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Community Involvement in Flood Mitigation: A Survey-Based Approach in Marion County, SC

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**Community Involvement in Flood Mitigation: A Survey-Based Approach in Marion
County, SC**

By

Lillian C. Howie

Submitted in Partial Fulfillment of the
Requirements for the Degree of Master of Science in
Coastal Marine and Wetland Studies in the
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2020

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Dedication

This thesis is dedicated to Mary and John Buie, for allowing me to live rent-free in their home and hearts while working on this project.

And to all the guinea pigs who have suffered in the name of science, including my dear Hazel and Honey, who have patiently endured all the kisses and cuddles necessary to keep me motivated over the past two years.

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Finally, thank you to Governor Henry McMaster and the South Carolina Floodwater Commission for supporting this study, and for their dedicated cooperation with the citizens of Marion County.

Abstract

Marion County is located in northern South Carolina between the Great Pee Dee and Little Pee Dee Rivers. Because Marion County was the location of severe flooding during hurricanes Matthew (2016) and Florence (2018), the South Carolina Floodwater Commission identified Marion County as a location for drainage system improvement by the Infrastructure and Shoreline Armoring Task Force. In order to align plans for drainage system improvement with the needs of the local communities, commission chairman Thomas Mullikin requested a community survey to gauge the residents' personal experiences and views on what changes should be made to address the problem. The purpose of this survey is not only to guide the Infrastructure and Shoreline Armoring Task Force in making and implementing decisions about drainage system improvement, but also to establish a connection with Marion County using a method that can be implemented in other flood-prone communities in the future. 320 individual survey responses were collected between May and September 2019, with respondents answering questions on topics such as their experiences with flooding and property damage over the past ten years, their knowledge of flood zones and flood insurance, and their opinions about flood mitigation strategies and responsibility in community recovery. Survey responses were digitally coded, individual question results were recorded, and the impact of demographic factors on select questions was examined using univariate analysis. The results indicate that, while few respondents know their flood zone or have implemented property-scale flood prevention measures, there is a significant interest in further education as well as support for building code updates and rezoning based on recent flooding. Older respondents reported more frequent flooding over the past ten years, and were more likely to know their flood zone, to support rezoning and building code updates, to report taking flood warnings seriously, and to express interest in further education than younger respondents. The results suggest that more educational

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1. Introduction



Figure 1. Homes and cars in Marion, SC are inundated with floodwater from Hurricane Florence in 2018 (Gerald Herbert, Associated Press).

Since the 1970s, an increase in the frequency of Atlantic hurricane formation has contributed to coastal flooding along the east coast of the United States (Saunders and Lea, 2008). Because there is a correlation between hurricane formation and sea surface temperature, researchers predict that rising global temperatures will contribute to greater hurricane frequency in the future (Saunders and Lea, 2008; Zhao and Held, 2012). South Carolina has borne the brunt of many of these hurricanes, with significant flooding in the Pee Dee River Basin related to Hurricanes Matthew (2016) and Florence (2018). The South Carolina Floodwater Commission, established in 2018 by Governor Henry McMaster and chaired by Thomas Mullikin, was created to address flooding concerns, both in recovery from past floods and preparation for future flood events. Within the larger Floodwater Commission, the Stakeholder Engagement Task Force is working to promote cooperation between individual residents, businesses, and government

agencies, to build more resilient communities in the face of future flooding. What constitutes a “stakeholder” varies depending on the situation, but for the Stakeholder Engagement Task Force uses a definition presented by Baroudi and Rapp (2014), which defines a “stakeholder” as “any person or organization that is either actively involved in, affected by, or can influence a project.” When it comes to disaster preparation, two important characteristics contribute to successful projects: experience with previous disaster events and effective planning processes (Kartez and Lindell, 1987). It is important, therefore, to assess community levels of experience with previous flood events and the potential for engagement in planning processes for future events. The South Carolina Floodwater Commission is interested in gauging the knowledge and experiences of South Carolina residents with recent flooding, along with their opinions and perspectives on how to effectively prepare for future flood events. This study focuses on Marion County, a county in northern South Carolina that has suffered significant flooding in recent years, most associated with hurricanes Matthew and Florence. Using a survey method developed specifically for use by the South Carolina Floodwater Commission, this study analyzes the responses from Marion County residents and interprets relationships between demographic factors and the flood experiences and opinions.

1.1 Research Questions and Hypotheses

This study aims to assess the flood knowledge, experience, and opinions of Marion County residents, and examine how demographic factors influence those responses.

- What do Marion County residents know about flood zones and flood mitigation techniques? “Flood knowledge,” in this study, consists of self-reported knowledge of their property flood zone and awareness of property-level flood mitigation techniques. Knowledge of flood zones is an important component of flood awareness, as evacuation orders are issued based on

flood zones during hurricanes and other flood events. General flood zone knowledge can also help residents assess their risk during future flood events. Property-scale flood mitigation measures, such as rain gardens- landscaped areas of low elevation that can retain water in the event of a flood- provide opportunities for home and business owners to mitigate property damage caused by flooding.

- How has flooding affected Marion County residents over the past decade? Flood experiences of interest to this study include reported frequency of flooding on personal property over the past ten years, whether the resident has flood insurance, and the reported severity of the following flood effects: property damage, loss of income, obstruction of travel, physical health problems, and mental health problems. The study of flood experiences not only helps researchers gauge the severity of the problem, but also provides insight into future disaster preparation, as experience with previous disasters can significantly improve local preparation efforts (Kartez and Lindell, 1987).
- What opinions do the residents of Marion County hold regarding flooding and community response? This study focuses on opinions about building codes, rezoning, responsibility for flood recovery, causes of flooding, interest in further education and cooperation between communities, and the seriousness of hurricane and flood warnings. These opinions are important to study, not only to help policymakers and educators gauge support for potential legislation and outreach projects, but also to examine the influence of demographic factors on these opinions.
- Do age, gender, education level, and home ownership have a significant effect on respondent knowledge, opinions, and experiences, and if so, how? This study hypothesizes that these demographic factors will influence responses in a variety of ways.

These hypotheses include:

(1) Younger respondents will be more likely to know their flood zone, more likely to support rezoning and building code updates, and report greater interest in further education than older respondents. This hypothesis assumes that older respondents are more conservative in their views and may be unwilling to consider major changes in their personal or political views, while younger respondents are more open to new information and political changes.

(2) Female respondents will report taking warnings more seriously than male respondents. This hypothesis assumes that women are more cautious in their perception of risk than men are.

(3) Highly educated respondents will be more likely to know their flood zone and have greater interest in further education than those respondents who have had less formal education. This hypothesis assumes that those respondents who have completed higher levels of education place greater value on education in all aspects of their life.

(4) Homeowners will be more likely to know their flood zone, have flood insurance, and report taking warnings more seriously than respondents who rent their homes. This hypothesis assumes that those who own their homes have made a greater financial investment in their property and place greater value on protecting that property.

2. Study Area

2.1 History of Marion County



Figure 2. A map of Marion County, with the location in South Carolina highlighted in red.

Marion County is located in the South Carolina coastal plain, bordered by the Great Pee Dee and Little Pee Dee Rivers (*Figure 2*). European settlement of Marion County began early in the 1800's (Reed and Olson, 2009). River transportation was the most effective method of travel for early residents (Stanley, 1977), so early settlements began along the Great Pee Dee and Little Pee Dee Rivers and Catfish Creek in central Marion County. Fertile upland soils gave rise to small farms and plantations, which began growing indigo and later transitioned to cotton and tobacco as the main cash crops (Reed and Olson, 2009). These crops were transported along the rivers to Georgetown, where they could be shipped to Charleston and then to other parts of the

world. River travel was the main method of shipping until rail travel became more efficient in the late nineteenth century (Stanley, 1977). Oats, rye, and wheat were also grown for personal use by farmers, and livestock such as pigs and cattle were raised throughout the county, particularly in the southern Brittons Neck region of the county. Between 1800 and 1900, the population of the county rose from almost 7,000 to over 35,000, and with the increase in land use, erosion rates also increased (Reed and Olson, 2009). While winter flooding of the Pee Dee River is common, sporadic but catastrophic flooding related to Atlantic hurricanes can occur during the late summer and autumn months. Large-scale flooding along the Pee Dee River in 1878, 1896, 1928, and 1945, resulted from hurricane-related rainfall (Conway, 2019). Marion County remains largely rural into modern day, with an estimated population of 31,000 in 2018 (U.S. Census Bureau, 2018).



Figure 3. An aerial view of flooding in Nichols, South Carolina, following Hurricane Matthew in 2016 (U.S. National Guard).

In 2016 and 2018, major flooding related to hurricanes Matthew and Florence devastated parts of Marion County, forcing evacuations and flooding homes and businesses. The effects were still being felt into 2019, with many residents still displaced from their homes. The town of Nichols (*Figure 2*), saw floodwater 4-6 feet deep and 95% of the 350 Nichols residents unable to return to their homes following Hurricane Matthew in 2016 (Duffy, 2019; Woolpert, 2019). Interviews with county residents suggested that many whose homes were flooded were previously unaware that they lived in flood zones (Brown, 2019b), and of the 1300 homes in Marion County flood zones, less than a third of them were insured against flooding (Brown, 2019a). While the 2011 Flood Prevention Ordinance currently requires residents in flood zones to elevate their homes, many do not have the money to do so, particularly retirees living on fixed incomes (Brown, 2019b). With the U.S. Census Bureau Small Area Income and Poverty Estimate reporting over 27% of county residents living under the poverty level in 2017, there are still significant financial barriers to flood recovery and mitigation.

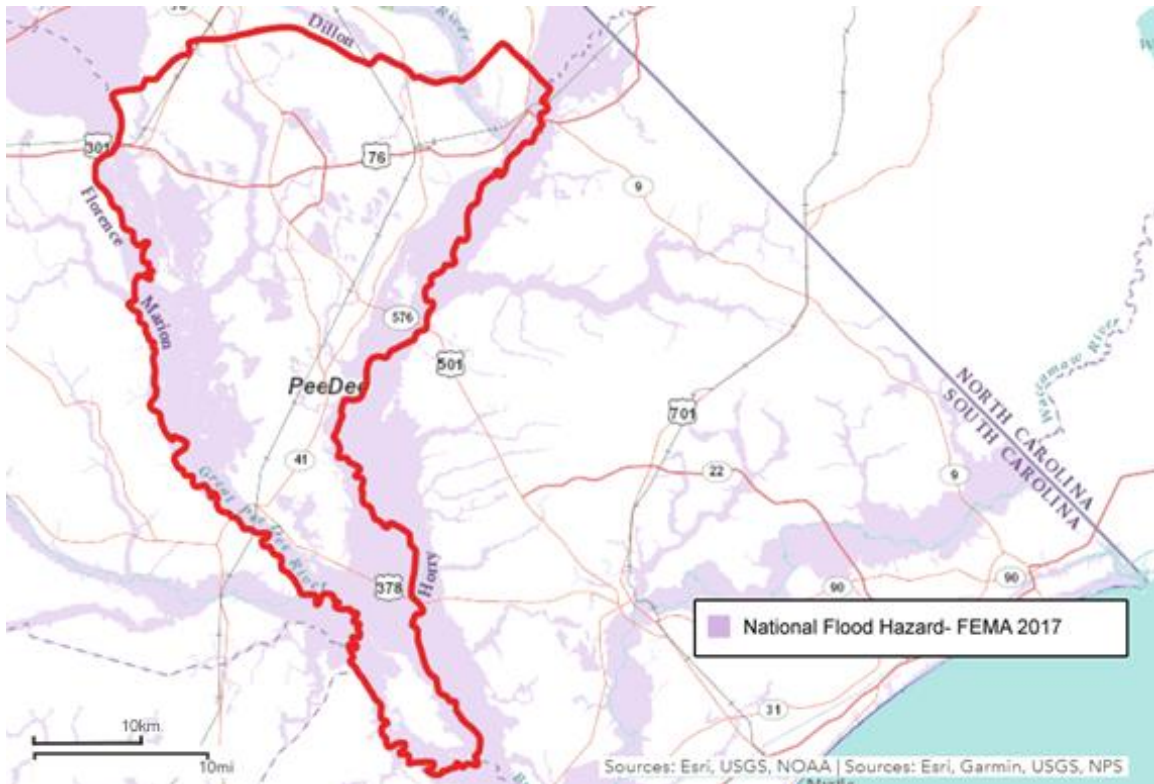


Figure 4. Flood Hazard map of South Carolina with Marion County highlighted. Adapted from SCDHEC.

2.2 Characteristics of Marion County and the Pee Dee River Basin

2.2.1 Geologic and Hydrologic Setting

The surface sedimentary deposits in Marion County are made up of unconsolidated to poorly consolidated sand and mud, late Cretaceous to Holocene in age. This is characteristic of South Carolina’s coastal plain, with a wedge of sediment that thickens seaward along the coastal plain (Reid, 1986). Streams carve out dendritic drainage courses to river level, some grading up to 40 feet (Feaster and Tasker, 2002; Thom, 1967).

Test well MRN-78 (*Figure 5*), is located in the southern Brittons Neck region of the county (Reid et al., 1986). Beneath 35 feet of unconsolidated deposits composed of mud and medium-grained sand, the geological Upper Cretaceous Formations- Peedee, Black Creek,

Middendorf, and Cape Fear- overlie a pre-Cretaceous system. The Peedee Formation, extending from 10.5 meters (35 feet) to 38.5 meters (127 feet) beneath the land surface, is composed of clay with calcareous marine fossils. Beneath the Peedee Formation, extending to 188.5 meters (619 feet) below the surface level, the Black Creek Formation contains dark clay and sandy beds with intercalated clay layers. The formation underneath, identified tentatively as the Middendorf Formation, extends from 188.5 to 237.5 meters (619 to 780 feet) below the surface and contains a mix of sand and clay. Beneath this, the Cape Fear Formation contains upward grading cycles of coarse-grained sand through fine-grained sand to silt and clay, continuing down to 357 meters (1,171 feet) beneath the surface (Reid et al., 1986).

Marion County experiences between 48 and 52 inches of precipitation annually, with 12-14 inches of runoff (Aucott, 1996). Runoff, described by Blick et al. as “a by-product of rainfall’s interaction with the land,” refers to water from rainfall that does not infiltrate into the soil or groundwater (2004; pp.5.2). This translates into flooding when the amount of runoff is greater than the surface water bodies such as lakes and rivers can support. The runoff from a single rainfall event, such as a hurricane or other large storm, is mainly influenced by the total amount of rainfall, but is also influenced by the intensity of the rainfall over time, with higher intensity rainfall events such as those associated with hurricanes creating higher peak discharge and more potential for flooding (Blick et al., 2004). Hydrologic characteristics of soils also affect runoff amounts, with low permeability- the ability of the soil to transmit water- allowing less infiltration and leading to greater runoff (Blick et al., 2004; Pitts, 1980). While highly permeable sandy soil is common in Marion County, loamy soil with silt and clay components is also common, reducing permeability where present. Much of Marion County must be artificially

drained (Pitts, 1980), and high-intensity rainfall combined with low soil permeability can lead to large-scale flood events.

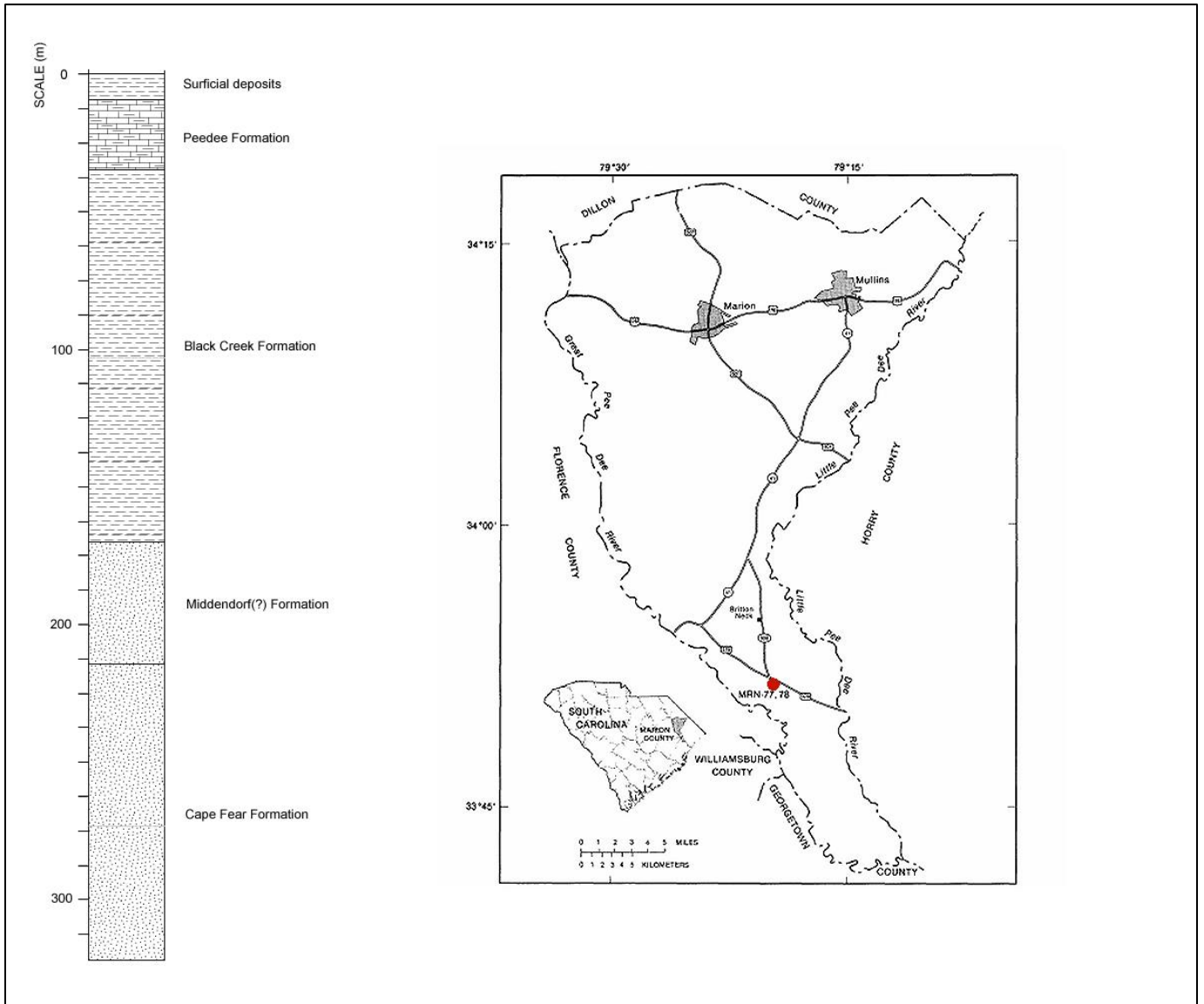


Figure 5. A simplified geologic column constructed from data from well MRN-78. The location within Marion County is shown in red. Adapted from Reid et al. 1986.

2.1.2 Pee Dee River

With headwaters in the Blue Ridge Mountains of North Carolina, the Pee Dee River (*Figure 6*) flows 692 kilometers (430 miles) before discharging into Winyah Bay. At its mouth, the Pee Dee River flow rate averages about 505 cubic meters per second (17,810 cubic feet per second) (Stanley, 1977). Between 1905 and 1928, a series of six dams were constructed along the Great Pee Dee River (known as the Yadkin River in North Carolina) for the generation of hydroelectric power (Feaster and Tasker, 2002; Conway, 2019). These dams create six reservoirs: High Rock Lake, Tuckertown Reservoir, Badin Lake, Falls Lake, Lake Tillery, and Blewett Falls Lake (*Figure 6*). The W. Scott Kerr Dam, in Wilkesboro, NC, was authorized by the Flood Control Act of 1946 and funded in 1960 in order to reduce flooding in the upper Yadkin Valley (Army Corps of Engineers, 1992). There are two distinct flooding seasons along the Pee Dee River, one being the winter, when rainfall from extratropical cyclones leads to regular annual floods. By contrast, late summer and fall “hurricane season can host dramatic flooding that is more difficult to predict, as it results from hurricane-related rainfall (Thom, 1967; Conway, 2019).

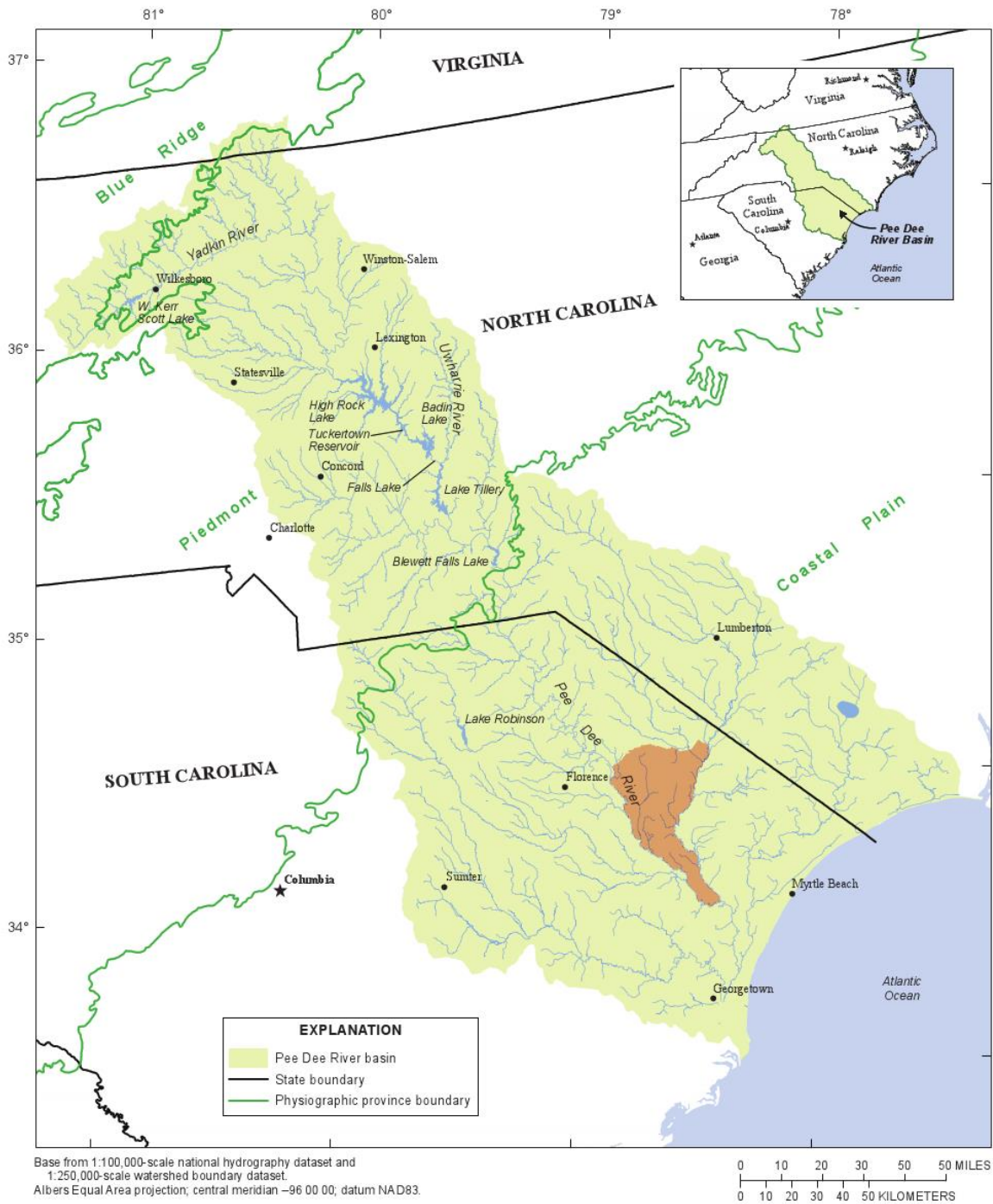


Figure 6. Map of the Pee Dee-Yadkin River Basin with locations of reservoirs, from Feaster and Guimaraes 2009. The Fall Line is marked in green, and Marion County is highlighted in red.

3. Literature Review

3.1 Survey Construction

Surveys provide an opportunity to collect and study information about a particular group or community. Distributing surveys in a written format rather than verbally provides the consistency needed for scientific data collection, as even small changes in wording can cause significant differences in the perceptions of respondents (Martin, 2006). Researchers can create surveys tailored to their research objectives, however, the use of established survey methods is encouraged where possible because new surveys must undergo pilot studies to establish reliability and validity before they can be administered to the intended audience (Kitchenham et al., 2002). Survey creators must strike a balance between the survey objectives- that is, the information they are interested in learning through the survey- and the practical length of a survey for the general public. Survey respondents may be unwilling to answer long surveys, or may “provide answers that are expedient, but not particularly accurate or thoughtful” if they feel the survey is taking too much time (Kitchenham et al., 2002; p.21). The set of questions that are deemed important enough to be included in the survey must then be considered in terms of the interest level of wording and question order.

In designing survey questions, researchers must consider multiple factors. While every question should pertain to the survey objective in some way, there are two types of questions that can be included, each yielding different types of results. “Closed” questions provide respondents with a set of answers from which to choose, limiting the responses that can be given but making the survey easier to code and analyze (Kitchenham et al., 2002; Martin, 2006). There are multiple types of answer sets for closed questions, including absolute and relative frequencies, evaluative responses, numerical scales, and expressions of agreement or disagreement (Martin,

2006). Unless the question allows respondents to choose more than one answer, the answer choices in closed questions must be mutually exclusive to avoid confusion (Kitchenham et al., 2002). Agree/disagree questions also provide the opportunity for an “I don’t know” response, the usefulness of which is debated. Allowing respondents to choose “I don’t know” removes those who are not informed enough to have opinions, but causes loss of data as a result (Martin, 2006). Martin argues that it can be detrimental, because “many respondents who take the easy out by saying ‘don’t know’ when given the opportunity are capable of providing meaningful and valid responses” (2006; p.7). With print surveys, respondents with no opinion may choose not to answer an agree/disagree question, making “don’t know” responses unnecessary. In contrast to closed questions that provide a series of responses to choose from, “open” questions let respondents to provide their own answers to questions, allowing for responses that the researchers or survey designers may not have predicted, but also presenting a greater difficulty for researchers in coding and analyzing results (Martin, 2006).

Once a question format is selected, the wording of the question itself must also be considered. Kitchenham et al. (2002) gives three important criteria to consider in wording questions: the question must clearly relate to the survey objective, the question must be unambiguous and provide clarifying details if necessary, and the question must use conventional language without technical jargon. Martin (2006) emphasizes similar points, saying that questions should avoid over-complexity and ambiguity, and that attention should be paid to the terminology used and any presuppositions found within the question. Presuppositions, such as the assumption that every respondent has experienced flooding in their home, can cause problems with data when the assumption does not apply to every respondent. Wording of questions also must take into account the average reading level and background knowledge of

respondents (Kitchenham et al., 2002). Questions asking respondents about past events should include a reference period so that respondents provide only relevant information to the survey objective (Kitchenham et al., 2002; Martin, 2006).

Finally, special attention should be paid to the order of the questions provided in the survey. Initial questions can change the context of the questions that follow (Martin, 2006), and it is recommended that general questions on a subject should precede more specific questions on said subject (McFarland, 1981). The placement of demographic questions is also an issue; while many surveys place demographic questions at the beginning, Kitchenham et al. (2002) recommend that, because demographic questions can discourage some respondents, any questions asking for demographic information should be included at the end of the survey. Questions can be grouped depending on the specific objectives they apply to, making it easier for respondents to see the relationships between questions and objectives (Kitchenham et al., 2002).

3.2 Reliability Analysis

Cronbach's alpha is a test of reliability that measures the internal consistency of a group of survey items. It measures variance in the sum of the items, with an alpha of 0 indicating complete variance, or no correlation between items, and 1 indicating no variance, or identical answers to all items (Bland and Altman, 1997).

$$\alpha = \frac{k}{k-1} \left(1 - \frac{\sum s_i^2}{s_T^2} \right)$$

Figure 7. An equation for calculating Cronbach's Alpha, where k is the number of survey items, s_i^2 is the variance of an item, and s_T^2 is the variance of the total score formed by summing all the items; from Bland and Altman, 1997.

Reliability measurements in the medical field generally must be >0.90 , but in other fields a score of >0.70 is acceptable (Bland and Altman, 1997; Santos, 1999). Should a group of survey items designed for a reliability estimate fail to provide a high enough reliability score, then the individual items should be reexamined and modified if necessary (Santos, 1999).

3.3 Validity Analysis

A 1985 publication by Baruch Nevo puts forward a method of determining face validity (FV) of a test or survey. The purpose of FV is not to determine the “actual” validity of the test but the appearance of validity to those who interact with it. This appearance of validity is important for any test or survey because of its ability to

- *“[induce] cooperation and positive motivation among subjects”*
- *“[convince] policymakers, employers, and administrators to implement the test”*
- *“[improve] public relations, including relations with the mass media and the courts”*

(Nevo, 1985; p. 288)

To obtain a measurement of FV, “raters” will be asked to evaluate the validity of the test “as it appears to them” (Nevo, 1985; p.288). Three groups of raters are specified as being of interest in calculating FV: those who actually take the test or survey, those outside the discipline who work with the survey results, and the general public (Nevo, 1985).

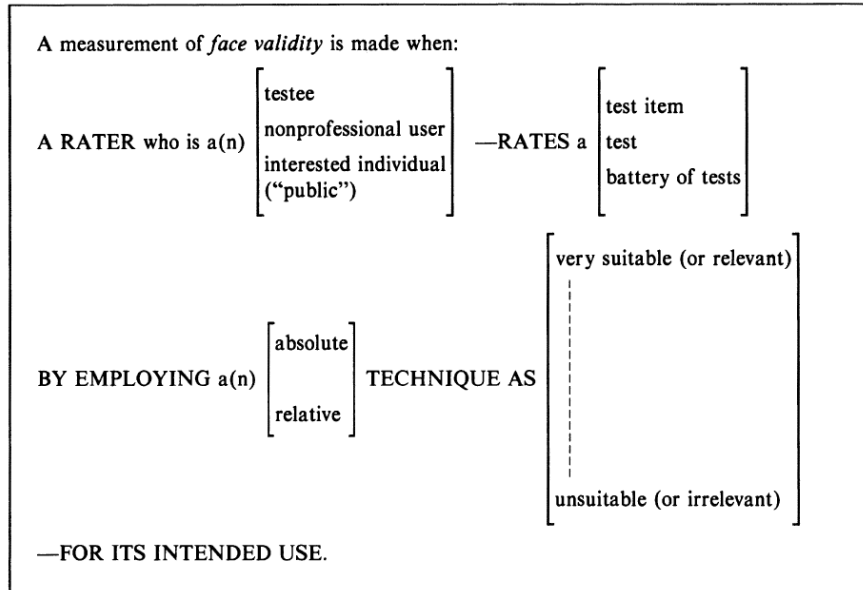


Figure 8. A visual description of face validity measurement, from Nevo, 1985.

The object evaluated by the rater can be a single test item, a full test, or a group of tests (Nevo, 1985). As for the method used to measure FV, Nevo (1985) suggests a 5-point scale ranging from “irrelevant” to “very relevant.”

4. Methods

4.1 Survey Overview

The following overview of the survey groups the questions in to seven sections based on question content and reviews the questions to be used for reliability and validity analyses.

4.1.1 Assessment of Personal Flood Knowledge

The questions in this group assess respondent knowledge about flooding, including the flood zone in which they live and the potential flood mitigation techniques they could implement (such as rain gardens and levees). Included in this section are questions related to whether or not the respondents have put these techniques into place, and whether they would be willing to if given the resources. This group is comprised of questions 1-3 on the survey, and contains “yes”-“no” answers alongside one multiple-choice question asking for flood zone (responses being “AE,” “A,” or “X”).

<p>1. Do you know what flood zone you live in?</p> <p><input type="radio"/>Yes <input type="radio"/>No</p> <p>If yes, what flood zone do you live in?</p> <p><input type="radio"/>AE <input type="radio"/>A <input type="radio"/>X</p>
<p>2. Are you aware of things you can do on your property to reduce the effects of flooding?</p> <p><input type="radio"/>Yes <input type="radio"/>No</p>
<p>3. Have you invested in flood protection on your own property (rain garden, levee, etc.)?</p> <p><input type="radio"/>Yes (see question 23) <input type="radio"/>No</p> <p>If you have not invested in personal flood protection, would you be interested if provided with education and resources?</p> <p><input type="radio"/>Yes <input type="radio"/>No</p>

4.1.2 Assessment of Personal Flood Experiences

The questions in this group address respondents' experiences during flooding events over the past ten years, including direct effects such as property damage and indirect effects such as loss of income, obstruction of traffic, and health problems. This group is comprised of questions 4 and 5 on the survey, and the questions were answered on a four-point scale of frequency (from "never" to "very often") and severity (from "not at all affected" to "very seriously affected"). A four-point scale was chosen to prevent respondents from gravitating toward a "middle" or neutral position in order to provide more meaningful results. The questions also provided a reference period of ten years, as recommended in Kitchenham et al., 2002 and Martin, 2006.

4. How often have you experienced flooding on your property over the past ten years?

- never
- occasionally
- often
- very often

5. How seriously has flooding affected your life in the following ways over the past ten years?

- **Property damage or destruction:**
 - not at all affected
 - somewhat affected
 - seriously affected
 - very seriously affected

- **Loss of work or income:**
 - not at all affected
 - somewhat affected
 - seriously affected
 - very seriously affected

- **Obstruction of traffic and travel:**
 - not at all affected
 - somewhat affected
 - seriously affected
 - very seriously affected

- **More frequent physical illness or infection:**
 - not at all affected
 - somewhat affected
 - seriously affected
 - very seriously affected

- **More severe mental health problems or illness:**
 - not at all affected
 - somewhat affected
 - seriously affected
 - very seriously affected

4.1.3 Financial and Property-Related Questions

The questions in this group address respondents' situation in regard to finance, property, and insurance. It is comprised of questions 6-8 on the survey and has a range of answer choices, as well as an open-ended question regarding the acreage of owned property. The answer choices provided on the second part of question seven are based on commonly perceived barriers to flood insurance, but a catch-all "other" option was also provided.

6. Do you own or rent your home?

- Own Rent

If you own property, how many acres of land do you own?

7. Do you have flood insurance?

- Yes No

If you do not have flood insurance, why not?

- too expensive
- didn't think I needed it
- didn't know about it
- other

8. If your house has been damaged or destroyed, do you or your landlord have the means to repair it?

- Yes**
- No**
- My house has not been damaged.**

4.1.4 Policy-Related Opinions

The questions in this group ask respondents about their opinions on property zoning, building codes, and allocation of resources. A later question about responsibility for flood recovery has also been included in this section. The section is comprised of questions 9, 10, 14, 15, and 18, with “yes”- “no” answers and a question that asks respondents to “mark all that apply.”

9. Should property zoning be revised because of flooding?

- Yes**
- No**

10. Should building codes be updated because of flooding?

- Yes**
- No**

14. Do you believe it is a worthwhile use of resources to address local flooding?

- Yes**
- No, resources should be used in other ways (see question 24)**

15. Do you have suggestions to help prevent flooding or reduce impacts?

- Yes (see question 25)**
- No**

18. Who is responsible for recovery after flooding? (mark all that apply)

- individual residents**
- local government**
- non-profit organizations**
- state government**
- federal programs (such as FEMA)**

4.1.5 Interest in Cooperation and Education

The questions in this group ask respondents about their experiences with cooperation in their communities, their willingness to cooperate with other communities, and their interest in further education. This group is comprised of questions 11-13 in the survey and the answer choices are all “yes”- “no.”

11. Have you used resources provided by local businesses after flooding? <input type="radio"/> Yes <input type="radio"/> No
12. Would you be willing to work with other communities to address flooding? <input type="radio"/> Yes <input type="radio"/> No
13. Would you be interested in further education about flood prevention? <input type="radio"/> Yes <input type="radio"/> No

4.1.6 Perceptions of Flooding Scenarios

The questions in this group ask respondents about their views on the seriousness of flood warning and their opinions on the causes of flooding events. Question 16 asks respondents to use a four-point scale to rate how seriously they take hurricane and flood warnings (from “not seriously at all” to “very seriously”), and question 17 asks respondents to “mark all that apply.”

16. How seriously do you take hurricane/flood warnings? <input type="radio"/> not seriously at all <input type="radio"/> not very seriously <input type="radio"/> somewhat seriously <input type="radio"/> very seriously
--

17. What is the cause of recent flooding? (*mark all that apply*)

- storms/heavy rain events**
- poor drainage**
- development of natural areas**
- climate change**
- other**

4.1.7 Demographics

The demographic questions, included as questions 20-22 at the end of the survey, ask respondents for age, gender, and education level.

20. What is your age?

- younger than 20**
- 20-29**
- 30-39**
- 40-49**
- 50-59**
- 60-69**
- 70-79**
- older than 80**

21. What is your gender?

- Male**
- Female**

22. What is the highest level of education you have completed?

- some K-12 schooling**
- high school diploma or GED**
- some college**
- 2-year (associate's) degree**
- 4-year (bachelor's) degree**
- postgraduate degree**

4.1.8 Open-Response Questions

Respondents with suggestions about flood prevention or resource management were directed to questions 23-25 at the end of the survey, where room was given to write open responses. This section also included a question about flood prevention measures.

23. If you have taken flood prevention measures on your property, please briefly describe them here.

24. If you have suggestions for other ways to use state and local resources, please share them here.

25. If you have suggestions for ways to help prevent flooding and reduce impacts, please share them here.

4.1.9 Reliability and Validity Measurements

One survey item, question 19, was designed to measure face validity as outlined in Nevo (1985). It asks respondents to rate the relevance of the survey as a whole to their experiences and opinions, based on the purpose of the survey. The question asks respondents to rate the survey on a four-point scale of relevance (from “not relevant at all” to “very relevant”).

19. How relevant are the questions in this survey to your experiences and opinions?

- not relevant at all**
- not very relevant**
- somewhat relevant**
- very relevant**

Five separate survey items were grouped together for a Cronbach’s Alpha analysis. This group included question 4, asking about the frequency of flooding on respondents’ properties, and four of the five responses to question 5 about flooding effects: property damage, loss of income, obstruction of traffic, physical illness, and mental illness.

4.2 Pilot Survey

The pilot study, performed at a community event in North Myrtle Beach, provided an initial test of the survey method among the general public (*full results included in appendix*). The event was attended mainly by local retirees, and the population was older and more highly educated than the general public. No respondent was below the age of 40, the largest age group was between 70 and 79, and three respondents were over 80 years old. Over 60% of respondents had either a 4-year degree or a postgraduate degree. The respondents to the pilot survey were also overwhelmingly female. While the gender makeup of the event itself was roughly equal, the surveys were distributed “one per household,” and the results suggest that the women took on the role of writing down the answers to the survey.

Among the pilot group, two thirds of respondents did not know their flood zone. While 55% of pilot respondents claimed to know about flood mitigation techniques, only 22% of those had actually invested in flood protection, and 22% of respondents had not but would be willing to, given the resources. This left 56% of respondents who had not invested in protection and had no interest in doing so.

Most pilot respondents were not significantly affected by flooding, with 63% reporting no flooding on their property over the past ten years. 52% of respondents were “not at all affected” by property damage, and over 80% were “not at all affected” by more frequent physical illness or infection, or more severe mental health problems. The only way that the majority of respondents reported being at least “somewhat affected” was “obstruction of traffic and travel.” As many pilot respondents were retired, some wrote “not applicable” on the question referring to loss of work or income. These answers were coded as “not at all affected.”

Pilot respondents as a whole were undecided on property zoning and building codes, with 56% of respondents supporting property zoning revisions and 59% of respondents supporting building code updates. The pilot respondents almost unanimously supported the use of resources to address local flooding, however, and placed the responsibility for recovery most heavily on individual residents and federal programs. Few reported having suggestions for flood prevention.

Only 22% of pilot respondents reported using resources provided by local businesses or being interested in further education, but about half of respondents reported a willingness to work with other communities to address flooding. 74% of pilot respondents reported taking hurricane and flood warnings “very seriously,” and placed the blame for flooding events largely on “heavy rain events” and “poor drainage.”

4.3 Implementation in Marion County

Surveys were distributed in print form through city and county organizations. During the spring and early summer of 2019, employees from the Mullikin Law Firm spoke with Marion County Schools to distribute surveys among students for their parents to fill out. In addition to this, they spoke with officials in the Town of Nichols, Town of Sellers, and the City of Marion, and with the Marion County Chamber of Commerce, Marion Fire Department, and Rotary Club about survey distribution. By the end of May 2019, 303 survey responses had been collected, and preliminary survey results were released on June 15, 2019 for the South Carolina Floodwater Commission Marion County Cleanup Day. These preliminary results (n=303) were also shared in the Floodwater Commission Report in November 2019, as part of the short-term deliverables for the Stakeholder Engagement Task Force. Further survey collection in June and July increased the total number of responses to 320 for the final results. The survey answers were coded and input into IBM SPSS Software for analysis.

5. Results

5.1 Individual Question Results

5.1.1 Assessment of Personal Flood Knowledge

Only 39 respondents out of 319 reported knowing what flood zone they lived in, just over 12% (Table 1.1). Despite this, 43% reported an awareness of property-scale flood mitigation techniques such as levees and rain gardens- though only 8% had actually implemented such measures on their own properties. Of those who had not invested in personal flood mitigation techniques, 60% reported an interest if provided with education and resources, indicating potential barriers to personal flood mitigation and an opportunity for a future community outreach project.

Table 1.1		
Do you know what flood zone you live in?		
	Frequency	Percent
Yes	39	12.2
No	280	87.8
Total	319	100.0

Table 1.2		
What flood zone do you live in?		
	Frequency	Percent
Don't Know	281	87.8
A	18	5.6
AE	4	1.3
X	17	5.3
Total	320	100.0

Table 1.3		
Are you aware of things you can do on your property to reduce the impacts of flooding?		
	Frequency	Percent
Yes	138	43.3
No	181	56.7
Total	319	100.0

Table 1.4		
Have you invested in flood protection on your own property?		
	Frequency	Percent
Yes	26	8.2
No	292	91.8
Total	318	100.0

Table 1.5		
If you have not invested in personal flood protection, would you be interested if provided with education and resources?		
	Frequency	Percent
Yes	167	60.1
No	111	39.9
Total	278	100.0

5.1.2 Assessment of Personal Flood Experiences

When asked about flooding on personal property, only about 35% of respondents reported having experienced flooding over the past ten years, with 20% reporting flooding “occasionally,” and 15% reporting flooding “often” or “very often.” Despite this, 54% reported being at least somewhat affected by property damage, and 66% by obstruction of traffic or travel. 39% of respondents reported being at least somewhat affected by loss of work or income, 25% by more frequent physical illness, and 24% by more severe mental health problems.

Table 2.1		
How often have you experienced flooding on your property over the past ten years?		
	Frequency	Percent
Never	187	65.2
Occasionally	58	20.2
Often	35	12.2
Very Often	7	2.4
Total	287	100.0

How seriously has flooding affected your life in the following ways over the past ten years?

Table 2.2		
Property Damage		
	Frequency	Percent
Not At All Affected	147	46.2
Somewhat Affected	101	31.8
Seriously Affected	21	6.6
Very Seriously Affected	49	15.4
Total	318	100.0

Table 2.3		
Loss of Work or Income		
	Frequency	Percent
Not At All Affected	196	61.3
Somewhat Affected	89	27.8
Seriously Affected	19	5.9
Very Seriously Affected	16	5.0
Total	320	100.0

Table 2.4		
Obstruction of Traffic and Travel		
	Frequency	Percent
Not At All Affected	110	34.4
Somewhat Affected	109	34.1
Seriously Affected	41	12.8
Very Seriously Affected	60	18.8
Total	320	100.0

Table 2.5		
More Frequent Physical Illness or Infection		
	Frequency	Percent
Not At All Affected	241	75.3
Somewhat Affected	61	19.1
Seriously Affected	8	2.5
Very Seriously Affected	10	3.1
Total	320	100.0

Table 2.6		
More Severe Mental Health Problems or Illness		
	Frequency	Percent
Not At All Affected	243	76.4
Somewhat Affected	58	18.2
Seriously Affected	11	3.5
Very Seriously Affected	6	1.9
Total	318	100.0

5.1.3 Financial and Property-Related Questions

The makeup of respondents was approximately 81% homeowners and 19% renters. Only about 11% of respondents reported having flood insurance. Of those who did not have flood insurance, only 9% cited the cost as the most significant barrier. 14% reported that they did not know about flood insurance, 45% did not think that they needed flood insurance, and 32% of respondents selected the “other” option. 67% of respondents reported that their home had not been significantly damaged, but of those who *did* report significant damage, 42% reported that they or their landlord did not have the resources for repairs.

Table 3.1		
Do you own or rent your home?		
	Frequency	Percent
own	257	80.6
rent	62	19.4
Total	319	100.0

Table 3.2		
Do you have flood insurance?		
	Frequency	Percent
Yes	34	10.7
No	284	89.3
Total	318	100.0

Table 3.3		
If you do not have flood insurance, why not?		
	Frequency	Percent
Too Expensive	25	8.9
Didn't Think I Needed It	125	44.6
Didn't Know About It	40	14.3
Other	90	32.1
Total	280	100.0

Table 3.4		
If your house has been damaged or destroyed, do you or your landlord have the means to repair it?		
	Frequency	Percent
Yes	60	19.0
No	44	14.0
My house has not been damaged.	211	67.0
Total	315	100.0

5.1.4 Policy-Related Opinions

The question about zoning revisions was divisive, with 52% agreeing that property zoning should be revised and 48% disagreeing. There was more support for updated building codes, with 76% of respondents supporting building code updates. The majority of respondents (83%) agreed that flood prevention was a worthwhile use of resources, but only 20% reported having suggestions for flood prevention and impact reduction. Not all those who reported having suggestions shared those suggestions in the open-response section.

In assigning responsibility for recovery following flooding, the largest percent of respondents placed the responsibility on individual residents (81%) and federal programs such as FEMA (75%). 57% of respondents assigned responsibility to local governments, 56% to the state government, and 45% to non-profit organizations.

Table 4.1		
Should property zoning be revised because of flooding?		
	Frequency	Percent
Yes	165	52.1
No	152	47.9
Total	317	100.0

Table 4.2		
Should building codes be updated because of flooding?		
	Frequency	Percent
Yes	242	76.3
No	75	23.7
Total	317	100.0

Table 4.3		
Do you believe it is a worthwhile use of resources to address local flooding?		
	Frequency	Percent
Yes	265	83.3
No	53	32.7
Total	318	100.0

Table 4.4		
Do you have suggestions to help prevent flooding or reduce impacts?		
	Frequency	Percent
Yes	64	20.1
No	254	79.9
Total	318	100.0

Table 4.5		
Who is responsible for recovery following flooding?		
	Frequency	Percent
Individual Residents	259	81.2
Local Government	181	56.7
Non-Profit Organizations	145	45.5
State Government	179	56.1
Federal Programs (such as FEMA)	238	74.6

5.1.5 Interest in Cooperation and Education

24% of respondents reported using resources provided by local businesses following flooding, but 70% reported a willingness to work with other communities to address flooding. In addition, 67% of respondents reported an interest in further education.

Table 5.1		
Have you used resources provided by local businesses after flooding?		
	Frequency	Percent
Yes	75	23.6
No	243	76.4
Total	318	100.0

Table 5.2		
Would you be willing to work with other communities to address flooding?		
	Frequency	Percent
Yes	223	70.1
No	95	29.9
Total	318	100.0

Table 5.3		
Would you be interested in further education about flood prevention?		
	Frequency	Percent
Yes	214	67.3
No	104	32.7
Total	318	100.0

5.1.6 Perceptions of Flooding Scenarios

The majority of respondents (68%) reported taking hurricane and flood warnings “very seriously.” In assigning what they believe to be the cause of flooding events, storms and heavy rain events were identified as a cause by most respondents (84%). 55% identified poor drainage as a cause, and 31% identified development of natural areas. 18% identified climate change as a cause, and 8% identified an “other” cause.

Table 6.1		
How seriously do you take hurricane/flood warnings?		
	Frequency	Percent
Not Seriously at All	14	4.4
Not Very Seriously	8	2.5
Somewhat Seriously	80	25.2
Very Seriously	215	67.8
Total	317	100.0

Table 6.2		
What is the cause of recent flooding?		
	Frequency	Percent
Storms/Heavy Rain Events	267	83.7
Poor Drainage	175	54.9
Development of Natural Areas	98	30.7
Climate Change	58	18.2
Other	26	8.2

5.1.7 Demographics

The demographic questions identified a wide range of respondent ages, from younger than 20 to over 80, with the largest age bracket being 50-59 (27%). In terms of education level, the largest group had a high school diploma or GED (28%), followed by 2-year and 4-year

degrees (20% each). The gender makeup was balanced, with approximately 50% male and 50% female respondents.

Table 7.1		
What is your age?		
	Frequency	Percent
Younger than 20	30	9.5
20-29	17	5.4
30-39	62	19.6
40-49	52	16.4
50-59	86	27.1
60-69	58	18.3
70-79	11	3.5
Older than 80	1	0.3
Total	317	100.0

Table 7.2		
What is your gender?		
	Frequency	Percent
Male	156	49.5
Female	159	50.5
Total	315	100.0

Table 7.3		
What is the highest level of education you have completed?		
	Frequency	Percent
Some K-12 schooling	24	7.6
High school diploma or GED	88	27.9
Some college	48	15.2
2-year degree	63	20.0
4-year degree	64	20.3
Postgraduate degree	28	8.9
Total	315	100.0

5.1.8 Open-Response Questions

The open-response questions were an optional portion of the survey where respondents could write in their own answers. Because it was optional and writing answers is time-intensive, there were few responses. The following are all the received responses for each question:

23. If you have taken flood prevention measures on your property, please briefly describe them here.
<i>"House is elevated 13 ft. Now when warning[s] come out we go down and move as much as we can to loft area. Water inside over kitchen counter tops. Have cut inside and start over due to mold and water damage."</i>
<i>"flood insurance"</i>
<i>"removing all moveable household items and sand bags"</i>
<i>"French drain, cleaned out storm drain"</i>
<i>"raising my new home higher off the ground"</i>

24. If you have suggestions for other ways to use state and local resources, please share them here.
<i>"Improve roads to have access to get in + out of the area."</i>
<i>"Deploy government resources before the flooding starts to help with prevention rather than deploying after the damage."</i>
<i>"Maintenance in areas that are in flood zone; Prevention and preparation is KEY to flooding issues; homeowners are limited to only so much prep"</i>
<i>"People of Marion need help"</i>
<i>"clean out ditches and drains regularly"</i>
<i>"drainage and runoff dredging"</i>

25. If you have suggestions for ways to help prevent flooding and reduce impacts, please share them here.
<i>"clean out water sewages in small neighborhoods"</i>
<i>"people need more information on the subject because some way or another it does [a]ffect everyone"</i>
<i>"saw videos regarding flooding issues and how they were handled in Europe"</i>
<i>"Fix Catfish [Creek]; infrastructure needs to be address[ed]; where is 52 million"</i>

25. If you have suggestions for ways to help prevent flooding and reduce impacts, please share them here. (cont.)
<i>"Cleaning the rivers out to open more room for water."</i>
<i>"more attention and maintenance in flood zone areas, such as Catfish Creek near Blue Street in Marion, SC."</i>
<i>"Keep the ditches clean/clear. They are grown over. Educate the community in ways to help with their property."</i>
<i>"Fix the dams- clean out ditches that have been blocked. Dredge the Little Pee Dee River at Davis Landing."</i>
<i>"Dig lot of big ditch[es]; we need more big ditch[es]"</i>
<i>"check drains"</i>
<i>"drainage"</i>

The following comments were written on surveys outside of the open-response area:

<i>"Lost house and car; PTSD required mental health; FEMA required after flood; infrastructure needs to be addressed- watershed in Nichols; FEMA is a joke"</i>
<i>"Failure to maintain flow of streams such as Catfish [contributes to flooding]"</i>
<i>"[flooding has led to] more mosquitoes"</i>

Important recurring words and phrases include "flooding/flood" (9 appearances), "drain/drains/drainage" (6), "ditch/ditches" (5), "water" (4), "clean out/cleaning out" (4), "help" (3), "Catfish [Creek]" (3), "maintenance" (2), "infrastructure" (2), and "FEMA" (2).

5.2 Univariate Analysis

A series of questions were tested as dependent variables using univariate analysis to determine which demographic covariant, if any, had a significant (<.10) effect on the responses. In the respondents' knowledge of flood zones, home ownership and age had significant effects. Flood zone knowledge was coded with a 1 for "yes" and a 2 for "no." As home ownership

trended towards renters “2,” flood zone knowledge trended toward “yes,” indicating that renters are more likely to know their flood zone than homeowners. As age increased, flood zone knowledge trended toward “yes,” indicating that older respondents were more likely to know their flood zone than younger respondents. Age had a greater effect on knowledge of flood zones than home ownership did.

Test of Between-Subject Effects				
Do you know what flood zone you live in?				
	F	Sig.	Effect Size (Partial Eta Squared)	B
Corrected Model	6.752	.000	.081	
Intercept	454.152	.000	.598	2.183
“Do you own or rent your home?”	7.375	.007	.024	-.126
“What is your age?”	17.351	.000	.054	-.048
“What is your gender?”	.678	.411	.002	.030
“What is the highest level of education you have completed?”	.021	.884	.000	-.002

In the respondent reports of flood frequency, home ownership and age also had significant effects. Flood frequency was coded on a scale of 1 to 4. As home ownership trended toward renters “2,” flood frequency increased, indicating that renters reported more frequent flooding than homeowners did. As age increased, flood frequency increased, indicating that older respondents reported more frequent flooding than younger respondents. Age had a larger effect on reports of flood frequency than home ownership did.

Table 8.2				
Test of Between-Subject Effects				
How often have you experienced flooding on your property over the past ten years?				
	F	Sig.	Effect Size (Partial Eta Squared)	B
Corrected Model	4.513	.002	.062	
Intercept	11.944	.001	.042	.909
“Do you own or rent your home?”	3.564	.060	.013	.231
“What is your age?”	12.370	.001	.043	.104
“What is your gender?”	.087	.769	.000	.028
“What is the highest level of education you have completed?”	1.491	.223	.005	-.041

In the respondent reports of flood insurance, age was the only covariate that had significant effects. Flood insurance was coded with a 1 for “yes” and a 2 for “no.” As age increased, flood insurance trended toward “yes,” indicating that older respondents were more likely to have flood insurance than younger respondents.

Table 8.3				
Test of Between-Subject Effects				
Do you have flood insurance?				
	F	Sig.	Effect Size (Partial Eta Squared)	B
Corrected Model	.805	.523	.010	
Intercept	407.266	.000	.572	1.967
“Do you own or rent your home?”	.040	.842	.000	.009
“What is your age?”	3.113	.079	.010	-.019
“What is your gender?”	.035	.851	.000	-.007
“What is the highest level of education you have completed?”	.052	.820	.000	.003

In the respondent support of property rezoning, age was once again the only covariate that had significant effects. Opinion of rezoning was coded with a 1 for “yes” and a 2 for “no.”

As age increased, opinion of rezoning trended toward “yes,” indicating that older respondents were more likely to support rezoning than younger respondents.

Test of Between-Subject Effects				
Should property zoning be revised because of flooding?				
	F	Sig.	Effect Size (Partial Eta Squared)	B
Corrected Model	5.860	.000	.071	
Intercept	131.317	.000	.301	1.778
“Do you own or rent your home?”	.255	.614	.001	.036
“What is your age?”	22.533	.000	.069	-.083
“What is your gender?”	.354	.552	.001	-.033
“What is the highest level of education you have completed?”	.915	.339	.003	.018

In the respondent support of building code updates, age and education had significant effects. Opinion of building code updates was coded with a 1 for “yes” and a 2 for “no.” As age increased, support of updated building codes trended toward “yes,” indicating that older respondents were more supportive of building code updates than younger respondents. As education level increased, support of updated building codes trended toward “yes,” indicating that more educated respondents were more supportive of building code updates than less educated respondents. Age had a larger effect on support of building codes than education level did.

Table 8.5				
Test of Between-Subject Effects				
Should building codes be updated because of flooding?				
	F	Sig.	Effect Size (Partial Eta Squared)	B
Corrected Model	13.813	.000	.153	
Intercept	208.572	.000	.406	1.834
“Do you own or rent your home?”	2.428	.120	.008	-.090
“What is your age?”	42.199	.000	.122	-.092
“What is your gender?”	.004	.951	.000	.003
“What is the highest level of education you have completed?”	3.905	.049	.013	-.031

In the respondent report of how seriously they take warnings, home ownership and age had significant effects. Reported seriousness was coded on a scale of 1 to 4. As home ownership trended toward renters “2,” reported seriousness decreased, indicating that renters reported taking warnings less seriously than homeowners did. As age increased, reported seriousness increased, indicating that older respondents reported taking warnings more seriously than younger respondents. Home ownership had a larger effect on reported seriousness than age did.

Table 8.6				
Test of Between-Subject Effects				
How seriously do you take hurricane/flood warnings?				
	F	Sig.	Effect Size (Partial Eta Squared)	B
Corrected Model	17.314	.000	.186	
Intercept	394.816	.000	.565	4.346
“Do you own or rent your home?”	66.998	.000	.181	-.822
“What is your age?”	2.843	.093	.009	.041
“What is your gender?”	.284	.594	.001	.042
“What is the highest level of education you have completed?”	.144	.705	.000	-.010

In the respondent interest in further education, age and education level had significant effects. Interest in education was coded with a 1 for “yes” and a 2 for “no.” As age increased, interest in education trended toward “yes,” indicating that older respondents were more interested in further education than younger respondents. As education level increased, interest in further education trended toward “yes,” indicating that more educated respondents were more interested in further flood prevention education than less educated respondents. Education level had slightly more effect on interest than age did.

Table 8.7				
Test of Between-Subject Effects				
Would you be interested in further education about flood prevention?				
	F	Sig.	Effect Size (Partial Eta Squared)	B
Corrected Model	16.891	.000	.181	
Intercept	205.221	.000	.401	1.959
“Do you own or rent your home?”	.054	.478	.002	.044
“What is your age?”	24.204	.000	.073	-.075
“What is your gender?”	.506	.478	.002	-.035
“What is the highest level of education you have completed?”	30.076	.000	.089	-.092

5.3 Chi-Square Analysis

In the respondent attribution of responsibility for flood recovery to individual residents, the reported frequency of flooding did not have a significant effect. No relationship was found between reported flood frequency and whether respondents believed individual residents were responsible for recovery after floods.

Table 9.1

Crosstabulation of Flood Frequency * Attribution of Responsibility to Individual Residents

			Attributed Responsibility to Individual Residents	
			No	Yes
Report of Flood Frequency	Never	Count	42	136
		% within Report of Flood Frequency	23.6%	76.4%
	Occasionally	Count	8	42
		% within Report of Flood Frequency	16.0%	84.0%
	Frequently	Count	3	30
		% within Report of Flood Frequency	9.1%	90.9%
	Very Frequently	Count	0	7
		% within Report of Flood Frequency	0.0%	100.0%
Total		Count	53	215
		% within Report of Flood Frequency	19.8%	80.2%

Table 9.2			
Chi-Square Test for Flood Frequency * Attribution of Responsibility to Individual Residents			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	6.186 ^a	3	.103
Likelihood Ratio	7.962	3	.047
Linear-by-Linear Association	6.153	1	.013
N of Valid Cases	268		

In the respondent attribution of responsibility for flood recovery to individual residents, the reported seriousness of property damage had a significant effect. Respondents who reported more serious property damage were more likely to attribute responsibility to individual residents.

Table 9.3					
Crosstabulation of Property Damage * Attribution of Responsibility to Individual Residents					
			Individual Residents		Total
			No	Yes	
Property Damage	Not At All Affected	Count	40	99	139
		% within Property Damage	28.8%	71.2%	100.0%
	Somewhat Affected	Count	13	79	92
		% within Property Damage	14.1%	85.9%	100.0%
	Seriously Affected	Count	3	18	21
		% within Property Damage	14.3%	85.7%	100.0%
	Very Seriously Affected	Count	1	48	49
		% within Property Damage	2.0%	98.0%	100.0%
Total		Count	57	244	301
		% within Property Damage	18.9%	81.1%	100.0%

Table 9.4			
Chi-Square Test for Property Damage * Attribution of Responsibility to Individual Residents			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	19.561 ^a	3	.000
Likelihood Ratio	23.379	3	.000
Linear-by-Linear Association	17.834	1	.000
N of Valid Cases	301		

5.4 Reliability Analysis

Six items were included in the reliability analysis, including questions about frequency of flooding, property damage, loss of work or income, obstruction of traffic and travel, physical illness, and mental illness. The Cronbach's Alpha value of 0.785 indicates high reliability.

Table 10.1		
Reliability Item		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.785	.821	6

Table 10.2			
Reliability Item			
	Mean	Std. Deviation	Cronbach's Alpha if Item Deleted
How often have you experienced flooding on your property in the past ten years?	1.52	.803	.731
How seriously has flooding affected your life in the following ways over the past ten years?			
Property damage	1.95	1.101	.841
Loss of work or income	1.54	.824	.722
Obstruction of traffic and travel	2.17	1.121	.760
More frequent physical illness or infection	1.36	.707	.725
More severe mental health problems or illness	1.34	.655	.730

5.4 Validity Analysis

Over 84% of respondents rated the survey at least somewhat relevant to their experiences and opinions, creating a mean of 3.09. This indicates a high level of face validity.

Table 11		
How relevant are the questions in this survey to your experiences and opinions?		
	Frequency	Percent
Not relevant at all	21	6.6
Not very relevant	28	8.8
Somewhat relevant	168	53.0
Very relevant	100	31.5
Total	317	100.0
Mean		3.09

6. Discussion

6.1 Survey Results and Implications

The results of this study indicate an interest in further educational outreach to the community of Marion County. The construction of property-scale flood mitigation measures such as rain gardens would be a good topic to begin with, as a majority of those who had not taken such measures on their own property were interested if they were provided with the education and resources to do so. Rain gardens can act as floodwater retention areas, and plants with well-developed root systems can increase permeability, allowing more water to infiltrate even in low-permeability soils such as those found in much of Marion County. Empowering residents to take such measures on their own property would not only help to mitigate the effects of flooding, but also help residents to feel empowered rather than feeling helpless in the face of future floods. Previous case studies in community resiliency (Documet et al., 2018; Kulig et al., 2011; Lin et al., 2016) emphasize the importance of stakeholder engagement in planning and preparation. Lin et al. found that, in restoring tsunami-damaged beaches, local leaders engaging the community in “collective efforts” gave community members “hope in a better future” (2016; pp. 21). Victims of wildfires interviewed by Kulig et al. cited “a positive attitude” and “an ability to change” as two of the most important characteristics for individual resiliency (2011; pp. 26). With over 80% of respondents placing responsibility for flood recovery on individual residents, and respondents who reported property damage *more* likely to attribute responsibility to individuals, residents in Marion County place great value on their independence and personal resilience. A campaign to provide residents with the resources necessary to mitigate flooding independently and with their neighbors (as 70% reported being willing to cooperate with other communities to address flooding), would be well-advised based on the results of this study. The

survey also indicates that residents would be open to general education programs as well, on flood zones (only 12% knew what flood zone they lived in), broader flood prevention measures (67% reported interest in further education), and working with FEMA (74% of respondents placed the responsibility for flood recovery on federal programs).

Access to flood insurance is also an issue that should be addressed for the residents of Marion County, according to the survey. With 89% of respondents without flood insurance and almost a third of those citing “other” reasons for their lack of insurance rather than selecting one of the provided choices (“too expensive,” “didn’t think I needed it,” “didn’t know about it”), the survey results suggest that there are more complex barriers preventing access to flood insurance than we as survey developers anticipated. Insurance from the National Flood Insurance Program can only be purchased through a participating insurer, and buying flood insurance may also require specific documents such as elevation certificates (FEMA, 2019), making the process seem daunting and potentially inaccessible to those in rural communities and those without internet access. More detailed interviews with residents about the barriers to accessing flood insurance could provide further information and guidance as to how to provide more vulnerable residents of the community with the financial resources- whether through insurance or federal disaster assistance- necessary to recover from flooding.

While respondents were split on the topic of rezoning (52% supporting rezoning due to flooding), there was considerable support (76%) for updated building codes due to flooding. Updated building codes could help prevent future property damage during flood events by taking flooding into account during the construction of new buildings. However, it is important to consider the potential implementation of such updates to building codes and how it will affect property owners. The 2011 ordinance requiring home elevations in flood zones did little to solve

the problem of property damage and instead left many residents paying fees because there were no resources available to help them with the prohibitively expensive process of elevating their homes to comply with the ordinance. The high rate of support for zoning and building code changes- in both cases a greater percent of respondents than reported flooding on their own properties- suggests that even those residents who have not personally experienced flooding are concerned about the general community. Whether these residents would support such changes if they understood the economic needs associated with implementing the changes as intended is a different question, one that deserves further investigation before any major changes can be made. The fact that so few respondents knew what flood zone they lived in also calls into question the understanding of the respondents who supported rezoning. Still, with the wide distribution of responses and the diversity found in respondent demographics, there is no evidence to suggest that the survey results were influenced by any groups promoting a political agenda.

The optional open-response questions received relatively few answers, with most respondents either uninterested or unwilling to put in the time to write out their opinions. But the consistency of the answers that were received suggests that the opinions expressed are widespread throughout the community. Respondents spoke of the county drainage system, such as ditches and the Catfish Creek canal located in Marion, SC. Complaints about drainage ditches appeared in multiple forms, pointing out that the county drainage system is poorly maintained and that poor maintenance contributes to flooding. The low permeability of the loamy soil in Marion County means that much of the county must be artificially drained (Pitts, 1980), and if these drainage systems are not functioning as designed, runoff from high-intensity storm events can more easily lead to flooding. The Marion County cleanup day held in June 2019 addressed some of these issues by mobilizing volunteers to clear drainage ditches around the town of

Nichols. However, the announcement of this event around the time of initial survey distribution may have influenced the answers of some respondents, generating a focus on the drainage systems over other potential factors, such as increased runoff from impermeable surfaces like buildings, roads, and parking lots, and the potential for more frequent and intense storm events related to changing climate. Only 18% cited “climate change” as a contributor to recent flood events, despite evidence that warming ocean water is contributing to the “heavy rain events” cited by 84% of respondents (Zhao and Held, 2012). Further study into the residents’ understanding of climate change may be necessary to understand this discrepancy.

Using univariate analysis, the effects of demographic factors on several survey items of interest were examined and the hypotheses were tested. A post-hoc power analysis returned a power of 0.99, indicating that the sample size was adequate for the tests being run. Hypothesis (1), which stated that younger respondents would be more likely to know their flood zone, more likely to support rezoning and building code updates, and report greater interest in further education than older respondents, was completely refuted. Older residents were more likely to know their flood zone, reported more frequent flooding, were more likely to have flood insurance, were more likely to support rezoning and building code updates, reported taking flood warnings more seriously, and were more likely to express interest in further education than younger respondents. This is not to say that the younger respondents were uninterested in flooding; the overwhelming interest in further education indicates involvement from a wide range of age levels. However, this does challenge the common notion found in environmental outreach that older stakeholders are resistant to new ideas and information. These survey results suggest that the opposite is true: the older residents of Marion County are the ones who are more affected by frequent flooding, and are the ones most interested and motivated to work with their

neighbors and the Floodwater Commission to promote recovery and mitigate damage from future flood events. Why does recent flooding seem to affect older residents more frequently? Older residents, especially those on fixed incomes, may live in more vulnerable, flood-prone areas, due to the lower prices of floodplain land. It is also possible that the older respondents were not necessarily giving an objective frequency of the past decade of flooding, but were comparing it to the previous six decades, during which catastrophic floods were uncommon in the area (Conway, 2019). In this sense, older residents may not necessarily have experienced more frequent flooding than their younger counterparts over the past decade, but have a more exaggerated perception of flood frequency due to their larger frame of reference. This perception may affect their outlook on recent flooding and explain their greater interest in flood insurance, education, and community cooperation, their reported consideration of flood warnings, and their support of potential policy changes. Older residents, who perceive a greater change in the world around them due to increased flooding, may have more motivation to respond to these events than younger residents for whom flooding is, or is growing to be “normal.”

Hypothesis (2) was also refuted based on the results. Gender had no significant impact on how seriously respondents reported taking flood warnings, nor did it have a significant impact on any of the other questions examined.

The results of the study support the portion of hypothesis (3) stating that highly educated respondents will have greater interest in further education than those respondents who have had less formal education. Respondents who have completed higher levels of education may place greater value on education- or say that they do- explaining their reported interest in further educational resources and outreach. However, the lack of a relationship between education level and flood zone knowledge suggests that higher levels of education do not necessarily translate

into more thorough established knowledge. This suggests a potential disconnect between respondent reports and actions, which is something to consider when planning and evaluating future educational outreach programs. Reported interest in education programs will not always translate directly into participation, and it will be important to examine factors that contribute to the retention of information provided by these programs.

Hypothesis (4) stated that homeowners would be more likely to know their flood zone, and have flood insurance than respondents who rent their homes. Both claims were refuted, with home ownership having no effect on flood insurance, and significantly more renters knowing their flood zones than homeowners. However, the results support the portion of the hypothesis that predicted homeowners would report taking warnings more seriously than renters. This may be because homeowners have more financial resources tied into their property, and therefore place more value on protecting it. But, then, why the apparent contradiction when it comes to risk perception and flood zone knowledge? One would expect, if homeowners place greater importance on protecting their homes than renters do, they would be more likely to know what flood zone they live in. A possible explanation for the results may lie in the relationship between home ownership and reported frequency of flooding: renters reported significantly more frequent flooding on their properties during the past ten years than homeowners did. This suggests that rental properties in Marion County may be in areas more vulnerable to flooding, and renters would therefore have more reason to know their flood zone after past flood events. Owners of homes in higher elevations may never have had the need or desire to know their flood zone. Another possibility is that renters may reflect a more transient population than homeowners, having occupied their homes for less time. Having more recently moved into their rental property, they would have researched or been presented with pertinent information about the

property more recently than owners who have lived on their property for decades or inherited the property from family.

While the Cronbach's alpha analysis suggested that the survey responses were reliable, there were still apparent discrepancies between several of the questions. When asked about frequency of flooding on their property, only 35% of respondents reported flooding during the past ten years. However, 54% of respondents reported property damage related to flooding. This discrepancy could potentially be explained by respondents reporting property damage caused by other hurricane effects such as strong wind, but because the questions ask specifically about flood damage, we cannot assume such a large number of respondents misinterpreted the question in the same way. Further studies should consider this discrepancy and investigate further.

6.2 Error and Limitations

With a voluntary survey, it is important to consider how much time and effort respondents are willing to put into answering, and what information they might be uncomfortable revealing. For the demographics section, the survey asked about age (split into age brackets so as not to ask respondents to reveal their exact age), gender (with only "male" and "female" as response choices due to the conservative nature of the study area; should the survey be repeated, a third "other" option may also be given depending on the audience), and education level (with care taken to avoid stigmatizing lower education levels, using phrases such as "some K-12 schooling" rather than "did not finish high school.") Though gender did not have any effect on the dependent variables tested, age and education level both had significant effects on responses to the tested questions. Despite the success in linking responses to demographic factors, some other important demographic factors were left out of the study. Race and income level are two factors that could have had significant effects on responses, but were not included in the survey

because of the combination of space concerns and worry over respondent willingness to provide information. Should a large portion of respondents have refused to provide demographic information, the pool of responses that could be analyzed would be reduced, and it would have interfered with the ability to draw meaningful conclusions from the data. Therefore, the space for demographic questions was filled with topics of interest that we believed respondents would be most willing to answer. Further work, both in Marion County and in other parts of the state, should include race and income level as demographic factors of interest to paint a broader picture of the role societal inequities play in flooding damage and recovery.

During the Marion County Cleanup Day in June 2019, flyers designed by Lillian Howie (*Figure 9*) were distributed with preliminary results from the survey. These preliminary results were based on the first 303 survey responses, and therefore are generally accurate to the final results. However, in regard to the relationship between flood zone knowledge and home ownership, the flyer claimed that homeowners were more likely to know their flood zone than renters. This is the opposite of the final survey results, which suggest that renters are more likely to know their flood zone than homeowners are. Reexamination of the first 303 responses reveals the same relationship as in the final survey results. The mistake was likely caused by a misinterpretation of the parameter estimates, influenced by a personal and societal bias. The stereotype that homeowners are more responsible with their property influenced the misinterpretation of the relationship, and that makes the true interpretation even more significant, as it challenges such stereotypes. While renters in Marion County were less likely to report taking warnings seriously than homeowners, this didn't mean they were less knowledgeable about their property. In fact, they were more likely to know their flood zone, possibly because of

their more frequent reports of flooding. Further investigation about the relationship between home ownership and flood knowledge and experience may help clarify the details.

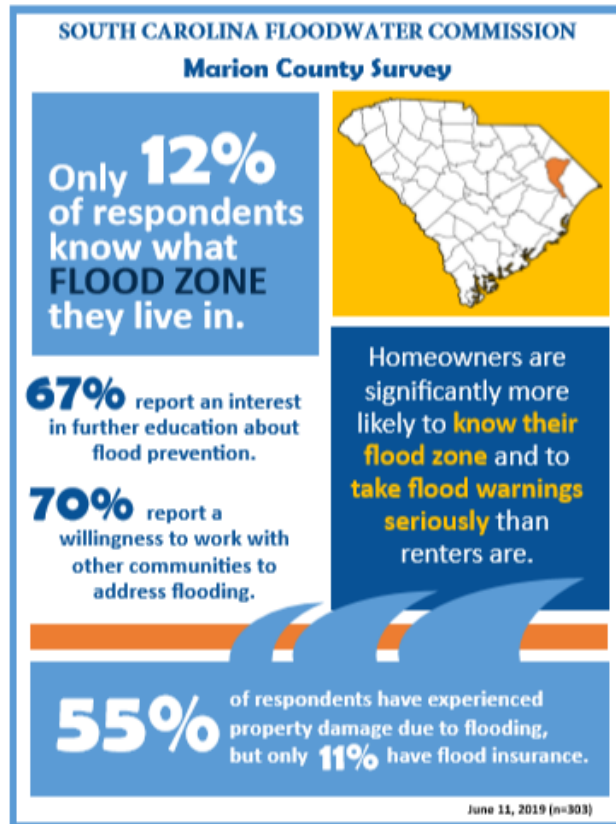


Figure 9. The flyer distributed at the Marion County Cleanup Day in June 2019, containing preliminary survey results (n=303). This flyer erroneously reported that homeowners were more likely to know their flood zone than renters, while the opposite was true even within the preliminary results. The claim that homeowners reported taking warnings more seriously than renters was accurate to the survey results.

7. Conclusion



Figure 10. A sign erected in 2016 to represent the determination of the Nichols community to recover from Hurricane Matthew is inundated with floodwater from Hurricane Florence in 2018; Gerald Herber, Associated Press, 2018.

Despite the frequent, severe, and recurrent destruction in Marion County resulting from recent hurricanes and floods, the county residents remain determined to rebuild and prepare to weather future storms rather than face retreat from the area. While knowledge of flood zones is rare and barriers to flood insurance access still exist, the survey respondents expressed interest in further education about flood prevention, cooperation between communities to prepare for future events, and policy changes such as rezoning and updated building codes. These results encourage future outreach programs by the South Carolina Floodwater Commission to help empower the residents of Marion County to prepare for and respond to future floods.

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Appendix I: Marion County Survey

I. Flood Knowledge and Experience	
<p>1. Do you know what flood zone you live in?</p> <p style="text-align: center;"><input type="radio"/> Yes <input type="radio"/> No</p> <p>▪ If <u>yes</u>, what flood zone do you live in?</p> <p style="text-align: center;"><input type="radio"/> AE <input type="radio"/> A <input type="radio"/> X</p>	<p>5. How seriously has flooding affected your life in the following ways over the past ten years?</p> <p>▪ Property damage or destruction:</p> <p><input type="radio"/> not at all affected <input type="radio"/> somewhat affected <input type="radio"/> seriously affected <input type="radio"/> very seriously affected</p> <p>▪ Loss of work or income:</p> <p><input type="radio"/> not at all affected <input type="radio"/> somewhat affected <input type="radio"/> seriously affected <input type="radio"/> very seriously affected</p> <p>▪ Obstruction of traffic and travel:</p> <p><input type="radio"/> not at all affected <input type="radio"/> somewhat affected <input type="radio"/> seriously affected <input type="radio"/> very seriously affected</p> <p>▪ More frequent physical illness or infection:</p> <p><input type="radio"/> not at all affected <input type="radio"/> somewhat affected <input type="radio"/> seriously affected <input type="radio"/> very seriously affected</p> <p>▪ More severe mental health problems or illness:</p> <p><input type="radio"/> not at all affected <input type="radio"/> somewhat affected <input type="radio"/> seriously affected <input type="radio"/> very seriously affected</p>
<p>2. Are you aware of things you can do on your property to reduce the effects of flooding?</p> <p style="text-align: center;"><input type="radio"/> Yes <input type="radio"/> No</p>	
<p>3. Have you invested in flood protection on your own property (rain garden, levee, etc.)?</p> <p style="text-align: center;"><input type="radio"/> Yes (<i>see question 23</i>) <input type="radio"/> No</p> <p>▪ If you have <u>not</u> invested in personal flood protection, would you be interested if provided with education and resources?</p> <p style="text-align: center;"><input type="radio"/> Yes <input type="radio"/> No</p>	
<p>4. How often have you experienced flooding on your property over the past ten years?</p> <p><input type="radio"/> never <input type="radio"/> occasionally <input type="radio"/> often <input type="radio"/> very often</p>	

II. Property and Community Resources	
<p>6. Do you own or rent your home?</p> <p style="text-align: center;"><input type="radio"/>Own <input type="radio"/>Rent</p> <p>▪ If you own property, how many acres of land do you own?</p> <p style="text-align: center;">_____</p>	<p>10. Should building codes be updated because of flooding?</p> <p style="text-align: center;"><input type="radio"/>Yes <input type="radio"/>No</p>
<p>7. Do you have flood insurance?</p> <p style="text-align: center;"><input type="radio"/>Yes <input type="radio"/>No</p> <p>▪ If you do <u>not</u> have flood insurance, why not?</p> <p><input type="radio"/> too expensive</p> <p><input type="radio"/> didn't think I needed it</p> <p><input type="radio"/> didn't know about it</p> <p><input type="radio"/> other</p>	<p>11. Have you used resources provided by local businesses after flooding?</p> <p style="text-align: center;"><input type="radio"/>Yes <input type="radio"/>No</p>
<p>8. If your house has been damaged or destroyed, do you or your landlord have the means to repair it?</p> <p><input type="radio"/>Yes <input type="radio"/>No</p> <p><input type="radio"/> My house has not been damaged.</p>	<p>12. Would you be willing to work with other communities to address flooding?</p> <p style="text-align: center;"><input type="radio"/>Yes <input type="radio"/>No</p>
<p>9. Should property zoning be revised because of flooding?</p> <p style="text-align: center;"><input type="radio"/>Yes <input type="radio"/>No</p>	<p>13. Would you be interested in further education about flood prevention?</p> <p style="text-align: center;"><input type="radio"/>Yes <input type="radio"/>No</p>
<p>14. Do you believe it is a worthwhile use of resources to address local flooding?</p> <p><input type="radio"/> Yes</p> <p><input type="radio"/> No, resources should be used in other ways (<i>see question 24</i>)</p>	<p>15. Do you have suggestions to help prevent flooding or reduce impacts?</p> <p style="text-align: center;"><input type="radio"/>Yes (<i>see question 25</i>) <input type="radio"/>No</p>

III. Responsibility and Your Community

<p style="text-align: center;">16. How seriously do you take hurricane/flood warnings?</p> <ul style="list-style-type: none"> <input type="radio"/> not seriously at all <input type="radio"/> not very seriously <input type="radio"/> somewhat seriously <input type="radio"/> very seriously 	<p style="text-align: center;">20. What is your age?</p> <ul style="list-style-type: none"> <input type="radio"/> younger than 20 <input type="radio"/> 20-29 <input type="radio"/> 30-39 <input type="radio"/> 40-49 <input type="radio"/> 50-59 <input type="radio"/> 60-69 <input type="radio"/> 70-79 <input type="radio"/> older than 80
<p style="text-align: center;">17. What is the cause of recent flooding? (mark all that apply)</p> <ul style="list-style-type: none"> <input type="checkbox"/> storms/heavy rain events <input type="checkbox"/> poor drainage <input type="checkbox"/> development of natural areas <input type="checkbox"/> climate change <input type="checkbox"/> other 	<p style="text-align: center;">21. What is your gender?</p> <p style="text-align: center;"><input type="radio"/> Male <input type="radio"/> Female</p>
<p style="text-align: center;">18. Who is responsible for recovery after flooding? (mark all that apply)</p> <ul style="list-style-type: none"> <input type="checkbox"/> individual residents <input type="checkbox"/> local government <input type="checkbox"/> non-profit organizations <input type="checkbox"/> state government <input type="checkbox"/> federal programs (such as FEMA) 	<p style="text-align: center;">22. What is the highest level of education you have completed?</p> <ul style="list-style-type: none"> <input type="radio"/> some K-12 schooling <input type="radio"/> high school diploma or GED <input type="radio"/> some college <input type="radio"/> 2-year (associate's) degree <input type="radio"/> 4-year (bachelor's) degree <input type="radio"/> postgraduate degree
<p style="text-align: center;">19. How relevant are the questions in this survey to your experiences and opinions?</p> <ul style="list-style-type: none"> <input type="radio"/> not relevant at all <input type="radio"/> not very relevant <input type="radio"/> somewhat relevant <input type="radio"/> very relevant 	

IV. Open Response Questions

23. If you have taken flood prevention measures on your property, please briefly describe them here.

24. If you have suggestions for other ways to use local and state resources, please share them here.

25. If you have suggestions for ways to help prevent flooding and reduce impacts, please share them here.

Appendix II: Pilot Survey Results

Table 12.1		
Do you know what flood zone you live in?		
	Frequency	Percent
Yes	9	33.3
No	18	66.7
Total	27	100.0

Table 12.2		
What flood zone do you live in?		
	Frequency	Percent
Don't Know	18	66.7
A	5	18.5
AE	1	3.7
X	3	11.1
Total	27	100.0

Table 12.3		
Are you aware of things you can do on your property to reduce the impacts of flooding?		
	Frequency	Percent
Yes	15	55.6
No	12	44.4
Total	27	100.0

Table 12.4		
Have you invested in flood protection on your own property?		
	Frequency	Percent
Yes	6	22.2
No	21	77.8
Total	27	100.0

Table 12.5		
If you have not invested in personal flood protection, would you be interested if provided with education and resources?		
	Frequency	Percent
Yes	6	22.2
No	15	55.6
Total	21	77.8
Have Invested	6	22.2
Total	27	100.0

Table 13.1		
How often have you experienced flooding on your property over the past ten years?		
	Frequency	Percent
Never	17	63.0
Occasionally	8	29.6
Often	2	7.4
Total	27	100.0

How seriously has flooding affected your life in the following ways over the past ten years?

Table 13.2		
Property Damage		
	Frequency	Percent
Not At All Affected	14	51.9
Somewhat Affected	9	33.3
Seriously Affected	2	7.4
Very Seriously Affected	2	7.4
Total	27	100.0

Table 13.3		
Loss of Work or Income		
	Frequency	Percent
Not At All Affected	20	74.1
Somewhat Affected	5	18.5
Seriously Affected	2	7.4
Total	27	100.0

Table 13.4		
Obstruction of Traffic and Travel		
	Frequency	Percent
Not At All Affected	8	29.6
Somewhat Affected	13	48.1
Seriously Affected	5	18.5
Very Seriously Affected	1	3.7
Total	27	100.0

Table 13.5		
More Frequent Physical Illness or Infection		
	Frequency	Percent
Not At All Affected	24	88.9
Somewhat Affected	3	11.1
Total	27	100.0

Table 13.6		
More Severe Mental Health Problems or Illness		
	Frequency	Percent
Not At All Affected	22	81.5
Somewhat Affected	5	18.5
Total	27	100.0

Table 14.1		
Do you own or rent your home?		
	Frequency	Percent
own	24	88.9
rent	3	11.1
Total	27	100.0

Table 14.2		
If you own property, how many acres of land do you own?		
	Frequency	Percent
No Response	10	37.0
<1	15	55.6
1	1	3.7
4	1	3.7
Total	27	100.0

Table 14.3		
Do you have flood insurance?		
	Frequency	Percent
Yes	14	51.9
No	13	48.1
Total	27	100.0

Table 14.4		
If you do not have flood insurance, why not?		
	Frequency	Percent
Too Expensive	2	7.4
Didn't Think I Needed It	10	37.0
Other	1	3.7
Total	13	48.1
Have Insurance	14	51.9
Total	27	100.0

Table 14.5		
If your house has been damaged or destroyed, do you or your landlord have the means to repair it?		
	Frequency	Percent
Yes	5	18.5
No	2	7.4
My house has not been damaged.	20	74.1
Total	27	100.0

Table 15.1		
Should property zoning be revised because of flooding?		
	Frequency	Percent
Yes	15	55.6
No	12	44.4
Total	27	100.0

Table 15.2		
Should building codes be updated because of flooding?		
	Frequency	Percent
Yes	16	59.3
No	11	40.7
Total	27	100.0

Table 15.3		
Do you believe it is a worthwhile use of resources to address local flooding?		
	Frequency	Percent
Yes	26	96.3
No	1	3.7
Total	27	100.0

Table 15.4		
Do you have suggestions to help prevent flooding or reduce impacts?		
	Frequency	Percent
Yes	4	14.8
No	23	85.2
Total	27	100.0

Table 15.5		
Who is responsible for recovery following flooding?		
	Frequency	Percent
Individual Residents	23	85.2
Local Government	18	66.7
Non-Profit Organizations	11	40.7
State Government	16	59.3
Federal Programs (such as FEMA)	19	70.4

Table 16.1		
Have you used resources provided by local businesses after flooding?		
	Frequency	Percent
Yes	6	22.2
No	21	77.8
Total	27	100.0

Table 16.2		
Would you be willing to work with other communities to address flooding?		
	Frequency	Percent
Yes	15	55.6
No	12	44.4
Total	27	100.0

Table 16.3		
Would you be interested in further education about flood prevention?		
	Frequency	Percent
Yes	9	33.3
No	18	66.7
Total	27	100.0

Table 17.1		
How seriously do you take hurricane/flood warnings?		
	Frequency	Percent
Not Very Seriously	1	3.7
Somewhat Seriously	5	18.5
Very Seriously	20	74.1
Total	26	96.3
Missing	1	3.7
Total	27	100.0

Table 17.2		
What is the cause of recent flooding?		
	Frequency	Percent
Storms/Heavy Rain Events	23	85.2
Poor Drainage	13	48.1
Development of Natural Areas	11	40.7
Climate Change	5	18.5
Other	3	11.1

Table 18.1		
What is your age?		
	Frequency	Percent
40-49	2	7.4
60-69	8	29.6
70-79	12	44.4
Older than 80	3	11.1
Total	25	92.6
Missing	2	7.4
Total	27	100.0

Table 18.2		
What is your gender?		
	Frequency	Percent
Male	5	18.5
Female	21	77.8
Total	26	96.3
Missing	1	3.7
Total	27	100.0

Table 18.3		
What is the highest level of education you have completed?		
	Frequency	Percent
High school diploma or GED	1	3.7
Some college	6	22.2
2-year degree	3	11.1
4-year degree	8	29.6
Postgraduate degree	8	29.6
Total	26	96.3
Missing	1	3.7
Total	27	100.0

Table 19.1		
How relevant are the questions in this survey to your experiences and opinions?		
	Frequency	Percent
Not relevant at all	2	7.4
Not very relevant	6	22.2
Somewhat relevant	12	44.4
Very relevant	5	18.5
Total	25	92.6
Missing	2	7.4
Total	27	100.0

Table 19.2	
Reliability Statistics:	
Cronbach's	
Alpha	N of Items
.742	5

Table 19.3		
Reliability Item		
	Mean	Std. Deviation
How frequently have you experienced flooding on your property in the past ten years?	1.44	.641
How seriously has flooding affected your life in the following ways over the past ten years?		
Property damage	1.70	.912
Loss of work or income	1.33	.620
More frequent physical illness or infection	1.11	.320
More severe mental health problems or illness	1.19	.396