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The Most Environmentally Beneficial Option: An Analysis on sPower's Solar Project in relation to the Endangered Species Act

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Spotsylvania Solar Farm: Watershed Environmental Analysis

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Abstract

Today, the current impacts of high greenhouse gas emissions due to energy production have been widely discussed in scholarly literature. In 2018, the University of Richmond (UR) announced a goal to match 100% of the campus' electricity demand with solar energy to decrease its carbon footprint. UR partnered with sPower to construct a 500-megawatt solar array in which UR will receive the 20-megawatts worth of energy from the site in Spotsylvania, Virginia. sPower's solar project engendered various environmental concerns surrounding Fawn Lake and the endangered species found in the proximity of the project. Acknowledging the environmental concerns, the objective of this project was to examine if sPower's solar power project is in violation of the Endangered Species Act of 1973. The aims of this project were to analyze the complex issue from a lens of political ecology, which strives to find answers that promote economic prosperity and environmental sustainability while considering the voices of all stakeholders and communities involved. The study consisted of constructing a series of infographics that bridge gaps between the scientific, social, and political perspectives. These short graphic explanations allow for a holistic analysis to be completed before drawing conclusions to the question. Results show that sPower's project cannot be considered to be in violation of the Endangered Species Act, given their consultations with the United States Fish and Wildlife Services and subsequent approval for the project.

Background

Introduction

In recent decades, the current and future impacts of high greenhouse gas (GHG) emissions have been widely discussed on an international and national level. Due to the global dependency on fossil fuels to such as coal, oil and natural gas, to produce energy, the global market has emitted large amounts of GHGs into the atmosphere. To mitigate the dependency on fossil fuels for energy, many industries and individuals have begun to transition to the use of renewable energy, specifically solar and wind. In 2018, the United States (U.S.) generated approximately 2% of the nation's energy off solar panels (Wiser, Barbose, & Holt, 2011). While the number seems minute, various companies and individuals are investing in solar for the future net benefits and the hope to mitigate environmental harm.

For instance, in 2018, the University of Richmond (UR) announced a goal to match 100% of the campus' electricity demand with solar energy (Andrejewski, 2019). To achieve this goal, UR partnered with sPower to construct a 500-megawatt solar array, in which UR will receive 20-megawatts worth of energy from the site in Spotsylvania, Virginia (Andrejewski, 2019). On April 15, 2019, the Spotsylvania Board of Supervisors approved the construction of the solar array (Ludt, 2019); however, since the proposal of the project in 2017, concerned citizens of Spotsylvania heavily contested the project due to their environmental, political, economic, and social concerns. The Concerned Citizens of Spotsylvania group is a grass roots group of homeowners in the area who have concerns about sPower's solar power plant in the county (Concerned Citizens of Spotsylvania, 2019).

The Concerned Citizens of Spotsylvania worry that the solar panels will harm the environment, specifically the area of Fawn Lake, because of potential toxins that the panels may

emit or erosion that could occur. Additionally, citizens feared the noise pollution that the solar power array could bring. To disprove fears and abide by regulation, sPower conducted various analyses such as a preliminary environmental analysis for a special use permit (SUP). Through the environmental analysis, it was discovered that various endangered and threatened species were located near the project and could be affected by the solar power project. Given the presence of endangered and threatened species and environmental concerns of the solar project, this paper seeks to examine if sPower's solar project is a violation of the Endangered Species Act of 1973.

To examine if sPower's solar project is in violation with the Endangered Species Act (ESA) of 1973, it is necessary to first define the framework of political ecology which is used to analyze sPower's solar project in Spotsylvania in relation to the ESA. This analysis will examine how this ideology requires study of various perspectives to make a sustainable decision for the future~~s~~ economy and communities. Next, the methods used to gather and portray the information throughout the research process to arrive at the conclusions will be examined and outlined. Then, under the methods outlined, there will follow an analysis each aspect that is required to answer whether sPower's solar project is in violation with the ESA, dividing it among the following sections: the Endangered Species Act of 1973, Endangered Species: Dwarf Wedgemussles, and sPowers project in relation to the endangered species and social desires. Lastly, after covering the nuances of each issue subset, each subset will be organized to explore the complexity of how the sPower solar site is might be in violation of the ESA. sPower's solar power project is extremely complex and while analyzing it from various perspectives, a straightforward answer may not be derived.

Literature Review

When approaching environmental issues today, one must confront political, economic, and social issues, given strong interconnection between fields. Due to the multifaceted nature of environmental issues, it is imperative to have a similar approach when exploring the issues at hand and proposing solutions. To successfully attempt to answer if sPower's solar power project in a violation of the Endangered Species Act and if so, should the solar project be continued or stopped, a political ecology theoretical approach can be employed given its all-encompassing framework of political, economic, social, and environmental issues.

Jenkins (2016) drew upon the definitions of political ecology from scholars McCarthy (2002), Schroeder, Martin and Albert (2006), who defined political ecology as an analytical approach that assess the "themes related to rural land use conflict and access to resources including community-based resource management, the question of competing scientific and lay knowledge systems, and intersecting processes of social and environmental marginalization" particularly in first-world applications (pg. 183). Other scholars have conjectured that in political ecology costs and benefits associated with environmental change are distributed unequally, and unequal distribution inevitably reinforces existing political, social, and economic inequalities (Bryant and Bailey 1997). An analytical political ecology approach requires seeking questions that consider the various stakeholders involved in a situation. A political ecology approach strives to find answers to questions that promote economic prosperity and environmental sustainability while considering the voices of all stakeholders and communities involved. Political ecology challenges the norms of how wicked problems are assessed and offers feedback that comes with trade-offs, given the extensive research put in to understand the problem at hand.

In Spotsylvania, the Dwarf Wedgemussel (*Alasmidonta heterodon*) and the Yellow Lance Mussel (*Elliptio lanceolate*) inhabits bodies of water near the sPower solar power project sites (Katie Crum; PWS; CPWD; Kimley-Horn and Associates, Inc., 2018). Given the proximity to endangered species, a conservationist would look towards the ESA signed into effect on December 28, 1973. The ESA was designed to protect species from extinction as a "consequence of economic growth and development untampered by adequate concern and conservation" (U.S. Fish & Wildlife Service, 1973). In the ESA § 3(5)(A), 16 U.S.C. and ESA § 1532(5)(A) defines critical habitat as:

> "[T]he specific area within the geographical area occupied by the species *** on which are found these physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection," AND "[S]pecific areas outside the geographical area occupied by the species *** [if] such areas are essential for the conservation of the species."

According to the ESA, the area of Spotsylvania can be considered critical habitat and must be protected for the conservation of the endangered mussels.

The current community members of Spotsylvania have apprehensions about the solar power project due to the perceived environmental impact that it will have during and after construction. Citizens believe that the solar panels will release toxic elements such as cadmium (Cd) into the environment, which will ruin the integrity of the land, as well as home endangered species such as the Dwarf Wedgemussel and Yellow Lance Mussel. The concern citizens would rather use the land for development that would bring revenue into the community, instead of a solar power project. However, other communities such as the industries who are funding the project, like UR and Microsoft, see the solar power project as an opportunity to achieve carbon

neutrality and lower GHG emissions. To the stakeholders and communities, the solar power project will bring environmental prosperity and aid in the nation strides to combat climate change. Overall, there are various stakeholders that want environmental prosperity, which could come in many forms such as solar power or panels, or the protection of endangered species without the project at all.

Following a political ecology approach, requires consideration of the ecological, political and economic impacts to be considered, alongside community perspectives. Not only must it be asked and answered if the project is in violation of the ESA, but how the answer to the answer promotes economic and environmental sustainability, and political and community welfare. Additionally, there remains the question of whether the advancement of such mussels is more environmentally critical than having lowered greenhouse gas emissions if economically viable, and most importantly, whether the project is more socially accepted. Therefore, using a political ecology framework will better inform and allow us to understand the decisions that policymaker and county boards have make about the natural environment in the context of their political environment, economic pressure, and societal regulations.

Methods

This paper will explore whether sPower's solar power project is a violation of the Endangered Species Act, and if so, whether the solar project be continued or stopped. The methods used to arrive at the conclusions in this piece are a mixture of analysis of quantitative and qualitative data. Drawing from a variety of current newspapers, photographs, scholarly articles, and pieces of legislation provides insight on various perspectives of sPowers project in relation to the ESA. Specifically, documents from sPower and the citizens of Spotsylvania lend a

more holistic perspective on how the solar power project will impact the endangered species in the area.

Once all documents and various perspectives on how the endangered mussel species could be impacted by the solar panel project in Spotsylvania, were examined, various infographics were completed to better explain all the information gathered. Given the complexity of the project, infographics were made to synthesize the information in an understandable way. Additionally, due to the variety of stakeholder involvement and documents required to understand the entirety of the relationship between endangered species in the solar power project, infographics were made to effectively communicate the information to various individuals. The infographics were made to explain all components of the ESA in relation to the solar power project while answering the question if sPowers solar panel project is under violation of the ESA.

Results

Graphic 1

All plants, animals, and insects can provide economic, ecological, and intangible value to the world. Species of plants, animals, and insects can provide economic value and stability through diversifying the gene pool, which ensures commercial products for society, such as medicine and agricultural resources (Republican Policy Committee, 2018). Varieties of species and natural habitats also bring large amounts of revenue through recreational activities such as tourism. Most importantly, various species can act as environmental monitors. When an animal is an environmental indicator, they can provide context and information to the biological and chemical quality of the overall environment, which is especially helpful with the world undergoing climate change. For the pubic, it is also imperative that they understand the importance of endangered species, particularly in Virginia. In the state of Virginia as of July

2016, there were approximately 50 endangered species and 19 threatened species. It is projected that there will be an additional 61 to 80 new endangered species and threatened species in Virginia by the year 2023 (Republican Policy Committee, 2018). These projections show the urgency for protecting the endangered species in Virginia.

To protect, conserve, and restore any species that were found endangered or threatened, the ESA of 1973, was created (U.S. Fish & Wildlife Service, 1973). The ESA aids in maintaining biodiversity to ecosystems and encourages agencies and individuals to consider their environmental impact. The ESA documents have various regulations which are explained in a legalistic and dense manner. Given the density of the ESA, it was decided to only draw from the sections that were applicable to the sPower solar panel project and display that information in the form of infographics for the public and other stakeholders to understand. The most important sections of the endangered species act were section 2(b), section 3(5)(a), Section 7 (2) (a), and section 10 (1) (a) (b). They are all listed below:

> ESA § 2(B) "PURPOSES.—The purposes of this Act are to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved, to provide a program for the conservation of such endangered species and threatened species, and to take such steps as may be appropriate to achieve the purposes of the treaties and conventions set forth in subsection (a) of this section." (U.S. Fish & Wildlife Service, 1973)

> ESA § 3(5)(A)"[T]he specific area within the geographical area occupied by the species *** on which are found these physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection," AND "[S]pecific areas outside the geographical area occupied by the

species *** [if] such areas are essential for the conservation of the species." (U.S. Fish & Wildlife Service, 1973)

ESA § 7(2)(A) "Each Federal agency shall, in consultation with and with the assistance of [FWS or NMFS], insure that any action authorized, funded, or carried out by such agency . . . is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of [critical] habitat . . ." (U.S. Fish & Wildlife Service, 1973)

ESA § 10(1)(A) (B) "PERMITS.—(1) The Secretary may permit, under such terms and conditions as he shall prescribe— (A) any act otherwise prohibited by section 9 for scientific purposes or to enhance the propagation or survival of the affected species, including, but not limited to, acts necessary for the establishment and maintenance of experimental populations pursuant to subsection (j); or (B) any taking otherwise prohibited by section 9(a)(1)(B) if such taking is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity." (U.S. Fish & Wildlife Service, 1973)

Section 2 sets the framework of the entire ESA as it outlines the purpose of the act, which is to protect species from economic growth and human activities. It is imperative properly explain the importance of the ESA, to understand it in the context of sPower's project. sPower's three solar panel sites are considered human activities that can potentially provide economic growth for community members and the investors of the project, while harming the endangered species. Therefore, consideration for the endangered species is required as stated in the ESA.

Section 3 defines the term critical habitat, which are areas of land that are home to endangered or threatened species, and if so, must be conserved. During the preliminary

environmental analysis, when focusing on the endangered species, it was found that there was no critical habitat in the proposed area of the solar power project. Instead, the U.S. Fish and Wildlife Services found that the endangered species of mussel were in jeopardy of "adverse modifications" to their habitat due to the potential erosion and chemical pollutants that can flow downstream of the site. By abiding by section 7, which requires agencies to consult with the U.S. Fish and Wildlife Services, sPower had to consider their environmental impact and assure they would mitigate to the best of their ability, any harm to the mussels or land itself. sPower received with a SUP after planning how they would conserve the land and species near the sites. Section 10 of the ESA and other legislation in place that allowed for sPower to receive permits for construction. These various components of the ESA are vital in understanding the act in relation to sPower's solar project.

Graphic 2

Dwarf Wedgemussels have been on the endangered species list since 1990 (U.S. Fish & Wildlife Services, 2018). They are found in streams and rivers of Connecticut, Maryland, Massachusetts, New Hampshire, New Jersey, New York, North Carolina, Pennsylvania, Vermont, and Virginia (U.S. Fish & Wildlife Services, 2018). The Dwarf Wedgemussel is a freshwater mussel that is no larger than 1.5 inches in length. Dwarf Wedgemussels are filter feeders for the river and stream ecosystems they are found in (Michaelson & Neves, 1995). A filter feeder is an animal that feeds on suspended matter and food particles from the water. Dwarf Wedgemussels tend to live in clean smaller streams and rivers, that have higher concentrations of dissolved oxygen (Michaelson & Neves, 1995). Dwarf Wedgemussels are important for the environment as they are filter-feeders, which mean they feed on particulates in the water. The presence of filter feeders in marine ecosystems is imperative for their integrity and stability, as

filter feeders help regulate the water quality of the environment. Additionally, Dwarf Wedgemussels can act as environmental monitors, as they respond to changes in water temperature, which can help track ecological changes in streams and rivers.

Dwarf Wedgemussels are sensitive to polluted waters with chemicals, sediment or nutrients. A disturbance in the quality of water can cause the mussels life cycles to weaken and, in some cases, die completely (Michaelson & Neves, 1995). Given the sensitivity of the Dwarf Wedgemussel, most agencies constructing near the mussel's habitat, adopt plans to protect and conserve mussel population. Agency plans include installation of buffers zone such as trees to mitigate runoff of sediment and other chemicals, moving their projects ever so slightly, so they do not impact the mussels, and some implement strict control standards upstream of mussel sights to control pollution. While Dwarf Wedgemussels have been listed as an endangered species for the past 10 years and are found throughout various states in North America, there have not been any nation-wide or large-scale conservation plans developed for the species (U.S. Fish & Wildlife Services, 2018). Instead, there have been small-scaled plans developed by agencies to mitigate harm to the Dwarf Wedgemussel; however, very few are open for public use.

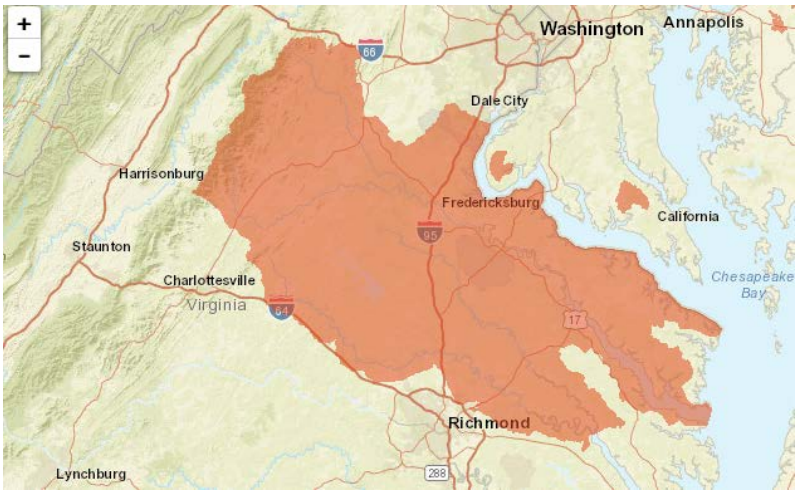

Figure 1. The map above depicts where Dwarf Wedgemussels are in the state of Virginia. (U.S. Fish & Wildlife Services, 2018)

Figure 1 illustrates that Dwarf Wedgemussels are widely found throughout the state of Virginia, including Spotsylvania, where the solar power sites are to be constructed. Given the importance of the Dwarf Wedgemussel and the lack of conservation plans currently out there, sPowers must consider the negative impacts their project could have on the species.

Graphic 3

Given the presence of the endangered Dwarf Wedgemussel and the Yellow Lance mussel in Spotsylvania, near sPower solar power project, it was required for sPower to consult with the U.S. Fish and Wildlife Services according to the ESA. Through consultation with the U.S. Fish and Wildlife Services, sPower had to consider their impacts on the surrounding environment and provide plans on how they will conserve the environment, particularly, the Dwarf Wedgemussels and other endangered and threatened species in the area (Katie Crum; PWS; CPWD; Kimley-Horn and Associates, Inc., 2018). After analyzing studies, it was found that the Yellow Lance Mussel was not present in major sites of interest; therefore, the Yellow Lance Mussel is not a major focus of the project.

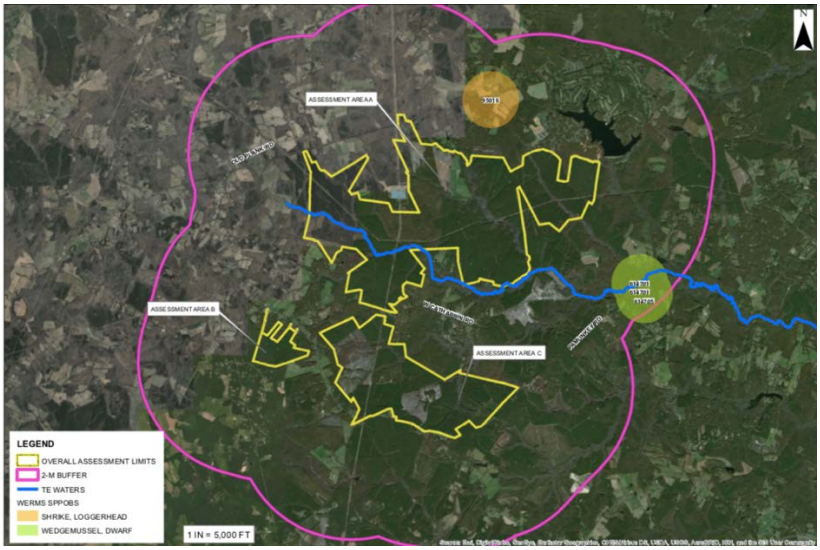

Figure 2. The map above depicts the zoned area (outlined in yellow) for sPower's solar project. The blue line signifies the Poe river which is classified as endangered and threatened waters due to the presence of the endangered Dwarf Wedgemussel (signified by the green circle). Given their position downstream, any runoff of materials from sPower's solar panel sites can affect the endangered mussels. (Katie Crum; PWS; CPWD; Kimley-Horn and Associates, Inc., 2018)

As illustrated on figure 2, the endangered Dwarf Wedgemussels are located downstream of the sPower sights. Since the mussels are found downstream and the solar panels will be at a higher elevation, the mussel's habitat is in jeopardy of being polluted by the sediments and potential elements, such as cadmium. After research conducted by sPower, it was found that the solar panels were to contain small amounts of Cadmium Telluride (CdTe), not just pure cadmium. Research on CdTe for solar power panels show that it is a non-toxic chemical to use. When cadmium is combined with tellurium, it is converted into a stable and non-volatile chemical compound (Kaczmar, 2011). Additionally, CdTe is insoluble in water and has a low evaporation rate and low vapor pressure, which makes CdTe an attractive clean energy alternative (Kaczmar, 2011). If the solar panels were to break, which is a very unlikely case, the amount of CdTe found in the solar panels would have negligible impact of the environment (Kaczmar, 2011). Therefore, there would be little to no harm to the mussels and other endangered or threatened species found in the vicinity of the solar power project.

Another concern for sPowers solar power project was the increase amounts of erosion that would occur when they cleared out the land to place the solar panels. Increased erosion would harm the Dwarf Wedgemussels and the natural environment. To mitigate the impacts of erosion, sPower has planned to recruit local companies to remove the excess mulch or sediments that is produced through construction (sPower, 2018). Additionally, sPower plans to use the best management practice for erosion controls, such as the use of drill seeding, mulch removal, fiber matting, super silt fencing, swales, retention basins (sPower, 2018). The listed erosion controls will not only ensure safety for the endangered Dwarf Wedgemussel, but the community and other species located in the Po River.

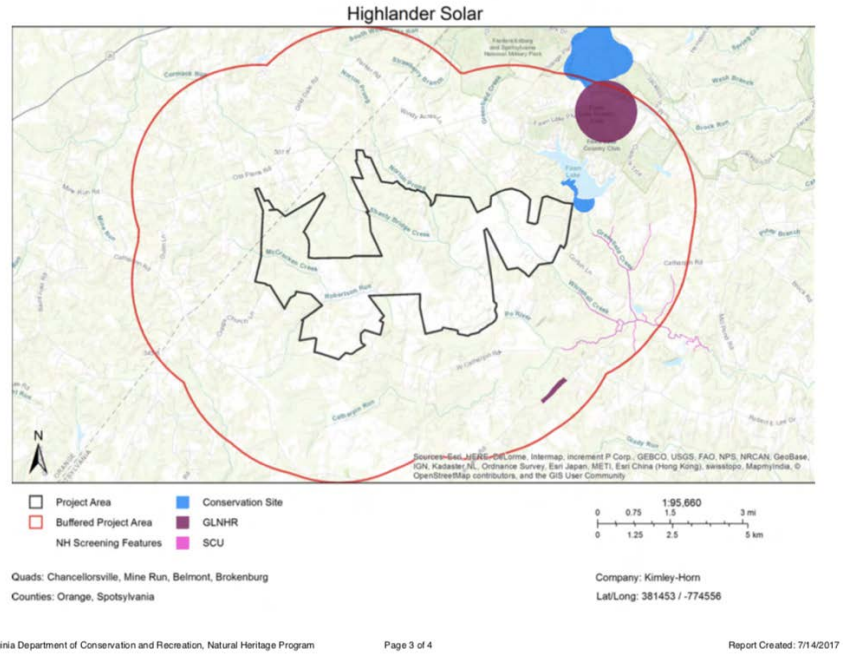

Figure 3. The map above shows the conservation sites in relation to one of sPower's solar sites in Spotsylvania. (Katie Crum; PWS; CPWD; Kimley-Horn and Associates, Inc., 2018)

The U.S. Fish and Wildlife Services did acknowledge that there are conversation sites near the solar power sites (Katie Crum; PWS; CPWD; Kimley-Horn and Associates, Inc., 2018); however, sPower has planned to place natural spaces and buffers to preserve the integrity of the natural spaces (sPower, 2018). Overall, the U.S. Fish and Wildlife Services saw that there was no critical habitat that needed to be protected and that if sPower took the steps to conserve and protect the environment and species near their project, the solar power project would have minimal impact to endangered and threatened species (Katie Crum; PWS; CPWD; Kimley-Horn and Associates, Inc., 2018). On April 15, 2019, the Spotsylvania Board of Supervisors approved the construction of the solar array. The board of supervisors and all agencies involved in examining the project saw minimal environmental harm created by the construction of the solar arrays (Ludt, 2019).

If the sPowers solar power project was not approved, the citizens of Spotsylvania still had it on their agenda to develop the land. It was suggested by the citizens of that the land could be

used for gas stations, housing, or other market options because it would bring more revenue to the community. However, such developments would have larger impacts on the environment and endangered or threatened species in the area. For instance, gas stations could result in runoff of petroleum which could deteriorate the water quality of the Po River and harm the Dwarf Wedgemussels or any wetlands in the area. Another option for the development of the area would be housing. Housing developments would have increased sediment runoff and nutrient runoff from lawns in the area. In this case, the Dwarf Wedgemussel and other species could be at risk of exposure to eutrophication and dead zones.

Overall, the projects that the citizens of Spotsylvania wanted to have in place of sPowers project would have had similar, if not more environmental impact. In the end, the U.S. Fish and Wildlife Services saw no large impacts on the environment or the endangered species in the area; therefore, sPowers solar power project is not in violation of the ESA (Katie Crum; PWS; CPWD; Kimley-Horn and Associates, Inc., 2018).

Discussion

Conclusion

This paper synthesizes the various perspective that are used to analyze the sPower solar power project in relation to the ESA. The contents of this paper present challenges one to consider what parts of the environment must be protected and hold the most importance. At the root, the question “is sPower’s solar power project a violation of the ESA”, is really a question of is mitigating GHG’s more important than the livelihood of endangered and threatened mussels. sPower’s solar project has the potential to abate the use of fossil fuels for UR and other companies that support the sPower project. Lessening the dependency on fossil fuels will help the environment as it will decrease the amount of GHG’s emitted, along with provide long-term

economic benefits and a sustainable future for generations to come. However, are the benefits of the solar power project more important than the benefits the mussels can bring to the environment? While studies shown that the project should have little to no impact on the environment, there is still the possibility of the mussels being harmed throughout this project.

The contents of this paper also force one to consider, what is the best use of land? Given the concerns of the Spotsylvania citizens, to maintain the integrity of the land, sPowers solar power project would seem to be the best use of the land since it will have little to no impact on the environment. However, the citizens of Spotsylvania see that other development would be better for the community. The varying desire add to the complexity of the project because it is now a question of community prosperity and environmental prosperity. Another dimension when considering prosperity of the community is considering proximity. Should UR and the other investors of the project considered in the community that has a say of how to use the land? Additionally, should and how can the environment have a voice in this matter?

While it may seem by deciding to forward sPower's solar project, on April 15th, 2019, that mitigating GHG's is the more important environmental concern and that the investors have a say how to use the land, the questions above are subjective and dependent on a case by case basis. The most important aspects of this paper were to provide the tools to analyze similar cases like this in the future. Currently, sPower's solar project is the biggest solar site East of the Rocky Mountains; however, due to the global need to mitigate GHG emission, sPower's project may not be the last big renewable site constructed. There is a growing need for stakeholders to have the tools to demonstrate an analytical processes, that explores multiple perspectives that achieve social, ecological, political, and economic sustainability. The need for such analytical processes

is why the framework of political ecology was used to construct the infographics. The world needs multiple perspectives when approaching such issues.

Additionally, the infographics served to bridge gaps between stakeholders. Environmental law and policy can be dense and difficult to comprehend for community members and scientists alike. Similarly, scientific research papers and studies are dense and difficult for community members and other stakeholders to understand. The goal when exploring the ESA in relation to sPowers solar panel project was to bridge gaps between stakeholders and allow varying perspectives to be demonstrated simple infographics. The infographics were an easy tool to use for others to understand. Currently, we must tackle the problems of climate change, which are not just biological issues, but political, economic, and social issues. The world must learn how to effectively bridge the gap approach between disciplines and perspectives to approach problems in a multifaceted way. By doing so, not only will future environmental analyses become stronger and more accessible; however, they will become more effective in providing the multifaceted change that this world needs to thrive and survive.

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