

tats in transmontane deserts such as those in Panamint and Death Valleys. The rainfall in such areas may be as low as two inches per year or less, but the soil is often saturated with highly saline water for much of the year because of seepage into these low areas. Summer temperatures in these desert regions may be excessively high (as they are, for example, in Death Valley). As might be expected in view of their halophytic nature, Alkali Sink Scrub shrubs characteristically have fleshy leaves and stems. Outside California, this vegetation type is especially well developed in the low areas around the Great Salt Lake in Utah.

Because these low desert areas are frequently inundated with water during the rainy season, a hard saline crust may form on the soil surface when the soil is dry. In association with this soil phenomenon, a curious symbiotic relationship has developed between local ant species and Alkali Sink Scrub plants. Ants bury seeds below the surface in the process of carrying them to their nest (or perhaps storing them) for use as food. This procedure results in the seeds being planted below the hard surface crust at a level where the salinity is lower and the moisture conditions are more favorable to germination.

Joshua Tree Woodland (Map 4)

Another desert community that is well known to many Californians is the Joshua Tree Woodland, a vegetation type that only marginally deserves the name "woodland." Joshua tree is a handsome treelike yucca (*Yucca brevifolia*), its name describing its shorter leaves than are found in other species of yucca. It is one of the most characteristic species of the Mojave Desert, which is at a higher elevation than the Sonoran Desert by 2,000 to 3,000 feet and thus has more rainfall and less severe temperatures. Common associates of Joshua tree are Mojave yucca (*Y. schidigera*), junipers, Mormon tea, cotton thorn, California buckwheat (*Eriogonum fasciculatum*), bladder sage (*Salazaria mexicana*), box thorn (*Lycium* spp.), and many species of the cholla cactus (*Opuntia* spp.). Rather few



Plate 150. Joshua Tree Woodland is a woodland only because of the presence of the handsome treelike yucca (*Yucca brevifolia*) called the Joshua tree. This vegetation type is found on well-drained mesas and slopes 2,500 to 4,000 feet or higher that receive six to 14 inches of rain per year.

of the woody plant species generally considered to be members of this vegetation type are restricted to it (pls. 150–152).

Joshua Tree Woodland occupies well-drained mesas and desert slopes from Owens Valley to the Little San Bernardino Mountains and southern Nevada and extreme southwestern Utah. It occurs at moderate elevations from somewhat over 2,000 feet to about 6,000 feet. The average annual rainfall is between six and 15 inches, depending on locality. Unlike most of the lowland vegetation types in California, Joshua Tree Woodland receives occasional summer showers. The individual Joshua trees and associated junipers are rather widely spaced and are seldom over 30 feet high. Numerous shrubby plants in addition to those listed above occur among the trees, and during the spring following a wet winter the ground among the shrubs and trees is carpeted with spectacular masses of showy annuals in flower.

Plate 151.
Teddy bear
cholla (*Opun-
tia bigelovii*) is
also known as
jumping cholla
because its vi-
cious spines
readily fasten
onto passing
animals and
humans.



Plate 152. Spring brings spectacular wildflower displays including this
desert primrose (*Oenothera deltoides*) that is common in sandy areas
and is pollinated by nocturnal hawkmoths.

Creosote Bush Scrub (Map 3)

The last vegetation type to be discussed is the one that is the most widespread in the southern desert portions of California. This is the Creosote Bush Scrub (pl. 153). Creosote bush (*Larrea tridentata*) is a rather attractive, tall shrub in the caltrop family (Zygophyllaceae) and dominates much of the desert landscape below 3,500 feet from Inyo County southward. It also occurs locally in some interior cismontane valleys such as at Poso Creek, Tulare County, and localities in western Riverside County. Also present as plant associates of the creosote bush are burro-weed (*Ambrosia dumosa*) and the colorful and brittle bush (*Encelia farinosae*), both in the sunflower family; burrobrush (*Hymenoclea salsola*); the showy, red-flowered ocotillo (*Fouquieria splendens* subsp.



Plate 153. Creosote Bush Scrub occurs on the well-drained soils of slopes, fans, and valleys below 3,500 feet in deserts of California. Large assemblages of plant species take advantage of the many different microhabitats within this vegetation type. In this view a mixture of Antelope bush (*Purshia tridentata*), sagebrush (*Artemisia* spp.), and California buckwheat (*Eriogonum fasciculatum*) grow on a rocky sloping hillside.

splendens); and prickly pears and chollas of the cactaceous genus *Opuntia*.

Over much of the Mojave Desert, creosote bush covers the landscape in a widely spaced, even monotonous fashion. It leafs out and blooms with yellow five-petaled flowers that are quickly replaced with white, fuzzy fruits in spring, which are particularly abundant in years of good rainfall. Often, shrubs by a roadside grow to a larger size as a result of the extra moisture from road drainage. In the 1970s, Frank Vasek from the University of California, Riverside, noticed that creosote bush grew in large clumps and that each clump had numerous stems at ground level. These turned out to emanate from several root crowns that appeared to have been connected at some time in the past. Thus the original seedling matures and crown sprouts, forming a ring away from the central stem. In time, a ring of genetically identical plants grows around the original plant. After Vasek had the centers of large, old rings carbon dated, he determined an average growth rate for the species. Assuming this same growth rate through time, he estimated that a large clone measuring 35 by 26 feet (King Kong clone) was 11,700 years old, making it the oldest living plant and twice the age of the oldest known bristlecone pine.

Because of the limitations of water supply in the area occupied by the Creosote Bush Scrub, watercourses (which are dry most of the year) support a characteristic flora that takes advantage of the abundant supply of water during rainy periods of winter or summer. In more complex vegetation-type listings, botanists consider this watercourse flora as a separate vegetation type called Wash Woodland; however, here it is included with the plants in Creosote Bush Scrub. Certain desert trees and shrubs generally occur only along these water courses. These include ironwood (*Olneya tesota*), palo verde (*Cercidium floridum* subsp. *floridum*), smoke tree (*Psoralea argemone*), and catclaw (*Acacia greggii*), all in the pea family; desert willow (*Chilopsis linearis* subsp. *arcuata*); chuparosa (*Justicia californica*); and desert lavender (*Hyptis emoryi*). An-



Plate 154. Ocotillo (*Fouquieria splendens* subsp. *splendens*) is a conspicuous shrub of the Creosote Bush Scrub below 2,500 feet. Its stout spiny stems grow to 20 feet, terminating in inch-long red flowers that attract hummingbirds and brighten the landscape.

other interesting tree that occurs around moist, somewhat alkaline spots in the Creosote Bush Scrub is California fan palm (*Washingtonia filifera*), which often coexists with various willows (*Salix* spp.). This species is rather uncommon in nature, although it is widely planted as an ornamental in subtropical regions (pls. 153–156).

The seeds of many Wash Woodland tree species are very hard coated and will not germinate even if left in water for more than a year. It is necessary to scratch the coat of these seeds for germination to take place; otherwise, they are impervious to water. The grinding action of sand and rocks in the flash floods of the desert performs the scarification function, and the floods provide the seedlings with abundant water to supply their requirements during the first few weeks of growth. Such floods also serve to disperse the seeds. Like many desert perennials, seedlings of Wash Woodland trees produce

Plate 155. White bear-poppy (*Arctomecon merriamii*) is a perennial herbaceous plant, now rare because of mining and damage from off-road vehicles in the desert.



Plate 156. Brittle bush (*Encelia farinosa*), in the sunflower family, is common in washes and stony slopes in Creosote Bush Scrub, where it blooms from March to May.

only two or three leaves immediately after germination and then seemingly become dormant. However, these plants are far from dormant during this time; they are devoting their chief energies to developing extensive, deep root systems that will enable them to survive long after the moisture from the flood has dissipated.

Summer temperatures in the Creosote Bush Scrub may be very high, and in many areas winter temperatures do not drop to the freezing point. The average annual rainfall in this vegetation type is very low, ranging from two to eight inches. In appearance, Creosote Bush Scrub is composed of numerous shrubs or small trees to 10 feet high or somewhat higher that are widely and symmetrically spaced. Some of these species, particularly those that occur along the desert washes, are very colorful when in flower.

Woody plants dominate the Creosote Bush Scrub community, although it also contains a rich representation of annual plant species. In addition to the annuals are many herbaceous perennials, although they are less abundant. The general aspect of the vegetation of the Creosote Bush Scrub during almost any month of the year belies its arid nature. It is usually green, and because it supports a cover of shrubs and small trees, it may give the impression that it receives more rain than it actually does.