

Sydney Paul
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The Sixth Extinction

Research has led to the prediction that Planet Earth is currently faced with a rising loss of species that is suggesting a sixth mass extinction. In the past, the first five extinctions— which occurred during the Permian, Ordovician-Silurian, Cretaceous-Tertiary (K-T), Triassic, and Devonian, were triggered by natural disasters, each of which wiped out between fifty and ninety percent of all species on the planet. [1] The sixth extinction is believed to be different in the sense that the causes were not due to nature at all, but rather by the actions of humans. Humans are the leading cause of the destruction of land and mass resources. The invention of agriculture required clearing lands to farm which dramatically transformed landscapes and has been projected as a major cause and starting point of the sixth extinction. [4]

To begin, extinctions in the past were major events that were caused by natural disasters that were far from normal climatic disasters like dramatic temperature changes, and/or physical disasters, such as volcanic eruptions and or a meteor strikes in the everyday life of species. The first major extinction, Permian extinction, occurred 440 million years ago. It was the most dramatic die off due to climate change of severe and sudden global cooling which wiped out around 25 percent of marine families.[1,2] The second major extinction, the Ordovician-Silurian extinction, occurred about 370 million years ago. It was said to have been caused by climate change as well, losing around 19 percent of families.[1] The third major extinction, Cretaceous-Tertiary (K-T) extinction, occurred about 245 million years ago and was said to have been caused by climate change due to plate tectonics movement, others speculate one or more large comets and or asteroids crashed down on Earth, either of which caused about 54 percent of species to go extinct.[1,2] The fourth major extinction, The Triassic extinction which occurred around 210 million years ago, suffered a loss of 23 percent of families.[1] The fifth major extinction, the Devonian extinction which occurred around 65 million years ago, wiped out the remaining dinosaurs and marine ammonites, as well 17 percent of other species families.[1] Now, these events may seem to have little significance to the Earth's present situation of the sixth extinction, but comparing the new event to past ones, the sixth extinction will be the first extinction due to biotic cause rather than physical.[1] Researchers have broken down the sixth extinction into two phases. Phase one began around 100,000 years ago, when humans began to migrate from Africa to different parts of the world. The second phase began about 10,000 years ago, when humans turned to agriculture. [1,4]

Essentially, the sixth extinction is different from the past five because of human involvement. Because of stress on the ecosystem and species with human transformation of landscape, overexploitation of species, and introduction of species, Earth and its inhabitants have become endangered. [5] Humans have cleared land for many reasons, the first being use for agriculture [4]; Other reasons include cutting down trees for building materials and urbanization. [4] Human overexploitation of species includes hunting and harvesting, so not only does the growing population continuously kill these animals for food, but they also are used for other reasons like entertainment and domestication, which results in depleting natural populations in some parts of the world.[1] Lastly, humans have caused a rearrangement of Earth's ecosystems through the mixing of plants and animals that have been isolated in their own natural habitats for so long.[7] Because humans dramatically transformed landscapes and habitats, barriers were broken down and biological invasions occur[6,7] Some species invasions dominate and destroy

the habitat being invaded as well as introduce disease, lessen biodiversity, and cause extinction. [7] With all the points above in mind, agriculture represents the most profound ecological change in the entire history of life. [1] Because of agriculture, humans in some ways did not have to adhere to the carrying capacity, resulting in over population. [1,6] Carrying capacity is when a population reaches the maximum level of inhabitants in a specific environment and can still sustain their population and remain stable. [8] The population's stability and sustainability is reflected by the resources that will support them in the environment they inhabit. When a population reaches that maximum number of inhabitants, and those resources sustain that number without depleting, that population will have reached their carry capacity. [8] Now, with the expansion of agriculture, food supplies expanded by growing crops and slaughtering domesticated animals for meat, which allowed for humans to create an abundance of resources to sustain themselves. This in turn increased their carrying capacity because more resources were readily available, and when they ran low, there was always more to be planted or harvested. Humans can modify their environments for survival while other animals rely on their natural environments and their resources to support them. Today this modification continues especially because more lands are cleared to make room for human living and the collected resources are used to build housing and other structures.

Another contributing factor to the growing population was the invention of the genetic engineering of food. [9] Genetic engineering of food was invented to prolong the life of crops by increasing crop yield to produce more food; as well as, increasing crop's resistance to insects, herbicides, and tolerance to heat, cold, or drought. [9] In the grand scheme of things, genetic engineering was a good idea because it was designed to solve issues of hunger and to feed more people. However, referring back to human carrying capacity, genetic engineering of food contributes to the exponential growth of the human population because even more resources become available. Back around 1850, the human population was at about one billion. In 1930, the world's population reached two billion. In 2000, the population jumped to six billion, and is now projected to reach ten billion by 2050. [2] Some researchers presume that there is an ultimate limit to the carrying capacity of humans on Earth that agriculture can only support for so long. With these numbers growing, more stress is put on the Earth's ecosystems and soon there will not be enough resources to support human needs and demands. [6]

There are many more factors other than agriculture that are contributing to the sixth extinction. Some of which have resulted from agriculture and the growth of the human population, and some from other sources. One for example, are increased levels of greenhouse gasses. There are two ways that greenhouse gas emissions enter our atmosphere. [10] One way is through human activities like fossil fuel use, deforestation, intensive livestock farming, use of synthetic fertilizers, and industrial processes. [10] The other is through natural processes like animal and plant respiration. [10] Why greenhouse gas emission is a bad thing is that these gasses trap heat in the Earth's atmosphere and the human activities mentioned above increases the amount of gas entering the atmosphere and contributes to the warming of Earth's surface. This is dangerous because this warming of the surface will increase surface temperatures and alter the world's climate. [2] Thus, species will be forced to migrate farther north to find habitats with like climate conditions. [2] Scientists predict that if the surface temperatures rise 7.7 degrees Fahrenheit, that 16 percent of species will be lost. [2] With this, the ultimate outcome and concern is global warming. Ecologists, conservation biologists, and climate scientists believe and have predicted that if average temperatures rise two degrees Fahrenheit, that 5.2

percent of species will be lost. [2] If these issues continue, it has been projected that humans will soon be deprived of biodiversity benefits in as little as three human lifetimes. [3]

Lastly, many are concerned that we are passed the point to conserve our planet and reverse the damage being done. [2] With the Earth's ecosystems being destroyed, scientists are saying that even with little conservation, nothing is guaranteed to be saved from destruction. [2] Since the damage that has been done, is done, scientists say slowing or even stopping future damage by changing these destructive behaviors will allow life to rebound. [1] There are many suggestions we can do to modify and change these behaviors to help conserve our planet. A basic step is to become educated and learn about the plants, animals, and their habitats around our homes where we live, especially if any are endangered. By learning how important these organisms are and how beneficial they are can drive an individual to be aware of these animals and to be aware of their own personal human behaviors effecting the animal's livelihood. [9] These behaviors, for example, would be spreading around herbicides and pesticides that many use to upkeep their lawns. Many herbicides and pesticides take a long time to degrade and build up in the soils, and when organisms come in contact with and or ingest these poisons, they move throughout the food chain. Predators such as hawks, owls and coyotes can be harmed if they eat poisoned animals. Some groups of animals such as amphibians are predominantly susceptible to these chemical pollutants and suffer from the high levels of herbicides and pesticides in their habitats. [9] Some more suggestions for conservation are recycling and buying sustainable products. These again are basic changes, but have great positive impact. Recycled materials are reused in many ways to produce new materials which reduces waste and its impact on the environment. Buying sustainable products is also important for longevity of the product so there is less consumption and less waste from the more disposable products. [9] Making sure products are not tested on animals is also important. If more people started rejecting companies that produce and market products that test on animals, eventually that may lead to more companies changing their ways and end animal testing, or possibly put these companies out of business. Be aware of product materials and the materials companies use. For example, furniture made from wood from rainforests, fur products from the skins of animals, and other products made from endangered animals and such as ivory, coral, and tortoiseshell. [9] Another step towards conservation is making small changes in energy use to reduce carbon footprints. Unplugging objects, turning down the heat a few degrees, and switching to more energy efficient light bulbs can create small steps to saving energy and reducing fossil fuel use. [9] One last challenging but important suggestion would be a change in diet. Ideally a vegan diet would make the greatest impact on conserving the planet in many ways because vegans do not consume or use any animal products and their diet is essentially plant based. [9] Considering a vegetarian diet is still a positive step because this diet refrains from eating meat as well, however animal products such as eggs and cheese are still allowed. [9] If these two options, do not seem like options, consider lessening the overall consumption of meat in your diet. Eating little to no meat will better your own health and conserve our animals. [9] We as humans need to realize we are still very much a part of the eco system, and will suffer with all the rest if there is not an initiation for change.

For my project, I would like to use the factors listed that are causing the current sixth extinction, and use them in a way to open people's eye to the real issues that are happening. I must admit, I knew some of these issues were happening, for example climate change and deforestation; however, it was not until I took on this research that I found the speculations of Earth being in its sixth mass extinction. I strongly feel since humans are the cause of these great misfortunes, we cannot be ignorant. We must know what is happening and that we are the

causes of it. We should also be aware to what steps we can and should take towards the conservation of our planet. For my creative work, my first idea would be to create a sort of visual timeline in an illustrative way, whether it is implied or obvious. It would show the progression of the first factors that started the sixth extinction, like how the earth was before agriculture with the start of deforestation and the clearing of lands. Then visually show where things started to turn in a downward spiral with effects of human population over growth and the death of animals due to human activities. Another idea similar to this, which I am also very interested in, is the idea of creating two alternative futures showing what an environment would look like without human interaction, and then showing one after human interactions. How I execute this would probably be a traditional illustrated work using pen and water color to illustrate these worlds. I may create two separate works showing each world and then display them side by side, or find some way to show a transition between the two worlds in a singular piece. I may also incorporate a sort of mixed media with collaging. If I do use mixed media, the materials would most likely be recycled objects that will represent what humans destroy and the waste we create. I want to make people grasp how big these issues really are so they can reflect on their own destructive habits, if any, and ultimately visually illustrate these issues and bring them to light in a unique way.

Bibliography

1. Eldredge, Niles. "The Sixth Extinction." *ActionBioscience*. June 2001.
http://endangeredink.com/programs/population_and_sustainability/extinction/pdfs/Eldridge-6th-extinction.pdf

This source has a wealth of information on the sixth extinction including facts, statistics, projections, and a breakdown of everything related to the sixth extinction. The article discusses what the sixth distinction is, the past five extinctions, the main causes of the event, its continuation, and conservation measures. This article has fueled much of my research in laying out an outlined paper hitting important topics and ideas.

2. Gittleman, John. "Extinction." *Encyclopedia Britannica*. February 15, 2017
<https://www.britannica.com/science/extinction-biology>

This source lays out general information of extinction, like what it is and how it happens. The article touches on extinction rates which helps illustrate how common extinction is along with the information given on mass extinction distinguished by the fossil record. The article is more for foundational purposes to build my research, points, and ideas upon.

3. Kaplan, Sarah. "Earth is on brink of a sixth mass extinction, scientists say, and it's humans' fault." *The Washington Post*. June 22, 2015.
https://www.washingtonpost.com/news/morning-mix/wp/2015/06/22/the-earth-is-on-the-brink-of-a-sixth-mass-extinction-scientists-say-and-its-humans-fault/?utm_term=.a621d36d7ed8

This article lays out basic information about the sixth extinction. I mainly used this article for facts and projections of where Earth is headed and the damage we have caused.

4. Kolbert, Elizabeth. *The Sixth Extinction: An Unnatural History*. Henry Holt & Company, 2014.

*At Pratt Library

In this book, the author shares her research for a concerning issue, which is that we are currently in the middle of another wave of mass extinctions. In the beginning, she briefly describes the evolution of humans. She states that people, both prehistoric and otherwise, are not particularly strong, swift, or fertile. They are, however, resourceful, and as our adaptability continued to grow, the landscape alterations that eventually followed led to a huge decrease in biodiversity. That diminished biodiversity, she claims, may be behind the so-called sixth extinction. She then goes on to discuss the species which are truly endangered and the steps she believes we need to take to prevent their extinction. This book gives a lot of background on the concerns of extinction with both human induced as well as natural order.

5. "The Mass Extinction." *Evolution: Library PBS*. Accessed February 18, 2017
http://www.pbs.org/wgbh/evolution/library/03/2/1_032_04.html

This source brings to light the current issues in the world, the sixth mass extinction. Human kind's mass destruction of natural habitat resources has set a trend and if this trend continues, the sixth mass extinction is underway. Those at high risk are top carnivores, species with small geographical range, marine reef species, and tropical rainforest species. The author shows concern that this path will lead to the withering of abundance and diversity and will ultimately lead to our own oblivion as humans. I would like to use this source to bring this research to the current moment, and to show what is happening right in front of our very eyes.

6. Vitousek, Peter M., Harold A. Mooney, Jane Lubchenco, and Jerry M. Melillo. "Human Domination of Earth's Ecosystems." *Science* 277, no. 5325 (1997): 494-99.
<http://www.jstor.org/stable/2892536>.

This journal is a great source outlining the sixth extinction from its start, causes, and where we are now. The journal hones in on the specifics done by humans to cause the sixth extinction. The journal also focused on the results of the damage being done and how these are contributing to extinction. I used this article for much of my research and for the outline of topics.

7. Wall, William. "Extinction." *Biology Reference*. Accessed February 18, 2017
<http://www.biologyreference.com/Ep-FI/Extinction.html>

This source sheds light on a few causes of extinction starting first with environmental change and how species survive by adapting to their environment and what happens when they are unable to. The article then transitions into discussing mass extinctions and with examples. There is mention of human influence, population increase, agricultural expansion, and deforestation as major threats and causes of extinction. This article sort of answers the question of how common extinction is by the leading examples provided, but I think the article is more useful towards the causes of extinction.

8. Abel Daniel, McConnell R.L., "Population Size." *Environmental Issues. Measuring, Analyzing, and Evaluating*. Accessed March 23, 2017.
<http://www.wou.edu/las/physci//ch371/lecture/popgrowth/carrying.htm>

This article defines carrying capacity and explains in a basic way what it is and discusses human carrying capacity compared to animal carrying capacity. I used this article to relay basic information to back up my ideas.

9. Colbert, Treacy. "GMOs: Pros and Cons." *Health Line*. October 5, 2016.
<http://www.healthline.com/health/gmos-pros-and-cons?m=0#Overview1>

This article discusses the pros and cons of genetically engineered food. I used this article to supply information on what genetically modified food is and what the pros were when invented.

10. "Green House Gas Emissions- Main Sources." *What's Your Impact?* Accessed March 23, 2017. <http://whatsyourimpact.org/greenhouse-gas-emissions>

This article supplies a wealth of information on greenhouse gasses and the main sources that create them. I used this article to give basic information on what greenhouse gasses were and used other information to illustrate how these gasses are effecting our planet.

11. "10 Things You Can Do to Save Endangered Species." *Endangered Species Coalition*. Accessed March 25, 2017. <http://www.endangered.org/10-easy-things-you-can-do-to-save-endangered-species/>

This article give ten suggestions on what humans can do to help conserve our planet. All of the suggestions are very impactful while still rather simple. I used this information to supply solutions to the problems I have listed in my research on extinction and animal endangerment.