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SPECIAL EDITION

KEN AKERS

Mountain lion

ASDM: The Desert's Best Lesson In Natural History

"The Desert Museum is actually part zoo, part museum, part botanical garden. Like other such places it celebrates nature, in this case the Sonoran Desert of Arizona and Mexico. But it is unlike any other in how well it does this. . . ."

The Wall Street Journal

etting standards from the beginning in research, recreation, conservation and education . . . the ARIZONA-SONORA DESERT MUSEUM moves into its fourth decade having topped a half million visitors for the first time since its opening on Labor Day in 1952. More than two decades ago a tour would have included an unpaved parking lot, a single row of large animal enclosures, a Papago Indian hut, a shade ramada and several nature trails. Today it has earned an international reputation for natural history interpretation and authentic habitat exhibitry that provides natural surroundings for the diversity of life found in the Sonoran Desert region.

The recognition and support the Desert Museum receives is the result of a consistent philosophy from its advent, a philosophy of caring about and effectively communicating the totality of the Sonoran Desert from its diverse ecosystems of water and sea life to its mountain ranges that are at times densely frosted and covered with snow.

Centered on 186 acres of pristine desert are fifteen acres devoted to outdoor animal habitats, botanical gardens and a geological interpretive center that tells the story of the evolution of the earth's beginning in a cave so realistic visitors argue when told it is artificial. This celebration of nature weaves some 500 species of animal and plants into a striking, integrated representation of the living desert instilling a conservation ethic in those who are willing to participate in the

many lessons it delivers.

These are the lessons of natural economy and adaptation as expressed in the behavior of the tiny kangaroo rat who satisfies its water needs by breaking down carbohydrates of dry seeds, the epitome in both behavior and anatomy of the desert-adapted mammal. And, in convergent evolution where the repeated development of similar adaptations in different lineages creates plants of widely separated families that adopt similar survival mechanisms, developing cactus like features to cope with a scarcity of water.

Also communicating the museum's mission of conservancy is the lesson of species recovery in those endangered plants and animals that have become fragmented and disturbed to the point of virtual extinction reminding us of the tenuous position that so many genetically distinct, natural populations are prey to.

Finally the paleoecological lessons of time and change that point to the paradox of the modern Sonoran Desert which lies not only in its formation of only four thousand years ago but in the discovery of its evolution. For this information we are indebted to Neotoma, the thieving but worthy packrat, whose middens or "junkpiles" provide us with well preserved, perishable plant remains from the desert, chronicling thousands of years from the Ice Ages to the warmth loving saguaro that is the signature of the Sonoran Desert today.

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In 1968 the Ice Age vegetation of the Sonoran Desert was unknown. In a course offered at that time, entitled "Paleoecology and Man," Professor Paul S. Martin of the University of Arizona presented packrat midden analysis as an exciting new source of well preserved, perishable plant remains from deserts. His enthusiasm and quiet support launched a small army (the Packrat Platoon) of students into most of the deserts of North America in search of "amber gold." Four master theses, five doctoral dissertations, and a decade later, the laboratory of Paleoenvironmental Studies at Tumamoc Hill was established as the major center of packrat midden analysis. Today we know quite a bit about the Ice Age vegetation and final modernization of the Sonoran and Chihuahuan deserts as a result of these beginnings and the ongoing research at ASDM.

From the meanings of adaptation and the tempo and mode of change, to the particularities of packrat middens and their history—research has traditionally been an important part of the Desert Museum's purpose.

Generations of packrats from the dry desert provide ASDM's research scientist with a figurative window to the past. Through a process of analysis, plant macrofossil assemblages found in midden deposits are isolated and carbon dated, providing a remarkably accurate picture of the ancient Sonoran Desert. Some of these plant re-

"... For decades the desert's lessons in natural economy, as taught by one of the most unusual and highly praised exhibitions in this country, have largely been lost on the people of the desert. Only in recent years has this wasteful race begun to listen . . ."

William Blundell

CHRIS KEITH

Saguaros and blooming palo verde

TIM FULLER

Congdon Earth Sciences Center tells the story of the evolution of the earth from a gaseous mass to the formation of the Sonoran Desert region.

mains show the modern desert around Tucson to be less than four thousand years old. In the last Ice Age, pinyon, junipers and oak grew here.

For the last two million years in the Pleistocene, glacial periods or ice ages have alternated with warm interglacials similar to the one today. In general, glacial periods have been 60,000 to 100,000 years in length and interglacials only 10,000 to 20,000 years long. The present interglacial began 11,000 years ago. Are we due for a new continental glacier any millennia now? When it comes, ASDM's research of the worthy packrat's plant collection through time will have given us a good idea of what to expect in the Sonoran Desert.

One of the most promising achievements to date in plant research is the "Desert Museum Hybrid" palo verde. With almost a decade of research behind it the best qualities of its ancestors have been inherited: fast growth, upright growth habit, huge flowers, pest-resistance and a bonus quality no other ancestor has possessed, spinelessness. It is at this point that serious research begins. Methods of mass propagation, rigorous testing under different soils, climates, and cultural methods continue.

Some of the most admired animals of the Sonoran Desert are vulnerable to a regional wave of extinctions. ASDM's role in the captive breeding of the Mexican gray wolf, its activities to save the Gila topminnow, the desert pup-

"The Sonoran Desert is not the world of our youth or childhood. Through the Desert Museum we are born again to understand this wonderful place."

Paul S. Martin
ASDM member for 10 years

The paradox of having the Sonoran Desert form only four thousand years ago yet needing many millions of years for its unique life forms to evolve can be resolved: During the most recent glacial period of heavy rainfall and very cool summers, only the more tolerant desert plants remained in the woodlands in the northern Sonoran Desert. Warmth-loving plants, in need of summer rainfall, were displaced south into the lowlands east of the Gulf of California in Sonora. As post-glacial climates warmed, summer rainfall increased and Sonoran plants began to disperse northward, each at its own pace.

Saguaros reached Arizona by about 10,500 years ago while foothills palo verde only arrived about 4000 years ago. The formation of the rich palo verde-saguaro community of the Arizona Upland did not happen until all of the principal actors made it to the stage—in this case the Tucson Mountains, the home of the Desert Museum.

Usually found under rock ledges, fossilized packrat middens last for millennia.

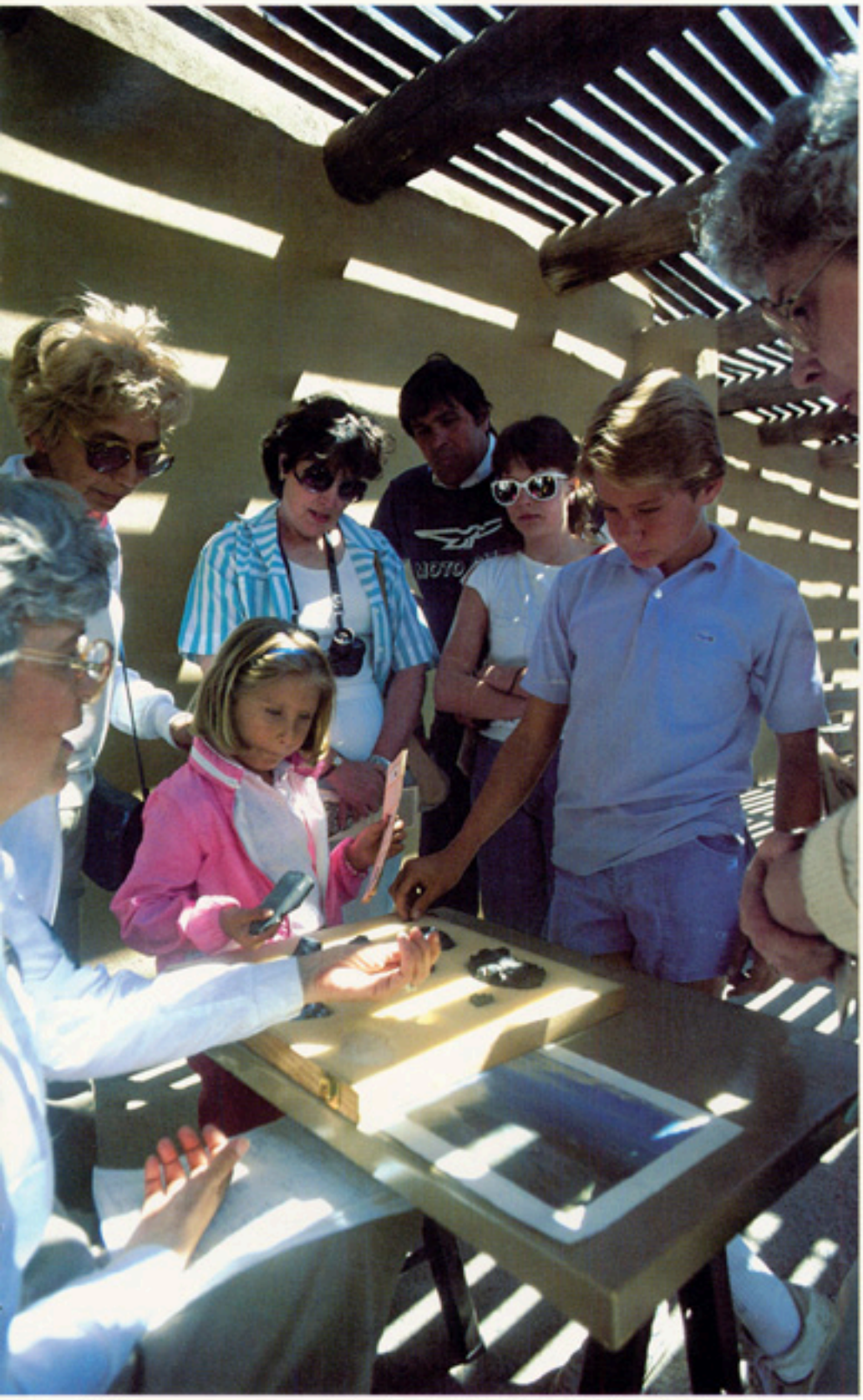
fish, and the Sonoran chub, to name only a few of the quickly vanishing fishes of the area and its efforts to breed the endangered thick-billed parrot in captivity for reintroduction to its natural habitat in the Chiricahua Mountains have received international attention.

While some of the greatest puzzles and wonders of natural history are the long and

Central to the museum's philosophical mission is a conservation ethic based on the concept of relatedness among organisms in countless ecosystems of potentially irreplaceable populations.

circuitous routes of migration followed by many animals, the rare Isla de San Esteban chuckwalla, confined to one small island in the Sea of Cortez, has been classified as Endangered under the U.S. Endangered Species Act. Currently uninhabited and in a primordial state, Isla San Esteban has scarcely been altered by humans since its initial inhabitants, a small band of Seri Indians, were exterminated by the Mexican military in one tragic event during the 1860s.

This circumstance of coexistence and eventual extinguishment is illustrated by the greatest risk to the chuckwalla's existence today—the human threat. Ineffective and clumsy escape maneuvers make the chuckwalla vulnerable to collectors in the live animal trade, as well as their occasional use as food by Mexican fishermen, and their original neighbors, the Seri Indians. The chuckwalla propagation and research program for the Isla de San Esteban chuckwalla is one part of the museum's conservation management efforts to not only manage them in captivity but to augment and enhance their survival in the wild.



TIM FULLER

On-the-grounds interpretation of meteorites.

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TOM VAN DEVENDER

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The jaguar (Felis onca) *inhabits the mountainous sub-tropical forests of the Sonoran Desert region. Once a regular though not abundant resident of southeastern Arizona, the likelihood of jaguars again occurring in the Southwest is increasingly remote. ASDM's Sub-tropical Riverine Habitat will include the jaguar, javelina, and a variety of tropical birds.*

C. ALLAN MORGAN

C. ALLAN MORGAN

Not seen in Arizona since 1982, the Tarahumara frog is dependent on standing water and has a long reproductive cycle, making it more sensitive to environmental changes than other frogs with shorter cycles. Five hundred to a thousand Tarahumara frogs were thriving in Arizona's Sycamore Canyon in April of 1973; by April 1975, they were gone.

The disappearance of the Tarahumara frog *(Rana tarahumarae)* and the jaguar *(Felis onca)* in Arizona emphasizes the concern for an epidemic of extinctions, not only of a species like the jaguar, but the extermination of local populations like the Tarahumara frog. One represents an early indication of loss in environmental quality; the other extermination due to organized predator control programs.

Mountain lion enclosure

CHRIS KEITH

But the museum's success in communicating its conservation message by way of captive breeding is only one strategy to promote the linkages between species. Another is the evolution of natural habitat design providing immediate encounters with the region's geology, its plants, animals and the ecological principles that bind them to the harmonic order of the Sonoran Desert environment.

The gecko lizard races straight out of its plastic jar to hide under a rock in the sand and brush . . . making its escape more slowly, the Sonoran Desert toad hops under a shady scrub to rest until a night-time visit to a nearby pond.

The release of these animals illustrates the main lesson for children enrolled in an animal care workshop at the Desert Museum. "When we see animals in the wild, we don't collect them and keep them in the house until they die," the interpretive naturalist explains, "we observe them for awhile to watch their natural behavior, take some notes, and then we release them where we found them so they can get back to the wild. If we keep them too long, they don't remember how to take care of themselves."

In surroundings where visitors may re-imagine their relationship to the natural environment, education is everywhere, in everything.

While identifying labels and interpretive wayside exhibits explore the ecological mechanisms of the desert region, it is the special hands-on demonstrations, tours and walks guided by trained natural history interpreters that best realize the goals

Another critically endangered species, the thick-billed parrot is found near the wolf enclosure.

ASDM's Mountain Habitat of forests, rocky terrain, and isolated stands of trees and mountain streams is the native land of the American black bear and the gray fox, the Mexican gray wolf and the white-tailed deer, the mountain lion (puma), the thick-billed parrot, raven and Steller's jay. More than 100 species of native plants, including grasses, manzanitas, oaks, pines, grapevines and wildflowers, complete this innovative approach to environmental settings, immersing the participant in a woodland vista.

White-tailed deer

of this interpretive museum. Over 150 docents provide encounters with the living representatives of the region, generating a focused appreciation for conservancy with programs that extend into the Tucson community and beyond the border into Mexico.

Three generations of Tucsonans have benefited from the museum's interpretive exhibits and educational programs. Children attending school from grades K-12 are exposed to the museum's outreach at least once, probably more. For this reason Tucsonans are some of the most environmentally aware people in the United States with a profound sense of belonging. As stated in a *Wall Street Journal* article on the museum, "School children in Tucson learn the water cycle, desert landscaping is more popular, waste water is recycled and new golf courses have more sand and less grass."

An important international extension of the museum's educational outreach efforts has resulted in the development of a comprehensive environmental education program in the primary schools of Sonora, Mexico and in ongoing discussions of environmental policy issues that address the problems of the increased impact of people on the environment.

Continually seeking to identify mutual aid and collaboration in research endeavors with Mexico, ASDM curators have also established procedures for the inter-institutional loan of specimens between ASDM and the Centro Ecologico de Sonora, a new living museum covering over one hundred acres of Sinoloan Desert in the foothills of Sonora.

"A visit to the Desert Museum is more than entertainment. I think that educational impact is the real measure of a successful museum or zoo. Every visitor leaving this museum leaves with a better understanding and appreciation of the Sonoran Desert."

Bill Shaw, Professor of Renewable Natural Resources
University of Arizona, ASDM member for 11 years

CHRIS KEITH

Mountain lion

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White-tailed deer

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CHRIS KEITH

Small visitor learns that even the creepy crawlies pose little threat to humans.

The Arizona-Sonora Desert Museum's fundamental commitment to resource conservation through education extends far beyond the combination of zoological, botanical and natural history presentations on the museum grounds. . . . When the summer rains return, the desert nights virtually come alive with the many forms of life whose survival depends upon their nocturnal habits to avoid the searing daytime desert where, as a *National Geographic Traveler* writer states, "the heat has teeth and the night talons." With these rains the Desert Museum opens it gates for an "after hours" view of nature's adaptations.

The museum's predominant recreational attraction is the opportunity for unhurried strolls through the desert landscape providing intimate encounters with its plants and animals.

These are the touring "Nightstalkers," participants who discover the nocturnal habits of the most unusual desert dwellers from the specialized communication of frogs and toads to close encounters with

"Nightstalking" members look for the spadefoot toad.

Visitors stroll by natural barrier moat in front of Mexican gray wolf enclosure.

". . . with a small group of visitors we looked at javelinas and jaguarundis, coyotes and coatimundis and then turned to see the jaguar sitting in a pool languidly wringing out her tail with her paws . . ."

Joan Johnston
ASDM member for 1 year

"There's always something different and new at the museum. It is the best investment in natural history education and recreation I know of."

Robert Fleming
ASDM member for 13 years

the many species of bats who visit the museum's beaver pond for water.

One of the special privileges of a Desert Museum membership, Special Events are fast becoming seasonal traditions in Tucson. They're so popular that often dates are filled within a week after *sonorensis* makes the mail and there is always an open invitation to friends and neighbors to join in any of the free events that take place during the year.

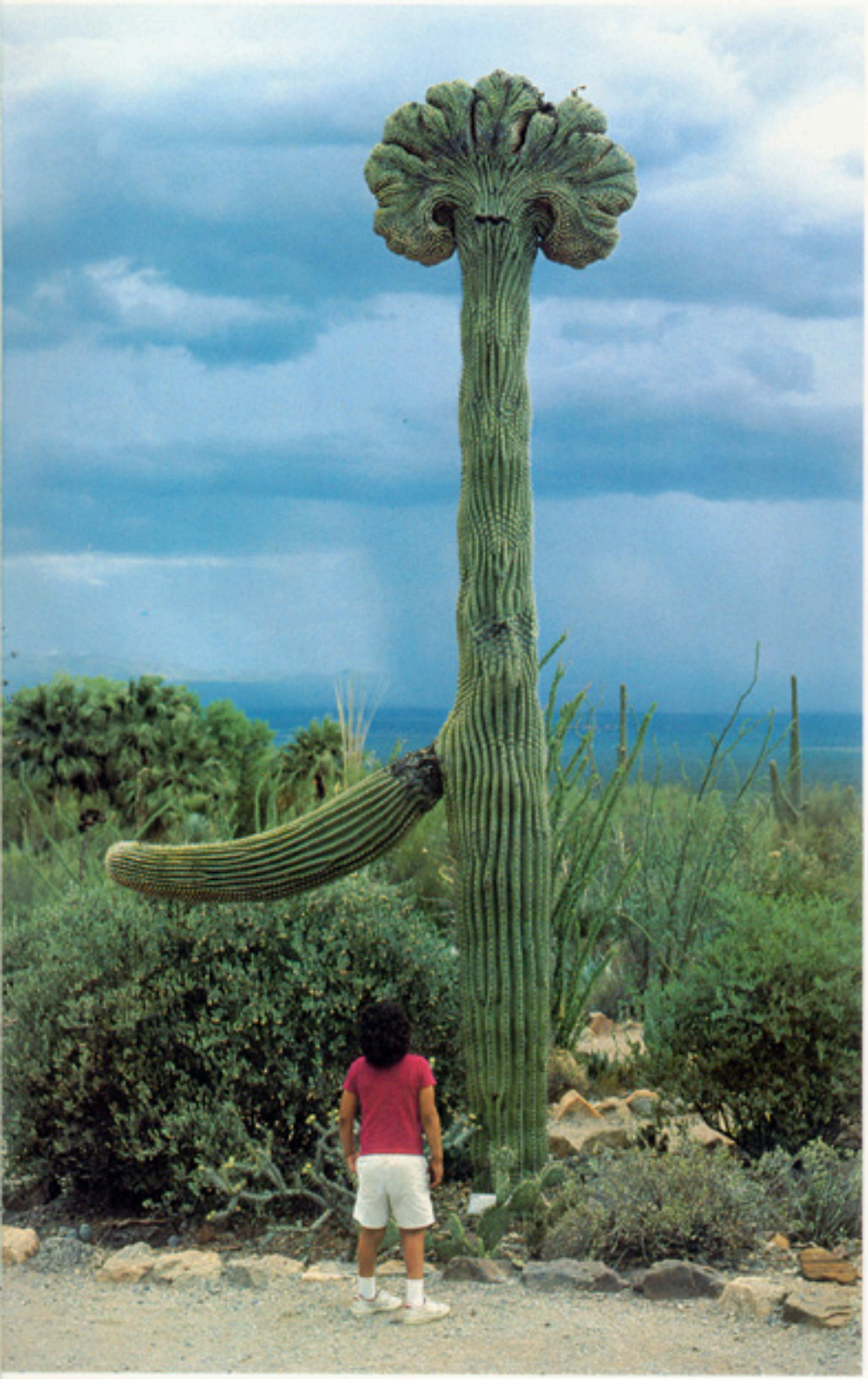
From the annual Desert Harvest Bazaar in the fall and the Spring Plant/Gem and Mineral Sale to the Baja Migration of the Gray Whale, Special Events are an extension of the in-depth training of experts in many areas of natural history. Under the guidance of the museum's interpretive naturalist and curators or experts from the University of Arizona and the community, members learn more than ecological concepts and facts. They experience the tangible lessons of harvesting saguaro fruit, learning from an elderly O'odham woman how the ritualized fruit harvest was performed, as well as listening to her family legends. While harvesting they observe and discuss the animals who make a living in the same fruits. Birds, coyotes, harvester ants and a woman's legends become the trigger for personal awareness and anecdotes that are the guiding characteristics of the museum's personal interpretative programs.

In the long run it is these lessons that reflect the phenomena of "life forms so tightly interconnected that a failure in one reverberates through the entire system like the striking of a gong."

"When I saw that bees, caterpillars and dragonflies had moved into the Mountain Habitat, I knew the ecosystem was at work."

Anne Poppy
ASDM member for 8 years

CHRIS KEITH



The rare cristate saguaro comes from a family that grows as tall as 30 feet and weighs several tons, most of it stored water.

GRAPEVINE PRODUCTIONS

"Nightstalking" members look for the spadefoot toad.

Visitors stroll by natural barrier moat in front of Mexican gray wolf enclosure.

GILL C. KENNEY

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sonorensis is the Latin, scientific term indicating the species classification of many plants and animals of the Sonoran Desert region.

Special thanks to Jim Hills.

The saguaro, signature of the Sonoran Desert. CHRIS KEITH