

Animal Extinction - the greatest threat to mankind

By the end of the century half of all species will be extinct. Does that matter?

By Julia Whitty

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In the final stages of dehydration the body shrinks, robbing youth from the young as the skin puckers, eyes recede into orbits, and the tongue swells and cracks. Brain cells shrivel and muscles seize. The kidneys shut down. Blood volume drops, triggering hypovolemic shock, with its attendant respiratory and cardiac failures. These combined assaults disrupt the chemical and electrical pathways of the body until all systems cascade toward death.

Such is also the path of a dying species. Beyond a critical point, the collective body of a unique kind of mammal or bird or amphibian or tree cannot be salvaged, no matter the first aid rendered. Too few individuals spread too far apart, or too genetically weakened, are susceptible to even small natural disasters: a passing thunderstorm; an unexpected freeze; drought. At fewer than 50 members, populations experience increasingly random fluctuations until a kind of fatal arrhythmia takes hold. Eventually, an entire genetic legacy, born in the beginnings of life on earth, is removed from the future.

Scientists recognise that species continually disappear at a background extinction rate estimated at about one species per million per year, with new species replacing the lost in a sustainable fashion. Occasional mass extinctions convulse this orderly norm, followed by excruciatingly slow recoveries as new species emerge from the remaining gene-pool, until the world is once again repopulated by a different catalogue of flora and fauna.

From what we understand so far, five great extinction events have reshaped earth in cataclysmic ways in the past 439 million years, each one wiping out between 50 and 95 per cent of the life of the day, including the dominant life forms; the most recent event killing off the non-avian dinosaurs. Speciations followed, but an analysis published in Nature showed that it takes 10 million years before biological diversity even begins to approach what existed before a die-off.

Today we're living through the sixth great extinction, sometimes known as the Holocene extinction event. We carried its seeds with us 50,000 years ago as we migrated beyond Africa with Stone Age blades, darts, and harpoons, entering pristine Ice Age ecosystems and changing them forever by wiping out at least some of the unique megafauna of the times, including, perhaps, the sabre-toothed cats and woolly mammoths. When the ice retreated, we terminated the long and biologically rich epoch sometimes called the Edenic period with assaults from our newest weapons: hoes, scythes, cattle, goats, and pigs.

But, as harmful as our forebears may have been, nothing compares to what's under way today. Throughout the 20th century the causes of extinction - habitat degradation, overexploitation, agricultural monocultures, human-borne invasive species, human-induced climate-change -

increased exponentially, until now in the 21st century the rate is nothing short of explosive. The World Conservation Union's Red List - a database measuring the global status of Earth's 1.5 million scientifically named species - tells a haunting tale of unchecked, unaddressed, and accelerating biocide.

When we hear of extinction, most of us think of the plight of the rhino, tiger, panda or blue whale. But these sad sagas are only small pieces of the extinction puzzle. The overall numbers are terrifying. Of the 40,168 species that the 10,000 scientists in the World Conservation Union have assessed, one in four mammals, one in eight birds, one in three amphibians, one in three conifers and other gymnosperms are at risk of extinction. The peril faced by other classes of organisms is less thoroughly analysed, but fully 40 per cent of the examined species of planet earth are in danger, including perhaps 51 per cent of reptiles, 52 per cent of insects, and 73 per cent of flowering plants.

By the most conservative measure - based on the last century's recorded extinctions - the current rate of extinction is 100 times the background rate. But the eminent Harvard biologist Edward O Wilson, and other scientists, estimate that the true rate is more like 1,000 to 10,000 times the background rate. The actual annual sum is only an educated guess, because no scientist believes that the tally of life ends at the 1.5 million species already discovered; estimates range as high as 100 million species on earth, with 10 million as the median guess. Bracketed between best- and worst-case scenarios, then, somewhere between 2.7 and 270 species are erased from existence every day. Including today.

We now understand that the majority of life on Earth has never been - and will never be - known to us. In a staggering forecast, Wilson predicts that our present course will lead to the extinction of half of all plant and animal species by 2100.

You probably had no idea. Few do. A poll by the American Museum of Natural History finds that seven in 10 biologists believe that mass extinction poses a colossal threat to human existence, a more serious environmental problem than even its contributor, global warming; and that the dangers of mass extinction are woefully underestimated by almost everyone outside science. In the 200 years since French naturalist Georges Cuvier first floated the concept of extinction, after examining fossil bones and concluding "the existence of a world previous to ours, destroyed by some sort of catastrophe", we have only slowly recognised and attempted to correct our own catastrophic behaviour.

Some nations move more slowly than others. In 1992, an international summit produced a treaty called the Convention on Biological Diversity that was subsequently ratified by 190 nations - all except the unlikely coalition of the United States, Iraq, the Vatican, Somalia, Andorra and Brunei. The European Union later called on the world to arrest the decline of species and ecosystems by 2010. Last year, worried biodiversity experts called for the establishment of a scientific body akin to the Intergovernmental Panel on Climate Change to provide a united voice on the extinction crisis and urge governments to action.

Yet, despite these efforts, the Red List, updated every two years, continues to show metastatic growth. There are a few heartening examples of so-called Lazarus species lost and then found: the wollemi pine and the mahogany glider in Australia, the Jerdon's courser in India, the takahe in New Zealand, and, maybe, the ivory-billed woodpecker in the United States. But for virtually all others, the Red List is a dry country with little hope of rain, as species ratchet down the listings from secure to vulnerable, to endangered, to critically endangered, to extinct.

All these disappearing species are part of a fragile membrane of organisms wrapped around the Earth so thinly, writes Wilson, that it "cannot be seen edgewise from a space shuttle, yet so internally complex that most species composing it remain undiscovered". We owe everything to this membrane of life. Literally everything. The air we breathe. The food we eat. The materials of our homes, clothes, books, computers, medicines. Goods and services that we can't even imagine we'll someday need will come from species we have yet to identify. The proverbial cure for cancer. The genetic fountain of youth. Immortality. Mortality. The living membrane we so recklessly destroy is existence itself.

Biodiversity is defined as the sum of an area's genes (the building blocks of inheritance), species (organisms that can interbreed), and ecosystems (amalgamations of species in their geological and chemical landscapes). The richer an area's biodiversity, the tougher its immune system, since biodiversity includes not only the number of species but also the number of individuals within that species, and all the inherent genetic variations - life's only army against the diseases of oblivion.

Yet it's a mistake to think that critical genetic pools exist only in the gaudy show of the coral reefs, or the cacophony of the rainforest. Although a hallmark of the desert is the sparseness of its garden, the orderly progression of plants and the understated camouflage of its animals, this is only an illusion. Turn the desert inside out and upside down and you'll discover its true nature. Escaping drought and heat, life goes underground in a tangled overexuberance of roots and burrows reminiscent of a rainforest canopy, competing for moisture, not light. Animal trails criss-cross this subterranean realm in private burrows engineered, inhabited, stolen, shared and fought over by ants, beetles, wasps, cicadas, tarantulas, spiders, lizards, snakes, mice, squirrels, rats, foxes, tortoises, badgers and coyotes.

To survive the heat and drought, desert life pioneers ingenious solutions. Coyotes dig and maintain wells in arroyos, probing deep for water. White-winged doves use their bodies as canteens, drinking enough when the opportunity arises to increase their bodyweight by more than 15 per cent. Black-tailed jack rabbits tolerate internal temperatures of 111F. Western box turtles store water in their oversized bladders and urinate on themselves to stay cool. Mesquite grows taproots more than 160ft deep in search of moisture.

These life-forms and their life strategies compose what we might think of as the "body" of the desert, with some species the lungs and others the liver, the blood, the skin. The trend in scientific investigation in recent decades has been toward understanding the interconnectedness of the bodily components, i.e. the effect one species has on the others. The loss of even one species irrevocably changes the desert (or the tundra, rainforest, prairie, coastal estuary, coral reef, and so on) as we know it, just as the loss of each human being changes his or her family forever.

Nowhere is this better proven than in a 12-year study conducted in the Chihuahuan desert by James H Brown and Edward Heske of the University of New Mexico. When a kangaroo-rat guild composed of three closely related species was removed, shrublands quickly converted to grasslands, which supported fewer annual plants, which in turn supported fewer birds. Even humble players mediate stability. So when you and I hear of this year's extinction of the Yangtze river dolphin, and think, "how sad", we're not calculating the deepest cost: that extinctions lead to co-extinctions because most living things on Earth support a few symbionts, while keystone species influence and support myriad plants and animals. Army ants, for example, are known to support 100 known species, from beetles to birds. A European study finds steep declines in honeybee diversity in the past 25 years but also significant attendant declines in plants that depend on bees for pollination - a job estimated to be worth £50bn worldwide. Meanwhile,

beekeepers in 24 American states report that perhaps 70 per cent of their colonies have recently died off, threatening £7bn in US agriculture. And bees are only a small part of the pollinator crisis.

One of the most alarming developments is the rapid decline not just of species but of higher taxa, such as the class Amphibia, the 300-million-year-old group of frogs, salamanders, newts and toads hardy enough to have preceded and then outlived most dinosaurs. Biologists first noticed die-offs two decades ago, and, since then, have watched as seemingly robust amphibian species vanished in as little as six months. The causes cover the spectrum of human environmental assaults, including rising ultraviolet radiation from a thinning ozone layer, increases in pollutants and pesticides, habitat loss from agriculture and urbanisation, invasions of exotic species, the wildlife trade, light pollution, and fungal diseases. Sometimes stressors merge to form an unwholesome synergy; an African frog brought to the West in the 1950s for use in human pregnancy tests likely introduced a fungus deadly to native frogs. Meanwhile, a recent analysis in *Nature* estimated that, in the past 20 years, at least 70 species of South American frogs had gone extinct as a result of climate change.

In a 2004 analysis published in *Science*, Lian Pin Koh and his colleagues predict that an initially modest co-extinction rate will climb alarmingly as host extinctions rise in the near future. Graphed out, the forecast mirrors the rising curve of an infectious disease, with the human species acting all the parts: the pathogen, the vector, the Typhoid Mary who refuses culpability, and, ultimately, one of up to 100 million victims.

"Rewilding" is bigger, broader, and bolder than humans have thought before. Many conservation biologists believe it's our best hope for arresting the sixth great extinction. Wilson calls it "mainstream conservation writ large for future generations". This is because more of what we've done until now - protecting pretty landscapes, attempts at sustainable development, community-based conservation and ecosystem management - will not preserve biodiversity through the critical next century. By then, half of all species will be lost, by Wilson's calculation.

To save Earth's living membrane, we must put its shattered pieces back together. Only "megapreserves" modelled on a deep scientific understanding of continent-wide ecosystem needs hold that promise. "What I have been preparing to say is this," wrote Thoreau more than 150 years ago. "In wildness is the preservation of the world." This, science finally understands.

The Wildlands Project, the conservation group spearheading the drive to rewild North America - by reconnecting remaining wildernesses (parks, refuges, national forests, and local land trust holdings) through corridors - calls for reconnecting wild North America in four broad "megalinkages": along the Rocky Mountain spine of the continent from Alaska to Mexico; across the arctic/boreal from Alaska to Labrador; along the Atlantic via the Appalachians; and along the Pacific via the Sierra Nevada into the Baja peninsula. Within each megalinkage, core protected areas would be connected by mosaics of public and private lands providing safe passage for wildlife to travel freely. Broad, vegetated overpasses would link wilderness areas split by roads. Private landowners would be enticed to either donate land or adopt policies of good stewardship along critical pathways.

It's a radical vision, one the Wildlands Project expects will take 100 years or more to complete, and one that has won the project a special enmity from those who view environmentalists with suspicion. Yet the core brainchild of the Wildlands Project - that true conservation must happen on an ecosystem-wide scale - is now widely accepted. Many conservation organisations are already collaborating on the project, including international players such as Naturalia in Mexico, US national heavyweights like Defenders of Wildlife, and regional experts from the Southern

Rockies Ecosystem Project to the Grand Canyon Wildlands Council. Kim Vacariu, the Southwest director of the US's Wildlands Project, reports that ranchers are coming round, one town meeting at a time, and that there is interest, if not yet support, from the insurance industry and others who "face the reality of car-wildlife collisions daily".

At its heart, rewilding is based on living with the monster under the bed, since the big, scary animals that frightened us in childhood, and still do, are the fierce guardians of biodiversity. Without wolves, wolverines, grizzlies, black bears, mountain lions and jaguars, wild populations shift toward the herbivores, who proceed to eat plants into extinction, taking birds, bees, reptiles, amphibians and rodents with them. A tenet of ecology states that the world is green because carnivores eat herbivores. Yet the big carnivores continue to die out because we fear and hunt them and because they need more room than we preserve and connect. Male wolverines, for instance, can possess home ranges of 600 sq m. Translated, Greater London would have room for only one.

The first campaign out of the Wildlands Project's starting gate is the "spine of the continent", along the mountains from Alaska to Mexico, today fractured by roads, logging, oil and gas development, grazing, ski resorts, motorised back-country recreation and sprawl.

The spine already contains dozens of core wildlands, including wilderness areas, national parks, national monuments, wildlife refuges, and private holdings. On the map, these scattered fragments look like debris falls from meteorite strikes. Some are already partially buffered by surrounding protected areas such as national forests. But all need interconnecting linkages across public and private lands - farms, ranches, suburbia - to facilitate the travels of big carnivores and the net of biodiversity that they tow behind them.

The Wildlands Project has also identified the five most critically endangered wildlife linkages along the spine, each associated with a keystone species. Grizzlies already pinched at Crowsnest Pass on Highway Three, between Alberta and British Columbia, will be entirely cut off from the bigger gene pool to the north if a larger road is built. Greater sage grouse, Canada lynx, black bears and jaguars face their own lethal obstacles further south.

But by far the most endangered wildlife-linkage is the borderland between the US and Mexico. The Sky Islands straddle this boundary, and some of North America's most threatened wildlife - jaguars, bison, Sonoran pronghorn, Mexican wolves - cross, or need to cross, here in the course of their life's travels. Unfortunately for wildlife, Mexican workers cross here too. Men, women, and children, running at night, one-gallon water jugs in hand.

The problem for wildlife is not so much the intrusions of illegal Mexican workers but the 700-mile border fence proposed to keep them out. From an ecological perspective, it will sever the spine at the lumbar, paralysing the lower continent.

Here, in a nutshell, is all that's wrong with our treatment of nature. Amid all the moral, practical, and legal issues with the border fence, the biological catastrophe has barely been noted. It's as if extinction is not contagious and we won't catch it.

If, as some indigenous people believe, the jaguar was sent to the world to test the will and integrity of human beings, then surely we need to reassess. Border fences have terrible consequences. One between India and Pakistan forces starving bears and leopards, which can no longer traverse their feeding territories, to attack villagers.

The truth is that wilderness is more dangerous to us caged than free - and has far more value to us wild than consumed. Wilson suggests the time has come to rename the "environmentalist view" the "real-world view", and to replace the gross national product with the more comprehensive "genuine progress indicator", which estimates the true environmental costs of farming, fishing, grazing, mining, smelting, driving, flying, building, paving, computing, medicating and so on. Until then, it's like keeping a ledger recording income but not expenses. Like us, the Earth has a finite budget.

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Disappearing World

More than 16,000 species of the world's mammals, birds, plants and other organisms are at present officially regarded as threatened with extinction to one degree or another, according to the Red List.

Maintained by the Swiss-based World Conservation Union (usually known by the initials IUCN), the Red List is one of the gloomiest books in the world, and is set to get even gloomier.

Since 1963 it has attempted to set out the conservation status of the planet's wildlife, in a series of categories which now range from Extinct (naturally), through Critically Endangered, Endangered, Vulnerable and Near-Threatened, and finishing with Least Concern. The numbers in the "threatened" categories are steadily rising.

Taxonomists at the IUCN regularly attempt to update the list, but that is a massive job to undertake - there are about 5,000 mammal species in the world and about 10,000 birds, but more than 300,000 types of plant, and undoubtedly well over a million insect species, and perhaps many more. Some species, such as beetles living in the rainforest canopy, could become extinct before they are even known to science.

The last Red List update, released in May last year, looked at 40,168 species and considered 16,118 to be threatened - including 7,725 animals of all types (mammals, birds, reptiles, fish, insects etc) and 8,390 plants.

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