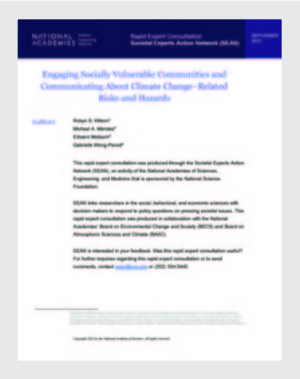

Engaging Socially Vulnerable Communities and Communicating About Climate Change–Related Risks and Hazards (2022)

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Rapid Expert Consultation
Societal Experts Action Network (SEAN)

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Engaging Socially Vulnerable Communities and Communicating About Climate Change–Related Risks and Hazards

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SEAN is interested in your feedback. Was this rapid expert consultation useful? For further inquiries regarding this rapid expert consultation or to send comments, contact sean@nas.edu or (202) 334-3440.

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Executive Summary

Extreme weather events intensified by climate change have been increasing in frequency and severity globally, including in the United States. The physical, social, economic, and health impacts of these events are felt disproportionately by vulnerable communities and are magnified by existing inequities. Decision makers engaged in planning and implementation for climate adaptation at all levels require continued support in communicating about climate risk; developing and promoting adaptation strategies; and helping to build capacities for individuals, families, and communities to respond to these extreme weather events and disasters.

This rapid expert consultation highlights how decision makers can continuously engage with vulnerable communities (**Box 1**), as well as communicate risk and promote adaptation in the face of extreme weather events exacerbated by climate change (**Box 2**). Implementing this guidance can help decision makers, researchers, and communities work collaboratively, linking analysis, deliberation, and program design to best adapt to climate change–related hazards and risks.

BOX 1
Four Strategies for Engaging Socially Vulnerable Communities

1. Form Partnerships with Trusted and Diverse Community Organizations
2. Facilitate a Structured Decision-Making Process between Decision Makers and Community Members
3. Address Key Structural Inequities That Increase Vulnerability
4. Allow and Encourage Community Ownership and Leadership of Responses

BOX 2
Strategies for Communicating Risk and Promoting Adaptation in the Face of Extreme Weather Events Exacerbated by Climate Change

1. Use Simple, Clear Messages by Paring Down Technical Information
2. Understand How Messages Are Interpreted by Different Communities
3. Repeat Messages Often
4. Enlist Caring Messengers Trusted by Both Decision Makers and Local Communities
5. Articulate Clear Objectives for Climate- and Disaster-Related Actions
6. Move beyond the Abstract, and Describe Risks in Terms That Are Psychologically Near in Space and Time
7. Trigger Affect-Driven Responses, but Use Emotional Appeals Judiciously
8. Emphasize Emerging Social Norms around Adaptation and Resilience
9. Frame Climate Change–Related Hazards and Risks Strategically
10. Convey the Available Risk Management Options and Their Effectiveness

Introduction

Over the past 20 years, the United States has seen an increase in climate change–related extreme weather events (Intergovernmental Panel on Climate Change [IPCC], 2022), such as wildfires, flooding, heavy precipitation, droughts, hurricanes, and extreme heat and cold, and these events are "expected to continue to increase or worsen" (U.S. Global Change Research Program [USGCRP], 2018, p. 57). The impacts of climate change are often experienced most directly through such events, making them "more frequent, intense, widespread, or of longer duration." Those impacts in turn have wide-ranging effects on society, the environment, public health, and the economy, all of which can affect people's physical, mental, social, and economic well-being (Garfin et al., 2022; USGCRP, 2018).

This rapid expert consultation focuses on how decision makers can communicate with individuals and with socially vulnerable communities on what actions they can take, personally and collectively, in response to extreme weather events, with an emphasis on enhancing their resilience and adaptation[5] at all points in time—before, during, and after extreme weather events. At the same time, however, tackling both current and future climate risks (including wildfires, flooding, heavy precipitation, droughts, hurricanes, and extreme heat and cold) and responding to extreme weather hazards will also require community, state, and federal actions and policies. These actions and policies include providing increased social support and services to build adaptive capacity and resilience. While this rapid expert consultation is oriented primarily to public-sector decision makers across federal, state, tribal, and local governments, the application of similar principles to choices and investments made by leaders in the private, civil society, and philanthropic sectors with respect to responding to climate risks could contribute to increased adaptive capacity and resilience in communities. The success of communication campaigns is limited if individuals have no agency; if the system is not supportive of the needed change; or if people lack the financial or other resources, including time or access, to help. Decisions made in the near term are critical building blocks for the broader, longer-term changes needed to adapt fully to climate change.

Equity is a crucial consideration in these efforts. It is important to recognize that information and communication are asymmetrical, and vulnerable[6] groups—including pregnant people, children, older adults, immigrant groups, Indigenous peoples, low-income communities, communities of color, people with disabilities, vulnerable occupational groups (e.g., workers who are exposed to extreme weather), and people with preexisting or chronic medical conditions, among others—often suffer from a comparative lack of authoritative information (American Public Health Association [APHA], 2022; USGCRP, 2018). Acknowledging the resilience of a community "does not mean a given social group or community should be left to its own devices in and through policy and planning...capacity is inhibited by structural constraints and can be enabled and enhanced by the provision of resources by governments, authorities and organizations" (Gorman-Murray et al., 2017, p. 40). Accordingly, federal, state, local, and tribal decision makers need information about how they can communicate

[5]Adaptation refers here to the process of adjusting to imminent and future effects of climate change. It can include structural and physical adaptation (e.g., engineering and built environment, technological, ecosystem-based, service-oriented); social adaptation (educational, informational, behavioral); and institutional adaptation (economic organizations, laws and regulation, government policies and programs) (Noble et al., 2015).

[6]Vulnerable is defined as "the tendency or predisposition to be adversely affected by stressors or impacts, including climate-related health effects" (Gamble et al., 2016, section 9.2).

effectively with socially vulnerable[7] communities about climate change–related hazards and risks to inform individual decision making. These groups include not only those enumerated above but also, for example, people without vehicles and those with limited English proficiency. In the face of acute climate change–exacerbated hazards, such as severe flooding, wildfires, or drought, the ways in which individuals respond can have immediate effects on their financial and physical well-being, but also contribute to long-term societal resilience when aggregated across individuals and under certain conditions (Dietz, Shwom, and Whitley, 2020; Nielsen et al., 2021; Shwom et al., 2017; van Valkengoed and Steg, 2019; Wilson et al., 2020; Wisner et al., 2014).[8]

The extreme weather events exacerbated by climate change also often have disproportionate impacts on the above vulnerable populations (APHA, 2022; Dietz, Shwom, and Whitley, 2020; IPCC, 2022; Jacobs, 2019; Méndez, Flores-Haro, and Zucker, 2020; USGCRP, 2018). Among these impacts are psychological distress; physical impairments; and loss of income, property, and livelihood (Wong-Parodi, 2020). Moreover, extreme weather events exacerbated by climate change can compound existing vulnerabilities and inequities experienced by these populations, stemming from past and present structural and systemic discriminatory practices that can limit the ability of communities to adapt (Chen et al., 2022; Jacobs, 2019; USGCRP, 2018).

The impacts of such events are felt more by these populations because of a lack of access to essential services; health disparities; limited financial resources (including insurance); a lack of environmental knowledge; and structural discrimination, including racism and other forms of privileging and exclusion (APHA, 2022; USGCRP, 2018). These inequities often also hamper the ability of communities and individuals to adapt to these events as a result of the cost of adaptation measures, the lack of economic resources, and limited access to technology and climate change–related information and skills (IPCC, 2001; Méndez, 2020).

Decision makers engaged with adaptation planning and implementation for climate change at the federal, state, local, tribal, and regional levels are key participants in communicating climate risk; developing and promoting adaptation strategies; helping to build capacities for individuals, families, and communities; and ideally listening and responding to the concerns and ideas of various stakeholders, including community members, with regard to managing and adapting to climate risks (Dow and Tuler, 2021; Lambright, Chjangnon, and Harvey, 1996; Pralle, 2009; Surminski and Leck, 2017). This rapid expert consultation[9] draws on research on climate and risk communication, decision making, and psychology and behavior change to identify strategies decision makers can use for effective communication and engagement with socially vulnerable populations, recognizing that implementation of these strategies, especially at the local level, may require additional investments and resources to develop capacity and expertise.

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[7]The Centers for Disease Control and Prevention (CDC) defines "social vulnerability" as "the resilience of communities (the ability to survive and thrive) when confronted by external stresses on human health, stresses such as natural or human-caused disasters, or disease outbreaks" (CDC, 2021, see "Helpful Terms & Facts").

[8]According to Wilson and colleagues (2020, p. 204), "complex interactions among individual beliefs, social dynamics and cultural worldviews can shape whether and how individuals and communities adapt to changing environmental conditions. Such a perspective aligns with recent calls to view individual behaviors as part of a complex adaptive system and as co-evolving with surrounding social, cultural and environmental contexts, and with emerging frameworks that address how transformative adaptation can be initiated and contribute to resilience and be transformative when widely adopted for an extended time, or when sufficiently innovative or of high enough intensity in their impact. In the short term, such actions may transform only the natural or physical environment, but in the longer term, they can shift social structures (such as norms), which then results in more widespread adoption of these actions in a mutually reinforcing process."

[9]The full statement of task states "The National Academies of Sciences, Engineering, and Medicine will produce a rapid expert consultation to assist decision makers in communicating with vulnerable communities about climate-related hazards and risks. This consultation will identify factors that increase the effectiveness of communication intended to inform individual decision making in the face of extreme weather events exacerbated by climate change. It will take into consideration the need for effective communication relevant to a broad range of climate-related hazards and types of communities, and will look to identify common strategies to communicate and engage with the public on risk assessment and decision making. Drawing from research on science and risk communication, decision making, and psychology and behavior change, this document will identify impactful and actionable guidance that decision makers can use to effectively communicate climate hazard information. This document will be designed to be of practical use to decision makers, but will not recommend specific actions or include other recommendations. It will be reviewed in accordance with institutional guidelines."

ENGAGING SOCIALLY VULNERABLE COMMUNITIES

Given the disproportionate impact of extreme weather events exacerbated by climate change on socially vulnerable communities, state and local decision makers need to adopt strategies for engaging these communities on an ongoing basis to inform individual decision making in anticipation of such events. These strategies need to reflect an understanding of the variety and local context of climate hazards and impacted communities. Accordingly, strong community engagement aimed at identifying and understanding local concerns and information needs will help determine what messaging, delivered by whom, will be most effective. Communicating with socially vulnerable communities is successful when these communities are part of the decision-making process; trust the process; and have the ability, resources, and agency to participate. Decision makers need to be thoughtful about not forcing actions on communities, instead building a suite of actions in conjunction with communities and ensuring that actions are community-focused and cognizant of long-term consequences so that risks are not passed on to others in the future. The subsections below detail four strategies decision makers can use to engage socially vulnerable populations in decision making with respect to adaptation in the face of climate change–related hazards and risks, including extreme weather events. These strategies are focused on needs in advance of such events rather than on post event response, although they can be useful post event as well.

1. Form Partnerships with Trusted and Diverse Community Organizations

Partnerships with trusted and diverse community organizations that have strong relationships within the community are critical because "these organizations are close to their audiences; know how to tailor information to those audiences effectively; and, most important, have trusted leaders who can be effective spokespersons" and are critical assets in communicating effectively and efficiently across communities and vulnerable populations (National Academies of Sciences, Engineering, and Medicine [NASEM], 2021, p. 7). Building credible partnerships requires early two-way dialogue to establish trust and build a shared vision for addressing a problem, resident/stakeholder involvement in the decision-making process, and sharing of information in a way that is understandable and responsive to local needs (NASEM, 2020; Quinn, Jamison, and Freimuth, 2020).

An example of a community partnership is the new Our Communities, Our Bay partnership between researchers and community organizations, which includes Stanford University; RTI International; Sonoma Technology, Inc.; El Concilio of San Mateo County; and Climate Resilient Communities. The partnership investigates the effectiveness of affordable interventions in reducing exposure to climate change–related hazards (e.g., extreme heat, wildfire smoke, flooding) among low-income, difficult-to-reach households.[10] Similarly, in California, migrant rights and environmental groups united to provide mutual aid (including emergency information in Spanish and Indigenous languages, labor protections for farmworkers, and private disaster relief funds) during disasters for undocumented Latino and Indigenous migrants (Méndez and Pizzaro, 2022; Méndez, Flores-Haro, and Zucker, 2020). And the Federal Emergency Management Agency (FEMA) has developed the Resilient Nation Partnership Network, which promotes natural hazard mitigation and climate adaptation[11] actions, advances equitable resilience initiatives, and expands capacity through partnerships across diverse communities and networks.[12]

[10] See https://www.ourcommunitiesourbay.org/project.
[11] Climate adaptation refers to "taking action to prepare for and adjust to both the current and projected impacts of climate change" (EPA, n.d.-b, last paragraph).
[12] See https://www.fema.gov/partnerships/resilient-nation-partnership-network.

Another example involves providing LGBTQ+ community centers with training and funding and entering into consultations on the renovations needed to qualify as state and federal emergency shelters, or offering other forms of disaster response assistance directly to the communities the centers serve. Such organizations often have strong cultural and structural competency in engaging with LGBTQ+ communities, enjoy high levels of trust with community members, and have the flexibility to provide assistance focused specifically on these populations.

In effective community-based planning processes, vulnerable groups are actively involved in the identification, analysis, monitoring, and evaluation of disaster risks (Goldsmith, Raditz, and Méndez, 2021). This approach helps reduce their vulnerabilities and enhance their capacities. Implementation processes can include such activities as community training, disaster response drills, early warning, and community-based participatory mapping projects (Gero, Méheux, and Dominey-Howes, 2011; Henly-Shepard, Gray, and Cox, 2015; Méndez, 2022).

2. Facilitate a Structured Decision-Making Process between Decision Makers and Community Members

A structured decision-making process can help groups establish a common basis for dialogue by identifying objectives and considering new sources and types of information (Goldsmith, Raditz, and Mendéz, 2021; NASEM, 2016).[13] Individuals and communities, especially marginalized individuals and groups, need to be empowered in decision making through representation, a process whereby they have access to public voice, are included fairly, and have a place at the decision-making table in an inclusive process (Blue, Bronson, and Lajoie-O'Malley, 2020). A decision pathways approach allows participants to explore the links between scientific information and other values using a set of common-sense questions. This approach can be used to

- situate the decision in its social and policy context;
- identify specific objectives;
- identify possible alternative actions;
- compare the benefits, costs, and risks of each alternative;
- reflect on key trade-offs; and
- reconcile differences and summarize the results of the process (Gregory, Satterfield, and Hasell, 2016).

To address any gaps in the information possessed by decision makers or community members, tutorials by credible and trusted sources can be used to form the basis of a common understanding across participants (NASEM, 2016). Such a process can guide people in better understanding, for example, scientific information or Indigenous knowledge and articulating their own values, and can help decision makers design actions that are responsive to stakeholders' concerns (NASEM, 2016). To facilitate their engagement, however, individuals may need to be compensated for their time and provided with other resources (e.g., transportation, meals, child care, translation services) necessary to make their participation possible, as well as to have cumbersome barriers to their participation (e.g., application processes for individuals) removed.

An example of a structured decision-making process is the Atlantic Salmon Recovery Plan. The process brought federal agencies, practitioners, and tribal officials together in guiding the species'

[13] The National Research Council (2008) provides a set of diagnostic questions to inform a participatory process.

recovery, outlining specific approaches for reducing threats to the species, identifying specific timetables for action, and estimating costs to achieve recovery goals.[14]

3. Address Key Structural Inequities That Increase Vulnerability

Talking about climate change–related hazards and risks in isolation obscures the broader exposure issues and structural factors—such as racial and gender inequities in resources, housing, and transportation—that also impact decision making and the ability to undertake adaptation or hazard mitigation actions at the individual or community level. It is critical for authorities to acknowledge these broader structural factors; to frame adaptive actions to be undertaken by individual community members as one of several tools that can help advance equity in communities vulnerable to climate change–related hazards and risks; and to convey a commitment to advancing equity beyond extreme weather events, with a focus on enhancing long-term resilience and adaptive capacity. An intersectional lens, or a contextual vulnerability framing, can help address the ways in which climate change–related hazards and risks intersect with human identity and culture (Crenshaw, 1989; Méndez, Flores-Haro, and Zucker, 2020).

Social vulnerability maps, such as the Centers for Disease Control and Prevention's (CDC's) Social Vulnerability Index Interactive Map,[15] identify communities that may need support when faced with a climate change–related hazard based on a variety of social factors related to socioeconomic status, household composition, race/ethnicity/language, and housing/transportation (Centers for Disease Control and Prevention [CDC], 2021). These maps can be helpful to public health officials and emergency responders when planning for and responding to hazardous events. However, they often do not reflect how individuals experience vulnerabilities within communities (Jacobs, 2019), and thus are not a substitute for sustained community engagement. Providers can also receive training in structural competence whereby they are educated about the social structures that create vulnerability, helping them understand and identify invisible subpopulations that require additional resources (Goldsmith, Raditz, and Méndez, 2021).

4. Allow and Encourage Community Ownership and Leadership of Responses

Best practices in public ownership include "actively seeking engagement with community members, listening to feedback and adapting accordingly, establishing local public oversight committees, and implementing bottom-up approaches with community members leading solutions" (NASEM, 2021, p. 8). But without adequate external support to ensure that this leadership is allowed to flourish, community members are asked to do significant work without financial, material, or moral support. Coproduction[16] can support research and community collaboration to produce actionable knowledge and inform climate change–related actions (Jagannathan et al., 2020), facilitating joint ownership of and investment in processes and outcomes among practitioners, community members, and decision makers (Howarth et al., 2022). It is important to have resources available to support the development of public ownership for all parties, including community members.

FEMA's Whole Community Approach, for example, is a model for bringing together a variety of stakeholders, including individuals, emergency management practitioners, community leaders, government officials, and the private and nonprofit sectors, to collectively understand and address

[14]See https://atlanticsalmonrestoration.org/news-announcements/atlantic-salmon-recovery-news-releases/noaa-and-usfws-release-atlantic-salmon-recovery-plan.
[15]See https://svi.cdc.gov/map.html. Other maps include rural capacity maps (see https://headwaterseconomics.org/equity/rural-capacity-map/).
[16]Coproduction is defined as "processes that iteratively unite ways of knowing and acting—including ideas, norms, practices, and discourses—leading to mutual reinforcement and reciprocal transformation of societal outcomes" (Wyborn et al., 2019, p. 320).

community needs, engage community members, and strengthen existing community structures when faced with climate threats (FEMA, 2011).

COMMUNICATING ABOUT RISK AND PROMOTING ADAPTATION IN THE FACE OF EXTREME WEATHER EVENTS EXACERBATED BY CLIMATE CHANGE

An individual's decision to adapt to escalating climate change–exacerbated hazards may be affected by intrapersonal and interpersonal factors. For example, psychological factors, including heightened personal risk perception and coping ability, promote behavior change (Reser and Swim, 2011), while social context is critical in promoting action through positive social norms, community strength, and institutional support (Grothmann and Patt, 2005; Reser and Swim, 2011; van der Linden, 2015; Wilson et al., 2020; Wong-Parodi and Garfin, 2022). Conversely, perceptions of low personal risk and limited ability to act, for example, have been shown to be barriers to behavior change, while social discourse—what people hear (including mis- and disinformation) from the media, friends, colleagues, neighbors, and public agencies—and financial disincentives can hinder adaptation (Grothmann and Patt, 2005).

Given what is known about what motivates and constrains adaptation, decision makers can communicate strategically to promote adaptation behaviors in the face of extreme weather events exacerbated by climate change (e.g., by working to heighten perceptions of personal risk and supportive social norms).[17] Cocreating a realistic set of actions requires that decision makers undertake a dialogue to listen to and understand community perceptions and realities. Communications need to be tailored, recognizing that regardless of whether individuals perceive themselves as vulnerable, they may need to take adaptive action. In addition, the degree to which communication can promote behavior change can be affected by both external barriers (e.g., limited resources, inadequate access to funding and opportunities, lack of cultural awareness) and internal factors (e.g., lack of concern, distrust, misperceptions of feasibility).

Decision makers will need to modify their communications and efforts as climate adaptation issues and goals evolve over time. They need to recognize that some actions that provide short-term relief—such as having local authorities provide or adapt window air-conditioning units in regions where heat waves occur more frequently and where housing typically lacks central air conditioning—may be maladaptive in the long term (e.g., by increasing pressure on energy infrastructure, and potentially by releasing additional greenhouse gases produced by the use of fossil fuels to generate electricity). Ten strategies for communicating about risk and adaptation in the face of extreme weather events exacerbated by climate change are detailed below.

1. Use Simple, Clear Messages by Paring Down Technical Information

Using simple, clear, nontechnical messaging that addresses people's underlying concerns can enhance understanding of complex information (Maibach, 2019), as can providing scientific information that is targeted to the level of their understanding and concerns (Joslyn and Demnitz, 2021). When communication is too complicated and not targeted to people's understanding, people may stop paying attention (Lupia, 2013); simplify the communication inappropriately (Downs, Bruine

[17]For example, hazard protection motivation theories focus on risk perception (how one sees the severity of the risk, how serious it is, and one's vulnerability to it), response efficacy (a person's expectation that carrying out an action can remove the threat), and self-efficacy (one's belief that one has the ability to carry out the action), all of which are critical components driving protective action (regardless of the hazard) (Babcicky and Seebauer, 2019; Rainear and Christensen, 2017; Westcott et al., 2017). Other literature shows that experience of an extreme weather event alone is not enough to enhance risk perception; rather, negative experiences may offer a window of opportunity for communicating about extreme weather events and adaptation (Wong-Parodi, 2022; Wong-Parodi and Garfin, 2022; Wong-Parodi and Rubin, 2021; Zhang and Maroulis, 2021). Individuals need to be appropriately concerned about the impending risk and attribute the threat to climate change, and they must believe that the actions available to them are feasible and effective (Wong-Parodi, 2022; Wong-Parodi and Garfin, 2022; Wong-Parodi and Rubin, 2021).

de Bruin, and Fischhoff, 2008); become hostile to the information or the messenger (Schnepf et al., 2021); or fail to develop coherent mental models, making subsequent learning less effective (see below) (Bruine de Bruin and Wong-Parodi, 2014; Kraft et al., 2015). Best practices for simple, clear messaging may include the following:

- Avoid jargon—Explain frequently used climate change–related terms in everyday language. Members of the public may not understand terms used frequently in climate communications, such as "carbon neutral," "mitigation," or "adaptation" (Bruine de Bruin et al., 2021; Shulman et al., 2020). When talking about mitigation, for example, decision makers can refer to preventing climate change from getting worse and to adaptation as making changes to live with the impacts of climate change.[18]
- Use a "mental models" approach—Mental models are the sets of causal beliefs people apply in thinking about what will happen in each situation (Bostrom, 2017). In the present context, applying the concept of mental models entails using analogies, metaphors, or other devices to make complex aspects of climate change more accessible to people without specialized knowledge (Stern and Raimi, 2015). An example is a carbon emissions model in which global warming is the result of deforestation and the burning of fossil fuels, which increases the emission of carbon (Bostrom, 2017). Mental models can also contribute to clear and open communication among stakeholders and aid in incorporating multiple sources of knowledge (Biggs et al., 2011). It should be noted, however, that mental models can lead to wrong conclusions if the analogies that inform them, such as the conflation of climate with weather, are misleading (Bostrom, 2017).
- Use culturally relevant messages—Messages need to be culturally, linguistically, and socially appropriate to resonate with target audiences. Accordingly, messages that are developed and tested with members of the intended audience are more likely to succeed (Downs et al., 2004, 2018). Using cultural models—shared mental models used to interpret and communicate about phenomena, including weather and climate—can help in designing culturally appropriate messages (Kempton, Boster, and Hartley, 1996).
- Use pictographs to show changes in risk—Pictographs help the audience engage with numbers and can clearly communicate the expected benefits of different actions, particularly when the communication includes individual statistics (Fagerlin, Zikmund-Fisher, and Ubel, 2011). An example comes from the Federal States of Micronesia, where pictographs developed using focus groups of local community members were used as an aid in understanding strategies for adapting to sea-level rise, coastal erosion, increases in heavy rainfall events, coral bleaching, and ocean acidification (Hagedoorn et al., 2019). It is important for pictographs to be culturally and geographically contextualized. Research in health settings also demonstrates that pictographs can be effective in communicating knowledge, particularly for individuals with lower numeracy, non–English speakers, and those lacking literacy (Hawley et al., 2008).
- Include uncertainty estimates—Including uncertainty estimates when discussing findings increases trust in climate projections (Joslyn and Savelli, 2010; Kause et al., 2021), and can increase perceptions of the robustness of scientific consensus, as well as expertise (Joslyn and Demnitz, 2019; Joslyn and LeClerc, 2016; Van Der Bles et al., 2020). The authors of a systematic review recommend the following strategies in designing communications about uncertainty: (1) "Describe the broader context of data variation

[18]See https://dornsife.usc.edu/news/stories/3568/guide-to-climate-change-jargon.

and consensus within the discipline"; (2) "Share a warning about the potential implicit politicization of climate messages"; (3) "Describe an interval as 'most likely to be correct' rather than 'conveying more uncertainty'"[19]; (4) "Describe the underlying distribution, using best estimates and range boundaries"[20]; (5) "Jointly present verbal probability expressions and numerical probability ranges, explicitly specifying upper and lower bounds"[21]; and (6) "Use positive rather than negative verbal probability expressions"[22] (Kause et al., 2021, p. 9).

2. Understand How Messages Are Interpreted by Different Communities

Close attention to what influences interpretations of communications may shed light on how adaptive actions can, in themselves, become signals in processes of amplification and attenuation of the level of perceived risk (Dow and Tuler, 2021; Masuda and Garvin, 2006). One way of understanding how messages are interpreted is by testing them using "concurrent verbal protocols," which involves asking target audiences to think aloud as they read drafts of a communication (Ericsson and Simon, 1994; NASEM, 2022). Another way of understanding how messages are interpreted is by using community-based scenarios whereby hypothetical situations are presented to a group of community members to reveal community perceptions of risk (Buchecker, Menzel, and Home, 2013; Cairns et al., 2013; Sheppard et al., 2011). In addition, understanding the relationship among social identity, perception of climate disaster information, and risk perception and adaptation can shed light on how intended audiences interpret messages (Frank, Eakin, and Lopez-Carr, 2011). For example, developing more green spaces in low-income neighborhoods can lead to gentrification, raising the question, "Who are new urban parks really for?"—signaling exclusion and marginalization to some and remediation of urban heat islands and flood control to others (Anguelovski, Connolly, and Brand, 2018).

3. Repeat Messages Often

Research on health communication shows that a sufficient level of reach and frequency is necessary for messages to have their intended effect (Abroms and Maibach, 2008; Hornik, 2002; Noar, Benac, and Harris, 2007). In contested communication environments, such as that characterizing the issue of climate change, repetition of messages reminds people of key facts, maintaining their salience (Maibach, 2019; NASEM, 2017) and thereby helping to make individuals less susceptible to misinformation that conflicts with the facts (Cook, Lewandowsky, and Ecker, 2017).

Messages do not need to be identical to be reinforced effectively through repetition. Variations on a message theme can be helpful, both for communicators (to reduce potential fatigue associated with repeatedly saying the same thing) and for audience members (to reduce potential fatigue associated with repeatedly hearing or seeing the same message) (Kim and So, 2018). Effective message repetition can also be achieved when multiple messengers use their trusted voices to convey the same messages, consistently, over time. To this end, decision makers can partner with local organizations to design and deliver a shared set of messages. Delivering the same message (or variations on the theme) can also be effective if multiple channels are used (e.g., social media platforms, traditional media, community newsletters, local radio, church pulpits, parent–teacher

[19]For example, "Two teams of climate scientists have made the following predictions regarding the temperature rise by 2099. Please select the prediction that is the most likely to be correct. Team A: The temperature will increase between 1.1 ◦C and 6.4 ◦C. Team B: The temperature will increase between 2.2 ◦C and 5.4 ◦C" (Kause et al., 2021, p. 9).

[20]For example, "If human activities are unchanged, our best estimate is a 4 degree increase in global temperature in 50 years and we are 90% confident that the increase will be between 1 and 8 degrees" (Kause et al., 2021, p. 9).

[21]For example, "The Greenland ice sheet and other Arctic ice fields likely (60%–100% probability) contributed no more than 4 m of the observed sea-level rise" (Kause et al., 2021, p. 9).

[22]For example, "It is very likely that hot extremes, heatwaves, and heavy precipitation events will continue to become more frequent" (Kause et al., 2021, p. 9).

association meetings). For example, a study on COVID-19 vaccine uptake found that using multiple media channels increased acceptance of the vaccines (Piltch-Loeb et al., 2021).

4. Enlist Caring Messengers Trusted by Both Decision Makers and Local Communities

The use of sources people deem credible can increase the chances that information and recommendations will be accepted (Maibach, 2019). In addition, subpopulations such as undocumented immigrants, communities of color, and LGBTQ+ individuals may lack trust in government officials (in particular, law enforcement), making the need for credible and trusted sources more critical.

Social science research has identified three dimensions that influence people's perceptions of credibility: expertise (seeing someone as having the knowledge, skills, and competency to provide accurate information), trustworthiness (seeing someone as having truthful intent), and benevolence (seeing someone as having goodwill and having people's best interests at heart) (Barki, Robert, and Dulipovici, 2015; Fiske, Cuddy, and Glick, 2007; Hovland, Janis, and Kelley, 1953; McCroskey and Teven, 1999; Pornpitakpan, 2004). An example of the use of trusted sources is the New Climate Voices[23] initiative, which used spokespeople in designing videos that could appeal to a conservative audience (Goldberg et al., 2021). A study in two districts in Missouri and Georgia found that the videos increased Republicans' understanding of the existence, causes, and harms of climate change in those districts (Goldberg et al., 2021).

Enlisting local opinion leaders—including both laypeople and professionals—in addition to trusted networks and institutions as intermediaries between climate experts and community members can be effective as these local leaders are already within the targeted audience's social network; they can use word of mouth to communicate; and they have local knowledge, including understanding of values and norms (Burn, 1991; Herr, Kardes, and Kim, 1991). Climate Matters,[24] for example, engages climate experts with trusted community members—weathercasters—to enhance public understanding of the local realities of climate change (Maibach et al., 2022). Another example is the Medical Society Consortium on Climate and Health,[25] which uses physicians as trusted messengers to provide information on climate change and health to communities and policy makers.

5. Articulate Clear Objectives for Climate- and Disaster-Related Actions

Setting clear communication and climate change–related objectives is important in all phases of the development of action plans. Clearly articulated objectives can help in designing an effective program, communicating its intent to the community, and prioritizing specific actions for achieving the objectives (Environmental Protection Agency [EPA], n.d.-a; Gregory et al., 2012). Examples of documents with clearly articulated goals include Greenworks Philadelphia,[26] a plan that outlines the city's five overarching goals, 15 specific targets, and specific initiatives for achieving the city's climate action objectives. Similarly, Chicago's Climate Action Plan[27] outlines goals, actions, and detailed methodologies for evaluating potential actions. The first key step in setting objectives and selecting actions to achieve them is to articulate general goals (e.g., increase the community's climate resilience or reduce energy use). The second is to understand relevant context. Questions to ask in

[23] See https://www.newclimatevoices.org.
[24] See https://www.climatecentral.org/climate-matters.
[25] See https://medsocietiesforclimatehealth.org.
[26] See https://archive.epa.gov/epa/statelocalclimate/set-goals-select-actions.html.
[27] See http://www.chicagoclimateaction.org/pages/introduction/10.php.

this regard include the following: What is already happening in your community relative to these goals? Are specific activities under way? Are there relevant plans and priorities? What is the path to adoption or implementation for this effort? Third is to set specific goals after conducting background research and engaging appropriate stakeholders. Fourth is to brainstorm actions with stakeholders, including the general public and expert advisors. The fifth step is to systematically review and evaluate potential actions, followed by selecting actions that are both reasonable and achievable (EPA, n.d.-a).

High-quality decisions are often defined as those that are consistent with the values or objectives of the individual or community involved. If a community prioritizes the health of its residents above all else, for example, actions that are consistent with the community's values and objectives are those that maximize public health. However, people have difficulty identifying decision-relevant objectives when the available options are not familiar to them. For example, if the options are for an energy infrastructure investment for a public health–focused community, tying that investment to health system energy needs in the community might be helpful. Thus, it is important to define precisely the values and objectives associated with the various options, and to evaluate their performance through that lens (NASEM, 2016). Like decisions, moreover, communications about those decisions need to be developed in line with objectives and values clearly tied to key concerns of the community.

6. Move beyond the Abstract, and Describe Risks in Terms That Are Psychologically Near in Space and Time

Research suggests that the risks most likely to motivate people are those that are psychologically near them in space (i.e., impacting family, species, and places close to them) and time (i.e., the present or the near future) (Ballew et al., 2019; Maibach, 2019). Framing climate change and its consequences as a present, local, personal, and likely risk/danger instead of a future, distant, global, impersonal, and abstract or highly uncertain threat can aid efforts to adapt to climate change and extreme weather events (van der Linden, Maibach, and Leiserowitz, 2015). Such framing also needs to take account of comparative optimism, whereby people tend to regard local conditions as being more favorable than global conditions and to think that major effects of climate change will be felt locally in the distant future and elsewhere immediately (Joslyn and LeClerc, 2016). Framing is also influenced by group membership. Relative to White respondents and those of higher socioeconomic status, non-White respondents and those of lower socioeconomic status view as environmental issues a greater number of pressing societal issues, including pollution, drought, poverty, traffic congestion, lack of access to parks and natural areas, and unemployment (Song et al., 2020).

Perception of personal risk is a precondition for adaptation to climate change–exacerbated hazards such as floods (Grothmann and Reusswig, 2006), wildfires (McCaffrey, 2004), and heat waves (Kalkstein and Sheridan, 2007; van Valkengoed and Steg, 2019). However, cognitive biases can constrain accurate assessment of the risk posed by these events because information about risks is difficult to recall, and because during uneventful periods, people become unrealistically optimistic about future exposure to such events (Grothmann and Patt, 2005; Taylor, Bruine de Bruin, and Dessai, 2014; Trumbo et al., 2014). These realities of risk perception highlight the importance of shifting the focus beyond abstract data about risks unlikely to affect people and localities in the near future.

The tendency of people to perceive events as being more likely when they have experienced such an event recently can be attenuated by providing explicit information about likelihood (Demnitz and

Joslyn, 2020). Some evidence suggests that concrete information about extreme weather events (e.g., an increase in the number of annual heat waves in a given location, as opposed to an increase in global average temperature) may be helpful for some groups (e.g., conservatives in one study [Joslyn and Demnitz, 2019]). Focusing on locally relevant impacts is also consistent with the scale at which adaptation often takes place (at the local, municipal, or community level).

7. Trigger Affect-Driven Responses, but Use Emotional Appeals Judiciously

Evoking a response that involves a sense of fear, worry, or concern about a hazard can elevate risk signals and has the potential to initiate a process of behavioral change through associative decision making (Slovic, 1987; Slovic and Peters, 2006). Research examining the emotional correlates of behavior and responses to communications about climate change points to the need to understand under what circumstances and how communications about climate change and related extreme weather events evoke emotional responses (Brosch, 2021). At the same time, however, evoking fear, worry, or concern can cause people to perceive a threat as uncontrollable, and so to either deny the risk or give up on doing anything about it (Folkman et al., 1986). These extreme responses are most likely when individuals are fearful but do not see a feasible and effective path forward for protecting themselves. In addition to denial and fatalism, there is a risk of harming the credibility of communications if levels of fear, worry, or concern evoked by communications are inconsistent with the magnitude of the risk (Bults et al., 2011; Mah et al., 2020).

If an affect-driven approach (an attempt to evoke emotions) is to be effective, the messaging must provide critical information about a hazard, including threat severity and personal susceptibility to the threat, as well as offer a course of action that is both feasible and effective in limiting the impact of the threat (Floyd, Prentice-Dunn, and Rogers, 2000; Peters, Ruiter, and Kok, 2013; Rogers, 1975; Tannenbaum et al., 2015; Witte, 1992). The latter information about how to protect oneself from the threat can empower individuals to take action to assuage their fear and address the underlying problem that caused it (Floyd, Prentice-Dunn, and Rogers, 2000; Peters, Ruiter, and Kok, 2013; Rogers, 1975; Tannenbaum et al., 2015; Witte, 1992). At the same time, however, it is important to remember that when it comes to climate change adaptation, beyond access to climate risk information, physical and financial resources are often necessary to implement an adaptive change.

As discussed above, research has shown that some people tend to see climate change as psychologically distant—a set of uncertain events that might occur far in the future, impacting distant places and affecting people dissimilar to themselves—because they do not see it as affecting their daily lives (Leiserowitz, Carman, et al., 2022; Leiserowitz, Maibach, et al., 2022; McDonald, Chai, and Newell, 2015; Spence, Poortinga, and Pidgeon, 2012; Weber, 2010). Experiencing weather events with unusual intensity, duration, or frequency heightens emotional engagement by establishing a link between climate change and the negative effects people personally experience during such an extreme event in their community, thus increasing the likelihood of behavioral adaptation (Li and Otto, 2022). One study, for example, found that farmers who had versus those who had not experienced water shortages several years in a row were more likely to take adaptive action, illustrating the importance of first-hand experience (Haden et al., 2012; Wilson et al., 2020). Research on subjective attribution—a person's understanding of how an extreme weather event was caused by or connected to climate change—found that individuals who had experienced flooding repeatedly reported significantly greater concern about climate change compared with those who had not experienced such an event (Dryden, Morgan, and Broomell, 2020; Ogunbode, Doran, and Böhm, 2020). Similarly,

research on hurricanes has shown that prior negative personal experience with these events is associated with greater perception of hurricane risk (Wong-Parodi and Rubin, 2022).

8. Emphasize Emerging Social Norms around Adaptation and Resilience

Cultural conventions and social norms are informal rules of social behavior (Fehr and Fischbacher, 2004; Ostrom, 2000) and shape adaptation (Norgaard, 2011; Swim et al., 2011; van Valkengoed and Steg, 2019). Research has shown that people tend to adopt a certain behavior if others they hold in high regard are also doing so or if that behavior is popular among people like themselves (Cialdini et al., 2006). Authors of an empirical review of the literature on social norms and proenvironmental behavior concluded that social norm interventions (i.e., efforts to influence perceptions of social norms) are effective at inducing significant behavior changes (Farrow, Grolleau, and Ibanez, 2017).

Other research has shown that social norm interventions targeting second-order climate beliefs—that is, beliefs about the beliefs of others—can be effective in reinforcing normative perceptions about climate change and increasing support for climate policy (Nolan, 2021). Such interventions can target second-order beliefs through messaging or through manipulation of the observed environment (Nolan, 2021). An example of an effective social norm intervention is telling both liberals and conservatives that 97 percent of climate scientists have concluded that human-caused global warming is happening. Study participants subsequently expressed higher estimates of the scientific consensus (Nolan, 2021; van der Linden, Leiserowitz, and Maibach, 2018). However, there is a risk that such messages may backfire among those who do not believe in climate change (Chinn and Hart, 2021). Another example is messaging that provides information about the percentage of people engaging in different climate adaptation and mitigation measures (Bhanot, 2021; Nolan et al., 2008).

Evidence specific to adaptation also indicates that perceptions of the acceptability of the behavior of others are critical to individual action (van Valkengoed and Steg, 2019). In Australia, for example, perceived social norms directly affected the decision to purchase flood insurance, with positive social norms increasing the likelihood of being insured (Lo, 2013). In another study, Canadian farmers were found to be more likely to experiment with an adaptation innovation (e.g, a conservation tillage technique) after observing their neighbors' success with it (Tarnoczi and Berkes, 2010). Likewise, a recent meta-analysis found evidence that social approval (or concern about avoiding social sanctions) increases behavioral adaptation, and that descriptive norms (or perceptions of the degree to which other individuals have adopted a behavior) also have a positive effect (van Valkengoed and Steg, 2019; Wilson et al., 2020).

9. Frame Climate Change–Related Hazards and Risks Strategically

The way information about climate change risks is framed is central to the way people understand the risks and the decisions they make in response (Wilson et al., 2020). An example is avoiding triggering words—such as "tax" for conservatives, which usually creates a partisan gap, rather than "offset," which may minimize that gap (Hardisty et al., 2019). Framing "refers to the process by which people develop a particular conceptualization of an issue or reorient their thinking about an issue" (Chong and Druckman, 2007, p. 104). Researchers who have studied the framing of scientific issues have found that different approaches are needed for topics that are controversial versus those that are not (NASEM, 2017). Examples of useful frames in climate change–related communication include the following:

- Provide clear information about the benefits, costs, and risks of possible actions or inaction—Examples include emphasizing altruism and empathy and drawing on what

people's peers are doing (Schultz and Kaiser, 2012; Schultz et al., 2007; Steg, 2016). Communication can focus on the benefits of actions that municipalities, for example, have already taken, and highlight the probability of outcomes given action as compared with inaction.

- Highlight issues related to environmental justice, equity, and fairness—Explicitly identifying these issues embedded in the experience of climate change–exacerbated hazards can assist communities in understanding the experiences of vulnerable populations. Populations that face structural racism, for example, may be impacted inequitably by current policies related to extreme weather events (Howell and Elliott, 2019).
- Present expected changes in absolute terms—Describing absolute changes often yields a more precise understanding compared with describing relative changes, which can communicate an over- or underestimation of the risks involved (NASEM, 2016). For example, "instead of using the phrase 'a 50 percent reduction,' describe the change as 'a reduction from 10 to 5 percent" (NASEM, 2016, p. 22). When communicating about potential catastrophic events (e.g., threats from falling asteroids, earthquakes), however, it may be preferable to focus on relative risks, which may be perceived as more significant and clearer (Spiegelhalter, 2017).
- Include different temporal frames—Temporal frames involve a set of events and the time associated with the relationships among those events (Zagal and Mateas, 2007). For climate change, communications can note both the risk that an event will happen during a lifetime and the annual risk (NASEM, 2016). As discussed above, using a present temporal frame in which climate change is seen as happening now instead of in the future can increase the willingness of people to act, causing them to view the problem as psychologically close, tangible, and important (Stecula and Merkley, 2019; Trope and Liberman, 2010). However, frames also need to be contextualized; studies have shown, for example, that conservatives prefer past framing, while liberals prefer future framing (Robinson et al., 2015).

10. Convey the Available Risk Management Options and Their Effectiveness

As highlighted earlier, individuals are more likely to act if they believe they are capable of implementing that action successfully and if they view it as being effective in minimizing adverse effects (Ashida et al., 2016; Kievik and Gutteling, 2011; Poussin, Botzen, and Aerts, 2014; van Valkengoed and Steg, 2019; Wilson et al., 2020). Victims of flooding in the Netherlands, for example, reported greater intention to adapt to flooding when they believed the recommended actions would be effective (Zaalberg et al., 2009). It is not just self-efficacy that matters, but also the context in which actions are taken. For example, work in central Arizona found that farmers were pessimistic about the political-economic future of agriculture given dominant narratives about state priorities regarding land and water allocation, and thus were less motivated to invest in adaptations to an uncertain climate future (Eakin et al., 2016).

CONCLUSION

Decision makers will need to involve the communities most vulnerable to climate change in developing responses to climate risks, to learn more explicitly about what their needs are, and to build confidence and buy-in and facilitate communication and action. Ideally, the responses and actions to be taken by and for those communities most vulnerable to climate change will be identified and prioritized by the communities themselves. Decision makers can facilitate this process by convening

conversations, bringing in outside expertise on risks when needed, committing resources to follow-up on actions, and implementing risk-reduction measures on the ground. If the resources and assistance needed by the community to implement the identified actions are not provided, communication about vulnerabilities and potential actions rings hollow and may be counterproductive by eroding trust. Decision makers will need to directly address social and economic inequities in how climate change impacts will be experienced.

While there are best practices in effectively communicating about climate change and promoting adaptation, such communication is rarely sufficient to bring about behavior change in isolation (Hornik, 2002; Snyder et al., 2004). Changing behavior takes effort, persistence, resources, and the ability to overcome cognitive and social obstacles. Decision makers can improve the effectiveness of their communications to constituent communities and encourage adaptation by attending to the cognitive, social, and behavioral processes that shape adaptation across climate change–exacerbated hazards and by ensuring that communities have the resources and capacities needed to adopt behaviors that can contribute to greater societal resilience.

SEAN is interested in your feedback. Was this rapid expert consultation useful? Send comments to sean@nas.edu or (202) 334-3440.

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