in April before the leaves. **Fruit** a plum about $\frac{3}{4}$ inch in diameter, yellowish red, juicy, acid, and edible, with large stone. **Bark** gray. **Wood** hard and heavy, dark brown tinged with red.

Distribution: Moist soil along streams, ditches, and hillsides and as an escape from cultivation, 5,000 to 7,200 feet elevation; not native in Arizona. New Mexico: apparently native in mountains of northeastern New Mexico, though in places it probably has spread from planted trees; recorded from Raton to Las Vegas, Pecos, and Taos, from White Mountains, and from Farmington perhaps as introduced.

The fruits of this wild plum are widely used in making preserves and jellies. As the plants form dense thickets they are excellent for erosion control and have been grown in quantities for this purpose. Over 200 named varieties of this native plum have been selected for cultivation, and its "blood" appears in at least 50 named and cultivated varieties.



Littleleaf lysiloma.



Catclaw acacia.



Sweet acacia.

Legume Family (Leguminosae)

LITTLELEAF LYSILOMA (*Lysiloma microphylla* Benth.)

Botanical synonyms: *L. watsoni* Rose, *L. thornberi* Britton & Rose.

Description: Shrub to 10 feet tall, dying back in severe winters; in cultivation a small tree 10 to 15 feet tall and 5 inches in trunk diameter, with spreading crown of dense feathery foliage; in Mexico a tree to 40 feet in height. **Leaves** numerous, bipinnately compound, 4 to 6 inches or more in length, with 4 to 9 pairs of primary divisions (pinnae), each with 25 to 33 pairs of feathery, oblong leaflets about $\frac{1}{4}$ inch long, nearly hairless or slightly hairy. **Flowers** crowded into balls $\frac{5}{8}$ inch in diameter, whitish, in May and June. **Pod** 4 to 9 inches long, broad and flat. **Bark** fissured and scaly, light brownish gray. **Wood** hard, brittle, dark brown.

Distribution: Very rare and local on rocky hillsides in upper desert and desert grassland, 2,800 to 4,000 feet elevation, known from two localities in southern Arizona; not in New Mexico. Arizona: Pima County, near Chimney Creek on western slopes of Rincon Mountains and in Baboquivari Mountains. Also widely distributed from northwestern Mexico to West Indies.

The plants of this Mexican species at its northern limit in southern Arizona may be relics of wider distribution in the past. They have large bases and are killed back by cold winters. This handsome shrub is planted at the Boyce Thompson Southwestern Arboretum at Superior, Ariz., and at Phoenix. It should be suitable as an ornamental in warmer areas, although subject to occasional winter kill.

CATCLAW ACACIA (*Acacia greggii* A. Gray)

Also called catclaw, devilsclaw, uña de gato. Botanical synonym: *Senegalia greggii* (A. Gray) Britton & Rose.

Description: Spiny, large spreading shrub or occasionally a small tree to 23 feet tall and 8 inches in trunk diameter, much-branched, with broad crown. **Twigs** light reddish brown or pur-

plish, angled, finely hairy, with scattered stout curved spines $\frac{1}{4}$ inch or less in length. **Leaves** bipinnately compound, 1 to 3 inches long, with 2 or 3 pairs of primary divisions (pinnae), each with 4 to 6 pairs of oblong, usually hairy leaflets $\frac{1}{4}$ inch or less in length. **Flowers** in dense clusters $1\frac{1}{2}$ to 2 inches long and $\frac{1}{2}$ inch in diameter, pale yellow, fragrant, from April to October. **Pod** $2\frac{1}{2}$ to 5 inches long and $\frac{1}{2}$ inch broad, flat, pale brown, often twisted and narrowed between the shiny brown seeds, remaining attached in winter. **Bark** thin, fissured into narrow scales, gray. **Wood** hard and heavy, the heartwood reddish brown and sapwood yellow.

Distribution: Often common to abundant, forming thickets along washes, slopes, and rocky canyons in desert and desert grassland, from slightly above sea level to 5,000 feet elevation. New Mexico: chiefly in southern part, north to Roswell in Pecos River valley and at Santa Rosa, north to Albuquerque in Rio Grande valley, and in Gila River drainage in Grant and Catron Counties. Arizona: widely distributed in southwestern two-thirds, north to Greenlee County and northwest below Mogollon Rim to Mohave County; also abundant in depths of Grand Canyon. From southern and central Texas west and northwest to southwestern Utah, southern Nevada, and southeastern California. Also in northern Mexico.

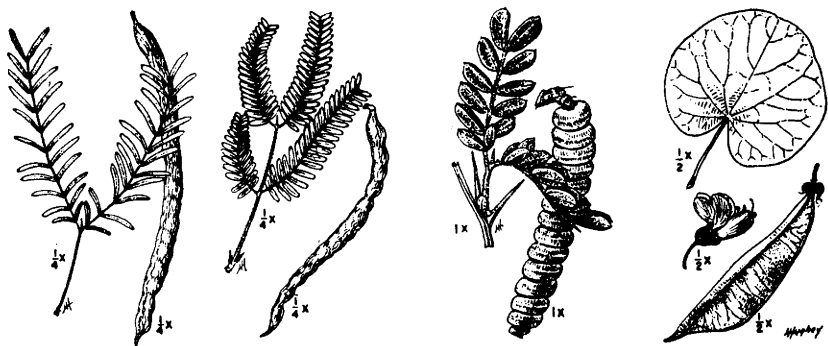
Catclaw acacia is to be avoided because of the sharp stout spines or prickles like a cat's claws, which tear clothing and flesh. The strong, heavy wood with contrasting heartwood and sapwood is used for souvenirs, locally for tool handles and similar objects, and also for fuel. The flowers are a good source of honey. Indians made meal from the seeds.

SWEET ACACIA (*Acacia farnesiana* (L.) Willd.)

Also called huisache. Botanical synonym: *Vachellia farnesiana* (L.) Wight & Arn.

Description: Spiny shrub or small tree to 20 feet tall and 1 foot in diameter at base, with widely spreading crown. **Twigs** with white, straight, slender spines $\frac{1}{8}$ to $\frac{1}{2}$ inch long or larger in pairs at nodes. **Leaves** bipinnately compound, 2 to 4 inches long, with usually 3 to 6 pairs of primary divisions (pinnae), each with 10 to 25 pairs of narrow leaflets $\frac{1}{8}$ to $\frac{1}{4}$ inch long, often slightly hairy. **Flowers** in balls $\frac{3}{8}$ inch in diameter, golden yellow, very fragrant, from April to November. **Pod** 2 to $2\frac{1}{2}$ inches long and $\frac{1}{4}$ to $\frac{3}{8}$ inch in diameter, not flattened, hard. **Bark** thin, ridged and scaly, reddish brown. **Wood** hard and heavy, reddish brown with thin pale sapwood.

Distribution: Very rare in desert grassland and lower oak woodland, 3,500 to 5,000 feet elevation, known from two localities in southern Arizona; not in New Mexico. Arizona: Mexican border at Sycamore Canyon near Ruby (Santa Cruz County) and Baboquivari Mountains (Pima County). Native also in southern Texas and collected at Otay, San Diego County, Calif. Widely planted and naturalized in southern United States from Florida to Texas and California. Also in Mexico, Central America, and South America.



Western honey mesquite. Velvet mesquite.

Fremont screwbean.

California redbud.

Cultivated as an ornamental because of the fragrant flowers. In southern Europe extensively grown for the flowers, known as cassie flowers, from which perfume is made.

Mesquit acacia, or "white-thorn" (*Acacia constricta* Benth.), a closely related species, is a common, smaller, branching and spreading shrub 2 to 10 feet tall, with longer white spines often 1 to 1½ inch long and with pods flattened and narrowed between the seeds. It is widely distributed in the desert and desert grassland in southern New Mexico and southern and central Arizona.

MESQUITE (*Prosopis juliflora* (Sw.) DC.)

Varieties: Honey mesquite (*P. juliflora* var. *glandulosa* (Torr.) Cockerell; botanical synonym, *P. glandulosa* Torr.). Western honey mesquite (*P. juliflora* var. *torreyana* L. Benson). Velvet mesquite (*P. juliflora* var. *velutina* (Woot.) Sarg.; botanical synonym, *P. velutina* Woot.).

Description: Spiny, spreading shrub branched from the base or a small to medium-sized tree 20 to 50 feet tall with a trunk 1 to 4 feet in diameter and with spreading crown of crooked branches. Twigs slightly zigzag, hairless (or in velvet mesquite densely short-hairy or velvety), with stout yellowish spines ¼ to 1 inch long in pairs at nodes, the nodes afterwards bearing short knotlike spurs ¼ to ½ inch in diameter. Leaves bipinnately compound, 3 to 8 inches long, with 1 or 2 pairs of primary divisions (pinnae), each with 9 to 22 pairs of yellow-green leaflets, usually very narrow and hairless (oblong and finely hairy in velvet mesquite). Flowers in dense narrow clusters 2 to 3 inches long, yellow, fragrant, from April to August. Pod 3 to 8 inches long, hairless (finely hairy in velvet mesquite), not splitting open, with sweetish pulp. Bark rough and thick, separating into long narrow strips, dark brown. Wood hard and heavy, reddish brown with thin yellow sapwood.

Distribution: Common to abundant on sandy plains and sand-hills and along stream valleys and washes, in short-grass, desert, desert-grassland, and infrequently lower oak-woodland zones, from slightly above sea level to 5,500 feet elevation. New Mexico: plains of eastern and southern parts north to Tucumcari and Santa Rosa

and in Rio Grande drainage to Socorro, and west to Hidalgo County. Arizona: widespread in southern, central, and northwestern parts northward in drainages of Gila, Salt, Verde, Bill Williams, and Virgin Rivers and up Colorado River to bottom of Grand Canyon. Texas to Kansas and southeastern Colorado, west to southwestern Utah, southern Nevada, and southern California. Also in West Indies, Mexico, Central America, Venezuela, and Colombia.

The mesquites of southwestern United States are considered here as a single species with three intergrading geographical varieties, following Benson and Darrow. Honey mesquite (var. *glandulosa*), a shrub or tree on the short-grass plains west to eastern New Mexico, is the variety with largest leaflets, 1 to 2½ inches long and widely spaced about ½ inch apart. Western honey mesquite (var. *torreyana*), usually shrubby or sometimes a small tree characteristic of southwestern New Mexico deserts, western Arizona, and southern California, has leaflets of intermediate size ½ to ¾ inch long spaced about ¼ inch apart. Velvet mesquite (var. *velutina*), usually a medium-sized tree found across southern and central Arizona, has the smallest leaflets, ¼ to ½ inch long and closely spaced about ⅛ inch apart. Velvet mesquite is further distinguished by the twigs, leaflets, and pods finely short-hairy to velvety, while the other varieties are essentially hairless. The leaves of velvet mesquite have 1 or 2 pairs of divisions (pinnae) in about equal numbers, while leaves of the other varieties have usually 1 pair. The typical Mexican and West Indian mesquite is similar to velvet mesquite but is hairless and has leaves with generally 1 pair of pinnae.

Mesquite provides one of the best wood fuels in the desert. Even the roots, which often are larger than the trunks and which penetrate to depths of 50 feet in areas with moist subsoils, are grubbed up. Plants cut back to the ground will send up new sprouts from the base. The wood is used also for fence posts and novelties. The sweet pods are relished by livestock and were prepared into meal and cakes as an important food of southwestern Indians. The flowers are a good source of honey.

Mesquites have created a serious problem in range management by spreading greatly onto southwestern grasslands in recent years following grazing. The hard seeds, which remain viable in the soil many years, have been widely disseminated by livestock. Methods of eradicating mesquite are being tested and applied in a few places. In sandy soils of southern New Mexico, dunes often form around shrubby mesquites, burying the plants except for a hemispherical mass of branching tips.

FREMONT SCREWBEAN (*Prosopis pubescens* Benth.)

Also called screwbean mesquite, tornillo. Botanical synonyms: *P. odorata* Torr. & Frém., *Strombocarpa pubescens* (Benth.) A. Gray, *S. odorata* (Torr. & Frém.) Torr.

Description: Spiny shrub or small tree to 20 feet tall and 1 foot in trunk diameter, or sometimes larger. Twigs usually gray-hairy when young, with white or pale gray stout spines ⅛ to ¾ inch long, paired at nodes and united to base of leafstalks. Leaves

bipinnately compound, 1 to 3 inches long, with 1 or sometimes 2 pairs of primary divisions (pinnae), each with 5 to 8 pairs of oblong, slightly hairy leaflets about $\frac{3}{8}$ inch long. **Flowers** in usually dense clusters 2 to 3 inches long, from May to August. **Pod** 1 to $1\frac{1}{2}$ inches long, less than $\frac{1}{4}$ inch in diameter, tightly coiled like a large screw, brown, not splitting open, with sweetish pulp. **Bark** separating in long fibrous strips, light brown or reddish. **Wood** very hard, heavy, light brown.

Distribution: Common along streams and valleys in desert zone, from slightly above sea level to 5,500 feet elevation. New Mexico: southwestern part, north in Rio Grande valley to Socorro. Arizona: southern and western parts, along larger valleys, from Cochise to Yuma and Mohave Counties. From southwestern Texas west and northwest to southwestern Utah, southern Nevada, and southeastern California. Also in northern Mexico.

Easily recognized by the screwlike pods and often called tornillo, which is Spanish for screw. The wood is used for fuel and fence posts. The sweet pods were made into meal and cakes by the Indians and can be chewed and eaten.

CALIFORNIA REDBUD (*Cercis occidentalis* Torr.)

Also called western redbud, Arizona redbud, Judas-tree. Botanical synonyms: *C. occidentalis* var. *orbiculata* (Greene) Tidestr., *C. arizonica* Rose.

Description: Large shrub or small tree to 15 feet tall, with many spreading branches and rounded crown. **Twigs** reddish brown when young, becoming dark gray the second year, without hairs. **Leaves** rounded, 2 to 4 inches long and broad, heart-shaped at base and rounded at apex, edges without teeth, thick, dark green above and paler beneath, usually hairless. **Flowers** appearing on old twigs before the leaves, numerous and very showy, several in a cluster, pealike, $\frac{1}{2}$ to $\frac{3}{4}$ inch long, purplish pink, in March and April. **Pods** 2 to 3 inches long, flat, thin, brown or purplish. **Bark** smooth, becoming slightly fissured, gray. **Wood** yellowish brown with thin whitish sapwood.

Distribution: Rare and local, restricted to a few scattered localities in canyons and mountains in upper desert and woodland zones, 4,000 to 6,000 feet elevation; not in New Mexico. Arizona: Baboquivari Mountains (Pima County), Superstition Mountains (Pinal County), Grand Canyon (Coconino County), and Pagumpa Springs (Mohave County). Also in southern Utah, southern Nevada, and California.

California redbud is common at Grand Canyon. It is worthy of cultivation as an ornamental for the spectacular flowers which cover the branches in early spring.

JERUSALEM-THORN (*Parkinsonia aculeata* L.)

Also called Mexican paloverde, horsebean, retama.

Description: Spiny, small or medium-sized tree to 40 feet tall and 1 foot in trunk diameter, with smooth, yellow-green bark, branches, and twigs, very open crown of spreading branches and drooping twigs and "streamers," appearing as if leafless most of

year. **Twigs** slightly zigzag, slender, with paired short spines at nodes bordering a third, larger, brownish spine 1 to $1\frac{1}{2}$ inch long at end of the very short leaf axis. **Leaves** bipinnately compound but appearing as if pinnate, consisting of the short, spine-tipped axis and 1 to 3 pairs of wiry but flattened, narrow, evergreen "streamers" (pinnae) 8 to 20 inches long. **Leaflets** 25 to 30 pairs on a "streamer," narrowly oblong, $\frac{1}{4}$ inch or less in length, light green, soon falling. **Flowers** in loose clusters 3 to 8 inches long, showy, about $\frac{3}{4}$ inch across, golden yellow except that upper petal is red-spotted and turns red in withering. **Pod** 2 to 4 inches long, less than $\frac{1}{2}$ inch in diameter, long-pointed, narrowed between the few seeds. **Bark** smooth, thin, yellow green, at base of larger trunks becoming scaly and brown. **Wood** hard and heavy.

Distribution: Rare and very local as a native tree in Arizona, in foothills, canyons, and valleys of desert and desert grassland zones, 3,000 to 4,500 feet elevation; also extensively planted as an ornamental tree and escaping. New Mexico: not native but reported to escape from cultivation in southern part. Arizona: native in southwestern part, in foothills of Coyote and Baboquivari Mountains (Pima County) and at Horse Tanks in Castle Dome Mountains (Yuma County); escaped from cultivation in Santa Cruz River valley (Santa Cruz County) and other places. Native also in southern Texas and south through Mexico to Central America and South America. Naturalized from Florida to Texas and California and in tropical parts of the world.

Jerusalem-thorn is a popular, fast-growing, attractive tree widely planted as an ornamental in warmer parts of the Southwest and in tropical countries. The word "Jerusalem" in this and other plant names (such as Jerusalem-artichoke) does not refer to the city in Palestine but is a corruption of *girasol*, meaning "turning toward the sun."

YELLOW PALOVERDE (*Cercidium microphyllum* (Torr.) Rose & Johnst.)

Also called foothill paloverde, littleleaf paloverde, littleleaf horsebean. Botanical synonym: *Parkinsonia microphylla* Torr.

Description: Spiny small tree to 25 feet tall and 1 foot in trunk diameter, with widely spreading, much-branched open crown, and with smooth, yellow-green bark, branches, and twigs, leafless most of the year. Short lateral twigs stiff and ending in stout spines. **Leaves** few, bipinnately compound but apparently pinnately compound, $\frac{3}{4}$ to 1 inch long, consisting of a very short axis and 1 pair of primary divisions (pinnae, each bearing 4 to 7 pairs of very small elliptical leaflets $\frac{1}{8}$ inch or less in length, yellow-green, slightly hairy, appearing in spring but soon shedding. **Flowers** numerous and covering the tree, few in a cluster 1 inch long, about $\frac{1}{2}$ inch across, pale yellow, about $\frac{1}{2}$ inch in diameter, the upper petal white or cream, in April and May. **Pod** 2 to 3 inches long, about $\frac{1}{4}$ inch in diameter, cylindric, 1- to 3-seeded, narrowed between the seeds. **Bark** smooth, thin, yellow green, at base of larger trunks becoming slightly rough and gray. **Wood** hard, heavy, dark



Jerusalem-thorn.

Yellow paloverde.

Blue paloverde.

Mescalbean.

orange brown streaked with red, with thick light brown or yellow sapwood.

Distribution: Abundant and characteristic tree on plains, foothills, and mountains in Arizona deserts, 500 to 4,000 feet elevation; not in New Mexico. Arizona: deserts of southern and central parts, from Benson (Cochise County) and Coolidge Dam (Gila County) west to southern Mohave County and Yuma County. Also in southeastern California (Whipple Mountains) and northwestern Mexico (Sonora and Lower California).

Yellow paloverde, or "foothill paloverde," is a characteristic, slowly growing tree of Arizona deserts, associated especially with the saguaro. This species is commoner than blue paloverde and grows on the widespread drier sites, while blue paloverde occurs chiefly along drainages. Both species are leafless most of the year. The Spanish common name "palo verde," meaning "green tree," "green pole," or "green stick," refers to the distinctive smooth green branches and twigs, which manufacture food in the absence of leaves and with much less evaporation of water. The specific names yellow paloverde and blue paloverde refer to the color shades of the branches, twigs, and foliage. Yellow paloverde blossoms later in the spring than blue paloverde and has smaller and paler yellow flowers. Seeds of paloverdes were ground and used as food by the Indians. The trees are grown as ornamentals.

BLUE PALOVERDE (*Cercidium floridum* Benth.)

Botanical synonyms: *C. torreyanum* (S. Wats.) Sarg., *Parkinsonia torreyana* (Benth.) S. Wats.

Description: Spiny, small tree to 30 feet in height and 1½ feet in trunk diameter, with widely spreading, very open crown and with smooth, blue-green bark, branches, and twigs, leafless most of the year. **Twigs** slightly zigzag, bearing a spine ¼ inch or less in length at each node. **Leaves** few and scattered, bipinnately compound, 1 inch long, with 1 pair of primary divisions (pinnae), each bearing 2 or 3 pairs of oblong leaflets about ¼ inch long, pale blue-green and hairless at maturity, appearing in spring but soon shedding. **Flowers** numerous over the tree, 4 or 5 in a cluster 1 to 2

inches long, about $\frac{3}{4}$ inch across, bright yellow, the upper petal with a few red spots but not turning red in withering, in late March or April (sometimes also from August to October). **Pod** 3 to 4 inches long, flattened. **Bark** smooth, thin, blue-green, at base of larger trunks becoming scaly and brown. **Wood** soft, heavy, light brown with light yellow sapwood.

Distribution: Common and characteristic tree along washes and valleys and sometimes on slopes, desert and desert grassland, from slightly above sea level to 4,000 feet elevation; not in New Mexico. **Arizona:** deserts of southern and central parts, from San Pedro River in Cochise County and Gila River at Duncan (Greenlee County), northwest to Gila, southern Yavapai, southern Mohave Counties and southwest to Yuma County. Also in southeastern California and northwestern Mexico (Sonora and Lower California).

Blue paloverde is very showy when in blossom, becoming a mass of bright yellow flowers.

MESCALBEAN (*Sophora secundiflora* (Ortega) Lag.)

Also called frijolito, mescalbean sophora, coralbean, goat-bean. Botanical synonym: *Broussonetia secundiflora* Ortega.

Description: Evergreen shrub usually 3 to 5 feet tall or rarely small tree to 15 feet tall and 4 inches in trunk diameter, much branched. **Twigs** densely white-hairy when young. **Leaves** pinnately compound, 3 to 6 inches long. **Leaflets** 7 to 13, elliptical, $\frac{3}{4}$ to 2 inches long, rounded or slightly notched at apex, leathery, shiny dark green above, paler and hairless or nearly so beneath. **Flowers** in dense dropping clusters 2 to 3 inches long, large and showy, $\frac{3}{4}$ to 1 inch long, pealike, purple, fragrant, in April. **Pod** 1 to 4 inches or more in length, $\frac{1}{2}$ inch in diameter, finely white-hairy, hard and thick-walled, narrowed between the seeds, with 1 to 4 or more rounded scarlet seeds $\frac{1}{2}$ inch long. **Wood** hard, very heavy, orange with red streaks and with thick yellow sapwood.

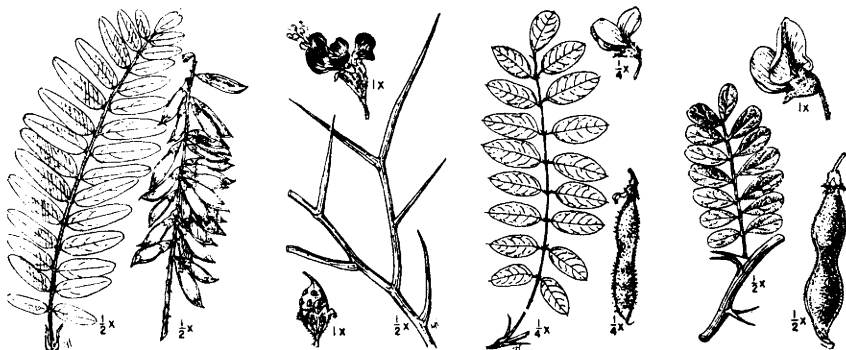
Distribution: Local in canyons and limestone cliffs of foothills and mountains, oak woodland zone, 4,500 to 6,500 feet elevation; not in Arizona. **New Mexico:** known only from Guadalupe Mountains in southeastern part. Also in Texas and northeastern Mexico.

This attractive shrub with beautiful blue flowers and conspicuous red seeds is reported to be cultivated in the southern States. **The seeds are poisonous.** One might be sufficient to kill an adult. Also, the foliage is thought to be toxic to livestock.

KIDNEYWOOD (*Eysenhardtia polystachya* (Ortega) Sarg.)

Botanical synonym: *E. orthocarpa* (A. Gray) S. Wats.

Description: Shrub or sometimes a small tree to 20 feet in height, with a short trunk 6 inches or more in diameter and many slender branches. **Twigs** gray or brown, hairy when young. **Leaves** pinnately compound, 2 to 5 inches long, resinous and gland-dotted, with disagreeable odor. **Leaflets** mostly 10 to 23 pairs with the last unpaired, narrowly oblong, $\frac{3}{8}$ to $\frac{3}{4}$ inch long, rounded or slightly notched at apex, thick, pale gray green, finely hairy, with con-



Kidneywood.

Smokethorn.

New Mexican locust.

Tesota.

spicuous brown dots beneath. **Flowers** numerous, crowded in clusters 3 to 4 inches long, stalkless and pointed downward, nearly $\frac{1}{2}$ inch long, white, with minute brown dots, from May to August. **Pods** many, $\frac{1}{2}$ inch long, flat and slightly curved, brown, hanging down, 1-seeded. **Bark** thin, scaly and peeling off, light gray. **Wood** heavy, hard, light reddish brown with thin yellow sapwood.

Distribution: Common on dry hillsides and rocky canyons of mountains, upper desert grassland, and lower oak woodland, 3,500 to 5,000 feet elevation, in Mexican border region. New Mexico: extreme southwestern corner, in southern Hidalgo County. Arizona: mountains of southeastern part, from Cochise County west to Pinal County and Baboquivari Mountains in Pima County. Also in northern and central Mexico.

The resinous foliage is readily browsed by livestock and wildlife. Water in which the heartwood has been soaked has a peculiar fluorescence and formerly was used for kidney and bladder diseases under the name *lignum nephriticum*. A dye has been made from the wood also.

SMOKETHORN (*Dalea spinosa* A. Gray)

Also called smoketree, indigobush, smokethorn dalea.

Description: Small, compact, spiny tree or large shrub to 20 feet tall, with a short, branching trunk up to $11\frac{1}{2}$ feet in diameter and with compact mass of smoky gray or silvery branches and spiny twigs, leafless most of the year. **Twigs** gray or silvery with dense pressed hairs, with brown gland dots, ending in sharp spines. **Leaves** few, reverse lance-shaped, $\frac{3}{4}$ to 1 inch long, gland-dotted, remaining only a few weeks and falling before flowering. **Flowers** few in a cluster, pealike, $\frac{1}{2}$ inch long, dark purple, with brown gland dots, in April and May. **Pods** egg-shaped, $\frac{3}{8}$ inch long, gland dotted, with 1 or 2 seeds. **Bark** of trunk thin, fissured and scaly, dark gray brown. **Wood** soft, lightweight, dark brown with whitish sapwood.

Distribution: Washes in the desert at low, frost-free elevations from slightly above sea level to 1,000 feet (rarely 1,500 feet); not in New Mexico. Arizona: deserts of southwestern part, from west-

ern Pima and western Maricopa Counties west to Yuma and southwestern Mohave Counties. Also in southeastern California and in northwestern Mexico (Lower California and Sonora).

Smokethorn, or "smoketree," derives its common names from the smoky gray color of the compact, leafless branches and twigs, as seen from a distance.

NEW MEXICAN LOCUST (*Robinia neo-mexicana* A. Gray)

Also called southwestern locust. Botanical synonyms: *R. neo-mexicana* var. *luxurians* Dieck, *R. neo-mexicana* var. *subvelutina* (Rydb.) Kearney & Peebles.

Description: Spiny shrub or small tree up to 25 feet tall and 8 inches in trunk diameter. Twigs with brownish, glandular hairs when young, with brown or reddish, stout spines $\frac{1}{4}$ to $\frac{1}{2}$ inch long in pairs at nodes. Leaves pinnately compound, 6 to 12 inches long. Leaflets 15 to 21, elliptical, $\frac{1}{2}$ to $1\frac{1}{2}$ inches long, bristle-tipped, thin, pale blue green, hairy when young but becoming nearly hairless. Flowers many in large clusters, large and showy, about $\frac{3}{4}$ inch long, pealike, purplish pink, fragrant, from May to August. Pod $2\frac{1}{2}$ to $4\frac{1}{2}$ inches long, flat, thin, reddish brown, bristly hairy and usually glandular. Bark furrowed and scaly, thin, light brown or gray. Wood very hard, heavy, yellow streaked with brown.

Distribution: Common to abundant in canyons and mountains, often forming almost pure thickets on north-facing slopes and also associated with Gambel oak, ponderosa pine forest and upper pinyon-juniper woodland, 4,000 to 8,500 feet elevation. New Mexico: widely distributed in mountains of western two-thirds and northeastern corner, from Sacramento, White, and Sandia Mountains and Union County, westward. Arizona: northeastern half, from Cochise and Pima Counties northwest to Hualpai Mountains and north rim of Grand Canyon. Also in northern Mexico.

Occasionally propagated as an ornamental and for erosion control and establishing itself from cultivation. Because of rapid growth and the tendencies to form thickets and to sprout from the horizontal roots, the plants are of special value in reducing erosion.

TESOTA (*Olneya tesota* A. Gray)

Also called desert ironwood, palo fierro, palo de hierro.

Description: Spiny evergreen tree to 30 feet in height, with a short trunk to 3 feet in diameter with symmetrical, widely spreading crown. Twigs green or gray and densely hairy when young, becoming light brown, with sharp spines about $\frac{1}{4}$ inch long in pairs at nodes. Leaves in dense clusters, pinnately compound, 1 to $2\frac{1}{4}$ inches long, generally evergreen. Leaflets 2 to 10 pairs, oblong or obovate, $\frac{3}{8}$ to $\frac{3}{4}$ inches long, usually rounded at ends, thick, blue-green, finely hairy with pressed hairs. Flowers in short clusters, pealike, $\frac{1}{2}$ inch long, purplish, in May and June. Pod 2 to $2\frac{1}{2}$ inches long, brown, glandular hairy, thick-walled, with few seeds. Bark thin, smoothish, gray, on large trunks becoming much fissured and shreddy. Wood very hard, very heavy, dark brown with thin yellow sapwood.

Distribution: Common and characteristic desert tree of sandy washes in foothills at lower, warmer elevations from slightly above sea level to 2,500 feet; not in New Mexico. Arizona: southwestern quarter, from Tucson and lower Verde River valley (Maricopa County) westward to southern Mohave County and Yuma County. Also in southeastern California and in northwestern Mexico (Lower California and Sonora).

The wood is so hard that it dulls tools. In weight, it is perhaps second only to leadwood (southern Florida), of all trees native in the United States. It is easily polished and is used for novelties, such as bowls and small boxes. Many trees have been cut for fuel. As tesota, or "ironwood," is limited to warm areas, it is regarded as an indicator in the selection of sites for citrus orchards. The seeds, which are produced in quantities, are edible when roasted and have been used for food by Indians and many other residents.

SOUTHWESTERN CORALBEAN (*Erythrina flabelliformis* Kearney)

Also called western coralbean, chilicote, Indian-bean.

Description: Spiny shrub or sometimes a small tree to 15 feet tall and 10 inches in diameter at base, leafless except in summer. Twigs thick, brittle, with many scattered, single or paired, short, hooked spines. Leaves pinnately compound, with spiny leafstalk and 3 leaflets, broadly triangular with rounded angles or fan-shaped, $1\frac{1}{2}$ to 3 inches long and 2 to 4 inches broad, gray-green, produced in summer. Flowers several in a cluster, large and showy, $1\frac{1}{2}$ to 2 inches long and only $\frac{1}{4}$ inch broad, bright red or scarlet, in spring and sometimes also late summer. Pod large, 6 to 10 inches long and $\frac{1}{2}$ to $\frac{3}{4}$ inch broad, thick-walled, with several large, bright red seeds about $\frac{1}{2}$ inch long. Bark light brown with longitudinal white lines. Wood very brittle.

Distribution: Fairly common on warm, dry rocky slopes, washes, and canyons of foothills and mountains in upper desert, desert grassland, and oak woodland zones, 3,000 to 5,000 feet elevation, in the Mexican border region. New Mexico: southwestern corner, in Hidalgo and Grant Counties. Arizona: southeastern part, from Cochise County west to Santa Catalina Mountains and Baboquivari Mountains in Pima County. Also in northern and northwestern Mexico.

Usually shrubby with branches freezing back in severe winters. The scarlet seeds are poisonous. They are used in making novelties and necklaces and formerly by Indians as a charm.

Rue Family (Rutaceae)

PALE HOPTREE (*Ptelea pallida* Greene)

Botanical synonym: *P. angustifolia* auth., not Benth.

Description: Shrub or small tree to 10 feet or more in height, with strong, lemon-scented odor of crushed foliage and twigs. Twigs straw-colored to greenish yellow. Leaves compound, long-

stalked, with 3 mostly lance-shaped leaflets 1 to 2 inches long, long-pointed, edges slightly wavy-toothed or without teeth, thick and firm, with many minute gland dots, yellow-green and often shiny above, beneath paler and hairless or sparsely hairy. **Flowers** in branching clusters, partly of separate sexes, small, greenish yellow, in May. **Fruit** disk-shaped, flat, light brown, 2- or 3-seeded, surrounded by a broad wing $\frac{5}{8}$ inch in diameter.

Distribution: Canyons, plateaus, and mountains, pinyon-juniper woodland and upper part of desert zone, 2,000 to 7,000 feet elevation. New Mexico: mountains in southern part, from Oregon Mountains westward. Arizona: central and northern parts, from Yavapai County to Coconino and Mohave Counties; especially common at Grand Canyon. Also in southwestern Texas.

NARROWLEAF HOPTREE (*Ptelea angustifolia* Benth.)

Botanical synonym: *P. angustifolia* var. *cognata* (Greene) Kearney & Peebles.

Description: Shrub or small tree to 13 feet or more in height, with strong, unpleasant odor in crushed foliage and twigs. **Twigs** brown or dark purple. **Leaves** compound, long-stalked, with 3 mostly ovate leaflets 1 to 3 inches long, long-pointed, edges slightly wavy-toothed or without teeth, thin, with many minute gland dots, green or blue-green but not shiny, beneath often with a bloom and soft-hairy or nearly hairless. **Flowers** in branching clusters, partly of separate sexes, small, greenish yellow, from March to June. **Fruit** disk-shaped, flat, light brown, 2- or 3-seeded, surrounded by a broad wing $\frac{5}{8}$ inch in diameter. **Bark** smooth, brownish gray.

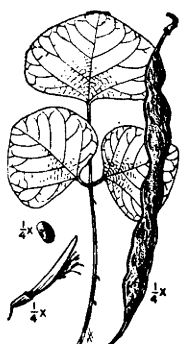
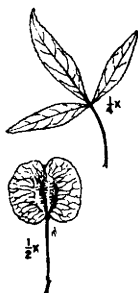
Distribution: Mostly in canyons, ponderosa pine forest and pinyon-juniper woodland, 3,500 to 8,500 feet elevation. New Mexico: widely distributed in mountains of western two-thirds, from Organ Mountains, White Mountains and Sandia Mountains north and west. Arizona: northeastern half, from Cochise and Apache Counties west to Hualpai Mountains and to Pima County. Texas to Colorado, Arizona, and California, and south to Mexico.

Ailanthus Family (Simaroubaceae)

HOLACANTHA (*Holacantha emoryi* A. Gray)

Also called crucifixion-thorn, corona de Cristo.

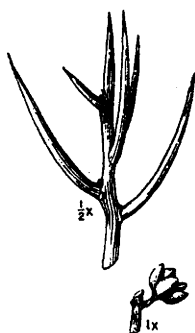
Description: Very spiny shrub or small tree to 12 feet in height, with numerous stiff, tangled branches and twigs, leafless most of the year. **Twigs** short, stout, $\frac{1}{8}$ to $\frac{1}{4}$ inch in diameter, finely hairy when young, ending in sharp spines. **Leaves** scalelike, soon shedding. **Flowers** male and female on different plants (dioecious), in dense many-flowered clusters, small, $\frac{1}{4}$ to $\frac{3}{8}$ inch in diameter, greenish yellow, in June and July. **Fruit** a ring of 5 to 10 flattened, 1-seeded segments $\frac{1}{4}$ inch long, the clusters of old fruits remaining attached for years. **Bark** smooth.

Southwestern
coralbean.

Pale hoptree.



Narrowleaf hoptree.



Holacantha.

Distribution: Frequent in desert valleys on clay soils but also on sand dunes, 500 to 2,000 feet elevation; not in New Mexico. **Arizona:** southwestern quarter, from western Pima County and Gila River at Florence (Pinal County) west in Maricopa and Yuma Counties, especially in lower Gila and Colorado River drainages. Also in southeastern California and in Sonora, Mexico.

Holacantha (Latin for allthorn) is one of the three very spiny, much branched, shrubby species known in the Southwest as "crucifixion-thorns." The others are canotia and allthorn. *Holacantha* is the only native southwestern representative of the ailanthus family (Simaroubaceae), which is mostly tropical.

Ailanthus (*Ailanthus altissima* (Mill.) Swingle; also called tree-of-heaven and tree-of-heaven ailanthus), a native tree of China belonging to the same family, is planted as a shade tree in southern New Mexico and Arizona. It occasionally escapes from cultivation in the Southwest, spreading by sprouts from the roots, and may in time become naturalized here as in many other parts of the United States. This medium-sized, coarsely branched tree has large pinnately compound leaves $1\frac{1}{2}$ to $2\frac{1}{2}$ feet long, with 13 to 25 broadly lance-shaped, long-pointed leaflets 3 to 5 inches long, each with 2 to 4 teeth near base.

Bursera Family (Burseraceae)

FRAGRANT BURSER (Bursera odorata T. S. Brandegee)

Description: Strongly aromatic shrub or small tree to 15 feet tall. **Leaves** pinnately compound, 2 to 4 inches long, with winged axis, aromatic, with odor of tangerine peel when crushed. **Leaflets** 5 to 11, lance-shaped, $\frac{1}{2}$ to $1\frac{1}{2}$ inches long, edges without teeth, hairless. **Flowers** several in a cluster below a group of new leaves at end of a short side twig, in July. **Fruits** 3-angled, less than $\frac{3}{8}$ inch long, gray, 1-seeded, splitting into 3 parts. **Bark** of branches gray brown, on old trunks peeling off in large, thin, papery sheets.

Distribution: Rare at one Arizona locality near Mexican border, on dry limestone cliffs in desert mountains, 4,000 feet elevation; not in New Mexico. **Arizona:** southern part, known only from western foothills of Baboquivari Mountains near Fresnal (Pima County). Also in Mexico.

This Mexican desert tree has been found in the United States at only one place, where the few living plants appear to be relics from a more favorable period.

ELEPHANTTREE (*Bursera microphylla* A. Gray)

Also called torote, copal, elephant bursera.

Description: Strongly aromatic shrub or small tree to 20 feet tall, with relatively thick, swollen trunk to 1 foot in diameter, short and sharply tapering, with stout, crooked, tapering branches, and with widely spreading, rounded, open crown of thin foliage. **Twigs** reddish brown, hairless. **Leaves** pinnately compound, 1 to 1¼ inches long, with winged axis, aromatic. **Leaflets**, 15 to 30, small, narrowly oblong leaflets about ¼ inch long, edges without teeth, hairless. **Flowers** single or 2 or 3 at a node, short-stalked, small, less than ¼ inch long, whitish, partly of separate sexes, in July. **Fruits** 3-angled, ¼ inch long, red, 1-seeded, splitting into 3 parts, aromatic. **Bark** of trunk and branches papery and peeling off in thin flakes, white on outside, the next thin layers green, and the inner thick layers red and corky. **Wood** hard, pale yellow.

Distribution: Common locally on rocky slopes of very arid desert mountains, 1,000 to 2,500 feet elevation; not in New Mexico. **Arizona:** mountains of southwestern part, south of Gila River, from western Pima County, western Pinal County and Salt River Mountains (Maricopa County) west to Gila and Tinajas Altas Mountains in southern Yuma County. Also at one locality in southeastern California and in Mexico.

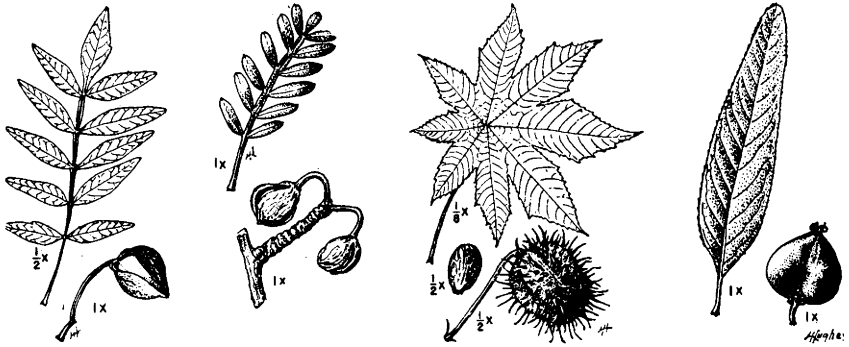
The common name is from the stout, tapering branches which resemble an elephant's trunk. The trees are not resistant to cold and are killed back when young.

Spurge Family (Euphorbiaceae)

CASTOR-BEAN (*Ricinus communis* L.)

Description: Herb, shrub, or in warm regions a small tree to 15 feet or more in height, with hollow stems and leafstalks. **Leaves** very long-stalked, very large, nearly circular, 1 foot or more in diameter, with usually 7 to 10 fingerlike (palmate) lobes surrounding the leafstalk, edges saw-toothed, thick, often reddish or purplish tinged. **Flowers** in large branched clusters at tops of branches, female flowers above and male flowers below. **Seed capsule** ⅝ to 1 inch in diameter, spiny, 3-celled, splitting open, with 3 large, poisonous seeds ½ to ¾ inch long. **Bark** smooth, light gray.

Distribution: Escaping from cultivation and naturalized along washes and streams in desert in Arizona but not New Mexico. Ari-



Fragrant bursera. Elephanttree.

Castor-bean. Jumping-bean sapium.

zona: naturalized near Superior (Pinal County), Fort Verde (Yavapai County), and perhaps elsewhere. Probably native of Africa but widely cultivated and naturalized over the world, escaping from cultivation in warmer parts of the United States.

Castor-bean is extensively planted for ornament, as a large annual herb in temperate regions and as a perennial shrub or small tree in regions with mild winters. **The raw seeds are very poisonous.** It is reported that eating three seeds may cause death. Other parts of the plant also contain the toxic principle, which is destroyed by heat. Castor oil, extracted from the seeds, is used in medicine and as a lubricant.

JUMPING-BEAN SAPIUM (*Sapium biloculare* (S. Wats.) Pax)

Also called Mexican jumping-bean.

Description: Tall shrub or small tree to 15 feet in height, with milky juice. **Leaves** lance-shaped, $\frac{3}{4}$ to $2\frac{1}{4}$ inches long, long-pointed, edges finely saw-toothed, leathery, without hairs. **Flowers** in narrow zigzag clusters 1 to $2\frac{1}{4}$ inches long at ends of twigs, stalkless, fragrant male flowers above and 1 or 2 female flowers at base, from March to November. **Seed capsule** 2-lobed, nearly $\frac{1}{2}$ inch broad, splitting open, with 2 nearly spherical, mottled brownish gray seeds about $\frac{1}{2}$ inch long.

Distribution: Common locally in rocky slopes and sandy washes of desert, 800 to 2,500 feet elevation; not in New Mexico. Arizona: southwestern part, south of Gila River, from western Pima County and near Gila Bend (southern Maricopa County) west to Tinajas Altas (Yuma County). Also in northwestern Mexico (Sonora and Lower California).

This species produces Mexican jumping-beans, though it is not the important, widely distributed Mexican jumping-bean. The larva of a small moth, which often infests the seeds, by its movements causes a seed to move and roll slightly. **The milky juice is poisonous.** It has been used as a fish poison and by Indians to poison their arrows. A very small amount of this juice rubbed into the eyes accidentally after a plant is handled will cause extreme pain for hours.

Cashew Family (Anacardiaceae)

SUGAR SUMAC (*Rhus ovata* S. Wats.)

Also called sugarbush, mountain-laurel.

Description: Evergreen shrub or small tree to 15 feet in height and 5 inches in trunk diameter, with rounded crown. **Leaves** ovate $1\frac{1}{2}$ to $3\frac{1}{4}$ inches long, short-pointed, rounded at base, edges without teeth, thick and leathery, not flat but curved upward at midrib, shiny light green on both sides, hairless. **Flowers** small in crowded clusters 2 inches long at tips of twigs, about $\frac{1}{4}$ inch across, pink or reddish in buds but cream-colored when open, in April. **Fruit** reddish, hairy, sweetish. **Bark** rough, shaggy and very scaly, gray brown. **Wood** light brown.

Distribution: Common on mountain slopes in chaparral, 3,000 to 5,000 feet elevation; not in New Mexico. Arizona: Gila, eastern Maricopa, southern Coconino (Oak Creek Canyon), and Yavapai Counties and on Hualpai Mountains. Also in southern California and in northern Lower California, Mexico.

This attractive broadleaf evergreen is one of several shrubby species of the chaparral vegetation in southern California which reappear in the same zone in the mountains of central Arizona. In California it is planted for erosion control and landscaping in mountains and as an ornamental. The common name refers to the sweetish, edible fruit coats, which were used as sugar by the Indians.

KEARNEY SUMAC (*Rhus kearneyi* Barkley)

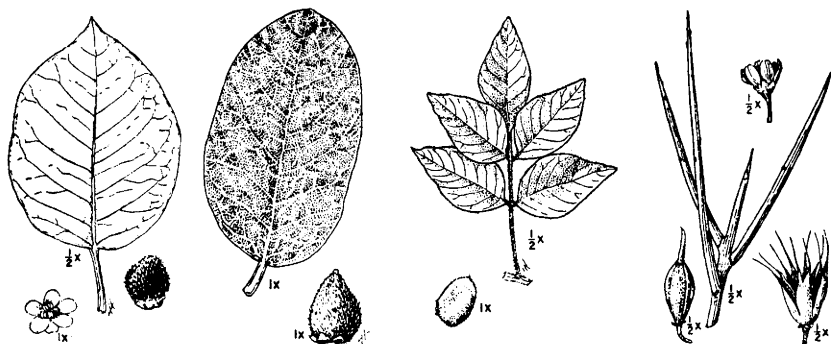
Description: Evergreen large shrub or small tree to 18 feet in height. **Leaves** oblong, 1 to $2\frac{1}{4}$ inches long, rounded or blunt-pointed at apex, edges without teeth but rolled under, very leathery, almost without hairs. **Flowers** small in short, crowded clusters at tips of twigs, less than $\frac{1}{4}$ inch across, whitish. **Fruit** oblong, $\frac{3}{8}$ inch long, slightly flattened, reddish and hairy.

Distribution: Known from a single locality on dry slopes in desert, 1,000 to 1,500 feet elevation, on Mexican border; not in New Mexico. Arizona: known only from Tinajas Altas Mountains, southern Yuma County, where this species was discovered.

Kearney sumac is named for Thomas H. Kearney, botanist of the United States Department of Agriculture and co-author of Flowering Plants and Ferns of Arizona.

MEARNS SUMAC (*Rhus choriophylla* Woot. & Standl.)

Description: Evergreen shrub usually less than 7 feet tall, rarely a small tree 15 feet in height and 3 inches in trunk diameter, with relatively few branches. **Leaves** pinnately compound, 2 to 3 inches long. **Leaflets** 3 or 5, ovate, 1 to 2 inches long, short-pointed, edges without teeth, thick and leathery, shiny green above and dull green below, slightly hairy. **Flowers** small, several in cluster, about $\frac{1}{8}$ inch long, whitish, in August and September. **Fruit** $\frac{1}{4}$ inch long, reddish, hairy. **Bark** scaly and shaggy, gray.



Sugar sumac.

Kearney sumac.

Mearns sumac.

Canotia.

Distribution: Dry rocky slopes especially on limestone, canyons and mountains in oak woodland, 4,000 to 6,000 feet elevation. New Mexico: mountains of southern part, from Sacramento Mountains, San Andres Mountains, and Organ Mountains west to Hidalgo County. Arizona: mountains of southeastern corner, in Cochise, Santa Cruz, Pima, and Pinal Counties. Also in Sonora, Mexico.

Previously known only as a shrub, Mearns sumac has been found by Leslie N. Goodding as a small tree in Santa Cruz County, Ariz. This species was discovered by Edgar A. Mearns (1856-1916), American naturalist and Army surgeon, who made very large plant and animal collections along the Mexican boundary from 1891 to 1894.

Bittersweet Family (Celastraceae)

CANOTIA (*Canotia holacantha* Torr.)

Also called crucifixion-thorn.

Description: Spiny shrub or small tree to 18 feet in height, with short trunk up to 1 foot in diameter, with many flexible, upright, yellowish green, rushlike branches and twigs in broomlike masses, leafless most of the year and resembling paloverdes. Twigs $\frac{1}{8}$ to $\frac{1}{4}$ inch in diameter, inconspicuously grooved, hairless, with small black rings at base where forked, partly ending in spines or dead tips. **Flowers** 3 to 7 in small clusters along the twigs, nearly $\frac{1}{4}$ inch in diameter, greenish white, May to August. **Fruit** a hard, egg-shaped, long-pointed capsule, $\frac{3}{4}$ inch or more in length, reddish brown, 5-celled and splitting open along 10 lines, seeds single or paired and winged. **Bark** on branches smooth and yellow green, at base fissured, becoming rough and slightly shreddy, gray.

Distribution: Common or abundant locally on dry slopes and hillsides in upper desert and lower chaparral, 2,000 to 5,000 feet elevation; not in New Mexico. Arizona: chiefly in central and western parts, from Graham and southern Navajo Counties west to southern Coconino (Oak Creek Canyon), Yavapai (Verde River

valley and southern part), Mohave, and Yuma Counties; at Havasu Canyon near Grand Canyon. Also at Rainbow Bridge Canyon, southern Utah.

Canotia resembles the paloverdes in its yellowish green, leafless branches and twigs which are more crowded, upright, and in broom-like masses. It replaces paloverdes as a common desert tree in the northern part of its range and is the commonest of the three spiny, much-branched shrubby species called "crucifixion-thorns."

Maple Family (Aceraceae)

INLAND BOXELDER (*Acer negundo* L. var. *interius* (Britton) Sarg.)

Also called boxelder, Rocky Mountain boxelder. Botanical synonyms: *A. negundo* var. *arizonicum* Sarg., *Negundo interius* (Britton) Rydb.

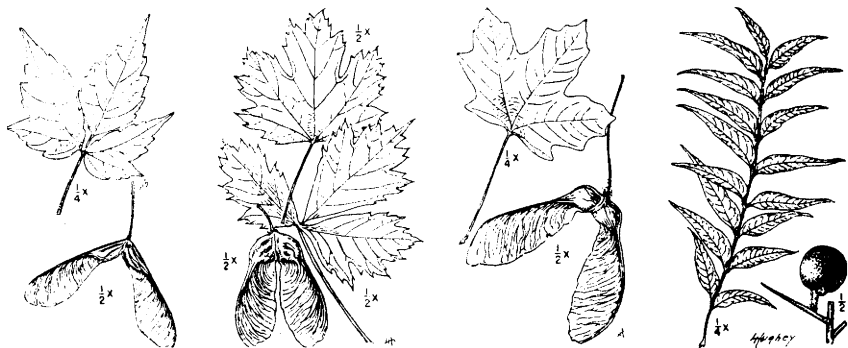
Description: Medium-sized tree to 50 feet in height and 21½ feet in trunk diameter, with broad, rounded crown. Twigs greenish, usually finely and densely hairy or hairless and covered with a bloom. **Leaves** paired, long-stalked, pinnately compound, about 6 inches long, with 3 or sometimes 5 leaflets, the end leaflet long-stalked. **Leaflets** ovate, 2 to 4 inches long, long-pointed, coarsely saw-toothed, usually thick, slightly hairy beneath or nearly hairless. **Flowers** male and female on different trees (dioecious), in small several-flowered clusters opening before or with the leaves, very small, yellow-green, in April. **Fruits** paired, clustered, long-winged "keys" 1½ to 2 inches long. **Bark** with many narrow fissures and ridges, light gray-brown, on large trunks becoming deeply furrowed. **Wood** soft, lightweight, whitish or pale yellow.

Distribution: Common along streams, chiefly in mountains, oak woodland and ponderosa pine forest zone, 4,000 to 8,000 feet elevation. New Mexico: widely distributed in high mountains of western two-thirds and northeastern corner, from White Mountains, Sangre de Cristo Range, and Union County westward. Arizona: high mountains and plateaus across the State except in southwest quarter, from Cochise to Apache County and west to Mohave and Pima Counties. Boxelder (*Acer negundo* L.), including a few geographical varieties, has a broad range from Massachusetts to Minnesota and Alberta, south to California, Texas, and Florida. Inland boxelder is a variety of the interior, from New Mexico to Missouri, north to Manitoba and Alberta, and south to Arizona.

Inland boxelder has thicker and more hairy leaves than the typical form of boxelder in eastern United States. It is a rapidly growing, short-lived tree often planted for shade where water is available and has become naturalized locally.

ROCKY MOUNTAIN MAPLE (*Acer glabrum* Torr.)

Also called dwarf maple. Botanical synonyms: *A. neomexicanum* Greene, *A. glabrum* var. *neomexicanum* (Greene) Kearney & Peebles.



Inland boxelder.

Rocky Mountain
maple.

Bigtooth maple.

Western soapberry.

Description: Shrub or sometimes small tree to 25 feet in height and 1 foot in trunk diameter. Twigs reddish brown and without hairs. **Leaves** paired, 3 to 5 inches long, with leafstalks long and often red, simple or of 3 leaflets. Leaf blades heart-shaped, 3- or 5-lobed, lobes sharply short-pointed, edges doubly saw-toothed, or some or all deeply divided into 3 lance-shaped leaflets, shiny dark green above and paler beneath, hairless, turning red in autumn. **Flowers** male and female usually on different trees (dioecious), in few-flowered terminal clusters, small, greenish yellow, in May and June. **Fruits** paired, clustered, long-winged "keys," about $\frac{3}{4}$ inch long, reddish when immature but turning brown. **Bark** smooth, thin, gray or brown. **Wood** hard, heavy, light brown.

Distribution: Moist soil and along streams in high mountains, ponderosa pine, Douglas-fir, and spruce-fir forests, 7,000 to 9,000 feet elevation. New Mexico: high mountains of western two-thirds and northeastern corner, from Sacramento Mountains, Sangre de Cristo Range, and Union County westward. Arizona: high mountains and plateaus in northeastern half, from Cochise County northwest to north rim of Grand Canyon. Rocky Mountain maple including geographical varieties ranges from New Mexico north to Montana, Alberta, and southern Alaska, south to California and Arizona. The typical form described here is distributed from New Mexico north to Black Hills and Montana, and south to California and Arizona.

BIGTOOTH MAPLE (*Acer grandidentatum* Nutt.)

Also called western sugar maple. Botanical synonyms: *A. brachypterum* Woot. & Standl., *A. grandidentatum* var. *brachypterum* (Woot. & Standl.) Palmer.

Description: Small to medium-sized tree to 50 feet tall and 1 foot in trunk diameter, with spreading, rounded crown. Twigs bright red and without hairs. **Leaves** paired, long-stalked, heart-shaped, 2 to 5 inches long and broad, 3-lobed, the lobes broad, blunt-pointed, and with few large blunt teeth or small lobes, thick and firm, shiny dark green above, beneath paler and usually finely

hairy, turning yellow or red in autumn. **Flowers** male and female on the same tree in several-flowered clusters, small, about $\frac{1}{4}$ inch long, yellow, in April. **Fruits** paired, clustered, long-winged "keys" 1 inch or less in length, greenish. **Bark** smoothish or scaly, thin, gray or dark brown. **Wood** hard, heavy, brown or whitish.

Distribution: Fairly common in moist soil in canyons of high mountains and plateaus, ponderosa pine forest, 4,700 to 7,000 feet elevation. New Mexico: high mountains of southern part, from Sacramento and White Mountains west to Black Range and San Luis Mountains (Hidalgo County). Arizona: high mountains and plateaus over the State, except in northeastern and southwestern parts, Cochise and Greenlee Counties west to Oak Creek Canyon and Grand Canyon (Coconino County), Hualpai Mountains, and Pima County. Southwestern Texas and New Mexico, north to Montana and Idaho, and south to Arizona; also in Wichita Mountains of southwestern Oklahoma. Northern Mexico.

Bigtooth maple is related to sugar maple of eastern United States and has been used as a source of maple sugar. The wood makes good fuel.

Soapberry Family (Sapindaceae)

WESTERN SOAPBERRY (*Sapindus drummondi* Hook. & Arn.)

Also called wild china-tree, cherioni, jaboncillo. Botanical synonym: *S. saponaria* L. var. *drummondi* (Hook. & Arn.) L. Benson.

Description: Small tree to 25 feet tall and 1 foot in trunk diameter or a large spreading shrub. **Twigs** yellow green, finely hairy. **Leaves** pinnately compound, 5 to 8 inches long, with 13 to 19 leaflets. **Leaflets** lance-shaped, $1\frac{1}{2}$ to 4 inches long, one-sided, long-pointed, edges not toothed, leathery, pale yellow green, hairless above and slightly hairy beneath. **Flowers** many in large terminal clusters 6 to 9 inches long, from May to August. **Fruits** yellow, translucent, berrylike, $\frac{1}{2}$ inch in diameter, leathery, 1-seeded, remaining on the twigs until spring. **Bark** smoothish or fissured and scaly, yellow gray. **Wood** heavy, yellowish.

Distribution: Along streams and canyons, in plains and mountains, plains grassland, upper desert, desert grassland, and oak woodland, 2,400 to 6,000 feet elevation. New Mexico: eastern and southern parts, eastern border from Union County southward, west through Roswell and Organ Mountains and north in Rio Grande drainage to Albuquerque and west to Gila River drainage. Arizona: southeastern and central parts, from Cochise County west to Santa Cruz and Pima Counties and northwest below Mogollon Rim to southern Coconino and Yavapai Counties; also near Hackberry (Mohave County). Louisiana to Missouri, west to southern Colorado, and south to Arizona, Texas, and northern Mexico.

The fruits are poisonous. The foliage is unpalatable and perhaps toxic to livestock. As the common name indicates, the fruits contain relatively high percentages of the alkaloid saponin and have been used for soap in washing clothes.

Buckthorn Family (Rhamnaceae)**LOTEWOOD CONDALIA (*Condalia obtusifolia* (Hook.) Weberb.)**

Also called lotebush, white crucillo, gray-thorn. Botanical synonyms: *C. lycioides* (A. Gray) Weberb., *Zizyphus lycioides* A. Gray. Includes *C. lycioides* var. *canescens* (A. Gray) Trel.

Description: Spiny, much-branched shrub 3 to 8 feet tall, rarely 10 feet tall with a trunk 4 inches in diameter or larger. **Twigs** numerous and widely spreading at right angles, 1 to 4 inches long, light gray, hairless or in a variety densely short-hairy, ending in sharp spines. **Leaves** small elliptical to ovate, $\frac{3}{8}$ to $\frac{3}{4}$ inch long and $\frac{1}{4}$ inch broad, hairless or in a variety densely short-hairy, pale green. **Flowers** several in a slightly stalked cluster in leaf axil, small, less than $\frac{1}{8}$ inch long, whitish green. **Fruit** berrylike, more than $\frac{1}{4}$ inch in diameter, blue black with a bloom, juicy and sweet, 1-seeded.

Distribution: Common, often forming thickets, on plains and mesas in desert and desert grassland, 1,000 to 5,000 feet elevation. New Mexico: southwestern part, from Organ Mountains north in Rio Grande drainage to Socorro County and west to Hidalgo County. Arizona: widespread in deserts of southern and central parts from Cochise and Greenlee Counties to Yavapai and Mohave Counties and Grand Canyon south to Yuma County. From central Texas to southeastern California and northern Mexico.

This shrubby species rarely becomes a small tree in Arizona and California and is here included as a tree. The variety in Arizona (except in southeastern Cochise County), California, and adjacent Mexico, shown at left in drawing, has densely short-hairy twigs and leaves.

BITTER CONDALIA (*Condalia globosa* Johnst.)

Botanical synonym: *C. globosa* var. *pubescens* Johnst.

Description: Spiny large shrub or small tree as much as 15 to 20 feet tall and 1 foot or more in trunk diameter, with broad crown of tangled spreading branches. **Twigs** stiff, light gray or brown, many ending in sharp spines. **Leaves** relatively few, not crowded, single or clustered, very small, oblong but narrowed toward base, $\frac{1}{4}$ to $\frac{1}{2}$ inch long, edges not toothed, usually densely and finely hairy. **Flowers** 1 or 2 in leaf axils, small. **Fruit** berrylike, almost $\frac{1}{4}$ inch in diameter, on stalks about the same length, black, juicy, very bitter, 1-seeded. **Bark** much fissured and becoming shreddy, brownish gray.

Distribution: Dry sandy plains and along washes in desert, 1,000 to 2,500 feet elevation; not in New Mexico. Arizona: southwestern part in Growler and Ajo Mountains and Sierra Blanca in western Pima County and Kofa and Castle Dome Mountains in Yuma County. Also in northwestern Mexico (Sonora and Lower California).

Originally described in 1924 from Lower California, Mexico, as a shrub 4 to 8 feet tall, bitter condalia becomes a small tree in southwestern Arizona and thus represents an addition to the native trees of the United States.

HOLLYLEAF BUCKTHORN (*Rhamnus crocea* Nutt. var. *ilicifolia* (Kellogg) Greene)

Also called hollyleaf redberry buckthorn.

Description: Evergreen shrub or small tree to 15 feet in height, with spreading branches. Leaves hollylike, oval to nearly round, $\frac{3}{4}$ to $1\frac{1}{2}$ inches long, rounded at apex and base, edges spiny-toothed, leathery, shiny yellow-green above, beneath yellow-green or paler and hairless or nearly so. **Flowers** usually male and female on different plants, few in small clusters in leaf axils, small, about $\frac{1}{8}$ inch long, yellow-green, from March to May. **Berries** bright red, $\frac{1}{4}$ inch in diameter, juicy, usually 2-seeded. **Bark** slightly rough and fissured, dark gray. **Wood** light brown.

Distribution: Common in mountains in chaparral and lower ponderosa pine forest, 3,000 to 7,000 feet elevation; not in New Mexico. Arizona: mountains of southeastern and central parts, from Cochise and Greenlee Counties west to Pima and Pinal Counties and northwest below Mogollon Rim to southern Coconino and Yavapai Counties and Hualpai Mountains. This variety and other varieties also in California and in Lower California, Mexico.

The typical form of this species, redberry buckthorn, found in California and Lower California, is a low shrub less than 5 feet tall, distinguished by the spine-tipped twigs and by smaller leaves $\frac{3}{8}$ to $\frac{5}{8}$ inch long.

Though generally a shrub in Arizona, hollyleaf buckthorn sometimes is a small tree with a distinct trunk. It is an evergreen component of the California chaparral vegetation which reappears in the mountains of Arizona. As the spiny evergreen leaves and red berries resemble holly, this attractive shrub could be used for Christmas decorations. It is worthy of cultivation as an ornamental, though slow growing.

CALIFORNIA BUCKTHORN (*Rhamnus californica* Eschsch. var. *ursina* (Greene) McMinn)

Also called coffeeberry, pigeonberry. Botanical synonyms: *R. ursina* Greene, *R. californica* Eschsch. subsp. *ursina* (Greene) Wolf.

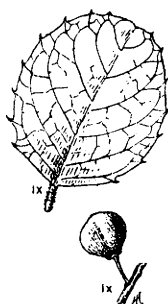
Description: Evergreen shrub 6 feet or more in height, commonly branched from base but sometimes a small tree to 20 feet tall and 6 inches in trunk diameter, with rounded spreading crown. **Leaves** elliptical or oval, $1\frac{1}{4}$ to 3 inches long, short-pointed at apex and base, edges finely and inconspicuously toothed and slightly rolled under, leathery, above dull green and hairless or nearly so, beneath paler and densely hairy. **Flowers** several in small cluster at leaf axil, small, less than $\frac{1}{8}$ inch long, greenish, from May to July. **Berries** changing from green to red and to black at ma-



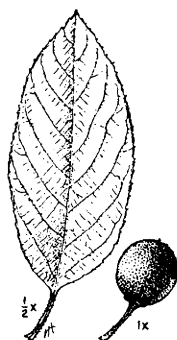
Lotewood
condalia.



Bitter condalia.



Hollyleaf buckthorn.



California
buckthorn.

turity, $\frac{3}{8}$ inch in diameter, juicy, with 2 or 3 large seeds. Bark smooth, gray.

Distribution: Common in canyons and along streams in mountains in chaparral, oak woodland, pinyon-juniper woodland, and ponderosa pine forest zones, 3,500 to 7,000 feet elevation. New Mexico: mountains of southwestern part from San Andres Mountains and Black Range westward. Arizona: mountains of southeastern and central parts, from Cochise and Graham Counties west to Pima and Pinal Counties and northwest below Mogollon Rim to southern Coconino and Yavapai Counties and Hualpai Mountains. This variety also in southern Nevada and southeastern California, and other varieties in southwestern Oregon, California, and Lower California, Mexico.

California buckthorn generally is a shrub, rather than a tree, and has several varieties besides the southwestern one described here. The typical form found along the Pacific Coast in California and Oregon has the leaves hairless or nearly so beneath.

BIRCHLEAF BUCKTHORN (*Rhamnus betulaeifolia* Greene)

Includes the variety *R. betulaeifolia* var. *obovata* Kearney & Peebles.

Description: Rounded shrub 8 feet or less in height, branching from the base, or rarely a small tree to 18 feet tall and 4 inches or more in trunk diameter. Leaves deciduous, oblong to elliptical or in a variety (var. *obovata*) obovate, 2 to 4 inches long, blunt- or short-pointed at apex, with edges finely and sharply toothed and not rolled under, thin, bright green, slightly hairy beneath. Flowers several in small cluster at leaf axil, small, less than $\frac{1}{8}$ inch long, greenish, in May and June. Berries $\frac{3}{8}$ inch in diameter, juicy, usually 3-seeded.

Distribution: Canyons and along streams in mountains, usually in shade, oak woodland and ponderosa pine forest zones, 5,500 to 7,500 feet elevation. New Mexico: mountains of southern part, north to White Mountains and west to Black Range and Mogollon Mountains. Arizona: southeastern part from Cochise County to southern Apache County; the variety with obovate leaves in north-

ern part in Coconino County (Navajo Mountain, north rim of Grand Canyon, and Kaibab Plateau). Also in southwestern Texas, and the variety in southern Utah and Nevada.

This shrubby species has been found as a small tree in Jumpup Canyon west of Kaibab Plateau by Leslie N. Goodding.

Sterculia Family (Sterculiaceae)

CALIFORNIA FREMONTIA (*Fremontodendron californicum* (Torr.) Cov.)

Also called flannelbush, mountain leatherwood, California slippery-elm. Botanical synonym: *Fremontia californica* Torr.

Description: Evergreen shrub or sometimes a small tree 10 to 20 feet tall. Twigs stout, densely rusty-hairy when young, becoming light reddish brown and hairless. Leaves on short lateral twigs, broadly ovate or slightly heart-shaped, $\frac{1}{2}$ to $1\frac{1}{2}$ inches long and broad, usually 3-lobed with rounded lobes, thick, dull or dark green and sparsely hairy above, beneath rusty and scurfy-hairy and with prominent veins. Flowers numerous, single on short lateral twigs, showy and large, $1\frac{1}{4}$ to 2 inches across, bright yellow, in April and May. Seed capsule egg-shaped, 1 to $1\frac{1}{2}$ inches long, pointed at end, 4- or 5-celled, densely hairy. Bark deeply fissured and scaly, brownish gray, the inner bark mucilaginous. Wood hard, heavy, dark brown tinged with red.

Distribution: Rare and local in a few places in mountain canyons in chaparral, 3,200 to 6,500 feet elevation; not in New Mexico. Arizona: central part, mountains in northeastern Pinal County, Mazatzal Mountains and near Payson in Gila County, and Bradshaw Mountains (Yavapai County). Also widespread in California.

California fremontia, a shrub of the California chaparral vegetation, is present also, though rather rare, in the same zone in central Arizona, mainly associated with Arizona cypress. When in flower the scattered plants are beautiful masses of yellow, standing out on the mountainside from a distance. The odd, scurfy-hairy, evergreen leaves, as well as the large bright yellow flowers, make this species an attractive ornamental.

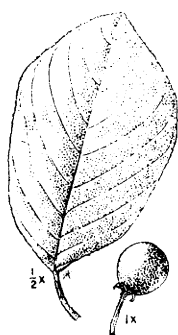
Fremontia was dedicated to Col. John C. Frémont (1813-90), politician, soldier, and noted explorer of western United States. This genus, which has another species in San Diego County, Calif., is the only native tree genus in the United States of the sterculia family (Sterculiaceae). This tropical family with a few native shrubby and herbaceous species contains the cacao tree, from which chocolate is obtained, and the Chinese parasoltree, which is planted and naturalized in the Southeast.

Tamarisk Family (Tamaricaceae)

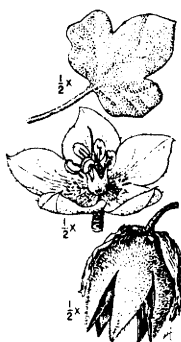
FRENCH TAMARISK (*Tamarix gallica* L.)

Also called salt-cedar.

Description: Shrub or small tree 10 to 15 feet or more in height,



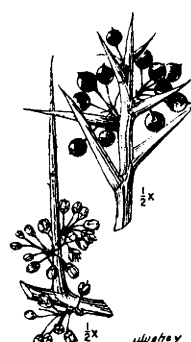
Birchleaf
buckthorn.



California
fremontia.



French tamarisk.



Allthorn.

with slender upright or spreading branches and narrow or rounded crown, resembling a juniper though not evergreen. **Leaves** deciduous, many, crowded, scalelike, about $\frac{1}{16}$ inch long, narrow and pointed, blue-green. **Flowers** numerous, crowded in many narrow clusters 1 to 2 inches long at ends of twigs, small, $\frac{1}{16}$ inch long, pink, from March to August. **Seed capsule** $\frac{1}{8}$ inch long, reddish brown, splitting into 3 to 5 parts, with many tiny hairy seeds. **Bark** smoothish, becoming furrowed and ridged, reddish brown.

Distribution: Common or abundant along streams and irrigation ditches, including alkali and salty soils, forming thickets, desert and grassland zones, from slightly above sea level to 5,000 feet elevation, not native. New Mexico: widely naturalized. Arizona: extensively naturalized, even in Grand Canyon. Native of Mediterranean region but escaped and established abundantly in southern and western United States.

French tamarisk, commonly called "salt-cedar" though not related to the cedars or junipers, is sometimes confused with tamarack (*Larix laricina* (Du Roi) K. Koch), an unrelated, coniferous tree of northeastern United States, Canada, and Alaska having a similar name. Tamarisk is a good erosion-control plant but in places is undesirable. Along Rio Grande and the Salt, Gila, and other rivers, its abundance has created a problem of eradication. It spreads by seeds and is easily propagated by cuttings or by transplanting small wild plants. It grows rapidly and is alkali-tolerant and drought-resistant. The flowers are a source of honey.

Athel tamarisk (*Tamarix aphylla* (L.) Karst.; botanical synonym, *T. articulata* Vahl), a related species from northeastern Africa and western Asia, is a small to large, fast-growing, evergreen tree planted for shade and windbreaks in southern and central Arizona and to a lesser extent in southern New Mexico. It has escaped from cultivation in a few places and may become naturalized eventually. The wiry, jointed, gray-green twigs are composed of scale leaves $\frac{1}{16}$ inch long, each encircling the twig and ending in a minute point. The heavy, brittle, light-colored wood is a possible source of furniture and fence posts.

Allthorn Family (Koeberliniaceae)

ALLTHORN (*Koeberlinia spinosa* Zucc.)

Also called crucifixion-thorn, crown-of-thorns, corona de Cristo, junco. Variety: *K. spinosa* var. *tenuispina* Kearney & Peebles.

Description: Very spiny, much-branched, rounded spreading shrub 3 to 6 feet tall or in a variety (var. *tenuispina*) also a small tree to 15 feet in height, with numerous, stout, widely forking, tangled, dark green branches and twigs, leafless most of the year. Twigs stout, $\frac{1}{8}$ inch or more in diameter, dark or pale green, nearly hairless, ending in spines 1 to 2 inches long (2 to 4 inches long and more slender in the variety). Leaves scalelike, soon shedding. Flowers few in small clusters on the twigs, less than $\frac{1}{4}$ inch long, greenish white, from March to June. Fruit a shiny black berry less than $\frac{1}{4}$ inch in diameter. Bark dark green, becoming scaly and gray. Wood very hard, heavy, dark brown streaked with orange, with lighter sapwood.

Distribution: Clay or sandy plains, slopes and foothills, often forming dense thickets and commonly growing with creosotebush and tarbush ("blackbrush"), desert and desert grassland, 1,500 to 5,000 feet elevation. New Mexico: deserts of southern part, from Tularosa Basin and Organ Mountains westward, north in Rio Grande drainage to Sierra County and west to Gila River drainage. Arizona: southeastern part, on Gila and San Pedro River drainages west to Winkelman and Tucson Mountains (Pima County); the variety (var. *tenuispina*) in southwestern Arizona, in Eagle Tail Mountains of western Maricopa County and mountains of Yuma County and in Chocolate Mountains, southeastern California. The typical form also in southern and southwestern Texas and in Mexico and Bolivia.

Allthorn is one of the three shrubby species of "crucifixion-thorns" in the Southwest. The variety (var. *tenuispina*) of southwestern Arizona, shown at left in drawing, becomes a small tree and is distinguished by darker green twigs, longer spines 2 to 4 inches long, earlier flowering, and occurrence at lower elevations and in more sandy soil. Allthorn is alone in its family.

Cactus Family (Cactaceae)

SAGUARO (*Cereus giganteus* Engelm.)

Also called giant cactus. Botanical synonym: *Carnegiea gigantea* (Engelm.) Britton & Rose.

Description: Giant columnar tree cactus 20 to 35 feet or rarely 40 feet or more (maximum 52 feet) in height, with a single, continuous, massive, spiny yellow-green trunk 1 to 2 feet or more in diameter, with usually 2 to 10 (or sometimes 20 or more) stout, nearly erect or curved spiny branches. Trunk and branches cylindrical with rounded or flattened tips, yellow-green, with 12 to 30 prominent vertical fleshy ridges (or ribs) 2 to 4 inches apart and with alternating grooves, the ridges bearing clusters of about 20

to 25 spreading gray spines $\frac{1}{2}$ to 2 inches or more in length. **Leaves** absent. **Flowers** many near tops of branches, large and showy, funnel-shaped, 4 to $4\frac{1}{2}$ inches long and 2 to 3 inches across, with many waxy white petals, with odor like melon, opening at night, in May and June and sometimes again in August. **Fruits** egg-shaped, 2 to $3\frac{1}{2}$ inches long, red, spineless or nearly so, fleshy, sweet and edible, splitting open along usually 3 lines and resembling flowers, maturing in June. **Wood** consisting of a framework or ring of vertical rods or ribs separated by long rays and large pith, visible as a skeleton after death and weathering of fleshy parts, the ribs hard, lightweight, light brown.

Distribution: Perhaps the most characteristic tree species of the Arizona desert, common on well-drained rocky or gravelly soils of foothills and slopes and less frequently in valleys, 700 to 3,500 feet (rarely 4,500 feet) elevation; toward the eastern and northern parts of the range confined to south-facing slopes; not in New Mexico. Arizona: southern, central, and southwestern parts, from eastern Pima and western Graham Counties northwest to southern Yavapai and southern Mohave Counties and southwest to Yuma County. At three localities west of Colorado River in southeastern California. Also in Sonora, Mexico.

Saguaro (pronounced sah-WAH-ro), the State flower of Arizona, has become a symbol for desert landscapes in general. One of the finest stands of mature saguaros is preserved within Saguaro National Monument, conveniently located about 14 miles east of Tucson. Other good cactus forests are protected in Papago State Park and Phoenix South Mountain Park, both near Phoenix, at Boyce Thompson Southwestern Arboretum near Superior, at Tucson Mountain Park, and at Organ Pipe Cactus National Monument on the Mexican border.

The Pima and Papago Indians gather the red fruits and eat them fresh, dried, or prepared as preserves, syrup, and beverages. They make butter from the oily seeds. The woody framework of ribs is useful in various ways, such as in making shelters, including roof poles and sides of houses, for fences, for kindling fires, and for novelties.

This is the largest cactus in the United States, though other species of similar or greater size occur in Mexico and South America. The champion at Saguaro National Monument is 52 feet tall, has 52 arms, an estimated weight of 10 tons, and an age of perhaps 235 years. Increase in height perhaps averages 3 inches or more a year, varying from 2 to 8 inches or in the seedling stage only about 1 inch annually. Large individuals 30 to 40 feet tall are believed to be as much as 150 to 200 years old and to weigh as much as 6 to 8 tons, most of which is water.

Saguaros are trees exceptionally well adapted to severe desert conditions, though they thrive in areas with rainfall above average for deserts, locally as much as 15 inches a year. Water from rains is absorbed quickly by the shallow roots spreading as much as 50 feet in every direction and is stored in quantity in the thick succulent trunks and branches for growth over the long dry periods. The relatively small surface area exposed, the thick, tough, waterproof

outer layer, and absence of leaves all tend to reduce water loss to the hot dry desert air. Specialized ridged green stems without dead bark substitute for leaves in manufacturing food, while the dense spreading spines prevent destruction by desert animals.

These giant succulents grow in the warmer places, such as ridges and southern or southwestern exposures, rather than in valleys, where cold air drains from the heights above. Continuous temperatures below freezing for 36 hours or more, that is, one entire day including two nights, will kill the plants or injure them severely. Rocky hillsides, where saguaros generally grow, provide better anchorage for the roots than do fine-textured soils of plains. Though the weight of these heavy plants is well centered and balanced, uprooting of large plants by strong winds in wet weather, when the ground is soft, probably is one of the main causes of death.

Some saguaros have been killed by a bacterial rot disease, which has become serious in a few localities. Rare individuals have a broadly spreading growth, or crest, at the top. This fan-shaped or cristate condition, though interesting as an oddity, represents abnormal growth resulting from an injury at the apex caused by fungi, bacteria, birds, or insects. Round holes observed near tops of branches are made by Gila woodpeckers and gilded flickers for their nests and afterwards are occupied by elf owls.

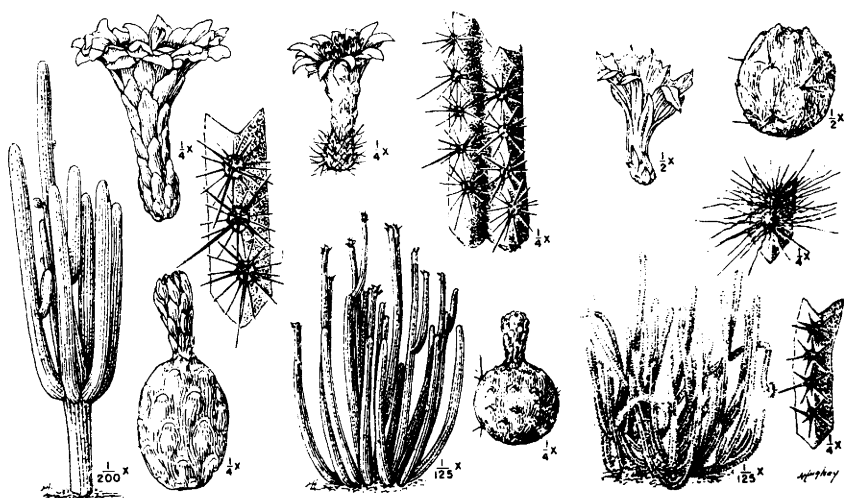
ORGANPIPE CACTUS (*Cereus thurberi* Engelm.)

Also called pitahaya, pitahaya dulce. Botanical synonym: *Lemaireocereus thurberi* (Engelm.) Britton & Rose.

Description: Large treelike cactus 10 to 15 feet or up to 25 feet in height, without a single trunk but with many (10 to 20 or more) erect, columnar, spiny, green branches from the ground, unbranched above unless injured. **Branches** cylindrical, 5 to 8 inches in diameter, with 12 to 19 prominent vertical fleshy ridges (or ribs) less than $1\frac{1}{2}$ inches apart and with alternating grooves, the ridges bearing clusters of about 10 to 19 gray or black spreading spines $\frac{1}{2}$ to $1\frac{1}{2}$ inches long. **Leaves** absent. **Flowers** scattered near tops of branches, large, $2\frac{1}{2}$ to 3 inches long and $1\frac{1}{2}$ to 2 inches across, with petals brownish green to greenish white or purple, opening at night, from May to July. **Fruits** egg-shaped or nearly spherical, 2 to 3 inches in diameter, red, with many black spines which are shed at maturity, juicy, sweet and edible, bursting irregularly.

Distribution: Of restricted occurrence on southwestern slopes of mountains in desert, 1,000 to 3,500 feet elevation, in southern Arizona; not in New Mexico. Arizona: desert mountains in southern part near Mexican border, chiefly in Pima County, from Roskrige Mountains and Picacho Mountains (southern Pinal County) west to southern Maricopa County and to Growler Mountains and Organ Pipe Cactus National Monument. Also in Sonora and Lower California, Mexico.

Organpipe cactus, with branches slightly suggesting a pipe organ, is of tree size, though without a single trunk, and probably should be included as a tree. This species is protected in the Organ



Saguaro.

Organpipe cactus.

Senita.

Pipe Cactus National Monument, an area of 5,127 square miles located on the Mexican boundary south of Ajo in western Pima County. The plants are sensitive to frost, which sometimes kills the growing tips. Papago Indians harvest quantities of the sweet fruits.

SENITA (*Cereus schottii* Engelm.)

Botanical synonym: *Lophocereus schottii* (Engelm.) Britton & Rose.

Description: Large treelike cactus 5 to 20 feet tall, without a single trunk, with many (up to 50 or more) erect, columnar, spiny, yellow-green branches from or near the ground and unbranched above. **Branches** angular, 4 to 8 inches in diameter, with usually 5 to 7 prominent vertical fleshy ridges (or ribs) 2 to 4 inches apart and with alternating grooves, the ridges on lower 4 to 5 feet spineless or with clusters of about 15 or fewer spreading gray spines about $\frac{1}{2}$ inch in length, the ridges on upper part of branch bearing clusters of about 30 gray, twisted, bristlelike spines 1 to 2 inches long. **Leaves** absent. **Flowers** near tops of branches, $1\frac{1}{4}$ to $1\frac{1}{2}$ inches long and 1 inch across, with pink petals, odorless, opening at night, from April to August. **Fruits** nearly spherical, about 1 inch in diameter, red, almost spineless, fleshy, bursting irregularly.

Distribution: Very rare and local on clay soils of valleys and plains, desert zone, about 1,500 feet elevation, southern Arizona on Mexican border; not in New Mexico. Arizona: about 50 plants in and near southeastern boundary of Organ Pipe Cactus National Monument, western Pima County. Also in Sonora and Lower California, Mexico.

Senita perhaps may be included as a tree because of its many columnar branches of tree size, though without a definite trunk.

The common name, meaning old, or an old person, refers to the conspicuous long bristles, resembling gray hair or beard, in the upper part of the branches. According to Benson (Ariz. Univ. Biol. Sci. Bul. 5: 76. 1940), the number of wild plants of this species in the United States is less than 50. Fortunately, most of these are preserved in Organ Pipe Cactus National Monument.

JUMPING CHOLLA (*Opuntia fulgida* Engelm.)

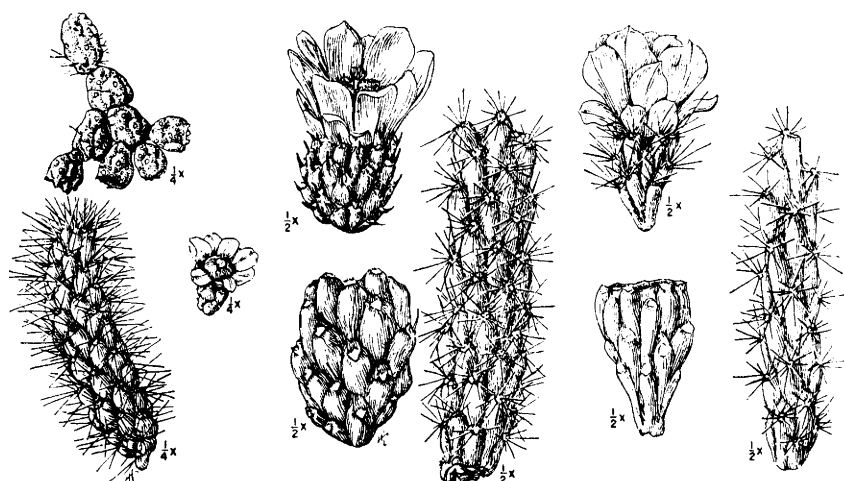
Also called Sonora jumping cholla. Variety: *O. fulgida* var. *mammillata* (Schott) Coult.

Description: Jointed, very spiny, branching cactus, commonly treelike shrub 6 feet or less in height or occasionally a small tree to 15 feet tall. **Trunk** as much as 6 inches in diameter, usually with several large spreading branches less than 3 feet above the ground forming an irregular open much-branched crown. Joints of **branches** cylindrical, 6 to 8 inches long, $1\frac{1}{4}$ to 2 inches in diameter, pale green but appearing straw-colored because of the numerous spines, fleshy in outer part and becoming woody within, readily detached, bearing many tubercles, each with a cluster of 2 to 12 large brown spines $\frac{3}{4}$ to $1\frac{1}{4}$ inch long and covered with straw-colored sheaths for a year or more; the variety (var. *mammillata*) with thicker branches, larger tubercles and 2 to 6 shorter spines $\frac{1}{2}$ inch long. **Leaves** narrowly cylindrical, $\frac{1}{2}$ to 1 inch long, light green, fleshy, soon falling. **Flowers** about 1 inch across, with 5 to 8 petals, pink or white streaked with lavender, from May to August. **Fruits** pear-shaped, 1 to $1\frac{3}{8}$ inches long and $\frac{3}{4}$ inch in diameter, green, tubercled but not spiny, fleshy, remaining attached many years and bearing new flowers and fruits annually, the many proliferating fruits hanging down in long branched chains or clusters. **Bark** of trunk and larger branches rough, scaly, spineless, black. **Wood** a hollow, perforated, gray cylinder with thick pith and broad rays, hard, lightweight.

Distribution: Often abundant and dominant and forming dense "cactus forests," sandy soils of valleys, plains, and slopes, cactus-shrub desert, 1,000 to 4,500 feet elevation; not in New Mexico. Arizona: southern part, from Cochise and Graham Counties west to Bill Williams River in southern Mohave County and to Yuma County. Also in Sonora and Sinaloa, northern Mexico.

Various erect, mostly shrubby cacti with jointed branches are known by the common name cholla (pronounced CHAW-ya or CHO-ya). This name, meaning skull or head in Spanish, may have been suggested by the short, thick branches of some species. Jumping cholla, the largest and perhaps most distinctive of the native chollas, forms dense cactus forests in some areas, especially near Tucson and Florence. Chollas of several species are rapidly spreading and have become a problem on some range lands in southern Arizona.

This species is easily recognized by the black trunks, the large hanging clusters of proliferating fruits, and the straw color of the joints caused by the numerous spines and sheaths. The impenetrable armed joints are easily detached by touching and adhere to



Jumping cholla.

Tasajo.

Staghorn cholla.

clothing and skin; hence the common name implying that they jump out and attach themselves to passersby. The sharp barbed spines penetrate the flesh, causing pain, and are not easily extracted. Detached branches of chollas will root and start new plants. The dead, weathered wood of old branches, in the shape of a hollow cylinder with numerous holes after decay of the softer tissues, is used in making novelties.

TASAJO (*Opuntia spinosior* (Engelm.) Toumey)

Also called cane cholla.

Description: Jointed, branching cactus, shrubby or treelike and usually less than 8 feet tall but sometimes a small tree 10 feet tall and 6 inches in trunk diameter, with irregular open crown of many spiny branches. Larger branches usually several at a point and spreading at right angles, smaller branches often 2-forked. Joints of branches cylindrical, 4 to 12 inches long, $\frac{3}{4}$ to $1\frac{1}{4}$ inches in diameter, fleshy in outer part and becoming woody within, bearing very many tubercles, each with a cluster of 10 to 20 usually gray spines $\frac{1}{4}$ to $\frac{1}{2}$ inch long. **Leaves** narrowly cylindrical, $\frac{3}{8}$ inch long, fleshy, soon falling. **Flowers** few, clustered at ends of branches, large, $1\frac{1}{2}$ to 2 inches across, with about 10 petals, varying in color from yellow to red, white, or purple, in May and June. **Fruits** pear-shaped, 1 to $1\frac{1}{2}$ inches long and broad, bright lemon yellow at maturity, strongly tubercled and becoming spineless, fleshy, remaining attached through the winter. **Bark** of trunk and larger branches nearly black, ridged and scaly, spineless. **Wood** a hollow, perforated, brown cylinder, hard, lightweight.

Distribution: Common and widely distributed, especially typical of desert grassland in southern Arizona but ranging from desert to oak woodland and pinyon-juniper woodland and occasionally to ponderosa pine forest, 1,200 to 7,000 feet elevation. New Mexico:

southwestern corner, in Luna, Hidalgo, and Grant Counties. Arizona: southeastern quarter, northwest to Bradshaw Mountains (Yavapai County) and southwest to Baboquivari Valley (Pima County). Also in Sonora, Mexico.

Tasajo (meaning jerked beef in Spanish) is a shrubby cholla in New Mexico but becomes treelike in Arizona. Canes and other novelties are made from the hollow wood of old trunks and large branches, which in this species are long and straight. The fruits are eaten by cattle. Hybrids of this species with jumping cholla, having intermediate characters, have been found along Gila River near Florence, Pinal County, Ariz.

STAGHORN CHOLLA (*Opuntia versicolor* Engelm.)

Also called tree cholla, deerhorn cholla.

Description: Jointed, very spiny, branching cactus, treelike shrub or sometimes a small tree up to 12 feet tall, with a trunk as much as 6 inches in diameter and with broad, rounded crown of many spreading branches. Joints of **branches** cylindrical, 4 to 12 inches or more in length, $\frac{5}{8}$ to 1 inch in diameter, purplish green or dark green, fleshy in outer part and becoming woody within, bearing many long tubercles, each with a cluster of 5 to 10 or more gray or purplish spines $\frac{1}{4}$ to $\frac{5}{8}$ inch long but of uneven length. **Leaves** narrowly cylindrical, $\frac{3}{8}$ inch long, fleshy, soon falling. **Flowers** few together at ends of branches, large, about $1\frac{1}{2}$ inches across, with many petals, varying in color, commonly orange or brown but also yellow, green, or red, in May. **Fruits** single or sometimes 2 or 3 in a chain, pear-shaped, 1 to $1\frac{1}{2}$ inches or more in length and $\frac{5}{8}$ to 1 inch in diameter, green tinged with purple or red, tubercled, usually not spiny, fleshy, remaining attached through the winter. **Bark** of trunk light brown or purple, smoothish, becoming scaly at base. **Wood** a hollow, perforated, gray cylinder, hard, lightweight.

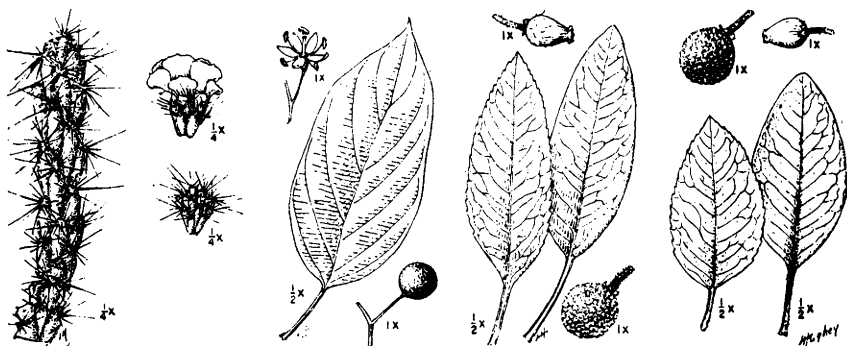
Distribution: Common in valleys and washes, and on watered slopes of foothills and mesas, cactus-shrub desert, 1,200 to 4,000 feet elevation, southern Arizona; not in New Mexico. Arizona: southern part, Pima and Pinal Counties, from Tanque Verde Mountains and Santa Cruz River valley west to Baboquivari Valley and Comobabi Mountains. Also in northern Sonora, Mexico.

The common name refers to the resemblance of the widely spreading forked branches to a deer's antlers.

BUCKHORN CHOLLA (*Opuntia acanthocarpa* Engelm. & Bigel.)

Variety: *O. acanthocarpa* var. *thornberi* (Thornber & Bonker) L. Benson (botanical synonym, *O. thornberi* Thornber & Bonker).

Description: Jointed, branching cactus, shrubby or treelike, commonly a shrub 3 to 8 feet tall but rarely a small tree to 15 feet in height, with short trunk and open or dense crown of long spiny branches. Joints of **branches** cylindrical, mostly 6 to 12 inches in length and 1 inch or more in diameter ($\frac{3}{4}$ to 1 inch in a variety, var. *thornberi*), gray-green, fleshy in outer part but be-



Buckhorn cholla. Red-osier dogwood. Arizona madrone. Texas madrone.

coming woody within, with long narrow tubercles each with a cluster of 6 to 20 brown spines to 1 or 1½ inches long (shorter in the variety) in straw-colored sheaths. **Flowers** large, 1½ to 2½ inches across, usually red or yellow in April and May. **Fruits** pear-shaped, about 1 inch long, dry and shriveled, spiny, not remaining attached or bearing flowers.

Distribution: Common on sandy flats and washes in desert, 1,500 to 4,000 feet elevation; not in New Mexico. Arizona: southern and western parts, from Graham County and northern Pima County, northwest and west to Mohave and Yuma Counties. The typical form also in southwestern Utah, southern Nevada, southeastern California, and Sonora, Mexico.

This species occasionally becomes treelike in Arizona, though usually shrubby, and accordingly is included here. Robert H. Peebles (Cact. and Succulent Jour. 9: 36. 1937) has recorded exceptional individuals of the typical form 15 feet tall in hills east of Hualpai Mountains (Mohave County) and has observed treelike plants of the variety (var. *thorneri*) in the vicinity of Coolidge Dam (Gila County). Another variety in southern Arizona is a low shrub.

Dogwood Family (Cornaceae)

RED-OSIER DOGWOOD (*Cornus stolonifera* Michx.)

Botanical synonym: *C. instolonea* A. Nels.

Description: Usually a shrub 8 feet or less in height but reported as rarely a small tree in southern Arizona. **Branches** and twigs purplish red, finely hairy. **Leaves** paired, ovate or elliptical, 2 to 3½ inches long, short-pointed, edges not toothed, dark green and nearly hairless above, beneath pale or whitish, and finely hairy, with about 5 long and curved veins on each side of midrib. **Flowers** several in flat-topped cluster 1 to 2 inches broad, small, less than ¼ inch across, white, in June and July. **Fruit** white, ¼ inch in diameter, 1-seeded. **Bark** greenish brown, smooth.

Distribution: Common along streams and canyons in mountains and plateaus, ponderosa pine forest and Douglas-fir forest, 6,000 to 9,000 feet elevation, widely distributed. New Mexico: high mountains in western two-thirds, from Sacramento Mountains north to Sandia Mountains and Sangre de Cristo Range and southwest to Mogollon Mountains. Arizona: northeastern half, west to Grand Canyon and to Pima County. Widely distributed from Newfoundland across Canada to Alaska, south in western mountains to California, Arizona, New Mexico, and northern Mexico, and south in northeast to Nebraska, Kentucky, and Virginia.

Red-osier dogwood is reported to reach tree size on Santa Catalina Mountains in southern Arizona. Records of large individuals and their measurements would be welcome. The common name refers to the resemblance of the reddish branches and twigs to those of some willows.

Heath Family (Ericaceae)

ARIZONA MADRONE (*Arbutus arizonica* (A. Gray) Sarg.)

Also called Arizona madroño.

Description: Evergreen medium-sized tree to 50 feet or more in height and 2 feet or more in trunk diameter, with compact, rounded crown. **Twigs** finely hairy, becoming reddish brown and peeling off in scales. **Leaves** lance-shaped, $1\frac{1}{2}$ to 3 inches long, short-pointed, edges without teeth or inconspicuously saw-toothed, thick and rigid, shiny light green above and paler beneath. **Flowers** in hairy terminal clusters 2 to $2\frac{1}{2}$ inches long, urn-shaped, $\frac{1}{4}$ inch long, white or pink, from April to September. **Fruit** berrylike, $\frac{3}{8}$ inch in diameter, orange red, finely warty, mealy and sweetish, with large stones. **Bark** of branches thin, reddish brown, peeling off in thin scales, on larger branches and trunks divided into squarish plates and light gray or whitish. **Wood** heavy, light brown tinged with red.

Distribution: Mountains in oak woodland, 4,000 to 8,000 feet elevation, near Mexican border. New Mexico: mountains of extreme southwestern corner, in Hidalgo County. Arizona: mountains of southeastern part, in Cochise, Graham, and Pima (Santa Catalina and Santa Rita Mountains) Counties. Also in northern Mexico.

Arizona madrone should make an attractive ornamental tree, though probably of slow growth. Under some conditions drops of water exude from the leaves, as if the trees were weeping or were "raintrees."

TEXAS MADRONE (*Arbutus texana* Buckl.)

Also called Texas madroño.

Description: Evergreen small tree to 20 feet tall and 1 foot in trunk diameter. **Twigs** bright red, densely hairy when young, becoming dark red brown and scaly. **Leaves** oval or lance-shaped, 1

to 3 inches long, rounded or short-pointed at apex, edges usually without teeth, thick and rigid, dark green and hairless above, paler and slightly hairy beneath. **Flowers** in hairy terminal clusters $2\frac{1}{2}$ inches long, urn-shaped, $\frac{1}{4}$ inch long, white or pink. **Fruit** berrylike, $\frac{3}{8}$ inch in diameter, dark red, finely warty, mealy and sweetish, with large stone. **Bark** of branches thin, orange-red, separating into papery scales, on larger trunks divided into square plates and dark reddish brown. **Wood** hard, heavy, brown tinged with red.

Distribution: Local in mountains in oak woodland zone, about 6,000 feet elevation, Guadalupe Mountains of southeastern New Mexico; not in Arizona. New Mexico: known only from Guadalupe Mountains in southwestern Eddy County, near Texas border. Also in central and western Texas and northern Mexico.

Sapote Family (Sapotaceae)

GUM BUMELIA (*Bumelia lanuginosa* (Michx.) Pers. var. *rigida* A. Gray)

Also called chittamwood, gum-elastic. Botanical synonym: *B. rigida* (A. Gray) Small.

Description: Spiny shrub or small tree to 13 feet tall, with trunk to 8 inches in diameter, and with compact crown of stiff spreading branches. **Twigs** stiff, brown, ending in stout spines and with additional spines single at base of leaves. **Leaves** single or clustered, elliptical or reverse lance-shaped, $\frac{3}{4}$ to $1\frac{1}{2}$ inches long, rounded at apex and narrowed toward base, edges without teeth, leathery, with matted white or tan hairs, especially beneath. **Flowers** several, in small clusters along the twigs, small, less than $\frac{1}{4}$ inch across, whitish, fragrant, in June. **Fruits** egg-shaped, $\frac{3}{8}$ inch or less in length, purplish black, juicy, 1-seeded. **Bark** fissured and scaly, dark gray.

Distribution: Along streams and washes, often forming thickets, in upper part of desert, desert grassland, and oak woodland, 3,000 to 5,300 feet elevation, Mexican border region. New Mexico: extreme southwestern corner, in southern Hidalgo County. Arizona: southeastern part, scattered in Cochise and Pima Counties west to Santa Catalina and Baboquivari Mountains. This variety is found also in Texas and northern Mexico. The species including varieties ranges from Florida west to Louisiana, Missouri, and southeastern Arizona, and south to northern Mexico.

The typical form of gum bumelia, occurring in the southeastern States, differs from the southwestern variety described here in being a medium-sized tree with larger and broader leaves mostly 2 to 4 inches long and with fewer spines. The common name refers to the gum which exudes from cuts in the trunk and which is chewed by children. Gum bumelia is the only southwestern representative of the sapote family (Sapotaceae), which is chiefly tropical. Sapodilla, the principal tree from which chewing gum is obtained, is a member of this family.

Olive Family (Oleaceae)

SINGLELEAF ASH (*Fraxinus anomala* Torr.)

Description: Shrub or sometimes a small tree to 20 feet tall and 6 inches in trunk diameter, with rounded crown. **Twigs** 4-angled, brown, without hairs. **Leaves** paired, simple or occasionally of 2 or 3 leaflets. Leaves broadly ovate or nearly round, $1\frac{1}{2}$ to 2 inches long (or leaflets 1 to $1\frac{1}{2}$ inches long), rounded or short-pointed at apex, inconspicuously wavy-toothed or without teeth, leathery, dark green above, paler beneath, becoming hairless. **Flowers** appearing with the leaves, in small hairy clusters, small, in April. **Fruits** few in clusters, long-winged "keys" $\frac{1}{2}$ inch long, with broad rounded wing $\frac{3}{8}$ inch wide extending to base. **Bark** fissured into narrow ridges, dark brown, reddish tinged. **Wood** hard, heavy, light brown.

Distribution: Canyons and hillsides, often on very dry rocky slopes, in upper desert, pinyon-juniper woodland, and lower ponderosa pine forest zones, 2,000 to 6,000 feet elevation. New Mexico: extreme northwestern corner in Carrizo Mountains, northwestern San Juan County. Arizona: northern part, from northern Apache County to Coconino County, where it is common at Grand Canyon. Also in southwestern Colorado, southern Utah, southern Nevada, and southeastern California.

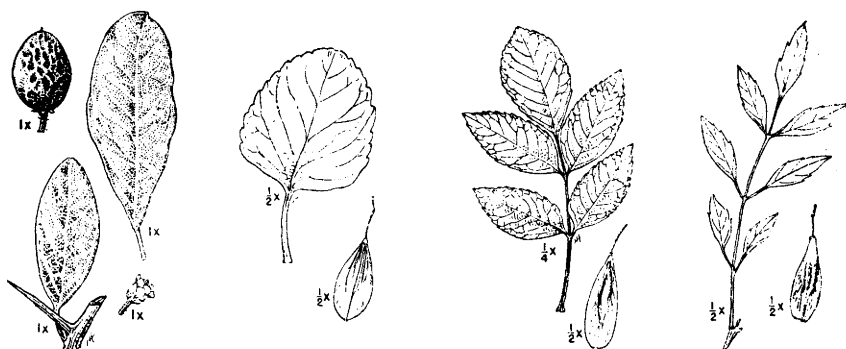
Singleleaf ash generally has simple leaves, making this species almost unique among the other ashes, which have pinnately compound leaves. A variety of fragrant ash in Arizona occasionally has simple leaves also.

LOWELL ASH (*Fraxinus lowellii* Sarg.)

Description: Shrub or small tree to 25 feet in height. **Twigs** 4-angled, often winged, orange-brown the first year, becoming gray-brown. **Leaves** paired, pinnately compound, $3\frac{1}{2}$ to 6 inches long. **Leaflets** 3, 5, or 7, ovate, $2\frac{1}{4}$ to 3 inches long, long- or short-pointed, edges saw-toothed, slightly leathery, yellow-green, without hairs or slightly hairy. **Flowers** male and female separate, in clusters $\frac{1}{2}$ to $1\frac{1}{2}$ inches long, small, in March. **Fruits** several in clusters, long-winged "keys" 1 to $1\frac{1}{2}$ inch long with broad rounded wing $\frac{3}{8}$ inch or less in width and extending to base. **Bark** deeply furrowed, brown.

Distribution: Along streams and canyons, 3,200 to 6,500 feet elevation, oak woodland and upper desert zones, known only from central Arizona; not in New Mexico. Arizona: central part, from western Gila and eastern Maricopa Counties northwest to Coconino County (Oak Creek Canyon and Havasu Canyon), Yavapai County, and eastern Mohave County.

Lowell ash commemorates Percival Lowell (1855-1916), American astronomer who established Lowell Observatory at Flagstaff and who found this ash in Oak Creek Canyon while collecting tree specimens in northern Arizona.



Gum bumelia.

Singleleaf ash.

Lowell ash.

Fragrant ash.

FRAGRANT ASH (*Fraxinus cuspidata* Torr.)

Also called flowering ash. Variety: *F. cuspidata* var. *macro-petala* (Eastw.) Rehd.

Description: Shrub or small tree to 20 feet tall and 8 inches in trunk diameter. **Leaves** paired, pinnately compound, 3 to 7 inches long, or occasionally simple (in var. *macro-petala*). **Leaflets** 3 to 7, long-stalked, lance-shaped or ovate, $1\frac{1}{2}$ to $2\frac{1}{2}$ inches long, long-pointed, slightly saw-toothed or without teeth, thin, shiny dark green above, beneath paler and slightly hairy when young. **Flowers** appearing with the leaves, in hairless clusters 3 to 4 inches long, about $\frac{1}{2}$ inch long, white, fragrant, differing from other native ashes in the larger size and presence of a 4-parted whitish corolla, in May and June. **Fruits** several in clusters, long-winged oblong "keys" $\frac{3}{4}$ to 1 inch long with rounded wing $\frac{1}{4}$ inch wide in upper half and extending nearly to base of flattened body. **Bark** smoothish, gray, becoming much fissured into ridges and scaly.

Distribution: Scattered and local on rocky slopes of canyons and mountains in oak woodland zone, 4,500 to 7,000 feet elevation. New Mexico: mountains of southern and northwestern parts, from Sacramento Mountains west to Hidalgo County and in Valencia and McKinley Counties. Arizona: northern part in Coconino County (Grand Canyon, Sycamore Canyon, etc.) and Yavapai County (Verde River valley). Also in southwestern Texas.

The Arizona plants are of a variety (var. *macro-petala*), differing in the usually fewer, broader leaflets without toothed edges or occasionally simple leaves. Fragrant ash deserves to be planted more as an ornamental, because of the showy pleasant-scented flowers and attractive foliage.

GREGG ASH (*Fraxinus greggii* A. Gray)

Also called littleleaf ash.

Description: Shrub or sometimes a small tree to 20 feet tall and 8 inches in trunk diameter, nearly evergreen. **Leaves** paired, pinnately compound, 1 to $1\frac{1}{2}$ inches long, axis narrowly winged, remaining attached through the winter until after flowering time. **Leaflets** usually 5 or 7 (or 3), reverse lance-shaped or obovate,

$\frac{1}{2}$ to $\frac{3}{4}$ (to $1\frac{1}{2}$) inches long, rounded at apex, inconspicuously toothed or without teeth, thick and leathery, dark green above, beneath paler and covered with small black dots. **Flowers** partly male and female and partly bisexual, appearing before the leaves, in small clusters, small. **Fruits** few in cluster, long-winged "keys" $\frac{1}{2}$ to $\frac{5}{8}$ inch long with broad wing about $\frac{1}{4}$ inch wide extending to base and much longer than body. **Bark** smooth, thin, gray. **Wood** hard, heavy, brown.

Distribution: At a single Arizona locality, on rocky slopes and in canyons, desert and oak woodland, 3,600 to 5,000 feet elevation, on Mexican border; not in New Mexico. Arizona: known only from Sycamore Canyon near Ruby (Santa Cruz County). Also in southwestern Texas and Mexico.

This ash bears the name of its discoverer, Josiah Gregg (1806–50), an early American trader in the West and author of *The Commerce of the Prairies*. He collected plant specimens in northern Mexico.

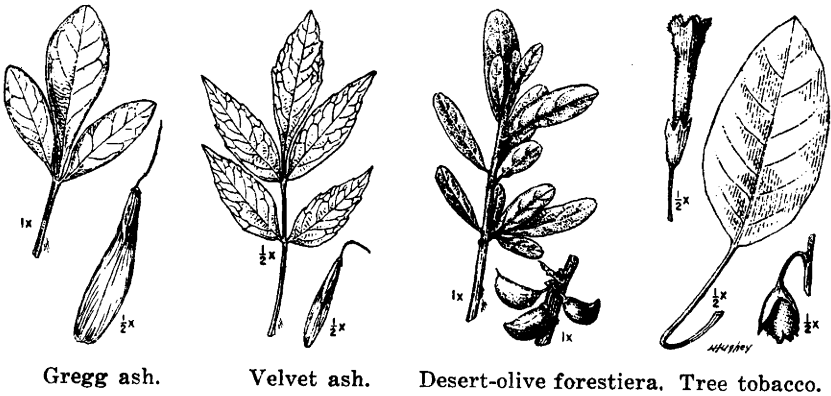
VELVET ASH (*Fraxinus velutina* Torr.)

Also called desert ash, smooth ash, Arizona ash, Toumey ash, fresno. Botanical synonyms: *F. velutina* var. *glabra* Rehd., *F. velutina* var. *toumeyii* (Britton) Rehd., *F. standleyi* Rehd.

Description: Small to medium-sized tree to 40 feet tall and 1 foot or more in trunk diameter, with spreading branches and rounded crown. **Twigs** brown, hairy or without hairs. **Leaves** paired, pinnately compound, 3 to 6 inches long. **Leaflets** 5 to 9, varying greatly in appearance, lance-shaped or elliptical, 1 to 3 inches long, short- or long-pointed, edges slightly toothed or without teeth, varying from thin to thick and leathery, varying from densely short-hairy beneath to hairless. **Flowers** yellow (male) and green (female) on different trees (dioecious), appearing before the leaves, many in clusters, small, in March and April. **Fruits** many in dense clusters, long-winged "keys" $\frac{3}{4}$ to 1 inch long, wing not extending to base. **Bark** deeply furrowed into broad ridges, gray. **Wood** soft, heavy, light brown.

Distribution: Common and characteristic tree of stream banks, moist washes, and moist canyons, chiefly in mountains, in the desert, desert grassland, oak woodland, and ponderosa pine forest zones, 2,500 to 7,000 feet elevation. New Mexico: mountains in southern part, from White Mountains west to Black Range and Mogollon Mountains and south to southern border. Arizona: southeastern, central, and northwestern parts, from Cochise and southern Apache Counties west to Santa Cruz and Pima (Baboquivari Mountains) Counties and northwest below Mogollon Rim to southern Coconino (Oak Creek Canyon) and Yavapai Counties; also in lower Grand Canyon region in Mohave County. Southern and southwestern Texas to southwestern Utah, southern Nevada, and southern California. Also in northern Mexico.

Velvet ash is highly variable in characters of leaflets, such as shape, edges, thickness, hairiness, and length of leaflet stalks.



Gregg ash.

Velvet ash.

Desert-olive forestiera. Tree tobacco.

Some botanists distinguish two or three varieties. In one common form the foliage and twigs are without hairs. This species is popular as a good shade tree and is widely planted in southern Arizona and California.

DESERT-OLIVE FORESTIERA (*Forestiera phillyreoides* (Benth.) Torr.)

Also called wild-olive, desert-olive.

Description: Much-branched shrub 3 to 12 feet tall or sometimes a small tree as much as 20 to 25 feet tall and 8 inches in trunk diameter, evergreen or nearly so. **Leaves** paired, more or less evergreen, lance-shaped or reverse lance-shaped, $\frac{5}{8}$ to 1 inch long, short-pointed, edges not toothed but slightly rolled under, green and hairy on both sides. **Flowers** male and female on different plants (dioecious), in small lateral clusters, very small, from December to March. **Fruit** egg-shaped, $\frac{1}{4}$ to $\frac{3}{8}$ inch long, one-sided, resembling a small olive, with thin flesh, 1-seeded. **Wood** very hard.

Distribution: Local on dry rocky slopes and canyons in desert, often forming thickets, 2,500 to 4,500 feet elevation; not in New Mexico. **Arizona:** of limited range and local on mountains of southwestern part, from Tucson Mountains and Baboquivari Mountains (Pima County) and Sierra Estrella (Maricopa County) west to Kofa Mountains (Yuma County). Also in Mexico.

This species, known from a few desert localities in southwestern Arizona as a shrub, sometimes becomes a small tree, according to Leslie N. Goodding, and therefore is to be added to the list of native trees in the United States.

Nightshade Family (Solanaceae)

TREE TOBACCO (*Nicotiana glauca* Graham)

Description: Evergreen shrub or small tree 6 to 20 feet tall, with a trunk as much as 3 to 6 inches in diameter. **Leaves** long-stalked, ovate, 2 to 6 inches long, blunt- or short-pointed, edges

without teeth, blue-green and covered with a bloom. **Flowers** in branched clusters at ends of twigs, tubular and narrow, about $1\frac{1}{2}$ inches long, yellow, nearly throughout the year. **Seed capsules** egg-shaped, $\frac{3}{8}$ to $\frac{1}{2}$ inch long, containing many tiny seeds. **Bark** smooth, blue-green.

Distribution: Common and widespread along stream beds, ditches, and washes in desert, from slightly above sea level to 3,000 feet elevation or sometimes higher; not native. New Mexico: introduced in southern part. Arizona: deserts of southern and central parts, widely naturalized. Also established in Florida and from southern Texas to California. Native of Argentina and Chile but extensively naturalized in the tropics.

Tree tobacco is unusual as an introduced shrub or tree sufficiently hardy to become adapted to moist soils in southwestern deserts. It is planted also as an ornamental and has escaped from cultivation so that, especially along streams, it is a conspicuous feature of local Arizona landscapes.

Bignonia Family (Bignoniaceae)

DESERTWILLOW (*Chilopsis linearis* (Cav.) Sweet)

Includes: *C. linearis* var. *arcuata* Fosberg, *C. linearis* var. *glutinosa* (Engelm.) Fosberg.

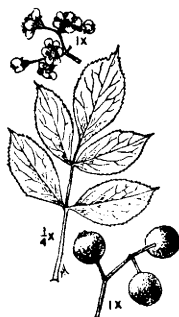
Description: Large shrub or small tree to 25 feet or more in height, with spreading crown. **Twigs** slender, varying in varieties from woolly to sticky or neither. **Leaves** very narrow or narrowly lance-shaped, 3 to 6 inches long and less than $\frac{3}{8}$ inch wide, straight or curved, not toothed, light green. **Flowers** several in clusters, large and showy, tubular, 1 to $1\frac{1}{4}$ inches long, whitish and tinged with purple or pink, fragrant, from April to August. **Seed capsules** long and very narrow, 4 to 8 inches long and less than $\frac{1}{4}$ inch in diameter, remaining attached in winter, containing many flat seeds with 2 hairy wings. **Bark** ridged and scaly, dark brown. **Wood** soft, brown streaked with yellow.

Distribution: Along washes and drainages in plains, mesas, and foothills, desert and desert grassland, 1,500 to 5,000 (or 6,000) feet elevation. New Mexico: deserts of southern part, north in Pecos River valley to Roswell and in Rio Grande drainage to Albuquerque, and west to Gila River drainage. Arizona: southern, central, and northwestern parts, from Cochise and Greenlee Counties west to Santa Cruz and western Pima Counties and northwest below Mogollon Rim to southern Coconino, Yavapai, and northern Yuma Counties, and to lower Grand Canyon and northwestern corner of State in Mohave County. Southern and southwestern Texas to southwestern Utah, southern Nevada, and southern California, south to northern Mexico.

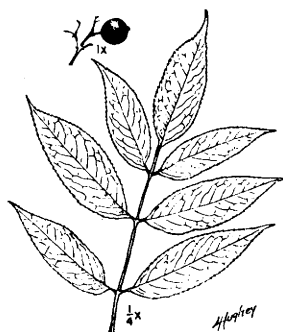
In spite of its general aspect and habitat in moist soil, desert-willow is not a true willow. Instead, it belongs to the same family as catalpa (bignonia family, Bignoniaceae) and has similar large flowers and long narrow fruits. As it forms thickets along washes, desertwillow is important in erosion control and has been widely



Desertwillow.



Mexican elder.



Blueberry elder.

planted for this purpose. It is propagated from seeds or cuttings, grows rapidly, and sprouts after cut. Desertwillow is sometimes used as an ornamental. The wood is durable and is suitable for fence posts.

Honeysuckle Family (Caprifoliaceae)

MEXICAN ELDER (*Sambucus mexicana* Presl)

Also called Arizona blueberry elder, Arizona elder, desert elderberry, sauco. Botanical synonyms: *S. glauca* Nutt. var. *arizonica* Sarg., *S. cerulea* Raf. var. *arizonica* Sarg., *S. cerulea* var. *mexicana* (Presl) L. Benson.

Description: Evergreen small to medium-sized tree 20 to 30 feet or more in height and 1 to 2 feet in trunk diameter, with compact, rounded crown, and with branches and twigs having large pith. **Leaves** paired, pinnately compound. **Leaflets** usually 3 (or 5), elliptical or ovate, 1 to 3 inches long, short-pointed, finely saw-toothed, thick and leathery, hairy or without hairs. **Flower** cluster flat-topped, 2 to 8 inches in diameter, containing many small, yellowish white flowers about $\frac{1}{4}$ inch across, nearly throughout the year. **Berries** almost $\frac{1}{4}$ inch in diameter, dark blue with a bloom, edible. **Bark** scaly, light brown. **Wood** soft, lightweight, light brown.

Distribution: Frequent along streams and drainages in desert and desert grassland, 1,200 to 5,000 feet elevation. New Mexico: southern part, along lower Rio Grande and Gila River drainages. Arizona: southern and central parts, from Cochise County west to Santa Cruz and Pima Counties and northwest to Gila, Yavapai, and Mohave Counties. From southwestern Texas west to southern California and in Mexico.

Mexican elder, one of the largest native elders, is distinguished from other southwestern species by its larger size, evergreen leaves, and occurrence in the desert, rather than mountains. These evergreen trees with numerous showy flower clusters are often cultivated as ornamentals and shade trees. The fruits are used in pies and jellies and are eaten by birds.

BLUEBERRY ELDER (*Sambucus glauca* Nutt.)

Botanical synonyms: *S. cerulea* Raf.; *S. neomexicana* (Woot.) A. Nels. Variety: Velvet elder (*S. glauca* var. *velutina* (Durand & Hilgard) Johnst.; also called velvetleaf elder; botanical synonym, *S. velutina* Durand & Hilgard).

Description: Tall shrub or small tree to 20 feet in height, with one or usually several trunks from base to 8 inches in diameter and with compact rounded crown. **Branches** and twigs with large pith, twigs without hairs or finely hairy. **Leaves** paired, pinnately compound, 5 to 7 inches long. **Leaflets** 5 to 9, ovate or lance-shaped, 1 to 5 inches long, long- or short-pointed, saw-toothed, thin or thick, without hairs or hairy. **Flower** cluster flat-topped, 4 to 10 inches across, containing many small, yellowish white flowers less than $\frac{1}{4}$ inch across, from June to August. **Berries** $\frac{1}{4}$ inch in diameter, dark blue with a bloom, juicy and edible. **Bark** furrowed, gray. **Wood** soft, lightweight, light brown.

Distribution: Streams, canyons, and other moist places in mountains, in ponderosa pine and Douglas-fir forest, 6,500 to 9,500 feet elevation. New Mexico: high mountains of southern part, from Sacramento and White Mountains west to Black Range, San Mateo Mountains, and Mogollon Mountains. Arizona: high mountains and plateaus except in northeastern and southwestern parts, from Cochise County west to Pima County and northwest to Yavapai County, Grand Canyon, and Hualpai Mountains. This species with varieties is widely distributed from southwestern Texas and New Mexico north to Montana, Alberta, and British Columbia, and south to California and Arizona. Velvet elder (var. *velutina*), with twigs and under surface of leaflets densely and finely hairy, is the variety on Hualpai Mountains and is found also in California.

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