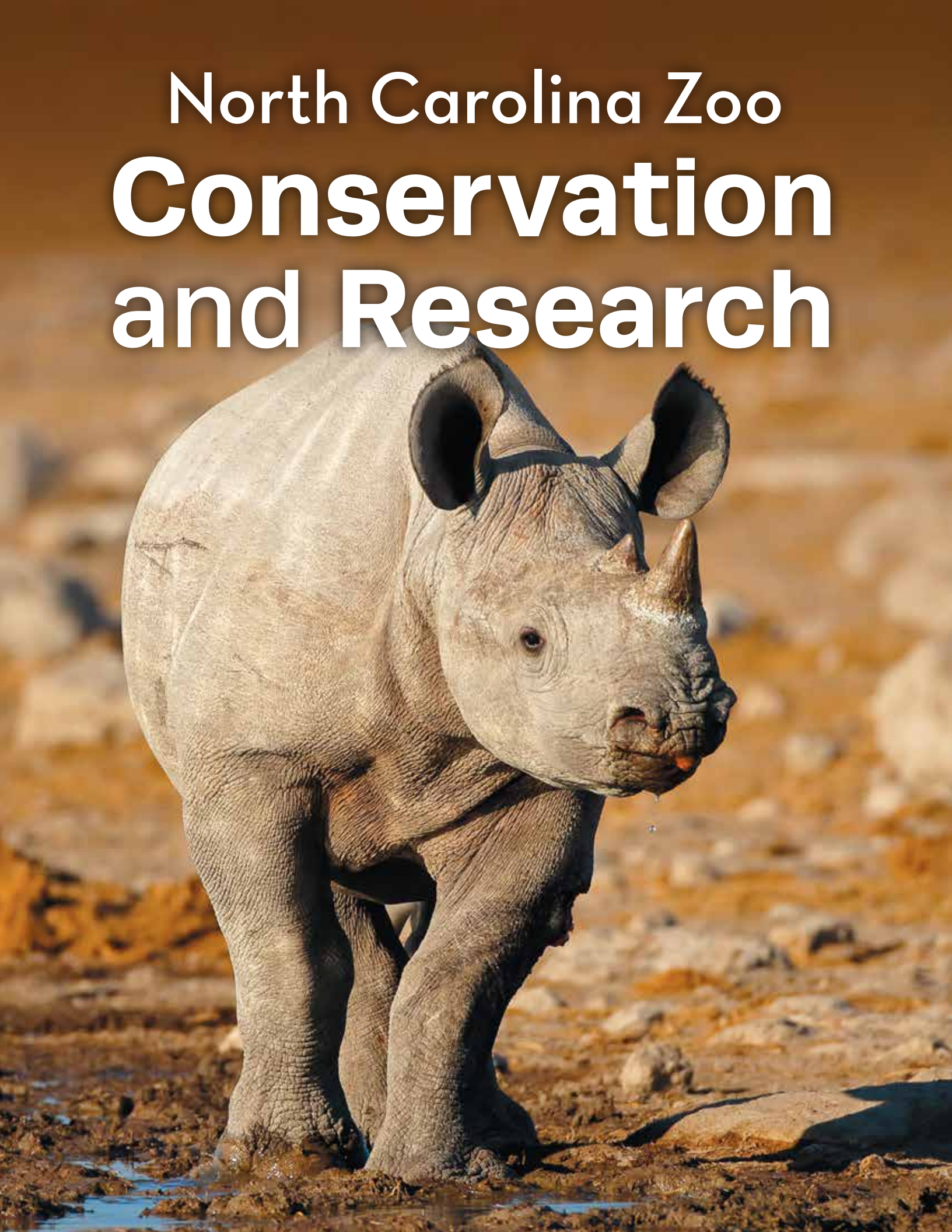
North Carolina Zoo

Conservation and Research



Conservation

is at the Heart of Everything We Do.

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Our mission is to protect wildlife and wild places and inspire people to join us in conserving the natural world. The North Carolina Zoo's staff are dedicated to local and global wildlife conservation, educating future generations, and ensuring the best possible care and wellness for the animals under our care. We do these things because we believe the diversity of nature is critical for our collective future."

L. Patricia Simmons
Director of North Carolina Zoo

International Conservation

Tracking Tanzania's Vultures

Vultures are currently the fastest declining group of birds globally, and several African vulture species are considered Critically Endangered. The primary threat to vultures is poisoning – often from livestock carcasses poisoned by people attempting to kill lions or hyenas, which occasionally prey upon their cows or goats. Vultures are wide-ranging and congregate at carcasses. A single poisoning event can have a catastrophic effect on vultures, and poisonings are also leading to declines in carnivores, such as lions. Therefore, finding effective solutions to address poisoning will save not only vultures, but also carnivores.

Since 2013, the Zoo has worked across southern Tanzania in two important vulture strongholds encompassing over 150,000 km^2: the Ruaha–Katavi landscape and Nyerere National Park. Led by the Zoo's Dr. Corinne Kendall, the goal of this work is to conserve southern Tanzania's vulture populations by reducing poisoning. Our approach is multifaceted. We monitor vulture population abundance over time, use satellite telemetry to discover poisoning events, train rangers in rapid response protocols for poisoning events, monitor lead levels in tagged vultures, and build partnerships to improve collaboration on coordinated conservation strategies.

45 vultures tagged

140 rangers trained in rapid response

0 poisonings in Ruaha National Park since February 2018

"Since 2013, the North Carolina Zoo and the Wildlife Conservation Society have partnered to conduct Tanzania's first substantial vulture monitoring program. This important collaboration continues to provide guidance to wildlife managers in terms of the overall status of various vulture species, the impact of poisoning events as well as providing protected areas with near real-time poaching-related intelligence to guide their protection operations."

Aaron Nicholas
Program Director,
Ruaha–Katavi Landscape, Tanzania,
Wildlife Conservation Society

Using SMART Technology to Protect Wildlife Around the World

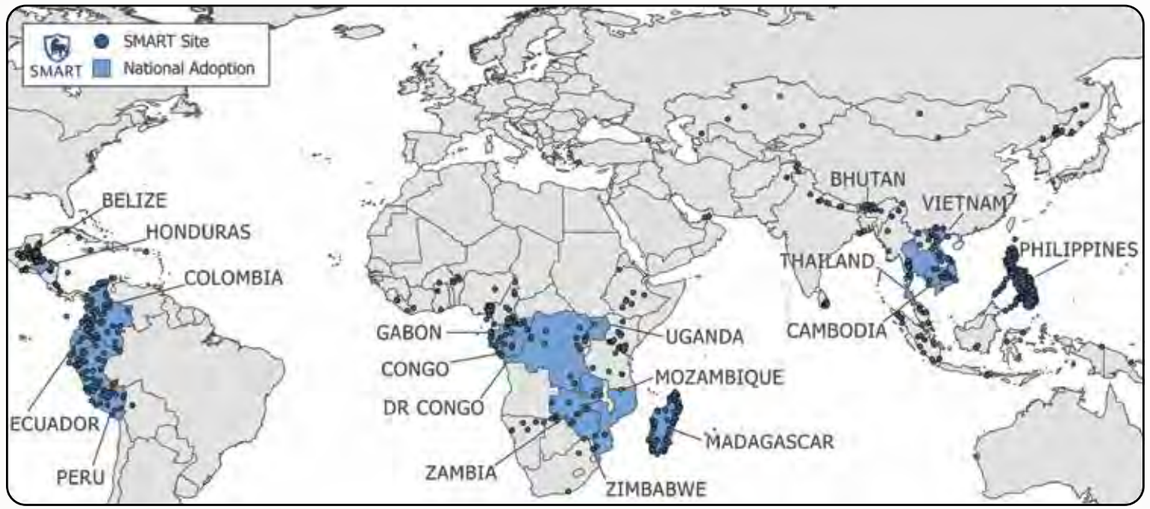
In partnership with some of the world's largest conservation organizations, the Zoo helped to develop the Spatial Monitoring and Reporting Tool (SMART; smartconservationtools.org) and found the SMART Partnership. SMART is the leading protected area management tool globally – used in more than 850 sites in over 65 countries and adopted as the national tool for park management in 18 countries.

>850
sites using SMART across 65 countries

SMART allows rangers working on the ground to use ruggedized smartphones to record data about what they encounter in the field, and track where their patrols go.

Information on animals, illegal activities and conservation actions taken are recorded and then fed into a central database. This allows the data to be quickly analyzed, visualized, mapped and acted upon so that park managers can rapidly respond to threats. Transforming raw data into usable information helps managers allocate their time and resources more effectively and better protect wildlife.

Through our leadership in the SMART Partnership and the development of SMART technologies, the Zoo has had a significant impact on wildlife conservation around the world. However, the Zoo also directly supports SMART use at more than 20 sites across seven countries in Africa, which are critical for the conservation of iconic wildlife, like black rhinos, Cross River gorillas, elephants, lions, and many other species. In addition to training hundreds of rangers across Africa, the Zoo has also provided technical support, equipment, funding, and even infrastructure, to its



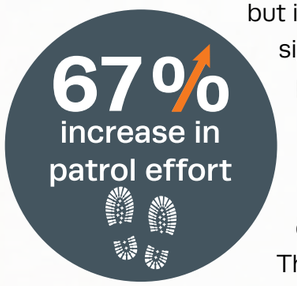
local SMART implementation partners. With SMART, the Zoo is not only putting powerful technology in the hands of rangers, we are giving them the advantage they need to be one step ahead of poachers.

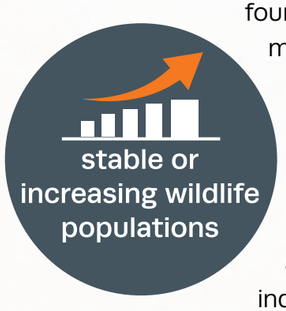
"SMART is an inspiring example of global collaboration and partnerships, and the positive impact they can have on research and conservation projects around the world."

Dan Ashe
President and CEO
Association of Zoos and Aquariums

Conserving Africa's Most Endangered Ape

Nigeria's Cross River region is one of Africa's most important biodiversity hotspots, but its wildlife are under significant threat from poaching and habitat loss, made worse by some of the highest human population densities in the world. The Cross River gorilla, found only in a few small, mountainous pockets of forest along the Nigeria–Cameroon border, is the most endangered ape in Africa, with only about 300 individuals remaining.





Led by the Zoo's Dr. Rich Bergl, we have been working to help save these gorillas by supporting better protection in the wild and by researching the threat posed by diseases to the gorillas. By working to conserve these gorillas, our efforts serve as an umbrella for the rest of the region's biodiversity, with action taken to preserve the gorillas helping to ensure the conservation of many other plant and animal species.

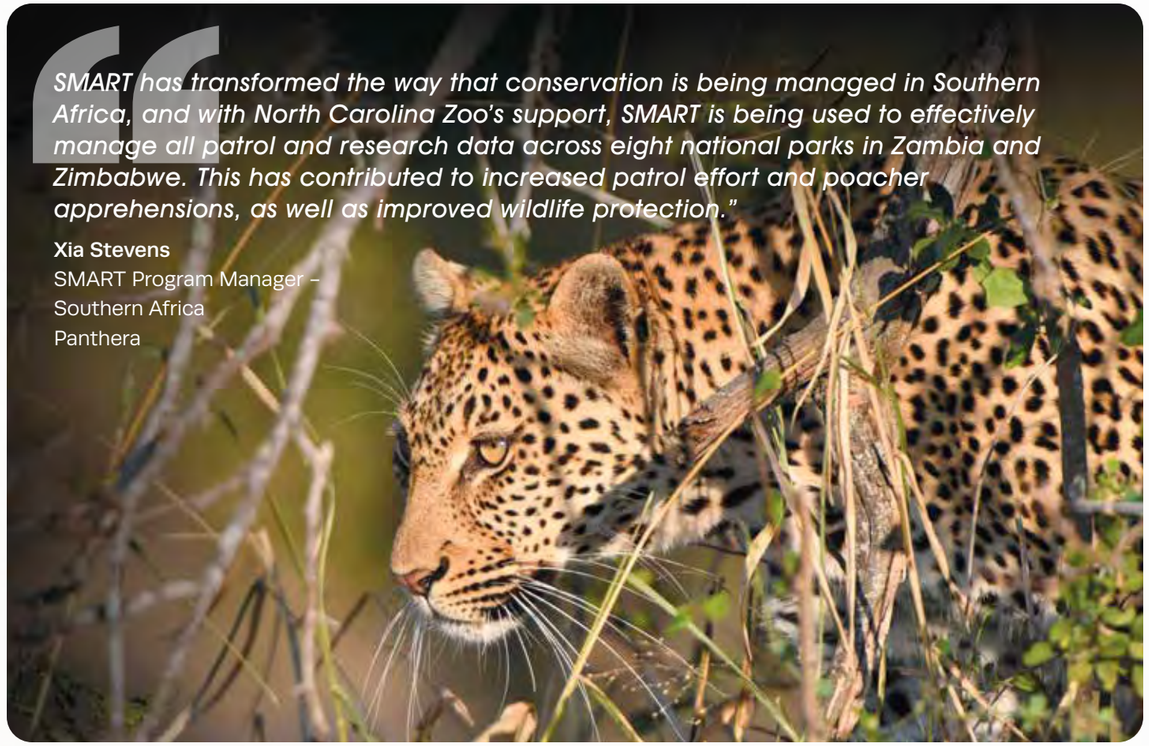
Working closely with our partners, at Wildlife Conservation Society (WCS) Nigeria, the Zoo has trained, equipped, and supported rangers to better protect this species in the wild. These efforts have become a case study on the use of SMART conservation software in the region, and the team on the ground has become a global SMART leader. SMART has helped WCS Nigeria to improve the effectiveness of law enforcement patrols and to more efficiently monitor illegal activities at all its sites. Using SMART has contributed to a significant increase in patrol effort (67%), a drastic reduction in hunting pressure (71%), and stable or slightly increasing wildlife populations at all WCS sites in Nigeria since implementation began.

Working with Emory University, the Zoo is also researching disease in Cross River gorillas, humans, and livestock populations to see if diseases may be transmitted to the gorillas. Results from the current genetic and parasitology work are still pending, but initial data suggest the presence of several human pathogens in the gorilla population. This information will help us better understand the health and genetics of the small remaining gorilla population, and will improve conservation planning efforts to reduce threats to both gorillas and the people who live in communities near the gorillas' habitat.

Conserving Carnivores Across Africa

Populations of large carnivores like lions, cheetahs, and wild dogs, are declining across all of Africa. Lions in particular have suffered due to poaching, unintentional snaring, and retaliation for livestock predation. As a result, the lion population has declined by nearly 50% across Africa since the 1990s. If these declines are not reversed, many African carnivores may face extinction. The Zoo supports conservation efforts in numerous key sites for carnivore conservation across Africa, including implementing SMART anti-poaching programs, to help protect these species and the national parks on which they depend.

Since 2014, we have worked with our partner, Panthera, to support anti-poaching work in Zambia, Zimbabwe, and Namibia in areas critical for the survival of lions, cheetahs, African wild dogs, and other carnivores. Improving conservation law enforcement is essential because carnivores in the region are under unprecedented pressure from both poaching, and reductions in prey populations.



SMART has transformed the way that conservation is being managed in Southern Africa, and with North Carolina Zoo's support, SMART is being used to effectively manage all patrol and research data across eight national parks in Zambia and Zimbabwe. This has contributed to increased patrol effort and poacher apprehensions, as well as improved wildlife protection."

Xia Stevens
SMART Program Manager – Southern Africa
Panthera

To date, we have set up SMART-based monitoring systems and trained staff in 14 protected areas across the region. Improved training and monitoring has resulted in both increased motivation of rangers and greater success protecting wildlife.

The range of West African lions has been reduced by 99% and only 500 individuals remain in the wild. The Zoo also works with the Wildlife Conservation Society in Nigeria to protect Yankari Game Reserve, home to Nigeria's last population of lions and elephants, in addition to other wildlife. The Zoo helped implement SMART in Yankari, which has improved anti-poaching strategies and contributed to no poached elephants in Yankari since May 2015. These improved anti-poaching patrols are benefiting all wildlife, and populations of many other large mammals at Yankari are now recovering.

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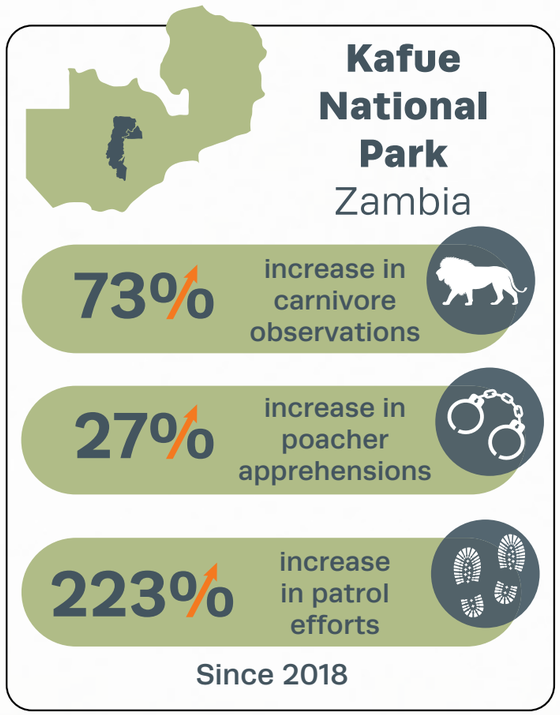


Protecting the Largest Remaining Black Rhino Populations

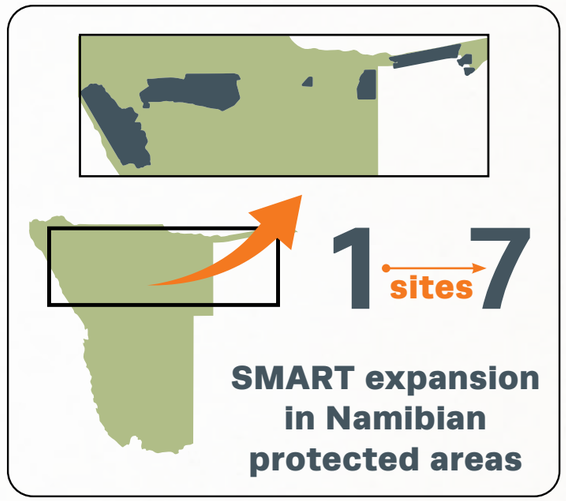
Across Africa, rhinoceros populations are declining due to poaching for their horns, primarily to supply traditional medicine markets in Asia. This poaching has driven the western black rhino to extinction, while only two northern white rhinos remain. If the threat of poaching is not reversed, rhinos in Africa will go extinct in the near future. Northern Namibia, and specifically Etosha National Park, is home to the largest black rhino population in the world; this area also supports a large population of southern white rhinos. The Kunene Region of northwestern Namibia is also home to the last free-roaming population of the desert-adapted black rhino, which is conserved largely through the efforts of local community conservancies.

The Zoo works with several partners in national parks and community conservancies in Namibia to implement an anti-poaching program based on SMART conservation software that the Zoo helped develop. Using SMART, both government and community ranger patrols are now collecting field observations on rugged smartphones, which allows information to be quickly analyzed and conservation strategies to be improved to better protect wildlife. This work began initially in Etosha National Park and the Kunene region, but based on the success of these initial deployments, the Zoo and its partners have expanded efforts to include all of the national parks in northeastern Namibia: Bwabwata, Khaudum, Mangetti, Mudumu, and Nkasa Rupara National Parks.

We look forward to continuing to build on these exciting and impactful partnerships through further capacity building efforts and long-term technical and logistical support, and we aim to work with our partners to further expand SMART use to more of Namibia's national parks in the future.

"Our work to save black rhinos is a great example of how the North Carolina Zoo is making a difference for endangered species around the world. If we are to save these amazing animals from extinction, we must continue to expand our conservation efforts both here in North Carolina and abroad."

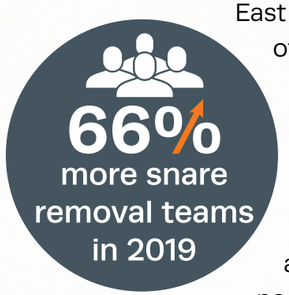
Richard Bergl, Ph.D.
Director of Conservation, Education and Science
North Carolina Zoo



Saving Chimps by Removing Snares

Kibale National Park in Uganda contains one of the largest chimpanzee populations in East Africa, making it one of the few remaining strongholds for chimpanzees in this part of the world. However, the chimpanzees in Kibale are threatened by poaching and often get caught in snares—so much so that it is estimated that one-third of all chimpanzees in the park have snare related injuries.

©Kevin Langergraber



To protect chimpanzees and other animals in Kibale from poaching, the Ngogo Chimpanzee Project began implementing regular snare removal patrols in 2010. They started with one three-person snare removal team that patrolled the area around the Ngogo study site, but it quickly became apparent that to be most effective, they would have to expand their presence to cover the entire park. Thanks in part to the Zoo, which has been supporting the project for nearly a decade, they were able to secure enough funds to meet this goal and patrol the whole park starting in Fall 2019. The project now employs five three-person snare teams that are based strategically throughout the park to enable them to patrol every square foot of Kibale and better protect the park's chimpanzees.

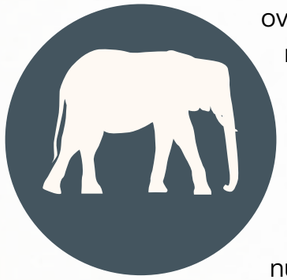
"I have been very lucky to observe many amazing things over the 20 years that I have studied the Ngogo community of chimpanzees. But the most rewarding thing I have observed is the dramatic reduction in snare injuries since we began our anti-poaching efforts."

Kevin Langergraber, Ph.D
Co-Director
Ngogo Chimpanzee Project

©Kevin Langergraber

Following Elephant Movement in West Africa

Elephant populations in Central and West Africa have significantly declined throughout the 20th and 21st centuries due to the expansion of human settlements, conflict with people and ivory poaching. The widespread loss and fragmentation of habitat forced elephants into closer contact with people, resulting in frequent conflict over finite space and resources. Crop raiding, injuries and deaths caused by elephants foster resentment and can result in elephants being viewed as a nuisance and killed for reasons other than their ivory.



42
elephants collared

Since 1998, the Zoo has worked to conserve wild elephants in Central and West Africa, by attempting to better understand movement patterns and habitat requirements of elephants through the use of GPS satellite tracking technology. Using this technology and in collaboration with the World Wildlife Fund, other NGOs, and local government agencies, we have been able to monitor elephant movement patterns in real time and identify several vital elephant migration routes.

28,000
individual elephant locations

The satellite tracking data have allowed rangers to anticipate where elephants are at greatest risk of encountering poachers and also alert them when the herds are heading toward human settlements, thereby reducing the risk of human–elephant conflict.

The Zoo's Director of Animal Health, Dr. Jb Minter, and Dr. Mike Loomis, the Zoo's Chief Veterinarian emeritus, have also recently begun collaborating with the Ministry of Waters and Forests of Cote D'Ivoire. This partnership aims to support Ivorian efforts to mitigate threats to elephants, as many elephant populations in Cote D'Ivoire are small, restricted to isolated forest fragments, and under intense pressure from poaching and human–elephant conflict. With the Zoo's continued support, the Ivorian government is committed to protecting these populations.

"The partnership between the Ministry of Waters and Forests of Cote D'Ivoire and the North Carolina Zoo is fundamental to the conservation of elephants in our country. The data will improve the management of elephants and their habitats in the country."

Kone Salimata
Director of Wildlife and Hunting Resources, Ministry of Waters and Forests, Côte d' Ivoire

Conserving Africa's Most Threatened Monkey Group

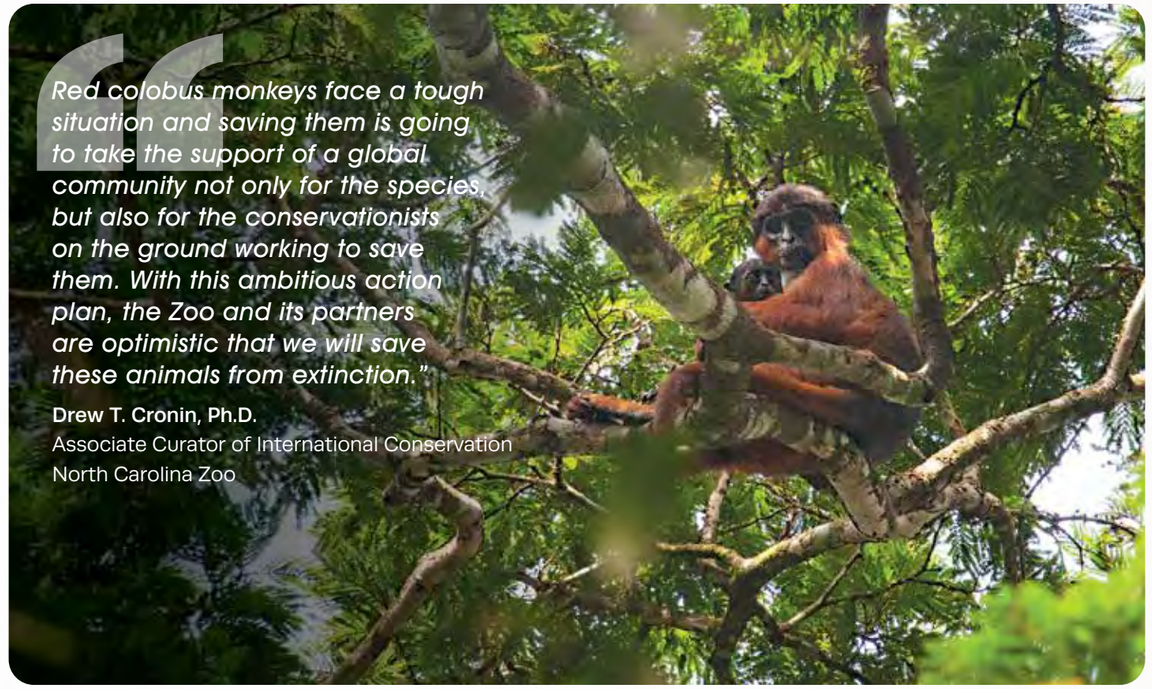
Ranging from the forests of Senegal to the islands of Zanzibar, red colobus monkeys are the most threatened group of African monkeys. According to the International Union for Conservation of Nature's (IUCN) Red List of Threatened Species, 13 of the 17 red colobus monkey species (>75%) are listed as Critically Endangered or Endangered and all are threatened with extinction. The primary threats facing red colobus are poaching, particularly for the commercial bushmeat trade, and habitat loss, both of which are ultimately driven by a combination of human population growth and increasing demand for natural resources. Despite their conservation status, only a few red colobus populations have been studied in any detail and the general public is largely unaware of these monkeys and their plight.

In response to this critical need, the Zoo's Dr. Drew Cronin and partners in the African Primatological Society and IUCN Primate Specialist Group are together spearheading

©WCS Nigeria

the first comprehensive Red Colobus Conservation Action Plan, uniting local and international conservation groups, governments, academic institutions, and zoos to prevent a continent-wide extinction of all 17 red colobus species. These groups have also launched a global effort – the Red Colobus Conservation Network (www.redcolobusnetwork.org), which the Zoo helps lead, in an effort to catalyze red colobus conservation and drive increased funding and actions for red colobus protection. Without urgent conservation measures across its range, Africa will lose many of its red colobus monkeys in the coming decades.

The Zoo also supports efforts to protect red colobus and its habitats on the ground in Africa. In Nigeria, our long running work in Cross River National Park supports ranger patrols giving protection to the Critically Endangered Preuss's red colobus. In Uganda, anti-poaching efforts with the Ngogo Chimpanzee Project have strengthened protections for all wildlife in Kibale National Park, including the Endangered Ashy red colobus. Finally, in Equatorial Guinea, we provide technical support for anti-poaching patrols using SMART to protect the Critically Endangered Pennant's red colobus.



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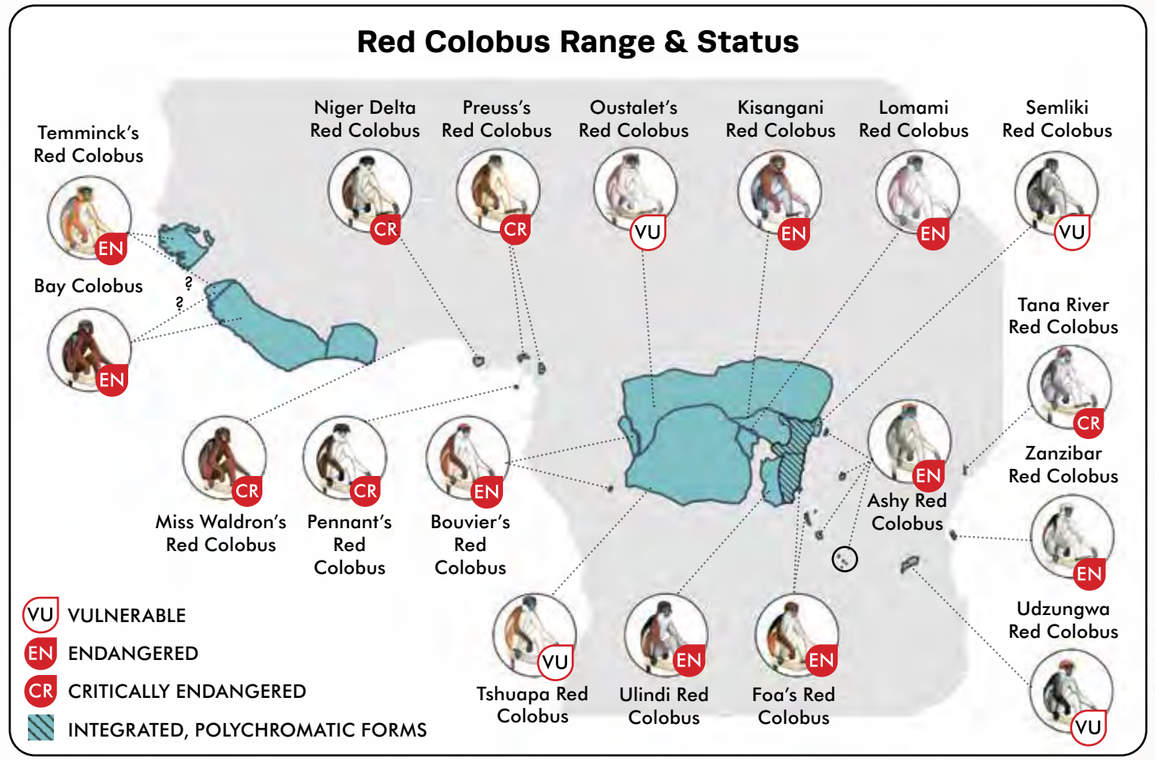

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Conserving Critically Endangered Pacific Birds

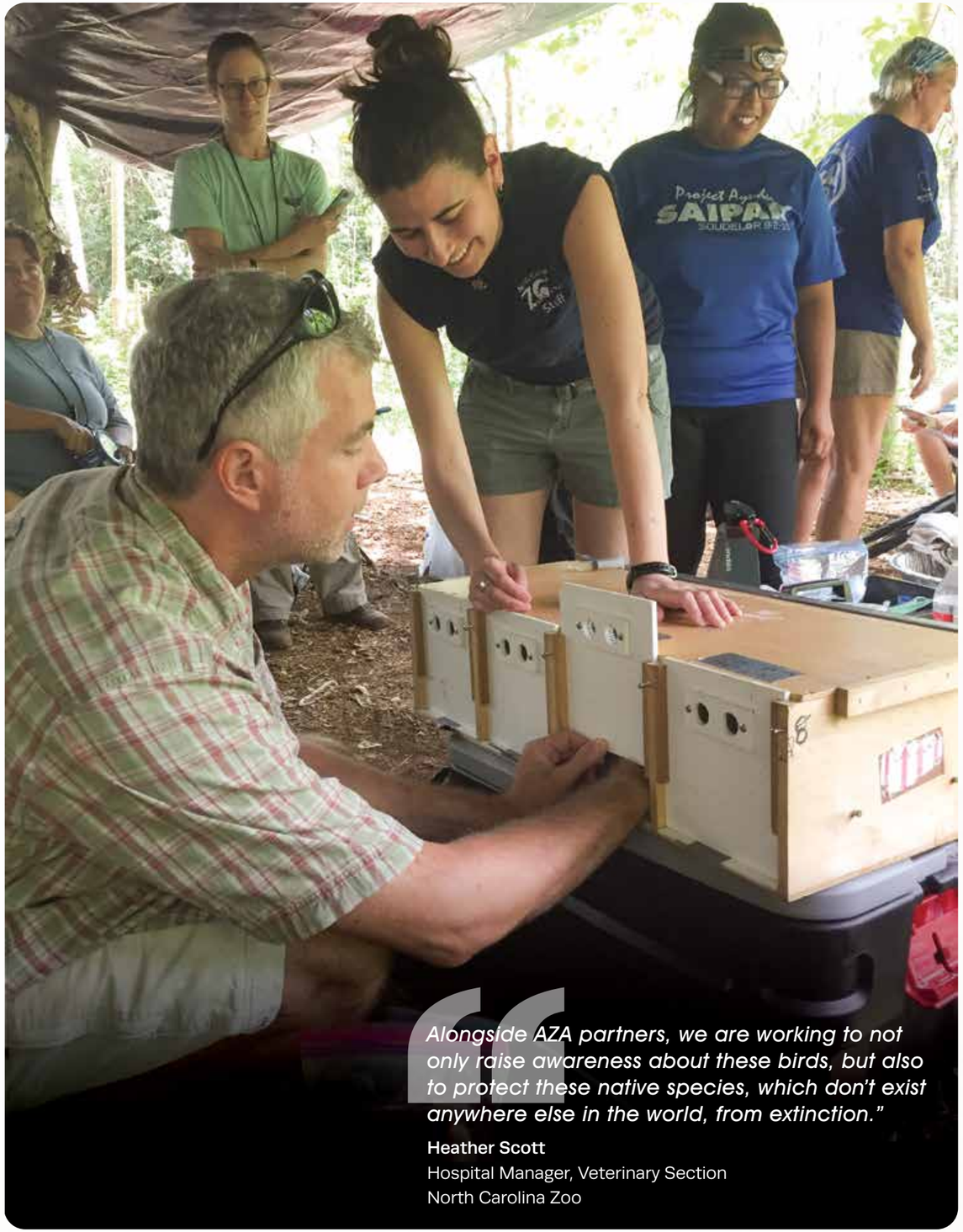
The Mariana Islands in the western Pacific Ocean are the northernmost string of islands in Micronesia, made up of Guam, a US territory, and the 14 islands of the Northern Mariana Islands, a US commonwealth. In the 1940's, the brown tree snake was accidentally introduced to Guam, and by the 1980's, the snake had decimated bird populations, driving nearly all of the native species on Guam to extinction in the wild. The Mariana Avifauna Conservation (MAC) Program's primary objective is to ensure the same fate doesn't befall the native endemic population of birds on the Northern Mariana Islands. The Zoo has been a long time MAC partner, providing critical conservation support in two ways: technical support for capturing birds to be translocated to snake-free islands, and providing veterinary care for the captured birds until they are released onto these new islands.

193
birds translocated since 2017

In the wild, Zoo staff have assisted with the capture and translocation of birds to snake-free islands with the MAC program for more than 10 years. Recently, translocation efforts have focused on capturing two bird species on Saipan and relocating them to the neighboring island of Alamagan. Teams of more than 25 staff from over 15 AZA institutions trapped 100 rufous fantails and 93 golden white-eyes. Captured birds are carefully cared for and

banded according to US Fish and Wildlife protocols and also undergo a veterinary health exam, before being transported to their release site. After their successful release, biologists from the Commonwealth of the Northern Mariana Islands Division of Fish & Wildlife continue to monitor how the birds do in their new home.

The Zoo also has a captive breeding program for the Critically Endangered golden white-eye, a bird native to Saipan, which received its first two pairs of wild-caught golden white-eyes in 2008. In 2009, the first healthy chick hatched, and was the first successful captive breeding for this species. We have had a total of six chicks successfully hatch and fledge since 2009, and have transferred several of these birds to other North American zoos as part of the effort to create a sustainable breeding population.



Alongside AZA partners, we are working to not only raise awareness about these birds, but also to protect these native species, which don't exist anywhere else in the world, from extinction."

Heather Scott
Hospital Manager, Veterinary Section
North Carolina Zoo

Conservation in the Caribbean

Under the leadership of Curator of Reptiles and Amphibians, Dustin Smith, the Zoo works on numerous projects in the Caribbean, including Puerto Rican crested toads, Virgin Island boas, and Conception Island silver boas. Although the geographic scope is broad, spanning from the Bahamas to Puerto Rico and throughout the Virgin Islands, the goal for all these species is the same: recover declining populations.

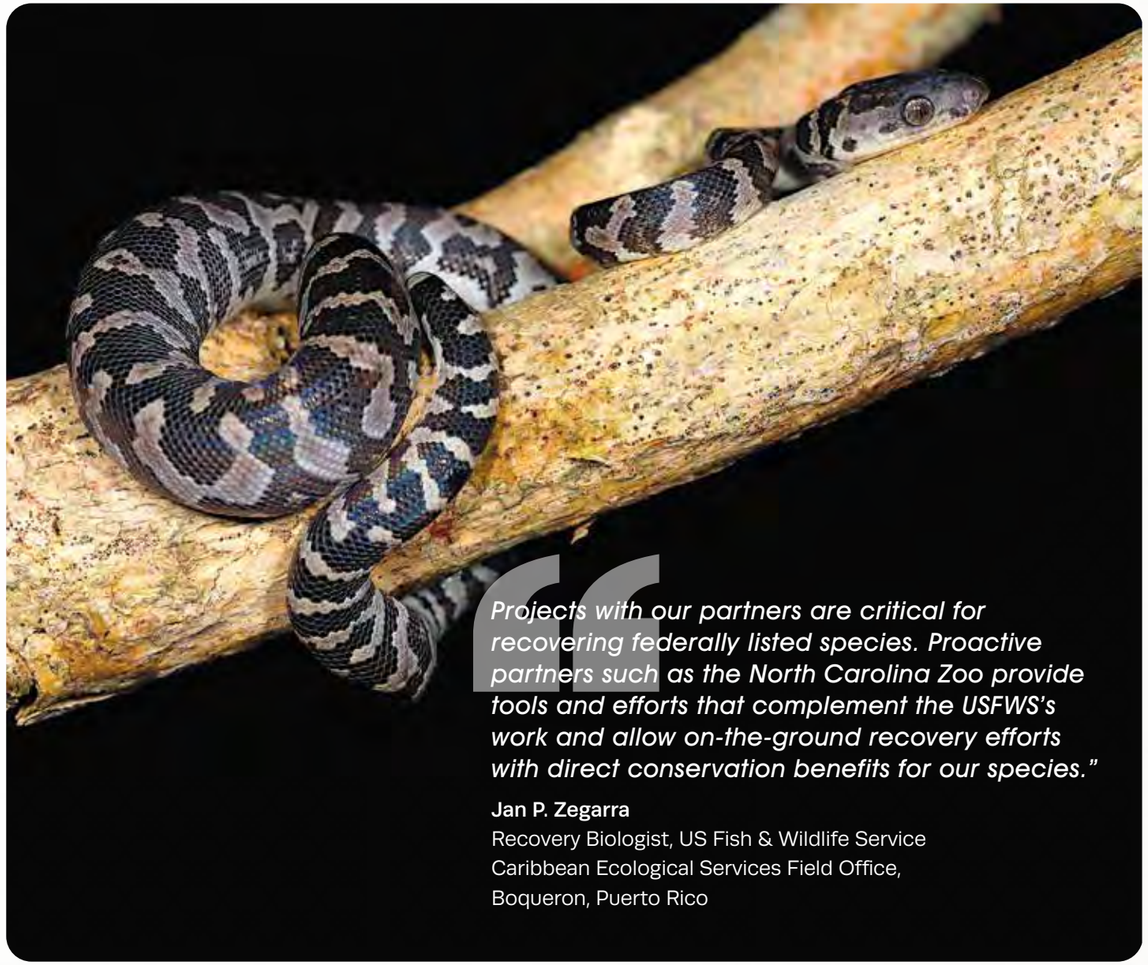
50+
Virgin Island boas observed during surveys in USVI and Puerto Rico

2,000+
Puerto Rican crested toad tadpoles released back into the wild in Puerto Rico

Since 2015, the Zoo has bred and released Puerto Rican crested toads annually to help bolster populations in the wild. The goal is to develop more self-sustaining populations, but this is difficult, as there are only two natural breeding ponds in existence. Because of this, we are working with Puerto Rican collaborators and AZA partners to design more wetlands and breeding sites for ongoing recovery. In 2017, we also assisted with the design and construction of two ponds, which have already been used multiple times by this Critically Endangered toad.

The Zoo also expanded its role in the Caribbean in 2017 by reinvigorating recovery efforts of the Virgin Island boa. We began conducting surveys to determine population sizes and better understand the overall status of the snakes. Zoo veterinary staff also conducted health assessments of the boas encountered. It was determined that we should begin breeding snakes at the Zoo for additional introductions to expand the wild population size. We also maintain an "assurance population" to make sure the species survives if something happens to the remaining wild population.

The Zoo is undertaking a similar effort in the Bahamas with the Silver boa. Although only recently described to science in 2015, it's already considered the world's rarest boa species, with fewer than 140 in existence. The Zoo is partnering with UNC Asheville and the Bahamas National Trust to conduct surveys for the species to learn more about its population and natural history. In addition, we are developing an assurance population to ensure its long-term survival and to better understand its reproductive biology.



"Projects with our partners are critical for recovering federally listed species. Proactive partners such as the North Carolina Zoo provide tools and efforts that complement the USFWS's work and allow on-the-ground recovery efforts with direct conservation benefits for our species."

Jan P. Zegarra
Recovery Biologist, US Fish & Wildlife Service
Caribbean Ecological Services Field Office,
Boqueron, Puerto Rico

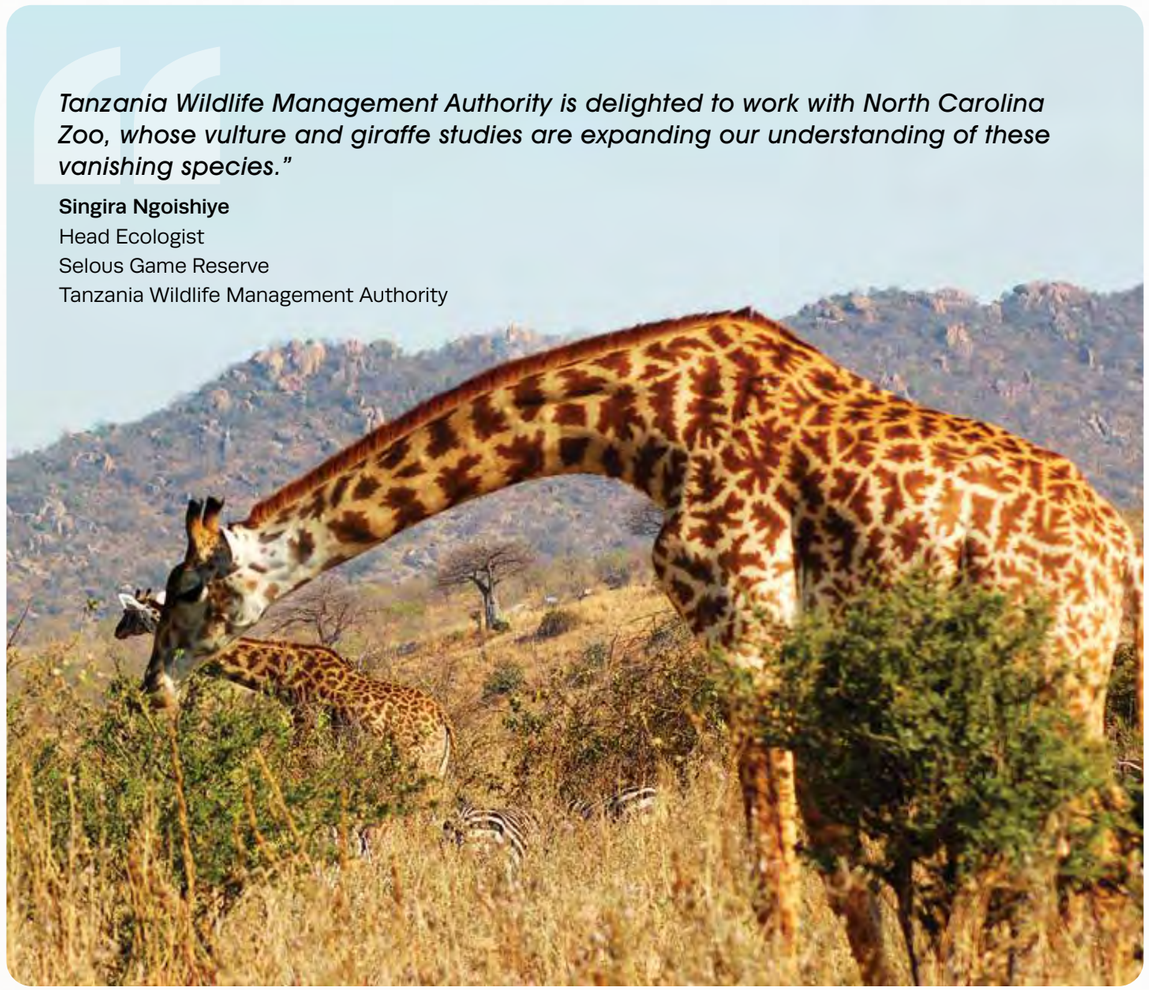
Conserving Tanzania's Giraffes

Global giraffe populations have declined by roughly 50% since the 1970's. Masai giraffe in Tanzania have faced similar declines and there is little information available on their population status and threats. The Zoo was privileged to attend the Tanzania National Giraffe Conservation Action Plan meeting in 2018. At that meeting, the needs for more population monitoring, detailed demographic data (age, sex, reproductive status, etc.), and better understanding of Giraffe Skin Disease progression for giraffe populations in southern Tanzania were highlighted.

To address these needs, the Zoo developed a research project for Nyerere National Park (formerly Selous Game Reserve) and Ruaha National Park to improve our understanding of giraffe population status and trends, as well as disease progression over time. The goal of the project is to use these data to develop and implement sustainable and well-informed conservation strategies.

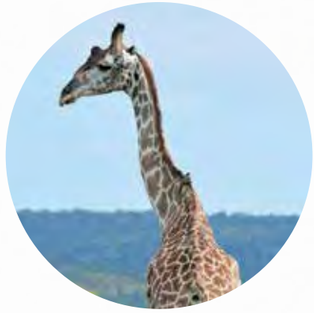
Tanzania Wildlife Management Authority is delighted to work with North Carolina Zoo, whose vulture and giraffe studies are expanding our understanding of these vanishing species."

Singira Ngoishiye
Head Ecologist
Selous Game Reserve
Tanzania Wildlife Management Authority



Collaborative Zoo & Field Conservation Through SAFE

Saving Animals from Extinction (SAFE) is a program of the Association of Zoos & Aquariums (AZA) that brings together AZA member institutions and field-based partners to work collaboratively towards the conservation of threatened wildlife. The Zoo has actively engaged with SAFE and is a Program Leader for African vultures, American red wolves, and Asian hornbills, and is a partner on black rhinos, chimpanzees, giraffe, gorillas, monarch butterflies, and North American songbirds. SAFE allows zoos and aquariums from across the country to use their collective expertise to work towards strategic actions to save animals in the wild.



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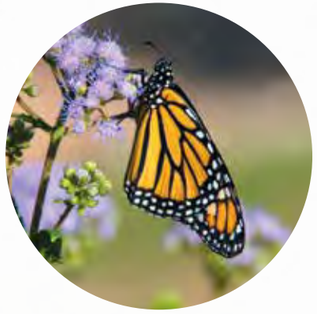
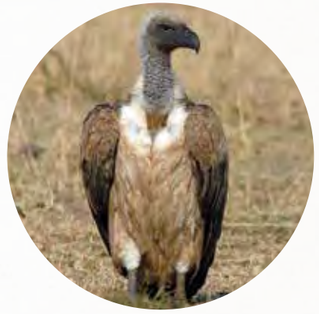




Translating Science into Conservation Action in the Philippines

The Zoo supports international conservation efforts by applying our resources and staff expertise to support evidence-based planning for important species of high conservation value around the world. Zoo staff often have unique knowledge which allows them to play key roles as members of IUCN SSC specialist groups and in species conservation planning. The One-Plan approach to conservation developed by the IUCN supports an integrated strategy for species conservation planning with a single plan to bridge the gap between wild and captive population management.

The Philippines is a biodiversity hotspot for hornbills, home to 10 endemic species, which the IUCN SSC Hornbill Specialist Group identified as a critical region due to four high priority hornbill species in need of conservation planning. In 2019, two species conservation planning workshops were organized for Philippine hornbill species, with many international and national stakeholders representing Philippine government agencies, landowners, conservation groups, universities, tourism, agriculture and local communities.

> *"The North Carolina Zoo brings significant ex situ hornbill experience and a deep understanding of both the Philippine context and IUCN Conservation Planning protocols, putting them in a unique position to support local NGO's to do the very best they can for these species."*
>
> **Dr. Lucy Kemp**
> Co-Chair of the IUCN SSC Hornbill Specialist Group

The first, held in March 2019, emphasized the Critically Endangered Sulu hornbill, while the second, in June 2019, focused more broadly on five high priority endemic species from the West Visayas region, including the Critically Endangered Rufous-headed hornbill and the Endangered Visayan hornbill. The Zoo's Director of Animal Management & Welfare, Roger Sweeney, contributed to both workshops as a member of the IUCN SSC Hornbill Specialist Group and led the specific ex situ working group for the Sulu hornbill workshop.

Zoo Staff Making a Difference

From Behind the Scenes into the Wild

Keepers at the Zoo work hard to care for our animals and ensure excellent guest experiences. One aspect of their work is behind the scenes tours, which generate funds that primarily support the Zoo's conservation programs, but that also provide support to external conservation organizations selected by the keepers. Recently supported organizations include the Zoos Victoria Bushfire Emergency Wildlife Fund, which provided emergency veterinary care to animals impacted by the Australian bushfires, the Philippine Eagle Foundation, which conserves the Critically Endangered Philippine Eagle, and the Orianne Society, which conserves reptiles and amphibians across the eastern United States.

Zookeepers support wildlife conservation

The American Association of Zoo Keepers (AAZK) is a non-profit, volunteer-led organization made up of professional zoo keepers and other interested individuals.

The North Carolina Chapter of American Association of Zookeepers (NCAAZK) is dedicated to advancing animal care, promoting public awareness, enhancing professional development, and contributing to local and international conservation efforts. AAZK and NCAAZK organize numerous fundraising events each year, such as Bowling for Rhinos, which provides support to Lewa Wildlife Conservancy, International Rhino Foundation, and Action for Cheetahs in Kenya, and the Run Wild 5K hosted at the Zoo, which supports keeper education and development, as well as a host of global and local conservation organizations. NCAAZK has raised more than $180,000 for Bowling For Rhinos. Collectively, AAZK chapters have raised more than 8 million dollars since 1990.

In addition to annual fundraisers, NCAAZK members also vote to select two local and two global conservation organizations to support each year, such as the Endangered Wolf Center and SaveNature.org. In an average year, the NCAAZK donates more than $7,000 to local and global conservation organizations through this effort.

Regional Conservation

Conserving North Carolina's Red Wolves

The Zoo has supported the conservation of the Critically Endangered American red wolf since 1995. In the wild, red wolves – the most endangered canid in the world – are restricted to a small area in eastern North Carolina, with a population of fewer than 20 individuals. Led by Chris Lasher, a Supervisor at the Zoo, Red Wolf Species Survival Plan (SSP) Coordinator and American Red Wolf Saving Animals From Extinction (SAFE) program leader, the mission of the SSP red wolf program is to increase conservation efforts for the American Red Wolf by maintaining a healthy and viable assurance population of red wolves under human care, expanding education and awareness efforts about the species, and aiding research vital to supporting the recovery and management of this species.

The initial goal of the SAFE program is to increase space for red wolves under human care from the current capacity of 225 wolves to the US Fish and Wildlife Service recommended minimum capacity of 330. To achieve this goal, the Zoo will identify and expand its capacity to house red wolves by 50 new spaces. The Zoo's wolf population will then become a source population for any additional recovery and reintroduction areas identified by US Fish and Wildlife Service.

In addition to increasing the population under human care, we are also working to educate and engage guests, non-government organizations, governments and land owners in recovery areas about the benefits the red wolf provides to the ecosystem and economies of the areas where reintroduction efforts are focused.

The North Carolina Zoo's contributions to conservation of the American red wolf are vital to the recovery of this species. The Zoo's management of the American Red Wolf Species Survival Plan ensures the long-term genetic health of the species and establishment of future new red wolf populations, and the Zoo's key role in the Red Wolf SAFE program addresses education and awareness efforts and research vital to recovery and management of this species."

Emily Weller
Red Wolf Recovery Lead
U.S. Fish and Wildlife Service

“Our partnership with the North Carolina Zoo has allowed the NC Wildlife Resources Commission to increase our capacity to work on amphibians in a way that we would otherwise be unable to do. Specifically, the Zoo’s ability and capacity to hatch eggs and head-start several rare frogs, such as the gopher frog and the ornate chorus frog, gives these species a better chance for long-term survival in the wild.”

Jeff Hall
Partners in Amphibian & Reptile Conservation Biologist, North Carolina Wildlife Resources Commission

40
hellbender nest boxes installed in rivers

>1,000
gopher frogs released into the wild

Amphibian Conservation in the Carolinas

Home to nearly 100 species of amphibians, North Carolina is a hotspot of amphibian diversity, including more species of salamanders than anywhere in the world. Unfortunately many species are in decline.

Eastern hellbenders are a type of salamander, known locally as “Snot Otters”. They require clean, well-oxygenated rivers with plenty of prey items, and appropriate shelter and nest rocks. Due to ongoing degradation of streams and surrounding habitats, most of North Carolina’s hellbender populations are in decline. The Zoo is working with the North Carolina Wildlife Resources Commission to bolster populations by installing artificial nest boxes in streams where hellbenders occur. The nest boxes are designed to withstand fast moving rivers, while protecting the hellbenders and their eggs inside. We are also monitoring these sites to determine the effectiveness of the boxes in different areas.

Many of our state’s endangered amphibians live in the piedmont/coastal plain and are specialists of the long-leaf pine ecosystem. Gopher frogs and ornate chorus frogs, both state Endangered species, breed during winter rain events in ephemeral wetlands. Each winter, we visit these ponds with staff from the Wildlife Resources Commission to conduct egg mass surveys and collect a small portion from each egg mass for headstarting. The eggs are transported to the zoo to hatch and we raise the tadpoles to small frogs. Once they’ve morphed, they are marked, measured, and released back into the wild. This effort gives the individuals a higher chance of surviving to be adults. In addition to releasing at the historic breeding sites, we are also expanding this effort to include recently restored wetlands.

Preserving Wild Places in North Carolina

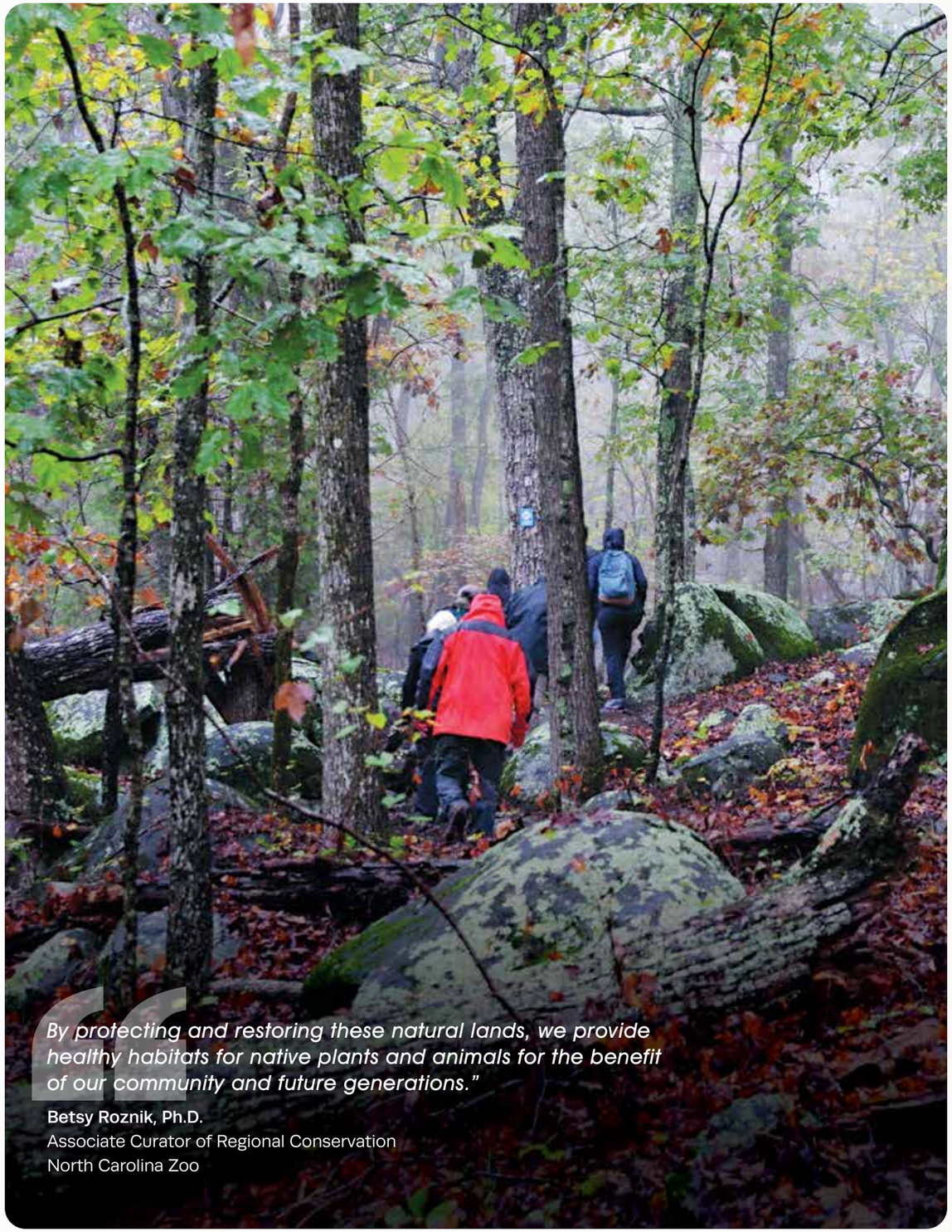
With over 2,800 acres, North Carolina Zoo is the world's largest natural habitat zoo. Aside from the 500 developed acres of the Zoo, much of this land is set aside for preservation due to its unique geological, botanical, and wildlife value.

One of the most interesting features of our local wild-lands is Purgatory Mountain, which is part of the Uwharrie mountain range. On the mountain, there are several isolated upland pools and seeps as well as a prairie home to the Endangered Schweinitz's sunflower (*Helianthus schweinitzii*). Purgatory Mountain Trail is the primary, original trail on Zoo property, and sole access remains via foot trails. However, the Zoo now features approximately four miles of marked trails.

>2,800
total acres preserved and managed

Another property, Ridge's Mountain Preserve, an area of approximately 280 acres, is home to unique geologic features, soils, plants, and even two upland pools which are breeding habitats for marbled salamanders. The Preserve also shares a deep and important connection with local communities around the Zoo. The preserve's trail system (approximately two miles) was constructed over time by two Eagle Scout members of the Asheboro Troop 527 chartered by the First United Methodist Church in Asheboro.

Most recently the Zoo has added three additional parcels that will serve as buffers for existing property from future developments. In this way, the Zoo helps to maintain important habitat and corridors for native wildlife.



By protecting and restoring these natural lands, we provide healthy habitats for native plants and animals for the benefit of our community and future generations."

Betsy Roznik, Ph.D.
Associate Curator of Regional Conservation
North Carolina Zoo

Conservation Education

UNITE: Sustainable, Community-driven Environmental Education

The Zoo believes in the power of education both for our visitors and as part of our international conservation efforts. Through our UNITE program, which has operated around Uganda's Kibale National Park for more than 17 years, the Zoo is training Ugandan teachers to be better environmental educators and stewards. Kibale is a critically important conservation area with the highest density of primates in all of Africa, including the largest chimpanzee population in East Africa and the only viable population of the Endangered Ashy red colobus monkey. Recently, the Zoo expanded efforts to neighboring Queen Elizabeth National Park, which, together with Kibale, forms a continuous forest corridor that is critically important for the conservation of many African wildlife species, including lions, leopards, elephants, and chimpanzees.

UNITE provides Ugandan communities with quality conservation education programming rooted in science and culture that addresses environmental needs with appropriate sustainable solutions. To do this, UNITE employs four Ugandan staff members year-round to work in close collaboration with 28 schools within a five-km radius around Kibale and Queen Elizabeth National Parks. UNITE staff empower teachers to enhance their teaching methods, incorporate more environmental topics into the classroom, and help the local community reduce their impact on the neighboring national parks. These objectives are accomplished through a combination of teacher workshops, school field trips, one-on-one work with head teachers, and creation of conservation clubs, all of which are carefully monitored and evaluated through classroom observations, student evaluations, and school and home visits. With our support, teachers, their students, and their communities are better protecting the forests and wildlife that they live alongside.

Educating Future Leaders

28 schools

300 teachers

9,200 students

Nurturing sustainable livelihoods

45 beehives built

615 fuel-efficient stoves built

105 vegetable gardens planted

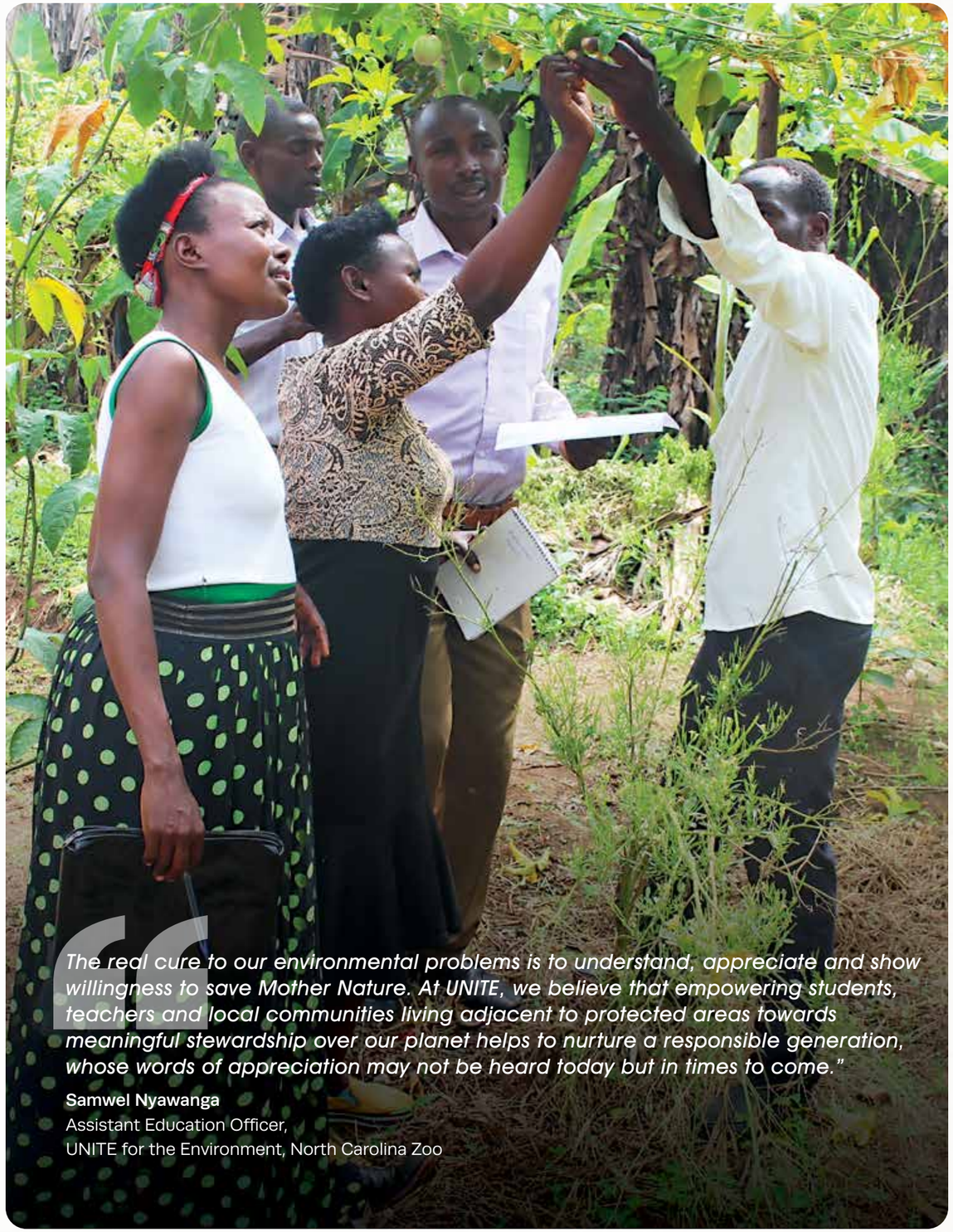
1,530 trees planted

225 banana trees planted

22 waste incinerators built

UNITE for the Environment

Training Ugandan teachers to be better environmental educators and stewards of the natural world.



"The real cure to our environmental problems is to understand, appreciate and show willingness to save Mother Nature. At UNITE, we believe that empowering students, teachers and local communities living adjacent to protected areas towards meaningful stewardship over our planet helps to nurture a responsible generation, whose words of appreciation may not be heard today but in times to come."

Samwel Nyawanga
Assistant Education Officer,
UNITE for the Environment, North Carolina Zoo

Providing a Refuge for Migrating Monarchs

Several monarch waystations can be found around the Zoo in areas like Kidzone and the Kaleidoscope Butterfly Garden, providing safe haven for migrating monarchs and habitat for other local pollinators and also demonstrating how simple it is to create pollinator habitat. Recently, the Zoo has been working closely with the community to share expertise in the creation of "Pollination Stations," which consist of planters of native nectar and host plants for local pollinator species. Working with community partners, we have installed Pollination Stations made with recycled containers and decorated by children at three Randolph County preschool sites and one at the Child Development Center at Davidson County Community College.

The Zoo's preschool pollinator program has also been incorporated into teacher trainings. The overall goal is to create pockets of plant diversity that support local pollinator species, help local schools meet curriculum guidelines, and reinforce community partnerships. Pollination stations are also part of the Zoo's contribution to the nationwide efforts of the Monarch Butterfly SAFE program.

"The pollination station helps spark a spirit of conservation in young children at an early age so that students can have positive experiences with nature and the outdoors."

Dena Harward
Early Childhood Teacher
Head Start, Asheboro

Using Polar Bears in Climate Change Education

>45,000
reached annually through climate change outreach & events

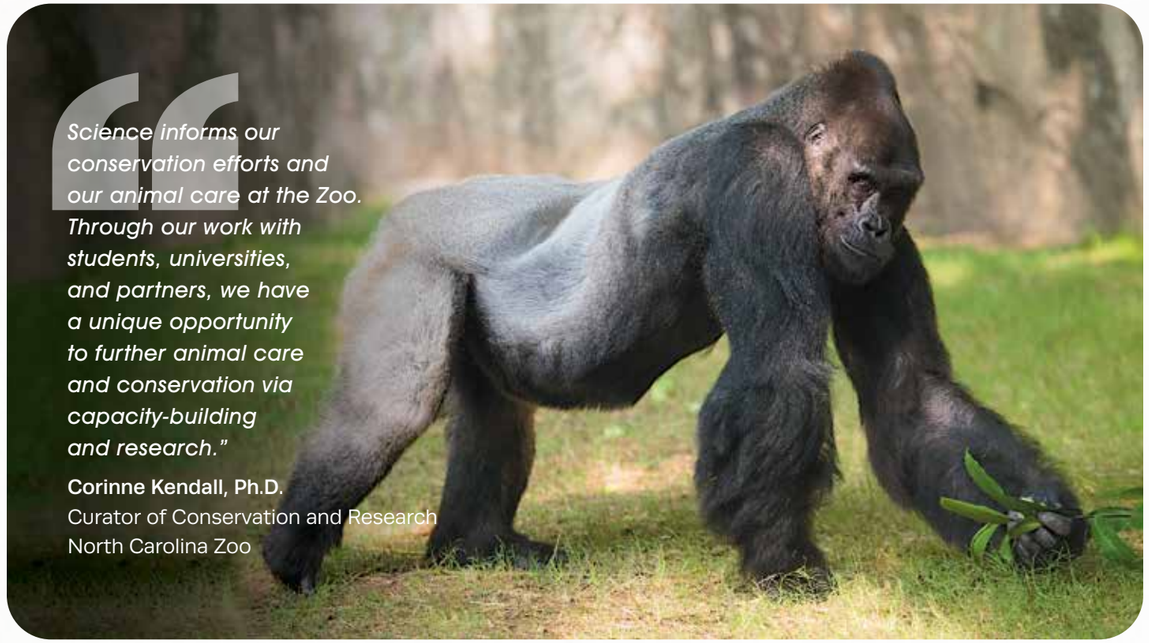
Polar Bears International (PBI) is the leading polar bear conservation group in the world. They work to conserve polar bears and save the sea ice the bears depend on. Since 2009, the Zoo has supported four keepers, two volunteers, and two educators to attend PBI's Climate Alliance Workshop in Churchill, Manitoba, which is considered the polar bear capital of the world due to the significant population of bears that migrate through the area. The Zoo is also among an elite group of 40 zoos, aquariums, and museums that partner with PBI as an Arctic Ambassador Center (AAC). With this partnership, the Zoo participates in actions which promote climate change awareness, such as tree planting at local parks and schools, facilitating workshops at colleges, and presenting the "Paw of Approval" awards to North Carolina businesses with green practices that work to mitigate the impact of climate change.

In 2019, educators from AAC's around the country met for the Climate Alliance Workshop. Emphasis was placed on how to engage in productive conversations about climate change with the help of evidence-based communications methods from the National Network for Ocean and Climate Change Interpretation (NNOCCI). This specialized training has been implemented in 184 institutions from 38 states. Creating a framework using universal values, explanatory metaphors to more clearly explain how climate change works, and community level solutions, the Zoo reaches more than 45,000 people annually through presentations at the North Carolina Science Teacher Association Conference, our Living with Nature Distance Learning Events, Facebook Live videos, and in-person interactions.

"Having the NNOCCI training has made me much more confident in my ability to educate guests on the mechanics of climate science and how to empower them to help protect our world and the plants and animals that live in it. I am excited to join the rest of the AAC team to support the Zoo's mission as a leader in conservation education."

Leslie Wilhoit
School Programs Coordinator
North Carolina Zoo
2019 Climate Alliance Workshop Participant

Research



Science informs our conservation efforts and our animal care at the Zoo. Through our work with students, universities, and partners, we have a unique opportunity to further animal care and conservation via capacity-building and research."

Corinne Kendall, Ph.D.
Curator of Conservation and Research
North Carolina Zoo

Science at the Zoo

Research conducted at the Zoo spans a variety of disciplines, including veterinary medicine, evolutionary biology, animal behavior, and conservation. The Zoo acts as a resource for universities and colleges all over the country to learn about and better understand wildlife in ways that are only possible by having animals in human care. Studies conducted at the Zoo have helped calibrate how scientists measure body condition in wild polar bears, improved our understanding of biomechanics (how animals move) in gorillas and chimpanzees, and provided a testing ground for new methods in using Doppler radar to detect poachers and wildlife in the field. Overall, by prioritizing research, the Zoo forges new pathways to discover little known, but desperately needed information on wildlife health and behavior.

Veterinary Research in the Field

Black-faced impala are genetically distinct from common impala and are endemic to Namibia, where only 3000–4000 individuals remain. In order to conserve this vulnerable species, they need to be translocated away from areas of poaching or inadequate resources.

Translocation involves darting the impala and using anesthesia, often in remote areas with limited support, which can be dangerous to the animals. Zoo veterinarian Dr. Katie Delk has partnered with the Ministry of Environment, Forestry and Tourism in Namibia to evaluate anesthetic protocols with the goal of decreasing morbidity and mortality during translocation in Etosha National Park.

Initial fieldwork has resulted in improved anesthetic methods and zero mortalities. In addition to safer translocations for the impala, this partnership also builds capacity of Namibian staff, who are trained to assist in procedures. Results from this work will be published in an open-access veterinary journal so that local or regional wildlife veterinarians can benefit.

Being able to immobilize black-faced impala in the safest way possible is a huge advancement and will greatly contribute to future translocation successes of this iconic species."

Carl-Heinz Moeller
Veterinarian and Chief Pilot
Wildlife Support Services
Ministry of Environment Forestry and Tourism

Improving the Lives of Animals through Research

In addition to facilitating external research, the Zoo has dedicated scientific staff working to improve the lives of our animals. Research projects are conducted through close collaboration among our research, veterinary, and animal teams, who work together on the implementation and supervision of all on-site research. Our staff use research to improve the lives of our animals by producing applicable results, which directly improve health, habitat design, enrichment use, diet plans, breeding behaviors, and overall animal management strategies.

>45
interns from NC State University and other NC colleges since 2015

70
scientific publications since 2015

The Zoo's dedication to research also facilitates educational and learning opportunities for students. Our staff work closely with undergraduate and graduate students, designing and implementing a variety of research projects. This experience enables students to gain the skills required to execute scientific research with wild animals, as they work towards careers in veterinary science, ecology, or wildlife conservation.

Zoo-based research is a fundamental step in enriching the lives of our animals. The science we do at North Carolina Zoo ensures that our animal husbandry practices are evidence-based and responsive to our animal's needs."

Emily Lynch, Ph.D.
Associate Curator of Research
North Carolina Zoo

Welfare

Wildlife Rehab Center

The Zoo's Valerie H. Schindler Wildlife Rehabilitation Center was established in 2001 to provide veterinary and rehabilitative care to sick, injured, and orphaned North Carolina native wildlife, and to provide opportunities for individuals to learn respectful and responsible techniques for caring for wildlife for the sole purpose of returning them to the wild. In an average year, more than 700 animals are admitted to the wildlife center, representing around 100 different species of birds, mammals, reptiles, and amphibians.

700
animals admitted per year

The center also works closely with the community and local agencies and institutions. For instance, the Zoo assists the North Carolina Wildlife Resource Commission with injured and orphaned bear cubs, providing the best care possible, while ensuring the cubs can be successfully returned to the wild.

100
different species of birds, mammals, reptiles, and amphibians

The center has also provided numerous opportunities for assistance and training for locally licensed wildlife rehabilitators. In 2019, the center had a waitlist of enthusiastic volunteers, topping out at 95 active contributing team members. This exceptional group included interns from the center's in-house program, as well as from North Carolina's Black Colleges and Universities and the Youth Advocacy and Involvement Office programs.

>90
volunteer interns per year

Center staff also work further afield having participated in Hellbender and American alligator research and conservations initiatives, contributing to a native salamander breeding project, and providing long-term guidance and assistance to Wild Sun Rescue Center in Costa Rica.

The Wildlife Rehabilitation Center continues to be an integral and invaluable resource that the Zoo provides to the wildlife and people of North Carolina."

Halley D. Buckanoff, Wildlife Center Veterinary Technician, North Carolina Zoo

International Animal Welfare

The Zoo is committed to the highest standards of animal welfare at our own facility, and by developing partnerships and working closely with zoos in developing countries, we are able to improve welfare for animals at other institutions as well. Most recently, we have been working with partners in Thailand, Madagascar, and South Africa.

In 2018, the Zoo began a partnership with Zoo Parks Organization of Thailand (ZPO) and Wild Welfare, a captive wild animal welfare program conceived at the North Carolina Zoo, which focuses on improving welfare standards in substandard wild animal facilities. In this new collaboration, the Zoo provides training to help Thailand ZPO zoos build staff capacity and meet the highest possible standards for animal welfare. Our Zoo staff are now regularly visiting ZPO zoos to review welfare assessment reports, identify critical performance gaps, and design staff training to build knowledge and skills capacity of the ZPO zoo staff. Training is currently focused on ZPO zoos – Chiang Mai Zoo and Khao Kheow Zoo – with these zoos being developed into centers of excellence that can train staff from other zoos in Thailand.

The Zoo also assisted authorities in Madagascar in 2018 when they intercepted an illegal wildlife smuggling operation involving nearly 10,000 endangered Madagascan radiated tortoises. The size and scope of this wildlife confiscation was beyond the abilities of local responders and conservation groups in Madagascar, so an international operation was mounted by members of the Association of Zoos & Aquariums, to which the Zoo contributed a three-person team, with each member contributing different skills to the response effort. Our team comprised a veterinary resident, who participated in the health assessment and medical care of the confiscated animals; an animal care supervisor, who participated in setting up animal care routines to house, feed, and monitor the confiscated animals; and also a member of our Zoo maintenance team to help develop the infrastructure to provide housing and secure facilities for such a large group of confiscated animals.

In January 2019, news broke that 1,800 lesser flamingo chicks were abandoned by their parents because of severe drought near the breeding area, Kamfers Dam, South Africa. The 1,800 abandoned chicks were rescued and sent to zoos and wildlife centers across Africa. Zoo Aviary zookeeper, Jeff Souther, joined other zoo professionals in Africa to care for the chicks. During his visit he prepared formula, hand fed the chicks, cleaned enclosures, bathed, and weighed the 115 chicks housed at his location.

"North Carolina Zoo has built an international reputation for practicing a high level of animal welfare science and we believe part of our mission is also to assist locally and globally, through building the capacity of partner organizations around the world and joining emergency response and rescue operations when needed."

Roger Sweeney
Director of Animal Management & Welfare
North Carolina Zoo

Green Practices & Sustainability

Green Practices & Sustainability at the Zoo

For more than 30 years, the North Carolina Zoo has been invested in natural resource conservation as a way to maintain natural ecosystems and prevent environmental degradation. The Zoo is also a long-term member of North Carolina's Environmental Stewardship Initiative and has received ISO 14001 certification, which signifies the Zoo's commitment to minimizing waste, conserving natural resources, and preventing environmental degradation in every aspect of Zoo operations.

Beginning with the initiation of its first 'green practices' in the late 1980's, the Zoo has enacted numerous projects, such as high efficiency LED lighting and HVAC control systems. Current priority initiatives include intensive recycling and composting programs, and a comprehensive approach to minimizing single-use plastics throughout Zoo operations. Reducing our plastics use helps accomplish numerous goals, including reducing consumption of fossil fuels (most plastics are made from petroleum), eliminating potential marine debris, and addressing growing concern over microplastic pollution.

At the Zoo, we strive to inspire others to make small incremental changes in their own lives to make the world a better place."

Bob Langston
Sustainability and Conservation
Outreach Coordinator
North Carolina Zoo

Making Strides at the Zoo...

- **4** refill stations within the park
- **8** Electric Charging stations
- **100%** fry grease waste recycled
- 64% less wattage using LED bulbs
- **1,800 tons** of waste composted annually
- **Solar Pointe** generates energy to power 12 homes for one year

...and Across the State.

- **725** miles of shoreline cleaned up
- **116** acres of longleaf pine forest restored
- **400** trees planted
- **5,000** seedlings given away
- **>750,000 lbs** trash removed from waterways
- **5,000** students/year educated on environmental stewardship

Conservation Partners

Conservation Partners

The North Carolina Zoo collaborates with more than 90 partners in more than 20 countries.

American Association of Zoo Keepers

ASEAN Center for Biodiversity

Association of Zoos & Aquariums

Bahamas National Trust

Bauchi State Government, Nigeria

BioCarbon Partners

Bioko Biodiversity Protection Program

Blue Ridge Biofuels

Bristol Zoological Society

Chimpanzee Sanctuary and Widlife Conservation Trust & Ngamba Island Chimpanzee Sanctuary

Citizens of the Karst

Cleveland Metroparks Zoo

Commonwealth of Northern Mariana Islands Division of Fish & Wildlife

Conservation Lower Zambezi

Conservation South Luangwa

Cross River State Forestry Commission, Nigeria

Disney Wildlife Conservation Fund

Drexel University

Duke University

Emory University

Frankfurt Zoological Society

Game Rangers International

Giraffe Conservation Foundation

Global Wildlife Conservation

Greater Uwharrie Conservation Partnership

High Point University

International Union for Conservation of Nature

Ivorian Office of Parks and Reserves, Côte d'Ivoire

Kamwenge District Local Government, Uganda

Kibale Association for Rural and Environmental Development

Kibale Chimpanzee Project

Leiden Conservation Foundation

Max Planck Institute for Evolutionary Anthropology

Ministry of Environment, Forestry and Tourism, Namibia

Ministry of Forestry and Wildlife, Cameroon

Ministry of Water and Forests, Côte d'Ivoire

Minnesota Zoo

Mohamed bin Zayed Species Conservation Fund

Namibia Nature Foundation

National Geographic Society

National University of Equatorial Guinea

NC GreenPower

Ngogo Chimpanzee Project

Nigeria National Parks Service

North Carolina Aquariums

North Carolina Department of Transportation

North Carolina Department of Environmental Quality Stewardship Initiative

North Carolina Land and Water Fund

North Carolina Museum of Natural Sciences

North Carolina Natural Heritage Program

North Carolina State University

North Carolina State University College of Veterinary Medicine

North Carolina Wildlife Resource Commission

Pacific Bird Conservation

Painted Dog Conservation

Panthera

Para la Naturaleza

Peace Parks Foundation

Philippine Biodiversity Conservation Foundation

Philippines Biodiversity Management Bureau

Piedmont Land Conservancy

Puerto Rican Crested Toad Conservancy

Puerto Rico Department of Natural Resources

Randolph Electric Membership Cooperative

Red Colobus Conservation Network

Ruaha Carnivore Project

Save Giraffes Now

Save the Rhino Trust

SMART Partnership

Talarak Foundation

Tanzania National Parks

Tanzania Wildlife Authority

Tanzania Wildlife Research Institute

Taronga Zoo

The Nature Conservancy

Three Rivers Land Trust

U.S. Fish & Wildlife Service

U.S. Forest Service

U.S. Virgin Islands Division of Fish and Wildlife

Uganda Wildlife Authority

Uganda Wildlife Education Center

University of North Carolina – Asheville

University of the Philippines

University of the West of England

Wild Welfare

Wildlife Conservation Society

Wildlife Protection Solutions

Wildlife Trafficking Alliance

World Wildlife Fund

Zambia Department of Parks and Wildlife

Zimbabwe Parks and Wildlife Management Authority

Zoo Miami

Zoo Parks Organization of Thailand

Zoological Society of London

Saving a Piece of the World for its Wildlife

North Carolina Zoo Society

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