



FRAME WORKS INSTITUTE



The Value of Explanation:

Using Values and Causal Explanations to Reframe Climate and Ocean Change

A FRAMEWORKS RESEARCH REPORT

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Introduction

Though research has shown that Americans have a basic understanding that climate change has negative impacts, they lack a fundamental understanding of the science of climate change and its impacts, especially on marine life and ocean systems. The challenge for climate change communicators, then, is not to convince Americans that climate change has negative repercussions, but to give them the ability to productively engage with solutions that address the issue at an appropriate scale.

The research presented in this report was conducted on behalf of the National Network for Ocean and Climate Change Interpretation (NNOCCI), and supported by the National Science Foundation.¹ NNOCCI represents a collaborative effort between the New England Aquarium, the FrameWorks Institute, the Association for Zoos and Aquariums, the Woods Hole Oceanographic Institution, the National Aquarium in Baltimore, the Monterey Bay Aquarium, and the New Knowledge Organization to transform the public understanding of climate change and its impacts on oceans via institutions of informal science education. This report presents the results of research designed to test the effects of various strategies for communicating about climate and ocean change. Specifically, we discuss the effects of value frames on people's attitudes and opinions towards climate and ocean change, and on their support for the policy solutions recommended by experts from these fields. We also examine how different ways of providing information on climate and ocean change interact with these value frames, further affecting public knowledge, attitudes and policy support.

The FrameWorks Institute has pioneered an approach to analyzing communications and developing messages — Strategic Frame Analysis™² — that empirically evaluates the capacity of frames, or the cognitive cues in information presentation that guide perception, to enhance public conversations and influence the direction and intensity of public support for social issues. In this report, we employ a quantitative framing experiment — a particular part of the Strategic Frame Analysis™ approach — to offer evidence-based recommendations that communicators can use to increase public understanding of climate and ocean issues, and generate support for policies that can address these issues.

The scientific literature tells us that the way an issue is framed strongly influences the probability that the public will embrace new ideas. Further, we know that frames shape the way people attribute responsibility, understand how an issue works and endorse specific solutions. Knowing how to frame climate change and its impacts on land and oceans, therefore, is a vital component in creating real and sustained change on this issue.

We also know that orienting a conversation through the use of shared values is a key part of framing an issue. Without a value, people struggle to see the point of engaging with an issue and frequently fall back on individualistic solutions to social issues. In this way, values serve as fundamental organizing principles that people use to evaluate social issues and reach decisions.³

Finally, we know that when people understand the mediating factors between the cause of a problem and its consequences, they are better able to reason about, and recognize, effective solutions. Explanatory Chains are framing tools that establish causal process by clearly connecting determinants to outcomes through concrete processes.⁴ Combined with values that provide a productive orientation to the issue, Explanatory Chains can motivate even greater policy support and issue engagement by supplying vital understandings of how issues work and how conditions might be improved through realistic interventions. The role of Explanatory Chains is especially salient on the issue of climate and ocean change, where previous FrameWorks research has demonstrated that a lack of understanding of how the burning of fossil fuels contributes to climate change leads the public to endorse ineffective policies and programs.

About This Experiment

To understand the potential of value-based messages and explanatory statements to affect attitudes about climate change and oceans and support for relevant policies, we designed a pretest and a larger survey experiment. The pretest explored a broad set of values and explanations, and was used to identify the most promising candidates for inclusion in the main, large-sample experiment.⁵ The values tested in the pretest were derived from communications devices currently in use by climate change communicators, those suggested by scientists, as well as tools and hypotheses that have emerged from over a decade of FrameWorks research on ocean and climate change.⁶

Based on the results of the pretest, the full experiment tested three values, and the effect of adding descriptions of the human health impacts of climate change to these values. In addition, the full experiment tested the effect of presenting information via descriptions or explanations. Descriptions laid out causes and effects, while explanations provided a causal process to link determinants to outcomes — in other words, descriptions were statements that X leads to Y, while explanations were statements about *why* X leads to Y. The full experiment was conducted with 7,000 registered U.S. voters who were randomly assigned to either a control or an experimental condition. All results reported below are from the full, large-sample experiment.

The following values were tested in the experiment (see Appendix A for the actual values language tested):

- *Protection* — This value emphasizes the need to shield people from harm, “stepping in to ensure people’s safety.” It also underlines the importance of risk reduction, concern for the welfare of others, and preserving habitats.
- *Responsible Management/Pragmatism/Stewardship* — The version of the value⁷ tested here was a composite that bundles several ideas found effective in previous research. It forefronts the importance of using common sense and step-by-step approaches to come up with responsible long-term plans that act in the interest of future generations
- *Scientific Authority* — This value appeals to the idea that science and scientific research have the power to improve climate change issues. The value emphasizes expert authority and the importance of “evidence,” explaining that the best approach to addressing climate change issues is to implement policies and solutions derived from scientific findings.

Each of these three values was tested with and without brief descriptions of the impacts of climate change on human health.

In addition to the values, the experiment tested the effect of *explaining* versus *describing* two pieces of information — one about the human health impacts of climate change, and one about the effects of ocean acidification. The human health explanation used an

Explanatory Chain to link the burning of fossil fuels, through climate change processes (excess CO₂ trapping heat), to a set of final consequences for human health. The description included the same language and phrasing as the explanation, but excluded the intervening process between cause and outcome. The ocean acidification explanation, likewise, linked the burning of fossil fuels, through an Explanatory Chain detailing the process of ocean acidification (excess CO₂ absorbed by the oceans and causing a change in chemistry), to a set of consequences on marine organisms and ecosystems more generally. The ocean acidification description used the same language and phrasing as the explanation but did not provide the Explanatory Chain about the intermediate process of ocean acidification.

All of the frames described above were tested against a common set of outcome measures (see Appendix B for more detail on outcome measures) designed to gauge the effect of the frames and identify productive messages and develop framing recommendations. Outcome measures were developed and refined from analysis of interviews with experts,⁸ a review of relevant materials, and through consultation with project partners.

After being randomly assigned to one of the message frames described above, respondents were asked a series of questions. These questions were grouped in analysis based on their ability to tap the following six specific areas of respondent attitudes and policy support, as well as three areas of respondent knowledge listed below:

Attitudes and Policy Support:

- Perceptions of the pervasiveness and significance of climate change impacts (referred to below as “*Pervasiveness and Significance*”)
- Attitudes about climate change and oceans (referred to below as “*Climate Change and Oceans*”)
- Salience of climate change as an issue (referred to below as “*Salience*”)
- Support for CO₂ reduction policies (referred to below as “*CO₂ Reduction Policies*”)
- Support for systemic climate change policies (referred to below as “*Systemic Policies*”)
- Efficacy to address climate change (referred to below as “*Efficacy*”)

Knowledge:

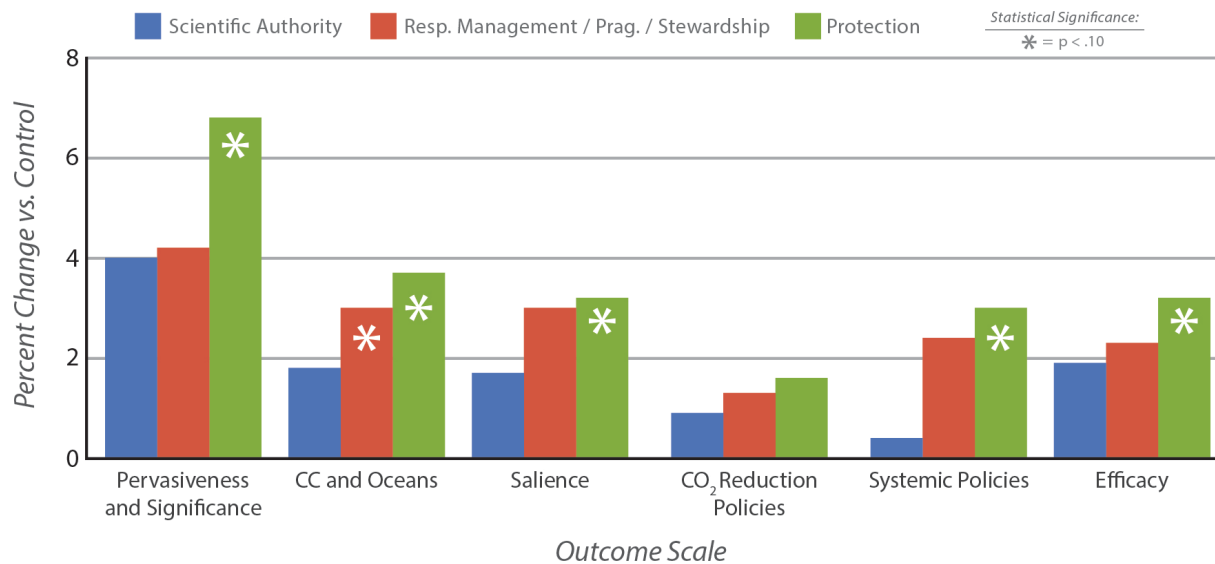
- Knowledge about the impact of excess CO₂ (referred to below as “*CO₂ Impact*”)
- Knowledge about ocean acidification (referred to below as “*Ocean Acidification*”)
- Knowledge about the climate system (referred to below as “*Climate System*”)

Strategic Recommendations

Communicators should incorporate the value of *Protection* in messaging about climate and ocean change. Moreover, this value becomes even more powerful when paired with discussions of the human health impacts of climate change. Therefore, where possible, evocations of the value of *Protection* should include language about the effects of climate change on human health. Use the value of *Responsible Management* in a supporting role when communicating about the role of oceans in climate change. Explain key processes using Explanatory Chains to increase the effectiveness of messages about climate and ocean change. Keep these causal explanations simple, but clearly connect the anthropogenic cause of climate change to effects through a mediating causal process. This will improve people's knowledge about how climate change issues work and, in turn, support their ability to reason productively about solutions and policies. Scientists who wish to engage ordinary citizens should adopt a tone of *Responsible Management*, and use explanatory language rather than relying upon scientific authority to give credence to their assertions.

Findings

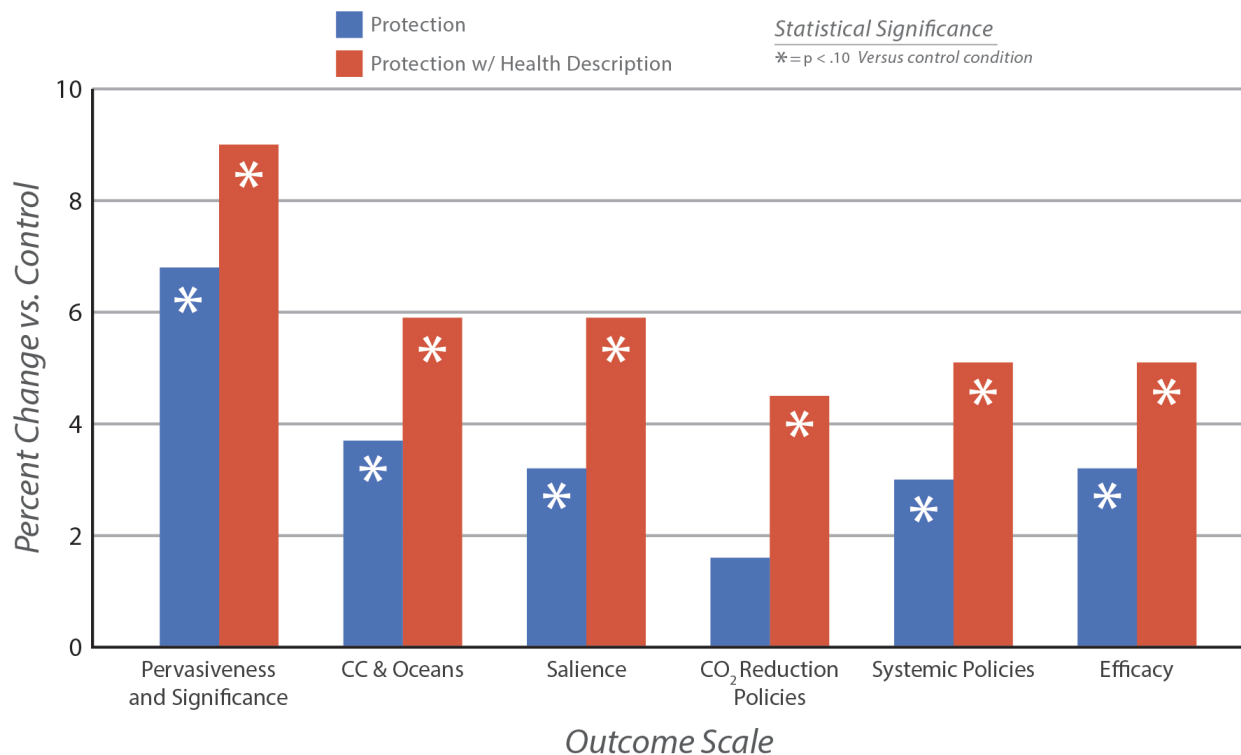
Question 1: *What are the most effective values to use in advancing attitudes and policy support with respect to climate change and its effects on oceans?*



- *Protection* is the most effective value, with statistically significant positive effects on five of the six dimensions of attitude and policy support.
- *Protection* produces large, statistically significant effects among respondents who identify as Republicans on five of the six dimensions of climate change opinion (with increases in support on these six dimensions ranging from 4.7 to 13.1 percent). Of note, exposure to the *Protection* value resulted in substantially significant movement on the climate change and ocean scale among those respondents identifying as Republican, increasing support for scale items by 7.9 percent ($p < .02$).
- The value of *Responsible Management* is effective in communicating about climate change and oceans, with statistically significant positive effects on that scale, and effects that approach statistical significance ($p < .15$) on three other scales: the pervasiveness and significance of the impacts of climate change; systemic policies; and the salience of climate change as a social issue.
- The value of *Scientific Authority* is *ineffective* in moving attitudes and policy opinions, and does not have statistically significant effects on any scale. In addition to being generally unsuccessful in increasing policy support, the value incurred two significant negative results.
 - Among respondents who identified as Democrat, the value of *Scientific Authority* resulted in statistically significant *negative* movement on attitudes regarding the pervasiveness and significance of climate change impacts, and carbon dioxide reduction policies.

- After exposure to the value of *Scientific Authority*, answers to the open-ended questions among all respondents included comments consistent with climate change denial, as well as statements expressing uncertainty about the right policies to adopt. These unproductive lines of thinking were strongly associated with exposure to the *Scientific Authority* value (statistically significant in comparison to the occurrence of these themes in both the control group and those exposed to the other two candidate values).
- Opinions about policies to reduce carbon emissions are particularly difficult to move. None of three values frames resulted in significant changes in respondents' support for this scale.

Question 2: *Can the effects of values be amplified by providing information about the human health impacts of climate change?*



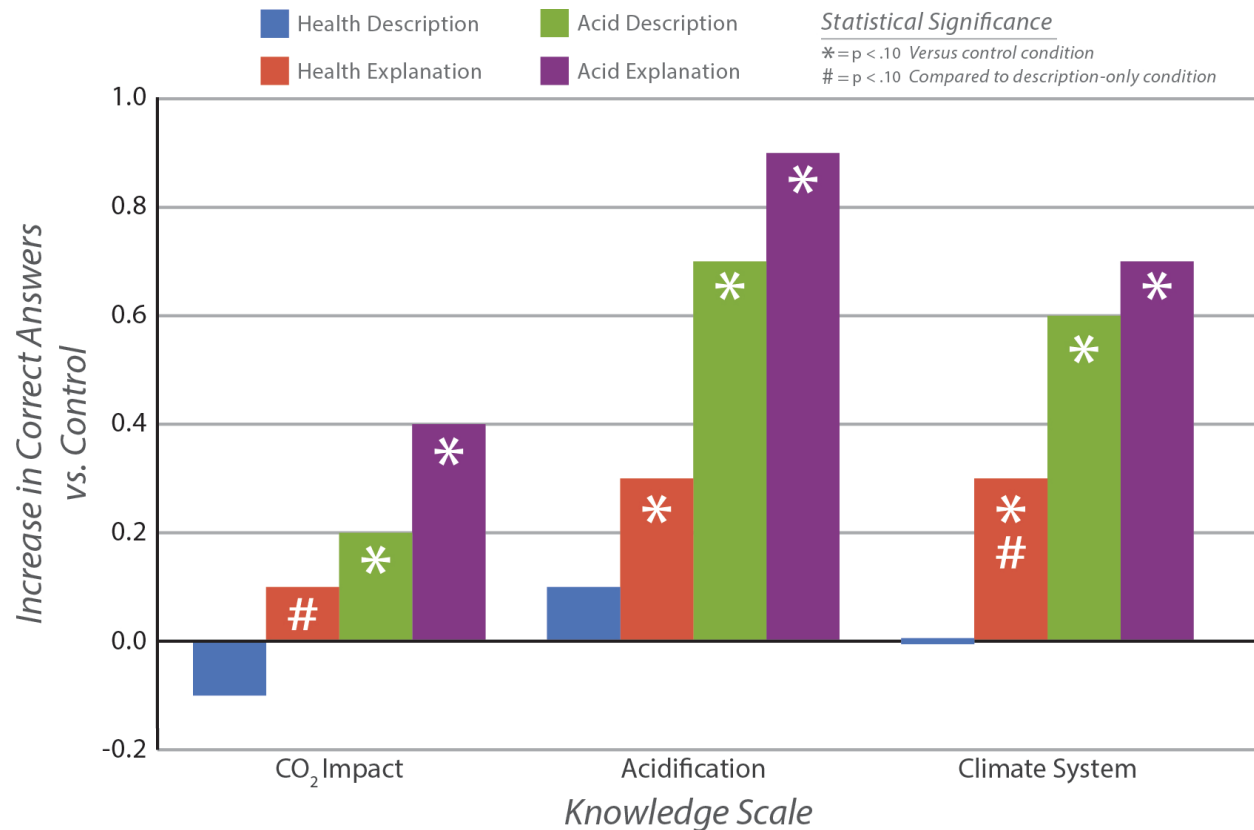
This part of the experiment explored whether providing additional information on the human health impacts of climate change — a recommended practice in the field of climate change communications⁹ — led to more productive attitudes and increased support for a wide range of climate change policies. On the surface, the logic of talking about human health impacts as a way to create more productive attitudes and increase support for polices around *ocean* change may be unclear. However, FrameWorks research has suggested that people are better able to connect oceans to environmental concerns when they consider the chain of life and put humans squarely in that process.¹⁰ Our interest was

thus in seeing whether evoking thinking about human health impacts might “spill over” and positively affect domains of climate change not explicitly related to human health — namely, ocean change.¹¹

- Pairing a description of the human health effects of climate change with the value of *Protection* produced positive and highly statistically significant effects ($p < .01$) on all six attitude and policy scales in comparison to the control condition. Notably, the combination of *Protection* and a description of the human health impacts was effective in moving attitudes on the otherwise difficult-to-move carbon reduction policy scale.
- In addition, including the descriptive information amplified the effect of the “pure” iteration of the *Protection* value. Compared with the *Protection*-only message, the message that included the human health impact description showed better performance on all six scales, causing an average increase in relation to the pure *Protection* value of 2.3 percent.
- The effect of embedding a description of human health impacts into the other two values (*Responsible Management* and *Scientific Authority*) was inconsistent. For these values, adding the description of health impacts resulted in increases on some scales but negligible effects on other scales. Adding the health description to *Responsible Management* produced sufficient increases on three scales (*Pervasiveness and Significance*, *Climate Change*, and *Oceans and Salience*) to render the value’s effects statistically significant on these scales. The version of *Scientific Authority* with the health description was notably more effective than the “pure” version of the value, with statistically significant effects on these same three scales.
- Results also show that presenting descriptions of the health impacts of climate *without* a value does *not* shift attitudes or increase policy support, suggesting that there is a synergistic effect created by combining these descriptions with values.

These results indicate that *descriptions of the human health effects of climate change only have significant effects on attitudes and policy support when they are part of a message that includes an effective value*. Absent a value to help frame thinking about the issue, increased knowledge of severe effects can result in a sense of urgency that may be reduced to fatalism — a sense that the situation is bad, but that there is little that can be done to remediate it. However, cuing this sense of urgency by providing salient information about negative outcomes *paired* with an effective value inoculates against this tendency to become overwhelmed and disengaged by providing people with a sense that these negative outcomes can be prevented if collective action is taken.¹²

Question 3: What are the respective roles of explanation and description in moving attitudes and policy opinions on climate change and oceans?



To further explore the amplifying effect described above, we conducted an experiment comparing the difference between providing information through *description* (which presents determinants and outcomes) versus *explanation* (which connects determinants to outcomes through a process) on respondents' knowledge, as well as their attitudes and support for policy. Knowledge was measured using three sets of questions — one on the impacts of excess CO₂ (labeled *CO₂ Impacts*), one on ocean acidification (labeled *Acidification*), and one on the workings of the climate system (labeled *Climate System*). To determine any differences in effects between explanation-based and description-based presentations, we selected two pieces of information — one on the human health impacts of climate change, and a second on climate change and ocean acidification — and created both description-based and explanation-based ways of presenting these pieces of information. Whereas the descriptions asserted basic facts about climate change effects, explanations were provided via Explanatory Chains that included causal links explaining *how* these effects come about.

- Both the acidification description and explanation treatments produced significant positive effects on respondents' knowledge — increasing knowledge on all three measures as compared to a control condition.
- The human health impacts explanation produced significant positive effects on two of three knowledge scales, while the description failed to produce any significant results.
- The explanations, both of human health impacts and acidification, performed consistently better than the descriptions — producing higher effects on all three knowledge measures. The difference in performance between the health explanation and the health description was statistically significant for the *CO₂ Impacts* and *Climate System* scales, and approached significance for the *Acidification* scale. The difference between the acidification explanation and the acidification description approached statistical significance for the *Acidification* scale.

This shows that, while presenting information via both explanations and descriptions can generate knowledge, explanations tend to be more effective in this task.

- Neither explanation-based nor description-based treatments produced significant increases on the attitude and policy outcome measures against which they were tested.

The amplifying effect of pairing descriptions of human health impacts with values (the finding from Question No. 2 above), and the superiority of explanation over description, can be combined to infer an important communication recommendation. From the finding that explanations outperform description-based presentations, we can infer that *messages combining an effective value with an Explanatory Chain about human health impacts should have an even greater effect on attitudes and policies than the combination of values and descriptive information. This suggests that using information to explain basic processes is more effective than merely using information to describe effects — but that, to influence attitudes and policy, all information presentations need to be paired with effective values.* While this is a theoretically grounded inference, extrapolated from the results of this experiment, future research should test this inference by combining values and Explanatory Chains and comparing these messages to values paired with descriptive-based information presentations.

Conclusion

- Value-based messages are an effective way to shift attitudes and increase support for the policies experts endorse. The value of *Protection* is most effective in this capacity, and can be used by communicators across a wide range of more specific issues within the broader climate change domain.
- The value of *Responsible Management* is clearly effective in communicating about climate change and oceans, and is potentially productive for communicating about the impacts of climate change, systemic policies, and the importance of addressing climate change.
- Integrating an explanation of the human impacts of climate change into value messages amplifies the value's effects. This amplification effect is especially potent in the case of the value of *Protection*.
- *How* information is presented matters. Explaining why effects happen, rather than merely listing effects, is a better way to use information to increase knowledge. An effective explanation links the anthropogenic cause of climate change to effects via one or more mediating statements that clarify scientific mechanisms.
- Increased knowledge does not automatically translate into attitude change or policy support. While explanations improve knowledge outcomes, the findings from this experiment suggest that values are required to productively channel knowledge toward attitude change and increased support for policies.

APPENDIX A: Treatments

Value Frames

Protection

It's important that we protect people and places from being harmed by solving the issues facing our environment. This means stepping in to ensure people's safety and well-being to the best of our ability and safeguarding the places we depend on. We also need to take measures to eliminate or reduce risks, making sure that people are able to go about their lives freely. Concern for the welfare of others and vigilance in preserving our habitats are the hallmarks of a protective approach. Simply put, we have a duty to protect our surroundings. Protection is the right thing for us to do.

Scientific Authority

It's important that we do what scientists recommend and implement their solutions to the problems facing our environment. This means respecting the scientific consensus and taking the actions that science has shown to be effective at dealing with the problems we face. We also need to support scientific research, so scientists can continue to discover the best solutions to our difficulties. Using empirical evidence is the hallmark of a scientific approach. Simply put, we should follow a research-based approach that uses scientific findings to take the best care of our surroundings. Following scientists' recommendations is the right thing for us to do.

Responsible Management

It's important that we take responsible steps to manage the issues facing our environment. This means thinking carefully about problems and focusing on the best ways to deal with the problems we face. We also need to keep future generations in mind while we look for the best solutions. Open-mindedness and long-term planning are the hallmarks of responsible management. Simply put, we should take a practical, step-by-step approach that relies on common sense and uses all the evidence we have to take care of our surroundings. Managing challenges responsibly is the right thing for us to do.

Climate Change and Health Descriptions

Protection w/Climate Change and Health

It's important that we protect people and places from being harmed by solving the issues that climate change poses for our health. We know that climate change creates severe health threats, generating extreme heat, violent storms and wildfires that kill people, as well as spreading infectious diseases and causing respiratory, heart and other health problems. To respond to these threats, we must step in to ensure people's safety and well-being to the best of our ability, and safeguard the places we depend on from the health threats that come with climate change. We also need to take measures to eliminate or reduce risks, making sure that people are able to go about their lives freely. Concern for the welfare of others and vigilance in preserving our habitats are the hallmarks of a protective

approach. Simply put, we have a duty to protect ourselves and our health from the effects of climate change. Protection is the right thing for us to do.

Scientific Authority w/Climate Change and Health

It's important that we do what scientists recommend and implement their solutions to the problems that climate change poses for our health. We know that climate change creates severe health threats, generating extreme heat, violent storms and wildfires that kill people, as well as spreading infectious diseases and causing respiratory, heart and other health problems. To respond to these threats, we must respect the scientific consensus and take the actions that science has shown to be most effective for dealing with the health threats that come with climate change. We also need to support scientific research, so scientists can continue to discover the best solutions to our difficulties. Using empirical evidence is the hallmark of a scientific approach. Simply put, we should follow a research-based approach that uses scientific findings to deal with climate change and with its effects on human health. Following scientists' recommendations is the right thing for us to do.

Responsible Management

It's important that we take responsible steps to manage the issues that climate change poses for our health. We know that climate change creates severe health threats, generating extreme heat, violent storms and wildfires that kill people, as well as spreading infectious diseases and causing respiratory, heart and other health problems. To respond to these threats, we must think carefully about these problems and focus on the best ways to deal with the health threats that come with climate change. We also need to keep future generations in mind while we look for the best solutions. Open-mindedness and long-term planning are the hallmarks of responsible management. Simply put, we should take a practical, step-by-step approach that relies on common sense and uses all the evidence we have to deal with climate change and with its effects on human health. Managing challenges responsibly is the right thing for us to do.

Information about Climate Change Effects

Climate Change and Health (Explanation)

Climate change creates real risks for people's health. When we burn fossil fuels like coal and gas, we release carbon dioxide into the air, which builds up and traps the Earth's heat. This creates higher temperatures that melt the polar ice caps and raise sea levels. When carbon dioxide traps heat, it also results in more frequent heat waves and severe storms, which lead to injuries and deaths. These and other effects of climate change, such as the increased spread of infectious disease due to the increase in average temperatures, are already harming people's health. We can limit these health problems and avoid worse consequences by reducing the amount of coal and gas we use.

Climate Change and Health (Description)

Climate change creates real risks for people's health. More frequent heat waves and severe storms increase injuries and deaths, and make it harder for people to access treatment. Carbon dioxide is making it hotter, raising sea levels and melting the polar ice caps. These

and other effects of climate change, such as the increased spread of infectious disease, are already harming people's health. We can limit these health problems and avoid worse consequences by reducing the amount of coal and gas we use.

Ocean Acidification (*Explanation*)

When we burn fossil fuels like coal and gas, we release carbon dioxide (CO₂) into the air. The oceans absorb a lot of this carbon dioxide, which changes the ocean's chemistry. This is called ocean acidification. One result of this change in chemistry is that carbonate — the thing that shellfish use to build their shells — becomes scarce. This means that there will be fewer shellfish in the food chain for other creatures to eat, which then affects the whole ecosystem.

Ocean Acidification (*Description*)

When we burn fossil fuels like coal and gas, we release carbon dioxide into the air. When excess CO₂ from the air gets absorbed into the oceans it causes ocean acidification. Ocean acidification makes it hard for shellfish to build their shells. The loss of these organisms affects the whole ecosystem.

APPENDIX B: Outcome Measures

Attitude and Policy Measures

Pervasiveness and Significance

1. Rising temperatures are causing problems for plants, animals and people.
2. The climate system is now being severely disrupted.
3. Excess carbon dioxide is leading to more severe weather and other problems that affect humans.
4. Carbon dioxide emissions produced by burning fossil fuels are harming marine life by changing the chemical make-up of the oceans.

Climate Change and Oceans

1. The rise in ocean temperatures is having serious effects in the ocean and on land.
2. The increase in the ocean's acidity due to climate change presents serious problems for marine life.
3. Changes in ocean temperatures are affecting weather patterns, which have serious effects on humans.
4. The rise in sea levels causes problems that affect people who live near the ocean.

Salience

1. We need to support policies to reduce the excess carbon dioxide in the oceans as soon as possible.
2. The government should create incentives for people to use less energy before it's too late for us to deal with climate change.
3. We need to create laws aimed at reducing carbon dioxide emissions and limiting the impacts of climate change.
4. The change in climate is a significant problem and we need to change our behavior now in order to deal with it.

CO₂ Reduction Policies

1. The amount of carbon dioxide released by human activities is too high.
2. We need to focus more of our attention on the things that produce the most carbon dioxide, especially transportation and manufacturing.
3. The best way to address climate change is to recycle more. (reverse code)
4. The best way to address climate change is to fix the hole in the ozone. (reverse code)

Systemic Policies

1. The government should set up a system where industries that emit more carbon dioxide should pay more and those that emit less are rewarded with lower taxes.
2. Creating more public transportation, such as subways, buses and bike paths, is vital to reducing carbon dioxide emissions.
3. The government should require auto manufacturers to make more fuel-efficient and cleaner-burning cars and trucks, and give incentives to people who buy them.
4. We should devote public funds to providing incentives for people to use less energy in their homes.

Efficacy

1. If we take the right steps now, we can slow the pace of climate change.
2. Taking the right actions can prevent the change in climate from causing further damage from severe weather.
3. Limiting the amount of excess carbon dioxide released into the air can promote the integrity of the ocean's food chain and keep ocean ecosystems in balance.
4. Together, we can push for and enact policy change that reduces climate change.
5. I feel confident about my understanding of the effects of carbon dioxide emissions on the health of the ocean.

Knowledge Measures

CO₂ Impact

1. Which of the following do you think is the main issue with CO₂?
 - A. Levels of CO₂ are rising in the atmosphere.
 - B. Plants and trees don't have enough CO₂.
 - C. Parts of the world are running out of CO₂.
2. Which of the following do you think is correct?
 - A. CO₂ can be beneficial or harmful depending on the amount.
 - B. Even in small doses, CO₂ is dangerous to breathe.
 - C. Our planet can never have too much CO₂.
3. Which of the following would you say is the main problem with rising levels of CO₂ in the atmosphere?
 - A. It traps heat in the earth's atmosphere.
 - B. It can damage people's lungs.
 - C. It makes the air less clear.

4. How does CO₂ affect the oceans?
 - A. Rising CO₂ levels disrupt normal life processes.
 - B. Rising CO₂ levels create holes in the ozone layer, letting more sunlight in, which leads to warmer oceans.
 - C. Rising CO₂ levels block sunlight and make the oceans colder.
5. What is the best way to limit the levels of CO₂ in the oceans?
 - A. Choose forms of energy that produce less CO₂.
 - B. Recycle more.
 - C. Clean up pollution in the ocean.

Ocean Acidification

1. What causes ocean acidification?
 - A. Too much CO₂ from the atmosphere being absorbed into the ocean.
 - B. Acid rain falling into the ocean.
 - C. Chemical waste being dumped into the ocean.
2. Please complete the sentence. Ocean acidification affects:
 - A. The ocean ecosystem and everything that depends on it.
 - B. People who eat shellfish.
 - C. Boats and tankers that sail in the ocean.
3. What is the main effect on the oceans of too much CO₂ in the atmosphere?
 - A. Changed chemistry.
 - B. Higher levels of UV radiation.
 - C. Murky water.
4. What is the best way to slow ocean acidification?
 - A. Choose forms of energy that produce less CO₂.
 - B. Limit pollution that causes acid rain.
 - C. Punish companies that dump waste into the oceans.
5. Which of the following do you think is the most promising way of addressing ocean acidification?
 - A. Designing energy systems that produce lower CO₂ emissions.
 - B. Put chemicals into the ocean that neutralize its pH levels.
 - C. Breed shellfish that are not affected by ocean acidification.

Climate System

1. What affects the climate system?
 - A. The atmosphere, the oceans and the land.
 - B. The weather.
 - C. It's difficult to affect the climate.

2. Which of the following plays the most important role in regulating the climate system?
 - A. The oceans.
 - B. The ozone layer.
 - C. The stars.

3. According to the <insert metaphor title> idea, why is the climate system changing? *In causal chain and control conditions: Why is the climate system changing?*
 - A. Emissions from burning fossil fuels are damaging the oceans.
 - B. The climate system is in a natural cycle of change.
 - C. Pollution dumped in the water is harming the oceans.

4. What is the best way to allow the ocean to perform its role in the climate system?
 - A. Burn less fossil fuel.
 - B. Wait for natural cycles to take their course.
 - C. Recycle cans and bottles so that they don't end up in the oceans.

About The FrameWorks Institute

The FrameWorks Institute is an independent nonprofit organization founded in 1999 to advance science-based communications research and practice. The Institute conducts original, multi-method research to identify the communications strategies that will advance public understanding of social problems and improve public support for remedial policies.

The Institute's work also includes teaching the nonprofit sector how to apply these science-based communications strategies in their work for social change. The Institute publishes its research and recommendations, as well as toolkits and other products for the nonprofit sector, at www.frameworksinstitute.org.

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Endnotes

¹ This research was supported by the National Science Foundation (NSF grant number DUE-1239775).

² More information on Strategic Frame Analysis™ can be found at <http://www.frameworksinstitute.org/sfa.html>.

³ Rokeach, M. (1973). *The Nature of Human Values*. New York, NY: The Free Press.

⁴ For more on Explanatory Chains, see Aubrun, A., & Grady, J. (2005). *Strengthening advocacy by explaining “causal sequences.”* Washington, DC: FrameWorks Institute. www.frameworksinstitute.org/assets/files/eZines/causal_sequences_ezine.pdf.

⁵ The following values were tested in the pretest: Scientific Authority, Responsible Management/Pragmatism, Innovation, Stewardship, Interconnectedness, Protection, and Global Cooperation.

⁶ For more on FrameWorks’ previous research on climate change see:

Aubrun, A., Grady, J., & Robinson, E.A. (2007). *Canadians’ grasp of global warming: Results from a cognitive survey*. Washington, DC: FrameWorks Institute.

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⁷ The version of *Responsible Management* tested in the experiment reported here differs substantially from that tested in previous FrameWorks research. Whereas *Responsible Management* was previously tested on its own, for this research the value of *Responsible Management* was combined with ideas of *Pragmatism* and *Stewardship*.

See the following reports for a description of the language previously tested: Simon, A. (2011). *Advancing support for health care sustainability: The role of values framing*. Washington, DC: FrameWorks Institute; Manuel, T., & Gilliam, F.D. (2009). *Advancing support for child mental health policies: Early results from Strategic Frame Analysis™ experimental research*. Washington, DC: FrameWorks Institute.

⁸ Volmert, A., Baran, M., Kendall-Taylor, N., Lindland, E., Haydon, A., Arvizu, S., & Bunten, A. (2013). *“Just the Earth doing its own thing”: Mapping the gaps between expert and public understandings of oceans and climate change*. Washington, DC: FrameWorks Institute.

⁹ For examples of current messaging strategies on climate change and health, see Myers, T., Nisbet, M., Maibach, E., & Leiserowitz, A. (2012). A public health frame arouses hopeful emotions around climate change. *Climate Change*, 113, 1105-1112.

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¹⁰ Aubrun, A., & Grady, J. (2003). *Keeping the oceans alive: Cognitive elicitations with residents of oceanside communities*. Washington, DC: FrameWorks Institute.

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¹¹ According to Maibach et al. (2011), framing climate change as a human health issue garners more public support across a broader set of policies than an environmental frame. The authors attribute this outcome to the health frame’s ability to resonate with existing belief systems and motivations, and to simultaneously personalize and localize the issue.

¹² Witte, K., & Allen, M. (2000). A meta-analysis of fear appeals: Implications for effective public health campaigns. *Health Education and Behavior*, 27(5), 608-632; Witte, K. (1994). Fear control and danger control: A test of the extended parallel process model. *Communication Monographs*, 61(2), 113-134.