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With the novel coronavirus outbreak that has swept the planet in 2020, our relationship with wildlife and nature has come into sharp focus. Because this new coronavirus may have originated in a seafood and wildlife market in China, it has brought renewed attention to the issue of wildlife trade and the thousands of species that are illegally poached, bought, sold, and trafficked across the globe.

Driven by unrelenting demand, the wildlife trafficking that could have contributed to starting the coronavirus pandemic are having devastating impacts beyond posing grave biosafety and public health threats. For one, poaching, overfishing, and overharvesting is fast-tracking innumerable species toward imminent extinction. The scope of the plunder has impaired the healthy functioning of entire ecosystems. The illegal wildlife trade also funds transnational criminal organizations and terrorist groups, abetted by governmental corruption that undermines the rule of law. Moreover, wildlife trafficking has become a national security concern for nations around the world. As a global issue, addressing the illicit wildlife trade will require a global effort.

The coronavirus pandemic is one of the most severe and immediate examples of the harms of wildlife trafficking. The coronavirus first emerged as a mysterious respiratory disease in Wuhan, China, in late 2019 and was declared an outbreak on December 31. Within days, Chinese researchers identified it as a new coronavirus and named it 2019-CoV-2; the resulting disease was termed COVID-19.[1]

For decades, we have heard dire warnings from epidemiologists and infectious disease experts, including Peter Daszak, president of the nonprofit EcoHealth Alliance in New York, that markets similar to the one in Wuhan—that sell live and dead wildlife for food and traditional medicines—are dangerous breeding grounds for the next pandemic.[2] They are microbial petri dishes where species from across the globe are caged side-by-side, exchanging pathogens that can mutate and jump into new, vulnerable hosts that lack natural immunity to them. About 70 percent of the emerging diseases that infect humans are zoonotic, originating in animals.[3] Nearly all zoonotic diseases originate in either mammal or bird hosts.

These markets are not unique to China: they are found across Asia, Africa, and Latin America. Zoonotic diseases have emerged from the wildlife trade in many parts of the world, and many are deadly, including AIDS (transmitted by chimpanzees in Africa that were butchered by hunters), Ebola

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(spread by fruit bats to other forest animals in Africa), and Nipah virus (which jumped from flying foxes to pigs in Malaysia).[4] In 2002–2003, SARS (spread from bats to civets, small nocturnal cat-like animals), the first coronavirus to originate in China, infected 8,098 people worldwide and killed 774.[5] China temporarily closed its wildlife markets, but they were permitted to reopen when the crisis passed. COVID-19 most likely originated in bats and passed to an intermediary before infecting humans. That intermediary may have been the pangolin, a scaly endangered mammal native to Africa and Asia. Voracious demand for its scales and meat in China and East Asia has made it the world's most-trafficked mammal.[6]

As of late April 2020, more than 2.7 million COVID-19 cases were reported globally, with nearly 200,000 confirmed deaths.[7] The pandemic had disrupted the social fabrics and economies of both developing and advanced nations, with schools, factories, and non-essential businesses shuttered, populations ordered to stay home, and travel bans in place. The International Monetary Fund anticipated "the worst economic fallout since the Great Depression."[8] Potential economic fallout from the pandemic has been projected to be $2.7 trillion in lost global output—equaling the United Kingdom's GDP.[9] But there are "few metrics to indicate how prolonged and expansive the economic effects may be," according to the Congressional Research Service.[10]

Amidst this latest epidemic, China's wildlife markets have again been shut down. The Standing Committee of the National People's Congress called for a prohibition on consumption of wildlife. However, the ruling included numerous loopholes that have raised concern, such as the exclusion of fifty-four wild species that are "farmed" for human consumption in captive-breeding facilities, including tigers, bears, bushmeat species such as civets, bamboo rats, and many others.[11]

There has been a global outcry for a total, permanent ban on global wildlife trade and wildlife markets. Resolving the zoonotic infectious disease crisis—and predicting, preventing, and responding to future outbreaks—will require action to address the root causes and incentives of wildlife trade. In order to prevent poaching, trafficking, and illegal trade that has the potential to start a global pandemic, countries must develop and adopt multipronged approaches that include strengthening policy and enforcement at national levels and changing consumer behavior by raising public awareness and promoting community involvement.

The Illegal Wildlife Trade

As a result of human activities, the planet is losing plants and animals in what is now called the Sixth Extinction.[12] It is driven by the destruction and pollution of ecosystems; overfished rivers and oceans; and climatic changes that are impacting all life on Earth. Unsustainable and poorly regulated hunting practices have become a major threat to biodiversity. In the past, hunting largely provided subsistence for immediate families and small communities; today, most animals taken from the wild supply commercial demand rather than meeting true human needs. Wildlife is bought, sold, and consumed in every country on Earth. Much of this trade is illegal, in violation of national and international laws and policies.

Resolving the zoonotic infectious disease crisis—and predicting, preventing, and responding to future outbreaks—will require action to address the root causes and incentives of wildlife trade.

The massive slaughter of wildlife, especially iconic species such as tigers, elephants, and rhinos, has elicited global attention. At the turn of the twentieth century, about 100,000 wild tigers roamed Asia. With demand for tiger products, fewer than 4,000 remain.[13] Hunted for their ivory, African elephants have plummeted in numbers from 12 million a century ago to an estimated 400,000 today.[14] Approximately 60 to 80 Javan and Sumatran rhinos remain.[15]

While iconic species make headlines, many others are silently slipping away. Millions of Tokay geckos, for example, are traded annually for use in traditional Chinese medicines and in smaller numbers for pets in the European Union and the United States.[16] A 2019 study found that at least one in five terrestrial animals is traded.[17]

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), a treaty signed by 183 nations, acts as a tool for wildlife conservation by regulating international trade in over 35,000 species of plants and animals. The CITES permit system seeks to ensure that international trade in listed species is sustainable, legal, and traceable, while prohibiting commercial trade in endangered species.

The protective international wildlife trade regime has not stemmed the booming illegal wildlife market. Illegal traders traffic millions of illegally sourced animals every year by "legalizing" shipments, laundering wild-caught animals with falsified permits (stating they are captive-bred), and falsifying their origins. The illegal and unsustainable trade in wildlife has increased dramatically in recent years. Research reveals new trends and major shifts in trade, from quantities and types of species in demand and the locations where wildlife is poached and smuggled from to expanding, novel uses for wildlife parts and products. While there is localized poaching, trade, and consumption, the greatest impact comes from the industrial-scale poaching and trafficking that feeds international demand.

The illegal wildlife trade has little respect for CITES principles. Animals are trafficked live, dead, and in parts. Some are used for traditional medicines. Others are fashioned into jewelry, rugs, luxury items, or tourist trinkets. Wildlife is butchered in open markets, sold as bushmeat or served at expensive restaurants: in Asia, wild meat is often more costly than chicken, pork, or beef. Some endangered species are sent to unlicensed zoos or circuses, such as the elephant calves that were removed from their herd in Zimbabwe and shipped to wildlife parks in China.[18] More wildlife species are poached for sale as pets than any other form of wildlife trade, from common, inexpensive animals to rare species that command hundreds of thousands of dollars: primates, birds, aquarium fish, lizards, and snakes.

The internet has become a key enabler. Social media platforms like Facebook, Instagram, WhatsApp, and WeChat have simplified commerce that often uses overnight delivery or containerized shipping. Live animals are moved in every way imaginable: taped to people's bodies or transported under buses, in suitcases, wheel wells, socks, plastic water bottles, or in poorly-ventilated crates in the hold of a ship. Many of these animals starve or are given the wrong food, suffer dehydration, and are exposed to extreme heat or cold. In many cases, mothers are killed to steal eggs or their offspring.

The Buyers

Poaching, illegal sale, purchase, and trafficking of wildlife is occurring in every country across the globe. During the 1990s, demand for traditional Chinese medicine (TCM) products, ivory, meat, and other

Figure 1. US Fish and Wildlife Service agents pose with the skulls of five tigers that were shot by roadside zoo owner Joseph Maldonado Passage, known as "Joe Exotic," at their headquarters in Edmond, Oklahoma. *Steve Winter/National Geographic. Used by permission.*

wildlife products skyrocketed. The market rose alongside China's expanding industrialization, fueled by greater spending power among the country's then-1.2 billion people. China is, by far, the largest consumer of wildlife for use in traditional medicines, and Vietnam is another large market.

TCM ingredients include parts from over 1,500 species.[19] For millennia, many ailments have been treated with TCM concoctions derived from tiger bone, pangolin scales, bear bile, rhino horn, and more. These species have suffered serious declines in the wild across their respective ranges. Asian bears are poached and trafficked for their gall bladder, or bile, which is used in TCM, and for their meat, especially the paws, which is considered a delicacy. Claws and teeth are sold as trophies, and live bear cubs are traded for pets and private collections.[20]

"Traditional" uses have also evolved. In Vietnam, rhino horn is currently being used to treat hangovers and cancer, and for a short while a few years ago, geckos were used for HIV/AIDS prevention.[21]

Overall, China is the largest consumer of trafficked endangered species and illegal wildlife products, but few people realize that the United States ranks second, with much of its trade for the pet industry. The United States is also a transit country: Many shipments come from Latin America containing imperiled species from some of the world's most biodiverse places, according to a 2015 Defenders of Wildlife report.[22] The Latin American trade has received far less attention than Asia and Africa.

There is a global market for bushmeat. Consumers range from locals who shop in outdoor markets and urban dwellers who

buy exotic meat to militias in the Democratic Republic of the Congo (DRC) who slaughter gorillas and other wildlife to feed soldiers and workers who are mining for "conflict minerals."[23]

Big Business

With low risk of detection and high profits, organized criminal networks are increasingly involved in environmental crime, selling off wildlife, forests, and fisheries on an international black market. Illegal wildlife trade generates up to $23 billion dollars a year—excluding illegal fishing—and now ranks as the world's fourth-largest source of criminal earnings after trafficking in drugs, arms, and humans.[24]

As commodities grow rarer or demand grows, market value rises. With a massive surge in poaching over the last decade, the critically endangered Ploughshare Tortoise of Madagascar is one of these rare, high-value species. This patterned tortoise is highly sought-after by reptile hobbyists, primarily in China and Southeast Asia. An estimated two hundred mature Ploughshare Tortoises remain in the wild, and a single animal commands thousands of dollars on the black market.[25]

Non-profits and the media have exposed the high-level corruption necessary to facilitate this trade. In December 2019, a report by the London-based Environmental Investigation Agency linked government officials in Zambia to large-scale rosewood trafficking operations.[26] "The Poacher's Pipeline," a documentary by Al Jazeera, connected a South African state security official to wildlife trafficking and alleged that rhino horn was shipped out of South Africa with the aid of Vietnamese embassy officials. It also reported that a North Korean diplomat was arrested in Mozambique with rhino horn and $100,000 in cash.[27]

Wildlife investigator and author Julian Rademeyer discussed the consumers. "The people who are buying rhino horn in Vietnam are some of its top CEOs, senior politicians, people who are government ministers," he said. "For them, this is the ultimate status symbol, something you can display. It's something you can give as a gift to buy influence." Many products, including tiger skins, tiger bone wine, and ivory, have elite clientele. Some Asian investors are now buying and warehousing rare species products, banking on extinction.

Heavily armed poachers are a constant threat to poorly equipped, under resourced rangers in Madagascar, and park rangers worldwide who are tasked with protecting rare and commercially valuable species face the same danger. More than 170 guards have been killed protecting critically endangered mountain gorillas in the DRC's Virunga National Park.[28] Twelve rangers were recently killed in an attack on the park in April 2020.[29] The nonprofit Thin Green Line Foundation reported 595 rangers' deaths from 2009 to 2016. "If you don't want to call it a war, give me another name and I'll use it, but that's pretty much what's happening in a lot of places around the world," the foundation wrote in a statement.[30]

Erosion of Ecosystems

The loss of species harms nature's balance, with the impact commensurate with the role that species play in the web of life. Each animal, plant, tree, and fish is woven into an interconnected system, and pulling threads from this fabric of life impacts the entire ecosystem. When the number of apex predators, prey species, or key seed dispersers is drastically reduced—or these animals are extirpated—it puts its ecosystem at a very real risk of collapse.

Elephants offer a good example of in-

Figure 2. A black rhino photographed at night in Timbavati, South Africa. Rhinos are poached for their horns, which are worth more than gold on the black market in Asia. *Steve Winter/National Geographic. Used by permission.*

Each animal, plant, tree, and fish is woven into an interconnected system, and pulling threads from this fabric of life impacts the entire ecosystem.

terdependence. They are the engineers of Africa's savannahs, eating and ripping out shrubs and saplings that would otherwise sprout into forest. This keeps the land open for great herds of wildebeest, zebras, antelope, and other hoofed grazers. In times of drought, elephants dig for water with their tusks, creating watering holes that sustain others. African forest elephants spread seeds further and more effectively than any other forest animal on the continent.

Protecting the many life forms that makes up those systems will keep them intact. One great opportunity for progress lies within the UN Decade on Ecosystem Restoration program for 2021–2030.[31] By contrast, environmental degradation compromises our ability to achieve the UN's seventeen Sustainable Development Goals.[32] But there are also local impacts. With charismatic species gone, nature-based tourism ends and rural communities lose a key segment of the local economy. A denuded, empty forest deprives local people of food and nature based resources and undermines legal and potentially sustainable livelihoods. Some experts argue that "ecocide" should be considered as a fifth International Crime Against Peace.[33]

The Next Steps

In order to prevent poaching, trafficking, and illegal trade, countries must develop

and adopt multipronged approaches that include strengthening policy and enforcement at national levels and changing consumer behavior by raising public awareness and promoting community involvement.

Effective efforts to fight wildlife trafficking require the commitment of the international community, and in the United States, that demands sustained congressional funding to enforce regulations. Countries across the globe have recognized environmental crime as a national security issue and a criminal industry, the sheer scale and sophistication of which demand a coordinated, international effort. Illegal wildlife trade has gained increasing attention from key agencies and international enforcement entities, including the UN Security Council, the UN Development Program, the UN Office on Drugs and Crime, the UN Counter-Terrorism Executive Directorate, and Interpol.[34] The fight against wildlife trafficking will require their continued participation. Although the United States has strong wildlife laws, policing this trade, even for a developed country, is daunting and extremely costly. Conservationists note that a strong and renewed commitment from Congress to provide adequate funding is necessary to keep regulations from becoming nothing more than paper tigers.

Policy and enforcement must be strengthened at national levels. The 183 parties to CITES must be held accountable and meet their obligations under the treaty to institute and enforce strict laws and develop regional conservation strategies.[35] Trade regulations and harvest quotas must be science based and effectively enforced, with traceability mechanisms in place to reduce opportunities for laundering. Overall, given the lessons learned from the current COVID-19 pandemic, every nation must close wildlife markets and carefully reconsider how to best prevent the emergence of the next deadly zoonotic disease. Any wild species may carry bad actor pathogens, whether they are legitimately traded or sold illegally.

Furthermore, enforcement must move beyond simply reporting seizures of illegal wildlife: this does little to deter traffickers or mitigate the overall threat. Most seizures and arrests happen only after animals or plants are already dead or cut.[36] Seizures of live animals are fraught with problems—live animals found in illegal shipments are often in poor health and can carry diseases. Their precise origins are often unknown and the quarantine and repatriation process is slow, expensive, and complicated—or even impossible. As a result, tens of thousands of live animals are euthanized annually.

Knowledge of emerging trends, shifting routes, and smuggling techniques is essential for effective enforcement. Numerous nonprofits use an intelligence-led approach to research wildlife crime and support policy interventions and law enforcement actions. These collaborations should continue and effective models should be replicated, adapted, and improved upon wherever possible.

Because the illicit wildlife trade is a global issue, it requires a global, cooperative, and comprehensive effort. Countries must develop and adopt multipronged approaches that include strengthening policy and enforcement at national levels. Nonprofit organizations and governments should work together to raise public awareness and promote community involvement to change consumer behavior and reduce demand for wild animals and their parts and products, particularly threatened species. This must include captive-breeding facilities, such as those in China that "farm" wild animals for human consumption.

Buyers are often unaware that their purchases may support illegal trade networks and contribute to the decline of species in the wild.[37] Consumers should be encour-

aged to demand proof from retailers that wildlife-based products have been sourced legally and sustainably.

With science-based policies in place, strong enforcement, and an educated and involved public, further extinctions can be prevented and species recovery can be encouraged. It will also help us save ourselves. By stopping this deadly trade and protecting wildlife, we will restore ecosystems that provide fresh water for millions of people and mitigate against climate change by providing a buffer from flooding and sequestering carbon. With global trends indicating that new microbial threats will continue to emerge at an unprecedented, accelerating rate, addressing global wildlife trade may also help save us from the next global pandemic.

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