

# NATIONAL GEOGRAPHIC

## Last of Its Kind

WHAT WE LOSE WHEN AN ANIMAL GOES EXTINCT

  [paperustrading@gmail.com](mailto:paperustrading@gmail.com)  
 0927-883-5847   
*Paperus Trading*

# CONTENTS

## On the Cover

Joseph Wachira, a keeper at the Ol Pejeta Conservancy in Kenya, says goodbye to Sudan, the last male northern white rhinoceros. Sudan died in 2018. Two females of the subspecies remain.

AMI VITALE

## PROOF



# 8

### Fragile Life in Freshwater

Many species that live in freshwater are endangered. A photographer is racing to document them before it's too late.

PHOTOGRAPHS BY DAVID HERASIMTSCHUK

## EMBARK

# 17



### THE BIG IDEA

### Cat vs. Bird: The Battle Lines

To save birds, should we kill off cats? A cat- and bird-lover seeks a better solution.

BY NOAH STRYCKER

### CAPTURED

### First Photo in the Wild of Largest Bee

See a Wallace's giant bee roughly life-size.

PHOTOGRAPH BY CLAY BOLT

### ALSO

Animals That Came Back Saving the Vaquita

## EXPLORE



# 32

### PLANT EXTINCTION

### Weakening Life's Green Foundation

Hundreds of the plant species that anchor Earth's ecosystems have disappeared.

BY MICHAEL GRESHKO

### DECODER

### Untangling Whales

Lines to lobster and crab traps harm right whales, but there are safer alternatives.

BY JASON TREAT

### ALSO

The Last of His Kind Rescuing Hawaii's Plants



**FEATURES**

**Vanishing**

The last mass extinction was caused by an asteroid. The blame for the next one lies much closer to home—with us. Soon all that’s left of some of the planet’s most vulnerable species may be the photographs of animals collected in Joel Sartore’s Photo Ark.

BY ELIZABETH KOLBERT  
PHOTOGRAPHS BY  
JOEL SARTORE

P. 40

**Surviving,  
Despite Us**

Sea turtles are resilient, but threats are rising.

BY CRAIG WELCH  
PHOTOGRAPHS BY  
THOMAS P. PESCHAK

P. 62

**Giraffes**

Relocating animals could save species—but poses risks.

BY JOSHUA FOER  
PHOTOGRAPHS BY  
AMI VITALE

P. 90

**The Fish Bunker**

Humans have damaged aquatic life. This creepy collection shows it.

BY RICHARD CONNIFF  
PHOTOGRAPHS BY  
CRAIG CUTLER

P. 114

**The Dinosaur  
in the Room**

Fossils for the rich.

BY RICHARD CONNIFF  
PHOTOGRAPHS BY  
GABRIELE GALIMBERTI  
AND JURI DE LUCA

P. 124

Vanishing Species ..... P. 40  
Sea Turtle Survivors ...P. 62  
Giraffes at Risk ..... P. 90  
Fish Collection..... P. 114  
Fossils for Sale ..... P. 124

# FEATURES



▲  
**62**

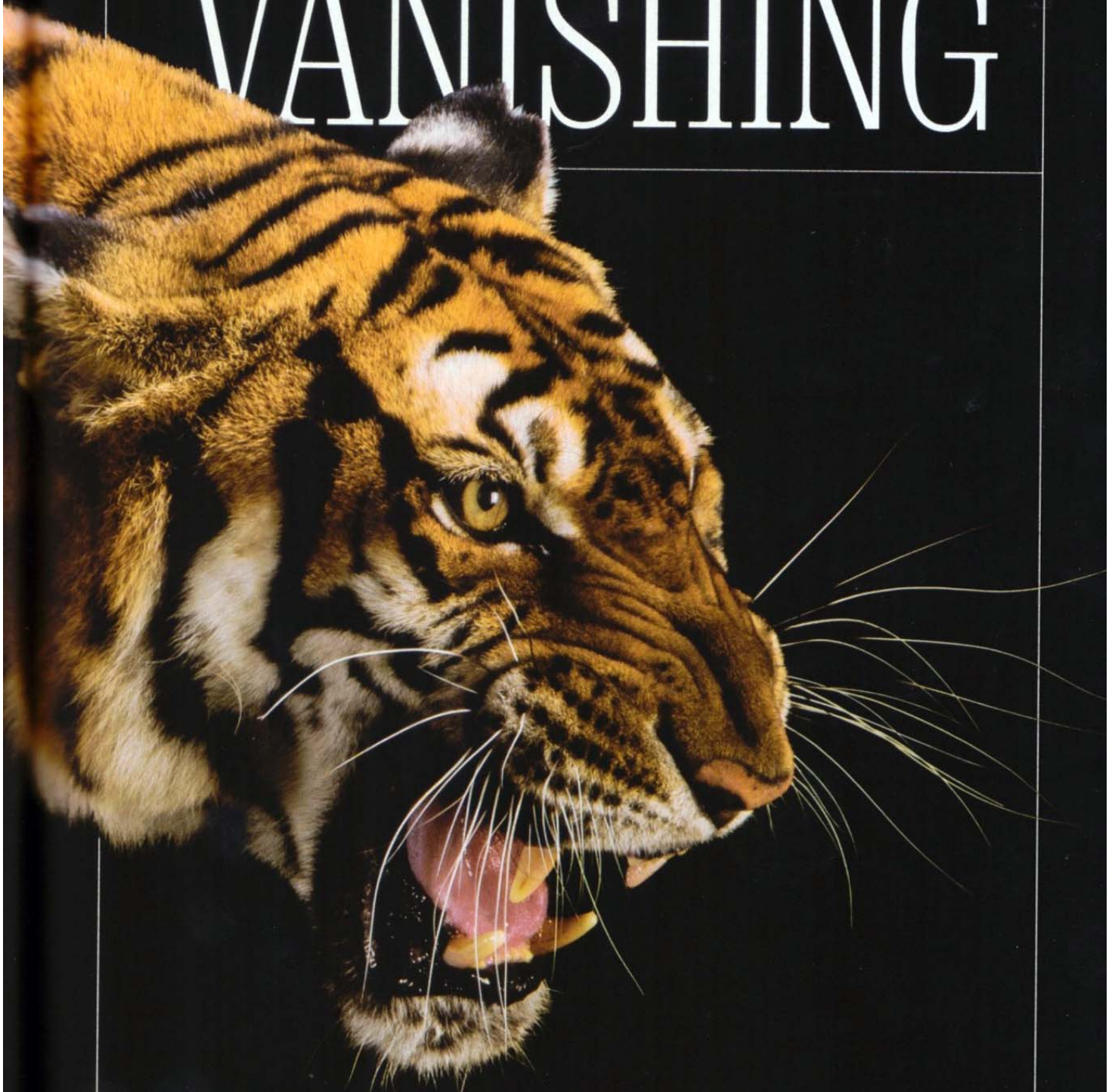
'MARINE TURTLES SPLIT FROM THEIR TERRESTRIAL RELATIVES MORE THAN 100 MILLION YEARS AGO. THEY SURVIVED THE ASTEROID THAT KILLED THE DINOSAURS.'

OCTOBER

A SPECIAL ISSUE

2019

# VANISHING



---

WHAT WE LOSE WHEN ANIMALS GO EXTINCT

PHOTOGRAPHS BY JOEL SARTORE

BY ELIZABETH KOLBERT

## LIFE, BESIEGED

Most of the animals shown on these pages are among the more than 28,000 species of animals and plants that the International Union for Conservation of Nature says are threatened with extinction. That number actually understates the risk. Since 1964, when the IUCN established a "red list" of threatened species and began compiling data gathered worldwide, the list has become the preeminent global database of endangered life and an essential tool for conservation policy. Yet the IUCN has been able to assess only about 106,000 species of the more than 1.5 million species of animals and more than 300,000 plants that scientists have described and named—which they estimate is less than a quarter of what's really out there. A recent intergovernmental report on the biodiversity crisis estimated that extinction threatens up to a million animal and plant species, known and unknown. The IUCN hopes to raise the number of species assessments to 160,000 by 2020. Next up on its agenda: a "green list" of conservation successes. It will be much shorter than the red one.

### LEVELS OF THREAT

◆ LEAST CONCERN (LC) ◆ NEAR THREATENED (NT) ◆ VULNERABLE (VU) ◆ ENDANGERED (EN) ◆ CRITICALLY ENDANGERED (CR)  
◆ EXTINCT IN THE WILD (EW) ◆ EXTINCT (EX) ◆ NOT EVALUATED (NE) ◆ DATA DEFICIENT (DD)



The large yellow-footed tortoise, *Chelonoidis denticulata* (VU ◆), from South America and the Caribbean, is hunted for its meat, which is considered a delicacy. It also is captured and traded as a pet.

**PREVIOUS PAGES:** No trace of the wild South China tiger, *Panthera tigris amoyensis* (CR ◆, possibly EW ◆), has been seen for more than a decade. Zoos hold fewer than 200 in breeding programs. If a Chinese plan to return some to the wild fails, they could become the fourth subspecies of tiger to go extinct.

TORTOISE: KANSAS CITY ZOO, MISSOURI; TIGER: SUZHOU SOUTH CHINA TIGER BREEDING BASE

# THE BIGGEST THREAT: HUMANS

Habitat loss—driven primarily by human expansion as we develop land for housing, agriculture, and commerce—is the biggest threat facing most animal species, followed by hunting and fishing. Even when habitat is not lost entirely, it may be changed so much that animals cannot adapt. Fences fragment a grassland or logging cuts through a forest, breaking up migration corridors; pollution renders a river toxic; pesticides kill widely and indiscriminately. To those local threats one must increasingly add global ones: Trade, which spreads disease and invasive species from place to place, and climate change, which eventually will affect every species on Earth—starting with the animals that live on cool mountaintops or depend on polar ice. All of these threats lead, directly or indirectly, back to humans and our expanding footprint. Most species face multiple threats. Some can adapt to us; others will vanish.

◆ 1.  
Javan green magpie  
*Cissa thalassina* (CR)

◆ 2.  
Nubian ibex  
*Capra nubiana* (VU)

◆ 3.  
March's palm pit viper  
*Bothriechis marchi* (EN)

◆ 4.  
Wrinkled hornbill  
*Rhabdotorhinus corrugatus* (EN)

◆ 5.  
Arctic fox  
*Vulpes lagopus* (LC)

◆ 6.  
Horsfield's tarsier  
*Tarsius bancanus boreanus* (VU)

◆ 7.  
Niho tree snail  
*Partula nodosa* (EW)

◆ 8.  
Gray's monitor  
*Varanus olivaceus* (VU)

◆ 9.  
European eel  
*Anguilla anguilla* (CR)

◆ 10.  
Lesser flamingo  
*Phoeniconaias minor* (NT)

◆ 11.  
Pacific walrus  
*Odobenus rosmarus divergens* (DD)

◆ 12.  
Silver rice rat  
*Oryzomys palustris natator* (NE)

◆ 13.  
Red panda  
*Ailurus fulgens fulgens* (EN)

◆ 14.  
Dakota skipper  
*Hesperia dacotae* (VU)

◆ 15.  
Humphead wrasse  
*Cheilinus undulatus* (EN)

◆ 16.  
Clouded leopard  
*Neofelis nebulosa* (VU)

◆ 17.  
Pinto abalone  
*Haliotis kamtschatkana* (EN)

◆ 18.  
West African slender-snouted  
crocodile  
*Mecistops cataphractus* (CR)

◆ 19.  
American burying beetle  
*Nicrophorus americanus* (CR)

◆ 20.  
Sumatran orangutan  
*Pongo abelii* (CR)



1.



8.



9.



13.



14.

1, 6: TAMAN SAFARI INDONESIA 2: DALLAS ZOO 3: LONDON ZOO 4, 16: HOUSTON ZOO 5: GREAT BEND—BRIT SPAUGH ZOO, KANSAS 7, 19: ST. LOUIS ZOO 8: LOS ANGELES ZOO 9: ENVIRONMENTAL EDUCATION CENTER OF THE RIBEIRAS DE GAIA, PORTUGAL 10: CLEVELAND METROPARKS ZOO 11: OCEAN PARK HONG KONG 12: IN THE WILD, NEAR KEY WEST 13: VIRGINIA ZOO 14: MINNESOTA ZOO 15: DALLAS WORLD AQUARIUM 17: ALUTIIQ PRIDE SHELLFISH HATCHERY, ALASKA 18: PRIVATE COLLECTION OF CURT HARBSMEIER 20: ROLLING HILLS ZOO, KANSAS



2.



3.



10.



9.

16.



15.





4.



5.



6.



7.



11.



12.



19.



20.



17.



18.



# IF

**WE LIVED IN AN ORDINARY TIME**—time here being understood in the long, unhurried sense of a geologic epoch—it would be nearly impossible to watch a species vanish. Such an event would occur too infrequently for a person to witness. In the case of mammals, the best-studied group of animals, the fossil record indicates that the “background” rate of extinction, the one that prevailed before humans entered the picture, is so low that over the course of a millennium, a single species should disappear.

But of course we don't live in an ordinary time. Everywhere we look, species are winking out. Just



◆ **BACHMAN'S WARBLER**  
*Vermivora bachmanii*  
(CR, possibly EX)

One of the United States' smallest native warblers, it may already be extinct because of severe habitat loss from development in the southeastern U.S. and its Cuban wintering grounds. The last time a live sighting was reported was in 1988.

TALL TIMBERS RESEARCH STATION AND  
LAND CONSERVANCY, FLORIDA



in the past decade, two mammal species have gone extinct: a bat known as the Christmas Island pipistrelle and a rat, the Bramble Cay melomys.

The International Union for Conservation of Nature lists more than 200 mammal species and subspecies as critically endangered. In some cases, like the Sumatran rhino or the vaquita—a porpoise native to the Gulf of California—there are fewer than a hundred individuals left. In others, like the baiji (also known as the Yangtze River dolphin), the species, though not yet officially declared extinct, has probably died out.

And unfortunately, what goes for mammals

goes for just about every other animal group: reptiles, amphibians, fish, even insects. Extinction rates today are hundreds—perhaps thousands—of times higher than the background rate. They're so high that scientists say we're on the brink of a mass extinction.

The last mass extinction, which did in the dinosaurs some 66 million years ago, followed an asteroid impact. Today the cause of extinction seems more diffuse. It's logging and poaching and introduced pathogens and climate change and overfishing and ocean acidification.

But trace all these back and you find yourself

face-to-face with the same culprit. The great naturalist E.O. Wilson has noted that humans are the “first species in the history of life to become a geophysical force.” Many scientists argue that we have entered a new geologic epoch—the Anthropocene, or age of man. This time around, in other words, the asteroid is us.

**WHAT'S LOST** when an animal goes extinct?

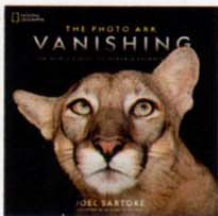
One way to think of a species, be it of ape or of ant, is as an answer to a puzzle: how to live on planet Earth. A species' genome is a sort of manual; when the species perishes, that manual is lost. We are, in this sense, plundering a library—the library of life. Instead of the Anthropocene, Wilson has dubbed the era we are entering the Eremozoic—the age of loneliness.

Joel Sartore has been photographing animals for his Photo Ark project for 13 years. In an ever growing number of cases, animals housed in zoos or special breeding facilities are among the last remaining members of their species. In some instances, they are the only members.

Toughie, a Rabbs' fringe-limbed tree frog from central Panama, lived at the Atlanta Botanical Garden. He became the last known of his kind when a fungal disease swept through his native habitat and a captive-breeding program failed. Toughie died in 2016, and it's likely the Rabbs' fringe-limbed tree frog is now extinct.

Romeo, a Sehuencas water frog that lives at the natural history museum in Cochabamba, Bolivia (and is shown on page 51), was likewise believed to be a sole survivor. Scientists created an online dating profile for him. It linked to a donation page, and the \$25,000 raised helped fund expeditions in the eastern Andes, where the species was once abundant.

Amazingly, the search has revealed five more Sehuencas water frogs, two males and three females. All were taken to Cochabamba; the one



This article is adapted from Joel Sartore's new book, *Vanishing*, published by National Geographic Books.

NATIONAL GEOGRAPHIC

PHOTOARK  
JOEL SARTORE

Photo Ark is a joint project of National Geographic and Joel Sartore. Learn more at [natgeophotoark.org](http://natgeophotoark.org).

BECAUSE EXTINCTION  
TAKES PLACE SO  
FREQUENTLY NOW,  
IT'S POSSIBLE TO  
BECOME INURED TO IT.

**THIS  
DESENSITIZING  
IS WHAT  
MAKES  
THESE PHOTOS  
SO CRUCIAL.**

female mature enough to breed with Romeo was named Juliet. Whether she will prove a worthy mate and perpetuate the species, no one knows.

Was the Rabbs' fringe-limbed tree frog beautiful? Not in the flashy way of, say, the Spix's macaw (which is believed to be extinct in the wild) or the Gee's golden langur (which is endangered). But with its expressive brown eyes and gangly limbs, it had its own kind of charm.

Sartore treats all creatures—great and small, handsome and homely—with reverence. His photos capture what's singular and, I'd also like to say, soulful about every living thing. One of my favorite images of Joel's is of a *Partula nodosa*, or niho tree snail, laying down a trail of slime. There used to be dozens of *Partula* species in the South Pacific, occupying different islands and different ecological niches. Much like Darwin's finches, they are the darlings of evolutionary biologists—living, slime-producing illustrations of the power of natural selection. The introduction of carnivorous snails from Florida drove nearly a third of the *Partula* species extinct; several survive solely thanks to captive-breeding programs.

Precisely because extinction takes place so frequently now, it's possible to become inured to it. This desensitizing is what makes Sartore's images so crucial: They show us just how remarkable each species is that's being lost.

We live in an extraordinary time. Perhaps by recognizing this, we can begin to imagine creating a different one—one that preserves, as much as is still possible, the wonderful diversity of life. □

**Elizabeth Kolbert's** most recent book, *The Sixth Extinction*, won the Pulitzer Prize. Photographer **Joel Sartore** has been called a modern-day Noah for building the Photo Ark, the world's largest collection of animal studio portraits.

◆ **Gray woolly monkey**

***Lagothrix cana* (EN)**

This young, malnourished woolly monkey from Brazil was raised as a pet. When she was captured, her mother likely was killed. Environmental police rescued her, and she's been treated, but she'll need to live in captivity the rest of her life.

CETAS-IBAMA, BRAZIL



## THREAT: DISEASE

Since the 1980s, a fungal disease called chytridiomycosis, likely spread through direct contact and by infected water, has ravaged global amphibian populations. More than 500 species have been affected; 90 of these may be extinct. The fungus disrupts transmission of electrolytes through the skin of a frog or toad, ultimately stopping its heart.

◆ 1.

**Andersson's stubfoot toad, *Atelopus palmatus* (CR)**

This Ecuadorian native, plagued by chytrid fungus, is also losing habitat to agriculture and urbanization. Its population has declined more than 80 percent over the past decade.

◆ 2.

**Espada's marsupial frog, *Gastrotheca testudinea* (LC)**

A rare tree frog from the eastern Andes of Ecuador, Peru, and Bolivia, Espada's is less vulnerable to the fungus because, unlike most frogs, it doesn't lay its eggs near water. The female hatches them in a pouch on her back.

◆ 3.

**Silver marsupial frog, *Gastrotheca plumbea* (VU)**

Habitat fragmentation and loss from agriculture and fire have hit this Ecuadorian mountain frog particularly hard.

◆ 4.

**Sehuencas water frog, *Telmatobius yuracare* (VU)**

For 10 years this frog, called Romeo, was thought to be the last of his kind. But on a 2018 expedition in Bolivia, scientists captured five more—including three potential mates.

◆ 5.

**Tabasara robber frog, *Craugastor tabasarae* (CR)**

Though chytrid fungus has nearly wiped this species out, researchers still report hearing it in Panamanian forests.

1, 2, 3: JAMBATU CENTER FOR RESEARCH AND CONSERVATION OF AMPHIBIANS, ECUADOR; 4: KAYRA CENTER, ALCIDE D'ORBIGNY NATURAL HISTORY MUSEUM, BOLIVIA; 5: EL VALLE AMPHIBIAN CONSERVATION CENTER, PANAMA



1.



3.



5.



## THREAT: INVASIVE SPECIES



### **Kagu, *Rhynochetos jubatus* (EN)**

Like many island species, the nearly flightless kagu, native to the French Pacific territory of New Caledonia, was seriously affected by the arrival in the late 1700s of European settlers and their animals. Roughly chicken size, the kagu continues to fall prey to non-native pigs, cats, and dogs. The birds nest on the ground, and rats eat their eggs. Recent population estimates suggest fewer than a thousand kagu survive. Scientists nevertheless have some hope for the future: Decades of successful captive breeding have resulted in the reintroduction of the birds to the wild, and predator control has allowed some populations to rebound.

HOUSTON ZOO









## THREAT: FRAGMENTATION

◆ **Mhorr gazelle, *Nanger dama mhorri* (CR)**

This subspecies of the dama gazelle was once widespread across the western Sahara. Now there are fewer than 300 damas combined in Mali, Chad, and Niger. Their range is broken up by grazing lands for livestock, and they're at risk from hunting. Reintroduction of captive-bred animals has had mixed success.

BUDAPEST ZOO



## THREAT: HABITAT LOSS

Butterflies can fly long distances and feed on many types of flowers, but caterpillars are locavores, eating plants they hatch on or near. As those plants are lost to development or farming, butterflies disappear. The ones here aren't listed by the IUCN—which has evaluated only 8,100 insect species—but are considered at risk by other authorities.

◆ 1.

**Atossa fritillary, *Speyeria adiastra atossa* (NE)**

This California butterfly lost habitat to grazing and drought and is considered to be extinct. The last live one was seen in the wild in 1960.

◆ 2.

**Atala butterfly, *Eumaeus atala* (NE)**

In the mid-1900s this butterfly from Florida and islands to the south and east was considered extinct. Now its host, a palmlike plant called coontie, has become popular in ornamental gardens, and the butterfly is starting to rebound.

◆ 3.

**Monarch butterfly, *Danaus plexippus* (NE)**

Some migratory monarchs depend on habitat in Mexico, the U.S., and Canada for their life cycle, which means conservation requires international cooperation. The milkweed their larvae eat is being lost to industrial farming and development; illegal logging in Mexico threatens their winter range.

◆ 4.

**Schaus' swallowtail,**

***Heraclides aristodemus ponceanus* (NE)**

A Florida native, the Schaus' swallowtail was down to as few as four individuals by 2012 due to habitat loss. Conservation has raised numbers to around a thousand; continuing threats include hurricanes, insecticide use, and climate change.

◆ 5.

**Florida leafwing butterfly,**

***Anaea troglodyta floridaalis* (NE)**

The only surviving population of this critically endangered species lives in Everglades National Park.

◆ 6.

**Malayan tree nymph, *Idea lynceus* (NE)**

Though not yet on the IUCN Red List, this large butterfly has been the focus of Malaysian conservation efforts. They include programs to breed the insect as well as the rare plant the caterpillar feeds on.





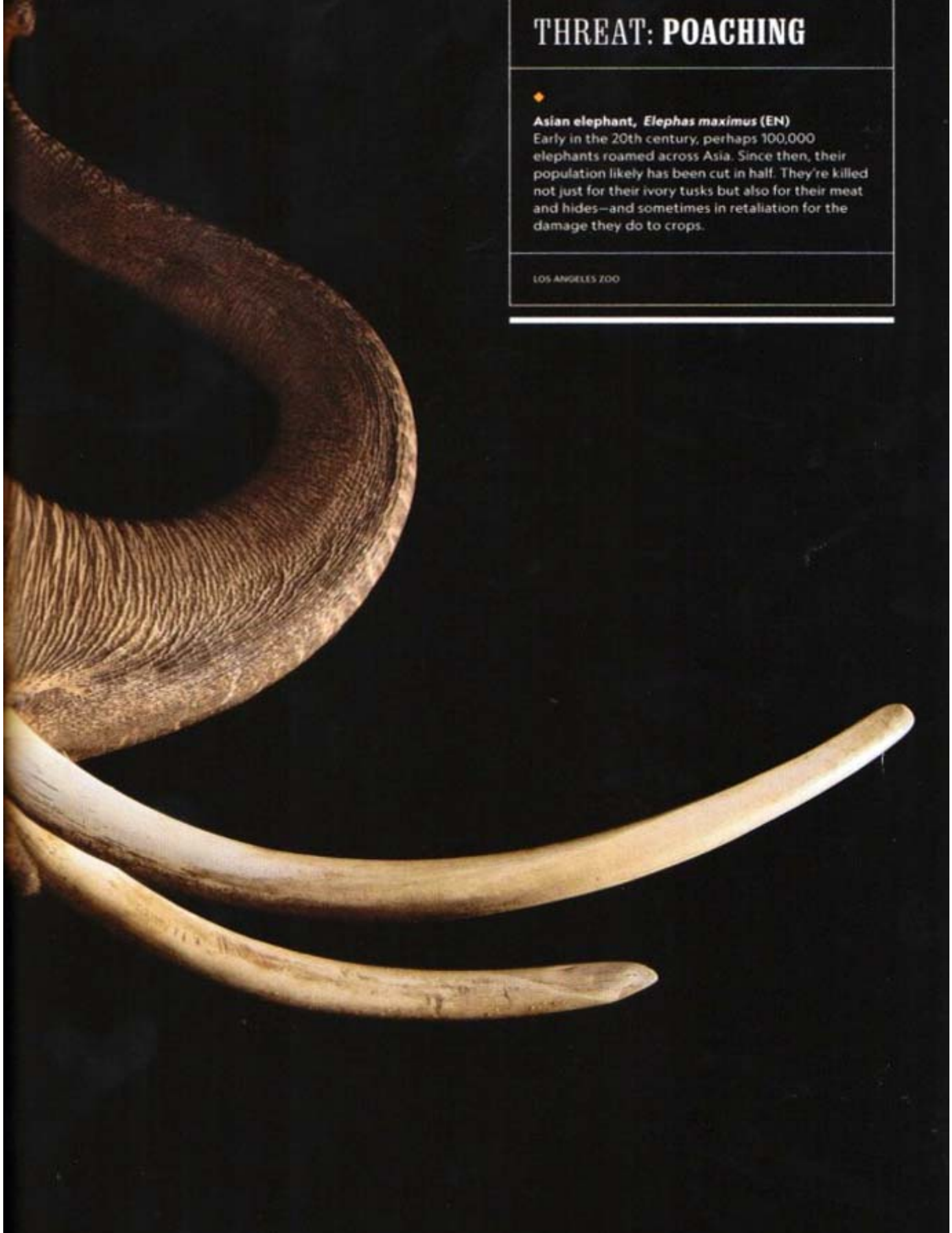
2.



4.



6.



## THREAT: POACHING

◆ **Asian elephant, *Elephas maximus* (EN)**

Early in the 20th century, perhaps 100,000 elephants roamed across Asia. Since then, their population likely has been cut in half. They're killed not just for their ivory tusks but also for their meat and hides—and sometimes in retaliation for the damage they do to crops.

LOS ANGELES ZOO





## THREAT: DEFORESTATION

For tree-dwelling lemurs, there's no life without the forest—or Madagascar, their only home. Yet the island nation has lost 80 percent of its trees to development, charcoal production, and slash-and-burn agriculture. Lemurs are squeezed into limited protected areas; 38 species are critically endangered. Fuel-efficient stoves are being introduced to encourage people to reduce wood use and protect forest habitat.

◆ 1.

**Diademed sifaka, *Propithecus diadema* (CR)**

Females may only be fertile one day a year, limiting this lemur's ability to rebuild fragmented populations.

◆ 2.

**Aye-aye, *Daubentonia madagascariensis* (EN)**

Though rare, this lemur—the world's largest nocturnal primate, at around six pounds—is still found across the island. But local lore holds that aye-eyes are bad luck, and they're often killed on sight.

◆ 3.

**Brown lemur, *Eulemur fulvus* (NT)**

Brown lemur populations have dropped by a quarter since 1995 and are expected to keep shrinking thanks to deforestation and hunting.

1: LEMUR ISLAND, MADAGASCAR 2: DENVER ZOO 3: OMAHA'S HENRY DORREY ZOO AND AQUARIUM, NEBRASKA