Alyssa Mohn
4 May 2021
The Natural Environment
My Nature Principle

The Freeing Effect of Limits

So much of what today's society holds dear stems from the concept of growth. We mark with chalk the height of our children on the door threshold and celebrate a new inch; we cultivate gardens; we measure a nation's worth based on its Gross Domestic Product and expect it to increase each year. The word "limitless" connotes a sense of excitement—so much that we use it commonly in slogans and campaigns to incite motivation towards a goal. However, we place no excitement on what really makes our Earth function so remarkably and efficiently: the ever-prevailing cycles of nature. Earth's limits should be celebrated too—the serenity of death in winter which gives way to the rebirth of Spring, and all of the cycles in nature which operate similarly to support life on the planet. We as humans can function more effectively as part of the biosphere when we allow ourselves to be part of the cycles which surround us, and everything we see is part of a cycle. Embracing our limits and appreciating these cycles can have the effect of inspiring creativity, as well as invoking the realization that even times of perceived stagnation are periods of quiet growth. This paper examines how connecting with our environments in this way will ironically make us feel liberated and lead to scientific discovery. After all, cycles continue while growth has its limits.

The first fact that is important to realize is that everything in nature, even the parts of the biosphere which are too small, or large, or far away to see, is part of a cycle, and all of these cycles are connected. Perhaps the first thinker to propose that vastly different fields of science should be considered simultaneously in the creation of scientific theories was Alfred Wegener. Wegener had an array of interests, beginning his career in astronomy, and then becoming

involved in meteorology, to eventually write a groundbreaking theory relating to geology. This theory was the Theory of Continental Drift. In fact, Wegener had made the observations about how the continents were once joined together and had drifted apart because of his background in meteorology. He had noticed that coal deposits characteristic of the coast of Africa were found in Antarctica, and conversely that glacial deposits characteristic of the coast of Antarctica were found in Africa. But because Wegener was theorizing out of his field of specialty, his ideas were disregarded (Kious & Tilling 1996). Had his peers of that era known that considering all fields of science in conjunction is instrumental to understanding the functioning of the biosphere as a whole, they may have taken him more seriously and made great strides in understanding continental drift much sooner.

Moreover, one is able to conceptualize the idea that so many of Earth's cycles are interrelated by considering that many of these cycles receive their energy from the sun. In the hydrologic cycle, the sun's warmth causes evaporation, which sends liquid water, mostly from the Earth's oceans, into the atmosphere. In this way, the oceans and the atmosphere are very interrelated. The warmth gradients that occur on the surface of the ocean and above, varying as heat rises off of the ocean and enters the atmosphere, is the cause for air currents and winds (Herring 1999). Solar energy is important for the process of photosynthesis, which converts solar energy, water, and carbon dioxide to produce chemical energy in plants (Harris 2019). As air currents and winds create weather patterns, and photosynthesis creates the energy for almost all plant life on Earth, the sun's energy is instrumental in the existence of life on the planet.

Because all of these environmental processes receive their energy from the sun, the sun cycle also affects their functioning in subtle yet influential ways. Cosmic rays, composed of electrons and bare positively charged nuclei, cause deposits of particles into Earth's upper

atmosphere. As sunspot numbers increase—which fluctuate over the course of an eleven year cycle—neutron numbers decrease due to the magnetic field present in Earth's atmosphere. The impact of these cosmic rays produce radioisotopes, which then oxidize and change. The radioisotopes oxidize into carbon dioxide which is taken in by plants, and beryllium-10 which attaches to aerosols in the atmosphere, precipitate in snow, and become the annual growth rings that can be observed in ice (Hathaway 2010). Scientists are still learning how to interpret the effects of the 11-year sun spot cycle, but the relationship between the sun's magnetic field and that of Earth's may help to understand the changes in Earth's climate, because sunspot-related magnetic field changes can have a large effect on the level of ultraviolet ray emissions in Earth's upper atmosphere (Hathaway 2010). Changes of the planet's climate have myriad other consequences, proving once again the relationship of the many cycles of the biosphere.

Seeing that all of the cycles are interconnected, it is easy to comprehend that humans and our role in the biosphere is just as interwoven. There are several examples of how humans function more effectively when we allow ourselves to be part of the cycles which surround us. A major example of how this connection works is biomimicry. For example, if we look at convective flow, which refers to the movement of softened rock in Earth's interior, we can closely compare the process to the way in which a pot of water boils (Kious and Tilling 1996). Examining large-scale operations that occur in nature and then comparing or translating them to terms that make sense in everyday life is a useful exercise in order to understand how to live sustainably, because nature is the best example of sustainability.

Therefore, biomimicry is when humans examine processes already occurring in nature and use this knowledge to propel sustainable development. If nature has already created a system that functions in complicated and successful ways that humans are even still understanding, then

the processes present in nature are an incredibly useful tool for creating innovative technology. Also, because the processes of nature are waste-free and sustainable, then modern society should be able to examine and emulate the ways in which nature has achieved green ways of creating energy and recycling materials, for example, in order to fight climate change. Hence, biomimicry is the key to reversing the destructive processes that were implemented for fast growth and production during the Industrial Revolution. In 2005, an industrial designer, Carl Hastrich, created a spiral diagram to act as a reference for how to carry on a design process using biomimicry. The process outlines six steps to creating a product, which includes identifying functions a designer would like a project to perform, discovering processes in nature which perform similar functions, reverse engineering the process to apply nature's strategies to the design, and then assessing its level of success (Fleming & Roberts 2019). Hastrich's biomimicry design spiral is not only useful for architecture and city planning projects, but for all kinds of technology including the harvesting of energy, the purification of resources, and agricultural techniques.

It is clear that the future of design and architecture is going to be defined by biomimicry and reducing a project's ecological footprint. The architect Sim Van der Ryn created a circular diagram to describe design's role as the mediator between nature and culture. Van der Ryn used the diagram to show his students how to bridge the gap between the desires of a client on an architectural project and the constraints necessary to apply in order to make the project respect the environment as well. The inner circle, marked "culture," represents the "why" of the project; the next ring, marked "design and technology," represents the bridge, or the "how" of the project; the outer circle, marked "nature," represents the "what": the materials and space available to meet the project's needs (2005). Van der Ryn's approach is a perfect example of

how taking into consideration given constraints is important in a design process, but also how the final product can be even more successful because of its awareness of how it will impact its surroundings as well as its client in a positive and healthy way.

There is also a word that describes the human tendency to want to connect with nature, and the concept that when we are around nature, we are happier and more productive. The concept is called “biophilia.” In a time in developed nations at which people are overloaded with technology exposure and urban settings lack the color green, they forget that they can use nature for relaxation and renewal. Biophilia as a concept was developed by Eric Fromm, a social psychologist. It was then made a common term by Edward Wilson, a biologist, in 1984. When architects find ways to incorporate nature into a living space, or even imagery or spatial sensations that feel like nature, it can have the effect of dramatically improving our capacity to focus, and lowering our anxiety, fatigue, and even blood pressure. Examples of biophilia incorporated into a building design include using airflow and humidity conditions, a presence of water, and light and shadows that emulate the outdoors (Browning et al. 2014). Even just the ability to hear or smell moving water has a positive, calming power to the senses. These built environment goals can be achieved through placement of windows, incorporation of fountains, the opening up of ceilings into skylights for natural light, the incorporation of indoor plants, or even pictures of plants to achieve these criteria. Window placement which takes into consideration the orientation of the building to minimize heat in the building from direct sunlight is an especially effective strategy, because it creates a pleasing balance of light and shadow in the space while minimizing the need for energy use for heating and air conditioning (Fleming and Roberts 2019).

Alternately, if humans do not spend enough time in nature, we can experience negative physical and mental side effects, referred to as "Nature Deficit Disorder." This term was originally meant to be applied to the lack of nature exposure that children receive, but it also applies widely to adults. Adults are at an even greater risk with their increasingly busy lifestyles, and more of the world's population is now living in an urban setting. Humans actually have senses—such as direction, proprioception, and echolocation—that animals possess, we just do not actively use them enough to know we have them. They are not vestigial senses that have become unusable through evolution, but senses that are still available to teach and harness with the proper training. Richard Louv in *The Nature Principle* argues that through more consistent exposure to the natural world, humans can tap into these senses and essentially engage in life on a new level of alertness (2012). Actually, the adaptations that are seen in recent science—evolution of species, for example—are changes that are meant to let species thrive in conditions that have already existed in the past. If we can tap into these senses by spending more time in nature and paying close attention to our surroundings, we can become more efficient creatures, safer in our surroundings, and happier in our ability to connect with other living things.

As society becomes more immersed in advanced technology, simulations and virtual realities, people—consciously or subconsciously—feel a sense of loss of creativity and decline in overall physical, mental, and emotional well-being. However, there is evidence that when people spend time in nature, we cooperate with each other better. In studies from the University of Rochester, after people were exposed to nature, they valued community, interpersonal relationships, and generosity more (Louv 2012). Nature is a perfect background to harbor a connection between people of differing backgrounds and cultures, as it is a common language that is engrained in us from the point of our making. If we are able to foster this sense of

community through being outdoors, it should be simple to create more opportunities in urban landscapes where these interactions can happen frequently. Community gardens as well as public parks could have the power to make us better collaborators and create harmony in our neighborhoods.

Whether or not we are able to perceive cycles as a whole in nature from beginning to end, the cycle is still occurring. These times of rest are only stagnant from our perspective, but in the grand scheme, each process is still leading to the next step in a cycle. Looking at the concept of time and the way humans function from an outside perspective, we can consider the period of one calendar year as a mere collection of beginnings and endings. Aldo Leopold discusses this perspective through observations of the seasons in *A Sand County Almanac*, describing the thawing of snow in spring, and the hibernating of animals in winter. He even examines the rings of a tree and the events in history which affected the growth of these rings (1966). The discussion of the tree's history is not rooted in a concern of the tree's monetary worth as a raw material, but in its intrinsic value. This display of respect for nature, and an understanding that humans have an impact on the life cycle of the plants, animals, soil, and water around us, diminishes our sense of power over the biosphere. It is important to behave as part of the whole in order preserve the careful balance of conditions on which nature relies, or else we will suffer from the imbalance as well.

Again zooming out, there are larger cycles which surround us that we have not even been able to document yet, or ones which humans cannot notice, because they are of such a greater scale. For instance, the Wilson Cycle describes the tendency for the continents to move away from each other and back together in a cyclical pattern. Most schoolchildren learn about the land mass called Pangaea, which was the supercontinent that existed the last time all of the land

masses were connected, 150 million year ago. However, if we look back to 1000 million years ago, the continents were actually apart, and then drifted together and apart again before Pangaea even formed (Wilson 2019). An even larger picture to consider is the oscillating universe theory, which states that the universe may be continuously expanding and then contracting in an ongoing cycle (Cataldo 2016). Hence, instead of the one Big Bang that is known to be the start of the universe, the theory implies that there were multiple big bangs.

In addition, one more large-scale cycle system to consider is the Milankovitch cycles. These cycles describe the small changes in Earth's orbit. The eccentricity of the Earth, or its elliptical orbit, has variations that follow a cycle that lasts over 100,000 years. Meanwhile, the obliquity, or axial tilt of the planet has a cycle of over 41,000 years, and the precession, or the "wobble" of Earth's tilt varies over a period of 26,000 years. These patterns have effects on Earth's climate, as the more the Earth is tilted the greater the contrast in our seasons, and a difference in precession may increase or decrease seasonal contrast and length for each hemisphere (Graham 2000). Studying these variations that are not possibly observable by humans without advanced scientific scrutiny is a tremendous help in finding patterns in Earth's climate. These three cycles are just a small sample of the many patterns that are happening that the average person cannot perceive, but signify that all parts of life have cycles.

Scientists are of course frequently discovering new cycles in recent times that let us understand the existence of patterns in nature. Sometimes, these patterns are new and are not even on scientists' radars as a possibility before they are discovered. Such a discovery is the Madden-Julian oscillation. According to the National Center for Atmospheric Research, the oscillation is a pattern of weather which migrates along Earth's equator and lets scientists predict weather in the tropics during a 30-90 day period. This major discovery provides an explanation

for what was otherwise unexplained rainfall in the area during this time (2013). It is important that scientists are constantly looking for these patterns because they can lead to invaluable new knowledge.

Thinking among nature promotes more creativity than thinking in man-made environments. There is a concept that supports this claim called the "loose parts theory." The loose parts theory explains that individual items, or parts, in an environment have the effect of sparking creative play (Louv 2012). This idea works in conjunction with the promotion of creativity through exposure to nature, because these loose parts endlessly exist in nature. Indoors, the number of loose parts is limited to the mind of the environment's creator. The same instance arguably occurs with computer games which are limited to their computer codes. However, since nature has no one creator and is made up of a network of countless interwoven parts with unpredictable actions, causes, and effects, there is an ample supply of matter to foster creativity. This expansion of creativity related to first creating a structure to play within is a similar concept to the aforementioned Van der Ryn's circular biomimicry model.

It is extremely advantageous in understanding systems and patterns of the biosphere to analyze Earth's cycles and their interconnectedness. In fact, cross-referencing between multiple fields of science in the creation of theories and discoveries is not only encouraged, but essential. Framing one's mindset within the constraints of existing cycles can actually have the effect of fostering new discoveries and creativity. Humans are just as much a part of these cycles as plants and animals are, and therefore it is important to partake in the environment as part of the whole instead of in a position of power over it. Nature has a large influence over the physical, mental, and emotional well-being of humans, and therefore should be enjoyed, respected, revered and

appreciated. If society is able to let go of today's model of continuous growth, Earth's inhabitants can be happier and healthier.

Works Cited

Browning, W.D., Ryan, C.O., Clancy, J.O. 2014. “14 Patterns of Biophilic Design”. *Terrapin Bright Green, LLC.*

Cataldo, C. 2016. “Further Remarks on the Oscillating Universe: An Explicative Approach.” *Research and Reviews: Journal of Pure and Applied Physics*, vol. 4, no. 3, pp. 1-5.

Fleming, R. and Roberts, S. H. 2019. *Sustainable Design for the Built Environment*. Routledge. New York, NY.

Graham, S. 2000. “Milutin Milankovitch.” *NASA Earth Observatory*.

Harris, K. 2019. “Photosynthesis.” *Hartnell College*.

Hathaway, D. H. 2010. “The Solar Cycle.” *Living Reviews in Solar Physics*, vol. 7, no. 1, pp. 1-65.

Herring, D. 1999. “Ocean and Climate.” *NASA Earth Observtory.*

Kious, W.J. and Tilling, R.I. 1996. “This Dynamic Earth: The Story of Plate Tectonics.” *U.S. Geological Survey.*

Leopold, A. 1966. *A Sand County Almanac.* The Random House Publishing Group. New York, NY.

Louv, R. 2012. *The Nature Principle: Reconnecting with Life in a Virtual Age*. Algonquin Books of Chapel Hill. Chapel Hill, NC.

National Center for Atmospheric Research Staff. 2013. “The Climate Data Guide: MJO: Madden-Julian Oscillation Diagnostics.” *National Center for Atmospheric Research Climate Data Guide*.

Ray, R. 2001. “Ocean Tides and the Earth’s Rotation.” *NASA International Earth Rotation Service Special Bureau for Tides.*

Van der Ryn, S. 2005. *Design for Life: The Architecture of Sim Van der Ryn*. Gibbs Smith. Layton, UT.

Wilson, R. W., et al. 2019. “Fifty Years of the Wilson Cycle Concept in Plate Tectonics: An Overview.” *Geological Society, London, Special Publications*, vol. 470, pp. 1-17.