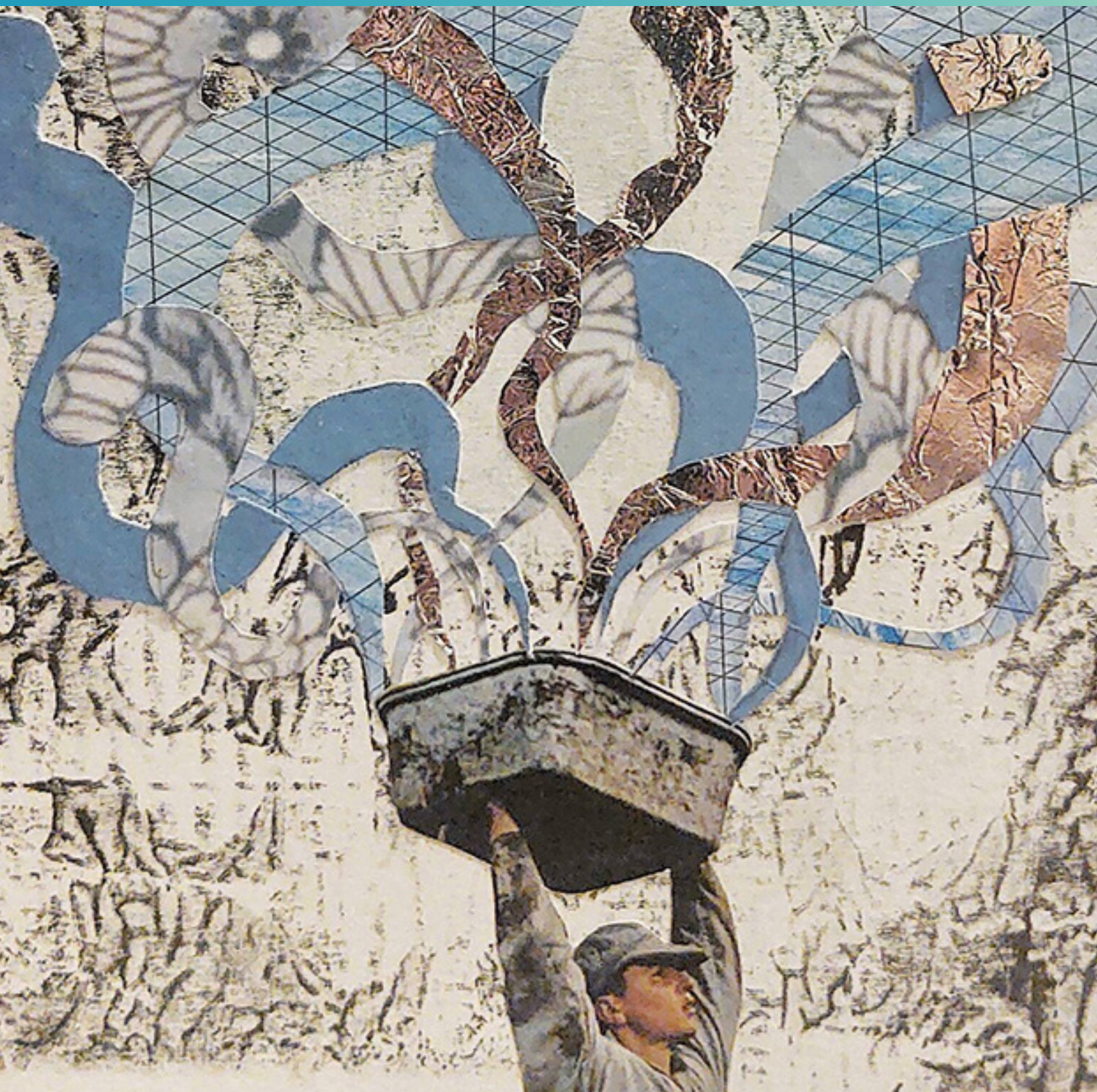
Fifth National Climate Assessment: Chapter 20

Social Systems and Justice



Chapter 20. Social Systems and Justice

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Introduction

Social Systems Are Where Climate Change Is Created and Experienced

Climate change is a result of human behavior and has differentiated effects on communities and peoples around the United States and the globe. It is inextricably tied to a history of human development and decision-making—from individuals to organizations to entire societies. For this reason, we cannot fully understand or respond to current or future changes in climate without understanding this history of human organization—that is, without understanding social systems.

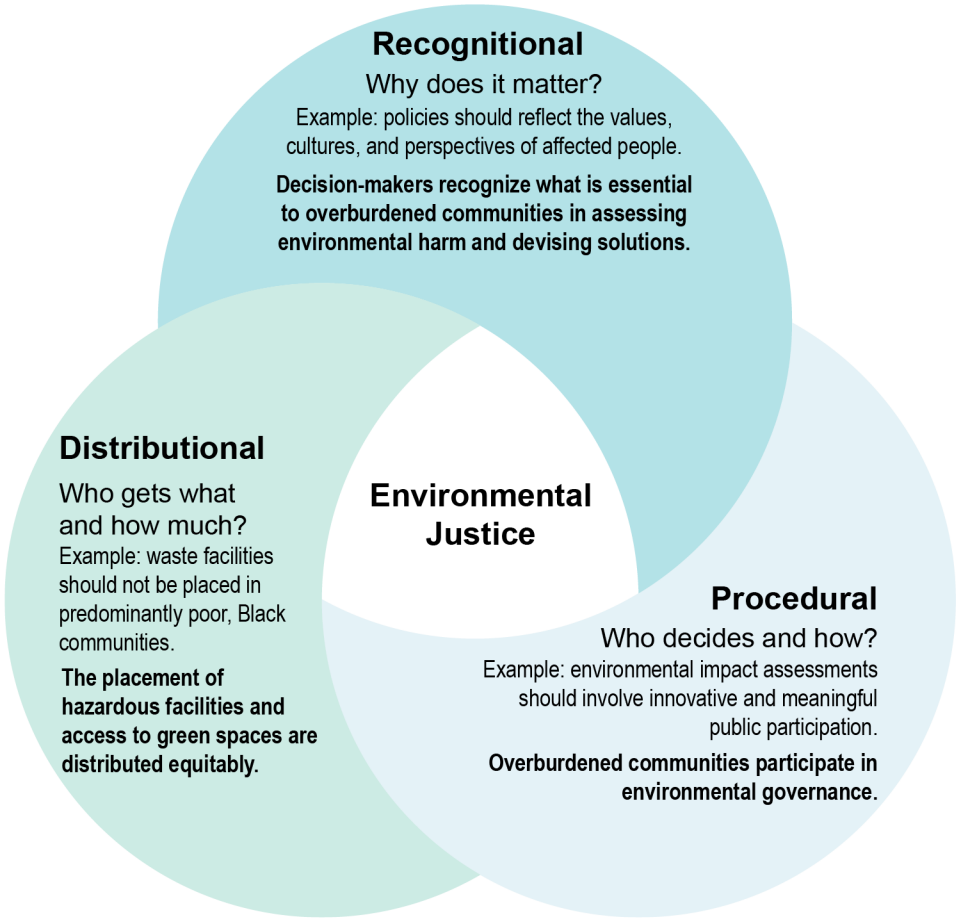
Social systems create and reproduce the assumptions that we—individuals and institutions—act on when making decisions about climate change over time and space. This might include what a given community considers sacred or taboo, or how we speak of and conceptualize environmental problems. Lack of rain, for example, may be conceptualized differently by scientists, farmers, government agencies, and land developers; and what is identified as cause for action (or sacrifice) may change depending on whether growing food is experienced as sacred, a national security issue, or an economic input.

Critically, social systems define who is seen as deserving of local, state, and federal interventions to address climate impacts. For example, they determine which neighborhoods receive hazard mitigation investment or post-disaster recovery aid. Through complex interactions, conscious and unconscious tendencies and biases, and visible and invisible social rules, social systems distribute climate risks and benefits; they also create the opportunities for climate adaptations and climate mitigation to be envisioned and acted upon.

There is growing evidence that understanding social systems is an integral part of climate science and climate solutions-making, including identifying links among adaptation, mitigation, and climate justice. The importance of social science and humanities research on climate change has been made clear by contributions across many fields, including but not limited to anthropology, communication, ethnic studies, geography, history, linguistics, philosophy, political science, psychology, public policy and administration, religious studies, and sociology.

This chapter highlights and summarizes contributions to climate change science from across the social sciences. It explains that social systems give rise to greenhouse gas emissions and distribute the risks and benefits of industrialization and climate change (KM 20.1). The chapter also explains how knowledge, culture, ethics, communication, and decision-making shape engagement with and responses to climate change (KM 20.2), as well as how climate adaptation and mitigation processes, such as human migration and transitions away from fossil fuels, may be just or unjust (KM 20.3). Central to this chapter is an explanation of how social systems inequitably distribute harm to BIPOC (Black, Indigenous, and People of Color), low-income, and rural communities; women and gender minorities; and other racialized or overburdened peoples. Key to this explanation are the concepts of environmental justice and environmental injustice. Environmental justice has three primary dimensions: recognitional, distributional, and procedural (Figure 20.1). This chapter uses these three dimensions to explore whether the actions taken to create, mitigate, or adapt to climate change are expected to produce just or unjust outcomes.

Three Dimensions of Environmental Justice



Environmental justice requires three dimensions: recognitional, distributional, and procedural justice.

Figure 20.1. These three dimensions of justice are based on a framework originally summarized by the "father of environmental justice," Robert Bullard,[1] who pointed to the "ethical and political questions of 'who gets what, why, and in what amounts?'" Commitments to each dimension are essential to achieving environmental justice, and each dimension can influence the others.[2,3,4] Figure credit: Puget Sound Partnership, Citizen Potawatomi Nation, and University of Michigan.

Key Message 20.1

Social Systems Are Changing the Climate and Distributing Its Impacts Inequitably

Social systems are changing the climate (*very high confidence*). Societal characteristics and processes shape greenhouse gas (GHG) emissions, primarily through the burning of fossil fuels (*very high confidence*). Social systems also inequitably distribute the benefits of energy consumption and the impacts of GHG emissions and climate change (*high confidence*). Governance is a critical process that distributes these impacts (*very high confidence*) and provides access to adaptation (*medium confidence*).

Emissions Are a Consequence of Social Systems

Social systems produce and distribute climate change and its impacts through mechanisms such as economic growth, population dynamics, social and economic inequities, governance, militarization, and world-economic integration (KM 2.1).[5,6,7,8] Greenhouse gas (GHG) emissions, and especially carbon emissions, are a significant and measurable outcome of energy use that leads directly to climate change (KM 3.1), the impacts of which are largely determined by social systems.[9,10,11,12] The relationships between emissions and standards of living in higher-income and lower-income nations exemplify unequal access to the benefits of industrialization and world-economic integration[13,14,15,16,17] and highlight different responsibilities for the human drivers of climate change.[17,18,19,20] Industrial processes over the past two centuries produced GHG emissions and improved quality of life, but these benefits have not been equitably distributed.[21,22,23,24] However, some societies (e.g., countries or smaller subnational units) have achieved high levels of human well-being, such as increased average life expectancy or perceived high quality of life, without consuming substantial amounts of fossil fuels per capita.[25,26,27,28,29,30,31,32,33]

Relationships between emissions and other social features are evident across time and space and at different scales. National-level carbon emissions are strongly associated with economic growth.[34,35,36,37,38,39,40,41] Using regression analysis, researchers have also identified structural factors that shape the relationship between economic growth and carbon emissions. For example, the relationship between emissions and economic growth is stronger for nations with greater levels of income and wealth inequality or whose economies are more reliant on natural resource exports.[42,43,44,45,46,47] All else being equal, nations with larger and more capital-intensive militaries have higher emissions,[48,49,50,51] most notably the United States.[52,53,54] Conversely, nations with a stronger environmental civil society or more gender equality experience a decrease in the relationship between economic growth and emissions.[55,56,57]

Carbon emissions, overall, have a positive association with population size.[39,58,59,60] Population growth is higher in lower-income nations than in higher-income nations and contributes to rising energy consumption and carbon emissions, although empirical research also suggests that such population growth threatens global climate stability less than higher-income nations' carbon-intensive economic activities.[61,62]

Subnational analyses show that increases in emissions over time are moderately lower in US states with a greater concentration of environmental nongovernmental organizations[63] and in US states with legislators exhibiting strong environmental records.[64] This research points to the role of governance and related institutional arrangements in mitigating emissions.

Climate Impacts Are Distributed Unevenly

While all people are exposed to human-caused climate change stemming from GHG emissions, social systems shape the degree of exposure and distribute climate impacts across people and places over time (KMs 4.2, 5.2, 11.2, 15.2, 23.1, 31.2). *Exposure* and *impact* are differentiated in the social science and climate change literature. As an example, flood exposure is understood as the probability of water inundation and risk to infrastructure, whereas flood impacts could be the displacement and housing insecurity that result from preexisting conditions interacting with the inundation or high water.[65] Individuals and communities that have lived at the margins of, or have been purposely excluded from the benefits of, industrialization have a greater probability of exposure to pollution and negative environmental impacts.[66] For example, in the United States, Black and BIPOC individuals and communities, members of low-income households, immigrants with limited English proficiency, unhoused individuals,[67,68,69] rural communities,[70,71,72,73] and agricultural workers are disproportionately impacted by environmental hazards[66,74] and climate change (Figures 4.15, 4.16, 18.2; KMs 4.2, 11.2, 14.3, 15.2). The convergence of exclusion, exposure, and impacts places unequal burdens on these individuals and communities, sometimes referred to as overburdened communities.

The burdens of climate change and social inequity become acute during disaster events[71,75,76,77,78,79] and can be exacerbated by governance decisions.[80] Hurricanes Maria and Harvey, for example, had disproportionate impacts on minority households, renters, multifamily households, and low-income families due in part to governance decisions related to aid distribution and documentation requirements (Box 4.2; KMs 23.1, 23.5; Figure 26.3). In this case, application and appeals processes for disaster assistance required documentation that some residents did not have or required the navigation of complex aid structures that some people could not successfully find their way through.[81] This left those same families and communities struggling to meet basic needs in the immediate aftermath[82,83] and unable to access funding for rebuilding. These obstacles to recovery can have long-term generational effects related to the loss of savings, housing insecurity, and displacement. For example, people who migrated to California from the southern Midwest during the Great Depression fared worse than native Californians for at least a generation.[84] The absence of data and data collection, such as demographic and hazard data, compounds the challenges of equitable governance during disasters. Data limitations in territories, for example, have direct impacts on the availability of resources and the visibility of at-risk populations.[85,86,87]

Policy processes and governance also influence the formation of socioecological landscapes before and after climate change–related disasters.[88,89,90] For example, the use of a cost–benefit analysis for the allocation of hazard mitigation funding, and disaster-related assistance for rebuilding, gives priority to areas of denser population and higher-value housing stock.[91] Pre-event social vulnerabilities, such as a lack of clear title for real estate, lack of financial capital, and subpar housing leave some populations at greater risk of negative impacts following a disaster.[81] For example, a family without clear title may have a more difficult time proving home ownership in order to access federal rebuilding assistance, and subpar housing may be more difficult to insure and repair.

Structural Inequalities Affect Outcomes

Even when all citizens are treated the same under the law, differential outcomes may result if the law ignores structural inequalities.[92,93] For example, when aid is delayed or not readily available following a disaster, low-income individuals and families may lack access to food and shelter even when those costs will be reimbursed. Under these same conditions, middle- or high-income individuals and families often have greater access to credit and other financial resources that allow them to spend money now and then wait for reimbursement.[94]

All levels of government (including federal, state, and county) shape the impacts of climate change and are impacted by a complex variety of social systems (Figure 20.2). Inclusive, rapid governance responses

that promote adaptation and mitigation are challenging to create,[95,96] in part because governmental institutions have difficulty innovating quickly.[97] Conditions that create the disaster impacts described above occur over decades or centuries, while governance responses to these impacts are asked to be created in far less time in order to be effective. The United States' three-branch system of government was designed to prevent those in power from taking quick action and harming those in the minority.[98] Stemming from this arrangement, a key challenge for climate adaptation and mitigation is how to react to quickly changing circumstances given the slow pace at which legislative action and other forms of governance occur (KMs 4.3, 31.3).

Climate Change Governance

Climate change governance is complex and multifaceted.

Figure 20.2. This figure recognizes the complex interaction of multiple social systems that give rise to governance. Climate change impacts, and the impacts of adaptation and mitigation strategies, will all be mediated by governance decisions and actions. Understanding this complex interplay allows the social scientists who study climate change to make predictions regarding climate impacts and to assess where governance systems are expected to produce climate justice or injustice. Figure credit: Jacksonville State University.

One example of adaptive governance in the face of climate risk occurred in Tulsa, Oklahoma, where a broad coalition of civil society and local, state, and federal government actors came together to address flood risk and to create structures and organizations that continue to drive risk reduction for all hazards. Tulsa was the most frequently flooded city in the United States from the 1960s through the 1980s.[99] Almost 40 years ago, a coalition of concerned citizens and flood victims brought pressure to bear on city hall to address the problem. This coalition was eventually joined by government and elected officials and supported by federal partners, which led to a comprehensive floodplain management approach that has served as a model for other cities.[100] The city was able to enact stricter land-use regulations and draw on federal incentives through the Community Rating System to garner public and political support.[101]

Key Message 20.2

Social Systems Structure How People Know and Communicate About Climate Change

People's histories, educations, cultures, and ethics determine how they understand and experience climate change (*high confidence*). These knowledges take multiple forms (*high confidence*) and generate diverse approaches to climate adaptation and mitigation (*medium confidence*). Engagement across communities that builds clear objectives and benchmarks has been shown to produce more desired outcomes (*medium confidence*). Effective engagement is challenging due in part to the complexity and uncertainty associated with climate science and politics (*high confidence*). Including community perspectives and multiple forms of knowledge in climate discussions and decision-making helps promote justice (*medium confidence*).

How People Know About Climate Change

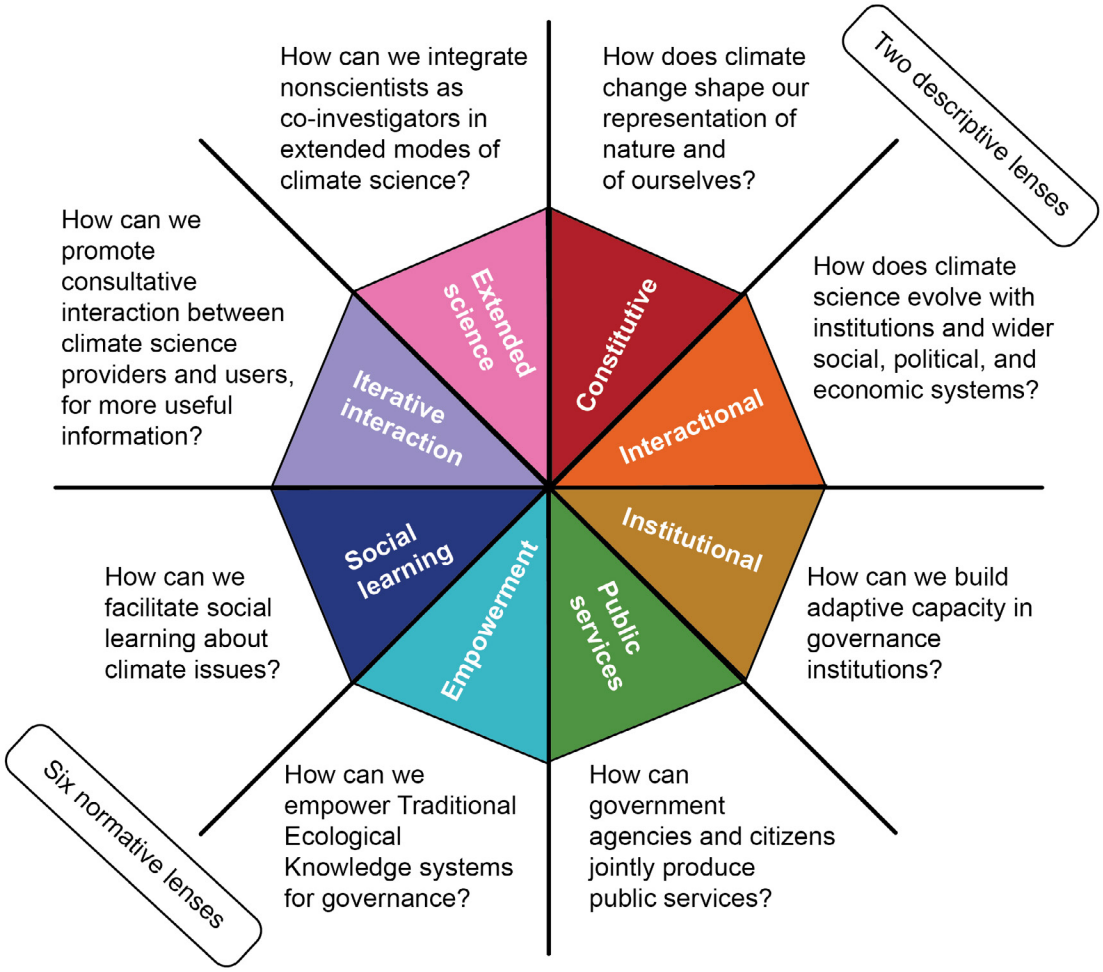
Researchers in the social sciences and humanities have studied the ways in which people and groups learn about and understand human–nature interactions, including climate change.[102,103,104] Epistemology is the name for the study of how people develop knowledge. For both scientists and nonscientists, epistemological assumptions influence an understanding of what the drivers of climate change are, what kinds of evidence matter, and what are seen as appropriate and ethical responses to its risks and impacts.[105,106,107,108,109,110,111,112] For example, climate modelers may use computer models to predict the thinning and reduction of Arctic Sea ice in order to produce more accurate maps and forecasts. Indigenous Arctic walrus hunters might instead draw on their experiences and observations to better understand the complex interconnections among ice thickness and timing, ocean currents, walrus behavior, prey dynamics, accessibility of hunting locations, travel safety, and food security to make decisions about the long-term sustainability and health of their community,[113] which may conceptually include both walruses and people.

Recognizing that knowledge emerges out of different histories and traditions can lead to new insights regarding mitigation and adaptation (Box 23.1).[114,115,116,117,118,119,120] For climate scientists, the principal driver of climate change is understood to be GHG emissions.[121] From this perspective, climate mitigation involves reducing emissions. In contrast, people who have been excluded from the benefits of industrialization, or disproportionately harmed by industrial processes, might see the principal driver of climate change as the social systems and ethical arrangements that allowed for the simultaneous exploitation of land, animals, and peoples.[77,119,122,123,124,125,126,127,128] If climate change is understood as an outcome of socioeconomic and ethical arrangements that resulted in exploitation and discrimination, then reexamining those arrangements also

becomes necessary.[129,130,131,132,133,134,135] Most often these insights are not contradictory but rather expand the universe of possible solutions for climate adaptation and mitigation.[136,137]

A promising area of research that takes different forms of knowledge seriously is called coproduced or cocreated research (Figure 20.3).[138,139,140] While coproduction is an increasingly widely used term with varied definitions (Figure 20.3), coproduced climate change research projects often integrate community-based insights and solutions to climate change with scientific insights and solutions. Coproduced research often foregrounds nonscientists, such as Indigenous Knowledge holders or multigenerational farming communities, as experts within their own knowledge contexts (KMs 18.3, 31.5). This kind of research can give rise to community-based resilience efforts. Research in the Arctic, for example, has been particularly successful at experimenting with coproduction, especially in integrating Indigenous and Western scientific knowledge bases.[141,142] However, integration can fail if power dynamics, goals, trust, and compensation within research teams and epistemologies are not equitable.[143]

Coproduction in Research



Coproduction is a way forward to include multiple epistemologies, or knowledge traditions, but must be defined to be productive.

Figure 20.3. This figure demonstrates the diverse approaches to coproduction and focuses on the need to define what a research team means when seeking to do a coproduced research project. The two items in the top right quadrant are descriptive lenses, while the other six are normative lenses. Adapted with permission from Bremer and Meisch 2017.[138]

One important consequence of different epistemological assumptions is that different people and groups perceive climate change risks and possible solutions in widely different, often compatible, but sometimes conflicting, ways.[144,145] For example, the politicization of climate change in the US helps to explain differences in public perceptions of severity and concern as a function of demographic factors such as gender and political ideology.[146,147] In this case, women and liberal-identifying individuals report relatively higher levels of concern and support for mitigative action and policy. In contrast, climate change is a relatively less polarizing issue among racial and ethnic minorities as well as socioeconomically disadvantaged groups compared to White populations and higher-income groups.[148] In part, beliefs and concerns about climate change have been shaped by well-documented, intentional efforts by industry groups supportive of the continued use and promotion of fossil fuels to misrepresent the uncertainty and knowledge about climate change and downplay the risks to society.[149,150,151,152]

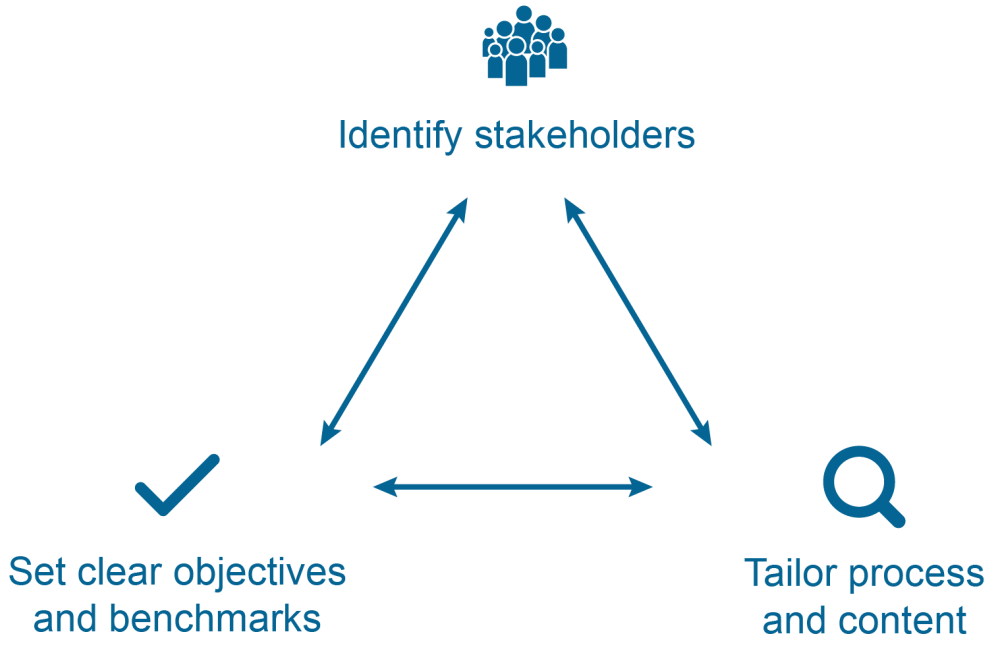
Processes for Promoting More Effective Climate Change Engagement Efforts

As suggested above, diverse communities have distinct knowledge traditions within which people interpret climate change. These diverse communities also engage with climate science and information in different social and cultural settings. There have been numerous explicit efforts over the past few decades to build greater levels of public engagement with the issue of climate change and climate science. These climate change engagement efforts have taken many forms, including traditional expert-to-public communication products (e.g., USGCRP National Climate Assessments, documentaries, journalism) and more participatory activities (e.g., public art installations, town meetings, deliberative democracy forums).[153] These efforts occur in both formal (e.g., K–12 and college classrooms) and informal (e.g., zoos, museums) settings and are sometimes tied to intentional educational activities; however, much climate change engagement occurs outside formal classroom settings.

Significant efforts and resources have been put into improving the effectiveness and accessibility of climate change information and engagement activities over the past decade. One outcome of these efforts has been collective learning regarding processes and actions that improve effectiveness of climate change engagement efforts. We describe some of these insights below.

First, establishing clear, measurable objectives with well-defined benchmarks or desired outcomes leads to more effective communication products and processes (Figure 20.4); bringing key stakeholders into the process at this early stage can improve effectiveness.

Successful Climate Engagement



A simple three-step process of communication can improve climate change engagement with diverse stakeholders.

Figure 20.4. Simple changes can help facilitate communication about climate change. Identifying the stakeholders, tailoring the process of communication and knowledge creation, and setting clear objectives for everyone involved has been shown to be an effective process. Figure credit: Rutgers University, University of Massachusetts Amherst, and Oregon State University–Cascades.

Second, to inform real-world decision-making, information needs to be calibrated to the needs of target audiences;[154,155] importantly, communicating relevant information sometimes involves translating science into accessible and actionable language, whereas in other cases it involves incorporating diverse forms of knowledge into communications products and efforts. For example, farmers and forest owners often have different informational needs with respect to climate change impacts and implications for management: whereas farmers may be most interested in seasonal forecasts or timescales of a few years, forest owners may be more interested in projections of trends for the next few decades. Climate change communicators must know—or put in place processes to uncover—the needs and epistemologies of their intended audiences.

Third, including intended target audiences throughout the process of developing communication products[156] both promotes procedural justice and increases the likelihood that such efforts meet shared goals.[157,158,159] In parallel, communicators—including formal and informal science educators—may in some cases better meet their own and audiences' goals via setting- and audience-specific trainings that provide a strong grounding in both climate science and effective communication, such as the National Network for Ocean and Climate Change Interpretation.[160,161]

Fourth, efforts that have been successful in engaging people on climate change across existing ideological and cultural divides generally do so by addressing the things people care about most, such as livelihoods, homes, investments, local communities, and family.[154,162,163] It is not always necessary to connect relevant impacts to climate change to motivate action, and doing so can sometimes backfire; for example, providing

environmental-benefit information (green labels) on energy-efficient products decreased the chances of their purchase by conservatives relative to when no label was provided.[164]

Fifth, engagement outcomes also strongly reflect the relationships and levels of trust between intended audiences and messengers. The use of trusted messengers increases acceptance and use of climate change risk information. For example, parents, teachers, peers, and scientists are considered trusted messengers for youth audiences, and the use of targeted messages and trusted messengers can increase engagement even among adversarial audiences;[165,166] similarly, experimental research has found that classroom-based climate change curricula offered to school-aged children can influence the climate change beliefs and engagement of adults who interact with those children.[167]

Sixth, pervasive uncertainty surrounding climate change (including public uncertainty) continues to be a major challenge to communication, but there is evidence that certain practices can help people understand the likelihood and magnitude of expected or possible changes and their implications for decision-making.[168] For science communicators, these include avoiding unfamiliar probabilistic statements and combining verbal and numerical assessments of likelihood—for example, when describing an outcome as "unlikely," simultaneously providing the corresponding numerical assessment of "0%–33%" probability;[169] using visualizations to show probabilistic information;[170] transparently discussing possible ranges for future outcomes or impacts, including both worst- and best-case scenarios;[171] and focusing attention on the types and magnitude of expected impacts rather than on when, specifically, those impacts might occur.[163] Commonly used technical phrases such as "1-in-1,000-year event" can often lead to mistaken beliefs or expectations about the probability of repeat occurrences of disasters such as flooding or wildfire.

Implications of Engagement Efforts for Decision-Making and Justice

A growing evidence base identifies how and when engagement and communication can lead to changes in climate decision-making.[114,172,173,174] Some work suggests that such efforts can, over time, move people from unawareness of the issue to initial awareness to more active and involved engagement at the personal and collective levels.[175] Although many engagement efforts aim to increase knowledge about climate change and climate science or shift attitudes, some efforts are more directly aimed at supporting mitigative and/or adaptive behavior change related to climate change. For example, extensive work on social norms messaging—which communicates information about the behavior of others, or expectations of behavior, and provides cues and social pressure—finds evidence that such information can influence several climate change-relevant behaviors, including household energy consumption.[176]

Efforts to engage diverse groups and communities with the issue of climate change also have critical upstream and downstream justice-related implications. For example, engagement activities or processes that actively work to include diverse stakeholders throughout the knowledge creation and/or application process (in, for example, setting objectives, developing content, and drawing implications) are more procedurally just than top-down efforts that simply attempt to provide actionable information to those groups.[177] Recognitional justice is similarly promoted by inclusive engagement efforts and inhibited when diverse, climate-impacted communities or groups are excluded from the process of setting engagement and/or knowledge-creation objectives. Thus, efforts to engage diverse publics, and the epistemologies and struggles they inhabit, within climate change decision-making are a key mechanism through which justice-related outcomes or objectives can be either realized or thwarted, intentionally or unintentionally.

Key Message 20.3

Climate Justice Is Possible If Processes like Migration and Energy Transitions Are Equitable

Climate justice—the recognition of diverse values and past harms, equitable distribution of benefits and risks, and the procedural inclusion of affected communities in decision-making processes—is possible (*medium confidence*). Complex social processes such as human migration affect climate inequities (*medium confidence*). Climate justice is also closely related to just transitions (*high confidence*), which involve equitably adapting societies, economies, and energy systems to climate change mitigation strategies and climate impacts (*high confidence*).

Human Migration May Be a Pathway to Climate Justice or Injustice

The concept of climate justice is useful in understanding how the impacts of climate change, and the impacts of climate change mitigation and adaptation, are distributed across communities. Climate justice recognizes that the inequitable distribution of resources and other social and political capital impacts the capacity for adaptation during times of upheaval, including the upheaval created by climate change. Human migration is a complex response to pressures created by social, political, economic, and environmental systems, including climate change.[178,179] The dynamic interactions among climatic changes, market processes, governance decisions, and historical inequity make human migration a critical example of how climate change interacts with preexisting social processes to alleviate or exacerbate inequity (Figure 20.5).

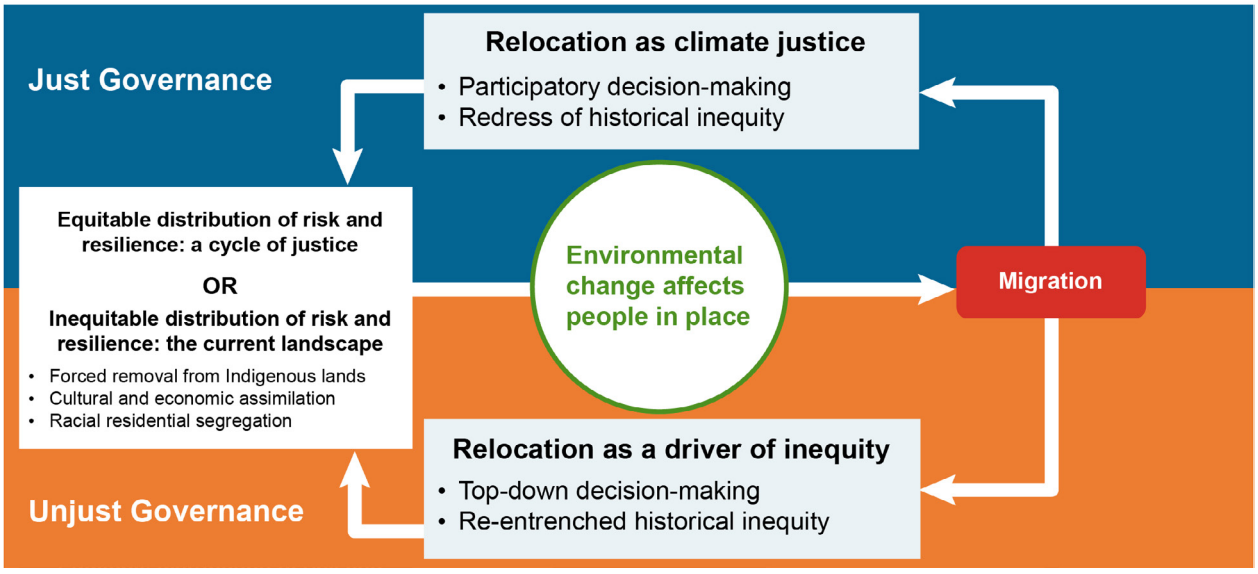
In the United States, climate change–related disasters are not yet a major driver of migration.[180,181] Most counties affected by hurricanes deviate only temporarily from their pre-disaster growth trend, although the demographic composition of affected areas may change.[182,183,184,185] Historically, most communities have adapted to climate hazards by engineering protections and adaptive technologies.[186,187,188] As climate change impacts overwhelm the protective ability of these solutions, as is expected to occur in the future (KM 9.2), communities are expected to adapt by accommodating hazards or by relocating away from hazardous areas.[189,190]

Recent hurricane events illustrate how extreme weather has displaced unprecedented numbers of people, mostly temporarily, and caused billions of dollars in damages.[191,192,193,194,195,196,197,198,199] Tropical storms pose an ongoing threat to about one-fifth of the US population that lives in coastal communities along the Atlantic and Gulf Coasts.[200] Further, every US region experiences climate-related hazards (KMs 21.1, 22.4, 23.3, 24.2, 25.1, 26.1, 27.4, 28.1, 29.2, 30.3). Efforts to predict future migration depend on assumptions about how climate hazards will affect the habitability of places far into the future, mostly informed by models of sea level rise or heat extremes.[201,202] These climate impacts are predicted to unfold gradually and unevenly, producing unpredictable impacts at small temporal and spatial scales. Governance that does or does not anticipate climate hazard events, and does or does not account for past harms, will determine whether migration will exacerbate inequities or offer a pathway toward climate justice (Figure 20.5).

Past experience with weather-related disasters illustrates the complexity of the relationship between environmental change and migration (Figure 20.5). Disasters that destroy housing and infrastructure have the potential to displace people from their homes, neighborhoods, and communities. Yet social systems that govern land and property—such as housing markets, homeowners' insurance, and federal disaster recovery housing assistance—promote in situ housing recovery for most homeowners (but notably not for renters and those with precarious title to property).[203] For example, federal disaster assistance and

private insurance incentivize many homeowners to rebuild in place, a social system that aligns with residents' place attachment.[204,205,206] Homeowners maintain and rebuild their housing to protect its market value and increase its resilience to future hazards.[207] In contrast, historic and ongoing discriminatory real estate practices, such as redlining and predatory lending, sort low-income and BIPOC households into environmentally risky neighborhoods and deteriorated housing[66,208,209] and into rental housing or housing types that are more susceptible to disaster-related damage, such as multiunit buildings and mobile homes.[210,211,212,213,214] The low property values in these neighborhoods and renters' tenuous connection to their homes also make residential mobility after a disaster more likely. For example, homeowners may be unable to repair and rebuild their homes because insurance and disaster recovery assistance align payments with pre-disaster property values, creating large gaps in the ratio of funds to rebuilding costs.[215,216] Rental properties, which house a disproportionate number of low-income and BIPOC households, are rebuilt more slowly than owner-occupied housing, driving up rents and limiting the number of affordable rental units.[203,207,217] Consequently, more residential mobility is observed among renters and those lacking clear title to their property.[182,185,218,219,220] Additionally, upheaval in housing markets after disasters is associated with increases in evictions and gentrification, as real estate speculators buy up deeply discounted properties for development.[221,222,223] Thus, there are multiple housing-related pathways through which low-income and BIPOC households are displaced or compelled to migrate as a result of climate-related disasters. These processes can therefore exacerbate pre-disaster inequalities through unjust governance and unequal distribution of risk and resilience.

Migration and Governance



Social systems create just or unjust conditions that influence migration outcomes.

Figure 20.5. Research shows that social systems exert influence on migration. Historically, forced migration has exacerbated inequities and caused social harm. It is not yet understood how these dynamics will play out under conditions of climate change and whether climate-inflected migration can be a pathway toward climate justice. This figure captures, conceptually, how migration may exacerbate inequity or be a remedy. Figure credit: Oregon State University–Cascades, Brown University, Jacksonville State University, and Puget Sound Partnership.

Current US policies governing relocation away from locations where repeated hazard events have occurred involve home buyout programs. Voluntary homeowner buyout programs have been used as a piecemeal strategy for hazard mitigation, often as part of post-disaster recovery assistance.[224,225,226] However, buyout programs often lack transparency, resulting in public distrust and low participation, as well as

disproportionate participation in low-income and BIPOC communities.[227,228] Buyout programs tend to be pursued in counties with higher property values, more home equity, and higher proportions of White residents, yet within these counties a greater number of buyouts tend to occur in BIPOC neighborhoods, suggesting home buyouts are an inequitable mechanism for moving people out of harm's way (KMs 18.2, 21.3, 22.1).[229] Furthermore, home buyout programs have been deemed inadequate to the scale and complexity of managing relocation away from climate-related hazards.[230] Programs designed to relocate residents out of areas exposed to hazards in a way that promotes climate justice would consider these historical and ongoing social inequities and take steps to mitigate their impact.

Relocation as an outcome of flooding can be prevented or forestalled with the preservation and installation of green infrastructure, such as riparian zones, wetlands, trees, parks, and other green stormwater management systems.[231,232,233,234,235] However, if justice is not taken into consideration, these same adaptation projects that alleviate climate-related displacement can cause the displacement of low-income residents, as property values often rise when improvement and hazard mitigation projects are planned and executed, leading long-time residents to be priced out of the market.[236] Climate adaptations therefore can create social risks similar to those of climate-related disasters.

What Are Just Transitions?

Central to climate justice is the concept of a just transition—or just transitions, as approaches may be diverse and locally specific. The idea of a just transition emerged from labor environmentalism in the 1970s. Labor union leaders recognized the need to support workers who lost their jobs due to stricter environmental policies or whose jobs exposed them to toxic materials.[237] Just transition approaches focused on the creation of green jobs and training workers to fill these jobs. In the past 40 years, the concept of just transitions has broadened and now refers to mitigating and adapting to climate change in a managed process that ensures equitable access to jobs, environmental goods, and quality of life.[238] If efforts are made to shift the economy away from fossil fuel extraction, thus displacing workers in coal, oil, gas, and other energy sectors, job creation and training will continue to be vital components of just transitions. This broader approach to just transitions emphasizes that poor and BIPOC communities that have experienced the brunt of environmental injustices, including both pollution and climate change impacts, are the least responsible for these impacts.[239] Without just transitions, these inequities are expected to be exacerbated as society moves away from fossil fuel extraction, responds to climate adaptation and mitigation processes, and shifts toward a sustainable and green society (KMs 5.3, 14.3).[88,240]

Just transitions recognize the capacity of green infrastructure not only to mitigate hazards, capture carbon, and provide local cooling but also to redress past harms and minimize social inequities. For example, decisions about where to place green infrastructure might take into account legacies of unjust social systems and ongoing social inequality that shape the unequal access of BIPOC and low-income communities to environmental amenities and their overexposure to environmental harms.[241,242,243,244]

The green infrastructure equity index can help provide a more nuanced examination of communities and their access to green space.[245] Not taking into account these forms of justice has been shown to contribute to the uneven distribution of urban green infrastructure.[246] Other examples have shown that using spatial tools and indices examining the built environment that include racial, social, and economic indicators can help us understand the inventory, condition, and distribution of green infrastructure[247] and use that information to promote equity.

Current Policy Creation as Part of Climate Justice

Mitigation and adaptation policies and programs are being implemented at federal, state, and municipal scales in multiple sectors (KMs 31.1, 32.5) and have implications for climate justice (KMs 31.2, 32.4). Both Colorado and California have charged agencies with creating plans to guide their transition away from coal, with a focus on economic diversification, job creation, and workforce training for former coal workers. Colorado's Just Transition Action Plan, approved in 2020, acknowledges a commitment to communities disproportionately impacted by coal power pollution.[248] California's Office of Planning and Research is in the process of creating a Just Transition Roadmap. Executive Order N-79-20, which mandates the roadmap's creation, includes language highlighting the disproportionate impact of coal pollution on low-income and BIPOC communities; however, it is still uncertain whether the roadmap, like Colorado's plan, will be focused on former coal workers.[249]

The Federal Government has also enacted a portfolio of environmental, climate, and economic justice policies that seek to ensure no one is left behind by climate change and energy transformations. These are examples of policies that seek to incorporate climate justice into governance structures. The Justice40 Initiative,[250] a policy that aims to ensure that 40% of the benefits in these investments flow directly to disadvantaged communities, is one example. Other indices and geospatial and measurement tools—such as the Climate and Economic Justice Screening Tool and the National Risk Index—have been developed to gauge whether climate exposures and impacts or the impacts of climate adaptation and mitigation are being distributed equitably. In addition, federal civil rights laws such as Title VI of the Civil Rights Act of 1964,[251] Section 504 of the Rehabilitation Act of 1973,[252] and Section 308 of the Stafford Act[253] are written to ensure that the implementation of environmental, climate, and economic policies do not discriminate against protected classes. The outcomes of these programs and the efficacy of these indices in leading to just and equitable access to resources have yet to be realized or analyzed.

Box 20.1. Quinault Indian Nation Relocation and Sovereignty

The Quinault Indian Reservation, located along the central coast of Washington State, is experiencing an accelerated loss of land caused by sea level rise, flooding, and erosion. To adapt, the Quinault Indian Nation (QIN) is relocating the Quinault Tribal community from their traditional village site, where they have lived and to which they have been tied since time immemorial, to a newly developed site at higher elevation.

Meaningful community engagement throughout relocation decision-making processes facilitates participation that recognizes community values and culture. Community engagement means engagement that involves local experts and nonexperts and allows impacted populations to have decision-making power and consent pathways (KM 16.3). This kind of engagement can be a profound way to incorporate local wisdom and values. Reflecting on possibly relocating, a Quinault Tribal member shared this sentiment: "I've made my life living off of the land and the water, and if it's my turn to give something back, I'll go with it" (interview with community member quoted in Watkinson-Schutten 2022[254]).

While many Indigenous communities are concerned with carrying out plans that consider seven generations into the future, historic US policies imposed on American Indian Tribes and other Indigenous communities have greatly limited Tribal self-determination to conduct long-term planning that allows the Tribe to adapt to changing conditions. Land allotment and assimilation policies that led to the fractionation of lands, for example, impact the available relocation sites that would help QIN adapt to climate change. Reacquiring and consolidating Tribal trust land through buyback programs enhances the adaptive capacity of Tribes experiencing climate change impacts.[254]

Relocation and Tribal Sovereignty

Quinault Indian Nation engaged the full community in its village relocation plan.

Figure 20.6. Community members gather for a ribbon cutting for Quinault Indian Nation's New Generations Building in Taholah, Washington. In March 2014, the Quinault Indian Reservation hired planners to work with the community to develop a plan for the relocation of the village. The master plan resulting from this effort directs the development of a new village beyond the tsunami zone and flooding inundation areas. The new village will replicate the uses in the lower village and will include single and multifamily residential, commercial, public, and institutional land uses. The plan also includes new streets and provides for open spaces, parks, and other recreational facilities. Photo credit: ©Larry Workman, Quinault Indian Nation.

Traceable Accounts

Process Description

This chapter's authors have scientific knowledge and credibility in the topical areas covered. In particular, the authors span a variety of social science disciplines, allowing the team to analyze social systems from multiple disciplinary perspectives. Author selection for the chapter proceeded as follows.

First, the US Global Change Research Program (USGCRP) released a Request for Public Nominations. Interested scientists were either nominated or self-nominated and their names placed into a database. A concurrent Request for Public Nominations also solicited scientists to serve as chapter leads. Both lists were reviewed by the USGCRP, with input from the coordinating lead author (CLA) and from the National Climate Assessment (NCA) Federal Steering Committee. All chapter lead (CL) and agency chapter lead (ACL) authors were selected by the USGCRP. The CLA, CL, and ACLs then convened to review the author nominations list and identify potential chapter authors. The list was coded for diverse disciplinary expertise, and a subset was identified that met our requirements for analysis.

In the second phase, the CLA and CL used both the list of nominees and a list of other scientists who had relevant expertise to build an author team that was representative of diverse social science disciplines, institutional affiliations (federal agencies and academic and research institutions), depth of subject-matter expertise, and knowledge of proposed topics.

Lastly, the authors were contacted by the CL to determine their level of interest and willingness to serve as experts on the first Human Social Systems chapter in the NCA. One author, Dr. Kyle Whyte, was invited to lead a different chapter of the NCA after the process had begun. Because his disciplinary expertise was needed on this chapter, Dr. Whyte was asked to remain as an author on this chapter as well. Although this was unusual, all authors felt it was the best course of action given the team's ongoing conversations.

In January 2022, the author team held a public engagement workshop, where the public was invited to weigh in on the prospectus stage of our chapter. Public comments were therefore incorporated at multiple stages of chapter development.

To ensure Tribal sovereignty, the chapter lead, Elizabeth Marino, chapter author Melissa Watkinson-Schutten, and the NCA5 director, Allison Crimmins, discussed and consulted on the contents of Box 20.1 and accompanying photograph with the Tribal Council of Quinault Indian Nation. Formal permission was received through a vote to include this information in this NCA chapter.

Key Message 20.1

Social Systems Are Changing the Climate and Distributing Its Impacts Inequitably

Description of Evidence Base

Decades of rigorous social science research identifies numerous human-caused drivers of climate change, with the burning of fossil fuels and resulting greenhouse gas (GHG) emissions being of great importance.[11,255,256] Human-caused drivers encompass social systems and individual and aggregated human actions causing GHG emissions, as well as societal factors shaping and conditioning those actions, emphasizing institutional or large-scale processes of social structure. Most research on how social systems produce and distribute climate change focuses on anthropogenic drivers and involves longitudinal analyses of carbon emissions for the world's nations, while subnational analyses of emissions, including for US states and smaller units such as corporations and power plants, are becoming increasingly common (e.g., Galli-Robertson and Collins 2019;[257] Grant et al. 2020;[10] Jorgenson et al. 2019;[61] Pulver and Manski 2021[258]). To generate the body of knowledge summarized here, researchers merge aggregate data for societal factors (e.g., economic growth, population, inequality, etc.) with emissions data and use many statistical modeling techniques, such as multilevel regression analysis and longitudinal regression analysis, to examine changes over time and to test linear and nonlinear hypotheses regarding the relationships between social systems and emissions.[259]

Empirical research seeks to analyze these processes and interrelationships at different spatial scales and temporal resolutions. When the unit of analysis is the nation-state, analyses usually examine data for most of the world's nations or are grouped in categories like higher- and lower-income nations or as particular regional clusters. Economic development (e.g., industrialization, GDP growth, wealth) and population dynamics (e.g., population size, population growth) are the most widely analyzed anthropogenic drivers. Other societal factors with many dimensions are analyzed as well, such as urbanization, which may lead to different findings, depending on which dimension is being modeled (e.g., urban density, urban slum prevalence, percent of overall population residing in urban areas) and at which scale (e.g., cross-national, subnational).[61,255]

Analyses of governance are often found in public policy and political science research. These literatures recognize that governments are frequently in the position to support human well-being and survival through policy interventions but also demonstrate that these policy processes interact with the institutions and conventions of human social systems and can play a role in the perpetuation of structural inequalities.

It is well-documented that land-use policies, including historic practices such as redlining and other governmental decisions, have concentrated hazard risk into zones of vulnerability and largely determined who will inhabit those zones.[260,261,262] Some disaster risk-reduction strategies and policy decisions function as disaster risk creation, while disaster relief has been shown to incentivize poor land-use decisions by local government.[263,264,265] An extensive literature exists in fields such as public administration, social geography, and political science, providing an evidence base that is generally in agreement regarding the role that governance and institutional arrangements play.

Major Uncertainties and Research Gaps

Although addressing human drivers is necessary for reducing GHG emissions, how to effectively harness global drivers of change is uncertain, given institutional inertia and the complexity of cross-scale social change. Curbing economic growth is not expected to proceed evenly at a global scale, given unbalanced resources, policies, and institutional mechanisms to promote change. The scale at which mitigation of

human drivers can be most effective is unclear, as efforts need to be multi-scalar and operate across various social-structural and spatial contexts.

There is uncertainty as to whether bureaucratic discretion can be utilized in service of adaptive governance, as opposed to when legal and regulatory changes are needed. Scholars are investigating the bounds of law and policy that limit and create options for climate adaptation, risk reduction, and support for communities faced with structural racism and discrimination. Transformative adaptive governance is only possible if there is action at all levels of government and civil society.[266] This action is dependent on key governance choices, including what problems to focus resources on, at what level of government actions should be taken, the timing of such actions, the mode of governance to be utilized, and what norms to rely on.[267] More research would be needed in order to identify the limitations of discretion and how best to build adaptive governance mechanisms.

Another important gap is a lack of alternatives to cost–benefit mechanisms, such as models that can account for the value of preserving community, protecting lifeways, and accounting for historic disenfranchisement that drives down economic value.

Description of Confidence and Likelihood

There is an extensive body of empirical research in the social sciences on the societal drivers of climate change.[61,255,268] Therefore, there is *very high confidence* that social systems create climate change via GHG emissions and that these emissions are mitigated by societal characteristics. Empirical research and theoretical modeling of human activity show that human systems demonstrably impact the atmospheric conditions of the Earth. A diverse set of studies also show that world economic integration, ongoing economic growth, population growth, and high levels of inequality are correlated with GHG emissions and continue to trend upward. A large body of research demonstrates correlations in world economic integration, life expectancy, and income distribution with GHG emissions. This body of literature is unambiguous. Therefore, the authors have *very high confidence* that social systems also inequitably distribute the benefits of energy consumption and the impacts of GHG emissions.

Case study literature and disaster studies for at least 40 years have shown that disasters do not affect everyone equitably; therefore, authors also have *high confidence* that the impacts of climate will be distributed inequitably. Public administration research, as well as case study literature from geography and anthropology, corroborates this claim.

The interactions between a variety of governance processes and hazards and disasters are well studied. Land-use policies, and in particular their impacts, have been studied in depth and show disparate impacts over time.[265,269] Institutional decisions, policies, and bureaucratic discretion have also been shown to cause greater harm to some populations than to others.[270,271] Here the authors do not suggest that inequitable distribution of climate impacts is certain in the future, but there is a robust literature that suggests governance decisions are clearly linked to how risk emerges within human and social life, thus leading to an assessment of *very high confidence*. There is research that demonstrates adaptive measures to climate changes, such as hazard mitigation, are similarly structured by governance decisions; but because there is a much shorter time frame for studying climate change–specific adaptation, authors have assigned *medium confidence*.

Key Message 20.2

Social Systems Structure How People Know and Communicate About Climate Change

Description of Evidence Base

There is a rapidly increasing, diverse, and transdisciplinary evidence base supporting the conclusion that social systems structure how people understand, think about, and respond to climate change in fundamental ways. Work on this topic comes out of philosophy, science and technological studies, intellectual history, Indigenous studies, psychology, sociology, and anthropology, among other fields, and includes a wide diversity of theoretical and methodological approaches to evidence gathering (including epistemological studies, survey research, ethnography, and others).

The evidence base includes studies that demarcate the diverse ways in which human–nature interactions are conceived, including worldviews that integrate human and nonhuman society. The evidence base also includes research that demonstrates that insights Indigenous Peoples and others make about climate drivers and action reflect their social position, history, culture, and connectedness to the environment.[77,105,119,122,123,125,128,163,272,273,274]

A robust literature in social psychology and science communication, among other fields, demonstrates how people respond to different messages and information about climate change and why different types of climate change engagement efforts have differential outcomes. These fields offer insight into how effective communication and engagement can promote decision-making and action through multiple pathways, including provision of actionable knowledge, growth of motivation to act, and development of new skills and sense of efficacy. However, while there is often much hope around initiatives to change household behaviors through communications and engagement, the impacts of these initiatives are oftentimes relatively small, if generally robust.[172,173]

Major Uncertainties and Research Gaps

The literature is clear that knowledge is influenced by social position, culture, and history, and that knowledge and justice are related; it is also clear that people engage with climate change in diverse ways as a function of who they are and how efforts to communicate climate change are designed and delivered. There are significant gaps in the relevant research base, however. One is that studies are only beginning to emerge that show how people who experience injustice related to climate change envision different solutions to climate change. While the available evidence is strong in some domains, such as fire management,[109,110] it is not comprehensive in other domains, such as with respect to responses among diverse BIPOC (Black, Indigenous, and People of Color) communities and communities with lower incomes that are experiencing a range of impacts and challenges. In addition, in part because it is so broad and comes from many different fields of study, the evidence base regarding social systems and how people understand and engage with climate change lacks integration across fields (and even within subfields). Although there are growing efforts to use coproduction approaches, as well as meta-analytic and other synthesizing approaches, to study social systems, there is a clear need for additional synergistic and interdisciplinary research that explores these issues from a diverse set of perspectives and using diverse methodological tools. Additionally, there is a need for more studies that employ coproduction approaches to understand more about how diverse knowledge contributes to climate adaptation and mitigation among communities that have been shaped by prior unjust experiences.[138,139,140]

While guidance to improve communications and engagement efforts has grown and strengthened in the past decades, there are also areas of uncertainty and research gaps in this domain. One such area concerns

the role of emotion in engagement and communication. Researchers and practitioners debate whether messages that evoke fear, guilt, hope, or other emotions can motivate behavior change effectively.[275] Climate communication that appeals to different emotions as a means to engage audiences and spur action is a growing research area, but there are conflicting findings about its effectiveness. Another research gap due to a lack of qualitative and quantitative studies involves the communication needs of vulnerable populations.[148] More generally, extant evidence tends to come from correlational studies and relatively small-scale and/or lab-based experiments with nonrepresentative samples, and there are open questions in the literature regarding the robustness, generalizability, and applicability of the research base to real-world engagement and communication efforts.

Description of Confidence and Likelihood

There is extensive evidence in both case study and other research that people's context impacts their understanding of knowledge and, in turn, how they experience climate change. Therefore, we have *high confidence* that people's histories, educations, cultures, and ethics determine how they understand climate change. Given the cultural diversity of knowledge and knowledge communication found in anthropology and other fields, we have *high confidence* that these knowledges take different forms.

Although there is evidence from within and beyond the climate change domain to suggest that clear objectives and benchmarks promote desired outcomes regarding public engagement efforts, there are gaps with regard to the diversity of communities that have been formally studied. For example, much attention has been dedicated to communicating more effectively across ideological divides. On the other hand, the authors identify research gaps regarding knowledge of the communication needs of overburdened communities that are potentially most vulnerable to climate change impacts. Therefore, the authors have *medium confidence* that building such components into engagement efforts will actually promote desired outcomes across diverse communities.

There is extensive evidence across multiple fields of study and practice that converges on a consistent finding: namely, that climate change is a challenging issue on which to engage diverse publics. This is due in part to the complex nature of the issue, as well as to pervasive deep uncertainty, such as tipping points, within the climate system and how social systems (including political systems and governance) will continue to adapt to evolving risks. Therefore, the author team has *high confidence* that these and other factors pose significant challenges to effective engagement.

Although there is a growing recognition of the importance of community-driven engagement and inclusion of diverse forms of knowledge in collective decision-making in the climate change space, relatively less attention has been paid in the literature to promoting (climate) justice through inclusion of diverse perspectives and epistemologies. Therefore, the existing evidence base provides for *medium confidence* that greater inclusion of diverse community perspectives and types of knowing in engagement and decision-making efforts can provide an effective mechanism to promote justice.

Key Message 20.3

Climate Justice Is Possible If Processes Like Migration and Energy Transitions Are Equitable

Description of Evidence Base

Research on environmental migration and relocation is represented in multiple social science disciplines, including demography, sociology, geography, anthropology, regional and urban planning, and urban studies. Research methods vary widely, from ethnography and other qualitative approaches to statistical analysis of survey, census, and administrative records and to scenario-based modeling. Much of the empirical research focuses on migration in response to extreme disaster events in order to speculate on future climate–migration interactions. Therefore, event-based case study approaches dominate the literature.[276,277] Meta-analyses of the climate migration literature have shown that hazards have heterogeneous effects on human migration, sometimes driving people out of and sometimes attracting people to hazard-affected areas and sometimes not having any effect.[278,279,280,281,282] In the United States, a few surveys ask respondents why they moved, although only very small percentages (less than 1%) name disasters or the environment as their reason for moving,[180,181] supporting the statement that the environment is not a major driver of internal US migration. Research on governance of housing recovery after disasters is based on a growing body of evidence about disaster impacts on housing, post-disaster permanent housing recovery, home buyout programs, and social and spatial inequalities therein, which originated in disaster research centers and has expanded to include scholars in all of the aforementioned disciplines.

This Key Message and supporting text were based on the extensive environmental justice, climate justice, and just transition literature. The overburdening and overexposure of low-income and BIPOC communities to environmental injustices and negative climate change impacts, as well as their lack of access to environmental amenities and green spaces, has been well documented, particularly by scholars such as Robert Bullard (e.g. Bullard 1994,[1] 1996,[241] 2001,[242] 2008[74]).

While the majority of environmental justice literature focuses on the distributional arm of justice, some key literature has discussed and demonstrated the importance of recognitional and procedural justice ameliorating histories of environmental injustices (e.g., Corburn 2003;[283] Rigolon and Németh 2018;[284] Whyte 2011[3]). The literature on just transition largely focuses on the transition to a low-carbon economy via the increased use of green energy.[238] Much of that literature is based on European case studies. As such, there are not many US case studies to discuss, and even fewer successful ones. However, the literature on green infrastructure, which can be considered a part of just transition strategies, is better developed, although it is still evolving (e.g., Zuniga-Teran et al. 2021[246]). Nevertheless, the literature available on these topics, albeit limited in some areas, is corroborating, clear, consistent, and overwhelmingly in agreement regarding the history of environmental racism, the evidence of disparate exposure and impact, and the potential for perpetuation in the context of climate.

Major Uncertainties and Research Gaps

There are several research gaps within this research areas. One such area is research on nontraditional hazardous scenarios or built-environment challenges, including the distribution and condition of critical infrastructure systems and utility services that pose risks in the instance of failure.[247] One well-known example of this is the Flint, Michigan, water crisis and the disrepair of drinking water systems that resulted in corrosion and lead poisoning in a majority-Black community. Emerging literatures are filling this gap in terms of justice in the areas of energy, sewerage, stormwater, transport infrastructure, and beyond. Similarly, research in just transitions is still developing, especially with regard to green energy and jobs, two

of the major focuses of the literature, and has few resolved or successful case studies. This is mainly because this phenomenon is relatively recent and the outcomes related to efforts are still to be determined.

Observational studies of environmental drivers of migration cannot predict the quantity or types of migration that will occur in the future, especially as changes occur in the environment, the economy, governance, risk perception, and systems exacerbating or mitigating social inequalities. Scenarios of expected conditions may allow for broad generalizations;[285] however, predicting the timing, location, and magnitude of climate-related hazards that may provoke migration requires many assumptions and uncertainties (e.g., Rigaud et al. 2018;[286] Clement et al. 2021[287]). Social science may contribute to filling a gap regarding how social systems influence collective and individual decisions to relocate away from or adapt in place to climate change impacts. There are growing literatures on immobility, whether climate induced[288] or voluntary.[289] Additional research gaps enumerated in a recent review include investigations of the long-term outcomes of disaster evacuees and the effects of climate change on demographic subgroups, such as children or older adults, and small populations, such as Indigenous People.[290]

There are not enough data available to evaluate the new federal initiatives mentioned in this section. In the past it has been challenging to understand environmental justice implications in federal policies because of a lack of data. FEMA, for example, has not historically collected data on race or ethnicity as part of its assistance programs. Recent changes have permitted this data to be collected,[291] and we anticipate new insights in the coming years.

Description of Confidence and Likelihood

Historical corollaries and new policies on environmental justice provide an opportunity for communities to envision climate justice; however, current case study research and ongoing research on environmental justice outcomes show that such a transition will be difficult and that there remain deep inequities in accessing environmental benefits and suffering environmental burdens. Additionally, it is unclear whether governance structures can adapt quickly enough to respond to climate risks and other societal pressures. There is therefore *medium confidence* that climate justice is possible. An extensive literature in demography, anthropology, geography, public administration, and legal studies demonstrates that migration is a complex phenomenon that has multiple push and pull factors and is mitigated by socioeconomic conditions. This research base gives us *medium confidence* that migration will impact the three categories of environmental justice or exacerbate these injustices. There is extensive literature that suggests justice is a complex, multifaceted process that includes understanding how benefits, burdens, and decision-making around climate change are distributed among diverse groups;[1] therefore, we have *high confidence* that adaptation to a changing climate and changes to energy production require a whole-systems approach that must consider the social dynamics of race, ethnicity, rurality, poverty, and infrastructure equity, among other factors.

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