



SONORENSIS

Arizona-Sonora Desert Museum

Jaguar

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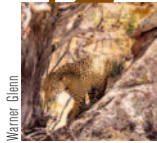
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Introduction

The Big Cat of the Americas

By **Craig Ivanyi**, Associate Executive Director for Living Collections and Exhibits, and
Shawnee Riplog Peterson, Curator of Mammalogy and Ornithology
Arizona-Sonora Desert Museum

This issue of *sonorensis* focuses on one of the Sonoran Desert Region's most beautiful and powerful inhabitants—the jaguar, *Panthera onca*. Chiefly solitary, this wide-ranging predator is the third-largest cat in the world and the *only* true big, or “roaring,” cat from the Americas! With an exceptionally powerful bite, it can crack the armor of turtles and tortoises, and will often kill mammals by biting directly through the skull, between the ears, puncturing its brain. It is the most powerful felid in the Western Hemisphere, capable of killing and eating large animals—our pets, our livestock, and even us. Although attacks on humans are rare, just the possibility tends to make us nervous. Any one of these characteristics and behaviors might contribute to the controversial status of jaguars in the opinion of some. For others of us in the post-industrial, technotronic world, this elusive predator may simply not occupy any space at all in our worldview. However, jaguars have long figured prominently in indigenous American cultures, making this species part of our cultural heritage. In addition, for thousands of years this apex predator was an important component of healthy New World ecosystems.

The story of jaguar in the Sonoran Desert is intriguing. The very fact that it occurs here may come as a shock to some (even to those of us who live here); but, indeed, the jaguar has been, and still is, in our backyard. So it is important for people to know about the history and, perhaps even more importantly, the *future* of this keystone predator. That is why the Desert



Jaguar (*Panthera onca*)



photo by Sue Morse

Jaguar habitat in Arizona.

Museum interprets the jaguar. In 1954 the museum received its first *Panthera onca*—a 185-pound adult male. We called it “El Tigre” (the Spanish common name for “jaguar” throughout most of its range). During the following thirty years the museum acquired several more jaguars, some of which even bore kittens. Though we currently have no jaguars on display, we are happy to say that you can expect an exhibit on jaguar in the Sonoran Desert in the near future.

Today, researchers estimate that perhaps 100 to 150 jaguars make a living in the 100,000 terrestrial square miles of the Sonoran Desert Region, but its range stretches all the way from Paraguay and northern Argentina to southern Arizona and New Mexico. Historically, jaguar sightings dotted Arizona as far north as the Grand Canyon, but in the latter part of the twentieth century, all recorded encounters have occurred in the southeast corner of the state, where this regal cat can still be found.

Unfortunately, the jaguar’s future in the United States is in jeopardy. A recent federal decision authorized abandoning jaguar recovery as a

federal goal under the Endangered Species Act. Some people have suggested that this decision may be tied to removing an impediment to the construction of a new border fence intended to reduce illegal access into the United States. Continued survival of this species north of the border, however, is likely to require that it stay connected to, and travel among, its brethren to the south.

In the following articles, biologists, ecologists, and natural historians explore the ecology of the American *Panthera*, along with efforts to conserve it in its northern range. They speak to the importance of natural corridors used by jaguar; they describe the ways in which landownership and land use have played into the cat’s diminishing numbers as well as their conservation; they tell of a growing cooperative movement for jaguar protection, including a new reserve in northern Mexico; and they tell us about novel methods being used in research and conservation education. You will also hear from Arizona residents who have recently encountered jaguar in southern Arizona and New Mexico. **S**

Jaguars: The New World Monarchs

Jaguars are powerful. Top predators, they are one of only two large felids surviving 500,000 years of climate change and human impacts in the New World. The jaguar has roamed from the desert shores of Sonora to the highest montane forests of the Andes. They are so powerful that pre-Columbian Olmecs who wanted to show their own special strength flattened their skulls to resemble the cats! These people believed jaguars turned into divine gods and could start earthquakes while inside caves (where they sometimes sleep). Their god-jaguar “roar” contains the sound of the earth cracking. Later, the Aztecs sculpted them out of stone, and positioned them, with rattlesnakes, as the great guardians of their temples. Their character is still mimicked by high-octane, flashy vehicles and, in their dark melanistic form, by a football team in Jacksonville (where jaguars haven’t roamed in recent times). Jaguar power is both feared and revered.

By Peter Warshall, Ph.D.,
Northern Jaguar Project



photo by Rafael Prognostic



NJP



NJP



photo by Eduardo Mendieta



NJP



NJP

All images on this page: jaguar (*Panthera onca*).



Jaguar in Northern Jaguar Reserve, Sonora.

Panthera onca comes in many sizes and colors. In fact, every jaguar is uniquely decorated with black stripes and clusters of spots. Genetically, jaguar populations differ, with the greatest differences marked by their residence

north or south of the Amazon River. Our jaguar—the jaguar of northern Mexico and southern Arizona and New Mexico—is typically about half the size of the Amazonian jaguar. In the northern jaguars, the rosettes of spots conjure up images of butterflies. This is called the “tigre mariposo” pattern, with a spot or three (the butterfly’s “body”) dividing the rosette into fluttering wings. No one has ever seen the strictly “pintada” form (a simple cluster of points) among northern jaguars, and no melanistic jaguar (all black with hints of the rosettes) has ever been confirmed

north of Chiapas. The pintada, melanistic, and heavy-set jaguars are the jaguars of movies—deep in the shadows of jungle with water dripping from giant, overhead epiphytes like large-leafed bromeliads. The northern jaguar, however, is a creature of seasonal subtropical forests, of thornscrub, pinyon-juniper, and pine-oak woodlands, that makes occasional forays into the conifers or down to beaches. The northern jaguar can be considered a separate race from the jaguars dwelling south of Mexico’s central plateau, a barrier to movement on which very few jaguars have been recorded.

From the Beginning

Jaguars came to North America from Eurasia about two million years ago. Fossils tell the story of a super-sized jaguar living at the same time as mammoths, shrub-oxen, and cats like African lions and saber-toothed tigers. About 600,000 years ago, our Cenozoic jaguar roamed much of North America and journeyed south across the Isthmus of Panama into South America. In Texas, New Mexico, Arizona, and Sonora this huge beast feasted on tapirs, mammoths, prehistoric peccaries, an extinct pronghorn, and ground sloths. As the glaciers grew, the grasslands changed composition, the large mammals (including the lionlike cats) disappeared, and the jaguar shrunk in size, apparently adapting to its now smaller smorgasbord of prey.

A mammalian carnivore in the Felidae family, the jaguar is equipped with large fangs, retractable claws, powerful jaws (the strongest among cats of their size), huge eyes (the biggest eyes of all carnivores for head size), “eyeshine” to improve night hunting, sensitive whiskers, a great sense of balance, acute hearing, perfumes for love, and purring for times of contentment. Jaguars belong to a subgroup called the “big cats” (subtribe Felini). They are the planet’s third largest cat, after the Old World lion and tiger. All the big cats have a rubber-band-like cartilage (the hyoid) that enables them to “roar” but limits purring to exhaling. Actually, the jaguar’s roar is more of a chthonian, voluminous grunting (uh-uh-uh-uh), which is non-directional—one of the many aspects of its personality that makes it scary in the wild. The “big cats” also contrast with the “little cats” by the hairs above their nose, their preference for eating while lying down,

and the way they tear at their meat jerking their heads rather than holding the meat down with their front paws. In bright light, the pupils of their eyes remain round, not contracting to vertical slits. Like all cats except lions, the males and females resemble each other, with the males bigger and stockier. Jaguars are such intense carnivorous hunters that the males and females live solitary lives, and the females guard their cubs from males who might devour them. They come together only for courtship and mating, when perfumes related to catnip and “infantile” playing temporarily overcome the desire to kill.

All cats are closely related, and all big cats (African and American *Pantheras*) have the same number of chromosomes, have two to four young per litter, and mate (with a few exceptions) once every two years. The young stay with the mother for at least a year and a half. The jaguar’s closest relatives are the African and Asian leopards, and hybrids (jagpards and leoguars) have been forced in zoos. These hybrid young are strong and fertile, which indicates their close genetic origins.

Humans and Jaguars

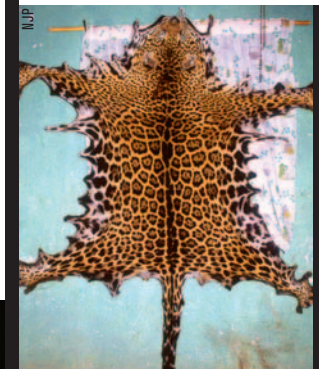
The jaguar, being nocturnal and highly secretive, is perhaps the least understood of the big cats. After Europeans arrived in North America, it was still abundant in Florida and reported breeding in Arizona, maybe New Mexico, and certainly Texas. A female was shot as far north as the Grand Canyon in 1932. The last known instance of a female jaguar killed in the United States was in 1963 in Arizona’s White Mountains.

Anywhere settlers arrived, they shot jaguars and mountain lions. Humans tended to view jaguars as

rivals in favored habitat—rich riparian lands with closed-canopy gallery forests. Jaguars, like tigers, are water cats, and they hunt turtles, fish and frogs, caimans and capybaras. In 1971, boys out duck hunting along the Santa Cruz River shot-gunned a jaguar whose belly was “full of frogs.” Riverside farmland has replaced prime jaguar habitat, but jaguars still visit springs and water tanks while hunting. Dams have further reduced the abundance of their turtle and fish prey.

Northern jaguars have been forced into the last, least populated pockets of nature where javelina and deer, their preferred prey, still persist. They are more montane in northern Mexico, either to escape hunters or because this is where their prey base of deer, or even elk, remains abundant. They are creatures of the Madrean woodlands—pine and oak, as well as pinyon-juniper and some coniferous forests. In Sonora, they seem to be most abundant in Foothills Thornscrub and definitely avoid the lower-elevation, hot Sonoran Desert. Occasionally, jaguars take up residence in mangroves along the coast of Mexico. It is not known whether these habitats ordinarily supported jaguars before the Euro-American invasion or are simply their last refuges from persecution.

In the 1600s, the Spanish introduced livestock, guns, and iron traps to Mexico, disrupting the natural and cultural balance that had existed between the big cats and the native peoples. The



Jaguar skinned and mounted on the wall.



Jaguar



White-tail deer (*Odocoileus virginianus*).





Zetasora Mountains



Rio Aros. All landscape images on pages 6 and 7 taken from the Northern Jaguar Reserve in Sonora.



Babisal



Foggy La Ventana

Spaniards' attempts to convert Native Americans to Christianity entailed breaking their religious connections to the jaguar. And with the arrival of ranching, jaguars were caught in a catch-22: more prey (cows, horses, goats, donkeys) closer to new human settlements, and hunters with better weapons to kill them. Females with cubs were hit especially hard. Mother jaguars need abundant food close to the den in order to maximize time with the cubs. A den close to cattle would have been ideal, except for the growing antagonism between rancher and big cat. In addition, the new, well-armed human communities depleted wild prey for their own food and other purposes, such as trophies. Another catch-22. As opposed to mountain lions, jaguars will readily eat carrion. They dined on livestock that died of natural causes, and ranchers interpreted their feasting as predation. As a result, many have been unfairly shot or poisoned at carcasses.

Emerging Protection

Starting in 1998, Dr. Carlos López González, a Mexican cat biologist, traveled Sonora, talked to ranchers, followed tracks, reviewed skulls, and read the historical records about *tigres nortenos*. He mapped the areas with lowest human density and, along with David Brown, an Arizona Game and Fish biologist, plotted jaguar kills and records for the last fifty years. Three areas still support breeding jaguars: 1) an area around the Sierra Bacatete, which borders the Sonoran Desert close to

the Sea of Cortez; 2) an area centered on the junction of the Rio Aros, Rio Bavispe, and Rio Yaqui that stretches from the towns of Nacori Chico to Sahuaripa; and 3) an area near the Sinaloan border north of the town of Alamos (where the Desert Museum has a large conservation program in place). They estimated 80 to 120 jaguars remained. López and Brown wrote the definitive book on *Borderland Jaguars (Tigres de la Frontera)*, and Carlos joined the board of Naturalia, a small but well-known Mexican conservation organization and, later, the Northern Jaguar Project.

Naturalia took the first step to save the northern jaguar by purchasing land at the heart of the Rio Aros/Rio Yaqui habitat. They then joined with the Northern Jaguar Project (NJP), a U.S.-based nonprofit, to purchase more land and more riverfront and to better understand, connect, and protect the jaguar homelands between the reserve and the U.S. border and the other high-quality areas for the jaguar (near Alamos and the Sierra Bacatete). In cooperation with many other conservation groups, NJP is also in the planning stages for two safe-passage corridors for jaguars from the Rio Aros sanctuary (and eventually Alamos) back to the United States. Because it is impossible to purchase all the land required, both NJP and Naturalia have begun to work with ranchers where jaguars appear. The Sky Island Alliance is doing similar work on a few ranches near the border. Other education and outreach programs are in place.

Success is far from assured. Our understanding of jaguar behavior is fragmentary at best, and more than fifty jaguars have been shot in northern Sonora in the last ten years, including four lactating females, two with cubs. The transition from old-style ranching to “conservation ranch-

ing” in Sonora has just begun. Methods to wean jaguars from livestock and return them to hunting wild prey are not clear. In addition, the border fence currently under construction will undoubtedly prevent jaguar populations from returning to relatively safe areas in the national forests and “conservation ranches” on the U.S. side of the border. (For instance, the Malpai Group, representing ten ranches covering nearly one million acres along the border in New Mexico and Arizona, has promised protection to the jaguar.)

the Umbrella Effect

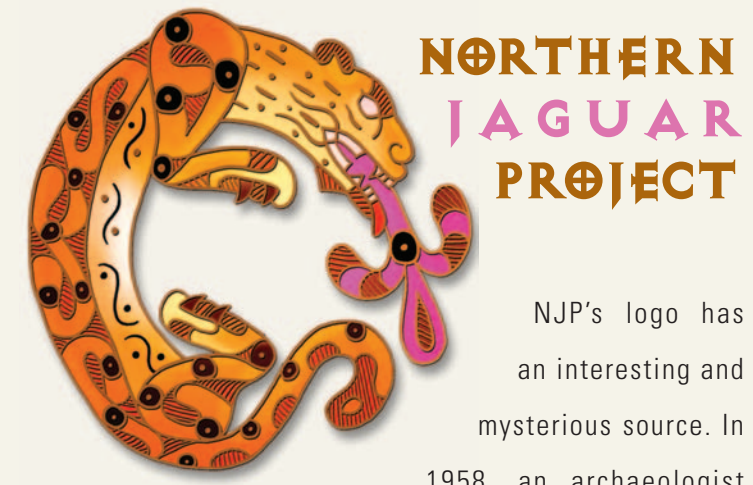
The importance of saving the northernmost jaguars goes far beyond the jaguar itself. The jaguar is an “umbrella species” because it needs such large territories to survive. Home ranges for jaguars may vary from 10 to 50 square miles. By protecting these large tracts, other species gain protection. The sanctuary purchased by Naturalia and NJP is a perfect example; the Northern Jaguar Reserve contains more than 150 bird species, 7 amphibians, 15 reptiles, and 29 mammals. It is one of the northernmost locations for four wild cats: jaguar, mountain lion (*Puma concolor*), bobcat (*Lynx rufus*), and ocelot (*Leopardus pardalis*). So far, over 100 species of butterflies have been identified, including a new species of owl butterfly that lives in the palm groves. Species in this little-known area of Mexico, so close to our border, extend known geographical ranges with each field trip by project biologists. Indigo, boa constrictor, and long-nosed snakes; a new damselfly; spotted tortoises; rufous-crowned sparrows and yellow grosbeaks; nesting white-striped woodcreepers; the southernmost nests of bald eagle; and probably the northernmost nest of the military macaw—the new insights and records go on and on.



Dubaral



La Ventana



NJP's logo has an interesting and mysterious source. In 1958, an archaeologist uncovered a small, carved conch shell pendant in a rock-and-earth mound in Benton County, Missouri. The pendant, known in archeology circles as a gorget, revealed unmistakable features mirroring that of a jaguar—from the animal's body shape and the nature of its spots to the form of its head, ears, and tail.

This discovery was an absolute surprise, since Missouri was further north than any location known to be part of the jaguar's former range. Although no one knows the exact age and origin of the gorget, it parallels important religious motifs seen throughout Mesoamerica, where the jaguar is a powerful symbol of the underworld and figured in countless Mayan glyphs.

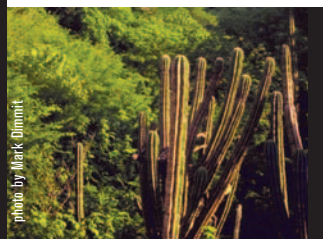
In 2007, the University of Missouri generously agreed to allow NJP to use the image as its logo. ■



Rio Aros



La Ventana



Alamos



Rio Aros

The “umbrella” of the New World’s king (and queen) of beasts has immediate conservation impacts. At the Northern Jaguar Reserve, we have recorded about 60 percent of the 150 or so birds of concern listed by the U.S. Fish and Wildlife Service

in the Neotropical Migratory Bird Act. The bird work will reveal new inland migration corridors for these birds and help us understand the importance of global warming on migratory patterns. The sanctuary is also the southwestern limit of the lowland and Chiricahua leopard frogs. It is both a resident and overwintering place for the elegant trogon and many of Arizona’s other favorite birds. In this way, North America’s jaguar royalty also protect their subjects, and the diverse flora and fauna can thrive.

Suggested Reading:

Brown, David E., and Carlos A. Lopez Gonzalez. *Borderland Jaguars (Tigres de la Frontera)* Salt Lake City: U of UT Press, 2001.

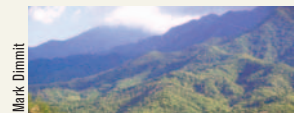
Childs, Jack L., and Anna M. *Ambushed on the Jaguar Trail.* Tucson, AZ: Rio Nuevo Press, 2008.

Hoogesteijn, Rafael, and Edgardo Mondolfi. *The Jaguar.* Caracas, Venezuela: Armitano Publishers, 1992.

Rabinowitz, Alan. *Jaguar: Struggle and Triumph in the Jungles of Belize.* New York, NY: Arbor House, 1986.

Glenn, Warner. *Eyes of Fire: Encounter with a Borderlands Jaguar.* The Printing Corner: El Paso, TX, 1998. **S**

Toward Jaguar Sanctuary in Southern Sonora



Alamos

By **Christine Conte, Ph.D.**, Director, Center for Sonoran Desert Studies, Arizona-Sonora Desert Museum

In an effort that will help connect and protect montane and riparian jaguar habitat, the Arizona-Sonora Desert Museum is working in the Alamos area of Sonora with another nonprofit conservation organization, Nature and Culture International (NCI). NCI is purchasing contiguous ranches to protect relatively pristine habitat in the area. The land purchased to date covers more than 16,000 acres along an altitudinal gradient from 500 to 4,000 feet or more. Eventually, the properties will be designated a private reserve and turned over to a Mexican nonprofit organization for management. The Northern Jaguar Project hopes to map the area between Alamos and the Northern Jaguar Reserve to identify the safest wildlife corridors between the two safe-havens.

Arizona-Sonora Desert Museum staff and research associates have been engaged in research, education, and conservation actions in the Alamos area since 1956, and they are currently conducting field research on a little-known and astounding variety of plants, insects, and reptiles, as well as migratory pollinators such as bats and birds. Together with our Mexican partners from Pronatura Noroeste (a nonprofit conservation and education organization) and CONANP (Mexico’s National Park Service), the museum has been developing conservation education programs in the Alamos community for children and adults. The Tropical Deciduous Forest and pine-oak-woodland habitats of the Alamos area support a richly biodiverse community, and key investments in this region promise ecological returns. **S**

The future of Jaguar Conservation in Mexico and our Conscience

Humans are cultural animals. We tend to structure and classify the world around us in good, bad, useful, useless, pretty, ugly, long, and short-term plans. Our relationship with nature clearly exemplifies this approach. In general, what we perceive as valuable consists of those plants, animals, and processes that provide us with goods or services, or what appeals to us as beautiful, remarkable, or extraordinary. For thousands of years, jaguars have exemplified the strength, power, and superiority of an animal that is feared, revered, and respected. The jaguar warriors of the ancient Aztecs, and the many sculptures and other cultural representations of the species—in dances, temples, utensils, masks, codices, calendars, and geographical names—clearly demonstrate that jaguars were an extraordinary element of the pre-Columbian world. The cultural iconic properties of jaguars permeate Western culture to the present day. For example, we can hardly see the occasional Jaguar car on the road without sensing its power and elegance. It is safe to say that jaguars are a clear transcultural representation of power, strength, and superiority.

Chichen Itza
Mayan ruins, Mexico

Rodrigo A. Medellín, Ph.D., Instituto de Ecología, Universidad Nacional Autónoma de México

But jaguars—the cats—are facing severe conservation threats. They have disappeared from well over 30% of the area they originally occupied in the Americas. In Mexico, they have been extirpated from over 60% of their historical range. Humans have cornered, killed, and isolated jaguars in ways that have left little refuge for these magnificent cats. We encroach in the areas they occupy. We remove the vegetation they need for cover. We kill (and often eat) their prey, thereby directly competing with them. We then establish high densities of helpless potential jaguar prey in the form of cattle and other livestock, and expect the jaguars not to touch them under the threat of an immediate, summary death penalty. We use their skins to cover ourselves in the most lavish and most costly, but most incomprehensible, fashion trends. We also use their teeth, claws, bones, and skins for medicinal, cultural, and ritual purposes.

This situation is unsustainable and has taken the jaguar to the brink of an extinction spiral that requires immediate action if we hope to avoid one of the most shameful, senseless, and selfish extinctions humans will have ever caused.

Jaguars are listed as an endangered species in Mexico and many other countries. They are by far the least known of the four large cat species of the genus *Panthera*. Judging by the number of published studies, we probably know four times more about the lion (*P. leo*), three times more about the tiger (*P. tigris*), and

more than twice as much about the leopard (*P. pardus*) than we do about the jaguar. And while the tiger is also an endangered species in most of its distribution, lions, tigers, and leopards are in a far better conservation state than jaguars. It is high time we tip the balance if we wish to avoid the looming extinction of the jaguar as a wild species across the Americas.

In Mexico,
jaguars have been
extirpated from over 60%
of their historical range.

Many incipient efforts have been launched to learn more about the jaguar and its needs, and some conservation strategies have been initiated. Mexico began emphasizing jaguar conservation about ten years ago. Supported by the National Autonomous University of Mexico (UNAM) and the Wildlife Conservation Society in the United States, “The Jaguar in the XXI Century”—the first-ever (and so far only) continent-wide jaguar conservation and biology symposium—was held in 1999. That conference provided a platform upon which to expand local, regional, and

national jaguar conservation strategies. A few years later, the international effort of “Jaguars without Borders” was initiated by the three governments, nongovernmental organizations, and academic institutions to protect jaguars in the Mayan Tropical Rainforest of Guatemala, Belize, and Mexico. Also, the Alliance for the Recovery of the Mexican Jaguar has met every year for the past five years to update and analyze the knowledge about and conservation status of jaguars within Mexico. We have determined strategies and priorities, and have standardized protocols for studies on jaguar natural history and jaguar diseases, and for jaguar surveys. And in 2007, Mexico established the Mexican Jaguar National Survey, CENJAGUAR.

CENJAGUAR is now a reality, and we have a protocol that is being implemented at 12 sites this year and several additional sites next year. Each site is using the standardized methodology designed at the most recent CENJAGUAR workshop. Subsequently published, this protocol is based on camera-trapping methods, one of the most useful tools to study elusive or hard-to-detect wildlife. Camera traps are currently used around the world to study a wide variety of species such as cats, tapirs, rhinos, bears, antelopes, etc. The area to be sampled for CENJAGUAR at each selected site is between 64 and 200 square kilometers (between 24 and 77 square miles), or up to 750 square kilometers (290 square miles) in low-density areas, as in

the extreme northern part of the Sonoran Desert. Because each jaguar has unique spot patterns, photos from camera traps allow us to identify specific individuals, especially with the double camera stations that photograph

The next *ten years*
will be absolutely decisive
for the *future* of jaguars
in Mexico.
Jaguars are *not simply*
“one more species”
of Mexican fauna.

both sides of the animal. Eventually, the CENJAGUAR surveys will produce density estimates, population-size estimates, and other demographic parameters for the threatened cats. The jaguar survey is complemented by a jaguar prey survey, which is simultaneously capturing data on relative abundance of species the cats feed upon.

Preliminary data from these census projects are already coming in, with very exciting results. Mexico still has important jaguar populations, at least in the Selva Lacandona in the southernmost state of Chiapas, in Campeche at the base of the Yucatan Peninsula, and in the Chimalapas region of Oaxaca. Other important populations have been documented in Chamela (Jalisco); near Puerto Vallarta in Tamaulipas; and in Querétaro in central Mexico. Other important populations are being monitored in Sonora and Sinaloa. The latter, a surprisingly large jaguar population, has yielded records of some of the largest individual Mexican jaguars.

Estimating jaguar population size and documenting viable populations in Mexico (and elsewhere) is a crucial step in implementing a nationwide jaguar conservation strategy. CENJAGUAR surveys will continue for the foreseeable future. They have been adopted by and are being funded by both the Mexican government and private donors. But this is only the first step. Considering the magnitude of threats jaguars face in Mexico, we must take decisive steps to ensure their future. President Calderon has already identified jaguars as one of five priority species to recover during his mandate.

The coin is in the air. The next ten years will be absolutely decisive for the future of jaguars in Mexico. Jaguars are not simply “one more species” of Mexican fauna. Jaguars are also considered a keystone species. If, in ten years,



PROTECT THE JAGUAR, BECAUSE THE
JAGUAR REPRESENTS ALL OF US.

*This poster was sponsored by Naturalia and other groups
working toward jaguar conservation.*

Mexico has been able to ensure the future of its jaguar populations, this species will continue to be a proud symbol of strength, superiority, power, and success. But if, in ten years, there are no viable populations left in Mexico, or the only remaining ones continue to decline while most Mexican jaguars are those found in zoos and private collections, then the jaguar will become an embarrassing symbol of failure and shame, both for the citizens of Mexico and for our government’s environmental policies. It is up to each and every one of us to load the coin on the right side so that jaguars can continue to protect our spirits and nourish our souls. **S**

BINATIONAL COLLABORATION
TO *Save*

THE PLANET'S NORTHERNMOST
Jaguars

WHEN YOU HEAR THE WORD “JAGUAR,” THE FIRST IMAGE THAT COMES TO MIND IS THAT OF A BIG SPOTTED CAT STALKING THROUGH THE JUNGLE—AN APPROPRIATE ASSOCIATION, SINCE TROPICAL FOREST IS THE MOST COMMON HABITAT OF THESE MAGNIFICENT ANIMALS. BUT JAGUARS ARE VERY ADAPTABLE ANIMALS. ON THEIR EVOLUTIONARY JOURNEY, AS THEY SPREAD THROUGHOUT THE CONTINENTS OF NORTH AND SOUTH AMERICA, THEY ALSO COLONIZED AREAS RADICALLY DIFFERENT FROM TROPICAL FORESTS. ONE OF THESE IS NORTHERN SONORA, JUST SOUTH OF THE U.S.-MEXICO BORDER. THIS EXTREMELY RUGGED TERRAIN, ABOUT 120 MILES SOUTH OF ARIZONA AT THE INTERSECTION OF FOOTHILLS THORNSCRUB AND TROPICAL DECIDUOUS FOREST ECOSYSTEMS, HARBORS A REMARKABLE POPULATION OF “DESERT JAGUARS” ADAPTED TO INTENSE WEATHER, SCANT RAINFALL, AND SEMI-ARID CONDITIONS. IN THIS REMOTE REGION, JAGUARS HAVE BECOME THE UMBRELLA SPECIES FOR A VAST RANGE OF WILDLIFE.

OSCAR MOCTEZUMA O., NATURALIA, A.C.
AND DIANA HADLEY, NORTHERN JAGUAR PROJECT

Some three and a half centuries ago, European livestock entered the territory of the desert jaguars, introduced by ranchers of New Spain who believed they could raise cattle in an environment ill-suited to domestic animals. In this mountainous terrain, cut by deep canyons where forage and water are scarce, cattle ranching became a marginal economic activity—at best. Every livestock loss was distressing, a situation that led to intense hostility toward predators in general and jaguars in particular.

El tigre, as local people call the jaguar, came to be known as a feared and loathsome creature—quickly blamed for livestock losses, even though jaguars more frequently performed the unromantic ecological services associated with vultures. Jaguars, as enthusiastic consumers of carrion, will feed on decayed carcasses of cattle that perish from a wide variety of natural or accidental causes.

Lack of understanding about this utilitarian role and their role as a keystone species for the area's broad variety of fauna,

led to a long war against *el tigre* in Sonora. Today, *los tigres* are so scarce and secretive that many doubt their existence in the region altogether, and some even question they ever existed in those dry mountain habitats.

Fortunately, not everyone shares these attitudes toward the largest and most majestic cat in this hemisphere. Since 1990, when a group of committed conservationists from central Mexico established Naturalia, this organization has been fighting to recover Mexico's endangered species, using jaguars as instruments of preservation for natural ecosystems. Naturalia has become one of the most active conservation organizations in Mexico, involved in a wide variety of conservation projects and environmental education activities, many with national impact. Naturalia leads the way with reforestation campaigns, evaluation of protected areas, production of environmental education materials, management of private protected areas (e.g. Los Fresnos, in the San Pedro River watershed of Sonora), protection of endangered species such as beaver and prairie dogs, and publication of the prize-winning conservation magazine *Especies*.

Since its inception, Naturalia has focused its attention on the most urgent wildlife conservation issues in the country, including the Mexican wolf (*Canis lupus baileyi*). Since large predators need huge territories, the wolf's protection provided an efficient framework for preserving large tracts of wild land. This same strategy was a major motivation for Naturalia's decision to protect Sonora's jaguar population. In 1997, Naturalia and the U.S.-based Wildlands Project organized a workshop to identify areas of highest priority for conservation in the northern Sierra Madre Occidental. It was at this workshop that Naturalia heard about the special group of jaguars identified by Carlos López González as probably the northernmost breeding population of jaguars on the American continent. Experts at the workshop

All images on this page:
jaguar (*Panthera onca*).



photo by Emil McCain

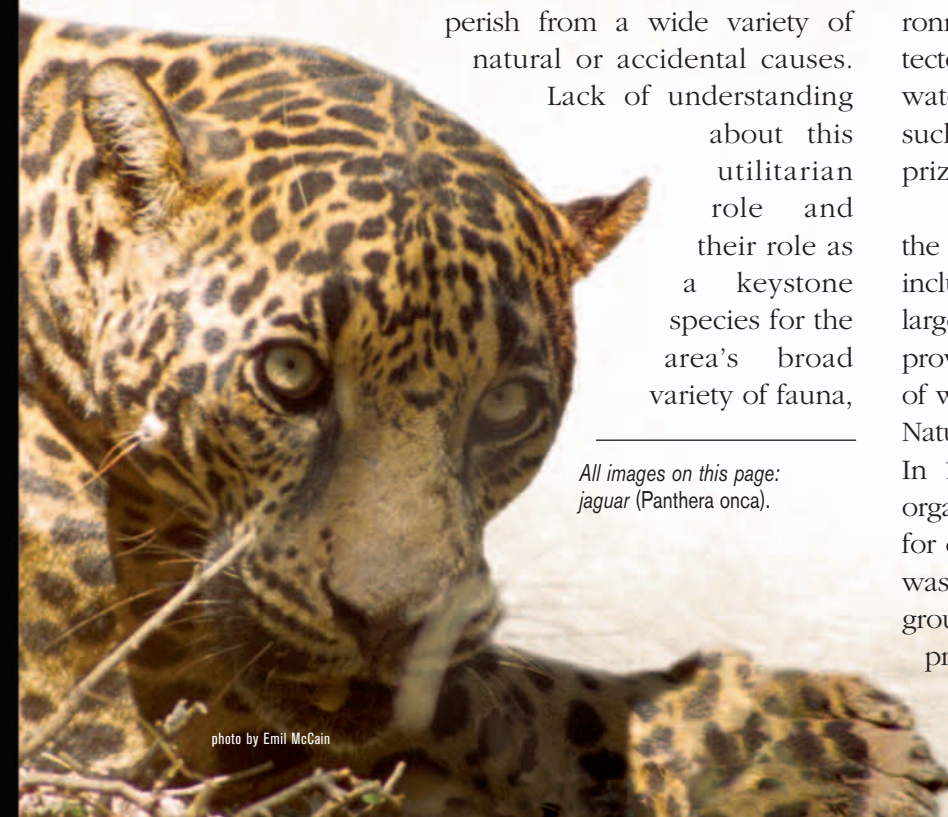


photo by Emil McCain



photo by Emil McCain



photo by Emil McCain



UJP



photo by Emil McCain



photo by Emil McCain



Mountain lion (*Puma concolor*).



Bobcat (*Felis rufus*).



Ocelot (*Felis pardalis*).

photo by Donald Knight

photo by Donald Knight

photo by Donald Knight

expressed concern about *Panthera onca's* precarious situation and the need to protect their home in the Aros-Yaqui area—an identified priority area for conservation. To purchase land in the heart of northern jaguar territory, Naturalia, in cooperation with the Bank of Mexico, launched a fundraising campaign in 2001 driven by the sale of a special issue of commemorative silver coins portraying ten of Mexico's endangered animals.

Shortly after the coin campaign, a group of conservationists in Tucson became aware of the plight of northern jaguars and formed the Northern Jaguar Project (NJP), with the goal of preserving the core population of jaguars in northern Sonora, and the possible reoccupation of its former habitat in the United States. A grassroots organization, NJP maintains a small but effective binational board. In 2003, using funds from the sale of the endangered-species coins, Naturalia acquired Rancho Los Pavos, a 10,000-acre cattle ranch in the heart of jaguar territory. NJP and Naturalia soon became full partners in managing the former ranch as a private jaguar reserve, the first reserve in Mexico established expressly for these cats.

The two conservation groups quickly identified three immediate challenges: creating more sympathetic attitudes toward jaguars; securing safe wildlife corridors between the Aros-Yaqui area (in which the Northern Jaguar Reserve is located) and other jaguar populations; and expanding the reserve to provide an adequate safe-haven for jaguars.

To meet our first challenge, we inaugurated the *Fotografías para Convivir con Felinos*, or *Fotos Felinos*, program—a totally new approach

to wildlife protection. Rather than compensating neighboring ranchers for livestock lost to predation, we decided to initiate a program of positive reinforcements by rewarding ranchers for the presence of wildlife on their lands. Traditionally, wildlife compensation programs provide funds following the death of a domestic animal that a specialist in wildlife depredations has certified as killed by a predator. One problem with this system is that the specialist

“DAD, YOU SHOULD *buy*
SOME MORE OF THOSE
cats —THEY'RE WORTH MORE
THAN COWS!”

must be close by and ready to visit the livestock carcass soon after its discovery—which is not possible in the vast, remote area surrounding the Northern Jaguar Reserve. Additionally, payment for losses may build tolerance for predators, but they do not increase appreciation for predators or create pride in the amazing complexity of wildlife in the area.

The *Fotos Felinos* program invites neighboring ranchers to join the project, signing a pledge not to kill or to permit others to kill wildlife on their properties, particularly large felines, and permitting Naturalia/NJP to place remote cameras on their ranches. In some cases, *vaqueros* on the ranches are paid a stipend to maintain the cameras. Ranch owners receive economic

incentives for photos of wild cats (bobcats, pumas, ocelots, and jaguars) ranging from 500 pesos (\$46 USD) for a bobcat, to 5,000 pesos (\$460 USD) for a jaguar.

The success of this program became evident when Naturalia's representative in Sonora, Juan Carlos Bravo, went to make reward payments to a nearby rancher for ten ocelot photos. When Juan Carlos asked what the family intended to do with the prize money, the son of the rancher piped up: “Dad, you should buy some more of those cats—they're worth more than cows!” In addition to building good will in the community, providing supplemental income for our neighbors, and opening many doors for us, the photo program provides us with valuable research information on wildlife populations. Complemented by community outreach, wildlife education in local schools, and dissemination of research results [see “Jaguar Conservation through Education and Outreach,” page 18], Naturalia and NJP are slowly increasing local pride in the region's amazing biodiversity and changing the perception of *el tigre* himself, from a loathsome, dangerous menace to a valued asset for all Sonorans.

The second challenge, identified through the research of Carlos López, was the creation of secure wildlife corridors to prevent isolation of the Aros-Yaqui jaguar population. Connectivity southward to jaguar populations in the Alamos region of Sonora and the states of Sinaloa, Nayarit, and Jalisco (on the west coast of Mexico) is important for the health of the Aros-Yaqui population. The importance of connectivity northward is evident from the increase

in jaguar sightings in Arizona and New Mexico during the past decade. Jaguars must be telling us something important—something like, “Suitable habitat still exists north of the international boundary.” It is possible that the male jaguars photographed in the Tumacacori Highlands of southern Arizona wended their way northward from the Aros-Yaqui population.

To identify connective corridors, we initiated projects in remote sensing and GIS mapping of possible wildlife routes north and the south of the reserve. Another of our Naturalia/NJP projects moves sets of remote cameras among various possible corridors, leaving them in place for several months before taking them to another likely site. We have also created a satellite map with overlays of crucial information, including property ownership, which will be useful in establishing agreements with willing landowners regarding protection of wildlife corridors.

Our third challenge, reserve expansion, required another long and vigorous fundraising campaign. Several years ago, we identified Rancho Zetásora, the 35,000-acre property adjacent to Los Pavos, as the most strategic area for reserve expansion—having the best jaguar habitat in the area. We began a lengthy, complicated purchase negotiation with its owner, a dignified, vigorous, traditional Sonoran rancher still roping horses and branding



Rancho los Pavos



Río Aros

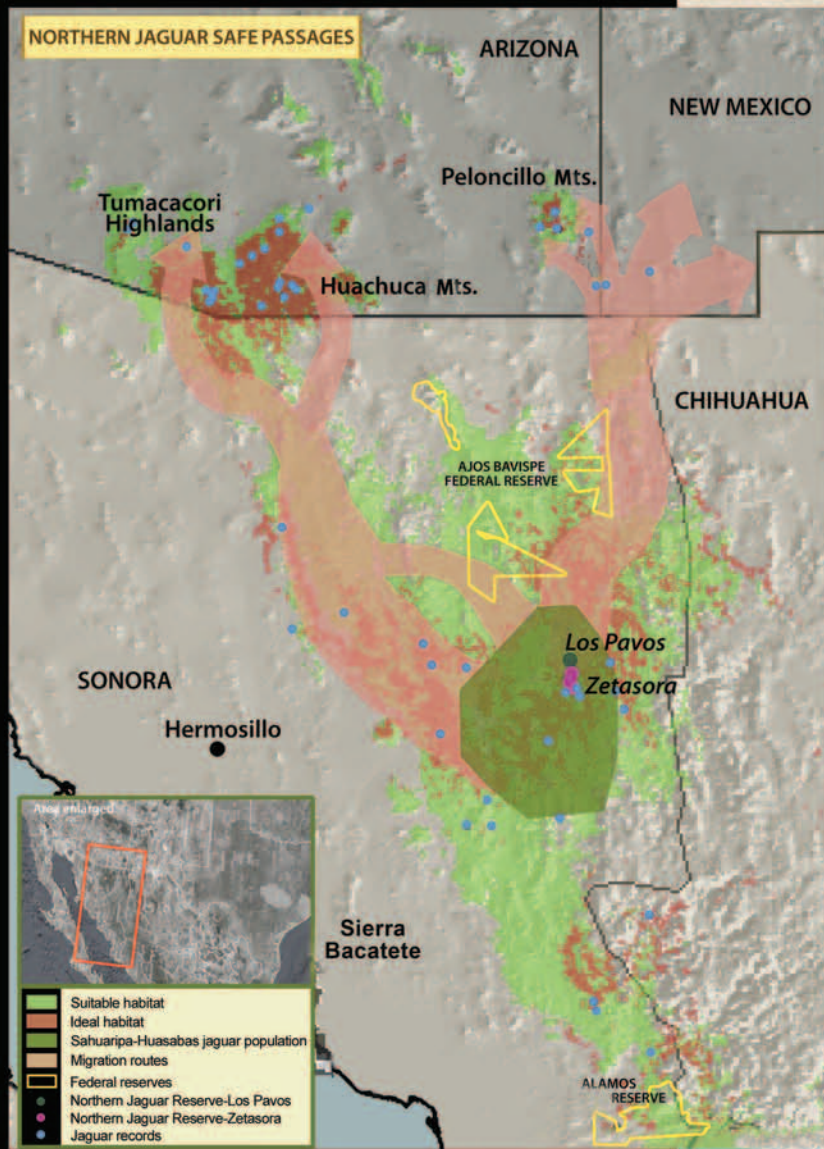


Las Columnas

NJP

photo by Ian Fritz

NJP



This map, developed at a Wildlands Project workshop in 2007, illustrates identified corridors that would allow jaguars in northwest Mexico to disperse to suitable habitat in Arizona and New Mexico.

calves although well into his eighties. After two years of negotiations and fund-raising, we secured the full purchase price—with the help of more than 600 individual donors (including many ASDM members) and 30 foundations. On January 31, 2008, we celebrated the purchase of Rancho Zetásora!

The Northern Jaguar Reserve now covers 70 square miles of consistently rough, steep terrain, sculpted by hundreds of canyons and cliffs. At the confluence of Foothills Thornscrub and fingerlike extensions of remnant Tropical Deciduous Forest, the reserve has an amazing mix of vegetation types. Oaks and palms grow side by side in the same canyons. Vegetation zones change with elevation. Situated on the Río Aros, the last undammed river in Sonora, the reserve is a major corridor for neotropical migratory birds, butterflies, and bats. The country is remarkably empty as well. The only traces of human presence are

a few *vaqueros* who live for part of each month in thatched, palm palapas with outdoor kitchens. In the twilight, from higher elevations, you can look in all directions, count up to 17 ridges, and not see a single electric light. Fortunately for its wildlife, the area has no transportation “improvements.” As Joseph Wood Krutch observed years ago, “a bad road is the

best filter.” The frequently impassible dirt road into the reserve has protected the area’s jaguars and its other endangered and threatened species—ocelots, neotropical river otters (*Lontra longicaudis*), military macaws (*Ara militaris*), and bald eagles (*Haliaeetus leucocephalus*) among them. The reserve’s road will always remain a bad road! And a locked gate at the entrance to this sanctuary provides extra protection. In addition to the 45,000-acre reserve, cooperation from neighboring ranchers in the *Fotos Felinos* project effectively protects another 33,000 acres from poaching, a good beginning in providing jaguars with ample room to roam. Another layer of protection will come with the property’s eventual recognition as a Mexican federal reserve.

During the next few years, the efforts of Naturalia and NJP will be directed toward creating regional partnerships for protection of jaguars and other wildlife. Some agreements have already been reached, like the one recently established between Naturalia and the Yaqui tribe, whose traditional tribal community lands include extensive jaguar habitat in the Sierra Bacatete, southwest of our reserve. Other partners on both sides of the border include the Cuenca Los Ojos Foundation, with a large complex of ranches in Sonora, and the Sky Island Alliance, which endeavors to protect the identified strategic corridor for jaguars through collaboration with regional landowners.

The map on this page was created in 2007 at a Wildlands Project workshop, and illustrates the identified corridors that would allow jaguars to disperse to suitable habitat in Arizona and

New Mexico. It is clear that the American Southwest cannot become jaguar country again unless we secure the source populations of Sonora, and allow them to expand naturally and re-colonize former habitat. Alas, the border wall, if built as currently planned (summer 2008), will cut off any possibility for recovery of a breeding jaguar population in the Southwest.

THE NORTHERN JAGUAR RESERVE
 NOW COVERS 70 square miles
 OF CONSISTENTLY ROUGH,
 STEEP TERRAIN, sculpted BY
 HUNDREDS OF CANYONS
 AND CLIFFS.

The jaguars of Sonora have faced many years of persecution. Even when laws have been passed to protect the endangered jaguar, enforcement on the ground has been almost nonexistent, particularly in the more remote areas. The jaguar population in Sonora is estimated at about 150 individuals, but during the past five years, at least 27 kills, including females and their cubs, have been documented. Obviously, it is urgent that we strengthen the conservation activities started by Naturalia and the Northern Jaguar Project if we are to secure a future for el tigre in Sonora, New Mexico, and Arizona. You can help by contacting us at www.naturalia.org.mx and www.northern-jaguarproject.org. **S**

In Search of the Northern Jaguar

When jaguar researcher Carlos López González heard about two 1996 jaguar sightings in southern Arizona, he'd been working in tropical habitats of Mexico. He said, "I was puzzled by the idea: jaguars living in temperate ecosystems?" But little more than a year later, he and wildlife biologist David E. Brown traversed the temperate landscapes of Sonora, searching for a breeding population of jaguar.

In spite of a lack of roads, poor site accessibility, and an antagonism toward jaguar in rural areas, López and Brown canvassed the State of Sonora; they interviewed ranchers, cattle associations, and government officials, looking for proof of jaguar encounters. The survey turned up a total of 128 jaguars killed between 1900 and 2005—including many females and kittens. And, it turned out, they indentified at least three subpopulations of jaguar in Sonora—the Huasabas-Sahuaripa, the Sierra Bacatete-San Javier, and the Quiriego-Sinaloa populations. After discovering the enigmatic Sonoran jaguars, López initiated Naturalia and Northern Jaguar Project's (NJP) interest in creating a reserve.

The northernmost Huasabas-Sahuaripa subpopulation (in the Aros-Yaqui area) became the focus for the Northern Jaguar Reserve now managed by Naturalia and NJP. López, a scientist at the University of Querétaro, has led intensive monitoring efforts there since 1999. He and his team have used tracks and camera-traps, and have hiked through the landscape on a monthly basis, noting tracks and describing the habitats present in the region.

Unfortunately, López says, "Jaguars in the Huasabas-Sahuaripa subpopulation are still being killed. Cougar populations can tolerate about 27% population decrease before beginning to collapse, but jaguars probably have a lower tolerance level of exploitation." Enforcement of the laws protecting endangered species could help keep the species *Panthera onca* from disappearing, he notes, but environmental education and sponsors for jaguar conservation projects will be the key to their survival. **S**



Carlos López riding a horse through the Northern Jaguar Reserve. López led the research that sparked conservation work in that habitat.



Samia Carrillo, aka Esperanza la Tigrera, lived on the Northern Jaguar Reserve for almost three years doing research with Carlos López, and is widely admired by the people of Sahuaripa. Samia is pictured here with a mountain lion she collared on the reserve.



All photos this page: ILJP

Jaguar Conservation

Juan Carlos J. Bravo, Naturalia, A.C.



Landscapes in the Northern Jaguar Reserve, Sonora, including the Zetasora Mountains (far right), and three views of la Ventana rock formation (three images to the left of the Zetasora Mountains).

through Education and Outreach

As Naturalia's representative in northwestern Mexico I have spent the past two and a half years promoting jaguar conservation throughout northern Sonora, as a means to ensure not only the survival of this charismatic species, but also of the wide array of habitats it uses and the many species and processes that depend on these habitats. In this quest, one of nature's constants keeps making itself evident: large predators need large preserved areas for long-term survival.

Naturalia and the Northern Jaguar Project, with support from Defenders of Wildlife, have secured a reserve for jaguars in the municipality of Sahuaripa—the Northern Jaguar Reserve [see “Binational Collaboration,” page 12] but, important as this effort is to our goal of

saving the jaguar from extinction, providing sanctuary would be insufficient if we did nothing else. The area in which the jaguars need free movement cannot be encompassed in any single reserve or protected by any single owner. We have known that from the beginning. Any conservation effort of this scale must have some support from the regional population if it is to be successful, and when success demands literally hundreds of thousands of acres of secure habitat, that support must come from many different sectors of society.

There lies the challenge. How do you garner that critical support for jaguars in a state historically devoted to cattle ranching, an activity long at odds with large carnivores? The answer is not an easy one.

No single action or activity will be enough to effectively transform a whole group of people strongly attached to their life-long practices. Thus, the Naturalia team created a multifaceted outreach and education strategy that we hope will trigger a change in perception among the cattle-growers and general audience of the state. This strategy is already being applied in Sahuaripa and, through our network of allies, all over the state of Sonora.

Reaching Out

Those activities designed to address the ranching community and engage them in thoughtful conversation about jaguar conservation we call “outreach.” Engaging ranch-

ers in positive discussions will bring them closer to understanding the need to coexist peacefully with large carnivores for the good of long-term habitat preservation, which will ultimately benefit them. But it is a hard and slow task. There is no shortcut. Conservationists need to spend time with ranchers, patiently probing for common ground and portraying, in all honesty, the conservation goals, techniques, and vision. So one-on-one informal conversations in past years, along with our innovative *Fotografías para Convivir con Felinos*, or Feline Photo Project, have allowed us to make friends with the majority of the ranchers surrounding our reserve. Begun in late 2006, the project provides economic incentives for tolerating the presence of wild cats on cattle ranches

around the reserve. It also sets the stage for productive relationships and allows discussions to flourish. In 2006 and 2007 the project provided close to 49,500 pesos (\$5,500 USD) in incentives to ranchers, and we intend to at least double that amount this year. Ranchers who sign up for the project sign an agreement to protect all wildlife and accept unannounced visits by the Northern Jaguar Reserve personnel to ensure the agreement is honored. They also attend meetings in which the project and jaguar conservation issues are openly discussed.

As part of Naturalia's larger Carnivore Conservation Initiative, and with the aid of PROFEPA (Mexico's Environmental Attorney General's Office), we have also printed posters and booklets that will be distributed all

over the state, with an emphasis in the mountain regions. These materials provide basic information on the large carnivorous species that live in Sonora, their importance for broader conservation goals, and their current status, as well as telephone numbers for ranchers who would like further information. This is the first stage in a statewide effort to change the common negative perceptions and attitudes towards all large carnivores.

The next stage includes giving workshops for ranchers. We will coordinate with the Unión Ganadera (Cattle Growers Association of Sonora) in eleven priority municipalities of the Sierra Madre to examine and suggest cattle-management techniques that promise to reduce predation by wildlife without threatening



photo by Ian Fritz



photo by Ian Fritz



photo by Ian Fritz



photo by Ian Fritz



photo by Ian Fritz

carnivores. In this effort, the current administration of Unión Ganadera is setting an example, reminding us that unlikely partnerships can do more to benefit both wildlife and ranching communities than any amount of animosity and struggle. As we say in Spanish, “*Es mejor un mal arreglo que un buen pleito*”, (A bad agreement is better than a good fight). And we are doing our best to show them this will not be a bad agreement, but the beginning of a positive relationship to address common concerns.

Naturalia and our allies keep fundraising to support other forms of direct communication with ranchers. We also participate in relevant media, including the regional magazine *El Rancho* and the radio program of the same name, both preferred sources of information for Sonoran ranchers.

Riparian and dryland scenes in the Northern Jaguar Reserve, Sonora.

Environmental Education

It is no secret that children and teachers are avid learners of new concepts, as well as generators of change in small, isolated, or strongly traditional communities. Children in particular have a special role as future stakeholders in events that will shape large carnivore conservation two or three decades from now. To ensure that children and teachers have access to current environmental and conservation issues, we have donated to several schools long-term subscriptions of *Especies*, a bimonthly magazine edited by Naturalia—Mexico’s only nationally distributed medium devoted entirely to conservation and wildlife.

To be in closer touch with students, Naturalia, with the aid of professional environmental educators, developed a workshop designed for children in the third to sixth grades, engaging them in fun activities that simultaneously teach them the importance of biodiversity and the relevance for conservation of the region in which they live.

In September 2008 Naturalia staff began touring the three municipalities where the core of the northern jaguar population lives, visiting elementary schools and providing internet tools for secondary (junior high) schools, as well as providing local teachers with materials and training on regional biodiversity. These workshops focus on jaguar conservation, migratory birds, and local-stewardship pride. The workshops steer students and teachers towards respect for all life forms, engage them emotionally with nature,

and highlight their personal roles in preserving their local environment. In one of our trial workshops children and teachers were moved by the sad story of grizzly and wolf extinctions in Sonora, but recognized there is still time to prevent *el tigre* from heading in the same direction.

In February 2008 we celebrated the completion of the first cycle in our Feline Photo Project at an occasion that married outreach and education. It was a gratifying experience. We printed all the feline pictures obtained in the ranches near the reserve and mounted an exhibit at the teacher’s center in Sahuaripa, an office that coordinates education in the region, where teachers have always supported our initiatives. After the workshop the children were asked to select their favorite among the pictures, not knowing they would be earning the ranchers an extra incentive. The children, quickly absorbing the value of wildlife conservation, were more than happy to run around marking the images of cats. Surprisingly to us, the children’s favorite photo was not the staff’s favorite (a cougar growling at the camera), but a young cougar drinking water in a tender, almost cute, position. Good for the kids, and good for Don Ricardo, the rancher who earned enough from the “cute cougar” and other pictures to more than compensate for a few head of cattle lost to predators! And good for the jaguars, cougars, ocelots, and bobcats that will survive the presence of humans in their habitat, if we can only broaden the perspective of enough people to get them to support wildlife conservation. **S**



IMP

Mi nombre es Diego Ezrré Romero y mi esposa es Valentina Herrán Gaxiola. Somos propietarios del Rancho el Calabozo, en Sahuaripa, Sonora, México. Somos vecinos de la reserva de Naturalia A.C., hogar del jaguar sonorense. Nuestra familia por generaciones hemos sido rancheros en esa zona. Nos da mucho gusto saber que hay personas que se interesan por la naturaleza.

Pensamos que podemos trabajar juntos ganaderos y ecologistas porque hay muchas cosas importantes que hacer. En aprovechamiento de nuestros recursos naturales, logrando un equilibrio entre ganadería y la preservación de todas las especies nativas incluyendo al jaguar.

Caminemos juntos jaguar y ganaderos.

My name is Diego Ezrré Romero and my wife is Valentina Herrán Gaxiola. We are owners of the Rancho el Calabozo, in the municipio of Sahuaripa, Sonora, Mexico. We are neighbors to the Northern Jaguar Reserve, some of the best habitat for the Sonoran jaguar. Our family has ranched in this area for generations. We are very happy to know that there are people who are interested in nature.

We think that ranchers and ecologists can work together because there are many important things that need to be done. We can make use of our natural resources and achieve a balance between livestock ranching and the preservation of all native species, including the jaguar.

Jaguar and ranchers will walk together

Diego Ezrré Romero, Rancho el Calabozo

QUICK GUIDE TO SOME OF MEXICO’S AGENCIES INVOLVED IN ENVIRONMENTAL ISSUES

FEDERAL AGENCIES

SEMARNAT: Secretaría del Medio Ambiente y Recursos Naturales (Ministry of Environment and Natural Resources)

Agencies housed within SEMARNAT:

CONANP: Comisión Nacional de Áreas Naturales Protegidas (National Commission for Protected Areas); oversees all federal reserves.

CONAFOR: Comisión Nacional Forestal (National Commission for Forests); like the U.S. Forest Service but with no owned lands. Oversees economic incentives for UMAS (Unidades de Manejo de Vida Silvestre [Units for Wildlife Management]).

CONAGUA: Comisión Nacional del Agua (National Water Commission); oversees all water management issues.

PROFEPA: Procuraduría Federal de Protección al Ambiente (Environmental Attorney General’s Office); federal law enforcement for environmental issues, with no police attributes. PROFEPA has inspectors that can act in cases of infringement of environmental law; they cannot make arrests or be armed, but can work in a coordinated fashion with regular police forces and present legal reports.

SAGARPA: Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación (Ministry of Agriculture, Ranching, Rural Development, Fishing and Food); in charge of regulating and supporting ranching and agriculture.

CDI: Comisión para el Desarrollo de los Pueblos Indígenas (Commission for Indigenous People’s Development), formerly known as INI (Instituto Nacional Indigenista).

STATE OF SONORA AGENCIES

SIDUR: Secretaría de Infraestructura y Desarrollo Urbano (Sonora’s Ministry of Infrastructure and Urban Development), formerly known as **SIDUE** (Secretaría de Desarrollo Urbano y Ecología; Ministry of Urban Development and Ecology); oversees the state’s environmental office (CEDES).

CEDES: Comisión de Ecología y Desarrollo Sustentable del Estado de Sonora (Sonora’s Ecology and Sustainable Development Commission), formerly known as **IMADES** (Instituto del Medio Ambiente y Desarrollo Sustentable del Estado de Sonora).

SAGARHPA: Secretaría de Agricultura, Ganadería, Recursos Hidráulicos y Pesca (Ministry of Agriculture, Ranching, Water Resources and Fishing); Sonora’s counterpart to the federal **SAGARPA** and referred to, familiarly, as SAGARPita.

NATURAL PROTECTED AREAS OF MEXICO

Presented in the order of size of area protected. (Figures are being continually updated, and may have changed since we went to print.)

From CONANP’s website, http://www.conanp.gob.mx/q_anp.html

Reservas de la Biosfera (RB), Biosphere Reserves (37 in Mexico, covering 11,581,344 hectares/44,715 square miles) Areas that represent one or more ecosystems not altered by human action, or that need to be preserved and restored, inhabited by species representative of the nation’s biodiversity, including those considered endemic or threatened by extinction.

Áreas de Protección de Flora y Fauna (APFF), Areas of Flora and Fauna Protection (29 in Mexico, covering 6,259,861 hectares/24,169 square miles) Protected areas established in places that hold large habitats for the existence, preservation, and development of wild flora and fauna.

Áreas de Protección de Recursos Naturales (APRN), Areas of Natural Resources Protection (6 in Mexico, covering 3,350,654 hectares/12,937 square miles) Areas designated for the preservation and protection of soil, watersheds, water, and natural resources in general, located in forest lands well suited for forestry purposes.

Parques Nacionales (PN), National Parks (68 in Mexico, covering 1,505,643 hectares/5,813 square miles) Areas with one or more ecosystems that are distinguished by their scenic beauty, their scientific, educational, or recreational value, their historical value, the existence of flora and fauna, their aptness for tourism development, or for similar reasons of general interest.

Monumentos Naturales (MN), Natural Monuments (4 in Mexico, covering 14,093 hectares/523 square miles) Areas placed under a regime of absolute protection because they contain one or several natural elements of unique character or aesthetic, historical, or scientific value. They generally lack the ecosystem variety or area necessary to be included in other management categories.

Santuarios (S), Sanctuaries (17 in Mexico, covering 689 hectares/2.7 square miles) Areas established in land characterized by a considerable richness of flora or fauna, or for the presence of species, subspecies, or habitat of highly restricted distribution.

Go CATS!

University of Arizona and the Real “Wildcats”

By **Lisa Haynes** Research Specialist and
Melanie Culver, Ph.D., Assistant Professor
University of Arizona Wild Cat Research
and Conservation Unit, School of Natural Resources

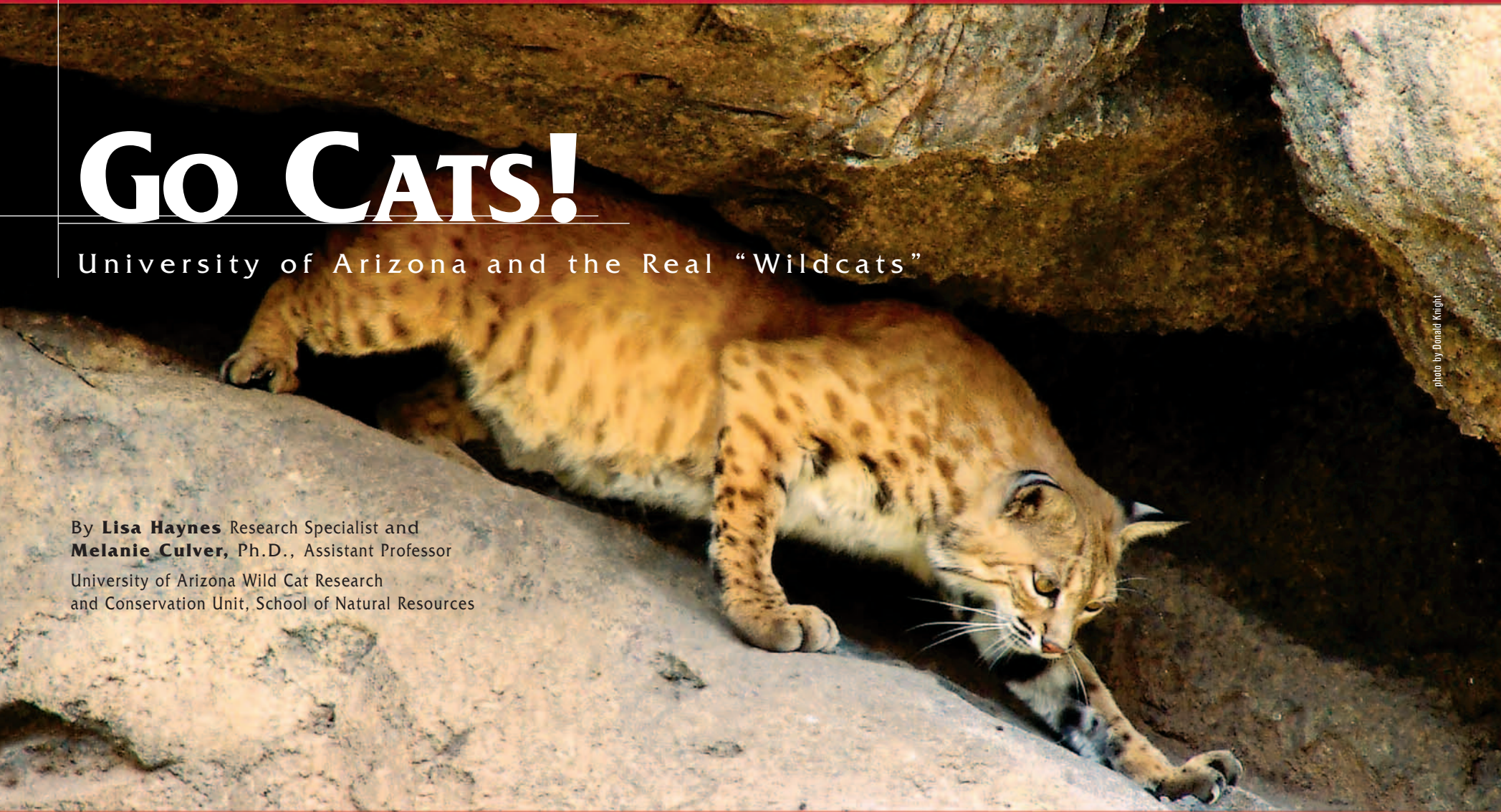


photo by Donald Knight

Bobcat



photo by Donald Knight

Mountain Lion



photo by Donald Knight

Ocelot

While the jaguar commands due attention in the borderlands and Mexico, a group of faculty and staff at University of Arizona (UA) are focused on research and conservation of wild cats worldwide. In the UA's School of Natural Resources, we are initiating a Wild Cat Research and Conservation Unit to provide full-service support and

training for students and biologists around the world that will allow them to conduct rigorous, science-based studies of wild cats (felids). Our mission is to understand and to conserve the world's wild cats, their prey, and their habitats in perpetuity, while promoting vibrant human communities nested within biologically rich and life-supporting

ecosystems. The program will also emphasize cultural and sociological skills so that these biologists can become catalysts for tangible conservation of wild cats and their habitats. As a highly collaborative and integrative group, we recognize that positive interactions with all involved groups fosters long-term success.

There are 36 recognized species of wild cats around the world. Most people are aware of the charismatic large cat species, such as the tiger, lion, leopard, cheetah (*Acinonyx jubatus*), and jaguar; however, most of the remaining 31 species are lesser celebrities. Most are medium to small cats about which little is known. All wild



UA Wild Cat collection

cats face serious threats from human activities—some species are nearing the point of extinction.

On the local front, bobcats and mountain lions (also called cougars, panthers, and pumas) play an integral role in our Sonoran Desert ecosystem, but a burgeoning human population and urbanization around Tucson in recent decades has put seri-

**Bobcats are living,
and often raising kittens,
in close proximity
to human dwellings.**



ous pressure on their habitat. Given these concerns, the UA has initiated a long-term research and monitoring project for both bobcats and mountain lions in the Tucson area. One study, funded by the Arizona Game and Fish Department's Heritage Fund, is looking at bobcat distribution in Tucson, integrating ecology and conservation genetics, as well as public outreach.

Anecdotally, bobcats seem to be thriving in the urban interface of Tucson where they find prey, water, and cover associated with landscaping and human structures adjacent to native desert habitat. Bobcats are living, and often raising kittens, in close proximity to human dwellings; they are literally lounging on the patio furniture, carousing on rooftops, and drinking from the Jacuzzi! On the other hand, past studies have found that bobcats are sensitive to urbanization, especially the effects of population fragmentation due to roads.

Above: two bobcat cubs. Left: bobcat sitting on a wall.

So, our first objective is to evaluate the patterns of gene frequencies in populations across the Tucson basin to identify potential barriers to their movement. Secondly, the study will provide information on the distribution of bobcats in the Tucson basin. In fact, we will be soliciting photographs of backyard bobcats from the public, which not only provides us with data, but also creates opportunities to involve and educate the public—to discuss impacts of urbanization on bobcats, mountain lions, and other wildlife, and to reduce or eliminate conflicts with wildlife.

Another project, supported by Pima County's Starr Pass Wildlife Enhancement Fund, is studying mountain lions and bobcats in a small, isolated mountain range on the west side of the city—the Tucson Mountains. We are monitoring lions and bobcats within this "sky island" (and in surrounding underpasses, culverts, bridges, and CAP crossings to identify wildlife corridors) using noninvasive techniques such as tracking, DNA analysis of felid scat (feces), and infrared-triggered "sensor" cameras. Mountain lions require large, interconnected, wild landscapes to survive, so protecting existing wildlife corridors and creating or retrofitting safe passages across or under our transportation grid will be critical. With this project we are training volunteers from the public to check cameras and collect scat. We want to involve citizens as much as possible.

Given our goal of public involvement coupled with reliable science, the Arizona-Sonora Desert Museum is an ideal partner! With the assistance of Museum docents, especially Richard Maxwell, we are placing sensor cameras near the Museum grounds—a strategic place with respect to potential wildlife corridors in the Tucson Mountains.

In other projects, a Ph.D. student in our department is winding up an intensive GPS-telemetry (radio-collar) study of mountain lions in other mountain ranges in the Tucson area, and we are gearing up for more intensive telemetry and genetic studies of bobcats and mountain lions. We also have mountain lion



UA Wild Cat collection



Above: Installing a sensor camera near the Museum.
Left to right: Museum docent and Wild Cat volunteer
Richard Maxwell with Lisa Haynes and
George Montgomery.
Left: ocelot.
Right: female bobcat with two young cubs.



UA Wild Cat collection

monitoring projects in many National Parks and National Wildlife Refuges around Arizona.

Finally, we collaborate with all of the researchers and conservationists working with jaguars and ocelots (and mountain lions and bobcats!) in northern Mexico and southern Arizona, and participate in the USFWS Ocelot Recovery Team. We are looking forward to expanding our efforts to both the little-known and endangered cats around the world, including a study of caracals (*Caracal caracal*) in Namibia by one of our department's newest Ph.D. students. As Wilbur the UA "Wildcat" would say, "GO CATS!"



Why

We Have Jaguars in *Mexico*



Not in the *United States*

Diana Hadley
Arizona State Museum and Northern Jaguar Project

Audiences at Northern Jaguar Project talks often express amazement that jaguars, the preeminent jungle cat in the Western Hemisphere, occupy desert and semi-desert territory in northern Mexico. They are even more surprised to hear that a hundred years ago jaguar territory extended along our entire southern tier of states, and that they have been recorded as far north as southern Colorado and the Grand Canyon. Then they ponder the crucial question: if jaguars ranged so recently from Florida to California and still occupy

habitat similar to that in Arizona and New Mexico just south of the U.S.-Mexico border, why do they no longer live in the United States?

Three possible reasons come to mind. First, south of the border, the habitat is more rugged and provides a better prey base, making it more compatible with jaguars; human population density is lower and infrastructure less developed. Second, predator control programs in Mexico have been less efficient. Third, land-ownership and land-holding patterns favor wildlife to a greater degree in Mexico than in the United States, with more compact villages and less urban sprawl. I would like to discuss the latter two points, both of which shed light on historical and cultural factors that have impacted wildlife populations, including jaguars.



Above: Bounty hunters, Tombstone, 1910. Bancroft Library, Berkeley, CA.
Far left: Rancho los Pavos.



Right: Lee Brothers of Cochise County with jaguar trophies taken in Sonora or Sinaloa. Arizona Historical Society.
Far right: remote southern Arizona canyon traveled by jaguar.



The Rio Aros flows through remote, rugged terrain in Sonora where the Northern Jaguar Reserve helps protect a jaguar population.

Arizona did have jaguars (and maybe still does).

Even with recent camera trapping and tracking projects, our knowledge of jaguar distribution in this country is scant, having come from sporadic observations and incomplete records. Nevertheless, these records do indicate that jaguars occupied territories north of the present international boundary in the states that share a

border with Mexico and east to Florida. In Arizona, jaguars persisted well into the twentieth century, as indicated by a list of 69 random sightings between 1848 and 1998 compiled by the Arizona Game and Fish Department.

The Game and Fish sightings are categorized as Class A—confirmed sightings (photo, carcass, or pelt), or Class B—reliable sightings (more than one observer or expert observer but no physical evidence), or as unreliable. On the list, fifteen sightings were confirmed through

mortalities, seven by pelts or skulls, twelve were live observations, and two were from confirmed tracks. Although sighting locations are listed only by county, they nevertheless indicate a widespread, if thin, distribution throughout Arizona. The majority occurred in border counties: Santa Cruz County (11), Cochise County (10), and Pima County (10). Farther north there were two in Coconino County and one each in Gila, Apache, Yavapai, and Navajo counties. Although the sex of the jaguars is not usually included in the records, sightings included a female and two kittens at the Grand Canyon in 1889 and again in 1900, and a female and young killed in Coconino County in 1900.

A decadal analysis of the Game and Fish records reveals a surprising pattern, and a possible resurgence of jaguars in recent decades. Between 1899 and 1910 there were four recorded sightings; the decades of the 1910s and 1920s, three sightings each; the 1930s, only one sighting; the 1940s, two; the 1950s, three; the 1960s, four; the 1970s, only one; the 1980s, four; and then in the 1990s, *eleven!* Had people become more observant and willing to make reports, were jaguar numbers increasing through northward migration from Mexico, or were camera traps finding resident jaguars that had previously remained secretive?

Prior to 1988, all of the confirmed sightings were mortalities or were confirmed through body parts. One of the more recent sightings involved a notorious arrest for poaching. Specialists believe that these records, particularly those that note the presence of kittens, indicate

an over-exploited resident jaguar population, rather than random immigration from Mexico.

So, what happened to Arizona's jaguars?

When the first wave of American settlers arrived in Arizona Territory, they were a tough and hungry bunch—miners, cattlemen, and soldiers—mostly single men in hostile Apache country. In the years before large-scale livestock importation, “market hunters” provided most of the territory’s meat, delivering heaping wagonloads of deer (*Odocoileus sp.*), pronghorn (*Antilocapra americana*), and bighorn sheep (*Ovis canadensis*) carcasses to mining camps like Tombstone or Bisbee. Had game regulations existed, they wouldn’t have been enforceable. As a result, Arizona’s native prey base for predators became severely depleted. After the completion of the railroad in 1881, tightly packed cattle cars deposited thousands of head of livestock on Arizona ranges. By the mid-1890s, Arizona Territory had an estimated 1.5 million head of cattle, plus sheep, mohair goats, and free-ranging swine. During the



Left: Colonel William Greene's ranch manager in jaguar chaps. Tombstone Courthouse State Park. Arizona Historical Society. Above: prime jaguar habitat in southern Arizona, Atascosa Mountains.

hunting extravaganza and the cattle boom, three prolonged droughts further reduced the native prey base. For predators, however, reliance on the easy new livestock prey proved to be dangerous.

In the United States, control of predators and other “nuisance animals” has been a major preoccupation for individuals and agencies involved with agriculture and animal husbandry. Although jaguars do not play a role in predator-control information, the widespread and efficient assault

on all wild carnivores undoubtedly impacted jaguar distribution and movement.

In Arizona, during the territorial period, livestock owners performed their own predator control—hunting, trapping and poisoning predators, and occasionally keeping fulltime professional trappers on the ranch payroll. Owners of large ranches made cash payments to hunters and trappers for physical proof that a predator had been killed, a practice later adopted by governmental agencies and livestock organizations.



photo by Ian Fritz

Canyon in the Northern Jaguar Reserve at Duberal.

Arizona's territorial legislature passed its first predator bounty act in 1893, enabling counties to appropriate money for bounty payments. Other organizations, often with overlapping jurisdictions, adopted the bounty system, offering a graduated schedule of payments for target species when proof was provided in the form of an entire skin, a scalp with two ears, or a set of paws. In some locations, counties, livestock sanitary boards, cattle growers associations, sheep raisers associations, and mohair growers associations paid bounties, some of them continuing the practice until the early 1930s. Records, if and when kept, were random. The system had obvi-

ous flaws, including fraud in the form of double or triple dipping, when trappers presented their proof of one kill to several organizations. After statehood in 1912, Arizona's legislature continued bounty payments on target species. In 1971 Arizona was the last state in the country to repeal bounty on mountain lions.

Federal agencies were equally active in predator control, focusing more on trapping and poisoning, although some agents hunted with hounds. In 1885, the United States Biological Survey, a new research branch of the United States Department of Agriculture (USDA), began the first federal rodent and predator control programs. The Lacey Act of 1900, which prohibited importation and interstate transfer of wildlife, gave the Biological Survey regulatory powers. The Biological Survey underwent a series of confusing changes in both name and department, appearing as PARC (Predator and Rodent Control) and later ADC (Animal Damage Control) as part of the U.S. Fish and Wildlife Service. In 1998, the agency resumed the name Biological Survey, once again within the USDA. Despite name and department changes, predator control remained a primary obligation. During the agency's early years, agents applied their experience with rodent control to predators, using poisons, such as strychnine and later the lethal rat poison Compound 1080, to kill carnivores—a method that is particularly harmful to non-target species. Although we have no records of jaguar kills, the agency's efficiency in controlling predators in general undoubtedly had impacts on jaguar populations.

In Mexico, predator control has been less systematic and widespread, more often conducted by livestock raisers than by agencies. In addition, rural residents frequently do not have the financial means to acquire firearms. Nonetheless, predator control has been practiced for centuries south of the border. Shortly after the Gadsden Purchase in 1854, members of the international boundary survey party observed Mexican ranchers near the new border lacing livestock carcasses with strychnine. As late as the 1990s, *tigreros* continued to hunt jaguars in the mountains of Sonora. Riding mules and accompanied by packs of hounds, *tigreros* used calling devices made from the horns of bulls or from gourds to call in their prey. Once the jaguar was killed, they rode to ranches in the area to display the pelt and solicit bounty payments.

Another cultural factor conducive to the elimination of jaguar populations in the United States is our pattern of settlement and land use. Between 1862 and 1916, Congress passed a series of homestead and preemption laws, all of which had the common objective of generating westward movement, populating the wilderness, and making property ownership available at a very low cost to the average American citizen—all commendable, democratic, nationalistic goals. Requirements for title to land included residence on a claim for five years, construction of improvements of a minimum value, and payment of a small filing fee. The laws were designed to transfer land from the public domain to *bona fide* settlers—families that

would reside on the land, render it productive through agricultural development, and create communities. Early homestead acts provided for claims of up to 160 acres, but later acts increased the acreage because agriculture could not be practiced on small acreage in arid areas. In addition to homesteads, individuals and, in this case, corporations could acquire land from the public domain through cash sale, public land scrip, purchase of railroad lieu lands, and, after 1912, purchase of state land. By the 1920s a homestead boom had taken place near the border in southern Arizona, creating a pattern of dispersed settlement. The small farmers and ranchers who homesteaded were often poor; most were hostile to predators; and many practiced trapping, supplementing their small incomes through the sale of pelts.

In contrast, patterns of land ownership in Mexico favored large tracts of land. The government of Spain, and Mexico after independence in 1821, issued large grants of vacant land to prominent, well-established citizens—mostly stock raisers—who could demonstrate the financial capacity to render the land productive through the importation of livestock and the construction of wells, irrigation ditches, corrals, and simple housing for the small number of *vaqueros* required to tend the cattle. Grants to raise *ganado mayor* (large livestock, i.e., cattle and horses) were for four *sitios*, a *sitio* being a square league, equivalent to 4,316.32 acres. Thus, stock-raisers received grants for more than 17,000 acres. Sometimes, as in the case of the Babocómari grant, the Elías family's grant in the

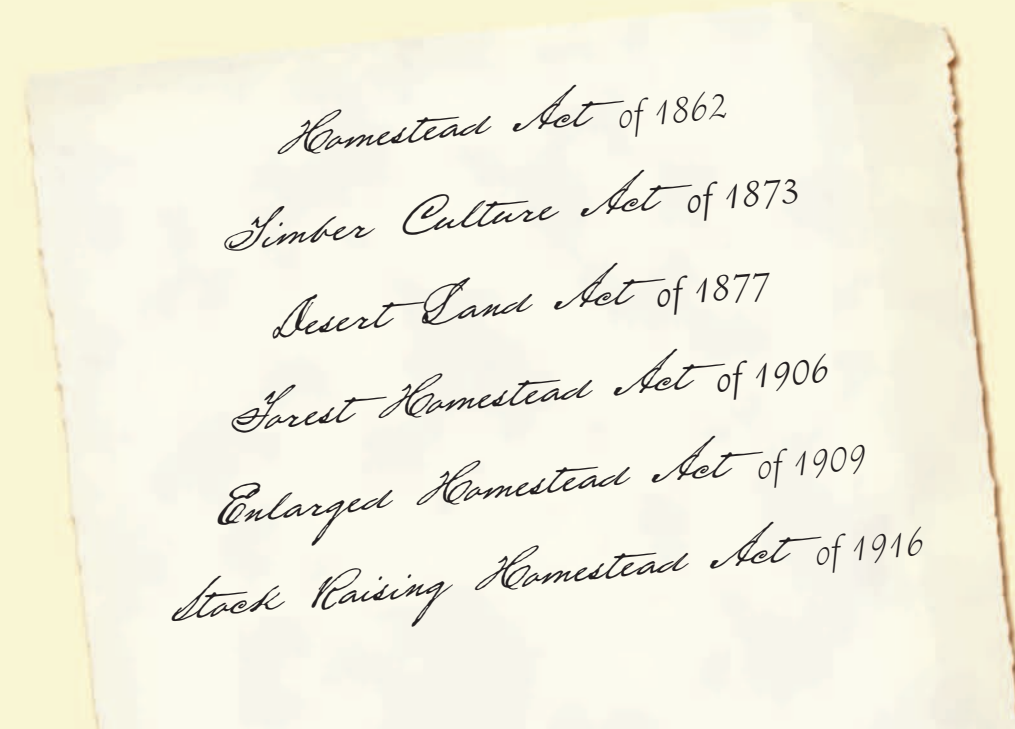
Arizona portion of the San Pedro River watershed, members of a single family joined together to receive two or more adjacent grants, making the holding even larger. The Spanish and Mexican system of issuing land grants had approximately the same set of goals as the United States homestead system—moving a population to the margins of settlement, protecting the frontier from hostile Indians, extending the “civilized world.”



photo by Amy Laska

Atascosa Mountains of southern Arizona.

Today in Sonora and other northern Mexican states, ranches are large and have small human populations, despite agrarian reform laws passed after the Mexican Revolution. In the area of the Northern Jaguar Reserve (Aros-Yaqui area) in the municipio of Sahuaripa, for example, the average rural landholding is more than 10,000 acres. Most ranches have non-resident owners, and their *vaqueros* occupy rustic housing, without utilities, on a part-time basis. Although the human imprint is present, it is much less evident than north of the border—a situation that has favored the persistence of jaguars and other wildlife. ■



The Borderlands Jaguar Detection Project

Cameras, Cats, and Cooperative Conservation

The relentless barking of the hounds announced they had their quarry at bay. After a long, hard climb up the steep, brushy mountainside, Anna, Matt Colvin, and I finally arrived at the source of the excitement. Staring up into the branches of a large alligator juniper, we did not initially see the well-camouflaged animal. Finally, our eyes focused on a magnificent jaguar. Fortunately, I always carry a video camera in a cante pack tied to the back of my saddle, and we were able to document this big cat. This life-changing event took place on August 31, 1996, in the Baboquivari Mountains of southern Arizona.

The jaguar is perhaps the most majestic and charismatic mammal in the state of Arizona. Although jaguars may not have been abundant in the Southwest in historic times, there was probably a small resident breeding population, as evidenced by the record of cats killed from 1900 through 1995, twenty-five of which were identified by gender, with eighteen males and seven females, including three cubs.

By Jack Childs, Anna Mary Childs, and Emil McCain, Borderlands Jaguar Detection Project

Left: Jaguar sighted in 1996 by the Jack Childs and Matt Colvin hunting party – Baboquivari Mountains, Arizona.

Following our 1996 jaguar sighting and another sighting that same year by Warner Glenn, the Arizona Game and Fish Department recognized the need for new jaguar conservation strategies. Working in conjunction with the New Mexico Department of Game and Fish, they created the Arizona-New Mexico Jaguar Conservation Team (Jag Team) in 1997. This team of state and federal wildlife and land-management agencies, university biologists, conservation groups, local landowners, ranchers, and concerned citizens collaborate in State and locally led conservation management of this endangered species. The team meets two to four times annually to compile recent observations and information pertaining to jaguars and to develop adaptive management strategies.

In March, 2001, with help from the Jag Team and a small grant from the Wildlife Conservation Society, Anna and I founded The Borderlands Jaguar Detection Project. We wanted to determine whether jaguars were residents here or dispersing immigrants from Mexico and, if residents, the size of their home range. We needed to learn about habitat requirements, major prey species, and whether or not this species has a viable breeding population in Arizona.

Focusing on major travel routes and natural funnels through areas of core habitat, we set out automatic trail cameras in the mountains of southeastern Arizona. We established our surveys in areas with a high density of mountain lion sign, since we suspected jaguars would use similar

habitats and travel corridors as mountain lions. In December 2001, one of the trail cameras snapped our first jaguar portrait—a three- to five-year-old male we called “Macho A”—*macho* being Spanish for “male.” We were thrilled! But progress was slow; it was 20 months before Macho A again walked in front of our cameras. The amount of jaguar data we were gathering those first few years was discouraging, with a photo detection rate of 0.2 jaguars per hundred camera nights as compared to a rate of 3 per hundred camera nights for mountain lions.



Macho A, borderlands jaguar, 2004, Coronado National Forest, Arizona.

Jaguar habitat in the Arizona borderlands.



photo by Susan Morse

A Shot in the Arm

In June of 2004 a graduate student from Humboldt State University, Emil McCain, joined the project. With several years of experience in jaguar research in Costa Rica and Mexico, as well as exceptional tracking skills, Emil soon increased the number of our jaguar camera captures—greatly. We now have more than 20,000 images of twenty-five local wildlife species, including seventy images of at least two different jaguars.

Emil brought a science background and strong field experience, which complemented Jack's background as a land surveyor and his knowledge of mountain lions in the borderlands. Together they combined modern science with traditional tracking skills to study and conserve this elusive cat. As the project grew, more advisors and partners became involved, and many of them joined the Jag Team's Research Committee, which Emil and Jack now chair. Since our first sighting in August of 1996, we had hoped for another appearance of "our" Baboquivari jaguar. We heard reports of jaguar sightings in the area, one of which

was in the Cerro Colorado Mountains to the east of the Baboquivari Mountains, but no confirmation as to that animal's identity. There was also a rumor that a trapper had illegally killed a jaguar, but this, too, could not be verified. We continued to hope. Then, shortly after Emil joined the team, he photographed an adult male jaguar that we named Macho B. You can imagine our delight when we compared spot patterns on Macho B's right side with the video from our encounter on the mountain and discovered that he was our handsome Baboquivari jaguar. Since this discovery, we have learned many things about Macho B.

Macho B has remained in the study area, crossing back and forth between Arizona and Sonora since 1996. When we first saw him that year, he was fully grown with an estimated age of two to three years. We have subsequently photographed him over fifty times, covering a minimum observed range of 1,359 square kilometers (525 square miles). Macho B was last photographed in July of 2007; he would have been thirteen to fourteen years of age at that time—a venerable old cat. A jaguar's life span in the wild typically runs twelve to sixteen years.

Macho A was at least six years old when last documented in 2004. Around that same time two photos were taken of the left profile of a so-far unidentified jaguar. By comparing spots pat-



photo by Emil McCain

Upper left: Emil and Jack install a new trail-camera monitoring station in the mountains of southern Arizona. Above: Female jaguar on Rancho Los Pavos, 2003, before it became Northern Jaguar Reserve. Right: Emil documenting Macho B tracks. Below: Macho B - 50 miles north of U.S.-Mexico border.



photo by Susan Morse



photo by Janey Brown B.J.P.



Left: Emil and Jack search for tracks where Macho B crossed the border fence, heading south into Mexico.

terns we know it is not Macho B; however, there are no left-side profile photos of Macho A for comparison. Therefore, although we cannot rule out that this unidentified animal might

be Macho A, these photographs could represent a third individual.

In addition to photographing jaguars, our cameras teach us invaluable lessons about the ecology of the borderlands region. We have photographed twenty-five other wildlife species. With this type of camera monitoring, we are able to detect trends and fluctuations in the populations of non-target species. Currently our data, coupled with records from the Arizona Game and Fish Department, confirm an abundance of natural prey in the area—Coues white-tail deer (*Odocoileus virginianus couesi*), desert mule deer (*O. hemionus crooki*), javelina, white-nosed coati (*Nasua narica*), three lagomorphs (rabbits or hares), and four skunk species. This abundant prey base is sustaining a high density of mountain lions, as well as an abundance of bobcats, coyotes (*Canis latrans*), foxes, and black bears (*Ursus americanus*). The landscape of the borderlands, in its present con-

dition, is capable of supporting jaguars if we can somehow manage to preserve our remaining open spaces. The diversity and numbers of wildlife species recorded by our cameras testify to improved land management practices being carried out here by ranchers and various governmental agencies.

A Hand from the Ranch, etc.

In order to install cameras in the best potential jaguar pathways, we had to approach several local ranchers for permission to cross or set up on their properties. The first reaction of Charley and Mary Miller, owners of the Elkhorn Ranch, was one of concern. Their ranch spreads through the mountain range where we photographed the original Baboquivari jaguar in 1996. They wondered what impact the presence of this mega-predator would have on their livelihood. They worried about livestock depredation and how the sighting might affect the regulatory environment of the area. But Charley recalls, "The basis for our cooperation in Jack's project was science. What is the jaguar doing out here? Where does it travel? The sighting



photo by Emil McCain



Top: Macho B. Above: Cleaning the lens on one of 50 trail cameras along the U.S./Mexico Border. Left: Documenting a fresh jaguar track in the Coronado National Forest, Arizona.



photo by Emil McCain



Right: Adult male, Macho B in southern Arizona.

photo by Emil McCain



Left: Jaguar habitat in the Atascosa Mountains of southern Arizona.

was indisputable, so we reasoned that additional knowledge of the animal's routes and habits would benefit everyone."

The Millers granted us permission to place our first cameras on the Elkhorn in October of 1997. Ross and Susan Humphreys soon followed suit and gave us access to their Baboquivari Ranch in Thomas Canyon. Later, we were granted permission to expand the Altar Valley portion of the study to include John and Pat King's Anvil Ranch.

A year before our initial encounter with Macho B in the Baboquivari range, the Millers, Humphreys, and Kings were already part of a group of landowners and resource managers who joined forces to form the Altar Valley Conservation Alliance, a nonprofit conservation group focusing on stewardship of the Altar Valley—a watershed roughly the size of Yosemite National Park. This area is located an hour southwest of the Tucson metropolitan region and extends south to the U.S.-Mexico border.

The Altar Valley Conservation Alliance and other similar groups play an important and vital role in keeping large blocks of country open for wildlife habitat.

The Buenos Aires National Wildlife Refuge issued us a permit to include all refuge lands in

our study, as did the U. S. Fish and Wildlife Service, the Coronado National Forest, and the Arizona Game & Fish Department for lands they manage. To complete our surveillance of potentially suitable jaguar habitat in the Altar Valley, we now have cameras on rangelands managed by the Marley Cattle Company, the San Juan Ranch, and Pima County to the west of the wildlife refuge, and to the south on the Sierra Vista Ranch. Much of this cooperation was facilitated

Our study has produced continuous jaguar sightings of at least two, possibly three, individuals from 2001 to 2007.

by Arizona Game and Fish Department unit managers, Mike Hollister and Gabriel Paz, who also regularly participate in the field work.

The Bell family of Nogales, owners of the ZZ Cattle Company and Bear Valley Cooperative, made it possible for us to expand our efforts west to Interstate 19. They furnished us with a modern house that served as a field station, home, and office for researchers. Dan and Scott Bell contributed technical and logistical support, and Scott participated in the day to day

field work. We are now working in the Chiricahua Mountains in southeastern Arizona with the avid support of ranchers Joe and Valer Austin.

The information gained in our jaguar detection project is shaping a new understanding of the jaguar at the arid northern extent of its range. Our findings, along with those of others, suggest the persistence of a thinly distributed and wide-ranging jaguar population from southern Arizona and New Mexico south through the mountains of eastern Sonora, Mexico. Our study has produced continuous jaguar sightings of at least two, possibly three, individuals from 2001 to 2007. These sightings confirm a need for more information on the current bioregional population, movement patterns, habitat use, and other natural history requirements of jaguar. The identification of core and connective habitats, including cross-border linkages, is essential if conservation actions are to make a difference in sustaining this population.

Obviously, the work of the Borderlands Jaguar Detection Project could not be accomplished without the cooperation and help of local landowners, state and federal land management and wildlife management agencies, and citizen volunteers. (Three of our dedicated field volunteers—Janay Brun of Arivaca, Keith Shallcross of Douglas, and Steve Bless of Tucson—deserve special recognition). We are grateful for and appreciate each individual who helps us shed light on the role of the jaguar along the U.S.-Mexico border.



Above: Emil and Jack interpret fresh tracks near the U.S./Mexico Border. Above right: Macho B in an alligator juniper tree, Baboquivari Mountains, 1996.

Below: In Macho B's habitat, southern Arizona. Far right: Macho B track. Bottom right: Changing film and batteries on a remote trail camera in southern Arizona.



photo by Emil McCann

Above: Macho B in 2004. Left: Anna, Jack, and Emil hike into a remote camera site in the Atascosa Mountains.



photo by Susan Morse



photo by Susan Morse



photo by Amy Leist

A Scent Message

from an Arizona Jaguar



Macho B claw-raking a mesquite tree.

By Emil B. McCain, Borderlands Jaguar Detection Project

All photos by Emil B. McCain, unless otherwise noted.

That late March day was cool and rainy. Sue, Jack, and I were checking our trail cameras in the Tumacacori Mountains, and the vast expanse and diversity of habitats we passed through were impressive. Eroded canyon rims around us offered ideal refugia for secretive cats, while the oak and acacia covered-slopes presented ideal hunting grounds. Sue said, “Good God, there’s a lot of prey!” The canyon bottoms here are often used as travel routes, and we were seeing puma and bobcat tracks, scats and scrapes.

Jack Childs and his wife, Anna Mary, had already videotaped a wild jaguar in the Baboquivari Mountains of southern Arizona in 1996—a stirring event that led to the formation of the Borderlands Jaguar Detection Project [see the article on BJD page 34]. These events turned Jack’s interests towards jaguar research and conservation, which ultimately connected him with me, a wildlife graduate student from Humboldt State University, and nationally recognized naturalist, habitat specialist, and professional tracker Susan Morse, who is based in Vermont. Strong connections between the seasoned houndsman and the field-based biologists were not surprising. Many valuable field experiences and insights fueled mutual respect and a desire to learn from one another.



*Left to right: Fresh claw marks deep in the bark of an Arizona rosewood. Black bear (*Ursus americanus*). Bobcat claw-raking on a juniper log. Mountain lion cheek-rubbing.*

After decades of tracking and research, Sue’s work with cats and bears has led to new approaches in detecting and monitoring the movements of wild felids, focusing on scent-marking behaviors—a subject of great interest for conservation planners looking to identify and preserve core and connective habitats. Conversations with Sue had sparked my interest in the scent-marking secrets of jaguars, and in March of 2007, she visited our project for a week to travel with us through jaguar territory in southern Arizona. We all hoped Sue’s keen observation skills and vast knowledge could help us learn more about jaguars and their conservation needs in Arizona.

Sue briefed us on scent-marking. She explained that when a solitary cat deposits its scent in strategic locations across a vast territory, it is effectively advertising its physical and temporal presence within its habitat, communicating with other cats its social and sexual status—sometimes delivering fair warning to its brethren and potentially avoiding unnecessary physical battles. At other times, posting scent facilitates

the meeting of breeding partners. By scent-marking, a jaguar can claim the extensive home range needed for a prey base and the other resources needed to support it. The upshot was, if we could find signs of repeated jaguar scent-marking in southern Arizona, it would confirm a jaguar had established residency.

All cats have scent glands—including perianal glands, and glands between their toes and on their cheeks, chin, and forehead—with which they can spray, claw, or rub their signature onto an appropriate surface. Also, jaguar mark with urine—a valuable odoriferous communicator that cats can easily spray onto strategically located objects. I needed to learn more about these various forms of chemical communication, and to do that I needed to learn how to predict the strategic locations where cats would likely place their “personal ads.” A good search image for scent-marking includes areas within the topography, at the larger landscape scale, that cats are likely to visit, as well as the specific substrates that best absorb and retain the different forms of scent excretions. For example,

within the travel routes or crossing/convergence zones we had identified, dry oak leaves were a favorite medium for scrapes and urine-marking. Sue correctly predicted that small, spongy pieces of a decaying oak log would be perfect for a puma scrape and singled out a horizontal juniper log claw-raked by a bobcat. “The medium is the message,” Sue smiled.

On another March morning in the Altar Valley, we approached a craggy mountain rising out of the desert floor; giant saguaro, teddy bear cholla, ocotillo, and prickly pear lined the trail, their rugged appearance accentuated by the towering cliffs beyond. Sue was drawn to where two washes came together, unaware that we already had a trail camera there. She stopped dead in her tracks. Her body language spoke for her. The unmistakable *fresh* tracks of a jaguar crossed the soft sand! The cat had come within 20 meters of our camera, but had managed to skirt it. Sue immediately pointed to a mesquite tree overhanging the wash. The underside of the trunk was just the right height and protected from sun and rain—a perfect



Left to right: jaguar. Bobcat urine-spraying. Mountain lion. Borderlands jaguar in Arizona.

place to mark with a cheek-rub or urine spray. The tracks led right under this marking post, but our human noses detected nothing. From here, the prints led up a small ravine, across a steep slope, and onto a trail where another camera was hidden. Sure enough, the digital camera had recorded jaguar, Macho B, at 10:04 P.M. the previous night. What luck!

A few months earlier, this camera with new infra-red video technology had recorded this same jaguar—the same one that Jack had seen eleven years earlier. He had approached a large and conspicuous mesquite, swung his rear end around, lifted his tail, and gave the tree a good urine-squirt before moving on down the trail.

Further up the trail, Sue found another big mesquite tree that stood out from the low brush and cacti around it. A prominent tree like this may act like a visual beacon, drawing cats to it to leave their scent signature and to check if any other cats have recently passed. Upon investigation, we found long, deep scratches marked the vertical trunk, four to five feet off the ground. Could this have been Macho B claw-raking?

For several miles out from the mountain, across the low desert floor, the hard-packed rocky ground resisted tracks, but we were able to make out occasional disturbances or displaced rocks, and when the track crossed a sandy wash our trail was confirmed. Several times the jaguar turned down a wash for several hundred meters, occasionally stopping to roll in the sand. We wondered if this, too, might be some sort of scent-marking behavior. Out in the palo verde, ironwood, cholla, and prickly pear of the Sonoran Desert, the tracks of Macho B led us by a sunbathing Gila monster (*Heloderma suspectum*). Here was a jaguar, some 50 miles north of the Mexican border, within eyesight of the Arizona-Sonora Desert Museum grounds, scent-marking, advertising his residency. Sue pointed out that the cat's "scent-marking repeatedly, in the same places over extended periods, means this is a portion of his home range, and he's trying to communicate with other jaguars!"

Shortly after that March excursion, I aimed a camera at the scratch-marks on that big mesquite tree. In July 2007 it captured video of

old Macho B aggressively claw-raking and cheek-rubbing on the mesquite's rough bark. This video and the one showing him spray-marking constitute significant evidence that Macho B is indeed a resident jaguar, with at least this portion of his home range in the United States!

You could say that Sue's trip was a booming success; we hiked through miles of great and diverse jaguar habitat; we found "smoking-fresh" jaguar tracks and followed them all over the desert; and we recovered new jaguar photographs only hours old—we could still feel Macho B's presence in the air. But our successes did not end there. Sue gave Jack and me a whole new awareness, a new perspective on chemical communications between cats. She, in turn, can now proudly add jaguar to the list of species she presents in her forthcoming books. (These books, now under contract with Princeton University Press, will cover selected species of interest to conservation planners in the United States, including details on how to detect and monitor them.)



Left to right: young mountain lions cheek-rubbing and forehead-rubbing. Ocelot rubbing its mandibular glands. Mountain lion cheek-rubbing. Borderlands jaguar.

Our long-term dataset had already demonstrated that adult jaguars were at least present in Arizona year-round, and for extended periods of time (Macho B used portions of Arizona from

Here was a jaguar, some 50 miles north of the Mexican border, within eyesight of the Arizona-Sonora Desert Museum grounds, scent-marking, advertising his residency.

1996 to 2007). However, with this scent-marking data, there is no question that Macho B is a resident within Arizona, and the implications are huge. This information dispels the widely

accepted assumption that jaguars in southern Arizona are only transient jaguars that occasionally stray north of the border.

Currently, after seven years of field research covering nearly one thousand square miles with up to 55 trail cameras, track and scat transects, and diet/DNA analysis, the Borderlands Jaguar Detection Project has documented at least two and possibly three jaguars in Arizona. In 1996 and 2006, houndsman Warner Glenn photographed two additional jaguars along the Arizona-New Mexico border. There are indeed jaguars in the Southwest, although skeptics have maintained that they were simply wandering on sporadic forays from Mexico.

Unfortunately, significant attention is only afforded to resident species within the United States, and many complicated political issues surround the recovery of endangered species, particularly large carnivores. As a result jaguars have not been considered legitimate for adequate funding for large-scale research. We hope our recent findings will draw new collaborators to the project and open new doors

to funding opportunities that would facilitate the continuation and expansion of our research. So far, we have been able to survey only twelve percent of the potentially suitable jaguar habitat in Arizona, and there is more unstudied territory in New Mexico. We hope to expand our research across the entirety of these areas.

We are still learning, still exploring new country, still hoping to find more jaguars and hoping that those jaguars can continue to thrive in vast wild terrain of the borderlands. Since that week in the field with Sue in 2007, I have viewed the landscapes of southern Arizona in a different light. I can almost hear Sue saying, "Half of tracking is knowing where to look; the other half is looking." I have developed a search image for those strategically located trees that act as "feline bulletin boards," and have since located six more of these special trees in three different mountain ranges throughout southern Arizona. Accordingly, the Borderlands Jaguar Detection Project team has set up six new video cameras to record the posting of any new scent messages. I can hardly wait to see what we get next. ■

Ranching with Jaguar

About a year ago I was honored to be invited to a meeting of the Altar Valley Conservation Alliance, a nonprofit group formed in 1995 by livestock ranchers. They called this meeting because they were interested in the continuing presence of the two jaguars that have been photographed in the region during the last twelve years.

Although they supported the jaguar research and are actively protecting endangered species in the valley, they expressed concern about how the media exposure might affect their way of life and cattle ranching in general. I told them that in my opinion, the jaguars' presence was a good indication that they were keeping the country in good enough condition to support jaguars and other wildlife species. I pointed out that they were developing and maintaining permanent waters, keeping unfragmented wildlife corridors open by not selling the land to developers, and managing their grazing practices to benefit both livestock and wildlife. In my opinion, they can be proud to have a jaguar in their vicinity, and the attention it is receiving worldwide shouldn't hurt them one bit.

Warner Glenn

Manager, Malpai Ranch; Licensed Hunting Guide; and Board Member, Malpai Borderlands Group



Right: This jaguar photo was taken by Warner Glenn in the "Bootheel" area of southwestern New Mexico, on a large privately owned ranch two miles north of the U.S.- Mexico border on February 20, 2006. Hounds bayed the jaguar for a very short time during a mountain lion hunt being conducted on the ranch. Pictures were taken of the cat while the hounds were being led away by the hunters. Warner's daughter, Kelly, and another rider observed the jaguar leaving the area at a slow trot. With the greatest confidence, the cat slowly disappeared into a nearby canyon. Estimated weight: 200 pounds. He appeared to be a very mature male, seven or eight years old, and in excellent condition.

We had a similar concern about media exposure focused on jaguars a dozen years ago in the Arizona-New Mexico borderlands, where another group of ranchers had previously formed the Malpai Borderlands Group. I am proud to be a board member of this group.

As a livestock manager on a working cattle ranch in southeastern Arizona and a hunting guide in that state for many years, I have a great interest in the condition of the land, not only for the forage and water for domestic livestock, but also for wildlife species and healthy wildlife habitat.

I was very fortunate, and surprised, to bay a jaguar on a rock outcrop in the Peloncillo Mountains along the Arizona-New Mexico

border in 1996. Fortunately, I was able to photograph this beautiful animal to document the sighting. Ten years later, in 2006, I was able to photograph another jaguar nearby in the Animas Mountains of southwestern New Mexico under similar circumstances. Both animals were bayed by our hounds while we hunted for mountain lions, and both were allowed to go on their way after I called off the hounds.

These two sightings, ten years apart, were the only times I've ever even come close to seeing a jaguar in the United States during my 65 years of hunting in Arizona and New Mexico. The question I have asked myself is, "Why now, after so many years of hunting these same mountain ranges?"



Jaguar peers down from an alligator juniper tree.



Prime jaguar habitat in southern Arizona, Bartolo Mountains.



I believe there may be several reasons. The jaguar population in northern Mexico may be doing much better than we think. If there are more jaguars, young males would be looking for new territory with an ample prey base. The natural wildlife corridors through the mountain chains leading into the United States from Mexico remain sparsely inhabited by people, by and large, and provide good access to the southwestern United States. Also, in southwestern New Mexico and southeastern Arizona there are large tracts of open, sparsely inhabited terrain due to National Forest, Bureau of Land Management (BLM), and State properties, which allow grazing privileges to the livestock industry. When combined with private

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land owned by ranchers, they constitute a vast expanse of prime wildlife habitat with permanent water and a healthy prey base for a large cat such as the jaguar.

Since the game departments in both Arizona and New Mexico manage the wildlife harvest to control predators in relation to prey-base populations, that means plenty of prey—which should look pretty good to a big cat looking for new territory.

Conditions right now are favorable for wildlife in spite of drought conditions these past several years, mostly due to careful managing of livestock grazing, developing permanent waters, maintaining unfragmented wildlife corridors, and balancing wildlife management. I am optimistic about the survival of jaguar, both in

Mexico and the southwestern United States. It is a big tough cat, and with a little help from us, it will do okay.

On the other hand, the concerns of the Altar Valley Association rancher are real, and we have to be careful in our efforts to protect the jaguar and other threatened species. It is important for the professional conservation community and ranchers to continue to work together. Working with those who live on and make their living from the land will bring mutual success. In the meantime, the future of the jaguar lies primarily in Mexico, where the breeding population is located. If it does not thrive there, we will cease to see jaguar in the United States.



Altar Valley Conservation Alliance

The Altar Valley Conservation Alliance (AVCA) was formed in 1995 by twelve ranching families interested in the health of the watershed, the conservation of its wildlife, and the preservation of family ranching. Since that time, it has incorporated as a nonprofit, and many others have joined the efforts of the Alliance, including public agencies (including a number of federal, state, and county game and resource agencies); and private organizations (including the Desert Museum and Malpai Borderlands Group). The Buenos Aires National Wildlife Refuge also participates, as do hunting groups, hikers, and individuals. AVCA works on habitat restoration and conservation—erosion control along the Altar Wash, the return of natural and prescribed fires, and protection of native species, including six that are threatened or endangered. (Source: Red Lodge Clearinghouse web site, <http://rlch.org/content/view/97/36/>)

Above right: Cerro Colorado Mountains, Arizona.

Malpai Borderlands Group

The Malpai Borderlands Group (MBG) is “a grassroots, landowner-driven nonprofit organization working to implement ecosystem management on nearly one million acres of open-space landscape in southeastern Arizona and southwestern New Mexico. Our goal is to restore and maintain the natural processes to create and protect a healthy, unfragmented landscape to support a diverse, flourishing community of human, plant, and animal life in our borderlands region....Together, we will accomplish this by working to encourage profitable ranching and other traditional livelihoods, which will sustain the open space nature of our land for generations to come.

The Malpai Borderlands area includes portions of the San Bernardino Valley, the Peloncillo Mountains, the Animas Valley, and the Animas Mountains...a diverse area of mountains, canyons, valleys and riparian corridors. Working with landowners, scientists, nongovernmental organizations, and key agencies, MBG funds conservation programs, including land and watershed restoration, endangered species habitat protection, cost-sharing range and water improvements, and conservation easements.” From the MBG website, www.malpaiborderlandsgroup.org



Emil McCain



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Arizona-Sonora Desert Museum

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