

Impact of Place & Climate Change

December 14,
2022

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An Interactive Qualifying Project Report Submitted to the Faculty of Worcester Polytechnic Institute
In partial fulfillment of the requirements for the degree of Bachelor of Science

White Mountains Project Center, Lincoln, New Hampshire

Project Sponsor(s):

Climate Change
Working Group

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Abstract

The urgency for recognition and action on climate change is becoming ever more dire, and, with that, the need for clear and effective communication is ever more important. In collaboration with the Climate Communications Working Group, a consortium of scientific and outdoor organizations in the White Mountain region of New Hampshire and Maine, our team developed recommendations for communicating climate change by exploring how place attachment relates to views on climate change. Through interviews with locals, business owners, and members of environmental agencies, along with a survey of over 700 respondents, we gained an understanding of residents and visitors sense of place, points on attachment, and some ways to effectively discuss and convey climate related topics.

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Meet the Team

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Communicating Climate Change

With distrust of science becoming a common concern in 2022's social and political climate (Kennedy et al., 2022), what can be done to better connect members of scientific communities to those they hope to inform? To explore this idea, our project aimed to gain an understanding of how, on a local scale, sense of place and place identity relates to an individual's views on climate change. According to the handbook for Intergovernmental Panel on Climate Change (IPCC) authors from 2018, it is more effective to communicate impact and risk of climate change on a local scale, rather than a global one, so it was our goal to examine how one might do this, specifically in the White Mountain region of New Hampshire.

Climate Change

The term climate change was first used by Wallace Broecker in 1975 when he described the relationship between rising carbon dioxide levels and rising global temperatures. Broecker predicted that, "Once this happens, the exponential rise in the atmospheric carbon dioxide content will tend to become a significant factor and by early in the next century will have driven the mean planetary temperature beyond the limits experienced during the last 1000 years" (1975). Unfortunately, we may be well on our way to proving him right, (see figure 1, top right).

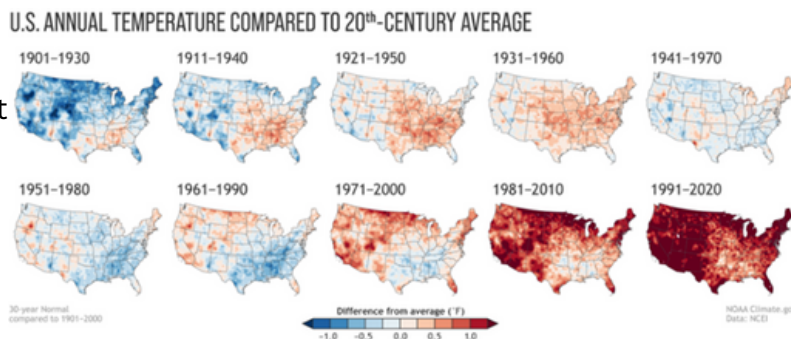


Figure 1 Maps showing the difference in temperature between 30-year time periods and the 20th century average. From the National Oceanic and Atmospheric Administration (2020)

According to the United Nations Intergovernmental Panel on Climate Change (IPCC), climate change is defined as “a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods” (United Nations & Intergovernmental Panel on Climate Change, 2022). Climate change is different from global warming. Global warming is one aspect of climate change, whereas climate change encompasses all changes to the atmosphere, such as changes in precipitation. Global warming only looks at the data of the long-term heating of the earth's surface (NASA Global Climate Change Center, 2022).

Impacts of Climate Change

The causes and impacts of climate change are numerous, from more intense heat waves to accelerated sea level rise (UN Climate Change Committee, 2021). The largest contributor to climate change is the emissions of greenhouse gases that trap heat in the atmosphere. These greenhouse gases include carbon dioxide, methane, nitrous oxide, and some fluorinated gases (US EPA, 2015). Carbon dioxide enters the atmosphere largely through the burning of fossil fuels, such as coal, natural gas, and oil, while methane is released in the production of fossil fuels, waste from livestock, and the decay of other organic waste.

Global-scale examples of environmental impacts of climate change include rising temperatures, rising sea levels, and changes in precipitation, but climate change can have a more nuanced effect at continental, regional, and local scales. Rising temperatures can increase the risk of typhoons (IPCC, 2022), rising sea levels can impact coastal ecosystems and worsen flooding (Ellison, 1994), and droughts can lengthen fire season and increase fire risk (Cazenave & Gonéri Le Cozannet, 2013; NASA Global Climate Change Center, 2022).



Figure 2 Visual Impacts of climate change (NASA, 2015)

Economic impacts often follow the environmental impacts. For example, infrastructure and agriculture are often at risk, especially in rural places, due to changes in climate. Infrastructure is what keeps an economy going forwards, allowing for shipments, transportation, communication, and much more. When unexpected or extreme weather events occur, it can damage means of transportation (Kintisch, 2008), utilities (Power Outages in Puerto Rico, 2022), and structures. When any of these begin to break down, it can have sweeping consequences, not just on an individual's wellbeing, but also an area's ability to conduct business.

There continue to be numerous efforts to mitigate climate change, including education, governmental policies, financial incentives, and social efforts. For the purposes of this research, we focus on one of the most effective methods for mitigating the impacts of climate change – communication (UN Environment Program, 2022).



Figure 3 Wind turbines in Maine to help reduce use of fossil fuels (Maine Climate Action, 2019)

Communication of Climate Change

Effective climate communication involves broadening public awareness and understanding of climate science and the impacts of climate change, as well as supporting people's beliefs that climate change is relevant to them, and that meaningful action is possible (Lujala, 2017). A key issue for improving climate communication is understanding how people receive climate information and messages. Preference for sources of news and information can vary between different generations and political leaning (Bergquist, 2022; Hamilton, 2021). Methods of distribution and presentation for communicating information are a wide range, and, in the digital age, changing constantly (Shearer, 2021). For example, it has been found that more than eight in ten Americans now get their news from digital devices (Elisa Shearer, 2021). Each method, however, has its own depth of information, barriers of entry, influence, and, of course, bias. A table summary can be found in the Supp. Mats, App. E.

When speaking of barriers of entry, it often comes down to cost and qualifications. For example, as a consumer, print news costs money to read, and, as a means to distribute information, it may be difficult for someone not already involved in the print industry to produce. On the other hand, something like social media is free to join and easy to post publicly.

High budget, widely distributed films, like you may see in a movie theater, will not only cost money to see, but also have high production costs associated. Meanwhile, public school is free for students to attend in the United States (Congressional Research Service, 2019), but an individual's ability to spread information within a school largely depends on how involved they are in the school system. Someone like a teacher may have a more direct influence on students, while curriculum and other regulations also impact what is taught.

Different modes of communication wield different abilities to influence consumer, what kind of appeal does each of these methods have, and how does that impact its consumers? With a media like film, you have examples such as *Before the Flood*, a documentary hosted by Leonardo DiCaprio. This film raised awareness of climate change around the world. Using Google analytics, Aleksandrina Mavrodieva found a strong correlation between searches for this film and the term "climate change" shortly after this film played (2019). The statistics are shown in figure 4. Just through one film airing there is a significant jump in overall awareness of the issue. It is important to note, however, that, if not specific, a call to action may leave viewers confused on what to actually do (Bieneck-Tobasco, 2019).



Figure 4 Graph that shows the correlation between the google analytics of the film "Before the Flood" and the term "climate change" (Mavrodieva, 2019)

While films may appeal to and influence an audience through emotion, public schools do so more from a place of development. In the US, primary education is compulsory (State Education Practices, 2017), and often where many people are first exposed to the idea of climate change. Increasing children's knowledge has been found to be an effective way of spreading ideas outside of school, such as with recycling (Buil et al., 2019).

Another institution with influence is that of print media, which appeals largely through its recognition as a traditional source of news (Twenge, Martin, & Spitzberg, 2019). Digital media—such as social media or online versions of print media—appeals not only through its ease of access, but also its speed of distribution. It doesn't come without its drawbacks, however.

Echo chambers are commonly found in communication methods such as social media. Echo chambers are when a person's views are constantly reinforced with truly little acknowledgment of other viewpoints. As an example, a person that likes posts about football on Facebook is more likely to see posts about football on their future feed. People are already reluctant to change their viewpoints, and social media will continue to bolster their point of view (Pearce, 2018). However, there are possible benefits found in echo chambers as well. Social media allows for a person that has no formal experience in journalism to share their experiences and thoughts on a matter, and often times it can grow to a much larger audience. Echo chambers are only one kind of bias, however.

Every communication channel comes with bias, but it is important to address the viewpoint of those communicating.

Depending on the type of news organization, the framing or focus of an issue or news story may be different.

Jeremiah Bohr describes “conservative” news outlets as more likely to talk about corporation's role in mitigating climate change, far more than independent and liberal news outlets (2020; Mitchell, 2014). Print news is also susceptible to bias found within an organization (Sanders, 2019).

This issue of framing is present in all media, in the form of both disinformation and misinformation. Disinformation is when true statements are selectively framed in a way to support a certain viewpoint, while misinformation is when false information is used (Treen, 2019). Depending on the driving message of a particular film, article, post, or lecture, one or both methods can be used to sway the observer. This becomes particularly hard to combat in mediums such as social media, with its ease of access and ability to spread information quickly and widely (Mavrodieva, 2019). Bias is also possible through the omission or lack of information. In public schools, only 75% of teachers devote time to teaching about climate change, however 30% of these teachers believe that climate change is caused by both human and non-human factors and give equal time to each topic. This disagreed with the overwhelming consensus among scientists that human activity is the primary and dominant cause of climate change (Mitchel, 2014; Papadimitriou, 2004). Bias even exists within the public school system due to the lack of common core structure. Depending on the schooling a person receives their view on climate change may be drastically different from another person.

Impact of Place on Climate Change Behavior

Place and Effective Climate Change Communication

Place itself can play a vital role in shaping a person's view of climate change and climate related issues. According to Prof. Päivi Lujala, the largest influence on an individual's perception of climate related risk is whether that individual has personally had a negative climate related experience (2017). Prof. Lujala also found that, by comparison, simply living in a vulnerable or disaster-prone area, without that personal experience, had a weaker correlation to concern about climate change (2017). Dismissing the possibility of solely relying on these firsthand experiences to foster concern, what can be done?

According to Prof. Lujala, increasing awareness of what makes a place vulnerable can reduce uncertainty and create more investment in the outcomes of climate change (2017). A handbook for Intergovernmental Panel on Climate Change (IPCC) authors, when drafting information on climate change, stresses the importance of connecting with what matters to the target audience and points of local interest. Values and political views have been found to have a larger influence on climate change attitudes than scientific knowledge or education level (Hamilton et al., 2018). Put simply, it helps to make climate change issues hit close to home. To do that, however, communicators need to develop an understanding of a community's sense of home. Here, the concepts of sense of place and place attachment can offer guidance.

What is Sense of Place / Place Attachment

Sense of place and place attachment are two sometimes blurred concepts that describe the collection of factors that connect an individual to a place. In some interpretations, sense of place can be divided into two concepts; place attachment and place meaning (Kudryavtsev et al., 2012). Place attachment deals with bonds to a location, while place meaning operates in the space of symbolic meanings ascribed to places (2012). Place attachment can be about locations, experiences, or even a sort of "ambience", or "spirit of place" (Belz, 2013). For the purposes of this research, we focus on the regions of New Hampshire and Maine in which the White Mountains are located.

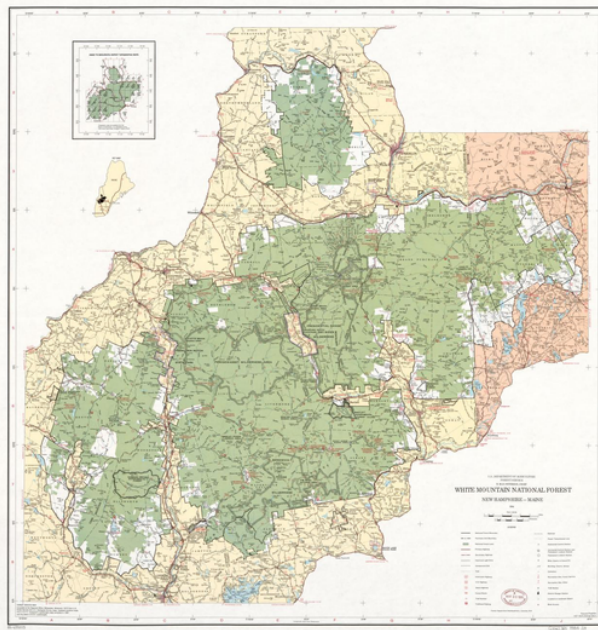


Figure 5 Map of the White Mountain National Forest (New Hampshire & Maine) From the Library of Congress

Unique issues in New Hampshire & Maine

The White Mountain region is an area that spreads through two different states, Maine and New Hampshire. This region is made up of mountain ridges and valleys, with a roughly estimated size of 3,500 square miles, and a population of ~30,000 people (State of NH Division of Travel and Tourism Development, 2020). The White Mountains, (the Whites), are part of the significantly larger region of the Appalachian Mountains which spreads from Georgia to North-east Canada (Library of Congress, 2008).

Local Impacts of Climate Change

The impacts of climate change on New Hampshire and Maine are numerous; and impacts many forms of life. It has been predicted and observed that the average annual temperatures would increase which would lead to more days above 90 degrees F (Lemcke-Stampone, Wake, & Burakowski, 2022). Due to climate change, the natural ecosystems have been shifting at an unprecedented rate where natural adaptation cannot occur and, the wildlife has been suffering due to the impact of the change on the ecosystems (New Hampshire Fish and Game, 2022).



Figure 6 The Northern Presidentials in the Whites
(Liam Piper, 2021)

A non-typical example of the impacts of climate change facing New Hampshire and Maine is climate migration. Climate migration is occurring throughout the United States, where people from one area move to an area that is less impacted by climate change {at least in the short-term}. People are also migrating to places not for environmental reasons, but for like-mindedness—to a place where more people share their views on climate change and support the same policy change that they want to be implemented (Hamilton, 2010). Another example of the effects of climate change in New Hampshire is what people and businesses are willing to do to help prevent climate change, from better recycling habits to producing less waste (New Hampshire Climate Change Policy Task Force, 2020).

The term climate zone refers to an area with a specific climate and general weather patterns throughout the years (US EPA, 2020). Changing climate zones are moving south every year compared to 1990 (2020). The average summer heat index in New Hampshire and Maine is expected to go higher each year, affecting the quality of life for residents and visitors (Maine Climate Conference, 2016).

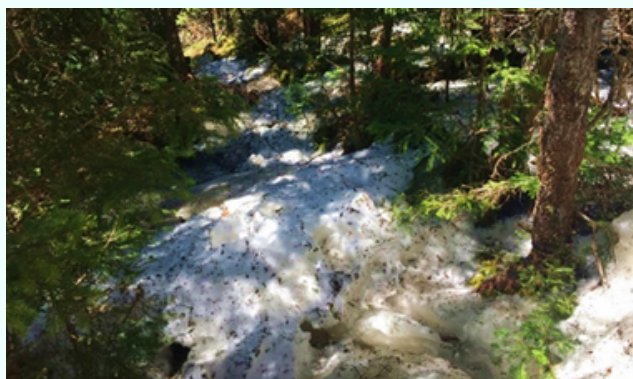


Figure 7 Early Snowmelt in the Whites (Liam Piper, 2022)

Additionally, climate change has led to increased flooding and wetter springs which in turn, delays planting dates for farmers, and can destroy infrastructures in the area (i.e., roads, communications, electricity grids, etc.). Droughts are also expected to be worse during the summer and the fall as time goes on (US EPA, 2020). These environmental impacts inevitably lead to economic impacts in the region.

Local Economic Impact

The impacts economically due to climate change are numerous. The sources of income in the area are plentiful, from timber, maple syrup, fishing, farming, skiing, and many more (Hamilton, 2003). Most professions in the area are directly linked to the natural resources and rely almost entirely on the continuation and persistence of the historical climate patterns. Change in economic factors over time has been gradual but noticeable; while a small difference now, ski seasons have gotten shorter and maple syrup production has been decreasing (Environmental Defense Fund, 1997).



Figure 8 Farmland near Bethel, Maine (Liam Piper, 2021)

Given the breadth of environmental and economic impacts of climate change in the White Mountain region, local organizations have become more involved. Through collaboration, The Hubbard Brook Research Foundation, Appalachian Mountain Club, and other organizations formed a Climate Communications Working Group (CCWG) to work together to improve public-facing communication about climate change in the White Mountains.

The Appalachian Mountain Club [AMC] is a non-profit organization, created in 1876, with the goal to protect and educate about the natural world. The AMC comprises eleven chapters spanning from the Northeast to the Mid-Atlantic. It has ~275,000 members, advocates, and supporters involved with a mix of outdoor recreation, mostly backpacking and hiking.

The AMC receives funding through member fees (AMC, 2022) as well as grants, contracts, and donations.

Established in 1993, the Hubbard Brook Research Foundation (HBRF) supports a long-term ecosystem study in the 7,800-acre Hubbard Brook Experimental Forest near Woodstock, NH. The long-term study has been ongoing continuously since 1963. The funding for HBRF is through grants and donations (HBRF, 2022).

Some of the deliverables of the project were recommendations for the Climate Communications Working Group, specifically how to better understand place attachment and how that impacts a person's view of climate change in the White Mountain region.

Methodology

The goal of this project was to study White Mountain Area residents and visitors' sense of place and connection to the White Mountain National Forest to assist the climate change working group in developing a more targeted communication strategy. To achieve this goal, we developed four objectives. We discuss each objective in more detail below.

Objective 1: Define Place Attachment to Support the Climate Communications Working Group's Strategy

In order to accomplish this objective, first, we explored place attachment; what that means and how it applies to people and gained some insight into the Climate Communications Working Group, which our sponsors, the Appalachian Mountain Club (AMC) and the Hubbard Brook Research Foundation and are a part of.

To properly communicate this idea of place attachment to project stakeholders our group needed to identify the clearest definition used by experts in the field. For this definition, we looked to Melissa Malouf Belz, a professor at Worcester Polytechnic Institute. She has written about place attachment and describes it as a person's character connected to a certain location (Belz, 2013). To help further our understanding we found additional information about place attachment through other experts on the topic. Having a clear definition of place attachment was critical not only so we could effectively communicate our project to others.

Since the aim of our project was to use our data to develop strategic communication recommendations for the Climate Communications Working Group, (CCWG), we first needed to know how the CCWG currently distributes information. It's not just how they communicate that's important, however, but who they are communicating to, and how those methods differ. In order to understand how the CCWG develops and distributes information, we analyzed climate change messaging of the Working Group as a whole and of the Hubbard Brook Research Foundation and the Appalachian Mountain Club (AMC).

The goal of the Hubbard Brook Research Foundation is to bridge the gap among the different fields. Communicating climate change information to many different audiences can be difficult, but they accomplish this through policy briefings and events, such as roundtables and town-halls. We have reviewed recordings, notes, and other materials from these events, and, through content analysis, isolate the messaging that is currently being used to educate the public.

The Appalachian Mountain Club is larger geographically and spans throughout New-England and Mid-Atlantic regions of the United States. With over 250,000 members, the ability to communicate with a massive audience is done through the usage of their email's aliases and newsletters (Appalachian Mountain Club, 2022). To develop an understanding of how AMC communicates during workshops, we participated in a Community Science Outreach strategy workshop. This, in conjunction with analyzing written materials and interviewing employees, gave us an understanding of the communication efforts of the AMC.



*Figure 9 AMC Pinkham Notch Visitor Center
(Liam Piper, 2020)*

Objective 2: Examine Communication Strategies Used by Other Nonprofit / Government Organizations

To assess climate change communication strategies more broadly, we explored the communication methods of other organizations and government agencies involved in climate change research and education. Specifically, we explored the communication strategies used by the Mount Washington Observatory and the White Mountain National Forest. Each organization has different target audiences, such as tourists, educators and/or children growing up in the area. Consequently, their communication methods differed based on the location -- whether in classrooms, on posters, or with museum exhibits. By exploring the methods of each of these organizations, we gained a fuller understanding of how climate information is being communicated in the White Mountain region.

We began by researching the Mount Washington Observatory (MWObs), a private, non-profit, and member-supported institution with a mission of helping advance the understanding of the natural systems that create and impact Earth's weather and climate (MWObs, 2022). The MWObs works toward this end by maintaining a weather station on the summit of Mount Washington [NH] where weather and climate research is performed alongside innovative science education programs. To better understand the communication strategy used by the Observatory, we interviewed Brian Fitzgerald, Director of Education at the MWObs (See Appendix C for interview questions). The reason for this is for the direct insight and background we could otherwise only speculate about by analyzing already existing messaging.

By going directly to the source, we hoped to better understand their philosophy (Mount Washington Observatory, 2022).



Figure 10 Mount Washington Observatory (Liam Piper, 2020)

Next, we researched the United States Forest Service in New Hampshire, which is the main government agency charged with managing the WMNF in the White Mountain area. As it is the job of the US Forest service to maintain the National Forest, we interviewed Pemigewasset district Backcountry Wilderness Manager Mike Benson as to how the organization communicates to the public about climate change. Unlike the more locally focused Mount Washington Observatory and New Hampshire State Parks Department, the United States Forest Service, as it is a federal government agency, has a different scope. In addition to interviews, we also performed content analysis on distributed materials such as pamphlets to aid in our understanding (Department of Agriculture, National Forest Service, White Mountain National Forest, 2022).

Objective 3: Gain Understanding of the Scope of Resident and Visitor Place Attachment in the White Mountain Region

To gain an understanding of what contributes to place attachment in the White Mountains area of New Hampshire, we used two methods of data collection: surveys and interviews. In each method, we aimed to collect information from residents, local businesspeople, and visitors on what about the area connects with them, but also their opinions on climate related topics.

We distributed a survey about a person's connection to the environment, if they notice changes to the local climate, and their stances on climate related issues (see Survey Appendix B, Supp. Mats). We used an online survey tool, Qualtrics, to develop our survey.

We spread this survey online and in person. Specifically, with assistance from Georgia Murray we have distributed the survey through an Appalachian Mountain Club newsletter. Recognizing that AMC members have already shown an inclination to support climate change policies, simply by way of their membership, we analyzed the data from the AMC list separately from our other sources, prior to aggregating it. That, however, was not the only method of distributing the survey. We used other methods such as distributing a QR code to local businesses to display and distributing a QR code and link for email use to local connections to further distribute to local groups and harder to reach communities.

In order to further build our data, we interviewed 15 business owners and managers in the White Mountain region. We largely focused on businesses that were stakeholders in terms of aspects of our project. This includes those directly dependent on factors recognized to be impacted by climate, such as ski shops, and those with stake in sense of place, such as those heavily involved in the local community. When visiting businesses, we had impromptu conversation with the owners and managers, which acted as informal interviews.

Lastly, we table-sat on two occasions. The first was on Saturday, November 12th at the AMC Highland Center to help distribute our survey and other AMC related research projects. The table sitting was not ultra-productive, as most people were not interested in talking about climate change. But it was a useful tool as it provided more key insight. It also allowed for us to see where else it would be useful to help distribute our QR code in more permanent locations. Another time we table sat at the Eastern Snow and Avalanche Workshop, on November 19th, in order to help get to our audience of outdoorspeople. This was productive as we were able to communicate both recreationalists and those more involved in the scientific community.



Figure 11 Liam Bry table sitting at the AMC Highland Center (Liam Piper, 2022)

To aid in the pursuit of honest responses and responses from those less likely to go out of their way to share their opinion, we used incentives. The incentives we used were snow scopes used to measure the depth of snow. Incentives for taking surveys have been found not only increase response rates, but also the amount of time spent answering questions (Khanal et al., 2018). And, while it has not been found that offering incentives alone increases the likelihood of answering outside of the status quo, which helps to gain a more accurate picture (2018), increasing the reach of the survey outside of those already interested in the topic gave us a more well-rounded view on the matter.

Lastly, we interviewed five New Hampshire residents. We used interviews to collect personal accounts. Interviews allowed for a more controlled environment so that we can ask for specific responses to questions regarding their views on climate change. Through this process, we gained qualitative data that could then be coded to find trends in the responses. The interview questions are listed in appendix F.

In all data collection instruments, the wording of questions and statements is important to avoid offending respondents, confusing respondents, or causing bias. To aid in this, the questions used in telephone surveys examined in papers done in 2013 and 2018 by Lawrence C. Hamilton and Mary D. Stampone were used as references. These surveys done by the University of New Hampshire also had the goal of gauging public opinion related to climate change. The questions asked during this study were clear and used neutral wording, which was helpful for limiting bias. Appendix B for the survey, and Appendix C for interviews.

Objective 4: Analyze the Data and Develop Recommendations for CCWG

Shortly after the surveying began, our analysis followed. Early on, our analysis mostly consisted of looking for preliminary trends and using built-in tools in Qualtrics, but as more data was collected, statistical analysis consisted of using programs such as MATLAB and/or Excel. Qualtrics was helpful for simple visuals, such as graphs and charts directly related to the responses. As for deeper analysis, an important goal for our team was finding correlations between aspects such as demographics or location in relation to responses. For example, if we found that local residents or frequent hikers respond to certain subject matter more than others, and/or responded to that material more than their peers, that is usable data to identify what would be effective messaging for that group. Other aspects for that we considered was data to support what may make current communication methods more or less effective, such as a disconnect between the perceived values of the climate working groups audience versus the reality.

Analyzing the interview data was not so simple, as people are hard to put into categories, but with the commonality of questions such as sense of place questions, we identified general trends so we could compare the interviews to each other. Analyzing the survey data was done using multiple methods, such as filtering data into responses from different groups, and then comparing these groups to both other, and overall, groups. Along with the basic pie charts, bar graphs were also used to help indicate trends found within our survey. An example can be seen in Fig. 12 below.

Using the results of the surveys and interviews discussed in objectives 1-3 we developed recommendations for the Climate Communications Working Group. These recommendations explain how the Working Group can incorporate the place attachment of visitors and residents in the White Mountain region of New Hampshire into their communication strategy.

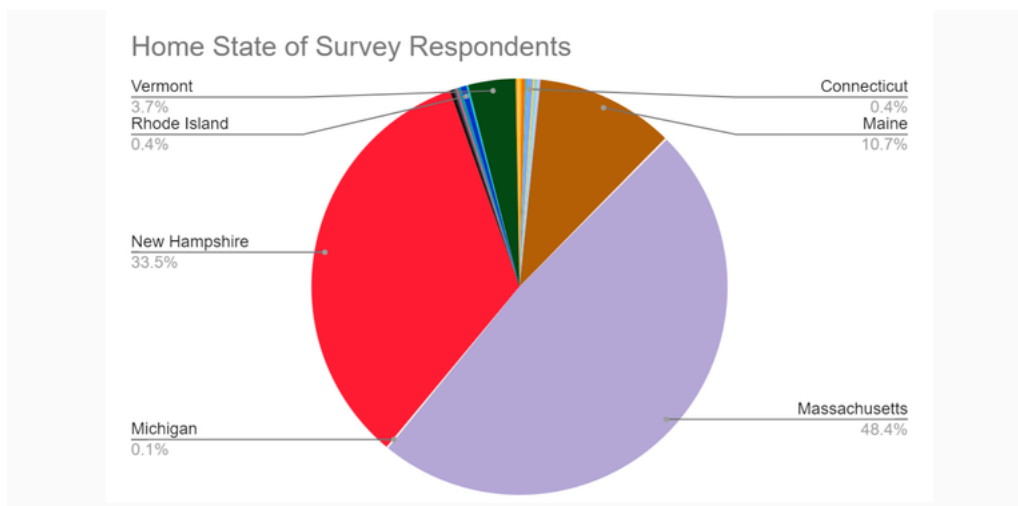


Figure 12 Breakdown of survey respondents by state

Findings & Recommendations

In order to develop recommendations for communicating climate information we learned how residents and visitors of the White Mountain region perceive climate change. These findings reflect the aggregate of our quantitative and qualitative data as well as our interview data analysis. At the conclusion of our research, we collected 774 survey respondents and 18 resident and business interviews. Our survey response data can be found in the supplemental materials, appendices I and J, and the coded interview data can be found in appendices G and H.

Perceptions of Climate change

The majority of those surveyed believe that climate change is occurring. It was found that 93% of individuals surveyed that have lived in the White Mountain region for any period of time believe that climate change is occurring. This information gives our group an instant understanding of the audience that our group surveyed and how it may differ from the statewide perception. In a Yale study it was estimated that 71% of people that live in New Hampshire believe that climate change is occurring. This trend is similar throughout the counties within the White Mountain region: Coos county, with 71%; Grafton County with 74%; Carroll County with 72%; and Oxford County, with 69% (Yale Study, 2021). At the same time, 81% of those same respondents from the Yale study think that climate change is a major danger as in a threat to human life. When comparing this to the Yale study estimates that 63% of New Hampshire believe that global warming will harm people in the United States. In our research similar beliefs were found, but there were others that were less confident in their stance.

Many survey respondents were more unsure of how climate change affects areas other than the one that they live in. Only 4% of people were unsure of how much climate change affects the Northeast. These values range greatly with the Southwest with 12% of respondents being uncertain all the way to Hawaii and Puerto Rico with 30%. This goes to show that people are much more likely to understand and care about an issue if it relates to where they are from or are familiar with the ecosystem and local factors.

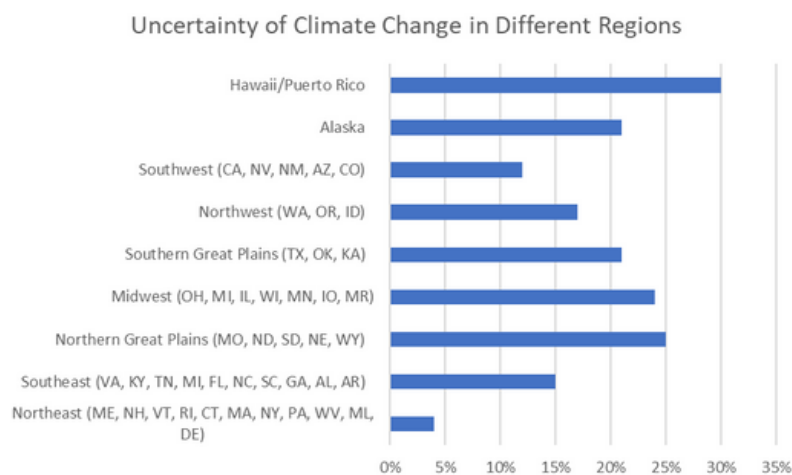


Figure 13 Breakdown of uncertainty of climate change impacts in regions across the United States (Out of 689 Respondents)

In our informal interviews, some said they were unsure of climate change, but although they were unsure about climate change as a concept, some still acknowledged environmental changes they had personally observed. This coincides with some of our survey responses. We found that even some of those that had reported they were unsure if climate change was happening, when asked if they had personally observed the winter activity season to have changed, did give answers in the categories of both that it arrives later, and that it is overall shorter. This can also be seen in questions about how, if at all, winters have been impacted.

Some of those who answered unsure in questions directly asking about whether climate change is happening did go on to say that they believed recent winter had changed. An important thing to note, however, is that out of over 700 responses, these data points are based on the twenty respondents who reported they were unsure about the statement that climate change is happening, and only twelve more reported they did not agree with the statement. While not statistically significant, this data offers hope in that **there seem to be more people unsure of climate change than those that oppose it.** United States Forest Service (USFS) Backwoods Wilderness Manager, Mike Benson says that, of the many people they might see on a given day, few of them are actively problematic when approached about a lack of knowledge, it's often just that those types of experiences are much more memorable (M. Benson, personal communication, November 4, 2022).

As mentioned before, we need to share some constraints of our data and its generalizability. For one, it is important to address the type of respondents that our group was able to reach through the survey. This may account for inconsistencies between our data and other studies on similar topics, such as the previously mentioned heightened rate of climate change belief, due to the methods of survey distribution done up to that point. The largest distribution of our survey was done through an Appalachian Mountain Club (AMC), e-alert newsletter, more specifically the Conservation Action Network email group. The individuals that take part in this group are actively choosing to receive emails and notifications from the AMC on conservation issues which means that they are more likely to hold the similar views of conservation and preservation of recreational areas.

The demographic of those surveyed differ from statistics from the demographics of the region. Out of our 774 respondents, 91.3% had a bachelor's degree or higher, including 120 individuals with doctorates and 273 with master's degrees. This is well above what the United States Census reports for Coos County New Hampshire, at 19.7% with a bachelors or above (U.S. Census Bureau, 2020), Carroll County New Hampshire, at 37.0% with a bachelors or above (2020), Grafton County New Hampshire, at 46.0% with a bachelors or above (2020), or even New Hampshire as a whole, at 40.2% with a bachelors or above (2020). Looking outside of New Hampshire, at the state from which the most responses were received, Massachusetts, it is also well below our 91.29% number, at 44.5% with a bachelor's degree or higher (2020).

Speaking of Massachusetts, 48.4% of all respondents reported their home state as Massachusetts, followed by 33.5% New Hampshire, and 10.7% Maine. This can be seen in Figure 12 on page 12. While this may be problematic to a project interested in understanding attachment in a region based largely in New Hampshire, it is important to note the degree to which out of state visitors contribute to the White Mountains use. Between Fall 2020 and Summer 2021, the New Hampshire Division of Travel & Tourism Development reports that 12.8 million people visited New Hampshire, compared to New Hampshire's population of 1.39 million (U.S. Census Bureau, 2020).

Therefore, given out of state visitation rate, we strove to assess both visitor and resident relationships with the region. Further breakdown and survey data can be found in the supplemental materials booklet, appendix J, while wording of questions can be found in appendix I. Information can still be extracted from the survey results, but it is important to be aware of these caveats if the data is to be used in further analysis. Because our data skewed toward out-of-state residents whose demographic characteristics were not aligned with some of those of local communities, we interviewed local residents and business owners to contextualize our results in terms of local perspectives.

Communication

Differing Communication Within Age Groups

The way a person gets their news information varies greatly from one individual to another. **However, we observed one common trend through age groups of respondents: the way in which information is consumed is changing.** In media such as television and print news, there are clear downward trends among the age groups. As shown in Figure 14, 53.4% of the 65+ aged respondents use print media as a news source. Conversely, only 20% of 18–21-year-olds use print news. **Media consumption is trending towards online media.** Online usage is one that is understandably greater because the younger generations have grown up with the usage of the internet and mobile devices are prevalent allowing this instant access.

Ninety percent of respondents between 18–21 and 86.7% between 22–28 use online sources for their news information.

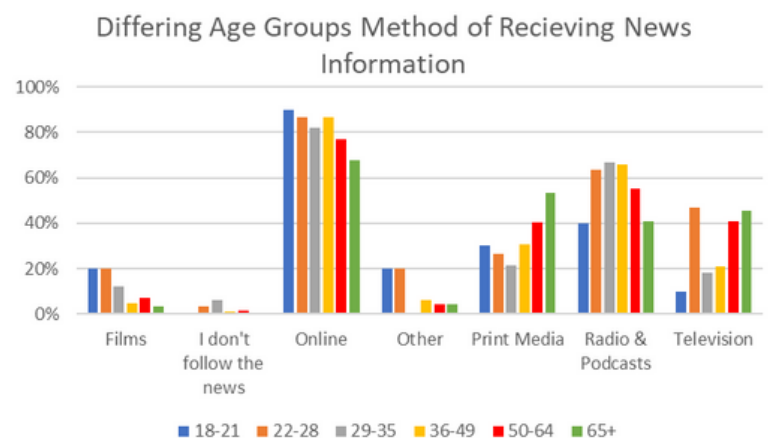


Figure 14 Distribution of how different age groups receive their news information (Out of 695 respondents).

When our group dove deeper into the different types of online news there are specific areas that can be targeted for more efficient communication. The downward trend for online newspapers has not been as drastic as for physical copies. An important area of this information is the emergence of social media as a large source of information, especially for a younger audience. *We recommend that the Climate Change Working Group use emerging methods of information distribution such as social media, to reach younger audiences.* When sitting in on a Community Snow Observations workshop, we noted the discussion of making use of a Tik Tok account. *We also recommend this option as from our personal experience we feel like this would be a very effective method of communication to younger generations.* This could be a good opportunity to test an outreach campaign, such as for climate information.

For example, posting things such as timelapses of snowfall could be effective to further both causes, making people aware of the amount of snow mountains may be getting, and encouraging others to join the group of citizen scientists taking measurements. This kind of active outreach may resonate well with younger demographics and engage them with the topic.

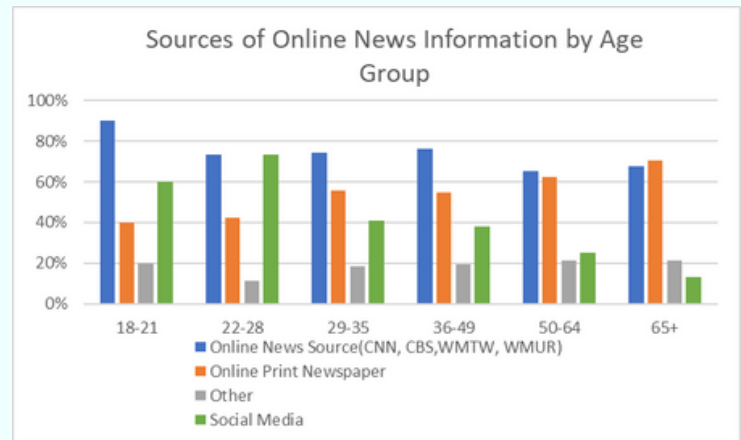


Figure 15 Distribution of how different age groups use various online sources for news information (out of 514 respondents).

Active and Passive Means of Communication

Most organizations in the White Mountain Region communicate information about climate change in a passive manner. For example, AMC uses communication methods such as their email lists, AMC-lead scientific journals, AMC website, outdoor workshops/trainings, information boards, posters and educational programming and a climate change curriculum. All of these are passive forms of communication; reliant on first being approached by someone interested in being involved, or learning.

We can also see passive forms of communication at the Mount Washington Observatory (MWObs). Brian Fitzgerald, Education Director at the MWObs, described to us the types of education programs that are offered. Many MWObs programs, such as speaking at schools, require interested parties to seek out the program (B. Fitzgerald, personal communication, October 25, 2022). This is useful for those who want to deepen their knowledge and know of the MWObs programs, but it is less effective in communicating with those who may not know where to look for information or are not looking to learn more.

On the other hand, the Hubbard Brook Research Foundation (HBRF), approaches climate change-based communication differently from how the AMC and MWObs conduct their communication. For example, the main methods of communication include roundtable and town-hall events, policy-relevant briefings and bulletins, social and mainstream media outreach, and communication training for students and early-career researchers. However, with the HBRF, it is important to note how their reach focuses more within scientific communities. This makes sense for the organization, but not for specifically climate change outreach to a broader audience. One organization with a connection to a broader audience would be New Hampshire Fish and Game. New Hampshire Fish and Game can communicate about climate change

oftentimes in a classroom setting, which is effective at getting the next generation active and caring about the issues of climate change. It can act as an aid to the curriculum already offered through the public school, but at the same time limits the information to a specific audience (NH Fish and Game, personal communication, October 28, 2022). Other than that, there is not a large amount of outside communication about climate other than webinars with guest speakers talking about various issues. Although there may be more mainstream interaction, this is another example of passive communication found in the Whites. From this analysis, *we recommend more active outreach that is able to reach a broader audience, beyond those that likely already agree with the organization's point of view.*

Importance and Effectiveness of Casual Conversation

Communicating what is “wrong”, without regard or attempt to connect with who is being communicated to, is often ineffective. An example Brendon Leonardi, the Education Director from the HBEF, gave was with a man littering near a lake. Upon witnessing this, the Hubbard Brook employee became frustrated and yelled at the man from across the lake ruining both of their experiences. However, it did not stop the littering, and it didn’t effectively communicate why he shouldn’t be littering to begin with (B. Leonardi, personal communication, November 16, 2022). Another thing of note, brought up by the educator, was how helpful it can be to meet on neutral terms.

When speaking to Forest Service Backcountry Manager Mike Benson, he said that most of their experience in education comes from random encounters with people on trails. **Using authority such as a uniform can be used as a tool to police areas but not as a tool to spread climate change information.** The manager said that when they’re seen in uniform it often seems like they have some authority, which can be good, but a barrier can form because some view it as a form of policing (M. Benson, personal communication, November 4, 2022). Because of this, managers have found that the best conversations occur when hikers initiate the conversation, rather than when a person of authority initiates it.

Often times this would occur when doing work on a trail, when someone approaches them and asks what they're working on. **This kind of neutral start, and the more casual conversation that followed, is a productive way to communicate ideas and information without alienating those you aim to communicate with.** It is important to note that although in this situation the intended audience approaches the educator, the educator actively placed themselves, for lack of a better phrase, in the path of their intended audience, so that no one needs to go out of their way to start a conversation. **Meeting people where they already are, lowers the amount of effort people need to put in to be informed, and therefore people of a wider range of interest can be reached.** A second important thing to note is that, in this more casual situation, the meeting still begins on a sort of neutral ground, which can put people at ease and make it feel less like someone's being talked down to. *We recommend the AMC and HBEF have staff trained for casual conversations at places such as trailheads to increase opportunities for discussion.*

Additional evidence of the effectiveness of meeting on neutral ground was offered by a trusted local and upstanding member in the area. He spoke to us about a class he once taught on climate change, and how his willingness to first acknowledge the benefits and strengths of oil, before explaining the negatives of relying on it as an energy source, allowed him to better connect with those that might otherwise feel attacked or condescended (Interviewee A, personal communication, November 16, 2022). This idea can also be seen in his experience interacting with those in religious communities. In our correspondence, the trusted local described how, in order to connect with people, it is important to remember you have to be willing to listen to and understand who you're talking to, and assumptions usually don't help. He also believes that regardless of to what degree he's engaged, reading the bible is helpful both for background and for having a point of connection. *We recommend that the CCWG uses casual discussions for more effective communication of climate change topics this is rather effective across the board in terms of political beliefs, age and location.* Points of connection such as this were of interest to us from early in our research, as, regardless of the exact method through which you are communicating, it does well to guide the path of conversation.

Points of Connection

When speaking to locals and business owners, our group found that **when communicating about climate change, it is helpful to communicate using climate change in terms of something that is important to the target audience.** There were a wide range of topics that came up in conversation, but there were also some recurring topics. All points of connection seemed related to aspects of what we have come to understand as this area's sense of place. We will explore those in the sections that follow.

Hobbies and Nature

During a casual interview with a local business owner, we talked about his love of skiing. He described how if a person really wanted him to care about the issues of climate change, they should talk about how it will impact his time for skiing. His love for it was so important to him that he said he doesn't care where he lays his head to sleep so long as he is still able to ski (Interviewee B, personal communication, October 24, 2022). The topic of hobbies and outdoor activities such as this came up often in our interviews, and often even aided us in speaking around climate related questions. Coded interview data can be found in the supplemental materials, appendices G and H. An interesting thing at the core of these conversations, though, is **that people have an underlying attachment to the locations where they engage in their activities.** We found that people care or would care about climate change if it directly effects their hobbies and free time activities. *We recommend using the important and influential relationship where someone will care about climate change if it directly effects and influences their ability to conduct their personal hobbies.*

It is often said that the best way to make someone care is to explain how it threatens their own backyard, but we have found that may not always be the case. In our survey, we asked participants to rank, 1 through 6, which they would be most concerned about if threatened by climate change. The list of options included their house, their neighborhood, their town/city, New Hampshire, their favorite place in the White Mountains, and the White Mountains as a whole. The rankings of the "house" option among those of varying residential status can be seen below.

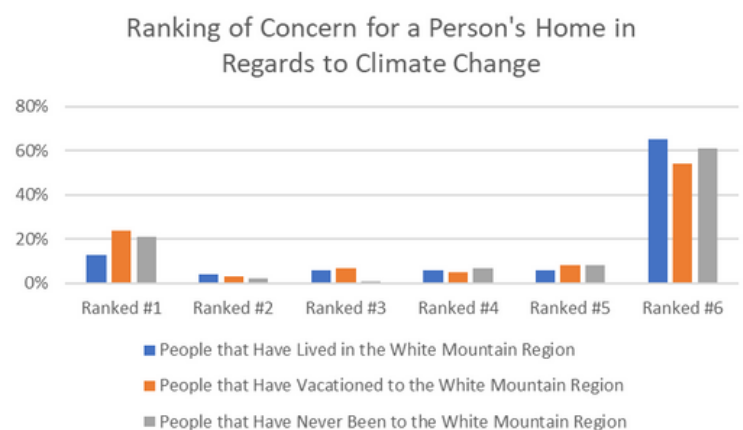


Figure 16 Ranking of a person's house as an area of concern in regard to climate change. The six options given were your neighborhood, your town/city, New Hampshire, the White Mountains as a whole, your favorite place in the White Mountains, and your house (out of 577 responses).

Among those who reported themselves to have lived in the White Mountains, 13% ranked their house as their number one concern. Compared to those that said they had vacationed in the White Mountains and those that stated they had not stayed in the White Mountains, 25% and 24% ranked home first respectively, almost double that of residents of the White Mountain area. It has often been thought that appealing to a person's own home may create more passion for climate change, but it is shown that this may not be the case. This was not the only instance of finding the Whites held closely, whether by locals or visitors.

Two mountain guides, who have worked in the White Mountains, reflected their observations that visitors quickly grow attached to the White Mountains. One mountain guide described a tourist's love for the mountain growing in front of them. Throughout the course of the hike mountain guide A and mountain guide B recognized clear changes in the visitor's opinion of the White Mountains (Interviewees C and D, personal communication, November 11, 2022).

Relevant Local Concerns

When interviewing businesses within the White Mountain region, nine interviewees talked about the impacts of larger resorts and their impacts on the community. Specifically, within the town of Lincoln, there are two major hotels and resorts being built, but in addition to that, there are also many large houses being built. **These projects will cause an influx of both tourists and new residents to the area, which will put pressure on infrastructure that is already running thin during the peak months of the tourist season.**

This is the place attachment that makes people care for the areas that surround them. The White Mountains are often seen as a unifying symbol for the region that people are proud of. It's a good place to have a breath of the wild, for people of a variety of skill levels. **The kind of broad appeal landmarks like this have makes for an excellent point of connection for locals and visitors alike.**



Figure 17 View of Mt Adams from Wamsutta Trail (Liam Piper, 2022)

Business owners in Lincoln, NH have vocalized their concern over infrastructure such as the transfer station, which handles trash and recycling, and the sewage system, which is an older system not built for a town the size of what Lincoln has since grown to (Interviewee E, personal communication, November 8, 2022). Many community members have expressed that they'd like the town expand at a slower pace, focusing less on tourists, and more on supporting local residents. On one hand, it is important to note the benefits that these tourists bring to the region by patronizing local businesses.

On the other hand, there are still reasons for some business owners and residents to be concerned. Compounded by the struggling infrastructure, one business owner (Interviewee E, personal connection November 8, 2022), noted the difficulty they had finding workers in the area due to the lack of affordable housing, and their belief that stores were being priced for tourists rather than local population and a lack of reasons to commute for low pay.

The cost of living has risen in the White Mountain region and the workers are finding it more difficult and concerned that in the towns that are becoming more tourist forward, which includes a feeling of a shift of tone of the towns. The median house price in Lincoln, New Hampshire rose by over 70% since July 2019 (Redfin, 2022), and the people that are working the businesses that draw the tourists in are able to afford to house less and less. Interviewee E surmised that there would need to be a large staff in these hotels and resorts, but as of right now there is not enough affordable housing in the area to support the current labor demands let alone the increase of the hotel staff. Something several other locals we spoke also noted was the pricing of goods and services at businesses such as supermarkets and gas stations, saying they go to other towns for errands. As far as housing costs, nearly all pointed to an influx of remote workers during the COVID-19 pandemic as the cause of the recent hike in prices, and while that is speculation, in our survey data, out of those who said they have lived in the White Mountain region, we do see a spike in those who say they have lived there for under 5 years, as can be seen in Figure 17 in the top left.

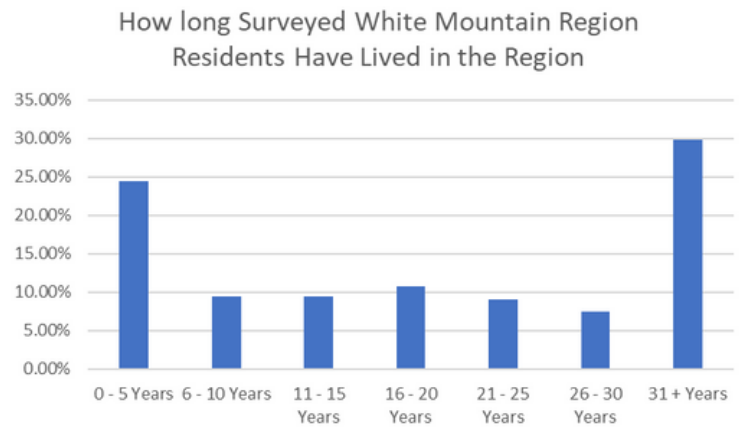


Figure 17 Survey responses to Q7 - How long have you lived, at any point in time, in the White Mountain Region? (out of 751 respondents)

We found that when communicating with people, a person can feel like they are able to address their concerns about this issue and describe how climate change will maybe worsen the effects. Not only is there an effect on the infrastructure of the area but the residents are also feeling a shift in the demographic of the White Mountain Region. Our group has found that connection over a topic is a great way to build trust in a conversation. After building that trust it is far easier to communicate about a controversial topic with that shared experience or memory. When communicating in the future we recommend that this is the first step, to understanding what concerns they have. From there you can weave in aspects of climate change that will impact these concerns of theirs. This previously mentioned conversation-based communication is much more conducive and leads to changing views.

Core Recommendations

We have discussed the way in which people consume information and how it is shifting to an online focus. If the CCWG is looking to communicate with a younger audience, *we recommend they focus on social media. Through the usage of a Tik Tok account, the CCWG can communicate ideas that interest younger audiences* such as timelapses of changing snowfall or how climate change is affecting winter ski seasons.

In an effort to communicate with residents of the White Mountain region, *we recommend the CCWG communicate through casual, discussion-based events with well-respected people of the community involved facilitating discussion.* In addition, the communication of this information should coincide with topics that are important to the individuals in the community. This could be things such as hobbies, landmarks, or local politics.

Lastly, *we recommend members of the CCWG attend town meetings to show support for the residents of these towns, hear about their concerns firsthand and build rapport.* This would go a long way in showing how the CCWG are more integrated with the community and therefore more trusted. Through these methods we believe that the messaging of the climate change working group will not only reach a broader audience but cause people to care about the information shown to them.

For future research into this topic, we recommend a deeper dive through more interviews or more targeted surveying, of the specific concerns of local residents and business owners. When going through this process this was the topic that led to the most fruitful conversations. In addition to that there needs to be a better understanding of how to distribute the survey to local residents, rather than the slightly skewed audience that our group had.



Figure 18 Stoneham, Maine (Liam Piper, 2022)

Acknowledgements

Our project group would like to thank all those who helped us over the course of our research. There were no small parts, and for all the help we got we are truly grateful.

First, thank you to our sponsors, Georgia Murray and Sarah Nelson of the Appalachian Mountain Club and Sarah Garlick of Hubbard Brook Research Foundation. Your guidance and support was indispensable to this project. We'd also like to thank Mark Zakutansky, Director of Conservation Policy Engagement at AMC, who contributed greatly to our survey and its distribution.

Second, thank you to our advisor, Prof. Corey Dehner, for not only organizing this project, but also keeping us on track and giving us feedback when it was needed.

Third, thank you to all the individuals who took the time to aid us in our efforts. Thank you for the great discussions and feedback on our survey. A big thank you also to the businesses who took the time to speak to us and/or spread our survey. We really appreciate it, thanks again.

Finally, Thank you to all those who participated and made their voice heard, whether through interview or survey. Without you there would be no project, so thank you, we were glad to hear from you.

Thank you,

Liam Bry, Regan Kahal, and Liam Piper

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