

1 **From abstract futures to concrete experiences: how does political**
2 **ideology interact with threat perception to affect climate adaptation**
3 **decisions?**

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Abstract

Climate change forecasts predict impacts that will increasingly expose coastal residents to existential risks, necessitating aggressive adaptation. While the polarization of climate change attitudes in American politics represents a barrier to climate adaptation efforts, it is not well-understood how political ideology mediates how individuals connect the abstract concept of “climate change” to concrete experiences with environmental risks. Understanding this link in the context of adaptation decision-making is important, as the effects of many, household-level adaptation efforts compound over space and time, affecting community flood risk and vulnerability. This paper asks, how do political ideologies interact with threat perception to affect coastal climate adaptation decisions? We frame this analysis using the Theory of Planned Behavior (TPB) and Protection Motivation Theory (PMT). Using responses from a survey of residents ($n=164$) in North Carolina’s (USA) Albemarle-Pamlico Peninsula, we examine how measures of residents’ subjective norms, threat-appraisals, and self-efficacy influence their intent to retreat or topographically adapt. We find that, despite political polarization around climate change, generally, when given concrete examples of risk, respondents’ political beliefs appear unrelated to their plans to protect their property and livelihoods.

Keywords: Climate adaptation; Theory of Planned Behavior; Protection Motivation Theory; flooding; sea level rise; coastal climate adaptation

1. Introduction

Coastal zones around the world are facing increasingly transformative effects of climate change, including sea level rise (SLR), more severe tropical storms and hurricanes, greater storm surges, enhanced erosion, saltwater intrusion, and ocean acidification (Wong et al. 2014; IPCC 2018).

While forecasts for coastlines traditionally focus on long-term trajectories, changing conditions and extreme events are poised to force shifts to human and natural coastal habitats in the near-term. This process is expected to accelerate in the coming years, resulting in changes to human and natural coastal habitats that will disrupt current livelihoods and settlements (Bhattachan, Emanuel, et al. 2018).

During this period, a wide variety of climate adaptation strategies become increasingly important for residents and their communities (Hinkel et al. 2018; Butler, Deyle, and Mutnansky 2016). In aggregate, these actions have implications for watershed-scale responses to SLR (Bhattachan, Emanuel, et al. 2018) and mapping of future SLR risk (NOAA 2017). The potential for the amalgamation of individual decisions into compounding impacts heightens the importance of understanding how these choices are made.

Importantly, individuals' decisions to take protective actions rest, in large part, on their acknowledgement of the risks of climate change and the associated problems these forces will bring to bear (Bubeck, Botzen, and Aerts 2012; Milne, Sheeran, and Orbell 2000; Rogers 1975). However, the dangers of climate change are often discussed abstractly, as a future issue based on statistical probabilities and scientific models, which has often led to an underestimation of risk and muted public concern (Weber 2006; Botzen and van den Bergh 2012). Further, this

recognition varies among the public in the United States (McCright and Dunlap 2011; McCright et al. 2016; Dunlap 2013; Pew Research Center 2016; Wolsko 2017). Specifically, the perception of this risk breaks differently across political ideological boundaries, with liberals largely viewing it as a real and present threat, and conservatives increasingly doubtful of its authenticity and impact through much of the last decade (Dunlap 2013; McCright and Dunlap 2011).

Comparatively, previous literature has established that the visceral reality of experiencing previous floods and storms is associated with individuals' increased risk perception, willingness to take protective measures, and preparation for future storms (see, for example, Botzen and van den Bergh 2012; Kellens, Terpstra, and De Maeyer 2013; Anton and Lawrence 2014). Therefore, while it is clear that there is an ideological gap in risk assessment in regards to climate change, it is not well established if this disconnect persists when moving from the relatively abstract concept of "climate change" to concrete experiences of flood risk and vulnerability.

In this paper, we ask: how does political ideology interact with threat perception to affect individuals' climate adaptation decisions (as filtered through their understanding of threats and openness to engaging protective actions)? Moreover, we ask: how do two prominent theories of risk perception and protective adaptation – Protection Motivation Theory (PMT; Rogers 1975) and the Theory of Planned Behavior (TPB; Ajzen 1985) – predict landowner willingness to enact structural adaptations and/or retreat? By analyzing these theories side by side, we aim to understand, beyond the broad political polarization around the *existence* of climate change (Jaffe 2018), how political ideology weighs with individuals' real-world experiences, perceptions, and willingness to act in the wake of increasingly threatening environmental conditions and concrete

experiences of hazards (Bhattachan, Jurjonas, et al. 2018). We hypothesize that we will observe either no impact (or a very limited impact) of political ideology on measured protective response outcomes because we expect that respondents will react to concrete events that can be disassociated from the larger, abstract concerns of climate change. Further, our findings will emphasize the value of the PMT model in understanding resident openness to different adaptive responses.

To address these, we use PMT and TBP as vehicles for analyzing responses ($n=164$) to a residential drop-off/pick-up survey conducted in 2017 across the Albemarle-Pamlico Peninsula in the State of North Carolina (USA). We use logistic regression modeling to examine how respondents' perceptions of their own control and knowledge, their experience and awareness of the risks of flooding, and their personal and community-based subjective norms are associated with their adaptation decisions. Specifically, we examine 1) residents' intentions to manipulate the topography of their property in an effort to prevent flooding or improve drainage (a specific action that we term more succinctly as, "future topographic adaptation"), and 2) residents' perceived openness of a future retreat from their home.

We begin this paper with a review of the literature on different climate adaption strategies and theories, and an overview of our study area, data, and analysis methods. We find that both theories (TPB and PMT) are useful in predicting willingness to engage in future topographic adaptation and openness to retreat, but that the PMT performs better overall. Regarding political influence, we find that ideological leanings do not prevent individuals from engaging in protective responses. This supports the hypothesis that concrete examples can be used to bridge

ideological gaps on the acceptance of climate change to support broadly supported strategies for community-wide protective responses.

2. Background

2.1 Climate risk perception

Climate change is predicted to have many impacts in the near-term (IPCC 2018; Conrad, McNitt, and Stout 1998). Among them, in the United States, the 100-year floodplain area is expected to increase by 45% in riverine environments and by 55% in coastal environments by the year 2100 (AECOM 2013). Without an estimated 45% decrease in global greenhouse gas emissions (compared to 2010 levels) by 2030 (Hultman 2018), climate change impacts pose some of the most substantial risks to human life, property, and productivity (Mitchell et al. 2016).

However, there are two major issues associated with acknowledging and acting upon these risks. First, in the United States, there is significant polarization on the *existence* of climate change (Jaffe 2018). Second, in the US and other western countries, climate change is typically regarded as a psychologically distant risk, a characterization driven by the assumption that the largest climate change impacts will happen in the distant future, in distant locations, and to other people (Leiserowitz 2006; Weber 2006; van der Linden 2015; Gifford and Comeau 2011). The intersection of these two issues confounds our ability to understand of how individuals may react to climate-induced risks.

First, acknowledgement of climate change, and the risks that climate change poses, varies across political ideologies in the United States (McCright and Dunlap 2011; McCright et al. 2016;

Dunlap 2013; Hornsey et al. 2016; Pew Research Center 2016; Wolsko 2017). Increasing disbelief and denial of climate change – and an associated belief in scientific disagreement on the subject – follows a well-documented, decades-long trend of decreasing trust in science among conservative Americans (Gauchat 2012). This political concentration of climate change denial is associated with reduced support for energy and environmental policies that could slow the progression of climate change (Ding et al. 2011; Engels et al. 2013). As a result, American political conservatism is associated with decreases in concern and awareness about the negative impacts of climate change, as well as reduced support in public and personal changes to mitigate the progression of climate change (Gromet, Kunreuther, and Larrick 2013; Mcright and Dunlap 2011; Pew Research Center 2016; Unsworth and Fielding 2014).

Second, climate change is broadly viewed as a psychologically distant risk within Western countries. This means that it is characterized as a problem that is both spatially and temporally removed from near-term concerns, with an assumption by the public that it will happen in the future and in other, remote, places (van der Linden 2015). Risks associated with these characteristics are viewed in abstract rather than concrete terms (Weber 2006). It is unclear how this perspective intersects with politics and the visceral reality of flooding that is increasing locally, and disaster events that are disruptive across the community in state (e.g. Hurricane Matthew, 2016; Hurricane Floyd, 1999). Because a key risk factor (climate change and its impacts) is politicized, it might curtail adaptation and preparation along political boundaries. However, because the impacts of it (flooding, saltwater intrusion, etc.) occur in the day-to-day lives of the residents, climate change may trigger reactions and proactive adaptation regardless of political boundaries through a process known as *agnostic adaptation*, which refers to the

paradoxical presence of actions to address climate change's effects without necessitating the acknowledgement of the larger patterns at play or the anthropogenic origins (Koslov 2019).

2.2 Climate adaptation strategies

Climate adaptation strategies can be categorized into three approaches: *retreat*, and *in situ structural* and *non-structural* mitigation measures (Perry et al. 2007; McLeman 2017). *Retreat* strategies avoid flooding by limiting construction in present and future flood prone areas or through the relocation of existing development and people from vulnerable areas (Hino, Field, and Mach 2017; Siders 2019). In the United States, this strategy largely takes the form of floodplain buyouts, where government agencies purchase homes based on their pre-disaster value with the expectation (not always realized) that the homeowners will move to less vulnerable locales. This process is capital intensive, time consuming, and is difficult for both participants and the public officials in the communities that they are leaving, often resulting in increased socio-economic problems for participants (Binder, Baker, and Barile 2015; Salvesen et al. 2018; Binder and Greer 2016; Sipe and Vella 2014; Koslov 2016).

Communities and households that prefer to stay in place can use *structural* or *nonstructural* strategies to protect existing development patterns, or to adjust to new development patterns that can be maintained in the face of changing conditions. *In Situ structural* strategies involve engineering solutions and construction to manipulate the built environment. At the community level, structural strategies include seawalls, levees, dikes, canal systems, or beach nourishment to avert flooding risks away from communities. At the individual level, this includes installation of culverts, tile drains, flashboard risers, home elevation, and topographic manipulation of

properties (National Research Council 2014). Historically, the primary method for approaching flood mitigation and protection have been structural, which has achieved mixed results at a high cost (Few 2003; Perry et al. 2007) (Few 2003; Perry et al. 2007). As a result, mitigation methods have shifted to prioritize non-structural solutions

In situ nonstructural measures allow individuals and communities to remain in place, and include flood insurance, building code alterations, risk communication strategies, evacuation planning, and the shifting of livelihood choices (such as shifting agricultural production from less tolerant to more tolerant plants) that adjust conditions to adapt to and alleviate the risks of flooding. Accommodation strategies have become increasingly common, particularly in the face of high initial and maintenance costs of engineered solutions and cases of well-publicized failures of engineered infrastructure (Tobin 1995). While some of classified retreat as a nonstructural mitigation measure, many researchers identify it as an inherently different response (McLeman 2017; Adger, Lorenzoni, and O'Brien 2009).

Depending on the adaptation strategy that residents implement, the impact of their efforts may reach beyond the borders of their property, particularly when it involves changes to the topography. This impact compounds as more residents in close proximity partake in similar or complimentary actions; if many individual property owners undertake strategies that divert existing paths of travel for flood waters, such as by building berms or channels, the overall community or regional topography may affect the area's watershed dynamics (Poulter, Goodall, and Halpin 2008). Therefore, understanding these changes is important both for understanding

the evolving risks within the watershed and for identifying appropriate policy mechanisms to support communities dealing with SLR.

2.3 Theories of household-level climate adaptation behavior

Protection Motivation Theory (PMT) and the Theory of Planned Behavior (TPB) have their roots in studies of health-related behavior (Weinstein 1993; Ajzen 1985; Rogers 1975). TPB primarily focuses on the relationship between an individual's beliefs and opinions and whether they will engage in a behavior. PMT primarily focuses on understanding how people respond to a threat based on their ability to manage that threat. Both theories presuppose individuals are more likely to engage in behaviors that they believe are achievable (Armitage and Conner 2001). That is, both theories emphasize some degree of knowledge (or perceived knowledge) about the issue, and a perceived ability to achieve certain actions. Therefore, there are strong parallels between "perceived behavioral controls" in the TPB model, and "coping appraisal" of the PMT model (see Figure 1).

[Insert Figure 1 about here]

2.3.2 The Theory of Planned Behavior

The Theory of Planned Behavior (TPB) is a popular and flexible conceptual framework for understanding how people may behave in the future (Figure 1a; Ajzen 1985). This theory argues that 1a) attitudes about a behavior, 2a) perceptions about one's ability to perform a behavior, and 3a) perceived social perceptions of a behavior, influence 4a) an individual's *intent* to perform a behavior. An individual's control over the behavior and situation mediates the relationship between intent to perform a behavior and actual performance of that behavior, but generally

intent is argued to be a reliable indicator of 5a) whether the individual will perform the behavior (Figure 1. Ajzen and Fishbein 2005; Greaves, Zibarras, and Stride 2013). Values, such as cultural, personal, and situational factors, act as “background factors” (Ajzen and Fishbein 2005) without clear pathways of influence on beliefs.

There is a long history of using the TPB to investigate environmental and climate-related behaviors (e.g. Armitage and Conner 2001) including individual travel behaviors (Bamberg and Schmidt 1997; Bamberg 2003; Tikir and Lehmann 2011), recycling behavior (Bamberg and Ludemann 1996), environmental behaviors in the workplace (Greaves, Zibarras, and Stride 2013), and choices for “green” hotels (Han, Hsu, and Sheu 2010). More directly related to this paper, researchers have used TPB to investigate how perceptions, behaviors, and communication interact to influence individual behavior on climate change mitigation and adaptation (Whitmarsh and Lorenzoni 2010).

Studies show individual TPB variables are generally strong predictors of behavioral intentions (Jonas and Doll 1996; Bamberg and Schmidt 1997); for example, Kaiser et al. (1999) used TPB to establish that “environmental attitude[s are] a powerful predictor of ecological behavior.” Importantly, however, TPB does not incorporate threat assessment – whether or not a threat exists and the extent of a threat – into a framework for understanding behavioral motivations. Moreover, the broad perspective of TPB limits its ability to key in on the variables relevant to hazard mitigation and personal response (Lindell and Hwang 2008). To incorporate this aspect into our analysis, we draw on a related theory, Protection Motivation Theory.

2.3.3 Protection Motivation Theory

The Protection Motivation Theory (PMT) was initially introduced by Rogers (1975) to better connect the literatures on “fear appeals” and attitude change. It was revised in 1983 to better understand the coping process that individuals might take when faced with information on the likelihood and magnitude of adverse events, including maladaptive responses that involve continuation of risky behaviors (Rogers 1983). As a result of its utility, it was adopted as a general model for understanding decision making processes in response to different threats (Milne, Sheeran, and Orbell 2000). PMT first gained traction with specific application to flooding risk and disaster events when Grothmann and Reusswig (2006) used the theory to better understand why residents in flood-prone areas would or would not use self-protective behavior to reduce flood exposure and risk of monetary damages. Since then, PMT has seen increased acceptance and use in studies analyzing flood risk perception (Aerts et al. 2018; Bubeck et al. 2013; Bubeck, Botzen, and Aerts 2012; Jennifer K. Poussin, Botzen, and Aerts 2014).

PMT offers constructs concerning precautionary adaptive measures that are absent from TPB (Figure 1B). As a socio-psychological model, PMT posits that there are two possible responses to a threat: a protective (taking an action to prevent damage from a perceived threat) or non-protective response (such as denial of threat, wishful thinking, or fatalism). Prior to choosing between a protective or non-protective response, an individual goes through at least two phases. First, a (1b) *threat appraisal phase* assesses the likelihood and extent of damage from a threat. If a certain threat threshold is met, a (2b) *coping appraisal phase* begins, where the individual assesses their ability and required costs to cope with or avert the threat. If the individual seeks a

protective response, they will go through a third phase called (3b) *protection motivation*, where the intent is formed to perform a protective action. Then, the actual action, or the (4b) *protective response*, is mediated by factors related to the individual's ability to perform the behavior such as costs or social norms. For example, this theory interprets flooding as a potential threat, which, once deemed a threat, may lead to coping mechanisms such as future topographic adaptation (Rogers 1983; Rogers and Prentice-Dunn 1997).

Threat appraisal is the process of evaluating the probability of a threat, and the amount of potential damage from that threat (Vance, Siponen, and Pahnla 2012). There are four key factors including: 1) the perceived probability of the threat, 2) the perception of the extent of the threat (i.e., how damaging the threat might be), 3) the role fear plays in affecting the second factor with the understanding that fear may increase the perceived severity of the threat, and 4) the perceived benefits of not taking action.

The *coping appraisal* assesses factors are based on three factors. First, the perception an action will effectively protect from the threat (analogous to attitudes about the behavior in the TPB). Second, the perceived ability to perform behavior will result in protection (also consistent with the TPB). Third, the perceived costs of performing the behavior, including money, time, and effort (distinct from TPB, which focuses more on social norms related to the behavior). Self-efficacy (i.e., "...how well one can execute courses of action required to deal with prospective situations"; Bandura 1982, 122) and protective response efficacy are positively correlated with protective responses, while non-protective responses such as avoidance are understood to inhibit the protection motivation phase (Grothmann and Reusswig 2006).

Analyzing these theories side by side is valuable in the context of climate change considering the inherent applicability of PMT to disasters and risks and the inherent applicability of TPB to social values. PMT enjoys greater adaption and utility in studies focusing on actions responding to climate change conditions (see, for example: Babicky and Seebauer 2018; Bubeck, Botzen, and Aerts 2012; Grothmann and Reusswig 2006), while the TPB framework allows for a more natural integration of social norms, such as political ideology. The PMT framework is designed to understand and explain reactions to threatening events. Therefore it is tailored to the specifics of natural hazard research and has more application in understanding the outcomes of protective actions (Lindell and Hwang 2008). Meanwhile, TPB is designed for the inclusion of social norms, such as political ideology, as a driver that may frame threat appraisal.

By comparing these theories, we aim to understand the interplay of political ideology with individuals' real-world experiences, perceptions, and willingness to act in the wake of increasingly threatening environmental conditions.

3. Study Area and data

3.1 Study area

Our study area consists of the Albemarle-Pamlico Peninsula (APP; Figure 2), a landmass extending into the Albemarle and Pamlico Sounds in the State of North Carolina (USA). One of the largest estuary systems in the conterminous United States (over 6000 km² of lagoonal waters) surrounds this low-relief, low-elevation peninsula (Luettich et al. 2002).

[Insert Figure 2 about here]

Prior to 1970, wetlands and low intensity timber operations occupied much of this landscape, which is typical of the Southern US coastal plain. The construction of extensive drainage networks in the 1970s and 1980s converted much of the region to row-crop agriculture, plantation forestry, and consolidated animal feeding operations (Poulter, Goodall, and Halpin 2008; Carter and Lyman 1975; Dahl 1990) resulting in a patchwork of land use types. Today, the region retains both drained and undrained natural areas including three national wildlife refuges and a variety of smaller nature preserves, parks, and conservation areas.

The five counties that make up the APP (including Tyrrell, Washington, and parts of Beaufort, Dare, and Hyde Counties) is also among the most economically distressed in North Carolina, evidenced by high poverty rates (ACS 2016 (5-Year Estimates); the official poverty rate in 2017 was 12.3 percent (U.S. Census Bureau). With the exception of Dare County, whose economy depends largely on tourism at the Outer Banks barrier islands (part of Dare County outside the APP), the APP economy remains largely agricultural (Table 1). However, these industries are facing increasing challenges. As a result, the region experienced rapid population and economic declines over the last two decades, driven by extensive loss of manufacturing employment and tobacco agricultural subsidies (ACS 2016; 5-Year Estimates). These economic issues increase the social vulnerability, which makes proactive adaption (particularly, *in situ* adaption) more difficult.

[Insert Table 1 here]

3.2 Regional climate risk

Almost half of the APP region is less than 1 m above average sea level, creating chronic risk of significant flooding and saltwater intrusion (Bhattachan, Emanuel, et al. 2018), particularly in the face of extended drought or storm surges (e.g., Hurricanes Matthew [2016] and Florence [2018]). Projections of 24-132 cm of relative SLR along the North Carolina coast by the year 2100 exacerbate this vulnerability (Kopp et al. 2015). Recent analysis suggest the extensive artificial surface drainage networks in the APP (and similar coastal plain regions) may inadvertently serve as conduits for surficial saltwater entry into the landscape during coastal storms (Bhattachan et al. 2019). Likewise, changes in flooding patterns in the region are linked to topographical changes brought about by road and canal construction to drain and clear the region for agriculture (Poulter and Halpin 2008).

3.3 Survey data collection

We used a random, address-based sample (based on the US Postal Service's Computerized Delivery Sequence File; obtained from Survey Sampling, Inc. [now Dynata, Inc.]) to select household survey participants, stratifying the sample by block-group to ensure complete spatial coverage of the APP.

Our survey instrument contained 126 questions (~30 minute completion time per pre-testing) including questions about respondents' property, knowledge, beliefs, opinions, experiences with flooding, saltwater intrusion (and other symptoms of SLR), and aspects of their civic engagement. We developed questions for this survey instrument in coordination with an advisory group consisting of professionals from NGO's and scholars experienced with this specific region and its population. We felt that this was an appropriate strategy for identifying core questions

due to the small size of the population (104,960 persons), and the fact that there have been a number of climate-related studies that have occurred in this area (e.g., Junjonas et al.; Bhattachan et al; Poulter et al).

After pre-testing the survey on potential participants using cognitive interviewing (January 2017; $n=22$ residents), we administered the survey to residents ($n=789$, with 70 un-replaced refusals) using a drop-off/pick-up protocol, which has been shown to increase response rates for surveys that seek sensitive information or raise uncomfortable issues with respondents (Allred and Ross-Davis 2011; Steele et al. 2001). Potential respondent households were physically visited up to three times (on different days/times of the week) in an effort to explain the intent and use of the survey, and distribute the survey instrument and a \$5 gift card incentive (Church 1993; Dillman, Smyth, and Christian 2008). If unsuccessful, survey staff left the survey materials at the residence along with a business reply envelope. Three attempts were also made to pick up the surveys 1-2 weeks later, and reminder letters and return envelopes were left at homes where in-person contact could not be made. Final reminders were also mailed to non-respondents two months after survey distribution.

Of the 789 surveys left at residents' houses, $n=227$ were returned, yielding a total response rate of 31.6%. However, not all surveys were completed in their entirety; there were 164 responses that answered all of the questions that we use in this paper, which is a completion rate of 72%. With this sample size and a reference population of just below 105,000 persons (ACS 2016), we estimate 6.41% and 7.64% margins of error, based on 90% and 95% confidence levels, respectively, based on Cochran's formula (Bartlett, Kotrlik, and Higgins 2001).

Based on these margins of errors, it is possible that the results show an Alpha error that finds differences that do not actually exist within a given population. However, we feel that we have taken reasonable measures to produce a high response rate based on the detailed level of survey instrument implement. While future studies will be needed to confirm our findings and increase validity in general applicability beyond the APP (Bartlett, Kotrlik, and Higgins 2001), these are reasonable response rates and error rates given the sensitive and detailed nature of our survey instrument.

Another concern is that, because the data was self-reported and cross-sectional, it is vulnerable to common method variance (CMV). This occurs when a same-source bias is introduced into the data due to the measurement method (in our case, a survey) and interferes with our measurements (Podsakoff et al. 2003). The prevalence and impact of CMV bias is still heavily debated (Spector 2006), but there is a general consensus that certain tests can allow for the detection of some types of CMV bias (Richardson and Sturman 2009). To check for fundamental signs of CMV bias, we entered all variables in each of our models into separate unrotated exploratory factor analyses (Vance, Siponen, and Pahnla 2012), which yielded six factors for each model. No individual factors accounted for more than 25% of the variance in each model, suggesting little evidence of CMV bias. While this does not comprehensively certify against CMV bias, this analysis is a step towards that certification.

4. Analysis methods

In order to understand the conditions under which landowners decide to invest in adaptation strategies, we developed two sets of logistic regression models. The dependent variables in these

models are based on responses to two survey questions indicating 1) whether respondents' intended to manipulate their topography to install WCS (i.e., "future topographic adaptation") and 2) respondents' perceived openness to retreat or relocate in the face of increasing flood risk.

There is a long history of using logistic regression and similar statistical analyses for studying this framework specifically, and risk perception generally. This is consistent with Botzen et. al.'s (2009) use of probit models for understanding PMT and Shao et. al.'s (2017) use of a multi-level logistic regression model to study PMT across multiple states and counties. Similarly, many authors have employed Ordinary Least Squares (OLS) regression models to understand climate adaptation; for example, Poussin et. al. (2012), Sullivan-Willey et. al. (2017), and Brown et. al. (2018) used OLS to study factors influencing flood damage mitigation, risk perception in multi-hazard environments, and risk perception regarding the likelihood and severity of future cyclones (with marginal effects analysis), respectively.

Our independent variables cover three major concepts. Per the TPB, we include variables for *subjective norms* regarding personal and community attitudes about a behavior. For PMT, we used variables to represent *threat appraisal*. For both, we used variables for person's perceived ability to cope with the threat through performing protective behaviors (*self-efficacy*). Regarding our specific selection of variables to match these concepts, there was a clearer antecedents for our use of the PMT framework. This is because PMT enjoys a more robust history of utilization in research examining protective actions in regards to flood risk (see, for example: Grothmann and Patt 2005; Kellens, Terpstra, and De Maeyer 2013). TPB has a more limited history in this

regard, but it does have a robust history in ecological conservation decisions, which we were able to rely upon for insight (see, for example: Kaiser, Hübner, and Bogner 2005).

[Insert Table 2 about here]

4.1 Subjective norms

In order to measure the perceived *subjective norms*, we used two variables representing community and personal attitudes towards climate change adaptation (Table 2). For community norms, we gauged resident perceptions about community pressure to build WCS with a 5-point Likert scale ranging from *strongly disagree* to *strongly agree*. For individual political attitudes, we focused on where the resident identified along a continuum from conservative to liberal (measured along a 5-point scale and recoded as binary; see Table 2). Social norms and social identity have both been shown to play a powerful role in mediating risk perception and affecting proactive behavior in anticipation of future floods (Lo 2013). This effect has been shown with studies analyzing community expectations for engaging in these specific protective behaviors (Bubeck et al. 2013), and a perception that neighbors are, themselves, engaging specific flood adaptive behavior (Kaiser, Hübner, and Bogner 2005). These studies align with a history of theoretical support regarding the mediating value of social identity in acting on threats of risk (Frank, Eakin, and López-Carr 2011).

4.2 Threat appraisal

To capture *threat appraisal*, we employed respondents' self-report of seeing standing water on their properties within the last five years and their concerns about how environmental changes

will affect their properties *in the future*. Experience with flooding is one of the most consistent factors in predicting future protective actions in the literature (see, for example: Bubeck, Botzen, and Aerts 2012). Worrying about the impact of future flooding, meanwhile, has a strong theoretical backing regarding its relationship to the emotional aspect of threat appraisal, and it often tracks with past exposure severity (Zaalberg et al. 2009). We theorize that exposure to previous flooding and future concerns would increase the severity of the perceived threat, leading to an increased likelihood for taking protective actions with consideration for issues of self-efficacy (Weinstein 1993; Aerts et al. 2018).

4.3 Self-efficacy

“Self-efficacy” refers to the perception of how possible it is to implement a given strategy (Vance, Siponen, and Pahnla 2012), which can refer to technical capability or know-how and knowledge for implementing protective strategies, as well as the rights residents have to engage in such measures (Bubeck et al. 2018). To address this category, we first asked if residents felt knowledgeable about local environmental issues (5-point Likert scale, ranging from *strongly disagree* to *strongly agree*). We also included two questions pertaining to their right, as homeowners and members in their community, to implement WCS. We asked about respondents’ feelings regarding the level of control they had over installing and maintaining WCS (5-point Likert scale, ranging from *strongly disagree* to *strongly agree*). Additionally, we included a variable for homeownership, which is indicative of the investment and control they have over their residence and property.

4.4 Demographic factors

Finally, we controlled for socio-economic background factors. Due to the sample size, we restricted the control variables to age, gender, educational attainment, and poverty. Additionally, we ran the variables in Table 5 and Table 6 with these demographic variables to better understand their effects (see Table S2 in Supplementary Materials), and found limited impacts. Only gender had a significant impact on the outcome in two of the four models, where being female had a negative impact ($OR=0.19$) on the resident's willingness to engage in future topographic adaptations.

For each model, we calculated the area under the Receiver Operating Characteristics curve (AUROC; Fawcett 2006). The AUROC depicts the fraction of positive cases correctly predicted by the model (or the true-positive rate, called the "sensitivity") and the fraction of negative cases correctly predicted (or the true-negative weight, called the "specificity") and compares them to a random model. Models with AUROCs over 0.8 are generally considered strong models, while models 0.7 and under are considered weak (Fawcett 2006).

We also calculate the Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) for each model. These measures are based on likelihood-ratio tests, which are helpful for non-nested comparing models using the same data and selecting best fit; the model with the lower AIC or BIC (relative to other models) is preferred (Burnham and Anderson 2004).

4.5 Hypotheses

We hypothesize that we will not observe an impact of political ideology on the two protective response outcomes because we expect that respondents will react to concrete events that can be

disassociated with the larger, abstract concerns of climate change. This follows the concept of “*agnostic adaptation*,” referencing the ability of individuals to implement climate adaptive strategies, while continuing to divorce these actions from acceptance of the very reasons necessitating adaptation (i.e., anthropogenic climate or environmental changes (Koslov 2019; Adams-Schoen et al. 2015)).

For example, extreme heat days (temperatures $\sim 35^{\circ}\text{C}$ [95°C]) in the City of Los Angeles (USA) are predicted to rise in prevalence from 6 days per year in previous decades to 22 days per year by 2050 under models presuming continued emissions increases (Sun, Walton, and Hall 2015). A local resident does not need to accept the role of climate change to justify purchasing an air conditioner to accommodate for these changing trends. Taking this example to a larger scale, the City of Los Angeles may not need a Climate Change action plan to recognize changing trends in electricity usage and invest in upgrades to the electrical grid to accommodate power surges for the increasing number of warm days (Times Editorial Board 2018; Sun, Walton, and Hall 2015). This example highlights our hypothesis that it may not necessary to understand and/or respond to the climate change directly in order to respond to specific *risks* created by climate change.

Second, we hypothesize that, without formulating a highly insightful measure of subjective norms that would elevate the value of the TPB model, the PMT framework will be a better predictor of intended future adaptation actions.

5. Results

5.1 Summary statistics

[Insert Table 3 about here]

Among survey respondents, only 9.15% indicated that they had future plans to manipulate topography of their property for the purposes of preventing flooding or improving drainage (i.e., “future topographic adaptation”; Table 3). Comparatively, 69 respondents, or 42.07% of the studied population acknowledged that they could foresee that flooding would force them to move from their property. Majorities have experienced standing water in the previous five years (61.59%), own their homes (91.46%), and either agree or strongly agree with having future concerns and the sense of control over their own land. Meanwhile, a minority of respondents (10.98%) agreed with the statement that community members pressure them to build WCS.

[Insert Table 4 about here]

5.2 Political factors

Table 4 depicts correlations between respondent conservatism and their answers to five questions: 1) their knowledge about local environmental issues and natural resources and their views on trends over the past 20 years for 2) storm strength, 3) storm frequency, 4) flooding on their own properties, and 5) flooding in their communities. Summary statistics on political beliefs among respondents related to these five questions are shown in Supplemental Materials Table 3. Two of these correlations are statistically significant; the belief that the strength of storms has increased over the past 20 years ($b=-0.31$; $p<0.01$) and the belief that frequency of storms has increased over the past 20 years ($b=-0.21$; $p<0.01$) are both negatively associated with respondent conservatism. Noticing an increase in flooding on one’s property over the past 20 years ($b=0.01$; $p>0.1$) and noticing an increase in flood in one’s community over the past 20 years ($b=-0.10$; $p>0.1$) were not significantly correlated with political beliefs.

5.3 Regression results

The first two models (1A and 1B; Table 5) investigate respondents' plans to install water control structures to reduce flooding (future topographic adaptation) using both the PMT (1A) and the TPB (1B) frameworks. The next two models (2A and 2B; Table 6) use the same theoretical frameworks and independent variables to examine residents' propensity to retreat (relocate) as a result of flooding.

We note that socio-demographic factors (gender, education, poverty status, age, and whether or not the respondent is a homeowner) were excluded from these models due to the limitations posed by our relatively small sample size. A test limited to these socio-demographic factors and respondent intentions (see Supplementary Material 1, Table 2) shows that these socio-demographic variables explain relatively little variation observed in plans to manipulate topography for water control purposes.

5.3.1 Models of future topographic adaptation (Models 1A and 1B)

Model 1A uses the PMT framework to examine resident's plans to install or upgrade water control structures to prevent future flooding (Table 5). Both the knowledge about environmental issues ($OR=3.55$; $p<0.01$) and the experience of having standing water on one's property ($OR=5.72$; $p<0.05$) positively contribute to a resident's intention to engage in future topographic adaptation.

Model 1B, representing the TPB framework, finds similar patterns for self-efficacy variables, where perceived knowledge about environmental issues is positively correlated with future topographic adaptation plans ($OR=3.24$; $p<0.01$). In the subjective-norms section, community pressure to install water control structures is positively associated ($OR=1.88$; $p<0.1$) with future topographic adaptation plans. The resident's self-described political ideology did not have a significant impact on plans for future topographic adaptation.

We compare Models 1A and 1B using the AUROC, AIC, and BIC. As noted previously, the AUROC depicts the fraction of positive cases correctly predicted by the model (or the true-positive rate, called the “sensitivity”) and the fraction of negative cases correctly predicted (or the true-negative weight, called the “specificity”) and compares them to a random model. Models with AUROCs over 0.8 are generally considered strong models, while models 0.7 and under are considered weak (Fawcett 2006). Across both metrics, the PMT framework appears to be slightly superior to the TPB framework. The AUROC value for Model 1A (0.7745) is close to the threshold for a ‘strong’ model, while the AUROC value for Model 1B (0.7327) is slightly weaker. Similarly, Model 1A has a lower AIC (36542.3 compared to 39373.0) and BIC (36560.9 compared to 39391.6) compared to Model 1B. As we previously note, the model with the lower AIC or BIC (relative to other models) is preferred (Burnham and Anderson 2004).

[Insert Table 5 here]

5.3.2 Models of willingness to retreat/relocate (Models 2A and 2B)

[Insert Table 6 here]

Models 2A and 2B analyze the relationships of explanatory variables from PMT and TPB (as explored above) on resident's perception that they may be forced to leave their home due to flooding in the future (retreat or relocation; Table 6).

In Model 2A, within the threat appraisal category, standing water ($OR=2.04$, $p<0.1$), and concern with future environmental impacts on one's property are both significant predictors of willingness to retreat ($OR=2.03$; $p<0.01$). In Model 2B, community pressure to build WCS is also a significant predictor ($OR=1.46$; $p\text{-value}<0.1$, at a level similar to what it was in Model 1B ($OR=1.88$ for plans for future topographic adaptation; $p<0.01$). In Model 2B, however, political beliefs begin to have some impact on the outcome variable. Compared to self-reporting a conservative ideology, both moderates and liberals are less likely to foresee that changes could force them to move (moderates: $OR=0.17$, $p<0.05$; liberals: $OR=0.30$; $p<0.1$).

Again, in comparing Models 2A and 2B using the AUROC, AIC, and BIC we see that the PMT framework appears to be slightly superior to the TPB framework. The AUROC value for Model 2A (0.7445) is higher than that of Model 2B (0.638), which is a weak model by this metric. Similarly, Model 2A has a lower AIC (77197.1 compared to 84342.6) and BIC (77215.7 compared to 84361.2) than Model 2B. As we previously note, the model with the lower AIC or BIC (relative to other models) is preferred (Burnham and Anderson 2004). It should also be noted that in comparing Models 1A to 2A and Models 1B to 2B, we see that the PMT and TPB frameworks are better fits in the first set of models examining residents' plans for future topographic adaptation.

6. Discussion and Conclusions

In this paper, we have asked, how does political ideology interact with threat perception to affect individuals' climate adaptation decisions (as filtered through their understanding of threats and openness to engaging protective actions)? Moreover, we asked, how do two prominent theories of risk perception and protective adaptation, PMT and TPB, predict residents' willingness to engage in protective adaptation and/or retreat?

Viewed as correlations in isolation (Table 4), we saw a clear relationship between political ideology and resistance with the abstract concept of climate change. Belief that the strength of storms has increased over the past 20 years and belief that the frequency of storms has increased over the past 20 years were both negatively correlated with conservative ideologies. These beliefs represent an abstract conceptualization of 'things are getting worse' in regards to climate change. However, these relationships disappeared in the presence of specific examples of climate change impacts, including residents' perceptions of an increase in flooding on their properties and within their communities. In these instances, political ideology has no significant correlation.

This result may seem odd in the context of the political polarization around the acceptance of anthropogenic climate change, where American conservatives have become increasingly skeptical of the scientific consensus on this phenomenon through the first part of the 21st century (McCright et al. 2016; Pew Research Center 2016; Jessani and Harris 2018).

However, when framed in the communication context of grounding otherwise-abstract ideas around climate change with concrete examples, the results become consistent with the larger literature. For example, Hine et. al. (2016) found that focusing on local impacts and excluding any reference to “climate change” increased openness to adaptation in audiences that were skeptical about climate change. Additionally, evaluations of how psychological distance (referring to the extent to which a concept is removed from oneself, including through the likelihood of occurrence, distance in time, distance in geographical space, or social distance) from climate change affects beliefs shows a great deal of nuance in the discussions (McDonald, Chai, and Newell 2015). Reducing psychological distance by emphasizing local impacts has been shown to correlate with higher levels of concern; however, emphasis on how climate change would impact distant countries has been shown to be correlated with the dismissive perceptions and lowered expectations of climate change severity (Spence and Pidgeon 2010).

Our regression models support the idea that political ideology is becomes less important in predicting adaptation behavior in wake of identified, concrete risks. In Model 1B, we did not find any significant relationship between a respondent’s ideology and their plans for future topographic adaptation. In Model 2B, we found that conservatives were comparatively more likely than moderates and liberals to foresee that flooding may one day force them to move. Our results suggest a lack of a clear relationship between residents’ political beliefs and their willingness to engage in two important forms of climate adaptation: plans for future topographic adaptation and willingness to retreat or relocate.

Our findings support our hypothesis that, in the wake of concrete experiences, political ideology becomes much less of blanket predictor of our two protective responses as it is a predictor of beliefs regarding broader, abstract concerns of climate change. Although respondents with conservative political beliefs tend to oppose adaptive measures in the abstract, in the face of specific threats, they are willing to react to protect their home and their property, or can foresee moving away from the increasing danger. Our results also suggest the presence of a complex relationship between ideology and adaptation actions, which will require additional studies to better understand how individuals decide on distinctly different paths for adaptation and that relationship to ideology.

In addition to viewing this system from a political perspective, we compared and contrasted two theoretical frameworks for predicating decision-making behavior: the TPB and PMT. As noted previously, PMT has experienced substantial coverage in literature focusing on risk assessment and protective behaviors. Across both sets of models, statistical measures of model fit showed that PMT was a superior model to the TPB in these applications. This supports an emergent behavior of the adaptation literature, which has largely relied on the PMT to understand how flood risk appraisal and coping appraisal explain adaptive responses (Grothmann and Reusswig 2006; Bubeck, Botzen, and Aerts 2012).

We found that residents' experience with indicators of past flooding and concern with future environmental issues (grouped as 'threat appraisal') were positively correlated with increased openness to proactive adaptation. This is consistent with Bubeck et. al.'s (2012) finding that prior experience is the most consistently influential predictor of protective responses. However, we found that knowledge about environmental issues to be positively (and significantly)

676 correlated with increased openness to proactive mitigation strategies in the regressions across
677 Table 5 and negatively correlated across Table 6, suggesting a mixed relationship. This is also
678 consistent with Bubeck et al.'s (2012) findings of a lack of consistent relationship (positive or
679 negative) between resident knowledge and protective intent (of the studies reviewed, two were
680 negative, and three were mildly positive).

681
682 Our findings imply that knowledge about environmental issues may have varying effects on
683 different adaptation responses; for example, as our models suggest, being more knowledgeable
684 may increase self-efficacy and empower individuals to protect in place, while lower knowledge
685 levels may be associated with increasing willingness of individuals to cut their losses and leave
686 for safer areas, where they do not need specialized knowledge to remain safe. This hypothesis is
687 in line with work by Zaalberg et al. (2009) and Babczyk and Seebaur (2018). Zaalberg et al.
688 looked at the relationship between variables associated with PMT and their correlation to
689 prevention, adaption, and threat denial as discrete outcomes. Their study found changing
690 significance and effects of the independent variables on the dependent variable for both
691 protective responses (prevention and adaptation). Similarly, Babczyk and Seebaur looked at the
692 relationship between variables associated with PMT, and protective and non-protective responses
693 as discrete outcomes. They also found complicated rather than linear relationships among the
694 variables at play. However, validating these relationships in causally-explicit ways necessitates
695 further, experimental or quasi-experimental research.

696
697 Together, understanding the role and influence of political ideology and theoretical processes for
698 analyses of protective response can have important impacts on how governments and public

699 service organizations engage with residents' in support of triggering protective responses. Our
700 findings suggest that communication based on specific, local examples rather than abstract and
701 global trends may be a promising strategy for helping residents from across the political
702 spectrum to prepare for climate change -induced changes. As such, we encourage adaptation of
703 climate communication efforts to bridge this gap and to avoid potential pitfalls that may be
704 triggered by explicitly mentioning the polarizing topic of 'climate change' (Rolfe-Redding,
705 Feldman, and Leiserowitz 2012; Carlton and Jacobson 2016).

706
707 Communication strategies should focus on local effects and impacts with concrete examples.
708 Additionally, in accordance with other literature on the subject, they should focus on the role of
709 personal responsibility to adapt, highlighting the effectiveness of potential strategies with
710 specific examples for protective responses (Punzo et al. 2019; Beiser-McGrath and Huber 2018).
711 Tailoring climate communication strategies in this way is particularly relevant for local
712 governments, who can focus on the particular experiences of their local population. For example,
713 instances of standing water and saltwater intrusion may be particularly germane to those living in
714 the APP, where the low elevation makes these issues particularly relevant. However, in other
715 areas, flash flooding and storm surges may be a more effective example if populations have had
716 recent experiences with these issues.

717
718 While additional work is needed to explore how recovery and adaptation discussions can
719 circumvent political sticking points to prompt broader support for protective actions, by
720 understanding the factors that motivate individuals to take action, policymakers may better
721 prepare and generate more effective community-wide approaches. Future research must continue

722 to explore the relationship between socio-psychological factors and behavior and political
723 leanings, to develop better strategies for informing the public of their risks and opportunities
724 across political boundaries, and explore nuances in the effectiveness of communication strategies
725 that rely on regional and community variation (Moser 2016; Koslov 2019).

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Table 1. Descriptive statistics for the five-county Albemarle-Pamlico Peninsula (APP) region
(US Census, ACS 2016, 5-year Estimates)

APP Region		
	Total	Percent of Population
Total Population	104,960	100.0%
Female	53,839	51.3%
Race		
White alone	77,358	73.7%
Black or African American alone	22,484	21.4%
Other/missing	5,118	5.0%
Educational attainment (among ≥ 25 years old)		
≤ High school	10,566	14.0%
Some high school (HS), HS grad or equivalent, some college	49,838	65.9%
≥ Bachelors	15,287	20.3%
Income (USD\$)		
≤ 19,999 annually	9,036	21.4%
20-49,999 annually	14,531	34.2%
50-99,999	12,914	30.5%
≥ 100,000	5,842	13.8%
Age		
≤ 18 years	21,471	20.5%
18 to 34 years	18,301	17.4%
35 to 64 years	43,933	41.9%
≥ 65 years	21,255	20.3%

Table 2: Explanatory variables used in binary logistic regression models and their links to TPB and PMT.

Framework	Conceptual Representation	Variables	Description	Coding
Dependent Variable		Protection	Do you have current or future plans to manipulate the topography of your property to prevent flooding or improve drainage?	(1) Yes (0) No
		Retreat	Could you foresee that flooding would ever force you to move from your property?	(1) Yes (0) No
TPB	Subjective Norms	Personal Politics	Which of the following best describes your political views?	(1) Liberal (2) Moderate (3) Conservative
	Subjective Norms	Community Pressures	Some of my community members pressure others to build water control structures.	(1) Strongly Disagree (2) Somewhat Disagree (3) Neither Agree nor Disagree (4) Somewhat Agree (5) Strongly Agree
PMT	Threat Appraisal	Standing Water	In the previous past 5 years, have you noticed standing water on your property?	(1) Yes (0) No
	Threat Appraisal	Future Concern	I am concerned with how environmental changes affect my property in the future.	(1) Strongly Disagree (2) Somewhat Disagree (3) Neither Agree nor Disagree (4) Somewhat Agree (5) Strongly Agree
PMT & TPB	Self-Efficacy	Homeownership	What is the ownership arrangement at your current residence?	(1) Own home (0) Renting or leasing
	Self-Efficacy	Control of Land	I have control over my own land use decisions when it comes to installing and maintaining water control structures	(1) Strongly Disagree (2) Somewhat Disagree (3) Neither Agree nor Disagree (4) Somewhat Agree (5) Strongly Agree
	Self-Efficacy	Knowledge of Issues	How knowledgeable about local environmental issues and natural resources are you?	(1) Not knowledgeable at all (2) Not very knowledgeable (3) Somewhat knowledgeable (4) Very knowledgeable

Table 3: Descriptive statistics of survey responses (additional demographic descriptive statistics in Supplementary Material 1, Table 1)

	Count		Percent of Respondents			
Total Population	164	100%	Plans to Manipulate	No plans to Manipulate	Can Foresee Leaving	Cannot Foresee leaving
Personal Politics						
Conservative	92	56.10%	4.88%	51.22%	23.78%	32.32%
Moderate	56	34.15%	3.66%	30.49%	11.59%	22.56%
Liberal	16	9.76%	0.61%	9.15%	6.71%	3.05%
Community Pressures						
Strongly Agree	5	3.05%	0.00%	3.05%	1.83%	1.22%
Somewhat Agree	13	7.93%	1.83%	6.10%	3.66%	4.27%
Neither Agree nor Disagree	107	65.24%	6.71%	58.54%	28.05%	37.20%
Somewhat Disagree	14	8.54%	0.61%	7.93%	4.27%	4.27%
Strongly Disagree	25	15.24%	0.00%	15.24%	4.27%	10.98%
Standing Water						
Yes	101	61.59%	7.93%	53.66%	28.66%	32.93%
No	63	38.41%	1.22%	37.20%	13.41%	25.00%
Future Concern						
Strongly Agree	44	26.83%	3.05%	23.78%	17.68%	9.15%
Somewhat Agree	55	33.54%	3.66%	29.88%	15.85%	17.68%
Neither Agree nor Disagree	43	26.22%	2.44%	23.78%	6.10%	20.12%
Somewhat Disagree	9	5.49%	0.00%	5.49%	0.61%	4.88%
Strongly Disagree	13	7.93%	0.00%	7.93%	1.83%	6.10%
Homeownership						
Yes	150	91.46%	8.54%	82.93%	37.20%	54.27%
No	14	8.54%	0.61%	7.93%	4.88%	3.66%
Control of Land						
Strongly Agree	84	51.22%	6.10%	45.12%	17.07%	34.15%
Somewhat Agree	27	16.46%	1.83%	14.63%	7.93%	8.54%
Neither Agree nor Disagree	24	14.63%	0.00%	14.63%	8.54%	6.10%
Somewhat Disagree	7	4.27%	0.61%	3.66%	2.44%	1.83%
Strongly Disagree	22	13.41%	0.61%	12.80%	6.10%	7.32%
Knowledge of Issues						
Very knowledgeable	21	12.80%	1.83%	10.98%	3.05%	9.76%
Somewhat knowledgeable	96	58.54%	7.32%	51.22%	26.22%	32.32%
Not very knowledgeable	44	26.83%	0.00%	26.83%	11.59%	15.24%
Not knowledgeable at all	3	1.83%	0.00%	1.83%	1.22%	0.61%

Table 4: Correlations between respondent conservatism, their perceived environmental knowledge, and perceptions of past storm and flooding trends their properties and communities;

*p<0.1, **p<0.05, ***p<0.01

	Correlation
Knowledge about local environment and natural resources	0.06
Belief that the strength of storms has increased over the past 20 years	-0.31***
Belief that the frequency of storms has increased over the past 20 years	-0.21***
Noticed increased flooding on respondent's property over the past 20 years	0.01
Noticed increased flooding in respondent's community over the past 20 years	-0.10

Table 5: Logistic regression models of residents' plans for future topographic adaptation, as explained by subjective norms, threat appraisal, and self-efficacy variables framed in Protection Motivation Theory (PMT; Model 1A), the Theory of Planned Behavior (TPB; Model 1B), and a combined theoretical framework (Model 1C). OR = odds ratio effect (exponentiated coefficient); 95% confidence interval [CI] given in square brackets; *p<0.1, **p<0.05, ***p<0.01; n=164 for all models.

		Model 1A: PMT		Model 1B: TPB	
		OR	CI	OR	CI
Self-Efficacy	Is Homeowner	0.43	[0.014,13.3]	1.06	[0.087,13.0]
	Knowledgeable about environ issues	3.55***	[1.62,7.77]	3.24***	[1.49,7.03]
	Control over land use decisions	1.13	[0.53,2.39]	1.11	[0.64,1.92]
Threat Appraisal	Standing water	5.72**	[1.15,28.4]		
	Concerned with future environ	1.54	[0.92,2.57]		
Subjective Norms	Political Ideology (Conservative) Moderate			0.65	[0.058,7.26]
	Liberal			0.79	[0.075,8.27]
	Community pressure WCS			1.88*	[0.98,3.61]
	Constant	1.8E-4***	[0.00,0.02]	4.3E-4***	[0.00,0.11]
AUROC		0.7745	[0.68,0.87]	0.7327	[0.63,0.84]
AIC		36542.3		39373.0	
BIC		36560.9		39391.6	

Table 6: Logistic regression models of residents' willingness to retreat (or relocate) due to flooding, as explained by subjective norms, threat appraisal, and self-efficacy variables framed in Protection Motivation Theory (PMT; Model 2A), the Theory of Planned Behavior (TPB; Model 2B), and a combined theoretical framework (Model 2C). OR = odds ratio effect (exponentiated coefficient); 95% confidence interval [CI] given in square brackets; *p<0.1, **p<0.05, ***p<0.01.

		Model 2A: PMT		Model 2B: TPB	
		OR	CI	OR	CI
Efficacy	Is Homeowner	0.33	[0.069,1.54]	1.24	[0.33,4.66]
	Knowledgeable about environ issues	0.60*	[0.35,1.00]	0.48***	[0.29,0.80]
Self-	Control over land use decisions	0.86	[0.66,1.13]	0.9	[0.69,1.19]
Threat Appraisal	Standing water	2.04*	[0.92,4.49]		
	Concerned with future environ	2.03***	[1.35,3.05]		
Subjective Norms	Political Ideology (Conservative) Moderate			0.17**	[0.043,0.70]
	Liberal			0.30*	[0.081,1.11]
	Community pressure WCS			1.46*	[0.96,2.21]
	Constant	0.59	[0.058,6.03]	7.41	[0.60,91.0]
AUROC		0.7445	[0.67,0.82]	0.6388	[0.55,073]
AIC		77197.1		84342.6	
BIC		77215.7		84361.2	

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Figure 1. Theoretical frameworks associated with the A) Theory of Planned Behavior (TPB; Adapted from Ajzen 1991, 1988) and B) Protection Motivation Theory (PMT; Adapted from Rogers 1983)

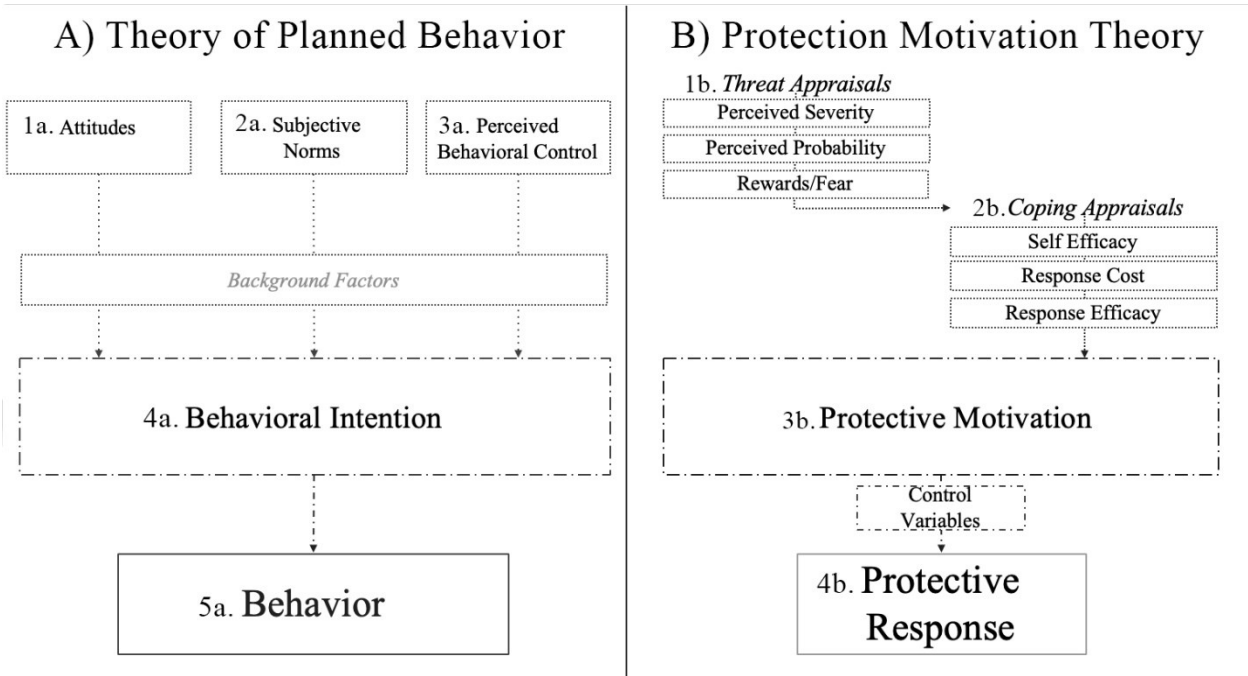


Figure 2. Map of flood plains and residents within the survey area of Albemarle-Pamlico Peninsula

