The Anthropocene Extinction: Our Dying Planet

As humans open a new chapter in the geological history of Earth, the tales of hundreds of species are swiftly approaching a close or have already ended. Scientists determined the Anthropocene epoch began once humans left a distinguishable imprint in the Earth. Since their origins in Africa, humans have created and innovated their way to the pinnacle of the food chain while using other species' habitat and resources as rungs on the ladder to the top. Humans have left a wake of destruction and lost species in their path; the list of extinct species is only expected to grow as long as humans continue their industrious habits. Species of the past, such as the wooly mammoth and passenger pigeon, are the posterchildren of anthropologic extinction. Everyone can recall from grade school that the dinosaurs were wiped out rapidly by an asteroid, but many changes go unnoticed today because it takes such a relatively long time from the perspective of a human lifespan for the climate to warm. Humans are causing significant losses of biodiversity from pole to pole and they must prioritize migratory actions to reduce their impact on the climate and environment before these losses result in an Anthropocene extinction.

Humans are causing massive changes in global climate which are having dramatic impacts on environments and species around the world. The burning of fossil fuels and the release of greenhouse gasses into the atmosphere by humans are responsible for the increases in temperature and concentration of carbon dioxide in the atmosphere. Many researchers including Dr. Steffen et al. (2007), a Climate Commissioner at the Fenner School of Environment and Society, asserts that these changes to our atmosphere and geological record are so pronounced that humans have caused the Earth to enter a new epoch known as the Anthropocene. These changes have real consequences in habitats. For example, changes in temperature are causing catastrophic hurricanes, dryer conditions conducive to wildfires, and changes in pH and acidity

of surface water. These changes affect some taxonomic levels more dramatically than others. For example, reptiles and amphibians are experiencing the brunt of climate change. Species of reptiles and amphibians are especially sensitive to their environments and water quality since they absorb water through their skin; therefore, pollution and changes in pH can have a major impact on their survival. Countries around the world experience significant acidification of rainwater due to the release of organic molecules into the atmosphere. Many amphibian and reptile species have suffered because of acid rain, but countries such as the United States and Canada have made legislative changes to reduce acid rain. However, these species face new and escalating risks from climate change.

Fungi and diseases such as chytridiomycete fungus (*Batrachochytrium dendrobatidis*) are increasing their range to target hosts further north of the equator than ever before. Jaime Bosch, a senior research scientist at The National Museum of Natural Science, studied the chytridiomycete fungus in Peñalara Natural Park, Spain and its capacity to expand its range and lethally influence species in traditionally colder parts of Europe as the climate warms. Bosch et al. (2007) explains the fungus is critically lethal and "is known to infect over 93 species worldwide." This illustrates the fungus' ability to be indiscriminate in amphibian host selection and epidemical capacity to infect new regions. Bosch's data showed that as the temperature rose throughout the Peñalara Natural Park, the range of the fungus increased as well, "doubling the number of ponds in which it was observed relative to 20 years ago." Even an average increase of less than one degree Celsius over 20 years has induced a climate catastrophe for many amphibian species. Before the fungus spread to their breeding pools in the national park, species were thriving in the mountains and experiencing minimal effects from pollution and acid rain. After the introduction of the fungus, two native salamander species went extinct because the fungus

encapsulates them and impedes their ability to absorb necessary water until death. There is no known cure or treatment for the fungus, but reducing the human impact on climate change would slow the spread of the fungus.

Some people are not yet convinced that climate change is being caused by humans or that greenhouse gas emissions from the burning of fossil fuels is driving the change. People with this ideology acknowledge that the climate is warming and damaging ecosystems, but believe that it is natural rather than anthropologic. The idea that humans are not the driving force behind climate change is misguided and has been invalidated by decades of irrefutable climate study. Actions can and should be taken to limit our greenhouse gas emissions. Simple legislation and abiding by emission standards outlined in the Paris Climate Accord can greatly reduce our impact of atmospheric concentrations of greenhouse gasses including carbon dioxide. Even if one believes there are other factors impacting our climate that are out of our control, there is no reason we should take actions to reduce the emissions we have control over. Dr. A. Townsend et al. (2004), from the University of York, explains that regardless of how aggressive our emission cutting actions are, at least 18% of currently endangered species are expected to be lost by the year 2050 even with the best possible results from emission cutting efforts. However, efforts to cut emissions would not be in vain because the worst-case scenario is the extinction of 35% of endangered species if emissions continue to be released globally at their current rate (Peterson et al. 2004). The damage has already been done to at least 18% of endangered species which are expected to be lost, but there is still value in reducing our global greenhouse gas emissions. For the 18% of species facing extinction due to climate change, there is still hope. Climate change is not the only anthropologic factor driving global species extinctions.

Habitat fragmentation is a worldwide phenomenon that has resulted in smaller and less fit species populations. Habitat fragmentation occurs as humans develop and build communities, farmland, and roadways breaking once connected ecosystems into much smaller microhabitats. The division of once interconnected populations of plants and animals can have dramatic repercussions on their health and ability to reproduce. The effects, such as inbreeding depression and loss of heterozygosity, can cause small populations to go extinct after relatively few breeding seasons. David Biello (2014), a contributing editor and journalist for the Scientific American, reported that "the population of any given animal among the five million or so species on the planet is, on average, 28 percent smaller, thanks to humans." Even if a certain species is not considered threatened or endangered, smaller average populations mean that genetic diversity is lost so the young are less fit for future reproduction. Continuing down a path of reducing animal populations will have dramatic effects on the genetic diversity available for evolution on Earth.

Thanks to the revolutionary thinking of many, including Theodore Roosevelt, we have 58 National Parks as well as numerous protected lands and waterways to help conserve species, but this is not enough. Some say that National Parks offer enough shelter for species in the United States from the threats of human influence. Some politicians have recently proposed that some parks should be downsized and activities such as mining, logging, and oil drilling should be permitted. However, some species find the area protected by National Parks to be too small for them to survive. The grey wolf (*Canis lupis)* used to range from Mexico to northern Canada as the dominant carnivore of North America. Since European colonization, less than 300 years ago, the range of the grey wolf has shrunk to Canada and protected pockets of individuals in the central United States. Dr. Rolf Peterson, who studied the wolves of Isle Royale first hand for

over 30 years, witnessed the rise and fall of wolves on Isle Royale. In his book, *The Wolves of Isle Royale; A Broken Balance* (2007), Rolf Peterson explains that humans, even on the most remote island National Park in the United States, managed to decimate a multi-pack population of wolves from 50 to two individuals incapable of breeding.

The grey wolves of Yellowstone are just beginning to rebound because of intense conservation efforts and favorable legislation (Wolves – Yellowstone National Park). Although Yellowstone National Park is the largest in the United States, its size is not sufficient to provide for wolves. Wolves are extremely territorial and are known to kill others of their own species who trespass within their domain. Packs monitor areas that extend out of the park onto farmland protected by farmers and cattle ranchers. Extreme pressure was placed on the wolves by defensive hunting by agriculturists and the wolves were eventually extirpated from Yellowstone National Park. It was not until wolves were reintroduced and legislation was passed to protect them that they were once again able to flourish (Wolves – Yellowstone National Park). Clearly, National Parks cannot be depended on as the only sanctuary for life in the United States. Although they play an important role in protecting species, the destructive tendril of the human species is wide reaching and infiltrates even the most protected ecosystems. Other methods of conservation need to be used in conjunction with the National Parks Service to combat habitat fragmentation.

An executive order issued on December 4th, 2017 by President Donald J. Trump substantially reduced the size of Bears Ear and Grand Staircase-Escalante National Monuments. Some people considered the size of the Utah monuments to be Obama-era federal government land grabs while others valued their cultural and ecological significance. Julie Turkewitz (2017) of the New York Times reported the executive order would “open millions of preserved public

acres to oil and gas extraction, mining, logging and other commercial activities." These types of commercial activities have proven time-and-time again to cause tremendous stress and permanent damage to fragile ecosystems. Now is the time to expand America's protected land for the sake of threatened biodiversity. However, President Trump made his intentions clear by ordering "the secretary of the interior, Ryan Zinke, to review 27 national monuments" for potential downsizing (Turkewitz 2017). Ryan Zinke's review suggested the reduction of six national monuments and the creation of three others. Of the three suggested monument designations, two would protect developed land including a home and a civil war training camp. These types of monuments would do little to protect ecologically valuable land for the preservation of species. The third proposed national monument, known as Badger-Two Medicine, is of cultural significance for the Montanan Blackfeet Native American Nation. If this land is protected from resource extraction, over 100,000 acres of valuable undeveloped habitat would be secured for generations. However, no action has been taken by the president to create any of the proposed national monuments.

Thankfully, individuals and small groups have taken it upon themselves to preserve and protect species in their own communities. A success story of overcoming habitat fragmentation is that of the North American pollinator. Many species of pollinators, from the bumblebee to the butterfly, have been on the decline for decades. Although there are other influences on their decline, habitat fragmentation and agricultural monocultures that exclude wildflowers are partially to blame. A campaign was started at the grassroots level to encourage people to plant native wildflowers preferred by pollinators around their houses, in their gardens, and on their property. Since the campaign started, many species have begun the long climb away from their threatened designations to higher population numbers.

Amphibians are not experiencing the positive population growth of the North American pollinators. Despite efforts to protect their migration routes and reduce our production of acidified rain, amphibians are known to be one of the most negatively impacted groups of animals by human activity. As the climate warms, their breeding ponds dry up; as we burn fossil fuels, their water acidifies; as population sizes drop, their genetic diversity weakens; as temperatures increase, lethal diseases spread north; as humans expand, their habitat shrinks. Each of these factors and many more are contributing to a massive amphibian extinction event that will only continue to grow. Professors Dr. Wake and Dr. Vredenburg (2008) advocate that we are quickly running out of time to conserve the remaining amphibian species because "current rates of extinction are 211 times the background extinction rate for amphibians, and rates would be as high as 25,000–45,000 times greater if all of the currently threatened species go extinct." From their perspective as herpetologists and climate science researchers, Dr. Wake and Dr. Vredenburg recommend that intensive greenhouse gases emission standards need to be imposed before the beginning of a mass extinction turns into a full-blown extinction event. They admit that it could take about 150 years at our current conditions for one-third of the threatened amphibian species to go extinct, but that is a relatively miniscule amount of time compared to the millions of years it took for that diversity to evolve. Dr. Malcolm McCallum (2007), a cofounder of the *Herpetological Conservation and Biology Journal* and a world-renowned herpetologist, came to comparable conclusions on the extinction rate of amphibians and the urgency of conserving them. Dr. McCallum's current extinction rate of 200 times greater than the background extinction rate confirms the dire circumstances faced by amphibians and the need for their protection.

The solution to this amphibian tragedy is not as cut and dry as slowing climate change and reducing human impact on their habitats. Although those conservation efforts would certainly help many species recover, there are other less understood factors contributing to amphibian species extinction. According to Dr. Simon Stuart et al. (2004), from the International Union for Conservation of Nature, amphibians face nameless threats which are "unidentified processes [that] threaten 48% of rapidly declining species." These unidentified processes loom over the weakest populations of amphibians and cannot be intentionally accounted for in conservation efforts. These unidentified threats could include parasites, disease, competition, and changing environmental factors that have not been thoroughly researched enough to understand the entirety of their impacts on amphibian populations. Clearly, even with the most passionate and well-funded conservation efforts, these rapidly declining amphibian species approach a much tougher climb away from their endangered status. Given the adversity amphibians already face, it is critical to adopt conservation efforts now to give them the best chance of survival. Additional research will surely reveal breakthroughs that can be utilized in future conservation efforts.

Humans have left a truly profound mark on the Earth. In the billions of years before humans, species were able to coexist at a chaotic equilibrium. Species are shaped by their environment through evolution and are able to manipulate the environment they live in, but humans have taken environmental manipulation to an extreme level. With the exponential increase and continued growth of human populations, the damage caused to the rest of the planet's species will increase without our intervention. Humans have to ability, unlike other species, to consciously measure the effects of our actions and implement change for the betterment of the environment. The creation of emission standards, protected lands, and habitat

restoration were a good start, but even these most basic compensations are being disputed and revoked. It is the duty of humans, as conscious stewards of this planet, to protect the fragile ecosystems with whom we share this Earth. Biodiversity is a precious commodity in the universe, and we are its keeper. Actions such as expanding protected lands and establishing strict climate regulating global standards would assist in sustaining habitable environments for all species remaining on this planet. Without swift action, irreversible and self-perpetuating changes will cause the Anthropocene Extinction, and the prefix will be well earned.

Resources

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