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The Contribution of Environmental Education to Dismantling an Increasingly Dysfunctional Environmental Attitude

Jenna Patricia Santacroce
University of Mississippi

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Jenna Patricia Santacroce

The University of Mississippi

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Thesis Advisor: Dr. David Rutherford

Second Reader: Dr. Zachary Vereb

Third Reader: Dr. Clifford Ochs

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Abstract

In part one, this thesis explains how a widespread environmental attitude, which is that it is permissible for humans to dominate the Earth, originated in early human history and remains prevalent today. This "domination attitude" is accompanied by American physical and social structures, otherwise referred to as provisioning systems, which largely constitute a current, prominent paradigm. This paradigm is leading to irreversible environmental degradation which adversely impacts all life on Earth. In part two, this thesis claims that this trajectory can be effectively diverted through a paradigm shift, one where the domination attitude is abandoned, humans pursue a more harmonious relationship with the environment, and current unsustainable provisioning systems are restructured. This thesis argues that one means to achieve a paradigm shift is by improving environmental education in the primary and secondary education system. This thesis discusses three specific areas of environmental education reform, including ecological literacy, critical thinking, and place-based and experiential learning.

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Acronyms

ELP	Environmental Literacy Plan
EPA	United States Environmental Protection Agency
IPCC	Intergovernmental Panel on Climate Change
OEE	Office of Environmental Education
NAAEE	North American Association of Environmental Education
NCLB	No Child Left Behind Act
NCLI	No Child Left Inside Act
NEEA	National Environmental Education Act

Introduction

The human view of the natural environment provides a window for understanding human interaction with the natural environment. Beginning in the ancient past, many humans viewed the Earth to be threatening. It is inferred that the fear of the Earth led to one of the earliest environmental attitudes - that it is permissible for humans to dominate the Earth. As humans gained a better understanding of Earth in more recent history, it became less threatening; nonetheless, the environmental attitude to dominate the natural environment was never abandoned. From the late 1500s until today, humans' widespread environmental attitude remained that it can be dominated, not so much to combat fear but instead to benefit humanity.

This domination attitude accompanies physical and social structures, otherwise referred to as provisioning systems, that place a demand on Earth's resources. The reason for this accompaniment could be that the domination attitude justified the emergence of environmentally-demanding provisioning systems, or that the provisioning systems constrain the kinds of attitudes that were and are reasonable for humans to adapt. Nonetheless, the domination attitude and provisioning systems existed, and still exist, intimately intertwined in what seems to be a feedback loop where they are mutually reinforcing.

In early history and for centuries after, the Earth was able to sustain these provisioning systems despite their demand on the environment because there were far fewer humans and human populations and activity were slow in growth. In more recent history, billions of people

have populated the planet and human activity has been expanding rapidly. Specifically, in the United States of America, provisioning systems became increasingly exploitative of the natural environment. These provisioning systems, which now exist not only in the United States but across the globe, are causing irreversible, life-threatening environmental degradation like rising sea levels which destroy entire coastal communities. An effective approach to diverting this trajectory is through a paradigm shift which entails abandoning the domination attitude, pursuing a more harmonious relationship with the environment, and restructuring unsustainable provisioning systems.

Many sectors of society must be altered to achieve a paradigm shift, however, improving environmental education in the United States' primary and secondary education system has great potential to lead humanity toward this achievement. Reform to primary and secondary environmental education in the United States is crucial because present-day environmental education, or lack thereof, perpetuates unsustainable provisioning systems, fails to equip learners with the necessary skills to recognize and respond to environmental threats, and disconnects students from the Earth. Three areas of environmental education that can address these insufficiencies include ecological literacy, critical thinking, and place-based and experiential learning.

First, improving ecological literacy education will provide students with an understanding of Earth's basic ecological functions and how humans interact, and usually interfere, with these functions. It will better help students view the world from an ecological perspective and employ a framework of thought referred to as systems thinking. Improving ecological literacy education will ultimately encourage students to create sustainable provisioning systems, rather than encourage them to successfully integrate into the unsustainable

provisioning systems that already exist. Second, improving critical thinking education, which is especially important in today's changing world, will enable students to apply new ideas to manage the existing and emerging challenges brought on by environmental threats. It will also help students challenge the causes of these threats, which are mostly unsustainable provisioning systems, and like ecological literacy education, it will enable students to create sustainable provisioning systems. Third, improving place-based and experiential education will foster learners' concern, curiosity, and capability to protect the environment by connecting them to the natural environment. Place-based and experiential learning will strengthen students' biophilic tendencies, underscore the relevance of the environment to everyday life, and reinforce students' capabilities through hands-on problem-solving activities.

The successful transition to a more sustainable paradigm requires more than reform to environmental education, including foundational changes in other sectors of society, however, environmental education is a crucial component to initiating and ultimately achieving this shift. Shifting to a sustainable paradigm is likely impractical without equipping the next generation for this transition through the improvement of environmental education that emphasizes ecological literacy, critical thinking, and place-based and experiential learning.

Part I:

The Increasingly Dysfunctional Environmental Attitude

Chapter 1:

Environmental Attitude: Domination

Emotions, beliefs, and behaviors toward the environment constitute an environmental attitude. It is important to acknowledge environmental attitudes because they provide an explanation, in part, for how and why humans interact with the Earth. In essence, environmental attitudes are a means to better understand human activity. The inferred environmental attitudes of some early humans are similar to those of present-day humans.

The Ancient Past

In the ancient past beginning about 1,000,000 BCE, which is otherwise referred to as the prehistoric era, early humans were threatened by the same environmental conditions that forced other species into extinction. Humans were defeated by carrying capacities, competed for resources, and generally had little understanding of natural phenomena which often led to inadequate protection from tornadoes, earthquakes, and other natural disasters. (Kemp, 2004) The complexity of Earth was threatening to humans, and in response, it is likely that many humans feared the natural environment. It is inferred that as a result of this fear, many prehistoric humans developed the environmental attitude that humans are permitted to dominate the Earth. Domination, in this context, includes the exertion of control and prevailing influence over many biotic and abiotic components of one's environment. This attitude, that it is permissible for

humans to dominate the natural environment, was never abandoned; it has been seen throughout history and now remains deep-rooted in present-day American and global systems.

One way to interpret how humans of the ancient past may have demonstrated this domination attitude was by their purposeful use of the Earth's resources. For example, prehistoric humans made tools from stone cores which were used to cut, chop, and scrape, specifically to improve their ability to hunt game and gather vegetation. (Sloan & Potts, 2010) Also, by 100,000 BCE, humans discovered fire which they used for hunting, warmth, and light. Despite these and other new tools and techniques, hunters and gatherers were nomadic and only hunted game, gathered vegetation, and lit fires in the general areas they occupied at that time. (Feeney, 2019) Because of their nomadism, the natural environment was able to recover once humans traveled elsewhere. (Kemp, 2004) Ultimately, while it is difficult to determine definitively whether humans maintained this environmental attitude based on the limited paleo evidence that is available to anthropologists, it can be inferred that one of the earliest environmental attitudes was that it can be dominated based on their behaviors. Despite this domination attitude and the physical and social systems that accompanied it, there was only regional and short-term environmental degradation during ancient times. (Kemp, 2004)

These physical and social systems, from here out, will be referred to as provisioning systems. Provisioning systems are the ways in which humans orient their lives, cultures, and institutions to achieve certain goals. (Fanning et al., 2020) Provisioning systems can be identified as physical systems, like infrastructure and technology, or social systems, like cultural norms, values, governmental institutions, the economy, and more. As illustrated in Figure 1.1, provisioning systems use resources from Earth's systems (referred to as biophysical resources) to

meet citizens' needs and wants (referred to as social outcomes). (Kemp, 2004) The first provisioning systems emerged in ancient times and have continually changed throughout history.

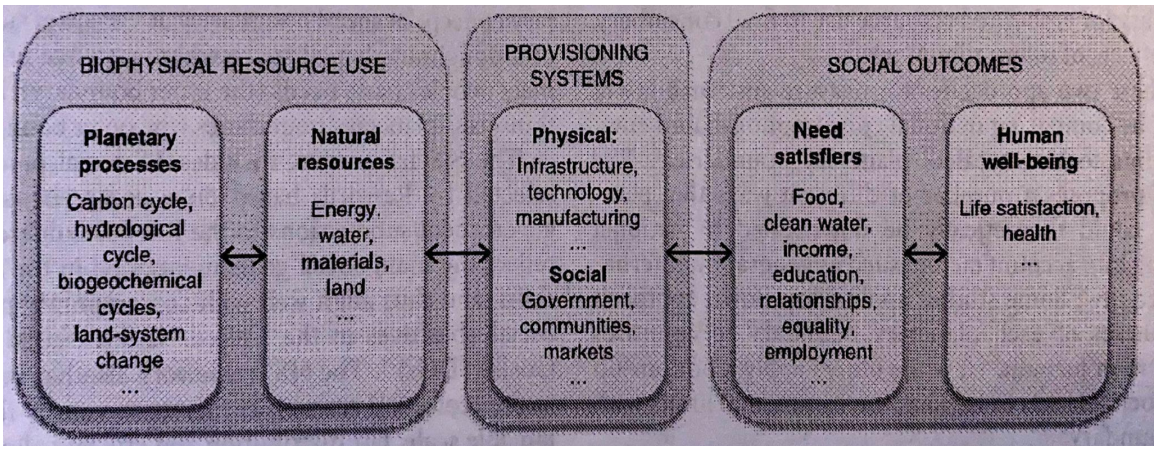

Figure 1.1. Components of provisioning systems (Kemp, 2004)

Agrarian Civilizations

New provisioning systems emerged with the rise of agrarian civilizations around 10,000 BCE when humans shifted away from nomadism to develop agrarian civilizations in some areas of the world. Perhaps because many humans maintained the domination attitude, they continued to frame their provisioning systems around dominating the environment; or, perhaps the behaviors and lifestyles that were inherited from the ancient past constrained the kinds of attitudes that were reasonable to adopt. In other words, if people of agrarian civilizations inherited and depended on prehistoric lifestyles that employed the domination attitude, then it may have been difficult to imagine a different environmental attitude, given their dependency. Whatever the reason for the accompaniment between the domination attitude and provisioning systems, in agrarian civilizations, humans engaged in behaviors that led to environmental degradation. Humans developed crop domestication, the use of natural irrigation systems, and the construction of artificial water distribution systems like small dams and ditches to maximize

food supply. Later, energy-converting techniques and coal combustion emerged around 1400 CE. The domination attitude and its accompanying practices led to substantial soil depletion and water pollution, but these practices spread very gradually through communities. Therefore, humans still had only regional and short-term impacts on ecological systems. (Kemp, 2004)

By the 1590s CE, the attitude to dominate the natural environment shifted slightly. Unlike the ancient past, where humans sought to dominate the natural environment to combat their fear of the Earth, beginning around 1590, humans instead sought to dominate the natural environment for more instrumental purposes, primarily to improve their quality of life. This motive shift was due in large part to philosophers like Francis Bacon and Galileo Galilei who developed scientific theories that defined Earth's systems in quantitative measures. These theories allowed for a better understanding and explanation of natural phenomena. Because these measures made the environment easier for Western thinkers to understand and control, it made the environment less threatening for many. Galilei stated, "The laws of nature are written by the hand of God in the language of mathematics." (The Famous People, n.d.) Similarly, Bacon explicitly claimed that knowledge of nature is power over nature and that the natural environment should be utilized to maximize benefits to humanity. (Serjeantson, 2014) In time, as this information and ideology spread across the world, the improvement of human life became a significant reinforcing factor of the domination attitude.

The Agricultural Revolution

The new instrumental motive, to improve the quality of human life, quickly expanded human activity. One of the earliest instances of this accelerated expansion occurred during the Agricultural Revolution. The Agricultural Revolution, which began in Great Britain in 1710, was

a time in which humans sought to increase food production by inventing major technological systems like marl treatment, crop rotation, and livestock breeding experimentation. These new provisioning systems led to the uprooting of natural ecosystems and habitats, soil erosion, and disruption to the hydrologic cycle, which first began in Great Britain, changing British landscapes and polluting the hydrosphere. Despite the environmental impacts of these provisioning systems, other countries, including the United States of America in the nineteenth century, recognized the effectiveness of these practices and quickly adopted them, in turn degrading their environments. Since the ancient past, the domination attitude and its accompanying provisioning systems had only regional and short-term environmental impacts. Beginning with the Agricultural Revolution, however, this domination attitude resulted in human-induced global and long-term environmental degradation. (Kemp, 2004)

The Industrial Revolution

The motive to maximize benefits to humanity even further accelerated human activity after the Agricultural Revolution. To maximize benefits to humanity, humans expanded not just agriculture but other sectors of society. An outgrowth of this was the Industrial Revolution, which also first began in Great Britain in about 1760 and made its way west to the United States of America by 1830. Now shifting the scope from global human activity to American activity, iron, steel, textile, and other industries emerged in the United States. In the United States, these, and other developments, like cities and the further development of railroads and steamships that connected them, brought economic growth to the communities in which they existed. Most notably, these developments resulted in economic growth. As the economy expanded, capitalistic economies and consumer culture, which is the focus on spending money on material goods,

emerged. (Jackson, 2011) Because the attitude to dominate the environment was growing increasingly more prominent, the demands of expanding systems like industrialization, the economy, and consumer culture were satisfied at the expense of the ecological systems. Natural resources were generally used with little reluctance, and people continued to pollute the atmosphere and hydrosphere. (Kemp, 2004)

The domination attitude that accompanied these provisioning systems remained prevalent throughout the Industrial Revolution. For example, in 1910, a mother sent her daughter a postcard of the American Tin Plate Company, which was a fifty-four-smokestack factory in Elwood, Indiana. The mother described the American Tin Plate Company to her daughter as “a pretty place," which she wrote across the bottom of the postcard. Figure 1.2 is an electronic image of this postcard. (Davis & Henderson, 2011, p. 143)

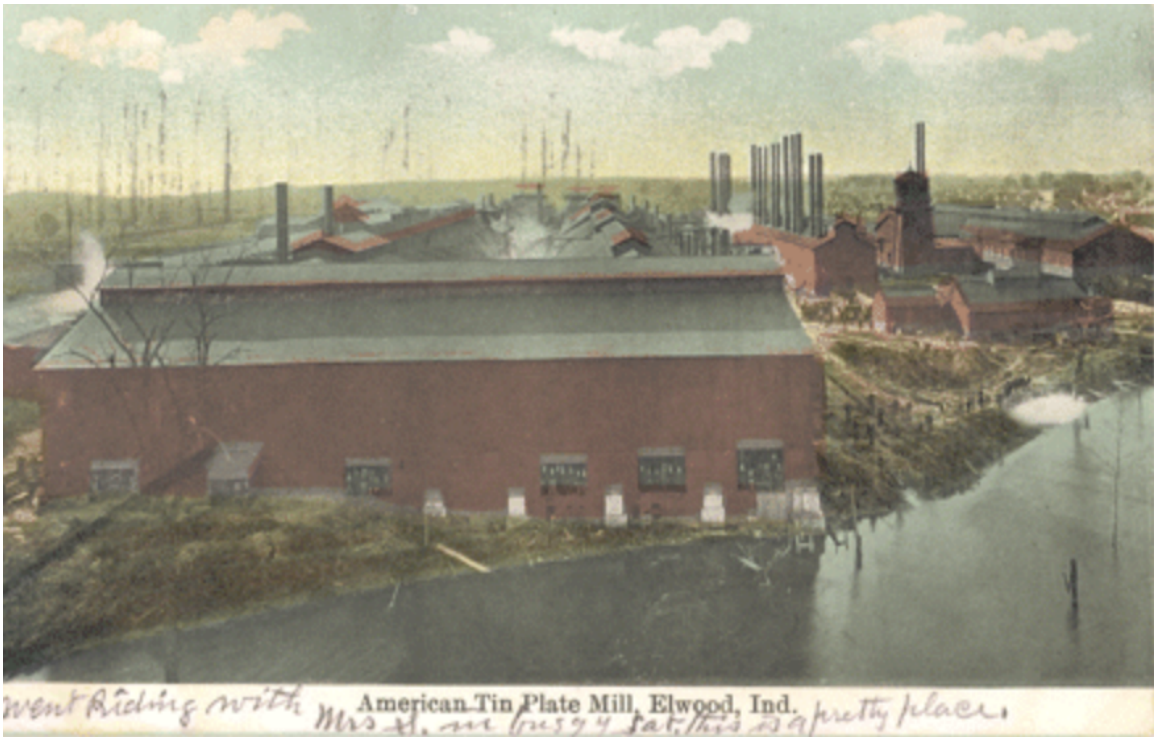

Figure 1.2. American Tin Plate Company in 1910 in Elwood, Indiana (Davis & Henderson, 2011, p. 143)

In 2011, two scientists in the Journal of Public Health conducted a research study examining this message in the context of public perceptions in the early 1900s. The researchers initially had suspicions that the mother's message was ingenuine; however, they ultimately found her message to be sincere. Like this mother, the general public in the early 1900s viewed smokestacks as a promise of wealth for the communities in which they were located. The general consensus among the public was that any visible pollutants these smokestacks produced should be excused by their promised benefits to humanity. It was not uncommon for humans, especially industrial and political economists, to believe, "what's good for the industry is good for us." (Davis & Henderson, 2011, p. 143) Thus, the Industrial Revolution improved the quality of many lives, and as a result, the attitude to dominate the natural environment persisted.

World War II

As years passed, Americans continued to create and expand the systems that depleted natural resources and polluted the atmosphere and hydrosphere likely because they continued to bring benefits to humanity. Especially after the end of World War II in 1945, Americans were left essentially unscathed compared to other nations involved in the conflict. This stability, compared to that of other nations, enabled the United States to continue progressing with urbanized, industrial, and consumer developments. These very provisioning systems were then adopted by unstable countries, and the United States enjoyed hegemony, which is social, cultural, ideological, or economic influence, over the rest of the world. (Stokes & Raphael, 2010) The American provisioning systems that were adopted by these then unstable countries are still mostly in practice today.

The Great Acceleration

It was not until the Great Acceleration that there became an observable reason to largely question the domination attitude and the provisioning systems of which it was intertwined. The term "Great Acceleration" refers to the significant changes to Earth's systems that appear to have resulted from increasing human activity, also referred to as anthropogenic forces. Beginning in 1950, it became clear to the scientific community that the degradation of these ecological systems inarguably coincided with the expansion of human activity. For example, Figure 1.3 illustrates many of Earth's system and socioeconomic trends that ramped up exponentially beginning around 1950. Particularly notable is how as primary energy use increased, the levels of carbon dioxide in the atmosphere saw an analogous increase. (Steffen et al., 2015a)

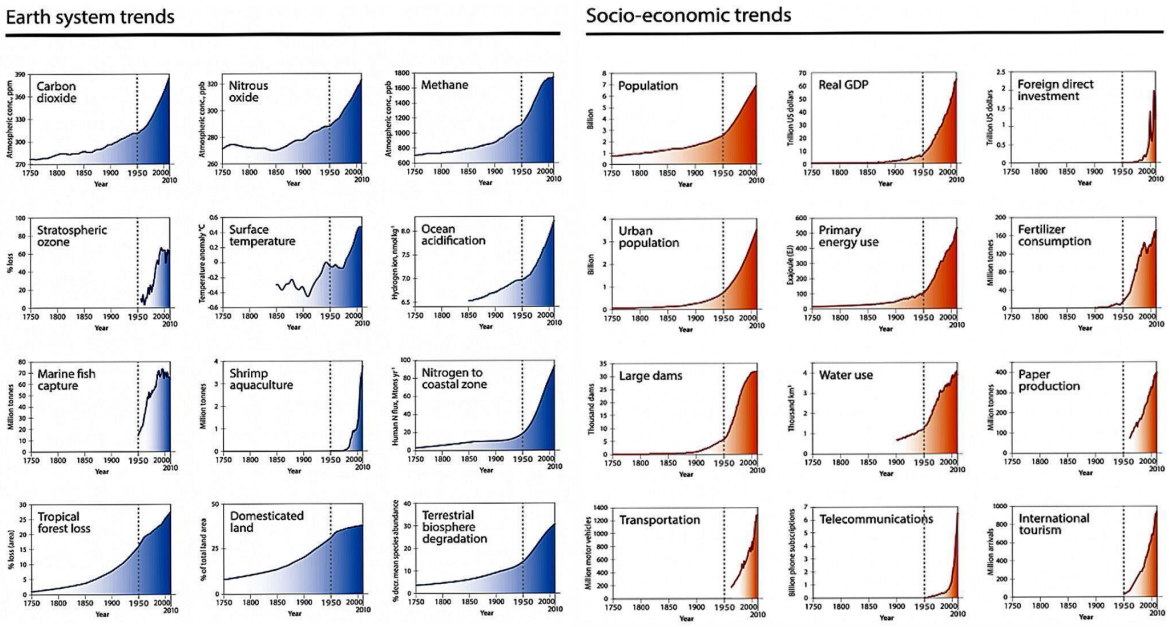

Figure 1.3. Earth systems and socioeconomic trends between 1750 and 2010 (Steffen et al., 2015a)

Initially, the understanding that anthropogenic forces were directly causing environmental degradation was known mostly by scientists, and thus, the domination attitude

remained virtually unquestioned. However, the work of scientists laid the foundation for environmental artists, philosophers, and other activists to translate these scientific findings into a language acknowledged and understood by the general public. In the United States, these activists and their supporters began to directly challenge the general attitude that it is permissible for humans to dominate the natural environment. (Kemp, 2004)

One of the most famous environmental activists in the United States is Rachel Carson, who was said to be "the single most effective catalyst for environmentalism," mobilizing American opinion on environmental conservation. (McNeil, 2001, p. 337) In her book *Silent Spring*, published in 1962, Carson exposed the United States' use of pesticides and their effects on the environment. She wrote descriptively to reveal the interconnected relationship between human activity and the natural environment. (Carson, 1962) Carson's early role in activism seemed to be a liaison between the scientific and harsh realities of environmental degradation, and the generally then-inattentive public.

Beyond the work of Rachel Carson and other activists, anthropogenic environmental degradation was becoming more apparent to the general public because the visible evidence was emerging, and it was increasingly difficult to dismiss. Air pollution, especially in congested cities, could be seen by the bare eye. (Kemp, 2004) Three million gallons of crude oil spilled into the Pacific Ocean during the Santa Barbara oil spill in 1969, causing a thirty-five-mile oil slick off California's coast, turning beaches black, and killing thousands of birds, fish, and sea mammals. (Hamilton, 2019) Also, in 1969, the Cuyahoga River in Cleveland, Ohio, caught fire for the eleventh time, resulting not only in the death of the fish and animals that depended on it but $50,000 worth of damage to infrastructure, which is equivalent to about $377,000 today.

(Folger, 2019) The smog-filled skies, black beaches, and burning rivers encouraged humans to challenge the domination attitude. A formal movement soon followed.

The Modern Environmental Movement

During the Modern Environmental Movement, a collective group of scientific, social, and political actors explicitly and formally challenged the attitude that humans ought to dominate the natural environment for human benefit. The "Modern Environmental Movement" refers specifically to the collective efforts taken to protect the environment from 1968 to 1976. As Robert Collins suggests in his book *More: The Politics of Economic Growth in Postwar America,* the 1970s was when humans first began to think of the Earth as having "limits." (Collins, 2000) Other scholars, too, have written about how the 1970s was the first period in which humans vastly acknowledged how the physical environment might set limits to the expansion of human activity. (Nordhaus, 1992)

The first wave of the Modern Environmental Movement focused primarily on pollution abatement, despite some anomalies including Arne Naess who founded the concept of "Deep Ecology" and called for environmental reform more comprehensive than just pollution abatement. (Naess, 2005) Nonetheless, many of the environmental groups that emerged and grew during this first wave, like Greenpeace and the Sierra Club, mainly publicized issues associated specifically with pollution far and wide. (Hill, 1969) In the United States especially, because of the resulting public pressure, many industrial institutions revealed their contribution to pollution. The federal government also succumbed to this public pressure and released information about pollution levels and other environmental conditions. (Kemp, 2004) In 1966, the first list of endangered species was created and publicized in the 1966 Endangered Species Preservation

Act. This list contained seventy-nine species, including the Bald Eagle. (US Fish and Wildlife Service, 1967) America's national symbol was directly threatened by American activity, underscoring the faults of the American environmental attitude.

Political actors followed the concern of the public and incorporated environmental protection agendas into their campaigns, which slowly but ultimately led to more governmental oversight. In the modern environmental movement, environmental legislation increased with the creation of the National Environmental Policy Act of 1970, the development of the Environmental Protection Agency in 1970, the Clean Water Act of 1972, and more. Also, during this movement, the first “Earth Day” occurred in 1970, and the United States contributed to environmental efforts on an international level at the United Nations Conference on the Human Environment in 1972, where the United Nations Environmental Programme was established. The first wave of the modern environmental movement saw a significantly coherent collaboration of scientific, social, and political actors discounting the domination attitude. (Kemp, 2004)

Toward the end of the 1970s, the modern environmental movement began to lose its momentum. The attitude that humans are permitted to dominate the natural environment became more widely accepted again in the 1980s when Ronald Reagan was elected president. During his candidacy, Reagan argued if humans wanted to abate pollution, their efforts would be best spent regulating pollution sourced from Mount Saint Helens rather than regulating human activity. (Ford, 1980) By dismissing human activity as a severe environmental threat, Reagan opened the door for Americans to revisit the domination attitude. He promised energy expansion, which would lead to economic expansion, and committed to environmental law reform "to ensure that the benefits achieved justify the costs imposed" and that "environmental protection must not be a cover for a 'no-growth policy.'" (Kraft & Vig, 1984, pp. 422-423) In a commencement address

delivered at the University of South Carolina, Reagan explicitly stated, “There are no limits to growth because there are no limits to human creativity.” (Reagan, 1983, para. 27) Not only did Reagan's ideology perpetuate the American attitude to dominate the natural environment, but his decisions during his presidency put this attitude into practice.

The Reagan Administration began dismantling the achievements of the modern environmental movement immediately. Reagan selected Anne Gorsuch, a corporate lawyer who opposed the Clean Air Act and other environmental regulations, to lead the Environmental Protection Agency (EPA). To work under Gorsuch, Reagan appointed more like-minded individuals, most of whom had more experience in the industries they were responsible for regulating, like Exxon, than experience in government. Reagan reduced EPA staff by 21% between 1981 and 1983, he created a Presidential Task Force on Regulatory Relief to tend to complaints from industry about environmental rules, he assigned industry-aligned scientists to the Science Advisory Board of the EPA, and he removed solar panels from the roof of the White House. (Fredrickson et al., 2018) These, among many other slackened environmental policies and initiatives, enabled Reagan to successfully cut taxes, strengthen the US military, and ultimately improve the quality of life for Americans at the expense of the natural environment.

Despite its interruption, presumably due in large part to Reagan's presidency, the Modern Environmental Movement returned with a second wave between 1986 and 1994. This second wave has been described as a public backlash against the anti-environmentalist Reagan Administration. As a result, the Modern Environmental Movement became much more polarized and politicized, with a clearer divide between environmentalists who mostly challenged the domination attitude and anti-environmentalists who seemed to support the attitude.

In the second wave of the Modern Environmental Movement, environmentalists shifted attention to global forums like the Framework Convention on Climate Change, perhaps due to this polarization and the inadequacy of the defunded EPA. Very rarely did nations make binding commitments at these international conferences; instead, the scientists and politicians who attended drew attention to the comprehensive causes and effects of environmental degradation, such as resource depletion. As a result, the visible pollution that induced the first wave was no longer the only area of focus for the environmentally-minded. The second wave of the Modern Environmental Movement became known for growing awareness of the breadth and complexity of anthropogenic environmental issues. (Kemp, 2004)

Unlike the first, there was no hard stop to the second wave of the Modern Environmental Movement. The second wave of the Modern Environmental Movement did not end in 1994 and instead transitioned into the Contemporary Environmental Movement.

The Contemporary Environmental Movement

The Contemporary Environmental Movement began around 1996 and continues into the present day. Similar to the Modern Environmental Movement, more legislation addressing air, water, and toxic waste pollution has been passed during the Contemporary Environmental Movement in the United States. In addition, the United States joined other countries in international agreements like the Kyoto Protocol and the Paris Agreement, making loose commitments to reduce greenhouse gas emissions. Although these actions move away from the problem of environmental degradation, they hardly move toward a preventative solution. (Hansen, 2007)

One of the most important distinctions between the Modern Environmental Movement and the Contemporary Environmental Movement is that the Modern Environmental Movement directly challenged the attitude that humans are permitted to dominate the natural environment to maximize benefits to humanity while the Contemporary Environmental Movement, in part, revisits and employs this attitude. This is not to say that there are no challengers of the environmental attitude in the Contemporary Environmental Movement; some of those who oppose the domination attitude in the Contemporary Environmental Movement are labeled as "ecocentric environmentalists." Some of these actors are known to advocate for the preservation of the environment, believing that nature is inherently valuable and humans are not permitted to dominate the natural environment to maximize human benefit.

Aggressive environmentalists maintain a similar ideology to ecocentric environmentalists, largely rejecting human domination and treating the natural environment with respect to its inherent value. Unlike ecocentric environmentalists, aggressive environmentalists take direct, often physically threatening actions to preserve the natural environment. (Kemp, 2004) Aggressive environmentalists, who are also referred to as radical environmentalists, take part in various strong actions such as spiking trees with metal rods to prevent deforestation and sinking or damaging ships to impede whaling. (Alberro, 2018)

Different from both ecocentric and aggressive environmentalists, the "technocentric environmentalist" population emerged during the Contemporary Environmental Movement. These actors believe a successful approach to mitigate anthropogenic forces is through the advancement of technology to achieve sustainable development. Because of an increase in innovation, technocentric environmentalists have developed renewable energy technologies like solar, onshore wind, offshore wind, and nuclear power.

Further, technocentric environmentalists have developed alternative solutions to environmental degradation, including carbon capturing and geoengineering. These technologies intervene with and manipulate the natural environment to either reduce increasing climate temperatures or remove pollutants, mainly carbon, from the atmosphere. (Temple, 2019) Through these developments, whether consciously or not, technocentric environmentalists are seeking to dominate the environment to improve the quality of human life, but seek to do so to achieve sustainability. The domination attitude, which is a primary source of environmental degradation, seems to have become part of some technocentric environmentalists' solution.

During the Modern and Contemporary Environmental Movements, people formally challenged the environmental attitude that humans are permitted to dominate the natural environment. Yet, the Modern and Contemporary Environmental Movements both saw the worst environmental degradation the world had experienced up until their time, which also continued to worsen in the years that followed. (Refer back to Figure 1.3) Perhaps the Modern and Contemporary Environmental movements both failed to adequately address the largest and longest contributor to environmental degradation: human-developed provisioning systems and the domination attitude by which they accompanied.

Beginning in prehistoric times and continuing into the present day, the domination attitude and provisioning systems have been intimately intertwined. For example, artificial water distribution systems that were developed during agrarian civilizations, crop rotation systems that were developed during the Agricultural Revolution, and consumer culture that was developed during the Industrial Revolution are all examples of provisioning systems that employ the domination attitude.

The domination attitude and all the provisioning systems which it accompanies ultimately constitute a paradigm, or worldview under which humans abide. As will be discussed in Chapter 2: Paradigm Shift, the current, prominent paradigm is no longer sufficient, leading humanity toward irreversible environmental degradation, and a shift in the current paradigm shift is one solution to diverting this trajectory.

Chapter 2:

Paradigm Shift

The current, prominent paradigm is expected to cause irreversible environmental degradation, but a shift in this paradigm could divert this trajectory. (Great Transition Network, 2021) To achieve this paradigm shift, humans must abandon the foundational attitude that the Earth can be dominated, pursue a more harmonious relationship with the environment, and restructure present-day provisioning systems so they become more environmentally sustainable. In early human history and for centuries after, the attitude to dominate the natural environment and the provisioning systems it accompanied did not have global and long-term impacts on the Earth. This insignificant environmental impact resulted because of two main reasons: population growth and the emergence of revolutionary lifestyles.

Population Growth

First, in early human history and for some centuries after, there were far fewer humans than there are today. In the ancient past, specifically in 10,000 BCE, the human population was estimated to be about four million. From the ancient past until 1700, the human population grew by about 0.04% each year, reaching about 600 million in 1700. However, by 1800, the human

population grew about 0.5% annually to reach about one billion and has been growing exponentially since. Figure 2.1 illustrates these trends.

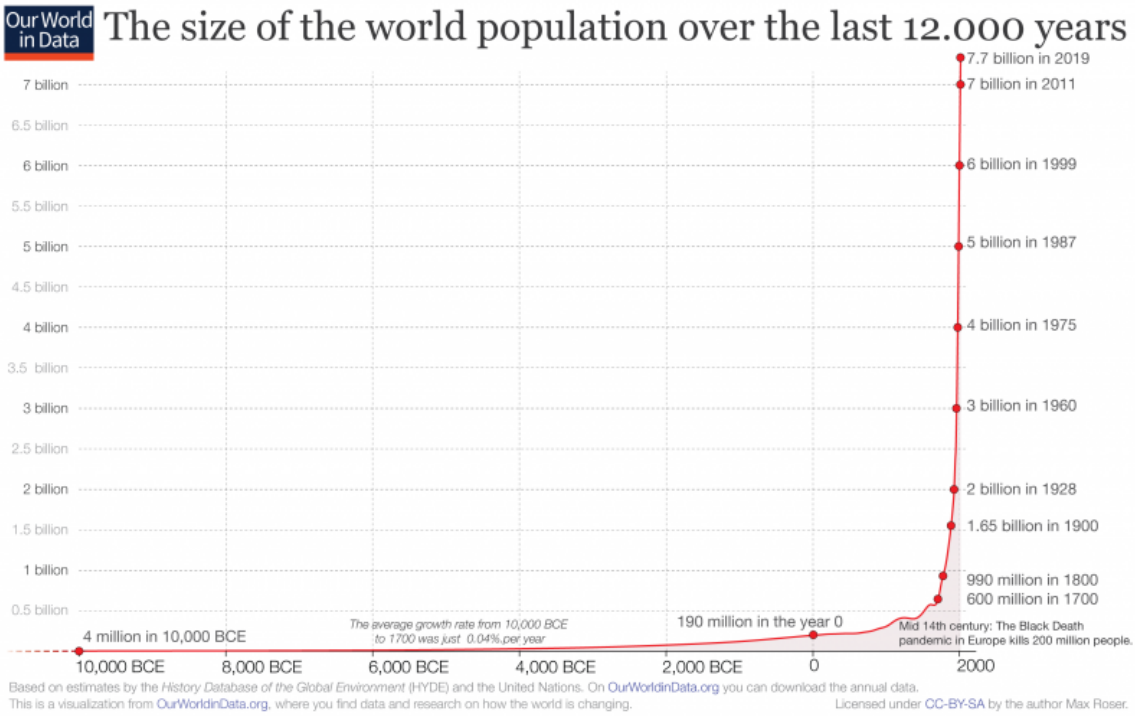

Figure 2.1. Growth rate and total population of the Earth over the last 12,000 years. (Roser et al., 2019)

Although the growth rate has been slowing in recent decades and is expected to continue slowing in the future, the total population of people on Earth continues to grow. This means there will continue to be more people living on Earth than there have ever been in history. For example, in total, nearly 108 billion people have ever lived on Earth, and today's population makes up 6.5% of that total. (Roser et al., 2019) With this increase in population comes an increase in demand for natural resources as well as additional stress on ecological systems, like using an abundance of water for industrial, agricultural, or domestic purposes and disrupting the hydrologic cycle. Even though population growth is slowing, the total population is exceeding the ability of the Earth to support it. (Roser et al., 2019)

Revolutionary Lifestyles

The second reason the environmental attitude and the provisioning systems it accompanied had an insignificant impact on the environment in early history is that until around the Agricultural Revolution, the types of activities humans employed were slow in growth. Prior to the Agricultural Revolution, human activity was *evolutionary* rather than *revolutionary*, which means that human activity was changing and expanding very slowly over successive generations. (Kemp, 2004) During these times, humans passed down their way of life, and each generation adopted it, slightly improving this way of life but making few, if any, major changes. However, since the Agricultural Revolution, especially due to the emergence of technology, humans have been continuously developing and deploying new, more environmentally demanding practices. A rudimentary example of this in recent history includes the invention of cars, which expanded to become trucks, which then expanded to become tractor-trailers. Much of these new inventions either require additional natural resources or add an additional strain to the ecological systems, like these vehicles emitting carbon dioxide and interfering with the carbon cycle. This rapid-growing activity is perhaps more relevant to the need for a paradigm shift than the number of people that populate the planet. More people on Earth does lead to more of an ecological impact; however, the way these people live is likely more damaging.

The Anthropocene

The combination of both large population sizes and extreme, expansive activity has, in part, led to what some consider the "Anthropocene." While Eugene Stoermer first coined the concept in the 1980s, it was not widely popularized until the early 2000s particularly due to the

publication of scientist Paul Crutzen. Stoermer, Crutzen, and other scholars agree that human-induced planet-scale impacts, or environmental degradation, was so severe and of such a long duration that it ought to be classified within its own epoch in the geologic time scale called the Anthropocene. (Crutzen, 2006) This new, proposed epoch is thought to have begun in 1950. (National Geographic, n.d.)

Scientists across the world have been determining the extent of these planet-scale impacts and whether the Earth can sustain humans. In other words, scientists are determining whether humans are living within planetary boundaries. Illustrated in Figure 2.2, one group of European researchers categorize planetary boundaries into nine areas: climate change, novel entities, stratospheric ozone depletion, atmospheric aerosol loading, ocean acidification, biogeochemical flows, freshwater use, land-system changes, and biodiversity integrity. The researchers include rings that indicate three zones: beyond uncertainty (high-risk zone), uncertainty (increasing risk zone), and below boundary (safe zone).

In their most recent study, these researchers concluded that humans reside in the zone of uncertainty (increasing risk) for climate change and land system change. They also concluded that humans reside in the beyond zone of uncertainty (high risk) for biosphere integrity, more specifically, genetic diversity which "ultimately determines the potential for life to continue to coevolve with the abiotic component of the Earth system in the most resilient way possible," and "provides the long-term capacity of the biosphere to persist under and adapt to abrupt and gradual abiotic change." (Steffen et al., 2015b, p. 5) Humans also reside in the beyond zone of uncertainty (high risk) for biochemical flows, specifically phosphorus and nitrogen, meaning there are excess in the environment and "the ratios between [these and other] elements in the environment may have impacts on biodiversity on land and in the sea." (Steffen et al., 2015b, p.

6). This study is just one of many conducted by scientists that determine the extent to which human activity affects the natural environment.

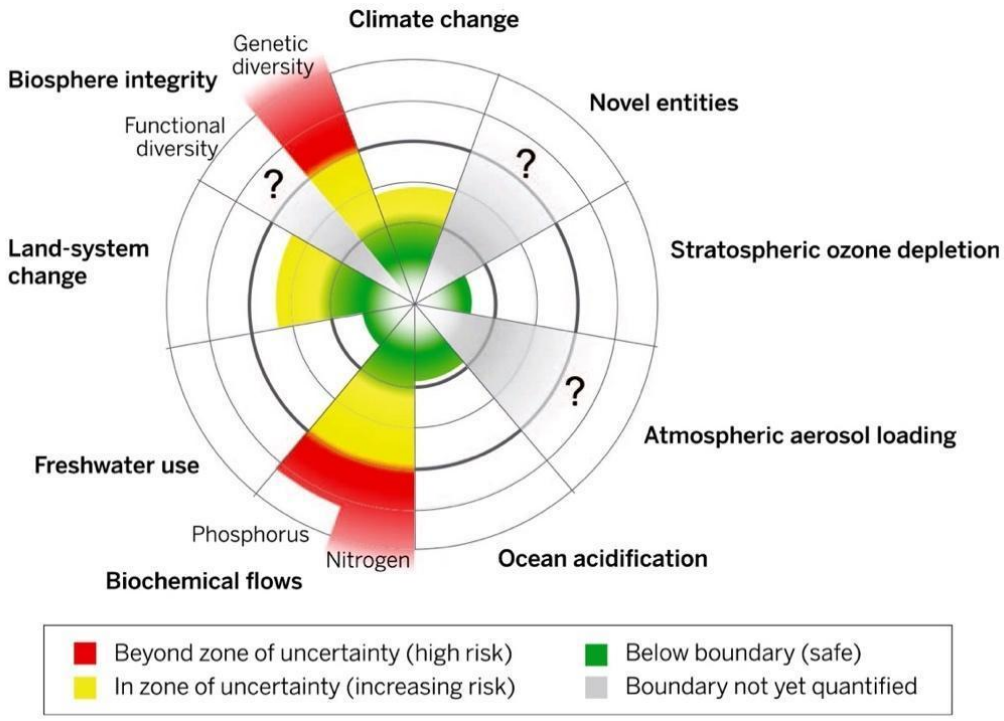

Figure 2.2. Human influence on a select group of planetary boundaries. (Steffen et al., 2015b)

Humans are feeling the effects of this today. Food scarcity, biodiversity extinction, frequent and intense wildfires, and social inequity are only a few effects of the exceedance of safe zones for planetary boundaries. (Robertson, 2021) If current provisioning systems continue as they are, these effects are expected to only worsen for future generations. The Intergovernmental Panel on Climate Change (IPCC), which is the United Nations (UN) body of scientists who assess climate change, estimates that humans have nine years to make major changes to their lifestyles. If major lifestyle changes are not made, humans will likely see a global temperature increase of 1.5 degrees Celsius above the pre-industrial temperature level by 2030. The IPCC clarifies that every fraction of a degree of increasing temperatures leads closer

to “tipping points,” which is when even a minor activity can cross a critical threshold and lead to a large response of accelerated and irreversible environmental degradation. An increase of 1.5 degrees Celsius would likely exceed highly dangerous tipping points that threaten all life. An example of an impending tipping point includes the melting of the West Antarctic ice sheet, which would lead to an eleven-foot increase in sea-level rise, threatening marine life and coastal communities. (Davies, 2020) The IPCC suggests that the consequences of tipping points should be included when planning for future development because of the high likelihood that they will continue to occur. (Levin et al., 2021)

According to studies conducted by the IPCC, this 1.5 degrees Celsius increase in global temperatures is not inevitable, although they claim it will definitely be exceeded in the twenty-first century if greenhouse gasses continue to be emitted at the current rate. (Working Group, 2021) However, studies conclude that this 1.5-degree Celsius increase can only be avoided if humans make “transformational change.” One recommendation from the IPCC includes redefining the production and use of energy, land, and other natural resources. (Levin et al., 2021) Likewise, the United Nations (UN) goes further by claiming the solution requires “fundamental structural changes” in values, norms, consumer culture, and more. (United Nations Environmental Programme, 2019) The IPCC’s suggested “transformational change” can be understood as a paradigm shift.

As previously discussed, the attitude that it is permissible for humans to dominate the Earth is intertwined with provisioning systems. At its core, perhaps the domination attitude takes some responsibility for humans exceeding planetary boundaries, nearing tipping points, and ultimately causing irreversible environmental degradation. The UN and its IPCC urge the restructuring of provisioning systems so that humans can sustain, rather than dominate, the

natural environment. The general consensus among the thousands of scientists who comprise the UN and IPCC is that there is a need for a paradigm shift.

Scientists from the Great Transition Network constructed a "Taxonomy of the Future," where they imagined three channels, including "conventional worlds," "barbarization," and "great transitions." They also imagined six possible global scenarios that could result from these channels. The UN and its IPCC are calling for something similar to the Great Transition Network "great transitions" channel, which they describe as "reform to embrace new values and institutions in pursuit of a just, fulfilling, and sustainable civilization." (Great Transition Network, 2021, para. 5) The global scenarios that result from the "great transitions" channel include "eco-communalism" and a "new paradigm." In an "eco-communalism" global scenario, bio-regionalism, localism, face-to-face democracy, small technology, and self-reliant economies are all prioritized and incorporated in what they call a green vision. In a new paradigm world scenario, global citizenship, humanity-as-whole, the wider web of life, and the well-being of future generations constitute a new environmental attitude, and globalization is used to construct a planetary civilization that operates in accordance with earth science. (Great Transition Network, 2021) Perhaps the main takeaway from these two scenarios is that climate and social scientists are arguing that humanity likely cannot reach a sustainable, non-environmentally degrading human civilization through the employment of the domination attitude, but instead through a foundational shift in environmental attitude.

Adhering to the UN and IPCC's recommendations or embracing the Great Transition Network's "great transitions" channel to achieve a paradigm shift is no small feat. Present-day provisioning systems have been strategically engineered into American society. For decades, policies and laws have been bolstering these provisioning systems while marketing and media

have been cultivating a deep dependence on them. (Assadourian, 2013) Also, there are many vested interests in present-day provisioning systems that have strong reasons to oppose their restructuring. For example, to decarbonize the atmosphere, humans must regulate one major provisioning system: non-renewable energy infrastructure. While incentives and subsidies can assist, it is probable that humans will also impose strict caps on carbon emissions, ban new coal-fired power plants, and close fossil fuel extraction projects. (Klein, 2011) Those involved in the non-renewable energy sector would be burdened with a loss of capital gain, investment depreciation, and job loss if this restructuring were to occur. However, soon, humanity is expected to face much larger, crueler burdens if humans choose not to restructure provisioning systems willingly. When environmental conditions worsen, the Earth will no longer be able to support provisioning systems' demands, which will perhaps force humanity to lead a less-controlled transition toward a more sustainable paradigm. Just as alarmingly, as the IPCC concluded, these provisioning systems push humanity toward tipping points which are already resulting in accelerated and irreversible environmental degradation and dangerous and costly consequences like thick air pollution, which exacerbates asthma, storms that demolish entire communities, and more.

Considering this trajectory, achieving a paradigm shift by abandoning the foundational attitude that the Earth can be dominated, pursuing a harmonious relationship with the environment, and restructuring provisions systems grows increasingly more crucial. Achieving this paradigm shift requires many changes to be made in society, likely including restructuring the economy, changing culture, improving international relations, and more. However, especially given the obstacles of bolstering policies, media reinforcement, and vested interests, improvement to primary and secondary environmental education offers great potential to achieve

this paradigm shift. Improved environmental education will equip future generations with the tools, skills, and desire needed to lead the transition to a sustainable paradigm.

Part II:

Environmental Education

Chapter 3:

Environmental Education

A paradigm shift requires foundational changes in every sector of society. There are many, but one of the most important foundational changes necessary to achieve a paradigm shift is reform to primary and secondary environmental education. In the United States of America, present-day environmental education, or lack thereof, is insufficient because it perpetuates unsustainable provisioning systems, fails to equip learners with necessary skills, and disconnects students from the Earth. Three areas of environmental education reform that will address these insufficiencies include ecological literacy, critical thinking, and place-based and experiential learning in the primary and secondary education system.

Ecological Literacy

The first insufficiency of current environmental education is that it perpetuates unsustainable provisioning systems. Primary and secondary education today generally prepares students to be successful in the world that already exists. This education system provides learners with the tools and knowledge needed to navigate both the physical and social realities of the present day. Students are encouraged to seek specialized skills that will eventually place them in a singular, niche corner of society. However, these niche corners of society, which in part constitute provisioning systems, typically do not prioritize environmental limits and are often

exploitative of the Earth's resources. An example of this may include the health care profession. (Eckelman & Sherman, 2016) The reason there is a lack of regard for the environment across professions is not the subject of focus but is the cause of many factors, possibly including the environmental attitude discussed in Chapter 1: Environmental Attitude: Domination. Ultimately the current primary and secondary education system is preparing students to enter into unsustainable provisioning systems. (Assadourian, 2017a) As discussed in Chapter 2, these are the very provisioning systems that climate scientists claim are leading to a cruel and uninhabitable world. One approach to restructuring unsustainable provisioning systems is to include ecological literacy in primary and secondary education. Ecological literacy will prepare students with the knowledge and skills to create more sustainable provisioning systems, rather than perpetuate the unsustainable provisioning systems of the present day.

Critical Thinking

The second insufficiency of present-day primary and secondary environmental education is that it fails to equip learners with the skills needed for them to manage already impending environmental degradation and resulting threats. Many educators today are "teaching to test," meaning they teach certain curricula, usually barebone, which are designed to prepare students for standardized or other tests. This "teach to test" model decreases students' excitement and motivation to learn. More alarmingly, because of the weighty emphasis on test scores under this model, students are more prone to memorize and reiterate rather than understand, absorb, and evaluate the information they are taught. (J. L. Styron & R. A. Styron, 2012) Memorization and reiteration, on their own, are hardly valuable skills in a world that demands creative solutions because of rapid and relentless environmental threats. Learners must have the skills to recognize

and respond to these threats, as well as challenge their causes - which are mostly current unsustainable provisioning systems. Like ecological literacy, they will also be better equipped to create sustainable provisioning systems. One way to foster these skills is by improving critical thinking education.

Place-Based and Experiential Learning

The third insufficiency of education today is that it disconnects students from the Earth. The current primary and secondary education system mostly confines learners to a classroom, depriving them of outdoor activity and inundating them with technology use. (Assadourian, 2017b) Also, present-day primary and secondary environmental education is often irrelevant and far distant from most students. Commonly, present-day environmental education does not directly affect the lives of the students being taught. (Nijhuis, 2011) Students must be connected with the natural environment, especially the local natural environment. They must spend time directly outdoors, exploring, discovering, and even playing, to be reminded of how it relates to their daily lives. Exposure to the outdoors, especially for early learners, has been proven to cultivate long-term curiosity for the natural environment, and through hands-on activities, the capability to protect it. (Robertson, 2021, p. 426)

Environmental education as a whole is a crucial component of a paradigm shift. There are many additional areas of environmental educational reform, such as addressing the issue of classroom overcrowding and increasing salaries for educators, among other areas. However, implementing environmental education that emphasizes ecological literacy, critical thinking, and place-based and experiential learning into present-day primary and secondary education curricula is an effective approach to initiating a paradigm shift. These three areas are the topic of focus,

not only because they are feasible in today's education climate, but because they are mutually complementary, as the practice of strengthening skills in one topic of focus often inadvertently strengthens skills in another.

Chapter 4:

Ecological Literacy

Defining Ecological Literacy

Ecological literacy is a concept that measures one's understanding of both Earth's basic ecological functions and the degree to which humans interfere with these functions. The Center for Ecoliteracy is one of many nonprofit organizations that leads initiatives, publishes resources, hosts conferences, and provides consulting to assist schools in expanding environmental education. The Center for Ecoliteracy does this with a specific focus on integrating ecological literacy into primary and secondary curricula. As one of the United States' most recognized organizations that specializes in this discipline, the Center for Ecoliteracy claims that ecological literacy lies at the junction of two measures: Earth-centric learning and the study of sustainability. (Assadourian, 2017a)

Earth-centric learning. Earth-centric learning is meant to cultivate learners who view the world from an environmental perspective. First, Earth-centric learners gain a basic scientific understanding of ecology, which is the study of organisms' interactions with themselves and their physical environments. It also includes the study of natural ecological processes like weather patterns, ocean functions, the carbon and hydrogen cycles, and more. Second, Earth-centric learners examine which current human-created physical and social systems affect these ecological functions. (Center for Ecological Literacy, 2021) As described in Chapter 1:

Environmental Attitude: Domination, these human-created physical and social systems are otherwise known as provisioning systems.

The Study of Sustainability. The study of sustainability is meant to encourage learners to create a society that aligns with ecological functions so humans ultimately live within the Earth's bounds. When studying sustainability, learners first examine the ways in which society, including provisioning systems, are or can be threatening to ecological functions. Second, learners are taught about how provisioning systems can potentially continue long term and without interruption only if they are oriented to work in tandem with, rather than exploitative of ecological functions. Finally, learners create ideas to restructure provisioning systems so that they are not threatening ecological functions. (Baird, 2020) To restructure provisioning systems, learners are taught about the concept of "systems thinking." (Robertson, 2021)

In systems thinking, a system is considered an arrangement of parts that create a whole that is larger than merely the sum of its parts. To be a system, the parts as a whole fulfill a specific purpose. Also, to be a system, each part must be interconnected and interdependent, meaning any significant change to one part will inevitably affect another. The specific arrangement of parts is what enables the system to operate and fulfill its purpose optimally. Therefore, to be considered a system, all parts must be present. If you are able to remove one part from something without interrupting its operations, then it is not a system but instead just a collection of parts. A vehicle can be easily understood as a system. If one was to analyze the parts of a vehicle, it would be clear that each part is arranged specifically in a way that enables the vehicle to be driven from one location to another. Furthermore, with any system, if one was to disassemble the parts of a vehicle, it would not fulfill its purpose and no longer be considered a vehicle. (Kim, 2018)

Systems thinking considers the physical Earth a system. However, like other non-human created systems, the purpose of the Earth as a system is difficult to determine and perhaps is not as determinant as that of a vehicle. Because of the inability to determine the purpose of the Earth as a system, it is difficult to determine how human interactions affect the system's parts and operations. Additionally, humans have attributed their own purpose to Earth as a system. (Kim, 2018) As discussed in Chapter 1: Environmental Attitude: Domination, beginning as early as the ancient past and remaining through the present day, many humans maintain the attitude that it is permissible to dominate the environment. Essentially, it can be argued that humans have assigned the Earth's purpose - that it is permissible to benefit humans by the means of domination, respectively.

Through systems thinking, learners focus on the specific arrangement of each part of the system or each ecological function to better gauge, but not assign, a more ecological purposiveness of the Earth as a system - rather than accepting that part of Earth's purpose is to benefit humans. Learners also focus on how human interactions, through provisioning systems, disrupt the arrangement of parts and ultimately threaten the Earth's ecological functionality, or ability to maintain equilibrium. Ultimately, in system thinking, learners view the Earth as a comprehensive whole, reject assigning the natural environment a determinant purpose, and learn to restructure provisioning systems in a way that enables the Earth as a system to continue maintaining equilibrium. (Seibert, 2018)

The main objective of ecological literacy is to prepare students with the knowledge and skills needed to create sustainable provisioning systems, rather than integrate into and perpetuate already-existing unsustainable provisioning systems. Ecological literacy achieves this through two measures: Earth-centric learning, which gives learners a scientific understanding of Earth's

natural ecological functions, and the study of sustainability, which gives learners the ability to understand the Earth as a system, and thus restructure provisioning systems so they work harmoniously with each part of the Earth that constitutes this system.

Ecological Literacy in the Current Education System

Without ecological literacy, as mentioned in Chapter 3: Environmental Education, it is likely that current primary and secondary education will continue perpetuating unsustainable provisioning systems. This is not to say that higher education does not do the same, but specifically in primary and secondary education, students are being groomed into these provisioning systems. Primary and secondary education students are taught about the world that already exists and are first beginning to learn how to be successful in that world. Ultimately, the primary and secondary education system lays the foundation for students to eventually integrate and participate in the unsustainable provisioning systems of our current society. However, as discussed in Chapter 3, scientists make it clear that the Earth cannot continue to sustain the already-existing society and its unsustainable provisioning systems. One approach to restructuring unsustainable provisioning systems is to include ecological literacy in primary and secondary education.

However, ecological literacy in the present-day primary and secondary education system is scant. According to a study conducted by Earth Day Network, which analyzed the implementation of environmental education in thirty-five countries across the globe, the United States and other developed countries fail to successfully implement environmental education mainly due to government structure and the economy. (Ritchie et al., 2016)

Government structure as an obstacle. In the United States, state and federal governments have shared regulatory power over the education system. The states retain the most control over school districts' standards and policies and the curriculum that is taught. (Schonrock et al., 2018) However, the federal government mandates equal access to public education, appropriates federal funds, and makes other overarching decisions about the broad education system of the United States. (Pelsue, 2021) The federal government's overarching decision about environmental education is that ecological literacy is encouraged but not required to be integrated into the primary and secondary education system. (Ritchie et al., 2016)

To encourage the integration of ecological literacy in states' education systems, the United States Congress passed the National Environmental Education Act (NEEA) in 1990, which required the United States Environmental Protection Agency (EPA) to "provide national leadership to increase environmental literacy." The EPA sought to achieve this by establishing the Office of Environmental Education (OEE). (National Environmental Education Act, 1990) The OEE is meant to implement national leadership on environmental education, which includes ecological literacy. The OEE's goal is "to establish and support a program of education on the environment, for students and personnel working with students, through activities in schools, institutions of higher education, and related educational activities, and to encourage post-secondary students to pursue careers related to the environment." (National Environmental Education Act, 1990) In other words, the OEE is responsible for providing federal, state, and local education departments with resources to expand environmental education across the United States.

There are multiple nongovernmental and nonprofit organizations and agencies that are partly funded through the OEE. These organizations and agencies guide state and local education

departments with their approach to expanding environmental education. For example, the North American Association of Environmental Education (NAAEE) is a nonprofit organization that helps state and local education departments create an Environmental Literacy Plan (ELP). Each ELP addresses which content areas ought to be taught, establishes skill training programs for teachers, creates a method for the department of education to measure the environmental literacy of students, and outlines a roadmap for funding, implementation, and execution, among many other considerations. The goal of each ELP is to cultivate “environmentally literate” students. Because students of ELPs have "knowledge and understanding of a wide range of environmental concepts, problems, and issues" and "apply such knowledge and understanding to make sound and effective decisions in a range of environmental contexts," environmental literacy and ecological literacy seem to be one and the same. (Bodor et al., 2009, p. 3)

The most recent State ELP Status Report from the NAAEE shows significant involvement from states, with only four states that have not drafted ELPs, thirteen states that are in the process of drafting their ELPs, thirteen states that are awaiting the adoption of their ELPs, one state that has adopted but not yet implemented their ELP, and nineteen states, as well as Washington DC, that have almost fully adopted and implemented their ELPs. (Bodor et al., 2009)

Even though most states are actively working on expanding environmental education with the support of federal government-provided resources, the federal government has instituted policies that usually have a greater influence, compared to the state’s influence, over the state's actions. These policies affect the extent to which states expand environmental education. For example, the United States Congress passed an amendment to the No Child Left Behind Act (NCLB) in 2007. The NCLB measures students' performance based on standardized tests,

specifically in core subjects which include reading, mathematics, and science. States have a large role in determining which subjects are to be tested. A state might not consider ecological literacy to be a "core science" to help narrow science testing requirements and ultimately improve their test scores. (American Geosciences Institute, 2021) One could assume this is an unintended consequence of the NCLB, but nonetheless, it is a reoccurring, significant obstacle preventing the successful implementation of ecological literacy in primary and secondary education.

The economy as an obstacle. The United States' economic system remains another barrier to the successful integration of ecological literacy into primary and secondary curricula. Although states receive some federal funding, most funding for education systems comes from state or local resources. (Chen, 2021) The scarcity of resources in certain socioeconomic areas of the country influences each public school district's operations. Furthermore, some states leave regulatory and management decisions directly to public school districts. Public school districts that are run by the local school board are often dependent on their community's tax revenue. Again, because revenue is scarce in certain areas, cultural and local values also influence the operations of public schools. (Ritchie et al., 2016) Economic obstacles remain a significant barrier to states and school districts expanding environmental education. Earth Day Network's study notes that environmental education fails to be implemented in developed countries across the globe, including the United States, due to "a strong trend of governments not successfully supporting its education system or impeding its success by underpaying teachers, not providing resources for mandated programs, and not equally distributing resources across the nation." (Ritchie et al., 2016)

Reform to Ecological Literacy in the Current Education System

To successfully implement ecological literacy into the primary and secondary education system, pressure and support need to be felt from both the federal and grassroots levels. First, there must be a top-down, federal government mandate that, at the very least, requires ecological literacy to be considered a core science and included in primary and secondary environmental curricula. There must be other significant reforms to the NCLB and the standardized tests it requires, which will be further discussed in Chapter 5: Critical Thinking.

The federal government should also provide support so it is feasible for school districts to include ecological literacy as a core science in primary and secondary curricula. For example, the No Child Left Inside Act (NCLI) was introduced to the United States Congress in 2008. The NCLI proposed that teachers be trained appropriately to instruct environmental education, including ecological literacy. The NCLI also proposed that the federal government provide technology to assist teachers with this instruction and that the effectiveness of environmental education programs be routinely monitored and improved when necessary. In 2008, the NCLI passed the House of Representatives but not the Senate. (No Child Left Inside Act, 2008) The NCLI should be amended to address the concern that it imposes "special interest-driven beliefs" on children, which was a large reason why it did not pass the Senate in 2008. (Penny, 2009) Second, grassroots support, such as a strong network of activists, can help ensure school districts integrate ecological literacy into the curriculum. If the local communities pressure the school districts to include ecological literacy into the curriculum, then even in the case of scarce resources, school districts are less likely to reduce instruction on ecological literacy. (Bodor et al., 2009)

Ecological literacy, or one's understanding of both Earth's basic ecological processes and the degree to which humans interfere with these processes, must be integrated into the primary and secondary education system so learners can be prepared to create sustainable provisioning systems after having gained an ecological perspective and an understanding of systems thinking. Without ecological literacy, learners are likely to continue perpetuating current unsustainable provisioning systems. By continuing these unsustainable provisions systems, humanity will maintain the domination attitude and thus, will be hard-pressed to achieve a sustainable paradigm.

Chapter 5:

Critical Thinking

Defining Critical Thinking

Critical thinking, broadly understood, is the process of synthesizing and analyzing information then applying original ideas to reach a conclusion regarding what to believe or how to behave. Critical thinking, an abstract concept, has no uniform definition but many varying interpretations consider an effective critical thinker to demonstrate a collection of the same skills. The California Department of Education groups the most prominent of these skills into three categories. The first category, "defining and clarifying the problem," includes skills like observing, comparing, contrasting, grouping, labeling, categorizing, classifying, ordering, patterning, and prioritizing. The second category, "judging information related to the problem," includes analyzing questions, distinguishing between facts and opinion, determining the relevance and reliability of information, inferring, understanding meanings, observing cause and effect, making predictions, analyzing assumptions, and identifying points of view. Finally, the third category, "solving problems/drawing conclusions," includes logical reasoning, creative thinking, and problem-solving. (Costa, 1985)

Educators have accredited critical thinking as a valuable skill in all of modern history; however, it is increasingly important in today's world - one that is rapidly and relentlessly changing due to environmental threats. (Willingham, 2019) Today's changing world demands

humans to recognize and respond to environmental threats. Humans must apply original, new ideas, or rethink and appropriate old ideas to new contexts to manage the already-existing and emerging challenges associated with the adverse effects of these threats, like severe storms, rising sea levels, extreme food insecurity, and other conditions that interrupt life as it is today. Also, humans must look ahead at the trajectory of these environmental threats and their adverse effects. To prevent the catastrophic, life-threatening environmental conditions that are to come, humans must challenge their causes. These causes, which are predominately unsustainable provisioning systems, must be restructured to operate more sustainably. The ability to observe, compare, classify, prioritize, make predictions, reason logically, and utilize other critical thinking skills is necessary for humans to effectively recognize and respond to the causes and adverse effects of environmental threats. Ultimately, critical thinking enables humans to reach conclusions about how to address existing and impending environmental threats and restructure current unsustainable provisioning systems to create a more sustainable world.

Critical thinking is not only important for environmental protection but also for everyday human functioning across all populations. Those of all cultures, ages, genders, and more use critical thinking skills daily to make decisions, answer complex problems, understand themselves and others, communicate, and more. Critical thinking skills have been noted to improve one's level of curiosity, creativity, and ability to think and act independently. Critical thinking is so axillary to human functioning it has been considered by educators "a skill for life, not just learning." (Crockett, 2021)

Although there is a general consensus among educators and cognitive scientists that critical thinking skills are of value to the learner, there are conflicting ideas around the approach to successfully cultivating these skills. Thus, similar to how there is no uniform definition, there

is no uniform, evidence-based approach to teaching critical thinking. (Barshay, 2019) Cognitive psychologist Daniel T. Willingham explores the idea that "Learning to think critically is akin to learning language as an infant. In a language-rich environment and with frequent situations where it is useful, the child will learn to use language without any formal instruction. Perhaps, in the same way, you learn about critical thinking based on what's available to you in the environment." He states that, unlike the language, there is not enough nor the appropriate emphasis on critical thinking skills in a learner's environment, and thus, school programs that teach critical thinking skills are inevitably and unsurprisingly seeing little success. (Willingham, 2019)

Critical Thinking in the Current Education System

The present-day primary and secondary education system fails to equip learners with critical thinking skills for a variety of reasons; however, two major reasons include the teacher-centered, rather than student-centered, classroom structure and the "teach to test" model.

Teacher-centered classroom structure. A teacher-centered primary and secondary education classroom is a traditional classroom setting where a teacher instructs, and the students passively receive the information that is being instructed. Students typically work independently and must ask permission before speaking. This structure is usually in place for the majority of the school day. In a student-centered classroom, which is sometimes referred to as a "learner-centered classroom," the educator's role is to facilitate but not dictate instruction. In a student-centered classroom, content instruction involves students moving, speaking, cooperating, and collaborating freely with each other to discuss and grasp the subject being taught. (Megwalu, 2014)

A teacher-centered classroom structure prevents students from developing many crucial skills, especially critical thinking skills. A teacher-centered classroom allows for little, if any, collaboration among students because there is a heavy focus on the teacher's instruction of the content. These classrooms also prevent students from communicating effectively, given they have limited time to speak and they mostly speak only to the teacher rather than among their peers. Additionally, because in a teacher-centered classroom, there is typically one instructor and one method of instruction, which is verbal instruction, a student might grow bored throughout the school day. (Lathan, n.d.) A student who finds instruction to be boring is likely to become disengaged. Even the most intellectual students can become disengaged, as studies indicate disengagement is not a reflection of academic ability. (Mora, 2011) A student-centered classroom, in opposition, presents students with the opportunity to develop critical thinking skills because there is an emphasis on learner engagement and activity during instruction. The learner works in groups, explores simulations, debates with peers, and completes other active tasks. (Howe & Warren, 1989) Additionally, a student-centered classroom is dynamic, which helps students stay engaged throughout the day.

"Teach to test" model. The second reason the education system fails to equip learners with critical thinking skills is the "teach to test" model. The "teach to test" model is an approach to education where teachers design the instruction of curriculum in a way that specifically prepares students to perform well on standardized or other tests. In practice, an educator may repetitively teach simple, very specific content that is later tested. Under this model, teachers narrow the curriculum only to what will be tested and often fail to instill a comprehensive understanding of the subject in their students. (Copp, 2018)

The "teach to test" model did not emerge from unqualified and unskilled educators; the model primarily emerged due to increasing emphasis on standardized tests to measure the effectiveness of school districts, especially after the implementation of the No Child Left Behind Act (NCLB) in 2005. NCLB, which was previously discussed in Chapter 4: Ecological Literacy, instituted failed test-and-punish policies, which allow federal and state departments to fire staff or close schools if students performed poorly on standardized tests. (Crisafulli, 2006) In 2015, President Obama passed the Every Child Succeeds Act which created more flexibility for evaluating the effectiveness of schools; however, standardized tests and failed test-and-punish policies still exist and are enacted today. (Strauss, 2018) Therefore, standardized tests, which are also considered "high-stakes tests," pressure educators to ensure that students perform well. Ultimately, to ensure this performance from students, educators are more inclined to adopt a "teach to test" instruction model.

The "teach to test" model not only fails to cultivate critical thinking skills in learners by failing to teach the necessary skills, but it is an inaccurate measure of evaluating the knowledge of students. Because of the weighty emphasis on test scores, students are more prone to memorize and reiterate rather than understand, absorb, and evaluate the information they are taught. (J. L. Styron & R. A. Styron, 2012) The "teach to test" model also diminishes students' excitement and motivation to learn. The colloquial term "drill and kill," which has been used for decades in the realm of education, describes the process of teaching one skill repetitively enough to essentially "kill" the student's curiosity and interest in learning. (Helwig, 2021)

Reform to Critical Thinking in the Current Education System

Teacher-centered classrooms and the "teach to test" model are partially advantageous and have their place in education settings, but to best cultivate critical thinking skills in learners, these structures should be scaled down in the primary and secondary education system. The teacher-centered classroom can sometimes be beneficial to both students and teachers. For students, a teacher-centered classroom structure allows for clear, direct instruction, which reduces the chances of students missing or misinterpreting content. For teachers, this structure can help keep the classroom controlled and quiet and enable them to move seamlessly from one subject to the next. (Lathan, n.d.) Despite these and other advantages, teacher-centered learning environments should not be the only classroom structure and should be balanced with student-centered learning environments.

The "teach to test" model can also sometimes be beneficial for both students and teachers. A student taught under the "teach to test" model is likely to retain content, prepare, concentrate, manage time, and make educated or intelligent guesses. (Stenlund et al., 2013) For educators, the "teach to test" model helps identify the areas of content in which students struggle. The educator can use this information to reorient their instruction accordingly. (J. Phelan & J. Phelan, 2013) Specifically, preparing students to perform well on tests under the "teach to test" model is not entirely harmful to the efficacy of the education system; however, it should not be teachers' primary method of instruction.

Additionally, returning to Willingham's idea that a student learns critical thinking skills based on what's available to them in their environment, there should be more of an explicit, continuous emphasis on critical thinking skills in schools. Critical thinking skills are not fully learned by students unless they are taught continuously, on an everyday basis. (Howe & Warren,

1989) Other skills, like riding a bicycle, can be taught once and used by the learner for years to follow. Unlike riding a bicycle, multiple studies indicate that critical thinking skills must be taught and practiced repeatedly in order for the learner to retain the skills, similar to the way language must be practiced continuously; otherwise, the learner will likely see a decline in their proficiency in that language. (Willingham, 2007) Therefore, there must be an explicit, continuous emphasis on critical thinking skills in schools. One example of this emphasis in practice would be the incorporation of discussion in everyday instruction. According to educator Sylvia Luise Christiansen at California State University, Northridge, "Discussion, because it provides immediate monitoring and feedback of student thought processes, has been found by research to be effective in teaching critical thinking." (Christiansen, 1985)

Scaling down teacher-centered classrooms and the "teach to test" model, as well as placing explicit, continuous emphasis on the instruction of critical thinking skills, will help students to become better critical thinkers, which will ultimately improve environmental education. As stated earlier in this chapter, learners with critical thinking skills will have a greater capacity to reach conclusions about how to address existing and impending environmental threats, restructure current unsustainable systems and ultimately create a more sustainable world.

Not only will improving critical thinking skills in students be a method to improve environmental education, but one way to teach critical thinking is through environmental education itself. More specifically, ecological literacy can be used as a vehicle to teach critical thinking skills. As listed earlier in this chapter, there are a variety of critical thinking skills categorized into three groups, including "defining and clarifying the problem," "judging information related to the problem," and "solving problems/drawing conclusions." These skills

can be applied to essentially any content area, especially ecological literacy. This is because there is increasing focus and attention directed toward environmental threats across the globe. Scientists, governments, agencies, concerned citizens, and others have their own, often conflicting ideas about how to address and resolve environmental threats. Ecological literacy, which is Earth-centric learning and the study of sustainability, can "provide topics and problems that cut across the school curriculum and can enhance the integration of knowledge, provide real problems that can be studied or simulated, and provide topics and problems that can be adjusted to the developmental levels of students." (Howe & Warren, 1989) Critical thinking and ecological literacy are important independent improvements to environmental education but are also complementary to one another in restructuring unsustainable provisioning systems and ultimately progressing toward a more sustainable paradigm.

Ultimately, improvement in critical thinking education in the primary and secondary education system will enable learners to recognize and respond to the adverse effects and causes of environmental degradation. Improved critical thinking education will help students manage and mitigate already-existing and impending environmental threats, as well as create sustainable provisioning systems. Like with ecological literacy, the creation of sustainable provisioning systems that are more harmonious with, rather than dominant over, the natural environment is necessary to achieve a paradigm shift.

Chapter 6:

Place-Based and Experiential Learning

Defining Place-Based and Experiential Learning

Place-based learning. Placed-based learning is a type of educational instruction where students are immersed in the environment that surrounds them. Educators use these environments to teach content through real-world lessons and examples. The Center for Place-Based Learning and Community Engagement defines place-based learning as an approach to education that "places students in local heritage, cultures, landscapes, opportunities, and experiences and uses these as a foundation for the study of language arts, mathematics, social studies, science and other subjects across the curriculum." (Getting Smart, 2017, p. 2) Place-based learning is practiced at different degrees around the globe.

Place-based learning specifically practiced in the natural environment is important in environmental education because it fosters environmental concern. Place-based learning in natural environments helps build positive, intimate relationships between students and their environment. These relationships, especially when developed early, are the foundation for environmental concern in adults. Similar to how humans are more likely to care for other humans with whom they share an intimate relationship, humans who have an intimate relationship with the environment will be more likely to care for it. This is not a phenomenon based solely on observation and assumption but is supported by scientific research. Biophilia, which translates to

"love of life" in the Greek language, is the scientific term that describes the innate human tendency to connect to and care for nature. Multiple studies indicate that humans are born with a predisposition to biophilia, but unless these tendencies are fostered at a young age, an adult person's biophilic tendencies will depreciate. (Robertson, 2021) Therefore, as studies conclude, children and young adults who spend more time immersed in the natural environment are more likely to show strong biophilic tendencies in their adult life. (Halim et al., 2019) Ultimately, place-based education increases one's individual biophilic tendencies, which takes environmental education to a more personal level. As said by educator Jonathan Dawson and ecologist Hugo Oliveria, "The revolution that is required in our educational practice needs to be felt on an embodied level as much as understood cognitively. It can be described as nothing short of bringing the classroom back to life." (Dawson & Oliveria, 2017, p. 217) Place-based education can be demonstrated through wilderness field trips, or in areas with limited resources or accessibility to the wilderness, it can be demonstrated through community gardens or history projects that focus on the natural environments that exist within or near urban areas. Because of its concentration on immersive educational experiences, place-based learning is a method to bring education back to life and can help students embody concern for the Earth.

Experiential learning. Experiential learning is complementary to place-based learning, where students "learn by doing." In practice, the "learn by doing" approach to education entails students engaging in activities, which are usually hands-on, then reflecting on their experience. (Kent State University, n.d.) In environmental education, experiential learning activities typically take place during place-based learning. Some examples of these activities might include fossil hunting, weather-watching, and even creating mock physical and social systems, referred to as provisioning systems, that are more sustainable than those which exist. (University of New

Brunswick, n.d.) Engaging in these activities also fosters critical thinking skills, which as discussed earlier, is an example of how these areas of reform are mutually reinforcing. Experiential learning, like place-based learning, cultivates curious students. Environmental education can be difficult to teach to all students, especially those without an already-existing intimate relationship with the natural environment. As a result, environmental education today is not always directly relevant to the lives of the students being taught and is thus often irrelevant and far distant. An example of this irrelevance includes teaching inner-city students in Birmingham, Alabama, about marine conservation. Marine conservation might not be of interest to these students, especially if they have no previous experience or interaction with the ocean or marine life. (Nijhuis, 2011) A more appropriate alternative might be educating the students on environmental conditions they are more familiar with, like nearby natural wonders including Cheaha Mountain. Because students have heightened concern for the environment through place-based learning, and are engaged and physically interacting with it during experiential learning, students become increasingly aware of how the natural environment is relevant to them and the ways it directly affects their lives. This awareness often drives curiosity.

Experiential learning is also important for environmental education because it cultivates capable students. The "learn by doing" model that constitutes experiential learning instills a better understanding and appreciation of the broader environment in students and helps them develop insight into their skills and interests, especially during the reflection process. (Kent State University, n.d.) Also, the "learn by doing" model empowers students to use the knowledge and skills they already have to approach and attempt to resolve a problem. It provides students with self-confidence that they are capable of problem-solving, which again is complementary to the other areas of reform at focus because it builds off the knowledge base obtained from ecological

literacy, and bolsters critical thinking skills. Ultimately, experiential learning increases students' interest in environmental education and makes them more curious about the environment as well as more capable of protecting it. While this sense of individual empowerment is not an area of focus, it is another crucial component to a paradigm shift.

Place-Based and Experiential Learning in the Current Education System

Place-based and experiential learning in the primary and secondary education system are not obsolete; however, they usually take the form of brief outdoor recess (only when the weather permits) or infrequent field trips. Present-day primary and secondary school districts that use place-based and experiential learning as two of their main, routinely used methods of instruction are few and far between. School districts may abstain from using place-based and experiential learning as routine instruction methods for many reasons, some of which could include lack of proper funding, scarce community connections, and the concentration of teacher-centered and "teach to test" educational models discussed in Chapter 5: Critical Thinking. Instead of place-based and experiential learning, today, we see that school districts' main methods of instruction are heavily integrated with technology.

Technology in the classroom has its purpose, however, especially when primary and secondary school instructors rely mainly on technology to teach, it can be detrimental to students' ability to learn. In practice, reliance on technology in the classroom could include delivering lectures solely through presentation slides, routinely showing pre-recorded education videos including documentaries, or only constructing interactive activities in which students must use technology to participate. One study conducted in China concluded that "technology use played a negative role in facilitating communicative classroom discourses" and "with high technology

use, teachers used more display questions and directives and facilitated less spontaneous or authentic output from students in the target language." (Li et al., 2019) Another study conducted in the United Arab Emirates examined the effect of technology use on students' performance and behavior in school. This study concluded that the overreliance on technology could "deteriorate students' competencies of reading and writing, distort social interactions between teachers and students, dehumanize educational environments," and "isolate individuals when using technology." (Alhumaid, 2019) These are two of many worldwide studies that support the theory that technology use in school alienates students from each other and the world around them.

Specifically concerning environmental education, technology use alienates students from the natural world. Since the implementation of technology in American schools over the last twenty years, likely paired with the implementation of technology at home, children have begun to favor the exploration of the internet over the exploration of the outdoors. In an interview with environmental educator and academic David Sobel, one American teenage girl admitted, "Before we had a computer, I used to read a lot and go outside more to be in the neighborhood. Now, it's so easy to go exploring on the computer, it's like too much work to go outside." (Sobel, 2017, p. 23) Ultimately, the overreliance on technological-concentrated instruction methods in the primary and secondary education system is accelerating the increasing divide between learners, especially younger learners, and the natural environment.

The result of this divide between learners and the natural environment is what American journalist and non-fiction author Richard Louv refers to as "nature-deficit disorder." "Nature-deficit disorder" is not a medical diagnosis but rather a colloquial term used to describe the phenomenon that when humans are disconnected from nature, their senses weaken, they experience attention difficulties, and they are more prone to physical and emotional illnesses. He

claims "nature deficit disorder" in a young person will later fundamentally change the same person's behavior as an adult. (Louv, 2008, p.36)

Those who suffer from "nature-deficit disorder" inevitably show depreciated biophilic tendencies. Concurrently, research finds there to be an increase in the human display of biophobic tendencies. Biophobia, which is the opposite of biophilia, is the fear of living things and negative attitudes towards nature. (Platt, 2020) One study conducted in Japan surveyed school children's attitudes toward common insect species. The study found that "Children's level of biophobia was negatively associated with their frequency of nature experiences and knowledge of invertebrates," "the extinction of experience is likely to increase biophobia in children in the future," and "there is likely a feedback loop in which an increase in people who have negative attitudes towards nature in one generation will lead to a further increase in people with similar attitudes in the next generation - a cycle of disaffection towards nature." (Soga et al., 2020) This is just one of many worldwide studies that show biophilia decreasing and biophobia taking its place, both of which are a result of young individuals' decreased exposure to the outdoors.

Reform to Place-Based and Experiential Learning in the Current Education System

David Strobel, Richard Louv, and other environmental educators do not see the consequences of decreased exposure to the outdoors as an irrevocable problem. To the environmental education community, the solution is clear: increase young learners' exposure to the outdoors. Research clearly supports the idea that young individuals who are immersed in nature are more likely to grow into adults who show concern for and are capable of caring for nature. Exposure to and immersion in the outdoors, especially at an early age, is linked to adult

care for the environment, which is often demonstrated through actions like volunteerism, support for environmental policies, environmental career choices, buying green products, conserving energy, recycling, and more. (Sobel, 2017, p. 24) In another of David Sobel's interviews, a second teenager admitted, "For me, I learned to love nature before I did computers, and so [technology] doesn't really affect me. But if I started to use computers when I was really young, it might have kept me from getting into nature." (Sobel, 2017, p. 23) The solution is so clear it seems to be easily identifiable not only by the environmental education community but also by adolescents.

Place-based and experiential learning in the primary and secondary education system are key to increasing young individuals' exposure to the outdoors, ultimately reducing biophobia and increasing biophilia among the future American populace. The obstacles that prevent primary and secondary school districts from routinely utilizing place-based and experiential learning, like the lack of proper funding, scarce community connections, the concentration of teacher-centered and "teach to test" educational models, and others, are surmountable. Place-based and experiential learning can be integrated into the primary and secondary education system if educators reduce technology use in the classroom and educate with unconventional resources in their community.

As mentioned earlier in this chapter, technology has its place in the classroom; however, an overreliance on technological-concentrated instruction methods should be renounced to avoid unintended consequences on students' performance in school. Instead, educators can replace technology use with place-based and experiential learning instruction methods. A realistic example of reducing technology use and increasing place-based instruction methods might include replacing presentation-slide lectures with outdoor lectures. Even if the lesson is unrelated

to nature, outdoor exposure could help foster a connection between students and their local, natural environment. Another example of reducing technology use and increasing place-based learning might be substituting or supplementing a pre-recorded documentary with an in-class visit from a professional in the field. By welcoming a visitor, the educator is bringing a piece of the community directly into the classroom. (Minero, 2019) A realistic example of reducing technology use and increasing experiential learning would be to substitute online interactive activities with scavenger hunts or other activities that require students to get up from their seats and physically explore their surroundings.

Also, educators could get creative to discover the many unconventional resources that hold potential for place-based and experiential learning opportunities. Place-based education can be taught right beyond the school doors on the premise of the property, or if accessible, at the local park. (Minero, 2019) In the case that the educator cannot leave the classroom, place-based learning can even be taught through literature. (Häggström & Schmidt, 2020) As for experiential learning, it can emerge through collaboration with other educators and their students in the school or school district. Also, experiential learning can simply take the form of open-ended discussions, which allow students to formulate their own opinions, analyze the opinions of others, and collectively guide the direction of the conversation. (Barton, 2019)

There are no strict rules for place-based and experiential learning, which make improvement even more feasible. By assigning place-based and experiential learning a more prominent role in education, students will likely become more concerned for the environment, due to the strengthening of their biophilic tendencies. Students will also grow curious about the environment, as it will become more relevant to their daily lives. Finally, students will become more capable of protecting the environment, through the “learn by doing” model and hands-on

problem-solving activities. A shift to a more sustainable paradigm, which includes the abandonment of the domination attitude, the pursuit of a harmonious relationship with the environment, and the restructuring of provisioning systems, likely cannot be achieved with the concern, curiosity, and capability of those who are leading the transition.

Conclusion

The need for reform to environmental education comes from the deep-rooted, unsustainable environmental attitude that humans have been maintaining since ancient times. The environmental attitude that humans are permitted to dominate the environment began initially out of fear, then later out of a desire to benefit humanity, respectively. This environmental attitude is intimately intertwined with American provisioning systems, which now exist globally, and constitute a prominent paradigm. This paradigm is leading to irreversible, life-threatening environmental degradation.

In early human history and for centuries after, the attitude to dominate the natural environment and the provisioning systems that accompanied it did not have such significant impacts on the Earth because there were far fewer humans and human activity was *evolutionary* rather than *revolutionary*. However, today, billions of people populate the planet and human activity is expanding rapidly. Human activity today is outpacing Earth's capacity to support it, and an effective approach to avoiding the irreversible, life-threatening environmental degradation it is causing is through a paradigm shift.

A paradigm shift requires foundational changes in every sector of society. There are many, but one of the most important foundational changes that are necessary to achieve a paradigm shift in the United States is reform to primary and secondary environmental education. Present-day environmental education, or lack thereof, is insufficient because it perpetuates

unsustainable provisioning systems, fails to equip learners with the necessary skills to recognize and respond to environmental threats, and disconnects students from the Earth. Ecological literacy, critical thinking, and place-based and experiential learning are feasible in today's education climate and have great potential to address these insufficiencies.

The first insufficiency is the lack of ecological literacy, which is one's understanding of Earth's basic ecological functions and the degree to which humans interact with these functions. It is important for ecological literacy to be included in environmental education reform because without it, students are being taught how to successfully integrate themselves into the unsustainable world that currently exists. With improvement to ecological literacy education, rather than perpetuate unsustainable provisioning systems, students will be prepared to create sustainable provisioning systems due to their ecological perspective and employment of systems thinking.

The second insufficiency is the lack of successful critical thinking education due to the teacher-centered classroom structure and the “teach to test” model. These are decreasing students' excitement and motivation to learn and encouraging students to memorize and reiterate rather than understand, absorb, and evaluate the information they are taught. Reform to critical thinking education will provide students with the adequate skills to recognize and respond to environmental threats in today's changing world by applying original, new ideas to manage the already-existing and emerging challenges associated with the adverse effects of these threats. It will also enable them to create sustainable provisioning systems.

Finally, the third insufficiency is the lack of place-based and experiential learning in the present-day primary and secondary education system. This disconnects, or removes and defamiliarizes, students from the natural environment. Reform to place-based and experiential

learning will foster learners' concern, curiosity, and capability to protect the environment. It will achieve this by strengthening biophilic tendencies through outdoor experiences, underscoring the relevance of the environment in everyday life, and incorporating hands-on activities in education. Improvement to environmental education will likely not entirely induce a paradigm shift on its own, as other sectors of society also need reform to achieve a full shift. However, environmental education is a crucial component to initiating a paradigm shift. Environmental education that specifically emphasizes ecological literacy, critical thinking, and place-based and experiential learning is an important agent in dismantling an increasingly dysfunctional environmental attitude, increasing the pursuit of a more harmonious relationship with the environment, and restructuring unsustainable provisioning systems, which will ultimately help usher humanity into a sustainable paradigm.

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