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Walter Hough

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ENVIRONMENTAL INTERRELATIONS IN ARIZONA¹

WALTER HOUGH

The plant life of the semi-arid Southwest shows many interesting adaptations to the geographic conditions. One accustomed to seeing the many species of plants here in the East struggling for place, covering the ground with a mat of vegetation, looks with surprise on the vast, red plains of Arizona and New Mexico, sparsely dotted with dull-colored, stunted bushes, popularly thrown together under the name of "sagebrush."

In the East, also, the tender, green mantle hides the scars of time, but in the West we see a world naked and in ruins, as though we were transported to a landscape in the moon.

These vast landscapes, bathed in clear air and lighted by the fervid sun, show tints of marvelous beauty, beyond the power of pen and brush to portray. There is a sense of freedom in these broad outlooks which is fascinating, and no doubt this is one of the reasons why those who have once visited this country are impelled to return.

To the geologist the country offers much greater opportunities for study than to the botanist, for all is open and clear—the crumpled leaves of the book of Nature show their edges on the mountain fronts. Often the general geology of the region is apparent for over a hundred miles at a glance. The details of stratification also can be followed by the eye for many miles, while at a distance over the red Jurassic plains the white Cretaceous hills and mesas and the ponderous remnants of the vast, black lava flows are clearly in sight.

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The curious thing about the precipitation of northeastern Arizona is that the rains come too early and too late to be of much use to a large number of the plants. The spring vegetation depends on the moisture produced by the melting of the winter snows, always problematic as to quantity. In the latter part of August thunder showers bring forward the later plants. These showers are also local and variable. On the track of a thunderstorm the succulent plants spring up like magic. The ground is full of seed, and, owing to the capricious course of the storms, perhaps in some stretches several years may elapse before the dormant seeds get a chance to sprout. Along the washes rains falling on the watershed above may furnish moisture, starting the growth of sunflowers and other weeds. Sometimes in favorable years the dry lake beds will be one mass of sunflowers, presenting a remarkable appearance.

Many plants wait for the seasons of moisture, but the hardy greasewood, artemisia, rhus, and other desert plants seem not to be affected by good fortune or adversity.

Moisture also determines the distribution of plants in the arid region. The botanist knows this, as does the archæologist, for the distribution of the ancient as well as the modern Arizonians is a matter of water. Wherever there is a spring or running water, there is the place to look for ruins. Around protected springs and in canyons where there is perennial water the botanist often reaps a rich harvest of plants. In such a canyon known to the writer there is a series of plants which are puzzling, not being found anywhere else in the region. It is as though these plants were the only survivors of the vicissitudes which have extirpated all their companions less favorably protected.

The location of individuals of a certain species has a profound effect in the modification of the classic characters. For example, it has been noticed that, owing to the favorable or non-favorable habitat of *Eriogonum microthecum*, the plant varies from the corymbosum type to the effusum type. Quite a number of other plants show variation according to well-being, and cause botanists no end of vexation.

Rivers and streams distribute plants along their flood plains where often the same species range the whole length of the stream. This was noticed on the Rio Grande above El Paso,

village has orchards. As the crop failed last year, one of our Indian workmen at Winslow invested all his earnings in peaches, which he would have to carry 80 miles north to his native village. The apricot, of which I saw but a few trees, does not bear, probably from the lack of a fertilizing insect. Very little wheat is raised and that by the Oraibi, at their agricultural summer village of Moenkopi, where cotton also is grown.

These plants fall under a number of classes, according to their uses for food, architecture, dress and adornment, domestic life, domestic arts, agriculture, medicine (as folk medicine and empirical medicine), religion, and folk-lore.

FOOD

- Kwákwi*, *Sporobolus cryptandrus strictus* Scribn. Seeds ground with corn to make a kind of cake greatly enjoyed by the Hopi.
- Shíbna*, *Astragalus pictus filifolius* Gray. Roots eaten for food.
- Túchima*, *Pectis angustifolia* Torrey. Much sought after and enjoyed boiled with green corn (shammi). The Zuñi also eat it.
- Tumi*, *Cleome integrifolia* T. & G. Leaves boiled with green corn.
- Túmintgiwa*, *Chamæsaracha coronopus* Gray. Berries are eaten.
- Wiwa*, *Acanthochiton Wrightii* Torr. Cooked as greens with meat. It is known as the "ancient Hopi food," and is gathered and strung in long bunches, which hang in nearly every house. The Hopi recount that this plant has warded off famine a number of times, springing up as it does before the corn is filled.
- Worshusha*, *Panicum obtusum* H. B. K. Seeds eaten ground with corn.
- Ūnátki*, *Atriplex argenteum* Nutt. The salty leaves are boiled with fat and eaten; "very sweet." This is the earliest spring plant used for food (Fewkes).
- Katókia*, *Dicoria Brandegii* Gray. Flowers and seeds ground up and eaten.
- Kótóki*, *Chenopodium cornutum* B. & H. Seeds and flowers eaten, the former ground and mixed with meal to make dumplings wrapped in corn-husk and called somipiki.
- Kébi*, *Lycium pallidum* Miers. The berries, which are much desired, are eaten raw or are dried for winter use.
- Kúsūñ'a*, *Parosela lanata* (Spreng). The roots are wholesome for food. They are scraped and eaten raw as a sweet.
- Lakápa* (probably Spanish), *Phoradendron juniperinum* Engelm. Used as a substitute for coffee.
- Léhi*, *Eriocoma membranacea* (Pursh) Beal. Seeds used in ancient times for food.
- Mashiláshi*, *Solidago missouriensis* Nutt. The young leaves are eaten with salt.