How Desert Plants Survive

As you can imagine, the plants – the producers – in our Southwestern desert basins live in one of the most stressful environments in the United States. They face scorching hot air and ground temperatures during the summer season, unpredictable and limited moisture even during the rainier seasons, only rare streams or ponds with dependable water, high rates of evaporation, soils with relatively few nutrients, intense competition for resources, and continual threats by predatory plants and animals.

The plants can answer the environmental challenges because they have developed both structural and behavioral strategies for surviving in the desert. Collectively, they stand among the supreme examples of the resourcefulness of Nature.

The desert plants include, as some examples, cacti, yuccas, agaves, shrubs, grasses and annual forbs (non-grass plants that live for only a season)—a community with a diversity that represents a broad span of survival strategies.

Cacti

The cacti, symbols of the desert, range from the teacup-size Thimble Plains Cactus to the 60-foot-tall 10-ton Saguaro. They rank high among the most drought-resistant plants on earth. For example, they have leaves that have evolved into spines, which help minimize water loss by evaporation and screen the plant from the sun. Their thorny weaponry also helps protect them from predators.

A cactus stem has fleshy tissue that soaks up water and a waxy coating that helps seal in the moisture. As the cactus uses up its store of water during prolonged drought, its stems (the pads of the prickly pear, for instance) may come to look drawn and shriveled. As it soaks water into its
tissues following a rain, its stems may regain a more swollen look. Unlike most plants, a cactus opens its pores, called “stomata,” at night rather than during the day to absorb the carbon dioxide gas it will need for photosynthesis (see Part 2 in this series). This strategy also helps minimize evaporation.

The cactus has a root system that radiates away from the plant, just below the surface of the ground, ready to capture any water from rain or snowfall and conduct it to the plant’s stems. Further, within hours after a rainfall, the cactus’ roots sprout tiny rootlets to help absorb water even more quickly.

Yuccas and Agaves

The desert’s yuccas and agaves, related plants with leaves that look like bouquets of daggers or swords, also rank high on the list of drought-resistant plants.

Their leaves, like cacti stems, have fleshy tissues and waxy coatings. The leaves of both the yuccas and the agaves are typically armed with sharp points, and the leaves of the agaves are further armed with wickedly barbed margins. The leaves of the agaves serve as a storehouse for resources, not only as a hedge against drought, but also as an energy source that the plant will need for its spectacular life-ending bloom.

Like the cacti, the yuccas and agaves open their stomata at night to absorb carbon dioxide for use the following day in photosynthesis.

Some yucca species may have stems, which have specialized tissues that store and conduct water. Agaves have virtually no stem.
Like the cacti, the yuccas and the agaves have shallow radiating root systems to intercept the water from rains and snowfalls. Moreover, some of the yuccas also have deep “tap” roots that reach for deeper water as well.

The agaves, like the cacti and yuccas, have fleshy tissues and waxy coatings, and they have sharp points and wickedly barbed margins to protect them from predators.

Shrubs

The shrubs, typically the dominate plants in the Southwestern desert landscape, follow perhaps the widest range of strategies for survival. Many come equipped with small leaves, protective thorns, multiple branches, disagreeable smells and tastes, and extensive root systems.
Some have small, shiny, waxy leaves that reflect heat and impede evaporation. Others have leaves covered with dense, light-colored hairs to reflect the intense sunlight. Others ooze light-colored salt onto the surfaces of their leaves to reflect the light. Some turn their leaf edges rather than the broad surfaces toward the sun, minimizing exposure to the intense light. Others shed leaves and even twigs to reduce exposure and resource requirements during prolonged periods of drought.

Many smaller shrubs have a dense network of shallow roots that allow them to compete with the cacti, yuccas and agaves for water. They are sometimes called “intensive exploiters.” Larger shrubs usually have extensive shallow as well as deep root systems that allow them to compete both for rain water and for deeper water. They may be called “extensive exploiters.” For example, a Velvet Mesquite, a thorny native to the Sonoran Desert, may send roots more than 100 feet or more into the earth in its reach for water. A few shrubs, for instance, the heavily branched and pungent-smelling Creosote Bush, may have roots that secrete chemicals that are toxic to nearby plants.

In addition to its other adaptations, a typical desert shrub produces a great abundance of hard-coated seeds that help ensure the future of the species.

Grasses

Compared with the shrubs, the grasses – which dominated much of the Southwestern landscape before they were heavily overgrazed by domestic livestock – have relatively straightforward adaptations to the desert environment. Given enough moisture, they grow swiftly, producing seeds that are distributed by the animal life and the wind. Some species curl their leaves,
shrinking away from the sunlight and heat. The grasses produce a dense tangle of shallow roots that compete effectively for rainwater. Before the suppression of wildfires, the grasses could often capitalize on lightening-sparked desert blazes, which did less damage to the grasses than to the shrubs that would otherwise compete for resources.

![Annual Forbs](image)

**The Annual Forbs**

The annual forbs—often called “ephemerals,” which means short lived—simply refuse to deal with the desert drought. They just wait for the right season and the right rainfall to arrive at the right time—an event that may not occur for years in the desert, with its erratic climatic events. When the moment does come, however, the annual forbs race to sprout, develop, flower and produce abundant seeds before drought comes again.

During this time, at least one of the forbs, the Indian Paintbrush, may dispatch roots to attack nearby plants’ roots, helping itself to its neighbors’ moisture and nutrients.

An annual forb purchases its future with its seeds. Scattered widely by wildlife, wind and even occasional flash flood waters, the seeds may lie in the desert soil for a decade or more, dormant, or “asleep,” awaiting just the right cues from Nature for germination. Some species even deposit different sizes of seeds into this “savings account,” as if anticipating that the large seeds can respond to perfect conditions and produce vigorous sprouts and the small seeds can respond to marginal conditions and produce less robust sprouts. In either event, the species reinforces its opportunity for survival.

**Basic Strategies**

While we have diverse species of plants in the desert, they tend to follow a relatively few basic strategies in their ongoing struggle for survival.
Some, for instance, the cacti, yuccas and agaves, have mastered the art of enduring in the desert environment by economizing in their expenditures of moisture. They rely on their waxy coatings, their spongy stem or leaf tissues, their root structures and their nighttime stomata openings to carefully regulate their water use. Such plants are sometimes called “drought endurers.”

Other plants, such as the shrubs, seek to avoid the desert hardships by turning their leaves to diminish full exposure to the sunlight, shedding leaves and twigs to minimize water requirements, and putting down deep tap roots to reach underground water. These plants may be called “drought avoiders.”

Still other plants, including some grasses and the annual forbs, escape the hardship of drought altogether by growing, blooming and seeding rapidly only when conditions are ideal, with adequate moisture, even if it takes years for that moment to arrive. They deposit their seeds in a “seed bank,” like a savings account, which they will spend when Nature provides all the right cues. These plants are, as you might expect, called “drought escapers.”

Over time, the plants – the producers – of the desert have developed various approaches to surviving under the stress of their environment, with the intense heat, drought, unpredictable rainfall patterns, and poor soils.

Simultaneously, in their diversity, they have influenced the animals – the consumers – in their development of adaptations for survival. That will be the subject of our next article in this series on the desert food chain.