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**ENVIRONMENTAL LITERACY AND ITS IMPLICATIONS FOR
EFFECTIVE PUBLIC POLICY FORMATION**

By

Julianna H. Burchett

A senior thesis submitted in partial fulfillment of the requirements for the distinction of

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Thesis Supervisor: Dr. John Nolt

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ABSTRACT

Environmental literacy is a measure of a person's knowledge about the interactions of humans and their environments, environmental issues, and the various connections in ecological systems. Recent studies have demonstrated that there are major shortcomings in the public's understanding and awareness of environmental issues, specifically the impacts humans have on climate change. The public's deficiency in environmental literacy is preventing the formation of environmental policy. This is because the level of the public's environmental awareness and concern has demonstrable effects on whether individuals are willing and able to participate in the creation of public policy that improves environmental quality. Based on an examination of public policy, environmental policy, environmental education literature pertaining to public knowledge and understanding of the environment, and environmental education literature, it is evident that the rapid growth of ecological issues in recent decades is demanding the need for a better informed society. The focus of this thesis is to analyze contemporary literature about public understanding of environmental problems, the role of the public in formulation of public policy related to environmental issues, and the role of education in combating environmental illiteracy. Further, this thesis addresses the increasingly important role of formal and informal education in enhancing and reinforcing the public's basic knowledge of science, the environment, and related issues that affect individuals' everyday lives and well-being.

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One final paragraph of advice: do not burn yourselves out. Be as I am - a reluctant enthusiast . . . a part-time crusader, a half-hearted fanatic. Save the other half of yourselves and your lives for pleasure and adventure. It is not enough to fight for the land; it is even more important to enjoy it. While you can. While it's still here. So get out there and hunt and fish and mess around with your friends, ramble out yonder and explore the forests, climb the mountains, bag the peaks, run the rivers, breathe deep of that yet sweet and lucid air, sit quietly for a while and contemplate the precious stillness, the lovely, mysterious, and awesome space. Enjoy yourselves, keep your brain in your head and your head firmly attached to the body, the body active and alive, and I promise you this much; I promise you this one sweet victory over our enemies, over those desk-bound men and women with their hearts in a safe deposit box, and their eyes hypnotized by desk calculators. I promise you this; You will outlive the bastards.

Edward Abbey, 1976

I. Introduction

Throughout the past several decades, results of various published studies, conducted in both the United States and abroad, have revealed major shortcomings in the public's understanding of environmental issues and the detrimental effects this weakness has had on sound public policy formation. Alternatively, complementary studies have focused on how scientists, educators, and the media are making an effort to abate environmental illiteracy and how information regarding this issue can best be made accessible to the broad populations that are seeking a better understanding of current environmental issues and their implications.

Based on an examination of public policy, environmental policy, environmental education literature pertaining to public knowledge and understanding of the environment, and environmental education literature, it is evident that the rapid growth of environmental issues in recent decades is demanding the need for a better informed society. It is also clear that human exploitation of natural resources is causing changes to the environment, which is having adverse effects on people's lives, as well as the ecological health of the planet. As a result, the attendant ethical, moral, political, and educational dilemmas are more complex than ever. The level of the public's environmental literacy has demonstrable effects on whether individuals are willing and able to participate in the creation of public policy that improves environmental quality. The literature offers many examples of the role of education, both formal and informal, in influencing the degree to which society is active and well informed.

The focus of this thesis is to analyze contemporary literature about public understanding of environmental problems, the role of the public in formulation of public policy related to environmental issues, and the role of education in combating environmental illiteracy. An attempt is made to synthesize information about the state of environmental literacy and to assess

the implications of an increase in the public's knowledge of the environment in their becoming more involved in the public policy arena. Further, this thesis addresses the increasingly important role of informal education in enhancing and reinforcing the public's basic knowledge of science, the environment, and related issues that affect individuals' everyday lives and well-being. The specific responsibilities of the media, professional educators, scientists, and other institutions in combating environmental illiteracy, which is often paralleled with science illiteracy, through education are also discussed.

II. Defining Environmental Literacy

Environmental literacy is a concept that has been reviewed in many time periods and by numerous individuals¹. The fundamental understanding of ecological literacy is the knowledge that the actions of humans have consequences far beyond what the average consumer is able to conceive. In his 1992 publication of essays titled *Ecological Literacy: Education and the Transition to a Postmodern World*, David Orr writes, "Literacy is the ability to read. Numeracy is the ability to count. Ecological literacy, according to Garrett Hardin, is the ability to ask "What then?""² This statement alludes to concepts of interconnectedness and individual understanding of how a person's actions impact the extended ecological communities, both now and in future generations. Orr further states that the ecologically literate individual will ". . . appreciate something of how social structures, religion, sciences, technology, patriarchy, culture, agriculture, and human cussedness combine as causes of our (environmental) predicament."³

¹ Orr, David (1992). *Ecological Literacy: Education and the Transition to a Postmodern World*. New York: SUNY, pp. 8; McBride, Brook (2011). "Essential Elements of Ecological Literacy and the Pathways to Achieve it: Perspectives of Ecologists"; Bruyere, Brett (2008). "The Effects of Environmental Education on Ecological Literacy of First-Year College Students." *Journal of Natural Resources and Life Sciences Education* 37, pp. 20-26

² Orr, pp. 8

³ Orr, pp. 93

In a more recent study conducted in 2011, Brook McBride reviewed over 1,000 perspectives of ecologists and other environmental scholars on ecological literacy and arrived at the conclusion that there are six common dimensions of ecological literacy, several of which parallel to Orr's definition⁴. The first dimension that McBride discusses is cycles and webs, which is the movement of matter and energy throughout the ecosystem. The most common example of this is the food web, in which energy and nutrients are transferred from primary producers to top consumers by the succession of trophic levels. The second dimension is ecosystem services, which is the multitude of benefits that humans receive from nature. These benefits include regulative ecosystem processes, such as the purification of water and air, as well as raw materials obtained from the environment, which can range from food and nutrients to timber and organic matter. The third dimension is negative human impacts, which is defined as the practices by humans that causes harm to the environment. These practices often involve the ways in which we exploit ecosystem services. The fourth dimension discussed is critical thinking and applications, which can be summarized by evidence-based thinking and its applications to everyday life. An example of this is being able to draw accurate conclusions from scientific facts about climate change and act accordingly. The fifth dimension is the nature of ecological science, which is a broad scope of the varying processes and orders in nature. An example of this is the interactions among different species in an ecosystem, such as competition and predation. The sixth and final dimension is biogeography, which can be defined as the distribution and change of communities and ecosystems throughout space and time.

Brett Bruyere's analysis of the multitude of definitions of literacy found that although varied definitions of the concept exist, there are commonalities throughout the literature. His study identified three main similar components: knowledge, affect, and behavior, which must

⁴ McBride (2011)

combine in order to complete the requirements of an ecologically literate individual⁵. Each of these three components is emphasized in different definitions. For example, in some definitions, knowledge is the primary emphasis, while others emphasize human behavior and action over knowledge. For the purposes of this thesis, each of the areas of environmental literacy is valued equally. In cohesion with Orr, McBride, and Bruyere, ecological literacy does not only refer to an understanding of ecological issues; ecological literacy refers to an individual's competence in evaluating issues, understanding the needs of the environment, and a willingness to actively participate in the environmental movement⁶.

The Connection Between Science, Environmental Literacy, and Public Policy

In order to have an adequate understanding of environmental literacy, it is first important to understand the implications of science and to have a scientific education that teaches the processes for how the Earth changes and has changed over time. Jon D. Miller defines scientific literacy as having “. . . the level of understanding of science and technology to function minimally as citizens and consumers in our society.”⁷ While the traditional notion of science was considered to be one-dimensional, the post World War II era saw significant changes in the practice of science and its implications⁸. Science began to be recognized as having an “impact on the social, economic, and political aspects of the nation, as well as on human welfare” and as a result, the relationship between studies of the environment and science education has become much more intertwined over time⁹.

⁵ Bruyere (2008); Orr (1992)

⁶ Orr (1992); McBride (2011); Bruyere (2008)

⁷ Miller, John D. (1992). “Public Understanding of Science and Technology in the United States.” *Report to the National Science Foundation, Division of Science Resource Studies*. Washington, DC: National Science Foundation

⁸ Hurd, Paul D. (1997). “Scientific Literacy: New Minds for a Changing World.”

⁹ Hurd (1997)

In today's society, there is an apparent attitude among the public that humanity may be able to utilize its ever-increasing knowledge of science and technology as a solution for environmental and economic issues. This belief is countered by those who promote public participation and education based on principles of conservation and preservation as a way to approach critical environmental and economic problems. Conservation and preservation deal with environmental threats and human problems – degradation of land, water, atmospheric resources, pollution, climate change, loss of biodiversity, poverty, and uneven economic growth¹⁰. A more modern term for the acts of conserving and preserving is sustainable development, which the Brundtland report defines as “. . . development that meets the needs of the present without compromising the ability of future generations to meet their own needs.”¹¹ The Brundtland definition requires that we meet the needs of the present generation, while also not compromising the ability of future generations to do so as well¹². Sustainable development is associated with both physical and economic concerns, as well as those of equity – “. . . equity for generations yet to come, whose interests are not represented by standard economic analyses or by market forces that discount the future, and equity for people living now who do not have equal access to natural resources or to social and economic goods.”¹³

Presently, science has entered an era of hybridization and is “becoming more holistic” in nature¹⁴. In other words, science is now an interdisciplinary field, often combining the natural and social sciences. Two distinguishably different needs are often coupled throughout literature

¹⁰ World Resources Institute (1992)

¹¹ Nolt, John (2014). *Environmental Ethics for the Long Term: An Introduction*. Hoboken: Taylor and Francis, pp. 119

¹² Nolt, pp. 119

¹³ World Resources Institute (1992)

¹⁴ Hurd (1997)

to describe a scientifically literate individual person. Dorothy Howell describes these two needs in her 1992 publication:

- (1) Economic: to prepare themselves for a future heavily dependent on science and technology affording individuals and nations the ability to compete in an increasingly technical and international workforce (including the need for future scientists and engineers).
- (2) Public Policy: to be a member of an informed electorate with the ability to participate in the policy debates that make our country a democracy (including the capability to make wiser consumer choices).¹⁵

Environmental Literacy from an Economic Perspective

While traditional economics studies the supply and demand of market goods and services, environmental economics focuses on “non-market” goods, or rather, goods that do not have a monetary value. For example, the market does not place a price on biodiversity, clean water and air, and wilderness, although, environmental economists often do try to find ways to price these environmental services. According to John Nolt, the market treats these as “worthless, and therefore negligible” because it assigns them no value¹⁶. In terms of public policy, the categorization of non-market goods is an issue because policies are made based on monetary costs. However, in terms of neoclassical preference theory, these items have value because they satisfy human preferences. Environmental economics, a subfield of neoclassical preference theory, exists to “create markets for . . . non-market goods, so that they acquire genuine market prices” or by assigning shadow prices in order to guide policy¹⁷.

In terms of education, it is important for people to understand environmental literacy from an economic perspective. Because the term “value” is often associated with a monetary

¹⁵ Howell, Dorothy J. (1992). *Scientific Literacy and Environmental Policy: The Missing Prerequisite for Sound Decision Making*. New York: Quorum Books, pp. 152

¹⁶ Nolt, pp. 71

¹⁷ Nolt, pp. 71-72

cost, individuals are often misguided on the true value of the ecosystem. Ecosystem services provide many of the basic necessities of life, but they do not have a market value. Due to the fact that traditional economic theory is solely based on assigning market values to goods, traditional economics is a very limited and anthropocentric way of viewing goods and services provided by the environment. This perspective is limiting because it only accounts for monetary consumerism among humans, which we know detracts from the concept of sustainable development. However, there is a strong culture for consumerism in the United States, which has created a strong desire for a lucrative market.

There is no doubt that people today, especially in the United States, have a strong obsession with material goods. This unprecedented need to drive new cars, live in bigger houses, and overall require more “stuff” is harming the planet in ways that humans are unable to see. In order to keep up with the demand for cars and houses, as well as other material goods, industries must continue to extract natural resources from the Earth, especially coal. The culture of consumerism has caused people to disregard the fact that the benefits from natural resources will be short-lived if they are exploited to a point where they cause irreversible damage to the Earth. For this reason, economic education should include environmental economics, which focuses on the importance of non-market items, such as the benefits of biodiversity, clean water, and other environmental goods and services. Environmental education should also include ecological economics, which is based on the concept that there is an ecological limit to the actions of humans. In other words, everything humans do must be done within ecological limits.

Environmental Literacy from a Public Policy Perspective

In order for the public to play an informed and contributing role in governing, it must be up to the challenges brought about by fast-paced socio-economic change. This is not a new

concept. John Miller's 1990 study about public understanding of science foreshadowed the importance of science and ecological literacy in the early decades of the 21st century:

It is clear that national, state, and local political agendas will include an increasing number of important scientific and technological controversies in the years ahead . . . the number of public policy controversies that require some scientific . . . knowledge for effective participation has been increasing . . . it is important to note now that the public plays the role of final arbiter in disputes, especially when the scientific community and the political leadership are divided on a particular issue . . . The preservation of the democratic process demands that there will be a sufficient number of citizens able to understand the issues, deliberate the alternatives, and adopt public policy.¹⁸

Howell states in the introduction to her book on scientific literacy and environmental policy, "...scientific illiteracy has disenfranchised society in the United States in decisions ranging from personal health . . . to environmental quality . . . there is little hope for sound policy formulation in these programs until nationwide scientific literacy is actively practiced . . ."¹⁹ In order for people to have an effective role in public policy debates, scientists and those knowledgeable about environmental issues must be willing to interpret and share the information and data they generate. Accordingly, the public must have the capability to understand the implications of this scientific and ecological information made available to them if they are to make informed choices with regard to environmental policy issues. There is, however, a major concern for ineffective communication and transfer of knowledge as one of the major shortcomings in our educational system related to scientific and, thus, ecological knowledge. As Howell asserts, "underlying realities of science . . . are propounded with little regard for their effective communication across disciplinary lines or to the lay public. The result is frequently

¹⁸ Miller, John D. (2002). "Civic Scientific Literacy: A Necessity in the 21st Century." FAS Public Interest Report. *The Journal of the Federation of American Scientists*, 55(1), pp. 3-9

¹⁹ Howell (1992), pp. 3

beneficial to one particularly articulate sector at the expense of others, including the larger society.”²⁰

In order to engage people in the public policy process, it is important to refer back to Miller’s contention that only a very small percentage of the population is actually aware of environmental issues, and a great majority of those people do not have a sound educational background or clear understanding of the issues. This pervasive level of environmental illiteracy is one of the key factors to keep in mind when developing educational campaigns designed to increase the number of individuals in the democratic policymaking process. Not only must those involved in the policy formulation process be well engaged with the issues, they also must have an adequate education of the complexities of the issues and how to place themselves into the policymaking process.

III. The History of Environmental Education

Prior to the advancement of science and technology, before the start of the Second World War, there was no formalized education specific to teaching people about the environment. In fact, the ways in which people learned about nature were much different. The history of environmental education is deeply intertwined with the history of the environmental conservation movement in America. According to environmental educator William B. Stapp in “Historical Setting of Environmental Education,” the history of environmental conservation is branched into three phases consisting of preservation, management, and environmental quality²¹. Significantly, environmental education in America was primarily referred to as “conservation

²⁰ Howell, pp. xiv

²¹ Stapp, William B. (1974). “Historical Setting of Environmental Education.” *Environmental Education: Strategies Toward a More Livable Future*. New York: Sage Publications, Inc., pp. 41

education” as a result of its association to the movement²². It played a major part in each phase and progressed as the environmental conservation movement grew in the United States.

However, despite its advances over time, its overall goal has not strayed from the importance of environmental consciousness. The objective of ecological education throughout the successive phases of environmental conservation has been to promote change by instilling a sense of environmental awareness in the public. This has been evident since the initial phase of the conservation movement in the United States.

Environmental education first began in the form of ecological publications at the start of the United States preservation movement. An example of one of these publications is *Man and Nature*, which was written by George Perkins Marsh in 1864. Marsh, who hoped to educate the public on the importance of conservation, published his book as a direct response to the extensive environmental degradation that was occurring in the United States at the time²³.

Colonial settlers, as Stapp explains, had spent almost two centuries viewing nature as an endless source of materials and an endless basin for pollution. These outlooks led to extensive degradation across the country. Marsh published his book in hopes that he could change the public’s behavior by explaining to them the reality of natural resource depletion. Following Marsh’s ideologies, author Wilbur Jackman published *Nature Study for the Common School* in 1891. Unlike Marsh’s work, which merely discussed the subject of environmental degradation, Jackman’s work taught students the various methods of how humans degrade the environment²⁴.

His emphasis on pedagogical techniques signified a major shift in environmental education.

Environmental education changed from being a subject of literature emphasizing conservation to being an actual model of pedagogy. In fact, shortly after this dynamic change, Cornell University

²² “Evolution of Environmental Education: Historical Development.” *The Encyclopedia of Earth*

²³ Stapp, pp. 43

²⁴ Stapp, pp. 44

founded America's first forestry college in 1898²⁵. The founding of Cornell's forestry school represented the evolution of environmental education from a subject material read on an individual's own time and into a field that was formally sought after in a university setting amongst one's peers.

The evolution of environmental education progressed with the emergence of what Stapp refers to as the environmental management movement in America. This occurred mainly during the first two decades of the 20th century, when the government began to contribute to environmental protection under the leadership of President Theodore Roosevelt. Numerous conservation agencies were then created with the objective of providing an environmental education to members of society who remained outside of the university setting. This was an early example of informal environmental education. In order to educate the public, conservation agencies invested in various initiatives, including the production of informative films, the hosting of interactive conferences, and the distribution of pro-conservation publications²⁶. These initiatives popularized the idea of environmental conservation, and by the 1930s, the public was insisting that environmental education, which was solely a university field of study at the time, be introduced into the public school curriculum. This marked a paramount moment in environmental education, as well as the start of the third and current phase of environmental conservation.

The role of environmental education in the third phase of environmental conservation in the United States persists today and raises the issue of education reform. This third phase, as identified by Stapp, is the ongoing pursuit to improve environmental quality. The enactment of legislation such as the National Environmental Education Act of 1990, which created the

²⁵ Stapp, pp. 44

²⁶ Stapp, pp. 46

education department of the Environmental Protection Agency, established the need to advocate on behalf of restoring ecological quality as a legal precedent²⁷. In theory, following the demand for environmental protection that occurred as a result of the government's endorsement of conservation, today's generation should embrace environmental sustainability and advocate on behalf of restoring ecological quality. David Orr notes in his 1992 publication the urgencies of educating the public about sustainability:

The crisis of sustainability, the fit between humanity and its habitat, is manifest in varying ways and degrees everywhere on earth. It is not only a permanent feature on the public agenda; for a practical purposes it is *the* agenda . . . Sustainability is about the terms and conditions of human survival, and yet we sill educate at all levels as if no such crisis existed.²⁸

Orr describes sustainability as a dynamic idea, its intentions to encourage humans to pursue alternative options for the harmful actions of people today in order to decrease the negative impacts on the environment. However, although today's generation is more knowledgeable about environmental issues and sustainability, that knowledge is not being translated into a deep concern for ecological issues or major alterations in human behavior. This could be due to the shift in education style following the second phase of the conservation movement. Essentially, environmental education transitioned from being an informal and unofficial form of education to being taught in a formal classroom setting due to the constraints of the traditional schooling process. This shift occurred just before World War II, when educational materials became available to the lay public and educators began to emphasize the importance of learning about conservation. It is for this reason that environmental education, despite a long history of effectiveness, has begun to flounder.

²⁷ Theobald, Paul and Ronchon, R. (2009). "Environmental Education." *Encyclopedia of Environmental Ethics and Philosophy*. Detroit: Macmillan Reference USA, pp. 329

²⁸ Orr (1992), pp. 83

IV. The Current State of Environmental Literacy

In this country and abroad, there appears to be a consensus that the American public is “. . . not only suffering from scientific, but also more fundamental general literacy. It is clear that general illiteracy is a fundamental impediment to scientific . . . literacy.”²⁹ After David Orr standardized the term ‘ecological literacy’ in the early 1990s, understanding and measuring ecological literacy saw increased scholarly interest, beyond what had originally been a limited subfield of scientific literacy. To quantify the statement made by Howell, a study by Jon Miller in 2002 revealed that more than 80 percent of Americans lack the vocabulary and critical thinking necessary to read a scientific article in a popular publication, understand and engage in a science-based television program, or comprehend a science book³⁰.

Additional studies have been conducted to measure ecological literacy across a scope of demographics from small populations of students to entire academic institutions. In 2005, Coyle produced the outcomes and conclusions of a decade-long study directed by the National Environmental Education and Training Foundation (NEETF) and Roper Research, “Environmental Literacy in America.” The National Science Foundation’s Advisory Committee for Environmental Research and Education carried out this study in order to measure what the general public understands about environmental issues³¹.

The study revealed, “most Americans believe they know more about the environment than they actually do.”³² The study also found that awareness of environmental issues is high, and the American public is in favor of the idea of environmental education. In assessing the relationships between intellect and attitude, the study found that environmental intellect

²⁹ Howell, pp. 152

³⁰ Miller (2002)

³¹ Coyle, Kevin (2005). “Environmental Literacy in America.” *The National Environmental Education and Training Foundation*

³² Coyle (2005)

corresponds significantly with sustainable actions; however, knowledge does not correspond with sustainable actions that result in greater shifts in behavior, and it does not correspond with “lasting environmental stewardship.”³³ In other words, people do not fully incorporate environmental impacts into their day-to-day decision-making in the short and long term. The researchers created levels of knowledge to categorize respondents. If every person in the United States achieved the level of “personal conduct knowledge,” which is a basic level of awareness, knowledge, and action, which they don’t, then about \$75 billion less would be spent on energy, water, and healthcare costs annually³⁴.

In 2001, Morrone et al. published a study that created a survey tool to measure intellect, opinions, sensitivities, and personal beliefs³⁵. The personal beliefs aspect of the study corresponded with an individual’s overall worldview of the environment. The authors characterized worldview with respect to the environmental psychology definitions: the dominant social paradigm (DSP), which is a “faith in science and technology, advocate of hands-off approach to government, and belief in resource abundance” perspective and the new environmental paradigm (NEP), which contrasts the DSP³⁶. The survey was distributed to four sample populations in Ohio, which represented a unique and varying set of demographics. The study found that there is not a correlation between intellect and a concern for the environment. The study also concluded that worldview is a more accurate gauge for concern of the ecological issues than knowledge. The subjects were also more knowledgeable about worldwide environmental issues in comparison to those occurring at a local level³⁷.

³³ Coyle (2005)

³⁴ Coyle (2005)

³⁵ Morrone, Michele, Mancl, K., Carr, K. (2001). “Development of a Metric to Test Group Differences in Ecological Knowledge as One Component of Environmental Literacy.” *The Journal of Environmental Education*, 32, pp. 33-42

³⁶ Morrone, et al (2001)

³⁷ Morrone, et al (2001)

In 2008, Bruyere published “The Effect of Environmental Education on the Ecological Literacy of First Year Students.” The objective of this research was to determine which sustainable behaviors are connected to knowledge of ecological problems and which behaviors are not connected by similar attitudes. The study administered at Colorado State University tested 136 freshman students in first year seminar courses. Each class in the survey was pre-tested following a presentation by the course instructor, and the control classes were given the post-survey after no prior presentation. The survey classes received two environmental education lectures, and then were administered the post-survey. Bruyere observed that “as individuals learn about environmental ideals, biological interactions, and ecological systems, their environmental perspectives become more apparent.”³⁸ Consumer attitudes presented a major shift in favor of a more environmentally aware worldview. This survey implied that awareness is a measure of behavior, or at minimal a small aspect of behavior; however, the survey did not measure the students following the post-test to determine if they maintained their environmentally conscious behaviors.

In 2010, the University of Iceland administered a survey of environmental literacy of faculty, staff, and students at the university to obtain general information about the level of the subjects’ ecological knowledge in an effort to update their sustainability procedures. The study was administered via an email survey sent to everyone who had a University of Iceland email domain. The survey was constructed of five divisions: demographic information, environmental attitudes, sustainable behaviors, environmental values, and views of the university³⁹. The results of the study contended that the older the test subject, the higher they scored on the survey. Test

³⁸ Bruyere (2008)

³⁹ Davidson, Mary F. (2010). “Ecological Literacy Evaluation of the University of Iceland Faculty, Staff, and Students: Implications for a University Sustainability Policy.” *University of Iceland*, pp. 21

subjects who were not from Iceland received a higher score on the survey, with the exception of the background knowledge part, where nationality was not a factor⁴⁰.

Based on the studies discussed in this section, there appears to be no general agreement on the indicators of environmental literacy. While some of the studies found that increased environmental education would translate to improved environmental literacy, other studies suggested that knowledge of ecological issues is secondary to a person's central ideologies. Although the studies conducted by Coyle and Morrone et al. showed conflicting results, both did indicate that environmental education and knowledge of issues was not effective in terms of long-term environmental stewardship. Specifically, Morrone et al. found that although in her study, knowledge did not directly correlate with environmental behavior, that a stronger indication of individuals' behavior was their overall view of the world. This seems to be a consistent theme throughout each of the studies. Although collectively, the studies did not demonstrate a correlation in improving environmental literacy, an important lesson to gain from these studies is that people do have, for the most part, some form of environmental awareness; however, it is not consistently clear if people's behaviors changed after gaining more knowledge of ecological issues. Furthermore, each of these studies involved a relatively small sample size and may not be a significantly indicative of the general public. Future studies need to be conducted over a longer period of time to study if people's environmental behaviors last an extended period of time after being exposed to ecological education. Additionally, studies should not only focus on knowledge-based factors, but also on external factors, specifically those involving environmental psychology.

⁴⁰ Davidson (2010)

V. Environmental Psychology and Ethics

Environmental Psychology

The interdisciplinary field of environmental psychology explores the “scientific study of the interplay between human behavior and its environmental settings.”⁴¹ Individuals who work in this field study environmental structure, wildlife, and global temperature increases, as well as other aspects of the world in an attempt to understand the ways in which different environments influence human behavior. As a result of these various studies, environmental psychologists have begun to understand and recognize the complex relationships between people and their environments.

The discipline of environmental psychology is relevant to the issues associated with this thesis in many aspects. One such aspect is what David Orr refers to as the fundamental issue of today’s society: “how we regard the natural world and our role in it.”⁴² In exploring this fundamental issue, Orr discusses the concepts of biophobia and biophilia. David Orr identifies biophobia as “the culturally acquired urge to affiliate with technology, human artifacts, and solely with human interests regarding the natural world.”⁴³ Furthermore, Orr defines biophobics as those “who regard nature ‘objectively’ as nothing more than ‘resource’ to be used any way the favored among the present generation see fit.”⁴⁴ This type of behavior is becoming more prevalent among individuals raised with a high presence of technological items, such as television and computers that limit the amount of time people spend outside. More often people prefer to exist in human-controlled environments as opposed to the natural world. Nature is

⁴¹ Craik, Kenneth H. (1973). “Environmental Psychology.” *Institute for Personality Research and Assessment*, University of California, Berkeley

⁴² Orr, David. (2004). *Earth in Mind: On Education, Environment, and Human Prospect*. (1994). Washington, DC: Island Press, pp. 133

⁴³ Orr (2004), pp. 133

⁴⁴ Orr (2004), pp. 133

being seen as something that is uncomfortable, inconvenient, and scary. This is mostly due to the fact that the natural environment is uncontrollable. The real issue at hand is that people have a higher desire to spend time inside with technology instead of outside where they can experience the natural world and learn from their surroundings. As Orr states, our manner of thinking is “so thoroughly ingrained in us that we can scarcely conceive of any other manner of thinking.”⁴⁵ This is due to many people’s lack of respect toward nature and the belief, also asserted by philosophers, Descartes and Bacon, that humans have the ability to control the environment and exploit it for human benefit. This manner of thinking parallels with “the ideology of perpetual economic growth, now the central mission of governments everywhere.”⁴⁶

In contrast to biophobia is biophilia, which is defined as the urge to interact with other life forms. Orr states that earlier societies tended toward a more biophilic behavior because they were forced to live in unison with nature⁴⁷. The individuals in these primitive societies had an “ecological innocence” that was dictated by the circumstances posed by nature⁴⁸. In other words, these societies did not have the ability to drastically alter the natural rhythms of the earth. Modern societies, however, have the choice of biophobia or biophilia. One reason that individuals have lost touch with nature is because various technologies, as well as science, have given humans the power to destroy anything blocking development. These technologies have also disengaged humans from understanding the damages that result from such destruction. Because of this, humans have been able to separate the natural world from the technologically dependent world that we exist in today. This causes people to view nature as though it is only there to be used for the benefit of humans. In terms of human behavior, it is important to

⁴⁵ Orr (2004), pp. 133

⁴⁶ Orr (2004), pp. 133

⁴⁷ Orr (2004), pp. 133

⁴⁸ Jamison, Andrew (2001). *The Making of Green Knowledge: Environmental Politics and Cultural Transformation*. Cambridge: Cambridge University Press, pp. 87

understand what encourages or motivates people to act in environmentally conscious ways. Psychologically speaking, what is the motivation to solve some of the greatest environmental problems that we face today and future generations will continue to face? The answer to this question lies at the intersection of philosophy and ecological consciousness.

Environmental Ethics

The argument that humans act in ways to benefit themselves has been debated for decades by some of the world's most noteworthy philosophers. John Stuart Mill's theory of utilitarianism describes what is known as 'The Greatest Happiness Principle.' Mill asserts that humans consider an action to be right when the result of that action is happiness. Complementary to this claim is that all unhappiness should be avoided. Significantly, Mill's theory was not egoistic; he took everyone's happiness into consideration. Mill's 1863 publication, appropriately titled *Utilitarianism*, states that "pleasure and freedom from pain, are the only things desirable as ends' and that all desirable things . . . are desirable either for the pleasure inherent in themselves, or as a means to the promotion of pleasure and the prevention of pain," and that there is no higher end than pleasure⁴⁹. In other words, Mill's theory argues that the most important thing is the elimination of suffering of people and animals and to create as much happiness with as little suffering.

In contrast to Mill's viewpoint is that of Immanuel Kant, who focuses on the quality of actions and their morality, and for what reasons actions should take place. Kantian ethics takes the form of a categorical imperative, which Kant describes as the fundamental principle that humans have the ability to understand such actions that will benefit all humans. Categorical imperatives describe actions motivated with respect to a set of moral rules that are derived from pure reason. Essentially, the categorical imperative implies that we ought to respect people as

⁴⁹ Mill, John Stuart (1998). *Utilitarianism*. Ed. Roger Crisp. New York: Oxford University Press, pp. 2.10

ends and not means. In his 1785 publication, *Groundwork of the Metaphysics of Morals*, Kant asserts, “the true vocation of reason must be to produce a will that is good, not perhaps as a mean to other purposes, but good in itself.”⁵⁰ In other words, the reason for acting should be based on the particular act itself.

Mill’s beliefs challenge those of Kant in that Kant argues that people should act based on universal moral rules, whereas Mill believes that we ought to act in ways that bring about the greatest happiness for all. However, the critical difference between the two theories is the approach to ethical thought taken by both philosophers. Kant builds his argument based on how people should be acting by attempting to define moral rules, while Mill asserts that humans do not always act in ways that maximize happiness, even though he believed we ought to. Significantly, both Mill and Kant build their theories on the premise that humans are not perfect, with Kant specifically believing that people do not always obey moral rules.

Having established the fundamental understanding of moral actions as they relate to human behavior, we can now understand their application to environmental consciousness. Many people today have difficulty in understanding non-anthropocentrism, which is the concept that nature has purposes that are unrelated to humans and should be considered morally in its own right. Humans believe that their lives are far more important than those of other species. Although humans are the most influential species, we are not always the most important in terms of producing the most good for all aspects of the Earth. Ethically speaking, humans do carry the most importance because we have the most potential for good in the world. Significantly, humans also possess the greatest potential to produce harm in the world. Humans possess resources and abilities unlike any other species on Earth, such as an extensive range of feelings,

⁵⁰ Kant, Immanuel (1998). *Groundwork of the Metaphysics of Morals*, trans. Mary Gregor. Cambridge: Cambridge University Press, pp. 10

senses, and communicative abilities, just to name a few. However, these abilities can be used in both beneficial and harmful ways. There are millions of other species that utilize the benefits of nature, and thus, if we cause harm to nature that eliminates the ecosystems and habitats of other species, then we have abused our abilities as humans. If we can channel our abilities and put them to use for the betterment of all species, then we will have created the most happiness for all. In ecological terms, the primary producers are the most important species to all life because they are the basis for the natural world. Primary producers are the root of the food chain and the sustenance for all life. Thus, humans ought to act in ways that protect the delicate ecosystems that are home to primary producers in order for all life to continue to prosper.

While Mill and Kant were only concerned with human life, environmental ethics expands our moral thinking to include the lives of future people and animals. In terms of procuring the existence of life for future generations, it is important for today's generation to understand our moral obligations to future generations. This is a concept developed by Stephen Gardiner, who referred to the ethics of distant people as the "pure intergenerational problem."⁵¹ John Nolt asserts that people today understand the consequences of carbon emissions, but that humans have made no substantial changes to decrease the amount of carbon that goes into the atmosphere. Present-day humans live in an era where they will not see the true extent of the consequences of their anthropocentric actions. Those who will be forced to deal with the mistakes made by people today are those who will exist centuries from now. Those people are what Nolt refers to as the "distant future people."⁵² These people are "voiceless and powerless" in terms of the actions of people today, yet they very well may suffer much more from climate change than any generation

⁵¹ Nolt, pp. 94

⁵² Nolt, pp. 91

that comes before them⁵³. The key point of intergenerational ethics is that the consequences of human actions are not isolated to a single generation. For example, the repercussions from decades of releasing carbon into the air will affect people for hundreds and thousands of years because every bit of carbon released causes the global temperature to increase (see Figure 1).

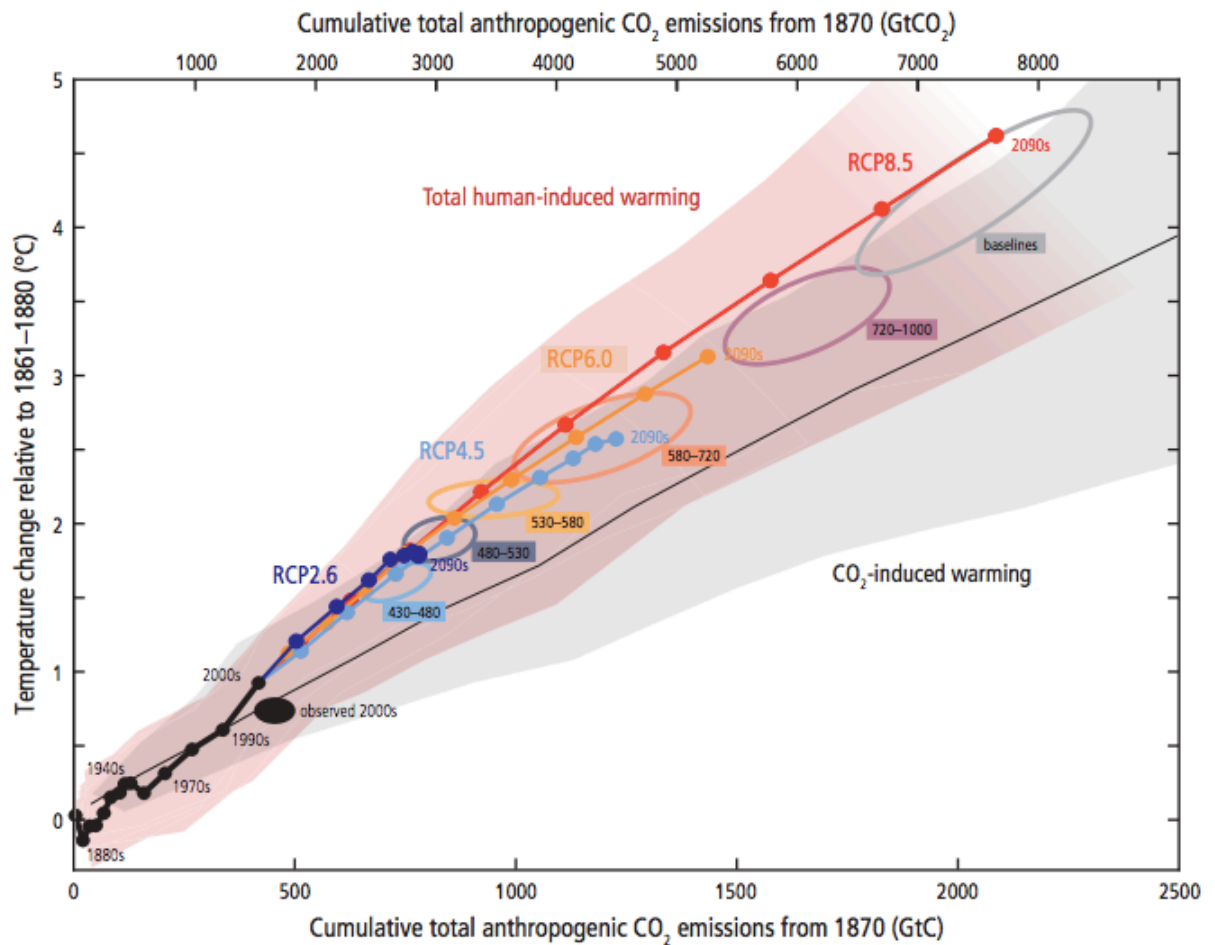


Figure 1. Global mean surface temperature as a result of CO₂ emissions⁵⁴.

As Figure 1 shows, there is a direct correlation between surface temperature of the Earth and the amount of carbon that we emit into the atmosphere. The graph displays a projected rise in temperature if we continue to burn fossil fuels at the same rate as we do now. Significantly,

⁵³ Nolt, pp. 103

⁵⁴ IPCC, 2014 Climate Change Synthesis Report

the next few centuries could see as much as a 5 degree Celsius increase. For perspective, the IPCC Fourth Assessment Report asserts, “as global temperature increase exceeds about 3.5 degrees Celsius, model projections suggest significant extinctions around the globe.”⁵⁵ At the current point in time, it is difficult to anticipate the exact point in which the increase in temperature will ignite the next mass extinction. As surface temperatures continue to rise, environmental disasters will become more frequent and more intense, hindering the ability of species to remain stable in their ecosystems. Furthermore, warming temperatures will continue to melt the ice caps, which impacts all species that require a colder climate in order to survive. Thus, if a mass extinction does occur within the next several decades and centuries, then it will be the result of both climate change and habit loss, and the Earth will become uninhabitable to a wide array of species. Not only is global climate change a threat to species, it also impacts human lives. Because much of the environmental disasters that are occurring are due to the anthropogenic activities of humans, climate change is causing the deaths of hundreds of thousands of people a year (see Figure 2).

⁵⁵ IPCC (2007). Fourth Assessment Report

Deaths from climate change

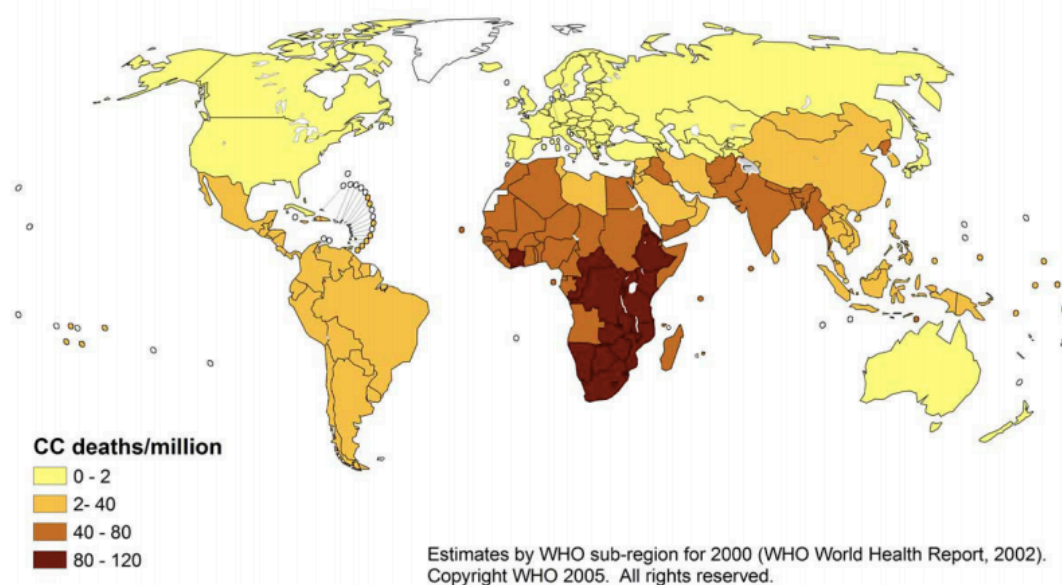


Figure 2. Estimated worldwide casualties per million caused by global climate change⁵⁶.

Humans are directly responsible for the deaths of other humans solely by their day-to-day actions. Moreover, as evidenced by Figure 2, the majority of these casualties are occurring in the periphery and semi-periphery countries.

Because this is a difficult concept for people to understand, especially since people tend to view this risk as centuries away, aggressive actions toward combating ignorance must begin now. These actions can begin with environmental education.

⁵⁶ WHO World Health Report (2002)

VI. The Role of Education

Methods of Pedagogy

An adequate education can instill an interest, which in turn can foster a sense of curiosity, which then has the ability encourage an individual to pursue knowledge on his or her own. When learning transitions from something students must do into something they actively pursue, wisdom is acquired. In theory, a proper education on environmental degradation is all the public needs to understand the importance of sustainable living. However, the truth is not as simple as the theory. As David Orr stresses, education is not the quick fix to ignorance. While this is true for a variety of factors, the main cause of this is the variability of education and critical thinking. There are two thought processes that occur as a result of the two primary education styles used today: convergent and divergent thinking.

Museum educators Jeanette Booth, Gerald Krockover, and Paula Woods in *Creative Museum Methods and Educational Techniques*, discuss the differences between convergent and divergent thinking. The authors assert that convergent thinking is based on structured learning and the identification of “right” answers. According to pedagogy experts, convergent thinking focuses on the concept that all facts will lead to a single, indisputable answer⁵⁷. In contrast to convergent thinking, divergent thinking is based on free-flowing thought processes and the interconnectedness of ideas⁵⁸. It encourages students to think about an issue from multiple perspectives in order to deduce as many potential solutions as possible.

Convergent thinking results when educators base their teaching on a more structured and formal style of learning. Divergent thinking contrasts from convergent thinking in that it invokes a deeper thought process that encourages an individual to make connections in order to arrive at

⁵⁷ Booth, Jeanette, Krockover, G., Woods, P. (1982). *Creative Museum Methods and Educational Techniques*. Springfield: Thomas, pp. 16.

⁵⁸ Booth, et al., pp. 18

unique and varied answers⁵⁹. While divergent thinking is important in developing critical thinking, it is complementary to convergent thinking. In essence, the best learning situation is one in which there is a balance of the two. The distinguishing factor that determines which thought process individuals use is which style of pedagogy educators utilize. Essentially, convergent thinking is enabled by what is known as formal education, while informal education typically results in divergent thinking.

The universally accepted definition of “formal education” is “. . . the traditional education in school, whose attributes are clear educational constructs . . .”⁶⁰ These constructs include, for example, licensed teachers, classrooms designated by age, and rigidly structured lessons⁶¹. The general education process, be it formal or not, takes place over a series of periods in an individual’s life. According to authors Antonio Martins, Teresa Mata, and Carlos Costa, the main educational periods in a student’s academic career include basic, university, organizational, and life-long⁶².

Basic education refers to the primary schooling all individuals receive. University learning, as the name suggests, refers to the higher level of learning students receive when they enter college or a university program. Organization and life-long learning, however, take place once an individual has left the figurative classroom. Organizational learning pertains to the lessons learned once a student enters the job market. Lastly, life-long lessons are based on an individual’s interests that are guided by personal experiences⁶³. Formal education, in theory, only applies to the initial two stages as a result of its basic core constructs: teachers, exams, and

⁵⁹ Booth et al., pp. 16

⁶⁰ Romi, Shiomo. (2009). “Non-Formal Education: A Major Educational Force In The Postmodern Era.” *Cambridge Journal of Education*, 39(2), pp. 260

⁶¹ Romi, Shiomo, pp. 257-273.

⁶² Martins, Antonio, Mata, T., Costa, C. (2006). “Education for Sustainability: Challenges and Trends.” *Clean Technologies and Environmental Policies*, 8, pp. 33

⁶³ Martins et al., pp. 33

lesson plans are not applicable outside of the classroom, and therefore do not apply to the organizational and life-long periods of learning. Formal education is therefore a limited style of pedagogy that only applies to early academic life. It is further restrained by its specific setting, as formal education is often limited in its ability to function outside of a school.

A study conducted by Janette Griffin revealed how formal education fails when it is conducted outside of the classroom. The study focused on several groups of students brought to a museum for a field trip. The data showed that teachers attempted to keep the lesson as formal as possible despite not being in a school setting. For example, some teachers gave out worksheets to their students to guide each student's thought process. Furthermore, these teachers attempted to uphold the structure of the learning experience by pulling students away from interactive exhibits that distracted them from their worksheets. Griffin, in reference to an interactive exhibit, explained that "one group in particular . . . was adamant that "you don't learn anything in there – you play",” and went on to note how "if the students did ever get the chance to get into this room, they were generally chased out again by the teachers, so they could get back to "the real learning" in the specified galleries.”⁶⁴ Essentially, these teachers attempted to bring the classroom to the museum. Following their trip, the students were questioned on the quality of their learning experience. The results of the study revealed the shortcomings of formal education outside of a school environment.

The data showed that students learned very little from their experience in the museum. The main reason for this is that the teachers attempted to make the trip to the museum no different than a day in the classroom. The worksheets they provided, which were designed to structure the day's lesson, served only to hinder the students' learning. In fact, many of the

⁶⁴ Griffin, Janette. (1994). "Learning to learn in informal science settings." *Research in Science Education*, 24(1), pp. 121-128

students asserted that the worksheets prevented them from viewing the exhibits they were interested in. Many of the students even claimed to have remembered very little as a result of the structured visit.⁶⁵ It is therefore evident by Griffin's study that the formal education conducted outside of the classroom was not effective.

Informal education results in a divergent style of thinking because it uses inquiry to teach. Inquiry, in the context of education, is a method of teaching where instructors guide their students' thoughts through a series of questions and prompts. The goal of inquiry is to have students reach their own conclusions by making their own connections. By continuously asking questions, instructors force their students to expand their thinking to include an increased amount of possibilities. Coupled with an education that emphasizes scientific education, it could enable students to see the bigger picture in which a particular subject lies.

Increasing Eco-Literacy

There are many different approaches of environmental education; however, inquiry-based experiential environmental education is the most capable method of successfully teaching environmental studies. This is due to the nature of environmental problems that are being taught. Environmental problems are incredibly complex and the best way for students to comprehend such complex ecological problems is if they are able to adopt a divergent thought process. Furthermore, if environmental education can convey the importance of conservation while also enabling students to think divergently, then it can foster a sense of eco-literacy. Eco-literacy is a form of environmental awareness that involves viewing the environment as a series of connections, and therefore enables an individual to understand the extent of environmental problems⁶⁶. However, eco-literacy is only attainable if an individual is capable of making

⁶⁵ Griffin (1994)

⁶⁶ Peacock, Alan. (2004). *Eco-Literacy for Primary Schools*. Stoke on Trent: Trentham Books, pp. 15

connections between concepts. In other words, in order to instill a sense of eco-literacy and an understanding of ecological problems, educators should encourage divergent thinking in their students, as well as systematic scientific understanding and logical problem-solving skills.

Due to the interconnected nature of ecological problems, divergent thinking, in addition to convergent thinking, is critical in order to achieve a full understanding of environmental degradation. Ecological issues usually pertain to damages done to ecosystems. Therefore, understanding how severe ecological degradation is means understanding how damaged an ecosystem is. However, damage assessment of ecosystems is difficult due to the nature of ecosystems. Natural life exists in a series of interconnected relationships, such as how different species influence each other in the food chain.

Convergent thinking and formal education, which emphasize limited thought processes and minimal connections between disciplines, fail to accurately teach these ecological problems and their subsequent effects on the environment. Orr explains that formal environmental education “. . . emphasized theories instead of values, concepts rather than human beings abstraction rather than consciousness, answers instead of questions, ideology and efficiency over conscience.”⁶⁷ These limited thought processes often hinder students’ ability to understand the severity of ecological issues due to the fact that, as a result of the narrow-mindedness of their education, students are often incapable of viewing the connections between ecological problems and environmental health. Therefore, they fail to understand the overall benefits of environmental protection, and will not understand the need to change their behavior. Furthermore, although individuals may understand that degradation refers to the damages caused by humans, they do not have the motivation to adjust their lifestyles to be more sustainable.

⁶⁷ Orr (1994), pp. 8

In addition to understanding ecological problems, the incorporation of divergent thought processes would enable children to develop a thorough and interdisciplinary sense of eco-literacy. Eco-literacy, in a brief summation, is “. . . understanding how ecosystems are organized and using these principles to live by.”⁶⁸ Alan Peacock, a pedagogy expert and author of *Eco-Literacy for Primary Schools*, stresses the importance of being ecologically literate by explaining that it allows individuals to “. . . draw together the important dimensions of science, humanities, and citizenship that are essential for children to understand what we have to do to ensure our continued survival on the planet.”⁶⁹ Thus, the same divergent thought process that encourages an understanding of ecological problems would also enable students to connect multiple disciplines and view those problems with various implications and contexts. According to the United States Environmental Protection Agency, this interdisciplinary eco-literacy enables students to become invested in environmental issues, be knowledgeable about environmental problems, have motivation to protect the environment, and be inclined to participate in environmental protection⁷⁰. Therefore, ecological literacy refers not only to an understanding of ecological issues, but also to an individual’s ability to analyze issues, understand the need for intervention, and willingness to contribute to the conservation movement.

For example, Theodore Roosevelt Senior saw to it that each of his children had an adequate environmental education. This not only included frequent excursions to the wilderness, but also involvement at the Museum of Natural History⁷¹. Theodore Roosevelt Junior spent much of his childhood in the halls of the Museum since its opening in 1877, and was subsequently one of the first people to experience the museum’s informal style of experiential environmental

⁶⁸ Peacock, pp. 15

⁶⁹ Peacock, pp. 8

⁷⁰ “What is Environmental Education?” *United States Environmental Protection Agency*.

⁷¹ Brinkley, Douglas (2009). *The Wilderness Warrior: Theodore Roosevelt and the Crusade for America*. New York: Harper Collins Publishers, pp. 43

education. This education amplified the one he received from his father, who was a major supporter of Charles Darwin. Roosevelt Senior provided his son with a copy of *On the Origin of Species* at a young age. Douglas Brinkley writes in a biography of Roosevelt Junior the effect Darwin had on the future president. Having read *On the Origin of Species*, Roosevelt Junior “. . . decided to become a foot soldier in the Darwinian ‘revolution of natural history’”⁷² and “for the rest of his life . . . use evolutionary theory as his guiding light . . .”⁷³ The effects of this early ecological education were evident as he grew older and saw his beloved wilderness begin to disappear. Inspired by the role his father played in environmental history, Roosevelt Junior created the Boone and Crockett Club with the intent to unite “. . . high-powered sportsmen like himself . . . to lead a new wildlife protection movement.”⁷⁴ Clearly, Theodore Roosevelt Junior was a visionary conservationist as a result of his environmental education and elevated eco-literacy.

As Peacock explains, the environmental responsibility and the sense of ecological awareness that accompany eco-literacy are dependent on an individual’s ability to understand the interconnectedness of environmental issues and ecological problems⁷⁵. It thus follows that the very same divergent thinking that enables an understanding of ecological issues is critical to obtaining a sense of ecological literacy. Therefore, it can be concluded that the pedagogy used to teach environmental education is a major factor in whether or not a student is able to gain a sense of eco-literacy. Environmental education must be reformed in order to emphasize the best teaching methods.

⁷² Brinkley, pp. 61

⁷³ Brinkley, pp. 64

⁷⁴ Brinkley, pp. 201

⁷⁵ Peacock, pp. 15

Environmental Education Reform

Environmental education is not as consistently effective as it could be. Stephen Sterling in *Sustainable Education: Re-visioning Learning and Change* argues that “education for change is often outweighed by the larger educational system which enacts vocational or socializing roles and purposes, and can ‘cancel out’ radical education endeavor.”⁷⁶ Here, Sterling is referring to the formal education system that reinforces narrow-mindedness, irrefutable conclusions, and the quest for a single “right” answer. Due to its nature, students inevitably receive a greater reinforcement of formal education than they do of informal education. Students must go to class and conform to the rigid structures of their educators every day, while informal educational experiences are carried out on their own time. Sterling points out that this has disastrous implications for the effectiveness of informal environmental education as it causes informal education to be taken less seriously. It is not uncommon for lessons learned in an informal setting to be overwhelmed and overruled by the consistent reinforcement of the information obtained from formal education. Informal environmental education is best taught in a manner that reinforces the lessons learned in the formal setting. Therefore, a healthy balance of informal and formal education should be included in a child’s education.

Environmental education should be taught with experiential learning in order to reinforce the subject material being taught. Experiential environmental education, as defined by environmental educator Richard Louv, teaches students about ecological processes by having them experience those processes for themselves⁷⁷. It is a method of informal education that teaches through direct interactions with nature. As opposed to experiencing a lesson on

⁷⁶ Sterling, Stephen (2001). *Sustainable Education: Re-Visioning Learning and Change*. Bristol: J.W. Arrowsmith Ltd., pp. 32

⁷⁷ Louv, Richard (2008). *Last Child in the Woods: Saving Our Children from Nature-Deficit Disorder*. Chapel Hill: Algonquin Books of Chapel Hill, pp. 203

horticulture through a museum exhibit, for example, experiential learning would involve actual time spent in a garden or similar setting. This particular style of informal education would not only encourage a sense of divergent thinking, but would also channel that thinking through hands-on interaction with the subject matter being taught. Louv argues on behalf of experiential learning by discussing a case study on schools in Finland. These schools use experiential learning to teach about environmental sustainability and have successfully encouraged large portions of public school education to be taught outside of the classroom and into the surrounding communities⁷⁸. The success of these programs is their ability to guide divergent thinking to focus on ecological issues, thereby fostering an ecological worldview in students.

Sterling explains that the ecological worldview emphasizes the concept of relationships with nature, as well as the connections between nature and society⁷⁹. According to Sterling, “such thinking is systematic rather than linear, integrative rather than fragmentary.”⁸⁰ Evidence of experiential learning’s ability to inspire an ecological worldview was seen in a Turkish case study. The study, conducted in 2008, examined the effects an environmental summer camp had on students. The study recorded how the experiential program affected each student’s environmental knowledge, environmental attitudes, environmental sensitivity, and responsible environmental behavior. The results of the study showed that, while the average student’s environmental knowledge did not increase significantly, attending the ecology camp tremendously improved the majority of students’ environmental behavior⁸¹. The author of the study, Mehmet Erdogan, attributes this to the interactive and informal nature of the camp,

⁷⁸ Louv, pp. 205

⁷⁹ Sterling, pp. 16

⁸⁰ Sterling, pp. 16

⁸¹ Erdogan, Mehmet (2011). “The Effects of Ecology-Based Summer Nature Education Program on Primary School Students’ Environmental Knowledge, Environmental Affect and Responsible Environmental Behavior.” *Educational Sciences: Theory and Practice* 11(4), pp. 2233-2237

claiming the students' “. . . outdoor activities provide hands-on activities which enable the students to integrate theory and practice, and to [obtain] cognitive attainments.”⁸² While the author doesn't specifically offer any explanation for the lack of environmental knowledge gained, the insignificance in the pre and posttests of the students could be due to the fact that they were only briefly exposed to environmental information through new reports and books prior to attending the camp. Additionally, the environmental information that the children were exposed to may not have been directly applicable to the learning that occurred at the camp. According to Erdogan, the outdoor learning inspired the students to witness and experience the connections within nature, thereby enabling them to develop their own connections with their environment⁸³. In turn, the students developed a sense of responsibility for the environment with which they had connected. Thus, it can be concluded that the interactive nature of the experiential lessons inspired the students to embrace an ecological worldview. The students viewed the environment as a collection of interconnected relationships, and thus viewed themselves as one of nature's various connections.

In addition to reforming the style of pedagogy used, environmental education can benefit from adjusting its goals in two critical ways. Orr touches upon both of these reforms in *Earth in Mind*. The first major goal of environmental education should be to bridge the gap between awareness of environmental issues and compassion for nature. When we care about an entity's well being, we strive to protect it from harm. If educators can teach students to emotionally value nature, then they provide students with an array of reasons to protect the environment. In *Earth in Mind*, Orr describes this critical reform, and argues “there is no way to separate feeling from knowledge . . . science without passion and love can give us no reason to appreciate the

⁸² Erdogan (2011)

⁸³ Erdogan (2011)

sunset . . .⁸⁴ The second major goal Orr also touches upon is that informal environmental education must focus on teaching students to take responsibility as part of nature's interconnected community. Increasing students' sense of environmental awareness is meaningless if they do not take action as a result. According to Orr, in order to establish this sense of environmental responsibility, individuals must view themselves as citizens of nature⁸⁵. If environmental education is successful in this goal, and students begin to view themselves as citizens of nature, they will subsequently be inclined to protect their newfound community. It thus follows that, due to the nature of American government, one of the ways that eco-literate public to accomplish this goal to protect their environmental community would be through environmental politics.

VII. Influencing Environmental Politics

In terms of the government and in elections, environmental policy is typically a weaker subfield of policy that does not usually have a huge impact on how votes are decided, even with regard to the large amount of attention the subject receives in politics. Despite the fact that the environment and its associated costs are a current and lively issue, environmental protection is usually seen as less of a priority in comparison to other national issues⁸⁶. However, there are moments when environmental issues become an undisputable priority to society. These intense, brief periods of public environmentalism are typically the result of an environmental crisis and are usually when the majority of environmental statutes are passed. This correlation demonstrates the effectiveness of a major disaster in fostering concern in people. Disasters in

⁸⁴ Orr, pp. 31-32.

⁸⁵ Orr, pp. 32

⁸⁶ Vaughn, Jacqueline (2011). *Environmental Politics: Domestic and Global Dimensions*. 6th ed. Boston: Wadsworth, Cengage Learning, pp. 7

themselves are a form of experiential learning and they alert people about the need for environmental protection. In fact, once people become educated about the need for environmental protection, a sense of environmental citizenship is inspired and the public can begin to utilize its power over government to enforce changes and influence the creation of environmental policy.

Environmental issues usually become relevant during times of environmental crises because each crisis is an informal educational experience for the public. A classic example of this was seen in the late 1960s when America suffered several major oil spills⁸⁷. The spills educated the public on environmental degradation when the public was able to see their impacts. Oil washed up on shores, animals died, and the media covered the news consistently. All at once, the public was bombarded with lectures on the consequences of environmental degradation and unsustainable behavior. Similar instances happened earlier in the same decade when Rachel Carson's *Silent Spring* was released in 1962⁸⁸. *Silent Spring* is historic for several reasons, mainly for the fact that it spoke out against the use of one of the most common pesticides at the time. The 1960s proved to be a decade of constant environmental devastation, and therefore, a decade of informal and experiential environmental education. This heightened society's awareness, as is made evident by the behavior of the public at the time. In fact, roughly 72 million people were visiting national parks, membership of the preservationist Sierra Club experienced a major increase, and the Wilderness Society had grown to nearly five times its size over the next two decades⁸⁹.

Due to the staggering spike in environmental consciousness, policymakers of the 1960s had no choice but to cater to the demands of the newly conversationalist public. According to

⁸⁷ Vaughn, pp. 14

⁸⁸ Vaughn, pp. 14

⁸⁹ Vaughn, pp. 17

professor Jacqueline Vaughn, “legislatively, the 1960s heralded a period of intense activity.”⁹⁰ Collectively, over the course of the 1960s and the decade following, the Land and Water Conservation Fund was created and the National Wilderness Act, Wild and Scenic Rivers Act, National Trails Act, Clean Air Act, Water Quality Act, and the Endangered Species Act were all passed⁹¹. This environmental movement eventually led up to the creation of the Environmental Protection Agency in 1970 by President Richard Nixon⁹².

If the 1960s are evidence of anything, it is that education has the power to influence the public to shift the political agenda. This was a time of idealistic belief among young people that society could be better. Although there was not as much environmental education as there is today, people were spending more time outside learning about nature. As Vaughn describes, the environmental legislation movement of the 1960s was the product of legislators hoping to “. . . take advantage of the public’s mood.”⁹³ For example, President Nixon did not create the Environmental Protection Agency out of genuine concern for the environment. He did so because he found himself leading a country that was distressed with water and air pollution, as well as pesticide usage. In fact, President Nixon was concerned with approval ratings, not the state of the environment. Unsurprisingly, politicians’ desire to please their constituents is an effective tool for approval. Due to the electoral system in the United States, the public has the ability to mold politicians through majority demand, although this power has decreased with the role of money in electoral politics.

The ability to influence politicians is a direct outcome of the structure of the U.S. political system. According to Michael Howes, two crucial members in the field of U.S. politics

⁹⁰ Vaughn, pp. 14

⁹¹ Vaughn, pp. 15

⁹² Vaughn, pp. 17

⁹³ Vaughn, pp. 17

are the “state” and the “community.”⁹⁴ The state consists of all forms of government, including the executive branch, legislature, judicial body, and bureaucracies. In turn, the community is an inclusive term to describe all participating voters and lobbyists.⁹⁵ The community has power over the state according to the nature of electoral politics. In the United States, members of the state must run in an election in order to obtain political power. The community must vote on who they want in office, and therefore, elections often turn into a system of negotiations between what the community is demanding and what the state can give. However, despite the power the community has, big money corporations are often the primary influencers of politicians.

Corporate Drivers of Misinformation

The current level of understanding by the general public of climate change is not entirely due to the complex nature of climate science. Rather, the lack of knowledge and acceptance of climate science and the overall warming of the earth is the result of a well-coordinated campaign run by corporations to deliberately keep the public misinformed about scientific information. The goals of this campaign are to generate widespread skepticism and doubt about climate science. Naomi Oreskes and Eric Conway, authors of *Merchants of Doubt*, identify this strategy of misinformation as “manufacturing uncertainty.”⁹⁶ According to Oreskes and Conway, climate change denial is not the central issue at hand. Rather, it is the denial that the actions of humans are causing climate change⁹⁷.

The main corporations that are funding this campaign to keep the public misinformed and ignorant are various fossil fuel companies and conservative think tanks, as well as politicians and

⁹⁴ Howes, Michael (2005). *Politics and the Environment: Risk and the Role of Government and Industry*. New York: Earthscan, pp. 87

⁹⁵ Howes, pp. xx

⁹⁶ Oreskes, Naomi and Conway, Eric. (2010). *Merchants of Doubt*. New York: Bloomsbury Press, pp. 16

⁹⁷ Oreskes and Conway, pp. 178

contrarian scientists⁹⁸. More specifically, two companies that have been funding this denial campaign are *ExxonMobile* and Koch Enterprises, both corporate authorities in the fossil fuel industry. Robert Brulle collectively identifies these corporations and their goals as the Climate Change Counter-Movement (CCCM), an extension of the growing conservative movement in America. According to Brulle, the CCCM was created in 1989, shortly following the development of the Intergovernmental Panel on Climate Change the previous year⁹⁹.

Not only have these organizational components caused widespread misinformation, they have also collectively delayed legislative action to address the issues of climate change. As Brulle writes, “the CCCM efforts focus on maintaining a field frame that justifies unlimited use of fossil fuels by attempting to delegitimize the science that supports the necessity of mandatory limits on carbon emissions.”¹⁰⁰ In the preface of his book, J.W. Grove offers his interpretation of the relationship of scientific knowledge and the role of the government with respect to public policy:

Scientists study nature; but nature places constraints on what they can discover about it. Scientific knowledge is often useful and thus feeds technology; but technology, in turn affects the practice of science, for example by making possible new techniques and instruments. Science impinges on politics when advances in knowledge pose questions for public policy; and politics impinges on science because governments today seek to sponsor and promote scientific work “in the national interest” and control its direction.¹⁰¹

The fossil fuel industry, which is a major financial supporter of the campaign to keep the public misinformed, is also the industry that would suffer the most financial losses if regulations

⁹⁸ Oreskes and Conway, pp. 233

⁹⁹ Brulle, Robert (2013). “Institutionalizing delay: foundation funding and the creation of U.S. climate change counter-movement organizations.” *Climate Change*, 122(4), pp. 681-694

¹⁰⁰ Brulle (2013)

¹⁰¹ Grove, J.W. (1989). In *Defense of Science: Science, Technology, and Politics in Modern Society*. Toronto: University of Toronto Press, Preface

on carbon emissions were more heavily regulated. This industry also contributes significantly to the global economy and provides financial support to several politicians, henceforth enabling government participators to direct and control legislation and public policy formation.

The lack of community influence in policy making is primarily due to the fact that many people fail to realize the control they have over the state. However, when voters are aware of their ability to demand change, as was seen in the 1960s, politicians are much more responsive. Therefore, members of the community who understand this relationship take it upon themselves to promote certain causes and encourage others to utilize their power. Inspiring the eco-literate to push for policy change is hardly possible without first explaining the process of environmental policymaking. The three most crucial steps, as outlined by Vaughn, are problem identification, policy formation, and policy evaluation. According to Vaughn, problem identification involves deciding which issues must be placed on the political agenda. This leads into the next step of policy formation, which occurs when an issue is clearly identified and studied and policymakers respond with appropriate initiatives and policy proposals.¹⁰² The final step is policy analyzing¹⁰³. If a policy is viewed as ineffective once it has been established, it will either be reformed or removed. The public's opinion, which guides how policymakers will analyze a policy, greatly molds this part of the policymaking process. If the public views a policy as ineffective and incapable of reform, the policy will most likely be abolished. Based on these particular aspects of environmental policymaking, it is now evident how environmental education can be influential in creating legislation.

The first and final steps are where environmental education can influence the formation of public policy. As Vaughn argues, the "conditions become problems when there is sufficient

¹⁰² Vaughn, pp. 3

¹⁰³ Vaughn, pp. 4

belief that something ought to be done about them . . . ¹⁰⁴ By using the methods of experiential education to ignite eco-literacy and ecological citizenship, educators can motivate the public to decide what is appropriate in terms of ecological degradation. Once educators have motivated environmental citizens into establishing improved environmental standards, policy formation is shifted, as policymakers would theoretically redevelop policy in order to reach these new standards. Furthermore, experiential environmental education would have a profound influence on policy evaluation. Experiential environmental education, which teaches students to use divergent thinking, would allow the public to view a policy from multiple disciplines and perspectives. This would help improve the quality of policy analysis, as well as the research of more effective policies, while also establishing an improved standard for the quality of policies and legislation proposed by policymakers.

Education thus has the responsibility to effectively communicate the scientific information regarding the environment in such a way that is understandable for everyone. Environmental education should also focus on skills that are less technical and involve more learning to appreciate the environment and its resources rather than exploit them for financial benefit. Most importantly, environmental education should foster a concern for ecological systems and a shift in the culture of how people view the natural world. Recent decades have already seen a trend in “going green,” but environmental education must be more than a simple phrase. This education should bring about the emergence of a new generation that puts pressure on policy-makers to act in ways that will procure the existence of humanity.

¹⁰⁴ Vaughn, pp. 3

VIII. The Media, Professional Educators, Scientists, and other Institutions

In the decades that have passed since the publication of *A Nation at Risk*, which was a landmark report by the Reagan administration to combat academic underachievement, there has been a great deal of progress made to enhance environmental literacy. There have been hundreds of reports and literary publications describing the state of environmental education, widespread attempts at educational reform, increased media coverage of environmental problems, and pressure from scientific, public policy, and grassroots organizations. Each of these institutions has played a role in solving environmental illiteracy and establishing it as a priority on the nation's agenda.

Today, universities are at the forefront of influence that is capable of fostering public understanding of environmental issues. While reporting on the state of the environment, the media regularly turn to university and research institutions for input from experts. Furthermore, universities have conducted seminars for the collaboration of science and journalism departments to better communicate information to the lay public. Additionally, universities educate future elementary and secondary school teachers, as well as the college professors of tomorrow. Students also study topics for future careers as librarians, as well as science and nature museum personnel. A large majority of informal science educators are employed by environmental advocacy organizations, conservation groups, and government agencies are university graduates. Universities have a great responsibility to provide future science and nature teachers and educators with an adequate science and environmental background so that they will be able to continue to advocate on behalf the environment and educate others on the importance of conservation and sustainability. Likewise, the general college student population, the group that represents one-third of those who choose to participate in the democratic process of

environmental politics, should graduate college with the knowledge that will enable them to seek out accurate scientific information about the environmental crisis.

Although university scientists still remain in their traditional roles as generators of knowledge and scientific information, organizations such as the Sierra Club and respected journals like *Nature and Culture* and the *Journal of Toxicology and Environmental Health* have led a charge aimed at involving university scientists into the ecological illiteracy solution. A cultural change appears to be taking place on university campuses, with scientists appearing more willing than ever to reach out to the various audiences that can use their talents the most – teachers, pre-college students, professional educators, the media, and the interested public.

Whether the driving force behind this cultural change at universities is a concern for accountability for the public-funded work conducted by the majority of university scientists or the sincere feeling of responsibility for passing on environmental education to others, the fact remains, a larger number of university scientists are making the effort to engage the lay public in the scientific data that supports issues regarding the environment by interacting with other educators to help create informal education curriculums, write science articles, and assist members of the electronic and print media. Furthermore, university scientists and educators have a growing role in the generation and dissemination of new curriculum materials and scientific knowledge as new information becomes relevant in topics regarding the environment. Universities are in a position to use their direct access to the scientific community to remain relevant in terms of research efforts.

Print and electronic media have a unique role in targeting audiences of all levels of environmental literacy through news and other specific communications. Some communications are designed to promote environmental literacy, while others stimulate participation in public

policy issues by providing information about ecological problems¹⁰⁵. Newspapers, such as the New York Times, are the source of many headlines regarding environmental issues, and provide renowned journalism that is reprinted in newspapers across the globe. Public broadcasting also provided a large amount of environment-related issues in the form of digital programming.

For many people, the reality of science and environmental news arrives via the media, that is, articles that are read in newspapers and magazines or television programs and motion pictures. The “filter of journalistic language and imagery” molds people’s perceptions of the issues that are most important¹⁰⁶. Because scientists do not write media reports, journalists have the unfortunate ability to provide inaccurate or biased information that can wrongly shape the public’s opinion. Thus, media reports of the environment are often sensationalized or exaggerated because the public has an inevitable demand to be entertained. As stated by Edwin Slosson, “. . . it is not the rule but the exception, to the rule that attracts public attention.”¹⁰⁷ Fortunately, the field of environmental journalism has emerged to provide well-researched and accurate scientific accounts of environmental issues that are written to both entertain and educate the public on important issues.

While there have been many advances in combating environmental illiteracy, the tasks of universities, the media, and the formal and informal education communities have barely begun. The fast-paced changes taking place in the world today brought about by environmental degradation and human impacts on the ecological world are clear evidence that environmental illiteracy will remain an important issue on the agendas of educators, politicians and government officials, as well as other institutions for decades to come.

¹⁰⁵ Miller (1992), pp. 92-93

¹⁰⁶ Nelkin, D. (1990). “Selling Science.” *Physics Today*, 43, pp 41-42

¹⁰⁷ Nelkin, pp. 44

IX. Conclusion

In today's political arena, U.S. politicians are generally unsympathetic to environmental issues. It is therefore questionable to whether or not public concern will successfully influence policies to be more environmentally-minded. In fact, it is not uncommon for environmental educators to be labeled as liberal radicals. As Fletcher Brown explains in "The Nowhere Land of the Environmental Educator," the intentions of environmental educators are often questioned. As Brown explains, "one of the major concerns . . . about environmental education over the years involves the perception that students are given biased information that may lead to their becoming environmental activists."¹⁰⁸ In other words, environmental educators are often accused of misinforming students in order to manipulate their thoughts. This is true for both sides of the environmental education debate. There is a concern over the balance of information that is provided to students. With this attitude circulating in the current political arena, the question of whether or not rigorous education reform is enough to bring change remains unanswered. Therefore, it is critical that additional methods of education reform are pursued and alternative solutions to environmental degradation be discussed and compared.

Further research into the effects of current environmental education programs must be conducted in order to evaluate what future methods of reform are necessary to improve environmental literacy in America. For example, the Children's Environmental Literacy Foundation (CELF) and the National Oceanic and Atmospheric Administration's Environmental Literacy Grant's Program (ELG) are two entities that are attempting to improve environmental education. Respectively, these two organizations hope to improve the quality of environmental studies and sustainability education and increase the funding and federal support of

¹⁰⁸ Brown, Fletcher (2007). "The Nowhere Land of the Environmental Educator." *Electronic Green Journal*, 1(25).

environmental education programs¹⁰⁹. Additional institutions such as the National Environmental Education Foundation and NYU Wallerstein Collaborative for Urban Environmental Education also promote the use of environmental education both inside and outside of the classroom. The prevalence of these organizations, and others like them, demonstrate the current drive to improve environmental education. Therefore, it is important to further research and analyze the effects of these initiatives in order to tailor future reforms to correspond with their successes and better their failures.

Furthermore, media reports of deteriorating ecosystems and environmental disasters should trigger an emotional reaction among people. People's initial reactions should not be to choose ignorance or be in denial of reality. Instead, they should be well-educated and be able to comprehend the magnitude of environmental issues that are occurring and how these issues affect them. There should be no reason for environmental denial, as everyone should be educated enough to be fully aware of what is happening in the world. Additionally, society should have a basic understanding of the importance of various ecosystems and resources for human existence. Furthermore, in order to interpret relevant information regarding the environment, the manner in which information is processed among individuals needs to be adjusted. As this thesis has argued, these ethical changes can be accomplished through environmental education.

In theory, education reform is the most straightforward method of improving environmental protection for two main reasons. First, we learn as we live and we live by what we have learned. Therefore, to learn about the environment is to immerse oneself in the natural world and become distant from everyday distractions, even if only for a small amount of time each day. Second, the governed are meant to use elections to control those doing the governing. If the public makes a demand, it should be in a politician's best interest to meet it. Thus, shaping

¹⁰⁹ CELF, celfeducation.org; ELG, oesd.noaa.gov

environmental literacy and inspiring the public to participate as citizens of the environment should result in influencing our leaders to value environmental protection. While further research is necessary in order to develop the most effective methods of educating, there is indisputable promise in improving environmental protection policies through experiential environmental learning.