On my mind: The Ecological Explanation for the Environmental Crisis

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The environmental crisis requires our attention like it has never done before. The year 2004 was a breakthrough year where it was widely acknowledged that we need to be concerned about climate changes. Finally, even some of the critics are now convinced that it is real. Icebergs are adrift, the global air temperature has increased, and water levels are rising. Eight of the last ten years have been the hottest recorded in human history. Polar bears are drowning because the distances between ice islands have gotten too large. In some areas glaciers have disappeared. Simulation photographs in magazines show some of our major cities under water. Also, harmful non-indigenous species are replacing native species, the rain forest and rare habitat are being destroyed, pollution legislation is being de-fanged, and the environmental movement could not rally enough support in 2004 to replace George W. Bush.

Out of necessity, the environmental movement needed to renew itself, to finds its way out of the rut it found itself in the aftermath of the 2004 election. The historical arguments and pronouncements of the environmental movement are still easy to understand and justify. The root causes of the environmental crisis can be explained by understanding roughly 20 ecological concepts. Environmentalism grew out of ecology and the preservation movement, which began by focusing on the protection of rare species and rare habitats. Ecology has blossomed into a science and a set of related concerns encapsulated by the term environmentalism. But one can find the root explanation of the environmental crisis by searching its ecological roots. Some of the biggest environmental (ecological) problems include global warming, pollution poisoning, extinction, harmful non-indigenous species, habitat destruction, and overpopulation. There are historical ecological concepts that explain what caused these problems.

But first, what is ecology? Ecology among other things is a natural science. Ecology means a number of things to different people, but its scientific definition is the study of the interaction between organisms and their environment. It is also concerned with the study of the interaction between organisms. There are competition ecologists who study the competition within the same species and between different species. There are niche ecologists who study how specific organisms make their living in their environment. The science of ecology is also concerned with large environmental chemical processes like oxygen, nitrogen, and water cycles.

Science is a methodology to ask questions and gather information to answer them. Science is a perspective with a set of values, assumptions, historical precedents, and lessons. Ecology is a new science which seeks to document and answer questions about connections in the natural world. Its concepts and ideas can explain the mess that we are now in. With the knowledge of a small number of ecological concepts one can explain the causes of the major environmental issues we face today.

What follows are the ecological explanations for six severe environmental problems.

1. Global Warming

Global warming is the result of societal overproduction of greenhouse gasses: mostly carbon dioxide but also others. Greenhouse gasses create a barrier in the atmosphere that traps heat near the surface of the planet. Just like in a greenhouse, cosmic heat can enter the atmosphere of the planet, but greenhouse gasses, just like glassing in a greenhouse, creating a barrier that keeps the heat from dispersing into space. Without greenhouse gasses the planet would be as cold as the vacuum of space. With too much greenhouse gasses the planet can become overheated like Venus where the surface temperature is hot enough to melt lead. We need greenhouse gasses to survive, but our overuse of fossil fuels has resulted in the creation of excess greenhouse gasses that will result in more heat being retained in the atmosphere. As a result, the temperature of the planet is rising. Over the past one hundred years the Earth's temperature is estimated to have risen between 0.5 and 1.25 degrees Celsius. If the current production of greenhouse gasses persists it is estimated that by the year 2100 the temperature of the Earth will rise between 1.8 and 5.8 degrees Celsius (Slobodkin, 2003).

The amount of carbon dioxide in the atmosphere is estimated to have increased by 30% in the last century and a half. A minor component, carbon dioxide is only slightly more than three parts per hundred thousand in the atmosphere (Slobodkin, 2003). When fossil fuels are broken down to provide energy for our millions of automobiles, excess carbon dioxide is produced and enters the atmosphere. Carbon dioxide is also produced by respiration, the process by which we process the oxygen, carbon, and water we need. We breathe in oxygen and exhale carbon dioxide. Plants consume carbon dioxide through the process of photosynthesis whereby cosmic energy from the sun is used to create the chemical bonds that form the energy rich sugars from carbon dioxide and water. Animals eat plants and gain energy from these compounds that are fueled by cosmic energy from the sun. When

the compounds are broken down or digested, the animals gain the energy they need to survive. The carbon and oxygen cycle processes cosmic energy which is transferred between plants and animals through the processes of photosynthesis and respiration, but industrialism has produced excess carbon dioxide and other gasses which affect the whole cycle by heating the whole global system. The result will be raising water levels due to water expansion caused by rising temperatures and an increased ocean volume caused by the melting of the polar ice caps. This increase in water volume will affect chemical cycles that affect all living things on the planet. Life has become an integral part of these chemical cycles that they depend upon. The deforestation of the rainforests also results in less carbon dioxide being absorbed by living systems. The ocean will only absorb a portion of the excess carbon dioxide in the process causing deleterious decalcification of marine life by making the ocean more acidic.

Plants are the base of the food chain that converts chemicals from the atmosphere and nutrients from the soil to produce the energy stocks that fuel the chain of life. Plants need chemicals such as phosphorus and nitrogen, as well as water and carbon dioxide, which also have global flow processes that include transport between the atmosphere, water, life, and soil. We can impact these cycles by the production of chemical pollutants. When we release excess chemicals into the atmosphere or bodies of water we shift the natural cycles that can result in the demise of organisms that have depended upon these sensitive global cycles.

Red tides are the result of excess nutrients entering water systems that can result in the deleterious success of microscopic life. With excess nutrients these microscopic animals can grow beyond their carrying capacity, i.e. the population level that the natural environment can support. A population in excess, even microscopic, will deplete the natural environment of its requirements. This can create exhausted or dead water systems that undermine all the creatures higher up on the food chain. Such situations are akin to knocking the legs out from underneath a table. The success of our species has the rest of the natural world trying to adapt to the changes we have caused. The excess carbon dioxide we have produced is heating up the whole planet. If left unchecked, more areas of the planet are likely to become unlivable.

We have also seen the more immediate effects of other dangerous chemicals we have let out into the environment.

2. Pollution Poisoning

The chemicals that enter the biosphere of living systems as a result of

industrial processes are not all beneficial or natural, i.e. they do not belong. Plants need carbon, nitrogen, etc., but there are many things that we have introduced into the world through industrial processes that are harmful to ourselves and other living creatures. We have produced dangerous chemicals that enter living systems and accumulate through the process of biomagnification, an increase in concentrations in living tissue as one travels up the food chain.

Plants (organisms that can photosynthesize, thereby gaining energy from sunlight) are consumed higher up the food chain by animals that cannot photosynthesize, and animals higher up the chain then eat these animals. At the top of the chain is the apex predator that serves as an indicator species for the whole ecosystem: an interactive collection of numerous creatures. Food webs are more complicated than food chains in that the relationships are not linear, but rather a collection of many interconnections of food chains. The creatures that eat photosynthesizing bacteria may be eaten by many creatures, but these critters may also help in the digestion of larger animals which are connected in webs of relationships rather than a linear chain upwards.

Pollution enters these webs and chains at all levels and the concentrations increase up the many chains, until it could pose a threat to the animals at the top of the chain. Human society is often at the top of the food chain. The animals we eat can potentially pollute us. We have learned that what we have polluted the environment with can wind up on our dinner plate due to biomagnification. These pollutants can cause problems and cancer in human beings as well as creatures in the wild. For example, DDT had a deleterious effect on brown pelicans by interfering with the production of their eggs, which were too thin to incubate their young. When the use of DDT was diminished the brown pelicans made a recovery. Pollution is also one of the factors that lead to the demise of wildlife populations. Through natural cycles we have all encountered and ingested dangerous chemicals. We need to wash the fruit we find at the supermarket because of pesticides that are used to deter insects that would eat what we grow. Birds eat these poisoned insects and are poisoned. Excess pesticides wind up in oceanic and riparian (river system) ecosystems, flowing downstream. Pollutants have also been dumped into bodies of water resulting in a poisonous harvest.

We as well as the other organisms depend upon these complicated cycles. When they are disturbed things disappear.

3. Extinction

Wild, rare animals have been compared to priceless pieces of art (Wilson,

1984; Slobodkin 2003). They have developed over millions of years through the process of evolution, which is really easy to explain and understand despite the intelligent design controversy. It is surprising why the belief in evolution has been so controversial. Theological arguments seem superfluous (Futuyma, 1984) or unnecessary when one understands the evolutionary process at work. Evolution can be explained by the following set of propositions or principles.

Diversity or differences exist within populations (members of the same species) of animals. Some of us are tall, others short. Some fat, others skinny. There is continuum of skin colors and hair colors. Some of these differences are caused by genetics, i.e. we have a different genetic makeup. Even though we are all members of the same species, i.e. we are similar and together we can reproduce more of our kind, we are different from each other.

One of the factors that create these differences between us is caused by natural mutations of our genetic material. We pass our genes (biological building instructions) from generation to generation, but sometimes this biological information is changed between generations creating more differences between members of a species. Species in groups also break apart and change so they can adapt to different local environments and situations. Some of these differences between us are more advantageous than others and are therefore more likely to be selected in the process of reproduction or sexual selection. When times are barbaric it may be more advantageous to have large children because they are more likely to survive battles. Birds of prey, like other animals, through natural selection are selected for features that enhance their ability to hunt. Natural selection is the process by which organisms compete to shape future generations. Local conditions and mutations result in differences, some of which are more beneficial to the species or competitive than others. The process results in different parts or groups of a species growing separate from each other. Sometimes the various populations of different species have grown so far apart that they cannot reproduce between each other, i.e. they cease to be part of the same species. Natural selection over billions of years has created the natural world which seems miraculous to many. The competition can be so fierce that species need to change over generations to survive in their niche or place and role in the environment. An animal or plant's niche is their way of making a living, a role that they have evolved to fill. That the fierce competition of natural selection should maybe be acknowledged but not emulated is part of driving force behind the arguments of intelligent design, but such proponents have yet to present a competing theory with scientific merit.

Living things are the result of million of years of evolution. As things change some species die off and others emerge. But we have the consciousness and the power to protect the other living things on the planet. We can mass-produce tools, we can pass huge amounts information from generation to generation; we can document the damage we have caused the environment. We can adjust to save these creatures that have evolved through the same process we have. Having understood the process that created ourselves we also have the potential to grow beyond them. We can thrive through cooperation. The presences of nuclear weapons, which threaten our very existence, require that we do so. But the changes we make to ourselves during our life and the decisions we make will not impact the genes we pass to our offspring. Natural selection passes along the genetic heritage rather than how it was expressed under the environmental conditions in which organisms develop. When we observe wildlife we are watching the interaction between genetic determination and impacted expression. But not all organisms have survived.

Extinction means that creatures have disappeared from the entire face of the planet. It means they are gone and will never exist again. The passenger pigeons that once flew across areas of America in flocks so big that they blocked out the entire sky were eradicated from the continent by hunting and habitat destruction. Extirpation, similar to extinction, means that a species had been removed from certain locations. One may be able to find them elsewhere, but from certain locations they are now gone, usually resulting from human actions.

When we change the environment we alter the fragile connections that exist. Creatures have depended upon these connections that we have altered. We need to keep an eye on our neighbors on the planet to make sure they do not disappear. Newcomers also pose a problem.

4. Harmful Non-Indigenous Species

Newcomers, even if only non-human animals and plants, have the potential to change and alter all established ecosystems, i.e. an assemblage of weather-dependent connections and relationships between organisms. Harmful non-indigenous creatures do not have the population limiting factors that have kept them in check in their original locations from which they are. There is a not a population of predators which depend upon them as a food source. There are not pathogens that are adapted to living within their populations. Without these population limiting factors, non-indigenous species out-compete native species. In the process of out-competing these native or previously resident creatures, the environment is altered. Species can be extirpated because of the success of these newcomers.

Harmful non-indigenous species are a problem on the same level as habitat destruction in its detrimental effects on native creatures. Local ecosystems are overrun with non-native species all across the world. There is a movement to return habitats, the biological communities in which animals live, back to their native conditions, i.e. before the advent of the biological newcomers. This movement takes the form of the habitat restoration movement that usually involves the removal of non-native plants and the propagation of native plants. These actions can create more diversity and therefore homes for a greater variety of animal and plants. But many people have favorite non-native species that they think should be an exception in the recreation of the past. For example, urban birds like pigeons, starlings, and house sparrows have adapted to living in urban environments and are harmful non-indigenous species like us. But there are many critters that are less charismatic and have had a more harmful impact to the organisms that have traditionally belonged in certain locales.

5. Habitat Destruction

One of the longstanding debates in the field of ecology was between Gleason and Clement (Worster, 1988), the argument being if associations and assemblages of organisms (ecosystems) were connected with each other because they had common connections (requirements) to their physical surroundings, i.e. climate and weather. Clement argued otherwise, that species were associated because of the interactions that had evolved between them. They had become connected or interconnected somewhat independently of the weather and environmental conditions. These organisms as a group, as a community of organisms, either visited with each other or decided to stay together, or they were circumspect among each other and did not visit or interact very often. A visit or interaction could be predation, symbiosis, or commensalism. Symbiosis and commensalism are terms that designate relationships that are mutually beneficial to all the organisms involved.

We have not formed symbiotic relationships with the natural environment. It is an old story - our encroachment and destruction of the natural environment. In the past we have altered the environment to serve our needs. Underneath the parking lot, underneath the city, there was once a field, wetland, stream, or forest which supported a variety of life. We were only recently reconnected to that world. Instead of that farm field there was once a native ecosystem or community of living interacting organisms. We now miss what was lost and have created preserves to protect pieces of what is left.

Human beings have been so destructive to the natural world that they have needed to be separated from the rest of the natural world in some definitions of nature. We have abilities, such as technology and the ability to purposefully alter our environment on a large scale. There is a general definition of nature synonymous with everything (also including the farm, city and cosmos), but there is also strict definition of nature that separates us from the rest of world because we are different. Our technological society is something the Earth has never seen the likes of before. We have not added diversity to the natural world; instead we have destroyed habitat and populations. There are areas in the world that are unpopulated, but we would be wise to reduce our population growth rather than increase it in the interest of maintaining a better standard of living for ourselves and our brethren around the world. Though we share abilities with other creatures of the planet, we are different than the other creatures that live on the planet. We are the only creatures that can be a steward of the globe, but we have left much destruction in our wake. We need to preserve pristine nature in order for other creatures to survive.

6. Overpopulation

It is not necessarily true that human beings, so far, have exceeded their carrying capacity on the whole planet, but that is clearly the case in many locations. The human population explosion has depleted the resources in many locations, and threatens the stability of human society in the long run (Ehrlich and Ehrlich, 2004). Millions of people are going to need to be relocated due to global warming, and overpopulation will continue to lead to famine and war. When resources become scarce due to overpopulation we will need to fight for them.

As a society we live, we reside on this planet, but it is more telling to say we also "ecologize" the planet in our own way. Other creatures merely follow the dictates of ecology, while we can choose our future. Acknowledging this also reminds us of our connection to and responsibility for the rest of life. We can do better by our children if we have less of them. An understanding of ecological principles derived from natural sciences reminds us of our fragility, and the fragility of other creatures that share the planet. As a society we are responsible for the other organisms on the planet as well. We have the capacity to acknowledge our situation and our effect on the rest of the planet and alter our behavior. Ecology has taught us we are part of an incredible interactive host of living things. Ecology has also taught us that we need to change in order to safeguard the other special organisms and connections on the planet. There are many ways to get involved. One is to change the way we live. Another is to lobby or vote for concerned parties. There are also many non-profit organizations that are concerned with the

environment that could use your support. Your help and understanding is needed.

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