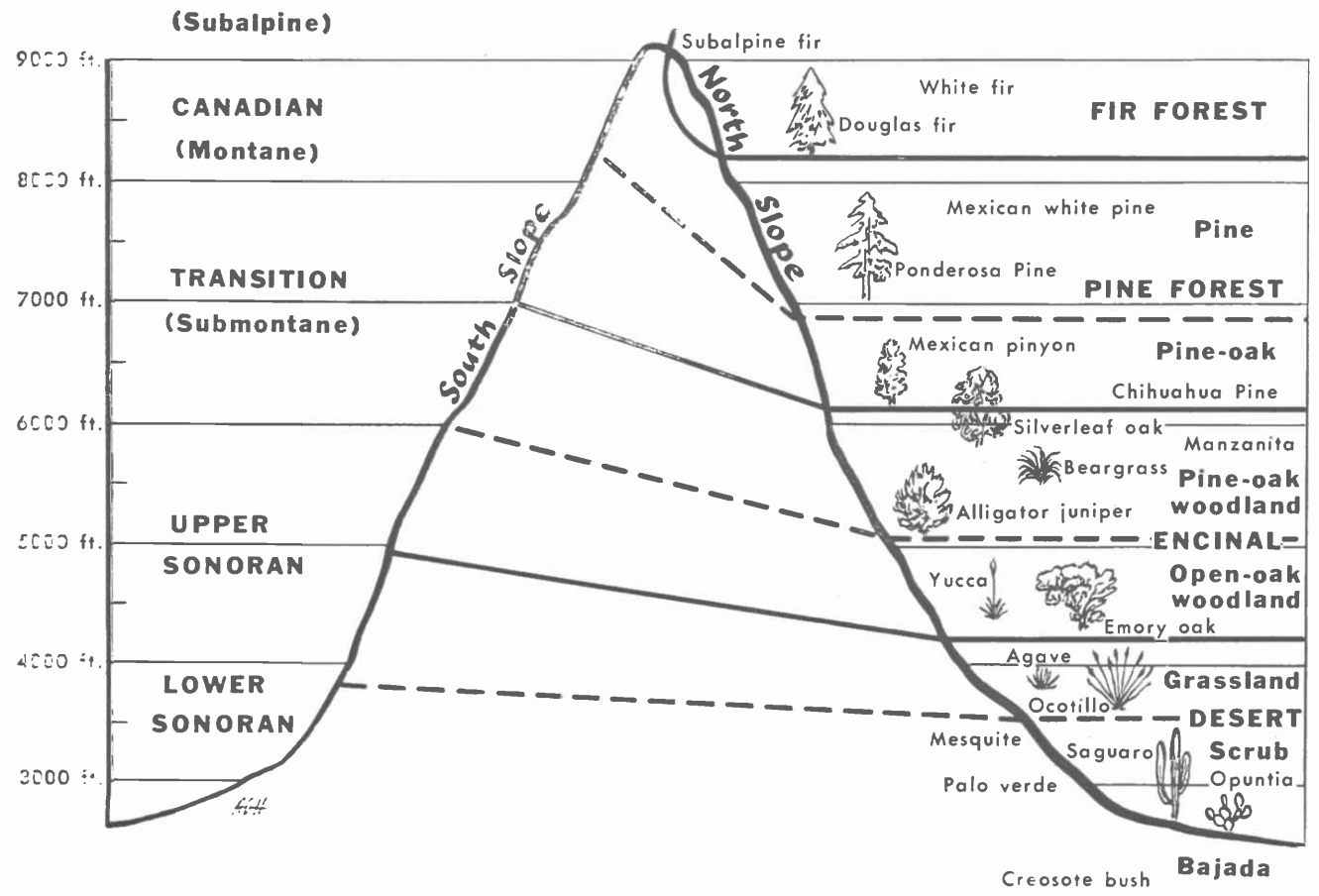
Vegetation of the Santa Catalina Mountains



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In the summer of 1962 the authors initiated a three-year study of Southwestern mountain vegetation under National Science Foundation support. The study is centered in the Santa Catalinas, although comparative data will be obtained on the vegetational pattern of other ranges, including the San Jacinto Mountains of California.

The work will seek an understanding of the relations of the plant populations to environment, productivity of plant communities, disturbance and successional changes, and the broader geographic and historic relationships of plant communities.

Have Much to Offer

The Catalinas were selected for intensive study since they offered relatively uniform geology, wide range of vegetation types, ease of access, and the proximity of excellent herbarium and research facilities at the University of Arizona.

In addition, the pioneer work of the late Forrest Shreve,[1] who was associated with the Desert Laboratory on Tumamoc Hill on the west edge of Tucson, would serve as an invaluable reference for more intensive studies.

The vegetation of the south side of the Catalinas has been sampled along the Mt. Lemmon Highway from Tucson (2500 feet) to the summit (9000 feet). Trees, shrubs and herbaceous plants were counted and measured in quadrants on various slopes and sites from the driest ridges to the moist ravines.

The authors are Associate Professor of Botany, Connecticut College, New London, and Associate Professor of Biology, Brooklyn College, respectively, both on leave during their Southwest vegetation studies.

[1] The vegetation of a desert mountain range as conditioned by climatic factors. Carnegie Inst., Washington, 1915.

Height Makes Many Climates

On the basis of over 400 such samples, the pattern of plant communities in relation to elevation and different exposures is revealed as belts of vegetation that extend to higher elevations on the warmer drier south slopes and to lower elevations on cooler more moist northern slopes.

Although numerous influences interact to produce this pattern, climatic factors, such as temperature and moisture, are of primary importance. With each 1000 foot rise in elevation one can expect a 3° F. reduction in temperature. However, during the summer the change may be twice this figure, with readings around 100° F. or more at the foot of the mountain in contrast to a comfortable 68° F. near the summit. Rainfall also increases with rise in elevation from 11 inches on the desert floor to 20 to 35 inches at the mountain top.

As a result of climatic differences, various life zones, characterized by distinctive plant and animal life, are encountered as one ascends the mountain. From the base of the mountain there extends a gently sloping valley plain (bajada) continuing west to the Tucson Mountains and east to the Rincons.

Soil Affects It, Too

Due to differences in soil texture, vegetational changes occur from the lower to upper bajada. The vegetational pattern from the base of the mountain, at the junction of Soldiers Trail and Mt. Lemmon Highway, upward to the summit is: desert scrub or spinose desert, characterized by saguaro and palo verde, on the lower mountain slopes; a narrow belt of open desert-grassland; an open oak woodland (above 4500 ft.); a pine-oak woodland extending to 7000 ft.; a pine-oak forest with oak decreasing; and a pine forest extending to the summit on the drier slopes. The fir forest is restricted to north slopes, primarily above 8000 feet to the summit.

The Sonoran Desert

BAJADA

On the lower bajada around Tucson, creosote bush desert predominates on the fine-textured soils, which are often underlain by caliche, a cemented calcareous layer. The shrubs are scattered, their density presumably being limited by competition for

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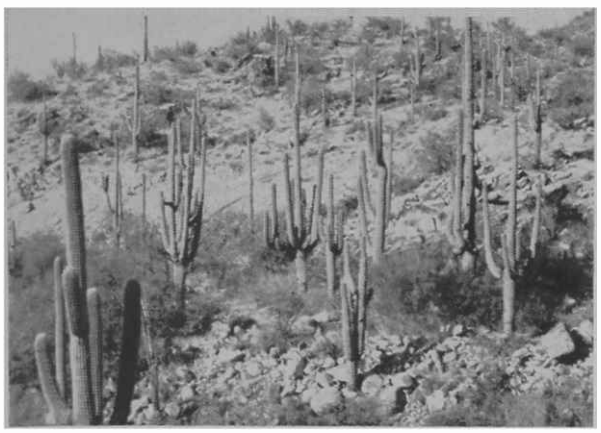

ON THE UPPER BAJADA THERE is the desert shrub, conspicuous with saguaro and palo verde trees on rocky slopes, and mesquite associated in the canyon, in ← foreground. This photo was taken at 2850 feet, just above Soldiers Trail, looking westward across the highway.

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moisture. Along the largest washes, such as Tanque Verde Creek, a mesquite bosque ("woodland") occurs with widely scattered taller cottonwood, willow or sycamore along the banks.

In the late 1800's "lush" vegetation, good fishing and occasional beaver dams occurred along certain of these washes. But, as pointed out by the early botanists at the University of Arizona Agricultural Experiment Station, heavy grazing in the late 1800's, accompanied by drought, resulted in a reduction in protective plant cover and an increase in run-off. This caused more severe erosion and eventually the cutting of channels, such as one observes today.

Farther up the bajada, palo verde and saguaro increase while creosote decreases. On the upper bajada, as one approaches the base of the mountain (2850 ft.) mesquite and jumping cholla increase, with scattered palo verde and large saguaro. Here at the mouth of Soldier's Canyon increased moisture, finer textured soils and grazing have modified the typical pattern from upper to lower bajada, *i. e.*, creosote bush on the finer textured lower bajada, and palo verde-bur sage type with saguaro on the more stony soils of the upper bajada.

Lower Mountain Slopes

DESERT SCRUB

As one starts up the mountain, the giant saguaro cactus and the green-barked foothill palo verde, along with ocotillo and various species of cacti, cover the steep rocky slopes. Low shrubs such as brittle bush, fairy duster, and many spring annuals, add to the extremely rich assemblage of desert species.

Adaptations to the desert environment are numerous: the reduction of leaves to spines to decrease water loss, the green barked stems which aid in photosynthesis, succulent habit of cacti for water storage and the semi-shrub habit — dying back during dry periods and quickly leafing out following the rains.

In addition, the many annuals are able to complete their life cycle rapidly during favorable periods. Saguaro, the giant cactus which typifies the Sonoran Desert, is reproducing under the protective cover of palo verde or other "nurse" plants and is in no danger of disappearing, as is the case on many parts of the bajada where grazing, combined with rodents, tends to limit reproduction.

Some Saguaro Frozen in '62

The many large dead saguaro evident on the slopes were killed by the January, 1962, freeze. Smaller plants were less adversely affected, and our studies indicate that the population will recover the loss. Saguaro decreases around 4000 feet, its upper limit apparently being determined by low temperatures.

DESERT-GRASSLAND

The desert scrub gives way to a narrow belt of desert-grassland (4000 feet) where a low agave, called amole, and grasses cover the slopes. This zone is a meeting place for ocotillo, which extends upward from the previous zone, and rose wood and blue oak, low evergreen trees which extend downward from the next zone, the encinal. When amole is burned, grasses and other forage plants tend to increase. The Forest Service is therefore using controlled burning to increase forage in parts of the range open to grazing.

The Encinal

The encinal (Spanish word meaning a grove of evergreen oaks) is a belt characterized by a variety of low, rounded evergreen oaks.

OPEN OAK WOODLAND

As the oaks appear they dot the slopes, forming an open grass woodland, but these trees increase in density on the north slopes as compared to the drier more open south slopes (Molino Basin, 4300 feet). Amole and grasses comprise the conspicuous ground cover under the various oaks —Blue, Emory and Arizona—appearing in this order up the mountain.

On certain slopes the low fine-leafed evergreen turpentine bush and sotol are conspicuous. The shrubby red-stemmed manzanita also appears at Molino Basin. Upward alligator juniper, followed by pinyon pine and increasing oak cover, form the pine-oak woodland or upper encinal.

PINE-OAK WOODLAND

This belt in its various phases extends from below Bear Canyon on the north slopes (5000 feet) to above Windy Point (7000 feet). It is interrupted by Bear Canyon, where a beautiful stand of large Arizona cypress occurs in the deep ravine just below (west of) the picnic area. Although typically a deep canyon species, young trees are becoming estab-

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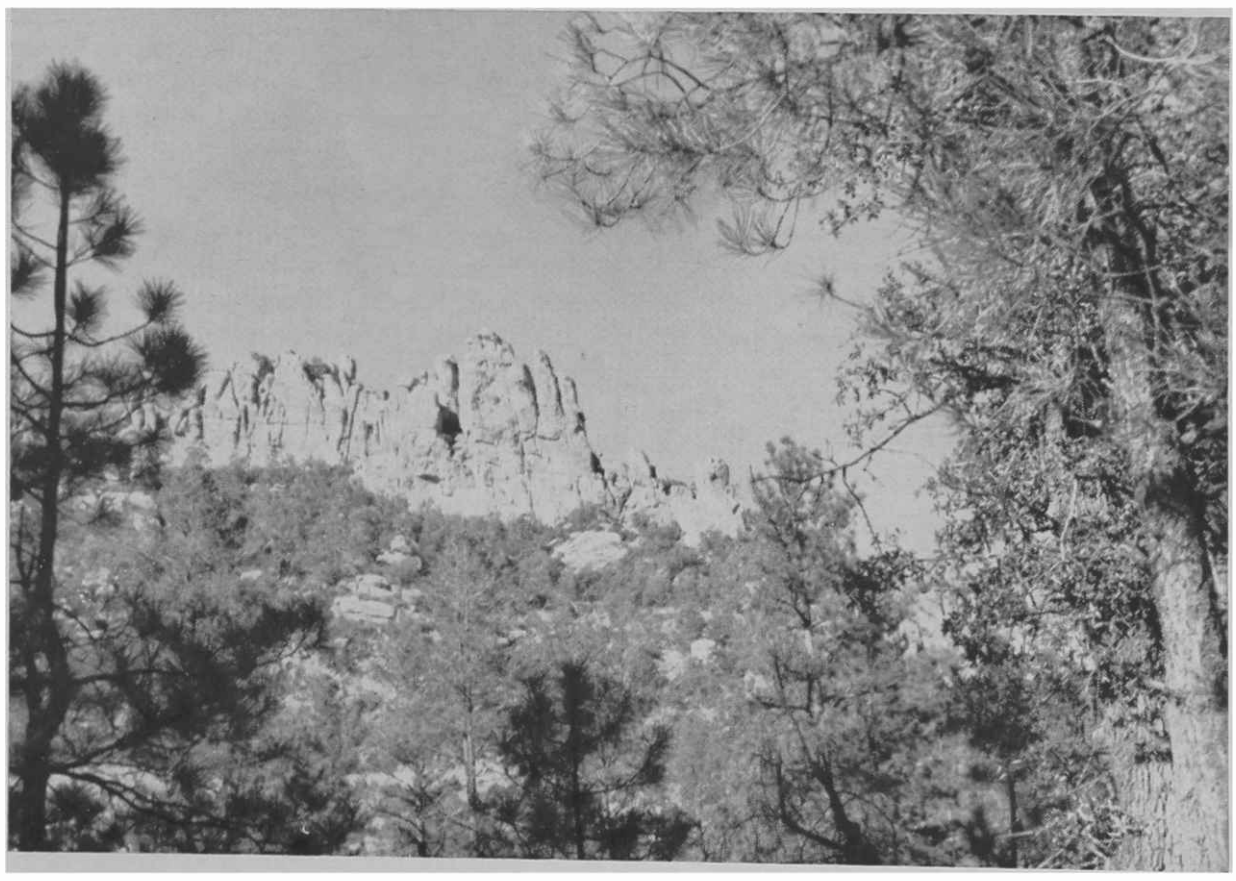
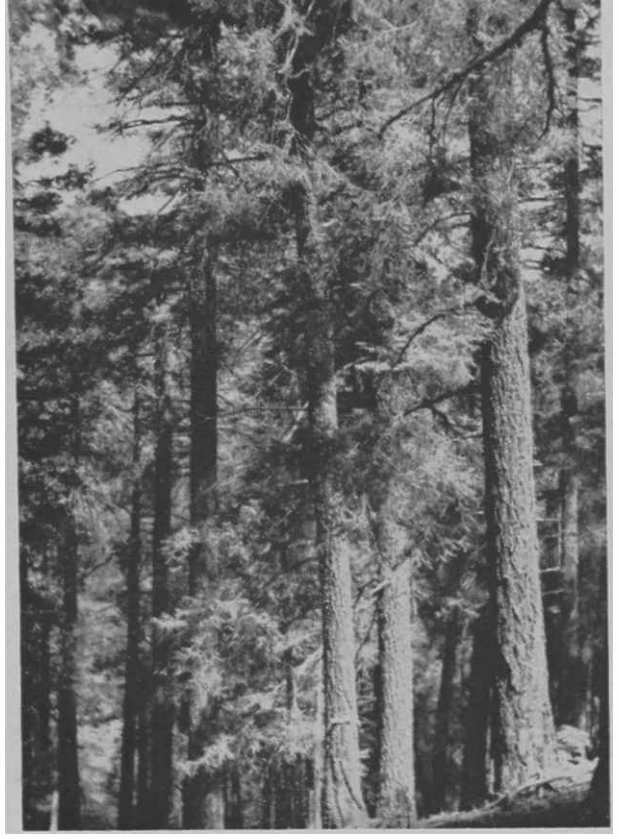
BELOW WE SEE a view from the 5800 foot level. Here is pine-oak woodland on rocky slopes, as seen from the Bear Canyon picnic area. Framing the picture, on either side in the foreground, are ponderosa pine.





HIGH AND COOL is the view from the ← 8700 foot level of Upper Sabino Canyon. The photo shows a glimpse of the fir forest at that level.

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lished on the adjacent north slopes as a result of fire protection.

At the Bear Canyon picnic ground (5800 feet) one enters a ponderosa pine-oak forest with silver leaf oak appearing over 1000 feet below its continuous range. On the adjacent slopes, which are more moist, a phase of the pine-oak woodland can be recognized with scattered chihuahua pine, identified by its shorter needles and persistent cones. This extends above a more continuous canopy of evergreen oak.

From Bear Canyon up to Windy Point (6500 feet) the very rocky slopes are covered with a more scrubby phase in which manzanita is most conspicuous, together with Arizona and silver leaf oak and scattered pinyon pine and juniper. The extreme rockiness and past fires have tended to reduce pine and juniper and favor manzanita and oaks, which have the ability to resprout following fire. Scattered throughout the open oak and pine-oak woodland are four large conspicuous monocots — bear grass, sotol, yucca and a large agave. As one leaves the open rocky area above Windy Point, there is a rapid transition into the Pine Forest (7000 feet).

The Pine Forest Area

In this forest ponderosa pine, with its long needles, forms an upper canopy with scattered silver leaf oak beneath the pine. However, as one proceeds upward to 8000 feet (above the Palisades Ranger Station) the oaks are replaced by young stands of ponderosa and scattered, shorter-needled, Mexican white pine. This excellent regeneration is a response to fire protection, although the larger pines developed under a natural regime of periodic lightning-caused fires that thinned the trees naturally.

Now, with fire protection currently an irreversible policy, the actual fire hazard is increased. This is because an accumulation of pine needles and the clumps of unthinned young pines and understory oaks could easily carry a fire into the crowns of the larger pines. The next generation pine forest will, therefore, develop under a new regime — a process which will be of interest to both the forester and lumberman. Ponderosa pine continues to the summit on the warmer south slopes, and Mexican white pine increases with elevation.

At Top the Fir Forest

The magnificent Douglas fir forest, with trees ranging up to from four to five feet in diameter and several hundred years old, is restricted to the north slopes, mostly above 8000 feet (Ski Lodge), but farther downward on protected slopes and into ravines.

White fir, an associate, increases in the draws. Due to the dense shade there is little or no undergrowth. Scattered stands of trembling aspen, appearing as lighter green areas, occur where lightning fires have presumably opened the fir canopy.

In uppermost Sabino Canyon (above Ski Lodge) a localized stand of subalpine fir has been bisected by the road to the summit. Engelmann spruce, frequently associated with this fir, is absent in the Catalinas but present in the Pinalenos and Chiricahuas.

National Forest Protection

The Forest Service is to be commended for designating the south slope of the range as a recreation and watershed area, which means cutting and grazing are excluded. Vegetationally, this range is a classic in the Southwest where within an hour's time one can pass from the Sonoran Desert, with its spectacular cacti and species diversity, to a forest of towering fir trees hundreds of years old.

It is the responsibility of the Forest Service and the public in general to preserve such an area as this — this *is* Arizona's heritage.

SEPTEMBER

16-20—State 4-H Advisory Committee Meeting — U of A Campus

23—Meeting of State Advisory Committee for Town and Country Life Conference — Phoenix

24—Meeting of Executive Board of Arizona Homemakers' Council, Phoenix

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Americans on the average will eat about a pound more this year than the estimated 162.5 pounds of red meats we ate during 1962.

Common and scientific names of Santa Catalina Mountain plants mentioned in text

Agave — *Agave palmeri*
Alligator juniper — *Juniperus deppeana*
Amole — *Agave schottii*
Arizona cypress — *Cupressus arizonica*
Arizona oak — *Quercus arizonica*
Bear grass — *Nolina microcarpa*
Blue oak — *Quercus oblongifolia*
Brittle bush — *Encelia farinosa*
Bur sage — *Franseria deltoidea*
Chihuahua pine — *Pinus chihuahuana*
Cottonwood — *Populus fremontii*
Creosote — *Larrea tridentata*
Douglas fir — *Pseudotsuga menziesii*
Emory oak — *Quercus emoryi*
Fairy duster — *Calliandra eriophylla*
Jumping cholla — *Opuntia fulgida*
Manzanita — *Arctostaphylos spp.*
Mesquite — *Prosopis juliflora*
Mexican pinyon pine — *Pinus cembroides*
Mexican white pine — *Pinus strobiformis*
Ocotillo — *Fouquieria splendens*
Palo verde — *Cercidium microphyllum*
Ponderosa pine — *Pinus ponderosa var. arizonica*
Rosewood — *Vauquelinia californica*
Saguaro — *Carnegiea gigantea*
Silverleaf oak — *Quercus hypoleucoides*
Sotol — *Dasylirion wheeleri*
Subalpine fir — *Abies lasiocarpa*
Sycamore — *Platanus wrightii*
Trembling aspen — *Populus tremuloides*
Turpentine bush — *Haplopappus laricifolius*
White fir — *Abies concolor*
Willow — *Salix spp.*
Yucca — *Yucca schottii*