

San Diego Zoo Global Institute for Conservation Research

SAVING SPECIES WORLDWIDE



CONSERVATION. IT MEANS THE WORLD TO US.

San Diego Zoo Global represents more than a century of work on behalf of wildlife. At the San Diego Zoo, San Diego Zoo Safari Park, and the Institute for Conservation Research, we have honed our skills in animal and plant care, veterinary medicine, and multidisciplinary science. Experienced in reintroducing sustainable populations of endangered species back into their native habitats, we honor our extraordinary history with a calling to conserve the natural world.

A hundred years of managing animals, healing animals, and growing our understanding of animals, plants, and their habitats have prepared us to bring our expertise far beyond our San Diego campuses. Today, our field programs help provide a future for more than 100 rare and endangered species on 6 continents. At the Institute for Conservation Research, we are seeking the most pressing challenges facing wildlife, while forming global partnerships and applying the latest advances in science and technology in the fight against extinction.

PANGOLINS

These unusual mammals are among the most trafficked in the world. Their scales are illegally marketed for use in traditional medicine despite the fact that they have no healing properties. Halting the illegal trade in pangolin scales and other wildlife products is one of our top priorities.



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HERBARIUM VOUCHERS

Floral specimens featured here are part of the Native Plant Seed Bank's herbarium, where rare plants are collected, dried, and cataloged. Currently, more than 1,000 plant vouchers are kept in special cabinets to protect them from dust, moisture, and insects at the Institute for Conservation Research.

A SHARED SENSE OF PURPOSE

From the Institute's beginning in 1975, we have remained true to our mission, using innovative science to serve species conservation. Back then, we never imagined technologies such as whole genome sequencing, stem cell biology, and GPS satellite tracking would be invented, let alone used for conserving species. Today, innovations such as geospatial analysis and remote monitoring are providing new ways to understand where species roam and what they need in order to survive. Incorporating engagement with local communities and encouraging stewardship are helping us make a real difference for wildlife and habitats worldwide.

An early focus on the San Diego Zoo's remarkable animal collection and its well-being later expanded to field programs in animal and plant ecology. Saving species like California condors and giant pandas exemplifies what is achieved when diverse disciplines work together to solve conservation challenges. Global in scope, our Conservation Research Postdoctoral Fellowship Program has allowed us to train future conservation scientists. Then, in 2003, a transformational grant from the Arnold and Mabel Beckman Foundation helped build our research facility at the Safari Park.

What has not changed in more than four decades is the depth of passion we bring to species conservation. It is an honor and a privilege to lead our talented and dedicated team. The diverse projects highlighted here exemplify the shared sense of purpose, infused with hope, that compels us to create a more sustainable future for wildlife.

~ Allison Alberts, Ph.D., Chief Conservation and Research Officer



RESEARCH TEAMS

The Arnold and Mabel Beckman Center for Conservation Research serves as a 50,000-square-foot home base for the research teams that form the Institute for Conservation Research: Population Sustainability, Recovery Ecology, Community Engagement, Disease Investigations, Conservation Genetics, Reproductive Sciences, Plant Conservation, and Biodiversity Banking. Each of our eight teams works with internal and external partners, while bringing its own unique strengths to some of the most challenging problems facing wildlife and their habitats.

POPULATION SUSTAINABILITY

Integrating behavior and ecology to ensure population viability.

Scientists on the Population Sustainability team use a variety of technologies to study how species are impacted by, and respond to, environmental changes and human activities. Working with partners and communities in the field, as well as animals at the San Diego Zoo and Safari Park, we take an integrative and innovative approach to conservation science. Given the pace at which the extinction crisis is unfolding, an important part of our work is to quickly integrate our scientific findings into conservation management.

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remaining tiger subspecies — all are endangered or critically endangered.



► SUMATRAN TIGERS

Only a few hundred Sumatran tigers are left in the wild. We have trained more than 130 field technicians from partner organizations in tracking and sensor techniques for a Sumatra-wide tiger survey. Data will provide tiger population trends over the past decade.



► GIANT PANDA

We are working with our Chinese partners to ensure that reintroduced giant pandas can thrive. Pandas chew bamboo loudly and have distinct vocalizations, so acoustic sensors can tell us how much time a panda in the wild spends feeding, and a lot about their social lives, by listening in.

The application of innovative technologies — coupled with good old-fashioned fieldwork on the ground — is revolutionizing our understanding of the natural world and doing so less invasively than ever.

~ Megan Owen, Ph.D., Director



► ANEGADA IGUANA

To help critically endangered iguanas defend themselves against feral predators, we headstart hatchlings in a safe environment. With our partners we have helped introduce more than 200 Anegada iguanas to the wild, while retaining assurance colonies in managed care.

► KOALA

A robust population of koalas was recently discovered in New South Wales at elevations above 3,280 feet (1,000 meters) in poor koala habitat. Using ear tag radiotelemetry, we partner with Australian researchers to track 11 koalas. Our goal is to assess movement and habitat use to determine sustainability of this high-elevation population.



RECOVERY ECOLOGY

Adaptively managing and restoring species to the wild.

The Recovery Ecology team works with local and global scientists on science-based strategies for conservation breeding, reintroduction, and translocation as well as monitoring and management of endangered species in the wild. This includes behavioral research, population modeling, three-dimensional (3-D) geospatial mapping, and use of remote survey methods to evaluate population status while minimizing human impacts. Our large-scale programs assist in the recovery of endangered and threatened populations in the wild.



► BURROWING OWL

Using the newest GPS satellite tracking technology, we are working to assess the effects of habitat loss and fragmentation from development by following owls that have been impacted, as well as a group of owls that has not, and examining nesting success, habitat, and survival. We are breeding owls for release to reestablish key populations in Southern California.



► ELLEN BROWNING SCRIPPS FOUNDATION SPATIAL ECOLOGY LAB

Our goal for this lab is to help save species using the latest techniques and technologies in spatial analysis. We model data acquired from remote-sensing satellites and drones to create detailed 3-D digital representations of natural landscapes. These spatial tools enable us to gather accurate baseline habitat data prior to species reintroductions; characterize the habitats needed to support wildlife populations; and determine the effectiveness of habitat conservation strategies.



► HAWAI'I ENDANGERED BIRD CONSERVATION PROGRAM

We breed several species of critically endangered forest birds at our two breeding centers on Maui and the Big Island of Hawai'i. When 'alalā, (Hawaiian crows) are released, we monitor the birds with tracking devices, trail cameras, and boots-on-the-ground observations.

► MOUNTAIN YELLOW-LEGGED FROG

To help recover this endangered species, our team found some low-tech solutions. Back at the Institute, wine chillers encouraged hibernation by mimicking temperatures in cold mountain streams. Also, dogs have been trained to use their keen sense of smell to help us find these cryptic frogs after release into their Southern California habitat. Other challenges to this species include the deadly chytrid fungus disease, wildfires, and drought.

The future of species recovery will rely increasingly on bold, large-scale intervention.

~ Ron Swaisgood, Ph.D.,
Brown Endowed Director



COMMUNITY ENGAGEMENT

Driving conservation action through science education and community collaborations.

Educating and engaging people around the world is critical to our conservation efforts. The Community Engagement team works with students, teachers, and local communities to foster understanding and encourage stewardship of the natural world. Using a social science approach at home and around the globe, our programs have a conservation focus and are tailored to each audience using diverse, collaborative methods that promote positive human behavior change.

► CONSERVATION EDUCATION LAB

Our full-service research lab lets students, teachers, and community members apply textbook knowledge of biology and chemistry to real-world scenarios in wildlife conservation. Visitors from middle school to graduate school engage with leading scientists, gain access to innovative research, and participate in hands-on learning.



► EDDY FAMILY OUTDOOR LEARNING LAB

This one-acre parcel of restored coastal sage scrub habitat is the site for our hands-on module, Life in a Biodiversity Hotspot, designed to teach high school students about our native flora and fauna and the research we use to monitor it. This program helps them gain an appreciation for their role as stewards of our local biodiversity.



► TEACHER TRAINING WORKSHOPS

Over 1,500 teachers from all 50 states and more than 20 countries have gained knowledge and new tools to bring science disciplines such as ecology, genetics, and molecular biology to life in their classrooms—and impacting more than 1 million middle and high school students in the U.S. alone.



► COMMUNITY-BASED GLOBAL CONSERVATION

With conservation partners in Southeast Asia, Peru, Bolivia, and northern Kenya, our team works on human dimensions research and education in communities where people live alongside endangered species. Understanding how people view wildlife within their local cultural context helps us reduce the threats that wildlife face.

“Conservation is inherently a human issue, one that demands innovative, human-driven solutions.”

~ Maggie Reinbold, Director

DISEASE INVESTIGATIONS

Removing disease as a roadblock to conservation.

The mission of the Disease Investigations team, the diagnostic specialty group of San Diego Zoo Global, is to remove disease as a roadblock to conservation. We accomplish this through comprehensive disease surveillance programs, disease outbreak investigations, and targeted disease research for all the animals in our care and in the wild. Our specialties include pathology, histology, molecular diagnostics, and epidemiology. A residency program in zoo and wildlife pathology is also offered through the Jane and Marshall Steel Endowment.

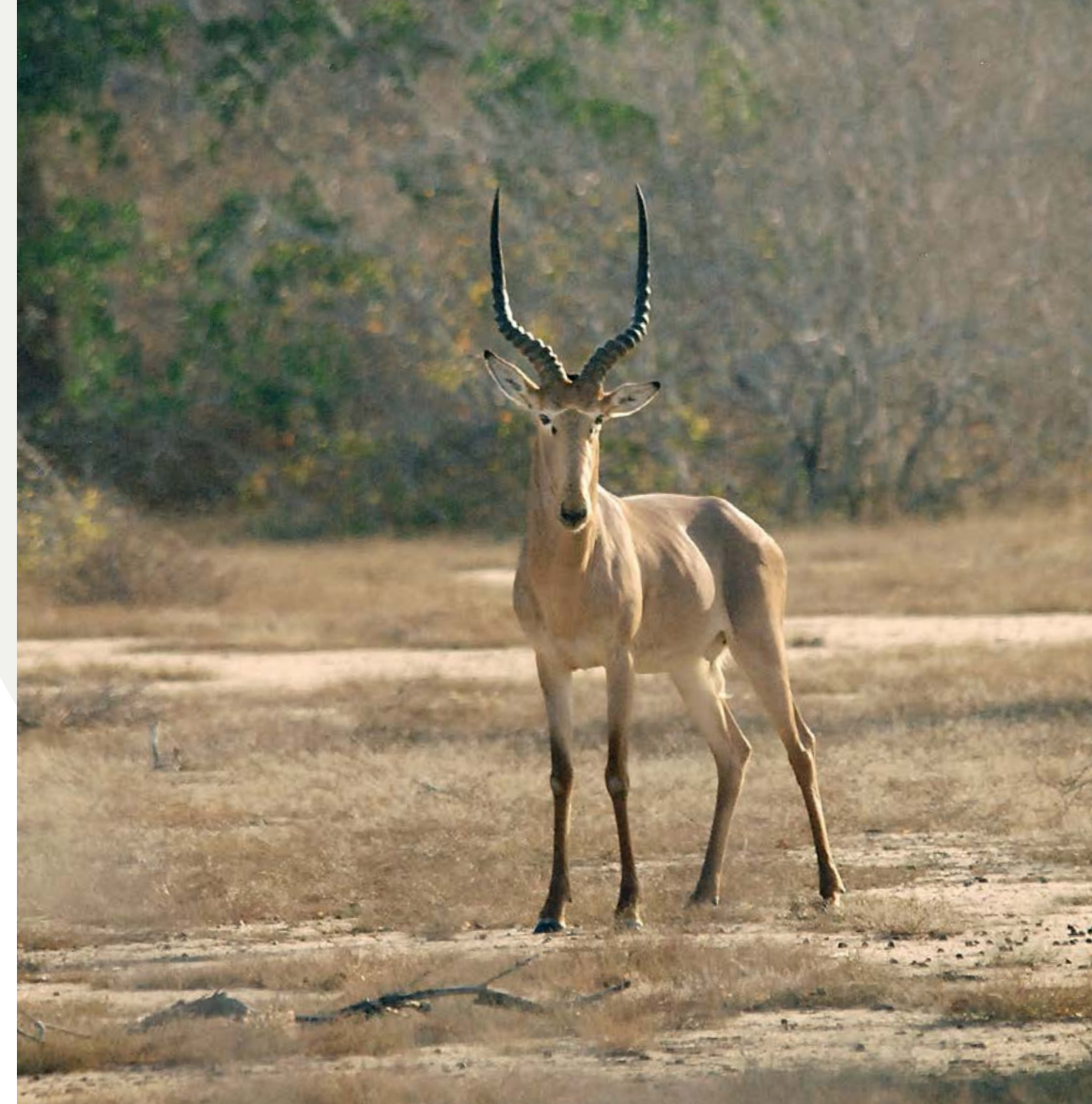
► AMPHIBIAN DISEASE LABORATORY

One-third of the world's 6,000 amphibian species are threatened with extinction. We established a lab with the expertise and capability to support amphibian disease control and diagnostics for our Zoo, as well as more than 100 other zoos and wildlife organizations in the U.S., Canada, and Latin America.

► PRE-RELEASE INVESTIGATIONS

Our pathologists are studying host switching by parasites in blue-crowned laughing thrushes to determine if birds from zoos carry the same strain of parasite as their wild counterparts. Our goal is to ensure that birds in conservation breeding programs, which might be destined for release into the wild, are not infected.

12+
novel pathogens
we discovered
that are new
to science.



“Social network analysis is our most exciting new approach for understanding and preventing disease transmission in wildlife.

It involves mapping out detailed contact networks in animal populations, overlaying disease status, and then running sophisticated mathematical models on ultrafast computers to understand if and how diseases are likely to spread, which can then guide targeted intervention, such as vaccination of the most highly connected animals in the network.

~ Bruce Rideout, D.V.M., Ph.D., Dipl. ACVP, Director

► FIELD CONSERVATION

The hirola is the most endangered antelope in the world and occurs only in a few small areas of East Africa, where it is threatened by livestock diseases, habitat loss, and poaching. The goal of our hirola conservation program is to protect them from any spillover of livestock diseases while developing an integrated livestock/wildlife health management program to benefit local pastoralist communities.

► VIRAL METAGENOMICS

Our team is using viral metagenomics with collaborators from the University of California, San Francisco, to search for possible viral causes for complicated diseases. This process can identify viruses previously unknown to science when other testing methods for viruses are negative. Confirming whether newly discovered viruses are causing disease is complex work that is ongoing in our Molecular Diagnostics Lab.

CONSERVATION GENETICS

Sustaining and restoring genetic diversity through scientific innovation.

The Conservation Genetics team develops and applies new methods for conservation, including population genetics and management, next-generation DNA sequencing, DNA barcoding, and hybrid and parentage identification. The resources of the Frozen Zoo® have made possible groundbreaking genomic, evolutionary, and conservation biology studies, including stem cell technologies. Our work informs the monitoring and management of endangered species in zoos and in the wild.



► DNA BARCODING

Of 6 species of coral trees native to Madagascar, *Erythrina perrieri* is the rarest. DNA sequencing of leaf samples from an unknown species of coral tree found on Oahu was conducted in the Conservation Genetics lab. Results revealed it to be only the second-known individual in the United States. Seeds and cuttings from both plants are now being propagated at the San Diego Zoo in order to establish additional collections.



► CALIFORNIA CONDOR GENETIC MANAGEMENT

The California Condor Recovery Program was the first to use whole genome sequencing information from founder birds to guide the breeding recommendations. Also, the California condor is the first endangered species to have a DNA-based test for identifying a lethal copy of a gene, a method developed here.



► NORTHERN WHITE RHINOCEROS

Functionally extinct, the northern white rhinoceros will survive to become a healthy reproducing population again only through genetic rescue. Using cells from the Frozen Zoo, a pioneering study with our partners is currently under way. As a step on the genetic pathway toward differentiation of induced pluripotent stem cells into gametes, our team successfully produced beating cardiomyocytes (cardiac cells) *in vitro*.

While our ability to anticipate major advances in genomics and cell biology is limited, we can say with certainty that future breakthroughs will prove again and again the value of the Frozen Zoo to understand life, conserve species, and serve humankind.

~ Oliver Ryder, Ph.D., Kleberg Endowed Director



► WHITE RHINOCEROS POPULATION GENOMICS

The analysis of genome sequence variation within and between northern and southern white rhinos has provided prospective evidence that the amount of genetic variation in the Frozen Zoo's materials from northern white rhinoceroses would be sufficient to recover this unique rhino species.

REPRODUCTIVE SCIENCES

Applying innovative science and technology to enhance reproduction.

The Reproductive Sciences team focuses on developing and implementing innovations in advanced reproductive technologies, including assisted reproduction, *in vitro* oocyte and embryo technology, stem cell biology, and environmental endocrine disruption. The team preserves germplasm and stem cells in our Frozen Zoo and develops methods to study and modulate reproductive processes. They also study the relationship between diet, gut microbes, environmental chemicals, and successful reproduction in a wide range of species.



► NIKITA KAHN RHINO RESCUE CENTER

The Reproductive Sciences team is accelerating investigations into the reproductive processes of the southern white rhino, including description of the estrous cycle through fecal hormone monitoring and ultrasound of the reproductive tract; *in vitro* oocyte maturation, fertilization, and embryo production; semen collection and cryopreservation; production of sperm from gonadal stem cells; and dietary and microbial influences on fertility. Our goal is that these southern white rhino females will one day be surrogate mothers for northern white rhino calves produced through genetic rescue.

Increasing reliance on assisted reproductive technology to maximize genetic diversity in managed care populations will stimulate the discovery of novel techniques to preserve and use germplasm and stem cells, devise methods to evaluate and modulate gonadal function, and explore the reproductive consequences of environmental endocrine disruptors. ~ Barbara Durrant, Ph.D., Henshaw Endowed Director



► REPTILE SEMEN CRYOPRESERVATION

The team is developing cryopreservation techniques for snakes and lizards, using the Burmese python as a model species. They published the first-ever scientific paper describing lizard semen freezing, which will be followed by the first paper to report a comprehensive experimental approach to snake semen freezing.



► LOW REPRODUCTIVE RATES IN KIWIS

The Reproductive Sciences team has completed a study comparing the reproductive hormones testosterone and prolactin in captive and wild North Island brown kiwis throughout the breeding season in New Zealand. The differences in testosterone levels between wild kiwi males and those in managed care may explain the poor reproductive rate in breeding programs.



► PROBLEM PREGNANCIES IN OKAPIS

Reproductive Sciences monitors the estrous cycles and pregnancies of all San Diego Zoo Global female okapis to inform animal care managers of potential problem pregnancies. In these cases, hormone supplementation has proven effective in sustaining pregnancy through a normal gestation and birth of healthy offspring. Similar hormone support has been successful in supporting pregnancies in the southern white rhino, greater one-horned rhino, and cheetah.

PLANT CONSERVATION

Working across scientific disciplines to save rare plants.

Our Plant Conservation team works in close association with the Center for Plant Conservation, co-located at the Beckman Center. Our plant scientists work with internal and external partners to conserve the extraordinary botanical diversity of our region. We preserve plants in our Native Plant Seed Bank, develop and test germination and propagation techniques, carry out genetic research, and restore native populations.



► TORREY PINE

San Diego's rare and iconic Torrey pine trees are facing drought and bark beetle attacks, causing large die-offs to occur. Using genomic analysis, we are working to understand genetic and environmental factors that influence a tree's susceptibility to beetle attacks. The resulting data can help inform seed banking and restoration efforts to aid Torrey pine conservation.



40+
endangered
San Diego County
plant species
whose seeds we
conserved.

► BIODIVERSITY RESERVE

The San Diego Zoo Safari Park includes a Biodiversity Reserve of more than 800 acres of coastal sage scrub that has extraordinarily high native species diversity and is home to 24 mammal, 179 bird, 28 reptile, and 4 amphibian species. We are working to eradicate invasive plants and replace them with plant species native to San Diego County.

One in five plant species is imperiled worldwide, and our backyard is no exception. Making conservation collections of the unique and highly threatened plants of our region increases our understanding of rare species and reduces plant extinction.

~ Joyce Maschinski, Ph.D., Director, Plant Conservation, and Vice President, Science and Conservation, Center for Plant Conservation

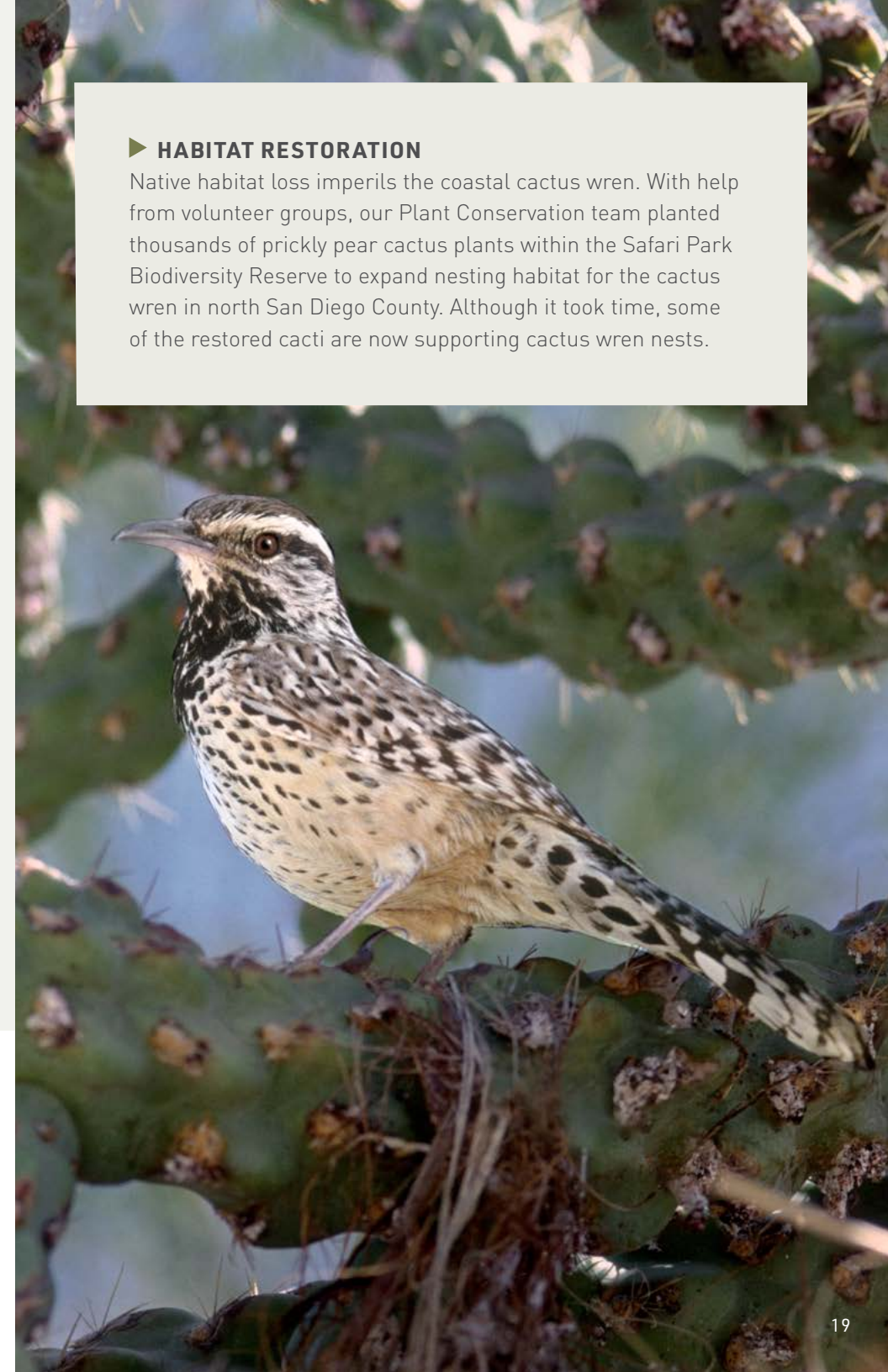


► PLANT REINTRODUCTION

Using seeds collected from the smallest and most imperiled wild population, we successfully grew the rare short-leaved dudleya in our nursery, producing 136 individuals, many of which matured, flowered, and produced seed. These plants are perennials, re-sprouting from corms each spring. We augmented the wild population by transplanting plants into suitable microsites.

► HABITAT RESTORATION

Native habitat loss imperils the coastal cactus wren. With help from volunteer groups, our Plant Conservation team planted thousands of prickly pear cactus plants within the Safari Park Biodiversity Reserve to expand nesting habitat for the cactus wren in north San Diego County. Although it took time, some of the restored cacti are now supporting cactus wren nests.



BIODIVERSITY BANKING

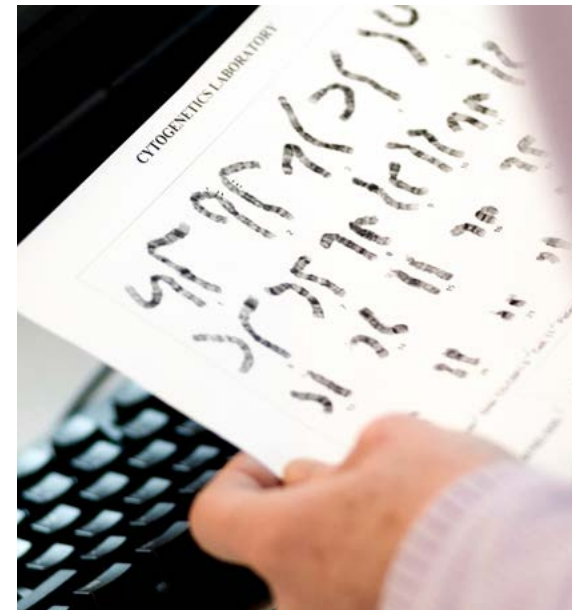
Advancing the science and curation of biomaterials for conservation.

The Frozen Zoo is the largest repository of its kind, containing viable cell cultures and gametes from nearly 10,000 animals representing over 1,100 species and subspecies. Our Native Plant Seed Bank contains more than 760 seed collections of over 430 unique plant taxa. Our Pathology Archive consists of more than 600,000 microscopic slides of tissue sections from more than 1,000 species. Our Biodiversity Banking team curates and manages these irreplaceable biological resources. As new technologies are developed, these collections provide unparalleled opportunities for sample sharing and conservation research worldwide.



► FROZEN ZOO

The Frozen Zoo consists of cryogenic freezers filled with viable cell cultures, gametes, embryos, blood, DNA, and tissue specimens. It represents 45 years of efforts to preserve the genetic legacy of life on our planet. Our goal is to help create a global network of frozen zoos dedicated to preventing extinction by banking samples from as many endangered species as possible.



► CYTOGENETICS LAB

This team is responsible for establishing cell lines from tissue samples that are then cryopreserved in the Frozen Zoo. Each cell line added to the Frozen Zoo undergoes chromosomal evaluation and confirmation of successful freezing by thawing samples and assessing the proportion of cells that resume growth. Typically, resumption of cell growth is greater than 90 percent. Accessions are added at a rate of 300–350 per year.



► NATIVE PLANT SEED BANK

The purpose of the Native Plant Seed Bank is to conserve the diversity of Southern California's flora by collecting, curating, cleaning, drying, and freezing seed for long-term storage. This seed collection conserves invaluable genetic material from hundreds of rare and endangered plant populations.

We must save things for reasons we do not yet understand.

~ Sign above the original Frozen Zoo tank, 1975

► PATHOLOGY ARCHIVE

Over 600,000 glass slides containing preserved and stained tissue sections from zoo animals, some dating back to the 1930s, are part of our histology database. This unique archive, the only one of its kind accredited by the American Alliance of Museums, is an irreplaceable resource for disease investigations and is used by scientists here and from other institutions around the world.

Pictured: A tangential section of intestinal villi from an owl. Look closely for a Coccidian (protozoal parasite) infection circled above.





TOP TEN CONSERVATION INITIATIVES

In our mission to save animals and plants worldwide, we focus our efforts on collaborative projects that leverage our unique combination of strengths and maximize our impact. Because many species in the wild require management to survive, there is a sharply rising demand for the scientific knowledge and expertise of zoos and botanic gardens.

San Diego Zoo Global has dedicated more than a century to cultivating knowledge and honing our abilities in animal husbandry, health and nutrition, plant propagation, scientific research, and education. Our early efforts focused on the genetic and reproductive health of our animal collection. Today, we engage with partners to save species around the world because we believe our greatest impact lies in what we are able to contribute back to the wild.



KENYA CONSERVATION

A guiding principal when developing conservation projects grows from an understanding that initiatives are most successful when they focus on the needs of local people as well as wildlife. Our work with the Northern Rangelands Trust and with pastoralist community partners in Kenya benefits African animals with a focus on elephants, rhinos, giraffes, zebras, hirola antelope, leopards, and vultures.

STUDIES OF LEOPARD ECOLOGY and community attitudes provide information that can promote coexistence between people and this large carnivore.

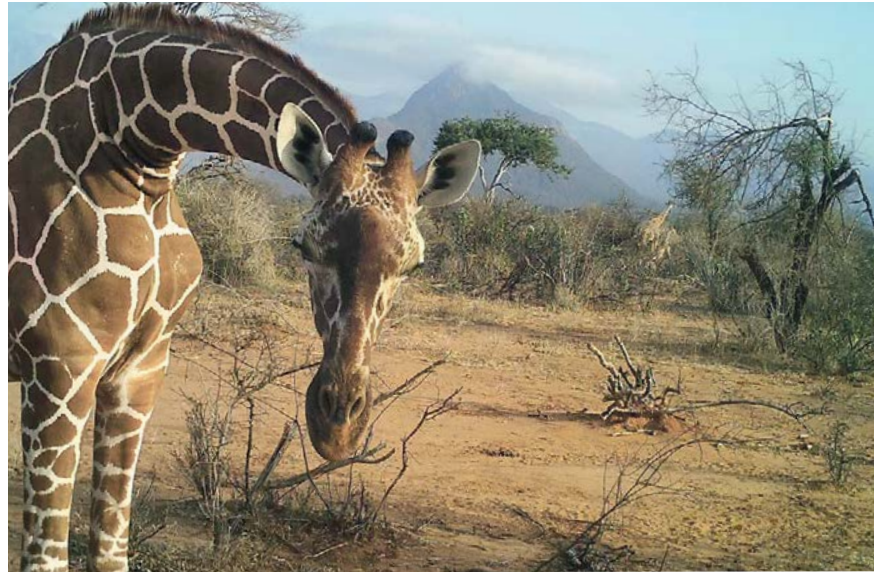


THE RETETI ELEPHANT SANCTUARY supports more than a dozen orphaned or abandoned elephant calves. We assist by helping them thrive while preparing to reunite them with elephant herds in the wild. San Diego Zoo Global's work at Reteti encompasses animal nutrition, veterinary medicine, laboratory sciences, disease investigation, behavioral ecology, animal management, and capacity building.



7
African countries where giraffes are now declared extinct.

THE RETICULATED GIRAFFE HAS OFFICIALLY BEEN LISTED AS ENDANGERED by the IUCN. This comes after research indicated a drastic population decline of 56 percent since 1985.



OUR ONLINE WILDWATCH KENYA CITIZEN SCIENCE PROGRAM invites the public to analyze trail camera photos of giraffes, leopards, and other wildlife for observation studies that help pinpoint their habitats, ranges, and population numbers.



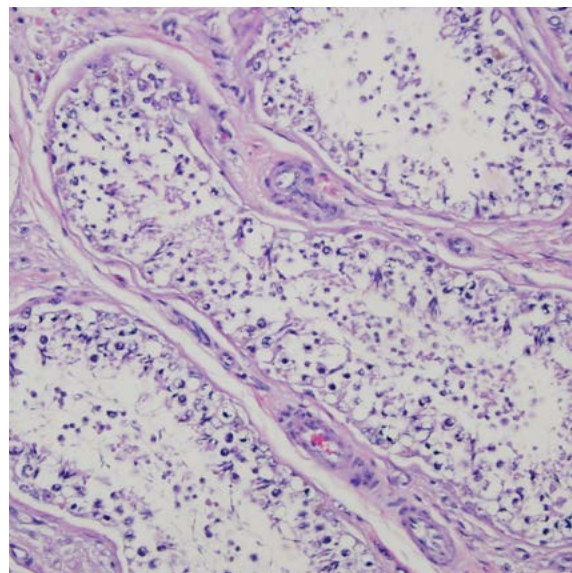
SAN DIEGO ZOO GLOBAL'S PARTNERSHIP WITH THE NORTHERN RANGELANDS TRUST is a model for community conservancies, improving lives of pastoralists and wildlife.

GENETIC RESCUE

The Genetic Rescue Initiative pioneers advanced reproductive and genetic technologies to rescue critically endangered species like the northern white rhino, black-footed ferret, and endemic Hawaiian plants from near extinction. With our partners we apply techniques from the biotech, human medicine, and domestic animal sectors in the search for remaining options when the survival of a species is at stake.



OUR CONSERVATION GENETICS TEAM, using skin cells from the Frozen Zoo, has successfully reprogrammed the cells of nine northern white rhino individuals into induced pluripotent stem cells. Our team works with partners toward the successful development of an embryo for implantation into a southern white rhino, its closest relative.



OUR REPRODUCTIVE SCIENCES TEAM is developing *in vitro* techniques with southern white rhino sperm, ova, and embryos until northern white rhino gametes and embryos can be generated from stem cells and implanted via embryo transfer into southern white rhino females at the Nikita Kahn Rhino Rescue Center.

Pictured: Northern white rhino testicular tissue stained with hematoxylin/eosin, cryopreserved and stored at -196°C in the Frozen Zoo.



PRZEWALSKI'S HORSE—Using cryobanked cells from hundreds of individuals throughout the pedigree, we are working with our partners to restore genetic diversity and ensure genetic health of captive and reintroduced populations of this unique species of wild horse.



THREE RHINOS ARE KILLED EVERY DAY IN AFRICA.

Only two northern white rhinos remain, under armed guard in Kenya. An unparalleled team of experts in the fields of stem cell technology and reproductive physiology is collaborating with our research team to help save the northern white rhino from extinction.

WILDLIFE TRAFFICKING

As a conservation organization, San Diego Zoo Global recognizes the far-reaching and devastating impact that unsustainable trafficking has on plant and animal species. This initiative aims to maximize the unique contribution that zoos can make to reduce the threats to plant and animal species posed by the illegal wildlife trade. We offer scientific expertise to partner organizations involved in combating wildlife trafficking: the U.S. Fish and Wildlife Service, U.S. Department of State, the U.S. Trafficking Alliance, the Association of Zoos and Aquariums, the Oxford Martin Programme on the Illegal Wildlife Trade, and others worldwide.

WE ACTIVELY PARTICIPATE IN EDUCATION AND OUTREACH EFFORTS IN ASIA to reduce demand for wildlife products from species decimated by wildlife trafficking. This includes saiga antelope, pangolins, sun bears, and Asiatic black bears.

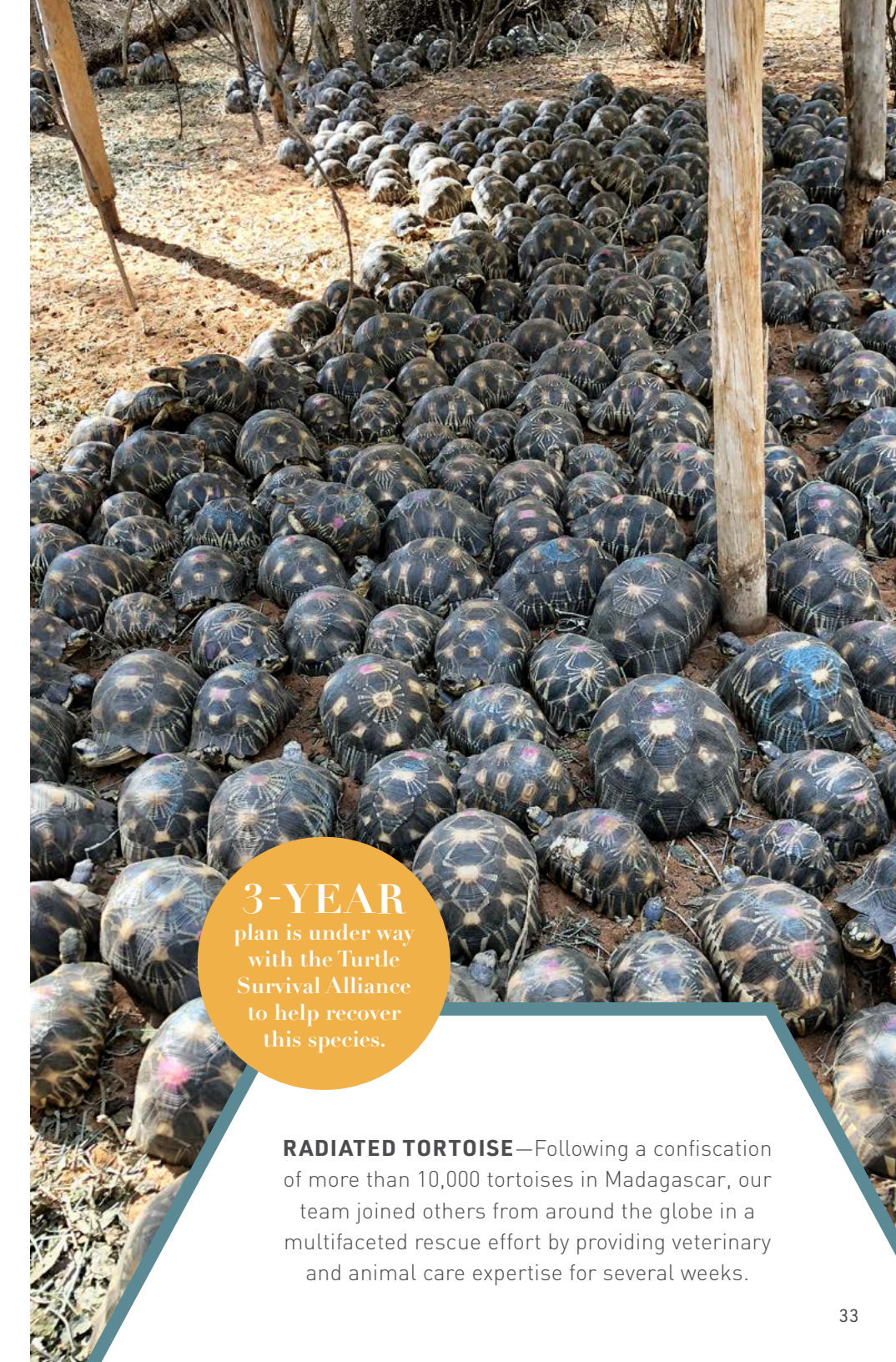




THE SAN DIEGO ZOO AND SAFARI PARK are designated safe havens for plants and animals rescued from the illegal trade, including rare orchids, cycads, exotic cats, reptiles, birds, and many others.



ZOOHACKATHON—The Arnold and Mabel Beckman Center hosted this tech community event, with a focus on designing solutions that combat the illegal wildlife trade. One team created Safe Souvenirs, a new mobile app that helps tourists avoid buying illegal products.



3-YEAR plan is under way with the Turtle Survival Alliance to help recover this species.

RADIATED TORTOISE—Following a confiscation of more than 10,000 tortoises in Madagascar, our team joined others from around the globe in a multifaceted rescue effort by providing veterinary and animal care expertise for several weeks.

REWILDING ASIAN MAMMALS

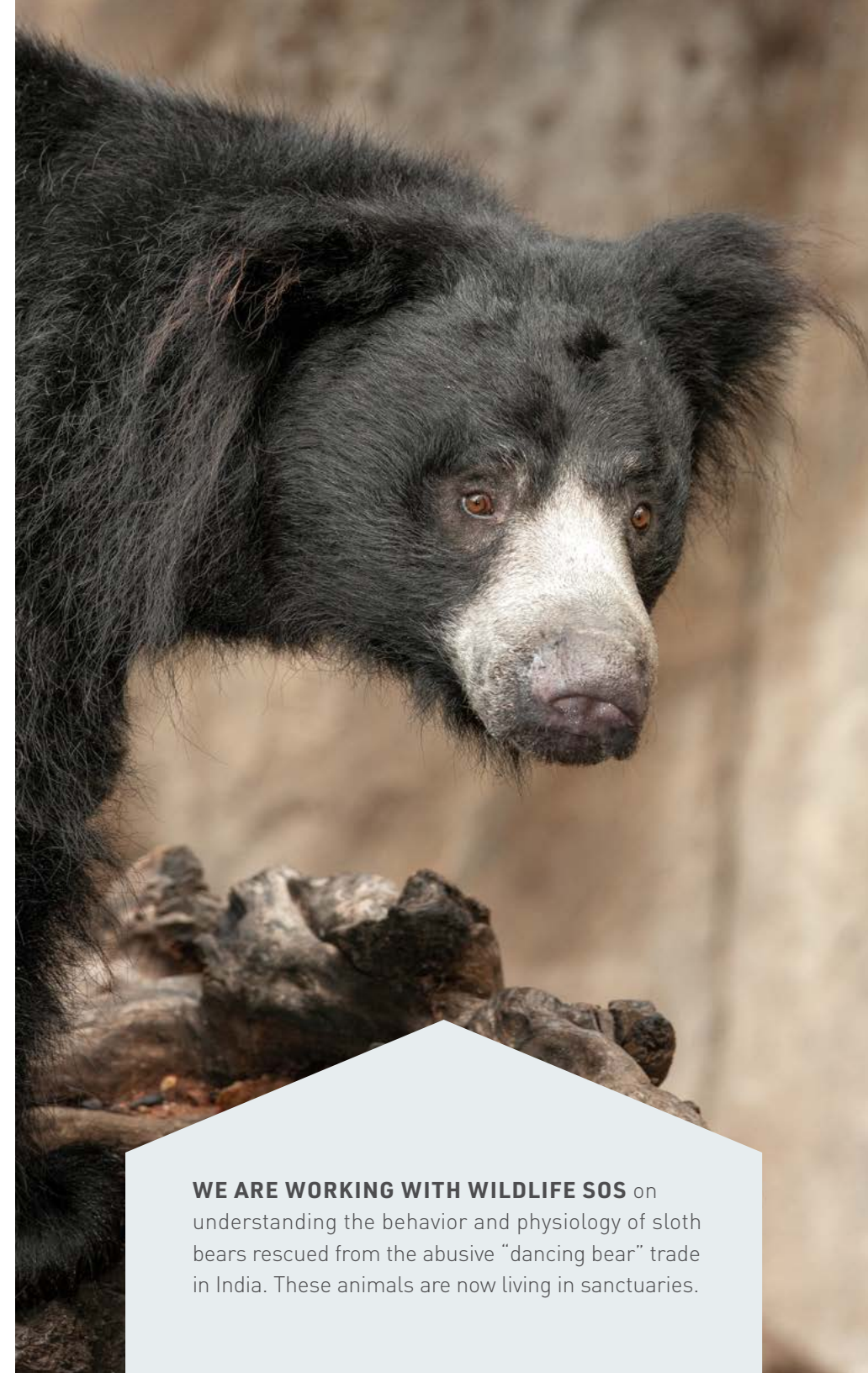
The unmatched expertise of zoos in animal care, reproduction, health, behavior, ecology, genetics, and social science together contribute to successful breeding and future reintroduction of large mammals to native landscapes. We will incorporate a variety of behavioral techniques and advanced monitoring technologies for conserving and rewilding these vulnerable species.



NEW DISCOVERIES AND ADVANCES IN RESEARCH led to the success of the giant panda's recovery. Our Reproductive Sciences team developed key advances that led to the first successful artificial insemination. For more than 20 years we have collaborated with Chinese researchers on behavioral studies, sensory biology, nutrition, spatial ecology, genetics, and animal health. Today, we continue behavioral studies of pandas as they are reintroduced into the wild.



RESEARCH IN MYANMAR IS FOCUSED ON ELEPHANTS that have long served people in heavy industry, such as logging. Future studies will determine how these elephants will behave in the wild and avoid human-wildlife conflicts. As we partner with local communities, the long-term goal is to better understand their attitudes about wildlife in order to promote coexistence.



WE ARE WORKING WITH WILDLIFE SOS on understanding the behavior and physiology of sloth bears rescued from the abusive "dancing bear" trade in India. These animals are now living in sanctuaries.



TO BETTER UNDERSTAND THE ECOLOGICAL NEEDS OF SUMATRAN TIGERS living in heavily populated regions of Sumatra, we are studying landscape connectivity, habitat use, diet, and movement patterns to lessen negative interactions between tigers and communities. We and our partners are evaluating the population status of tigers across the island of Sumatra through sign surveys and trail camera studies.

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reintroduced 'alalā, once extinct in the wild, are now flying free in Hawaiian forests, with more releases planned.



ISLAND CONSERVATION

Eighty percent of vertebrate extinctions occur on islands. Our teams work together with partners to restore threatened plant, mammal, reptile, and bird species on islands in Hawai'i, the South Pacific, Caribbean, and Galápagos. Strategies include field research, observation, breeding, headstarting, translocation, and reintroduction programs.

THE 'ALALĀ, OR HAWAIIAN CROW, has made a comeback from fewer than 20 birds in the 1990s to more than 125 birds today that were bred, hatched, and raised as part of our Hawai'i Endangered Bird Conservation Program. We play matchmaker by choosing mates based on genetics and behavior.



OUR GRIFFIN REPTILE CONSERVATION CENTER is the most advanced rock iguana breeding facility in the world. Learning about iguana reproduction and behavior has contributed greatly to the success of rare iguanas in the wild.



AROUND-THE-CLOCK AVIAN PROPAGATION has helped us raise more than 45 critically endangered 'akikiki (pictured) and 7 'akeke'e chicks as candidates for future release into Hawaiian forests.



AN NIRS MACHINE (NEAR INFRARED SPECTROSCOPY) is used to analyze the nutritional value of plants in wild habitats, like 'ōhelo and pūkiawe berries that 'alalā eat. Suitable reintroduction sites must have sufficient native foods available to support released individuals.

WE ARE PROVIDING CRUCIAL GUIDANCE on population management of headstarted Jamaican (pictured) and Anegada iguanas.



FROZEN ZOO® GLOBAL EXPANSION

More than 23,000 species of animals and plants are threatened with extinction, including more than 3,000 that are critically endangered on the IUCN Red List. We are launching a new era of environmental stewardship through a global scaling up of the Frozen Zoo into an international network of biobanking partners. Living cell lines, gametes, and seeds will be banked in collaboratively curated collections maintained in perpetuity at replicated sites around the world.



OUR FROZEN ZOO contains nearly 10,000 samples of viable cell cultures and gametes from more than 1,100 vertebrate species. We have provided more than 6,700 Frozen Zoo samples to more than 500 scientific investigators at more than 300 institutions worldwide.



AS NEW TECHNOLOGIES EMERGE, the viable cell cultures, gametes, and seeds in our collection provide opportunities for genome sequencing, stem cell applications, advanced reproductive technologies, and genetic rescue.



WE ARE INVESTING IN TRAINING INTERNATIONAL SCIENTISTS by expanding our annual international seminar on cryopreservation banking techniques and supporting development of in-country cryobanking efforts worldwide.



THE NATIVE PLANT SEED BANK contains more than 800 seed collections representing more than 450 unique plant taxa. Seeds are used in plant propagation, habitat restoration, and in the development of advanced germination techniques.

Pictured: Forget-me-not (Cryptantha utahensis) seeds.

1 MM

SOUTHWEST CONSERVATION

Southern California contains over 1,900 native plant species, 54 of them found nowhere else in the world. Our region is a biodiversity hotspot with over 100 rare native plant species occurring in San Diego's varied microhabitats. With our partners we are actively conserving more than four dozen rare and endangered animals and plants.



TINY LOCAL RESIDENTS—Trail cameras placed in the last remaining burrowing owl habitat in San Diego County help us learn how these owls raise chicks, avoid predators, and hunt for food. Habitat conservation and burrows are essential for their survival.



“By attaching ‘bio-logging’ devices such as GPS-tracking devices and acoustic collars that record sound, we can follow the movement of individual animals and discover previously unknown patterns of behavior.

~ Ron Swaisgood, Ph.D., Brown Endowed Director,
Recovery Ecology



We know what constitutes ‘suitable’ desert tortoise habitat. We are studying what constitutes ‘great’ habitat for translocation of more than 100 headstarted tortoises over two years.

~ Ron Swaisgood, Ph.D., Brown Endowed Director, Recovery Ecology



PACIFIC POCKET MOUSE—Our conservation breeding and release program uses research to develop effective strategies to boost reproduction and release success as well as reestablish the species in protected areas.



RESCUING DESERT TORTOISES—Working with the U.S. Fish and Wildlife Service from 2009–2014, we rescued and rehabilitated more than 2,000 desert tortoises, raising hatchlings and releasing them into the wild.

1 to 3

condor chicks have been hatched annually since 2012 to condors we released in Baja California.

CALIFORNIA CONDOR SUCCESS STORY:

37 YEARS IN THE MAKING—From only 22 birds remaining in the wild in the 1980s, more than 500 are living today, and 60 percent are flying free.



SAVING AFRICAN PRIMATES

The bushmeat crisis threatens to drive many primate species to extinction. This initiative focuses on conserving primates in Cameroon and Madagascar, including chimpanzees, gorillas, drills, lemurs, and small monkey species. Our approach combines primate behavior, spatial ecology, and genetics. We work closely with local communities on alternative livelihoods, as well as on capacity building for in-country conservation practitioners.



SINCE 2002, we and our partners have worked to conserve gorillas and chimpanzees in Cameroon's Ebo Forest. An exciting discovery through this program identified a new gorilla subspecies living in this region.



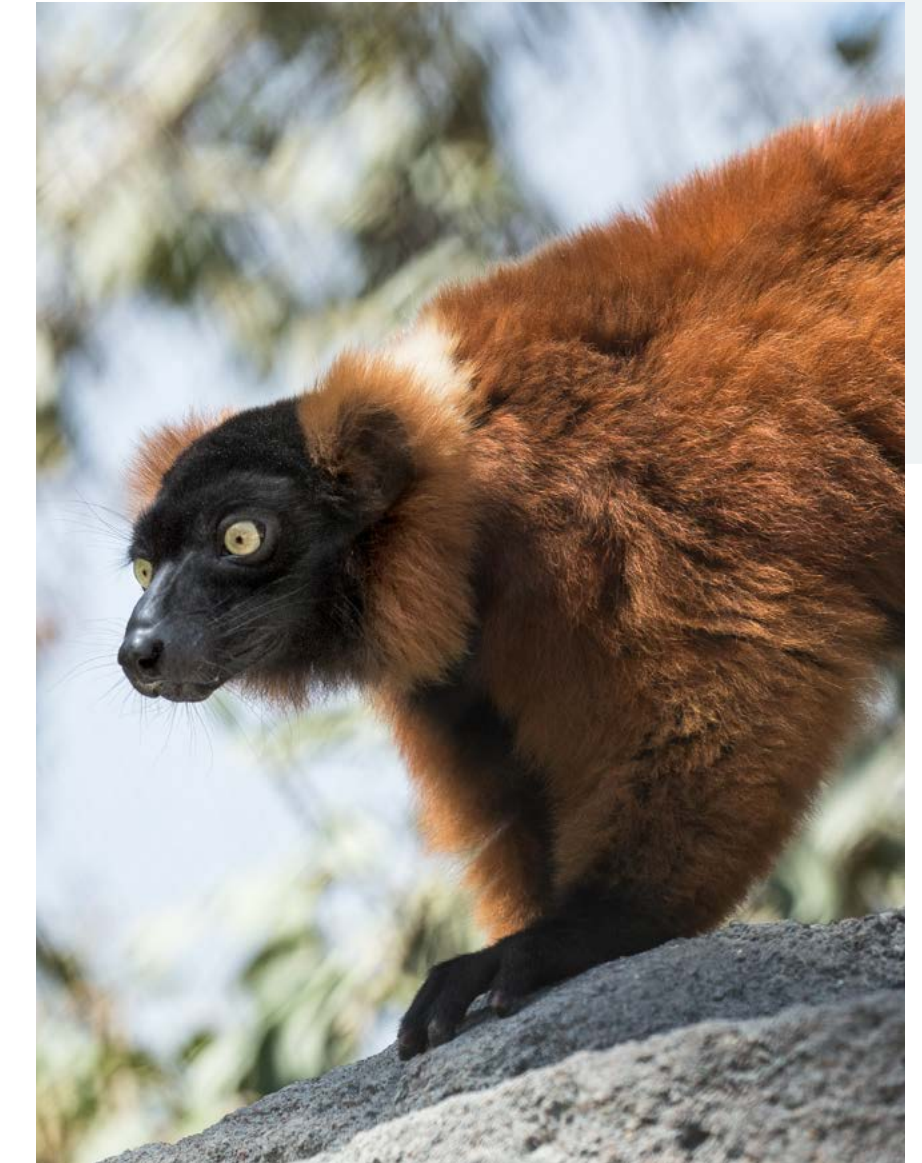
HABITAT ASSESSMENT OF FOREST AND CANOPY COVER from satellite images and botanical plots will give direction on seed- and tree-planting corridors. Local communities in Madagascar are being engaged to establish tree nurseries and plant corridors.



TEAM MEMBERS FROM THE LOCAL COMMUNITY IN CAMEROON monitor gorillas and chimpanzees daily, using trail cameras to collect data on threats to many species in the Ebo Forest.



THE CLUBS DES AMIS DES GORILLES (Gorilla Guardian Clubs) were established in communities closest to Ebo Forest gorillas, which number fewer than 25. The clubs work to decrease threats to gorilla populations.



THE RED RUFFED LEMUR, a flagship species for conservation in Madagascar, is listed as critically endangered by IUCN. We successfully radiocollared 11 red ruffed lemurs with VHF accelerometer tags for daily monitoring in Madagascar's Masoala National Park. Data and sample collection contribute to studies of red ruffed lemur genetic diversity, ecology, health, and population viability.



AMAZON TO ANDES

To help save jaguars, giant otters, Andean bears, and other South American species in their native habitats, we work closely with local communities. Throughout the region, we contribute to the knowledge and conservation of tropical biodiversity by improving infrastructure, educating the public, building conservation capacity, and promoting and conducting innovative scientific research.

WITH OVER 19,000 VASCULAR PLANT SPECIES, including 5,000 endemics, Peru is a hotspot of floristic diversity. We established a digital herbarium of over 100,000 images that cover 80 years of botanical exploration.

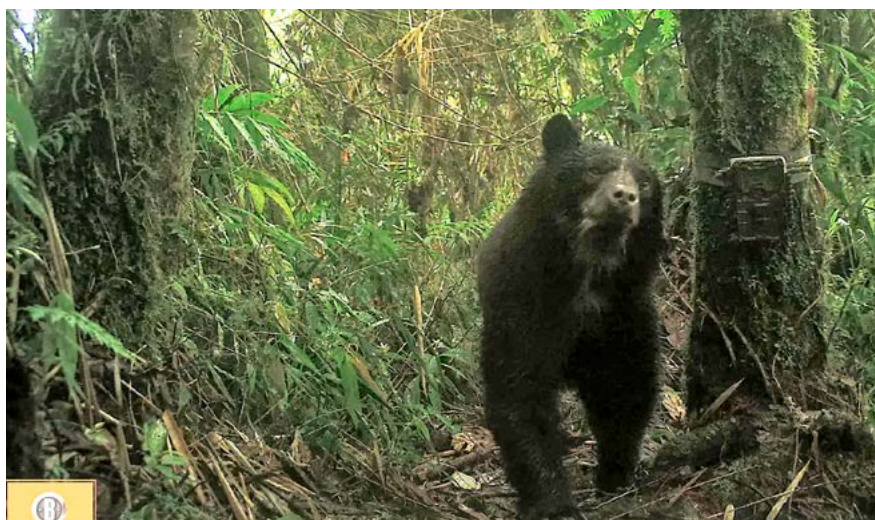
Pictured: A flowering bromeliad, Aechmea orlandianna, in the Peruvian Amazon.

WE MONITOR WILDLIFE POPULATIONS

in communities in Peru using GPS tracking, trail cameras, and remote audio recorders that can detect gunshots and other sounds related to human activities over a mile away.



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Bushnell M SDZG286 59°F 15°C 02-17-2017 14:22:06

TRAIL CAMERAS provide data that field researchers in dense tropical forests rarely see. Technology has evolved from former film-based, 36-exposure capability to tens of thousands of digital images captured by trail cameras that can operate independently for up to 6 months.



AT THE COCHA CASHU BIOLOGICAL STATION in Manu National Park, our field course prepares Peruvian college students to pursue careers in tropical ecology and conservation: 90 percent of graduates are currently active in conservation research at universities and NGOs.



TO LEARN HOW ANDEAN BEARS MOVE between habitats in order to access key resources, we gather data on spatial behaviors and landscape use ranging from high-elevation open grasslands to dense cloud forests.

CLIMATE CHANGE

Stresses placed on plants and animals—because of changing climate conditions, drought, disease, invasive species, increased wildfire frequency, and other impacts—are creating complex and emerging challenges in the fight against extinction. We focus on the polar bear, koala, penguin, amphibians, and many other animals and plants, all impacted by a changing environment.



ALTERATIONS IN CLIMATE IMPACT PLANTS AND THEIR ABILITY TO SURVIVE in their habitats. We are modeling endangered plant distribution changes across Baja California, Mexico, and Southern California to predict how climate change will impact these species' ranges into the future.



TORREY PINES STATE NATURAL RESERVE in San Diego, California, has lost hundreds of its iconic Torrey pine trees as attacks by bark beetles exacerbate the impacts of drought. We are studying the genetics of trees to determine if any individuals have beetle- or drought-resistant genes.

WE ARE DETERMINING HOW CHANGES in the distribution and abundance of sea ice affect polar bear maternal denning and cub survival. We are also studying noise disturbance from industrial activities on polar bear denning, especially impacts to mothers and cubs.





WARMING TEMPERATURES IN THE HAWAIIAN ISLANDS are allowing mosquitoes to spread to higher-elevation forests that were once a refuge for the last remaining native Hawaiian forest birds, threatening them with extinction due to avian malaria.



THERE IS EVIDENCE THAT RIFT VALLEY FEVER—a viral disease spread by mosquitoes across Central Africa—could spread north as climate change shifts the range of the mosquito vector, resulting in the exposure of wildlife to a potentially deadly disease they have never before encountered.



DRONE SURVEYS ARE USED to document the rate of Arctic sea ice losses, which affect polar bear survival. We are modeling polar bear sea ice habitat in 3-D.



THE WARMER, WETTER CLIMATE IN CENTRAL ASIA has facilitated the spread of deadly *Pasteurella* bacteria, resulting in the deaths of over 200,000 saiga antelope in Kazakhstan.

WILDFIRES, which increase in frequency with higher temperatures and drought, threaten to burn wild Tecate cypress populations before they have had the opportunity to produce seed. To safeguard against disastrous fire, we care for a living collection of more than 400 Tecate cypress trees that provide seed for restoration.



GIANT OTTER

A giant otter basks in the sun at Cocha Cashu National Park in Peru. Our team works with local communities to assess aquatic health in rivers and lakes, evaluating the impact of runoff from illegal gold mining on this endangered species.



WE THANK THOSE WHO SHARE OUR VISION

Global Partnerships

Preventing extinction requires collaboration with others at many levels. We partner with nearly 400 organizations around the world that share our conservation goals and philosophy. We work closely with a broad range of government, nonprofit, corporate, private, and academic organizations to accomplish our shared mission of saving species.

Our Investors

Since 1916, San Diego Zoo Global has relied on philanthropic investments to fuel its vision and goals. We are deeply grateful to those individuals, foundations, corporations, and others who join us to make great things happen. Our destination is clear, but we cannot get there without your help.

Published Articles

Our contributions to the field of wildlife conservation are documented in more than 3,500 publications and reports. The majority of these can be accessed at institute.sandiegozoo.org/resources/all-publications.

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SAN DIEGO ZOO GLOBAL CONSERVATION PROJECTS AND PARTNERSHIPS

- CARIBBEAN**
 BRITISH VIRGIN ISLANDS
 Anegada rock iguana
 CAYMAN ISLANDS
 Grand Cayman iguana
 Sister Isles rock iguana
 JAMAICA
 Jamaican iguana
 TURKS & CAICOS ISLANDS
 Turks & Caicos iguana

- HAWAII'**
 BIG ISLAND, KAUA'I, MAUI
 'Alalā
 Coral trees
 Hawaiian forest birds
 Hawaiian hawk
 Maui parrotbill
 Nene

- SOUTH AMERICA**
 COLOMBIA
 Andean condor
 ECUADOR
 (GALÁPAGOS ISLANDS)
 Mangrove finch
 Galápagos pink land iguana
 PERU/AMAZON REGION
 Andean bear
 Giant otter
 Jaguar
 Paca
 Uakari
 White-lipped peccary
 Woolly monkey

- NORTH AMERICA**
 CANADA
 Polar bear
 COSTA RICA
 Baird's tapir
 MEXICO
 Bighorn sheep
 Golden eagle
 Peninsular pronghorn
 Thick-billed parrot
 Vaquita
 MOJAVE DESERT
 Desert tortoise
 SOUTHERN CALIFORNIA
 Anna's hummingbird
 Burrowing owl
 California condor
 California least tern
 Coastal cactus wren
 Coastal patch-nosed snake
 Flat-tailed horned lizard
 Light-footed Ridgway's rail
 Mexican flannelbush
 Mountain yellow-legged frog
 Orcutt's bird's-beak
 Otay tarplant
 Pacific pocket mouse
 Quino checkerspot butterfly
 Ringtail
 Salt marsh bird's-beak
 San Bernardino kangaroo rat
 San Clemente loggerhead shrike
 San Diego thornmint
 Short-leaved dudleya
 Stephens' kangaroo rat



- MADAGASCAR**
 Aye-aye
 Red ruffed lemur
 Ring-tailed lemur
REPUBLIC OF MAURITIUS
 Rodrigues fruit bat
SENEGAL
 Giant eland
SOUTHERN AFRICA
 African penguin
 Black-footed cat
 Cape vulture
 Klipspringer
 Southern ground hornbill
 Southern white rhinoceros



- ASIA**
 AFGHANISTAN
 Snow leopard
 CAMBODIA
 Asiatic black bear
 Sun bear
 CHINA
 Dhole
 Giant panda
 HIMALAYAS
 Snow leopard
 Western red panda
 INDIA
 Greater one-horned rhinoceros
 Sloth bear
 INDONESIA
 Anoa
 Banteng
 North Sulawesi babirusa
 Orangutan
 Sumatran tiger
 KAZAKHSTAN
 Przewalski's horse
 Saiga
 MYANMAR
 Asian elephant
- NEPAL**
 Western red panda
PHILIPPINES
 Visayan warty pig
THAILAND
 Helmeted hornbill
 Malayan tapir
VIETNAM
 Saola
OCEANIA
 COOK ISLANDS
 Rimatara lory
FIJI
 Fiji iguana
NORTHERN MARIANA ISLANDS
 Mariana crow
PAPUA NEW GUINEA
 Tree kangaroo
AUSTRALIA
 Koala
 Lord Howe Island stick insect
 Tasmanian devil





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SAN DIEGO ZOO.
GLOBAL