Plants and People of the Sonoran Desert

This special issue of AGAVE is devoted to a new exhibit trail that soon will be constructed here at the Desert Botanical Garden. It is based on a concept developed by Garden research associates Ruth Greenhouse and Robert Gasser. Called Plants and People of the Sonoran Desert, its purposes are to interpret the ethnobotany of the Sonoran Desert — the ways that plants have been used by people for food, medicine, construction and other needs — and to provide a sense of how fully and successfully people were able to live in this hot, dry land.

Plants and People of the Sonoran Desert will differ from other trails in the Garden in that it will recreate distinct plant communities to illustrate how human beings have used plants through time. By weaving together botany, anthropology and history, this trail will provide a fundamental education on the real but often misunderstood richness of this desert land.
Introduction

From the very beginning of humankind — until the recent past in our common history — all peoples have had an intimate relationship with the land and its plants. Human beings have lived in the Sonoran Desert for at least 150 centuries — perhaps longer. For most of that time, until about 300 B.C., the people were exclusively hunters and gatherers. Then, with the introduction of agriculture from ancient Mexico, some of the people developed subsistence systems that mixed hunting and gathering with food growing. But the knowledge of how and where to gather wild plants remained with the cultures up until very recent times.

In our highly technological world of today, we sometimes have incorrect stereotypes about food gathering peoples. They are often viewed as simple, unsophisticated folk who wandered about the wilderness in small bands picking up a seed here and a berry there. In some ways their lives were simple, for they travelled lightly over great distances, always on the move, and thus did not invest their energies in technology. However, that does not mean they were simple in their understanding of their world. Their knowledge of the land was as vast and complex as the land itself. Archaeologist William Lipe once described food collecting cultures as having a technology of knowledge. What this concept means is that these cultures were highly developed in their understanding of how to extract a livelihood from the land. This knowledge was accumulated over many generations. They knew about hundreds of plants — and they had to know much more than just which plants were out there. They had to know exactly where each plant species grew, just when it could be harvested, and how much would be available. This information was critical because the optimal harvest time for a given species was usually very short, and a miscalculation meant a loss of access to that particular food. In addition, they had to know how the plants would be affected by that year's general and local climatic conditions and how to properly process the plant for its intended use.

The movements of these bands had to be carefully planned. The result was an endless series of annual migrations from lowland to highland, river bottom to plain, from bajada to upland forest, then back again to the lowland. They had to be in the right place at the right time. An incorrect decision could mean starvation.

Knowledge of these wild plants, foods, and desert-adapted agricultural systems is not simply of academic interest. This knowledge can work for us today, if we have the creativity and wisdom to use it. It can enrich our lives and improve our economy in this water-scarce land.

One of the primary messages of this new exhibit — one that is important to a growing population of people who are new to the desert — is that the desert and human beings need not be alienated, that humans can live with this environment. So often the desert is presented as a hostile place — and indeed it can be, if people do not learn about it, understand it and respect it. But the desert is more than a place where "man survives." This lesson was taught to me several years ago when I was working on an exhibit that included a section on the O'odham or Pima and Papago people. At a meeting on that subject with several Papago people, I continually made reference to the fact that we wanted to explain how the Indian people "survived" in the desert. Finally, one said, "We don't survive in the desert — the desert is our home, we live here."

That should be our common message — that no matter how complex our technology, we are all desert dwellers. If we are going to live here for a hundred centuries or a thousand centuries, we, too, must bind ourselves to the land and truly make it our home. **Plants and People of the Sonoran Desert** will help in the process of awakening people to this understanding.

by Dr. Robert Breunig, Director, Desert Botanical Garden

**Contents**

To familiarize you with our planning process for the trail, this journal includes a series of background articles about the Sonoran Desert and descriptions of the trail itself, explaining the concepts behind each section of the exhibit. The background essays are brief sketches about Sonoran Desert evolution, vegetation, people, ethnobotany, agriculture, foods and plant research. When the exhibit is complete, we will provide detailed information about these topics in the form of booklets, annotated bibliographies and other publications.

**Cover:** Mrs. Dorothy Lewis, a Pima Indian who lives in the Salt River Indian Community, pounds mesquite bean pods in a traditional wooden mortar.
We are sowing the seeds of an ancient saga — that of human dependence on desert plants, as it has been unfolding over thousands of years. *Plants and People of the Sonoran Desert* will be a three-acre, permanent, living exhibit that is a microcosm of the range of habitats which desert dwellers have drawn upon since prehistoric times to meet their physical, social, economic and spiritual needs. A 1/3 mile trail will lead us through this story as we pass through a saguaro cactus forest in a desert foothills habitat, a lush desert riverine environment and a floodplain mesquite thicket to arrive at an upland grassland and a shrubby chaparral habitat.

By walking this trail we will be reminded of the length of time that humans have been sustained by this land’s diverse resources. Historic and prehistoric structures reproduced along the trail will provide authentic settings for the interpretations of native plant uses. Through a saguaro fruit harvesting camp, earthen pit ovens for roasting cacti and succulents, a Piman Indian household, terraced gardens and other structures, we will see how plants were used throughout history as raw materials for many purposes. Graphic panels, displays and demonstrations will show us the transitions that plants have passed through, from wild to domestic, from raw to cooked and from whole to processed.

We will see that plant/people relationships are not static. They changed as crops were prehistorically introduced from Meso-America and as local peoples domesticated some varieties in their gardens. An Hispanic-style homestead will illustrate the dramatic changes brought by the introduction of livestock and winter field crops. We will see how the uses of many desert plants with unique chemical, culinary or aesthetic characteristics have endured into the present time, and which of these may gain further importance in the future.

There will be opportunities to participate in ethnobotanical activities along the trail or in the outdoor classroom that will be built nearby. Garden visitors, including children, will be able to explore the process of how plants were gathered and used. Among the many activities that will be scheduled through the changing seasons are collecting ripened saguaro fruit, making yucca root soap, threshing the pods of sun-dried tepary beans, twisting agave fiber into string and preparing mesquite pod tea.

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THE PEOPLE

PREHISTORY: Little is known about the Paleo-Indians that swept across North America between 10,000 and 15,000 years ago, other than that they were nomadic big game hunters. Subsequent scattered nomadic bands spread into Southwestern North America from 10,000 to 2,000 years ago, perhaps reversing the earlier movement and coming northward from Mexico. The Hohokam Indians, who evolved from the earlier Cochise Culture and immigrants from Mexico, occupied much of southern Arizona from about 2,000 years ago to A.D. 1450. They developed a complex society based on agriculture that flourished in the desert. The Hohokam irrigation system was the most extensive in North America with more than 300 miles of canals in the Phoenix area alone.

EARLY HISTORY: Estimates of the native population when the Spanish arrived in the early 1500's are as high as 400,000. The majority of the people were concentrated in a few southern river valleys. Sonoran Desert people represent four different language families: Uto-Aztecan — O'odham (Pima and Papago), Cahuilla and others; Yuman — Quechan, Cocopa, Manicopa and others; Shoshonean — Chemehuevi; and Athapascan — Apache. Subsistence activities ranged from intensive agriculture with river irrigation to nomadic hunting and gathering. The map shows the approximate locations of the different groups of indigenous peoples.

RECENT HISTORY: After Spanish missionaries and explorers came to the Sonoran Desert, mountainmen, soldiers, townsmen and ranchers followed. The foundations of the missions, agricultural settlements, forts and towns that these newcomers occupied were based on the patterns of Spain and England and interrupted the ancient settlement patterns. The annexation of the northern part of the desert by the 1853 Gadsden purchase and the construction of railways dramatically altered the old demographic patterns. Steady economic growth in Phoenix, Tucson and northern Sonora, Mexico continues the development of large metropolitan areas.

THE DESERT

from Man, Climate and the Sonoran Desert
by David E. Brown

Most people think deserts are ageless, that they have existed for eons, their origins obscured by time. Such is not the case in North America. Both the archaeological and fossil pollen records agree. The great deserts of the Southwest evolved only after the last ice age. They are less than 10,000 years old: a mere tick on the geologic time scale comprising less than 250 human generations!

Much of the Southwest was woodland or grassland until about 10,000 years ago. With the retreat of the last ice sheet and the advent of recent or Holocene times, the incidence and severity of droughts increased. By the middle of the Holocene, 8,000 years ago, reduction and fluctuation in precipitation caused the expansion of four regional deserts, each subject to different climatic controls: the cold Great Basin Desert in the north; the warm, summer-dry Mojave Desert, intermediate between the Great Basin Desert and the subtropical Sonoran Desert in the South; and the warm, winter-dry Chihuahuan Desert southeastward in the Mexican highlands. With the passage of time, each desert became increasingly specialized as it was
inhabited by arid-adapted plants and animals derived from the region's native scrubland, woodland, and savannah communities. The deserts continued to expand, attendant with climatic shifts in temperature and rainfall, until reaching their present and greatest extent.

The Sonoran Desert is thought to be the most recent of the southwest deserts, occurring as a recognizable entry in most of Arizona only during the last 6-8,000 years. The flora, composed of such plants as saguaro, ironwood, and paloverde, is derived from subtropic and tropic elements from the south. As the more drought-adapted of these tropic plants moved into the area, new species continued to evolve. Even today, the occurrence and distribution of many of the plants are in great flux.

The most important physical condition limiting the boundaries of the Sonoran Desert is the amount and distribution of precipitation. Sonoran Desert rainfall is bi-seasonal, occurring both in widespread, gentle winter storms and in torrential localized summer monsoons with periods of spring and fall drought between. This bi-modal rainfall pattern and low incidence of freezing temperatures allows for a great diversity of vegetation. Compared to the other North American deserts, which are dominated by low shrubs, the Sonoran Desert is noted for its trees, tall shrubs, large cacti and succulent life forms which provide for its distinctive landscapes.

THE VEGETATION

The Sonoran Desert is composed of 7 regional divisions. Some plants, like mesquite, occur throughout the area while other plants like the boojum tree are found only within specific regions. Following is a list of the regional divisions and just a few of their characteristic plants:

**Arizona Upland**
- Carnegiea gigantea (saguaro)
- Cercidium microphyllum (fothill paloverde)
- Ambrosia deltoidea (triangle bursage)
- Opuntia spp. (cholla cactus)

**Lower Colorado Valley**
- Larrea tridentata (creosote)
- Ambrosia dumosa (white bursage)
- Dalea spinosa (smoketree)
- Hilaria rigida (big gallreta grass)

**Plains of Sonora**
- Rathbunia alamosensis (octopus cactus)
- Lophostereus schottii (old man cactus)
- Forchammeria watsonii (jito)
- Guaiacum coulteri (guayacan)

**Foothills of Sonora**
- Acacia cymbispina (espino)
- Lysiloma divaricata (mauto)
- Fouquieria macdougalii (tree ocotillo)
- Bursera spp.
- Vizcaíno
  - Pachycormus discolor (elephant tree)
  - Pachycereus pringlei (cardon)
  - Yucca valida (yucca)
  - Fouquieria columnaris (boojum tree)

**Central Gulf Coast**
- Bursera spp.
- Jatropha spp.
- Fouquieria columnaris (boojum tree)
- Pachycereus pringlei (cardon)

**Magdalena**
- Pachycereus Pringlei (cardon)
- Lysiloma candida (palo blanco)
- Machaerocereus gummosus (pilahaya agra)
- Opuntia spp. (cholla)

At the present time, some researchers are suggesting that the Foothills of Sonora region not be included within the Sonoran Desert boundary, thereby reducing the number of vegetational regions to 6.
Within the Exhibit: Traveling Down the Trail

DEsert FoottHills

Saguaro Forest

Visitors will first come upon a stand of towering saguaro cacti that occupy the desert foothills habitat. This stately columnar cactus is the "indicator plant" of the eastern Sonoran Desert, covering many of the coarse, dry slopes this side of the Colorado River. Its establishment is dependent upon the protective cover of cholla cactus, paloverdes and other thorny shrubs. Dozens of animals are, in turn, dependent upon its nest holes, fruits and oil-rich seeds. Only one out of several million seeds may germinate, and fewer still live to maximum ages of two centuries.

Cactus Gathering Camp

Visitors will be able to pick up a ripe saguaro fruit as it is prodded from the top of a 20 foot cactus. The hardened, withered flower that remains attached to the ripening fruit can be broken off and used as a natural knife to slice the juicy red fruit open and scoop its pulp and seeds into a brewing pot. Our saguaro fruit processing camp will be much the same as those used by Hohokam and O'odham cultures. Saguaro fruit, whether eaten fresh or made into syrup, jam or seed meal, has been an important food to many desert people for thousands of years. Ripening during the early summer drought, the fruit provided the wine used in ceremonies to bring the rains needed for crop planting.

Cholla Cactus Community

During the desert spring, the spiny, cylindroidal stems of various species of cholla cactus show yellow, orange, red and purple flowers. Protective homes for birds, ground squirrels, and wood rats, several varieties of cholla cactus are found in the driest habitats of the desert, from the sandy flats to the rocky slopes. Like their cousin the prickly pear, new cholla plants reproduce readily from detached stems that root where they fall. Some joints detach so easily they seem to jump, hence the name jumping cactus.

The flower buds of the cholla cactus were one of the first substantial plant foods available after the lean winter months. An excellent source of calcium, nutritious cholla buds were gathered in large quantities, roasted in underground pit ovens and then dried and stored for future use. A cholla cactus community and a cholla bud roasting pit will be part of the desert foothills habitat. Here, visitors will be able to twist the spiny buds off the cactus using tongs made from desert branches, observe bud preparation.
methods and taste the cooked buds. Cholla buds are not unlike the other flower buds we enjoy such as cauliflower, broccoli, and artichokes. Dried buds can be rehydrated and boiled until tender or ground into a meal and combined with other foods. A traditional Pima Indian recipe for a hearty stew uses ground white corn, saguaro cactus seeds and cholla cactus buds.
DESSERT STREAM

Desert stream habitats have long provided sanctuary for people as well as for birds and other animals. Here, visitors will find willow and cottonwood trees surrounding a refreshing pond which supports a lush growth of cattail, cane and arrowweed. Leafy annual plants, important for their medicinal and edible qualities, also thrive here. In this habitat basketweavers may demonstrate the skillful splitting of willow splints and cattail stems. Visitors can also learn about the uses of other wetland plants for food, mats, flutes, arrows and furnishings.

Few and far between, most permanent desert streams originate outside the desert itself in areas of higher rainfall. Others, far rarer, emanate from seeps and springs. While gallery forests line the flowing channels, other plants thrive in protected marshes, seeps and ponds. During the last century, dams, water diversion and ground water pumping have greatly reduced wetland habitats and the enormous variety of aquatic and semi-aquatic life they supported.

Piman Household

For over 2,000 years, the materials for building homes and other structures were obtained from local native vegetation. In this exhibit, visitors will learn about the construction and function of an aromatic Piman roundhouse, an outdoor brush kitchen, a shaded work ramada and a rectangular storehouse. They will also experience the favorable microclimates these structures established by reducing heat gain. Human behavioral adaptations to the heat included working in the early morning or late afternoon and seeking shelter from the sun under the ramada. Demonstrations of native food preparation, basket weaving and other ethnobotanical activities will take place in this display area.

Canal Irrigated Garden and Hedgerow

The canal irrigated vegetable garden demonstrates the importance and antiquity of river diversion in the desert.

Growing in this demonstration garden will be the same varieties of corn, beans, squash, cotton, gourds, devil’s claw, grain amaranth and tobacco that were cultivated here in the past. Edible weedy plants such as pigweed, false purslane and lambsquarter will also come into use as they become established in the disturbed, moist garden soil. Many of these weedy plants can be double-harvested; the young plants provide leafy greens and
The mature plants provide seeds. Behind the garden, a dense, thorny border of trees, shrubs, and cacti will form an impenetrable barrier. This Sonoran-style hedgerow was used to protect fields prior to the introduction of barbed wire. It also can serve as a windbreak or shelterbelt to reduce evaporation, scouring and temperature extremes across the field. Birds that perch in the hedge feed on insects which might otherwise damage the crops. In the past, this living fence provided edible fruits and flowerbuds as well as other food sources, the rodents and quail which lived in the understory.
Mesquite Bosque or Forest: the inset shows mesquite bean pods being pounded into flour using a stone pestle.

MESQUITE BOSQUE

A canopy of tall mesquite trees will lead into the mesquite “bosque” (Spanish for gallery forest). Here, ripe mesquite bean pods can be pounded into flour using authentic mortars and pestles. Thick, sweet mesquite pods have been a wild food staple throughout the Southwest for thousands of years. In addition to food, mesquite trees provide wood for fuel and construction, fibrous roots for cordage, and pitch for paint, cosmetics, and medicine. Bees, quail, foxes and other desert creatures find food and cover in mesquite bosques.

Dense mesquite forests such as
these, common a century ago, are only a memory today. In part due to water diversion, the depletion of trees for firewood and the clearing of land, the main reason for their disappearance is the lowering of groundwater tables.

Mesquite and other plants with deep roots dependent upon groundwater continue to disappear as the aquifers are tapped faster than they can be naturally recharged.

Today, scientists are exploring the chemical properties of mesquite beans as well as the tree's potential as a food and fuel source in third world countries.

DRY WASH and TERRACE GARDEN

During a summer thunderstorm the normally dry washes course with rainwater. Acting as storm drains, desert washes, arroyos and canyons carry away runoff from the heights above. These ephemerally flowing desert streamways provide a favorable environment for the growth of large trees and shrubs (blue paloverde, ironwood, desert hackberry, mesquite, wolfberry) which form a sharp contrast with the open stands of creosote nearby.

Viewing our terrace gardens will help visitors understand the techniques Indians utilized to collect runoff from thunderstorms by damming washes and diverting the water into prepared gardens. In one of the gardens the soil can be worked with traditional hoes and digging sticks.

SEMI-DESERT GRASSLAND

A century ago, much of the Sonoran Desert edge was covered with vast stretches of grasslands. Overgrazing thinned out or entirely eliminated many of these habitats. Cacti and unpalatable shrubs have invaded these zones and outcompeted the grasses for moisture which further reduced their chance for survival. Before the Spanish introduction of wheat, wild grass grains were important as dietary supplements. Grasses were also used for basketry, brushes, and construction.

Tall soaptree yuccas, their fibrous leaves useful for cordage, brushes, baskets and tying material, will also grow in this habitat along with prickly pear cacti and beargrass, a shrub lifeform related to yuccas. In our grassland habitat we will demonstrate the various uses of grasses, yucca, prickly pear and beargrass.
CHAPARRAL

Located between the desert below and the woodland above, semi-arid chaparral communities support a wide variety of shrubs and dwarf trees. When you reach the highest elevation of the trail you will find agaves, yuccas, juniper, scrub oak and other important chaparral plants. Chaparral is derived from the Spanish word chaparro, meaning scruffy vegetation, the same root word for the chaps that cowboys wear when riding through these areas. Here, visitors will learn about the many uses of the plants found in this habitat.

Apache Wickiup

A foot path will lead to the Apache wickiup. Plants from the grassland and chaparral were used to build similar temporary shelters by the semi-nomadic and wide-ranging Apache and Pai peoples.

Prehistoric Indian Ruin

An authentic archaeological site will be relocated to our trail at the Desert Botanical Garden where it will be carefully reassembled. Here, visitors will be able to sift soil samples as archaeologists do when they examine soil from ancient ruins to find plant materials. We will show how cordage is made from yucca fiber and soap-like suds from yucca roots, using techniques that are centuries old.

Agave Roasting Pit

In a dense community of agaves, we will roast the pineapple-like hearts in a roasting pit and offer our visitors the opportunity to taste this special food. Agaves, a food staple for many indigenous groups, were collected in large quantities, cooked and dried for future use. Several fermented beverages, including the historic tequila and mescal, are made from roasted agave hearts.

HISPANIC/ANGLO INFLUENCES

Today, Hispanic influences are so pervasive in the Sonoran Desert that it is hard to imagine what the human landscape here was like before the Spanish introduced the seeds, livestock, architecture, tools and new concepts of property and religion that went along with their way of life. Throughout the Spanish "conduit," a mix of material culture from the Moors, Mesoamericans and Europeans added to the flavor of Sonoran Desert life.

In this display you will see ocotillo fences and mesquite corrals, gardens of wheat, lentils, figs and other Old World crops, wooden plows and saddles, mule-turned millstones and other examples of Hispanic introductions to this area.

TODAY AND TOMORROW

Industrial oils — cancer treatment — synthetic rubber — erosion control — cosmetics — food — these are a few of the contemporary uses of desert plants that were first so important to the indigenous peoples of the Sonoran Desert. You will learn more about current and future utilization of desert plants in the final stop along the trail. This exhibit will join the continuum of ancient and historic plant uses to modern and future practices. You will also learn about the other exhibits at the Desert Botanical Garden that deal with contemporary life in the desert.

Archeological site in the Chaparral Habitat: the insets show agave fiber cordage, woven yucca fiber sandals and a cross-section of an agave roasting pit.
Plants and People of the Sonoran Desert will be located to the east of the existing Native Flora Trail at the Garden. The site rises gently in elevation from the east to the west and includes three natural washes with undulations between them.

SITE SELECTION: This area was selected because the site terrain provides opportunities for a variety of habitat settings. After studying the terrain and assessing drainage, circulation and aesthetic needs, the conceptual design was tied to specific site locations. Logically, the chaparral was located at the highest level and the riparian area at the lowest. Other habitats were placed where site conditions were most appropriate. The trail will wind 1/3 mile around the site as it passes through the various habitats and displays.

SITE MODIFICATION: Creating the habitats of this exhibit will mean gently reshaping a portion of the three acre site and selectively adding or substituting plant species. The pond area will need the most modification and the desert foothills the least. Installing the irrigation and electrical systems will also require some trenching and excavation. All the material that is removed or excavated when creating each habitat will be reused elsewhere on the site.

A COMFORTABLE ENVIRONMENT: In designing the exhibit, care will be taken to create both a natural appearance and a comfortable environment for visitors. The path surfaces will be composed of stabilized desert granite that will blend with the surrounding ground surfaces yet still be suitable for wheelchairs and strollers. Shaded rest areas and drinking fountains will be located near the primary exhibits and there will be provisions for lighting for nighttime use. Off-path areas for demonstration and places of optimal views will also be located along the trail.

OUTDOOR CLASSROOM RAMADA: Our plans include the construction of an open-air, outdoor educational facility which would provide a site for workshops, demonstrations and classes in an outdoor setting. This structure or ramada will be large enough to provide space for about 40 people. Lighting and provision for audiovisual equipment will allow for evening programs and maximum use throughout the year.

THE PLANTS: Hundreds of plants must be acquired for this exhibit. Many will be salvaged from areas under development. Others will be obtained through field collections, purchases, donations, propagation and plant exchanges. The plants will be grouped in a naturalistic simulation of their particular biome or plant association with large and small plants intermixed. In many parts of the exhibit the existing plants will remain and a few new species will be introduced. Only the desert stream, grassland and chaparral habitats will require major clearing of existing vegetation to make room for the appropriate species. Most plants which are moved from one part of the site will be relocated to another. Since all of the plant communities represented in the exhibit (except the grassland and chaparral) can be found in the Lower Sonoran Desert, they should be easy to establish in the exhibit. The grassland and chaparral plants are expected to adapt given an appropriate watering schedule.
Reconstructing The Folk Architecture

THE ARCHAEOLOGICAL SITE

Located at the desert-woodland edge, the chaparral habitat provides a diverse and fascinating assortment of plants of ethnobotanical importance. In addition to many varieties of useful plants, this habitat is often suitable for farming and hunting and provides access to resources located in the woodland above and the desert below.

The chaparral habitat south of Payson, Arizona, approximately 70 miles northeast of Phoenix, is dotted with remnants of prehistoric Indian homes and villages. These were occupied by people identified as Salado Culture who lived in the area from about 1000 to 1400 A.D.

Some of these sites are located in the path of State Route #87 and will be destroyed. The sites were excavated by the Arizona Department of Transportation in 1983 for the Arizona Department of Transportation. Since the cultural significance of the sites has been recovered, the Tonto National Forest (in which they are located) and the Arizona Department of Transportation have given the Desert Botanical Garden permission to relocate some of these ruins to the Garden for this new exhibit.

Archaeologists feel that the original structures were seasonal dwellings used in the summer while farming and gathering in this upland area. The rooms had cobbled walls that stood only about three feet above the ground. Posts supported a roof of woody stems and thatch. The low walls would serve as a windbreak and a barrier to pests but would allow plenty of fresh air inside.

This display of authentic prehistoric Salado Indian ruins will give a feeling of time depth to our exhibit. It will also serve as the focus for interpreting uses of chaparral plants. In addition, this area will be used to demonstrate how archaeologists learn about the roles and importance of plants to prehistoric peoples of the southwest deserts.

from a paper by Jeffrey H. King

The shelters set along the trail will all be made from plants native to the habitats surrounding them. Each is from a different culture or point in time, but together they provide examples of the architecture which developed in this region.

Dwellings, shade ramadas and cooking and storage structures will replicate historic traditions as closely as possible, down to the smallest details.

Materials used for construction reflect available resources. Desert dwellers used mesquite, saguaro, ocotillo, ironwood and desert grasses for construction. Similar functions were filled by arrowweed, cottonwood, willow or even coriander driftwood among those who had ready access to perennial rivers and their riparian gallery forests.

Saguaro Fruit Processing Ramada

This open ramada or sunshade is typical of those used by O'odham when camping in saguaro forests during the fruit harvest season. O'odhan families returned to the same ramadas every year at the end of June to camp for four to six weeks while the saguaro fruit ripened. The ramada was typically built of mesquite timbers which support a saguaro rib and thatch roof. It was used for a variety of purposes including sleeping, resting, cooking, food processing, and temporary storage.

Roundhouse, Storeroom, Outdoor Kitchen, Shade Ramada

The roundhouse was the traditional Piman Indian dwelling before the 20th century. It is made of a square framework of cottonwood posts supporting a circular framework of arched willow withes. The closing material is arrowweed.

In the recent historic period, the Pima outdoor kitchen and ramada have been the stage of most daily activities including food processing, basketry weaving and pottery making. The ramada is built of upright posts — either mesquite or, more commonly, cottonwood — with horizontal rafters on which are placed bundles of brush for shade. Construction of the ramada is much like the Papago sunshade except that the materials reflect a more riverine environment.

The kitchen is a simple windbreak of arrowweeds held vertically between waist-high posts by horizontal stays of saguaro ribs or willow withes.

Apache Wickiup

Typical camps of the semi-nomadic Apache and Pai people were composed of low, dome-shaped shelters of arched green saplings and brush, called wickiups. Saplings were often willow cut from thickets along streams. The framework was held together with yucca twine and supported a thatch of bear grass or whatever material was close at hand. Wickiups served as shelter long enough for local resources such as wild plants or game to be gathered.

Roasting Pits

Roasting pits, often conical in shape, range from three to twelve feet in diameter and are from two to six feet deep. They are commonly found as part of archaeological sites and have a tradition of use that is many centuries old. Roasting pits are used for cooking corn, cholla buds, agave hearts, game and other gathered resources. After lining the pit with rocks, a fire is built in it and allowed to die down. The rocks, which retain the heat from the fires are carefully selected and sometimes have to be brought in from a distance. Usually, the foods to be roasted are sandwiched between layers of moist grasses or other herbage. A layer of soil on top prevents heat and steam from escaping while the food is cooking.

Hispanic Homestead

With the introduction of oxen, horses, and other livestock by the Spanish in the 17th century, came the need for corrals and fences. The use of native materials continued with the addition of adobe, metal nails and barbed wire.
The Plants and The People

TURNING ANCIENT RESOURCES TO MODERN USE

from a paper by Howard Scott Gentry, Desert Botanical Garden

Deserts have always required innovative and adaptive farmers because of their environmental extremes. Particularly because of this background, farmers from the arid Southwest are leaders in today’s trend to new crops for arid lands. Modern investigations have found desirable characteristics in old Indian cultivars and useful wild plants. These and other neglected economic plants are now being researched and developed in Arizona and neighboring states. Examples of Sonoran Desert plants being researched are canaigre, jojoba, mesquite and tepary beans.

Canaigre
*Rumex hymenosepalus*

The leaves of this winter-spring wildling have been eaten locally as greens and the roots used as a tonic, astringent and dye. However, modern interest centers on its refinement as a tanning agent, the roots being particularly rich in tannic acid. Most of the vegetable tannin used in the United States is imported. Canaigre can be cultivated as an annual crop and lends itself to mechanized methods of propagation and harvesting.

Jojoba
*Simmondsia chinensis*

Jojoba is the only plant in the world known to produce a liquid wax very similar to that obtained from the endangered sperm whale. The wax, obtained from the seeds, has a variety of potential commercial uses in cosmetics, pharmaceuticals, printing, machinery, and other industries. Like sperm whale oil, it is tolerant to high heat and oxidizing conditions. Jojoba has a history of medicinal, cosmetic and dietary use by Sonoran Desert Indian people.

Mesquite
*Prosopis spp.*

This important leguminous desert tree prevents erosion and desertification, enriches soil with nitrogen, is an excellent fuel, and provides abundant carbohydrate-rich bean pods and protein-rich seeds. These qualities make the mesquite tree a potential crop plant for arid areas of the world where food for people and livestock is scarce. In addition, mesquite seed gum is being studied for its dietary applications.

Tepary Beans
*Phaseolus acutifolius*

Tepary beans are an ancient crop of both the American Southwest and Mexico. They are one of the most drought and heat adapted food crops known. Since large yields of high protein beans are possible with a minimum amount of water, these plants may lend themselves to cultivation in arid regions of the world. The dried beans are a delicious and nutritious substitute for other beans such as pinto and kidney beans.

New economic crops from other arid areas of the world are also being researched and developed on Sonoran Desert farms. Two examples of these are red squill (*Urginea maritima*), useful as a rodenticide and gum tragacanth (*Astragalus spp.*), useful for its dietary and industrial applications. Altogether, arid land crops constitute a new frontier in agriculture and involve a broad range of ethnic groups both north and south of the United States/Mexican border.
Vegetal resources to meet their needs. It is easy to imagine the uses of animal and mineral resources such as stone hammers, knives and pigments; clay plates, bowls and storage containers; animal meat, hides and bone. Vegetal resources also were essential and were used for hundreds of purposes ranging from everyday necessities to serious religious symbols. Most desert people were knowledgeable about the various uses of native plants but a few, such as basketweavers, doctors and shamans had specialized knowledge. Selected examples of the ways in which wild and cultivated desert plants were used are introduced here. Food and architectural uses are omitted because they are discussed on other pages.

Clothing and Adornment
Since the beginning of the Christian era, shirts, kilts and other articles of clothing were woven from native cultivated cotton grown in the Sonoran Desert. Fiber from yucca and agave leaves also was woven into clothing or twined with fur and feathers to make warm blankets. Leaves of yucca were plaited into sandals. Even elaborate headdresses were made from desert plants. Plant parts, particularly seeds, were strung as beads.

Cosmetics and Soap
Soap-like suds for cleansing were obtained from yucca, agave and saltbush. The black pitch that oozes from mesquite trees and mashed jojoba seeds were used as specialized hair treatments and hair was combed with brushes made from grasses and yucca fiber. Faces were tattooed with the spines of cacti, and ashes of selected desert plants or pitch that oozes from mesquite trees and leaves of agave were used to make tapered, black pottery paint. The eerily whir of wooden bullroarers, the sharp percussion of gourd rattles, the scraping sound of musical rasps, and the hum of fiddles made out of agave stalks. Children of all ages enjoyed using prickly pear pads as arrow targets.

Tools, Implements and Furnishings
The wood of desert trees was fashioned into stirring sticks, ladles, digging sticks, hoes, axe handles, arrow points, bows, arrows, fire starters, brushes, looms, tongs, awls, and other implements. Rope, cordage, nets, fastenings and traps were made from fibers from yucca and agave leaves and mesquite roots. Saguaro rib shelves, plaited sotol and cane sleeping mats and willow bark cradleboard padding were a few of the furnishings made from desert plants.

Containers
Baskets of all shapes, sizes and functions were made from several desert plants including sotol, limberbush, willow, cottonwood, beargrass, catail, yucca and devil’s claw. Carved wood, gourds, saguaro boots and hollowed agave stalks were also made into containers.

Fuel
Mesquite and ironwood were the preferred woods for hot, long-burning, low-smoke fires. Softer woods such as paloverde and ocotillo were also used when necessary.

Paints, Dyes, Glues and Sealers
Black pottery paint was obtained from black mesquite pitch and the carbonized broth of boiled plant leaves such as tansy mustard. Colors of dye included rattany root red, prickly pear fruit magenta, mesquite pitch black, and barberry root yellow. Brittlebush resins, mesquite pitch and lac formed by insects on creosote bushes provided waterproof glues, sealers and moldable adhesives.

Medicines
The flowers, leaves, roots and inner bark of desert plants were boiled, mashed, pulverized, or otherwise processed for use as tonics, topical applications and poultices. Creosote leaves, prickly pear stems, and mistletoe berries were some of the more common medicinal plants of the desert people.

Music and Recreation
The sounds of desert music included the rhythmic beat of drums made from gourds and baskets, the soulful whistle of cane flutes, the eerie whir of wooden bullroarers, the sharp percussion of gourd rattles, the scraping sound of musical rasps, and the hum of fiddles made out of agave stalks. Children of all ages enjoyed using prickly pear pads as arrow targets, finding the hidden bean in cane reeds, and catching gourd rings on a stick, gambling with saguaro rib dice and kicking mesquite wood balls.

Ceremonial Uses
In ceremonies of various desert peoples, bodies were adorned with yellow cattail pollen, corn meal and special paint, wooden or gourd masks were donned, saguaro fruit wine and other special foods were consumed, tobacco was smoked, and orations and myths which include plants as narrative elements were recited.

When the ecological and cultural significance of native plants is unknown, they may be seen only as obstructions to be cleared, reminders of a seemingly hostile environment, or curious but unimportant life forms. By understanding the growth habits of plants, their cultural uses and ecological relationships, we are more likely to see them as beautiful and worthy members of the desert community. Looking at the relationship between people and plants in the Sonoran Desert assists us in teaching appreciation of this rich cultural and botanical legacy.
SONORAN DESERT AGRICULTURE
 excerpted from
 A History of Sonoran Desert Agriculture
 by Karen Reichhardt

Donde hay arboles hay agua
Where there are trees there is water
Donde hay agua hay vida
Where there is water there is life

The availability of water is the greatest limiting factor in Sonoran Desert agriculture. Farmers are faced with the excessive loss of water from plants and soil, low rainfall and unpredictability of rain. Even within the desert, local conditions vary dramatically.

Modern agriculture depends on irrigation made possible year-round by pumping ground water or using water diverted from rivers and lakes into canals. Ancient farmers were required to adapt to the environment. Throughout the Sonoran Desert field were placed in several different landscape situations to maximize water availability.

The prehistoric Hohokam Indians of central Arizona used complex canal systems to irrigate the broad, rich flood plains of the Gila, Salt, Verde, and other perennially flowing rivers. Early Anglo settlers in the Phoenix area placed their first irrigation canals along these ancient canal beds. The historic Pima and Santa Cruz Papago were also using river irrigation. Two planting seasons were possible for those who irrigated: one in the spring when snowmelt was highest and the other during the summer rainy season. Maricopa and Quechan Indians planted crops directly into the Colorado River delta after the snowmelt receded so there was no need to construct canals.

In the outlying desert, Papago Indians moved from the mountains ranges to the plains in midsummer so that they could practice floodwater agriculture. In floodwater agriculture drainage basins not bisected by perennially flowing rivers were watered by

of processing foods before drying them that were necessary to separate the food into usable ingredients, prevent it from spoiling, and render it palatable, digestible and nutritious. Seeds were often parched and other foods like cholla buds were cooked before drying. Fruit syrups and jam could be preserved since their high sugar content discouraged microbial growth.

Summer was, by far, the richest time for food gathering. Beginning in mid-summer, saguaro fruit was harvested and soon after that ripe mesquite pods, beans from paloverde and ironwood trees, and fruits of yucca and prickly-pear became available. The wild greens that emerged at various times during the summer were boiled and eaten like spinach. Early fall saw the ripening of wild seeds and cultivated garden crops. Winter and early spring were the leanest times. One wild green, patata, became available as early as January in response to winter rains. Barrel cactus pulp and the hearts and immature flower stalks of agave were about the only other fresh plant foods available at this time. In spring, new stems of prickly pear cactus appeared along with cholla buds, greens, the green pods of the paloverde tree, flowers and berries. Finally, in early summer, crops planted in spring were harvested. The cycle began again.
Plants and Habitats

The Sonoran Desert is described as having a basin-range topography, or in other words, plains interrupted by mountain ranges. The topographical characteristics are so diverse, however, that several types of habitats are found here including arroyos, streamways, sand dunes, valleys, foothills, bajadas, grasslands, canyons and mountains. Approximately 2,500 species of plants can be found in the various habitats of the Sonoran Desert.

The habitats and plants in *Plants and People of the Sonoran Desert* mainly represent those found in the Lower Colorado Valley and Arizona Upland regions of the Sonoran Desert but they are found in the other desert regions as well. The 100 or so plants selected for our exhibit are those that are characteristic of certain desert habitats or have significant ethnobotanical importance. Additional species will be planted in the exhibit as required in the future.

Exhibit habitats include desert foothills, a permanent desert stream area, mesquite bosque, dry wash, semi-desert grassland and chaparral. While chaparral, characterized by dense, shrubby growth of fairly uniform size, usually occurs outside the Sonoran Desert boundaries between 3,000 and 6,000 feet, small stands can be found at lower elevations especially in the mountain ranges to the north and east. Desert vegetation, found up to about 3,000 feet sometimes mixes in with chaparral species. The chaparral habitat was included in this exhibit because it was an important area of plant exploitation by desert dwellers.

### Desert Foothills

<table>
<thead>
<tr>
<th>Plant Name</th>
<th>Common Name</th>
<th>Habitat</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Ambrosia deltoides</em></td>
<td>Triangle Bursage</td>
<td>Medicine</td>
<td>Food, wine, ceremony, construction</td>
</tr>
<tr>
<td><em>Carnegiea gigantea</em></td>
<td>Saguaro</td>
<td>Medicine</td>
<td>Food, construction, fuel</td>
</tr>
<tr>
<td><em>Cercidium microphyllum</em></td>
<td>Littleleaf paloverde</td>
<td>Medicine</td>
<td>Food, construction, fuel, food</td>
</tr>
<tr>
<td><em>Echinocereus spp.</em></td>
<td>Hedgehog</td>
<td>Food, glue, sealers, medicine</td>
<td>Construction, food, fuel, medicine</td>
</tr>
<tr>
<td><em>Ferocactus wislizenii</em></td>
<td>Ferocactus</td>
<td>Medicine</td>
<td>Baskets</td>
</tr>
<tr>
<td><em>Fouquieria splendens</em></td>
<td>Ocotillo</td>
<td>Dye, medicine</td>
<td>Medicine, construction, glue, sealers, fuel</td>
</tr>
<tr>
<td><em>Jatropha spp.</em></td>
<td>Limberbush</td>
<td>Medicine</td>
<td>Food, medicine</td>
</tr>
<tr>
<td><em>Krameria parviflora</em></td>
<td>White Ratany</td>
<td>Medicine</td>
<td>Food, construction, fuel</td>
</tr>
<tr>
<td><em>Larrea tridentata</em></td>
<td>Creosote</td>
<td>Food, construction, fuel</td>
<td>Food, liquid, containers</td>
</tr>
<tr>
<td><em>Mammillaria microcarpa</em></td>
<td>Fishhook pincushion</td>
<td>Food, construction, fuel</td>
<td>Construction, food, fuel, medicine</td>
</tr>
<tr>
<td><em>Olneya tesota</em></td>
<td>Ironwood</td>
<td>Food, construction, fuel</td>
<td>Food, medicine</td>
</tr>
<tr>
<td><em>Opuntia fulgida, O. versicolor, O. acanthocarpa, O. arbuscula, O. leptocaulis</em></td>
<td>Cluffia</td>
<td>Food, construction, fuel</td>
<td>Food, medicine</td>
</tr>
<tr>
<td><em>Phoradendron californicum</em></td>
<td>Mistletoe</td>
<td>Food</td>
<td>Food, medicine</td>
</tr>
<tr>
<td><em>Simmondsia chinensis</em></td>
<td>Jojoba</td>
<td>Food</td>
<td>Food, shampoo, medicine</td>
</tr>
</tbody>
</table>

### Desert Stream

<table>
<thead>
<tr>
<th>Plant Name</th>
<th>Common Name</th>
<th>Habitat</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Atriplex lentiformis</em></td>
<td>Quailbush</td>
<td>Food, soap</td>
<td>Food, construction</td>
</tr>
<tr>
<td><em>Celtis reticulata</em></td>
<td>Hackberry</td>
<td>Ceramic, construction, use</td>
<td>Medicine</td>
</tr>
<tr>
<td><em>Datura spp.</em></td>
<td>Datura</td>
<td>Food, medicine</td>
<td>Mats, construction, arrows, flutes, pipes</td>
</tr>
<tr>
<td><em>Helianthus annus</em></td>
<td>Sunflower</td>
<td>Food, dyes, medicine</td>
<td>Baskets, construction, medicine</td>
</tr>
<tr>
<td><em>Phragmites communis</em></td>
<td>Cane</td>
<td>Food, dyes, medicine</td>
<td>Baskets, construction, cradle padding, clothing, medicine</td>
</tr>
<tr>
<td><em>Populus fremontii</em></td>
<td>Cottonwood</td>
<td>Construction, arrows, baskets, food, medicine</td>
<td>Food, baskets, paint, ceremony, construction</td>
</tr>
<tr>
<td><em>Rumex hymenosepalus</em></td>
<td>Canaigre</td>
<td>Food, dyes, medicine</td>
<td>Construction, arrows, baskets, food, medicine</td>
</tr>
<tr>
<td><em>Salix gooddingi</em></td>
<td>Willow</td>
<td>Food, dyes, medicine</td>
<td>Construction, arrows, baskets, food, medicine</td>
</tr>
<tr>
<td><em>Tessaria sericea</em></td>
<td>Arrowweed</td>
<td>Food, dyes, medicine</td>
<td>Construction, arrows, baskets, food, medicine</td>
</tr>
<tr>
<td><em>Typha domingensis</em></td>
<td>Cattail</td>
<td>Food, dyes, medicine</td>
<td>Construction, arrows, baskets, food, medicine</td>
</tr>
</tbody>
</table>

### Irrigated Vegetable Garden

<table>
<thead>
<tr>
<th>Plant Name</th>
<th>Common Name</th>
<th>Habitat</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Amaranthus hypochondriacus, A. cruentus</em></td>
<td>Grain Amaranth</td>
<td>Food, dye</td>
<td>Food</td>
</tr>
<tr>
<td><em>Cucurbita pepo, C. moschata, C. agrimuscula</em></td>
<td>Squash</td>
<td>Food, clothing, twine, food</td>
<td>Containers, utensils, smoking, ceremony, food</td>
</tr>
<tr>
<td><em>Gossypium hirsutum var. punctatum</em></td>
<td>Cotton</td>
<td>Food, clothing, twine, food</td>
<td>Containers, utensils, smoking, ceremony, food</td>
</tr>
<tr>
<td><em>Lagernaria siceraria</em></td>
<td>Gourds</td>
<td>Food, clothing, twine, food</td>
<td>Containers, utensils, smoking, ceremony, food</td>
</tr>
<tr>
<td><em>Nicotiana spp.</em></td>
<td>Tobacco</td>
<td>Food, clothing, twine, food</td>
<td>Containers, utensils, smoking, ceremony, food</td>
</tr>
<tr>
<td><em>Panicum sonorae</em></td>
<td>Sonoran Panic Grass</td>
<td>Food, clothing, twine, food</td>
<td>Containers, utensils, smoking, ceremony, food</td>
</tr>
<tr>
<td><em>Phaseolus acutifolius, P. lunatus, P. vulgaris</em></td>
<td>Beans</td>
<td>Food, clothing, twine, food</td>
<td>Containers, utensils, smoking, ceremony, food</td>
</tr>
<tr>
<td><em>Proboscidea parviflora</em></td>
<td>Devil’s Claw</td>
<td>Food, clothing, twine, food</td>
<td>Containers, utensils, smoking, ceremony, food</td>
</tr>
<tr>
<td><em>Zea mays</em></td>
<td>Corn</td>
<td>Food, clothing, twine, food</td>
<td>Containers, utensils, smoking, ceremony, food</td>
</tr>
</tbody>
</table>

### Hedgerow

<table>
<thead>
<tr>
<th>Plant Name</th>
<th>Common Name</th>
<th>Habitat</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Atriplex canescens</em></td>
<td>Fourwing saltbush</td>
<td>Food, soap</td>
<td>Food</td>
</tr>
<tr>
<td><em>Lycium fremontii</em></td>
<td>Wolfberry</td>
<td>Food</td>
<td>Food</td>
</tr>
<tr>
<td><em>Suaeda torreyana</em></td>
<td>Seepweed</td>
<td>Food</td>
<td>Pit oven liner, food</td>
</tr>
<tr>
<td><em>Zizyphus obtusifolia var. canescens</em></td>
<td>Greythorn</td>
<td>Food, medicine</td>
<td>Food, medicine</td>
</tr>
</tbody>
</table>

### Volunteer Garden

<table>
<thead>
<tr>
<th>Plant Name</th>
<th>Common Name</th>
<th>Habitat</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Amaranthus palmeri</em></td>
<td>Pigweed</td>
<td>Food</td>
<td>Food</td>
</tr>
<tr>
<td><em>Atriplex wrightii</em></td>
<td>Wright Saltbush</td>
<td>Food</td>
<td>Food</td>
</tr>
<tr>
<td><em>Chenopodium spp.</em></td>
<td>Lambquart</td>
<td>Food</td>
<td>Food</td>
</tr>
<tr>
<td><em>Descurainea pinnata</em></td>
<td>Tansy Mustard</td>
<td>Food</td>
<td>Food</td>
</tr>
<tr>
<td><em>Hoffmanseggia glauca</em></td>
<td>Wild Sweet-Potato</td>
<td>Food</td>
<td>Food</td>
</tr>
<tr>
<td><em>Monolepis nuttalliana</em></td>
<td>Patata</td>
<td>Food</td>
<td>Food</td>
</tr>
<tr>
<td><em>Salvia columbariae</em></td>
<td>Chia</td>
<td>Food</td>
<td>Food</td>
</tr>
<tr>
<td><em>Trianthema portulacastrum</em></td>
<td>False purslane</td>
<td>Food</td>
<td>Food</td>
</tr>
</tbody>
</table>
Share in the Dream

As you have learned from this special issue of Agave, *Plants and People of the Sonoran Desert* will combine many elements and will embrace several disciplines. It will allow us to present to visitors a set of philosophical and scientific concepts and relationships in the framework of a very real human experience.

To develop a major exhibit in an outdoor museum, a number of professions must join hands to achieve a common goal. The talents and trades of many people are needed: landscape architects and anthropologists; folklorists and fundraisers; engineers and ecologists; botanists and builders; horticulturists and agricultural historians. *Plants and People of the Sonoran Desert* began as an idea and developed into a dream. Now it is about to become a reality.

Preliminary funding for this exhibit has been provided by COMPAS (Combined Metropolitan Phoenix Arts and Sciences). Construction will begin in the fall of 1986 and we hope to open the exhibit in late 1987. A campaign to raise additional funds and to secure in-kind donations is underway. If you would like to have a share in building this exhibit, please contact the Desert Botanical Garden.

New Collections: Plants and Artifacts

For *Plants and People of the Sonoran Desert* we hope to assemble a special collection of artifacts and objects that will be on permanent display in Webster Auditorium. Some of the items that we hope to acquire include:

- American Indian baskets made from Sonoran Desert plants such as yucca, beargrass, devil’s claw, willow, cottonwood and sotol.
- Papago, Pima and Maricopa pottery painted with mesquite pitch paint.
- Mesquite and ironwood utensils, carvings and implements.
- Rattles, flutes, fiddles and other musical instruments.
- Agave and yucca fiber cordage, bags, sandals and nets.
- Furniture, curios and other items made out of desert plants.

<table>
<thead>
<tr>
<th>Mesquite Bosque</th>
<th>Dry Wash</th>
<th>Semi-Desert Grassland</th>
<th>Chaparral</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Lycium fremontii</em></td>
<td><em>Acacia greggii</em></td>
<td><em>Aristida spp.</em></td>
<td><em>Agave palmeri, A. parryi, A. murpheyi, A. chrysantha</em></td>
</tr>
<tr>
<td><em>Prosopis velutina, P. glandulosa</em></td>
<td><em>Ambrosia ambrosiodes</em></td>
<td><em>Bouteloua eriopoda</em></td>
<td><em>Arctostaphylos pungens</em></td>
</tr>
<tr>
<td><em>Zizyphus obtusifolia var. canescens</em></td>
<td><em>Celtis pallida</em></td>
<td><em>Hilaria mutica</em></td>
<td><em>Berberis haematocarpa</em></td>
</tr>
<tr>
<td><em>Wolfberry</em></td>
<td><em>Cercidium floridum</em></td>
<td><em>Muhlenbergia porteri</em></td>
<td><em>Cercocarpus spp.</em></td>
</tr>
<tr>
<td><em>Mesquite</em></td>
<td><em>Chilopsis linearis</em></td>
<td><em>Nolina microcarpa</em></td>
<td><em>Cowania mexicana</em></td>
</tr>
<tr>
<td><em>Greythorn</em></td>
<td><em>Cucurbita digitata</em></td>
<td><em>Opuntia phaeacantha, O. violacea, O. chlorotica</em></td>
<td><em>Cucurbita foetidissima</em></td>
</tr>
<tr>
<td><em>Food</em></td>
<td><em>Desert hackberry</em></td>
<td><em>Sporobolus wrightii</em></td>
<td><em>Buffalo gourd</em></td>
</tr>
<tr>
<td><em>Food, construction, fuel, medicine, adhesive, cosmetic, cordage</em></td>
<td><em>Blue paloverde</em></td>
<td><em>Yucca elata</em></td>
<td><em>Sotol</em></td>
</tr>
<tr>
<td><em>Food</em></td>
<td><em>Desert willow</em></td>
<td><em>Yucca data</em></td>
<td><em>Juniper</em></td>
</tr>
<tr>
<td><em>Food, construction, fuel, Baskets, construction</em></td>
<td><em>Coyote gourd</em></td>
<td><em>Palmilla</em></td>
<td><em>Juniperus monosperma</em></td>
</tr>
<tr>
<td><em>Wolfberry</em></td>
<td><em>Palo Verde</em></td>
<td><em>Fiber, baskets, mats, Lashing, baskets, soap</em></td>
<td><em>Quercus turbinella</em></td>
</tr>
<tr>
<td><em>Ironwood</em></td>
<td><em>Food, construction, medicine</em></td>
<td><em>Food, construction, brushes, food</em></td>
<td><em>Rhus trilobata</em></td>
</tr>
<tr>
<td><em>Mesquite</em></td>
<td><em>Construction, fuel, food</em></td>
<td><em>Food, construction, medicine, paint, cosmetics</em></td>
<td><em>Yucca baccata</em></td>
</tr>
</tbody>
</table>

**New Collections:**

**Plants and Artifacts**

- American Indian baskets made from Sonoran Desert plants such as yucca, beargrass, devil’s claw, willow, cottonwood and sotol.
- Papago, Pima and Maricopa pottery painted with mesquite pitch paint.
- Mesquite and ironwood utensils, carvings and implements.
- Rattles, flutes, fiddles and other musical instruments.
- Agave and yucca fiber cordage, bags, sandals and nets.
- Furniture, curios and other items made out of desert plants.
The Desert Botanical Garden is a privately funded, nonprofit institution located on 150 acres of the lower Sonoran Desert in the heart of metropolitan Phoenix. It was founded in 1937 and accredited by the American Association of Museums in 1983. The Garden is a living museum dedicated to education, conservation and research of the desert habitat. Its resources are available to the public for their pleasure, interpretation and study. In addition to supporting botanical research in and land plant studies, the Desert Botanical Garden promotes the use of arid land plants, cultivars adaptable to desert life and water saving techniques.