

UC San Diego

Capstone Papers

Title

Climate Science and Communication for Mountain Guides: Program effectiveness and future potential

Permalink

<https://escholarship.org/uc/item/63d400ns>

Author

Headley, Eliot

Publication Date

2022

Data Availability

The data associated with this publication are within the manuscript.

Climate Science and Communication for Mountain Guides:
Program effectiveness and future potential

Eliot Headley
Master of Advanced Studies - Climate Science and Policy
2022



SCRIPPS INSTITUTE OF
OCEANOGRAPHY

UC San Diego

Abstract:

Guided mountain climbing such as on Mt. Rainier, WA operates in environments that are significantly impacted by climate change. This project explores the underutilized opportunity to communicate the impacts of climate change via the mountain guiding industry and analyzes the effectiveness of a climate science and communication program workshop developed for guides on Mt. Rainier. Results from survey responses from guides who attended the program workshop show a significant increase in stated comfortability in discussing climate change with their clients. Trust and emotional engagement are important factors when communicating climate change. Since the guide-client relationship fosters a setting of implied trust and the guided mountain climbing experience has potential for emotional engagement, guides with the resources to comfortably discuss climate change with clients are in a unique position to communicate the impacts of climate change with the public.

Outline:

Introduction
Background
Climate Change, Extreme Weather, and Glaciers
Atmospheric Rivers and Heatwaves
Trust and Emotional Engagement
Assessment Methods and Workshop Effectiveness
Survey Results: Figures
Discussion
Conclusion
Acknowledgments

Capstone Chair: Corey Gabriel, Ph.D., J.D.

Capstone Committee Member and in dedication to Jane Teranes, Ph.D.

Introduction:

Human-caused climate change is a global issue, impacting a variety of peoples, cultures, and industries¹ and communication is an important tool to motivate a response to climate change.² This paper presents and analyzes an example of climate science communication in the mountain guiding industry and explores the underutilized potential of the guiding industry to incorporate climate change communication.

With the goal of increasing mountain guides' comfortability in communicating the impacts of climate change on the areas in which they guide, and using the knowledge and skills I gained during my graduate studies at Scripps Institution of Oceanography (SIO), I developed and provided a climate science and communication program workshop for mountain guides who operate on Mt. Rainier. I then gave a survey to the guides who attended the workshop to measure the effectiveness of achieving the goal of the program. My motivation to develop a climate science and communication workshop for mountain guides grew from my experience guiding in areas being impacted by climate change without the knowledge or tools to communicate the impacts. While deepening my skills and knowledge on the impacts of climate change at SIO I learned that other guides also sought to further develop their climate communication skillset. The current conversation of the impacts of climate change is present in the media and reports such as those released by the Intergovernmental

¹ IPCC, 2022: Summary for Policymakers [H.-O. Pörtner, D.C. Roberts, E.S. Poloczanska, K. Mintenbeck, M. Tignor, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem (eds.)]. In: *Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* [H.-O. Pörtner, D.C. Roberts, M. Tignor, E.S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, B. Rama (eds.)]. Cambridge University Press. In Press.

² Mukherjee, Ishani, and Michael Howlett. "Communicating about Climate Change with Policymakers." *Oxford Research Encyclopedia of Climate Science*, November 22, 2016. <https://doi.org/10.1093/acrefore/9780190228620.013.416>.

Panel on Climate Change, though the guiding industry is ripe for broader communication of climate impacts with a broad audience. I argue that there is a gap between academia and the guiding industry, a gap that if bridged, would benefit both academia and the guiding industry. Guides carry valuable experiential knowledge of the changing environments in which they guide and many would likely gain from deepened skills in communicating climate science. With the knowledge and resources I gained from SIO and my experience as a guide, I sought to offer a small bridge spanning the gap between academia and the guiding industry.

Mt. Rainier, along with other guided mountain climbing locations are some of the most affected by climate change. For example, at least 27% of the glacial mass on Mt. Rainier has been lost since the early 1900s³. Guided climbing routes on Mt. Rainier travel atop or are in full view of rapidly melting glaciers. Assuming that traveling over glaciers being impacted by climate change has the potential to be an emotionally engaging experience for a guided client, I explore the potential to develop mountain guides' skillset in communicating these impacts so that the clients can better feel and understand that human activities are changing our planet's climate.

While a primary role of mountain guides is to safely lead their clients through often hazardous terrain and conditions, guides also often act as communicators of non-technical information such as the natural history surrounding the guided route. Guides, some of whom I spoke with during this project, have valuable anecdotes to share regarding the impacts of climate change. An implied degree of trust exists within the guide-client relationship as the guide is assumed to be the "expert" who safely leads

³ Puyallup Tribe of Indians. 2016. Climate Change Impact Assessment and Adaptation Options. A collaboration of the Puyallup Tribe of Indians and Cascadia Consulting Group.

their clients through hazardous terrain. This implied guide-client trust is a unique setting for communicating topics of climate change with the general public. Research suggests the importance of emotional engagement while communicating climate change⁴. For the average guided climber on Mt. Rainier, the visceral experience of climbing in an area that is being severely affected by climate change, coupled with a trusted guide trained to discuss climate change impacts on the area, holds unique potential for effective experiential learning.

Rethinking the conventional social theory, “the deficit model”, that members of the general public are “empty vessels” waiting to be filled with useful info⁵, I instead explore the opportunity to more deeply engage the public in discussing climate change from an emotional standpoint, an approach that some research suggests could be effective⁶. Similar to the trust developed within the guide-client relationship, I also made a casual effort to develop a level of trust with the guides that attended the climate science workshop. There, in that casual setting, I was able to hear the concerns of the guides including one senior guide staff member expressing worry that climate change will severely impact the environment in which they operate. One senior guide shared with me his concerns that the glacial routes that he has explored and come to appreciate over his climbing career may not be there for his soon-to-be-born son.

⁴ Salama, Sefat, and Khalil Aboukoura. “Role of Emotions in Climate Change Communication.” In *Handbook of Climate Change Communication: Vol. 1: Theory of Climate Change Communication*, edited by Walter Leal Filho, Evangelos Manolas, Anabela Marisa Azul, Ulisses M. Azeiteiro, and Henry McGhie, 137–50. Cham: Springer International Publishing, 2018. https://doi.org/10.1007/978-3-319-69838-0_9.

⁵ Simis, Molly J., Haley Madden, Michael A. Cacciatore, and Sara K. Yeo. “The lure of rationality: Why does the deficit model persist in science communication?.” *Public understanding of science* 25, no. 4 (2016): 400-414.

⁶ Nerlich, Brigitte, Nelya Koteyko, and Brian Brown. “Theory and Language of Climate Change Communication.” *WIREs Climate Change* 1, no. 1 (January 2010): 97–110. <https://doi.org/10.1002/wcc.2>.

Sharing information on the impacts of climate change from an emotional standpoint has a unique potential to engage the audience. This paper shares one example of the effectiveness of developing climate science and communication skills with a group of recently hired Mt. Rainier guides and explores the value of further embedding communication of the impacts of climate change in the guiding industry.

Background

As a past guide, I have experienced first-hand the role that most guides hold as communicators. From a guide's position, effective communication is embedded into safely leading clients through the natural environment in which guided climbing takes place. Typically guides are asked many questions about the natural environment and expected to fill much of the time spent guiding with information about the surrounding ecosystems, which of course also requires effective communication. Thus, many guide operations give training that includes developing communication skills and providing guides with resources to quickly learn information on the natural environment where guided experiences take place. Mountain guides on Mt. Rainier are no exception and are expected to be able to effectively share information on the natural history of the Park with guided clients.

Rainier Mountaineering Inc. (RMI) is a major guiding operation that holds a concession to guide climbers on Mt. Rainier. The RMI guide staff are trained such that they are expected to effectively communicate aspects of the natural environment of the Park while guiding clients. As a response to many guided clients having questions about climate change and recent extreme weather events affecting Mt. Rainier, RMI sought

further information on how climate change affects the environments on Mt Rainier so that their guide staff is comfortable in discussing climate science with their clients.

RMI thus extended an invitation for me to lead a climate science and communication workshop for the company's newly hired guides. According to some of RMI's senior guide staff, recent extreme weather events, such as the record heatwave affecting the Pacific Northwest in June 2021 have led to more questions from guided clients about climate change and how Mt. Rainier glaciers are being impacted. The desire to increase comfortability among guides to discuss climate change impacts on Rainier's glaciers was one of the primary motivations for my invitation to lead a climate workshop for guides.

Climate Change, Extreme Weather, and Glaciers

Climate change has caused and is projected to cause more severe and frequent extreme weather⁷, threatening livelihoods and communities. Here I will describe two significant weather phenomena that occur at Mt. Rainier and how extreme weather driven by human-caused climate change is projected to further impact the natural environment at Mt. Rainier National Park. Weather phenomena in the Pacific Northwest such as high elevation rain on snow events caused by atmospheric rivers are projected to become more frequent and more severe due to climate change⁸. Using these two

⁷ IPCC, 2022: Summary for Policymakers [H.-O. Pörtner, D.C. Roberts, E.S. Poloczanska, K. Mintenbeck, M. Tignor, A. Alegría, M. Craig, S. Langsdorf, S. Lösche, V. Möller, A. Okem (eds.)]. In: *Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* [H.-O. Pörtner, D.C. Roberts, M. Tignor, E.S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Lösche, V. Möller, A. Okem, B. Rama (eds.)]. Cambridge University Press. In Press.

⁸ Gershunov, A., Shulgina, T., Clemesha, R.E.S. *et al.* Precipitation regime change in Western North America: The role of Atmospheric Rivers. *Sci Rep* 9, 9944 (2019).
<https://doi.org/10.1038/s41598-019-46169-w>

climate-linked weather phenomena, presented in this paper, I presented the connection of extreme weather to climate change in the program workshop. The occurrence of these extreme weather events presents unique adaptation challenges for the guiding industry and the National Park Service, though with the challenges also comes a unique opportunity for guides to open discussion and engage guided climbers emotionally with the impacts of climate change.

High-pressure ridging in the Pacific Northwest has caused record heat waves in recent years, with record temperatures recorded in June of 2021. Many people in rural and metropolitan areas of the Pacific Northwest found it difficult to adapt to the heat and hundreds lost their lives⁹. Mt. Rainer was severely affected by this heat event as well, where a substantial glacier and snow loss occurred in a short period¹⁰. Heat waves such as the one that occurred in the Pacific Northwest in June 2021 are extreme weather events and are projected to become more frequent and severe due to climate change¹¹. The heatwave of June of 2021 brought challenges for the guiding industry, as guides mentioned that some more difficult routes had become even more difficult or even unclimbable. The challenges from extreme weather events such as heat waves carry an impending tone as well, where guides describe that as more of the glaciers on Mt. Rainer melts, the loose volcanic rock of the Mountain becomes exposed, increasing the likelihood of rockfall, according to some guides, which makes some routes much more hazardous or even unclimbable.

⁹ "Extreme Heat Events Are Public Health Emergencies | British Columbia Medical Journal." Accessed May 23, 2022. <https://bcmj.org/bccdc/extreme-heat-events-are-public-health-emergencies>.

¹⁰ Almekinder, Kyle. "Using Spectral Indices To Determine the Effects of the Summer 2021 North American Heat Wave at Mount Rainier, Washington," April 28, 2022. <https://repository.arizona.edu/handle/10150/664141>.

¹¹ Atlantic Council. "Impact on Health Outcomes." *EXTREME HEAT: The Economic and Social Consequences for the United States*. Atlantic Council, 2021. <http://www.jstor.org/stable/resrep35134.6>.

The effect of the June 2021 heatwave did not go unnoticed by mountain guides that I spoke with that were guiding climbers during the time of the heat event, where one guide stated that he was comfortable in a t-shirt at the 14,411' summit. Guided clients also noticed the significance of the June heatwave, where guides mentioned that many questions from clients arose later in the guiding season regarding the heatwave and its connection to climate change. Though guides that I spoke with stated that they did not feel entirely comfortable or prepared to discuss or answer questions regarding the role of climate change in extreme weather events such as heat waves.

Atmospheric Rivers and Heatwaves

Atmospheric rivers or ARs are weather phenomena that bring a substantial amount of moisture in a narrow area or “river”¹². ARs have been observed to bring large amounts of precipitation to the Pacific Northwest, causing flooding and debris flows in some areas¹³. Mt. Rainier has the most glaciers of any mountain in the contiguous U.S.¹⁴, however, when precipitation falls as rain instead of snow, rapid melting of glaciers and snowpack occurs¹⁵. During atmospheric river events, the snow levels are often higher than during other winter storms and create a higher chance of flooding¹⁶

¹² Gimeno, Luis, Raquel Nieto, Marta Vázquez, and David Lavers. “Atmospheric Rivers: A Mini-Review.” *Frontiers in Earth Science* 2 (2014). <https://www.frontiersin.org/article/10.3389/feart.2014.00002>.

¹³ Neiman, Paul J., F. Martin Ralph, Gary A. Wick, Ying-Hwa Kuo, Tae-Kwon Wee, Zaizhong Ma, George H. Taylor, and Michael D. Dettinger. “Diagnosis of an Intense Atmospheric River Impacting the Pacific Northwest: Storm Summary and Offshore Vertical Structure Observed with COSMIC Satellite Retrievals.” *Monthly Weather Review* 136, no. 11 (November 1, 2008): 4398–4420. <https://doi.org/10.1175/2008MWR2550.1>.

¹⁴ “Which Mountain in the Conterminous U.S. Has the Most Glaciers? | U.S. Geological Survey.” Accessed May 24, 2022. <https://www.usgs.gov/faqs/which-mountain-conterminous-us-has-most-glaciers>.

¹⁵ Sobota, Ireneusz, Piotr Weckwerth, and Tomasz Grajewski. “Rain-On-Snow (ROS) Events and Their Relations to Snowpack and Ice Layer Changes on Small Glaciers in Svalbard, the High Arctic.” *Journal of Hydrology* 590 (November 1, 2020): 125279. <https://doi.org/10.1016/j.jhydrol.2020.125279>.

¹⁶ Neiman, Paul J., F. Martin Ralph, Gary A. Wick, Jessica D. Lundquist, and Michael D. Dettinger. “Meteorological Characteristics and Overland Precipitation Impacts of Atmospheric Rivers Affecting the

Rain on snow events, as they are known, are a significant effect of climate change¹⁷ and since projections show that a higher proportion of the precipitation in the Pacific Northwest will come in the form of ARs, Mt. Rainier will likely receive more rain on snow events.

Glacial recession on Mt. Rainier is apparent in historical photos and guide testimony, and the National Park Service performs glacial mass recordings that measure the change in volume of the glaciers on Mt. Rainier¹⁸, where every glacier in Mt. Rainier lost volume from a survey from 1970 to 2008¹⁹ with much of the volume loss occurring vertically. Glacier mass balance showed that Mt. Rainier's glaciers have decreased by over 5% from 1985 to 2009²⁰. One senior guide stated that he recently could even hear gushing water underneath a popular climbing route, a phenomenon he had never experienced before in over 10 years of guiding on the mountain.

Extreme weather events such as heatwaves and atmospheric rivers are projected to become more severe and frequent with climate change, though these events present a unique opportunity to open the discussion of climate change and extreme weather in a visceral, emotional way. Clients who notice events such as the heatwave of June 2021 may come to their guided experience with questions regarding the impact of these events on the mountain's glaciers and the causal link of these

West Coast of North America Based on Eight Years of SSM/I Satellite Observations." *Journal of Hydrometeorology* 9, no. 1 (February 1, 2008): 22–47. <https://doi.org/10.1175/2007JHM855.1>.

¹⁷ Rennert, Kevin J., Gerard Roe, Jaakko Putkonen, and Cecilia M. Bitz. "Soil Thermal and Ecological Impacts of Rain on Snow Events in the Circumpolar Arctic." *Journal of Climate* 22, no. 9 (May 1, 2009): 2302–15. <https://doi.org/10.1175/2008JCLI2117.1>.

¹⁸ "Glaciers Monitoring (U.S. National Park Service)." Accessed May 24, 2022. <https://www.nps.gov/im/nccn/glaciers.htm>.

¹⁹ T.W. Sisson, J.E. Robinson, D.D. Swinney; Whole-edifice ice volume change A.D. 1970 to 2007/2008 at Mount Rainier, Washington, based on LiDAR surveying. *Geology* 2011;; 39 (7): 639–642. doi: <https://doi.org/10.1130/G31902.1>

²⁰ Sanford, Jon Eric. "Glacial Changes Between 1985-2009 and Implications for Volcanic Hazards at Mt. Rainier, Washington," December 1, 2011. <https://shareok.org/handle/11244/8054>.

events to human-caused climate change. Several guides noted curiosity from their clients of the heat wave-climate change connection. Guided climbers on Mt. Rainier come face-to-face with the effects of human-caused climate change, where the impacts on the glaciers are visible and audible. Since guides are the ones that are expected to be knowledgeable in areas such as safety and crevasse rescue while on the glacier, they ought to also be the ones that can comfortably lead a discussion or answer questions regarding how human-caused climate change via extreme weather and overall warming is affecting Mt. Rainier. A climate change discussion atop a melting alpine glacier likely will elicit more emotional engagement than reading a climate report in the comfort of one's own home.

Trust and Emotional Engagement

Climate change educational resources for the general public are many, including recent documentaries, IPCC reports, and various publications. Though the program presented in this report offers mountain guides a means to develop their communication skills on the impacts of climate change specifically in the context of the areas in which they guide. Typical avenues of experts and institutions sharing scientific information regarding climate change have been questionably effective²¹, according to some social scientists. Though mountain guiding is an underutilized mode of communicating climate change.

The “deficit model” assumes that non-experts are “empty vessels” waiting to be filled with information, this model has been problematized as a means of science

²¹ Collins, H. M., and Robert Evans. *Rethinking Expertise*. Chicago: University of Chicago Press, 2007.

communication by some scholars²². The implied trust that comes with the guide-client relationship offers a setting to share information in a unique and emotionally engaging setting, which may prove to be an effective route in communicating the impacts of climate change.

A channel of research suggests the importance of trust in the communication of scientific topics such as climate change²³ and trust is likely to be an important factor in knowledge acquisition and shaping perceptions of an issue such as climate change²⁴. Typically, experts of institutions such as those from universities receive the greatest level of trust in sharing scientific knowledge²⁵. While a guide certainly wields a certain degree of expertise while guiding, I suggest the notion that the trust developed in the guide-client relationship is not the typical “expert” and “non-expert” communication relationship but has the potential to incorporate more emotional engagement than typical modes of climate change communication. From personal experience and guide testimony, many guiding operations give a component of communication in guide training. Though the implied guide-client trust pivots from a certain degree of assumed expertise held by the guide, I argue that the guided mountain experience is personal and emotional, where a guide, utilizing communication skills, acts more as a facilitator of an emotionally engaging experience.

²² Collins, H. M., and Robert Evans. *Rethinking Expertise*. Chicago: University of Chicago Press, 2007.

²³Azadi, Yousof, Masoud Yazdanpanah, and Hossein Mahmoudi. “Understanding Smallholder Farmers’ Adaptation Behaviors through Climate Change Beliefs, Risk Perception, Trust, and Psychological Distance: Evidence from Wheat Growers in Iran.” *Journal of Environmental Management* 250 (November 15, 2019): 109456. <https://doi.org/10.1016/j.jenvman.2019.109456>.

²⁴ Lorenzoni, Irene, and Nick F. Pidgeon. “Public Views on Climate Change: European and USA Perspectives.” *Climatic Change* 77, no. 1 (July 1, 2006): 73–95. <https://doi.org/10.1007/s10584-006-9072-z>.

²⁵Weingart, Peter, and Lars Guenther. “Science Communication and the Issue of Trust | JCOM.” *Journal of Science Communication* 15, no. 5 (September 21, 2016): C01. <https://doi.org/10.22323/2.15050301>.

Emotional engagement of climate impacts has been suggested to be an important and underappreciated factor in communicating climate change by Salama et. al²⁶. Fueled by the trust of a guide who wields knowledge of climate science and climate change and its impacts, the visceral setting of guided mountain climbing offers a unique, underutilized, and emotionally engaging communication opportunity.

Assessment Methods and Workshop Effectiveness

With the goal of increasing guides' skillset in discussing climate change with their clients, I developed and provided a program workshop for 12 new-hire RMI guides. To assess the effectiveness of this workshop in achieving this goal, I invited the attending guides to respond to a survey. The survey I presented to the guides had the following two questions: 1) What is your current comfort level in answering questions regarding climate change during guiding operations? And, 2) How likely are you to initiate discussion on topics of climate change affecting Mt. Rainier during guiding operations? All of the 12 guides responded to each question using a Likert Scale, one to five rating system²⁷. These survey questions were asked both before and after the program workshop to assess its effectiveness.

All twelve attending guides responded to each question before and after the workshop and then the survey results were plotted into an area graph with the before and after workshop responses graphed atop one another for each survey question. The change in averages before and after the workshop, shown in red, in *figure 1* represents

²⁶ Salama, Sefat, and Khalil Aboukoura. "Role of Emotions in Climate Change Communication." In *Handbook of Climate Change Communication: Vol. 1: Theory of Climate Change Communication*, edited by Walter Leal Filho, Evangelos Manolas, Anabela Marisa Azul, Ulisses M. Azeiteiro, and Henry McGhie, 137–50. Cham: Springer International Publishing, 2018. https://doi.org/10.1007/978-3-319-69838-0_9.

²⁷ Likert, R. (1932). A technique for the measurement of attitudes. *Archives of Psychology*, 22 140, 55.

the improvement of the reported comfort level in answering questions regarding climate change. The positive value of this average change suggests that the program workshop was successful in its intended goal. Respectively, the positive value of change in averages in *figure 2* represents the increase in the reported likelihood that the attending guides will initiate a discussion with their clients on topics of climate change and how those changes affect Mt Rainier. The results of the survey indicate that after the program workshop, the attending guides stated that they are more comfortable answering questions related to climate change as well as more likely to initiate questions related to climate change and its effects on Mt. Rainier.

Survey Results

Figure 1: What is your current comfort level in answering questions regarding climate change during guiding operations?

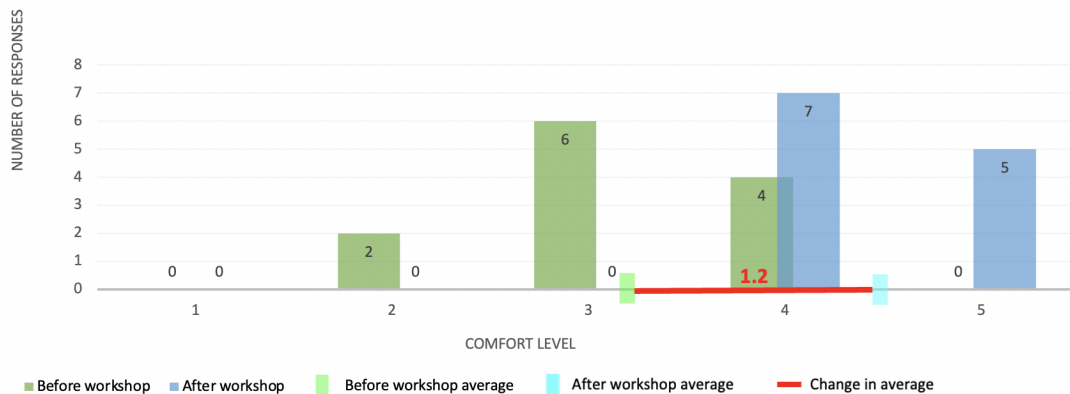


Figure 1 shows the reported comfort level in answering climate change questions of the attending guides both before and after the workshop program. Guides reported their comfortability in discussing climate change with their clients on a 1 to 5 scale, which is represented on the x-axis. The averages of the reported comfort levels before and after the workshop are shown respectively, and the difference in averages, shown in red, represents the guides' reported improvement in comfort in discussing climate change impacts with their clients.

Figure 2: How likely are you to initiate discussion on topics of climate change affecting Mt. Rainier during guiding operations?

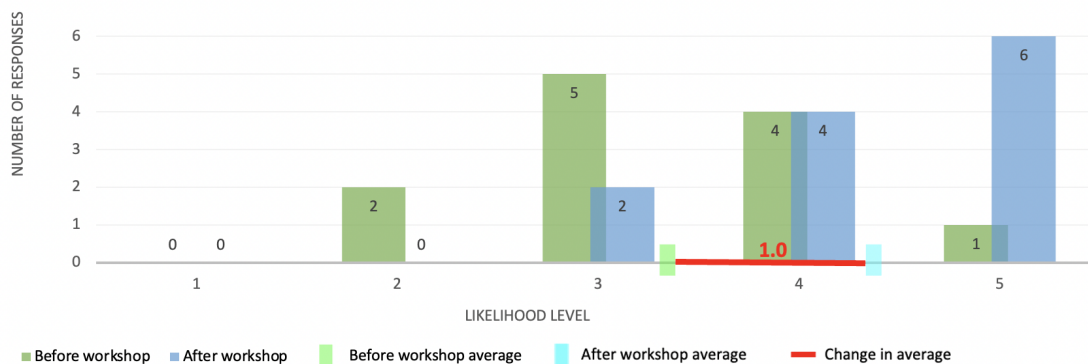


Figure 2 shows the reported likelihood of attending guides to initiate discussion of climate change impacting Mt. Rainier during guiding operations both before and after the workshop program. Guides reported their likelihood to initiate discussion of climate change impacts with their clients on a 1 to 5 scale, which is represented on the x-axis. The averages of the reported likelihood to initiate discussion before and after the workshop are shown respectively, and the difference in averages, shown in red, represents the guides' reported increase in likelihood of discussing climate change impacts with their clients.

Discussion

Further research and follow-up with the guides and clients would be useful in the discussion of the effectiveness of a workshop program of this nature. Useful research may include inviting guided clients to respond to a survey to assess the effectiveness of their guided experience to broaden their understanding of climate change and its impacts. Additionally, assessing the emotional response of guided clients while participating in a climate change discussion in mountain terrain would likely be useful information to further understand the importance of emotional engagement in communicating the impacts of climate change.

To follow this study, a continuation of contact with the guides who participated in the program workshop throughout and after a guiding season would be useful to further

develop the guides' climate communication skills and feedback on how to best develop future program workshops. Discussing the experiences and assessing the effectiveness of the workshop program from the attending guides' perspective would allow for an improvement of follow-up climate science and communication programs for mountain guides as well as how to better develop a similar program for other guiding operations.

Many guiding operations operate in the Pacific Northwest, and many more throughout the world; preliminary research suggests that there is no current program that provides climate science and communication workshops directly to mountain guides. Since guides often operate in areas that are experiencing some of the harshest impacts of climate change and given their unique role as communicators, the guiding community at large is in a unique position to utilize and develop their communication to further include human-caused climate change and its effects. I plan to continue developing this program workshop with the learned experience of the workshop with RMI's guides to improve future workshops aimed at providing resources for guides to develop their communication skills regarding climate change impacts. With the learned experience from the program workshop at RMI, I also plan to reach out and offer similar programs to other guiding operations. I intend for this project to grow as a means to emotionally engage as many people as possible to elicit a societal response toward a more stable climate.

Conclusion

The program workshop developed and provided to RMI guides described in this paper is an example of an opportunity to communicate the impacts of climate change

with the general public. Rethinking how a guided client, as a member of the general public, experiences an activity such as a guided climbing trip on Mt. Rainier could be useful in creating momentum in climate mitigation and adaptive responses. Guides have the ability to communicate and engage emotionally with the impacts of climate change such that clients could come away from a guided experience more as stewards of the environment.

Mountain guides operate in areas that are of the most affected by climate change and hold valuable anecdotal evidence of the impacts of these impacts. In their role as communicators, guides ought to have the resources necessary to be comfortable in discussing climate change and its effects with clients. From personal experience and talking with guides, I found there to be potential for collaboration between academia and the guiding industry, where academia could glean much from the anecdotal experiences of guides. As natural communicators, many guides notice the changes that occur in the areas in which they guide, and there exists potential to deepen guides' skillset to communicate the impacts of climate change. Resources provided to guides such as in the program described in this paper would likely broaden the communication of the impacts of climate change among the public.

Trust and emotional engagement are important factors in communicating the impacts of climate change and the implied trust within the guide-client relationship and the potential for emotional engagement during guided mountain climbing is an underutilized mode of communicating these impacts.

The global issue of human-caused climate change requires multifaceted mitigatory and adaptive responses. The importance of communication and engagement

of climate change and its effects with as broad an audience as possible cannot be understated, as climate-friendly policy and behavior responses come only as rapidly as emotional engagement of the issue. To communicate the issue of climate change and its effects with the public in an engaging way, we ought to look to any underutilized communication channels such as the guiding industry.

Acknowledgments

I would like to thank Tim Kelly Rossiter for his continued support and for opening the door to work with RMI. Thank you to Paul Maier and Jeff Martin of RMI for their kindness in providing the platform for this project, and to the mountain guides at RMI for contributing their time and voices. Thank you to the inspiring and unwavering supportive CSP cohort at SIO and Allison Cusick for her help in networking with guides. Thank you does not say enough to Corey Gabriel, whose leadership and inspiration was paramount to this project. Lastly, I would like to thank Jane Teranes, whose instruction and unrivaled empathy in education guided this project. May this project be dedicated to her memory.