4-26-2018

The Rhetoric of Landscape: Through Oil and Water

Alexandrea Davis
Western Michigan University, davisalexandrea@yahoo.com

Alexandrea Davis

Chair: Dr. Sarah Hill

Co-chair: Jane Baas

Lee Honors College Thesis Paper

The Rhetoric of Landscape: Through Oil and Water

Abstract:

"The Rhetoric of Landscape: Through Oil and Water" analyzes five water resources—Lake Erie, Lake Powell, the Aral Sea, the Gulf of Mexico, and the Great Barrier Reef—and uses the visual rhetoric introduced by an accompanying series of oil pastel illustrations to compare how the beauty of the landscapes equates to their true states. This project discusses the harmful effects of human activities on water bodies, first through direct pollution and ultimately through anthropogenic climate change. Furthermore, a final summary covering the history of environmental initiatives in the United States and the idea of "wicked problems" offers an overview of reasons for the worsening conditions of Earth's water resources. The paper introduces the concept of "second-order change" as a potential solution and a last chance initiative to revive the natural rhetoric of the planet's landscape.

The Rhetoric of Landscape: Through Oil and Water

Through imagery and personal experience, I learned that each landscape on Earth is its own form of artistry. I drew a series of oil pastel illustrations to accompany this paper and reflect the exquisiteness I see so often in nature. More specifically, I focused on water resources in varying locations: Lake Erie in the eastern United States, Lake Powell in the western United States, the Aral Sea in Kazakhstan and Uzbekistan, the Gulf of Mexico in the southern United States, and the Great Barrier Reef in Australia. I used the final two pictures of the series, one depicting toxic oil pastel pigments and the second showing effluent from a paper mill, as models of self-reflective scrutiny, demonstrating the overall issue on which the group of images sheds light: the destructive impact that human activity causes on the earth's water sources.

1. The Rhetoric of the Images

The prettiness behind the seven oil pastel pictures I created is intentionally deceiving. I wanted the radiant colors, swirling effects, and distorted perspectives to illuminate the attractiveness of each scene to show audiences that, although it may not be obvious, underlying problems reside below the surface (and often just before our eyes). Careless treatment of the environment leaves water bodies extremely polluted, causes them to lose significant amounts of volume, and leads to reduced flora and fauna inhabitant populations and, in some cases, complete extinction. I was struck by how easily I could ignore these issues while gazing at the mesmerizing landscapes, and I realized that people with less of an understanding about the ever worsening water problems can effortlessly do the same.

The concept of visual rhetoric refers to the "framing of messages…and finding the method and manner for effective persuasion" through the design and structure of images

(Campelo, Aitken, and Gnoth 3). It addresses both the place depicted and the viewer, attempting to capture the "essence of a place" to provide a proper representation to the target audience with little room for misinterpretation (Campelo, et al. 3). However, my intention when creating the oil pastel art pieces was to invite such misinterpretation. I wanted to show the ease with which we misread water landscapes that provide immense support to Earth's ecosystems and natural order. While viewing the pictures I recreated, I also found myself unable to determine what they portrayed before conducting further research, and I realized how easily a lack of knowledge and understanding transfers to the stagnation of environmental conservation initiatives.

Part I: Causes of Water Degradation and Pollution

2. **Lake Erie, United States**

Lake Erie is the "warmest, shallowest, and most biologically productive" of the five Great Lakes and a major drinking water source for more than 11 million people (Watson et al. 45). The freshwater body gathers over $50 billion in revenue from tourist and recreational activities, industries, fisheries, and more while providing a home for a variety of socially and environmentally significant organisms (Watson et al. 45). Lake Erie is the most prone of the Great Lakes to disturbance because of its smaller volume, higher temperatures, and larger populations, so the impact of agricultural development and climate change has caused a significant amount of stress on the lake's functionality (Watson et al. 46).

Since the 1990s, the exponential increase in agricultural fertilization runoff, rich with growth-promoting nutrients like phosphorus and nitrogen, has caused eutrophication from an outburst of toxic cyanobacteria harmful algal blooms (cHAB) during the summer and fall seasons (Watson et al. 46). Most frequently, cHABs occur along Lake Erie's western basin, where the largest amounts of runoff carry the nutrients to the water's surface (Watson et al. 46). Dissolved reactive phosphorus (DRP) from fertilizers is one of the most notable contributors to the algal bloom in the western basin (Michalak, et al. 6448). From 1995 to 2011—the year the world saw a record-setting cHAB in the lake, estimated to be 5,000 square kilometers at its peak—the amount of DRP in Lake Erie from the Maumee River, which is the foremost tributary into the lake's western basin, increased by 218% (Michalak, et al. 6449).

Climate change induced by human activity is altering weather events and thus furthering the severity of fertilization runoff. The average yearly temperature is becoming warmer for longer periods of time, extending growing periods and decreasing annual snow and ice coverage (Bosch, et al. 581). In addition, rainfall events continue to increase in both severity and frequency, directing more runoff to the western basin throughout the season (Bosch, et al. 581). Governmental policies have been implemented in an attempt to resolve some of the quickly-worsening problems surrounding Lake Erie. Initially, the 1909 Boundary Waters Treaty was introduced with a primary focus on structuring the use and quantity of the Great Lakes water between Canada and the United States (Johns, Thorn, and VanNijnatten 5). But, as Lake Erie's conditions continually degraded, it became clear that more steps towards conservation were necessary.

In 1972, the Great Lakes Water Quality Agreement (GLWQA) was established "to address significant environmental problems in the lakes," amended six years later "to include a focus on toxic substances" and adding an "ecosystem approach to environmental restoration" in 1987 (Johns, et al. 5). Following the historical cHAB in Lake Erie in 2011, the GLWQA was revised again in 2012, specifying primary efforts to achieve the policy's past goals and a new focus on climate change issues and improvements regarding implementation (Johns, et al. 5).

The International Joint Commission (IJC)—created in the early 1900s to resolve disputes, oversee implementation, and conduct investigations regarding the Great Lakes water resources (5)—is responsible for reporting the progress of the GLWQA every three years (Johns, et al. 6). However, the continued use of harmful, nutrient-loading agricultural fertilizers and the changing climate in the wake of human-related activity make it extremely difficult for policies and conservation efforts to prove extremely effective.

3. Lake Powell, United States

The Colorado River carves through one of the greatest landscapes in the United States of America, serving as a water source for over 30 million people in the southwest and providing space for 73.4 billion cubic meters of water storage within its ten grandest reservoirs (Myers 1213). One of the largest reservoirs is Lake Powell, located in the Upper Basin at the border of Arizona and Utah. Lake Powell's water system experiences water loss in two forms: surface-water evaporation and bank seepage, or "flow to the banks that does not return to the river system" (Myers 1214). Drought conditions severely affect the former method of water loss, as was demonstrated in the drought from 1999 to 2004 when Lake Powell's river inflow was essentially cut in half—lower than overall withdrawals—and the lake level fell by more than 44 meters (Pratson, et al. 843).

Lake Powell's inflow levels returned to normal during the summer of 2005; however, the drought continued and reached a historical high through 2014—and is still ongoing (Pratson, et al. 843). The average annual water flows during the 2000-2014 drought period were the lowest ever recorded over any 15-year time extension (Udall and Overpeck 2407). Although the average rainfall and flow reduction percentages do not vary immensely from those during the last 15-year drought from 1953 to 1967—a "-4.6% precipitation decline and -19.3% flow decline" in the 2000s drought as compared to a -6.1% precipitation decline and -18.1% flow decline in the 1950s drought—the most significant differentiating factor is the increase in temperature (Udall and Overpeck 2408). While temperatures during the mid-nineteenth century drought were cooler, the Upper Basin temperatures were around 0.9 degree Celsius greater than the average temperatures between 1896 and 1999, causing increased evaporation (Udall and Overpeck 2408).

Precipitation in the Upper Colorado River Basin where Lake Powell resides is, historically, the "main runoff driver" (Udall and Overpeck 2407). Rainfall in this area is so influential that years with high flow, like the 1920s and 1980s, were generally associated with years featuring high precipitation (Udall and Overpeck 2407). Still, the low precipitation numbers during the 2000 to 2014 drought range were only part of the reason it proved so detrimental; instead, about one-third of flow reduction in the Colorado River was an outcome of the century's record-setting heat (Udall and Overpeck 2408). A correlation between the "frequency of warm years has been strongly associated with lower flows than expected" and droughts following this pattern have been labeled "'global-change type droughts'" (Udall and Overpeck 2408). Many dry spells that would normally be average are turning severe because of human-induced climate change, thus threatening the water bodies in those areas and the life systems that rely on them for sustenance.

The Colorado River and its reservoirs are managed by the United States Bureau of Reclamation (USBR) according to the Law of the River, which includes various accords, agreements, and regulations (Myers 1214). The USBR uses a specific software to simulate the river system and predict river changes, including Lake Powell loss rates; however, assumptions are used during this process that sometimes support decisions made regarding the river, leading to questions of true accuracy and true benefit to the environment (Myers 1214). Since the estimates are made before the event has truly happened based on current conditions, the possibility of inaccuracy is prevalent. Decisions made about the river system before it demonstrates the predicted events could not only influence the Colorado River to behave differently; it could also drive an entirely different reaction for which no one is prepared.

4. The Aral Sea

The Aral Sea is arguably one of the greatest environmental disasters brought about by mankind on a body of water. Once the fourth-largest inland water source in the world, by 2012, the Aral Sea was estimated to be only 25% of its original volume, with a capacity for slightly more than 60,000 square kilometers of water surface (which it contained in 1960) (Gadaev and Yasakov 8). The Aral Sea Basin contains 115 cubic kilometers of water that could have prevented its drastic reduction in water flow and volume, but the essential water was prevented from reaching the Asian landmark (Gadaev and Yasakov 8).

Central Asia's arid climate forces residents to rely on water diversions to support agricultural development and, throughout the past fifty years, "intensive cultivation of new irrigated territories" drove increased water consumption (Gadaev and Yasakov 6). Mostly rice and cotton are grown in this area and the rise in population heightened the need for food and water (Gadaev and Yasakov 6). During the early twentieth century, the Aral region housed between seven and eight million people using over eight million acres of land for agricultural purposes (Gadaev and Yasakov 6). By the early twenty-first century, the population in this zone exceeded fifty million people with irrigated land coverage reaching over 18 million acres, supporting the population with food, a major source of exports, and a stable economy (Gadaev and Yasakov 6).

The Aral Sea produced habitats for 20 types of fish—which were once caught at a rate of 30,000 fish per year—and other varying forms of flora and fauna (Micklin 172). The Amu Darya and Syr Darya, two rivers that provided the Aral Sea with the essential inflow it needed to maintain sustainable levels, were diverted from the water resource to provide for human cultivation, stopping inflow and practically reducing the lake to nothing (Gadaev and Yaskov 6). Hundreds of the region's unique species were lost after the worsening of the lake, which altered the environmental conditions in the surrounding area, the composition of the water through amplified salinity, and the means for survival (Micklin 172). People lost their jobs and were subjected to "a high risk of growth disorders due to a sharp deterioration of the environment" (Micklin 172).

Climate change strengthens the negative impact on the Aral Sea Basin area by amplifying seasonal droughts, enhancing "dryness and heat in the summertime" and causing "longer and colder winters" (Micklin 173). The impacts of more severe weather patterns will likely invite a 10-15% rise in water evaporation and a 10-20% surge in plant transpiration, leading to an "average increase in irrevocable water consumption of 18%" and further amplifying the already significant water withdrawals (Micklin 173).

Attempts to preserve the Aral Sea did not begin until 1993 after the collapse of the Soviet Union and the reformation of the battered economy (Gadaev and Yasakov 9). The International Fund for Saving the Aral Sea (IFAS) was created with the focus being the "improper use of water taken from the Aral Sea Basin and its numerous consequences," but the Central Asian economic state is still too weak to productively restore the lake to its natural efficiency (Gadaev and Yasakov 9). Efforts by all of the Central Asian countries to cooperatively manage the water resource is also lacking, and, coupled with other factors like diversion of water from the Amu Darya and Syr Darya outside of Uzbekistan for hydroelectric dams, there has been very little progress in restoring the Aral Sea (Gadaev and Yasakov 9). It will take extreme determination, collaborative cooperation for restoration solutions, and an extensive amount of time if there is any hope for the revitalization of the Central Asian lake.

5. The Gulf of Mexico, United States

In April 2010, one of the British Petroleum (BP) wellheads exploded from the *Deepwater Horizon* oil drilling platform, leaking over 4.9 million gallons of crude oil into the Gulf of Mexico over the course of three months before it was finally capped (Fitzgerald and Gohlke 1993). Around 2 million gallons of the dispersant Corexit "were used to break up the oil in both subsea and surface applications" (Fitzgerald and Gohlke 1993). While the BP spill, christened the largest oil spill in United States history, only lasted for a total of 87 days, the effects it induced on the Gulf of Mexico continue to haunt the landscape today.

As one of the sixty-four water bodies recognized as a Large Marine Ecosystem by the United States Oceanic and Atmospheric Administration (NOAA) and featuring over 1.5 million kilometers of surface area coverage, there is little dispute over the significance of the Gulf of Mexico to the organisms and ecosystems it houses (Ward and Tunnell, Jr. 1). The coastal shoreline boasts a wide array of vegetated aquatic habitats, including mangroves and seagrasses in the tropical southern region and oyster reefs and salt marshes in the shallow, warmer waters of the northern region (Ward and Tunnell, Jr. 2). The western Gulf contains a highly productive hypersaline lagoon, one of only five worldwide, and the deeper waters in the Gulf contain "[u]nique, recently discovered, and highly diverse habitats" including "chemosynthetic communities and communities of deepwater corals" (Ward and Tunnell, Jr. 2).

These habitats and the many others throughout the Gulf provide extremely important organic matter for trophic support to the Gulf's fauna, enabling coastal organism groupings, valuable fish nursery grounds, and a safe haven from predation (Ward and Tunnell, Jr. 16). The coastal creatures also exhibit numerous feeding strategies that play an important role in varying species' life histories and the conversion of vegetative waste, supporting the trophic dynamics between ecosystems throughout the Gulf (Ward and Tunnell, Jr. 16). Humans are also dependent on the biota and sustenance of the Gulf of Mexico. The three countries surrounding its borders—the United States, Cuba, and Mexico—rely on its waters for social, economic, and "natural system maintenance and regulation" services (Ward and Tunnell, Jr. 15).

Less than two weeks after the spill occurred, fisheries located in the area began announcing emergency closures for seafood safety testing (Fitzgerald and Gohlke 1993). The NOAA, the Food and Drug Administration (FDA), and the five states surrounding the Gulf collaborated to develop more efficient procedures for fishing area closures and eventually reopening sampling areas (Fitzgerald and Gohlke 1993). Meanwhile, the seafood industry took an economic hit. The largest fisheries in the Gulf experienced extreme seafood landing (marine fish catches in ports) decreases—in some cases, up to 60%—and Louisiana fisheries alone expected a three-year revenue loss of up to $172 million (Fitzgerald and Gohlke 1994). Fish residing around the reef introduced another risk. Numerous species living near the reef at the time of the oil spill, even if it was only a temporary phase in their life histories, made the industries that depend on them vulnerable to the aftereffects of the event, whether relating to ecology or public health (Fitzgerald and Gohlke 1994).

The impacts of the oil spill on coral communities were clearly noticed in late October and early November of 2010, where researchers found colonies in the Gulf's central area "partially or completely covered in brown, flocculent material"—later tested and found to be crude oil from the BP *Deepwater Horizon* spill—and demonstrating recent tissue damage (White, et al. 20303). Most of the coral communities demonstrated reactions aligning with stress responses observed in experiments exposing corals to crude oil, including "excessive mucous production and retracted polyps" (White, et al. 20304). Photographs of 43 observed corals were taken for further examination and, based on the percentage of the colonies indicating specified signs of stress, it was concluded that 86% of the corals showed signs of influence from the BP oil spill (White, et al. 20304). Of this percentage, 46% showed damage to at least half of the community and 23% demonstrated damage to at least 90% of the community (White, et al. 20304). Samples studies were observed again on the same coral sites in December and assessed for signs of improvement, but "neither progression of the visible damage nor clear evidence of recovery or growth" could be detected for most of the communities (White, et al. 20305).

After the BP oil spill, the United States government worked to implement new policies and safety regulations that would minimize the chance that it might happen again. It wasn't until 2016—six years after the spill occurred—that revised oil well control plans were unveiled by the Interior Department's Bureau of Safety and Environmental Enforcement (Davenport). The rules outlined "tougher inspection requirements and an overhaul of the government agencies that oversee offshore drilling," describing stricter regulations on blowout preventers (the standard last lines of defense before wellhead explosions), undersea well designs and coat linings, and "real-time monitoring of subsea drilling and spill containment" (Davenport). Although these standards are meant to help, it will require cooperation from the oil companies that drill along the Gulf of

Mexico and government enforcement to ensure that incidents like the *Deepwater Horizon* oil spill remain in the past.

6. The Great Barrier Reef, Australia

The Great Barrier Reef extends for more than 2000 kilometers along Queensland's northeastern coast, housing over 2900 coral reef colonies (Daley, Griggs, and Marsh 586). The ecosystem is the "largest complex of corals and associated species" presently known, in addition to being immensely biologically diverse (Daley, et al. 585). Over the past thirty years, coral communities in Australia's Great Barrier Reef have experienced extensive and detrimental coral bleaching, an event through which the extended warming of ocean water causes stress on the organism and it becomes damaged, often resulting in death (Ainsworth 338). The thermal trauma "disrupts the symbiotic relationship between corals and their algal symbionts," leading to color loss in the corals, and prolonged bleaching can cause mortality (Hughes, et al. 373). In a 2016 survey of 1,156 corals, only about 9% of them were unaffected by bleaching (Hughes, et al. 373). For fast-growing and effective colonizing corals, bleaching recovery could take ten to fifteen years; however, for long-lived coral species to recover, extended absence of disturbing events is required, and it would take many decades (Hughes, et al. 376). Therefore, the Great Barrier Reef's coral structure and population is likely permanently changed due to the recent intense bleaching (Hughes, et al. 376).

The Great Barrier Reef covers 424,000 square kilometers of space and encompasses thirty-five river basins that house approximately 1.1 million people—a number that is quickly increasing (Stoeckl, et al. 115). With growing settlement comes greater urban and agricultural development, which "has generated increased sediment, nutrient, and pesticides loads to the

[Great Barrier Reef] lagoon" and has a verified connection to the degradation of the residing ecosystems (Stoeckl, et al. 115). A 2003 study by the Policy Development Planning Australia produced reports estimating the "gross value of reef-based activities," showing results in six different areas: mineral production ($7.4 billion), tourism ($4.3 billion), agricultural production ($3.2 billion), fisheries ($130.1 billion), recreational activities ($80.7 billion), and the research value of the Great Barrier Reef ($25 million) (Stoeckl, et al. 117). These numbers are likely to have risen over the past fifteen years, but the degradation of the reef's ecosystem and ecological function could pose a threat to future economic advancement.

Research analyses leave little debate over the reason for the exponential growth of coral bleaching in the Great Barrier Reef. Human-induced climate change is increasing the average temperature of the earth and thus the temperature of the oceans. The coral bleaching events seen in the Great Barrier Reef and throughout other parts of the world will only continue to worsen if the ocean's surface temperatures continue to rise (Ainsworth, et al. 338). The Australian government recently introduced a long-term sustainability initiative in response to increasing public concern for the Great Barrier Reef from 2016-2050 (Wolff, et al. 1979). The plan hopes to improve water quality and efficiently control Crown of Thorns Starfish, which will better the ability of the corals to battle global warming (Wolff, et al. 1979). Furthermore, by 2025, the proposal aims to reduce nutrient loading from rivers by 80% since coral reef communities are sensitive to nutrient augmentation (Wolff, et al. 1979).

Part II: Environmental Impacts of Creating Visual Art

After analyzing the effects of human activity on the water resources in each of my drawings, I researched the impact of creating the images as a form of self-reflection. Even in my *attempt to bring awareness to the issue of human-induced climate change and its enhancement of water pollution and water degradation, I contribute to the problem. Oil pastels and paper, which I used to compose my illustrations, both produce waste that harms the environment. The last two images in the series attest to this irony; one depicts a water droplet in toxic pigments and the second shows effluent waste produced at paper mills.*

7. Oil Pastels

Oil pastels, my favorite medium of choice, might be described as a mixture between paint and crayons. Oil pastels are composed using a combination of pigment and a “non-drying mineral oil and wax binder” (Marder). They can be used on practically any type of surface and, when mixed with oil painting media like linseed oil or thinners like turpentine, can take on similar qualities and effects of paint (Marder). The pigments used in pastels and other art media, especially chromate pigments such as zinc yellow and chrome yellow, are hazardous when ingested or inhaled, potentially causing ulcerations on the skin, allergic reactions, and lung cancer (Baylor University). A pigment known as flake white is a “basic lead carbonate,” which can lead to a number of health problems: kidney damage, anemia, gastrointestinal issues, nerve damage, children’s brain damage, and harm to the reproductive system (Baylor University). Furthermore, lamp black and carbon black risk causing skin cancer because of the toxic impurities they contain (Baylor University).

In addition to the toxic pigments, turpentine thinners that are sometimes mixed with oil pastels also contain hazardous chemicals that pose health risks (Local Hazardous Waste Management Program). Liquid turpentine can irritate skin to the touch; inhalation causes vomiting, nausea, difficulty breathing, headaches, and sometimes loss of consciousness; and ingestion could lead to digestive system irritation and kidney injury (Toxicology Data Network). Moreover, pneumonitis can arise if the chemical reaches the lungs, and chronic exposure to turpentine can cause extreme irritation, inflammation, and various diseases in both humans and animals (Toxicology Data Network).

Many of these art tools can be safely disposed of as hazardous waste; however, their toxic impact on the health of the environment will likely cause many more decades of harm. The use of turpentine in solvents and thinners results in “its direct release to the environment via evaporation” (Toxicology Data Network). It can be released into the air and turn to vapor, which will eventually degrade into the atmosphere (Toxicology Data Network). When released into the soil, because it is not readily biodegradable, it often volatizes and, in water, it “is expected to absorb to suspended solids and sediment” (Toxicology Data Network). Since turpentine conforms to whatever landscape it enters, the likelihood that surrounding organisms and ecosystems will be exposed to the chemical in some form are extremely high.

8. Paper

Paper serves as the foundation of my drawings—the base of my artwork to speak out against water contamination. However, not only does the production of paper require immense deforestation, altering the atmospheric composition and enhancing global warming; paper mills also pose environmental risks to the surrounding areas. While the environmental impact the pulp and paper industry has on air, water, and land has been reduced by 80-90% over the past few decades, there remain notable pollutant and human risks from the process (Asghar, Khan, and Mushtaq 1285). Intake of fresh water for the paper making process has declined as industries shifted to “closed water circulation systems;” still, the mills need clean water to operate, which is achieved through water treatment (Shukla, et al. 781).

For every pulp and paper mill, anywhere between 5 and 300 cubic meters of water is consumed “per ton of pulp products,” producing around 2,000 cubic meters of effluent waste each day in an average-sized paper mill (Zodi, et al. 62). The effluents, which are the main source of pollution released by these operations, contain significant amounts of chemical oxygen demand (COD) and total organic carbon (TOC), along with a variety of micropollutants including heavy metals, metalloids, bleaching agents, and organic substances (Zodi, et al. 62). The effluent wastewater that is discharged after the paper making process cannot be easily degraded and is thus problematic to dispose of due to the health and environmental threats it poses (Zodi, et al. 62). Additionally, the wood, groundwater, and recycled paper used in paper mills possess arsenic, a poisonous substance that further contaminates discharged water (Zodi, et al 63).

The growth of coliforms—including *E.coli* and other forms of coli—in the process streams in paper mills raise another area of concern (Long, et al. E150). The grouping of “high temperatures, high carbohydrate levels, low dissolved oxygen levels, and low fixed nitrogen levels” allow coliforms to evolve in paper mill environments (Long, et al. E150). These bacteria are some of the indicators used when evaluating water quality and human health hazards in recreational waters, sometimes causing beach closures and advisory notices in nearby areas (Long, et al. E150). Studies have also shown reduced that water quality negatively impacts the local wildlife, such as fish populations, which often cycles back around as a threat to human wellbeing.

9. The Rhetoric of Water

Each of the images I recreated show an aerial view of a water resource in distress. Interestingly, as I studied my bird's-eye-view photograph selections, I began mentally comparing them to similar images of cells. Cells are a basic life form; every living organism has them; they are necessary for survival—and the same is true for water. Without water, life cannot persist, therefore we *must* care for and protect our water resources. Nonetheless, climate change and its impacts on worldwide water bodies are only getting worse. Why?

The creation of the Environmental Protection Agency in 1970 marked a historic accomplishment for Earth's sustainable future and for environmentalist advocates. The United States government finally opened the discussion to addressing the connection between environmental quality and human health, prompting the establishment of the National Environmental Policy Act (NEPA) (Fiksel, et al. 8717). NEPA's goal was to create " 'conditions under which [humans] and nature can exist in productive harmony, and fulfill the social, economic and other requirements of *present and future generations of Americans*' " (Fiksel, et al. 8717). The federal government needed to implement the values represented by NEPA in four distinct areas: Long-term planning, defined as the fulfillment of each generation's duty "as trustee[s] of the environment for succeeding generations"; Equity, to ensure all Americans have "safe, healthful, productive, and esthetically and culturally pleasing surroundings"; Widespread prosperity, allowing "a balance between population and resource use" to "permit high standards of living and a wide sharing of life's amenities"; and Resource management, which described the enhancement of "the quality of renewable resources" and movement towards "the maximum attainable recycling of depletable resources" (Fiksel, et al. 8717).

So, following the implementation of NEPA, why are our water sources still suffering? I contemplated this question tirelessly throughout my analysis of the drawings I created. In short, our failure to revitalize the earth occurred for many reasons. However, the concept of "wicked problems," first introduced in the 1960s by Horst Rittel, describes one of the largest obstacles surrounding the issue today (McCall and Burge 200). Rittel's theory defines wicked problems as "'that class of problems which are ill-formulated, where the information is confusing, where there are many decision makers and clients with conflicting values, and where ramifications in the whole system are confusing'" (McCall and Burge 200). While reading this explanation, a number of relevant events came to mind: varying media sources that present information in different ways and often inadequately, a split United States government that is struggling to move past the initial argument over whether climate change is real, industries that rely on activities which are proven harmful to the environment for revenue, and many more.

My studies in English rhetoric discussed how the same information can be interpreted differently by different people, so it is important to depict messages clearly and keep the audience's prior knowledge—or lack thereof—in mind. A 2017 article describes studies showing that companies twist certain information to promote this lack of knowledge; that "when faced with a crisis situation, companies choose to highlight positive information and shift the attention away from negative issues" as a form of "risk management" to maintain their reputations (Arora and Lodhia 1287). In doing so, companies distract consumers from the reality of the situation. This tactic is even more impactful if a previous relationship of trust was already established, driving consumers to believe and support the industries. Then, the question of voluntary ignorance comes into play; are consumers justified in trusting industries they've built relationships with to present them with all of the facts, or should they assume there is more to the problem and take further steps to educate themselves? Of course, in some cases, consumers simply do not care and thus would understandably choose not to deepen their knowledge of certain topics.

However, I found another examination that discussed the feedback from consumers after the massive BP spill. Surveys targeting the perceptions of consumers on seafood from the Gulf after the incident showed “broad skepticism about the safety of the Gulf seafood and the veracity of government statements” (Fitzgerald and Gohlke 1993). In August of 2010, a national census revealed that more than half of the respondents “lacked confidence in the safety of Gulf seafood from areas affected by the spill;” later that year, just under half of respondents claimed they would eat less seafood because of the oil spill and 18% claimed they would not consume seafood coming from the Gulf area (Fitzgerald and Gohlke 1993).

I located a 2016 study conducted over the course of three years (2012-2015) by Tulane University analyzing the effects of the BP oil spill on Louisiana residents’ perceptions and consumption of seafood. The researchers found that 50% of participants reported a decrease or change in seafood consumption during the oil spill, but by 2015 these numbers returned to normal (Simon-Friedt, et al. 532). However, more than one-third of participants indicated that they would trust their family, friends, and neighbors the most with information about local seafood, even more so than scientists and government officials and even after over 90% of them listed scientists and officials as most knowledgeable about the subject (Simon-Friedt, et al. 534). These results are rather intriguing because they demonstrate the significance of strong relationships built on a foundation of trust when searching for feedback or finding assistance in the decision-making process.

Myriad studies have strongly supported the notion that anthropogenic climate change is a serious issue and the root of many of the escalating problems we are encountering around the world today. From coral bleaching in the Great Barrier Reef to the disappearance of the Aral Sea to the depletion of the Colorado River, global warming's effects are universal and irrepressible. The effects are already being seen: severe weather events that are greater in number and magnitude, habitat and species declination and extinction, altered atmospheric composition, changing weather and geographical layout due to rising oceans, and many, many more. As long as humans ignore environmental protection ideals and continue to pollute and degrade the planet, humans will also continue to suffer.

I believe the best answer is a complete second-order change in the system; structural reform throughout our culture that requires "new learning and non-linear progression"—a transformation of practices and rewriting of society (Harrison). A second-order change requires extensive amounts of time, money, and national cooperation—a combination I do not foresee under a split government. So, where do we go from here? All we can do is try to build reformation from the inside out; begin small and gradually expand environmental conservation initiatives outward. Many people will listen; many will not. But knowledge through education is invaluable to the progression of both human livelihood and the preservation of the earth, and we must continue to fight for the betterment of the future.

Works Cited

1. The Rhetoric of the Images

Campelo, Adriana, Robert Aitken, and Juergen Gnoth. “Visual Rhetoric and Ethics in Marketing of Destinations.” *Journal of Travel Research*, vol. 50, no. 1, 2011, pp. 3-14.

Davis, Alexandrea. *Lake Erie*. 2018, oil pastel on paper.

---. *Lake Powell*. 2018, oil pastel on paper.

---. *Oil Pastels*. 2018, oil pastel on paper.

---. *Paper*. 2018, oil pastel on paper.

---. *The Aral Sea*. 2018, oil pastel on paper.

---. *The Great Barrier Reef*. 2018, oil pastel on paper.

---. *The Gulf of Mexico*. 2018, oil pastel on paper.

2. Lake Erie, United States

Bosch, Nathan S., Mary Anne Evans, Donald Scavia, and David J. Allan. “Interacting Effects of Climate Change and Agricultural BMPs on Nutrient Runoff Entering Lake Erie.” *Journal of Great Lakes Research*, vol. 40, no. 3, 2014, pp. 581-589.

Johns, Carolyn, Adam Thorn, and Debora VanNijnatten. “Environmental Regime Effectiveness and the North American Great Lakes Water Quality Agreement.” *International Environmental Agreements: Politics, Law, and Economics*, vol. 1, no. 1, 2018, pp. 1-19.

Michalak, Anna M., et al. “Record-Setting Algal Bloom in Lake Erie Caused by Agricultural and Meteorological Trends Consistent with Expected Future Conditions.” *Proceedings of the National Academy of Sciences of the United States of America*, vol. 110, no. 16, 2013, pp. 6448–6452.

Watson, Susan B., et al. “The Re-Eutrophication of Lake Erie: Harmful Algae Blooms and Hypoxia.” *Harmful Algae*, vol. 56, 2016, pp. 44-66.

3. Lake Powell, United States

Myers, Tom. “Loss Rates from Lake Powell and their Impact on Management of the Colorado River.” *Journal of the American Water Resources Association*, vol. 49, no. 5, 2013, pp. 1213-1224.

Pratson, Lincoln, et al. “Timing and Patterns of Basin Infilling as Documented in Lake Powell During a Drought.” *Geology*, vol. 36, no. 11, 2008, pp. 843-846.

Udall, Bradley and Jonathan Overpeck. “The Twenty-First Century Colorado River Hot Drought and Implications for the Future.” *Water Resources Research*, vol. 53, no. 3, March 2017, pp. 2404-2418.

4. The Aral Sea, Kazakhstan and Uzbekistan

Gadaev, Abror and Zikrilla Yasakov. “An Overview of the Aral Sea Disaster.” *Social Problems and Public Policy*, vol. 20, 2012, pp. 5-15.

Micklin, Philip, et al. *The Aral Sea: The Devastation and Partial Rehabilitation of a Great Lake*, Springer Berlin Heidelberg, 2014.

5. The Gulf of Mexico, United States

Davenport, Coral. “U.S. Issues New Rules on Offshore Oil and Gas Drilling.” *The New York Times*, 14 April 2016, https://www.nytimes.com/2016/04/15/us/politics/us-issuesnew-rules-on-offshore-oil-and-gas-drilling.html.

Fitzgerald, Timothy P. and Julia M. Gohlke. "Contaminant Levels in Gulf of Mexico Reef Fish after the *Deepwater Horizon* Oil Spill as Measured by Fishermen-Led Testing Program." *Environmental Science and Technology*, vol. 48, no. 3, 2014, pp. 1993-2000.

Ward, C. Herb and John W. Tunnell, Jr. "Chapter 1: Habitats and Biota of the Gulf of Mexico: An Overview." *Habitats and Biota of the Gulf of Mexico: Before the Deepwater Horizon Spill: Volume 1: Water Quality, Sediments, Sediment Contaminants, Oil and Gas Seeps, Coastal Habitats, Offshore Plankton and Benthos, and Shellfish*, Springer, 2017, pp. 1-54.

White, Helen K., et al. "Impact of the Deepwater Horizon Oil Spill on a Deep-Water Coral Community in the Gulf of Mexico." *Proceedings of the National Academy of Sciences of the United States of America*, vol. 109, no. 50, 2012, pp. 20303-20308.

6. The Great Barrier Reef, Australia

Ainsworth, Tracy D., et al. "Climate Change Disables Coral Bleaching Protection on the Great Barrier Reef." *Science*, vol. 352, no. 6283, 2016, pp. 338-42.

Daley, Ben, Peter Griggs, and Helene Marsh. "Reconstructing Reefs: Qualitative Research and the Environmental History of the Great Barrier Reef, Australia." *Qualitative Research*, vol. 8, no. 5, 2008, pp. 584-615.

Hughes, Terry P., et al. "Global Warming and Recurrent Mass Bleaching of Corals." *Nature*, vol. 543, 2017, pp. 373-377.

Stoeckl, Natalie, et al. "The Economic Value of Ecosystem Services in the Great Barrier Reef: Our State of Knowledge." *Annals of the New York Academy of Sciences*, vol. 1219, 2011, pp. 113-133.

Wolff, Nicholas H., et al. "Vulnerability of the Great Barrier Reef to Climate Change and

Local Pressures." *Global Change Biology*, vol. 24, no. 5, 2018, pp. 1978-1991.

7. Oil Pastels

Marder, Lisa. "Oil Pastels and Oil Sticks: Characteristics and Uses." *Thoughtco,* 6 March 2017, https://www.thoughtco.com/oil-pastels-and-oil-sticks-characteristics-4051831.

"Painting and Pastels." *Local Hazardous Waste Management Program*, 2018, http://www.hazwastehelp.org/ArtHazards/Painting.aspx.

"Section 10: Painting and Drawing." *Baylor University: Environmental Health and Safety*, https://www.baylor.edu/ehs/index.php?id=94372.

"Turpentine." *Toxicology Data Network,* 2015, https://toxnet.nlm.nih.gov/cgi-bin/sis/search/a?dbs+hsdb:@term+@DOCNO+204.

8. Paper

Asghar, Mohammed Nadeem, Shahbaz Khan, and Shahbaz Mushtaq. "Management of Treated Pulp and Paper Mill Efffluent to Achieve Zero Discharge." *Journal of Environmental Management*, vol. 88, no. 4, 2008, pp. 1285-1299.

Long, Sharon, et al. "Characterizing Paper Mill Effluent Using Indicators and Source Tracking Methods." *American Water Works Association*, vol. 104, no. 3, 2012, pp. E150-E161.

Shukla, Sudheer, et al. "Combining Activated Sludge Process with Membrane Separation to Obtain Recyclable Quality Water from Paper Mill Effluent." *Clean Technologies and Environmental Policy,* vol. 17, no. 3, 2015, pp. 781-788.

Zodi, Salim, et al. "Electrocoagulation as a Tertiary Treatment for Paper Mill Wastewater: Removal of Non-Biodegradable Organic Pollution and Arsenic." *Separation and Purification*

Technology, vol. 81, no. 1, pp. 62-68.

9. The Rhetoric of Water

Arora, Mitali P. and Sumit Lodhia. "The BP Gulf of Mexico Oil Spill: Exploring the Link Between Social and Environmental Disclosures and Reputation Risk Management." *Journal of Cleaner Production*, vol. 140, no. 3, 2017, pp. 1287-1297.

Fiksel, Joseph, et al. "EPA at 40: Bringing Environmental Protection to the 21st Century." *Environmental Science and Technology*, vol. 43, no. 23, 2009, pp. 8716-8720.

Fitzgerald, Timothy P. and Julia M. Gohlke. "Contaminant Levels in Gulf of Mexico Reef Fish after the *Deepwater Horizon* Oil Spill as Measured by Fishermen-Led Testing Program." *Environmental Science and Technology*, vol. 48, no. 3, 2014, pp. 1993-2000.

Harrison, Ian. "First and Second Order Change." *The Open University*, 31 July 2016, https://learn1.open.ac.uk/mod/oublog/viewpost.php?post=178202.

McCall, Raymond and Janet Burge. "Untangling Wicked Problems." *Artificial Intelligence for Engineering Design, Analysis and Manufacturing*, vol. 20, no. 2, 2016, pp. 200-210.

Simon-Friedt, Bridget R., et al. "Louisiana Residents' Self-Reported Lack of Information Following the *Deepwater Horizon* Oil Spill: Effects on Seafood Consumption and Risk Perception." *Journal of Environmental Management*, vol. 180, 2016, pp. 526-537.