**Sense of Place & Environmental Ethic Essay**

**Abstract**

My essay reflects my sense of place, which is ‘dependent’. Every living organism is dependent on Earth’s mysterious ability to produce and sustain life. We are also dependent on the diverse ecosystems of the planet, “we depend on these organisms to do things like filter water, take CO2 out of the atmosphere, and create all of our food.” My personal environmental ethic falls somewhere in the categories of restoration ecology, and conservation biology. “The primary goals that these ethics tackle is protecting the current ecosystems of the world, and cleaning up all the messes we have already made.”

**Sustaining Life On Planet Earth**

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The canyon is a place of wonder. I don’t necessarily have a ‘connection’ with a place, however some places have aspects that stimulate my senses and effectively raise my dopamine levels bringing me a sense of happiness and awe. Every summer I spend a sufficient amount of time exploring the canyons of the southwest on some short-lived adventure. Rafting through these trenches of history is one of my favorite things to do. Maybe it’s because of the interaction with happy people on a carefree journey, endless games of Frisbee, or my profound respect for this piece of art 6 million years in the making.

Among the countless canyons in the four corners lies the San Juan River canyon. The San Juan River snakes its way through southwest Colorado, northwest New Mexico, and San Juan county Utah. The river lays nestled at the bottom of the towering canyon. A diverse ecosystem flourishes throughout the river, isolated by walls hundreds of feet high. This ecosystem has been changing and evolving with the river for millions of years, however there has been no change as drastic as the introduction of the tamarisk, an invasive non-native plant. Also known as salt cedar, tamarisk plants hoard light, water and nutrients. This has impacted natural cycles and destroyed the native wildlife habitat. The first species was brought to North America in the 1800s from Southern Europe or the Eastern Mediterranean region. They were first grown as ornamentals and later they were planted as windbreaks and to stabilize riverbanks. Unfortunately the species escaped cultivation and now tamarisk is widespread across the United States, more heavily concentrated in the southwest. In the San Juan canyon like in many others, tamarisk has spread to such an extent it has effectively smothered the natural functions and processes of the river’s ecosystem. In the western United States, 1.6 million acres of native vegetation has been displaced, leaving the banks of most of the rivers starving for biodiversity. Biodiversity is crucial because an ecosystem that sustains a broader population is directly more balanced, which ensures natural sustainability for all life forms.

Planet Earth is a sanctuary for life, however it wasn’t always one. At the beginning of our planet’s existence (about 4.6 billion years ago), Earth was still a molten mass, constantly pummeled by ice and rocks flying around during the formation of our solar system. About 200 million years later, planet Earth was finally cool enough to cause some of the water in the atmosphere to turn from vapor to liquid. The first oceans formed, and with them, life. We don’t know how it happened, the first life on Earth probably wasn’t even life as we know it. It is theorized that the first life was just a group of chemicals surrounded by a membrane. Over time these chemical groups evolved to create RNA. RNA is a nucleic acid that was disputably the first genetic material. These RNA life forms furiously replicated themselves until a random copying error gave way to DNA. DNA is much more capable of storing genetic information because of it’s double helix shape. Once these little organisms had DNA, they were on their way. Life eventually evolved to yield the very first forms of photosynthesis (about 2.1 billion years ago). Photosynthesis is the means by which plant’s harvest light energy from the sun and convert it into chemical energy, in turn, releasing oxygen into the atmosphere. Earth’s atmosphere suddenly experienced a huge oxygen peak. This was a milestone for life on Earth as it was the first example of living things bringing massive changes to their environment. It was also the first mass extinction because all the organisms that had evolved to live without oxygen were suffocated by the steady rise of oxygen levels. After that, aerobic organisms began to evolve, breathing in oxygen and providing a balance in its abundance.

Fast forward through 5 more mass extinctions and billions of years of evolution. By now tetrapods had crawled into existence and Earth had been churning out species for eons. Diverse ecosystems had begun to cover the planet interacting with each other and continuously shuffling around energy, nutrients, and other materials. No ecosystems have clear-cut borders; they are separated by fuzzy ill-defined lines that sometimes bleed into the neighboring ecosystems. Ecosystems are always in coexistence with their neighbors.

Energy and nutrients enter an ecosystem from some place; they are absorbed by the residence of an ecosystem and then finally passed out, sometimes into another ecosystem. The energy, or food, in an ecosystem moves through the trophic structure of that particular food chain. Autotrophs like plants are able to harvest the constant energy of the sun and store it in the form of chemical energy. This is the foundation for which all the remaining organisms in the system get their energy and nutrients. When the energy has moved to the most elite predators in the ecosystem the energy is passed on to bacteria that live to decompose dead bodies.

The size and scope of the food chain in an ecosystem is dependent on things like water and temperature. This is because plants, being the first stage of the food web, rely on precise amounts of water and heat in order to survive. Interestingly enough, the passage of energy through a food chain is far from perfectly efficient. Most of the energy in an ecosystem is exhausted simply from the act of living. These animals need energy to power their muscles and to run all their vital functions; the energy is simply used up. Planet Earth is occupied by millions of ecosystems, some huge and flourishing, some small and starving for balance.

 A man by the name of Heraclitus once said, “Change is the only constant.” Nothing in the universe is permanent; no object can escape the grasps of altercation. Planet Earth passes time in cycles. The passage of time and accompanying change on Earth is called ecological succession. Succession is all about change, and my argument is that change is good. Change is how a universe full of nothing but hydrogen and some helium came to harness a planet full of life.

 Ecosystems are always experiencing disturbances including wildfires, floods and windstorms. After these unpredictable events in ecosystems, predictable, even orderly changes occur in the affected system. These altercations directly influence the microclimate of the habitat. These changes are constant and never ending because change doesn’t end. Scientists are able to make predictions about ecosystems however not with certainty. Stochasticity is a fancy word for randomness, or unpredictable variability, which prevents us from knowing exactly what a community will look like after disturbances. So scientists are able to guess what ecosystems will do or how they will change, however these should always be thought of as probabilities not certainties.

 These changes are prevalent even at the large scale of the planet. Earth is always going through some stage of its life whether it be the wasteland left behind after a mass extinction, or the flourishing life supporting climate more like today. The planet is always going through things called cycles, which also govern many of the worlds other characteristics. One cycle we’re all familiar with is the water cycle. This describes how water moves on, above, and below the surface of the Earth relying on energy provided by the wind and the sun. All the water on the planet is a liquid, solid, or gas, the condition always changes and because it never ends, there is no starting point for water, so lets just start at precipitation. This is when the water that is being suspended in the atmosphere condenses and turns from a gas to a liquid, and sometimes freezes into a solid and is brought down to Earth by gravity. Snow, rain, sleet, and hail are all examples of precipitation. Next is evaporation, the conversion of liquid into a gas, which occurs when the sun heats up the surface of a body of water sending water molecules into the air which condense to forms clouds. Clouds are basically huge reservoirs of water that are pushed around by the wind and eventually drop their load down somewhere on the surface of the planet. Once water is on the ground, gravity continues to work on it, drawing it to the lowest point in a process called run off, or it pulls the water straight down underground. Most of the water that ever falls on the surfaces eventually reaches the oceans. In very cold places water will freeze and sometimes stay in the same place for thousands of years before returning back to the oceans.

 As you can see oceans are a big deal for our planet, they’re the reason we have the water cycle in the first place and other things including weather, and life on Earth. Living things also play a small role in the water cycle, seeing as we are 70% water. In both plants and animals, the breakdown of food to produce energy creates water as a waste product. In turn, we lose water through evaporation from our skin, we also exhale water vapor, and of course we pee it out. Water is a very crucial component that makes life on Earth possible.

 Another crucial cycle is the carbon cycle. Carbon is one of the most abundant elements in the universe and on Earth it is always in a constant cycle, just like water. Carbon is very important because all living things depend on it for their structure and to provide energy. It is also a major component to a lot of non-living things, in the ocean in the form of water and in the atmosphere, where it helps regulate global temperature. In the absence of carbon dioxide (CO2) Earth would be a frozen wasteland so lucky for us; there is a huge abundance of carbon. The first step n the carbon cycle is plants. Plants take in carbon dioxide out of the atmosphere because they need it to photosynthesize. This carbon then has three possible fates, it can be released back into the atmosphere through respiration, an animal can eat it, or it can be present when the plant dies. When plants die in a forested area and stockpile they gets buried and squished together to form rocks or fossil fuels such as coal. Humanity has become obsessed with digging up all of this old carbon in the form of coal, oil, and natural gas, and then burning it to fuel the modern lifestyle. Burning these carbon rich fuels releases the carbon back into the atmosphere in the form of carbon dioxide. This process is what started the rise in atmospheric carbon dioxide levels. This increase directly causes global climate change, because CO2 in the atmosphere prevents some of the heat from the son from radiating back out into space. Our planet is steadily getting warmer because we are burning through this massive stockpile of carbon that was locked underground. This causes lots of problems, ones that we can see already, and based on predictions, will keep creating bigger problems with time. This situation could be helped if we just suddenly stopped burning up all this carbon however in some aspects we have no control. Believe it or not, ice traps a lot of carbon in the form of permafrost, which is an area that is frozen year round. Over the years dead plant matter is compounded under the permafrost and as the temperature rises the permafrost melts, causing the plants to decompose. The decomposition in turn releases tons of carbon in the form of CO2 and methane. This creates a positive feedback loop; our carbon burning lifestyles release CO2 which heats the planet, in turn releasing more carbon from melting ice, keeping the greenhouse effect going with or without us.

 Humans have been studying the effects we have on our environment for a solid 50 years, but it is obvious that we humans are putting the hurt on ecosystems all around the world. Human activity alone could be responsible for nearly a thousand plant and animal extinctions, nearly all of them in the last century. But why is it our problem if some unintelligent species no longer exist? Believe it or not we depend on these organisms to do things like filter water, take CO2 out of the atmosphere, and create all of our food. These are a few of the countless free services provided by the natural ecosystems of Earth. It is also important to note that these services would currently be impossible to duplicate with even the most advanced man-made technology.

 Other services include the water and carbon cycles that were previously discussed. They also include other process like sustaining nutrient rich soils and producing the oxygen in our atmosphere. More importantly, ecosystems provide us with the raw materials we need to live. Things like the ocean, which provides us with food in the form of fish, and rivers and streams, which provide us with fresh water. Other species also benefit us by yielding fibers that we make shelter and clothing out of, and lets not forget fuel. Whether it’s biomass in the form of grasses or wood, or hydropower in the form of rivers, or all that carbon that is trapped in coal. In a sense also have the task of moderating many of the Earth’s systems. Fungi and other organisms decompose dead things feces, while plants filter the water we drink and the air we breathe as well as absorbing all the carbon we breathe out and that our cars belch out. All of this in turn, helps regulate the climate.

Another reason ecosystems are important humans is for the simple beauty of them. Places like a lake nested at the base of a towering, snow capped peak. Diverse grasses rustle in the crisp breeze, as a mighty eagle soars overhead surveying every inch of the landscape hoping to spot a mouse carrying vital nutrients and energy. Thriving diverse ecosystems give us places to play, landscapes that inspire us, and subjects to pull on our curiosity driving us to learn and discover. These are the less tangible, but still important cultural services. We rely more heavily on some ecosystems than others, but none can accomplish these rudimentary jobs unless they are intact.

Specifically, a thriving, robust ecosystem must have its biodiversity intact. Because ecosystems are just a group of living and nonliving things living dependent on each other, they are basically just rocks and weather unless all the living parts are healthy. The main reason biodiversity is so crucial to humans and the whole planet is because it makes areas more resilient to the constant, never-ending change. In an ecosystem with high biodiversity, if one species goes extinct and is removed; it is less likely that ecosystem will collapse. The best way to understand how humans impact the environment is by understanding how we affect biodiversity. It turns out we’ve done a less than adequate job because we have managed to endanger some of the most ecologically diverse ecosystems on the planet. Take clear-cutting forests for example. When 8 thousand hectares of trees are being removed every day, suddenly places with thousands of species turn into habitats for only a handful species. Furthermore, all of these trees that are removed no longer do things like regulate the flow of rain by absorbing some of it and slowing down runoff preventing erosion. Without the forests the water hits the ground and rushes straight for the oceans carrying countless chemicals and bacteria, thus affecting the marine ecosystems of the ocean. This is called a cascade effect, in this case caused by deforestation, which is one of the most harmful, observable human impacts. The cascade effect creates chain reactions of events, which can eventually lead to other impacts live desertification, essentially turning an oasis into an abandoned desert. It is also crucial to remember trees perform the important service of releasing oxygen and absorbing the increasing amounts of CO2 in the atmosphere.

The combination of the steady release of previously stored CO2 into the atmosphere, and the removal of CO2 absorbing trees, is much of what is driving global warming. As a result, the planet is becoming less and less bio-diverse. For example, the increase in climate temperature has lead to the depletion of polar ice, destroying the habitats for many species including polar bears, seals, and sea birds. The heat has also caused more temperate animals to move closer to the poles, and dryer conditions are leading to grass fires and forest fires. While it is true that climate change has occurred many times in the past, they have primarily taken place over hundreds or even millions of years. Climate change this time however, is taking place in our lifetimes, which gives organisms including humans, no time to adapt or move. The key point is that one human impact can lead to another, and even indirectly, results in less biodiversity.

My personal environmental ethic falls somewhere in the categories of restoration ecology, and conservation biology. The primary goals that these ethics tackle is protecting the current ecosystems of the world, and cleaning up all the messes we have already made. Conservation biology specifically involves measuring the biodiversity of ecosystems and then determining a strategy to protect them. Restoration ecology, however, is the science of restoring collapsed ecosystems around the world that directly affect us as humans. This is easier said than done because before you can fix something you need to know how it works, and then what is broken. In order to repair an ecosystem, you need to know what holds it all together. As I covered earlier, the glue keeping everything stable in an ecosystem is biodiversity. Not only the biodiversity in one specific ecosystem but also the diversity of all of Earth’s ecosystems.

 It is easier to cook an egg than to un-cook an egg. This is also true with the ecosystems of Earth. While it is important to do our best to repair the ecosystems that we have damaged, it is much more effective to not damage these ecosystems in the first place. Unfortunately it is not nearly as easy as cooking an egg and there are many varying approaches to this issue. One approach is called small population conservation. This deals with identifying species and populations that are dwindling and are in danger of becoming extinct, and tries to help increase their population and genetic diversity. The next step is to determine the optimal size of a population. Scientists do this by calculating the minimum viable population, which is the smallest size that a population can sustain itself. This involves many factors that take lots of research such as, the history of the species, life expectancy, breeding habits, and many more.

It is impossible and illogical to try and make the planet exactly how it was before humans, but as humans, we can at least try to eliminate whatever is causing the problem and help reestablish the necessary components that ecosystems need to function properly. This takes a lot of research and time. First, there is structural restoration, which is the removal and cleanup the human impact causing the problem. Then we must rebuild the historical natural structure to do our best to replicate ideal conditions that support biodiversity. Another strategy is called bioremediation, which is a process in which organisms are temporarily recruited to help remove toxic substances. Some types of bacteria are even being researched as ways to cleanup oil spills.

After all of this research I have come to the conclusion that it’s simply easier to protect ecosystems, rather than trying to rebuild them. We know a lot about ecosystems and how they work, so my proposal is that we spend more time working to protect them from negative human impact. As a result we will spend less time attempting to clean up after ourselves and potentially getting it wrong. It is much easier to cook an egg and eat it, than it is to un-cook one.

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