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# Place, Experience, and Conversation: Understanding How to Most Effectively Talk About Climate Change Risks

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**Place, Experience, and Conversation: Understanding How to Most Effectively Talk About  
Climate Change Risks**

**Presented to the Faculty of the  
Environmental Studies Program**

**In Partial Fulfillment of the  
Requirement for the Degree of the Bachelor of Arts**

**Bates College  
ENVR 417 Capstone Project**

**By  
Michaela Heffernan, Avery Wolfe, & Nicole Friedman**

**Lewiston, Maine**

**Fall 2017**

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## **Executive Summary**

The risks associated with sea level rise and climate change pose a major threat to coastal cities around the United States and the globe. Currently, the climate conversation is essentially a one way conversation based on power structures that fails to recognize the importance of how people approach the abstract nature of this problem. The overarching goals of this research project are 1) to understand the nuances of content framing and delivery approaches of climate change communication and 2) to discover if this reveals more effective ways to truly engage individuals in this difficult topic and to foster further discussions. This report culminates the first steps in a larger project, with the creation of a field tested social science research survey. The resulting survey measures the relative effectiveness of content framing and deliverance approaches to communication strategies regarding risks of sea level rise on individuals' concern and stated willingness to take action in three locational spheres (local, home place, and national).

## **Background**

### *The Risks of Sea Level Rise*

Beginning with Rachel Carson's *Silent Spring* and warnings from scientists and advisory committees in the 60's, the topic of climate change began to circulate as a concern (BBC, 2013). Over the last half century, this topic has gained much traction as warming trends continue and expanded scientific research has revealed the many associated threats to natural environments and human populations. One such threat is sea level rise, which scientists report is due to thermal expansion of warming oceans, melting glaciers all over the world and melting ice sheets in Greenland, the Arctic, and Antarctica (IPCC, 2014). The average global rate of sea level rise is about 0.06 inches (0.15 cm) per year (1991-2010). Not only are sea levels rising, but the rate at

which they are rising is increasing over time. From 1993-2010 the average rate of global sea level rise was 0.1 inches (0.25 cm) per year. While predicting future sea level rise is difficult due to its variable conditions, highly mathematical formulas utilize various emission scenarios to indicate that we could see between 2.5 and 6.2 total feet (0.8 - 1.9 m) of sea level rise within this century (Vermeer and Rahmstorf, 2009).

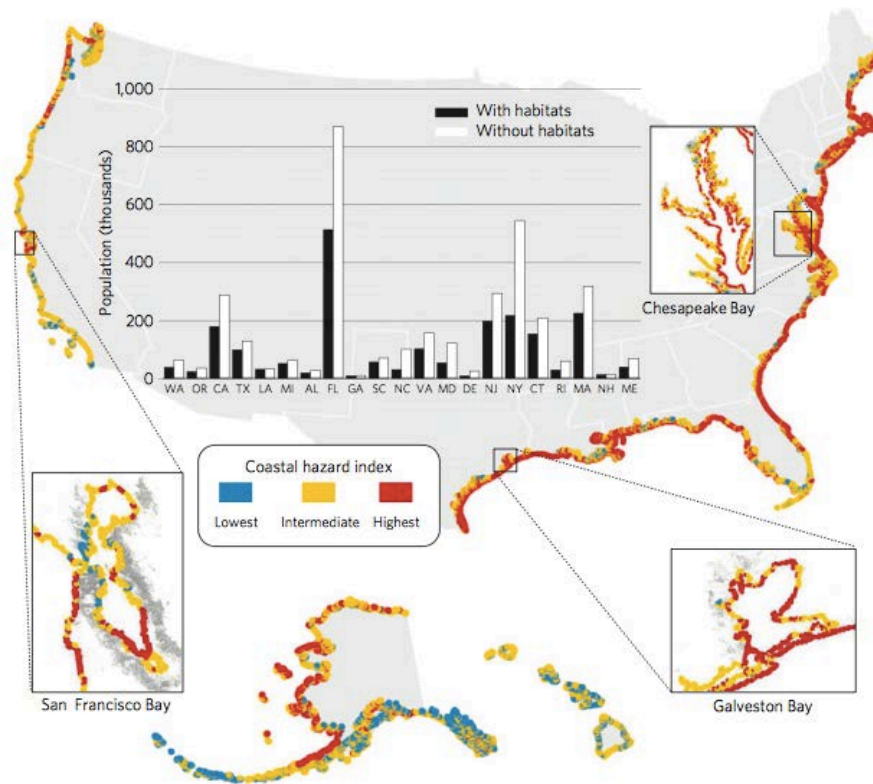


Figure 1. Many coastal communities in the U.S. face threats from sea level rise (Arkema et al., 2013)

In the U.S., 23 of the top 25 most densely populated communities are coastal (Figure 1) (Arkema et al., 2013). Sea level rise trends impose varying levels of risk for coastal communities and ecosystems (NOAA, 2017), including property loss and economic costs associated with damage and rebuilding after flood or storm events, displacement, and land erosion and ecosystem disruption (Arkema et al., 2013; Wescott, 2013 ). There are people who are already



facing these threats or who are very likely to soon face detrimental circumstances if we do not actively work towards mitigating these risks. However, most people are not actively realizing these threats or engaging in conversations about what to do. Unfortunately, many individuals still do not believe in climate change. Others do not feel any sense of urgency in these matters as the concepts are fairly abstract and as observed changes are incremental and do not *appear* to pose very real threats to most people on a day to day basis (Appendix A). Can the ways that we talk about climate change and climate risks influence people's engagement in these issues?

### *How Do We Talk About Climate Change?*

There are several trends in the ways that we talk about climate change risks, which indicate why there is a current lack of engagement. First, climate change is often communicated *to* the common person *by* people of power (scientists, politicians, environmental organizations, etc.). As reflected in the information on sea level rise provided above, climate change is often communicated a) using vague fact-based declarations, b) using scientific terms and jargon, and c) is often framed in broad terms, making use of global, national, or regional trends.

Currently, the climate conversation is essentially a one way conversation, based on power structures. The use of declarative, fact-based statements in a hierarchical structure of knowledge and power means that people cannot ask clarifying questions or provide their own input based on experience or expertise. Another problem with these trends is that they make the information and conversation inaccessible to all audiences. By necessitating a certain understanding in the sciences, a belief in concept of climate change, and trust in the science and those who report it, certain people are left out of the conversation. Having a basic knowledge about climate change and its risks is essential for individual engagement, but cannot be

adequately digested if presented in an inaccessible way. This approach also fails to recognize the ways in which individual experience can provide powerful depth to these abstract topics, making the conversation and information more accessible. Due to these factors, trending climate communication approaches do not result in effectively and actively engaging people in these issues or eliciting that aforementioned sense of urgency or concern. As self-interested individuals, when we process information, we seek out ways that the provided information relates to us personally (Moore & Loewenstein, 2004). By limiting the conversation to broad-scale trends, it is more difficult for people to feel personally connected to the topic.

### *How Should We Talk About Climate Change?*

How do we approach the abstract nature of climate change and the power-based methods in which we typically communicate it (Appendix A). By having two-way conversations about about the risks associated with climate change we can open the conversation in a way that makes it easier for some people to grasp and understand; it also allows for greater clarification and interpretation. In addition to this approach of conversational communication, we make concrete the abstract nature of climate change through content framing. To diminish the psychological distance of climate change we can utilize individual's sense of place by framing messages locally. This heightens people's risk perceptions by placing them in a context geographically close to themselves or the places in which they hold emotional bonds. This approach can change the scale in which individuals look at the larger phenomenon of climate change.

### *Talking About Sea Level Rise in Maine*

In 2010, the Gulf of Maine Council on the Marine Environment produced a report stating that parts of coastal Maine are classified as highly vulnerable to impacts of climate-related sea-level rise and associated storm events (Walmsley, 2010), including the town of Phippsburg. There are many homes and roads in Phippsburg that will soon be affected by rising sea levels. In line with general trends, not much is being done to prepare for these impending threats. Laura Sewall, a local resident and active member of the Phippsburg community (and our community partner for this project), stated that she and others have tried to initiate conversations to talk about and plan ahead for rising sea levels. These efforts have been unsuccessful, Sewall says. The Gulf of Maine Report concludes that “strategic decisions will be required by communities...to protect flood and hazard zone[s].” In order to enact strategic decisions, both leaders and citizens in these communities must begin to talk about these risks and engage in such conversations and decision making processes.

### *Research Context*

Bates Morse Mountain, which lies within the municipality of Phippsburg, consists of over 600 acres of coastal land, conserved for the purpose of research. Additionally, over 20,000 visitors come each year to recreate on this land, and at adjoining Seawall Beach (Bates College, 2017). While this area is used extensively for research in the natural sciences, never has it been used for social science research. The unique location of Bates Morse Mountain along the coast - and thus its exposure to impacts of sea level rise (Appendix E) - provides a unique opportunity for this social science project.

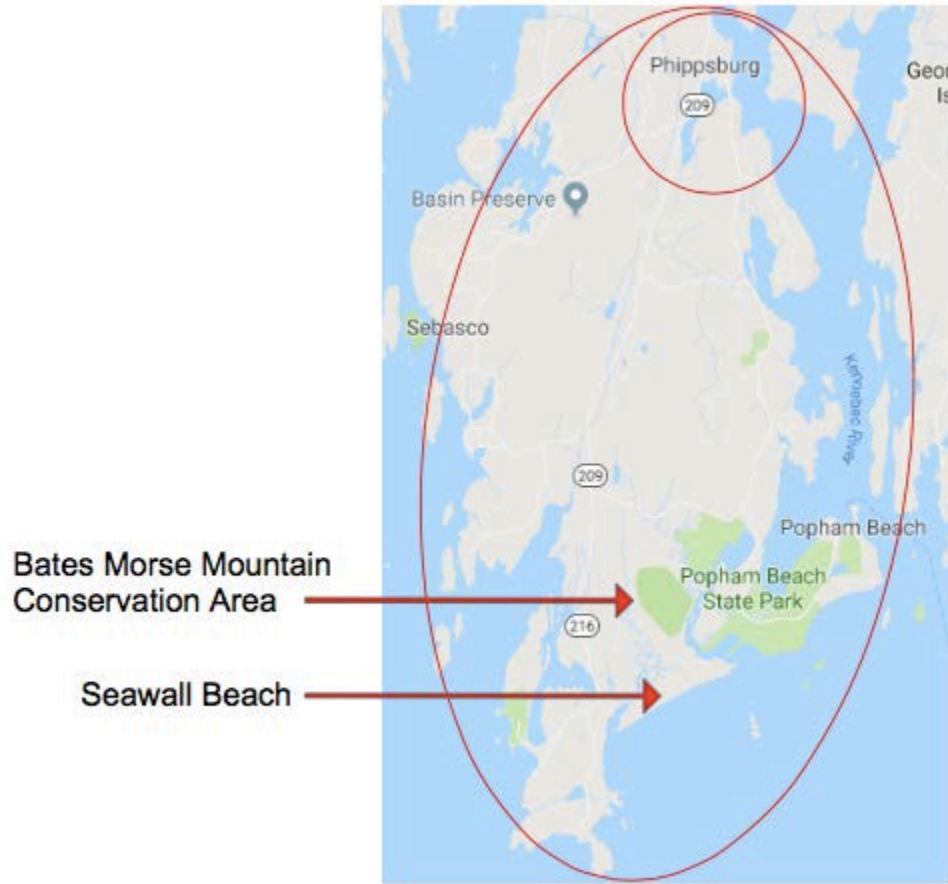


Figure 2. Bates Morse Mountain and Seawall Beach lie within the municipality of Phippsburg

### **Project Objectives**

The overarching goals of this research project are 1) to understand the nuances of content framing and delivery approaches of climate change communication and 2) to discover if this reveals more effective ways to truly engage individuals in this difficult topic and to foster further discussions. The specific purpose of this capstone project, as part of these larger research objectives, is to lay the groundwork for and provide a social science research survey tool, which can be implemented at Bates Morse Mountain and Seawall Beach. Based on the relevant literature, the purpose of our survey is to understand whether place-based framing and two-way

conversational approaches to climate communication can elicit place-based engagement in topics of sea level rise. It is also designed to reveal whether place-based experience and climate communication framing can act as mediators to diminish psychological discounting and elicit engagement in geographically and conceptually distant spheres (home region and nationally).

## **Methodology**

When we came into this project, our community partner had outlined the overarching goal to understand whether various communication styles influence individuals' engagement differently. In addition to this research goal, she had also outlined the main deliverable objectives to a) analyze and compile the predicted impacts to Bates Morse Mountain as it relates to sea level rise, b) to synthesize this compilation into a product which can be easily accessed and digested, c) to produce a review of the literature on climate communication, and d) to produce a validated, pre-tested survey tool that will test the comparative effects of different climate communication approaches. We used these objectives as a launching point for our project.

Through extensive academic research, we utilized relevant literature, reports, websites, and news articles to inform our understanding of climate communication, climate trends and risks, and the process of creating a survey tool for social science research. In addition to this research, our processes and decisions were greatly shaped by reports from and meetings with key informants, such as professors Francis Eanes, and Holly Ewing, our community partner, Laura Sewall, Bates Morse Mountain board member Barbara Vickery, and Bates Morse Mountain gatekeepers Don Bruce and Frank Wezner. In particular, Francis Eanes provided valuable guidance and expertise in constructing the structure and components of our survey tool. Laura

Sewall also provided essential knowledge and experience about the Phippsburg community, Bates Morse Mountain and Seawall Beach, and her knowledge and background in the social sciences. We also made several visits to Bates Morse Mountain to familiarize ourselves with the local landscapes and contexts. Our research, consultations, and visits informed our decisions regarding the content, structure, and implementation design of our survey. Once the survey was completed, field testing of the survey at Bates Morse Mountain informed our survey revision process and our resulting recommendations.

### Survey Mechanics

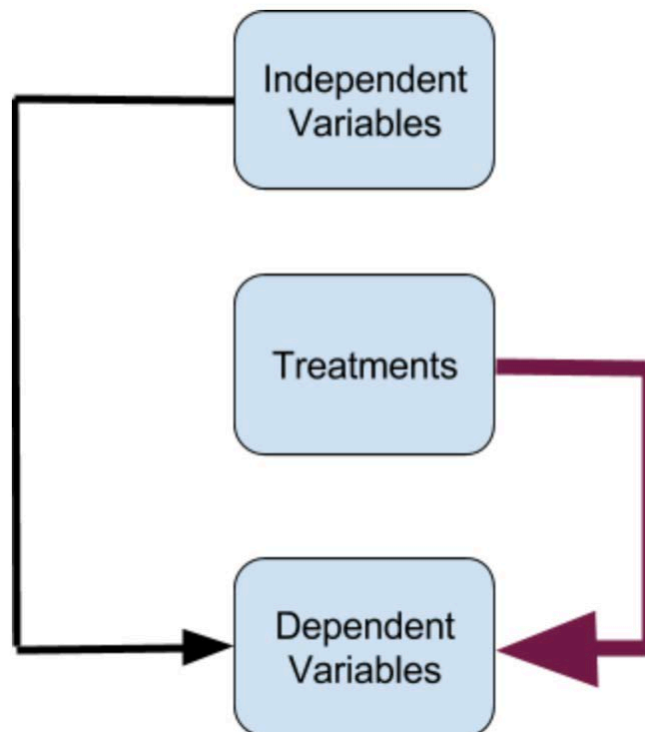


Figure 3. Additional survey model showing how each section affects the other.

**Section A** (Independent Variables)

Part I - Place Attachment

Part II - Climate Change Belief

Part III - Locus of Control

Part IV - Spatial and Temporal Discounting

Part V - Demographics

*Please stop here and follow further instructions from the survey administer*

**Treatment** - one of four treatments administered

**Section B** (Dependent Variables)

Part I - Concern (BMMCA)

Part II - Action (BMMCA)

Part III - Concern (Home Place)

Part IV - Action (Home Place)

Part V - Concern (National)

Part VI - Action (National)

Figure 4. Survey model. Each participant will receive sections A and B of the survey (independent and dependent variables), but will receive only one of the four treatments.

### *Independent Variables*

Independent variables are factors that inherently influence responses to the dependent variable, independent of any intervention or added experimental aspects of the survey design (Figure 3.). Measuring these variables allows for us to control confounding effects and therefore increase the validity of our experiment. It is important that these factors be tested prior to the treatment (Figure 4.) so as to adequately measure their effects, independently. The independent variables for this survey are 1) place attachment, 2) climate change belief, 3) locus of control, 4) spatial and temporal discounting, and 5) demographics. Each of these variables correspond with a series of related questions. These variables will be described in depth in the *Survey Contents* section of this report.

### *Treatments*

A treatment is an intervention or experiment created by the researchers to test its effect on the dependent variable(s) (Figure 3.). This portion will be administered in between the independent variable and dependent variable sections of the survey (Figure 4.). For the purposes of this survey, the treatments measure the impacts of two different types of climate communication strategies on the outcomes of the dependent variables. These two types of communication are framing, and delivery approach. Within each type of communication, there are two distinct levels. For framing, we compare universal with place-based tactics. For delivery approach, we compare declarative with conversational approaches. The four resulting treatments are: A: conversational and place-based, B: conversational and universal, C: declarative and place-based, and D: declarative and universal (Figure 5.). See *Survey Content* section for a further description of each individual treatment. Declarative treatments will be administered



using a series of facts provided on a sheet of paper, whereas conversational treatments will be administered through engagement in oral conversations.

	Place-Based Framing	Universal Framing
Conversational Approach	Treatment A: place-based framing and conversational approach (orally presented)	Treatment B: universal framing and conversational approach (orally presented)
Declarative Approach	Treatment C: place-based framing and declarative approach (visually presented: fact sheet)	Treatment D: universal framing and declarative approach (visually presented: fact sheet)

Figure 5. Box model for treatments.

### *Dependent Variables*

The dependent variables is essentially the result of the survey experiment. It is the factor that indicates the influence and effectiveness of the treatments. For the purposes of this study, our dependent variables are a measurement of concern and stated willingness to take action regarding sea level rise. We decided to ask about these variables in terms of three distinct geographical spheres. These spheres consist of local engagement at Bates-Morse Mountain, engagement in the participant’s home place, and engagement on a national level. To maintain validity, each sphere of dependent variable measurements centers around the same themes of

concern and action. For example, the questions about possible actions in each sphere all ask one monetary question, one question about seeking out conversations, and one question regarding political action. This ensures consistency across each geographical measurement, and aids in a greater understanding of the relationships and effects between treatments and dependent variables.

### *Measurement: Likert Scale*

Almost all questions, with the exception of demographic questions, utilize a Likert Scale as a response format for the participant. A Likert Scale is defined as:

A psychometric response scale primarily used in questionnaires to obtain participant's preferences or degree of agreement with a statement or set of statements. Likert scales are a non-comparative scaling technique and are unidimensional (only measure a single trait) in nature. Respondents are asked to indicate their level of agreement with a given statement by way of an ordinal scale (Bertram, 2016).

The most common Likert Scales measure responses on a scale of three, five, or seven. Based on several examples from the literature on climate communication surveys (Schweizer, 2013) we decided on a five point Likert Scale to measure degrees of agreement with the statements we created for our survey. Additionally, a Likert Scale is especially helpful because many of the concepts we utilized are typically measured across a spectrum in psychological research. They cannot be answered in simple yes/no format. An example of one of our likert scale questions is below. See Appendix G for the full survey.

Please indicate the degree to which you agree or disagree with the following statement:

	Disagree		Neutral		Agree
I believe that climate change will harm communities in developing countries	1	2	3	4	5

Figure 6. Example of a Likert Scale question taken from survey.

## Survey Content

### *Dependent Variables*

We decided to measure concern and stated willingness to engage for geographically and conceptually distant spheres because many visitors to Bates Morse Mountain are not local residents. Learning about sea level rise in a place-based manner and experiencing the effects firsthand at Bates Morse Mountain may have *an* impact on individuals who live elsewhere. However, their lack of attachment to and experience with the Phippsburg community itself may allow them to retain the psychological distance that keeps them from engaging in issues that do not relate to them directly. For this purpose, we included the geographical sphere of “home place” so as to see if people could utilize this particular place-based example of sea level rise to relate the general issue of climate change threats to a place that they do feel personal attachment.. We included the sphere of “nation” so as to see if people could utilize this experience and the place-based nature of climate communication to engage in the abstract, broad-scale concept of climate change risks on a national level.

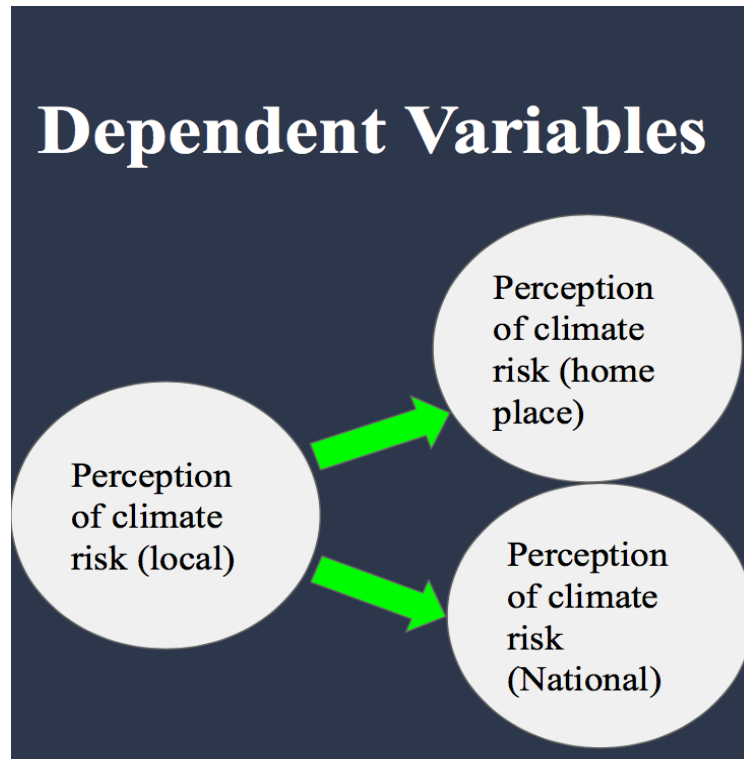


Figure 7. Visual representation of dependent variables and their hypothesized relationships with one another.

We chose concern as a dependent variable because concern is considered in the literature to be an action in regards to climate change (Corbett and Nicolosi, 2017). Additionally, measuring concern has more validity than measuring actual actions (such as calling your senator) because concern is something one experiences in the moment, and potential physical actions are easy to initially support or commit to, but there is no guarantee of follow-through. We chose to measure actions of monetary engagement because it is applicable throughout each geographical sphere. Additionally, lack of monetary action from governments and individuals is one of the largest roadblocks in the fight against climate change and sea level rise. This also gave us the opportunity to ask about managed retreat as it pertains to tax spending. Managed retreat is one of the most important topics of conversation in Phippsburg and many other low-lying areas on the coast, and it was an impetus for Laura Sewall to conceptualize the idea for this survey. Political

action is similar to monetary action in that it is applicable across all locational spheres, and is an important step in mitigating and adapting to climate change. The measurement of stated willingness to seek out conversation about climate change issues is an indication that the survey and/or the treatments have sparked the interest of the participant in issues of climate change and sea level rise.

### *Independent Variables*

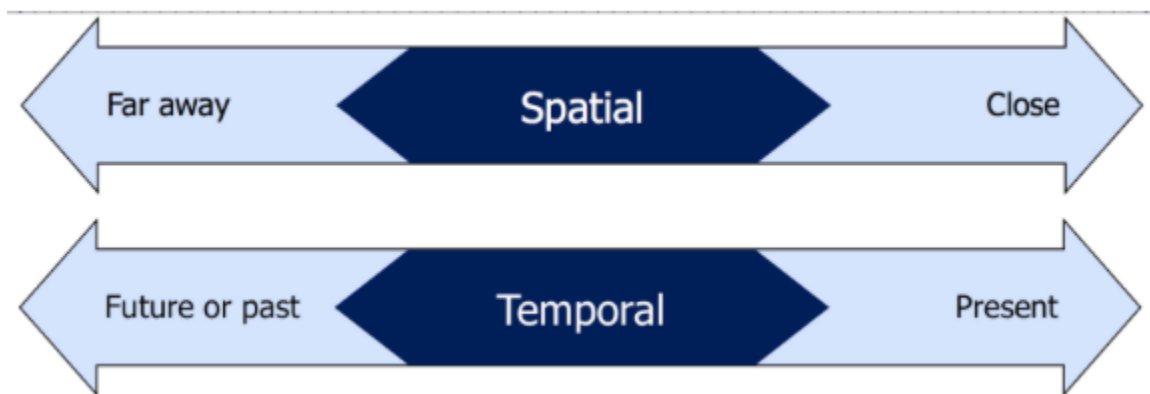


Figure 8. Spatial and temporal discounting create psychological distance between a person and their conception of climate risks.

The first of the independent variables are spatial and temporal discounting (Figure 8.; Appendix A), which are significant measurements as they impact how the survey recipient views the risks associated with climate change. Spatial discounting influences whether or not the individual views these as geographically distant from themselves. Spatial discounting as an independent variable is shaped by the recipients climate change belief and thus their stated willingness to engage; the literature indicates that those who view the risks associated with climate change as abstract and mentally distant are less likely to engage. Measurements of spatial discounting include statements such as “I believe that climate change will harm me personally”

or “I believe that climate change will harm communities in the US. Temporal discounting is an additionally important independent variable as it influences whether the survey recipients are predisposed to view climate change as occurring outside of their lifetime or in the distant future, as opposed to it occurring in the near future. This metric is measured with statements such as statements such as “I believe that climate change will harm communities sometime in the near future” or “Climate change will only harm future generations.”

Place attachment will be measured in Section A of the survey. It is important to measure, as all survey recipients enter the survey with different levels of attachment to BMMCA. Their emotional attachments to that place influences how likely they are to state concern or willingness to act. Their level of place attachment also impacts how influential the place-based treatments will be on them, as the literature indicates that lower levels of place attachment will lead to a lesser impact of locally framed climate change messages (Appendix A).

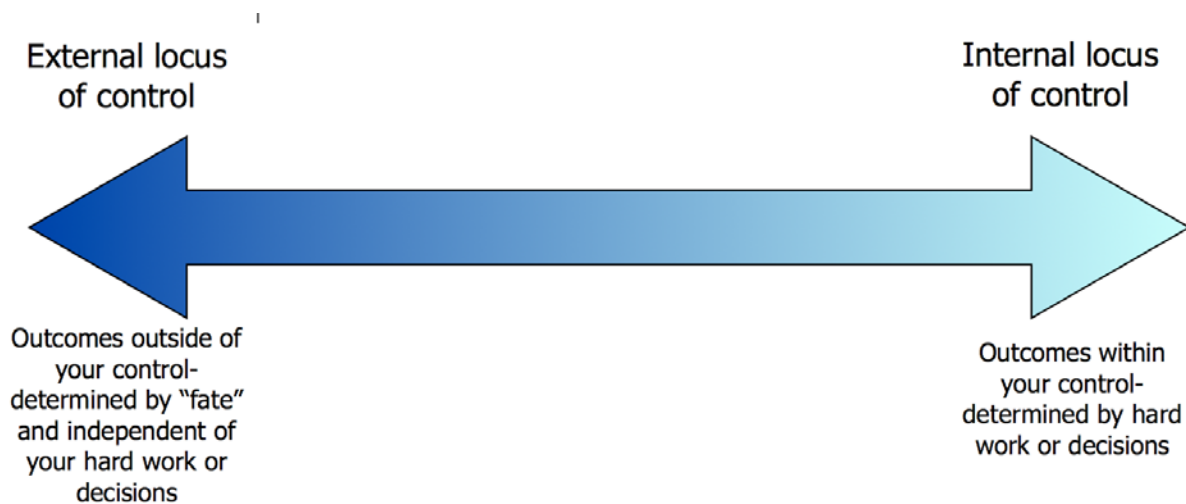


Figure 9. Model of external locus of control and internal locus of control (Adapted from Utilitarianism and Locus of Control).

Locus of control is measured in the survey because it also influences how likely the recipient is to state concern or willingness to act. An individual's locus of control, with regard to climate change, influences how likely they are to state their willingness to act specifically. Locus of control is a variable that determines whether or not people believe that the control on the events in their life resides internally or externally (Rotter 1966). Someone with an external locus of control believes that the outcomes in their life are largely determined by fate and that their hard work and decisions play little to no role. While someone with a largely internal locus of control believes that their hard work and decisions can impact the overall outcomes in society. Therefore, locus of control acts as an independent variable that influences stated willingness to act because someone with an internal locus of control is inherently more likely to state willingness to act because they feel as though their actions will make a difference in the larger problem (Gifford 2011). Locus of control is measured using statements such as "Climate change is inevitable, there is nothing I can do to change it" or "I feel that I can influence government policy regarding climate change" (Appendix G).

Climate change belief is an independent variable that will heavily affect the participant's concern and stated willingness to take action. If a participant does not believe in climate change, the science behind climate change, and/or the human impact on the issue, they will likely not have a high level of concern about climate change, they will be less likely to engage. This is because they will not want to take action on something that they do not believe to be an issue.

Demographic information is the last category of independent variable questions on the survey. Many of the questions are relatively standard, such as age, race, and gender. We additionally ask questions such as home place (and whether it is coastal or inland), political

affiliation, level of education, and ways of engagement with climate change information. These factors may additionally influence concern and stated willingness to engage. Demographic information is important because it can help break the survey into meaningful groups of respondents when it is analyzed. It is helpful in understanding what types of people were surveyed, and how their demographic information could affect their stated concern and willingness to engage in the dependent variables.

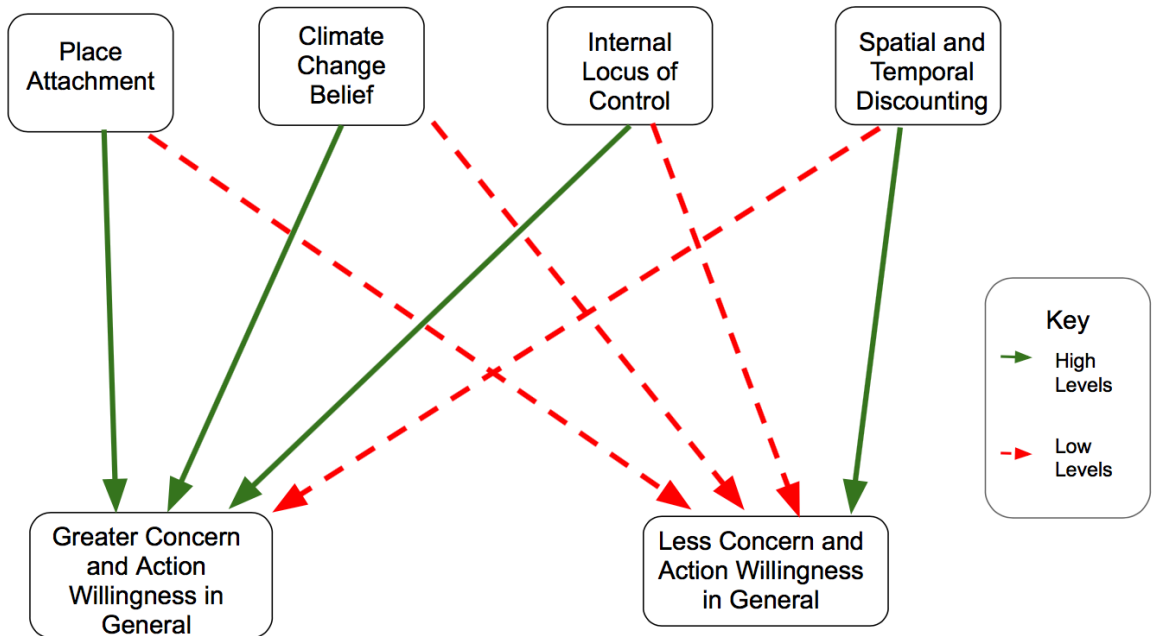


Figure 10. Hypothesized relationships between independent variable categories and dependent variables (concern and stated action willingness).



## *Treatments*

### *Conversational vs. Declarative Treatments*

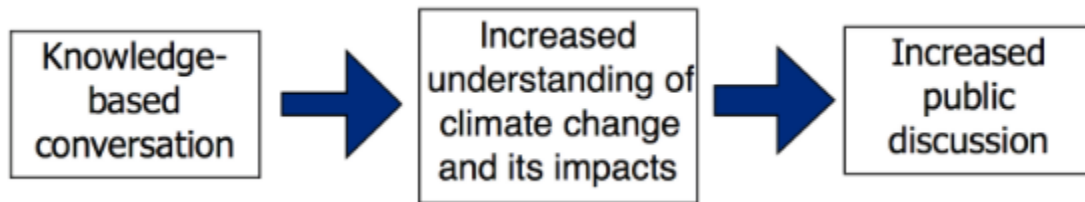


Figure 11. Illustrative diagram of knowledge based conversation and its influence on climate change understanding.

As previously discussed, climate communication is often a one-way, power-based and often declaration-based narrative. There is no space for the individuals to ask questions or discuss their own interpretation of the facts provided to them which could be partly attributed to the lack of understanding or the skepticism in climate science. By providing opportunities for simple, depoliticized discussions about the risks associated with climate change, individuals can further understand these facts and allows for two-way interpretation (Appendix A). Comparing conversational and declarative treatments will offer an opportunity to examine which approach to climate communication is most effective in eliciting engagement. The treatments differ in nature, as the conversational treatments present the facts in a two-way conversation, while the declarative treatments are presented on written fact sheets. In the conversational treatments, recipient is asked what they know about the subject and the facts that are provided, is allowed to interpret the facts through discourse, can have a discussion about them and so on. In the declarative treatments however, the recipient simply reviews the information provided internally.

### *Place-Based vs. Universal Treatments*

The previously mentioned independent variable of place attachment details the strong emotional bonds people have with certain places, especially places like Bates-Morse Mountain. Our survey treatments serve to discover how these bonds can be used to influence the survey recipient's stated concern or willingness to act regarding climate change.

There is a wide range of literature that supports the use of place attachment as a method for increasing concern and engagement in the topic of climate change. Much of the literature asserts that framing climate change messages and facts locally can counteract psychological distance such as spatial and temporal discounting. This is because the consequences are localized, and risk perceptions are heightened by placing them in a context that people have an emotional bond or attachment to. We hope that by using Bates-Morse Mountain as a local example of current and evident climate change, people will be able to, through contextualization and real visuals of sea level rise, attribute the feelings stemming from the treatments and this survey to the greater issue of global climate change.

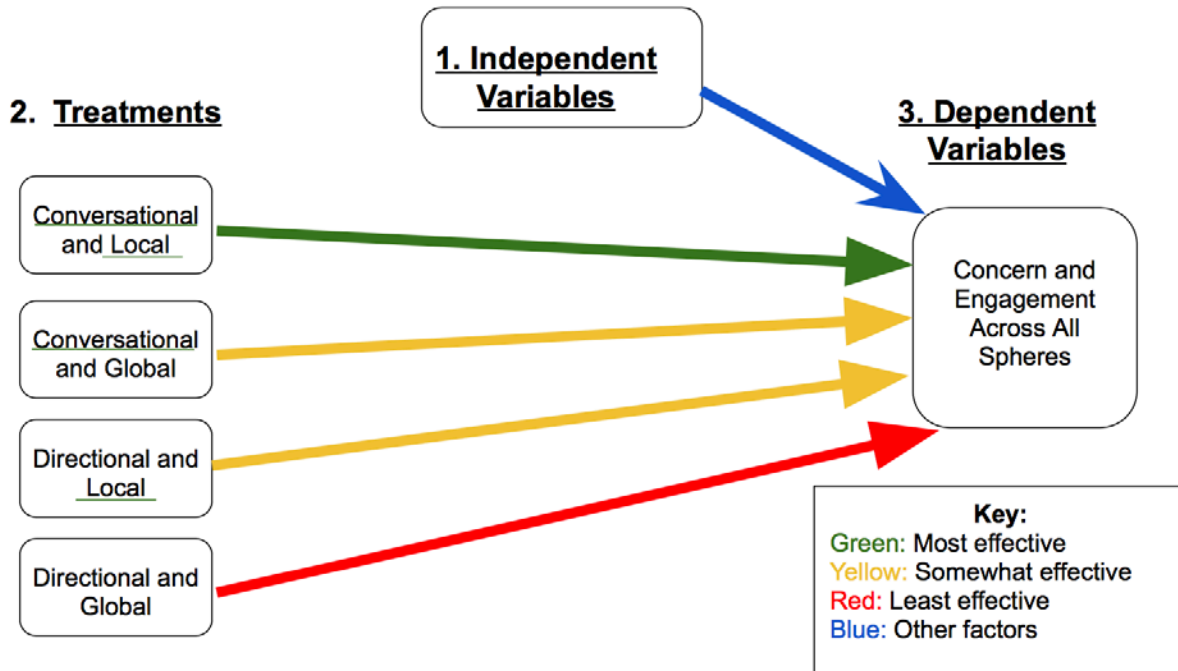


Figure 12. Hypothesized relationships between treatment types and dependent variable answers.

## Hypothesis

We hypothesize that treatment A, which is conversational and place-based, will be the most effective in eliciting high levels of stated concern and willingness to act. Based on the literature regarding place-based framing, we think that participants may demonstrate higher levels of engagement in this sphere. However, visitors who live farther away, may exhibit lower levels of engagement than their locally residing counterparts. This is because they may have lower levels of attachment to and familiarity with this particular place, causing their psychological distancing to persevere. We hope that the place-based and conversational treatment will elicit higher levels of engagement for both home region and national measures across all participants.

## **Field Testing**

We were able to conduct field testing for our survey two times. We administered the survey to a total of 12 individuals. During field testing we were able to feel out the logistics of administering the survey and receive feedback from participants about their experience. We used this information and experience to make revisions to our survey and for our recommendations going forward with this project. Following are further details regarding each day of field testing.

### *Day One*

On our first day of field testing, ironically, the causeway was flooded. Because of this, we were forced to administer the survey in the parking lot at the Bates-Morse Mountain trailhead. The people we surveyed had been stuck on the other side of the causeway, and had either waded through the cold water, or waited over an hour for the tide to recede. Therefore, people were slightly impatient with the length of our survey. Even so, everybody we approached agreed to take the survey, and several participants provided valuable feedback. The feedback mainly regarded the length of the survey. We also learned a lot about the many moving parts in survey implementation and the need for an organized filing system.

## *Day Two*

The second day of field testing was a sunny and cold day, and we arrived at low tide. Because of this we were able to access the beach and survey people there. Due to the cold weather, there was a small population of visitors to the beach that day, but we nevertheless managed to survey several people. The most noticeable difference between the first day in the parking lot and the day at the beach was the patience of the survey-takers. We received no comments on the length of the survey, and several participants even took extra time to chat afterward. Additionally, it was extremely helpful to be able to point out examples of beach erosion and sea level rise while actually standing on the beach. It helped the place-based treatments, and especially the place-based/conversational treatment feel more effective.

## **Project Limitations**

### *Correlation, Not Causation*

The data collected from the implementation of this survey, will not reveal a causal relationship between communication style and relative engagement. While the data will not be able to inform that “X” communication style will result in “Y” level of engagement, it will provide valuable correlational relationships and trends. These relationships and trends can provide essential insight to people who want to more effectively relay topics of climate risk and initiate conversations about mitigation and adaptation. Passionate individuals, environmental activists or organizations, local initiative leaders, policymakers and government officials could use these trends to inform their actions and endeavors when it comes to these tough topics. By understanding that “X” communication style *generally* relates to higher or lower levels of

engagement, provides an extremely valuable understanding of how effective that approach to climate communication may likely be.

### *Variation and Validity*

Due to the active and interpersonal nature of the conversational treatments, there will inevitably be variations in these treatments. No two conversations will be the exact same, even if the content discussed is similar. This variation will have an impact on the dependent variables, independent of the treatments and other independent variables. If implementation of this survey involves more than one administrator, there will be variation between their individual characteristics and demeanors. This may additionally impact the participants' responses to the the dependent variable measures. It is paramount that these variations, which do threaten the validity of the findings, be acknowledged in data analysis and interpretation.

### *Implication of Treatment Effects*

It is important to note that an individual's statement of willingness to take action regarding climate risks does not indicate actual action taken. The findings of this study will not reveal that any of the tested communication styles will actually influence individual action, but only *willingness* to take action. This means that it will test whether a person states whether or not they would be willing to take action, but does not provide follow up on whether they actually took that action or engaged in these topics further. Additionally, it will not indicate any longevity of engagement in the effects of any of the communication styles. Participants *could* go home and forget about what they learned during this survey, never actually take action, and never engage in

the issue again of their own accord. While this is a limitation to the current study, it provides an opportunity for further research on this topic.

### *Sample Restrictions*

The sample of visitors to Bates Morse Mountain, which will be the subjects of this research, is not necessarily representative of broader global or national populations. Individuals who visit Bates Morse Mountain first and foremost all have access to a car and to significant free time for outdoor recreation. Likewise, they are likely active individuals who value outdoor recreation and spending time in natural settings; they may even particularly value and support nature conservation. Due to these factors, this population may be skewed towards a predisposition to believe in climate change and related risks. Individuals in this population may thus be more willing to engage in these topics initially than other populations. While the results will still be valuable and hopefully reveal significant relationships, these factors are important to note in data analysis and interpretation.

Attempting to measure the effects of place-based communication on a population of people who do not necessarily live in or have great familiarity with that place poses some limitations to this project. Since not all visitors to Bates Morse Mountain are from Phippsburg, we felt that we could not validly ask questions about support for mitigation strategies in that local coastal community. This is because place attachment and experience have such a large impact on engagement (Appendix A). Working with this unique population, which includes a mix of both local and non-local individuals, competed with our desire to measure whether place-based communication strategies can elicit engagement in the very real local threats to homes and livelihoods of coastal communities. Since Bates Morse Mountain and Seawall Beach are

conservation and recreation areas, the threats of sea level rise relate primarily to their effects on natural geographies and ecosystems, and to their effects on recreational access to the beach from flooding.

## **Recommendations**

Based on our experiences throughout the process of creating this survey tool and testing it in the field, we believe that this study is an essential first step in an area of research that is highly relevant and that is paramount to the way that we handle climate risks going forward. While we believe in the integrity and merit of this project, there are several recommendations that we believe should inform the implementation of this survey tool as well as future research on this topic.

### *Recommendations for Implementation*

#### *Timeframe*

We believe that the survey should be implemented in the spring, summer and fall months, as this is when there is the greatest visitation at Bates Morse Mountain. Warmer weather will also be more conducive to the nature of this survey, which requires that participants be able to spend time talking with survey administrators (Appendix C). We believe it would most effective to hire a student (or two) to conduct this research during short term and the summer months, and into the fall, if possible. A fall semester or year long thesis project or future capstone projects are two possible opportunities for the implementation of this survey tool. There is ample opportunity to continue to administer the survey for more extensive periods of time, or for several seasons successively, however considerations of validity must be considered with the



addition of new survey administrators over time. With each new administrator, the variation between conversational treatments becomes greater, threatening the purity of the found outcomes. In order to control for these variations as much as possible, we recommend that no more than two students administer the survey at a single time, and we highly recommend that efforts be taken to retain administrators for long-term or successive seasonal implementations. It is generally our recommendation to limit the total number of survey administrators as much as possible.

While survey administration should happen at all times to get a range of participant responses, we believe that there may be particular benefits to administering during high tides that flood the causeway. We found that participants were really able to grasp the concepts presented in the treatments when they had personally experienced this (Appendix C). This would require that students implementing this survey look ahead at tide charts and plan to be out collecting data when high tides are over 9 feet. It is paramount that administrators record whether the causeway was flooded at the time of administration in the post-survey debrief sheet. Understanding whether this direct experience has a correlational relationship with engagement outcomes is essential.

### *Location*

We believe that administering the survey along the access road or at Seawall Beach will be more conducive to the nature of this survey (Appendix C). We found that administering the survey at the beach was more successful, as participants felt more at ease and were less concerned about the length of the survey. Participants were more impatient and ready to head home when we administered the survey in the parking lot. Additionally, at the beach we were

better able to point out physical features of the landscape, which we felt were helpful for the place-based conversational treatment.

### *Logistics*

In further efforts to limit the variation between individual conversational treatments, it is essential that any survey administrator memorizes the information and scripts provided for those treatments. Due to time constraints, we were unable to memorize the information that must be relayed and discussed, and thus had to refer to the written scripts during treatment administration. This threatens the effects and validity of the survey, as the two approaches (declarative and conversational) became less distinct. In order to truly test the effectiveness of a conversational approach to relaying climate risk information, implementation of this survey *must* include treatments that are truly conversational. This means that the administrators must be extremely familiar with the information about sea level rise, both at Bates Morse Mountain and Seawall Beach and globally. They also must be comfortable speaking to these topics in a flexible manner, as there will be little structure to the conversation and the participant may take it in an unexpected direction. The survey administrator(s) must be able to steer the conversation back to the focus of the treatment -whether it be the broad discussion of sea level rise, or the localized discussion of it - while still allowing the participant the opportunity to make cognitive connections to experience and provide their own input on the matter.

We also recommend that survey the administrator(s) establish an organized system for implementation and filing. We found that there were many individual parts in the structure of this survey (written survey, sections A and B, treatment, consent form, and debrief sheet) which made it easy to become quickly disorganized and lose track of which survey section went with

which treatment. Keeping these pieces organized is thus, essential. We recommend that the organizational system should consist of prepared “packets” for each participant, which includes a consent sheet, the written survey sections (stapled separately), a treatment sheet (if declarative), and a qualitative debrief sheet. Participant identification numbers and which treatment they receive should be written on the front page of each item in the packet. Each packet should be kept together in some manner (e.g. paper clips or a folder). Blank packets should be kept in an order of rotating treatments (A, B, C, D) so that treatment allocation is randomized.

Administrators should also always have plenty of pens and clipboards available at all times to help maintain organization and preparedness. We recommend that the first page (consent page) for the successive blank packets in the system should be ready to go on a clipboard at all times (Appendix D). We believe that having some sort of file crate would likely be effective in keeping these many files organized and protected from wind or other outdoor elements.

Those who analyze the collected data should conduct research and consult with experts to ensure that the best methods for statistical analysis are used. We believe that a two-way ANOVA may be an effective method (Glen, 2017), however the three distinct levels of the dependent variable pose an additional challenge. A MANOVA or another method may be more appropriate. We recommend that analysis should consider the factors in the post-survey checklist.

### *Recommendations for Further Research*

While we do feel that this study will be valuable in initiating research on such an important topic, we also believe it to be essential that this topic be investigated more fully. We believe that this study should be the first step in a greater pursuit to help coastal communities understand how to initiate, facilitate, and participate in the difficult conversations that must be

had regarding the very real threats of sea level rise. We recommend that efforts should be made to adapt this survey for implementation within the Phippsburg community, or in other coastal communities. We believe that measuring the effectiveness of communication style - particularly place-based framing - within coastal communities will provide valuable insight that can then be directly utilized in community initiatives, by government officials, local organizations, or by individual community members.

We also believe that further research should be done to understand a) the longevity that the effects a communication style might have on individual engagement, and b) the effectiveness communication style might have on actual behavioral change or action taken. We also feel that it will be important to further investigate, through additional research, our proposition that specific, experiential examples of climate change threat *could* help to diminish spatial distancing and allow for individuals to conceptualize the severity of threats associated with climate change, or elicit engagement in other geographical areas.

## REFERENCES

- Adger, W. N., Barnett, J., Chapin, F. S., & Ellemor, H. (2011). This Must Be the Place: Underrepresentation of Identity and Meaning in Climate Change Decision-Making. *Global Environmental Politics*, 11(2), 1-25. doi:10.1162/GLEP\_a\_00051
- Agnew, J., Shelley, F., & Pringle, D. (2003). *Agnew, J.A. 1987: Place and Politics: the geographical mediation of state and society* (Vol. 27).
- Agyeman, J., Devine-Wright, P., & Prange, J. (2009). Close to the Edge, down by the River? Joining up Managed Retreat and Place Attachment in a Climate Changed World. *Environment and Planning A*, 41(3), 509-513. doi:10.1068/a41301
- Altinay, Z. (2017). Visual Communication of Climate Change: Local Framing and Place Attachment. *Coastal Management*, 45(4), 293-309. doi:10.1080/08920753.2017.1327344
- Amundsen, H. (2015). Place attachment as a driver of adaptation in coastal communities in Northern Norway. *Local Environment*, 20(3), 257-276. doi:10.1080/13549839.2013.838751
- Anton, C. E., & Lawrence, C. (2014). Home is Where the Heart Is: The Effect of Place of Residence on Place Attachment and Community Participation. *Journal of Environmental Psychology*, 40, 451-461. doi:10.1016/j.jenvp.2014.10.007
- Arkema, K., Guannel, G., Verutes, G., Wood, S., Guerry, A., & Ruckelshaus, M. et al. (2013). Coastal habitats shield people and property from sea-level rise and storms. *Nature Climate Change*, 3(10), 913-918. <http://dx.doi.org/10.1038/nclimate1944>
- B. Rotter, J. (1966). *General Expectancies for Internal Versus External Control of Reinforcement* (Vol. 80).
- Bates College, (2017). *Bates-Morse Mountain & Shortridge | Bates College. Bates.edu*. Retrieved 18 September 2017, from <https://www.bates.edu/bates-morse-mountain-shortridge/>
- BBC News: Science & Environment. (2013). A brief history of climate change. Retrieved from <http://www.bbc.com/news/science-environment-15874560>
- Beadell, S. (n.d.). Surveys 101: A Simple Guide to Asking Effective Questions. Retrieved September, 2017, from <https://zapier.com/learn/forms-surveys/writing-effective-survey/#best>

Bertram, D. (n.d.). *Likert Scales*(Rep. No. CPSC 681). Retrieved December 14, 2017, from <http://poincare.matf.bg.ac.rs/~kristina/topic-dane-likert.pdf>

Bott, S. E. (2000). The Development of Psychometric Scales to Measure Sense of Place (Doctoral dissertation, Colorado State University Fort Collins).

Devine-Wright, P. (2013). *Think Global, Act Local? The Relevance of Place Attachments and Place Identities in a Climate Changed World* (Vol. 23).

Geiger, N., Swim, J., & Fraser, J. (2017). *Creating a climate for change: Interventions, efficacy and public discussion about climate change* (Vol. 51).

Gifford, R. (2011). The dragons of inaction: Psychological barriers that limit climate change mitigation and adaptation. *American Psychologist*, 66(4), 290-302. doi:10.1037/a0023566

Glen, S. (2017). *ANOVA Test: Definition, Types, Examples. Statistics How To*. Retrieved 14 December 2017, from <http://www.statisticshowto.com/anova/>

Graefe, A., Kyle, G., & Manning, R. (2005). Testing the Dimensionality of Place Attachment in Recreational Settings. *Environment and Behavior*, 37(2), 153-177. doi:10.1177/0013916504269654

Halpenny, E. A. (2010). Pro-environmental behaviours and park visitors: The effect of place attachment. *Journal of Environmental Psychology*, 30(4), 409-421. doi:<https://doi.org/10.1016/j.jenvp.2010.04.006>

Howe, P. D., Mildemberger, M., Marlon, J. R., & Leiserowitz, A. (2015). Geographic variation in opinions on climate change at state and local scales in the USA. *Nature Climate Change*, 5, 596. doi:10.1038/nclimate2583 <https://www.nature.com/articles/nclimate2583#supplementary-information>

IPCC. (2014). *Climate Change 2014: Mitigation of Climate Change*. New York: Cambridge University Press. Retrieved from [https://www.ipcc.ch/pdf/assessment-report/ar5/wg3/ipcc\\_wg3\\_ar5\\_full.pdf](https://www.ipcc.ch/pdf/assessment-report/ar5/wg3/ipcc_wg3_ar5_full.pdf)

Jones, C., Hine, D. W., & Marks, A. D. G. (2017). The Future is Now: Reducing Psychological Distance to Increase Public Engagement with Climate Change. *Risk Analysis*, 37(2), 331-341. doi:10.1111/risa.12601

Kaltenborn, B. (1998). *Effects of sense of place on responses to environmental impacts: A study among residents in Svalbard in the Norwegian high Arctic*.

Kaltenborn, B., & Williams, D. (2002). *The meaning of place: Attachments to Femundsmarka National Park, Norway, among tourists and locals* (Vol. 56).

Leeuw, E. D., Hox, J. J., & Dillman, D. A. (2009). *International handbook of survey methodology*. Hove, East Sussex, GB: Psychology Press.

Leiserowitz, A. A. (2005). American Risk Perceptions: Is Climate Change Dangerous? *Risk Analysis*, 25(6), 1433-1442. doi:10.1111/j.1540-6261.2005.00690.x

Leiserowitz, A. A. (2007). *Communicating the risks of global warming: American risk perceptions, affective images, and interpretive communities*.

Leiserowitz, A., Maibach, E., Roser-Renouf, C., Rosenthal, S., Cutler, M., & Kotcher, J. (2017). *Politics & Global Warming, October 2017*. Yale University and George Mason University. New Haven, CT: Yale Program on Climate Change Communication.

McDonald, R. I., Chai, H. Y., & Newell, B. R. (2015). Personal experience and the 'psychological distance' of climate change: An integrative review. *Journal of Environmental Psychology*, 44(Supplement C), 109-118. doi:https://doi.org/10.1016/j.jenvp.2015.10.003

Moore, D. A., & Loewenstein, G. (2004). Self-interest, automaticity, and the psychology of conflict of interest. *Social Justice Research*, 17(2), 189-202.  
<http://eds.a.ebscohost.com/eds/pdfviewer/pdfviewer?vid=0&sid=8eb35848-4ed6-41e9-8ca7-f1562e73440f%40sessionmgr4010>

Moore, S., & J. Reblin (2010). Chapter 6: Climate Change in *The Kennebec Estuary: Restoration Challenges and Opportunities*. Biological Conservation, Bowdoinham, Maine.  
<http://kennebecestuary.org/resources/state-of-the-kennebec-estuary>

Nicolosi, E., & Corbett, J. B. (2017). Engagement with climate change and the environment: a review of the role of relationships to place. *Local Environment*, 1-23.  
doi:10.1080/13549839.2017.1385002

NOAA (2013). *Sea Level Trends - State Selection*. [Tidesandcurrents.noaa.gov](http://tidesandcurrents.noaa.gov). Retrieved 10 October 2017, from  
[https://tidesandcurrents.noaa.gov/sltrends/sltrends\\_station.shtml?stnid=8418150](https://tidesandcurrents.noaa.gov/sltrends/sltrends_station.shtml?stnid=8418150)

NOAA (2017). *What threats do coastal communities face?* [Oceanservice.noaa.gov](http://oceanservice.noaa.gov). Retrieved 18 September 2017, from <https://oceanservice.noaa.gov/facts/coastalthreat.html>

Peet, R. (1998). *Modern Geographical Thought*: Wiley-Blackwell.

*Principles of Survey Methodology*. (2014). Lecture presented at Applied Research Methods in the LA Labor Community in UCLA, Los Angeles. Retrieved September 26, 2017, from <https://www.labor.ucla.edu/wp-content/uploads/2015/03/Principles-of-Survey-Methodology.pdf>

Scannell, L., & Gifford, R. (2011). Personally Relevant Climate Change: The Role of Place Attachment and Local Versus Global Message Framing in Engagement. *Environment and Behavior*, 45(1), 60-85. doi:10.1177/0013916511421196

Schweizer, S., Davis, S., & Thompson, J. L. (2013). Changing the Conversation about Climate Change: A Theoretical Framework for Place-Based Climate Change Engagement. *Environmental Communication*, 7(1), 42-62. doi:10.1080/17524032.2012.753634

Singh, A. S., Zwickle, A., Bruskotter, J. T., & Wilson, R. (2017). The perceived psychological distance of climate change impacts and its influence on support for adaptation policy. *Environmental Science & Policy*, 73(Supplement C), 93-99. doi:<https://doi.org/10.1016/j.envsci.2017.04.011>

Spence, A., Poortinga, W., & Pidgeon, N. (2012). The Psychological Distance of Climate Change. *Risk Analysis*, 32(6), 957-972. doi:10.1111/j.1539-6924.2011.01695.x

Trope, Y., & Liberman, N. (2010). Construal-Level Theory of Psychological Distance. *Psychological review*, 117(2), 440-463. doi:10.1037/a0018963

Utilitarianism and Locus of Control. *Ethics in Public Relations*. <https://ethicsinpr.wikispaces.com/Utilitarianism+%26+Locus+of+Control>

Vaske, J. J., & Kobrin, K. C. (2001). Place Attachment and Environmentally Responsible Behavior. *The Journal of Environmental Education*, 32(4), 16-21. doi:10.1080/00958960109598658

Vermeer, M., & Rahmstorf, S. (2009). Global Sea Level Linked to Global Temperature. *Proceedings Of The National Academy Of Sciences*, 106(51), 21527-21532. <http://dx.doi.org/10.1073/pnas.0907765106>

Walker, A. J., & Ryan, R. L. (2008). Place attachment and landscape preservation in rural New England: A Maine case study. *Landscape and Urban Planning*, 86(2), 141-152. doi:<https://doi.org/10.1016/j.landurbplan.2008.02.001>



Walmsley, D. (2010). *Climate Change and its Effects on Humans*. Gulf of Maine Council on the Marine Environment. Retrieved from <http://www.gulfofmaine.org/2/wp-content/uploads/2014/03/climate-change-and-its-effects-on-humans.pdf>

Westcott, A. (2013). *Tracking Seasonal and Storm Induced Recession of the Popham-Seawall Barrier Beach Complex, Phippsburg, Maine* (Undergraduate). Bates College. [http://scarab.bates.edu/geology\\_theses/8/](http://scarab.bates.edu/geology_theses/8/)

Williams, D., & Vaske, J. (2003). *The Measurement of Place Attachment: Validity and Generalizability of a Psychometric Approach* (Vol. 49).

## APPENDIX

### *Appendix A: Climate Change Communication Literature Review*

Determining how we communicate climate change is crucial in terms of increasing public engagement and support for climate change policy. Regardless of the mass agreement among scientists that climate change is occurring and anthropogenic, the general public has overall trouble with engaging the problem. Research has demonstrated that individuals do not view the risks associated with climate change as an immediate or impending issue. Climate change is often viewed as a psychologically distant problem that will impact other locations through uncertain events and may occur far in the future (Geiger et al., 2017, Spence et al., 2012, Leiserowitz, 2005, Lierserowitz 2007). The psychological distance of the problem has been identified as a key problem in both discussing climate change and enacting support for policy changes. Construal Level Theory creates a helpful method for examining this issue.

### *Construal Level Theory and Psychological Distance*

Construal Level Theory identifies psychological distance through four dimensions: geographic, temporal, social and uncertainty (Jones et al., 2017). It proposes that psychological distance from an object is directly related to the way people mentally represent it. Due to psychological distance, individuals view climate change as spatially and temporally distant issue that will have global and not local affects (Jones et al., 2017). Psychological distance is the extent to which an object of concept is perceived as distant from the self in time, space, certainty or social similarity (McDonald, 2016). As mental representations become more distant, they become less concrete and more abstract. Spatial distance is a matter of the abstract nature of

climate change and the fact that individuals believe it will impact places geographically distant from themselves (Singh et al., 2017). Temporal distance is a matter of when an event will occur (Singh et al., 2017). Social distance is a matter of who will be impacted by an event (Singh et al., 2017). Due to the disconnect of risk perception there is a spatial distance between individuals and the impacts. According to construal level theory as distance increases, mental representations become less concrete and more abstract (Trope and Liberman, 2010). For this reason, temporal and spatial distance present a serious obstacle to interest in climate change engagement.

Leiserowitz (2005) in a survey of US residents determined that the majority of Americans demonstrate awareness of the existence of climate change. However, the study supported that a very small percentage of Americans see climate change as an imminent threat or a high-priority danger. Leiserowitz found that most Americans believe that climate change will be associated with impacts of moderate severity and will have impacts geographically and temporally distant from themselves. He found a range of climate change interpretations, from alarmists to naysayers. The study also identified that only 1% of the representative sample of the American public was most concerned about climate change associated impacts on their local community. However 50% were most concerned by worldwide impacts.

Leiserowitz (2005) conducted a similar study with the American public that further supported the same concepts. However the following study was through the additional lense of how perceptions can influence policy support. In this study he observed that 62% of Americans associated climate change with geographically and psychologically distant impacts. He found overall that the nation has relatively moderate climate change risk perceptions which are generally driven by the perception of danger to people geographically distant to themselves. Engagement often requires an understanding of impending risk.

Singh et al. (2017) additionally discovered that in a study of the U.S. public, the more temporally, socially and spatially distant climate change impacts are perceived to be and therefore the less concerned they are about climate change impacts, the less supportive they are about adaptation policy. This supports that beliefs and judgments of climate change are a function of time and space. Their findings also support that the closer individuals believe climate change impacts are to them, the more supportive they are for policy changes and adaptation strategies.

Spence et al. (2012), within a nationally representative UK sample, found that by reducing the distance of climate change it would make the issue more real, relevant, and increase concern, which has been found to increase support for mitigation policy. They found that dimensions of psychological distance have a strong relationship with one another. Additionally, lower psychological distance was related to higher concern with regard to climate change. But within the realm of engagement, they discovered that the risk of climate change impacts on developing countries appeared the most important. Their results overall support the importance of highlighting local, but also certain distant, impacts of climate change.

Jones et al. (2017) in a study of Australian residents found that message frames can be used to reduce psychological distance. Their results indicated that the psychological distance of climate change was best expressed through the four dimensional approach: geographic, temporal, social distance and uncertainty. Their approach emphasized the importance of proximal as opposed to distal impacts to ultimately increase climate change concern and thus mitigation intentions.

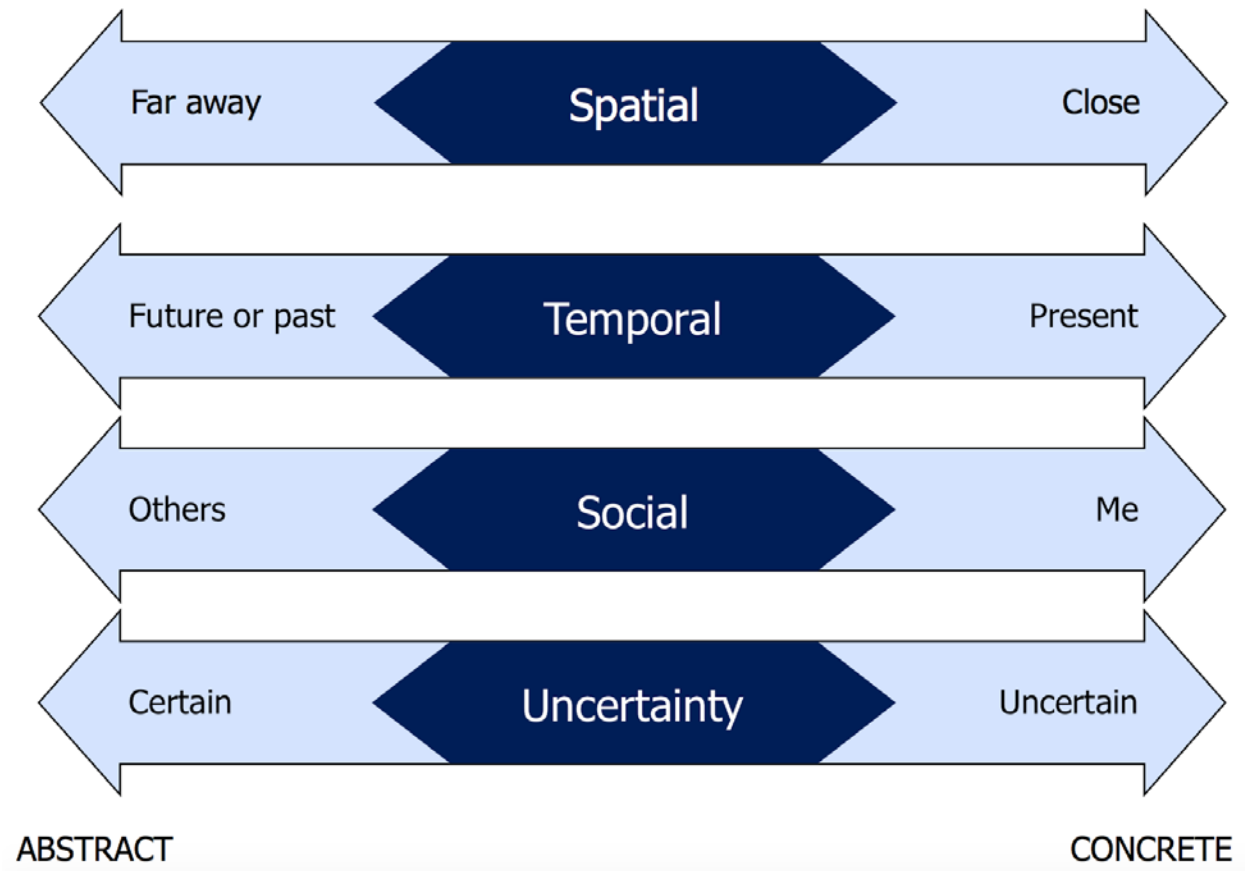


Figure 13. Illustrative model of the four dimensions of psychological distance.

### *Sense of Place and Place Attachment*

Reducing the temporal and spatial distance of climate change is crucial for increasing cognitive and emotional engagement. In order to develop the concreteness of climate change, many have turned to various methods of framing. One of the most important and effective methods of framing is local framing, which utilizes individual's sense of place (Nicolosi, 2017). Place attachment theory suggests that people have emotional bonds to certain landscapes. The term "place" seems rather easy to understand, however it is used in a variety of ways in academia. According to Agnew (1987), place as a "meaningful location" involves three fundamental dimensions: location, or a geographical setting on the globe, (2) locale, or the material setting in which the social relationships unfold, and (3) sense of place, or the emotional

bond that individuals form with the specific place. Place can also be viewed in a similar 3-dimensional model as place identity, place dependence and social bonding (Halpenny, 2010). Along a similar line, place can be identified as a location where people discover themselves, have significant experiences, interpret, understand and find meaning (Peet, 1998).

Adger et al. (2017) argue that sense of place has been underutilized in the world of climate change communication. They claim that the localized material and symbolic value centralized in place associations highlight the methods in which individuals lives derive meaning. These factors have significant value in people's lives and can therefore be used in climate change policy. They identify that places are "manifestations of economic, ecological, and cultural resources and meanings" and these places have varying degrees of vulnerability in the face of climate change, some of them very high. They attest to the fact that these high degrees of vulnerability in valued places must be utilized in communication.

Places are largely socially constructed expressions of the self and how our surroundings reflect the characteristics, beliefs and elements we see in ourselves (Aygeman, 2009). The association of place can help increase cognitive and emotional engagement with locally relevant messages (Altinay, 2017). Devine-Wright (2013) also identifies place attachment as the emotional bonds that people develop with their socio-physical environment.

Place attachments are also heavily associated with experience and length of time. Walker and Ryan (2008) found in rural Maine residents that increased place attachment was correlated with longer lengths of residence. Additionally, strong enough place attachment can ultimately lead to place dependence.

Nicolosi (2017) found in a review of studies that examined climate change, the environment and individual's relationship to place, that strong relationships to place act as a

positive means to communicate climate change. Kaltenborn and Williams (2002) found that place attachment does play a role in influencing environmental management preferences in the face of climate change in a Norwegian National Park. They also used various attachment items to parse out level of attachment across different scales. This study was done in specific relation to place attachment and management preferences, and therefore on an environmental basis rather than a specific climate change basis. However, Kaltenborn (1998) found, in coastal communities in the High Arctic of Norway, specifically Svalbard, respondents with a strong sense of place also had more positive perceptions of the environment.

Amundsen (2015), in a study of coastal communities in Northern Norway, found that place attachment can act as a driver in motivating collective responses to mitigation strategies. Her results supported that people are committed to their place and the places in which they feel strong emotional bonds to and they support adaptation strategies to improve those places in the face of climate change. This study additionally supports that place attachment leads to commitment to the challenges facing the community.

In Vaske and Kobrin (2001) they examined the relationship between place attachment and environmentally responsible behavior in youth in a natural areas service work program. In the study they viewed place attachment through a two-dimensional lens, as place identity and place dependence, and found that encouraging an individual's connection to a natural setting facilitates the development of environmentally responsible behavior. They found that: (a) as place dependence increases, place identity increased; (b) as place identity increased, environmentally responsible behavior increased; and (c) place identity mediated the relationship between environmentally responsible behavior and place dependence.

### *Local Framing*

Framing theory is often used alongside abstract concepts that are found to be difficult to communicate (Altinay, 2017). By framing concepts locally you can use individual's attachment to place to make concepts more concrete. Local framing is significant due to its ability to counteract psychological distancing by localizing the consequences and heightening the risk perceptions by placing them in the context of a place that people have an emotional bond to.

Halpenny (2010) found that place identity served a positive role in pro-environmental intention in tourists at a Natural Park in Canada. Altinay (2017) studied the use of local framing to prompt engagement in young adults at a southern coastal university. She discovered that local framing prompts climate-change-related engagement in young adult stakeholders. She also found that the use of local framing moderates and strengthens place attachment, such that the effects of local framing would be stronger for those who reported more attachment to their local areas.

Scannel and Gifford (2011) in a study of residents of British Columbia, inquired as to whether messages that emphasize the local versus global impacts of climate change influence individual's engagement in climate change issues. They found that locally framing messages are more engaging than receiving no message at all. But they also found that climate change engagement is higher with individuals that had stronger place attachment and that women tend to report higher levels of engagement than men. The ultimate hypothesis here supports the concept that connections to one's local area can translate into concern and engagement for the broader issue on a global scale.

Walker and Ryan (2008), in a study conducted in rural Maine, found that high place attachment and the use of local framing led to increased affinity to pro-environmental and pro-conservation attitudes. They hypothesized that local messages would be more effective than



global messages and found that climate change was greater among those who had received a local message as opposed to those who received no message at all. But engagement did not differ between those that received a global message and those in the control group. There resulted also determined that there were three significant and unique predictors of climate change engagement: place attachment, receiving the local message, and gender (female).

### *Interpersonal Discussions*

Regular and interpersonal discussions about climate change are important for establishing positive social change and addressing the issue at hand. However a majority of the public does not converse about the topic regularly. Public and social discussion on the interpersonal level is fundamental with regard to civic engagement. It is these conversations that can facilitate the movement and understanding of the need for social change and create an opportunity for it to arise. Only a small minority of Americans claim that they currently discuss climate change regularly in their everyday life (Leiserowitz, 2007). The literature provides that regular, simple and depoliticized conversations that are perceived as relatively uncontroversial and promote knowledge through the implementation of facts could have potential benefits for social change (Lieserowitz, 2007, Geiger et al., 2017).

Geiger et al. (2017) studied knowledge based interventions and efficacy beliefs in in university student. They hypothesized that knowledge-based interventions will increase individuals knowledge about climate change and therefore there self-efficacy, which will then lead to further increased discussion about climate change. They speculate that further and continual increased discussion on climate change will lead to an increase in engagement. Their

results supported that promoting discussion led to positive impacts with regard to efficacy beliefs and overall knowledge.

In a study conducted on national park visitors, Schweizer et al. (2013) observed that 68% of visitors expressed that they were eager to learn more about how climate change was affecting the parks and national refuges. This demonstrates an interest in understanding and education. They concluded that the results propose a framework to rethink how we engage in climate change conversations due to the widely available opportunities supported by their study on climate change and place attachments in national parks and refuges.

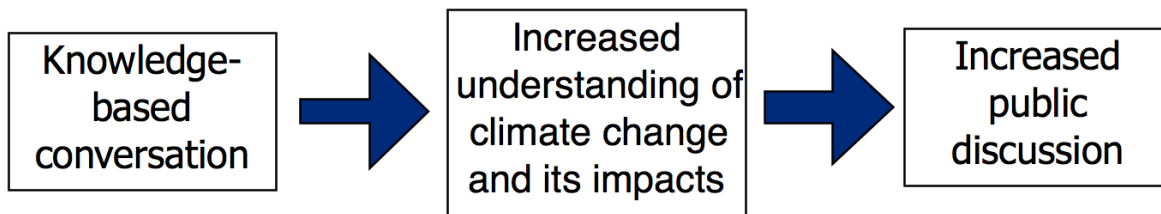


Figure 14. Model of how knowledge-based conversation influences climate change understanding.

### *Conclusion*

The psychological distance of climate change is a major aspect in the gap in effective climate change communication. This form of distance leads to spatial and temporal distance, which is why individuals view the risks associated with climate change as geographically distant from them. By framing messages locally you can counteract psychological distance and communicate the risks associated with climate change in a way that helps people view them in their own geographical realm and their own lifetime. Another method to bridge the gap is to communicate these facts in an uncontroversial, conversational way to allow a two-way discourse. By allowing people to understand them through discussion allows for further conversation amongst the general public.

## *Appendix B: Developing the Survey Questions*

The specific survey questions within the dependent and independent variable sections were adapted from existing surveys within the literature that we had reviewed. We chose questions that we saw fit based on specifically what they were gauging within each of the different variables. Within Section A, the independent variables measurements of place attachment were developed from the 3 dimensional model of place identity, place dependence and social bonding based on Halpenny 2010, Kaltenborn and Williams 2002, Schweizer et al. 2013 and Kyle and Graefe 2005 (Appendix A). The climate change belief measurements were established based on agree or disagree statements across a Likert scale adapted from Howe et al. 2015 and Schweizer et al. 2013. The locus of control measurements were also developed from a 5 point, agree or disagree scale adapted from Rotter 1966. Measurements of spatial and temporal discounting were additionally developed from an agree or disagree scale modified from Howe et al. 2015 and Leiserowitz et al. 2005. Finally the demographics questions consisted of basic questions used to understand race, political affiliation, age, gender and where recipients previous engage in climate change information. The specific survey questions for the dependent variables were largely adapted from the extensive collection of questions measuring willingness to engage through various contexts in Leiserowitz 2017. These questions effectively examined various types of action and engagement which was why they were so helpful to modify in way that was useful to examine the dependent variables of statement of willingness to act in our survey. These questions were also modified to measure recipients statement of willingness to act across the 3-dimensions that we were testing the dependent variables.

## *Appendix C: Field Testing- Anecdotal Accounts*

### *Dealing With a Lengthy Survey*

Due to the timeline of this project, by the time we got out to field test our newly created survey, the leaves had mostly fallen and temperatures had dropped significantly. There were few cars in the parking lot when we arrived, and though Don - the gatekeeper - told us that people do continue to visit Bates Morse Mountain into the winter months, the visitation drops off significantly around October, and is definitely at its pique during the warm summer months. Nonetheless we were determined to try out our survey on at least a few people. The causeway was flooded and Don told us that he had sent a few eager visitors away, telling them to come back in a few hours when the causeway was clear again. We took the opportunity to walk down to the causeway to see the effects of the high tide flooding. Sure enough, the entire marsh was flooded and there was a significant portion of water stretched for several yards across the causeway. About seven people waiting on the other side. Excited that we had happened to pick a flood day to do our field testing, we decided, “if only we’d known, we could have gotten here in time to be caught on the other side with those people! What a perfect opportunity to administer the survey with the causeway flooded right in front of you!”

We headed back to the parking lot and patiently waited until the visitors came straggling back as the water slowly retreated. The first two men that we approached asked us how long the survey would take; they were hungry and they wanted to go get lunch. Not really knowing how long the survey would take, we told them we thought it would be fairly quick, maybe 15 minutes. They agreed to take the survey, but were somewhat reluctant. When they finally completed the survey about 20 minutes later, they gave us plenty of feedback, pointing out little grammatical errors or parts of the survey that were a bit confusing. We took these comments into account in

our revision process. Their biggest complaint was that the survey was too long. They said that they didn't think people would be willing to take 20 minutes to talk with us. While we were able to cut a few questions out that were redundancies, we felt that most of the content was vital, so the survey is still roughly the same length as it was then. We received similar feedback from another woman, who had chosen to wade across the causeway. Her feet were wet and cold so she changed her socks before coming to talk with us. While we were concerned that the length of the survey would continue to be an issue, we found that in the second day of field testing, when we were able to head out to the beach, people were much less stressed about timing, and were happy to stop and chat with us. We didn't not receive complaints about the length of the survey when administering at the beach, and some people even stayed after to continue talking and sharing experiences with us.

### *Effectiveness of Discourse Based on Previous Experience*

The nature of the conversational treatments will naturally be variable as a result of the survey recipient. As there are two individuals taking part in a two-way conversation there is no way to control how the other person will take part. These variations in discourse will largely be due to the experience and the knowledge that the recipient enters the treatment with. Through these variations, parts of the treatment might be more or less impactful in comparison to others. During field testing we had various experiences with this concept. One of the place-based and conversational treatments was administered to an individual who, through the discourse of the treatment, expressed that he had spent decades recreating in the Seawall, Popham, and Small Point Beach area. He had been surfing there since he was young and when we discussed the topic of beach erosion with him and how the beach system had changed over time he made several

connections to his experience surfing, and how the beach has changed, he has changed how he approached the sport in that specific place. Through this conversation it was easy to see how he was making the connections with the facts that we being discussed and how they had more of an impact because he had experiences with the place that directly related to the changes in the beach system that we were talking about.

An additional way that some treatments may vary from others, and therefore have more or less of an impact is through the previous knowledge and understanding that the survey recipients enter the treatment with. During field testing one of the National and Conversational treatments was administered to an individual that had vast experience doing with in research related to the field and therefore was clearly well versed in the facts and information. This conversation was more of a discourse where both parties were previously engaged with the facts as opposed to a treatment where the conversation consisted of providing a lot of information. The latter is still important because the recipient is still learning, but the nature of the conversation is very different than when the individual already has a vast understanding of what is being provided.

*Appendix D: Survey Implementation Instructions*

1. Approach individual(s) and state that you are a student at Bates conducting social science research about how we communicate about risks associated with climate change. Tell them that the survey will take about 20 minutes. Ask them if they would be willing to participate in the study.
2. Upon agreement, provide them with a consent form on a clipboard. Ask them to read the form and sign and date at the bottom. You can explain to them verbally that all data will be completely anonymous and that they have the right to withdraw from the study at any point.
3. Once you have their signed consent form, provide them with section I of the survey (Independent Variables) on a clipboard.
4. Once they have completed section I, retrieve it from them and provide them with 1 of the 4 treatments. Treatment allocation should be predetermined and randomized.
  - a. For declarative treatments, simply provide them with the fact sheet and ask them to review the information provided.
  - b. For conversational treatments, tell them that at this point in the study, you will engage in a conversation about sea level rise (either globally or locally). Initiate this conversation as based on your memorization of the script information.
5. After treatments are complete, provide them with section II of the survey (Dependent Variables).

6. Once they have completed the survey, thank them for their participation. You can provide them with information regarding how they can follow up with the research if they want to. You can also provide them with a sea level rise pamphlet.
7. You can complete the post-treatment checklist at this point, or while they are filling out section II of the survey.
8. Make sure to safely collect all components related to this participant and store them together in your data filing system.

\*It is important to note that, during the timeframe in which you are collecting data, sea level rise pamphlets should not be available to individuals who may participate in the study until *after* they have participated. If participants are exposed to the information in this pamphlet prior to their participation, the effects of the treatments will be compromised.



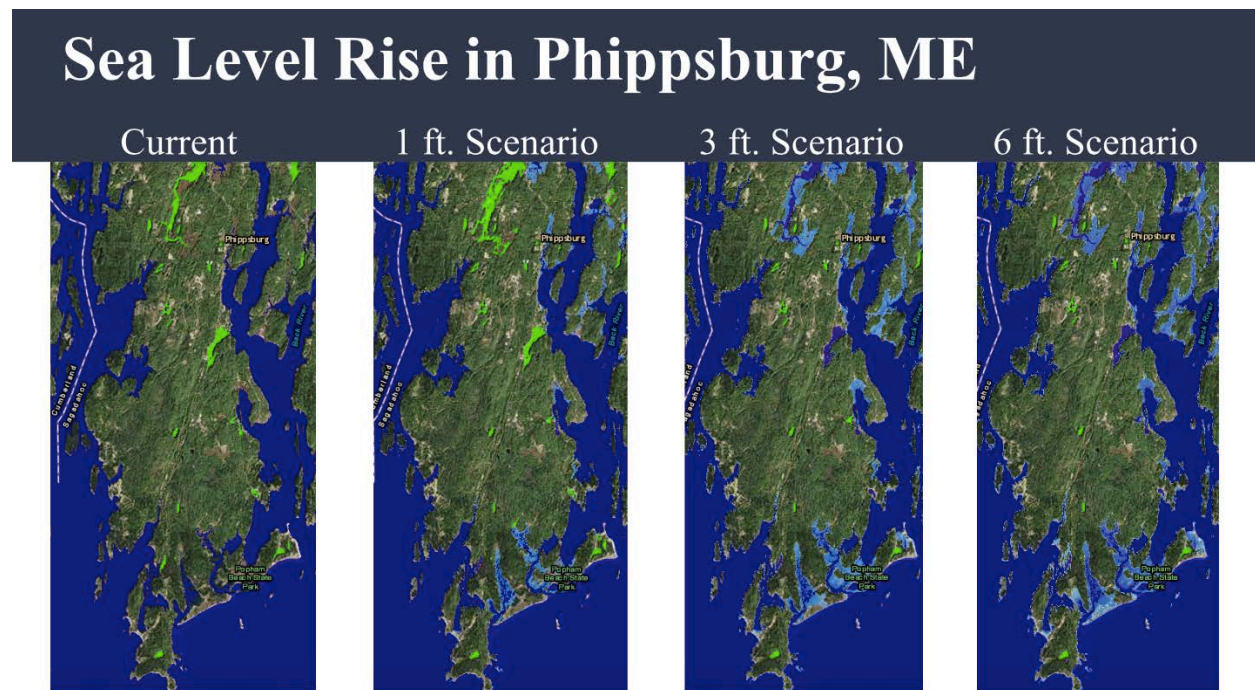


Figure 15: Local scenarios of sea level rise (NOAA, 2017), show deep water in dark blue, shallow water and high tide flooding in light blue, and low-lying areas in green.

In the Gulf of Maine, sea levels are rising at a rate of about 0.07 inches (0.18 cm) per year, a rate that is slightly above that of the global average (NOAA, 2013). Local research done at Seawall Beach indicates that future prediction rates range from 0.1 to 0.8 inches (0.25 - 2 cm) per year for the current century (Oster, 2009). These predictions indicate that, at the mid-range scenario, we could see a one foot (30.5 cm) rise in sea level within the next 30-40 years (Figure 15). Additionally, water surface temperatures in the Gulf of Maine are increasing at a rate faster than 99% of the rest of the world's oceans (Walmsley, 2015). Warmer water surface temperatures increases storm activity, which poses additional flooding risks to coastlines (Moore & Reblin, 2010, Wescott, 2013).



Figure 16. The flooded causeway. Visiting recreators sat waiting on the other side, waiting for at least an hour to get back to their cars (Avery Wolfe)

# Sea Level Rise at Bates Morse Mountain

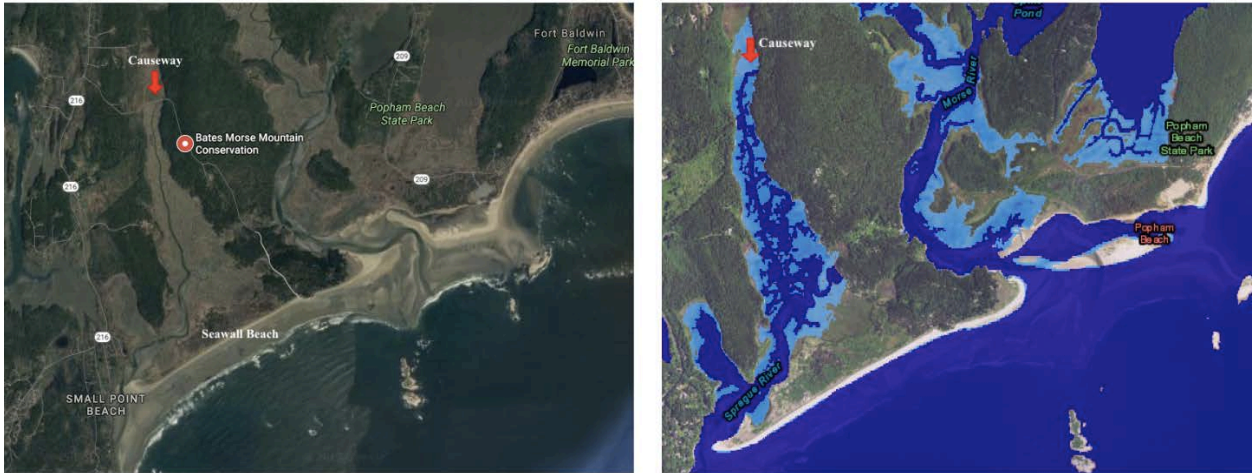


Figure 17. Pictured on the left is the current sea level (Google Maps, 2017), and on the right shows a one foot increase scenario (NOAA, 2017).

Along the access road from the Bates Morse Mountain Trailhead to Seawall Beach, a causeway crosses the Sprague River outlet. This causeway floods every time there is a high tide over nine

feet (2.7 m) (Vickery, 2017) (Figure 17). As sea levels rise the impacts of high tide flooding becomes more severe. With a one foot increase in sea level, a nine foot tide would have the effects of a current 10 foot (3 m) tide, and the causeway would flood with every 8 foot (2.4 m) tide (Figure 17). With these changes, the causeway would flood every day, restricting access to and from the Beach more frequently and for longer periods of time.

*Appendix F: Post-Survey Checklist*

Post-Survey Checklist

Check all that apply.

During the conversational/universal treatment, the participant brought up local issues

During the conversational/local treatment, the participant brought up global/universal/national issues

The causeway was flooded coinciding with the survey administration

The survey was administered at the beach

The survey was administered on the trail

The survey was administered in the parking lot

Weather conditions: \_\_\_\_\_

Appendix G. Climate Change Survey

Climate Change Survey

Section A

Notice:

-When the word “place” is mentioned, it is in reference to the Bates-Morse Mountain recreation area and Seawall Beach.

Other definitions:

-Climate change mitigation: Efforts to reduce or eliminate the root causes of climate change

-Climate change adaptation: Efforts to lower the risks associated with the consequences of climate change

Part I:

1. How many times have you visited Bates Morse Mountain?
  - a) First visit
  - b) A few visits (2-5 times)
  - c) Seasonally
  - d) Regular visitor (e.g. monthly, weekly, etc.)

Please indicate the degree to which you agree or disagree with the following statements:

	Strongly Disagree	Agree	Neutral	Agree	Strongly Agree
1. I identify strongly with this place	1	2	3	4	5
2. I feel connected to this place	1	2	3	4	5
3. I get more satisfaction recreating in this place than in other places	1	2	3	4	5
4. This is the best place for doing what I like to do	1	2	3	4	5
5. This place plays a central role in my lifestyle	1	2	3	4	5
6. Having access to this place is important to me	1	2	3	4	5
7. I have fond memories in this place	1	2	3	4	5
8. I value the experiences I have in this place	1	2	3	4	5

**Part II:**

Please indicate the degree to which you agree or disagree with the following statements:

	Strongly Disagree	Agree	Neutral	Agree	Strongly Agree
1. I believe that climate change is happening	1	2	3	4	5
2. I believe that climate change is caused mostly by human activity	1	2	3	4	5
3. I believe that climate change has associated risks	1	2	3	4	5
4. I believe the science backing the phenomenon of climate change	1	2	3	4	5
5. I trust the scientists that provide evidence of climate change	1	2	3	4	5
6. I am well informed about climate change	1	2	3	4	5
7. I am well informed about climate change risks	1	2	3	4	5

**Part III:**

Please indicate the degree to which you agree or disagree with the following statements:

	Strongly Disagree	Agree	Neutral	Agree	Strongly Agree
1. Climate change is inevitable, there's nothing I can do to change it	1	2	3	4	5
2. Government efforts are the only hope for solving climate issues	1	2	3	4	5
3. I feel that I can influence government policy regarding climate change	1	2	3	4	5
4. Industry efforts are the only hope for solving climate issues	1	2	3	4	5
5. I feel that I can influence industrial regulations that protect the environment	1	2	3	4	5
6. I feel that individual action can help to mitigate the effects of climate change	1	2	3	4	5
7. I feel that my actions can help to mitigate the effects of climate change	1	2	3	4	5

**Part IV:**

Please indicate the degree to which you agree or disagree with the following statements:

	Strongly Disagree	Agree	Neutral	Agree	Strongly Agree
1. I believe that climate change will harm me personally	1	2	3	4	5
2. I believe that climate change will harm communities in my home region	1	2	3	4	5
3. I believe that climate change will harm communities in the US	1	2	3	4	5
4. I believe that climate change will harm communities in developing countries	1	2	3	4	5
5. I believe that climate change will harm communities sometime in the near future	1	2	3	4	5
6. Climate change will only harm future generations	1	2	3	4	5

**Part V:**

1. What is your age?
  - a) 18-24 years old
  - b) 25-34 years old
  - c) 35-44 years old
  - d) 45-54 years old
  - e) 55-64 years old
  - f) 65-74 years old
  - g) 75 years or older
1. From which city or state (or country) are you from?  
\_\_\_\_\_
2. Is it inland or coastal?
  - a) Inland
  - b) Coastal
3. Is your home region subject to climate-related risks (e.g. wild fires, flooding, storms, etc.)?
  - a) Yes
  - b) No
  - c) Unsure
  - d) If yes, do you know what the specific risks are? \_\_\_\_\_

4. What is your race?
  - a) American Indian or Alaska Native
  - b) Asian
  - c) Black or African American
  - d) Native Hawaiian or Other Pacific Islander
  - e) White
  - f) Hispanic or Latino
  - a. Mixed race (or more than one race)
5. What is your gender identification?
  - a) Male
  - b) Female
  - c) Other \_\_\_\_\_
6. What is your political affiliation?
  - a) Democrat
  - b) Republican
  - c) Independent
  - d) Other \_\_\_\_\_
7. In what ways do you hear about or engage in climate change information? (please circle all that apply)
  - a) News
  - b) Social media
  - c) Interpersonal conversations with friends and family
  - d) Academia
  - e) Environmental activists or organizations
8. What is your level of education?
  - a) Some high school
  - b) High school diploma
  - c) Some college/university
  - d) College/university degree
  - e) Postgraduate study

**Stop Here and Follow Directions from Survey Administrator**



## Section B

Notice: When the word “place” is mentioned, it is in reference to the Bates-Morse Mountain recreation area and Seawall Beach.

Other definitions:

-Climate change mitigation: Efforts to reduce or eliminate the root causes of climate change

-Climate change adaptation: Efforts to lower the risks associated with the consequences of climate change

### Part I:

Please circle one answer for each of the following questions below:

1. How concerned are you about the effects associated with climate change that threaten this place?
  - a) Very concerned
  - b) Somewhat concerned
  - c) Neutral
  - d) Not very concerned
  - e) Not concerned at all
2. To what degree are you invested in learning more about how climate change will affect the ecology and community here?
  - a) Very invested
  - b) Somewhat invested
  - c) Neutral
  - d) Not very invested
  - e) Not invested at all

**Part II:**

Please indicate the degree to which you agree or disagree with the following statements:

	Strongly Disagree	Agree	Neutral	Agree	Strongly Agree
1. I would be willing to donate money to help Bates Morse Mountain adapt to rising sea levels	1	2	3	4	5
2. I will actively seek out conversations about climate change and its effects on the ecology and community here	1	2	3	4	5
3. I would attend a public meeting about mitigation strategies in regards to climate risks in this place	1	2	3	4	5

**Part III:**

Please circle one answer for each of the following questions below:

1. How concerned are you about the effects associated with climate change that threaten the place where you live?
  - a) Very concerned
  - b) Concerned
  - c) Neutral
  - d) Not very concerned
  - e) Not concerned at all
  
2. To what degree are you invested in learning about how climate change will affect the ecology and communities of the U.S.?
  - a) Very invested
  - b) Somewhat invested
  - c) Neutral
  - d) Not very invested
  - e) Not invested at all

**Part VI:**

Please indicate the degree to which you agree or disagree with the following statements:

	Strongly Disagree	Agree	Neutral	Agree	Strongly Agree
1. I would prefer that my tax dollars go towards relocating at risk communities rather than rebuilding homes affected	1	2	3	4	5
2. I will actively seek out conversations about climate change and how it's affecting the globe	1	2	3	4	5
3. I would call my state representative(s) to urge them to take action on proactive environmental policy	1	2	3	4	5

## *Appendix H. Treatments*

### *Place-Based and Conversational*

→ Have you been here before and where are you from?

- Have you noticed the causeway at Bates-Morse Mountain flooding? Can you describe that experience? If you have experienced the flooding, what was your reaction to it?

Do you think it's flooding more often?

- (If they do) → Every time there is a 9+ ft tide the causeway floods, which can restrict access. As sea levels rise, tidal flooding moves farther inland.
- At Seawall beach future predictions range from 0.1 to 0.8 inches/year (Oster, 2009). All predictions indicate exponential increases.
- If sea level rise in this area remains constant, Seawall beach will experience a 1' rise in less than 15 years. → With a 1' rise in sea level, the effects of a 9' tide would be equivalent to the effects of a 10' tide currently.  
→ what are your reactions to this? Have you heard either of these facts before?
- Have you noticed any changes at seawall beach such as erosion or dune loss? Can you describe those changes? How do you feel about these changes?
  - sea level rise and storms are mainly responsible for the major physical changes occurring at beach systems (Wescott, 2013).
  - A 3.96°F increase in the surface temperature of water could cause hurricane winds to strengthen by 5-10%. This would increase the destructive power of storms on beaches and dunes (Kennebec Estuary Land Trust).
  - Since 2004, the rate of ocean surface warming in the Gulf of Maine has accelerated to 0.4 °F / year. This rate is faster than 99% of the world's oceans. (University of Maine, 2015).

*National and Conversational*

How familiar are you with the concept of sea level rise? Do you know current and projected rates globally?

→ (if yes,) - climate scientists reported in 2014 that within the last century global sea levels rose at an average rate of 0.07 inches/year. That rate, however, is increasing. Between 1993 and 2010 global sea levels rose at an average rate of 0.1 inches/year.

→ rates of global sea level rise are predicted to continue to increase. From 2081-2100. Scientists predicts a rate of 0.3 to 0.6 inches/year. What is your reaction to this? Are these statistics surprising to you?

How familiar are you with the concept of coastal erosion? Do you know how coastal erosion is affecting people and places around the country or the world?

- A study has shown that at least 70% of beaches worldwide are eroding. This is because sea levels are rising and because increased frequency and intensity of storms causes more damage and disrupts the natural systems of coastlines' ability to stabilize.
- Increases in ocean surface temperature increases wind and wave destruction power in storms. Globally ocean surface temperatures have increased 0.13°F per decade
- How do you feel about these changes?
- Scientists reports that, since 1970 storms have increased, particularly in reference to intense tropical cyclone events.

What is your reaction?

*Place-based and Directional*

**Please Review the Following Facts About Local Climate Change**

Return to facilitator when finished

- Locally, sea levels are rising at a rate of 0.07 inches/year from 1912-2016 (NOAA)
- Local predictions for sea level rise at Seawall beach range from 0.1 to 0.8 inches/year (Oster, 2009)
- Rising sea levels cause increased flood risk at Bates Morse Mountain. The causeway floods every time there is a 9' tide.
  - With every 9' tide the causeway floods. As sea levels rise, tidal flooding moves farther inland.
  - If sea level rise in this area remains constant, Seawall beach will experience a 1' rise in less than 15 years.
    - With a 1' rise in sea level, the effects of a 9' tide would be equivalent to the effects of a 10' tide currently.
  - The rate at which the Gulf of Maine's water surface temperatures are increasing is faster than 99% of the world's oceans. (University of Maine, 2015).
- The physical structure of Seawall Beach is beginning to erode and change.
  - Sea level rise and storms are mainly responsible for the major structural and ecological changes occurring at beach systems
  - Storms cause drastic erosion over a short period of time (Wescott, 2013).
  - A 3.96°F increase in water surface temperature could increase hurricane wind strength by 5-10% and a resulting 25% increase in destructive power from waves and wind. (Kennebec Estuary Land Trust).
  - Since 2004, the rate of ocean surface warming in the Gulf of Maine has accelerated to 0.4 °F / year. This rate is faster than 99% of the world's oceans. (University of Maine, 2015).

**Please Review the Following Facts About Climate Change**

Return to facilitator when finished

- Sea level is rising at an average rate of 0.07 inches/year (1910-2010), however, this rate is increasing (IPCC, 2014).
- Studies show that in recent years, sea level is rising more rapidly than ever before. From 1993-2010 sea level rose at an average rate of 0.1 inches/year (IPCC, 2014)
- The rate of sea level rise will *very likely* exceed the observed average rates in future years (IPCC, 2014). → By 2100 scientists predict sea levels to rise between 8 and 20 inches.
- At least 70% of sandy beaches around the world are recessional due to rising sea levels and increased storm activity (Zhang, Douglas, & Leatherman, 2004).
- It is *virtually certain* that intense tropical cyclone activity has increased in the North Atlantic since 1970 (IPCC, 2014). Global increase in ocean surface temperature is a main contributor to these trends.
- Since 1901 ocean surface temperatures have increased at an average rate of 0.13 inches per decade (EPA)

**Understanding Communication Strategies and Climate Risk at Bates-Morse Mountain  
Survey Consent Form**

Avery Wolfe '18, Nicole Friedman '19, and Michaela Heffernan '18  
Bates College Department of Environmental Studies  
719-207-786-6289  
[nfriedm2@bates.edu](mailto:nfriedm2@bates.edu), [awolfe@bates.edu](mailto:awolfe@bates.edu), [mheffer2@bates.edu](mailto:mheffer2@bates.edu)

You are invited to take part in a research study of climate change risk and communication strategies at Bates-Morse Mountain.

**What the study is about:** This study is meant to explore the best modes of communicating about climate change

**What you will be asked to do:** You will be asked to take a written survey regarding your views on climate change, and feelings about this location. You will then be given information in either a written or spoken form, and finally you will be given a second set of written survey questions. The total process should take less than twenty minutes.

**Risks and benefits:** There are no anticipated risks to you if you participate in this study, beyond those encountered in everyday life.

There are no monetary benefits to this study, however your honest input is vital to our research and we greatly appreciate it.

**Taking part is voluntary:** Taking part in this study is completely voluntary. If you choose to be in the study you can withdraw at any time without consequences of any kind. You can choose to skip any question for any reason. Participating in this study does not mean that you are giving up any of your legal rights.

**Your answers will be confidential:** The records of this study will be kept private. Any report of this research that is made available to the public will not include your name or any other individual information by which you could be identified.

**If you have questions or want a copy or summary of the study results:** Contact the researchers at the email addresses or phone number above. You will be given a copy of this form to keep for your records. If you have any questions about whether you have been treated in an illegal or unethical way, contact the Colorado College Institutional Research Board chair, Amanda Udis-Kessler at 719-227-8177 or [audiskessler@coloradocollege.edu](mailto:audiskessler@coloradocollege.edu).

**Statement of Consent:** I have read the above information, and have received answers to any questions. I affirm that I am 18 years of age or older. I consent to take part in the research study of climate change communications

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Participant's Signature

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Date



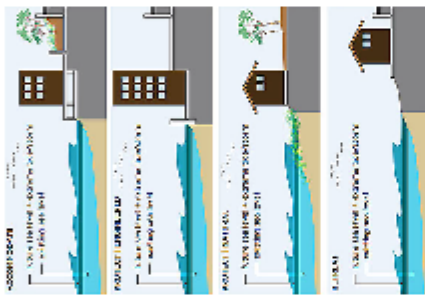


**Sea Level Rise at Bates Morse Mountain & Seawall Beach**



**WHAT CAN WE DO?**

There are ways to proactively prepare for and reduce the impacts of sea level rise.



**HOW DO WE DO IT?**

1. Stay informed! Seek out ways to learn more about the effect of sea level rise.
2. Talk about it with friends, family, your community, and your local government or state representatives!
3. Take individual actions to mitigate the effects of climate change: Plant a tree! Recycle and compost! Bike to work! Reduce electricity use!

**WHY DOES SEA LEVEL RISE MATTER?**

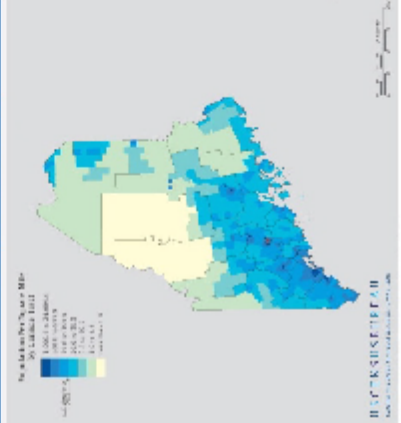
Rising sea levels pose risks to coastal communities, like Phippsburg.

The flooding that restricts access to Seawall Beach is just one example of the ways rising sea levels will impact people and the places they love.

23 of the 25 most densely populated cities in the U.S. are coastal.

Much of Maine's population lives along the coast.

**MAINE POPULATION DENSITY**



MAINE'S POPULATION DISTRIBUTION

## **SEA LEVEL RISE**

Over the past century, sea levels have risen at an average rate of 0.07 inches per year in the Gulf of Maine (NOAA, 2013).

Local predictions indicate accelerated rates between 0.1 and 0.8 inches per year this century (Oster, 2009).

At the mid-range of these scenarios, sea levels *could* rise by 1 foot within 50-40 years.

Have you experienced sea level rise over time here or elsewhere?



Seawall Beach and Bates Morse Mountain currently (Google Maps)

## **Sea Level Rise (cont'd)**

Sea level rise is attributed to effects of climate change and rising global temperatures (IPCC, 2014):

- warming waters expand, which increases ocean volume.

- melting glaciers and ice sheets produce greater volumes of ocean water.

- warmer ocean surface temperatures cause more severe and more frequent storm activities, including flooding from storm surges (Wescott, 2013).



1-foot sea level rise scenario (NOAA).

## **TIDES**

The causeway (along the access road) floods with every tide over 9 feet. In 2017 this happened, on average, about 13 times per month.

Flooding temporarily restricts access for researchers and visitors to Bates Morse Mountain and Seawall Beach.

Have you experienced the causeway flooding?



Flooding on the causeway

With a 1 foot increase in local sea levels, flooding would happen almost every day. A 9-foot tide would have the effects of a current 10-foot tide.

This pamphlet was created by Avery Wolfe as part of an Environmental Studies Capstone Project at Bates College.