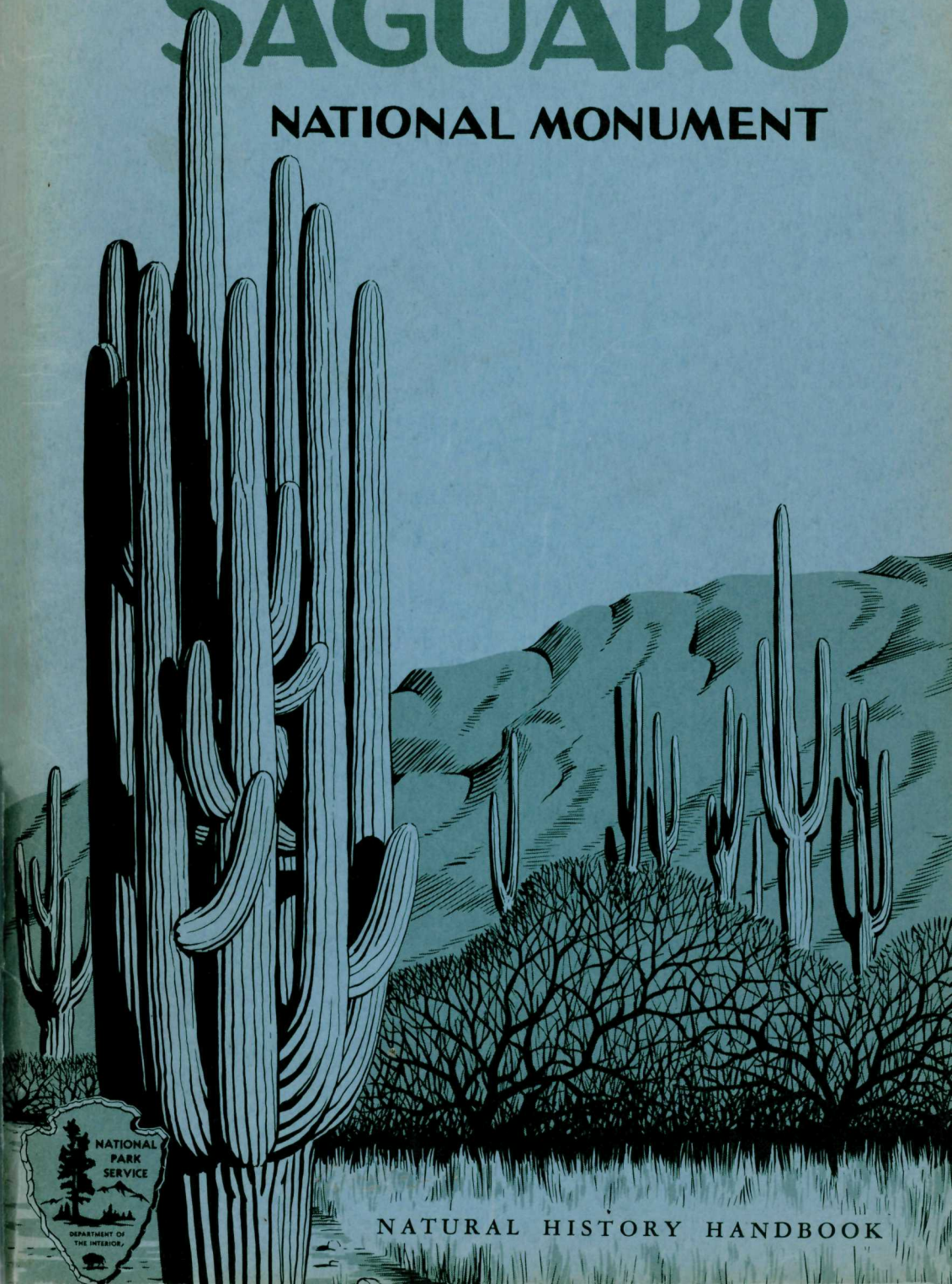


SAGUARO

NATIONAL MONUMENT



NATURAL HISTORY HANDBOOK



UNITED STATES DEPARTMENT OF THE INTERIOR

Fred A. Seaton, *Secretary*

NATIONAL PARK SERVICE

Conrad L. Wirth, *Director*

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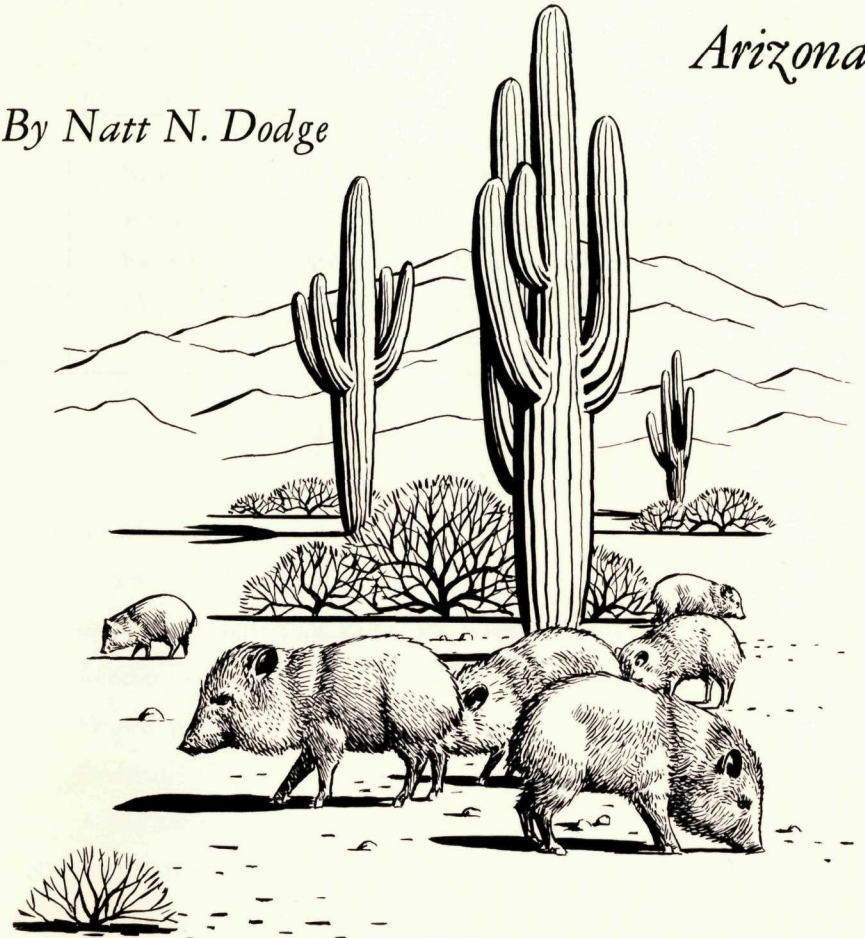
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SAGUARO

NATIONAL MONUMENT

Arizona

By Natt N. Dodge



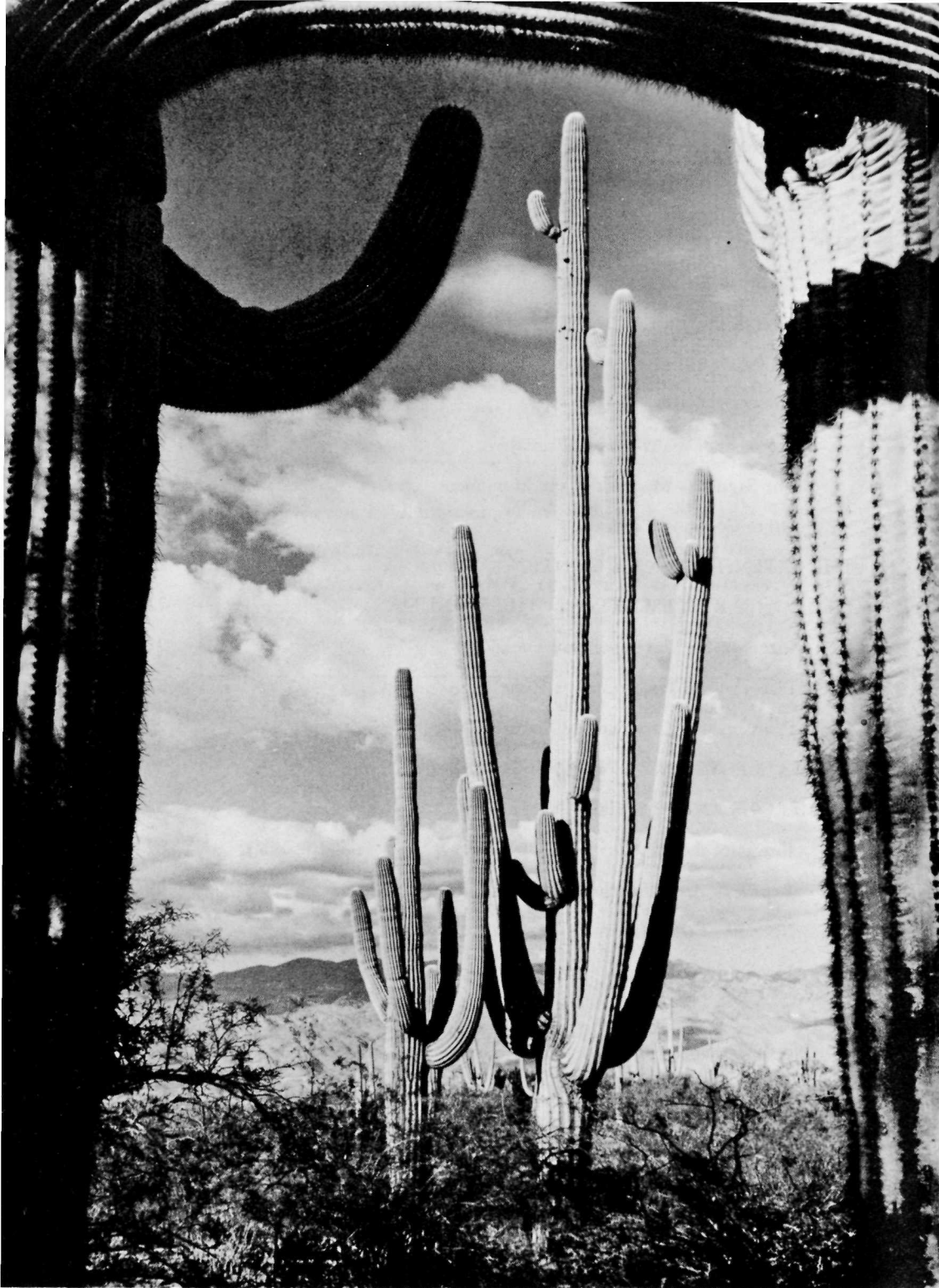
NATURAL HISTORY HANDBOOK SERIES No. 4

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The National Park System, of which Saguaro National Monument is a unit, is dedicated to conserving the scenic, scientific, and historic heritage of the United States for the benefit and enjoyment of its people.



Stately saguaros provide a wealth of vistas for the photographer.



The Desert Scene

WHERE THE TANQUE VERDE MOUNTAINS of southeastern Arizona settle gently into the broad lap of the Santa Cruz Valley, topography and climate have collaborated to produce a superlative exhibit of Sonoran Desert vegetation. To complete this outdoor museum, the Rincon Range has added a magnificent island which lifts its green, tree-blanketed crest above the surrounding desert sea. To those who think of a desert as a barren waste of sand devoid of vegetation, Saguaro National Monument will come as a stimulating revelation. Dr. Forrest Shreve, a master student of deserts, defines, one as "an area in which deficient and uncertain rainfall, and its consequences, have made a strong impression on the structure, functions, and behavior of living things."

Saguaro National Monument is of great interest because of its wide range of elevations and resulting variety in plant and animal life. In effect, it is a mountain island surrounded by a desert sea. Its supreme feature, however, is the magnificent stand of saguaros of which Dr. H. L. Shantz, formerly president of the University of Arizona, is quoted as saying, "nowhere in the world is there so fine a stand of the Giant Saguaro as in the area of the Cactus Forest of the monument; it ranks with the great redwoods, not in age and not in mass of vegetation; but certainly in the unique character, and surpasses in variety of form."

What's In a Name?

In spite of unrelenting drought and heat, cactuses have been particularly successful and have populated the landscape with weird and bizarre shapes, so effectively that Saguaro National Monument has been called "a wilderness of unreality." Largest of the cactuses in the United States, the giant saguaro attains maximum size and density of growth in the "cactus forest," thereby giving the monument its name.

The word "saguaro" is believed to stem from a Spanish corruption of a Papago Indian word for the big cactus. Following Coronado's historic expedition into this region in 1540, European explorers found peaceful Papagos and Opatas living here, hunting animals and utilizing many native plants. Among the most dependable of Papago food sources was the fruit of the giant cactus. So important was this fruit harvest in their economy that they designed this season as the start of a new year. Thus, the native Indians and the rich and varied animal life made use of the desert vegetation, thereby adjusting themselves to a meager existence in this land of much sunshine and little rain. Saguaro National Monument is not merely a rectangle on the map

The Cactus Forest Loop Drive through typical Lower Sonoran, or Arboreal Desert vegetation.



made up of so many square miles of land; rather, you should think of it as a living community of interdependent plants and animals, each one striving, as an individual and as a species, to expand its activities within limitations set by climate, elevation, soil, topography, competition, and enemies.

Here then is a splendid exhibit of nature in action illustrating the response of the animate and the inanimate to the unchangeable laws of the Creator. Here is an outdoor experience that you may enjoy according to your personal desires as long as you help to retain for others the delicate adjustment of the living desert. This adjustment has been attained through hundreds of centuries of adaptation of plants and animals to an unique and inflexible environment.

The Sonoran, or Arboreal, Desert

Named for the State of Sonora, Mexico, in which the greater portion of it lies, the Sonoran Desert is one of four divisions of the North American desert of the Southwest. Each division is characterized by plant and animal communities or associations, some of which are represented in several or all of the divisions while others are restricted to only one. The giant saguaro, for example, is found only in the Sonoran Desert whereas the creosotebush and ocotillo occur in three.

Within the Sonoran Desert, different elevations have temperature and precipitation variations which exert a profound influence upon plants and animals. An example of this is the Tanque Verde-Rincon uplift rising across the eastern end of the monument. This uplift and the adjacent Santa Catalinas are high enough to intercept the prevailing movement of rain-clouds causing greater rainfall on the mountains than in the surrounding desert. The greater moisture and lower temperature of these highlands create conditions favorable to an entirely different plant-animal ecology.

Adaptation of Plants to a Desert Environment

You can realize from the foregoing that the monument contains three environments—desert, foothill, and mountain. The Tanque Verdes represents the foothill region, and the Rincon Range, the mountains. All of the area immediately adjacent to the base of these uplifts is the desert wherein much of unique interest may be found.

It would be enlightening to know how many species and varieties of plants which developed during the past 60 million years or so have failed

in their attempt to survive under Sonoran Desert conditions. It is even more interesting to study the hundreds that have survived and to try to determine just what structures they have perfected and what methods they have originated in order to establish and maintain themselves in a land so inhospitable toward the usual forms of plant life. All of these plants in the desert area belong within the Lower Sonoran Life Zone, which is discussed in a later chapter. Let's look at some that are easily found in Saguaro National Monument.

NON-SUCCULENT PLANTS

For pure ingenuity in devising a variety of ways and means of making the best of an inhospitable environment, the many species making up the non-succulent type of desert vegetation provide an absorbing field for study. There are two ways to survive the harsh desert climate; one is to avoid the periods of excessive heat and drought; the other is to adopt various protective devices. The short-lived plants follow the first method, the perennials, the second.

The Ephemerals, or Short-lived, Plants

Every spring that follows a winter of normal rainfall, the desert floor is carpeted with a lush blanket of fast growing annual herbs and flowers—the early spring ephemerals. Many of these “quickies” do not have the characteristics of desert plants, in fact, some of them are part of the common vegetation of other climes where moisture is plentiful and summer temperatures much less extreme. What are these “foreign” plants doing in the desert, and how do they survive? With its often frostfree winter climate and its normal December-to-March rains, the desert presents in the early spring ideal growing weather for annuals that are able to compress a generation into several months. Several hundred species of plants have taken advantage of this situation.

There is a WILD CARROT (*Daucus pusillus*), which is a summer plant in South Carolina and a winter annual in California where it is called “rattlesnake weed.” In the desert, its seeds lie dormant in the soil through the long, hot summer and the drying weather of autumn. Then, under the influence of winter rains and the soil-warming effects of early spring sunshine, they burst into rapid growth. With a host of other species, this early spring ephemeral is enabled by these favorable conditions to flower and mature its seed before the pall of summer heat and drought descends upon the desert. With their task complete, the parent plants wither and die. Their ripened seeds are scattered over the desert to await the coming of winter rains for the opportunity to cover the desert with another multicolored but short-lived carpet of foliage and bloom.

The one-season ephemerals do not limit themselves to the winter growing period alone. From July to September, there are spotty thunder showers that deluge parts of the desert while other areas, not so fortunate, remain parched and dry. Where rain has fallen, another and entirely different group of plants, called the summer ephemerals find ideal conditions for growth and take their turn at weaving a desert carpet. Their seeds have lain dormant over winter. These summer “quickies” are plants that normally flourish during the winter rainy season farther south in Lower California and Sonora, Mexico. Saguaro National Monument is doubly fortunate in that it lies within a section of desert having not only its own year-round vegetation, but also summer flowers “borrowed” from its eastern and western neighbors for winter use, and from the winter wildflower gardens of its southern neighbors for summer decorations.

The short-lived leafy plants of summer and winter have found that they can compress their entire life activity into 6 to 12 weeks when conditions are most suitable. Thus, they can escape all the rigorous periods of the desert climate by living for 8 or 9 months in the dormant seed stage. Some of the spectacular and colorful flowers of the monument are among these ephemerals that survive desert conditions by escaping them. It must be remembered that when drought conditions or abnormally cold spring weather upset the norm, response of ephemeral plants is greatly restricted. If suitable conditions do not develop during the season for growth of a particular kind of ephemeral, its seeds will simply wait a year or more until conditions are favorable for growth.

Early spring ephemerals climax their show in March. From late February to mid-April they are completing their growth and putting forth the precious seeds that will assure survival for the next generation. At the head of this parade of the flowers in the monument is a purple-blossomed immigrant from the Mediterranean, the now thoroughly naturalized, FILAREE (*Erodium cicutarium*). In addition to the small purple flowers which may appear as early as January, the conspicuous “tailed” fruits almost always attract attention. When dry, they are tightly twisted, corkscrewlike; when damp they uncoil, forcing the needle-tipped seeds into the soil.

INDIAN WHEAT (*Plantago purshii*) is among the first plants to lay its green carpet over sandy spots on the desert floor following short winter days. The tan-colored individual flower heads are inconspicuous, but their numerous, close-growing spikes form a thick, luxurious pile-like ground cover. The countless tiny seeds are eagerly sought each spring by coveys of Gambel's quail; they were formerly also harvested by Pima and Papago Indians.

Among the most common and delicately beautiful of the early spring ephemeral plants are the SUNDROPS (*Oenothera* sp.). The large ground-hugging blossoms, with tissue-paper petals either white or pale yellow, open at night, to droop and close soon after sunrise. Usually found in sandy arroyos or open flats, these flowers of the evening primrose family sometimes create a mass display, but more often appear as individual plants scattered among desert perennials such as cholla cactus.

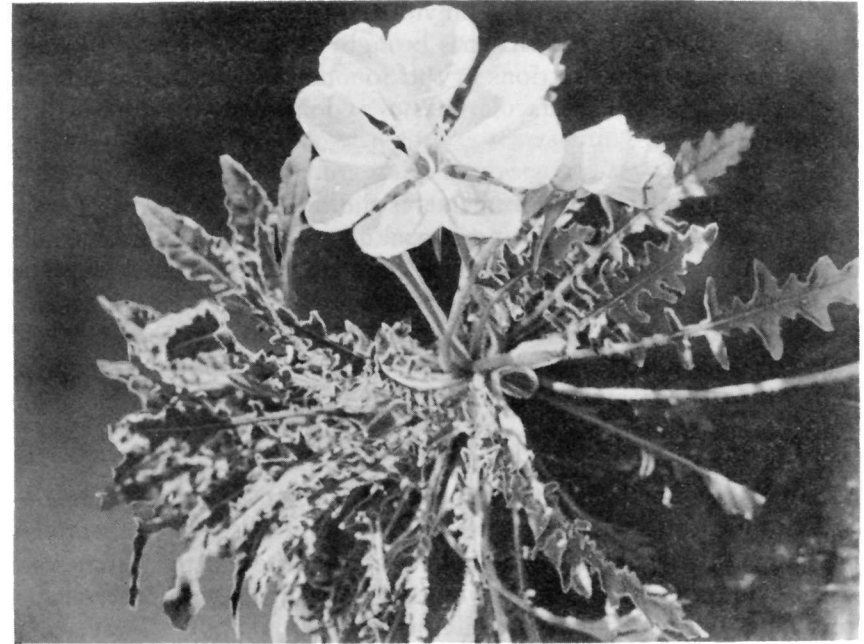
Often associated with sundrops along sandy washes, clusters of pink-flowered SAND VERBENAS (*Abronia villosa*) are conspicuous as early as February. They are sometimes found in solid patches, but also mingle with other spring flowers to produce a gay pattern of color in open, sunny locations.

DESERT CHICORY (*Rafinesquia neomexicana*) is somewhat like the common yellow dandelion but is longer stemmed and less coarse. Its white or butter-yellow blossoms make it one of the noticeable spring annuals in the desert. It rarely grows in pure stands but appears in conspicuous clumps among other short-lived plants.

Somewhat similar in appearance to the desert chicory is WHITE TACK-STEM (*Calycoseris wrightii*), one of the handsomest of the spring quickies. It is usually found on dry, rocky hillsides with white, or rose-colored flowers. Its name is derived from the presence of small glands which protrude much as would tiny tacks partially driven into the stems.

Following abnormally wet winters, FIDDLENECK (*Amsinckia intermedia*) covers patches of sandy or gravelly soil with a dense growth of bristly erect plants. These bear tight clusters of small yellow-orange blossoms arranged along a curling flower stem resembling the scroll end of a violin or fiddle, hence the name. This plant prefers the same growing conditions as creosotebush, frequently forming a dense, though short-lived, growth around the bases of these shrubs.

Associated with fiddleneck and creosotebush, SCORPIONWEED (*Phacelia crenulata ambigua*) adds its violet-purple blooms to the spring flower display following winters of above-normal precipitation. The name is derived from the curling habit of the blossom heads which may remind the observer of the flexed tail of a scorpion. Touching the plant may cause skin irritation in susceptible individuals. Unfortunately, scorpionweed is also widely known as wild heliotrope thus contributing to the confusion engendered by duplication of popular names. The plant properly called WILD-HELIOTROPE (*Heliotropium curassavicum*) is similar in general appearance, but the flowers are white to pale purple and their odor more pleasing than that of the scorpionweed. Wild-



Sundrops (evening primrose).

heliotrope, or quailplant, is another of the early spring ephemerals, but under favorable conditions, where soils are moist, it may continue to live and bloom throughout the year.

Very common on sandy locations and quite noticeable because of its showy long-stemmed, large, yellow, circular flowers, the DESERT-MARIGOLD (*Baileya multiradiata*) helps to open the spring blossoming season. Where moisture conditions are favorable, plants may continue to bloom throughout the summer and well into autumn. Sometimes during the hottest, driest time of the year, desert-marigolds are among the very few blossoms brightening the desert floor. Their bleached, papery petals persist for days after the flowers have faded, giving the plant the name paper-daisy.

THE PAPERFLOWER (*Psilostrophe cooperi*) is not easily confused with the desert-marigold because of its short stems and its habit of growing in dense, dome-shaped clumps covered with 3- to 6-petaled yellow flowers. They sometimes continue to bloom throughout the entire year. In common with the desert-marigold, the petals of the paperflower bleach and dry and may remain on the plant weeks after the blossoms have faded.

Although all of the species previously discussed contribute to the early spring floral display that has brought fame to Saguaro National Monument and other sections of the Sonoran Desert, the majority of them do not grow in spectacular masses as do some of the other winter short-lived plants.

Among the pre-season ephemerals is the tiny BLADDER-POD (*Lesquerella gordonii*). This low-growing annual member of the mustard family begins to cover open stretches of desert with a yellow blanket in late February or early March following wet winters. Bladder-pod is usually found in pure stands surrounding islands of cholla, creosotebush, and palo verde. However, bladder-pod also mingles with other spring ephemerals where it is promptly submerged by the ranker, taller-growing, more conspicuous annuals.

Similar in growth habit to the bladder-pod, PURPLE MAT (*Nama demissum*) is a small plant that produces large, reddish-purple blossoms making a spectacular show in pure stands, although the patches are usually quite small. When growing singly or mixed with other plants, this exquisite little flower is easily overlooked.

The tiny sunflower-like GOLDFIELDS (*Baeria chrystoma*) is also similar to the bladder-pod in its low growth and consequent likelihood of being dominated by taller plants. Even so, it plays a part each year in the spring flower parade, sometimes carpeting extensive areas with bright-yellow flowers.

The bright-yellow GOLD-POPPY (*Eschscholtzia mexicana*) competes with filaree for the lead position in the spring flower parade, and almost every year captures top honors for its lavish and spectacular splashes of color. It covers wide sections of desert with its "cloth of gold," but in the monument, it rarely develops into a mass display because of the irregularity of the terrain and the abundance and variety of other vegetation. In places, it mixes with such other brightly colored annuals as the purple OWLCLOVER (*Orthocarpus purpurascens palmer*) and the blue-to-indigo LUPINES (*Lupinus* sp.) to form a gay and varied patchwork of color.

Illustrating one of the interesting phases in evolutionary variations among plants, the lupines are represented by several kinds which are able to survive and prosper in the desert. Some of these lupines are annuals of the quickie type which help to glorify the desert with their massed colors for a few short weeks. Others are perennials with a life cycle of several years. Some of these longer-lived species join with the ephemerals in the spring flower show, while others are more leisurely

in approaching their blossoming time. All of them have developed devices for withstanding or avoiding the periods of the year when unendurable conditions prevail.

In this group of plants with species representing both the drought-escaping and drought-evading types are the GLOBE-MALLOWS (*Sphaeralcea* sp.). These vary in size from the small annuals (*S. coulteri* and *S. emoryi*) 5 or 6 inches high, whose blossoms paint the sandy desert flats with shades of apricot, bright yellow, and rich red from February to April; to coarse, woody-stemmed shrubs 4 or 5 feet tall blossoming throughout the year. These perennials along with hundreds of others, a number of of them of tree size, form a second major group of non-succulent desert dwellers.

The Perennials

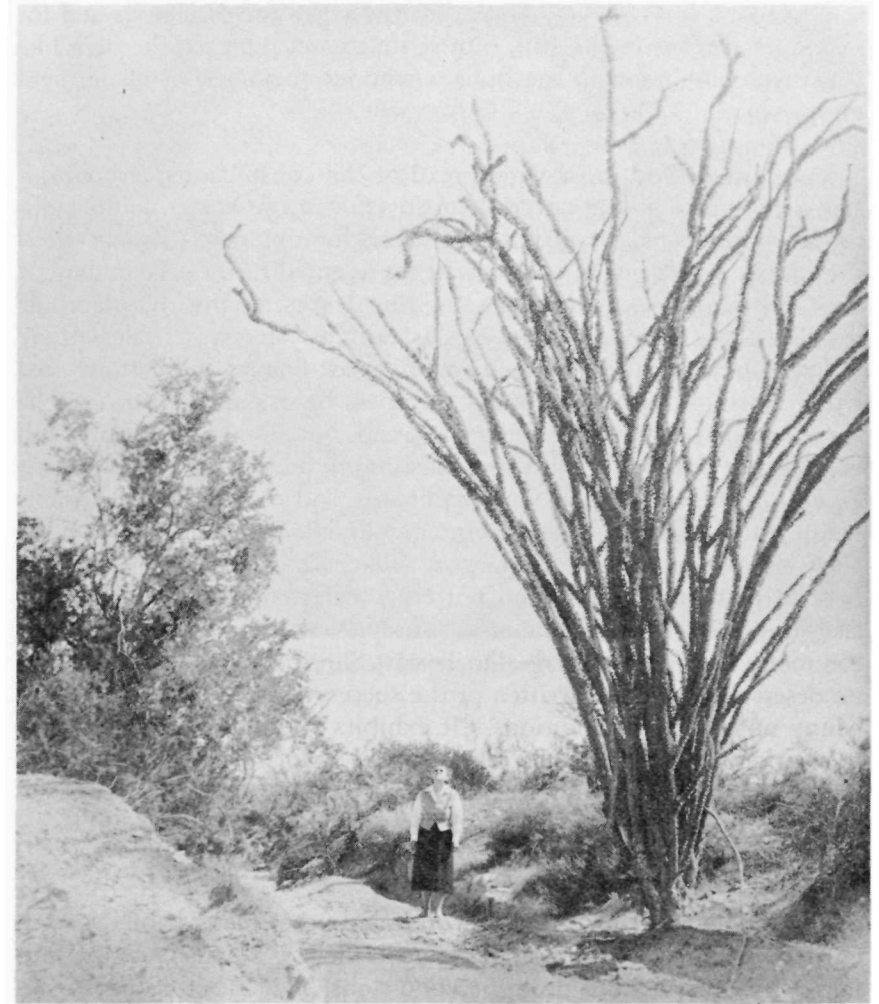
Chief among the requirements for year-round survival in the desert is a plant's ability to control transpiration (loss of water through surface areas) and thus maintain a balance between water loss and water supply. In this struggle, the hours of darkness are a great aid because in the cool of the night the air is unable to take up as much moisture as it does under the influence of the evaporating heat of the sun. Therefore, less exhaling and evaporating of water occurs from plants, thus reducing both the rate and the amount of water loss. This reduction in transpiration at night allows the plants to recover from the severe drying effects of the day. As one biologist stated, "If the celestial machinery should break down so that just one night were omitted in the midst of a dry season, it would spell the doom of half the non-succulent plants in the desert."

One of the common trees in the desert part of the monument is the MESQUITE (*Prosopis juliflora*). In general appearance it resembles a small but spiny apple or peach tree with divided leaves, but its roots sometimes penetrate to a depth of 40 feet. Thus the roots secure moisture at the deeper, cooler soil levels, from a supply which remains nearly constant throughout the year. This enables the tree to expose a rather large expanse of leaf surface without losing more water than it can replace. A number of mechanical devices help the tree to reduce its water loss during the driest part of the day (10 a. m. to 4 p. m.). Among these are its ability to fold its leaves and close the stomata (breathing pores) thereby greatly reducing the surface exposed to exhaling and evaporating influences. In April and May, mesquite trees are covered with pale-yellow, catkinlike flowers which attract swarms of insects. These flowers develop to stringbean-like pods rich in sugar and important as food for deer and other animals. In early days, the mesquite was also a valuable source of food and firewood for Indians and pioneers.

Another desert tree abundant in the monument is the YELLOW PALO VERDE (*Cercidium microphyllum*). It is somewhat similar in size and general shape to the mesquite. Without the deeply penetrating root system of the mesquite, the palo verde (Spanish meaning "green stick") cannot count on a dependable moisture source, so has taken even greater precautions to retain as much as possible of the water which its roots gather. In early spring, while the soil still contains moisture from the winter rains, the tree leafs out with dense foliage, followed closely by a blanket of yellow blossoms. At this season, the palo verdes provide one of the most spectacular displays of the desert, particularly along washes where they grow especially well. With the coming of the hot, drying weather of summer, the trees need to reduce their moisture losses. They gradually drop their leaves until, by midsummer, each tree has become practically bare. However, the trees do not enter a period of dormancy but are able to remain active because their green bark contains chlorophyll. Thus the bark takes over some of the food manufacturing function that the leaves normally perform but without the high rate of water loss.

Carrying the drought evasion habits of the palo verde a step further, the OCOTILLO (*Fouquieria splendens*) comes into full leaf following each rainy spell. During the intervening dry periods it sheds its foliage. The

A good specimen of palo verde.



The ocotillo.

ocotillo, a common and conspicuous desert dweller, is a shrub of striking appearance with slender, thorny, whiplike, unbranching stems 8 to 12 feet long growing upward and outward from a common base in the shape of a funnel. In late spring, brilliant scarlet flower clusters appear at the tips of the stems making each plant a glowing splash of color.

A number of desert shrubs fail to display as much ingenuity as the palo verde. Some of these, such as the DESERT-THORN (*Lycium* sp.), evade the dry season simply by going into a state of dormancy. It bursts into full leaf soon after the coming of the first winter rains and blossoms as early as January. The small tomato-colored, juicy fruits are

sought by birds which also find protective cover for their nests and for overnight perches in the stiff, thorny shrubs. In the past, the berrylike fruits were important to the Indians who ate them raw or made them into a sauce.

Commonest and most widespread of the conspicuous desert non-succulent shrubs, is the CREOSOTEBUSH (*Larrea tridentata*), found principally on the extensive fills of rock debris forming desert flats between the mountain ranges. It is also well represented in the monument. A new crop of wax-coated musty-smelling leaves, giving the plant the local name "greasewood," appears as early as January. The leaves are followed by a profuse bloom of small yellow flowers and cottony seed balls. During abnormally moist summers or in damp locations, the leaves and flowers persist the year round, but usually the coming of dry weather brings an end to the blossoming period. If the dry spell is exceptionally long, the leaves turn brown, and the plants remain dormant until awakened by next winter's rainfall. Pima Indians formerly gathered a resinous material known as lac, which accumulates on the bark of its branches, to mend pottery and fasten arrow points. They also steeped the leaves to obtain an antiseptic medicine. Ground squirrels commonly feed on the seeds. Dr. Forrest Shreve, well-known authority on desert plant life has written of the success of creosotebush in flourishing under desert conditions, "It exhibits an unusually high degree of what may be designated as 'physiological elasticity' by virtue of which its size, rate of growth, density of stand, amount of foliage, size and structure of leaves, and size of seed crop vary within wide limits according to habitat and season."

Ferns, notably plants of dank woods and other moist habitats, seem entirely out of place in the desert; nevertheless, members of the fern family have overcome drought conditions. The GOLDFERN (*Pityrogramma triangularis*) is not uncommon on rocky ledges where, by means of special drought-resistant cells, it persists in spite of trying conditions and hardships of the relentless desert climate.

Among the smaller perennials, there are many that add each year to the seasonal flower display while conditions of moisture and temperature are most favorable. Since the perennials do not need to mature their seeds before the coming of summer as do the ephemerals, a majority start blossoming somewhat later in the spring, and gaily flaunt their flowers long after the annuals have faded and died. When the heat and drought of summer begin to bear down, they gradually die back, surviving the "long dry" by their persistent roots and larger stems. One of the most noticeable and beautiful of this group of small perennials fairly common in the monument is PARRY'S PENSTEMON (*Pen-*



The pricklepoppy blooms throughout the year.

stemon parryi). It occurs in scattered clumps on well-drained slopes along the base of the Tanque Verdes. The showy rose-magenta flowers and the glossy-green leaves arise from erect stems that may grow 4 feet tall in favorable seasons.

Although not limited to a desert habitat, one of the conspicuous perennials found here is the PRICKLEPOPPY (*Argemone platyceras*) bearing large, white-petaled, yellow-centered flowers on thistlelike stems with prickly, gray-green leaves. Of especial interest is the fact that a closely related species, the Mexican pricklepoppy, with yellow petals, is found in the United States only in the vicinity of Tucson and Saguaro National Monument.

Among the first of the shrubby perennials to cover the rocky hillsides with a blanket of winter and springtime bloom is the BRITTLE-BUSH (*Encelia farinosa*). Masses of yellow sunflower-like blossoms are borne on long stems that exude a gum which was chewed by the Indians and also burned as incense in early mission churches.

Two of the conspicuous perennials that survive the dry season as underground bulbs are the DESERT-MARIPOSA (*Calochortus kennedyi*), and the PAPAGO LILY (*Dichelostemma pulchellum*). Although neither

occurs in massed bloom, they add spots of color to the desert scene. Usually appearing from February to May, the papago lily has violet flower clusters on long, slender, erect stems. The bulbs were dug and eaten by Papago and Pima Indians. The desert-mariposa is particularly noted for its deep, rich-orange, three-petaled blossoms appearing from March to May.

Although neither conspicuous nor attractive, the common WESTERN RAGWEED or BUR-SAGE (*Franseria* sp.) of the desert is so important a part of the palo verde, bur-sage, and cactus association (which covers much of the desert part of the monument) that it should not be omitted from this discussion.

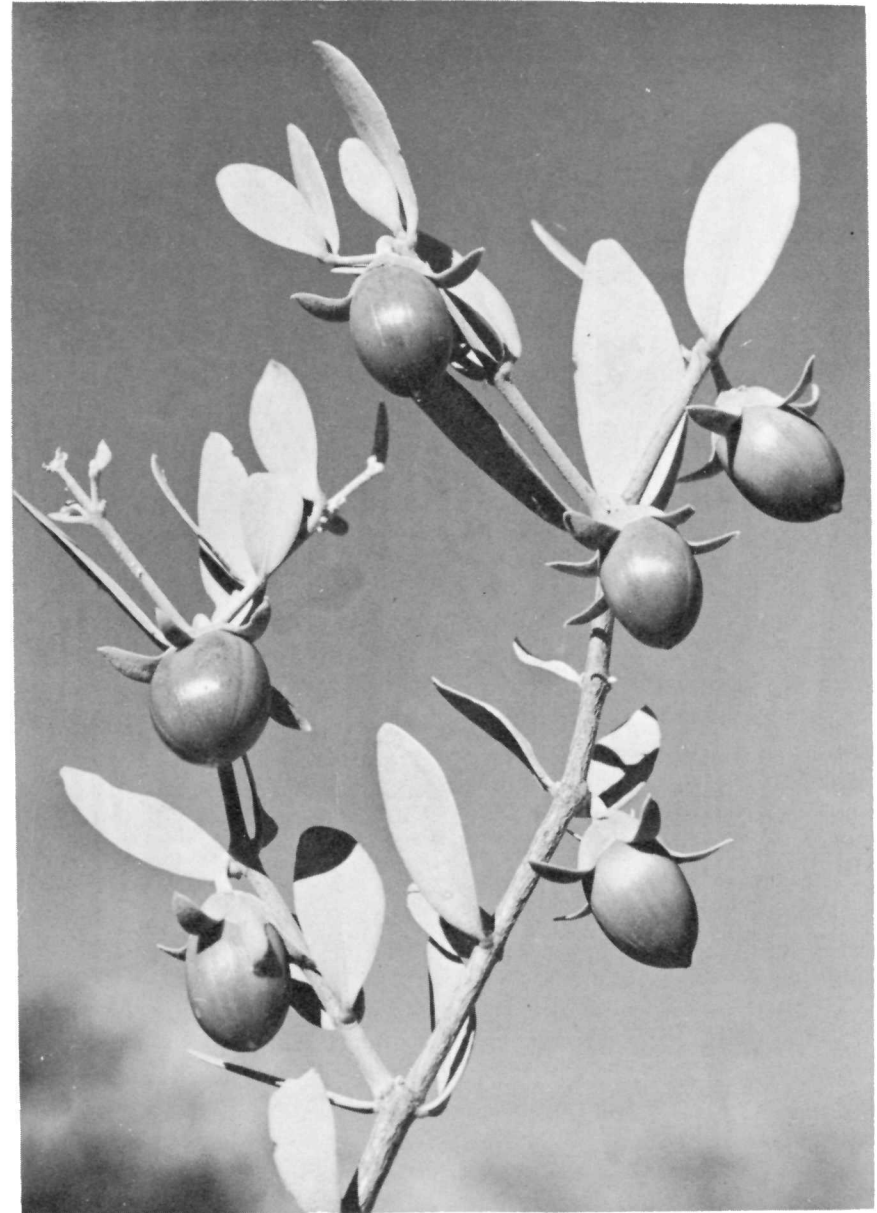
One of the handsome shrubs abundant in the high desert along the base of the Tanque Verdes is the JOJOBA (*Simmondsia chinensis*) or deernut. Its thick, leathery, evergreen leaves are especially noticeable in winter, and furnish excellent browse for deer. The flowers are small and yellowish, but the nutlike fruits are large and edible, although bitter. They were eaten raw or parched by the Indians, and were pulverized by early-day settlers for use as a coffee substitute.

Among the attractive flowering shrubs are the INDIGOBUSHES (*Dalea* sp.) of which there are several species adapted to the desert environment. Most publicized of these is the smoketree of the lower deserts, not found in the monument. The local, low-growing indigobushes are especially ornamental when covered with masses of deep-blue flowers in spring.

Another small shrub, noticeable from February to May because of its large tassel-like pink blossoms and fernlike leaves is FAIRY-DUSTER (*Calliandra eriophylla*). Deer browse on its delicate foliage.

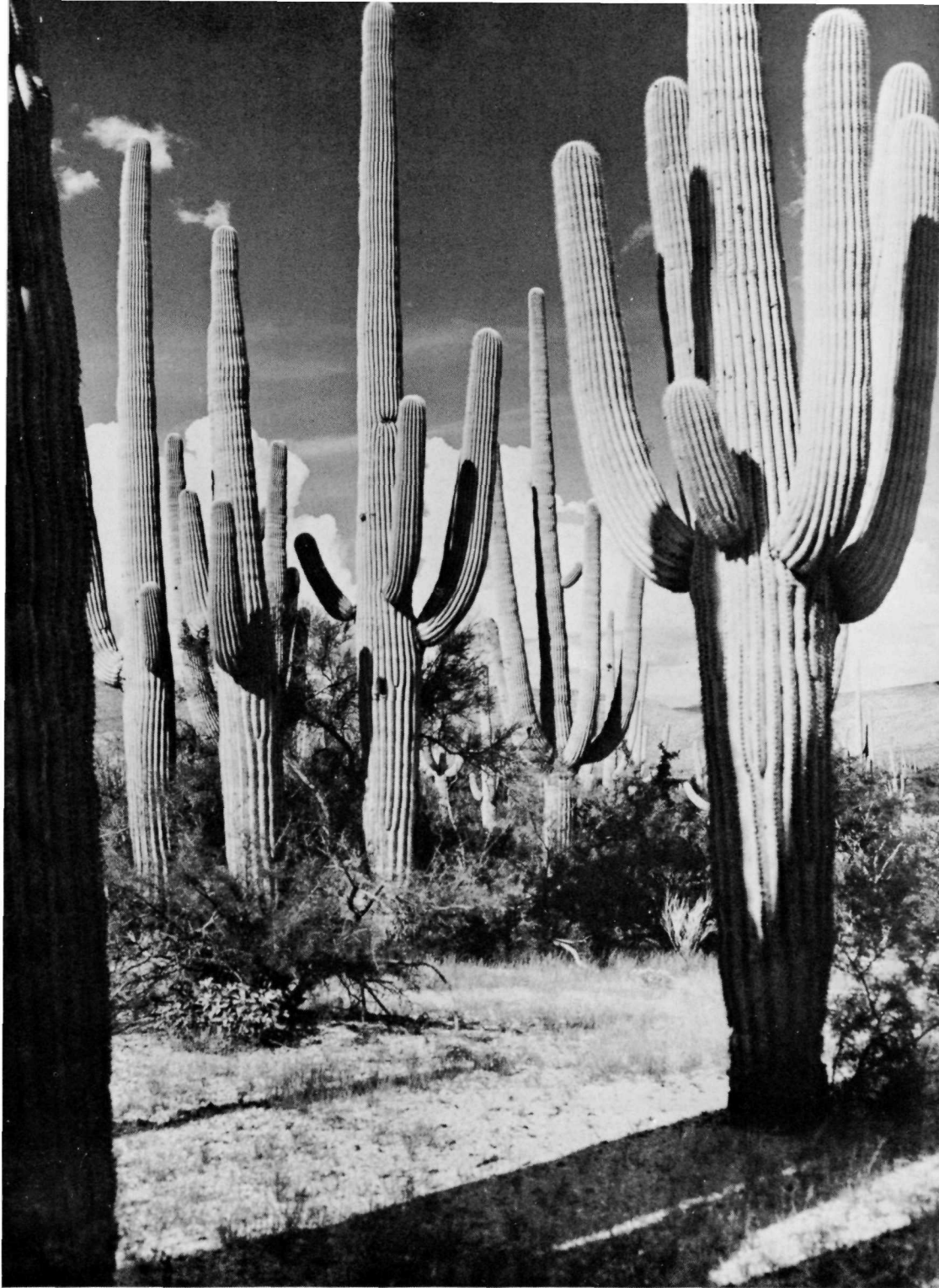
A larger shrub of open, sprawling growth sometimes reaching tree size and usually found along desert washes in company with mesquite is CATCLAW (*Acacia greggii*). In April and May, the small trees are covered with fragrant, pale-yellow, catkinlike flower clusters that attract swarms of insects. The seed pods were ground into meal by the Indians and eaten as mush and cakes.

Quick to attract attention because of their apparent lack of foliage, the JOINTFIRS (*Ephedra* sp.) of which there are several desert species, grow in clumps of harsh, stringy, yellow-green, erect stems. The skin or outer bark of the stems carries on the functions of leaves which have been reduced to scales. Small, fragrant, yellow blossom clusters at the stem joints are noticeable in spring and attract insects by their nectar. The device of lessening the water-transpiring surface by reducing or



Jojoba nuts are attractive and edible.

entirely eliminating their leaves is one which has been employed successfully by many plants that have adapted their way of life to a desert environment. Of these, the stem succulents are among the most numerous and conspicuous.



The Cactus Forest has been called a wilderness of unreality.

SUCCULENTS (WATER-STORING PLANTS)

The cactuses are called stem succulents. In many varied forms they dominate the palo verde, bur-sage, and cactus plant association in Saguaro National Monument. In size they range from tiny button and pincushion types, some of which weigh only a few ounces, to the giant saguaro, the bulkiest of which have been estimated at more than 10 tons. All cactuses have developed moisture-retaining tissues in their stems which enable them to store quantities of water during the wet season for use during long periods of drought, thereby equalizing the irregularities of water supply. In the course of evolution the cactus has eliminated its leaves, and their function has been taken over by the green outer covering of the stems. By so doing the amount of transpiration (main source of moisture loss from plants) has been greatly reduced.

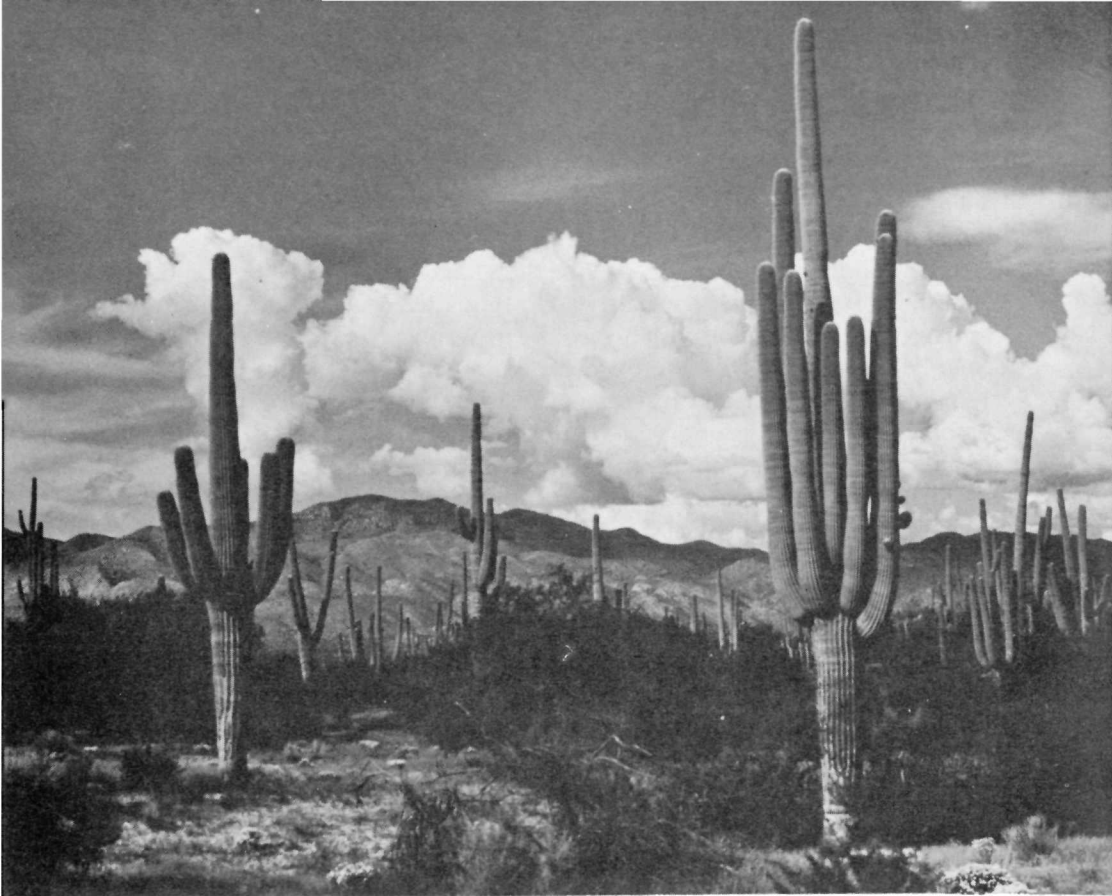
Certain other desert plants, principally the yuccas, echevarias, and the agaves, have retained their leaves and have developed additional water-storage tissues in them. A few, notably the NIGHTBLOOMING CEREUS (*Peniocereus greggii*), have slender stems but an enormous, carrot-shaped root in which the moisture-storage tissue is located. The GOURDS (*Cucurbita* sp.) also have large, thick, moisture-retaining roots, as does the WILD-CUCUMBER (*Marah gilensis*).

Cactuses are easily recognized, although many people mistakenly believe that any plant with spines or thorns is a cactus. Dr. Forrest Shreve states,

Several structural features have served to give the cacti their outstanding appearance, so unlike that of other plants. Most general have been the loss of the leaf as a permanent organ, the enlargement of the stem to accommodate water-storing tissue, and the development of local spine-bearing structures known as "areoles." In several genera, the stem is segmented into sections which are flat and somewhat leaflike; in others the stem is round, much branched, and the surface occupied by close-set tubercles. In a large group, including massive erect forms, as well as slender climbing ones, the stem is grooved or fluted and thus able readily to accommodate its surface to great fluctuations in the water content of the tissues.

THE SAGUARO—MONARCH OF THE MONUMENT

Of the 27 species of cactus recorded in Saguaro National Monument, the giant SAGUARO (*Carnegiea gigantea*) holds the center of interest. From the visitor standpoint all the other plants, no matter how bizarre in appearance or peculiar in their living habits, are just so much stage scenery for setting off the star of the desert drama. For size, this vegetable mammoth tops all other succulents of this country; heights of more than 50 feet and weights in excess of 10 tons have been recorded.



Desert area and Tanque Verde Mountains in background.

And there have been specimens with more than 50 arms or branches. Although no accurate method of determining age has been devised, it is estimated that an occasional veteran may reach the two-century mark.

Structurally the giant cactus is well adapted to meet the stern requirements of its habitat. Its widespread root system, up to 60 or 70 feet in diameter, lying close to the surface of the ground securely anchors and holds the heavy plant erect. The root system collects and channels to the main stem any moisture that may penetrate the topsoil. The trunk and branches have a cylindrical framework of long slender poles or ribs fused at the constricted base. This skeleton supports the mass of pulpy tissue, the whole being covered with tough, spinebearing skin. Numerous vertical ridges, like the pleats of a huge accordion, permit the stems and branches to expand in girth as the tissues swell with water during wet weather and to shrink during times of drought.

So efficient is the saguaro's water-storage system that, even after years of extreme drought, the plant still has enough moisture in reserve to enable it to produce flower buds. The buds appear in crowded clusters

at the tips of the branches, a few opening each night over a period of several weeks, usually in May. Petals are waxy white with blossoms up to 4 inches in diameter. This beautiful blossom is the State flower of Arizona. The egg-shaped fruits mature in June and July, splitting open when ripe to reveal masses of juicy, deep-red pulp filled with tiny black seeds. Pulp and seeds are consumed by several kinds of birds, especially white-winged doves. Fruits that fall to the ground are promptly eaten by rodents and other animals. Pima and Papago Indians still harvest the fruits in some parts of the desert.

Although billions of saguaro seeds are produced yearly in the extensive stand in Saguaro National Monument, only a very few find favorable locations for germination and growth. Since it requires a shaded location with moisture-retaining humus in the soil, a saguaro seed must come to rest beneath a desert shrub or tree with low leafy branches. Woodcutting, livestock grazing, and other activities of man have done much to reduce the expanse of desert suitable for normal saguaro reproduction. It has been estimated that only one out of each 275,000 saguaro seeds produces a plant. Early growth is extremely slow, a 2-year-old saguaro being only one-quarter of an inch in diameter, and a 10-year-old plant 4 inches high.

Mankind has inadvertently endangered the future of the cactus forest in other ways. For example, rodents rely upon the tender tissues of young succulents as a source of vital moisture. Any expansion of the rodent population increases the hazards of life for small saguaros and reduces the number able to survive. Snakes, coyotes, hawks, and owls are among the chief predators that keep the rodent population within bounds. By killing snakes and hawks, and by waging poison campaigns against coyotes and foxes, man has lessened nature's control over rodent populations. Among the unexpected results of extensive predator reduction projects of the past is the present serious lack of young saguaros to replace today's mature stands.

OTHER COMMON CACTUSES

The barrel cactus, or bisnaga, is sometimes mistaken for a young saguaro. Stocky and unbranching, this cactus rarely attains a height of more than 5 or 6 feet. It bears clusters of sharp spines, called "areoles," with the stout central spine flattened and curved like a fishhook. In bloom this succulent plant produces yellow or orange flower clusters on its crown in late summer or early autumn. The widely circulated story that water may be obtained by tapping the barrel cactus has little basis in fact, although it is possible that the thick, bitter juice squeezed from the plant's moist tissues might, under extreme conditions, prevent death from thirst. Carefully avoiding the spines, desert rats, mice, and rabbits sometimes gnaw into the plant's tissues to obtain moisture.

The group of cactuses called opuntias have jointed stems and branches. They are common and widespread throughout the desert and are well represented in the monument. Members of this group with cylindrical joints are known as chollas, while those with flat or padlike joints are called prickly pears. Many of the chollas attain shrub or tree size and often grow in extensive stands or forests. The joints of some are brittle, often breaking off when the bristling spines become entangled in the clothing of persons or in the hair of animals brushing against them. Flowers of many are large and colorful. The prickly pears, too, produce large blossoms in the late spring, plants on the monument being principally the yellow-flowered species. The red-brown to mahogany colored fruits, called tunas, attain the size of large strawberries, and are edible. When mature in the autumn, they are consumed by many desert animals.

Some of the smaller cactuses are so tiny as to be unnoticeable except when in bloom; examples are the hedgehogs, the fishhooks, and the pincushions. Blossoms of these ground-hugging species are large, in some cases larger than the plants themselves, and spectacular in form and color. All of them add to the monument's spring and early summer display of floral beauty.

The Extensive Back Country

Although it contains the most spectacular desert features and is the only part readily accessible by automobile, the Cactus Forest includes only a small part of the monument's area of about 100 square miles. The remainder consists of the extensive grass-and-chaparral-covered slopes of the Tanque Verde hills. These lead up to the imposing, forested highlands of the Rincon Mountains extending all the way across the eastern end of the monument. From Wrong Peak (7,767 feet above sea level) on the southern border to Mica Mountain (8,590 feet above sea level) just inside the northern boundary, the Rincon Range towers more than a mile above the surrounding desert. In winter, the crest of this lofty cloud-barrier is frequently whitened with a blanket of snow. In summer, the temperature at monument headquarters in the desert (3,090 feet) drops below 100° only at night, but high in the Rincons cool breezes whisper among the branches of firs, pines, and aspens.

The abrupt change of almost 6,000 feet from the level of the Cactus Forest to the summit of Mica Mountain has a profound influence on precipitation and temperature within the monument. This is reflected in the marked difference in type of vegetation you will find in going from the hot, dry desert at the foot of the mountains to the cool, moist forests along their crest. Much of Saguaro's back country has never been



The saguaro blossom, Arizona's state flower.

scientifically explored and accurate information about many of the plants and animals to be found there is extremely meager. This extensive hinterland affords an excellent opportunity for natural history research with National Park Service protection policies assuring the researcher that he will find undisturbed natural relationships among plants and animals.

Life Zones Represented in the Monument

In journeying northward across the Americas from the equator to the polar ice cap, biologists have recorded seven major belts, or zones, of plant and animal life. These have been called life zones and given names descriptive of the parts of the continent in which they reach their greatest development: Tropical, Lower Sonoran or Austral, Upper Sonoran, Transition, Canadian, Hudsonian, and Arctic. Of outstanding interest is the fact that these life zones may occur locally within fairly definite elevation limits in mountain ranges. This similarity between latitudinal changes in plant and animal life near sea level and a variety of elevations at the same latitude has been expressed in the life zone concept. Its application in Saguaro National Monument is illustrated by the fact that in climbing from the Cactus Forest at about 2,600 feet to the top of Mica Mountain at nearly 8,600 feet you may readily recognize many of the plants and animals that you would meet in traveling northward 1,500 miles from the State of Sonora, Mexico, to the Provinces of southern Canada. Thus, in a trip of some 6,000 feet up the mountain within the monument you encounter plants and animals of the Lower Sonoran, Upper Sonoran, Transition, and Canadian Life Zones. These life zones within the monument are illustrated in the tabulation on the facing page.

Overlaps in the foregoing tabulation indicate that there are no sharp dividing lines between life zones, the typical plants of one zone blending with those of another zone quite gradually. Steepness of slope, angle of exposure to the sun at various times of day and season, and the type of soil have important bearing on the kind of plants which can survive even at a given elevation. For example, aspens and Douglas-firs indicative of the Canadian Life Zone extend down the cool north slopes of Mica Mountain and Rincon Peak to elevations occupied by pinyons and junipers of the Upper Sonoran Life Zone on the hot, dry southern face of nearby Wrong Mountain. Elevation figures expressing the life zone concept thus are simply averages or approximations which are helpful as guides to persons on the lookout for the plants and animals that serve as markers or indicators of these vegetation and animal zones. Until a road is built into the Tanque Verde and Rincon

VEGETATIVE COVER TYPES IN SAGUARO NATIONAL MONUMENT
(Adapted from A. A. Nichol, "Vegetation of Arizona")

COVER TYPE	JULY AVER. TEMP.	ELEVATIONS	ANNUAL RAINFALL	PROMINENT SPECIES	LIFE ZONE
Arizona Microphyl Desert	94	Below 3,000	3 to 11	Creosotebush Saltbush Needle grama-grass Indian wheat	LOWER SONORAN
Succulent Desert	94	3,000 to 3,500	3 to 11	Prickly pear Cholla Saguaro Palo verde Bur-sage Catclaw Ocotillo Mesquite	
Grasslands	85	3,500 to 5,000	12 to 16	Curly mesquite grass Emory oak Tobosagrass Gramagrass Agave (century plant)	UPPER SONORAN
Chaparral	82	5,000 to 7,000	14 to 18	Juniper Pinyon Algerita Scrub oak Mountain mahogany Sumac Manzanita Bluestemgrass Tobosagrass	
Forest	68	Above 6,000	21 to 35	Gambel oak Ponderosa pine Mountain muhly Douglas-fir White fir Spruce Aspen Snowberry Buckbrush New Mexico locust	TRANSITION and start of CANADIAN

Mountains, the back country containing examples of the Transition and Canadian Life Zones will remain accessible only by foot or horseback. Several well maintained horse trails lead from both the west and east sides of the Rincons to the crest of the range.

PLANTS OF THE UPPER SONORAN LIFE ZONE

The thinning and final disappearance of saguaros from along the trailside, although mesquites and ocotillos seem almost as numerous as on the floor of the desert, indicate that you are leaving the Lower Sonoran and entering the Upper Sonoran Life Zone. An occasional EMORY OAK (*Quercus emorii*) and NETLEAF HACKBERRY (*Celtis reticulata*) appears among the mesquites along the washes. Ground cover includes galletagrass, the gramas, curly mesquitegrass, clumps of snakeweed, rabbitbrush, and a variety of herbs.

A spectacular inhabitant of the grasslands and oak woodlands of the Upper Sonoran Zone is the AMOLE (*Agave schottii*), also called AGAVE, or CENTURY PLANT, whose rapidly growing blossom stalks attract attention from May to as late as August. The plants themselves, which grow crowded together in patches, consist of rosettes of succulent leaves superficially resembling bunches of flattened, green bananas. Stiff leaf tips are needle-sharp and can inflict a painful jab to man and beast. During its lifetime, the plant stores food in its short, thick stem. Finally after several years it sends up an unbranched flower stalk that grows 5 to 9 feet high. The light-yellow flowers mature to brown capsulelike fruits, after which the plant dies. The short stems or crowns containing saponin were used by Indians as soap. They also roasted the young bud stalks of some species by covering them with heated stones in pits.

Two noticeable plants of the lily family which sometimes dominate gravelly slopes of the grassland-woodland belt are the SOTOL (*Dasylirion wheeleri*) and SACAUISTA, or BEARGRASS (*Nolina microcarpa*). The former grows from a compact crown as a dense, rather symmetrical, cluster of long, thin, ribbonlike leaves, usually frayed at the tips and armed along the margins with curved thorns. In early summer many small cream-colored blossoms develop along the upper extremity of single fast growing flower stalks 8 to 10 feet high. The bud stalks formerly were harvested and roasted by Indians. In Mexico a powerful alcoholic drink, sotol, is distilled from the fermented juice of the pounded crowns. Sacahuista resembles huge sprawling clusters of coarse grass. Flower stalks are short, producing conspicuous, open, loose sprays of small, tan to brownish flowers in May and June. Indians used the tender bud stalks for food and obtained fiber from the long, slender leaves, weaving them into baskets and mats.



The Rincons where grassland and chaparral merge with pinyon-juniper woodland of the Upper Sonoran Life Zone.

Although a close relative of poison ivy and sumac, the aromatic foliage of SKUNKBUSH (*Rhus trilobata*) is harmless. Growing in compact thickets, often with scrub oak and other types of chaparral, skunkbush provides food and cover for birds and small animals. Inconspicuous yellow flowers appear from March to June, followed by berrylike fruits which are dull red when mature.

Especially abundant on the lower eastern flanks of the Rincon Mountains in the Happy Valley area, is POINTLEAF MANZANITA (*Arctostaphylos pungens*) which forms thickets on dry slopes. Early in spring the waxy, urn-shaped blossoms, the leathery, glossy, evergreen leaves, and the typical grotesquely crooked, red-barked limbs, make manzanita one of the attractive shrubs of the chaparral belt.

Two trees worthy of mention, although rare in the monument, are the ARIZONA SYCAMORE (*Platanus wrightii*) and the ARIZONA CYPRESS (*Cupressus arizonica*). They are sometimes found growing together along canyon watercourses such as Chiminea Wash and Rincon Creek



A platy bark pattern helps to identify the alligator juniper tree.

which drain south from Cow Saddle and the rugged back country between the Rincons and the Tanque Verdes.

As you continue to climb, open, grassy, shrub-dotted slopes gradually give place to sprawling thickets of chaparral. These are made up of manzanita and skunkbush, SILKTASSEL (*Garrya wrightii*), with scrub oak and underbrush of smaller shrubs. Among the common oaks are the ARIZONA WHITE OAK (*Quercus arizonica*), SILVERLEAF OAK (*Quercus hypoleuca*), SHRUB LIVE OAK (*Quercus turbinella*), and emory oak. They furnish protective cover, browse, and acorns for deer and other mammals and birds, and are of great value in retarding soil erosion

on steep, gravelly slopes. As you follow the trail higher, occasional MEXICAN PINYON PINE (*Pinus cembroides*) and ALLIGATOR JUNIPER (*Juniperus pachyphloea*) appear. Gradually these evergreens become more abundant, chaparral merging almost imperceptibly with the pigmy forest of pinyons and junipers. Clumps of MOUNTAIN-MAHOGANY (*Cercocarpus breviflorus*) are noticeable, their feathery seed "tails" gleaming in the sunshine.

Pinyons are among the commonest and most widespread trees of the middle elevations throughout the Southwest. The Mexican pinyon, which is the species growing abundantly in the Tanque Verde-Rincon upland of the monument, may be recognized by the fact that its foliage is in clusters of three needles to the group or bundle. Its cones require nearly 2 years to mature and contain hard-shelled seeds or nuts which are a source of food for many kinds of birds and mammals. The trees are usually shrubby, rarely more than 15 to 25 feet high, with horizontal, twisted, low-growing limbs. Intermingled with the pinyons are occasional junipers, often mistakenly called cedars. Those in the monument are conspicuous because of their platy bark forming an attractive pattern somewhat resembling the squarish-scaled skin of alligators. The berrylike cones are soft and mealy, and are eaten by many forms of wildlife.

Although the pinyon-juniper woodland supports a heavy stand of shrubby trees over much of the terrain, there are numerous open glades and grassy hillsides. BLUEGRASS (*Poa fenleriana*) and VINE MESQUITEGRASS (*Panicum bulbosum*) furnish ground cover. Following summer showers, many flowering herbs brighten the open slopes. Yellow to orange petals of PUCCOON (*Lithospermum multiflorum*), the white to lavender and rose blossoms of MOCK-PENNYROYAL (*Hedeoma hysopifolium*), BEEBALM (*Monarda austromontana*), and HOUSTONIA (*Houstonia wrightii*) are among those seen along the trailside.

PLANTS OF THE TRANSITION LIFE ZONE

Just as grassland merges with chaparral, and chaparral with pinyon-juniper woodland, so you will notice as you climb steadily higher, that these woodlands gradually mingle with the open pine forests that cover much of the Rincon Mountains above 6,000 to 7,000 feet. PONDEROSA PINE (*Pinus ponderosa*) is the "big tree" of the Rincons, growing in clear, open stands. Its high canopy of spreading branches allows sunlight to mottle the shaded forest floor. Its presence indicates the prevalence of conditions associated with the Transition Life Zone.

Except for grasses such as FESCUE (*Festuca sororia*), MOUNTAIN MUHLY (*Muhlenbergia montana*), and BLUE GRAMA (*Bouteloua gracilis*),



Ponderosa pines in open stands cover much of the Rincon Range above 6,000 feet.

ground cover is scarce. However, in tree-glades or on old burns, intermediate-type shrubs such as BUCKBRUSH (*Ceanothus fendleri*) and herbs have established themselves. Some of these herbs develop into patches of colorful flowers in summer and autumn. Common flowering plants found among the pines are COLOGANIA (*Cologania lemmoni*), PEAVINE (*Lathyrus graminifolius*) with its large and showy, white sweetpea-like blossoms throughout the summer, lupines, DOGBANE (*Apocynum androsaemifolium*), and the well-known white WESTERN YARROW (*Achillea lanulosa*). Here, too, may be found LARKSPUR (*Delphinium* sp.), GROUNDSEL (*Senecio neomexicanus*), ASTER (*Aster commutatus*), FLEABANE (*Erigeron arizonicus*), and others often brightened by the presence of butterflies and other insects seeking nectar and pollen. Most of these forest flowers bloom in the late summer or autumn when plants in the desert, far below, are drab and dormant.

Throughout the pine forests, numerous small canyons and rocky outcrops favor the development of thickets of oak and locust, frequently growing together. GAMBEL'S OAK (*Quercus gambelii*), a leaf-shedding, white oak, ranges in size from a small shrub to a handsome tree. It has broad, deeply lobed leaves which provide browse for deer. Its acorns are consumed by deer, rodents, and birds, including wild turkeys. The NEW MEXICAN LOCUST (*Robinia neomexicana*) also is browsed by deer.

Rarely reaching tree size, this species is an attractive addition to the vegetative cover with its odd-pinnate leaves and large clusters of purplish-pink flowers that appear in May and June. Locust sprout freely from roots and form expanding thickets which encroach upon oak clumps. They provide a valuable network of soil-holding roots, important in retarding erosion.

Relatively few in number, compared with the stands of the dominant ponderosa pine, the smaller CHIHUAHUA PINE (*Pinus chihuahuana*) grows on dry slopes and benches. Its needles are shorter than those of the ponderosa pine, and its cones are conspicuously persistent, remaining on the tree for several years. This Mexican species invades the United States among the mountain ranges of southern Arizona and southwestern New Mexico. In the monument it is found along the border line between the Upper Sonoran and Transition Life Zones.

A cone-bearing tree growing with the ponderosa pine, especially on higher northern and northeastern slopes of Mica Mountain, is the WHITE FIR (*Abies concolor*). It is also found with stands of Douglas-fir and southwestern pine. Flattened, gray-green needles curving upward from the branches, and large, green cones growing upright on limbs near the tops of the trees identify this beautiful evergreen. In open stands, the branches of even the large trees extend close to the ground. Bark is gray or ash colored. An occasional Arizona cypress may be found by the careful observer hidden among the larger white firs and Douglas-firs.

PLANTS OF THE CANADIAN LIFE ZONE

The Rincon Mountains are not high enough to provide a Canadian Life Zone habitat except in a few favorable locations. Such areas as the north slopes of Mica Mountain and Rincon Peak support small stands of trees and lesser plants typical of the borderline between the Transition and Canadian Zones. At the highest part of the Rincons, ponderosa pines dominate in the warmer, exposed locations, but white-barked QUAKING ASPENS (*Populus tremuloides*) grow in pure stands on cooler slopes near Spud Rock Ranger Station or with DOUGLAS-FIRS (*Pseudotsuga menziesii*) on the north side of the Rincon Peak. West of Spud Rock are abundant small groves of SOUTHWESTERN WHITE PINE (*Pinus reflexa*), a close relative of the limber pine and also of the Mexican white pine, which attest to the elevation but remind the observer that he is close to the southern border of the United States.

BRACKEN (*Pteridium aquilinum*) forms a green ground cover in heavy stands of pine and fir. This fern grows 3 feet high over much of the cooler, forested Rincon highland. Among the shrubs found on the

mountaintop is the SNOWBERRY (*Symphoricarpos oreophilus*) whose leaves are browsed by deer and whose berries are eaten by birds and chipmunks.

A spring, a small mountain stream, and a meadow near Manning Camp complete the picture of the higher elevations in the monument. In this bit of meadowland are found NEW MEXICAN ALDER (*Alnus oblongifolia*), CINQUEFOIL (*Potentilla subviscosa*), CHOKECHERRY (*Prunus melanocarpa*), GOLDENROD (*Solidago sparsiflora*), ORANGE SNEEZEWEED (*Helenium hoopesii*), MARIGOLD (*Tagetes lemmoni*), WILLOW (*Salix* sp.), and a number of other shrubs, grasses, and herbs characteristic of the high mountain meadows of the Southwest.

Rocks Important in Forming Soil

Although zonal plant growth is mainly influenced by elevation and exposure, the chemical and physical makeup of soils have an important influence. These properties are derived largely from the rocks which have decomposed and become converted into soil by forces of nature.

By far the largest part of the monument consists of very old recrystallized rocks, classified by geologists as gneisses and schists of Precambrian age. These rocks form the Tanque Verde and Rincon Mountains which are, geologically, a part of the same ancient uplift as the nearby Santa Catalina Mountains. Hundreds of millions of years ago, deep within the earth's crust, these older rocks were invaded by molten materials which cooled slowly to form granite. Numerous alternating bands, readily observable today, represent this preexisting host mass, together with the readily recognizable "injected" material.

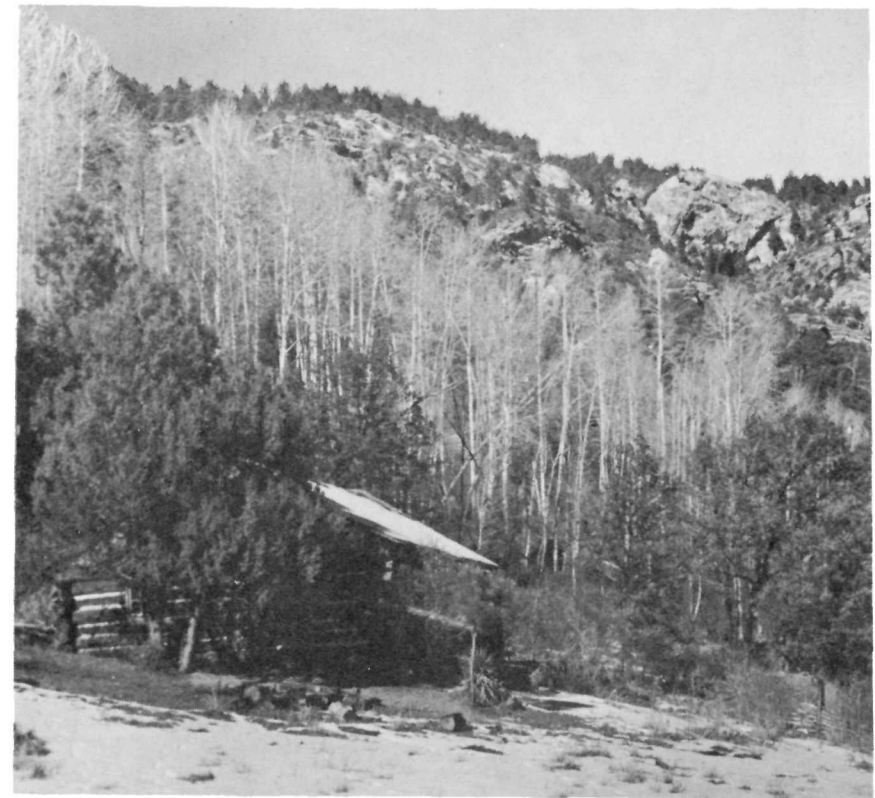
Thus the Tanque Verdes and Rincons represent the "roots" of very old mountains, the overlying parts of which have been carried away through the ages by erosion—the wearing away process of water, wind, and weather. Some of these removed materials form deeply buried layers of outwash sands and gravels covering much of the Cactus Forest area of the monument at the western base of the Tanque Verdes. There is an abundance of mica in the granitic rocks of the Rincons, especially in the vicinity of Mica Mountain, Manhead Lookout, and Manning Camp. Some of these old rocks contain garnets in profusion, as well.

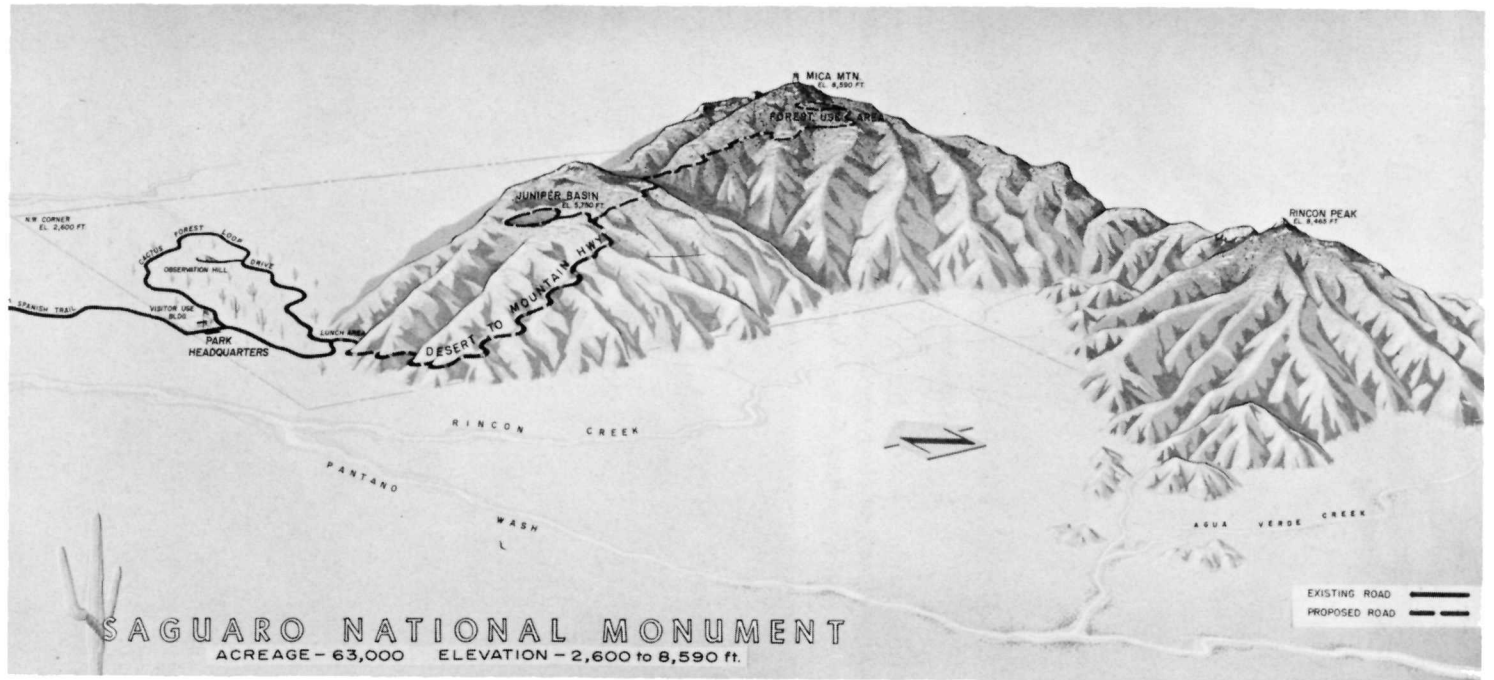
Along the flanks of the Tanque Verdes, outcroppings of ancient quartzite are noticeable in the Cactus Forest area. They are very tough resistant rocks made by the partial welding together of quartz sand grains. These quartzite layers belong to the Apache group of rock beds believed to be of Cambrian age—part of the second (Paleozoic) of four great chapters of earth history. Cambrian, and, somewhat later



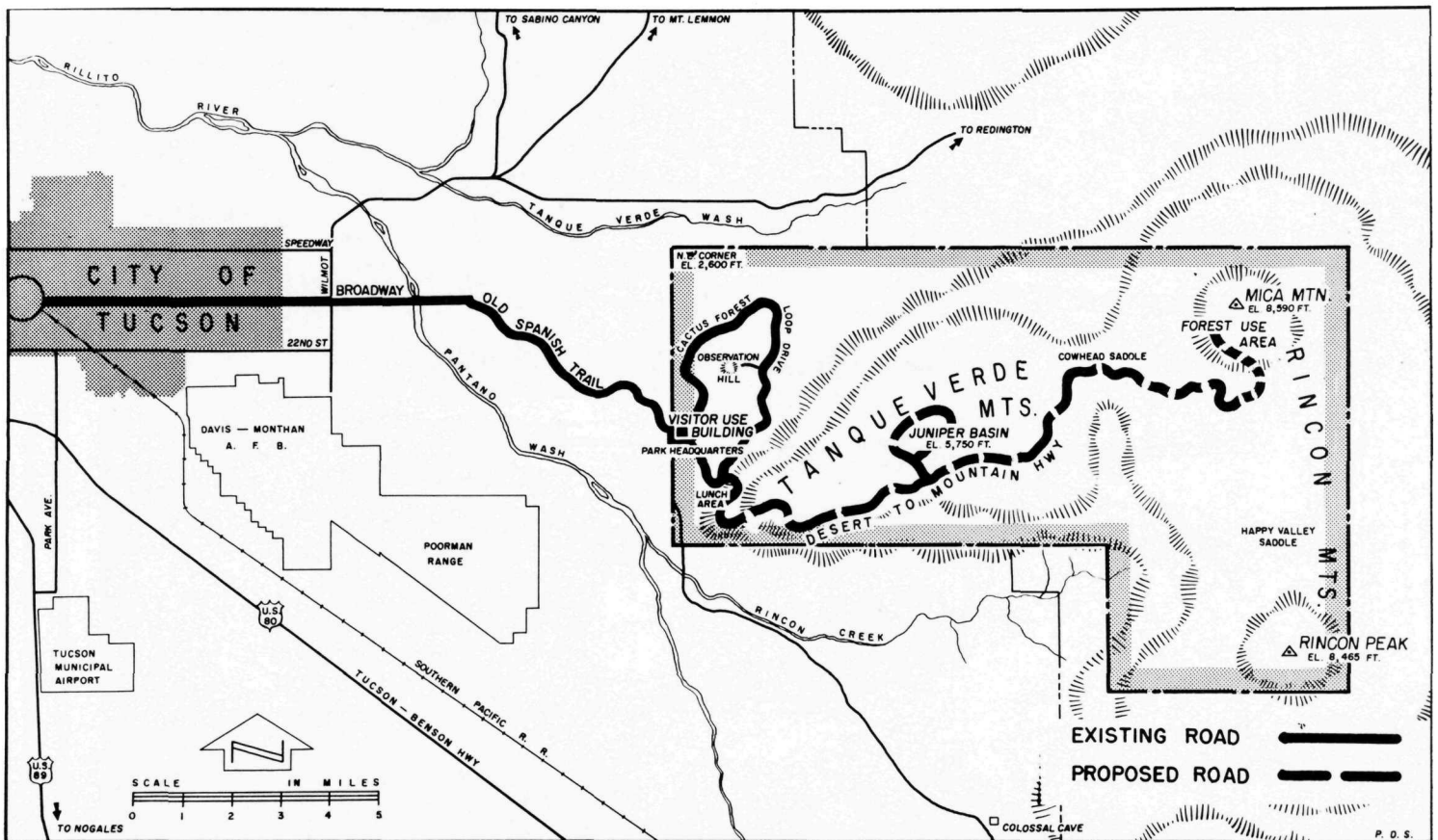
Snowberry.

Quaking aspen and other vegetation of the Canadian Life Zone at Spud Rock Ranger Station—7,400 feet.

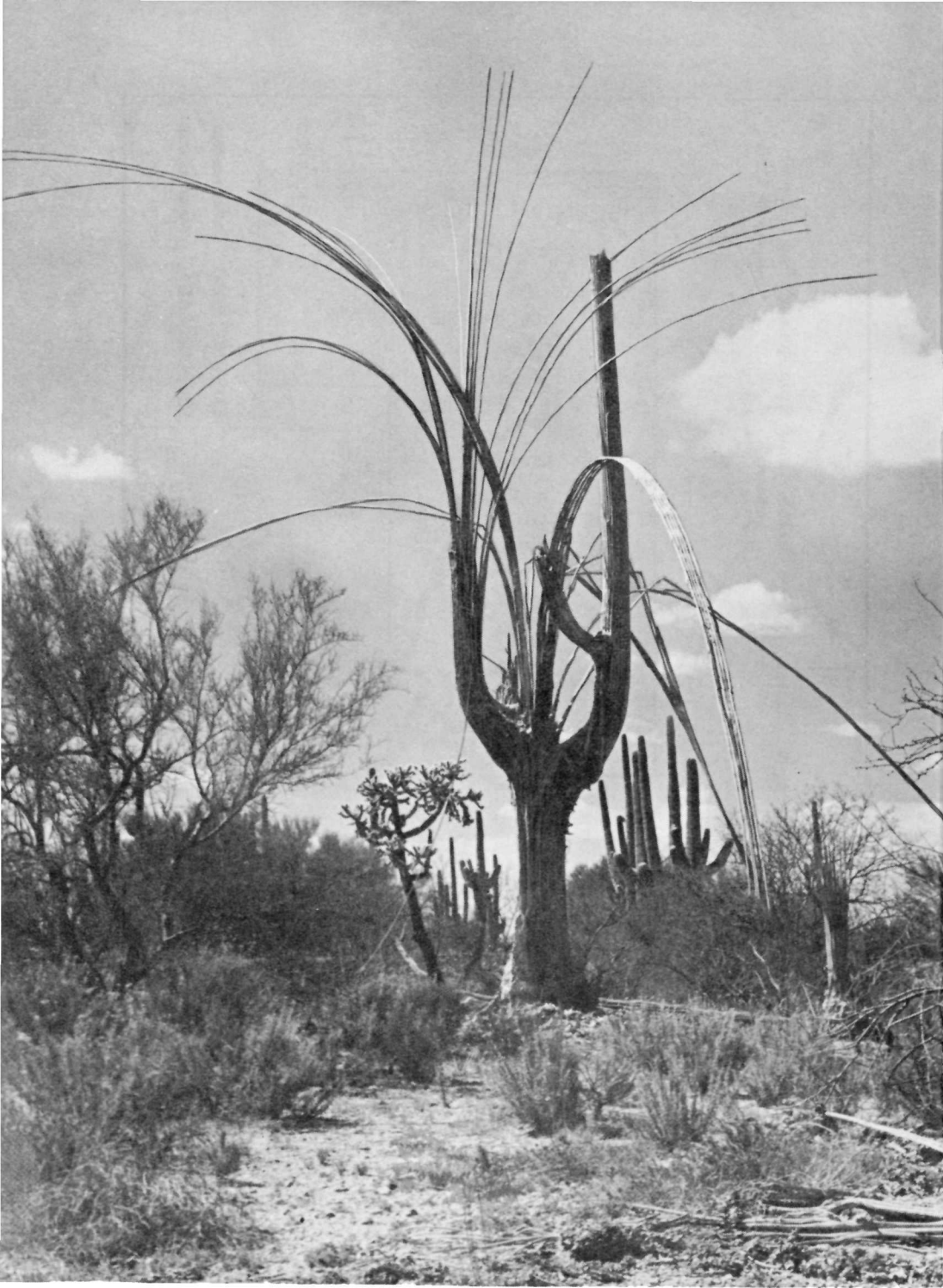




A diagrammatic view showing the developed area at the left and the route of the proposed desert-to-mountain highway.



Saguardo National Monument and vicinity.



Even in death the Saguaro is spectacular. After the succulent tissue dries and falls away, the many-ribbed skeleton bleaches under the desert sun.

Devonian, limestone deposits made during periods when this region was beneath the sea are to be found here too. In the Cactus Forest area, there are also small outcroppings of two kinds of lava flows, dark basalt and the lighter colored rhyolite, indicating local volcanic activity during Tertiary times—part of the fourth and current era of earth history, the Cenozoic.

The Rincon limestone, which although of Cambrian age, is one of the topmost sedimentary formations of southern Arizona, occurs only sparingly in the monument. However, a much larger deposit occurs in the vicinity of Colossal Cave a few miles south of the eastern part of the monument. This Rincon formation is composed of about 40 feet of thick-bedded, coarse-grained, pink limestone containing numerous fragments of ancient crablike trilobites and other fossils. These had lived here in ancient seas before the advent of today's plants and air-breathing animals.

Ancient movements in this part of the earth's crust are indicated along several faults or cracks within the rocks of the monument. One of these is brought to your attention by the self-guiding leaflet available at monument headquarters and also by a small wayside marker where the faultline is crossed by the roadway of the Cactus Forest Loop Drive.

Numerous and Varied Animals

Many species of reptiles, birds, and mammals as well as of plants have become adapted to the soils and the climatic limitations of the Tanque Verde and Rincon Mountains, and of the surrounding deserts. These creatures have found the food and shelter essential to life in the plant communities and habitats within the monument. Animals are influenced by elevational differences to a lesser degree than plants but are somewhat restricted to the life zones of their habitat. However, because of their great mobility, many birds and some of the larger mammals spend the winter in the desert, moving upward in the summer to the cooler life zones of the highlands, practicing a sort of "vertical migration."

When many people use the word "animals" they are thinking only of mammals; and they are likely to be surprised at the statement that animals are numerous in the desert. If you travel by automobile, the desert may appear devoid of animal life, especially in summer. You may see only an occasional rabbit carcass on the road, or a raven or vulture circling overhead. Nearly all desert animals have learned that survival means conservation of moisture. Therefore, during the heat and low humidity of midday, loss of moisture may be greatly reduced by remaining quiet in the shade of a creosotebush or mesquite tree, or



The fierce appearing praying mantid is harmless to humans.

resting underground in a burrow. Reptiles are unable to endure extended exposure to excessive heat or direct sunlight because they have no internal control over body temperature. In the spring and autumn, however, when the sunshine is not so intensely hot, desert reptiles are often seen abroad at midday. In cool weather they need the sun's heat to raise their body temperature to the level of comfort and effective activity.

INSECTS OF THE DESERT

Insects are generally not bothered by excessive heat, many species carrying on their activity during the hottest hours. This is especially true when the plant blossoming season is at its height. Flowers of the mesquite, palo verde, catclaw, saguaro, and other desert plants are "alive" all through the day with many species of winged creatures seeking nectar and pollen, or preying on other insects attracted to the blossoms. The insects, in turn, provide food for various species of birds, the flycatchers flocking to parts of the desert where nectar-yielding flowers are numerous. By their abundance and because of the absence of extreme cold, the desert climate enables insects to be active throughout much of the year and support a considerable bird population.

Insects play a far more important part in the plant and animal life of the desert than is usually realized. Many desert flowers must be insect pollinated to produce viable seeds. Birds of the flycatcher groups depend upon insects for food; and even the seed-eating birds, during the nesting season, rely upon insects to provide the enormous quantities of food and moisture required by their fast-growing nestlings. Many other desert creatures, including certain snakes and lizards and some spiders, depend upon insects for food. The body juices of the insects provide the all-important moisture which these creatures can get from no other source. Bats, too, are insect eaters, spending the hours of darkness in seemingly aimless and erratic flight while foraging for moths and other night-flying insects which visit the usually white or light-colored blossoms of night-blooming plants.

Some species of insects may become so numerous that they threaten to wipe out the plants on which they live. In a national monument this would endanger scenic values. Insects may also spread plant diseases. A serious necrosis disease which has reduced stands of mature saguaros has been traced to bacteria spread by larvae of a desert moth. Bark beetles annually damage or kill numbers of pinyons and ponderosa pines in the Rincon Mountains, but have been kept sufficiently under control by their natural enemies so that their ravages have never reached epidemic proportions in the monument.

Among the common spectacular insects is the TARANTULA HAWK (*Pepsis formosa*), a large blue-black, red-winged wasp that preys on large

spiders. Paralyzing the spider with its sting, the wasp lays a single egg on its victim thereby assuring an abundance of living food for its young. The PRAYING MANTID (*Stagmomantis californica*) is another large insect, usually green in color making it inconspicuous among the foliage of desert plants which it frequents in search of small insects. Ants of many species are active almost everywhere in the desert, harvesting seeds of various plants. Some species construct mazes of underground nest tunnels depositing the excavated materials on the surface, forming conical, sometimes craterlike, anthills.

There are a number of other jointed-leg creatures, including the spiders, which are somewhat similar to insects. Among these, the North American TARANTULAS (*Aphonopelma* sp. and *Dugesiella* sp.) are famous for their large size and formidable appearance. This has given them the wholly undeserved reputation of being dangerous to humans. The really dangerous creatures are the SCORPIONS of which several species are found in the monument. Only the small straw-colored scorpion has venom known to have been fatal to humans in some cases. The other scorpions found in the area are capable of inflicting painful stings which have only localized and rarely serious effects.

The brown or black tarantula spiders are timid and retiring. Their poison is less potent than that of a honey bee.



The Gila monster.

REPTILES—AN INTERESTING PART OF THE WILDLIFE DRAMA

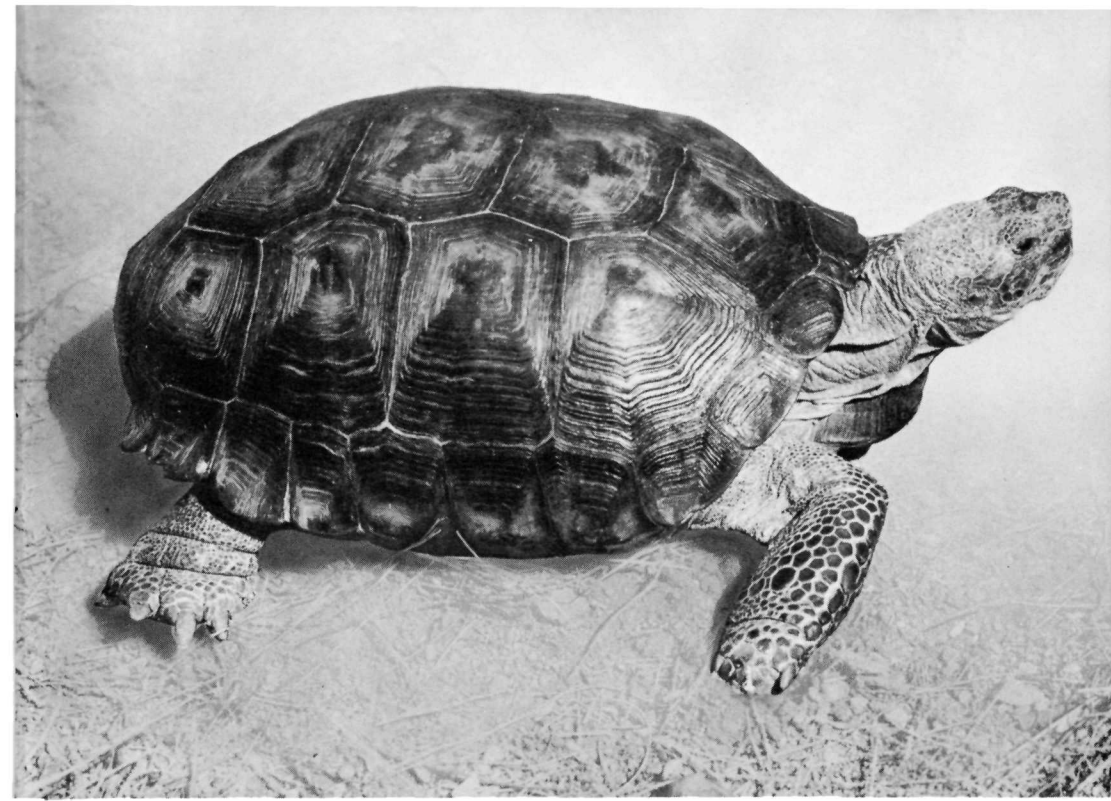
Except for small lizards, reptiles are not much in evidence in the monument. Nevertheless they are present and are important in the various plant-animal communities in which they are active. Almost all of the lizards are insect eaters, cooperating with birds in keeping the countless numbers of these crawling and flying creatures within bounds. A notable exception is the GILA MONSTER (*Heloderma suspectum*) largest of the lizards found in the United States. It is also the only poisonous species of lizard in this country. The Gila Monster is especially fond of bird eggs, and also eats nestlings and small rodents, obtaining necessary moisture from their body juices. These food habits are quite similar to those of the several species of snakes found in the monument, the majority of which are perfectly harmless to humans.

As the lizards help to hold down the insect population, so the snakes are important in preventing the buildup of large numbers of rodents which might result in widespread damage to vegetation. Visitors to the monument rarely have opportunity to observe snakes since they are in hibernation during the winter and remain in the shade or in underground burrows during the hot part of each day during summer. Perhaps those most frequently seen are the GOPHER SNAKE (*Pituophis sayi affinis*) and the RED RACER (*Masticophis flagellum frenatus*). Many

desert snakes hunt only at night, while others that are normally active during days of moderate temperature, become night hunters during hot weather. Although not abundant, there are several kinds of rattlesnakes in the monument, the commonest species in the desert being the WESTERN DIAMOND RATTLESNAKE (*Crotalus atrox*). Except for the small and very rare SONORA CORAL SNAKE (*Micruroides euryxanthus*), rattlesnakes are the only poisonous snakes in the monument.

Don't be surprised if, while following a desert footpath you come upon a plodding tortoise. This is a bona fide desert dweller, the DESERT TORTOISE (*Gopherus gassizi*), which is a vegetarian.

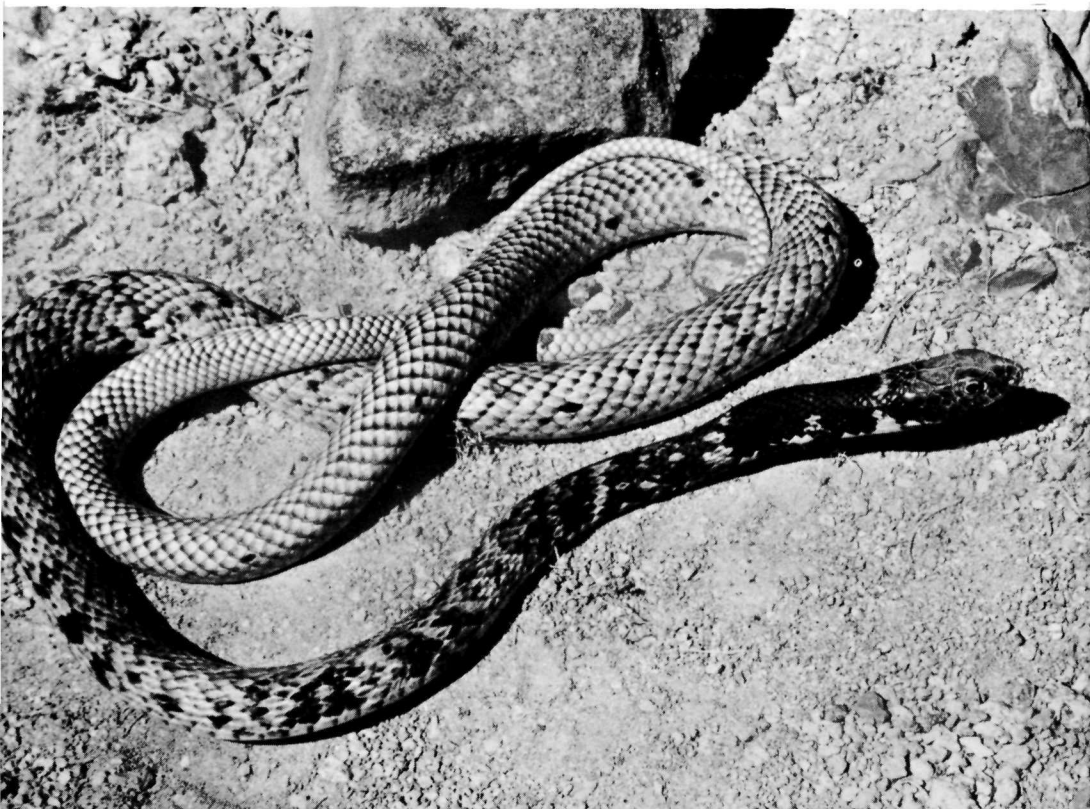
As might be expected, amphibians are scarce in the monument because of lack of permanent water. However, the few springs and seeps furnish excellent places for several species of amphibians to breed. Best known among these are the DESERT TOAD (*Bufo punctatus*) and the CANYON TREE TOAD (*Hyla arenicolor*). Most spectacular of the desert amphibians and largest toad in the United States is the huge COLORADO RIVER TOAD (*Bufo alverius*) sometimes found around residences in the evening when outdoor lights attract swarms of insects upon which these big amphibians feed.

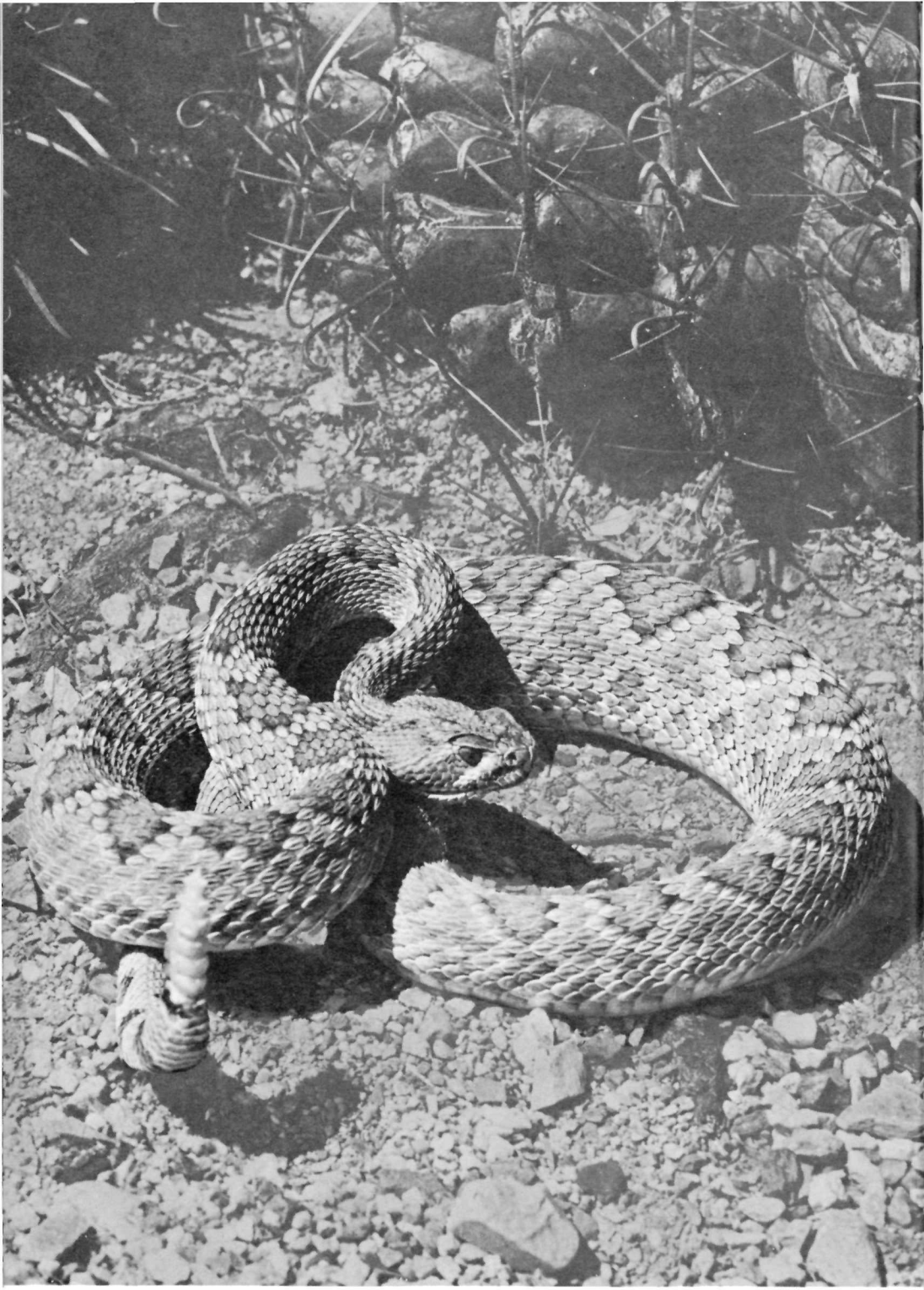


The desert tortoise.

Slender and light-bodied, the western red racer or whipsnake climbs into bushes and low trees in search of bird eggs.

Colorado river toad.





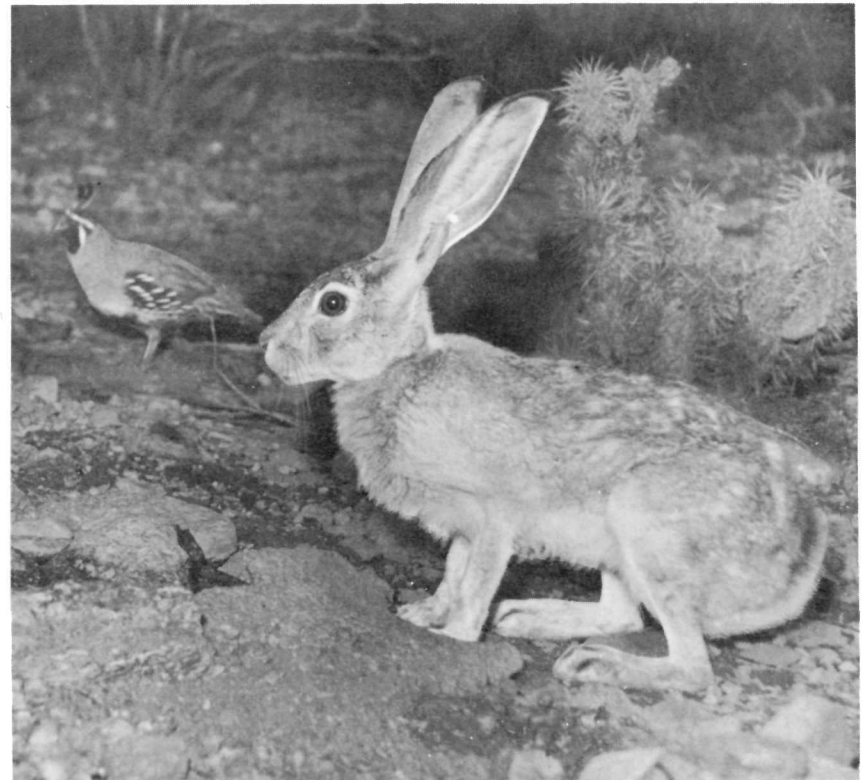
Western diamond rattlesnake.

RODENTS OF THE MONUMENT

Of all the rodents, COTTONTAILS (*Sylvilagus* sp.) are probably commonest throughout the monument from the lowest levels of the desert at 2,600 feet to the densely wooded top of Mica Mountain at 8,590 feet. Cosmopolitan in their habits, they find food and shelter under almost any condition, and augment the water they obtain from springs and seeps by moisture derived from the sap of vegetation. The larger hares, or JACKRABBITS, of which there are two species in the monument (*Lepus californica* and *L. alleni*), remain at the lower levels where they are a common sight amid the cactuses.

PORCUPINES (*Erethizon epixanthum*) are rarely seen, but they leave characteristic scars on pinyons and ponderosa pines recording their feeding habits at higher elevations in the monument. They are also active in the chaparral belt, and an individual occasionally wanders down into the desert where it samples the bark of ocotillos and other Lower Sonoran Zone shrubs and trees including the mesquite bean.

Jackrabbit and a Gambel's quail.





The shy Harris ground squirrel. This tame fellow is having lunch.

Several species of ground squirrels are abundant. At the lower levels, especially in creosotebush flats, the ARIZONA ROUND-TAILED GROUND SQUIRREL (*Citellus tereticaudus arizonae*) finds suitable living conditions while the HARRIS GROUND SQUIRREL (*Citellus harrisi*) ranges from the Cactus Forest into the grassland and chaparral belt. At this elevation and upward through the pinyons and junipers, the ROCK SQUIRREL (*Citellus variegatus*) makes its burrows in rocky ledges and brushy

Kangaroo rats are among the most numerous of the nocturnal rodents of the desert and grasslands.



Woodrat.

canyons. Chipmunks of several species enliven the chaparral and forested parts of the monument with their quick movements and cheerful chatter. The CLIFF CHIPMUNK (*Eutamias dorsalis*) occupies the oak and pinyon-juniper woodlands where it harvests grass seeds, pinyon nuts, fruits, and berries.

KANGAROO RATS (*Dipodomys* sp.) honeycomb the soil with their burrows ranging from the Cactus Forest up to the pinyon-juniper belt. Remaining underground during the day, they are frequently seen at night. One species at least requires no water, obtaining adequate moisture from a chemical process within its body during the digestion of its food, consisting principally of dry seeds. WOODRATS (*Neotoma* sp.), famous in song and story as pack rats or trade rats because of their inclination to carry away objects of human use leaving something else in their place, are found throughout the monument at all elevations. The parasitic CONENOSE (*Triatoma* sp.), an insect that may bite humans with unpleasant and sometimes serious effects, lives in the nests of the woodrats.

Others of the rat family common in the monument include the GRASSHOPPER MOUSE (*Onychomys* sp.), DEER MOUSE (*Peromyscus* sp.), and the POCKET GOPHER (*Thomomys bottae*).



Desert mule deer frequently come to the waterhole behind the Visitor Center.

HOOFED MAMMALS

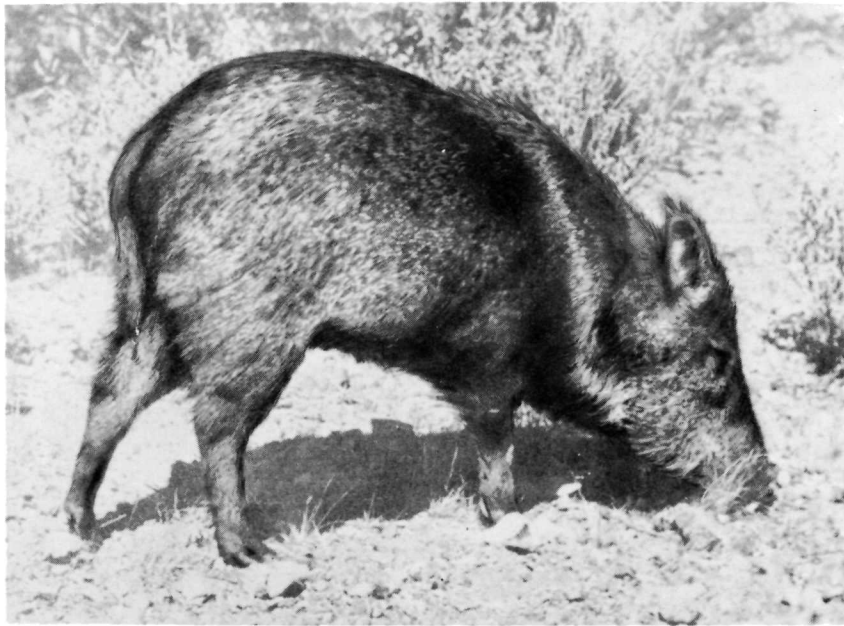
Two species of deer find suitable conditions in the monument. The DESERT MULE DEER (*Odocoileus hemionus*) subsists in winter on cactus fruits, ephemerals, and other Lower Sonoran vegetation. In summer they find abundant browse in the higher chaparral and pinyon-juniper belts. The forested areas along the crest of the Rincons support a sizable population of the smaller ARIZONA WHITETAIL DEER (*Odocoileus virginianus couesi*). These graceful animals browse on aspen, buckbrush, and other shrubs and small trees. When snow flies they descend to the protective cover of the pinyon-juniper woodlands and the chaparral belt. They are particularly fond of acorns.

The PECCARY (*Pecari angulatus*) is believed to be increasing in numbers in the monument, and is one of the animals characteristic of the deserts of the Southwest. These wild pigs usually travel in herds of from 3 to as many as 50 animals. They wander through the groves of mesquites along desert washes, and root among beds of prickly pear. Cactus fruits are a favorite item in their summer and autumn diet. In summer, peccaries are often found in the chaparral belt where they remain to harvest fallen acorns before returning to the desert to winter. In addition to the moisture obtained from succulent stems and fruits, peccaries require considerable water, hence they frequent springs and seeps. Small bands of these animals occasionally visit the waterhole near monument headquarters where they are excitedly watched by visitors fortunate enough to be in the lobby of the adjacent Visitor Center at the time.

PREDATORS

Saguaro National Monument has a large number of predatory animals—those which kill other animals for food. Many of these, popularly believed to be exclusively meat-eaters, actually also eat a lot of vegetable matter. But, the predators do play an important part in preventing serious overpopulation of the prolific rodents.

Chief among the predators is the COYOTE (*Canis latrans*) which ranges throughout the entire monument. In winter, coyotes are found principally below 6,000 feet where hunting is easier, and where rodents remain longer out of hibernation. However, they are also known to roam the forested heights of the Rincons and Tanque Verdes. Studies of the coyotes in the monument made by Biologist Lowell Sumner in January 1951 showed that their winter diet consisted of 77.8 percent fruits and seeds, 10.7 percent small rodents, 7.4 percent deer, 3.73 percent birds, reptiles, insects, and carrion, and 1 percent debris. The coyote is one of the principal wild creatures associated with the history

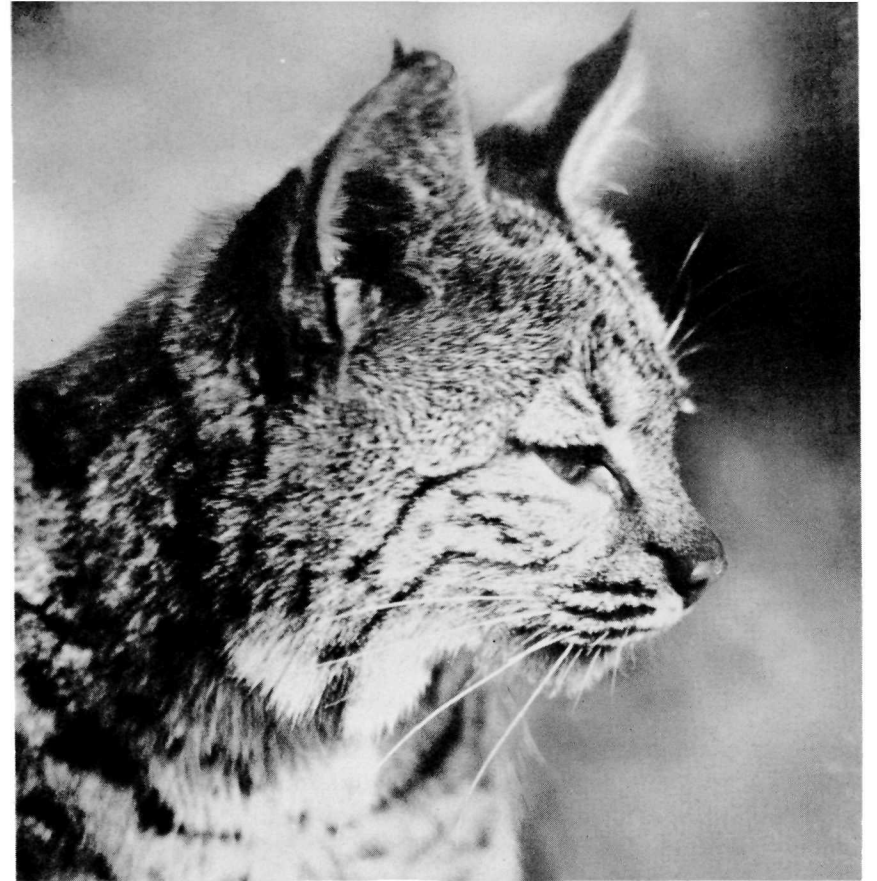


Peccaries in the monument are becoming accustomed to humans.

of the West, and its continuing presence in the monument brings a thrill of pleasure to visitors who hear the voices of the pack during the calm of evening, or catch a glimpse of one of these small gray canines trotting through open stands of saguaros. WILD CATS (*Lynx rufus*) range over much the same territory as coyotes, subsisting principally on rodents, birds, and insects.

The ARIZONA GRAY FOX (*Urocyon cinereoargenteus*) is another fairly common inhabitant of the cactus desert and the higher chaparral brushlands, and is also known to roam the forested uplands. It is usually seen at night and depends upon rodents for its principal source of food. It also preys on birds and reptiles and eats considerable vegetable matter. The smaller and rather rare KIT FOX (*Vulpes macrotis*) is also a night hunter, and prefers the desert to the uplands. Kangaroo rats are a favorite item in the kit fox diet, but these small predators also eat grasshoppers and other insects.

Skunks, which are members of the weasel family, are relatively common in the monument, several species being known to inhabit part of the area where water is available. They are usually active at night. The HOG-NOSED SKUNK (*Conepatus mesoleucus*) is a desert dweller recognizable by its solid-white back. It roots in the ground for insect larvae. It



The wildcat, considered a ferocious predator, looks like a large domestic housecat.

Arizona gray fox searches the thickets for unsuspecting rodents.





The ringtail is not often seen in daylight. It inhabits rocky canyons from the Lower Sonoran to the Transition Life Zones.



Raccoon.

also eats cactus fruits, bird eggs, and nestlings. The STRIPED SKUNK (*Mephitis* sp.) ranges throughout the monument and the CANYON SPOTTED SKUNK (*Spilogale gracilis*) is found at all elevations, usually among the rocks. Insects, rodents, and fruits are its main food.

Another member of the weasel family is the BADGER (*Taxidea taxus*). He is occasionally seen in the desert although by no means limited to that habitat. The badger feeds mainly on rodents which it digs from their burrows with its strong forelegs armed with heavy claws.

The RACCOON (*Procyon lotor*) is longer-legged than the badger, and readily recognized by its gray fur, black mask, and ambling gait. It inhabits brushy canyons with permanent water in both the Lower and Upper Sonoran Life Zones. Raccoons sometimes wander up into the pine belt in summer. Amphibians, scarce as they are, and other water creatures are among the preferred foods of raccoons, but they also eat small rodents and vegetable products including berries, acorns, and other fruits. The RINGTAIL (*Bassariscus astutus*), a smaller relative of the raccoon, is somewhat similar in habitat preference and nocturnal habits. It is sometimes called ringtailed cat because of its size and a slight resemblance to the domestic cat. Its large eyes and ears and its long, bushy tail ringed with alternating dark and light bands make it both conspicuous and attractive. It sometimes takes up residence in little-used or abandoned buildings where small rodents, its principal source of food, are usually abundant.

Hognosed skunk eating the fruits of a barrel cactus.





Cactus wren nesting in a cholla.

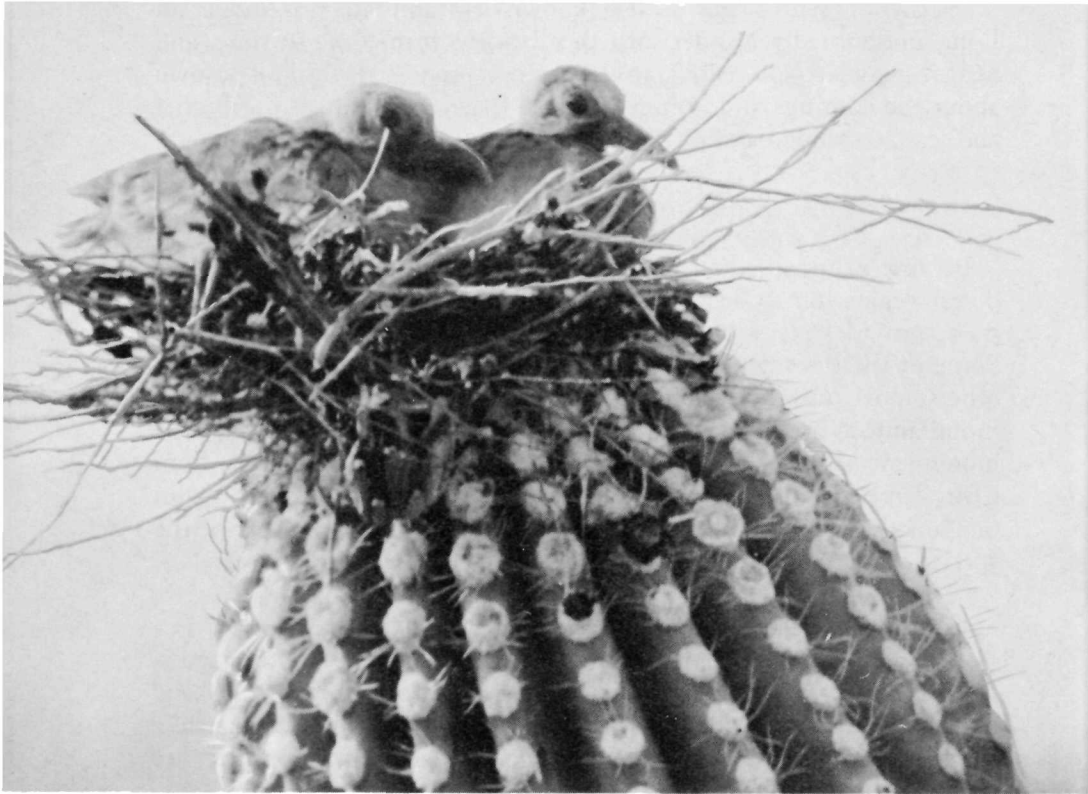
COUGARS (*Felis concolor*), also known less accurately as mountain lions, undoubtedly wander into the Rincons from time to time, and BLACK BEARS (*Ursus americanus*) have been reported. Little is known about the comings and goings of these large mammals of the higher and less accessible parts of the monument.

A BIRD-WATCHERS' PARADISE

Because of its great variety of bird habitats ranging from luxurious desert vegetation to deep mountain forests, Saguaro National Monument provides favorable food and shelter for many species of birds. Some of these reside the year around within a single life zone, while others move upward in summer, returning to the desert when the mountaintops are covered with snow. Other species pass through the monument in the spring and autumn in their annual migrations from Central America to summer nesting grounds in northern United States or Canada. Space limitations permit a discussion of only a few of the species you are most likely to see.

Common year-round desert residents are the THRASHERS (*Toxostoma* sp.). Noticeable, noisy, and about as large as a robin, these energetic inhabitants of the Cactus Forest nest in mesquite clumps and cholla thickets, and feed on insects and succulent fruits which make the birds comparatively independent of water. All of the thrashers are delightful songsters. The CACTUS WREN (*Heleodytes brunneicapillus couesi*) is likely to be confused with the thrashers, although it is somewhat smaller and even more noisy. It also protects its nest by building in cactus bushes. This wren lives largely on a diet of insects but about 17 percent of its food is seeds and fruits. One of the most attractive of the ground birds is the GAMBEL'S QUAIL (*Lophortyx gambeli*). There are many coveys of them throughout the desert within close range of water. In winter, Gambel's quail feed mainly on seeds, berries, and plant shoots; in summer they augment this diet with ants, grasshoppers, and other insects. The ROADRUNNER (*Geococcyx californianus*), ungainly clown of the desert, is frequently seen by visitors as it scuttles through the underbrush along the margins of sandy washes. Not particular as to food, it is often seen with the tail of a lizard protruding from its beak, and it is known to eat insects and spiders, snakes, young rodents, small birds, seeds and fruits. Quite capable of flight, the roadrunner prefers to trust to its legs and the security of thickets of creosotebush and cholla, but will take to its wings if pursued in the open.

Two members of the woodpecker family which are closely associated with the saguaro cactus are the GILA WOODPECKER (*Centurus uropygialis*) and the GILDED FLICKER (*Colaptes chrysoides*). Both species drill



Young white-winged doves in their fragile nest on the tip of a saguaro arm.

nest holes or pockets in the saguaro stems, and both are of particular interest to visitors because of their limited range and specialized habitat. Two other desert birds, both quite rare and sufficiently similar to be easily confused, are the crested CARDINAL (*Richmondia cardinalis superbus*) and the gray-and-red PYRRHULOXIA (*Pyrrhuloxia sinuata*). Several species of doves are found in the monument including the tiny GROUND DOVE (*Chamaepelis passerina pallescens*), the slightly larger INCA DOVE (*Scardafella inca*), the common MOURNING DOVE (*Zenaidura macroura marginella*), and the WHITE-WINGED DOVE (*Melopelia asiatica mearnsi*). In addition, the BAND-TAILED PIGEON (*Columba fasciata*) is common in the oak-pinyon-pine-fir forests of the Tanque Verde and Rincon Mountains. Whereas the ground dove and the Inca dove are all-year desert dwellers, mourning doves are mainly winter residents. The large white-wings drift in from Mexico in May remaining long enough to raise families and join other animals in harvesting the fruits of the saguaro.

Although seen in the desert the year around, the canary-voiced HOUSE FINCH (*Carpodacus mexicanus frontalis*) apparently is not a permanent resident. Individual birds that winter in the cactus country move farther north to nest, while those that raise families among the cholla and mesquite thickets have come north from their winter homes in Mexico. The tinkling song of the ROCK WREN (*Salpinctes obsoletus*) is a familiar sound in the desert in winter. These gray ground dwellers go farther north or to higher elevations to nest. Whether those found in the rocky brushlands in the Tanque Verdes and lower canyons of the Rincons in summer are the same individuals that inhabit the Cactus Forest in winter is not known.

The PHAINOPEPLA (*Phainopepla nitens*) is one of the most noticeable of the desert birds because of its silky crest, glossy black plumage, and habit of perching on the topmost branch of a mesquite or palo verde while indulging in flute-like song. Subsisting on mistletoe berries and other vegetable matter in winter, this permanent resident changes to a diet of insects, principally ants, during the rest of the year. Flycatchers are especially abundant and conspicuous during the spring and early summer when the blossoms of trees, shrubs, and the larger cactuses attract swarms of insects. Among these birds are the SAY'S PHOEBE (*Sayornis saya*), the VERMILION FLYCATCHER (*Pyrocephalus rubinus mexicanus*), and the ASH-THROATED FLYCATCHER (*Myiarchus cinerascens*). The TEXAS NIGHTHAWK (*Chordeiles acutipennis texensis*) lives on a diet of insects which it catches while on the wing. It is especially noticeable from May to October as it skims the tops of the tallest saguaros in the dusk of evening. The Texas nighthawk ranges into the grasslands and chaparral belt of the Tanque Verdes.

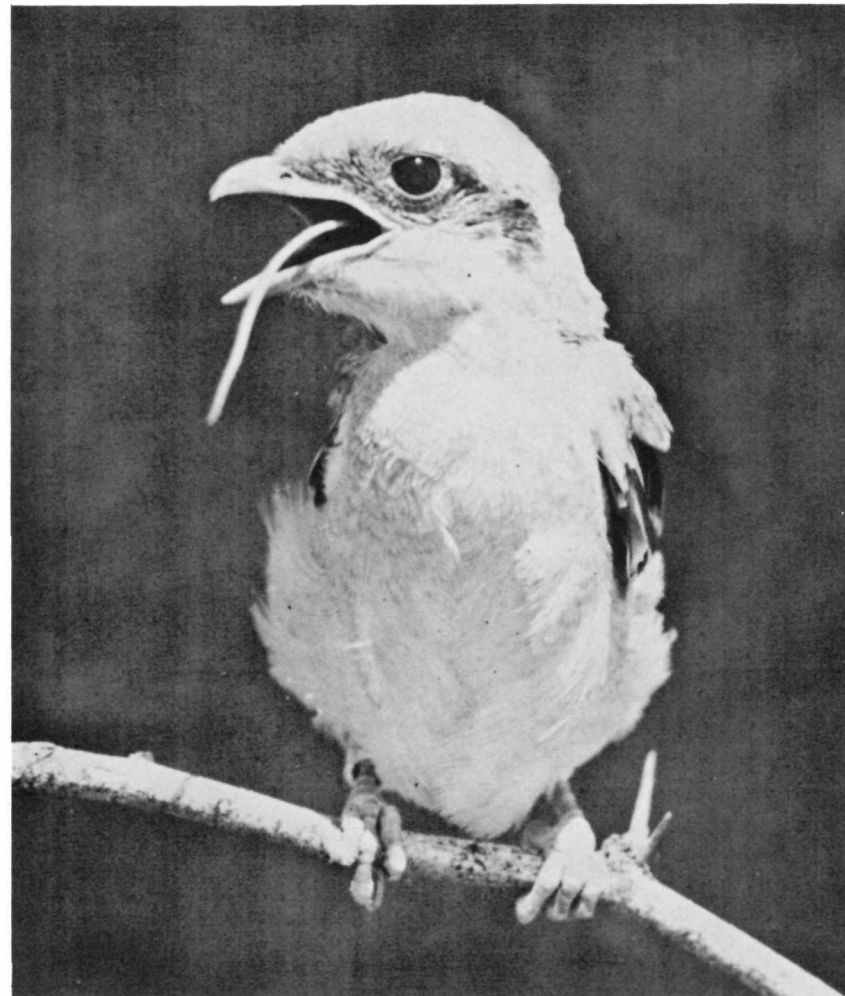
Predators are an integral part of the bird population, one of the most active being the LOGGERHEAD SHRIKE (WHITE-RUMPED) (*Lanius ludovicianus excubitorides*). This medium-sized black-and-gray bird gorges itself on beetles and grasshoppers when insects are abundant, turning to lizards, rodents, and small birds at other times. Of the several hawks, the RED-TAILED (*Buteo borealis calurus*) is probably the commonest of the large soaring hawks that live mainly on rodents and reptiles. It builds its large stick nest in the forks of saguaro arms. Like the shrike and the SPARROW HAWK (*Falco sparverius phalaena*), the red-tailed hawk is found in the grasslands, chaparral, and woodlands as well as in the desert. Because of their nocturnal habits, owls are probably more abundant in the monument than is generally believed. In addition to the GREAT HORNED OWL (*Bubo virginianus pallescens*) which, like the red-tailed hawk, feeds principally on rodents and builds cumbersome nests in saguaro branch forks, the PIGMY OWL (*Glaucidium gnoma*) and the tiny ELF OWL (*Micropallas whitneyi*) are



Although many species of birds build their nests among the cactus branches, some fall prey to the very spines whose protection they seek.

numerous in the Cactus Forest. Pygmy and elf owls make use of abandoned woodpecker nest pockets in the saguaro arms, not so much for nests as for dark and comfortable hiding places during daylight hours, emerging after sunset to hunt insects and small rodents which are abroad at night. Best known of the carrion eaters, the TURKEY VULTURE (*Cathartes aura teter*) is rarely seen on the ground, but is a common sight, singly or in groups, circling high in the sky.

One of the noisiest, most quarrelsome, and mischievous birds is the ULTRAMARINE JAY (*Apelocoma ultramarina arizonae*). It is a permanent resident of the Upper Sonoran Life Zone where it finds food and shelter among the oaks, pinyons, and junipers of the chaparral and



This young shrike just swallowed a lizard—all except the tail.

woodland. In summer, it shares this habitat with the night-flying POOR WILL (*Phalaenoptilus nuttalli*) which closely resembles the nighthawk. Shy, secretive, and protectively colored, this bird is rarely seen, but its plaintive call is a familiar twilight sound at the middle elevations of the Tanque Verdes and Rincons. Here, too, is found the rare HARLEQUIN QUAIL (*Cyrtonyx montezumae mearnsi*) until recently believed to have died out in Saguaro National Monument. The RUFUS-SIDED TOWHEE (*Pipilo erythrophthalmus*) lives in the brushy slopes and canyons of the chaparral. It trills its monotonous song from the branch of a skunkbush or scratches noisily and industriously among the fallen leaves beneath an oak.

The pine, fir, and aspen forests of the higher Rincons are rich in bird life in summer, but only a few species remain the year around. Among the latter is the STELLER'S JAY (*Cyanocitta stelleri neacrolopha*) which includes insects in its summer diet but feeds mainly on acorns and other vegetable material in winter. The MOUNTAIN CHICKADEE (*Penthestes gambeli*), and possibly the MEXICAN CHICKADEE (*P. sclateri eidas*) are busy among the branches of the large pines and firs even when snow lies deep on the ground. Nuthatches also remain the year around. The most spectacular and largest bird known to inhabit the Rincon Mountains is the native MERRIAM'S TURKEY (*Meleagris gallopavo merriami*) which nests and raises its young among the firs and aspens. It descends in winter, to the pinyon-juniper woodlands where it feeds on pinyon nuts, acorns, and grass seeds.

During the summer, when insects are plentiful, the mountain forests are alive with so many species of warblers there is not space to discuss them here. The MEXICAN JUNCO (*Junco phaeonotus palliatus*) that winters in the Upper Sonoran Life Zone, hides its nest in grass clumps among the firs and aspens. Hummingbirds of several species pause on vibrating wings to suck nectar from blossoms in the mountain meadow at Manning Camp. Brightly colored summer visitors such as the HEPATIC TANAGER (*Piranga flava hepatica*) and the PAINTED REDSTART (*Setophaga picta*) search for insects among the pine needles or reflect the sunlight as they flutter across open glades in the forest. The mountaintops are by no means devoid of predators; the COOPER'S HAWK (*Accipiter cooperi*), nesting in wooded canyons, is large enough to lift a grouse or rabbit, but generally preys on small birds and rodents.

The Monument Shares Southwest's Colorful History

That prehistoric man lived in the southwestern part of the monument is indicated by the crude petroglyphs (carved or stone-pecked pictures) found there. Centuries later, Papago and Opata Indians, from villages along the Santa Cruz River, once hunted and harvested saguaro fruits in this area.

Probably the first European to see the monument highlands was the Spaniard, Coronado, who with his exploring conquistadores from the south passed to the east of the Rincons in 1540. From then until it became a national monument in 1933, the history of the saguaro area is the history of the vicinity of Tucson, Ariz., established as a Spanish outpost in 1776. The Apaches of this area warred on the Spanish settlements, and later on the American settlers and the soldiers sent to protect them. This strife lasted for almost two centuries from the early 1700's until the capture of Geronimo in 1886.



A rare cristate saguaro, a lesion, cleaned of the necrosis decay by a woodpecker, is indicated by one of the scientists studying the disease. To the right is seen the skeleton of a giant cactus which has been killed by this disease.

Other historic chapters in the monument area's colorful background were trapping and copper mining and the transfer, in 1853, of these lands from Mexico to the United States under the Gadsden Purchase. The Butterfield Stage route, from St. Louis to Los Angeles, active for a few years prior to the Civil War, passed nearby on the way to Tucson.

The desert areas of Saguaro National Monument were at one time State owned or privately owned; the mountain areas were in Federal ownership. Hunting caused the depletion of animal life, and the heavy grazing and trampling by livestock destroyed much of the ground cover. In the desert, grazing and unrestricted woodcutting over many years removed or damaged many of the trees so necessary for the



Desert mule deer as seen through view-window of the Visitor Center.

survival and development of young saguaros. Scars caused by all such overuse by man can be centuries deep. It may require many years of protection for natural forces to reestablish in the desert the normal ecology of the area. Saguaro National Monument was established by Presidential proclamation on March 1, 1933, and now has an area of almost 86 square miles of Federal lands.

Autumn, Winter, and Spring Climate Ideal

Due to the wide range in elevation, temperature, and rainfall, the weather records for the low, desert part of the monument are quite different from those for the middle and higher elevations. In the Cactus Forest, temperatures range from a minimum of 16° F. in January to as much as 110° F. during the summer. The average annual rainfall is 11.5 inches. Snowfall in the Cactus Forest is rare, but the higher parts of the Rincons (where weather records have not been kept) are normally blanketed with snow each winter. It is believed that temperatures range in the higher Rincons from 0°, or below, in January to a high of 80° in June. An estimated annual precipitation of 25 inches comes principally during January–February and July–August.

Ideal weather for visiting the Cactus Forest may be expected from early October until Christmas and throughout March and April. Winter daytime temperatures in the desert are usually mild and comfortable, but hot days may be expected at any time from May through September. Day–night temperature differences average 30 degrees. Prevailing winds are from the southwest. High winds are rare; the maximum recorded being 50 miles an hour.

About Your Visit

No water, gasoline, food, lodging, or similar facilities are available in the monument. A picnic ground has shaded tables and fireplaces, but overnight camping is not permitted, and there is no water. However, the entrance to the monument is only 17 miles from downtown Tucson where every type of accommodation can be obtained. The monument can be reached from Tucson by a paved highway called "Old Spanish Trail," leaving Broadway Avenue, at the eastern edge of the city. You will find a large parking area at the National Park Service headquarters near the entrance. The Administration-Visitor Center has an air-cooled lobby where information service is provided. Here, also, are a number of exhibits which explain the natural history features of the area and help make the monument of greater interest and significance to you. A small cactus garden outside the building will help you identify these remarkable plants.

At the Visitor Center is the start and finish of a 9-mile loop drive along a surfaced road that provides access to the Cactus Forest, the most spectacular and heavily vegetated part of the desert. A self-guiding booklet, obtained at the information desk, explains significant features marked along the drive. If you enjoy horseback riding you can rent saddle horses at private ranches adjoining the monument to ride either through the Cactus Forest or over mountain trails of the Tanque Verdes and Rincons.

Administration

Saguaro National Monument is administered by the National Park Service of the United States Department of the Interior. A superintendent and several park rangers live in the monument. They maintain and protect the area and provide assistance and interpretive service for you. Other national monuments in the vicinity include Chiricahua, an area of weird rock formations in extreme southeastern Arizona; Tumacacori, an old Spanish Mission on U. S. 89 between Tucson and Nogales; Organ Pipe Cactus featuring strange plants of the Sonoran Desert, on the Mexican border about 140 miles west of Saguaro; and Casa Grande, spectacular remains of a prehistoric Indian village, about halfway between Phoenix and Tucson.

Glossary

Agave	(ah-GAH-vay)	Century plant.
Amole	(ah-MOH-lay)	Spanish name for the agave.
Bisnaga	(bees-NAH-gah)	Barrel cactus.
Cereus	(SEE-re-us)	One of several cactuses, mostly erect and columnar with night-blooming flowers.
Chaparral	(shap-pah-RAHL)	A dense thicket of dwarf oaks or other tough, woody trees or shrubs.
Chihuahua	(chee-WAH-wah)	A State in Mexico, bordering nearby New Mexico.
Chiricahua	(cheery-COW-ah)	A national monument in SE Arizona named after an Apache Indian tribe.
Chlorophyl	(CLOR-oh-fill)	The green coloring matter of plants.
Cholla	(CHO-yah)	A Spanish word for any of several very spiny cactuses.
Cinquefoil	(SINK-foil)	A wildflower with a leaf having 5 divisions.
Ephemeral	(ef-FEM-er-ahl)	Short-lived.
Gneiss	(NICE)	A rock, banded by recrystallization due to tremendous heat and pressure.

Jojoba	(ho-HOH-bah)	Deernut, a small tree or shrub of the high desert.
Mescal	(mess-KAHL)	A small cactus with rounded stems or joints covered with ribbed tubercles.
Mesquite	(mess-KEET)	A spiny, deep-rooted tree of the Southwest.
Mica	(MY-kah)	A shiny, semi-transparent mineral which splits easily into thin sheets.
Nogales	(no-GAHL-aze)	Town on the border between Arizona and Mexico.
Ocotillo	(oh-koh-TEE-yoh)	A thorny shrub with long whiplike unbranched stems tipped in April-May with bright-red flower clusters.
Opata	(oh-PAH-tah)	One of a group of Pima Indian tribes in northeastern Sonora, Mexico.
Opuntia	(oh-POON-cha)	A group of cactuses having jointed stems and branches.
Papago	(PAHP-ah-go)	Indians of northern Mexico and southern Arizona, related to the Pimas.
Pima	(PEA-mah)	Indians of northern Mexico and southern Arizona, related to the Papagos.
Rincon	(RIN-cone)	The mountain range in which are located the higher parts of Saguaro National Monument.
Sacahuista	(sah-kah-WEES-tah)	Spanish name for beargrass.
Saguaro	(sah-WAH-roe)	A tall columnar cactus—principal feature of Saguaro National Monument.
Sonoran	(So-NOR-ahn)	The arid division of the austral (southern) zone including warmer parts of the western United States.
Sotol	(SO-tohl)	Any yucca-like plant of the genus <i>Dasy-lirion</i> .
Tanque Verde	(TAHN-kay VERH-day)	Mountain range, foothills of the Rincons.
Tucson	(TOO-sahn)	Principal city of southeastern Arizona.
Tumacacori	(too-mah-KAH-koh-ree)	Old Spanish mission and a national monument near Nogales, Ariz.
Yucca	(YUK-kuh)	A genus of American plants of the lily family such as the Spanish dagger, Spanish bayonet and Joshua-tree.

Suggested Readings

We hope this handbook will arouse your interest and help you understand and appreciate Saguaro National Monument. Because the space is limited, we have outlined only the many attractions of the

monument, and have not even mentioned many interesting things. The following publications, some of them available for purchase or reference at the information desk at monument headquarters, will help answer many of your questions, and give you a deeper insight into the fascinating methods by which plants and animals of the desert, and the mountain ranges, meet the unyielding requirements of a hot and arid climate.

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