

**COASTAL RESIDENTS' PERSPECTIVES ON ENVIRONMENTAL  
HEALTH RISK FACTORS: ANALYSIS USING CULTURAL THEORY AND  
DELIBERATIVE DISCUSSION**

**A thesis submitted in partial fulfillment of the requirements for the degree**

**MASTER OF SCIENCE**

**in**

**ENVIRONMENTAL STUDIES**

**by**

**MELTON LEE BUNDRICK JR.**

**APRIL 2019**

**at**

**THE GRADUATE SCHOOL OF THE UNIVERSITY OF CHARLESTON,  
SOUTH CAROLINA AT THE COLLEGE OF CHARLESTON**

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**ABSTRACT**

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The aim of this project was to study the perception of environmental health risks among coastal South Carolina residents and the effect of cultural worldview and deliberative discussions on their perception of risks. Risk perceptions were analyzed through a survey administered to state and coastal residents in the fall of 2017 and included questions regarding cultural worldview and information based on location. Survey data were also compared before and after a deliberative forum to assess whether and how an individual's perception of risks changed as a result of the forum. In this forum, coastal residents were educated by expert scientists on environmental issues and were later able to deliberate on the issues with fellow coastal residents to find solutions and seek strategies to mitigate environmental health risks. Qualitative data analysis was also conducted on 15 transcripts of group discussions during the forum through the use of open coding to identify themes and topics within conversations throughout the deliberations. The mixed-method approach used provides insights into how coastal residents perceive environmental health and factors which influence health risks. Data suggest an egalitarian cultural worldview and location of residence are significant factors for determining an individual's risk perception concerning factors influencing environmental health. The group discussions suggest that cultural worldview plays a role in risk perception through the process of placing weights on social, economic and environmental factors within a community. Further studies such as this one should include a diverse group of participants in order to ensure a variety of perspectives enter the deliberations. Deliberations such as these can in turn be used to better inform decision-makers about how residents perceive environmental health risks and provide policy recommendations based on common ground found amongst a diverse citizenry.



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# Table of Contents

<b>Abstract</b> .....	<b>i</b>
<b>Acknowledgements</b> .....	<b>iii</b>
<b>Table of Contents</b> .....	<b>v</b>
<b>List of Figures</b> .....	<b>vii</b>
<b>List of Tables</b> .....	<b>viii</b>
<b>Chapter 1 Introduction</b> .....	<b>1</b>
<b>Chapter 2 Cultural Theory of Risk</b> .....	<b>9</b>
2.1 <i>Cultural Theory of Risk</i> .....	10
2.1.1 Cultural Types .....	12
2.1.2 Geographic Location and ‘Sense of Place’ .....	16
2.2 <i>Methods</i> .....	18
2.3 <i>Results</i> .....	23
2.3.1 Support for Coastal Policy .....	23
2.3.2 Coastal Environmental Health Concerns .....	26
2.3.3 Environmental Health Categories.....	29
2.4 <i>Discussion</i> .....	31
2.4.1 Egalitarian and Hierarchical Scales .....	31
2.4.2 Individualist and Fatalist Scales .....	34
2.4.3 Cultural Theory as a Whole .....	36
2.4.4 Location Based.....	38
<b>Chapter 3 Deliberative Discussion</b> .....	<b>42</b>
3.1 <i>Deliberative Discussion</i> .....	43
3.2 <i>Methods</i> .....	46
3.3 <i>Results</i> .....	52
Survey Responses .....	52
Deliberative Discussion.....	53
3.4 <i>Discussion</i> .....	60
3.4.1 Biodiversity .....	60
3.4.2 Chemical Contamination .....	62
3.4.3 Development .....	66
3.4.4 General Risk Perceptions and Synthesis .....	72
<b>Chapter 4 Conclusion</b> .....	<b>76</b>
<b>Bibliography</b> .....	<b>85</b>
<b>Appendices</b> .....	<b>98</b>

*Appendix A.1 - Pre-Forum Survey* ..... 99

*Appendix A.2 - Questions From Pre-Forum Survey Related to Environmental Health Risk Factors*..... 110

*Appendix B - Codebook*..... 111

*Appendix C - Transcription Coding Records*..... 119

*Appendix D - Institutional Review Board Letter*..... 127

## List of Figures

<b>Figure 1</b> Four scales of cultural theory.....	<b>13</b>
<b>Figure 2</b> Group Comparisons of Transcript Code Counts.....	<b>57</b>

## List of Tables

<b>Table 1</b> Environmental Health Risk Factor Survey Questions.....	<b>19</b>
<b>Table 2</b> Cultural Theory Questions From State Survey.....	<b>21</b>
<b>Table 3</b> OLS Estimates of Coastal Policies.....	<b>24</b>
<b>Table 4</b> OLS Estimates of Coastal Health Concerns.....	<b>28</b>
<b>Table 5</b> Linkages between codes and survey questions.....	<b>50</b>
<b>Table 6</b> Paired T-test of Environmental Health Factors.....	<b>53</b>
<b>Table 7</b> Descriptive analysis of group transcript coding.....	<b>55</b>

# **Chapter 1 Introduction**

The ways in which people interact with the environment play an important role in determining public health risks and the well-being of communities (Kurtz and Smoyer-Tomic, 2009; Sandifer *et al.*, 2015). From the anthropogenic perspective, ecosystems benefit humans by providing ecosystem services which sustain life and contribute to factors that produce livable communities (Millennium Ecosystem Assessment, 2005). As more pressure is exerted on estuarine and coastal ecosystems from the consequences of human interactions with the environment, ecosystems will become less resilient to disaster events, such as hurricanes and oil spills, and diminish their ability to provide ecosystem services in the future (Cairns and Pratt, 1995; Millennium Ecosystem Assessment, 2005; Kelble *et al.*, 2013; Barbier *et al.*, 2013; Sandifer *et al.*, 2017). The decline in the resilience of ecosystems will lead to declines in the resilience of human communities as a result of pressures placed upon ecosystems. Four interrelated environmental factors place pressure on local ecosystems and affect the quality of environmental health in human communities: land use changes in the form of development, urbanization and habitat destruction; loss of species and habitat diversity in an ecosystem; concentration and abundance of contaminants in the environment; and global climatic change (Kurtz and Smoyer-Tomic, 2009; Gomez *et al.*, 2013).

In the United States, coastal communities are experiencing ever growing populations and urban sprawl that outpace inland communities threefold (Sandifer *et al.*, 2004, Neumann *et al.*, 2015). This is certainly the case for coastal communities in South Carolina. Between 2010 and 2016, the population of the Charleston, S.C. Metro Area increased by an average of 1,286 people/month and the Myrtle Beach, S.C. Metro Area grew by an average of 967 people/month (U.S. Census Bureau, 2017). Currently, there

are around 800,000 residents within Charleston county and that number is projected to exceed one million in the year 2040 (Sarah Watson, S.C. Sea Grant Consortium, personal communication, 2018). Population growth in coastal communities has contributed to residential and commercial development characterized by a trend in urban and suburban sprawl which continues to change land use within coastal metropolitan areas. Sprawl contributes to many ecosystem changes, including fragmentation of natural and semi-natural habitats within and around urban areas, often severely limiting the amount of suitable habitat and resources available to plants and animals (Radeloff *et al.*, 2005; McKinney, 2008; Corlett and Wescott, 2013).

Intensified land use changes also expand into the rural periphery for acquiring resources (*i.e.*, forest materials, water) to catalyze and sustain growth in metropolitan areas at various local scales (Radeloff *et al.*, 2005). Growing public concern about ever-increasing land use changes and development has prompted responses from local governments. One such entity is Charleston County, South Carolina, which established an urban growth boundary in their comprehensive plan around the turn of the millennia to place geographical limits on urban development. The decision to establish an urban growth boundary continues to receive high approval among City of Charleston residents more than a decade after its inception (City of Charleston, 2010). However, pressure for land development beyond the boundary continues to increase, including areas with high risk associated with flooding with unstable soil structure (Darlington, 2018). With 40% of the United States population living in coastal counties and a projected growth in coastal populations (National Oceanic and Atmospheric Administration, 2013), there is expanding recognition of the need to address the human factors which influence

environmental health. This also includes the impact of these changes on the conditions of coastal and estuarine ecosystems which may increase the potential for human health risks (Sandifer *et al.*, 2004).

One aspect of ecosystem health is biodiversity, described as the variety of life and habitats that exists within an ecosystem. Biodiversity is credited as the main ecosystem service producing positive impacts on humanity (Haines-Young and Potschin, 2010). Reduction in biodiversity restricts ecosystem services, leading to potential health risks to the environmental and human communities (Worm *et al.*, 2006; Cardinale *et al.*, 2012; Gomez *et al.*, 2013; Sandifer and Sutton-Grier, 2014). Biodiversity contributes to the resilience of communities impacted by ecosystem pressures and disaster events (Das and Vincent, 2009; Barbier *et al.*, 2013; Sandifer *et al.*, 2017). Diverse life forms contribute to the recovery from ecological pressures towards a stable ecosystem state. When the number and intensity of ecosystem pressures is increased, the ability of the ecosystem to recover from other pressures and disaster events can be reduced over time. In some cases, these pressures facilitate the loss of biodiversity to such an extent as to cause irreparable loss of ecosystem services (Chapin III *et al.*, 2000) resulting from diminished resilience of the ecosystem state (Elmqvist *et al.*, 2003). This deterioration results in the limitation or inhibition of the ecosystem's ability to recover to an equilibrium matching the service provision of retrospective ecosystem states (Hooper *et al.*, 2005; Oliver *et al.*, 2015; Sandifer *et al.*, 2017). One consequence is the potential loss of organisms that can be harvested for biomedical purposes (*e.g.*, horseshoe crabs, deep sea sponges) and loss of useful contributions to scientific discoveries in cancer research (Chivian and Bernstein, 2008). Land use changes can affect biodiversity by altering or removing natural habitats,

leading to habitat fragmentation and limiting the ranges of organisms in terms of accessing suitable habitat and resources (McKinney, 2008).

One of the most prominent forms of ecosystem pressures is contaminants introduced into the environment. Traditionally, concerns about environmental contamination have focused on conventional contaminants, such as pesticides, oil products, and heavy metals to mention a few, that make it increasingly difficult for natural organisms to survive and maintain their roles within an ecosystem (Daughton and Ternes, 1999; DeLorenzo *et al.*, 2001). Contemporary researchers and scientists are now beginning to focus on unregulated contaminants with unknown impacts and long-term consequences. These are often termed contaminants of emerging concern (CECs), and include chemicals such as flame retardants (Costa *et al.*, 2008), pharmaceuticals and personal care products (PPCPs) (Kolpin *et al.*, 2002), and nanomaterials (Oberdorster *et al.*, 2005; Pope *et al.*, 2006; da Costa *et al.*, 2016). CECs have the potential to place additional pressures on ecosystems and negatively impact public health (Daughton and Ternes, 1999; Richardson and Ternes, 2005; Scott *et al.*, 2012; Wilkenson *et al.*, 2017). CECs are introduced into the environment through human interactions, such as improper use and management of these chemicals, leakage runoff from septic systems, and effluent from wastewater treatment plants (Kummerer, 2009, Rivera-Utrilla *et al.*, 2013). Of particular concern is that CECs are not degraded or otherwise treated at sewage treatment facilities, allowing the passage of these contaminants into the environment (Vidal-Dorsch *et al.*, 2012; Prasse *et al.*, 2015). Flame retardants are added to textiles and plastics materials used in household products and come in brominated, phosphorus, organophosphate, and halogenated forms. These chemicals are easily leached from these

materials into the environment and accumulate in sediment and biota (de Wit, 2002). Flame retardants have been shown to bioaccumulate (Klosterhaus *et al.*, 2012) and change the behavior of wildlife (Jarema *et al.*, 2016; Guigueno and Fernie, 2017), as well as cause negative health outcomes in humans (Kim *et al.*, 2014).

Antibiotics introduced into the environment are also of concern for their negative impacts on health. When antibiotics are introduced in small amounts, there is potential to gradually increase the antibiotic resistance of pathogenic bacteria, such as *Vibrio parahaemolyticus* (Baker-Austin *et al.*, 2008) and *Vibrio vulnificus* (Baker-Austin *et al.*, 2009), over time. As these antibiotic-resistant pathogenic bacteria proliferate in the environment, treatment of their infections in humans with antibiotics could potentially become less effective. As a result, there will be a reduction in the available options for treating infections and further inflate health concerns (Daughton and Ternes, 1999). Increase in bacterial resistance to antibiotics and the accumulation of toxic contaminants in ecosystems will also cause more health risks for humans who interact with and consume seafood from coastal waterways (Newton *et al.*, 2013). There is also growing concern about the presence of nanoparticles, particles smaller than 100 nanometers, such as nanoplastics produced from the degradation of plastic products in the environment (Koelmans *et al.*, 2015, da Costa *et al.*, 2016). Not much is known about the extent to which nanoplastics impact human health, but recent studies have shown they can bind to toxic chemicals and are capable of passing through the blood-brain barrier of marine organisms, impacting their nervous system and resulting in behavioral changes that threaten their survival (Kashiwada, 2006; Koelmans *et al.*, 2015; Mattsson *et al.*, 2017).

Changing coastal weather and climate has the potential to greatly impact ecosystem services and processes (Walther *et al.*, 2002). Temperature changes have been shown to cause range shifts in suitable habitat for marine and terrestrial species, affecting genetic drift and trophic interactions of both flora and fauna (Parmesan, 2006; Chen *et al.*, 2011). Habitat fragmentation from land use changes further complicates species survival by limiting suitable habitat necessary for facilitating range shifts caused by climatic change. Climate change also has the potential to expand the area of habitat suitable along spatial and temporal scales for bacteria that cause infectious diseases, such as *V. vulnificus* and *V. parahaemolyticus* (Baker-Austin *et al.*, 2013; Gomez *et al.*, 2013; Wu *et al.*, 2016). Increases in intensity and duration of extreme weather events affect how resilient ecosystems and communities respond and recover from ecosystem pressures (Sandifer and Sutton-Grier, 2014). Long periods of drought followed by a short period of heavy rainfall have created severe weather events, such as major flooding. During October 2015, a historic rainfall event with associated flooding caused significant damage to property and civil infrastructure in coastal and inland communities in South Carolina (National Weather Service, 2016; Bacon, 2015). Rapid changes in coastal ecosystems caused by human activities, coupled with the effects of changing coastal weather and climate, pose a great threat to human health and well-being in coastal regions (Gomez *et al.*, 2013).

Overdevelopment, biodiversity loss, and chemical contamination ultimately have an impact on the health of ecosystems and nearby communities. As these factors degrade the local environment and continue to impact the ecosystems where humans live, the need for solutions to counteract realized and potential negative effects on people becomes

greater. Governmental decision-makers are at the center of providing solutions to these issues and rely heavily on identified needs of communities to formulate solutions. However, divisiveness or opposition within a given community about how much of a concern a given issue may be or what to do about the issue can impact the development and implementation of solutions. Thus, policy makers and decision-makers need to understand how residents perceive risks within their community, identify strategies that work best for gathering information from the community, and levels of agreement or disagreement about potential solutions. The two chapters herein describe the concept of cultural theory as a way to understand perception of risk and deliberative discussion as a strategy for collaborative efforts to unify opinions to formulate solutions within a community.

## **Chapter 2 Cultural Theory of Risk**

## 2.1 Cultural Theory of Risk

Investigations of connections between humans and the natural environment can be used to better understand the presence of public health risks. Knowledge of impacts from land development, chemical contamination, weather and climate change, and biodiversity can be passed on to decision-makers to assess the present risks and develop solutions to avoid negative consequences of diminished environmental health outcomes. The process of creating solutions to address environmental health concerns needs to also consider the potential impacts to residents and stakeholders in a given community.

For policy and public health solutions to be sustainable for the long-term, decision-makers need to consider social, cultural, and economic factors during their development (Mayer, 1996; World Health Organization, 2002; van Bueren and Jong, 2007). Addressing environmental health issues requires decision-makers to have a comprehensive understanding of the often complex scientific and technical details in order to work with communities to find viable solutions. This involves the need to practice collaborative communication with community stakeholders to formulate solutions (Irvin and Stansbury, 2004). Including residents in the decision-making processes can assist in development of solutions that are acceptable to stakeholders, workable, and useful in terms of reducing risk and impacts. However, perceptions of risks within the general public are often polarized (Flynn *et al.*, 1994; Kahan *et al.*, 2012). Also, the general public cannot be assumed to recognize environmental health risks to the same degree as risk experts or public health professionals (World Health Organization, 2002). The differences in evidence-based knowledge and experiences between decision-makers and the public, as well as the complexity of information, can lead to

misunderstandings that can produce divisions between individuals in the public with differing perceptions.

Mitigation of risks is also becoming more individualized through the proliferation of ‘risk society’ in which there is increasingly more pressure on individuals to mitigate their own exposure to risks (French, 2009). Because the number and magnitude of risks of different kinds within the community are numerous, individuals often prioritize risks and only focus on mitigating risks with the greatest perceived threat to themselves (French, 2009). This can explain why there is more concern for mitigating certain risks in a community, as compared to others that are avoided or ignored due to a low level of perceived danger. However, there are often differing perceptions of risks within the general public, including the degree to which human intervention impacts the environment, making the development of integrated solutions to mitigate risks complicated. This also makes it difficult for decision-makers to determine how residents’ value solutions put forth to address risks, especially when there is not clear evidence about how the public perceives issues and the effect these risks have on their daily lives.

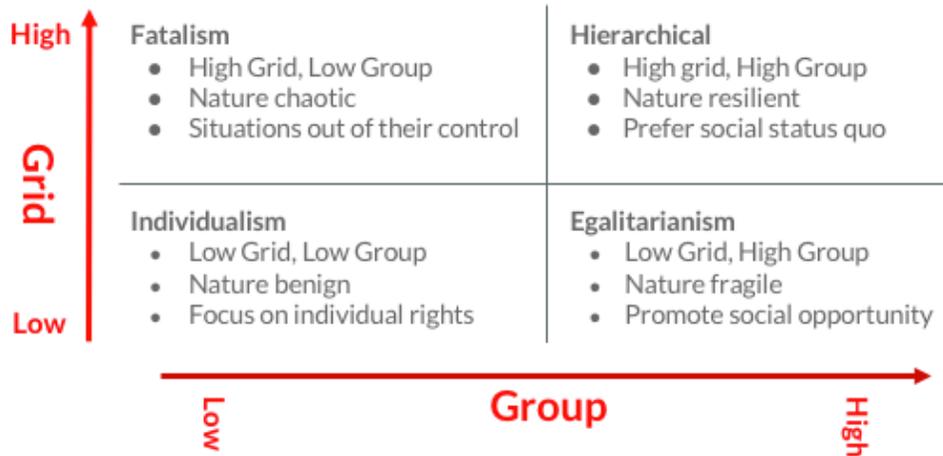
Cultural theory attempts to improve understanding of this disconnect by studying how a person’s perception of risks reflects and reinforces their cultural worldviews, and causes individuals to dismiss or credit novel information about risks from experiences and/or experts (Douglas and Wildavsky, 1982; Wildavsky and Dake, 1990; Dake 1992; Kahan, 2012; Drummond and Fischhoff, 2017). Cultural theory of risk has been utilized to study perceptions of controversial topics such as climate change (Leiserowitz, 2006; Kahan *et al.*, 2012), which is widely accepted by 97% of scientists (Cook *et al.*, 2016) and 70% of the general public in the United States (Howe *et al.*, 2015). Recent polls

suggest around 90% of South Carolina residents agree that climate change is occurring (Winthrop University Poll, November 2018). While there is agreement, many in the state are split on whether climate change is influenced by anthropogenic or natural factors, with most suggesting a combination of both (Winthrop University Poll, November 2018).

### *2.1.1 Cultural Types*

Dake (1992) developed a survey method for studying cultural theory to measure someone's cultural worldview. Dake's concept of cultural theory is separated into four scales: fatalism, hierarchy, individualism, and egalitarianism (**Figure 1**). These are used to position the cultural worldview of individuals based on a "group" and "grid" dimension, referring to an individual's normative views on congregating and social structure within a community, respectively (Douglas and Wildavsky, 1982). For the group dimension, the characterization of high-group refers to individuals who are highly connected and cohesive, while low-group refers to individuals who are more individualized and independent (Oltedal *et al.*, 2004). On the grid dimension, the characterization of high-grid refers to individuals who prefer more rigid social structures with defined rules for engaging with others, while low grid refers to more laissez-faire structures where individuals are free to manage social relations at their own will (Oltedal *et al.*, 2004).

A combination of the group and grid dimensions from cultural theory creates the separate worldviews which guide an individual's perceptions of risk. Each of the four scales is measured separately by averaging the results and then compared side-by-side to



**Figure 1** Four Scales of Cultural Theory

determine an individual’s cultural worldview. The resulting score from each scale explains how closely they align with each of the four cultural worldviews. Understanding these four cultural worldviews can help us better understand how individuals perceive risks and how to effectively communicate information about risks (NOAA, 2016). Oltedal *et al.* (2004) provides a robust explanation of the common characteristics for each of the four cultural worldviews, upon which the following descriptions are based.

The egalitarian worldview is associated with the low-grid and high-group dimensions. Individuals with this characteristic are skeptical towards expert knowledge due to perceived potential for misuse of authority and are likely to support actions which promote social equality. These views on societal interactions often cause egalitarians to be associated with having a left-leaning or liberal political ideology. Egalitarians also oppose destructive human intervention with nature (i.e., development, deforestation), because they view nature as fragile and vulnerable. Egalitarians are likely to be opposed

to increasing risks due to the fear of potentially causing irreversible damage to the ecosystem and promoting actions which increase the likelihood of placing negative conditions on the future of society. In sum, those who fall within the egalitarian worldview are likely to have heightened concerns regarding social and environmental risks.

Individualistic worldviews are associated with the low-grid, low-group dimensions. At the center of this worldview is the concern for freedom and opposition towards any action which may obstruct, limit, or remove individual rights. Individualists accept risks as potential opportunities with the exception that those risks do not have a negative impact on individual rights. Individualists often oppose actions such as warfare and installation of socialist governments, viewing them as controls on individual freedoms. They are likely to align with neoliberal economic practices, including free trade, minimal government intervention in markets, and accumulation of individual wealth. Politically, individualists are likely to associate themselves with right-leaning or conservative ideologies. Individualists starkly contrast the egalitarians perception of nature, viewing nature as highly resilient to human intervention and causing them to be less concerned with human treatment of nature. Individualists are likely to have minimal concern for environmental risks and high concerns for societal risk.

Fatalistic cultural worldviews fit within the high-grid, low-group dimensions. Generally, fatalists are not concerned with risk due to the perceived lack of authority to mitigate them. Because they feel constrained by societal norms, fatalists will feel indifferent about risks and view risks as mostly brought about and decided upon by others. Since fatalists have the perception that they lack the authority to mitigate risks,

they often strive to distance themselves from learning about risks due to their unavoidable nature. From this viewpoint, nature also does not provide any clues to the moral status of human interventions, accepting that nature is chaotic, and individuals must solve problems with nature as they present themselves. Those who align closely with a fatalist worldview are likely to have minimal concern for risks in general, hinging on the lack of perceived capability to mitigate risks themselves.

The fourth cultural worldview is hierarchical, which is associated with the high-grid and high-group dimensions. Hierarchical individuals place emphasis on maintaining the status quo of the “natural order” of society and are averse to social commotion, demonstrations, and crime which have the potential to threaten this order. They also differ from egalitarians by trusting expert knowledge, often accepting risks as long as the risk is justified by reputable individuals or groups, such as government or subject experts. Their view on nature is seemingly a combination of the individualistic and egalitarian worldviews, and perceives nature being fairly resilient to human-induced changes and able to recuperate within certain limits. Once people begin to overstep these limits, nature will not be able to recuperate. High scores for hierarchical worldview likely point to moderate levels of concern for social and environmental risks.

These four worldviews make up cultural theory and contribute to better understanding how individuals within society perceive their exposure to risk, how they view the natural environment, and how they make decisions based on their awareness of risks. Cultural worldview can be used to understand how people view a multitude of subjects, including ecosystem dynamics and climate change. Thompson *et al.* (1990; as cited in Oltedal *et al.*, 2004) used cultural theory to explain how people’s way of life was

connected to their thoughts on nature by analyzing people's attitudes towards ecological systems. A better understanding of these connections between humans and their perception of nature can provide insights of values to decision-makers, scientists, and practitioners for communicating risk to the public and for making decisions which mitigate risks.

### *2.1.2 Geographic Location and 'Sense of Place'*

Cultural worldview can vary across temporal and spatial scales, meaning that geographic location is likely to play a key role in determining the perception of risk. For example, people living in mountainous regions far inland will not perceive sea-level rise as a serious risk to the same degree as individuals living in coastal communities who will experience its immediate impacts. However, topics such as environmental health, which relate to human health impacts caused by environmental conditions, may have varying levels of risk perception across spatial scales. It is likely that individuals living near bodies of water will have a high perception of risk related towards polychlorinated-biphenyls (PCBs) which are man-made chemicals found in some inland lakes (*e.g.*, Lake Hartwell), river systems (*e.g.*, Great Pee Dee River) and brackish estuarine habitat (*e.g.*, Charleston Harbor) in South Carolina. People in all these areas who live close to the water or regularly use the water may have similar perceptions of risk from contaminated fish or waters. To this point, it is important to consider the immediacy of risk and proximity to which the individuals are located to said risk. Living in close proximity to certain natural environments has the potential for individuals to perceive risks to these

areas as greater than those who are more distantly located. Geography in this context can influence an individual's perception of risk.

While geography certainly plays a role in determining an individual's perception of risk, the length of residence in these areas, either at the individual or generational level, also impacts the perception of risk. Drawing on an extreme example, residents in subtropical, temperate regions (*i.e.*, South Carolina) may not perceive the impact of climate change as immediately and personally as Alaskan residents, who are experiencing rapid erosion and changing soil structure due to rising temperatures. Likewise, Alaskan residents and researchers may also perceive the impacts of melting permafrost differently than the indigenous Alaskans who have extensive knowledge of the landscape to which they maintain their spiritual and ancestral ties (Watson and Huntington, 2014). In this context, sense of place can ultimately influence how an individual perceives risks.

Sense of place is also a factor within South Carolina coastal communities. Halfacre (2016) noted that sense of place in the lowcountry, characterized by feelings of nostalgia, act as a catalyst for conservation efforts for culturally significant areas in the region. Halfacre further noted how nostalgia from lived experiences has cultivated liberal environmental views in individuals living within a predominantly conservative region. Ethnographic evidence of coastal South Carolina residents, such as from Halfacre (2016), suggest sense of place plays a role in determining someone's perception of the environment, and likely their perception of risks relating to said environment. Investigating the connections between geography, sense of place, and environmental concerns can provide further evidence to understand individual and community perceptions of risks associated with impacts to and from nature.

## 2.2 Methods

A public opinion survey was administered to a random sample of residents in South Carolina, including individuals within and outside of the eight coastal counties. This was a multi-section survey which was electronically administered via the Qualtrics online survey software. The survey contained multiple sections with fixed-response questions (McLafferty, 2009) concerning how respondents view environmental issues facing the coast, such as weather and climate, biodiversity, living marine resources, environmental health, and ocean mineral and energy resources, as well as questions related to demographics, cultural worldview, political ideology, and their views on climate change (See **Appendix A.1** and **Appendix A.2**). Responses to the survey were obtained from Survey Sampling International (SSI) and a marketing agency, Dunhill. Survey responses were administered from the beginning of August 2017 to the end of September 2017.

Questions being investigated in this study come from the sections involving concern for environmental issues, coastal policy support, cultural theory, and demographic sections. The primary focus of this chapter is to analyze survey responses from a subset of questions regarding how land use and development, biodiversity, and chemical contamination act as determinants of environmental health. These factors were chosen to focus on issues in South Carolina that have a direct impact on communities and have the potential to be exacerbated by climate change. From the survey, eight questions relating to environmental health factors were chosen to investigate resident perceptions as shown in **Table 1**. These questions were taken from the level of concern and coastal policy support sections of the survey. The questions for **habitat** and **seawalls** were

prompted by asking the respondent to record their level of opposition or support for policies on a Likert scale with 1 being strongly opposed and 7 being strongly support. The question asking about support for seawalls was included in the analysis because they are often desired as by coastal residents to protect property, usually developed portions. However, they are controversial due to the negative impacts they place on properties adjacent to the sea wall.

---

**Table 1** Environmental Health Risk Factor Survey Questions

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Factors	Questions
Chemical contamination	<p><b>contam:</b> <i>The contamination of coastal waters</i></p> <ul style="list-style-type: none"> <li>• Likert scale 0 - 10 (no concern to extremely concerned)</li> </ul> <p><b>infections:</b> <i>An increase in infections resistant to antibiotics</i></p> <ul style="list-style-type: none"> <li>• Likert scale 0 - 10 (no concern to extremely concerned)</li> </ul> <p><b>waterways:</b> <i>The quality of natural waterways such as streams, lakes, and rivers in your local area</i></p> <ul style="list-style-type: none"> <li>• Likert scale 0 - 10 (no concern to extremely concerned)</li> </ul>
Biodiversity	<p><b>biodiversity:</b> <i>Loss of biodiversity</i></p> <ul style="list-style-type: none"> <li>• Likert scale 0 - 10 (no concern to extremely concerned)</li> </ul> <p><b>habitat:</b> <i>Habitat restoration projects to protect biodiversity along the South Carolina coast</i></p> <ul style="list-style-type: none"> <li>• Likert scale 1 - 7 (strongly oppose to strongly support)</li> </ul>
Development	<p><b>development:</b> <i>The impacts of development on the land and water quality of coastal areas</i></p> <ul style="list-style-type: none"> <li>• Likert scale 0 - 10 (no concern to extremely concerned)</li> </ul> <p><b>pop:</b> <i>Increases in population in your local area</i></p> <ul style="list-style-type: none"> <li>• Likert scale 0 - 10 (no concern to extremely concerned)</li> </ul> <p><b>seaWalls:</b> <i>Building sea walls or other barriers to protect coastal areas from sea-level rise and flooding</i></p> <ul style="list-style-type: none"> <li>• Likert scale 0 - 10 (no concern to extremely concerned)</li> </ul>

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Because of this, they were included as a specific example of an issue related to development. Likewise, **habitat** was chosen to see whether there would be support for habitat restoration efforts specifically to protect biodiversity. For **contam, infection, waterways, biodiversity, development, and pop**, these questions were prompted by asking the respondent to record the level of concern to a set of statements. These were recorded on a Likert scale with 0 being no concern and 10 being extremely concerned.

One section in the survey contained 12 questions used previously in cultural theory research and used in this study to measure an individual's cultural worldview and how it affects their perception of environmental health risk factors (Wildavsky and Dake, 1990; Ripberger *et al.*, 2012; Song, 2014). Cultural theory survey questions included statements such as "*the best way to get ahead in life is to work hard and do what you are told to do*" (hierarchical) and "*It is our responsibility to reduce differences in income between the rich and the poor*" (egalitarian). These statements were followed by a series of fixed responses to allow the respondent to provide their level of agreement or disagreement with the statement on a scale of 1 to 7. Each cultural theory scale incorporated three questions and were averaged into a single 1 to 7 scale for analysis. If a respondent had a high average, then they are likely to exhibit characteristics of the worldview. Low scores would suggest they are less likely to exhibit the characteristics. A full list of the survey question statements asked in the survey for cultural theory are in **Table 2**.

The cultural theory and environmental health factor responses were examined using regression analysis to determine the impact of each cultural worldview on perception of environmental health risks. Survey responses were grouped by geographic

location of responders to examine whether differences in regional location has the potential to influence an individual’s perception of risks. Two distinct regions in the state, the coastal (identified as the eight coastal counties) and inland regions, were considered in this analysis. Information gathered on geographical region was based on responses to a question asking if the respondent resided in one of the eight coastal counties in South Carolina and confirmed by providing their ZIP code. Insight about sense of place was

**Table 2** Cultural Theory Questions From State Survey

<p>Prompt: <i>Now, please respond to each of the following statements using a scale from 1 to 7, where 1 means strongly disagree and 7 means strongly agree.</i></p>	
Scale	Statement
Egalitarian	<ul style="list-style-type: none"> <li>• <i>What society needs is a fairness revolution to make the distribution of goods more equal</i></li> <li>• <i>Society works best if power is shared equally</i></li> <li>• <i>It is our responsibility to reduce differences in income between the rich and the poor</i></li> </ul>
Individualism	<ul style="list-style-type: none"> <li>• <i>Even if some people are at a disadvantage, it is best for society to let people succeed or fail on their own</i></li> <li>• <i>Even the disadvantaged should have to make their own way in the world</i></li> <li>• <i>We are all better off when we compete as individuals</i></li> </ul>
Hierarchy	<ul style="list-style-type: none"> <li>• <i>The best way to get ahead in life is to work hard and do what you are told to do</i></li> <li>• <i>Society is in trouble because people do not obey those in authority</i></li> <li>• <i>Society would be much better off if we imposed strict and swift punishment on those who break the rules</i></li> </ul>
Fatalism	<ul style="list-style-type: none"> <li>• <i>The most important things that take place in life happen by chance</i></li> <li>• <i>No matter how hard we try, the course of our lives is largely determined by forces beyond our control</i></li> <li>• <i>For the most part, succeeding in life is a matter of chance</i></li> </ul>

provided through responses to a question which measured an individual's duration of residency within the region (*How long have you been a resident of your current county?*).

Both regional distinctions and cultural worldview variables were included to investigate how each variable affects the perception of environmental risks. Other independent variables considered included age, gender, race, education, and income. Survey responses were analyzed using the R Statistical Package [R] (RStudio Team, 2015) utilizing statistical methods for public policy analysis (Berman and Wang, 2011; Jenkins-Smith *et al.*, 2017). Geographic region, length of residency, and cultural worldview were investigated for their influence on perception of risk using a regression analysis, specifically analyzing the perception of environmental health factors in relation to each of the four scales of cultural theory.

## 2.3 Results

Survey responses were recorded and exported for analysis in the R statistical package. There were 488 responses in total to the state and coastal surveys; however, several respondents were excluded from the analysis due to incomplete responses, leaving a total of 386 that were included in the analysis. Out of the total responses considered for analysis, 132 (34%) of the respondents were from the coastal region. Analysis was conducted on both the support for coastal policies and level of concern for different environmental risks, both associated with potential impacts to environmental health.

### *2.3.1 Support for Coastal Policy*

Respondents to two state survey items were asked their level of support or opposition towards coastal policies related to environmental health impact. These questions were related to habitat restoration projects to restore biodiversity (1) and the building of sea-walls to mitigate issues from sea-level rise and flooding in coastal areas (2). Responses were analyzed using ordinary least squares regression (OLS) (**Table 3**). In total, 386 responses were recorded in the survey data for the question involving habitat, while 385 responses were recorded for support for sea walls. Values listed in this table suggests how an individual's support for policy changes based on the values from the independent variable.

Each of the cultural theory scales was analyzed against the respondents' support for coastal policy. There was a positive correlation for level of support for both of the coastal policy responses analyzed on the egalitarian and hierarchical scales. This suggests

**Table 3: OLS Estimates of Coastal Policies**

	<i>Dependent variable:</i>	
	Habitat (1)	Sea Walls (2)
Hierarch	0.035 (0.049)	0.085 (0.056)
Egalitarian	<b>0.195<sup>***</sup></b> (0.042)	<b>0.206<sup>***</sup></b> (0.049)
Individualist	<b>-0.131<sup>**</sup></b> (0.052)	-0.010 (0.060)
Fatalist	<b>-0.082<sup>*</sup></b> (0.046)	<b>-0.098<sup>*</sup></b> (0.053)
Coastal County	<b>0.240<sup>*</sup></b> (0.141)	<b>0.281<sup>*</sup></b> (0.162)
Time as Resident	-0.048 (0.046)	-0.036 (0.053)
Age	-0.003 (0.004)	-0.007 (0.005)
Gender (Male=1)	-0.166 (0.132)	-0.174 (0.152)
Race (White=1)	-0.043 (0.162)	-0.011 (0.188)
Education	0.007 (0.038)	-0.070 (0.044)
Income	-0.036 (0.039)	0.018 (0.045)
Constant	6.082 <sup>***</sup> (0.409)	5.137 <sup>***</sup> (0.471)
Observations	386	385
Adjusted R <sup>2</sup>	0.076	0.056

Results from the analysis of responses to state survey with questions regarding coastal policy. Questions are related to habitat restoration projects to restore biodiversity (1) and building sea-walls to mitigate issues from sea-level rise and flooding in coastal areas (2). Top number denotes the change in support for policy per unit increase with the number in parentheses represent standard errors. \* indicates p-value < 0.10; \*\* indicates p-value < 0.05; \*\*\* indicates p-value < 0.01

that individuals who are more aligned with egalitarian or hierarchical worldviews will have increased support and/or diminishing opposition for these coastal policies.

Egalitarian worldview stood out as a statistically significant variable in both responses to support for coastal policy. Negative correlations were exhibited in the individualist and fatalist scales. The responses exhibited increased opposition or diminishing support with statistical significance in the fatalist scale, while the results for individualist responses only show significance for habitat restoration efforts.

Responses to support for coastal policies were analyzed alongside coastal county residence and time as resident. Results for the coastal county residence show a statistically significant, positive correlation, suggesting more support for habitat restoration efforts and building of seawalls. Length of residence had a low negative correlation with no significance. Demographic information was also analyzed alongside the responses to support for coastal policies as well; age, gender, race, education, and income. Age, gender, and race were shown to have negative values associated with support for both of the coastal policy responses. Results for age show similar changes in support to that seen in the responses for time as resident while also showing low variance. Education had a marginal positive correlation for changing support in habitat, while it suggested growing opposition in sea walls. Income showed opposite findings, with a negative correlation in support for habitat restoration and positive support for sea walls.

Statistical significance was not found in the independent variables outside of the variables used to study cultural theory and place-based opinions. The adjusted R-squared ( $R^2$ ) values for the responses to support for habitat and sea walls was 0.076 and 0.056, respectively. In general, the average of the state responses fell into the middle of

the support range, with support for habitat restoration efforts being in the moderate support range (=6.08) and support for sea walls towards the lower end of the support range (=5.137).

### *2.3.2 Coastal Environmental Health Concerns*

The state survey included a set of questions about the level of concern the respondent had for environmental issues. Of these questions, six were chosen for analysis. These were analyzed against the independent variables relating to the cultural worldview scales, location-based variables, and demographics. The relationships between the concern for environmental issues and the independent variables were analyzed using ordinary least squares regression (**Table 3**). Similar to the coastal policy questions, the values in this table suggest how an individual's level of concern changes based on the certain responses in the survey.

Average results for the state survey showed varying levels of concern amongst the different categories of environmental issues. Results for the cultural worldviews remained uniform in most of the responses. Results for the hierarchical scale maintain a positive correlation across the board in all health concerns. However, there was an exception for concern for biodiversity which exhibited decreasing concern with an increased alignment with the hierarchical worldview. Results in relation to concern for water quality, biodiversity, and population are statistically significant for the hierarchical worldview. The egalitarian scale maintains a positive correlation across the board with a statistical significance in all environmental concerns except for the concern for population growth. Individualist worldview scale results show a negative correlation

relating to concern for environmental issues. Statistical significance for the negative correlation was exhibited for concern for contaminants and water quality. Results for the fatalist scale show a negative correlation in all concerns for environmental issues with statistical significance only shown for concern for contamination.

Location-based variables were used in the regression analysis to explain the effect of geographic location on responses. This includes whether or not the respondent lived within the coastal or inland region of the state and the length of time in which they have resided in that region. For both independent variables there was a positive correlation. Statistical significance in the coastal county results was found with concerns about contamination, biodiversity, development, and population. The sole variable showing statistical significance in relation to length of residence was concern for population.

The results based on demographics varied, as shown in **Table 4**. There was very little to no correlation with age. Race and income exhibited no statistical significance and maintained a negative correlation in concern to all variables, except for contamination and population for income and infection in the results for race. Results for gender showed a negative correlation, suggesting that male respondents on average were less concerned with environmental issues than females. Statistical significance for gender was found in the results for environmental concerns for contamination and development. Concern for environmental issues increased with higher education level. Education level was statistically significant in results relating to concern for contamination, biodiversity, development and population.

**Table 4** OLS Estimates of Coastal Health Concern

	<i>Dependent variable:</i>					
	Contam (1)	Infect (2)	Water (3)	Biodiv (4)	Develop (5)	Pop (6)
Hierarch	0.086 (0.090)	0.116 (0.090)	<b>0.181**</b> (0.091)	<b>-0.180*</b> (0.105)	0.034 (0.090)	<b>0.287**</b> (0.113)
Egalitarian	<b>0.489***</b> (0.079)	<b>0.298***</b> (0.078)	<b>0.341***</b> (0.080)	<b>0.507***</b> (0.091)	<b>0.428***</b> (0.078)	0.161 (0.098)
Individualist	<b>-0.177*</b> (0.096)	-0.135 (0.097)	<b>-0.271***</b> (0.098)	0.054 (0.112)	-0.070 (0.096)	-0.054 (0.121)
Fatalist	<b>-0.180**</b> (0.085)	-0.067 (0.085)	-0.006 (0.086)	-0.128 (0.098)	-0.116 (0.085)	-0.080 (0.106)
Coastal County	<b>0.497*</b> (0.260)	0.079 (0.259)	0.198 (0.264)	<b>0.775**</b> (0.301)	<b>0.548**</b> (0.258)	<b>1.190***</b> (0.325)
Time as Resident	0.034 (0.084)	0.129 (0.084)	0.121 (0.086)	0.092 (0.098)	0.001 (0.084)	<b>0.185*</b> (0.106)
Age	-0.003 (0.007)	0.002 (0.007)	0.009 (0.008)	-0.008 (0.009)	0.001 (0.007)	-0.009 (0.009)
Gender (Male=1)	<b>-0.457*</b> (0.242)	-0.344 (0.242)	-0.358 (0.247)	-0.193 (0.282)	<b>-0.530**</b> (0.242)	-0.059 (0.304)
Race (White=1)	-0.173 (0.298)	0.021 (0.299)	-0.184 (0.304)	-0.042 (0.347)	-0.188 (0.299)	-0.178 (0.374)
Education	<b>0.145**</b> (0.071)	0.045 (0.071)	0.103 (0.072)	<b>0.180**</b> (0.082)	<b>0.158**</b> (0.071)	<b>0.183**</b> (0.089)
Income	0.054 (0.072)	-0.004 (0.072)	-0.064 (0.073)	0.096 (0.083)	-0.050 (0.072)	0.087 (0.090)
Constant	<b>5.920***</b> (0.751)	<b>6.466***</b> (0.752)	<b>5.562***</b> (0.766)	<b>4.127***</b> (0.874)	<b>5.661***</b> (0.751)	<b>3.496***</b> (0.943)
Observations	384	386	386	385	384	385
Adjusted R <sup>2</sup>	0.115	0.038	0.076	0.098	0.090	0.057

Results from the analysis of responses to state survey with questions regarding environmental health concerns. Top number denotes the change in support for policy per unit increase with the number in parentheses represent standard errors. \* indicates p-value < 0.10; \*\* indicates p-value < 0.05; \*\*\* indicates p-value < 0.01

Overall, the average response remained moderate for concerns to environmental issues in the state. More statistically significant findings were shown in the analysis of independent variables alongside responses to contamination. Adjusted R-squared values remained low for the analysis of the survey results in all categories, with the highest being 0.115 in the variable regarding concern for contamination.

### *2.3.3 Environmental Health Categories*

The questions were analyzed based on their relation to one of the three outlined categories of environmental health risk factors. Biodiversity referred to the questions **habitat** in the coastal policy analysis (**Table 3**) and **biodiv** in the analysis of results for health concerns (**Table 4**). Support for habitat had a negative correlation in all variables except for the egalitarian scale, hierarchical scale, and coastal county responses. Statistical significance was shown in the egalitarian (+), individualistic (-), and fatalist scales (-), as well as the coastal county results (-). Length of residence showed a negative correlation which was not statistically significant. Concern for biodiversity showed a negative correlation in the hierarchical and fatalist scales, while the egalitarian and individualistic scales showed a positive correlation. Location-based results for concern for biodiversity both showed a positive correlation but lacked statistical significance.

Chemical contamination looked into the responses to **contam**, **waterways**, and **infect** (see **Table 4**), which were all contained within the health concerns section of the survey. The hierarchical and egalitarian scales exhibited positive correlations in concern for contamination, quality of waterways, and antibiotic-resistant infections, while the individualistic and fatalist scales showed negative correlations. However, the negative

correlation between concern for quality of waterways and fatalist scale was marginal. For contamination concerns, statistical significance was found in the egalitarian, individualistic, and fatalist scales in relation to concern for contaminants. Quality of waterways concern showed a statistical significance in the hierarchical, egalitarian, and individualistic scales. Concern for antibiotic resistant infections showed a positive correlation in the egalitarian scale. Location-based results remained positive with statistical significance found in the coastal county responses. The analysis of location-based variables suggests a positive correlation for all three chemical contamination variables, but most lack statistical significance. Results of the regression analysis between concern for contamination and coastal county residence show a statistically significant positive correlation.

Both development and population variables were included in the coastal health concerns portion, while the question regarding seawalls came from the coastal policy support section. All three variables showed a positive correlation between the egalitarian and hierarchical scales, while a negative correlation was found in the individualistic and fatalist scales. Support for sea walls showed a statistical significance in the positive egalitarian results and the negative fatalist results (see **Table 3**). Concern for development showed a statistically significant positive result in the egalitarian scale. Concern for population growth exhibited a sole positive statistically significant result within the hierarchical scale. **Sea Walls** showed a positive correlation in coastal county residence, with statistically significant results for all three variables. Time of residence showed a positive correlation in all but the support for sea walls, with statistical significance only being exhibited in the population results.

## 2.4 Discussion

### 2.4.1 *Egalitarian and Hierarchical Scales*

Respondents became more concerned and showed more support for environmental issues as their worldview aligned more with egalitarian and hierarchical worldviews. This mirrors the description of each of these two worldviews where egalitarians view the environment as delicate and sensitive to change and the hierarchical view which views nature as resilient to a certain degree of change (Oltedal *et al.*, 2004). Notably, most of the results were significant for the egalitarian scale, suggesting an egalitarian worldview may be a critical factor in determining an individual's concern for environmental issues (Douglas and Wildavsky, 1982; Ellis and Thompson, 1997, Xue *et al.*, 2014).

Some peculiarities exist within the results, such as lack of significant results in the egalitarian scale for concerns for population growth but noteworthy concerns for development and support for seawalls. In contrast, the hierarchical cultural worldview showed no statistically significant results in concern for development or seawalls but did for population growth. A likely reason for this is that hierarchical individuals and cultures embrace the "embeddedness" of individuals already living within a community and are averse to outsiders moving into their community (Schwartz, 2006). This aversion to outsiders could be attributed to population growth due to domestic migration into their community, which has been shown to be a main contributing factor for population increase in some coastal communities (U.S. Census Bureau, 2016).

Regarding the results for concern for development, the egalitarian scale suggested a significant increase in concern for environmental impacts due to development, as well as support for building seawalls to protect communities from flooding. Expectedly, egalitarians show concern for increased development and its impact on the environment. While considering the environmental aspects of building seawalls, the results are not initially apparent; however, when considering its societal impacts, the results are more tenable. The question regarding concern for development mostly referred to impacts on the environment, whereas the questions for population and seawalls were prompted as societal concerns to natural hazards. While egalitarians may be invested in ensuring the balance of the environment is not affected by growing populations, they would also weigh the environmental issues alongside the need to accommodate new individuals into a community. This suggests that there might be competing values within a cultural worldview which cause individuals to relax their concern for certain issues in order to seek benefits in another aspect of an issue. Schwartz (2006) notes egalitarians are concerned with the welfare of other individuals, suggesting those who align more with the egalitarian worldview are likely to support implementing solutions to mitigate issues within a community.

Another peculiar finding between these two cultural scales relates to the perception of risk associated with loss of biodiversity. The hierarchical scale showed a significant negative correlation while the egalitarian showed a significant and extremely high valued correlation. These results are opposite of what was to be expected based on previous descriptions of hierarchs. Hierarchs are generally concerned with whether nature can recuperate or recover from impacts; however, loss of biodiversity is a form of natural

degradation that is potentially not regenerative. Level of education was shown to be a significant factor for determining the level of concern for biodiversity, with those with higher levels of formal education exhibiting increased concern. One study found that higher levels of scientific literacy and formal education contributed to more polarizing views in environmental issues, such as climate change (Kahan *et al.*, 2012). This study also suggests it is more likely there are conflicts between an individual's personal interests which attempt to align with views of those close to them and a collective interest to use necessary resources to promote common welfare. For the results shown in this study, education may be a determining factor for hierarchs since it may drive much of their understanding about what constitutes a risk, whether it be within the realm of environmental or social issues. This could also explain the results for the hierarchical scale for development and population, because there is statistical significance in the responses for education level for those responses as well.

Support for habitat to protect biodiversity (**habitat**) also showed similar results to support for building sea walls (**seaWalls**) in both the hierarchical and egalitarian scales. While the hierarchical scale showed decreasing concern for loss of biodiversity, the results for the support for habitat restoration efforts to protect biodiversity showed a positive correlation. This was unexpected and should be looked into with more detail in further studies. There could be some reasonable assumptions made which may provide light to the potential reasons behind the differing perceptions. One potential reason is biodiversity may not have been a factor for respondents higher on the hierarchical scale, but rather these individuals may have perceived risks associated with impacts to the ecosystem. Increasing concern about environmental quality caused by development

**(development)** along the hierarchical scale provides some evidence that impacts to the ecosystem could be a driver for support and concern.

In terms of concerns for chemical contamination and water quality, egalitarians were consistent in each of the three variables with statistical significance as expected. Showing the highest value in the contamination domain for the egalitarian scale was the concern for contamination of coastal waters. The hierarchical results for concern for quality of local waterways was extremely telling about their cultural worldview. Although the hierarchical scale showed some increase in concern for *coastal* waters, the respondents exhibited more concern about the quality of their *local* waterways when they became more aligned with the hierarchical worldview. While the questions are connected, both concerning water quality which is impacted by contaminants, concern for the coastal waters was lower than their concern for local waters. This could likely point to an individual's concern being more localized to smaller geographical scales in the hierarchical worldview and larger in the egalitarian worldview.

#### ***2.4.2 Individualist and Fatalist Scales***

The negative correlations shown the results for the fatalist and individualist scales were to be expected (Oltedal *et al.*, 2004). Generally, there was a negative correlation for each of the environmental health concerns and support for coastal policies except for a positively correlated result for the individualist scale concerning biodiversity.

Within the domain of the three questions relating to development, most of the results were consistent with low negative values. Fatalists showed less, although not significantly so, concern than individualists within each of the results. This suggests

alignment with either worldview is not a determining factor for an individual's concern for development or population. With nature being viewed as benign in the individualist view and chaotic in the fatalist view, it could be expected that the results might also be relatively benign. For the fatalist scale, there is a statistically significant result in decreasing support for sea walls to mitigate flooding and sea-level rise in coastal areas. Considering the average response was 5.14 for this question, the fatalist scale is leaning more towards a neutral position (=4). This was to be expected, because those aligning more as fatalists view situations as out of their control and decided by other individuals, leaving no decision to be of their concern to support or oppose. However, there still seems to be a lean towards supporting sea walls despite negative correlation.

Questions relating to biodiversity varied greatly in both cultural scales. There was an unexpected result in the individualist scale for *biodiversity* which suggested increased concern for loss of biodiversity as someone becomes more individualistic. This finding somewhat aligns with Halfacre's (2016) observation about lowcountry residents with conservative worldviews, whom fit within the individualistic worldview, being concerned about wildlife and natural habitat. The fatalist scale maintained an increasingly negative or neutral negative correlation in the results, which is to be expected when fatalists often view decisions as out of their control, and subsequently not of their concern. Within the results for habitat restoration to improve biodiversity, both the fatalist and individualist scales showed a negative correlation towards a more neutral policy position. Despite the negative correlation of the results, there is still a great deal of support from individualists and fatalists for policy to augment habitat in means of increasing biodiversity. Overall, as

responses on each scale are progressively higher, the individuals become more neutral in their opinions on policy and less concerned with risks associated with biodiversity.

Concern for chemical contamination showed negative correlations throughout each of the results for both the individualist and fatalist scales. For water quality in the local area, there was little to no change in the fatalist concern. While the fatalist result was benign and insignificant, the individualist worldview was determined to be a significant factor in determining an individual's lack of concern for water quality. There was also a similar result in concern for antibiotic-resistant infections, but there was no statistical significance from which to draw any hard conclusions. However, concern for antibiotic-resistant infections remains fairly high in the average results, showing that health is a strong concern among individuals in each of the cultural worldviews. Average results for contamination of coastal waterways was also high, but experienced similar values of significant, negative correlations in the fatalist and individual worldviews. The only conclusion that could be drawn from the results for coastal water quality is these two scales have the same predictive power for determining concern in this subject, with the fatalist scale showing more predictive significance.

### *2.4.3 Cultural Theory as a Whole*

The resulting trend in responses from each of the scales of cultural theory was expected with some variation in the results. For the most part, there were positive correlations in the results for both the hierarchical and egalitarian scales and negative correlations in the individualist and fatalist scales. Looking at the significant results can

shed light on what was more of determining factor for the results in each of the study topics.

For development related questions, the egalitarian scale maintained more significant results. This suggests that the egalitarian view has the most impact on determining concern for environmental impacts caused by factors related to development and egalitarians would support measures to protect development - seemingly through more development of physical infrastructure such as a sea wall. Again, this could likely be a stance on protecting social opportunities and avoiding negative impacts which are integral to the egalitarian perspective. Lower rise in concern throughout the egalitarian scale with insignificant results supports this theory. Playing a smaller determining role is the hierarchical worldview with most concern following on population, potentially through the lens of the Malthusian perspective of increasing over-extraction of natural resources to support growing populations.

Results for the biodiversity related questions were peculiar, showing the only deviations from the normal correlations within the results for the scales of cultural theory. Results for concern for loss of biodiversity showed positive correlations in the egalitarian and individualist scales, while negative correlations were exhibited in the hierarchical and fatalist scales. The hierarchical and egalitarian scales showed significant results and could likely point to other factors which contribute to this change in the norm. Education was also a significant factor for determining concern for biodiversity, suggesting that scientific literacy may play a role in the concern for biodiversity for hierarchs who may not view loss of biodiversity as a threat to nature's status quo. Support for habitat

exhibited results which were expected in the cultural theory, with only hierarchical worldviews not being a determining factor for support.

In concern to chemical contaminants, the egalitarian scale remained the determining factor for a rise in concern for associated risks. Water quality in local areas and in coastal areas also showed the most amount of significant results, with individualist views being a dominant determining factor alongside egalitarian worldviews. The change in the fatalist scale remained benign in concerns for water quality, but still maintained high levels of concern based on the average responses. While significance was found in the coastal and local water quality in the cultural theory scales, there is potential for these questions to be associated with location-based factors.

#### *2.4.4 Location Based*

Location plays a special role in determining an individual's personal assessment of risk. When an individual is closer to an area which is associated with a certain risk, that individual likely will begin to perceive said risk to a greater extent based on the proximity and increased immediacy of its impacts on themselves. Length of residence also plays a role in knowledge of exposure and resistance to increasing risks to themselves in the community. Time as resident and coastal county results were compared using the regression analysis. Throughout the results, coastal county residence was a stronger determining factor than length of time as a resident.

In terms of development related questions, coastal county residence was a significant determining factor for each result. Showing the highest significant value within the data associated with increased concern was the concern for population growth

in the coastal county results. The amount of time as a resident also played a significant role in determining higher concern for population as well, albeit a smaller role than coastal residence. It is highly likely that coastal residents of South Carolina are very concerned with the increase in population within their region with length of residence being a major factor for increasing an individual's concern. This could also relate to the significance of coastal residence on concern to development, which is often connected to the rise in population within the coastal region. Also expected is coastal residence as a significant factor in determining increased support for sea walls to mitigate issues associated with flooding and sea-level rise. Time as a resident did not play a significant role in any other result other than population growth, suggesting the longer someone lives in an area the less likely they would like to welcome more individuals into their community.

Questions related to biodiversity showed significance in results for coastal county residence. Coastal county residence was a significant factor in determining concern for loss of biodiversity, exhibiting a high-value in comparison to most of the results. Coastal county residence was also a significant factor for support for habitat restoration efforts to enhance biodiversity. These results support Halfacre's (2016) observation that individuals in the coastal region of South Carolina are attached to the wildlife and landscape in the region and are proponents of conservation. While nostalgia was recorded as the main contributor to these conservation efforts, our results for 'time as a resident' suggested this was not a major contributor. A more convincing reason for our results is the concept of solastalgia, which associates any type of localized environmental change as mentally distressing and would likely spark individuals to seek opportunities to avoid these

consequences (Albrecht *et al.*, 2007). Solastalgia could potentially present itself before, during, and after an environmental change which induces stress and highly depends on how perceptible the changes may be to an individual. While respondent perceptions of environmental change were able to be monitored, where respondents fall along the timeline of environmental change is unclear based on the data gathered. Undoubtedly, there are differences in perception to those who perceive future changes to the environment, those who are currently experiencing changes, and those who previously experienced changes. The perceptions of individuals towards environmental changes in their lives will vary based on the timeline in which people are situated. Investigating the perception of these risks, as well as if and when negative changes are affecting individuals, will provide more understanding about how environmental changes induce stress to individuals within a community.

Lastly, the questions revolving around chemical contamination showed mostly insignificant results. There was an exception for coastal county results relating to concern for contamination in coastal waterways. As mentioned previously, locale was expected to be a determining factor in an individual's concern for quality of waterways. Results for concern for contaminants in coastal waterways from coastal county responses supports this idea; however, the lack of significant increased concern for quality in local waterways suggests this is not the case. Perhaps coastal county residents are more concerned with the quality of waterways than their inland counterparts because of their location downstream from the inland communities.

These results point mostly towards a higher likelihood for cultural worldview to have a significant impact on an individual's perception of environmental risks associated

with local water quality. However, it is unclear in the results whether cultural worldview or coastal residence has a greater impact on a respondent's perception of risk associated with contaminated coastal waters. From the perspective of location, coastal county residence would most likely be the greater contributor to concern for risks associated with coastal water quality.

Overall, the results point to specific cultural worldviews playing a significant role in an individual's perception of risk. Residence in coastal counties was also found to be a significant variable for determining environmental risks in respondents. While the data gathered were valuable for investigating the status of risk perception in individuals, there were no data related to if and when an individual experienced negative environmental change. Learning more about lived experiences and the timeline of those experiences could provide valuable information about how individuals respond to environmental changes and how stress manifests from these changes. Education was also a significant factor in the results, potentially affecting how individuals responded to certain questions. A potential variable in these responses is the context into which questions are placed and how individuals perceive the questions within surveys. If a question involves different types of issues, respondents could weigh these issues against the other, such as egalitarians balancing their perception of population from a Malthusian perspective of overconsumption and the compulsion to provide social opportunities to those coming into their community.

## **Chapter 3 Deliberative Discussion**

### 3.1 Deliberative Discussion

Results of investigations into connections between humans and the natural environment can be used to better understand the presence of public health risks. Knowledge of actual and potential impacts from land development, chemical contamination, weather and climate change, and loss of biodiversity can then be passed on to decision-makers to assess the level and immediacy of risks and develop solutions to avoid the consequences of diminished environmental health. The process of creating solutions to address environmental health concerns needs to also consider the potential impacts to community residents and other stakeholders. For policy and public health solutions to be sustainable for the long-term, decision-makers need to consider social, cultural, and economic factors during the process of developing solutions (Mayer, 1996; World Health Organization, 2002; van Bueren and Jong, 2007).

To address environmental health risks and produce meaningful results that translate into public value, some decision-makers have sought to utilize communication methods between the public, decision-makers, and technical experts (Slovic, 1987). This involves practicing collaborative communication with stakeholders during policy formulation (Irvin and Stansbury, 2004). Collaborative communication allows decision-makers to formulate integrated, holistic solutions that provide more benefits by mitigating risks (Irvin and Stansbury, 2004). As an added benefit, the inclusion of stakeholders has potential to build increased rapport between government leaders and stakeholders and lead to better understanding of administrative decisions through transparency (Irvin and Stansbury, 2004).

Researchers have sought to respectfully channel and manage divisiveness amongst residents in a community through facilitated deliberative discussions with the aim to inform policy decisions (Gastil *et al.*, 2007; Luskin *et al.*, 2014). Deliberative Polling is one of the methods used in this regard and does so by gathering individuals from a community in a central location to participate in small group facilitated discussions following an informational session (Fishkin and Luskin, 2005). In this method, experts and scientists disseminate information about their topic of expertise and residents are encouraged to ask the presenter questions, then the participants are split into small-groups to engage in facilitated deliberations. Individuals are given the chance to comprehend the information more effectively through consulting with experts and other residents in a respectful, inclusive environment.

This process is not focused on changing the opinions or worldview of the participants through advocacy or persuasion *per se*. Rather, the aim of informative deliberative discussions is to act as a catalyst for finding common ground on topics among people with potentially opposing views (Bratman, 2014). However, interactions between residents in this setting also has the potential to alter their perception of an issue via group deliberations. Changes in perception could be a result of an individual being more reflexive about their own position by considering the perspectives of others or by gaining a better understanding of the status quo within community discourse or through information presented by experts. Changes in participant opinions about issues are important to study and can be analyzed by gathering survey data from participants from before the event and directly after deliberations. Deliberative polling and similar methods offer ways to better understand the public's perception of risks in a community. As a

result, decision-makers can better determine what the public values in terms of how residents envision their community and develop policy that is tailored to the needs of the public.

This thesis discusses the perception of environmental health risks in coastal South Carolina residents and the effect of cultural worldview and deliberation on the perception of risks. It also assesses the potential for an individual to alter their perception of risks after a participation in deliberation discussion with other coastal residents. Combining the metrics from studying the cultural worldview of coastal residents and their perception of environmental health risks provides us with more understanding of the cultural significance of these risks. Allowing the same individuals to deliberate on these topics also allows a researcher to study the reasoning behind their perception of risks.

## 3.2 Methods

Following the state-wide survey described in the Chapter 1, respondents residing in one of SC's eight coastal counties were asked if they would be interested in participating in a two-day deliberative forum in Charleston, S.C. to discuss coastal issues. The survey respondents were offered a stipend for their participation to provide compensation for their time and travel expense. Out of the completed coastal surveys, 67 respondents participated in the forum in October of 2017. Altogether, the forum consisted of 109 individuals, including the 67 recruited coastal residents, plus natural resource managers, community managers, scientists, and trained group facilitators. Prior to attending the forum, all participants were provided briefing materials to inform them about the topics they would be discussing (See **Appendix D**). The forum was held in facilities of Trident Technical College in North Charleston, SC, on Friday, October 20 in the evening and all-day Saturday, October 21, 2017

The forum layout consisted of presentations by expert scientists and subsequent discussions with the full panel of participants, which later moved into eight facilitated small groups to deliberate on the presented topics. The small-group discussions were led by eight facilitators who were trained in deliberative discussion. The group facilitators were trained in a day-long session hosted by the project team and the lead facilitator a month before the forum. During the training session the facilitators learned the layout of the forum, the topics to be discussed, the goals and objectives of the deliberative forum, and participated in facilitation exercises. During the forum, each of the facilitators split the group deliberations into parts to discuss each of the topics presented during plenary sessions prior to breaking into groups. In the last small-group session, the facilitators

asked the participants to synthesize what was discussed in their groups. The forum concluded with a session allowing a representative from each group to summarize what their group discussed and the recommendations for addressing issues they discussed. After adjourning, participants were given a post-event survey with matching questions from the initial survey in order to assess any changes in attitudes or beliefs as a result of the deliberative polling activity. All 67 original respondents filled out both the initial and post-event surveys.

The pre- and post-forum surveys contained the same 8 questions, designated as **contam2**, **infection2**, **waterways2**, **biodiversity2**, **habitat2**, **development2**, **pop2**, and **seawalls2** (See **Table 1** and **Appendix A.2**). Survey responses were analyzed using the R Statistical Package [R] (RStudio Team, 2015) utilizing statistical methods for public policy analysis (Berman and Wang, 2011; Jenkins-Smith *et al.*, 2017). Change between the pre-survey and post-survey responses were analyzed using the difference in means taken from one-tailed, paired t-tests.

Discussions from the small-groups following the full panel deliberations were audio recorded and later transcribed (Longhurst, 2009) for qualitative analysis. Seven of eight of the morning groups were recorded and transcribed as were all eight of the afternoon groups. Qualitative analysis of these transcripts allowed identification of connections between certain themes in the small-group conversations. This information was then used to expound on the results gathered from survey data. Analysis of the transcript contents also allowed for the mixed-method triangulation of results within the study to provide a rich representation of the causal relationships that determine the perceptions of environmental health risks among coastal residents (Cope, 2009).

Analysis of the transcripts involved in-vivo coding of group deliberations for content analysis. Coding is frequently used as a qualitative data analysis method to organize and evaluate textual data to make connections from the identification of categories and patterns (Cope, 2009). The coding process began with open coding from a grounded theory approach, which involves the identification of themes and topics in the discussions by methodically reading and re-reading portions of the forum transcripts (Wutich and Gravlee, 2010). This process of identifying codes eventually led to the development of a collection of codes which was later condensed into topics and further developed into an initial codebook. The codebook so developed includes all of the categorical codes identified in the texts, a description of the meaning of each code, and several examples of a block quotation, or excerpt, that would be selected for the code (Wutich and Gravlee, 2010). Four categories of codes developed by Strauss (1987, as cited in Cope, 2009) were used in the development of the codebook used in this study and were adjusted to fit the research approach for this project:

- ***Conditions*** - the state of something, in regard to its quality, appearance, or working order
- ***Interactions with Others*** - groups and types of people that are mentioned
- ***Strategies and Tactics*** - suggested solutions relating to conditions
- ***Consequences*** - perception of end results, obstacles, and/or changes

This process continued with open coding, which involves the aggregation and abstraction of codes to fit within one of the four aforementioned categories (Wutich and Gravlee, 2010). These codes were further refined through in-vivo coding by coding each speaking excerpt or block quotation with all applicable codes within the sample of texts

and making adjustments to the codes. The following is an example of a speaking turn, or discussion block, from a participant in Group C at the forum:

*“If you’ve had anyone in the hospital recently, and you know you might have had that person where you have to don a gown and gloves to go in and see them. Because if you’re in a hospital now, when you go in you’re randomly – or some days, all persons who are admitted are checked for MRSA resistance.”*

This block of spoken dialogue would be assigned concurrently with the human health (“*MRSA [Methicillin Resistant Staph aureus]*” & “*hospital*”), monitoring (“*checked*”), behavior (“*...don a gown and gloves...*”), and close contacts (“*If you’ve had anyone in the hospital recently...*”) codes. After all of the blocks of conversation are coded with software, categories, such as “human health” and “close contacts”, can be investigated to find all instances where these codes were used and to obtain a total count of instances the codes were applied to in each transcript. This ultimately led to the development of a formal codebook to analyze all of the thematic subject matter relating to the forums. This codebook was then used in the process of in-vivo coding the entirety of the forum transcripts (Cope, 2010). The final in-vivo coding of the transcripts was conducted using the online program Dedoose (Wutich and Gravlee, 2010). Once the corpus of texts was coded, several analyses were conducted to make connections between the coded data and the survey responses to find relationships between the number of instances a certain topic was discussed and the effect it had on the survey responses (Cope, 2009). Through the identification of these relationships, patterns and themes could be found within the transcripts that would not be possible otherwise and which might not be inherently apparent (Cope, 2009).

To measure the impact of group deliberations on perceptions, analysis was conducted on the number of times a code was utilized in each group and the change in responses to similar questions in the pre-surveys and post-surveys. Each of the eight survey questions were paired with their respective transcription code which was closely related to the survey questions (**Table 5**).

Survey Question	Transcription Code
Contam	Contamination
Infections	Human Health
Waterways	Environment
Biodiversity	Biodiversity
Habitat	Ecosystem
Development	Development
Population	Population
Sea Walls	Infrastructure

Several of the pairings contained the same categorical name (*e.g.*, contamination, biodiversity, development); however, some pairings have different categorical names, but relate specifically to the question. The combinations of survey questions and transcription codes in which different words are chosen based on the question content and the code descriptions. The survey question **infections** asks about concern for “*an increase in infections resistant to antibiotics*” and relates to the thematic code about human health which includes “*mention[s] of human health related topics, such as illness and disease, antibiotic resistance, mental health, physical health, and well-being.*” The survey question **waterways** ask for the respondent’s concern for “*The quality of natural*

*waterways such as streams, lakes, and rivers in your local area”* while the code for **environment** includes “*mention[s] of the state and/or quality of the environment.*” This combination was utilized based on the connection between the quality of the environment in general and the quality of natural waterways, which is of particular environmental concern to coastal communities. The **habitat** survey question asks about the level of support for “*habitat restoration projects to protect biodiversity along the South Carolina coast*” and connected to the code for **ecosystem** includes “*mention[s] of... specific habitats*” in conversation. Finally, the survey question **seawalls** ask about the level of support for “*building sea walls or other barriers to protect coastal areas from sea-level rise and flooding*” and is connected to the code **infrastructure** which includes the following descriptor:

*Mention of a physical structure or system deemed necessary for societal function. Includes the information technology, communications, water and wastewater systems, transportation systems, energy, and dam sectors of USDHS 'critical infrastructure' (2018).*

The text prompts for each survey question can be found in **Appendix A.2** and the description for each thematic code can be found in **Appendix B**. The transcriptions were also analyzed to provide a summary of policy recommendations made by the small-groups according to the outcome of their discussions and what they mentioned in their report out to the full panel. Codebooks such as these can be tested for reliability and used in similar projects for further studies of the subject matter.

### 3.3 Results

#### *Survey Responses*

From the October 2017 forum pre-survey and post-survey data were gathered from 67 participants. Paired t-tests were conducted on means from each of the questions from the 67 pre-and post-forum surveys. Results of the t-test analyses can be found in **Table 6**. Survey responses regarding concern for environmental risks were higher in the post-forum surveys compared to the pre-forum surveys. Questions receiving statistically significant results in the post-forum data include *infections* and *biodiversity*, both with increased values in survey responses post-forum. Average responses for concern for environmental health factors within the study remain in the range of high levels of concern, between the scores of 8 and 10 which denotes extreme concern.

Responses regarding support for coastal policies had lower results in the post-forum surveys. This includes the questions involving support for habitat restoration efforts in concern to biodiversity (*habitat*) and building seawalls to protect coastal areas from flooding and sea-level rise (*seawalls*). Each of these questions involved a Likert scale question on a scale of 1-7, with the 1 being strong opposition, 4 being neutral and 7 being strong support. This varies from the 0-10 scale from the questions involving the degree of concern to environmental health issues. Average results for questions involving support for habitat ranges between support (6) and strong support (7) for the response values of 6.58 and 6.39. Pre-forum results leaned toward strong support while post-forum

**Table 6** Paired T-test Results For Participant Surveys

	Pre-Forum Survey	Post-Forum Survey
Contamination	9.000	9.246
Infections	8.083	<b>9.200*</b>
Waterways	8.933	9.123
Biodiversity	8.390	<b>8.932*</b>
Habitat #	6.583	6.385
Development	9.300	9.460
Population	8.183	8.292
Sea Walls #	5.867	5.815

Means of pre-forum and post-forum survey results. Paired t-test was used to statistical significance for change in the post-forum survey from the pre-forum survey.

\* indicates statistical significance with a p-value < 0.10

# Indicates a Likert question on a scale of 1 to 7. All other questions were unilateral and asked about concern for risk on a scale from 1 to 10.

results lean towards intermediate support albeit with no statistically significant results.

Average results for the question involving sea walls in pre-forum and post-forum responses leaned toward support (6), with values of 5.87 and 5.82. Both of the responses leaned towards intermediate levels of support, with no statistical significance found as observed through little to no change in post-forum responses.

### *Deliberative Discussion*

Morning and afternoon group discussions were transcribed and later coded using Dedoose coding software the codebook (**Appendix B**) to study all of the topics covered at the deliberative forum. The codebook took two months to develop and contained 38

different codes and organized into the 4 coding categories (Strauss, 1987). Coding of the 15 transcripts took about 3 months. 4,426 excerpts, or speaking turns, were identified in the transcripts and a total of 23,616 codes were applied to the excerpts. On average there were about 5 codes applied to each of the transcript excerpts ( $=5.34$ ). The results and the observations within this section will focus on the general results and will delve deeper into the three environmental health categories in the discussion section. This is so there is a robust understanding of the salience of each of the topics covered at the forum to act as a comparison to the topic of environmental health concerns.

There were portions of the transcripts not considered in the coding process, including whenever the facilitator was addressing the group, introductions of group members, speaking interjections within the group (*e.g.*, “oh okay”, “yeah”, “right”), any excessive repetition from the group, and general off-topic conversation. These portions were removed from consideration to focus specifically on participant input towards the discussion of the forum topics. During the transcription process, records were taken of instances of words which called for clarification of what codes were to be used (see **Appendix C**).

Coding results for the forum transcripts can be found in **Table 7**. The table splits the information into each of the coding categories and displays information about the number of times a code occurred in each transcript. Codes with the most applications ( $>1300$ ) include behavior, development, resources, and residents. Receiving the least amount of applications ( $<300$ ) were biodiversity, climate, close-contacts, non-profits

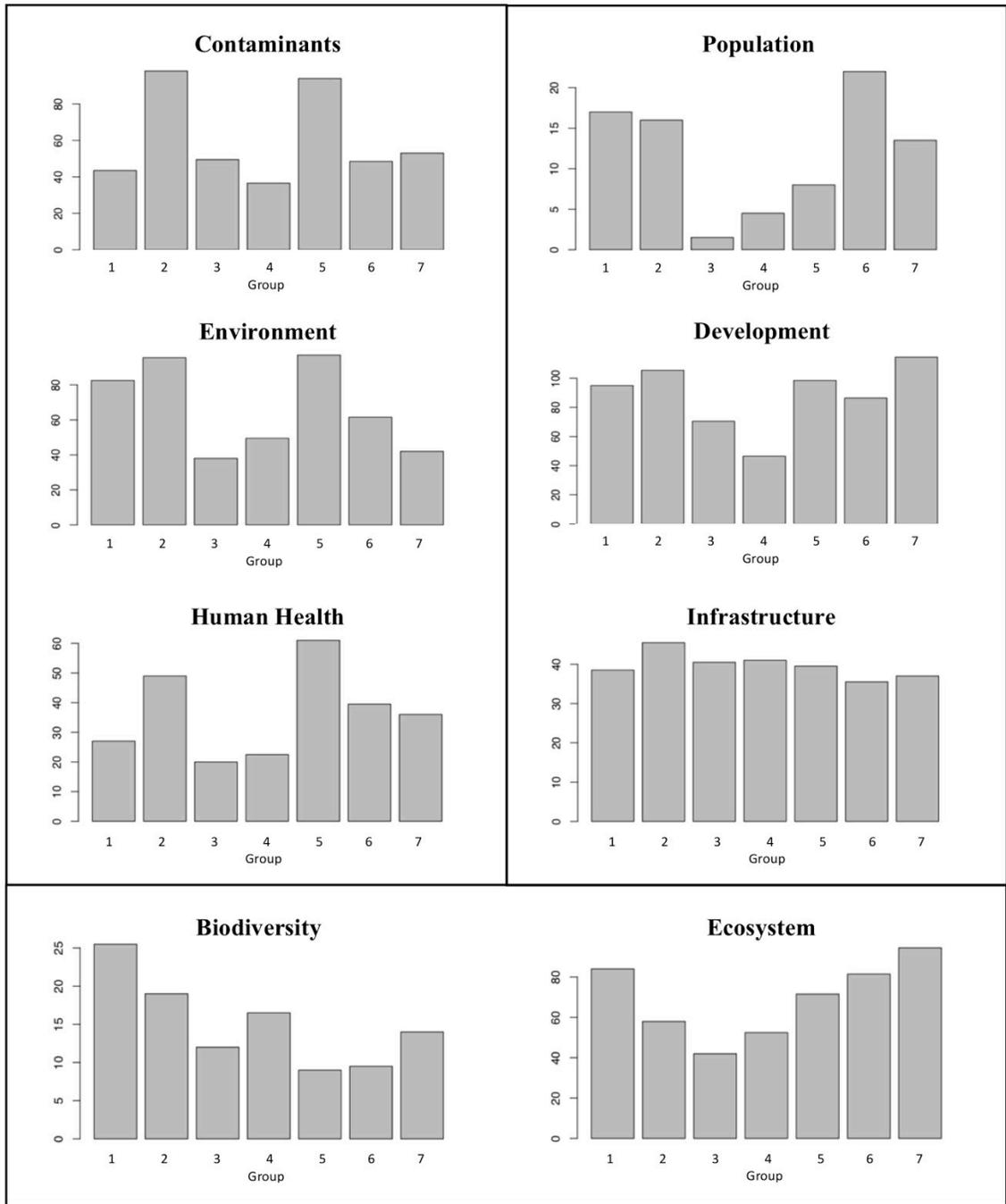
**Table 7** Descriptive analysis of coding of all group transcripts

	Condition															Consequences							Interactions with Others							Strategies						Totals
	Behavior	Biodiversity	Climate	Contaminants	Development	Economics	Ecosystem	Energy	Environment	Human Health	Infrastructure	Knowledge	Natural Hazards	Organism	Population	Resources	Beliefs	Efficacy	Negative	Positive	Priority	Business	Close Contacts	Government	Non-profit	Politics	Professionals	Residents	Activity	Collaboration	Education	Innovation	Monitoring	Policy		
Group 1 am	97	34	23	12	50	112	83	4	60	8	23	56	7	40	32	124	54	44	35	13	50	79	18	35	3	13	46	27	34	21	65	45	30	76	1457	
Group 1 pm	128	17	16	75	140	113	85	67	105	46	54	49	46	24	2	130	32	69	21	11	74	32	17	37	13	10	14	98	30	10	83	92	49	76	1865	
Group 2 am	71	19	34	77	73	45	80	7	100	27	30	52	26	93	12	150	39	56	46	15	20	50	7	109	16	10	32	110	85	14	75	5	48	87	1720	
Group 2 pm	107	0	8	119	138	66	36	61	91	71	61	56	50	21	20	136	58	69	74	20	43	32	18	43	4	3	35	115	75	58	65	61	26	40	1880	
Group 3 am	125	14	3	60	49	70	36	4	39	11	24	48	2	37	2	60	42	75	27	24	79	30	9	38	10	9	9	95	36	10	36	19	13	39	1185	
Group 3 pm	74	10	6	39	92	100	48	77	37	29	57	41	83	16	1	94	34	128	56	34	78	19	5	84	3	2	28	84	60	16	30	59	7	55	1586	
Group 4 am	19	27	2	22	36	33	53	0	35	11	16	33	7	27	8	40	21	26	19	12	33	34	10	18	8	1	17	50	42	20	32	7	18	19	756	
Group 4 pm	32	6	20	51	57	25	52	24	64	34	66	36	27	17	1	40	20	61	32	10	24	20	8	32	1	1	24	56	45	19	24	17	28	15	989	
Group 5 am	96	9	21	71	49	89	86	15	106	26	19	40	29	47	9	93	33	72	41	12	55	69	18	51	9	3	32	143	81	24	84	16	19	55	1622	
Group 5 pm	99	0	19	117	148	138	57	111	88	96	60	29	120	21	7	128	35	79	72	34	70	89	9	77	17	2	29	158	106	12	53	130	51	93	2354	
Group 6 am	109	11	17	8	94	70	94	19	52	14	23	39	33	67	2	92	101	62	37	24	118	48	43	76	15	42	12	114	100	59	100	64	12	55	1826	
Group 6 pm	184	8	12	89	79	85	69	85	71	65	48	69	28	32	42	214	60	84	75	24	64	50	6	67	16	16	6	52	95	38	67	105	46	54	2107	
Group 7 pm	161	0	34	75	137	103	99	0	58	67	57	50	43	17	14	111	11	73	63	40	67	53	14	40	4	1	36	101	73	6	76	5	29	44	1762	
Group 7 am	81	14	25	31	92	66	90	7	26	5	17	81	35	32	13	80	47	96	61	29	44	17	37	86	21	12	40	124	112	34	81	12	13	44	1606	
Group 8 am	80	0	16	32	92	37	35	49	29	20	31	25	11	13	26	56	13	23	28	3	34	14	2	23	2	7	14	31	24	8	29	48	7	39	901	
Totals	1463	169	256	878	1326	1152	1003	530	961	530	586	704	547	504	191	1548	600	1017	687	305	853	636	221	816	142	132	374	1358	996	349	900	685	396	791		

(including volunteerism), and politics. The table also includes information about group codes and totals of coding applications. Groups receiving the least amount of codes include group 3, group 4, and group 8. Receiving the most code applications (>3400) were group 2, group 5, and group 6. Generally, the average group produced around 2,700 code applications from both transcripts, with a majority of the codes being produced in the afternoon transcripts compared to the morning transcripts.

Data in **table 7** are color coded to visualize the extent to which each code was applied to each transcript. Codes receiving between 54 - 160 coding applications are denoted with a green to yellow color, respective to scale. Red cells denote codes receiving more than 160 coding applications in a transcript. Individual codes within the conditions category consistently receiving high levels of applications throughout each group (counts) include *Development* (11), *Economics* (11), *Behavior* (13) and *Resources* (13). For the consequences category, *Priority* (8) and *Efficacy* (12) received consistent high applications. In interactions with others, *Government* (6) and *Residents* (11) received the most consistent coding applications. And finally, in the strategies category *Policy* (8), *Education* (9), and *Activity* (9) received the most consistent applications.

Groups receiving consistently high applications of codes in discussion transcripts were group 2 (=32), group 5 (=33), and group 6 (=35). Consistent, high-level applications of codes in the morning transcripts was generally lower compared to afternoon transcripts. Total numbers of coding applications are also consistent with the observation that code counts were higher in afternoon than in morning transcripts. Count summaries of the 8 codes relating to the 8 survey questions about environmental health from **table 5** are provided in **figure 2**. Groups which had both morning and afternoon transcripts were



**Figure 2** Charts depicting group comparisons of average transcript code application counts. Numbers visualized for each group are the mean counts per transcripts, taken from the average counts from morning and afternoon transcripts. Each pane depicts codes related to each category in this study; chemical contamination (top left), development (top right), and biodiversity (bottom).

considered in the summary, with Group 8 being excluded due to a missing recording and transcript. Within the three codes for the chemical contamination category, group 2 and group 5 contained more code applications than all other groups. Most groups maintained about half the code applications as group 2 and group 5, except for in the summary for environment where group 1 had substantially more code applications in comparison to the other code results for the group. For development, the results varied between each code summary. Coding applications for infrastructure had moderate code counts and results remained consistent across all groups concerning the number of applications.

Development had high code counts for five groups but was substantially lower in groups 3 and 4. Population experienced the greatest variation in results within the table with average code application counts per group remaining low. Coding applications for codes relating to biodiversity are included in the bottom of figure 2 for comparison. The code for biodiversity maintained a low average amount of code applications per transcript with some variation in the results. Group 1 had the most code applications with group 2, group 4, and group 7 following with moderate results and the rest with consistently low application counts. Ecosystem contained a moderately high amount of code applications with four groups exhibiting high average code applications per transcript.

While reading the transcripts in an effort to implement the code applications, notes were taken to identify patterns for applying codes to certain subject (see Appendix C). This process also recorded discussion points and quotes within the transcript which highlight concepts to be elaborated on in the discussion session. From this process, 30 pages of handwritten notes were produced with data involving code applications and

highlighted portions of the transcripts. Description of these notes will be discussed in the following section and will be used to triangulate the data.

## 3.4 Discussion

### 3.4.1 Biodiversity

The two transcript codes considered in the analysis of biodiversity include biodiversity and ecosystem, with organism being a secondary consideration based on its relevance to biodiversity. Biodiversity was not specifically mentioned much in the transcripts, a likely result of the low count of coding applications. Most mentions of biodiversity referred to it as an aspect to consider when making decisions rather than explicitly discussing it within the conversations. In several groups, it was often mentioned alongside other ideas, concepts, and risks in context of making decisions. While the groups grasped the importance of biodiversity as a concept, it was not included in deeper discussion. A likely explanation is that it may have been too ambiguous for individuals of the general public to relate to, while specific aspects of biodiversity, including sets of species (transcript code: *organisms*) or individual habitats (transcript code: *ecosystems*) may have been easier to grasp and communicate. Compartmentalizing it into specific species or habitat types may have reduced the complexity of discussion about biodiversity within the groups.

Code analysis revealed that the topic of ecosystems (*i.e.*, habitats) was discussed more frequently than organisms. This likely points to people being more concerned about the ecosystem as a whole instead of a set of individual organisms. When specifically referring to organisms, participants were referring to organisms such as vegetation, oysters, and lionfish. Vegetation was mentioned in conversation but was considered on the landscape or ecosystem-wide scale. Occasionally there was mention of trees or

specific plants in group conversation. Some conversations about oysters were used in the context of being in-situ as opposed to ones intended for harvest for human consumption (*i.e.*, *Resources* transcript code). Mentions of oyster beds, which are situated in marshland habitats, call for concurrent application of the transcript codes *ecosystem* and *organism* (see Appendix D). These concurrent code applications were applied to a list of specific words, terms, or catch-phrases to provide the full thematic representation of its meaning within conversation. This was not an attempt to conflate the two codes, but rather to judge how much each concept was considered within the conversations.

Lionfish were also concurrently coded with *organism* and *negative* based on its status as an invasive species which has a negative effect on biodiversity within the ecosystem. Although lionfish have this negative effect and the subject of concern might be related to reduction in biodiversity or damage to the ecosystem, the *biodiversity* and *ecosystem* transcription codes could not be applied without an explicit mention of the subject or being clearly implied within the conversation. On occasion, mentions of lionfish also included the *resource* code because several groups discussed controlling populations of lionfish in coastal waters by using it as an edible food source to be served in restaurants and available at grocers. One conversation drifted into the preferred method of harvesting of lionfish, spearfishing, which is labor-intensive and usually practiced by recreational fishermen. Many came to the conclusion it was difficult to commercially harvest, but still a desirable natural resource for consumption. While not a finding from the group discussions but rather an observation, it appeared likely that the forum participants would support ecosystem-based conservation efforts over efforts aimed at individual target species.

Although there was relatively limited conversation about biodiversity, participant data pre-forum and post-forum suggest high concern for biodiversity and strong support for habitat restoration efforts to promote biodiversity. Coastal policy support changed only slightly from pre-forum to post-forum, suggesting that participants expressed intermediate to strong support for habitat restoration efforts independent of the forum. In contrast, concern for biodiversity was significantly higher in the post-forum responses. Despite biodiversity not being explicitly mentioned frequently within the group discussions, average concern among participants for biodiversity increased. This suggests that conversations tagged with *organisms* and *ecosystem* could have been considered compartmentalized discussions about biodiversity but were not explicitly mentioned or implied to the point where codes could be applied.

### ***3.4.2 Chemical Contamination***

Contamination in the paired t-test analysis showed high levels of concern in the pre-forum participant surveys and marginally higher concern following the deliberative forum. While contamination was discussed frequently throughout the transcripts (half of the group transcripts included moderate coding applications for contamination), there was not a significant rise in concern for contamination. It could be suggested that discussions about contamination were more about validating common ground between participants or included as a condition to consider when discussing its impact on other topics.

Contamination was coded alongside environment consistently despite differences in the code descriptors. Most conversations dealt with connections between the two, often discussing the effect of contamination on environmental quality, but the environment

code was used more frequently within the transcripts (=9). Likewise, the t-test results also suggest a marginal increase in concern for the environmental quality of waterways.

One of the group sessions included mention of concern about the efficacy of drinking water quality monitoring and testing at local water utility systems. Some participants mentioned there would be backlash on water utility systems if they released accurate test results of water quality tests. One participant suggested water quality results conducted by private companies for water utilities being hidden from public view or information doctored to avoid public unease about issues involving drinking water quality. While information about hiding or doctoring information could not be found to support this claim, a special report from The State newspaper cited multiple concerns about the provision of safe drinking water from small water utilities in South Carolina (Fretwell, March 12, 2019). This report cited recent findings and regulatory fines by officials from SCDHEC placed on water utility systems for not addressing the presence of disease-causing bacteria, carcinogenic chemicals, nitrates, and heavy metals, including lead, beyond action levels. One of the reasons stated for this lack of response was the lack of sufficient funding to maintain facilities, secure chemicals for treating water, and fix declining infrastructure.

Contamination also included many conversations which dealt with the topic of reducing human use of antibiotics to decrease their release into the environment. One group focused on reducing the use of antibiotics to mitigate disease states in livestock, citing agricultural runoff into waterways as a contributing factor to increased antibiotic resistance in bacteria. While the group agreed with the environmental benefits of reduced contamination, they were also concerned about reducing the production of food.

Eventually, they sought alternatives, such as reducing consumption of meat or only choosing to eat locally sourced, organic meat products.

Also included in the discussions about release of pharmaceuticals into the environment was the role of wastewater treatment plants and septic systems. Wastewater treatment plants subject raw sewage to multiple treatments and eventually release treated water back into the environment, usually into waterways through effluent. While effective at removing solids and reducing the presence of some chemicals through the multiple types of treatments, contaminants such as pharmaceuticals (*e.g.*, antibiotics, ibuprofen), caffeine, pesticides, personal care products, and others can persist beyond the treatment process depending on the methods used. Septic systems also release chemicals into the environment. By design, septic systems leak wastewater into the soil over time carrying contaminants along with it. This process may inadvertently carry these contaminants into waterways via stormwater runoff.

Several groups focused on disposal of unused pharmaceuticals, specifically those that are either thrown in the garbage or flushed down the drain. Of importance to these conversations is participants were aware that residents probably do not know how and where to dispose of unused pharmaceuticals. Because there are limited known options for residents, they often end up either flushing them down the drain or throwing them away in the trash. Participants later moved the discussion towards marketing drug take-back programs and drug drop-off boxes, which could be placed at pharmacies, hospitals, health centers, and police offices. Another option the group explored was to convince health professionals to prescribe antibiotics only when necessary to reduce unnecessary over-use. This view was often met with statements relating to residents being overly concerned

about their health and expecting to receive medicine from health professionals whenever they have an ailment. One example provided by a participant included having a viral infection and receiving antibiotics to treat it, when in reality antibiotics are ineffective against treating viral infections.

Others sought to convince health professionals to promote outdoor lifestyles to their patients to increase exposure to nature and greenspaces for purposes of health and well-being. Participants were fairly receptive to the concept of human health being connected to their exposure to nature and greenspaces. There were also connections made to mental health, with one group discussing how some people resort to pharmaceuticals as a short-term solution instead of long-term techniques such as nature-based therapies to treat the symptoms. There have been numerous studies which note the health benefits of exposure to green spaces (Sandifer *et al.*, 2015).

The transcript code human health was analyzed in tandem with infections, with a strong connection between antibiotic resistant infections and bacteria and some weaker connections to general health between the two. Human health was not discussed with high frequency in most transcripts. Comparisons of the morning and afternoon transcripts reveal more frequency in code applications for human health in the afternoon transcripts, which is likely a result of changed perceptions following the expert presentation on environmental health. Results of the paired t-test for *infections* show the most significant increase in concern among all of the survey questions considered for analysis. Placing the presentation about antibiotic resistant infections towards the end of the forum might have influenced more concentrated discussion about the topic closer to the post-forum survey. In this regard, it appeared that potential impacts to personal health was a strong

influence on changing the perception of many participants. This conclusion is based on their reaction to expert information presented about infectious *Vibrio* bacteria, their voiced concerns relating to antibiotic resistance, and the significant change in concern in the post-forum survey. It should also be noted the presentation and subsequent discussion about energy development was addressed in the afternoon session and the survey questions for *energy* also produced statistically significant results (pre=7.36, post=7.96, p-value = 0.006\*).

### ***3.4.3 Development***

Metrics for development included the survey questions *development*, *population*, and *seawalls* along with the corresponding transcript codes *development*, *population*, and *infrastructure*, respectively. Not much change was shown in the post-forum responses to survey questions relating to development despite the relatively large amount of coding applications indicating conversations relating to the topics.

Population was chosen as a metric based on its implications of increasing the need for development in communities. As a discussion topic, it received the least amount of coding counts out of all of the considered transcript codes with a total of 191 from all group transcripts. There was a small but insignificant increase in post-forum survey responses, and population was mentioned occasionally within group conversations with occasional, explicit mentions of population being an issue to participants and leading to increased development. One participant had the following to say about the effect of population growth on development:

*“One of my concerns is the pace of development. I mean somebody mentioned last night; you don’t have to go far to see construction everywhere. ...near my house in West Ashley there, they’re tearing down wetlands and putting up more condominiums or strip malls or whatever. ... So, we have to make a choice and say, ‘Look, how much is enough?’ I mean, obviously, people are moving here, and they need a place to stay. But if we exceed what we can hold – right? We’re only setting ourselves up for problems later. So, we have to start making some choices to, you know, making that balance. And keeping enough of the natural system active.”*

While development was more or less a concern for this participant, most of the underlying reasons for their concern of development was the impact to local ecosystems near their home. In this context, there is room to suggest sense of place with attachment to ecosystems is a factor which affects an individual’s level of concern. The participant carries some of the Malthusian perspective of human communities being metabolic and reaching a threshold beyond which resources cannot be sustained. However, there is also the fatalistic perspective where development in a community is inevitable and seemingly unavoidable based on need for living spaces.

Development itself as a topic of conversation was discussed widely within the groups. Times when *development* received the highest amount of code applications was in the afternoon following the presentation on environmental health and the final presentation on beach renourishment and coastal energy development. However, while discussed frequently in the groups, it did not experience much change in post-forum participant survey responses - similar to the results for *population*. Many conversations discussed development broadly, only occasionally referring to specific types of development, such as housing mentioned previously in the quote about population growth. The conversations seemingly implied that development of housing was the main concern to them by mentioning places where people desired to live.

Participants made the connection between residents wanting to live and build homes in areas that are characterized as aesthetic greenspaces, having idyllic natural views, or in close proximity to areas of high scenic value. Discussions which provided examples of these scenic venues mentioned areas like golf courses and marshland. In the aforementioned quote, the speaker specifically called out wetlands (*e.g.*, marshlands) over other habitats. Within the transcripts, forest habitat was only mentioned in 4 different excerpts and trees were only mentioned in 6. These excerpts touched on their ubiquity, with quotes like “South Carolina has a large forest area” and importance to environmental awareness:

“About 67 percent of the land area in South Carolina is made up of forest land. Forest land-owners have a lot to do when it comes to climate change”

Other instances included the role of trees in reducing wind damage for inland coastal communities and the comparison between tree coverage and impervious surfaces caused by development.

Despite these insights, overall there was little talk about forest habitats or trees, and this may have been at least partially related to the fact that neither forests nor trees received much if any attention in the forum’s expert presentations. An interesting take away from these discussions on habitats is the preference for preserving specific areas over others based on their aesthetic values over their value to the ecosystem. Cronon (1996) discussed this anthropocentric perception of nature, or “wilderness”, and how human perceptions focus mainly on idyllic natural areas for protection and admiration while seemingly placing less importance on preserving nature within our own backyards. Some groups did relate to this concept but drew back on the idea after

considering the maintenance involved with preserving an area. One group discussed the efficacy of closing golf courses for environmental reasons and maintaining the aesthetics of the landscape. They later reconsidered based on the maintenance needed for upkeep and the potential for landscape chemicals to continue being used in these areas. Within the topic of development, there was also talk of maintaining infrastructure for coastal communities, including those used for protection.

Coinciding with the increased frequency of code applications for *development* were the codes for *infrastructure* within the transcripts. There is a noticeable pattern in the code application summary (Table 5) of *infrastructure* and *development* having an increased number of applications in the afternoon deliberative session. While the concern for development was high and opinion about building seawalls for flood and sea-level rise mitigation was supportive, there was no significant change in the responses to either question. There were some insights brought up about existing infrastructure and its impact on development, specifically relating to the feasibility of seawalls based on the maintenance and attention needed. Mentioned specifically was the flap gate installed in a creekshed to reduce impacts of flooding. One of the flaps on the gate was broken and fell into the creek bed following a storm. Because the gate was open and allowing water to flow freely, it was causing flooding issues in a nearby neighborhood and damage to homes. It should be noted that the flap gate has since been located and reattached. Follow up with that community in 2018 for a project unrelated to this project showed improvement in reducing issues related to flooding. The residents still perceived the issue to a small degree but have noticed the reduction in problems associated with the broken flood controls. Frequent visits to this area were made during varying tide levels and

showed little to no change in water level behind the flap gate although levels changed substantially in front of the gate, such as during a “king tide” (*i.e.*, perigean spring tides) which causes water levels to reach their highest in the region, often 6.3 feet or more above mean lower low water.

Discussions also included talks about the South Carolina Department of Health and Environmental Control [SCDHEC] beach setback lines and their impact on reducing development in coastal areas. Many participants were knowledgeable about the landmark property rights case *Lucas v. South Carolina Coastal Council* (1993) which took place in Isle of Palms, S.C. and related to development and regulatory takings. This discussion also included many comments about the public trust doctrine, a well-known concept in land-use and environmental law relating to waterways being considered available to the public. Dune and beach ecosystems were implied in these conversations which often turned towards further preventing individuals from building in these areas. Many participants mentioned placing setback lines further back and limiting future development or rebuilding within these areas, despite any pleas from existing property owners.

It was then brought up that there should be limits to rebuilding on repetitive loss properties, especially if there were public monies attached to the rebuilding activities. Cited within several of the conversations was the National Flood Insurance Program available for people who reside in Federal Emergency Management Agency (FEMA) designated flood-zones and federal disaster recovery funds. Participants sought to place limits on redeveloping in repetitive loss areas primarily to prevent the public funds being ultimately responsible for multiple claims for the same property over time. Also considered was the impact of mold on human health in repetitive loss areas. Participants

ultimately perceived that money was being unsustainably administered to high-risk properties that also might harbor mold as result of previous flooding impacts with negative effects on the health of anyone living in the dwelling.

Lastly, energy development (wind and fossil fuels) was also cited as a concern of participants. While not directly a part of this thesis, participants were concerned about the impacts to the ecosystems and organisms off the coast of South Carolina associated with energy development. During the deliberations, the groups talked about wind turbines and discussed the potential impacts to birds, mammals, and fish habitat within these areas. Participants were concerned wind turbines might impact bird migration patterns and population. Some mentioned birds would just fly around the turbines, and some studies suggest migratory birds adopt this behavior (May, 2015). For marine mammals, the concern was sound pollution coming from the wind turbines which may affect the health and survival of right whales, other marine mammals, and other organisms. There was discussion about the positive impact of physical structures (*i.e.*, wind turbines and oil rigs) providing habitat for marine life and being a spot where numerous fishes congregate. Participants mentioned fish are attracted to these physical structures and recreational fisherman often visit these areas. Aesthetics also played a role in the conversations, and participants were receptive to finding out that wind turbines would not be visible from beach areas. However, a split occurred among a few groups about only wind turbines being considered for diversifying the types of energy sources, with preference for a variety of renewable sources.

#### *3.4.4 General Risk Perceptions and Synthesis*

Many participants noted that information about the environmental risks discussed at the forum would be a challenge to disseminate to other residents in South Carolina. In the discussions, many participants mentioned that residents are not going to actively seek information about environmental topics without first being introduced to the topics. It was also noted that individuals are often aware of these risks, but they are constantly bombarded with new risks to consider when making decisions. People are often overwhelmed with information about risks but can only comprehend so much information due to the large number of issues present and the complexity involved with mitigating those issues. Because of the amount of risk exposure, there comes a point where individuals may disregard information being presented to them and shelter themselves from gaining knowledge about the issue. Participants eventually realized that individuals needed to be able to receive, digest, and retain information about risks so they could make informed decisions. A necessary step in this direction will be for relevant information to be presented in clear language, not scientific/technical jargon. In essence, providing information which overwhelms individuals, often characterized as doom-and-gloom and overly academic, is less ideal because it decreases the efficacy of outreach about risks.

Many participants came to these conclusions in the discussions about communicating risks. Professional risk communicators and researchers have come to similar conclusions (NOAA, 2016a). People often have other things that require their

attention and to worry about, placing a challenge on convincing others about the salience of risks and guiding them to mitigate those risks. Often times, it is best to present a value to them to help realize the impact of risks. This allows them to change their priorities and perceive the salience of the issue, eventually leading to a mitigative effort. In reading the transcripts, it became apparent that individuals focus specifically on risks they perceive as a high priority or produce the most impacts on their own well-being. Participants began to realize that individuals are less likely to identify issues which have the potential to increase risks within the community or are present in minor symptoms of unhealthy communities.

Participants frequently mentioned frustration about not being able to discuss these issues with and provide solutions to others. Conversely, some individuals spoke about taking responsibility for bearing the burden of risks on an individual level and expecting others to do the same by staying knowledgeable about mitigating their own risks, mostly involving natural hazards (*e.g.*, flooding and sea-level rise). This could also be affected by whether or not the individual thinks they have the means to mitigate risks, often found in more fatalistic cultural worldviews (Oltedal *et al.*, 2004). Effective risk communication often entails both education about an issue, as well as introducing actions to mitigate risk exposure (Pelletier and Sharp, 2008; Lieske *et al.*, 2013).

Overall, the groups concluded that education was most likely the best strategy for mitigating issues related to the environment. This included education for all age levels, types of individuals, and through a variety of mediums and methods. Marketing was considered a medium and several participants noted examples of marketing techniques to

bring awareness about environmental issues. An example provided by a participant was a video billboard of fish swimming in a river with various plastics floating by.

A few participants mentioned having conflicting viewpoints on certain issues because of differences within their professional and personal life and worried about “going on the record” to publicly state their position. This conflict was noted by some government administrators and real estate agents. While development was good for their organization in terms of economic benefits, the environmental and social aspects were concerning to them, nonetheless. Weighing the costs and benefits of a particular issue from different aspects and perspectives seemed to be a theme carried throughout the forum, with individuals considering perspectives that were not their own.

Participant conversations also included discussion about environmental issues having a greater effect on individuals of low socioeconomic status. Although none of the participants identified as being in a low socioeconomic status, the participants were aware of this and thought they should be included in the discussions based on their proximity and level of exposure to environmental risks. A characteristic lacking within the forum was participation from a diverse range of residents in the coastal region. This was eloquently brought to our attention towards the end of the forum when a participant raised concerns over participant diversity. The predominant characteristics of most of the participants were white, middle-class, and educated. With these characteristics in mind, it is unlikely that our discussion groups were adequately representative of SC coastal communities.

A majority of the participants would also be likely identified as environmentalists. This is not surprising given the recruitment of the event noted environmental topics to be discussed and would usually draw the attention of individuals concerned with the environment, or perhaps those who are curious about it. In order for the deliberation to be robust and gather evidence of common ground, there would need to first be a wide diversity of opinions to include. However, this might have been the case for some issues as there was push back on opinions. Generally speaking, the participants were generally committed to deliberating and finding common ground. They often made comments regarding their achievements in reaching common ground within the discussions.

# Chapter 4 Conclusion

As residents are becoming more aware of environmental health risks within their community, it is also important for decision-makers and risk communicators to know how individuals perceive those risks. A comprehensive understanding of their perceptions allows for more effective risk communication to educate and encourage risk mitigation efforts at the community and individual levels. Several variables place an influence on an individual's perception of risk which ultimately determine their acceptance of risk, their level of concern, the immediacy of their exposure to risks, whether or not they should take active mitigation efforts. Within this thesis, two different mixed-method analyses were covered in separate chapters and offered different insights into how and why individuals in South Carolina have certain levels of perceived environmental risks.

The first chapter covered a state survey which asked questions regarding concern for coastal environmental health issues, support for coastal policy to mitigate coastal issues relating to environmental health, a series of questions used for measuring cultural worldview, information about their residence, and simple demographics. Of interest was the relationship between cultural worldview and coastal residence with concern and support relating to environmental health risks. The second chapter elaborated on the deliberative portion of the project and provided some dynamic input and a deeper understanding behind the motivations for the results in the survey. In the second chapter, I was able to identify the major concerns participants had through changes in survey data, frequency in which topics were discussed, and anecdotal evidence which seeks to identify causation behind relationships in survey data. While the relationships between the variables in the state survey analyses were weak, the second section solidified

understanding behind these results by providing more detailed input from the residents (participants) themselves. In other words, qualitative analysis was conducted within the deliberative portion to triangulate the data to confirm the findings in the quantitative analyses and to establish rigor (Baxter and Eyles, 1997).

Through the analysis there were many relationships identified between the various scales of cultural worldview and concern/support regarding environmental health risks. The scale for egalitarianism had the most significant and consistent relationship amongst the questions compared to the other cultural scales. Most of the correlations within the cultural scales were expected, with respondents exhibiting progressively less concerned with environmental issues as they become more aligned with individualistic or fatalistic worldviews, and individuals being progressively more concerned as they align with egalitarian or hierarchical worldviews.

Occasionally, there were surprising results, such as the unexpected correlations from the hierarchic and individualist scales on *biodiversity* and the significance of responses for *population* between the hierarchic and egalitarian scales. Likely a cause of this phenomenon is respondents considering multiple aspects of the issue based on the question provided. While *population* within the context of this project was in environmental concerns, it could also be perceived as a social issue. Those who align as egalitarians might weigh the environmental impacts to population as well as advocate the need for social opportunity, likely suppressing a heightened level of concern. Weighing different aspects of the issue provides a simple mental framework for understanding the influences to cultural worldview and risk perception. Discussions within the forum often weighed the costs and benefits to certain strategies by looking into who or what would be

affected in the process. While the deliberative groups felt like environmental issues needed to be addressed, some reconsidered some aspects of their position based on the economic and societal implications, which align with the Brundtland Commission's definition for sustainability (1987). Looking further into these nuances of each cultural worldview using the principles of sustainability can provide clues to better understanding public perception to make for more effective risk communication.

Sense of place was also investigated within this section and included analysis of questions identifying respondents residence in a coastal county and the number of years an individual has lived in their current residence. Coastal county residence was shown to have a significant relationship for many of the questions of concern. Length of residence did not show similar relationships with the same consistency as coastal county residence, suggesting nostalgia from personal experiences would not be a major driver for supporting conservation efforts (Halfacre, 2016). Solastalgia is an alternative theory for determining conservation, as it relates to sense of place and existential stress caused by environmental changes which might drive nostalgia in some shape or form (Albrecht *et al.*, 2007). Another concept to reconsider is historical nostalgia brought on by American ideals of wilderness and nature (Cronon, 1996). Within the deliberative groups, many participants expressed concern over the environmental issues within the region despite also claiming to be "transplants" who moved to the area from out of the state, as well as outside of the Southeastern United States. While sense of place can be established through generations or long-term residence, it was also identified in participants who identified as short-term residents within the region. The perceptions and opinions of short-term residents and opinions also aligned closely with long-term residents, showing

there is similar cultural worldviews existing between the two. This suggests sense of place is established less based on the time lived within a location and more about being a member of a community. Cultural worldview is most likely a result of establishing oneself within the community, even within short periods of time, and develops their perception of risk to align more with individuals around them.

Generally, the survey responses for development were varied. Population had results which showed considerably low concern among respondents. Other results within the development category include the concerns for development, which were moderate and average level of concern, and sea walls for flooding and sea-level rise mitigation, which showed slight support. Concern for biodiversity remained fairly low but respondents maintained solid support for habitat restoration efforts for preserving biodiversity. Among the highest average response values were the questions regarding chemical contamination: concern for chemical contamination of oceans, quality of local waterways, and the increase of antibiotic-resistant infections. What received the noticeably highest average response in the state surveys was the concern for antibiotic-resistant infections.

Results such as this strongly suggest human health is a major contributing factor to risk perception. Several groups expressed major concern over the issue of antibiotic resistance in disease causing infections within their discussions following the presentation on environmental health. One group even referred to it as the “nasty water discussion” in the group report out session to the full panel of participants. This carried on into conversations about the misuse and disposal of pharmaceuticals, specifically antibiotics, which result in unintended consequences in the environment that impact

human health. The significant spike in infections was a result of the presentation and subsequent conversations, which strongly suggests there is a connection between direct health impacts and risk perception.

Participants were also focused on identifying solutions and strategies for each of these issues. After much deliberation, most of the groups decidedly settled on education from a broad, comprehensive perspective to reach out to a wide audience, including community decision-makers. At first many suggested focusing on the next generation of residents, children, as the focus of education efforts. Cited among the reasons is the peer pressure exhibited by children on their parents for not practicing environmentally friendly options. One instance included a resident being ashamed of not recycling after their daughter came home from school and asking about why they did not actively practice recycling at their home.

However, some perceived the immediacy of environmental issues to a greater degree and suggested not waiting on the next generation to cause changes in the community. This was followed with mentions of previous generations bearing the same burden and the issue continuing into present day. With this in mind, it was decided by most groups to also include adults and decision-makers into the educational target audience to produce change in the near future. Some strategies included talking to individuals in their neighborhood or community groups, educating decision-makers about environmental issues, and marketing environmentalism on billboards.

Engaging decision-makers and activism at the grassroots level were also strategies considered by several groups. This included going to public meetings to engage decision-

makers and discuss issues affecting the community and community activism to promote awareness of issues. Collaboration was often involved in the discussion of these activities and was closely aligned with education efforts. Research and monitoring were also constantly mentioned as a strategy, often due to the uncertainty of issues within a community or ecosystem and the need to reduce uncertainty. This was often stated with uncertainty of issues relating to environmental quality, but occasionally referred to other conditions, with one group focusing more on economic conditions.

The conclusions drawn from the analyses provide insights into the motivations and causes of an individual's perception of risks relating to factors contributing to environmental health. However, further consideration needs to be taken on the diversity of individuals within deliberative forums, as well as the survey data. This diversity is defined by the demographic and cultural worldview characteristics of the survey respondents and the forum participants. State survey data in this project provided representation for individuals within the state. However, the forum participants were less diverse with most being characterized as white, middle-class, highly educated, and generally environmentally-minded. Because of this, the results from the forum provide a narrow view of the full range of perspectives within the coastal region.

Particularly the aim of the deliberations was to find common ground among individuals with opposing views. A reoccurring comment among participants was there was minimal disagreement on the environmental issues discussed. While common ground was certainly reached, this was not challenging for the groups because the participants had similar perceptions about environmental risk and lacked widely contrasting opinions. Studies following this would benefit by seeking to place diverse perspectives within the

deliberations by targeting audiences with a wide variation of cultural worldviews to participate. Other considerations include ethnicity, socioeconomic status, age group, and education, which factor into an individual's perception of risks. Including participant diversity in further deliberations will provide a more comprehensive look into risk perceptions which encompass the range of cultural worldviews within a community. Likewise, finding common ground within a group with a diverse perspective will provide more integrative, holistic information to form solutions out of and promote the ideals of democracy and representativeness.

Overall, what was found in the analyses was a connection between cultural worldview, regional residence, and concerns about factors influencing environmental health risks. Deliberations provided evidence which suggest specific environmental health risks are weighed by residents against different aspects of community, including the social, environmental, and economic. Helping to weigh these risks are their cultural worldviews which place different weights on each of the community aspects. Descriptions of cultural worldviews provided by Olstedal *et al.* (2004) and other cultural theory researchers suggest the four cultural worldviews weigh these three cultural aspects differently. Including these aspects within surveys could provide more evidence about the effect of cultural worldview on risk perception. This would provide more insight into developing more effective risk communication methods toward specific audiences. Deliberation which includes a diversity of participants with different perspectives and backgrounds can also provide insights into risk perception, as well as provide an avenue for identifying common ground which provides the basis for holistic, integrative problem solving. While opposing views can constrain progress in community resilience building,

respectful deliberation that relies on common ground rather than focusing on changing opposing views appears to be a solution many of our participants wanted to see more of.

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# Appendices

## Appendix A.1 - Pre-Forum Survey

### Pre-Forum Survey

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Thank you for agreeing to participate in this research study. The purpose of this research is to better understand how residents of South Carolina's coastal counties perceive important topics such as coastal habitat, energy production, climate, and environmental health. This survey should take less than 20 minutes to complete. Your survey responses are confidential and will only be used for research purposes. We hope this research will benefit South Carolina's communities by providing insights as to how residents understand the science, risks, policy options, and political processes related to energy and the natural environment.

Your participation is voluntary and you may stop taking the survey at any time. For questions or concerns about the survey, please contact Dr. Matthew Nowlin, assistant professor in the department of Political Science at the College of Charleston at [nowlinmc@cofc.edu](mailto:nowlinmc@cofc.edu) or (843) 953-0279. You may also contact Research Protections and Compliance in the Office of Research and Grants Administration at the College of Charleston at [compliance@cofc.edu](mailto:compliance@cofc.edu) or (843) 952-7421. Be sure to use approval code FQJG-01-26-2017.

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Listed below are several issues that may impact the natural environment and human health. On a scale from 0 to 10, with **0 being not at all concerned** and **10 being extremely concerned**, how concerned are you about each of the following? **Please mark the number to indicate your response.**

**The availability of fresh and locally harvested seafood**

Not at all											Extremely
Concerned											Concerned
0	1	2	3	4	5	6	7	8	9	10	

**The impacts of development on the land and water quality of coastal areas**

Not at all											Extremely
Concerned											Concerned
0	1	2	3	4	5	6	7	8	9	10	

**Loss of biodiversity**

Not at all											Extremely
Concerned											Concerned
0	1	2	3	4	5	6	7	8	9	10	

**Changes in South Carolina's shoreline**

Not at all											Extremely
Concerned											Concerned
0	1	2	3	4	5	6	7	8	9	10	

**The contamination of coastal waters**

Not at all											Extremely
Concerned											Concerned
0	1	2	3	4	5	6	7	8	9	10	

**Sea level rise**

Not at all											Extremely
Concerned											Concerned
0	1	2	3	4	5	6	7	8	9	10	

**Flooding in your local area**

Not at all											Extremely
Concerned											Concerned
0	1	2	3	4	5	6	7	8	9	10	

**Increases in population in your local area**

Not at all											Extremely
Concerned											Concerned
0	1	2	3	4	5	6	7	8	9	10	

**Drought in your local area**

Not at all											Extremely
Concerned											Concerned
0	1	2	3	4	5	6	7	8	9	10	

**Changes in the chemical balance of the oceans**

Not at all Concerned 0 1 2 3 4 5 6 7 8 9 10 Extremely Concerned

**An increase in infections resistant to antibiotics**

Not at all Concerned 0 1 2 3 4 5 6 7 8 9 10 Extremely Concerned

**An increase in the intensity of hurricanes**

Not at all Concerned 0 1 2 3 4 5 6 7 8 9 10 Extremely Concerned

**The availability and costs of energy in South Carolina**

Not at all Concerned 0 1 2 3 4 5 6 7 8 9 10 Extremely Concerned

**The quality of natural waterways such as streams, lakes, and rivers in your local area**

Not at all Concerned 0 1 2 3 4 5 6 7 8 9 10 Extremely Concerned

Listed below are several actions that private businesses and/or state and local governments can take to resolve some community concerns. On a scale from 1 to 7, with **1 being strongly oppose** and **7 being strongly support**. Please mark the number to indicate your view on the following actions.

**Drilling for oil and natural gas off the shore of South Carolina**

Strongly Oppose 1 2 3 4 5 6 Strongly Support 7

**Placing wind turbines for wind energy off the shore of South Carolina**

Strongly Oppose 1 2 3 4 5 6 Strongly Support 7

**Beach restoration projects that move sand from the ocean or other areas to replace sand loss**

Strongly Oppose 1 2 3 4 5 6 Strongly Support 7

**Habitat restoration projects to protect biodiversity along the South Carolina coast**

Strongly Oppose 1 2 3 4 5 6 Strongly Support 7

**Catch limits to ensure the presence of future fish populations for commercial harvest**

Strongly Oppose 1 2 3 4 5 6 Strongly Support 7

**Building nuclear power plants in your local area**

Strongly Oppose 1 2 3 4 5 6 Strongly Support 7

**Require vulnerable, highly populated residential and commercial areas to retreat inland and away from the coast**

Strongly Oppose 1 2 3 4 5 6 Strongly Support 7

**Change government regulations and zoning laws in coastal areas to restrict development**

Strongly Oppose 1 2 3 4 5 6 Strongly Support 7

**Public investment in infrastructure projects to improve drainage following a flood**

Strongly Oppose 1 2 3 4 5 6 Strongly Support 7

**Building sea walls or other barriers to protect coastal areas from sea-level rise and flooding**

Strongly Oppose 1 2 3 4 5 6 Strongly Support 7

**Government subsidies and tax incentives for homes and business to place solar panels on their property**

Strongly Oppose 1 2 3 4 5 6 Strongly Support 7

The next several statements are about your views on participation in government and politics. Please respond to each of the following statements using a scale from 1 to 7, where **1 means strongly disagree** and **7 means strongly agree**. Please mark the number to indicate your view.

**Politics is so complex that people like me cannot understand what is going on**

Strongly Disagree							Strongly Agree
1	2	3	4	5	6		7

**People like me don't have any say about what the government does**

Strongly Disagree							Strongly Agree
1	2	3	4	5	6		7

**Public officials don't care much what people like me think**

Strongly Disagree							Strongly Agree
1	2	3	4	5	6		7

**I feel I could play an active role in a group dealing with political issues**

Strongly Disagree							Strongly Agree
1	2	3	4	5	6		7

**I am perfectly able to understand and assess important political question**

Strongly Disagree							Strongly Agree
1	2	3	4	5	6		7

The next several statements are about your views on science and the scientific method of hypothesis testing using empirical data. Please respond to each of the following statements using a scale from 1 to 7, where **1 means strongly disagree** and **7 means strongly agree**.

The scientific process is the only valid and reliable way to understand nature

Strongly Disagree							Strongly Agree
1	2	3	4	5	6		7

Scientific evidence can be interpreted to fit opposing points of view

Strongly Disagree							Strongly Agree
1	2	3	4	5	6		7

Intuition can provide an understanding of nature as valid as that of science

Strongly Disagree							Strongly Agree
1	2	3	4	5	6	7	

**The results of scientific research will always be significantly affected by the values held by the researcher**

Strongly Disagree							Strongly Agree
1	2	3	4	5	6	7	

**Science and advanced technologies can solve almost all of society's problems**

Strongly Disagree							Strongly Agree
1	2	3	4	5	6	7	

The next several statements are about your views on the role of science in political and policy decision-making. Please respond to each of the following statements using a scale from 1 to 7, where **1 means strongly disagree** and **7 means strongly agree**.

**Scientists and technically trained experts, not the public, should make decisions about the applications of advanced technologies to address energy needs and environmental concerns**

Strongly Disagree							Strongly Agree
1	2	3	4	5	6	7	

**Those who are better informed and knowledgeable should have greater influence in policy making**

Strongly Disagree							Strongly Agree
1	2	3	4	5	6	7	

**Technical issues are so complex that most people cannot contribute to reasonable policy choices**

Strongly Disagree							Strongly Agree
1	2	3	4	5	6	7	

**Even if the public is not well-informed about an issue, policy makers should rely on popular opinion in making important policy decision about that issue**

Strongly Disagree							Strongly Agree
1	2	3	4	5	6	7	



1 2 3 4 5 6 7

**It is difficult to make a personal impact on climate change**

Strongly Disagree Strongly Agree  
1 2 3 4 5 6 7

**Others hinder my ability to do anything regarding climate change**

Strongly Disagree Strongly Agree  
1 2 3 4 5 6 7

Please respond to each of the following statements using a scale from 1 to 7, where **1 means strongly disagree** and **7 means strongly agree**.

**What society needs is a fairness revolution to make the distribution of goods more equal**

Strongly Disagree Strongly Agree  
1 2 3 4 5 6 7

**Even if some people are at a disadvantage, it is best for society to let people succeed or fail on their own**

Strongly Disagree Strongly Agree  
1 2 3 4 5 6 7

**The best way to get ahead in life is to work hard and do what you are told to do**

Strongly Disagree Strongly Agree  
1 2 3 4 5 6 7

**The most important things that take place in life happen by chance**

Strongly Disagree Strongly Agree  
1 2 3 4 5 6 7

**Society works best if power is shared equally**

Strongly Disagree Strongly Agree  
1 2 3 4 5 6 7

**Even the disadvantaged should have to make their own way in the world**

Strongly Disagree Strongly Agree  
1 2 3 4 5 6 7

**Society is in trouble because people do not obey those in authority**

Strongly Disagree							Strongly Agree
1	2	3	4	5	6	7	

**No matter how hard we try, the course of our lives is largely determined by forces beyond our control**

Strongly Disagree							Strongly Agree
1	2	3	4	5	6	7	

**It is our responsibility to reduce differences in income between the rich and the poor**

Strongly Disagree							Strongly Agree
1	2	3	4	5	6	7	

**We are all better off when we compete as individuals**

Strongly Disagree							Strongly Agree
1	2	3	4	5	6	7	

**Society would be much better off if we imposed strict and swift punishment on those who break the rules**

Strongly Disagree							Strongly Agree
1	2	3	4	5	6	7	

**For the most part, succeeding in life is a matter of chance**

Strongly Disagree							Strongly Agree
1	2	3	4	5	6	7	

How old are you?

\_\_\_\_\_

Are you male or female?

- Male (1)
- Female (0)

What is the highest level of education that you have **completed**?

- Less than high school (1)
- High school graduate / GED (2)
- Vocational or technical training (3)

- Some college (4)
- 2 year / Associate's degree (5)
- 4 year / Bachelor's degree (6)
- Graduate or professional degree (7)

What is the five digit zip code of your primary residence?

\_\_\_\_\_

How long have you been a resident of your current county?

- Less than 2 years (1)
- 2 to 5 years (2)
- 5 to 10 years (3)
- 10 to 20 years (4)
- More than 20 years (5)

What is your present religion, if any? Are you...

- Protestant (1)
- Catholic (2)
- Mormon (3)
- Orthodox (4)
- Jewish (5)
- Muslim (6)
- Buddhist (7)
- Hindu (8)
- Atheist (9)
- Agnostic (10)
- Other (please specify) (11)

- \_\_\_\_\_
- Choose not to answer (12)

Would you describe yourself as a "born again" or evangelical Christian, or not?

- Yes (4)
- No (5)
- Don't Know (6)

Aside from weddings and funerals, how often do you attend religious services?

- More than once a week (1)
- Once a week (2)
- Once or twice a month (3)
- A few times a year (4)
- Seldom (5)
- Never (6)

With which political party do you most identify?

- Democratic (1)
- Republican (2)
- Independent (3)

- Other (please specify) (4)
- 

Do you completely, somewhat, or slightly identify with that party?

- Completely (1)
- Somewhat (2)
- Slightly (3)

If Independent or other party, as of today do you lean more to the Republican Party or more to the Democratic Party or neither?

- Republican (1)
- Democratic (2)
- Neither (3)

On a scale of political ideology, individuals can be arranged from strongly liberal to strongly conservative. Which of the following best describes your views? Would you say that you are

- Strongly Liberal (1)
- Liberal (2)
- Slightly Liberal (3)
- Middle of the Road (4)
- Slightly Conservative (5)
- Conservative (6)
- Strongly Conservative (7)

Which of the following best describes your race or ethnic background?

- American Indian (1)
- Asian (2)
- Black (3)
- Hispanic (4)
- White (5)
- Something Else (6)

Last year, that is in 2017, what was your total family income from all sources, before taxes?

- 0 to \$19,999 (1)
- 20 to \$39,999 (2)
- 40 to \$59,999 (3)
- 60 to \$79,999 (4)
- 80 to \$99,999 (5)
- 100 to \$149,999 (11)
- \$150,000 or more (12)

## Appendix A.2 - Questions From Pre-Forum Survey Related to Environmental Health Risk Factors

### Chemical Contamination

- **contam**: The contamination of coastal waters (national, state, coastal, participants)
  - Likert scale 0 (no concern) - 10 (extremely concerned)
  - Also **contam2**: repeat of contam
- **infections**: An increase in infections resistant to antibiotics (national, state, coastal, participants)
  - Likert scale 0 (no concern) - 10 (extremely concerned)
  - Also **infections2**: repeat of infections
- **waterways**: The quality of natural waterways such as streams, lakes, and rivers in your local area (national, state, coastal, participants)
  - Likert scale 0 (no concern) - 10 (extremely concerned)
  - Also **waterways2**: repeat of waterways

### Biodiversity

- **biodiversity**: Loss of biodiversity (national, state, coastal, participants)
  - Likert scale 0 (no concern) - 10 (extremely concerned)
  - Also **biodiversity2**: repeat of biodiversity
- **habitat**: Habitat restoration projects to protect biodiversity along the South Carolina coast (state, coastal, participants)
  - Likert scale 1 (strongly oppose) - 7 (strongly support)
  - Also **habitat2**

### Development

- **development**: The impacts of development on the land and water quality of coastal areas (state, coastal, participants)
  - Likert scale 0 (no concern) - 10 (extremely concerned)
  - Also **development2**: repeat of development
- **pop**: Increases in population in your local area (state, coastal, participants)
  - Likert scale 0 (no concern) - 10 (extremely concerned)
  - Also **pop2**: repeat of pop
- **seaWalls**: Building sea walls or other barriers to protect coastal areas from sea-level rise and flooding (national, state, coastal, participants)
  - Likert scale 1 (strongly oppose) - 7 (strongly support)
  - **seaWalls2**

## Appendix B - Codebook

Categories recommended by Strauss (1987) for use in coding, with corresponding definitions for each; **Conditions** - the state of something, in regards to its quality, appearance, or working order; **Interactions with Others** - groups and types of people that are mentioned; **Strategies and Tactics** - suggested solutions relating to conditions; and **Consequences** - perception of end results, obstacles, and/or changes. The codebook is laid out in the following manner:

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### Code Category

*Description of category*

#### **Code 1**

Description of code

- Example quote for code 1
- Example quote for code 1

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### Conditions

*The state of something, in regards to its quality, appearance, or working order*

#### **Development**

Mention of any human-induced land use changes, including explicit mentions of development. Also includes offshore development for energy resources and green infrastructure.

- "There are places along the coast -- and it obviously would be where it's less **developed** - where the water quality is significantly more pristine than others..."[Bam 00:48:57]
- "Yeah I just think that our current development practices really affect ecosystem services in the present, but it also affects adaptability in the long-term just as far as degrading the systems and limiting their resilience and capacity to adapt." [Apm 01:14:34]

#### **Population**

Mention of human population, growth or decline in population, or the cause of population changes.

- "...essentially the problem that is generated from that increasing population is the demands on the environment" [Aam 00:44:06]
- "Sometimes I feel like they're doing it by letting us get poisoned by all these toxins and reproductive unintelligible issue -- I'm like, "Oh, this is their way of fighting population."'" [Bpm 01:13:51]

#### **Economics**

Mention of topics relating to economics or business/personal finances. Includes mention of technical terms relating to these topics (e.g., cost-benefit, willingness to pay, profit, expenses).

- " "What's that worth to you monetary-wise to know that that system is there untouched and unscathed" " [Aam 00:55:30]
- "If they knew they'd have to pay more for it because it's moving away because of what we're doing or what's happening with the climate then maybe they'd be a little bit more concerned." [Bam 00:32:00]

### ***Infrastructure***

Mention of a physical structure or system deemed necessary for societal function. Includes the information technology, communications, water and wastewater systems, transportation systems, energy, and dam sectors of USDHS 'critical infrastructure' (2018).

- "The City of Davis was building a new water purification plant not to get water from down in the well, but to get it from the Sacramento River, which did not have all of those heavy chemicals in it. So, anyway, that's a thing." [Bam 00:40:00]
- "... In a lot of treatment systems their filters are just physically not small enough to be able to capture the molecules of that and others." [Apm 00:48:06]

### ***Energy***

Mention of the use and methods of producing electricity.

*Note: Differs from infrastructure by being the 'means' and 'end' of electrical production while infrastructure deals with delivery of electricity between the means and end.*

- "Yeah. Something I heard earlier was why haven't we discussed solar at all and it should be part of the energy equation." [Apm 01:07:30]
- "Oh, yeah. That kind of touches on what stuck out from Paul's presentation to me. It was like I was looking more at windmills." [Apm 01:08:12]

### ***Biodiversity***

Mention of biodiversity explicitly, the variety of organisms or habitats, or other topics relating to the concept of biodiversity.

- "... and normal people like to say, "Yeah, I like seeing a lot of different types of birds, butterflies, or whatever"" [Bam 00:27:00]
- "a sort of power that makes change is that with biodiversity...is just how much of the economic influence has on the health influence." [Bam 00:25:06]

### ***Organism***

Any mention of a living organism. Does not include biota that cause disease (*i.e.*, *Vibrio* sp.) or organisms in context of a consumable resource (*i.e.*, shrimp, trees).

- "But sea turtles are charismatic megafauna and people connect with them just by looking at them. If there's a spotted sea trout, or a fish, or whatever --" [Bam 01:08:30]
- "... I can look it up , and I'll tell you exactly. But there's a lionfish part, there's a to-be-released sea level rise thing..." [Apm 00:36:29]

### ***Ecosystem***

Mention of the ecosystem, including the biotic elements, abiotic elements, and/or specific habitats.

- "We can talk about productivity with marshes all day long, but if sea level rise does away with marshes -- because one foot would really fill in our marsh habitat and change the way marshes are -- that's -- I don't know..." [Bam 01:10:31]
- "In my community of over 15,000, people know that the retention ponds, the lagoons all over are not for swimming, not for fishing. You can fish in some of them, but it's catch and release. You can't eat anything. But that doesn't stop them from wanting to grow a northern lawn in .... County of [sic] Buford County." [Apm 00:33:30]

### ***Resources***

Mention of the use of consumable natural resources, such as shrimp, water, timber, and soils. Includes mention of their use and disposal.

- "Making it more expensive to have shrimp from somewhere else" [Bam 00:35:29]
- "Pretty soon we'll all be eating tilapia. That's all that will be left." [Apm 01:21:01]

### ***Contaminants***

Mention of any contaminants, pollutants, waste products, and chemicals, including contaminants of emerging concern.

- "If we can allow rivers to flood and absorb some of the pollutants that we're throwing into the water from agriculture, etc., then the dead zones along our estuaries, in the gulf, or wherever are going to be decreasing." [Bam 01:27:59]
- "and that's a kind of grass that requires incredible amounts of fertilizer, the Bermuda." [Apm 00:35:00]

### ***Environment***

Mention of the state and/or quality of the environment or when someone explicitly mentions "environment" or related terminology.

- "We have additional water testing in our community because its important and we have a requirement to meet certain guidelines under the MPDES process..." [Bam 00:19:59]
- "The health community needs to be talking about the impacts of rising sea levels, standing water, all of that the bacteria, the runoff, and the health implications because that's where people might get a little more nervous than biodiversity loss or even economic loss." [Bam 01:29:04]

### ***Natural Hazards***

Mentions of any severe weather or natural hazard, such as hurricanes, sea-level rise, flooding, etc.

- "So, if you need space for a fish farm, you cut trees out of an area, then you put an impervious surface in and you're increasing flooding." [Bam 00:44:10]
- "Oh yeah. Our beaches are under seige. Their nesting habitat is under seige by sea level rise now." [Bam 01:09:00]

### ***Climate***

Mention of climate related topics, such as temperature, rainfall, climate change, drought, humidity, etc.

- "So, I don't think it's storms, but I do think sea turtles are absolutely temperature-sensitive... when water starts warming up and they're looking for food after a lean winter of not feeding much, they're coming in sooner because maybe it's warming quicker or later because it's not warming as quick." [Bam 01:13:00]
- "It also affects our adaptability to climate change in so many ways. If we develop all of the wetlands or develop around these wetlands and then either fill them in or degrade them and then they're unable to adapt as easily to climate change, then it's a long-term loss of an ecosystem. ..." [Apm 01:13:29] - also a great example for development and ecosystem

### ***Human Health***

Mention of human health related topics, such as illness and disease, antibiotic resistance, mental health, physical health, and well-being.

- "The health community needs to be talking about the impacts of rising sea levels, standing water, all of that the bacteria, the runoff, and the health implications because that's where people might get a little more nervous than biodiversity loss or even economic loss." [Bam 01:29:04]
- ".. research has shown that if you educate users on the health impacts, environmental and public health impacts of fertilizer and other chemical use, they are likely to switch to ... practices which are costlier but will help mitigate the impacts." [Apm 00:39:29]

### ***Behavior***

Mention of human behavior and decisions, including certain actions or inaction.

- "It's the species that they're trying to grow. They don't want to grow what grows well here and is drought-tolerant in the summer." [Apm 00:35:00]
- "It's interesting, because a lot of them seem to know that they shouldn't eat the fish they catch out of there, they should let their pets swim in there." [Apm 00:33:00]

### ***Knowledge***

Mention of a state of knowledge on a specific topic or in general and can refer to an individual or a group of people. Includes any mention of data, data sources, false information, and disinformation.

- "It's interesting, because a lot of them seem to know that they shouldn't eat the fish they catch out of there, they should let their pets swim in there." [Apm 00:33:00]
- "And that I think is a big issue in general with the scientists to the educators. There's that big disconnect, and as an educator, I might read a paper and be like, "i honestly don't even know what I've read."" [Bpm 00:59:30]

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## **Interactions with Others**

*Groups and types of people that are mentioned*

### ***Close Contacts***

Mention of a person/group with whom they have a continual relationship, such as coworkers, friends, neighbors, or family members. Also, includes mentions of social media sites.

- "I think the common ground we came to is to save the environment starts with each person individually, and to teach their families and their neighbors, and from there it can spread out." [Bpm 00:54:57]
- "Yes. I think it's a personal thing. My best friend just got married to a guy from Scotland, and he didn't drink milk there, because I don't think they pasteurize their milk, but now he drinks milk. He thought he was lactose intolerant, but now he's not all of a sudden." [Bpm 00:18:31]

### ***Residents***

Mention of any group of people in a community, and includes references to "children", "the public", or "general public". Includes mention of neighborhood social media sites such as Next Door or neighborhood-focused Facebook groups.

- "So, for all the good that we get our residents to do and our single-family homes, one hotel can wipe out an entire neighborhood's worth of good." [Bpm 00:20:35]
- "Other states will allow you to take your fence right on out into the ocean and prevent the public from crossing the beach." [Bpm 00:49:58]

### ***Professionals***

Mention of a professional or someone working in a specific position, excluding those in government.

- "... I probably could figure it out if i go on the internet, but who does the testing, what is the test being done, how precise and accurate are the tests that are being informed, and where are the results." [Bam 00:16:57]
- "Especially if you go to the manager and ask him for the lionfish, he's got to make the effort to get it in for you and you can report them to corporate if they don't do it. It's part of their customer service. They're all about it." [Bam 00:12:33]

### ***Government***

Refers to any official or organization in the public sector. This includes federal, state, and local government, as well as elected officials, appointed officials, and employed public servants.

- "I'm not sure if the CDC does that with the environmental effects downstream of urine and things like that with the drug. I'm not sure where -- I think that might fall under liek more DHEC-type of things." [Apm 00:46:51]
- "and we have to remember that politicians are public, normal people without scientific backgrounds, many of them need to have it watered down a bit." [Bpm 00:59:30]

### ***Business***

Mention of any for-profit industry, organization, or company in the private sector

- "It's actually in court right now relative to agriculture withdrawals that the legislature has given carte blanche to saying, "Big ag, come on it to our state. all of the water that you want and you don't even have to apply for a permit.""[Aam 00:32:26]
- "But a lot of our seafood markets get their fish that they are selling to the public from regional fisheries, so if you want my opinion I would just keep asking your local fish market, your Crosby's, or whoever, like, "Can you get lionfish? Can you get lionfish?" Because they can." [Bam 00:11:28]

### ***Non-Profit Organizations / Volunteers***

Mention of volunteers, not-for-profit organizations, or other volunteer organizations.

- "The local one is Charleston Waterkeeper, so they test surface waters, they're not groundwater." [Apm 00:28:55]
- "It started off a 3000 acre protected area. I worked with a former Audubon South Carolina director who is headquartered there." [Apm 01:18:05]

### ***Politics***

Mention of complex interactions between individuals involved with decision-making, not limited to elected government officials.

- "If you do have to be declared a disaster area then that becomes political." [Apm 00:58:58]
- "When people get together and they show up at the town council meeting and they're all wearing green, you can see the support for -- in this particular case -- keeping our police department." [Bam 01:04:01]

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## **Strategies and Tactics**

*Suggested solutions and strategies for conditions*

### ***Policy***

Mention of policies or regulations, and also refers to incentives or taxes.

- "If you want higher and better data you're going to have [to] pay taxes for it and that's not high up on the priority list." [Bam - 00:19:28]
- "We talk about these bans on plastic bags in the stores. We're probably infusing the environment with more plastic from plastic water bottles than any sources. They're everywhere." [Apm 00:19:30]

### ***Education***

Mention of education, outreach, or extension to any individual by means of any type of learning experience. Marketing tactics are also included.

- "They have a training program to get people certified on all of these issues, and then putting teachers in schools" [Apm 00:23:05]
- "But it has to be translated for the majority of people in order for the populous as a whole to come onboard, accept and go along with it." [Bpm 01:02:33]

### ***Activity***

Mention of individuals adopting a specific activity or different practice, and/or engaging the community at any level. Related to 'behavior'. Could also be coded for mentions of reactivity or proactivity.

- "Yes, something like that. People should do it voluntarily. If you have concerns about the water quality in your area, you should volunteer to get it tested." [Apm 00:29:33]
- "I think the reverse osmosis of that -- But would adding like UV light? Like is there like one more step that could be --" [Apm 00:48:31]

### ***Innovation***

Mention of technology, processes, or research that can be used to impact society. This could also refer to anything considered novel or updated, including infrastructure.

- "Okay, so it's SCA Citizen Science is the name of the app. ... It's super easy. Once you get used to it, it takes a couple of times because it takes a little time to scroll through." [Apm near 00:38:05]
- "I think the reverse osmosis of that -- But would adding like UV light? Like is there like one more step that could be --" [Apm 00:48:31]

### ***Monitoring***

Mention of observing, recording and reporting conditions, as well as being warned of conditions.

- "Maybe there could be some water quality testing, voluntary, for people who depend on groundwater for instance, or on resources that get contaminated with chemicals from water pollution." [Apm 00:25:27]
- " But I do know about water quality and the like, and we're always monitoring to keep it going. I know that there's a lot of impacts and a lot of points of impact." [Bam 00:51:32]

### ***Collaboration***

Mention of performing a task in conjunction with another individual and/or organization.

Includes mention of stakeholders.

- "Then I would say that -- I think that's kind of it at this point. But I think stakeholder involvement is critical." [Bam 01:18:59]
- " Id just like to say one thing on a positive note. The [SCDNR] got together with a bunch of different interest groups, forest folks and all of that, and out of that came the ACE Basin." [Bam 01:40:33]

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## **Consequences**

*Perception of end results, obstacles, and/or changes*

### ***Efficacy***

Mention about the potential of reaching desired result or when a person is skeptical of the outcomes

- "I think it's going to be easier to implement because the regulation thing has to overcome so much." [Bam 01:00:33]
- "And children are more effective at changing their parents' minds" [Apm 00:15:31]

### ***Beliefs***

Mention of an individual's or group beliefs, trust in someone or something, or their opinions. Also includes any sort of mention of an emotional response or expression.

- "It goes into biblical stories at times. ""God gave us the land to use, not to protect."" Those are things I've heard." [Bam 00:58:58]
- "It's "the land, waters, and air are all of the people's and we shall do everything we can to protect it for the people." Then when you look at the actual application of the policies that have been created since that was enacted of course there are these huge disparities.

But the power is still there. It's still written in the law. It's just something that -- I don't think there's a lot of awareness that there's protection against pollution just written just for the general public." [Aam 00:34:01]

### ***Priority***

Mention of priorities, including thresholds in which people begin to realize the gravity of a situation and potentially change their stance. Includes conversations relating to long-term versus short-term outcomes.

- "If you want higher and better data you're going to have [to] pay taxes for it and that's not high up on the priority list " [Bam - 00:19:28]
- "It is absolutely worth your time to figure that out before you have to worry that much about it." [Bam 00:22:29]

### ***Negative***

Mention of a negative impact, a negative perspective on a topic, the deterioration of conditions, or negative changes.

- Speaking on water quality testing "They do, they just can't because if you tell people the truth around an area, then you create fear and panic." [Apm 00:26:02]
- "... shrimpers will tell you that their numbers have been going down every year, they can't sustain fuel costs, and all of these other things."

### ***Positive***

Mention of a positive impact, optimistic perspective on a topic, the betterment of conditions, or positive changes

- "I think people would get onboard for that for protecting areas because look at what we do with the logger turtles. Everybody is protecting eggs, there's signs, and people" [Bam 01:08:01]
- "They're not only delicious, but it is truly preserving our local fish populations to eat them so it should be on the top of our list for dinner." [Bam 00:11:02]

## Appendix C - Transcription Coding Records

Below is a list of recorded code applications for words and phrases taken while in the process of coding the transcripts. The list is not in any particular order. The first column includes a word, phrase, or statement about what was within the transcripts, the second column includes the coding applications for the item in the first column, and the third column is reserved for additional or optional codes which can be used for the object in question. Some of these are placed in context and are denoted with a parentheses “()” and a word briefling placing the additional code in context.

Word / Phrase	Coding Applications	Optional Coding Applications
Harmful Algal Blooms	Natural Hazard + Contamination	
Plastics	Contamination	Resource (products), Resources + Behavior (Single-use)
Golf Course	Development + Business	
Stormwater Pond	Infrastructure + Climate	Contaminants, Environment, Development
Stormwater Runoff	Contaminants + Climate	
Stormwater Consortium	Government + Infrastructure + Climate	
Stormwater Fee	Policy + Economics + Natural Hazards + Infrastructure + Government	
Real Estate	Business + Development	
House	Development	
Paying Premiums	Economics	
Water Testing (drinking)	Resource + Monitoring	
Renourishment (beach)	Resource + Development	
Programs	Activity (General)	Education, Policy, Innovation, Collaboration (Specific)
Planning	Collaboration + Policy	Business, Government, Non-profit
Mitigation	Innovation + Activity	
Harmful Bacteria	Human Health	
“You never heard about that before”	Knowledge	

Fishing Industry	Business + Resources	
Identification of source	Monitoring + Resources	
Regulation	Government + Policy	
Stormwater Treatment	Climate + Contaminants	Behavior (present use), Activity (future use or adopted)
Management	Activity or Monitoring (in context)	
Greenspace or Park Area	Development + Ecosystem	
Sustainable(-ility)	Economics + Residents (social) + Environment	
DHEC, NOAA, Department of Commerce, et cetera	Government	
Wind Turbines	Energy + Innovation + Development	
Offshore Wind Energy	Energy + Innovation	
Coal Power Plants	Energy + Resource	
Green <i>descriptor</i> (e.g., green energy, green practices)	Environment	Descriptor-based
Views	Resident + Priority + Ecosystem	
Consumer Demand	Economics + Residents + Behavior	
Support	Beliefs + Priority	
“The Dutch”	Government	
Canals or Dikes	Infrastructure + Activity + Development	Natural Hazards (referring to flooding or sea-level rise)
Retreat	Natural Hazard + Activity	
Infrastructure implementation	Infrastructure	Activity (current) Innovation (novel or adopted)
“New Flood Maps”	Monitoring + Natural Hazard + Government + Policy	
Market Self-Correction	Economics + Priority	
War of Attrition	Priority + Behavior	

Insurance	Economic + Policy	Natural Hazards (Flooding), Negative (General)
Jetty	Infrastructure + Development + Economics + Resources	
Real-estate Laws	Professionals + Business + Government + Policy + Development	
Realtor	Professional + Development	
Private-Property Rights	Residents + Development + Property	
Genetically Modified Organism (GMOs)	Resource + Organism + Innovation	
Dissolved Oxygen	Environment	
Organisms preferred range of conditions	Environment + Ecosystem + Organism	
Tax	Economic + Policy	
Drinking Water	Resource + Infrastructure	
Natural Gas Information	Contamination + Resource + Energy + Education	
Researching news sources	Beliefs + Education + Knowledge	
False Information	Education + Knowledge	
Farm-based	Development + Resources + Activity	
Subsidies	Policy + Economics	
Website	Education + Knowledge	
Study	Monitoring	
Invasive Species	Negative + Organism	
Growth (community)	Population + Development	
Xeroscaping	Development + Behavior	
Urban Planning	Development + Infrastructure + Policy	
Branding	Education (marketing)	

Public Engagement or Public Forum	Collaboration + Residents + Activity	Government (elected officials or public servants), Professionals (natural resource managers, experts)
Household	Close Contacts	
Oil and/or Gas	Resource	
Noise Pollution	Environment	
Geothermal Energy	Energy + Innovation + Development	
Unsustainable Practice	Environment + Residents + Economy + Behavior	
Unfortunately	Negative	
Lucas case	Policy + Government + Development + Ecosystems	
Common Ground	Beliefs + Collaboration	
Risk	Negative	
Concern / Focus	Priority	
Carbon Footprint	Contamination + Environment	
Climate Change Denial	Beliefs + Climate + Knowledge	Priority (denier responses to changes)
Tides	Ecosystem	
Checking tides before biking or driving to work	Ecosystem + Infrastructure + Natural Hazards + Behavior	Monitoring
Planning to Move	Behavior + Activity	Natural Hazards (escape flooding), Population
Depression	Human Health + Negative	
Lobby	Politics	Resource + Energy (Coal)
Watershed Plan	Collaboration + Policy + Ecosystem + Environment + Contaminants	
Oyster Beds	Ecosystem + Organism or Resources (consumable)	
“Stuff you care about”	Beliefs + Priority	
“Eat the shrimp”	Resource + Behavior	

Conversation or Talking to people	Activity + Residents (general) or Close-contacts (friends and family)	
Market	Business + Economy	
Sun Poisoning	Climate + Human Health	
“Our beaches all have to stay the same”	Ecosystem + Development + Behavior + Belief	
Culture	Resident + Behavior	Policy (“sue” culture)
Delineations (saltwater, wetlands, beachfront)	Government + Policy + Ecosystem + Development	
Bankrupt	Economics + Negative	Add organizational type
Open for public comment	Resident + Activity	
Not enough information	Negative + Efficacy + Knowledge	
University	Education	
Vegetation	Ecosystem + Organism	
Conferences	Education + Collaboration	
Litter	Resources + Contamination	
Clean-up	Activity + Contaminants	
Recycling	Resources	Contaminants
Barriers to completing tasks	Efficacy + Negative	
Volunteer(s)(ing)	Non-profit	Activity (volunteerism)
Convincing People	Priority + Efficacy + Residents	
Trust	Belief	
“Let’s go do this together”	Activity + Collaboration	
Expressing concern or care	Priority	
Lionfish	Organism + Resource	
Spearfishing	Behavior + Resource	
Dumping aquarium [contents] into the toilet	Organism + Infrastructure	
Intellectual Community	Professional + Education	

Waterkeepers / Riverkeepers	Environment + Non-profit	
Environmentalism or stewards of the earth	Environment + Behavior	
Fishing	Behavior + Ecosystem + Resources	
Someone values resources	Priority + Resources	Economy (valuation)
Bible Study	Close Contacts + Beliefs	
Asking about the source of fish	Resources + Activity + Behavior + Knowledge	
“Don't have time to do that”	Priority + Activity + Efficacy + Negative	
Presenting a value to an individual	Education + Priority + Beliefs	Close contacts, Residents
Green Belt Committee (Folly Beach)	Development + Ecosystem + Government + Collaboration	
Conservation Easements	Ecosystem + Development + Policy	
Hurricane Preparedness	Natural Hazards + Behavior + Priority	
Communication Strategies	Activity + Efficacy	
Comprehensive Plan / Planning Commission	Collaboration + Government + Policy	Development
Environmental Health	Environment + Human Health	
Mold	Contaminant + Human Health + Environment	
Inspectors	Professional + Monitoring	
Dangerous Pathogens	Negative + Human Health	
Microbiome	Ecosystem	
Replacing Filters	Environment + Behavior	Activity (getting better filters)
Homeowners Association (HOAs)	Residents + Policy	
Landscape Architecture Firm	Development + Professional + Business	
Cruise Ships	Business	

Dumping out at sea	Behavior + Contaminants	
Navy	Government	
Who is watching you?	Negative + Behavior + Monitoring + Efficacy	
Ocean	Ecosystem	
Awareness	Knowledge	
Signage	Education	
Research	Innovation or monitoring (context)	
Pharmaceuticals	Human Health + Contaminants	
Developing Antibiotic Resistance in Bacteria	Contamination + Human Health	
Wastewater	Resources + Contaminants	
Wastewater Treatment or Management	Resources + Contaminants + Behavior	Infrastructure
Statistics	Monitoring	
Opioid Epidemic	Human Health + Negative + Contaminants	Behavior
Dispose	Resources	Contaminants
Structure (physical)	Infrastructure + Development	
What you're willing to fight for	Priority + Residents	
Rebuilding	Development + Behavior	Natural Hazard (usually)
Tourism	Economic + Business	
Webpage	Innovation + Education	
Incentives	Policy + Behavior	Economics
Quality of Life	Human Health + Residents + Environment	
Community Efforts or Events	Education + Activity	
Not in my backyard (NIMBY)	Residents + Development + Beliefs + Negative	

Ocean Conservation	Ecosystem + Resources + Behavior + Activity	
Awareness	Knowledge	
Alarmed / Alarming	Priority + Beliefs	
Run-off	Contaminants + Environment + Development	
Lawns	Development + Behavior + Residents	
Exxon-Valdez (Oil Spill)	Resources + Ecosystem + Negative + Contaminants	
Interdisciplinary	Knowledge	Education
Consumer Products	Economics	Resources
Triclosan	Contaminants + Human Health	
Better	Efficacy	Positive
Landfill	Resources + Development	
Ramification	Negative	
Utility	Resources	
“I moved here recently”	Population + Behavior	
Public Trust Doctrine	Development + Policy + Resources	Professional + Behavior
Mitigation	Activity + [Subject of Mitigation]	
Purposeful Ignorance	Priority + Knowledge	Education + Beliefs
Identity of Place	Residents + Priority + Beliefs	Ecosystem + Development

## Appendix D - Institutional Review Board Letter

College of Charleston Institutional Review Board  
FWA 00000772

Letter of Approval  
Effective Dates: 01/26/2017 - 01/25/2018

Matthew C. Nowlin PhD  
Political Science  
University of Charleston, South Carolina  
College of Charleston  
Charleston, SC 29424

Re: IRB-2017-01-18-093153 - New Protocol  
Can Deliberative Discussions Lay a Foundation for Integrated Decision- Making  
Networks Under Pressure from Changes in Population, Climate, and Energy  
Needs?

On 01/26/2017, the College of Charleston IRB completed its review of your application. I am pleased to advise you that your protocol has been approved for a period of one year, expiring on 01/25/2018. Your approval code is **FQJG-01-26-2017**. This code must appear on consent forms and all recruitment advertisements.

If the project will continue beyond 01/25/2018, a request for continuation or continuation with modification must be submitted and approved by the IRB. Protocol continuation includes the data analysis phase after data collection is complete. Please allow at least 30 days for processing and IRB review.

If any adverse events or unanticipated problems involving risks or injury to the participants or other persons occur at any time during the study, such events or problems must be immediately reported to the IRB through the Research Compliance Coordinator and to the cognizant administrator (department chair, dean, or unit director).

If changes in the protocol, whether major or minor, are required, a Protocol Modification Form must be submitted and approved by the IRB before the changes may be implemented.

Upon completion of the project, a Final Report must be submitted to the IRB.

Online forms for continuing reviews, protocol modifications, the final report, and/or the reporting of adverse events are available at  
[http://www.orga.cofc.edu/pub/\\_eforms\\_irb.shtml](http://www.orga.cofc.edu/pub/_eforms_irb.shtml).

Please do not hesitate to contact me if you have any questions.

Eileen Callahan

Research Protections & Compliance  
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cc: IRB File, IRB Chair, PI Department Chair