Chapter 8 - The Intricate Web of Life

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What's a Diverse Ecosystem?

We should be proud of our earth and its diversity. We are very lucky to be here, to live here, to have the perfect ecosystem to match our needs. An ecosystem in which we humans have evolved along with the complex biodiversity that exists here over millions of years. We now have the technology to understand how rare our planet really is, yet we are choosing to blow it off, take it for granted, and, literally, murder it, through our own complacency. When we know. We have no excuses here. Has the human experiment failed epically, so catastrophically, is our arrogance and entitlement so great, that we are willing to knowingly and consciously allow ourselves to destroy our planet and all its diversity, including us, when we really don't have to do very much to change course?

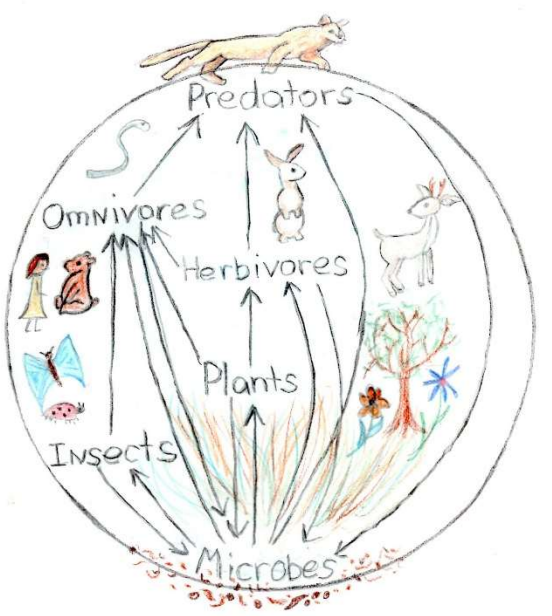
> Ecosystem: The complex of a community of organisms and its environment functioning as an ecological unit.[1]

The definition of an ecosystem can be extended to specify that a "diverse" ecosystem is comprised of all levels of species that make up the complex web of life, with a huge variety of species at each level to fill every ecological niche, so that the system is constantly in a state of balance or fluctuation towards balance. Basically, there are enough species to back each other up, so that if one or more species are lost, there are others to fill in the gaps and keep the entire ecosystem sound and functional.

Over the past several millions of years, as the earth's environmental conditions and orientation with the sun have continuously changed gradually, ecosystems have changed, to stay in balance with their environments. In this process, species that can no longer function in their ecosystem have inevitably gone extinct, to be replaced by more successful species that can function in the new environment. The problem is, that in the past two centuries, mankind has blown this natural rate of extinction out of the water, and the extinction rate is now about a thousand times the natural extinction rate. This is why our current level of wildlife decimation is being referred to as the 6th mass extinction.

Figure 1 is a very basic sketch of the complex web of life that shows general functional categories of organisms. At the very bottom are the microbes and fungi, the simplest organisms, many of which are single-celled, that form the basis of all life. They make up by far the largest portion of life on our planet, and are the foundation of all of the more complex life above them, providing all nutrients for growth of plants and animals. The plants and animals that grow from the microbes ultimately break down into those same microbes after they expire, or die, creating a true circle of life that is ultimately balanced, sustainable and resilient.

Moving up from the microbes, we have plants and insects, the smaller critters that are also foundational to life forms above them, because they perform the extremely important functions of converting the nutrients provided by the microbes and fungi into more complex organisms that are required to feed the upper levels, including species like humans, birds, dogs and elephants. In the upper levels we have meat-eaters, plant-eaters and omnivores, which eat both plants and animals. Humans, rats and most bears are examples of omnivores. At the very top, we have top predators, that eat only meat, and are important for keeping the ecosystem in balance by systematically removing middle species. All species return the nutrients they consume back to the earth in their defecations, and ultimately their bodies when they die, which are broken down into basic nutrients and bacteria, to join the foundation and supply the next generations of organisms.



Thomas Lovejoy, a tropical biologist who teaches at George Mason University, coined the term "biological diversity" in 1980 to refer to the millions of different species that comprise life on Earth, of which scientists have documented maybe 10% at most.

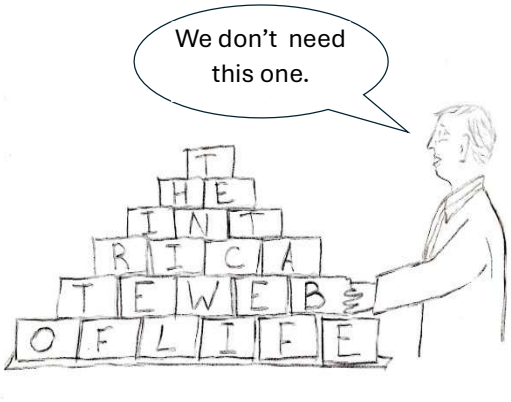
At this point, it's not just individual species that are going extinct, it's entire ecosystems. That's when you know it's bad. Most of the lowland tropical rainforests in Southeast Asia are already gone, and Africa is soon to follow with massive deforestation going on right now. Forests are being lost in the western U.S. because of the pine bark beetle, forest fires, logging and wood harvest for toilet paper. And native grasslands everywhere are being replaced by land for agriculture like a runaway train.

We are literally squeezing out the land for wildlife so they have no place to live, and tearing up ecosystems so fast we can barely measure it. There is also pollution, the soup of toxic chemicals we have created and spewed everywhere. We have distorted the nitrogen cycle, key to the web of life, with our wasteful overuse of synthetic fertilizers. At a certain point, ecosystems simply disassemble, and once they're gone, that's it. Nothing we or nature can do will replace them. Not for millions of years at any rate. Too late for us, that's for sure. All this destruction to satisfy the massive needs of humanity. Does that sound scary? Personally, I'm horrified.

"Ecosystem Collapse" A new phrase that means the collapse of species that make up the natural ecosystems, including a lot of which are absolutely essential for human existence, such as watershed forests and maintenance of arable land.[2]

Save Diversity Save Ourselves

For this planet and for our species to survive and thrive, we need diversity, with all its checks and balances, and we need all species from the top to the bottom of the food chain, to thrive and be in balance. And we need that to happen naturally, without human intervention that wastes resources that could be left in the ecosystem, such as energy, water and materials, that are consumed in the process of "rehabilitating" a species. Right now, we still have a chance to do this right. Just leave the environment and species alone and many will regain their footing in their ecosystems.



My take on the intricate web of life is that we have only a high level general understanding of how ecosystems on our planet actually work, and how much of the plant and wildlife species our planet can do without until our destruction passes a point of no return. Of one thing I'm absolutely positive: if we don't stop the carnage now, there will be no chance at all. Think about that. This means stopping the human activity that is destroying the life on our planet.

> "Nature is like an airplane, and species the rivets that hold it together. Without a few rivets, a plane can still fly, but if you take too many out, the plane will fall apart and crash." Paul Ehrlich
>
> "The trouble is, we don't know how many rivets we can take out." Peter Kareiva
>
> "Mass global extinctions have happened five times before, but this time it's different, because we humans have the capacity to understand that we're causing this one. Because we know, I think we have the moral responsibility to take care of our fellow earthlings." Tierra Curry
>
> "Nature is like a machine that we humans are tinkering with, and we should not take apart what we can't put back together." Aldo Leopold

At this point, hundreds of species have gone extinct, and that's just the ones we know about.[3] It's estimated that we only know about 10% of the species on the planet.

The Amazon is an extremely complex and far-reaching ecosystem. It's enormous, with a length of about 4,000 miles and an area of 2.3 million square miles. It discharges fresh water to the Atlantic ocean, impacting an estimated 3,700 square miles of reefs with more than 3,000 known fish species and 16,000 species of trees. The region is mostly inhabited by indigenous tribes that are in balance with the environment, and is largely unexplored, due to the extreme remoteness and access challenges. Now we're chipping away at it around the edges, to feed our enormous population. In August, 2019, Brazilian farmers set fire to forests in a coordinated burn, increasing the baseline burn rate by 700%.[4] We are destroying this unique ecosystem of critical global importance that is 4,000 thousand miles away to supply cheap hamburgers to fast food restaurants right here in the U.S, and irreversibly destroying an entire ecosystem while we're at it.

By the way, when the forest is burned, the loss of trees destroys yet more CO_2 absorbing capacity that helps keep atmospheric CO_2 from increasing even faster than it is already.

Specifically, we lose 2.4 tonnes of CO_2 per acre per year, forever, until decades after the forest is replanted, if it is replanted at all. And we lose many times that amount when we burn the forest, as smoke and CO_2 into the sky, when we burn the trees that have accumulated all that CO_2 for decades and centuries, depending on how old the forest is. Think about that. Is that all-important cheap hamburger really worth all that? Really? Personally, I think it's time for more impossible burgers, or at least pay a fair price for responsible grass-fed beef that's raised right here in the U.S.A.

> "The outstanding scientific discovery of the twentieth century is not television, or radio, but rather the complexities of the land organism. Only those who know the most about it can appreciate how little we know about it." Aldo Leopold, Round River, Oxford, 1953.

And it gets worse. Now studies are showing that rainforest canopies are changing due to nutrient imbalances and overload.[5] With more people on the planet, we have more pollution. This is scary because rainforests house most of the biological diversity on the planet. So if we're not burning the forests directly to make way for ourselves and our endless needs, we're killing the rest indirectly by trashing and polluting their environment so they die more gradually. And this is how it happens, gradually, so we don't really notice day-to-day, then all of a sudden it's over. The earth can't take any more abuse, we've pulled too many key pieces out of the complex natural web of life and failed to balance it out or give back, and that's it. It's over. It's gone. Done and done.

The Bottom Of It

It's interesting and ironic that the microbes, the tiny invisible organisms that lie at the very bottom of the web of life, also make up the largest portion, by far, of the life on our planet, yet we know the least about this category of life. We didn't even know they existed until 1590, when Zacharias Janssen developed the microscope, and discovered an entire new and shocking miniature world. We only determined in the past few decades that all of the metabolic processes in our own bodies are driven by microbes, and we still know next to nothing about them. For example, we still don't understand exactly how acetaminophen relieves pain, just that it works. If we don't even understand our own bodies' functions, how can we possibly expect to understand the roles microbes play in the complex web of life, and how removing random components from this web will impact the rest of it?

We do know that every single natural process on this planet starts and ends with microbes, and that microbes are the foundation of life everywhere, in the deepest oceans, the highest mountains, the driest deserts, the coldest and hottest places, the deepest reaches within the earth and within every living creature and plant on the planet. While microbes exist and live by their own laws, which we are far from understanding, from the human perspective some are harmless, some are beneficial, some are indispensable and others are threats.

The microbial ecosystem is so complex that we can't even study most of them, because they can't survive if they're removed from their environment. At this point, most of the world's bacteria are unknown for that reason. They depend on other organisms for several basic requirements, and to untangle that complex and mysterious web is beyond our scientific understanding, and may always be. Think about that. We don't even know for sure how cancers

initiate, not with assurance, right in our own bodies, and cancer is arguably microbially driven, since it's essentially cells that go wild and multiply out of control within our bodies to the point that it ultimately kills us. Sort of like what humans are doing to the planet, when you think about it. We have no idea how tightly organisms are interconnected, and that's why it's a bad idea to mess with them.

A tiny percentage of microbes are pathogens, which means they are capable of causing diseases in humans and other animals. We know a little more about pathogens because they are more closely studied since they can impact us directly by making us sick, and possibly killing us.

A recent meta-analysis of nearly 1000 studies reported in the journal Nature found that biodiversity loss is the biggest driver of infectious disease spread, followed by introduced (non-native) species, climate change and pollution.[6] According to the National Science Foundation, the species most likely to disappear as biodiversity declines are often those that buffer infectious disease transmission, while those that remain tend to be the ones that magnify the transmission of infectious diseases like West Nile virus, Lyme disease and hantavirus.[7] An example is Lyme disease, where strong buffering species like the opossum are lost when forests are fragmented, but white-footed mice thrive. The opossums consume huge amounts of tics, preventing them from spreading the disease, but the mice do not, instead spreading the disease.

Three out of four emerging infectious diseases are zoonotic, which means they spread from animals to humans. Many of these animals are mammals, both domesticated and wild. There are many viruses that have spilled over to humans, causing major outbreaks such as Zika and Ebola. Opportunities for pathogen spillover multiply when humans exploit wildlife or alter natural habitats through encroachment and development. These activities increase the probability of human-wildlife interactions that facilitate virus transmission.[8]

When we mess with biodiversity by driving species to extinction, we are risking our own health as well as the health of our planet. Think about that.

So, who cares about a little beetle? What does it eat? Where does it live? What does it do? How long does it live? How does it reproduce? Who does it feed? Do birds eat it? Lizards? Frogs? What about them? If we kill all the beetles, what happens to the birds? Who eats the birds? If we kill all the beetles so the birds have no food, what happens to them? What do birds do anyway? Other than sing songs? What if birds eat poisoned beetles? Do they die right away? Do they get sick and die later? And what happens to whoever eats the birds? And on and on and on…

Next Up

Small as they are, insects make up more than half the biomass of all animals, and have the largest diversity in the animal kingdom, with at least a million different species, by some estimates. They are central to pretty much every key biological process and do enormous work throughout all ecosystems. We absolutely can't live without them, and all life will literally fail if we lose our insects. So, it's particularly scary to realize that, while we've been living life as usual, basically ignoring insects unless they annoy us, in which case we slap, squash or spray them with poisons, that we've literally taken out 75% of all flying insects in the past three decades.[9] If you ask me, that's pretty damn quick.

The extinction rate of vertebrate species is estimated to have accelerated by a hundred times the natural rate in the past century due to human activity. Insect data is harder to define, but the extinction rate is estimated to be about eight times that of vertebrates in one study.[10,11]

Butterflies in the west are following this trend. In one study, ecologist Matt Forister and his colleagues sifted through more than 40 years of butterfly counts across the West and found that surveyors saw 1.6% fewer every year.[12] As one well-studied example, the Xerces Society, which conducts an annual California count, reported in 2021 that monarch butterfly populations have declined by 99% since the 1980's.[13] The mostly likely causes are climate change, increased use of the herbicide glyphosate (Roundup), industrialization and the residential development of farmland.

The global pace and scope of human activities has been aggressively expanding in the past few centuries, as we've taken over more and more land for our endless wants and needs, while polluting and poisoning what's left.

The main drivers listed in the box show that "conventional" agriculture is responsible for nearly half of the losses, which isn't too much of a surprise. Basically, the whole point of "conventional" agriculture is to poison the hell out of everything so the crop can grow with as few insects as possible. Of course, this not only kills all the insects, it also sickens the farmers who work these crops and anybody who happens to live nearby or be passing through when the crops are being sprayed, but that's another story. This is why we need to grow organically, and if we can't feed our population without spewing poisons everywhere, we need to reduce our population so that we can feed ourselves without poisoning all the life on the planet. Think about that.

Main drivers of insect species declines:

Intensive agriculture (23.9%)
Pesticides (12.6%)
Ecological Traits (12.6%)
Urbanization (10.7%)
Fertilizers (10.1%)
Deforestation (8.8%)
Wetlands/Rivers Alteration (6.3%)
Warming (5.0%)
Other Pollutants (3.1%)
Pathogens (1.9%)
Fires (1.9%)
Introduced Species (1.3%)
Genetic (1.3%)

By the way, the term "conventional" is a brainwashing misnomer. Growing with poisonous petrochemicals isn't conventional at all. It's the opposite of conventional. The original way of growing crops was organic. That is, until we grew our population so large that we couldn't feed everybody organically. Or, at least, that's the mentality we've been brainwashed with by big corp. We can most certainly feed all our people organically.[14] It simply takes a bit more effort, diligence and knowledge to do so, which obviously flies in the face of big corp mentality, which is all about mass production, big machines and instant gratification through poisons.

The Amazon is home to at least 10% of the world's known biodiversity and hundreds of thousands of insect species.[15] Tragically, about a third of insect species are likely to go extinct in the next few decades, a result of habitat loss from intensive agriculture, pesticide and fertilizer pollution, and climate change, among other factors. The Amazon has lost more than 300,000 square miles of forest since the 70's, and the loss is accelerating with increasing population.

Crickets as a food source is kind of a new thing in the U.S., a fun nuevo cuisine and a potential way of getting protein with a far lower carbon footprint than cows or fish. Passionate chefs are creating protein bars, supplements and gourmet dishes with farm-raised crickets. After all, they're everywhere, in endless supply, so how can we go wrong? Right? Um, maybe, and maybe not. In Uganda, the natives love crickets and have relied on them as an important food source for ages, but now they've harvested so many that they're almost gone.[16] This is entirely due to overpopulation. When you're running out of crickets, that's when you know it's bad. Think about that.

I admit it. I have a thing with crickets. I look forward to spring, when they begin to emerge, cautiously, a few at a time, and I can hear them chirping outside when I take a walk in the open space. Eventually, in mid-summer, a few make their way to our backyard garden, and I can hear the soothing sound of chirping through the open bedroom window as I fall asleep. It almost feels like they're there for me, though I know they're not even aware of my existence. If I try to look for them in daylight, they immediately go silent, a valuable instinctive response to avoid predators. In fall, as the nights chill, they slowly disappear and we close the window to ward off the cold. I miss them then.

In the mid-90's the monarch butterfly population was estimated to be around a billion, and now it's less than 50 million. They used to be everywhere, and now it's rare to see even one. Think about that. That's a 95% reduction in just 30 years. In California it's even worse. In fall, monarch butterflies migrate south to Mexico and California, but now human development has taken over the over-wintering sites, and the native milkweeds they need are gone. In 1997, there were more than a million monarchs, in 2013 they were down less than 150,000, and now they're down to 28,000. This is a 99% reduction in 40 years.[17] Ouch. Think how scary this is. Butterflies are primary pollinators that are integral to plant reproduction, including food crops. The demise of the monarchs indicates that this is likely happening with most or all species of butterflies.

Another primary pollinator that we're taking out with our irresponsibility is the bees. While butterflies may be beautiful and bees may sting, the bees are even more important to the intricate web of life than the butterflies, so we really don't want to lose them.

Bumblebees, unlike honeybees, actually buzz when they pollinate plants, which appears to be a pollen-releasing methods that some plants require, making it essential for entire ecosystems to function. Beyond that, scientists don't know very much about them, other than they're among the most important pollinators on Earth. Now, a quarter of the bumblebee species in North America are at risk of extinction.[18]

Another new thing that scientists have figured out is that bumblebees can actually force plants to flower by biting their leaves, if they're not flowering.

Imagine you're getting on an airplane and you see someone popping rivets off the wing. So, you talk to them, and they say, "Oh well, we probably don't need all of these rivets. They're all doing more or less the same thing, and if we get rid of a few of them, it's not going to make any difference." Then the plane takes off and the wings fall apart. Oops. That's how species are in ecosystems. People who don't care say, "We're not going to miss a few phorid flies." But at some point, we're going to get to where ecosystems aren't functioning anymore, because we've removed too many rivets. (flies, etc.)

These incisions somehow speed the arrival of the pollen-laden blooms. When scientists tried to mimic the bite marks, it didn't work very well, compared to when the bees do it.[19] Personally, I wouldn't be surprised if it's some sort of enzyme in the saliva that does the trick, something that humans would be hard-pressed to duplicate, making this yet another example of why we're asking for it if we trash our wildlife.

We're even killing our commercial honeybees, that we've been using to pollinate crops globally. Populations have plummeted in the past few decades, and the bees aren't keeping up as usual with pollinating about 1000 species of plants grown for food, beverage, fibers, spices and medicines. The rapid decreases are due to colony collapse disorder, infestations like varroa mites, poisonous chemicals sprayed on fields, habitat loss and paving of roads.[20,21]

Mosquitoes, considered the most dangerous animal on the planet, other than man, is responsible for over a million human deaths every year, from diseases that they carry and impart to hapless individuals through their bites. We all hate mosquitoes. I hate them, and I'll bet you do too. However, I have to point out that their lethality to our species is of our own doing, and is a clear example of what happens when we mess with nature. We are the ones who have taken away their environment and replaced it with human settlements and farms. We're the ones who have chosen to live in their world and push them into the corners. Then, we're so stupid that we create microcosms in the form of standing water in gutters, old tires and trash, and even overwater potted plants and fields, giving them plenty of places to live within our settlements. Since they have no choice, they inhabit these locations where they can.

And then, in our unbelievable cluelessness, we spray the tar out of them with toxic pesticides, in a futile effort to get rid of them. So, what's the problem with that? Um, well, the problem is that the poisons don't just kill the mosquitoes, they kill everything in the contact zone, and they sicken any other animals, including humans, that happen to be around. And, the reality is, that at the end of the day, the mosquitoes will be just fine, thanks to their amazing abilities to mutate and adapt to nasty chemicals, while the other species, including us, maybe not so much. Think about that. And think about how our wanton use of poisons for instant gratification to get rid of bugs may seem like it's working just great, but it's also taking out indispensable contributors within the intricate web of life. And think about how we're not going to get the insects back once they're gone. Although I heard that Walmart is working on a plan to replace the bees with drones.

Anything Goes

Omnivores are animals that eat anything from plants to meats, depending on what's available at the time. Humans are omnivores, as well as most bears, mice, many kinds of birds and fish, gorillas, racoons and bats, as a few examples. Their flexibility when it comes to what they can eat is a useful and productive link in the intricate web of life, as they fill in important ecological niches from scavenging to pest control, keeping overall ecological systems in balance.

There are only about 1000 mountain gorillas left in the world, half in the Bwindi Impenetrable Forest, a sanctuary, in Uganda.[22] Poaching, loss of habitat as humans take out yet more forest for farming and firewood, and even transmittal of human disease, through feces, lack of

sanitation and trash, are killing them off, one by one. A recent example is an outbreak of scabies transmitted to gorillas when they touched old clothing worn by human carriers.[23]

Bats make up about 20% of all mammal species globally, with about 1,400 species.[24] Bats are an integral part of just about every ecosystem. They consume mosquitoes and agricultural pests, and pollinate plants. In the U.S., white nose syndrome is a fungus that is devastating colonies, and has killed millions of bats since it was accidentally introduced to a cave in New York, by humans who carried it from infected caves in Europe.[25]

The Vegetarians

The plant eaters, or herbivores, are at the center of the intricate web of life, consuming plants and dispersing them back to the earth in the form of basic nutrients, and seeds for new plant growth. They are also prey for predators at the top of the food chain. The herbivores are made up of the tiniest birds and lizards, up to massive rhinos, giraffes and elephants. As a whole, we've lost nearly 70% of the herbivores in the past 50 years.

Those Who Tread

Asian elephants are down to 5% of their original range, with only about 40,000 left.[26] The decimation is mainly due to habitat loss and human-elephant conflict, as human population growth requires more land for farming, and the elephants are left with nowhere to go, other than the crops that replaced their original habitats. From 2020 to 2022, people in Sri Lanka killed more than 1,100 elephants, and nearly 400 people died in elephant encounters. In India, from 2018 – 2020, 300 elephants and 1,400 people died from human-elephant conflict, not really a shocking outcome when habitat loss forces both species into close contact. Asian elephants spend around 16 hours a day eating grasses, leaves and bark. This kind of diet, hundreds of pounds a day – requires a large area, which is why an Asian elephant can have a home range of hundreds of square miles.[27]

Africa's elephants are in the same situation, with a decline of 95% in the past 100 years, and only about 400,000 out of the original 10 million remain.[28] Forest elephants are key ecosystem engineers in Africa's tropical rainforests. More than a dozen tree species in the region rely on elephants to disperse seeds through their dung. The elephants, in turn, depend on the highly nutritious fruit for their diet. But climate change may be threatening this relationship by disrupting fruit growth.[29] Fifty years ago, Chad had around 300,000 elephants, but wholesale slaughter by poachers decimated them, and now they're down to around 1% of the original population. In addition to food, they're slaughtered for their tusks, in a desperately overpopulated region where there is also armed conflict over scarce resources.[30]

In the past century, rhinos have gone from nearly a million down to around 25,000, a reduction of 98%.[31] Now, how awful is that? Rhinos are killed relentlessly for their horns in Africa and India, another example of use in medicine even though there is absolutely no scientific evidence that they do any good. Again, the simple truth is that desperate people in overpopulated regions with insufficient resources are doing what they can to survive. The horns are worth $3,000 -

$30,000 on the black market. And what's really pathetic is that horns can be farmed – they can be painlessly removed once every 3 years without killing the animals, because they grow back, like fingernails.

In the past 30 years, caribou have declined by nearly 60%, from about 5 million to 2 million. The main drivers are habitat destruction from gold and diamond mines and oilfields, and over-hunting due to increased human population. Several studies have shown that industrial development disrupts caribou behavior. The animals often seem to perceive roads and pipelines in particular as obstacles blocking their migratory paths and feeding patterns. They also tend to avoid mining camps and oil fields, which can leak chemical odors and tailings, shake the earth with drilling equipment and truck traffic, and fill the air with the racket of planes and helicopters. The government has issued hunting bans, and has been shooting the wolves that naturally prey on caribou.[32] Once again, we have man trying to play god and messing with the natural balance of predator and prey, as if wolves were the problem, when the real problem is us. Think about that. Are gold and diamonds and oil worth all that? Are we going to keep demanding more and more and more until the caribou are completely gone?

Ruminants like caribou, deer, sheep, buffalo and elk play an important role in ecosystems, because they convert plants that many other animals can't eat into nutrients. They're also important for dispersing seeds, which supports biodiversity in the ecosystem.

The pronghorn antelope is the fastest land mammal in North America, able to sprint at 60 miles per hour. Originally, they were literally everywhere, but in the past 2 centuries, basically since our European ancestors moved into the picture in the American west, we've taken out most of the population, from an estimated 35 million to a measly 500,000, if that.[33] We've literally taken out 99% of the population. Personally, I can remember road trips in Colorado and Wyoming in the 70's and 80's where we'd see a lot of them, even though the population was pretty well decimated by then, but now it's a pleasant surprise to see any at all. Now, even that dismal population is continuing to decrease, from climate change, and fences that impede their migration patterns.

We did the same thing to the bison in North America, so at least we're consistent, albeit for different reasons. Two centuries ago, bison filled the plains, and there were about 30 million of them, but now we're down to about 500,000. When I say different reasons, the loss of the bison stands out as an absolutely horrible legacy that history didn't want us to know about when I was in school, because it's so intensely shameful and disgusting. Basically, our white ancestors, intent on stealing the western land from the rightful owners, the Native Americans who had occupied the land for thousands of years, decided that they could win this battle over lands by killing off their primary food source, which was the bison. And they did. They shot every bison they could find, and left them to rot on the great plains.

> "A strong case might, in fact, be made for civilized man being the only "wild" animal in existence. Animals in the state of nature do not make war upon their own kind; they have no Attilas or Hitlers. They seldom exhibit the kind of savagery that civilized men exhibit toward one another. Civilized man, especially in the western world, has projected an image of his own violent self upon the screen of nature." Ashley Montagu[34]

The decimation of the bison was driven by human overpopulation, but it was the overpopulation of whites that had already overrun Europe, then we overran the eastern portion of the North American continent, until we moved to the American west and trashed that too. And now, we've managed to save barely a spec of their original range, Yellowstone National Park, and any bison that dare to stray from that relative safe space onto the "private" cattle ranches that surround it are culled annually. Too bad they can't read the "No Trespassing" signs. Anyway, it seems unlikely the bison population will ever bounce back to anywhere near their original splendor in North America.

Instead, the priority these days is cattle, which might be the neediest domesticated species on the planet. As a teenager, when I was considering a career in large animal veterinary medicine, I spent three years assisting a large animal veterinarian, so I know that cows in general are typically unable to give birth without help from humans. Hell, my horses could do better than that. I never had to pull a foal out of a mare. Seriously. Domestic cattle must be the most unsustainable animal on the planet, and they couldn't even exist without us. Yet here they are, displacing wildlife that could exist just fine without us, just so we can eat more beef than we need, and so ranchers can benefit from outdated subsidies that get squeezed from us taxpayers, whether we like it or not. By the way, if we let the buffalo live unimpeded, the meat is absolutely wonderful, and much healthier for us, so you have to wonder why on earth we insist on culling bison to make way for cattle. Does it get any stupider? Is stupider even a word?

As a final pathetic example of our trashing of North American Wildlife, the biggest decimation of all, in terms of numbers, is the Big Horn Sheep population, which was 1.5 to 2 million, just 200 years ago, and is now reduced to less than 70,000, a decrease of more than 99%. Way to go people. The story is not too different from the other grass eaters. A couple recovery projects are underway, as we scramble at the last possible second to save the few that are left.

At the end of the day, the best possible long-term solution for big horns and the other barely surviving ungulates is to get out of their way and let them recover on their own. This would probably not take more than a decade or two, because these species multiply pretty quickly when undisturbed.

Fly Fly Away

It shouldn't be too much of a surprise that the birds are going down too. Despite Rachel Carson's famous warnings in 1962,[35] which led ultimately to the establishment of the Environmental Protection Agency and many of the environmental regulations that protect our land, water and air to this day, we can now be proud to say that we've mostly gotten rid of our pesky birds. Who needs them anyway? After all, they just make a mess of everything, wherever they go. So, I hope you're happy.

I'm not. I'm horrified. In addition to being among earth's most enigmatic, beautiful, resourceful creatures, they play hugely important roles in our environment. Recent research has even revealed that birds have an intricate avian culture, with incredible memories of specific caching locations for food (hundreds in some cases), huge repertoires of memorized songs (they

may sound alike to us, but it turns out the songs are specific, handed down to next generations, and very intricate, like language), construction and use of tools, and intricate building of nests and courtship displays.[36] And most of us are aware of their incredible navigation skills, as many migrate thousands of miles seasonally. Think about that. Birds make up an entire civilization on our planet, and we're killing them off. What kind of monsters does that make us?

Birds give ecosystem services, such as seed dispersal, pest control and pollination. There's even an economic argument for those who need it: According to a 2019 paper, "47 million people spend $9.3 billion/year on bird-related activities in the U.S.".[37] Birds are an indicator of greater ecological health and integrity. The term "canary in a coal mine" is very appropriate to all birds in general. They make up rivets in the intricate web of life that we can ill afford to lose.

Since 1970, we've lost around three billion birds in the U.S. alone, 22% of forest birds, 37% of shore birds and 53% of grassland birds.[38] In Europe, it's even worse. Since 1980, the bird population has decreased by 55%, and a recent survey reports that the numbers of birds are at a "level approaching ecological catastrophe". Industrial farms are quiet, with no more bird song. Is that depressing or what? And the reasons are the same as for the other wildlife we're trashing. We've taken over their habitat with industrial farms, and spewed everything with pesticides, so if they try to eat, they get poisoned. In the past 3 decades, Germany has lost 75% of its flying insects by mass, so there's not much left for the birds to eat.[39]

Figure 1 clearly shows that the causes of death for threatened bird species in the U.S. are pretty much all human driven, other than a tiny percentage of geologic events. We're probably not to blame for all fires or invasive species, but we're likely responsible for most of it. The biggest threat of all is habitat loss for agriculture, logging, industry and urbanization and mining.

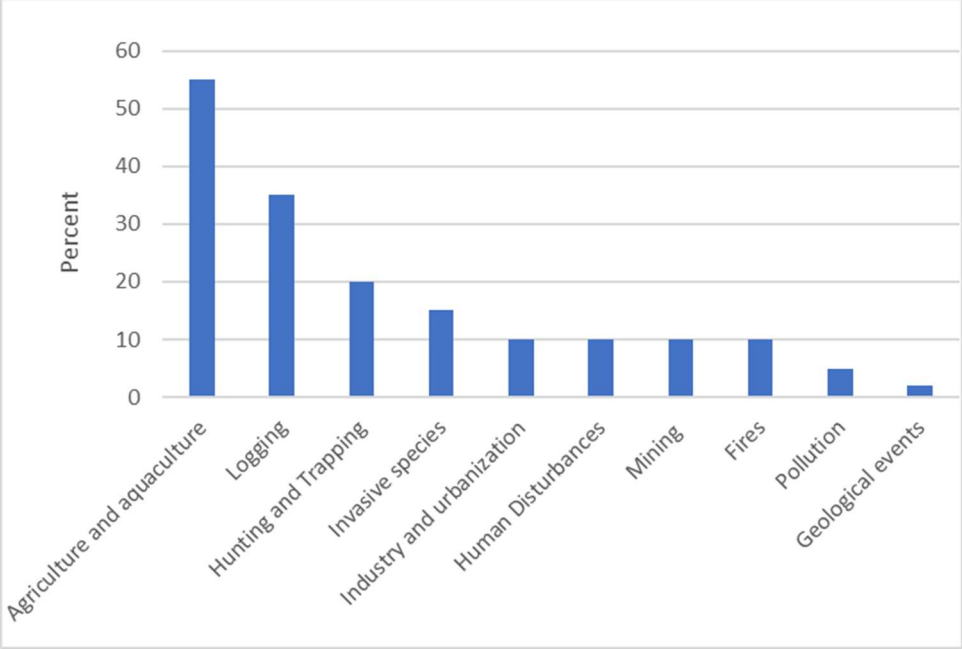


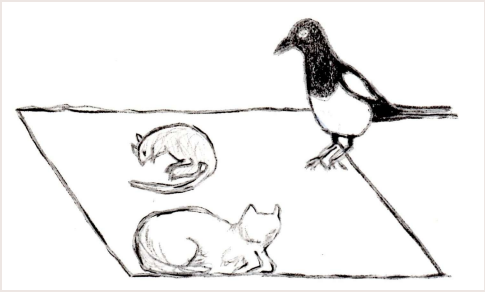
Figure 1 - Causes of Death for threatened bird species in the U.S.[40]

Human disturbances is a catch-all for all the other impacts we have that aren't in a specific category, like power lines, vehicle collisions, airplane collisions and windmills, which are estimated to kill off up to 100,000 birds annually. One million migratory birds die in oilfield wastewater pits annually. Others die by flying into transmission lines, windmills or communications towers or by

getting tangled in fishing equipment. Interestingly, cats aren't addressed separately in Figure 1, but are likely included in either invasive species or general human disturbances.

We definitely have a lot of feral cats in the U.S.. About 90 million cats live with their owners, and another 30 – 80 million roam wild.[43] The domestic cats eat mainly cat food, and many live strictly indoors, while the feral cats are wholly dependent on whatever scraps they can find or hunt, so they're likely taking out a significant number of threatened birds. Obviously cats that live with their owners take some birds if they're allowed to roam outdoors. Our cat used to take mainly ground critters like mice, rats and rabbits, but would manage to grab a bird once in a while.

Our cat, Baxter, used to keep our property free of rats, and, though he was more than happy to kill them, he found them unpalatable for some reason. Maybe something about the tail, or the mouthfeel. Who knows? He would leave them, sort of like a calling card, by an outside door, presumably as verification that he was doing his job and keeping his place (and ours) free of diseased varmints. One day, he mortally wounded a rat on the front porch, and for some reason didn't feel like finishing the job. Maybe he was just tired. Anyway, he sat there off to the side, while the poor hapless rat writhed in pain on the cement a few feet away. It was sad, and our son, Skyler, was considering putting it out of its misery. Then a magpie landed on the porch, right next to the rat. The magpie looked at the rat, then at Baxter, who did a sort of cat shrug and stayed where he was. The magpie, evidently feeling free to go, took the rat in its talons and flew off with it. So don't even begin to tell me that our wildlife doesn't communicate across species and understand each other and work together.



In Australia, it's a different story. Cats have become such deadly and prolific predators that they threaten to extinguish whole species of indigenous birds, reptiles and small mammals. To prevent that, the Australian government launched a drive in 2015 to kill two million feral cats by 2020. Worldwide, approximately half a billion cats, give or take a couple hundred million, populate six continents, 118 of the world's 131 main island groups, and the farthest reaches of the internet. To find a more successful invasive species, you'll need a mirror.

People generally agree that the feral cat population is too large, although the honest truth is that the human population is larger and more destructive by far. The status of global bird populations continues to deteriorate, and even once common birds are vanishing, according to a recent report from Bird Life International. It cites agriculture and logging as today's top threats to imperiled species and ranks introduced predators a distant third. In terms of trashing the planet, humans are plainly the worst offenders. And blaming cats only deflects our responsibility onto an animal with no concept of saving the world.[41]

One of my positively favorite birds is the camp robber, otherwise known as the gray jay. Living in the mountains of Colorado, we camp and hike a lot, and they seem to be everywhere. They can be a bit of a pain, going after the food on the picnic tables, but no more so than squirrels, chipmunks, field mice and bears. It's definitely a good idea to keep the food contained, packed and covered out there! Otherwise, you could technically be feeding the wildlife things that aren't good

for them, not to mention getting them used to humans, which can be dangerous for them if they encounter less friendly types.

Back to the camp robbers, most people I know regard them as pests, but my attitude is that it's all in how we view them. I love them because they are confident and strong, and so darned cute. I know people who actually stand quietly with a tidbit on the palm of their hand, hoping that one of the robbers will land on them, and sometimes they do. While I don't personally recommend this, I think it's an example of their ability to not only tolerate our presence, but to thrive in the desperately dangerous world we humans have created. For me, they've provided some level of hope for our avian friends, like if we really do kill all the birds on the planet with our sheer idiocy, at least the gray jays will survive. Ya think? Um, nope.

Even the ubiquitous gray jays are going down. Turns out that in the past 50 years, they have declined by as much as 85%. Seriously. That's when you know it's bad. It seems that we've scraped too much of the woodland that they depend on. By the way, they are pivotal in spreading seeds of trees, particularly junipers, which I also love. So much for junipers. But I guess if we don't have birds, we don't need trees either, right? The robbers are also members of the corvid family, which includes the ultra-intelligent crows, and are an example of the birds that are capable of memorizing hundreds of stash locations that they store food in. So it goes. I'm ready to cry. This makes me sick.

The same thing is happening to the sage grouse. There used to be millions of them, but with overgrazing, oil and gas development, wildfires and other threats, there are less than 10% of the original population. Sage grouse are another bird that's absolutely delightful to run across in the great outdoors, but that, too will come to an end in less than a decade if we keep it up with our destructive ways.[42]

Birds in the tropics are going down just as ugly, for the same reasons, endless clearing of forests to make way for humans and the endless land needed to grow food for our endlessly growing population. The rare Hornbill in the old-growth tropical forests of Southeast Asia is but one example of many. It plays a key role in the ecosystem, spreading seeds, and these birds are absolutely gorgeous. As if clearing their homes and food sources isn't killing them fast enough, they also get constantly poached, because it turns out that their horns make great carvings. There's a huge market in Asia for hornbill beads, pendants and intricate works of art, and I imagine a fair share of these precious little tokens end up here in the U.S. as well. Now it's so rare that it's almost gone, making the international critically endangered list, the ultimate kiss of death. Way to go, hornbill! Good to know ya![43]

Vultures are one of those less charismatic birds that would be unlikely to be chosen as the poster bird for endangered species. They are typically considered disgusting and are reviled, and it's easy to think we don't need them. But we do. While they arguably possess a face only a mother could love, it turns out that they are absolutely necessary for a balanced ecosystem. And, for the very reason we revile them. Their special role in this world is to eat carcasses. And they do it very well. Vultures can clean up a carcass down to the bone in less than 30 minutes, and their guts obliterate disease organisms and limit the spread from dead animals. Basically, they show up when an animal dies from disease or is killed by predators. They hang out off to the side until the predators are finished, then they step in for the cleanup.

Vulture populations in Africa are plummeting because of poisoning of livestock carcasses to kill lions. 96% of several vulture species in India have been decimated, and again the culprit is toxins in cattle, but in this case it's pharmaceuticals used to treat inflammation. In India, the loss of the vultures was devastating, and is yet another example of how bad things can get when we pick apart the web of life. Since Indians don't eat cattle, when cattle die, the vultures have historically taken care of them. With the vultures gone, the cattle carcasses pile up, and the feral dog population has increased dramatically, since they have no competition from vultures. Dog bites have increased as a result, and human deaths from rabies have increased by nearly 50,000, which cost about $34 billion in mortality, treatment expenses and lost wages. Who saw that coming? Think about that. Meddling with nature is a bad idea, and we'll never be able to accurately predict the unintended consequences, because we don't know as much as we think we do.[44]

The Carnivores

Predators are yet another category of wildlife that we kill simply because they annoy us. After taking over their territory for ourselves, and replacing their original prey with our livestock, we shoot, poison and trap them if they dare to hunt the livestock. Do you notice a trend here? All that livestock to feed all those people who are eating way too much meat as it is, and then killing the wildlife that interferes. Aren't we special? Most predators were hunted to extinction or near-extinction by the end of the 19th century, and now that we understand their importance in natural ecosystems, we're trying to bring them back. At least, some of us.

In Colorado, the gray wolf was hunted to extinction, and in 2021, voters approved an initiative to bring them back. I'm proud to say that I voted for the reintroduction. Wolves are an apex predator, and are absolutely necessary in an ecosystem to keep prey from overpopulating. Not everybody agrees. Ranchers have been either killing them or having them dispatched by Wildlife Services. Wolves get blamed for killing cattle as well as their normal prey, deer and elk, which humans would rather hunt themselves, without competition from wolves. Yet, in reality, wolves only kill a small portion of livestock. About 8,000 livestock animals are killed by wolves annually, compared to about 200,000 by predators as a whole. And we lose about 3.8 million cows each year to disease and weather. Remember what I said about cows being about the neediest creature on the planet? They are. They shouldn't even be running loose in wild areas, because they're unsuited for the conditions. And when it comes to deer and elk, more are killed by far in vehicle conditions than by wolves.

The number one cattle killer isn't wolves at all. Not even close. Wolves are only responsible for about 1% of cattle deaths. The number one killer of cattle is actually toxic plants, such as larkspur.[45] And, more cattle are killed by vehicles than by wolves.[46] Yet ranchers are up in arms against wolves. How ignorant is that? Think about that. Does it get any more self-righteous and entitled? And, to make it even more idiotic, if that's possible, the government actually reimburses ranchers for cattle killed by wolves. Our tax dollars. Yours and mine. When wolves are the very least of their worries. When their cattle shouldn't even be out there. To be forced to support such an enterprise completely infuriates me. I don't even eat cow meat and I pay for this insanity. I'm glad we at least don't have to pay for the deaths from larkspur.

Did you know that wolves even help keep stream water clean, which in turn helps the trout population? This is an example of the value of apex predators. Basically, they keep the prey, like elk, moving, so they don't over-browse cottonwood saplings along stream beds. This prevents erosion into the streams, keeping the water clear, which is great for trout.[47] Another example of the impact of wolves is in Yellowstone National Park, where they were eradicated in the early 1900's. The tree saplings were grazed to nothing because there were no predators to keep the herbivores moving.

We're losing the polar bears, mainly because they need thick ice, and the ice is thinning due to global warming. The southern Beaufort Sea population fell by 40% in just 10 years. The bears are less healthy, having fewer cubs, and the cubs are dying.[48] And, as you saw in Chapter 7, we continue to hunt them.

We've wiped out about 96% of tigers in the past century, and are down to around 3,900 left in the wild, making them closer to extinction than any other big cat. We've shot them for trophies and fur, and have taken over their habitat. There are more tigers in cages than there are in the wild, about 5,000 in the U.S. alone. It's legal for private owners who use them for petting zoos to kill them. They are bred in tiger mills, and when the babies get too old for the petting zoos, at about 12 weeks, they are killed.[49] I mean, what kind of nasty monster chooses to do that? As if the puppy mills weren't bad enough.

Frogs eat mainly insects, making them carnivores as well. Scientists believe they've identified only a fraction of the world's frog species. The ones we do know are disappearing fast. By some estimates, up to 200 frog species may have already gone extinct since the 1970's.[50]

The Freeloaders

Parasites make up yet another category of the intricate web of life. They can't really be represented by a specific level in the cycle, but as a whole, they make up 40% of all known animal species on Earth, and are largely unseen, but they're instrumental in running our planet. The very word "parasite" conjures up grotesque visions of lice or intestinal worms, but, like all wildlife, they are irreplaceable in the web of life, and we have no idea of what the unexpected consequences of losing them would be. Pretty much every group in the web of life includes parasites, from microbes and plants to birds and insects and more.

The role parasites play in ecosystems is not well understood, even though they're everywhere, and there's concern that climate change is putting them at risk just like all the other animals. Scientists are beginning to study them more closely, because of the scary potential of their disappearance.

Safe Travels

Many wildlife species migrate seasonally for survival, and our extensive network of roads, developments, fences and habitat that we've taken over has created serious problems for them. Our decimation of wetlands has made it extremely difficult for birds, who need these to rest and replenish during long journeys, many of which are thousands of miles.

In the west, mule deer, antelope and elk migrate, but many of their routes have been blocked by human development. Now they have to jump over or crawl under fences and cross highways, often with their offspring. All this stymied movement, combined with chronic wasting disease, drought-diminished food supplies and loss of habitat is reducing their numbers. In Colorado, mule deer population dropped by 28% in twelve years, and Wyoming's dropped by 43% in thirty years.[52]

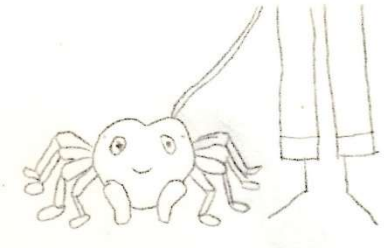
Whooping cranes migrate 5,000 miles through North America, and encounter endless man-made hazards along the way, including getting poached, collisions with power lines and fences and poisoning from agricultural chemicals when they stop to eat. They were nearly driven to extinction in 1941, from an original population of around 10,000 to just 15 cranes.[52] They have been slowly increasing, and now stand at around 500, about 5% of their original population. They winter in coastal wetlands in Texas, which are protected, but these are being lost to coastal development and sea level rise caused by climate change. To make things worse, freshwater inflows are dropping because of drought and cities extracting water.[53]

Since the first Earth Day, shore birds in the U.S. have crashed by 70%. Once again, the main reason is the continuing destruction of stopover sites, where tidal wetlands are being taken over for ports, factories and housing, and land is being cleared for agriculture. In the Mediterranean, 11 to 36 million birds are captured or killed outright by hunting and poaching,[54] depending on regional legal status. Do you think uncontrolled human population growth might be the underlying cause of all this destruction? Um, that would be my guess.

Culture and Society

Since we humans tend to view our world from our own standpoint, we don't tend to consider the viewpoints of other animals, such as wildlife. Historically, animals have been treated like objects or things, and not really taken as any kind of thoughtful being. Mainly they've been viewed and treated in terms of what they can do or provide, or as a pest if they're inconveniencing us. We've thought of animals as completely governed by instincts that are inborn, for their survival. Which is true, to a point, but the same is true of humans. The difference is that other animals haven't really been thought of as having any kind of conscience, or language, or culture, or soul. Of course, by objectivizing them as we do, it may make it easier to simply get used to the mass destruction we are currently inflicting on all wildlife. I mean, things come and things go, and it is what it is.

The idea of anthropomorphizing animals isn't really new, as any pet owner can tell you, but the idea of wildlife actually having real feelings is usually reserved for literature and Hollywood. However, research in recent decades, beginning with Jane Goodall's work with the chimpanzees in the mid twentieth century, which revealed that chimps make and use tools, and have social culture, has found that there are many examples of wild animals with culture.



Now we know that many species have language, feelings and culture. Elephants have amazing memories and mourn losses within their herds. Same for whales. Many birds, in particular the corvids, but also many kinds of songbirds have language and tool making ability. Ants, bees and termites have a very intricate culture, and bees are known to have language, in the form of dances to indicate to hive members where nectar can be found. Predators like wolves and lions work as teams to hunt, with each member taking specific positions to hunt. I don't know of a single mammal that hasn't been found to be playful.

Have you ever petted a bumblebee?

Beings that can't express themselves verbally have historically been assumed to feel no pain. It wasn't until the 1980s that doctors began to realize that human babies felt pain. Before that, surgery on infants was routinely done with no anesthesia. A growing body of research is making some surprising discoveries about insects: Honeybees have emotional ups and downs. Bumblebees play with toys. Cockroaches have personalities, recognize their relatives and team up to make decisions. Fruit flies experience something very like what we might call fear. The U.K. government recently recognized lobsters, crabs and octopuses as sentient.

In 2016, Andrew Barron, who studies the neural mechanisms of natural animal behaviors at Macquarie University in Australia, and Colin Klein, a philosopher of cognitive neuroscience at The Australian National University, published a paper arguing that insects' brains have the capacity for

subjective experience. Swedish neuroscientist Bjorn Merker's work suggests that the more basic forms of consciousness are located not in the cortex, which insects do not have, but in subcortical structures to the brain, which insects do have.[55]

Think about this. Just because wildlife doesn't speak like we do doesn't mean they don't communicate or have feelings. There are a lot of important things that we remain unaware of on our planet, so we need to take care about dismissing out of hand the extreme loss of wildlife at any level in the intricate web of life.