Routledge
Taylor & Francis Group

Journal of the American Planning Association

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/rjpa20

Community-Centered Climate Planning

Using Local Knowledge and Communication Frames to Catalyze Climate Planning in Texas

Katherine Lieberknecht

To cite this article: Katherine Lieberknecht (2022) Community-Centered Climate Planning, Journal of the American Planning Association, 88:1, 97-112, DOI: 10.1080/01944363.2021.1896974

To link to this article: https://doi.org/10.1080/01944363.2021.1896974

Community-Centered Climate Planning

Using Local Knowledge and Communication Frames to Catalyze Climate Planning in Texas

Katherine Lieberknecht

ABSTRACT

Problem, research strategy, and findings: Places around the world already experience significant damage from climate change–related weather events, economic disruption, and health impacts, exacerbated by poverty, segregation, and inequitable infrastructure. Unfortunately, Texas provides a perfect illustration of these forces, with impacts made even more severe by a lack of climate planning. How can planners minimize harm and reduce risk, given the state leadership's unwillingness to undertake climate planning? One place to start is to investigate residents' climate change beliefs to understand whether they share the state's climate antagonism and then use this information to shape a planning response. In this study, I analyzed a survey ($n = 1{,}053$) to ask: What are Texans' perceptions of climate change, and how can planners use this knowledge to create strategies to catalyze climate planning? Respondents expressed strong agreement about negative effects of climate change and increased frequency of extreme weather. They believed that climate change is due at least in part to human activity, and they expressed robust support for climate-related planning activities. These responses sharply differ from the state's approach. However, despite agreement about climate issues, respondents did not identify climate change as a major concern about the future. This contrast suggests an opportunity for new climate-related communication frames to bridge the gap between climate perceptions and planning action.

Takeaway for practice: These findings inform three recommendations: better connect climate change impacts to everyday concerns, including housing, air quality, and health; emphasize common ground about benefits provided by nature, especially related to health; and use community engagement to refine these frames. I propose that planners can accelerate climate planning by following the lead of other disciplines that emphasize human health impacts of the climate crisis. In addition, planners can strengthen climate planning by extending environmental planning's use of local knowledge from environmental health, urban heat planning, and climate-related land use planning to climate planning more broadly.

Keywords: climate justice, climate planning, communication frames, community-centered climate planning, local knowledge

Texas presents a critical challenge for climate planning because it combines high risk from climate-related events; disproportionate harm from poverty, segregation, and inequitable infrastructure; and state leadership unwilling to acknowledge climate change (Blake & Zelinsky, 2018; Depland, 2019; Fox, 2018; Lieberknecht et al., 2021; Pew Research Center, 2012; Wuebbles et al., 2017).[1] In response, Texas's municipalities, communities, and researchers have sought to bridge the climate planning gap. However, their successes, although important, do not aggregate to necessary statewide planning. Planners need strategies and processes to catalyze climate planning in Texas, as well as other places where state leadership lags behind. Planners' ethical and professional charges prompt us to "plan for the needs of the disadvantaged" with a "special concern for the long-range consequences of present actions" (AICP, 2016, p. 2). As the climate crisis unfolds in a state with one of the highest frequencies of socio-natural disasters, staggering levels of damage from disasters, and unjust access to opportunity, services, and infrastructure, how can planners minimize harm and reduce risk at a scale that matches this populous, diverse, and geographically vast state (National Aeronautics and Space Administration [NASA], 2017; ValuePenguin, 2020)? In particular, what mechanisms might unify and activate disparate communities across Texas to address the climate crisis? To develop these efforts, planners need better information about residents' perceptions of climate change for the

DOI: 10.1080/01944363.2021.1896974

Color version available at ***tandfonline.com/rjpa***

purpose of more effectively framing discussions around and building support for climate planning. Planners can then use this knowledge to connect residents across the state with the constellation of municipalities, community groups, and researchers already working on local and regional climate planning efforts, in hopes of building support for statewide climate planning.

In this study, I analyzed a survey ($n = 1{,}053$) to address the following research questions: What are Texans' perceptions of climate change and related issues, and how can planners use this knowledge to create strategies to catalyze climate planning? These findings offer lessons for planners about how to move forward climate planning, perhaps especially in politically conservative places slow to adopt this work.

I first review literature about climate planning, community-centered climate planning and local knowledge, climate-related beliefs and frames, and context about the Texas case. I then present the survey method and analyze key findings. These findings inform three recommendations for planners: better connect impacts of climate change to more immediate concerns, such as housing affordability, air quality, and health; emphasize common ground about benefits provided to humans by nature, especially those related to health; and use community engagement to refine these frames. Through these analyses and recommendations, I propose two contributions to planning theory: 1) planners may be able to accelerate climate planning by following the lead of other disciplines, such as public health and communications, that emphasize human health impacts of the climate crisis; and 2) planners should extend environmental planning's use of local knowledge from climate-related arenas such as urban heat, disasters, and land use planning to climate planning more broadly (Berke & Stevens, 2016; Corburn, 2009; Peters-Guarin et al., 2012). Doing so will advance community-centered climate planning, which I define as climate planning that seeks to better incorporate local knowledge about climate and residents' participation in climate strategies.

Climate Planning

I frame this article around climate planning, that is, planning activities that seek to mitigate or adapt to climate change (e.g., Fitzgerald & Lenhart, 2016). Planning scholars and practitioners have accelerated climate planning through research, leadership, and support, but much critical work remains (Anguelovski et al., 2016; Berke & Stevens, 2016; Shi et al., 2015; Shi et al., 2016; Woodruff et al., 2018). Underscoring the importance of this work, the Intergovernmental Panel on Climate Change (IPCC) recommends that climate change "should be the leading policy concern for cities, states, and country governments" (IPCC, 2018, p. 53). Here I use the Texas case study to examine how planners might move forward climate planning in places characterized by high risk but slow progress.

Climate planning intersects with several other environmental and equity planning terms, sometimes resulting in confusion about meaning (Meerow & Newell, 2019; Weichselgartner & Kelman, 2015). I clarify here how I use *climate planning* and related terms in this article. When referring to climate planning, researchers and practitioners at times also use *climate change planning* or *climate action planning*, although climate action planning is sometimes limited to climate mitigation (e.g., Institute for Local Government, 2020). *Climate mitigation* includes planning focused on reducing, preventing, and stabilizing emissions of greenhouse gases, whereas *climate adaptation* focuses on planning "aimed at preparation and adjustment to inevitable impact" of the climate crisis (Berke & Stevens, 2016, p. 283; NASA, 2020; ValuePenguin, 2020). Practitioners and researchers sometimes use *resilience* to refer to climate adaptation, although resilience more broadly refers to the ability "to maintain or rapidly return to desired functions in the face of a disturbance, to adapt to change, and to quickly transform systems that limit current or future adaptive capacity" (Meerow et al., 2016, quoted in Meerow & Newell, 2019, p. 315). Scholars have contested the concept of resilience because of concerns about racism, poor attention to equity, and lack of resonance of the term with community members, among other critiques (Friend & Moench, 2013; Joseph, 2013; Ranganathan & Bratman, 2021).

Climate planning discussions sometimes also use the terms *vulnerability* and *vulnerable populations* to describe people most affected by the climate crisis. In this article, I use *historically marginalized populations* instead of *vulnerable populations* and *injustice* instead of *vulnerability*. Historically marginalized populations include people belonging to demographic groups that have experienced inequities that result in disproportionate harm (Browne et al., 2012). Because of marginalizing conditions such as systemic racism or ageism, these populations experience unjust access to services, infrastructure, and opportunities related to mitigating and adapting to the climate crisis. The phrase *historically marginalized populations* increases accountability to some degree (populations experience harm from marginalizing conditions created by others, not because they are inherently vulnerable), which avoids some of the critique about passivity associated with the term *vulnerability* (Ford et al., 2018; Thomas & Warner, 2019). When possible, like Browne et al. (2012), I refer to the marginalizing conditions that have created climate inequities (e.g., segregation), rather than labeling populations as marginalized.

Community-Centered Climate Planning and Local Knowledge

Populations experiencing marginalizing conditions such as racism or underinvestment confront magnified climate impacts (Barros & Field, 2014; Cushing et al., 2015; Jesdale et al., 2013; Rosenzweig et al., 2018; Uejio et al., 2011; Wuebbles et al., 2017). As a result, researchers and practitioners must pay attention to equity and justice implications of climate adaptation and mitigation so that planning does not exacerbate harms (Brown, 2014; Shi et al., 2016). Community-centered climate planning—planning that seeks to better incorporate local knowledge and participation in development of climate strategies—supports climate justice. Communicative planning, which includes stakeholders in decision making, forms a theoretical foundation for community-centered climate planning (Forester, 1988; Healey, 1996; Innes, 1995).

In particular, communicative planning provides a valuable framework when using residents' local knowledge, especially when focused on policy issues considered to be controversial, such as climate change (Corburn, 2005; Yearly, 2000). The idea of local knowledge bridges theory and practice. Participatory planning theory acknowledges that multiple, diverse types of knowledge will produce more robust planning solutions and that local or "ordinary" knowledge held by residents comprises a key contribution for planning (Berke & Stevens, 2016; Clavel, 1986; Innes, 1998; Lindblom & Cohen, 1979). Corburn (2003) built on his earlier work as a practitioner and sought to co-produce knowledge with the public to address environmental and public health issues. Scholars later extended this framework to climate-related planning issues such as urban heat island effect, extreme heat events, disasters, and land use planning (Berke & Stevens, 2016; Corburn, 2009; Peters-Guarin et al., 2012). I extend consideration of local knowledge to climate planning more generally.

Community-centered climate planning values knowledge and experiences that residents hold and then uses that information earlier to shape planning solutions. It draws on the integration of public participation into environmental hazards planning, which helps balance critical but sometimes overly privileged technical and professional planning knowledge (Brody et al. 2003, 2008). Scholars have also found that processes that include some level of community-centered climate planning can improve outcomes (Bassett & Shandas, 2010; Haverkamp, 2017). In addition, Shi (2020) argued for more participation of frontline communities in climate solutions to increase equity and attain results. However, communities often perceive climate planning as a matter for scientists and bureaucrats, where residents' knowledge and perceptions remain unwelcome (Cutter et al., 2008; Graham & Marvin, 2001; Kearns, 2012, 2015). This gap between researchers and community members can sometimes lead to poorly conceived and implemented climate programs that cause additional harm (Clouse & Lamb, 2013). Planners' efforts to place local knowledge on equal footing with other types of planning intelligence can help address this unbalance (Berke & Stevens, 2016).

Better integration of participation and local knowledge in climate planning also aligns with Brody et al.'s (2008) findings that residents' perceptions of efficacy (i.e., their perceived ability to contribute to climate planning) results in increased perception of risk from climate change. In a similar way, local knowledge—particularly individual perceptions of the local environment—may be more effective in catalyzing behavior change than secondary knowledge transferred through education or outreach (Egan & Mullin, 2012; Myers et al., 2013; Zaval et al., 2014). Communications theory reports a similar finding: Communications that inspire a sense of positive self-efficacy create more support for climate action (Hart & Feldman, 2016, 2018). As a result, the act of participating in climate planning may in turn lead to more support for and implementation of climate planning.

Researchers have identified gaps in knowledge about including stakeholders and local knowledge in climate planning (Brink et al., 2016; Pyhälä et al., 2016; Wamsler, 2015, 2017). Thus, research that documents the use of local knowledge in climate planning fills an identified need in both theory and practice. This may be met in part by including residents' local knowledge about climate change throughout the climate planning process, beginning with residents' perceptions of climate change, as the survey I report on here assessed. In the next section, I provide an overview of climate change perceptions and communication framing.

Climate Change Beliefs and Communication Frames

National data from the 2020 Yale Program on Climate Change Communications show that 73% of Americans believe that climate change is happening, with 62% believing it is human caused (Leiserowitz et al., 2020). This agreement has increased since 2013, when 63% of Americans believed climate change was happening and 42% believed it was human caused (Leiserowitz et al., 2013). Although national data help planners understand broad trends, beliefs about climate change vary across smaller geographies because people with similar demographic, cultural, and ideological characteristics often co-locate in a region (Gromet et al., 2013; Howe et al., 2015; Kahan et al., 2011; Leiserowitz, 2006; McCright & Dunlap, 2011). Geography also may influence beliefs about climate change because experiences of extreme weather influence perceptions of climate change (Akerlof et al., 2013; Capstick & Pidgeon, 2014; Egan &

Mullin, 2012; Goebbert et al., 2012; Hamilton & Keim, 2009; Howe & Leiserowitz, 2013; Howe et al., 2013; Zaval et al., 2014). In addition, cultural, demographic, and ideological characteristics (which may be linked to region) may affect personal experiences with extreme weather and perceptions of climate change (Howe & Leiserowitz, 2013; Myers et al., 2013; Van der Linden, 2014).

These regional influences make it important to have regionally specific data about beliefs and knowledge related to climate change. Because of this identified need, the University of Texas at Austin (UT Austin) Planet Texas 2050 research program conducted a baseline survey about climate change and related issues across each metropolitan statistical area (MSA) and a grouping of rural counties in the state. Planners and policymakers working on climate issues in Texas and similar places will find this aggregated local knowledge in itself useful, in part because findings can be used to establish discussion about climate planning in a state historically resistant to it (Douglas, 2021; Satija, 2014). In particular, the concept of *framing* offers one potential way to transform this aggregated local knowledge from survey into discourse.

The idea of framing evolves from communication research and practice. Framing emphasizes particular characteristics or themes associated with an issue to influence how people understand that issue (Badullovich et al., 2020). For example, atmospheric scientist Katherine Hayoe frames climate change as a moral issue rather than an environmental issue as a way to bridge to broader audiences (Haluza-DeLay, 2017). Activists and journalists have used frames to address environmental injustices, shift mainstream politics, and strengthen social movements (Benford & Snow, 2000; Hopke, 2012; Nepstad, 2001). A recent bibliometric study showed that the most commonly used climate frames focus on scientific, economic, and environmental themes, with frames that reference public health, disaster, and morality gaining ground (Badullovich et al., 2020). In particular, researchers argue that health frames are more easily understood, more concrete, and more personal than more traditional climate data (Adlong & Dietsch, 2015; Myers et al., 2012; Weathers, 2013; Weathers & Kendall, 2016; World Health Organization, 2011).

Framing "is not an elixir," and the development and use of new frames is not a quick fix (Druckman & Lupia, 2000, p. 7; Hart & Nisbet, 2012). However, scholars find that frames can increase support for political action focused on climate change (Bolsen & Shaprio, 2018; Petrovic et al., 2014). If this is the case, then it is possible that new climate frames can be used to coalesce political support for statewide climate planning. As such, my examination of ways to translate climate beliefs into communication frames is relevant for planning practice (I. Baker et al., 2012; Reckien et al., 2014).

In this last section of the literature review, I provide context about the Texas case and why planners should be concerned about climate planning in Texas.

Texas's Future: Climate Crisis in a Time of Injustice, Population Growth, and Continued Urbanization

Texas receives frequent criticism about its politics, land use, ego, and more (for example, see Wright, 2019). The state also significantly contributes to the climate crisis itself: If Texas were a nation, it would rank seventh globally in terms of energy-related greenhouse gas emissions, and it releases more greenhouse gas emissions than any other state (U.S. Energy Information Administration, 2017). If people outside the state think about Texas and climate change at all, they may consider the state's current situation appropriate comeuppance for its sprawling land use, fossil fuel economy, and low-regulation governance. Although this critique has merit, planners should also understand that climate change—from economic devastation associated with the 2011 drought to flooding after Hurricane Harvey—has already harmed millions of Texans. Many of these residents have also experienced chronic social, economic, and environmental injustices. The lack of statewide climate planning in Texas is a significant human rights and climate justice issue—one that planners can help address.

Texas also represents a microcosm of places in the United States and around the world grappling with an increase in extreme weather events, rapid population growth, and continued urbanization. Projections show drought, flood, wildfire, and heat waves in the state will increase, becoming more intense as emissions and temperatures rise (Intergovernmental Panel on Climate Change, 2018). At the same time, Texas will see continued population growth, perhaps doubling to 54.4 million by 2050 (White et al., 2017). The state contains 5 of the 11 fastest growing U.S. cities and 4 of the 11 most populous (U.S. Census Bureau, 2016). Almost 90% of residents now live in MSAs, where almost all future growth is projected to occur (White et al., 2017).

Continued urbanization promises wealth creation but may also harm households with reduced social mobility and inadequate access to housing, transportation, and food, with growing poverty, segregation, and negative health outcomes. Residents of Texas's cities experience significant segregation, with Houston, Dallas–Fort Worth, San Antonio, and Austin among the 10 most economically segregated large cities in the United States (Florida & Mellander, 2015; Pew Research Center, 2012). Texas's high statewide poverty rate

(13.7%) affects housing, food, and health security (Fox, 2018). The state ranks 37th in health outcomes, and at least half a million Texans live in neighborhoods that may lack basic services, including potable water supply and wastewater (Barton et al., 2015; United Health Foundation, 2018).[2] The climate crisis will exacerbate environmental and health problems such as air pollution, water security, and heat-related illness, all of which disproportionately affect populations already experiencing marginalizing conditions (Friend & Moench, 2013; Wolch et al., 2014).

Climate Planning in Texas

As Texas approaches the mid-century, these interactions create significant stressors for individuals and pose tremendous challenges for planning, made worse by the absence of statewide climate planning. However, analogous to municipalities across the United States, large Texas cities have been proactive about climate planning (Rabe, 2004; Shi et al., 2015). Austin and San Antonio participated in the Bloomberg American Cities Climate Challenge (Bloomberg Philanthropies, 2019; Rockefeller Foundation, 2019), and El Paso, Dallas, and Houston (as well as El Paso's sister city, Ciudad Juarez, in Mexico) joined the Rockefeller Foundation 100 Resilient Cities program, which in part focused on climate resilience. Houston, Dallas, San Antonio, and Austin (collectively, two-thirds of the state's population) are in the process of drafting, or have already completed, climate plans (American Council for an Energy-Efficient Economy, 2019). Through efforts such as these, Texas municipalities have prepared for new climate futures while working to reverse climate change.

Scholars in the state also have contributed data, expertise, and research to climate planning, as well as partnered to support community-led climate planning. For instance, in Rockport, where Hurricane Harvey made landfall in 2017, community leaders partnered with Texas A&M University's Texas Target Communities program to develop Rockport's first comprehensive plan (City of Rockport, 2019). The plan includes numerous objectives and actions related to climate adaptation and mitigation, moving climate planning forward in this Texas town. The nongovernmental organization Community Powered Workshop provides another model through their partnership with UT Austin and the Montopolis neighborhood in Austin to develop a Solutions-Driven Community Center pilot. The pilot establishes a community-led resource center where residents can exchange information and devise solutions to climate-related challenges (Moore et al., 2019; Torrado & Joslin, 2019).

Despite these successes, the availability of technical climate planning knowledge and existence of community-led climate planning projects have not translated to climate planning at the state level. However, with new knowledge about Texas residents' climate perceptions, planners can create more effective climate frames, which the literature suggests may assist in producing better climate planning strategies as well as more political support for climate action. This process of using climate beliefs to develop climate frames aligns with planning theory focused on how local knowledge can contribute to more effective environmental planning while extending it to climate planning more generally. And although scholars recognize that local knowledge and community perception are critical to considerations of climate change, few studies with primary data about local perceptions of climate change exist. I help close that gap by analyzing statewide trends of survey data aggregated from the MSA scale and then using that knowledge to suggest frames to build support for statewide climate planning. Planners may find the resulting ideas useful mechanisms for catalyzing climate planning as well as for integrating residents' knowledge into climate planning.

Methods

In the fall of 2018, the Planet Texas 2050 research program undertook an online survey of 1,053 Texas residents representing each MSA in the state as well as a grouping of rural areas. The survey asked about beliefs related to climate and environmental issues, as well as potential behavior changes. Due to the priority of including respondents from all areas of the state, the research program partnered with UT Austin's Office of Institutional Reporting, Research, and Information Systems and Qualtrics to use a voluntary panel to obtain survey respondents. The survey limited respondents to Texas residents 18 years or older and geographically distributed across the state, with a minimum quota of respondents set for each of Texas's 25 MSAs, as well as a non-MSA (i.e., rural) grouping, to ensure geographic representation. The survey included 30 questions (see the Technical Appendix), and respondents could choose a Likert-scale response of *strongly disagree*, *disagree*, *agree*, *strongly agree*, or *don't know*. Survey design followed Dillman et al.'s (2014) recommendations for nonbiased and clear questions. In addition, questions were not identical to but were inspired by the Yale Program on Climate Change Communication's "Climate Change in the American Mind" survey, the most recognized and longest running U.S. climate survey (Leiserowitz et al., 2020).

Planet Texas 2050 used a voluntary panel for the online survey because of the importance of gathering responses from across the state. They chose a voluntary internet panel over a mail or phone survey because of concerns about cost, equitable access to landlines

Table 1. Demographic characteristics of survey respondents ($n = 1,053$).

Gender	% Survey respondents	% Texas population (U.S. Census Bureau, 2010)
Female	72.3	50.4
Male	26.7	49.6
Trans female	0.2	Not available
Trans male	—	Not available
Genderqueer/gender nonconforming	0.6	Not available
Other	0.3	Not available
Age	**% Survey respondents**	**% Texas adult population (U.S. Census Bureau, 2010)**
18–24[a]	15.4	9.6
25–34	31.1	20.4
35–44	17.3	19.0
45–54	13.1	17.1
55–64	13.1	8.3
65 or older	10.1	18.01
Race/ethnicity	**% Survey respondents[b]**	**% Texas population (U.S. Census Bureau, 2010)**
American Indian or Alaska Native	1.0	0.5
Asian	3.1	5.2
Black or African American	7.1	12.9
Hispanic/Latinx (of any race)	27.7	39.7
White alone, not Hispanic/Latinx	59.4	41.2
Other[c]	1.7	2.2
Income	**% Survey respondents**	**% Texas population (U.S. Census Bureau, 2019)**
Less than $24,999	20.1	19.8
$25,000–$34,999	20.9	9.1
$35,000–$49,999	13.9	12.7
$50,000–$74,999	20.7	17.7
$75,000 or more	24.4	40.8

Notes: a. The age category for the U.S. Census Bureau is 20–24; the survey was limited to adults, so we do not include the Census Bureau 15–19 age category for comparison. Totals may not add up to 100%. b. The Census Bureau asks participants to identify race first and then Hispanic ethnicity; this survey included Hispanic/Latinx as one choice among all racial and ethnicity categories. c. Other includes those who selected Native Hawaiian or Pacific Islander, two or more races, and other.

across demographic groups, and accuracy of interview-based answers about controversial topics. In addition, phone surveys have been losing response rates, which are now often less than 10%, leading to concerns about nonrespondents, representation, and bias (Dutwin & Buskirk, 2017). And although research from the previous decade found that phone surveys mostly avoided bias related to nonresponse (Groves, 2006; Groves & Peytcheva, 2008; Keeter et al., 2000, 2006), these studies were conducted when response rates were around 20%, making it difficult to draw conclusions about bias stemming from current, lower response rates. In addition, phone-based interview-administered surveys can affect the perceived social desirability of responses, especially in regard to sensitive topics (such as climate change in Texas; see Silva, 2012).

Because of these reasons, voluntary panel surveys have gained ground (R. Baker et al., 2010; Dutwin & Buskirk, 2017), despite some methodological weaknesses. Voluntary panel online surveys present several challenges when using them to draw generalizations. Participants who choose to participate in panels may differ from those who decline in unknown ways (Schoeni et al., 2013). In addition, online surveys often have higher participation from respondents who are female, young, non-Hispanic/Latinx, more educated, literate, and non–visually impaired; have higher income; and speak English as a first language, as well as persons with low time costs (e.g., unemployed, retired, etc.; R. Baker et al., 2010; Craig et al., 2013; Eysenbach & Wyatt, 2002; Grandjean et al., 2009; Hirsch et al., 2013; Liu et al., 2010; Roster et al., 2004).

Table 2. Beliefs about main causes of climate change reported by respondents (by total and race/ethnicity identification; $n = 1{,}053$).

	Respondents (%)				
	Total	Black/African American	Hispanic/Latinx	White	Other
Mostly due to natural cycles	25.7	17.3	16.7	28.3	19.7
Equally due to human activities and natural cycles	36.9	48.0	40.6	34.2	32.8
Mostly due to human activities	26.9	16.0	35.4	23.0	37.7
I don't know	12.5	18.7	7.3	14.5	9.8

Table 3. Support for climate-related behavior changes ($n = 1{,}053$).

	Strongly agree	Agree	Disagree	Strongly disagree	Don't know
Prohibit new homes from being built in areas prone to flooding	37.8	40.8	9.5	2.6	9.3
Reduce overall water consumption by 50% if needed	20.9	50.9	15.4	3.8	9.0
Drink "toilet to tap" (reclaimed wastewater)	9.2	18.6	25.6	30.5	16.1
Pay an additional 20% for energy bill for 100% renewable energy	15.5	30.4	28.2	11.8	14.1
Pay 3× water bill to ensure water security	7.0	14.1	43.6	24.6	10.8
Support policymakers who enact laws to reduce air/water pollution	31.5	46.6	7.1	3.2	11.6
Support policymakers who enact laws to reduce risk of natural disasters	22.4	48.5	8.9	3.5	16.7

There does not yet appear to be agreement about how to best statistically compensate for participation bias in panels. One potential method is weighting (also known as *raking*) the panel respondents' answers so that marginal distributions of gender, age, race/ethnicity, and reported household income meet a standard (e.g., the 2010 U.S. Census Bureau distribution for each demographic category; Craig et al., 2013). Another approach is to use a propensity score adjustment; however, this method may not effectively address participation bias (Silva, 2012). Given that gender, age, race/ethnicity, and household income have all been found to influence considerations of climate change and environmental issues (McKnight, 2010; McCright & Dunlap, 2011; Poortinga et al., 2011), I chose to weight the raw data to account for possible participation bias. However, to address concerns about the potential impact on standard error created by weighting all demographic variables, I weighted respondents' answers in two different groupings: one weighted for gender and age and one weighted for race/ethnicity and household income. These two groupings allowed for investigating participation bias while reducing impact on standard error.

I found that weighting for age and gender and race/ethnicity and household income did not appreciably change results. Therefore, I report on and simultaneously analyze the unweighted survey data here because in this case, weighting introduces a level of uncertainty without providing substantially different results. I include the weighted data in the Technical Appendix for comparison (Appendix Tables 2–5).

Planet Texas 2050 developed this survey to gather baseline data about residents' perceptions of climate change, not to gather information on framing. However, the survey questions have strong overlap with the major categories of climate frames identified by Badullovich et al. (2020) and summarized in the literature review, resulting in material useful for examining framing.

Findings

The survey provided 1,053 fully complete and usable responses.[3] Survey respondents fit the pattern of online surveys, skewing young, female, and non-Hispanic/Latinx (Table 1). Overall, survey respondents report that they have experienced more frequent extreme weather and believe that climate change will create additional negative impacts. They believe that climate change is due at least in part to human activity, and they support climate-related planning activities. However, despite these beliefs, climate change–related extreme weather events did not make it into the top five greatest concerns identified about the future. Highlights from these findings follow.

Nature Is Important to Everyday Life, Climate Change Affects the Benefits Humans Derive From Nature, and Environmental Regulations Are Important

A strong majority of respondents agreed or strongly agreed that nature is important to their everyday life (86.9%) and that climate change will affect benefits from nature (64.4%; Table 1). Respondents also agreed or

Table 4. Greatest concerns about the future ($n = 1,053$).

Concerns	% Respondents selecting the concern within their top three concerns (unweighted)
Housing/housing affordability	46.9
Air pollution	39.7
Human health/health care	39.4
Texas economy or job availability	38.2
Stresses on K–12 education	29.6
Water quality	24.7
Transportation infrastructure	24.5
Water scarcity	23.4
Hurricanes and/or flooding	15.6
Biodiversity of the natural environment	11.3
Reduced recreational opportunities in nature	9.1
I have no concerns	0.0

strongly agreed that environmental regulations and policies are important for promoting wellbeing in Texas (71.0%). However, respondents were more mixed about environmental regulations and the economy: 46.3% disagreed/strongly disagreed that environmental regulations and policies are a threat to economic prosperity, 37.5% of respondents agreed or strongly agreed, and 22.2% were unsure.

Climate Change Is Caused, at Least in Part, by Human Activity, and Extreme Weather Is Becoming More Frequent

Most (63.8%) respondents attributed human activity as at least the partial cause of climate change (Table 2). About a quarter responded that climate change is mostly due to natural cycles, and 12.5% were unsure. Most (58.3%) respondents reported that extreme weather is becoming more frequent, whereas 35.2% believe that extreme weather has stayed the same, and 6.5% believe that extreme weather was becoming less frequent.

Respondents Expressed Robust Support in General for Policies and Policymakers Addressing Climate Planning and Environmental Health, but Less Support for Significant Price Increases

A very strong majority of respondents agreed or strongly agreed that they would support policymakers who enacted laws to reduce risk of harm by pollutants in water and air (80.0%) and natural disasters (70.9%; Table 3). In addition, respondents expressed support for some aspects of climate planning, such as reducing household water use by 50% to address water scarcity (71.8%) and requiring flood-resilient land use planning (78.6%). Many fewer respondents expressed support for individual behavioral changes that increased financial cost, such as willingness to pay three times as much for their water bill to improve water security (21.1% agreed or strongly agreed). Only 27.8% agreed or strongly agreed that they would drink treated wastewater (direct potable reuse water) to help address water shortages.

Residents Prioritize Housing, Pollution, and Health as Concerns About the Future

Respondents chose their top three concerns about Texas's future as it relates to impacts from climate change and population growth (Table 4). Respondents most frequently chose housing and housing affordability, air pollution, and human health.

Air pollution, human health, water quality, and water scarcity were the most frequently chosen concerns that relate directly to climate stressors.

Discussion

In this discussion, I examine how the survey results provide knowledge that can be used to develop frames to build support for statewide climate planning. I argue that residents' knowledge and perceptions about climate change comprise a necessary piece of the knowledge base, political strategy, and support for climate planning. As discussed in the literature review, researchers have identified a gap in knowledge about including residents' perceptions in climate planning activities (Brink et al., 2016; Wamsler, 2015, 2017). In addition, planners have argued for increased public participation in climate change policy and planning (Brody et al., 2008; Shi, 2020). Planners have also emphasized the

need to co-produce climate change-related planning strategies with the public (Berke & Stevens, 2016; Corburn, 2009). The suggestions I describe below contribute to all three of these identified planning needs and offer relevance for planning practice in general. Below, I discuss three ideas to develop frames and build support for statewide climate planning.

Climate Frame 1: Better Connect Impacts of Climate Change to Immediate (i.e., Health and Pocketbook) Concerns About Housing Affordability, Air Quality, and Health

Survey findings indicate strong belief in climate change and robust support for climate planning, yet respondents did not identify climate change as a significant concern about the future. Is there a way to frame climate change as affecting more immediate concerns, such as housing? Although affordable housing, air pollution, and health may not at first glance be directly related to climate change, all three are and will continue to be affected by climate change. For instance, the pricing of housing in areas affected by climate risks will decline, possibly resulting in a situation in which homeowners are unable to sell because the plummeting sale price restricts their ability to purchase housing in a safer neighborhood. Managed or strategic retreat—purposefully relocating homes and neighborhoods experiencing sea level rise and other types of climate damage (Siders et al., 2019)—may add both to the short-term costs of moving as well as the potential longer-term costs of trying to replicate existing housing and neighborhood benefits.

Like housing, air quality and human health similarly connect to climate change in complex and interconnected ways. As planners and researchers, we can work to elucidate and communicate these connections while simultaneously receiving and incorporating new knowledge from residents about interactions among housing, air quality, health, and climate change that may not yet be apparent to us. For example, the following two planning projects seek to better connect impacts of climate change to more immediate observations held by the public. The Texas Urban Futures Virtual Reality Experience allows participants to view future climate scenarios presented through virtual reality in ways that connect to immediate concerns such as water availability and urban density (Leite, 2020). Using different types of visualizations, the Texas Metro Observatory provides dashboards that connect climate and social risk while providing a place for community members to explore connections between urgent concerns about housing affordability and health with longer-term concerns about climate risk and change (Bixler et al., 2019). Projects such as these provide an opportunity for researchers and planners to better explore the interface between community concerns about the future and climate change, which may be useful in Texas and beyond.

Working to connect the climate crisis to issues identified as more immediate concerns by respondents may also help bridge the gap that currently exists between the support expressed in this survey for politicians who enact environmental regulations and the current level of low environmental regulation by elected officials at the state level. Although there are likely many reasons creating this differential, including the 2003 state legislative redistricting plan that heavily skews election districts toward candidates who are less likely to support climate planning (McKee et al., 2006), focus groups also could be used to explore this gap between survey responses and statewide political reality.

Climate Frame 2: Emphasize Common Ground, Especially Agreement on Health Costs of Climate Change and the Benefits Provided to Humans by the Environment

Planners can also deploy these survey findings by emphasizing common ground revealed in the responses. Even if responses are not universally generalizable, strong agreement from respondents across demographic groups suggest that these perspectives will resonate for multiple audiences across the state. For instance, the very strong agreement that the natural environment provides benefits for humans, that climate change threatens those benefits, and that environmental regulation is important for human health indicates a potentially useful framework to use for climate issues. This narrative moves toward unifying commonalities: Texans are concerned about the health of their families and want a healthy place to live, and climate change threatens residents' health.

Planners can underscore the strong connections among climate and environmental conditions and human health, frames that have been used in public health and communications (Adlong & Dietsch, 2015; Myers et al., 2012; Weathers, 2013; Weathers & Kendall, 2016; World Health Organization, 2011). In particular, Myers et al.'s (2012) finding that a public health frame increased feelings of hope and support for climate planning, especially among people who indicated being dismissive of the climate crisis at the beginning of the study, seems especially applicable here. In light of this research, it could be useful for planners to consider how to connect public understanding of climate-related health impacts to the development of climate planning programs. Planners could also choose to emphasize the human health impacts of common climate-related

environmental concerns, rather than labeling these problems as solely environmental challenges. Treating environmental degradation and toxicity as a phenomenon separate from human health echoes the "nature–society divide" cited by geographers, historians, and economists as a major disconnect among humans, our economic activities that drive the climate crisis, and the health of humans and the rest of the ecosystem (Cronon, 1995; Foster et al., 2011). This divide permits people to consider the environment as separate from and exploitable by humans, with devastating impact on people and the rest of nature. Framing climate change in language that accurately reflects immediate health-related impacts may help move forward climate planning while also acknowledging that when humans overuse natural resources (e.g., fossil fuel), we are harming ourselves, our health, and our communities, in addition to damaging the broader ecosystem.

Use Community Engagement to Further Refine and Tailor Climate Frames

Planners can use community engagement processes such as interviews and focus groups to further explore and improve the climate frames described above. The survey responses mirrored what the literature has identified as challenges with volunteer panel online surveys: Respondents skewed toward those who are female, younger, and White. Even though little difference was found when results were weighted to better reflect statewide age, gender, race/ethnicity, and income distributions, interviews and focus groups designed to be representative of Texas's diversity would help validate findings from the survey as well as test and improve climate frames derived from these findings. And, because the survey data are at the MSA scale, it would be possible to match local data with particular focus groups or interviews. Using knowledge from this survey to guide follow-up interviews and focus groups leverages participatory planning theory as a mechanism to catalyze statewide climate planning and builds upon best practices in environmental hazards planning and climate planning (Brody et al., 2003, 2008).

As an illustration, the Climate Navigators program developed by residents of the Dove Springs neighborhood of Austin, the City of Austin, the nongovernmental organization Go Austin!, Vamos Austin!, and UT Austin provides an example of community engagement leading to more useful climate frames (Huber, 2020). The Climate Navigators program uses a "train the trainer" approach adapted from public health to build a network of community members who gather and disseminate climate-related local knowledge (Marks et al., 2013). Neighborhood-based climate navigators, who receive payment for their participation, will use cell phones and program-distributed tablets to upload their climate-related local knowledge into a secure online data portal. Researchers, city staff, and community-serving organizations will then analyze these data, link them to existing information about climate and social risk, and use them to co-develop local and regional climate planning and implementation. But before this work began, Go Austin!, Vamos Austin! and residents developed a new frame for *climate adaptation* and *climate resilience*, which were terms used by researchers and city staff that did not resonate with residents. They now frame this work around *response* and *responsibility*: for example, the residents' responses to flooding (e.g., moving safely out of harm's way) or city responsibilities (e.g., creating an equitable floodplain buyout program). In this example, community engagement and residents' preferences led to more useful climate frames, which will in turn contribute to improved climate planning outcomes, empowered residents, and strengthened ties among researchers, practitioners, and community members (Bassett & Shandas, 2010; Clouse & Lamb, 2013; Cutter et al., 2008; Haverkamp, 2017; Shi, 2020).

Conclusion

In this study I explored survey findings from 1,053 Texas residents to answer two research questions: What are Texans' perceptions of climate change and related issues, and how can planners use this knowledge to create strategies to catalyze climate planning? Survey respondents reported that they value the environment, believe that climate change will create negative impacts, and experience more frequent extreme weather. They believe that climate change is due at least in part to human activity, and they expressed support for climate-related planning activities. Respondents' beliefs starkly contrast with the level of attention climate planning receives at the state level. However, despite strong agreement about climate issues, respondents did not identify climate change as a major concern about the future, instead naming health, housing, and air quality as more important challenges. This dichotomy suggests an opportunity for new communication frames that planners could use to bridge the gap between climate perceptions and climate planning action. These recommendations include better connecting impacts of climate change to "bread and butter" concerns, such as housing affordability, air quality, and health; emphasizing common ground about benefits provided to humans by nature, especially those related to health; and using community engagement to refine frames identified in the survey. Although it will require skillful and energetic organizing to shift Texas toward statewide climate planning, a key first step is understanding

the language and frames that will resonate with the millions of Texans at risk from the climate crisis.

ABOUT THE AUTHOR

KATHERINE LIEBERKNECHT *(klieberknecht@utexas.edu) is an assistant professor at The University of Texas at Austin.*

ORCID

Katherine Lieberknecht *http://orcid.org/0000-0002-4168-7457*

ACKNOWLEDGMENTS

I thank the three reviewers and Editor Ann Forsyth for their helpful and thoughtful comments and critiques; they much strengthened the organization and contribution of this article. I also express gratitude to Managing Editor Michelle Treviño for her assistance. I am also especially grateful for my extended family, who created uninterrupted writing time through their gift of childcare during a time of closed schools and childcare facilities.

RESEARCH SUPPORT

This work was supported by The University of Texas at Austin's Bridging Barriers Grand Challenge Initiative.

SUPPLEMENTAL MATERIAL

Supplemental data for this article can be found on the publisher's website.

NOTES

1. Texas state agencies do not refer to climate change and do not use climate projections in planning and modeling. For example, the Texas Water Development Board (TWDB) does not acknowledge human-caused climate change in their plan and does not use climate change projections to estimate drought and flood occurrence and impact (TWDB, 2017). The Texas General Land Office, responsible for leading the state response to disasters, does not refer to climate change nor use climate change projections (Levitz, 2018). In addition, Texas is not among the 23 U.S. states that have adopted a climate change action plan (Center for Climate and Energy Solutions, 2020), and climate-related bills such as one requiring the state climatologist to provide climate projections to the legislature have failed (HB 2571, 2016).

2. An estimated 500,000 Texans live in 2,294 informally developed neighborhoods known as *colonías*, defined by the Texas Office of the Secretary of State as residential areas that lack complete infrastructure and services including potable water, septic or sewer systems, electricity, paved roads, or safe and sanitary housing (Barton et al., 2015). The Texas State Legislature has passed bills beginning in the late 1980s to authorize grants and loans for water and wastewater infrastructure development in *colonías*, but implementation has been slow (Esquinca & Jaramillo, 2017; Texas Office of the Secretary of State, 2020).

3. This number does not include respondents who attempted to complete the survey but did not meet the study criteria of being Texas residents 18 or older, respondents who took an extremely long or short time to complete the survey, and individuals who only partially finished the survey.

REFERENCES

Adlong, W., & Dietsch, E. (2015). Environmental education and the health professions: Framing climate change as a health issue. *Environmental Education Research*, *21*(5), 687–709. https://doi.org/10.1080/13504622.2014.930727

Akerlof, K., Maibach, E. W., Fitzgerald, D., Cedeno, A. Y., & Neuman, A. (2013). Do people "personally experience" global warming, and if so how, and does it matter? *Global Environmental Change*, *23*(1), 81–91. https://doi.org/10.1016/j.gloenvcha.2012.07.006

American Council for an Energy-Efficient Economy (ACEEE). (2019). *State and local database*. https://database.aceee.org/

American Institute of Certified Planners. (2016). *AICP code of ethics and professional conduct*. https://www.planning.org/ethics/ethicscode/

Anguelovski, I., Shi, L., Chu, E., Gallagher, D., Goh, K., Lamb, Z., Reeve, K., & Teicher, H. (2016). Equity impacts of urban land use planning for climate adaptation: Critical perspectives from the global north and south. *Journal of Planning Education and Research*, *36*(3), 333–348. https://doi.org/10.1177/0739456X16645166

Badullovich, N., Grant, W. J., & Colvin, R. M. (2020). Framing climate change for effective communication: A systematic map. *Environmental Research Letters*, *15*(12), 123002. https://doi.org/10.1088/1748-9326/aba4c7

Baker, I., Peterson, A., Brown, G., & McAlpine, C. (2012). Local government response to the impacts of climate change: An evaluation of local climate adaptation plans. *Landscape and Urban Planning*, *107*(2), 127–136. https://doi.org/10.1016/j.landurbplan.2012.05.009

Baker, R., Blumberg, S., Brick, J. M., Couper, M. P., Courtright, M., Dennis, M., Dillman, D., Frankel, M. R., Garland, P., Groves, R. M., Kennedy, C., Krosnick, J., Lee, S., Lavrakas, P., Link, M., Piekarski, L., Rao, K., Rivers, D., Thomas, R. K., & Zahs, D. (2010). *AAPOR report on online panels*. http://www.aapor.org/AM/Template.cfm?Section=AAPOR_Committee_and_Task_Force_Reports&Template=/CM/ContentDisplay.cfm&ContentID=2223

Barros, V. R., & Field, C. B. (2014). *Climate change 2014: Impacts, adaptation, and vulnerability. Part B: Regional aspects*. Intergovernmental Climate Change Panel. https://www.ipcc.ch/report/ar5/wg2/

Barton, J., Ryder Perlmeter, E., Sobel-Blum, E., & Marquez, R. (2015). *Las colonias in the 21st century: Progress along the Texas-Mexico border*. Federal Reserve Bank of Dallas.

Bassett, E., & Shandas, V. (2010). Innovation and climate action planning: Perspectives from municipal plans. *Journal of the American Planning Association*, *76*(4), 435–450. https://doi.org/10.1080/01944363.2010.509703

Benford, R. D., & Snow, D. A. (2000). Framing processes and social movements: An overview and assessment. *Annual Review of Sociology*, *26*(1), 611–639. https://doi.org/10.1146/annurev.soc.26.1.611

Berke, P. R., & Stevens, M. R. (2016). Land use planning for climate adaptation: Theory and practice. *Journal of Planning Education and Research*, *36*(3), 283–289. https://doi.org/10.1177/0739456X16660714

Bixler, R. P., Lieberknecht, K., Leite, F., Felkner, J., Oden, M., Richter, S. M., Atshan, S., Zilveti, A., & Thomas, R. (2019).

An observatory framework for metropolitan change: Understanding urban social–ecological–technical systems in Texas and beyond. *Sustainability*, *11*(13), Article 3611. https://doi.org/10.3390/su11133611

Blake, E. S., & Zelinsky, D. A. (2018). *Tropical cyclone report Hurricane Harvey*. National Hurricane Center.

Bloomberg Philanthropies. (2019). *American Cities Climate Challenge*. https://www.bloomberg.org/program/environment/climatechallenge/

Bolsen, T., & Shapiro, M. A. (2018). The US news media, polarization on climate change, and pathways to effective communication. *Environmental Communication*, *12*(2), 149–163. https://doi.org/10.1080/17524032.2017.1397039

Brink, E., Aalders, T., Ádám, D., Feller, R., Henselek, Y., Hoffmann, A., Ibe, K., Matthey-Doret, A., Meyer, M., Negrut, N. L., Rau, A.-L., Riewerts, B., von Schuckmann, L., Törnros, S., von Wehrden, H., Abson, D. J., & Wamsler, C. (2016). Cascades of green: A review of ecosystem-based adaptation in urban areas. *Global Environmental Change*, *36*, 111–123. https://doi.org/10.1016/j.gloenvcha.2015.11.003

Brody, S. D., Godschalk, D. R., & Burby, R. J. (2003). Mandating citizen participation in plan making: Six strategic planning choices. *Journal of the American Planning Association*, *69*(3), 245–264. https://doi.org/10.1080/01944360308978018

Brody, S. D., Zahran, S., Vedlitz, A., & Grover, H. (2008). Examining the relationship between physical vulnerability and public perceptions of global climate change in the United States. *Environment and Behavior*, *40*(1), 72–95. https://doi.org/10.1177/0013916506298800

Brown, K. (2014). Global environmental change: A social turn for resilience? *Progress in Human Geography*, *38*(1), 107–117. https://doi.org/10.1177/0309132513498837

Browne, A. J., Varcoe, C. M., Wong, S. T., Smye, V. L., Lavoie, J., Littlejohn, D., Tu, D., Godwin, O., Krause, M., Khan, K. B., Fridkin, A., Rodney, P., O'Neil, J., & Lennox, S. (2012). Closing the health equity gap: Evidence-based strategies for primary health care organizations. *International Journal for Equity in Health*, *11*(1), 59–15. https://doi.org/10.1186/1475-9276-11-59

Capstick, S. B., & Pidgeon, N. F. (2014). Public perception of cold weather events as evidence for and against climate change. *Climatic Change*, *122*(4), 695–708. https://doi.org/10.1007/s10584-013-1003-1

Center for Climate and Energy Solutions (C2ES). (2020). *State climate policies*. https://www.c2es.org/content/state-climate-policy/

City of Rockport. (2019). *City of Rockport comprehensive plan 2020–2040*. https://cityofrockport.com/739/Comment-on-Future-Plans

Clavel, P. (1986). *The progressive city: Planning and participation, 1969–1984*. Rutgers University Press.

Clouse, C., & Lamb, Z. (2013). Post-crisis: Embracing public service architecture with humility. *Journal of Architectural Education*, *67*(2), 186–194. https://doi.org/10.1080/10464883.2013.817157

Corburn, J. (2003). Bringing local knowledge into environmental decision making: Improving urban planning for communities at risk. *Journal of Planning Education and Research*, *22*(4), 420–433. https://doi.org/10.1177/0739456X03022004008

Corburn, J. (2005). *Street science: Community knowledge and environmental health justice*. MIT Press.

Corburn, J. (2009). Cities, climate change and urban heat island mitigation: Localising global environmental science. *Urban Studies*, *46*(2), 413–427. https://doi.org/10.1177/0042098008099361

Craig, B. M., Hays, R. D., Pickard, A. S., Cella, D., Revicki, D. A., & Reeve, B. B. (2013). Comparison of US panel vendors for online surveys. *Journal of Medical Internet Research*, *15*(11), e260. https://doi.org/10.2196/jmir.2903

Cronon, W. (1995). *Uncommon ground: Toward reinventing nature*. WW Norton & Company.

Cushing, L., Morello-Frosch, R., Wander, M., & Pastor, M. (2015). The haves, the have-nots, and the health of everyone: The relationship between social inequality and environmental quality. *Annual Review of Public Health*, *36*, 193–209. https://doi.org/10.1146/annurev-publhealth-031914-122646

Cutter, S. L., Barnes, L., Berry, M., Burton, C., Evans, E., Tate, E., & Webb, J. (2008). A place-based model for understanding community resilience to natural disasters. *Global Environmental Change*, *18*(4), 598–606. https://doi.org/10.1016/j.gloenvcha.2008.07.013

Depland, M. (2019, March 13). The stunning difference between these neighborhood storm drains is inequality at work. *Texas Low Income Housing Information Services*. https://texashousers.org/2019/03/13/drainage-ditches-houston-stunning-difference/

Dillman, D. A., Smyth, J. D., & % Christian, L. M. (2014). *Internet, phone, mail, and mixed-mode surveys: The tailored design method*. John Wiley & Sons.

Douglas, E. (2021, February 10). Texas House Democrats launch climate, environment caucus with one goal: Talk about climate change in the Legislature. *Texas Tribune*. https://www.texastribune.org/2021/02/10/texas-democrats-climate-environment-caucus/

Druckman, J. N., & Lupia, A. (2000). Preference formation. *Annual Review of Political Science*, *3*(1), 1–24. https://doi.org/10.1146/annurev.polisci.3.1.1

Dutwin, D., & Buskirk, T. D. (2017). Apples to oranges or Gala versus Golden Delicious? Comparing data quality of nonprobability Internet samples to low response rate probability samples. *Public Opinion Quarterly*, *81*(S1), 213–239. https://doi.org/10.1093/poq/nfw061

Egan, P. J., & Mullin, M. (2012). Turning personal experience into political attitudes: The effect of local weather on Americans' perceptions about global warming. *The Journal of Politics*, *74*(3), 796–809. https://doi.org/10.1017/S0022381612000448

Esquinca, M., & Jaramillo, A. (2017, August 22). Colonias on the border struggle with decades-old water issues. *Texas Tribune*. https://www.texastribune.org/2017/08/22/colonias-border-struggle-decades-old-water-issues/

Eysenbach, G., & Wyatt, J. (2002). Using the Internet for surveys and health research. *Journal of Medical Internet Research*, *4*(2), E13. https://doi.org/10.2196/jmir.4.2.e13

Fitzgerald, J., & Lenhart, J. (2016). Eco-districts: Can they accelerate urban climate planning? *Environment and Planning C: Government and Policy*, *34*(2), 364–380. https://doi.org/10.1177/0263774X15614666

Florida, R., & Mellander, C. (2015). *Segregated city: The geography of economic segregation in America's metros*. Martin Prosperity Institute, Rotman School of Management, University of Toronto.

Ford, J. D., Pearce, T., McDowell, G., Berrang-Ford, L., Sayles, J. S., & Belfer, E. (2018). Vulnerability and its discontents: The past, present, and future of climate change vulnerability research. *Climatic Change*, *151*(2), 189–203. https://doi.org/10.1007/s10584-018-2304-1

Forester, J. (1988). *Planning in the face of power*. University of California Press.

Foster, J. B., Clark, B., & York, R. (2011). *The ecological rift: Capitalism's war on the earth*. New York University Press.

Fox, L. (2018). *The supplemental poverty measure: 2016*. U.S. Census Bureau.

Friend, R., & Moench, M. (2013). What is the purpose of urban climate resilience? *Urban Climate*, *6*, 98–113. https://doi.org/10.1016/j.uclim.2013.09.002

Goebbert, K., Jenkins-Smith, H. C., Klockow, K., Nowlin, M. C., & Silva, C. L. (2012). and worldviews: The sources and consequences of public perceptions of changes in local weather patterns. *Weather, Climate, and Society*, *4*(2), 132–144. https://doi.org/10.1111/j.1541-0072.2010.00389_4.x

Graham, S., & Marvin, S. (2001). *Splintering urbanism: Networked infrastructures, technological mobilities and the urban condition*. Psychology Press.

Grandjean, B. D., Nelson, N. M., & Taylor, P. A. (2009, May). Comparing an internet panel survey to mail and phone surveys on willingness to pay for environmental quality: A national mode test. In *64th Annual Conference of the American Association for Public Opinion Research*, 14–17. https://www.researchgate.net/profile/Burke-Grandjean/publication/266210768_Comparing_an_Internet_Panel_Survey_to_Mail_and_Phone_Surveys_on_Willingness_to_Pay_for_Environmental_Quality_A_National_Mode_Test/links/5526e6eb0cf229e6d635e9ba/Comparing-an-Internet-Panel-Survey-to-Mail-and-Phone-Surveys-on-Willingness-to-Pay-for-Environmental-Quality-A-National-Mode-Test.pdf

Gromet, D. M., Kunreuther, H., & Larrick, R. P. (2013). Political ideology affects energy-efficiency attitudes and choices. *Proceedings of the National Academy of Sciences of the United States of America*, *110*(23), 9314–9319. https://doi.org/10.1073/pnas.1218453110

Groves, R. M. (2006). Nonresponse rates and nonresponse bias in household surveys. *Public Opinion Quarterly*, *70*(5), 646–675. https://doi.org/10.1093/poq/nfl033

Groves, R. M., & Peytcheva, E. (2008). The impact of nonresponse rates on nonresponse bias: A meta-analysis. *Public Opinion Quarterly*, *72*(2), 167–189. https://doi.org/10.1093/poq/nfn011

Haluza-DeLay, R. (2017). Communicating about climate change with religious groups and leaders. In H. Von Storch (Ed.), *Oxford research encyclopedia of climate science* (pp. 392–396). Oxford University Press.

Hamilton, L. C., & Keim, B. D. (2009). Regional variation in perceptions about climate change. *International Journal of Climatology*, *29*(15), 2348–2352. https://doi.org/10.1002/joc.1930

Hart, P. S., & Feldman, L. (2016). The impact of climate change–related imagery and text on public opinion and behavior change. *Science Communication*, *38*(4), 415–441. https://doi.org/10.1177/1075547016655357

Hart, P. S., & Feldman, L. (2018). Would it be better to not talk about climate change? The impact of climate change and air pollution frames on support for regulating power plant emissions. *Journal of Environmental Psychology*, *60*, 1–8. https://doi.org/10.1016/j.jenvp.2018.08.013

Hart, P. S., & Nisbet, E. C. (2012). Boomerang effects in science communication: How motivated reasoning and identity cues amplify opinion polarization about climate mitigation policies. *Communication Research*, *39*(6), 701–723. https://doi.org/10.1177/0093650211416646

Haverkamp, J. A. R. (2017). Politics, values, and reflexivity: The case of adaptation to climate change in Hampton Roads, Virginia. *Environment and Planning A: Economy and Space*, *49*(11), 2673–2692. https://doi:10.1177/0308518X17707525

HB 2571. (2016). Relating to information on projected changes in weather, water availability, and climate variability in strategic plans of certain state agencies, H.B. 2571, 84th Legislature. https://legiscan.com/TX/text/HB2571/2015

Healey, P. (1996). The communicative turn in planning theory and its implications for spatial strategy formation. *Environment and Planning B: Planning and Design*, *23*(2), 217–234. https://doi.org/10.1068/b230217

Hirsch, O., Hauschild, F., Schmidt, M. H., Baum, E., & Christiansen, H. (2013). Comparison of Web-based and paper-based administration of ADHD questionnaires for adults. *Journal of Medical Internet Research*, *15*(3), e47. https://doi.org/10.2196/jmir.2225

Hopke, J. E. (2012). Water gives life: Framing an environmental justice movement in the mainstream and alternative Salvadoran press. *Environmental Communication: A. Environmental Communication*, *6*(3), 365–382. https://doi.org/10.1080/17524032.2012.695742

Howe, P. D., & Leiserowitz, A. (2013). Who remembers a hot summer or a cold winter? The asymmetric effect of beliefs about global warming on perceptions of local climate conditions in the US. *Global Environmental Change*, *23*(6), 1488–1500. https://doi.org/10.1016/j.gloenvcha.2013.09.014

Howe, P. D., Markowitz, E. M., Lee, T. M., Ko, C. Y., & Leiserowitz, A. (2013). Global perceptions of local temperature change. *Nature Climate Change*, *3*(4), 352–356. https://doi.org/10.1038/nclimate1768

Howe, P. D., Mildenberger, M., Marlon, J. R., & Leiserowitz, A. (2015). Geographic variation in opinions on climate change at state and local scales in the USA. *Nature Climate Change*, *5*(6), 596–603. https://doi.org/10.1038/nclimate2583

Huber, M. (2020). Engaging communities to fight a climate crisis. *Planet Texas 2050-News Stories*. https://repositories.lib.utexas.edu/bitstream/handle/2152/83745/Engaging%20Communities%20to%20Fight%20Climate%20Crisis%20_%20PlanetTexas2050.pdf?sequence=2

Innes, J. E. (1995). Planning theory's emerging paradigm: Communicative action and interactive practice. *Journal of Planning Education and Research*, *14*(3), 183–189. https://doi.org/10.1177/0739456X9501400307

Innes, J. E. (1998). Information in communicative planning. *Journal of the American Planning Association*, *64*(1), 52–63. https://doi.org/10.1080/01944369808975956

Institute for Local Government. (2020). *Climate action planning*. https://www.ca-ilg.org/climate-action-plans

Intergovernmental Panel on Climate Change (IPCC). (2018). Summary for policymakers. In V. Masson-Delmotte, P. Zhai, H. O. Pörtner, D. Roberts, J. Skea, P. R. Shukla, & T. Waterfield (Eds.), *Global warming of 1.5°C: An IPCC special report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change*. https://www.ipcc.ch/sr15/

Jesdale, B. M., Morello-Frosch, R., & Cushing, L. (2013). The racial/ethnic distribution of heat risk-related land cover in relation to residential segregation. *Environmental Health Perspectives*, *121*(7), 811–817. https://doi.org/10.1289/ehp.1205919

Joseph, J. (2013). Resilience as embedded neoliberalism: A governmentality approach. *Resilience*, *1*(1), 38–52. https://doi.org/10.1080/21693293.2013.765741

Kahan, D. M., Jenkins-Smith, H., & Braman, D. (2011). Cultural cognition of scientific consensus. *Journal of Risk Research*, *14*(2), 147–174. https://doi.org/10.1080/13669877.2010.511246

Kearns, F. R. (2012). From science communication to relationship-building: Contemplative practice and community engagement in the environmental sciences. *Journal of Environmental Studies and Sciences*, *2*(3), 275–277. https://doi.org/10.1007/s13412-012-0083-y

Kearns, F. R. (2015). Stretching science: Why emotional intelligence is key to tackling climate change. *The Conversation*. http://theconversation.com/stretching-science-why-emotional-intelligence-is-key-totackling-climate-change-50654/

Keeter, S., Kennedy, C., Dimock, M., Best, J., & Craighill, P. (2006). Gauging the impact of growing nonresponse on estimates from a national RDD telephone survey. *Public Opinion Quarterly*, *70*(5), 759–779. https://doi.org/10.1093/poq/nfl035

Keeter, S., Miller, C., Kohut, A., Groves, R. M., & Presser, S. (2000). Consequences of reducing nonresponse in a national telephone survey. *Public Opinion Quarterly*, *64*(2), 125–148. https://doi.org/10.1086/317759

Leiserowitz, A. (2006). Climate change risk perception and policy preferences: The role of affect, imagery, and values. *Climatic Change*, *77*(1–2), 45–72. https://doi.org/10.1007/s10584-006-9059-9

Leiserowitz, A., Maibach, E., Rosenthal, S., Kotcher, J., Bergquist, P., Ballew, M., Goldberg, M., Gustafson, A., & Wang, X. (2020). *Climate change in the American mind: April 2020*. Yale University and George Mason University, Yale Program on Climate Change Communication.

Leiserowitz, A., Maibach, E. W., Roser-Renouf, C., Feinberg, G., & Howe, P. (2013). *Climate change in the American mind: Americans' global warming beliefs and attitudes in April 2013*. Yale Program on Climate Change Communication.

Leite, F. (2020). From virtual to reality: Take a walk around Austin in 2050. *Planet Texas 2050-News Stories*. https://repositories.lib.utexas.edu/bitstream/handle/2152/83772/Take%20a%20Virtual%20Walk%20Around%20Austin%20in%202050%20_%20PlanetTexas2050.pdf?sequence=2

Levitz, C. (2018). The 2019 Texas coastal resiliency master plan. *Coastal Engineering Proceedings*, *1*(36), 25. https://doi.org/10.9753/icce.v36.risk.25

Lieberknecht, K., Zoll, D., Jiao, J., & Castles, K. (2021). Hurricane Harvey: Equal opportunity storm or disparate disaster? *Local Environment*, *84*, 242–261. https://doi.org/10.1080/13549839.2021.1886063

Lindblom, C. E., & Cohen, D. K. (1979). *Usable knowledge: Social science and social problem solving* (Vol. 21). Yale University Press.

Liu, H., Cella, D., Gershon, R., Shen, J., Morales, L. S., Riley, W., & Hays, R. D. (2010). Representativeness of the patient-reported outcomes measurement information system internet panel. *Journal of Clinical Epidemiology*, *63*(11), 1169–1178. https://doi.org/10.1016/j.jclinepi.2009.11.021

Marks, B., Sisirak, J., & Chang, Y. C. (2013). Efficacy of the HealthMatters program train-the-trainer model. *Journal of Applied Research in Intellectual Disabilities*, *26*(4), 319–334. https://doi.org/10.1111/jar.12045

McCright, A. M., & Dunlap, R. E. (2011). Cool dudes: The denial of climate change among conservative white males in the United States. *Global Environmental Change*, *21*(4), 1163–1172. https://doi.org/10.1016/j.gloenvcha.2011.06.003

McKee, S. C., Teigen, J. M., & Turgeon, M. (2006). The partisan impact of congressional redistricting: The case of Texas, 2001–2003. *Social Science Quarterly*, *87*(2), 308–317. https://doi.org/10.1111/j.1540-6237.2006.2006.00382.x

McKnight, D. (2010). A change in the climate? The journalism of opinion at News Corporation. *Journalism*, *11*(6), 693–706. https://doi.org/10.1177/1464884910379704

Meerow, S., & Newell, J. P. (2019). Urban resilience for whom, what, when, where, and why? *Urban Geography*, *40*(3), 309–329. https://doi.org/10.1080/02723638.2016.1206395

Moore, S. A., Torrado, M., & Joslin, N. (2019). Knowledge production for interdependent critical infrastructures: Constructing context-rich relationships across ecosociotechnical boundaries. *Environmental Science & Policy*, *99*, 97–104. https://doi.org/10.1016/j.envsci.2019.05.018

Myers, T. A., Maibach, E. W., Roser-Renouf, C., Akerlof, K., & Leiserowitz, A. A. (2013). The relationship between personal experience and belief in the reality of global warming. *Nature Climate Change*, *3*(4), 343–347. https://doi.org/10.1038/nclimate1754

Myers, T. A., Nisbet, M. C., Maibach, E. W., & Leiserowitz, A. A. (2012). A public health frame arouses hopeful emotions about climate change. *Climatic Change*, *113*(3–4), 1105–1112. https://doi.org/10.1007/s10584-012-0513-6

National Aeronautics and Space Administration (NASA). (2017). *Natural and manmade hazards in the state of Texas*. http://nisar.jpl.nasa.gov/applications

National Aeronautics and Space Administration (NASA). (2020). *Responding to climate change*. https://climate.nasa.gov/solutions/adaptation-mitigation/

Nepstad, S. (2001). Creating transnational solidarity: The use of narrative in the US–Central America peace movement. *Mobilization: An International Quarterly*, *6*(1), 21–36. https://doi.org/10.17813/maiq.6.1.8606h50k7135180h

Peters-Guarin, G., McCall, M. K., & van Westen, C. (2012). Coping strategies and risk manageability: Using participatory geographical information systems to represent local knowledge. *Disasters*, *36*(1), 1–27. https://doi.org/10.1111/j.1467-7717.2011.01247.x

Petrovic, N., Madrigano, J., & Zaval, L. (2014). Motivating mitigation: When health matters more than climate change. *Climatic Change*, *126*(1–2), 245–254. https://doi.org/10.1007/s10584-014-1192-2

Pew Research Center. (2012). *The rise of residential segregation by income*. http://www.pewsocialtrends.org/files/2012/08/Rise-of-Residential-Income-Segregation-2012.2.pdf

Poortinga, W., Spence, A., Whitmarsh, L., Capstick, S., & Pidgeon, N. F. (2011). Uncertain climate: An investigation into public scepticism about anthropogenic climate change. *Global Environmental Change*, *21*(3), 1015–1024. https://doi.org/10.1016/j.gloenvcha.2011.03.001

Pyhälä, A., Fernández-Llamazares, Á., Lehvävirta, H., Byg, A., Ruiz-Mallén, I., Salpeteur, M., & Thornton, T. F. (2016). Global environmental change: Local perceptions, understandings, and

explanations. *Ecology and Society*, *21*(3), 25. https://doi.org/10.1016/j.gloenvcha.2011.03.001

Rabe, B. G. (2004). *Statehouse and greenhouse: The emerging politics of American climate change policy*. Brookings Institution Press.

Ranganathan, M., & Bratman, E. (2021). From urban resilience to abolitionist climate justice in Washington, DC. *Antipode*, *53*(1), 115–137. https://doi.org/10.1111/anti.12555

Reckien, D., Flacke, J., Dawson, R. J., Heidrich, O., Olazabal, M., Foley, A., Hamann, J. J.-P., Orru, H., Salvia, M., De Gregorio Hurtado, S., Geneletti, D., & Pietrapertosa, F. (2014). Climate change response in Europe: What's the reality? Analysis of adaptation and mitigation plans from 200 urban areas in 11 countries. *Climatic Change*, *122*(1–2), 331–340. https://doi.org/10.1007/s10584-013-0989-8

Rockefeller Foundation. (2019). *100 resilient cities*. https://www.rockefellerfoundation.org/our-work/initiatives/100-resilient-cities/

Rosenzweig, C., Solecki, W. D., Romero-Lankao, P., Mehrotra, S., Dhakal, S., & Ibrahim, S. A. (Eds.). (2018). *Climate change and cities: Second assessment report of the urban climate change research network*. Cambridge University Press.

Roster, C. A., Rogers, R. D., Albaum, G., & Klein, D. (2004). A comparison of response characteristics from web and telephone surveys. *International Journal of Market Research*, *46*(3), 359–373. https://doi.org/10.1177/147078530404600301

Satija, N. (2014, July 13). Climate scientists: Texas is missing an opportunity. *Texas Tribune*. https://www.texastribune.org/2014/07/13/growth-adds-denial-and-vulnerability-climate-chang/

Schoeni, R. F., Stafford, F., McGonagle, K. A., & Andreski, P. (2013). Response rates in national panel surveys. *The Annals of the American Academy of Political and Social Science*, *645*(1), 60–87. https://doi.org/10.1177/0002716212456363

Shi, L. (2020). From progressive cities to resilient cities: Lessons from history for new debates in equitable adaptation to climate change. *Urban Affairs Review*. Advance online publication. https://doi.org/10.1177/1078087419910827

Shi, L., Chu, E., Anguelovski, I., Aylett, A., Debats, J., Goh, K., Schenk, T., Seto, K. C., Dodman, D., Roberts, D., Roberts, J. T., & VanDeveer, S. D. (2016). Roadmap towards justice in urban climate adaptation research. *Nature Climate Change*, *6*(2), 131–137. https://doi.org/10.1038/nclimate2841

Shi, L., Chu, E., & Debats, J. (2015). Explaining progress in climate adaptation planning across 156 US municipalities. *Journal of the American Planning Association*, *81*(3), 191–202. https://doi.org/10.1080/01944363.2015.1074526

Siders, A. R., Hino, M., & Mach, K. J. (2019). The case for strategic and managed climate retreat. *Science*, *365*(6455), 761–763. https://doi.org/10.1126/science.aax8346

Silva, C. N. (Ed.). (2012). *Online research methods in urban and planning studies: Design and outcomes*. IGI Global.

Texas Office of the Secretary of State. (2020). *Colonia legislation in Texas*. https://www.sos.state.tx.us/border/reports/legislation.shtm

Texas Water Development Board (TWDB). (2017). *Water for Texas: Texas state water plan*. https://texasstatewaterplan.org

Thomas, K. A., & Warner, B. P. (2019). Weaponizing vulnerability to climate change. *Global Environmental Change*, *57*, Article 101928. https://doi.org/10.1016/j.gloenvcha.2019.101928

Torrado, M., & Joslin, N. (2019). Imagining Solutions-Driven Community Centers. *Medium*. https://medium.com/planettexas2050/imagining-solutions-driven-community-centers-a1b82433d08c

Uejio, C. K., Wilhelmi, O. V., Golden, J. S., Mills, D. M., Gulino, S. P., & Samenow, J. P. (2011). Intra-urban societal vulnerability to extreme heat: The role of heat exposure and the built environment, socioeconomics, and neighborhood stability. *Health & Place*, *17*(2), 498–507. https://doi.org/10.1016/j.gloenvcha.2019.101928

United Health Foundation. (2018). *American health rankings annual report*. https://www.americashealthrankings.org/

U.S. Census Bureau. (2010). *Profile of general population and housing characteristics: 2010*. https://data.census.gov/cedsci/table?q=texas_population_gender_age_race_and_ethnicity&tid=DECENNIALDPCD1132010.113DP1

U.S. Census Bureau. (2016, May 19). Five of the nation's eleven fastest-growing cities are in Texas, Census Bureau reports. http://www.census.gov/newsroom/pressreleases/v2016/cb16-81.html

U.S. Census Bureau. (2019). *Selected characteristics of the total and native populations in the United States, 2017 American Community Survey 1-year estimates for the state of Texas*. https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_17_1YR_S0601&prodType=table

U.S. Energy Information Administration (USEIA). (2017). *State profile and energy estimates*. U.S. EIA, Office of Energy Analysis, U.S. Department of Energy.

ValuePenguin. (2020). *States most at risk for natural disasters in 2020*. https://www.valuepenguin.com/property-insurance/states-most-at-risk-natural-disasters

Van der Linden, S. (2014). On the relationship between personal experience, affect and risk perception: The case of climate change. *European Journal of Social Psychology*, *44*(5), 430–440. https://doi.org/10.1002/ejsp.2008

Wamsler, C. (2015). Mainstreaming ecosystem-based adaptation: Transformation toward sustainability in urban governance and planning. *Ecology and Society*, *20*(2), 196. https://doi.org/10.5751/ES-07489-200230

Wamsler, C. (2017). Stakeholder involvement in strategic adaptation planning: Transdisciplinarity and co-production at stake? *Environmental Science & Policy*, *75*, 148–157. https://doi.org/10.1016/j.envsci.2017.03.016

Weathers, M. R. (2013). Newspaper coverage of global warming and climate change (GWCC) as a public health issue. *Applied Environmental Education & Communication*, *12*(1), 19–28. https://doi.org/10.1080/1533015X.2013.795829

Weathers, M. R., & Kendall, B. E. (2016). Developments in the framing of climate change as a public health issue in US newspapers. *Environmental Communication*, *10*(5), 593–611. https://doi.org/10.1080/17524032.2015.1050436

Weichselgartner, J., & Kelman, I. (2015). Geographies of resilience: Challenges and opportunities of a descriptive concept. *Progress in Human Geography*, *39*(3), 249–267. https://doi.org/10.1177/0309132513518834

White, S., Potter, L., You, H., Valencia, L., Jordan, J., Pecotte, B., & Robinson, S. (2017). *Urban Texas*. Texas Demographic Center.

Wolch, J. R., Byrne, J., & Newell, J. P. (2014). Urban green space, public health, and environmental justice: The challenge of making cities "just green enough." *Landscape and Urban Planning*, *125*, 234–244. https://doi.org/10.1016/j.landurbplan.2014.01.017

Woodruff, S. C., Meerow, S., Stults, M., & Wilkins, C. (2018). Adaptation to resilience planning: Alternative pathways to

prepare for climate change. *Journal of Planning Education and Research*. Advance online publication. https://doi.org/10.1177/0739456X18801057

World Health Organization. (2011). *Health in the green economy: Health co-benefits of climate change mitigation-housing sector*. World Health Organization.

Wright, L. (2019). *God save Texas: A journey into the soul of the Lone Star State*. Vintage.

Wuebbles, D. J., Fahey, D. W., & Hibbard, K. A. (2017). *Climate science special report: Fourth National Climate Assessment, Volume I*. US Global Change Research Program.

Yearley, S. (2000). Making systematic sense of public discontents with expert knowledge: Two analytical approaches and a case study. *Public Understanding of Science*, *9*(2), 105–122. https://doi.org/10.1088/0963-6625/9/2/302

Zaval, L., Keenan, E. A., Johnson, E. J., & Weber, E. U. (2014). How warm days increase belief in global warming. *Nature Climate Change*, *4*(2), 143–147. https://doi.org/10.1038/nclimate2093