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Insights from Local Knowledge for Climate Adaptation Planning

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ABSTRACT

Problem, research strategy, and findings: Although theory and practice contend that local knowledge improves climate adaptation planning, little research has documented the kinds of information shared by residents. Planners can use this information to assist in the creation of planning processes and tools, as well as investigate how local knowledge contributes—or does not contribute—to planning outcomes. We developed a provisional typology of how local knowledge has been used for adaptation planning and used a case study to ask: When compared with existing research, what information do residents share? How might this knowledge be useful for climate adaptation? In interviews, residents identified new ideas about local knowledge and climate adaptation planning: cascading harms and repeated trauma from—and mental health implications related to—climate events, lack of trust in municipalities, and how community capacity increases climate adaptation. Although these themes support existing research, to our knowledge, these findings are the first empirical data from studies focused on local knowledge in which frontline residents themselves identified the need for increased attention to mental health, community capacity, and trust building. Our findings contribute to larger conversations about climate adaptation planning as well as help inform the development of an adaptation tool in Austin (TX).

Takeaway for practice: We identified three takeaways for climate adaptation planning: increase acknowledgment of and attention to mental health effects, integrate local knowledge about community capacity, and consider incorporating local knowledge to build trust.

Keywords: climate adaptation planning, climate trauma, community capacity, local knowledge, mental health

Researchers, communities, agencies, and non-profit organizations have identified the importance of climate adaptation planning that reflects residents' local knowledge (CityScale, 2021; Corburn, 2009; Eakin et al., 2021; Maldonado et al., 2014; Marino & Ribot, 2012; Peters-Guarin et al., 2012; Sansom et al., 2016; Shi, 2021; Urban Sustainability Directors Network, 2017; Yarina et al., 2019; Ziervogel et al., 2017). Although it is important not to idealize local knowledge, scholars have argued that residents' knowledge can contribute to improved justice and effectiveness of adaptation-related planning (Berke & Stevens, 2016; Corburn, 2003; Eakin et al., 2021; Goldstein, 2015; Haverkamp, 2017; Malloy & Ashcraft, 2020; Marino & Ribot, 2012; Meyer et al., 2018; Yarina et al., 2019). Scholars also have found that inclusion of local knowledge in planning can contribute to trust building and repair of past harms (Stern et al., 2023; Suškevičs et al., 2018; Wachinger et al., 2013). For these reasons, it is important for planners to be familiar with types of adaptation-related local knowledge. In addition, understanding different forms of local knowledge may help

planners evaluate how this information may or may not contribute to planning outcomes.

This understanding also may inform processes and tools designed to integrate local knowledge into adaptation-related planning, for those seeking to do so. For example, in Austin (TX), residents, municipal staff, and community organizations have cited the need to better incorporate local knowledge into climate adaptation planning (Coudert, 2023; Lieberknecht, 2023). In response, the Go! Austin/Vamos! Austin community organization created the Climate Navigators program, a participatory process to design a data portal to provide preparedness information and link local knowledge to planning. To support this project, we identified types of residents' local knowledge previously used in North American adaptation-related planning: local issues, assets, and strategies. To assist portal design as well as better understand how local knowledge can inform climate adaptation more generally, we asked:

- What local knowledge did residents share when participating in this case study?

- How might this knowledge be useful for climate adaptation?

Here we focus on *climate adaptation planning*, defined as planning focused on preparation for and adjustment to already existing impacts from climate crisis (Berke & Stevens, 2016) and more specifically on equitable climate adaptation planning. Equitable climate adaptation aims to develop strategies that do not favor “those who are already better off” (Fainstein, 2010, p. 36) while also addressing past harms, especially those experienced by marginalized groups (Lieberknecht & Mueller, 2023). Often, we simply refer to adaptation-related planning.

We first review literature regarding equitable climate adaptation planning, local knowledge held by residents and used in adaptation-related planning, and case study context. We then describe our processes of gathering and analyzing data from interviews with 25 program participants. Findings aligned with empirical studies but contributed new themes, including cascading harms and repeated trauma from climate events, a lack of trust, and community capacity. We then discuss community-driven recommendations: increase acknowledgement of and attention to mental health effects of climate-related events, integrate local knowledge about community capacity, and build trust with residents by incorporating local knowledge. Though these themes substantiate broader planning theory and research, to our knowledge, these findings are the first empirical data from studies focused on local knowledge in which frontline residents *themselves* identified the need for increased attention to mental health, community capacity, and trust building in adaptation-related planning. Our findings are relevant for scholars and practitioners considering how to incorporate local knowledge into adaptation-related planning and support Wall et al. (2017, p. 551) called “place-based, use-inspired, policy-relevant research about disasters and environmental change.”

The Role of Local Knowledge in Equitable Climate Adaptation

Local communities experience firsthand climate event impacts, which are often exacerbated for marginalized residents (Dow et al., 2006; Klinsky & Mavrogianni, 2020; Marino & Ribot, 2012). Researchers also have documented how climate adaptation planning can amplify climate injustice (Anguelovski et al., 2018; Barnett & O’Neill, 2010; Marino & Ribot, 2012; Webber, 2016). For example, Anguelovski et al. (2018) found examples of adaptation planning that replaced low-income communities or communities of color with green space.

Marino and Ribot (2012) described prioritization of physical infrastructure to address sea level rise and erosion, at the expense of investing in community relocation desired by residents. To address uneven justice outcomes, Eakin et al. (2021) underscored the need for climate adaptation to incorporate procedural justice (effective participation in decision making) as well as distributive justice (resources, capacity, and power to achieve material outcomes). Adaptation planning also relates to recognition justice, which shows respect for lived experience, identity, and culture, as well as reparative justice, which seeks to address and repair past harms (Fraser et al., 2003; Klinsky & Mavrogianni, 2020; Martin et al., 2016).

Theory underscores that strategies require a foundation of diverse knowledge types, including residents’ ordinary or local knowledge (Berke & Stevens, 2016; Clavel, 1986; Innes, 1995; Lindblom & Cohen, 1979). Local knowledge, defined by Corburn (2003) as a community member’s firsthand experiences, and by Raymond et al. (2010) as information that reflects expertise about local phenomena, can contribute to more effective solutions for planning in general, land use planning, and environmental health planning (Berke & Stevens, 2016; Corburn, 2005; Crewe, 2001; Fischer, 1993, 2000; Nelson et al., 2022; Van Herzele, 2004). Residents’ lived experiences of climate change and climate adaptation planning can translate to important knowledge about characteristics of climate challenges, harms they cause, and potential solutions (Berke & Stevens, 2016; Corburn, 2009; Lieberknecht, 2022; Peters-Guarin et al., 2012; Sansom et al., 2016). It remains important to not romanticize local knowledge (Corburn, 2003), and to our knowledge, no studies have yet evaluated the value of local knowledge by comparing adaptation-related planning outcomes. However, researchers who have conducted research on adaptation-related planning processes argue that local knowledge will advance climate adaptation plans and plan implementation by increasing inclusion, extending understandings of adaptation-related systems, and improving proposed solutions (Goldstein, 2015; Haverkamp, 2017; Meyer et al., 2018).

Adaptation planning builds on hazards planning, which emphasizes that local knowledge complements technical knowledge (Berke & Stevens, 2016; Brody, 2003). In addition, processes that allow for exchange of local knowledge in adaptation planning, as well as related fields of hazards and natural resource planning, can increase trust (Stern et al., 2023; Suškevičs et al., 2018; Wachinger et al., 2013). Trust building is an important outcome of planning, especially climate-related planning and planning with marginalized populations (Clark, 2021; Fitzgerald, 2022; Lee, 2019; Nelson et al., 2007). Communities can move toward justice using

processes such as knowledge co-production: joint development of planning information by residents alongside professionals (Berke & Stevens, 2016; Eakin et al., 2021; Malloy & Ashcraft, 2020; Yarina et al., 2019). For example, Kreslake (2019) found that residents' priorities for policies correlated with race, income, and health, concluding that inclusion of local knowledge in climate adaptation contributed to justice. Adaptation that includes "local needs and aspirations" can help increase recognitional justice and reduce inequity (Marino & Ribot, 2012, p. 323). In sum, incorporation of local knowledge into adaptation-related planning can improve outcomes, contribute to trust building, and move planning toward repair and healing by "respecting the diagnostic capacity of communities to identify their own assets, opportunities, and planning and development strategies" (Knapp et al., 2022, p. 427).

Connecting Local Knowledge to Climate Adaptation Planning: A Critical Yet Challenging Need

Researchers and practitioners have identified the need to better connect everyday knowledge about climate events to planning (Eakin et al., 2021; Hahn et al., 2020; Marino & Ribot, 2012; Shi, 2021; Yarina et al., 2019). However, in the United States, researchers have cited challenges such as planners' lack of attention to local knowledge and limited opportunities or processes to link this information to planning stages such as data gathering and analysis, visioning, and goal setting. For example, Meyer et al. (2018) cited "a lack of appreciation for community expertise ... in the often technical built environment planning processes" (p. 404). Haverkamp (2017) described scarce opportunities for local knowledge sharing in Hampton Roads' (VA) adaptation planning. Other scholars have noted that planners and residents lack systems to better incorporate local knowledge into adaptation planning (Hardy et al., 2017; Shi et al., 2016; Van Zandt et al., 2012).

Challenges of linking local knowledge and adaptation may in part explain the limited amount of research in North America that explores how local knowledge has been useful for adaptation-related planning, which contrasts with more frequent investigations in Global South and Indigenous planning (Becker et al., 2008; Chu et al., 2016; Kumasaka et al., 2021). Below, we summarize ways in which local knowledge has been applied to adaptation-related planning in North America. In August 2022 and again in May 2023, we conducted a Web of Science search for peer-reviewed articles with *climate adaptation planning* and *local knowledge*, *public participation*, *public inclusion*, and *community engagement* in text, abstract, or keywords (356 articles); we then expanded to *disaster planning* (118 articles),

hazards planning (64 articles), and *resilience planning* (107 articles) in November 2023 to include related disciplines. We then selected for empirical studies focused on local knowledge being incorporated into adaptation-related planning in North America. Because of the specifics of the portal design, we did not include studies focused only on mitigation planning, studies outside North America, or research using citizen science, which we consider to be a different type of knowledge system (Tengö et al., 2021).¹ Three research team members read all abstracts to identify articles that focused on adaptation-related planning and then read articles to select manuscripts that included empirical data about local knowledge. Table 1 presents the group of articles that both focused on adaptation-related planning and included empirical data about local knowledge. The research team then developed themes by iteratively grouping key findings that emerged from reading the articles (Hart, 2018). We found that existing research described different types of local knowledge, which we grouped into categories of local issues, assets, and strategies. We defined *local issues* as challenges or problems related to adaptation planning, *local assets* as things that provide benefits or values related to adaptation planning, and *local strategies* as actions related to adaptation planning. Given the range of information in the articles, Table 1 categories are not equal in length, but we included all three categories because we believe all are important for adaptation planning.

LOCAL ISSUES

Local issues identified by residents in these studies included problem definitions, challenges, and climate risk and conditions. Residents defined problems such as existing inequalities, intersectionality of climate injustice, and timing of evacuation (Baer et al., 2022; Guardaro et al., 2020). Challenges noted by residents included the need for community-based planning and co-visioning related to climate migration, infrastructure gaps, advocacy and health training, and spatial inequities (Guardaro et al., 2020; Kumasaka et al., 2021; Sansom et al., 2016). Hahn et al. (2020) found that one of the major challenges for municipal adaptation strategy development was missing and inaccessible information about the impacts at the local scale, which could be provided by residents. Other challenges included residents feeling significant emotions regarding government response to flooding, contrasting with the technical scientific framework used by government staff (Haeffner & Hellman, 2020).

This attention to emotion supports broader research on climate change and emotional and mental health (Ai et al., 2023; Berry et al., 2018; Bourque & Cunsolo Willox, 2014; Charlson et al., 2021; Cianconi et al., 2020; Norris et al., 2002; Schwartz et al.,

Table 1. Preliminary typology of residents' local knowledge used for climate adaptation-related planning in North America.

Local issues	Local assets	Local strategies
<p>Problem definitions, including:</p> <ul style="list-style-type: none"> Existing inequalities (Guardaro et al., 2020) Intersectionality of climate adaptation-related injustice (Guardaro et al., 2020) Timing of evacuation during hurricanes (Baer et al., 2022) <p>Challenges (Sansom et al., 2016), including:</p> <ul style="list-style-type: none"> Infrastructure gaps, need for advocacy and health training, and spatial inequities (Guardaro et al., 2020) Need for community-based planning and co-visioning related to relocation (Kumasaka et al., 2021) Missing, inaccessible information about climate change at the local scale (Hahn et al., 2020) Emotional health related to public sector's flooding event response (Haeffner & Hellman, 2020) Climate risk and conditions (Davis et al., 2023; Guardaro et al., 2020; Hahn et al., 2020; Newman et al., 2014; Sullivan et al., 2021; Yusuf et al., 2018) 	<ul style="list-style-type: none"> Need to preserve cultural traditions and languages (Kumasaka et al., 2021) Nature-based services (Hemmerling et al., 2020, 2022) Ecosystem service provision (Chamberlain & Jones, 2022) Physical community assets (Yusuf et al., 2018) 	<ul style="list-style-type: none"> Urban greening (Kreslake, 2019) Health care access during climate events (Kreslake, 2019) Evacuation services during climate events (Becker et al., 2008; Kreslake, 2019) Subsidies for adaptation-related household infrastructure and services (Kreslake, 2019) Residents' suggestions to mitigate impacts at local scales (Davis et al., 2023; Guardaro et al., 2020, 2022; Newman et al., 2014; Saladyga & Standlee, 2018). Need for advocacy training and health training (Guardaro et al., 2020)

2017). However, to our knowledge, Haeffner and Hellman's (2020) study of flood vulnerability based on 12 interviews in Tillamook County (OR) appeared to be the only published planning research that noted a specific connection among local knowledge, climate adaptation planning, and emotional health. Haeffner and Hellman's findings support Koslov et al.'s (2021) survey data from 223 residents of New Jersey and New York about stress felt by those who could or would not relocate after climate-related events. Koslov et al. underscored that "climate change's consequences for mental health and well-being make up a budding area of study, not least in relation to climate-linked relocation and migration" (Koslov et al., 2021, p. 16). However, existing analyses of climate adaptation plans did not mention goals or strategies focused on emotional and mental health (Cottrell, 2023; Lyles & Stevens, 2014; Preston et al., 2011; Woodruff et al., 2022; Woodruff & Stults, 2016).

Koslov et al. (2021) also emphasized the complexity of emotional and mental effects of climate-related events, noting increased community capacity and positive mental health when residents joined together to restore damaged places (Silver & Grek-Martin, 2015). Moser's (2021) review also found significant attention to the mental health implications of climate migration. However, planning researchers appear to not have yet described a trauma-informed approach to climate

adaptation in ways considered by other disciplines (e.g., public health) focusing on climate adaptation or within other planning domains (Fernandez et al., 2015; Mukherjee & Sanyal, 2021; Poe, 2022).

Other studies provide examples of information about climate risks and conditions shared by residents. Sullivan et al. (2021) investigated Texas coastal residents' perceptions and prioritization of extreme heat, which had not been a previous focus of local government hazard mitigation. Newman et al. (2014) discovered that Lee County (FL) residents paid more attention to hurricane risk than wildfire, despite the area's higher wildfire frequency and vulnerability, but also found that their hurricane preparation translated to multi-hazard preparedness. Guardaro et al.'s (2020) study included stories about climate impacts and locations of urban heat. Several articles provided specific geographic information shared by residents, including flood mapping as well as overlapping areas of ecosystem service provisioning and high wildfire risk (Chamberlain & Jones, 2022; Davis et al., 2023; Yusuf et al., 2018).

LOCAL ASSETS

A few articles discussed assets highlighted by residents. Kumasaka et al. (2021) relayed the need to preserve residents' cultural traditions and languages that may provide value for adaptation planning. Other research shared residents' geographic identification of local

assets, such as nature-based services and physical community assets (Chamberlain & Jones, 2022; Hemmerling et al., 2020, 2022; Yusuf et al., 2018).

LOCAL STRATEGIES

Research has provided details about how local knowledge contributes to adaptation strategies. Kreslake (2019) found that in California, Arizona, and Florida, lower-income residents ranked emergency alerts, subsidies for adaptation-related household infrastructure and services, and expansion of urban greening as important adaptation-related strategies. Becker et al. (2008) described how knowledge from Indigenous residents informed outreach about, and implementation of, tsunami evacuation strategies. Guardaro et al. (2020) included residents' suggestions about heat mitigation at household and neighborhood scales. Pennsylvania residents shared strategies to reduce wildfire risk, including improved communication and education, locations of fire towers, and more public resources (Saladyga & Standlee, 2018).

These three main categories of local knowledge—local issues, assets, and strategies—identified in adaptation-related planning can help inform the participatory design of the portal described in the following case study.

Case Study: Inclusion of Local Knowledge in Climate Adaptation Planning

Austin, the Dove Springs Neighborhood, and the Climate Navigators: Creating a Bi-Directional Flow of Local Knowledge and Climate Information

The research for this case study took place in the Austin–Round Rock–San Marcos (TX) metropolitan area (2.3 million population), a fast-growing city experiencing economic and racial segregation (Busch, 2016; Florida & Mellander, 2018; Tretter et al., 2022; U.S. Census Bureau, 2021). Austin faces amplified climate-related events including flooding, heat, drought, and wildfire (Hayhoe, 2014; Saharia et al., 2017). Segregation created disproportionate exposure to climate-related events, with risk concentrated in eastern neighborhoods, which have also experienced uneven access to adaptation infrastructure (Bixler et al., 2021; Prudent et al., 2016; Tretter & Adams, 2016; Zoll, 2021).

About 48,000 residents live in the Dove Springs neighborhood, located in historically segregated and currently gentrifying East Austin (Figure 1). Dove Springs has considerable ethnic and cultural diversity but also economic and climate challenges (Bixler & Yang, 2020; Table 2). After repeated flooding in the area, the city

purchased 943 neighborhood homes through a voluntary flood buyout program (Adaptation Clearinghouse, 2021; City of Austin, n.d.e). Residents have also experienced displacement due to growing housing unaffordability in this census tract, which has Austin's highest rate of Hispanic/Latinx homeownership (U.S. Census Bureau, 2021; Way et al., 2018).

After loss of life and property due to flooding, residents worked with a community-based organization, Go! Austin/Vamos! Austin (GAVA), to identify a need for an online portal to share knowledge about their community, climate events, and chronic stressors, in addition to finding climate preparedness information (Lieberknecht, 2023). In 2019, GAVA developed the Climate Navigators program to train residents in community organizing and climate preparedness as an early step in the process to develop the portal.² We note that one of the authors of this article is a GAVA staff member and founder of the Navigators program. The program attempts in part to address the gap between the need for local knowledge in adaptation planning and the difficulties of linking this knowledge to planning, which was identified as a priority by City of Austin (COA) staff (Coudert, 2023). In 2020, GAVA, the COA, and researchers (including the authors) won a grant to develop a portal to better connect local knowledge and planning.

Austin, Climate Adaptation, and Local Knowledge: Identified Need, but Scant Attention in Adaptation-Related Network of Plans

Though Austin does not yet have an adaptation plan, the City's Office of Resilience focuses in part on adaptation and is developing a resilience plan (COA, n.d.b). The COA has also identified seven existing plans as contributing to climate adaptation, adopted from 2012 to 2021;³ a review of these plans used content analysis and a plan evaluation framework and found that, with a few exceptions, these plans included minimal information about local knowledge being incorporated into climate adaptation planning (Lieberknecht, 2023; see also Technical Appendix Table 3). Most primarily described a *one-way street* for knowledge transfer—from city to residents—and included very few goals and processes focused on local knowledge. Though plan documents do not represent the totality of adaptation planning, this plan analysis provides data about the nominal degree to which Austin has formally documented inclusion of local knowledge into past adaptation planning. This pattern contrasts with current City staff support for including local knowledge in climate adaptation-related planning mentioned above and discussed in our findings.

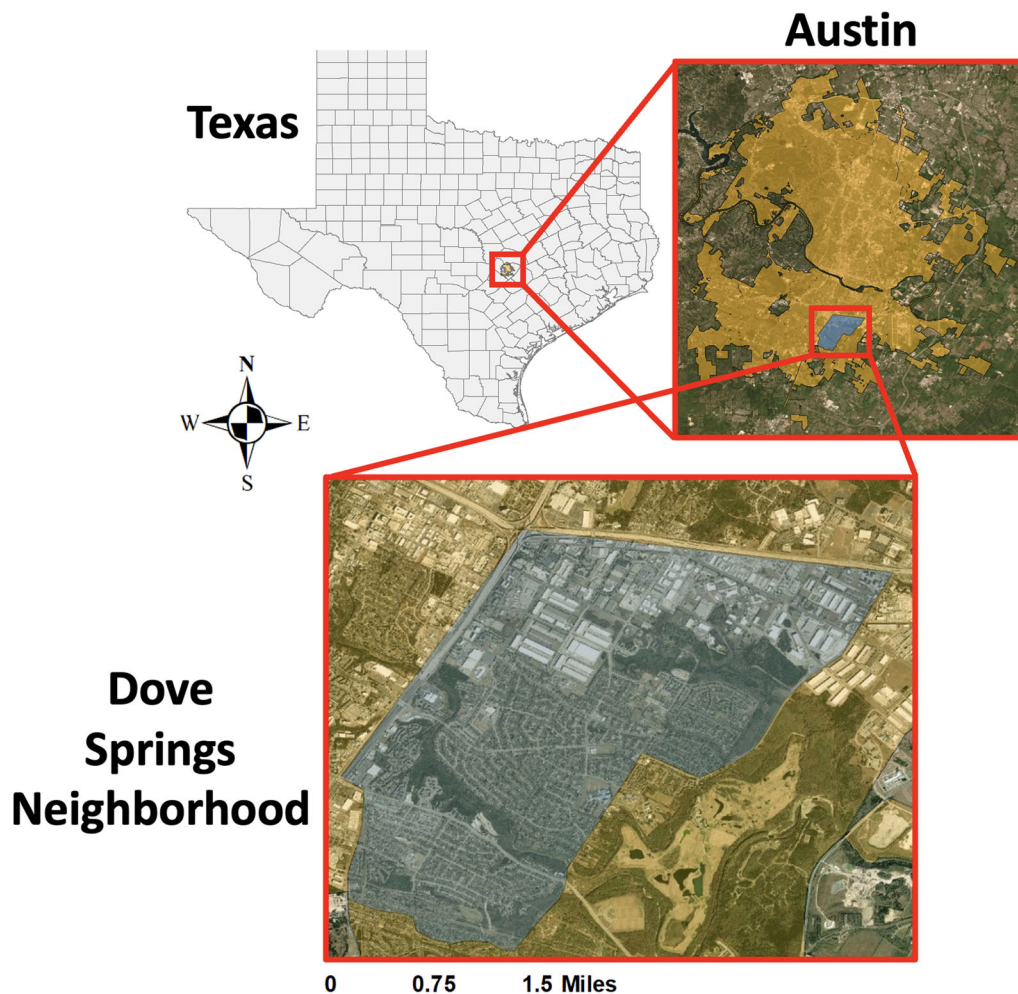


Figure 1. Dove Springs neighborhood, Austin, Texas (graphic created by Jong Won Ma and used with permission).

Table 2. Demographic characteristics of Dove Springs and City of Austin as a whole.

	Dove Springs	City of Austin
Hispanic/Latinx residents (%)	75	34
Family households (%)	71	36
Undocumented residents (%)	25	13
Median annual income (\$)	45,000	87,000
Residents living below poverty line (%)	25	13

Source: U.S. Census Bureau, 2021.

In sum, researchers have argued that local knowledge can comprise an important addition to adaptation planning, although one that has been challenging to fulfill. The limited empirical data about use of local knowledge in adaptation-related planning show that residents have shared information about local issues, assets, and strategies. COA staff have expressed the need for more access to local knowledge to improve adaptation planning, which contrasts with the existing network of plans, which pays little attention to local knowledge. This suggests that

increasing access to local knowledge for adaptation-related planning will fill a gap identified by municipal staff, as well as the residents and the community-based organization involved in the design of the portal.

Our case study addresses this gap in part by providing additional empirical information about the types of adaptation-related local knowledge residents share related to local issues, assets, and strategies. These findings will inform the design of a planning tool to increase availability of local knowledge and contribute

to a broader conversation about how local knowledge might benefit adaptation planning.

Using Interview Data and Content Analysis to Describe How Local Knowledge Relates to Austin’s Climate Adaptation Planning

From October 2021 to February 2022, we interviewed 25 of the 30 Climate Navigators and six municipal staff involved in adaptation-related work. Five Climate Navigators were unable to schedule interviews. Navigators received compensation for each hour of project work. Materials, meetings, interviews, workshops, and trainings were provided in Spanish and English, and project events were held at times and locations to accommodate work and family schedules and included food and childcare activities. GAVA originally recruited the Navigators by asking neighborhood leaders and others who expressed interest in climate preparedness to participate. All but one of the Navigator interviewees were women and all were Hispanic/Latinx; researchers did not ask for information about income and citizenship status due to concerns that those questions would impair trust building at the beginning of a multiyear project, but GAVA reported that Navigators are representative of income, homeownership, and citizenship characteristics held by residents (Table 2).

Using a semistructured interview protocol, we conducted interviews virtually or in person. Interviews lasted 45 to 75 min, were conducted in Spanish or English, and were transcribed and translated. Participant identification information was stored separately from the interview recordings and transcripts. Navigators were paid for their interview participation (one interviewee declined payment).

Each transcript was analyzed using best practices for content analysis and coded into themes (Krippendorff, 2018; Neuendorf, 2017). We used a two-stage coding process that drew upon Eisenman et al. (2021). We began with three deductive categories based on the literature review and then coded using inductively created subcategories (Technical Appendix Table 1) to increase reliability (Montgomery & Crittenden, 1977). Three team members read interviews, initially coded responses, and then created a common set of inductive subcategories (MacQueen et al., 1998). Content analyzed for this article focused on climate events, gaps in adaptation planning, and neighborhood assets, taken from a broader set of interview questions (Technical Appendix Table 2). To increase accountability, we provided participants with a summary of interview themes.

This research approach has at least two limitations. The uneven history of university engagement with this neighborhood and the gap in educational opportunity between interviewees and interviewers may have contributed to feelings of mistrust that affected interview content to some degree. We also acknowledge that 25 participants cannot fully represent a neighborhood of 48,000; however, interviews provided examples of the types of information residents might share about climate-related events and therefore contributed value toward our research questions. This study also would be complemented by perspectives from additional municipal staff who work in aligned units such as water, energy, and urban forestry.

Climate Adaptation-Related Issues, Assets, and Strategies Shared by Residents

Residents provided information about local issues, assets, and strategies (Table 3), with highlights that differed from or extended existing research about local knowledge used in adaptation-planning described in the following section.⁴ In general, findings supported earlier empirical studies while adding novel themes not found in existing research focused on local knowledge used in adaptation-related planning, including cascading harms and repeated trauma from climate events, a lack of trust, and community capacity. We address how these findings answer our second research question below.

Local Issues

PROBLEM DEFINITIONS

Many Navigators referred to cascading harms from past flooding and repeated trauma from both past and anticipated flooding. Several Navigators described an amplification of flooding-related stressors, including damage to homes from water and mud, followed by mold; financial stress of repairs; and psychological impacts of floods and their aftermath. Residents expressed anxiety about reoccurring impacts on children and other vulnerable residents. Many interviewees emphasized trauma stemming from repeated, and future risk of, flooding:

I used to love and enjoy thunder and lightning and pouring rain, because that’s the way it was in Mexico. The best thing was seeing God himself. But now, you don’t. And it’s sad, because this is something that you enjoyed. And now, you’re thinking—3 o’clock in the morning, you’re thinking, “Should I go and check to see if my neighbors are flooded?”

Numerous Navigators mentioned significant mental health impacts that resulted from ongoing and

Table 3. Summary of Climate Navigators’ shared local knowledge organized by the provisional typology of local knowledge used for climate adaptation planning from Table 1.

Climate Navigators’ local issues	Climate Navigators’ local assets	Climate Navigators’ local strategies
<p>Problem definitions, including:</p> <ul style="list-style-type: none"> • Cascading harms and repeated trauma from flooding • Mental health implications of climate events • Lack of trust in municipal departments and staff • Inadequate stormwater systems • Inequitable stormwater systems in comparison to other neighborhoods (existing inequalities) <p>Challenges:</p> <ul style="list-style-type: none"> • Displacement (both economic and from flooding) • Factors contributing to flooding events (e.g., increase in impervious cover) <p>Climate risk and conditions:</p> <ul style="list-style-type: none"> • Geographic identification of areas of significant flooding 	<ul style="list-style-type: none"> • Community capacity and increased preparedness • Nearby nature 	<ul style="list-style-type: none"> • Improvements to and maintenance of stormwater infrastructure • Better information • An integrated plan

Note: Some categories may overlap because of the integrated nature of climate adaptation.

cascading threats of flooding. For example, interviewees explained that they and their neighbors became tense and anxious every time it rained, which they perceived as contributing to severe illness.

Almost all interviewees mentioned a lack of trust as a key issue. For example, one Navigator expressed a lack of trust in the city because when this resident saw debris backing up stormwater sewers and requested that the city clean them, the city staff member reported that the systems did not need maintenance. The resident believed that subsequent flood damage was due in part to poor stormwater system maintenance. Several Navigators repeated versions of a similar story, in which residents tried to clear debris from a blocked storm drain during a storm event but were prevented from doing so by municipal staff. The residents’ perception was that the city provided inadequate stormwater maintenance and then prevented residents from at least clearing the drains. As a result, some residents’ homes ended up with flood damage, further eroding trust.

Interviewees described inadequate and poorly maintained stormwater infrastructure, and many participants directly blamed the city’s inadequate maintenance of stormwater infrastructure and creek beds as a primary cause of flooding. Others noted that the neighborhood needed more and higher-capacity stormwater infrastructure, especially when compared with wealthier areas. In general, residents perceived stormwater infrastructure as inadequate and strained by growth.

CHALLENGES

Navigators mentioned displacement of residents as a significant negative outcome from flooding, stemming from renters moving because of flooding as well as buy-outs. Other Navigators noted how economic displacement intersected with neighbors being forced out by flooding, as well as contributing to feelings of negative mental health. One interviewee evocatively described intersectional and cultural ramifications of economic displacement:

And [I love] the people of course. Because if I’m walking, everybody says, “Buenos Dias! Buenas Tardes!” Like the way we do over there [in Mexico]. There’s no person that you walk by that you don’t say “Buenos Dias” or “Buenas Tardes,” right? So, it makes you feel like they’re family. And this area of course has been a bit gentrified where the people that live here don’t look like us anymore, and they are not—their culture is not of a Buenos Dias, Buenas Tardes kind of people.

Navigators also noted specific areas in their neighborhood that flood frequently or in ways that prevent evacuation.

CLIMATE RISK AND CONDITIONS

Residents shared numerous reasons for flooding, including topography, existing weather patterns amplified by climate change, increasing impervious cover, and a history of floodplain homebuilding; they also described

impacts of extreme heat as well as areas of air quality concern due to wildfire.

Local Assets

Interviewees frequently spoke of one category of local assets not noted in existing research about residents' local knowledge: community assets held by residents that could contribute to adaptation. For example, several Navigators noted that their neighborhood's experience has contributed to greater preparedness. One observed that the self-organizing done by the residents has helped unify the neighborhood and strengthen social ties. Several interviewees remarked that when Austin experienced 2021's winter storm, neighborhood residents appeared to be better organized in their response, perhaps due to increased communication and preparation stemming from previous flood events. In general, Navigators frequently mentioned strengths of the Dove Springs community, commenting on endurance of residents, family values and faith, and a culture of support and unity.

Navigators often mentioned how residents checked on each other before, during, and after climate-related events. Residents maintained phone and text trees but also went door to door, especially to check on the elderly and residents with more limited mobility and monitor flood infrastructure during events. Several Navigators also identified the importance of stories told by residents to help their neighbors prepare for future climate-related events, to learn from past experiences, and to celebrate successes and strengths. In addition, in a neighborhood rapidly changing due to displacement, stories provided an additional value of helping existing and new residents better understand the neighborhood's climate risks, past responses, and ongoing stress stemming from inadequate infrastructure and preparedness. Navigators also noted that it can be retraumatizing for residents to retell stories about floods and other events.

Though every interviewee shared stories about damage and trauma caused by climate-related events, participants also commonly identified the neighborhood's natural beauty, especially its tranquility and peacefulness, creeks, parks, trails, green space, and tree cover. Although none of the interview questions asked about neighborhood nature, numerous residents referred to it. A few examples:

I saw this area ... and it was all of this beautiful green space that I fell in love with. Because it was a little bit like the way that we lived in Mexico, where we have water and trees and trails.

I really like the area, the very big trees. I like the green. ... I like being in touch with nature, because

somehow it relaxes you and, and sometimes life is very, very stressful and very in a hurry. But, being in contact with nature, with the trees, that kind of gives me a little peace.

Strategies

Navigators described several other adaptation strategies in addition to solutions to improve communication and flood monitoring described earlier. None of these strategies matched the categories in Table 1, highlighting the value of local knowledge but also the challenge of scaling and transferring it. Residents frequently mentioned the need for increased maintenance and cleaning of stormwater infrastructure, perhaps in collaboration with residents. Many Navigators shared stories of how neighbors worked together to reduce flood damage by voluntarily maintaining municipal stormwater infrastructure, driving as a group across flooded intersections to help force flood water out of the road, moving cars to flood-safe streets, and building structures to keep water out.

Navigators, while acknowledging that they had good access to climate preparedness information due to GAVA's programming, stated that other residents needed better information. One Navigator identified a need for a new plan that focuses holistically on long-term stressors, such as food insecurity, as well as climate-related events.

In six interviews conducted with municipal staff for background information, all municipal staff highlighted support for more inclusion of local knowledge in adaptation-related knowledge. For example, a staff member discussed the value of working with residents and community-based organizations because it provides information about lived experience to include in adaptation-related planning. A staff member acknowledged a shift in how the city is approaching information exchange with residents toward a more bi-directional approach, and another expressed support for local knowledge being more easily joined with scientific and technical knowledge. Interviewees agreed with the need for a portal that could provide a pathway for residents to share knowledge while also serving as a *one-stop shop* for information needed by residents for climate preparedness.

New Considerations of How Local Knowledge Can Inform Climate Adaptation

Researchers emphasized the need to integrate local knowledge into adaptation planning (Eakin et al., 2021; Hahn et al., 2020; Marino & Ribot, 2012; Shi, 2021; Yarina

et al., 2019). We analyzed interview findings from residents co-designing a planning tool to explore what local issues, assets, and strategies residents shared and how this knowledge may be useful for adaptation more broadly. These findings can inform the portal design, advise adaptation planning needs in Austin, and provide ideas for other municipalities as they consider whether, and in what ways, local knowledge may be useful for their adaptation-related planning.

Below, we highlight three contributions to scholarship about residents' local knowledge and municipal adaptation planning: increase attention to mental health effects of climate-related events; incorporate residents' local knowledge-informed strategies, especially those focused on community assets; and focus on gaps in trust. To our knowledge, our findings are the first empirical data about residents' local knowledge and adaptation planning that contribute to conversations about increased attention to the mental health effects of climate change and the need for trust building in other sectors of climate planning (e.g., mitigation; Berry et al., 2018; Charlson et al., 2021; Cianconi et al., 2020; Fitzgerald, 2022; Koslov et al., 2021). Based on planning theory and previous research, we contend that listening to and integrating frontline residents' own information and preferences into adaptation-related planning can increase procedural and recognitional justice as well as potentially improve outcomes (Berke & Stevens, 2016; Eakin et al., 2021; Fraser et al., 2003; Malloy & Ashcraft, 2020; Martin et al., 2016; Yarina et al., 2019). The types of knowledge we describe in the previous section, and the broader recommendations we share here, can be used to improve climate preparedness, expand exchange of local knowledge, and build trust with adaptation-related institutions. Knapp et al.'s (2022) call to respect "the diagnostic capacity of communities to identify their own assets, opportunities, and planning and development strategies" applies equally well to adaptation planning, in Austin and beyond, as to other planning domains (p. 427). Planners can also use these descriptions as they consider whether local knowledge might bring value to their adaptation planning.

Acknowledge and Address Climate-Related Mental Health Implications in Climate Adaptation Planning

Our findings show that residents emphasized mental health and trauma-related harms when considering adaptation planning, suggesting that planners must address ongoing and future mental health needs, a topic not identified in existing adaptation plan analyses (Lyles & Stevens, 2014; Preston et al., 2011; Woodruff et al., 2022; Woodruff & Stults, 2016). Interviewees emphasized mental health harms associated with

climate-related events and, in particular, reoccurring trauma from living in unsafe neighborhoods. These findings mirrored Koslov et al.'s (2021) description of how "experiencing and re-experiencing the damage of one's home and neighborhood on an everyday basis can represent continuous emotional trauma" (p. 15). Until the COA addresses this risk through infrastructure or equitable home buyout programs, residents will experience ongoing stress related to climate-related events. Our findings suggest municipalities should pay critical attention to mental health in adaptation planning, especially in places like Dove Springs, where residents have experienced reoccurring floods compounded by intersecting stressors such as structural racism, poverty, and citizenship status. As the COA develops their first resilience plan, staff should consider including climate preparedness goals, objectives, and policies that focus on preventing future mental health harms as well as providing resources to mitigate existing harms.

Interviewees offered two ideas about assets that may partially address residents' trauma: increased access to green amenities and a focus on community capacity. Participants' focus on the positive emotional and mental health benefits of green space and nature in their neighborhood, though not a panacea, offers one tool to support climate-related mental health, as long as nature-based strategies take into account the risks of green gentrification. Participants also emphasized their community's strengths and growing capacity; other research has linked positive mental health trajectories to when residents have built community capacity after climate-related events (Koslov et al., 2021). However, it is important to note that although green amenities and community capacity may foster positive mental health, municipalities still must address root causes of harm.

Integrate Local Knowledge About Community Capacity into Climate Adaptation Planning

In our study, interviewees discussed community capacity developed in the aftermath of climate-related events in their neighborhood, as well as a diversity of social and physical strategies that residents have developed. For example, Navigators described how they organized to communicate information about flooding conditions, formed groups of residents to monitor stormwater ponds, and shared stories to help neighbors understand the need to prepare. Infrastructure fragilities such as those experienced in Austin and other places during 2021's Winter Storm Uri make neighborhood-scaled community capacity not only a complement to technology-based strategies but also a necessity, which supports existing research on the importance of

community capacity for disaster recovery (Aldrich, 2010; Aldrich & Meyer, 2015).

Austin has an opportunity to integrate residents' lived experiences about community capacity in future planning efforts. For example, some Navigators serve on the city's Resilience Community Advisory Committee to contribute to Austin's first resilience plan, and we have shared these findings with city staff developing the resilience plan (COA, n.d.d). Also in response to this finding, the portal design has expanded to share and celebrate community strengths, alongside the original intent of inventorying residents' knowledge about challenges. Residents' understanding of community assets can also contribute to adaptation planning efforts in other municipalities in the United States seeking to build community-based safety nets into their strategy portfolios.

Build Trust by Incorporating Local Knowledge into Climate Adaptation Planning

Navigators emphasized the lack of trust many residents feel for city staff and units, due to slow pacing of adaptation implementation, insensitive communications, uneven distribution of infrastructure, and structural racism. Our findings highlight the importance residents place on trust building, which corroborates research from related fields but places these patterns within a different planning context: adaptation planning (Fitzgerald, 2022; Lee, 2019).

Building trust in Dove Springs, or neighborhoods in other places with similar histories, will take considerable effort, time, and humility. Processes that increase trust by incorporating local knowledge in adaptation planning offers one possible pathway forward (Stern et al., 2023). As we have shared research outcomes with the COA, staff has begun to incorporate some of the findings into materials and programs such as the ReadyCentralTexas.org site, which indicates willingness to implement local knowledge (COA, n.d.c). And as the Navigator program develops stronger connections with Austin's adaptation planning, more opportunities for residents and municipal staff to collaborate, share knowledge, and co-design strategies may arise. For example, in addition to the community capacity strategies discussed earlier, interviewees also shared suggestions such as community-organized maintenance of stormwater infrastructure and local expertise about drainage and flood prevention (Technical Appendix Table 4).

Our findings suggest the need for additional scholarship focused on incorporation of local knowledge into climate adaptation planning. Interviewees highlighted the reoccurring trauma and mental health implications of climate-related events, which has not yet been a focus of adaptation planning that exists in Austin or in

national surveys of adaptation plans (Cottrell, 2023; Lieberknecht, 2023; Lyles & Stevens, 2014; Preston et al., 2011; Woodruff et al., 2022; Woodruff & Stults, 2016). Likewise, the specific intersection of mental health, local knowledge, and climate adaptation planning also appears to be underexplored in planning scholarship. As noted earlier, additional research with municipal staff about their perceptions of the usefulness of specific local knowledge and the feasibility of creating systems to integrate it would deepen our understanding of the role of local knowledge. We also suggest more investigation into the potential of including residents' local knowledge in adaptation planning as a pathway to building trust toward the public sector. Last, given that residents in Dove Springs have already been implementing locally informed adaptation strategies, we see a need for research that better connects the distributive justice potential of formalized resident-centered adaptation implementation (e.g., workforce development, well-paying jobs) with potential neighborhood-scaled reparative justice outcomes (e.g., addressing infrastructure gaps). What adaptation benefits, alongside other distributive and reparative justice outcomes, might stem from an expanded Green New Deal jobs program, in Austin or elsewhere, focused on strategies suggested by interviewees, such as climate communication and local stormwater design, maintenance, and monitoring?

Conclusion

Here we explore two research questions by analyzing interview data from 25 residents who participated in a community organizing and climate preparedness program: What local knowledge do residents in this case study share about climate adaptation, and how might this knowledge be useful for climate adaptation? Our findings led to three recommendations for adaptation planning that came directly from frontline residents: increase acknowledgment of and attention to mental health effects of climate-related events, integrate local knowledge about community capacity, and build trust with residents by incorporating local knowledge into adaptation planning. Through consideration of these recommendations, we suggest that planning scholars a) join others as they seek to increase attention to intersections among mental health, climate change, and adaptation; b) investigate the potential for inclusion of residents' local knowledge in adaptation planning to serve as a mechanism to build trust; and c) explore the potential to match distributive justice benefits to reparative justice outcomes via adaptation strategies that integrate local knowledge. Our findings contribute to emerging research on climate adaptation planning and local knowledge, including that focused on community capacity, mental health, and trauma.

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SUPPLEMENTAL MATERIAL

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NOTES

1. We differentiate *local knowledge* from *citizen science*, with citizen science defined as “invit(ing) laypersons to contribute observations, perspectives, and interpretations feeding into scientific knowledge systems,” compared with local knowledge as a separate knowledge system operating in parallel to scientific knowledge (Tengö et al., 2021, p. 503).

2. The City of Austin defines *climate preparedness* as “having the necessary policies, infrastructure, relationships, and behaviors in place to prepare for and recover from climate impacts,” both at home in and within a community (City of Austin, n.d.a). The city’s definition of climate preparedness is aligned with the definition of *climate adaptation* we use here and is broader than *disaster preparedness*, which is defined as knowledge and ability held by governments, organizations, and individuals to anticipate, respond to, and recover from disasters such as floods, heat events, and wildfires (United Nations Office for Disaster Risk Reduction, n.d.).

3. The Imagine Austin Comprehensive Plan, the Resilience Action Plan for City Assets and Operations, the City of Austin Hazard Mitigation Plan, Austin Water Utility’s Water Forward Plan, Austin/Travis County Community Wildfire Protection Plan, the City of Austin Urban Forest Plan, and the City of Austin Climate Equity Plan (City of Austin, n.d.b).

4. Table 4 in the **Technical Appendix** shows existing research compared with the Navigators’ information (Tables 1 and 3 combined).

REFERENCES

- Adaptation Clearinghouse. (2021). *Managing the retreat from rising seas—City of Austin, Texas: Flood risk reduction buyout projects*. <https://www.adaptationclearinghouse.org/resources/managing-the-retreat-from-rising-seas-eo-city-of-austin-texas-flood-risk-reduction-buyout-projects.html>
- Ai, A. L., Raney, A. A., & Paloutzian, R. F. (2023). Perceived spiritual support counteracts the traumatic impact of extreme disasters: Exploration of moderators. *Psychological Trauma: Theory, Research, Practice and Policy*, 15(2), 199–209. <https://doi.org/10.1037/tra0001133>
- Aldrich, D. P. (2010). *Fixing recovery: Social capital in post-crisis resilience* (Department of Political Science Faculty Publications, Paper 3). <http://docs.lib.purdue.edu/pspubs/3>
- Aldrich, D. P., & Meyer, M. A. (2015). Social capital and community resilience. *American Behavioral Scientist*, 59(2), 254–269. <https://doi.org/10.1177/0002764214550299>
- Anguelovski, I., Connolly, J., & Brand, A. L. (2018). From landscapes of utopia to the margins of the green urban life: For whom is the new green city? *City*, 22(3), 417–436. <https://doi.org/10.1080/13604813.2018.1473126>
- Baer, R. D., Holbrook, E., Kelly, K., & Weller, S. C. (2022). Understanding the decision to evacuate on the United States Gulf Coast: The case of Hurricane Irma in Florida. *Human Organization*, 81(3), 203–212. <https://doi.org/10.17730/1938-3525-81.3.203>
- Barnett, J., & O’Neill, S. (2010). Maladaptation. *Global Environmental Change*, 20(2), 211–213. <https://doi.org/10.1016/j.gloenvcha.2009.11.004>
- Becker, J., Johnston, D., Lazrus, H., Crawford, G., & Nelson, D. (2008). Use of traditional knowledge in emergency management for tsunami hazard: A case study from Washington State, USA. *Disaster Prevention and Management: An International Journal*, 17(4), 488–502. <https://doi.org/10.1108/09653560810901737>
- 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>
- Berry, H. L., Waite, T. D., Dear, K. B., Capon, A. G., & Murray, V. (2018). The case for systems thinking about climate change and mental health. *Nature Climate Change*, 8(4), 282–290. <https://doi.org/10.1038/s41558-018-0102-4>
- Bixler, R. P., & Yang, E. (2020). *Climate vulnerability in Austin: A multi-risk assessment*. Austin Area Sustainability Indicators & Texas Metropolitan Observatory of Planet Texas 2050, The University of Texas at Austin. <https://repositories.lib.utexas.edu/items/d0157e6f-c101-45da-846e-8721f82a3e7a>
- Bixler, R. P., Yang, E., Richter, S. M., & Coudert, M. (2021). Boundary crossing for urban community resilience: A social vulnerability and multi-hazard approach in Austin, Texas, USA. *International Journal of Disaster Risk Reduction*, 66(102613), 102613. <https://doi.org/10.1016/j.ijdrr.2021.102613>
- Bourque, F., & Cunsolo Willox, A. (2014). Climate change: The next challenge for public mental health? *International Review of Psychiatry*, 26(4), 415–422. <https://doi.org/10.3109/09540261.2014.925851>
- Brody, S. D. (2003). Measuring the effects of stakeholder participation on the quality of local plans based on the principles

- of collaborative ecosystem management. *Journal of Planning Education and Research*, 22(4), 407–419. <https://doi.org/10.1177/0739456X03022004007>
- Busch, A. M. (2016). The perils of participatory planning: Space, race, environmentalism, and history in “Austin Tomorrow”. *Journal of Planning History*, 15(2), 87–107. <https://doi.org/10.1177/15385132155590>
- Chamberlain, J. L., & Jones, K. W. (2022). Sociocultural mapping of ecosystem service values can inform where to mitigate wildfire risk: A case study from Colorado. *Journal of Environmental Planning and Management*, 9(298), 1–19. <https://doi.org/10.3390/su9020298>
- Charlson, F., Ali, S., Benmarhnia, T., Pearl, M., Massazza, A., Augustinavicius, J., & Scott, J. G. (2021). Climate change and mental health: A scoping review. *International Journal of Environmental Research and Public Health*, 18(9), 4486. <https://doi.org/10.3390/ijerph18094486>
- Chu, E., Anguelovski, I., & Carmin, J. (2016). Inclusive approaches to urban climate adaptation planning and implementation in the Global South. *Climate Policy*, 16(3), 372–392. <https://doi.org/10.1080/14693062.2015.1019822>
- Cianconi, P., Betrò, S., & Janiri, L. (2020). The impact of climate change on mental health: A systematic descriptive review. *Frontiers in Psychiatry*, 11(74), 74. <https://doi.org/10.3389/fpsyt.2020.00074>
- City of Austin. (n.d.a). *Climate preparedness*. <https://www.austintexas.gov/page/climate-preparedness>
- City of Austin. (n.d.b). *Planning for resilience and adaptation*. <https://austintexas.gov/page/climate-change-resilience-and-adaptation>
- City of Austin. (n.d.c). *Ready central Texas*. <https://www.austintexas.gov/readycentraltexas>
- City of Austin. (n.d.d). *Resilience community advisory committee notes*. On file with authors.
- City of Austin. (n.d.e). *Watershed protection: Projects*. <https://www.austintexas.gov/department/watershed-protection/projects>
- CityScale. (2021). *The state of U.S. local climate action planning*. <https://cityscale.org/2021/05/20/the-state-of-local-climate-planning/>
- Clark, J. K. (2021). Public values and public participation: A case of collaborative governance of a planning process. *The American Review of Public Administration*, 51(3), 199–212. <https://doi.org/10.1177/0275074020956397>
- Clavel, P. (1986). *The progressive city: Planning and participation, 1969-1984*. Rutgers University Press.
- 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>
- Cottrell, C. (2023). From assembly to action: How planning language guides execution in indigenous climate adaptation. *Mitigation and Adaptation Strategies for Global Change*, 28(5), 24–36. <https://doi.org/10.1007/s11027-023-10060-x>
- Coudert, M. (2023). *Resilience hubs network: A community framework* [slide deck]. On file with the authors.
- Crewe, K. (2001). The quality of participatory design: The effects of citizen input on the design of the Boston Southwest Corridor. *Journal of the American Planning Association*, 67(4), 437–455. <https://doi.org/10.1080/01944360108976251>
- Davis, K. T., Robles, M. D., Kemp, K. B., Higuera, P. E., Chapman, T., Metlen, K. L., Peeler, J. L., Rodman, K. C., Woolley, T., Addington, R. N., Buma, B. J., Cansler, C. A., Case, M. J., Collins, B. M., Coop, J. D., Dobrowski, S. Z., Gill, N. S., Haffey, C., Harris, L. B., & Campbell, J. L. (2023). Reduced fire severity offers near-term buffer to climate-driven declines in conifer resilience across the western United States. *Proceedings of the National Academy of Sciences* 120(11), e2208120120. <https://doi.org/10.1073/pnas.2208120120>
- Dow, K., Kasperson, R. E., & Bohn, M. (2006). Exploring the social justice implications of adaptation and vulnerability. In W. N. Adger, J. Paavola, S. Hug, & M. J. Mace (Eds.), *Fairness in adaptation to climate change* (pp. 79–96). MIT Press. <https://doi.org/10.7551/mitpress/2957.003.0009>
- Eakin, H., Parajuli, J., Yogya, Y., Hernández, B., & Manheim, M. (2021). Entry points for addressing justice and politics in urban flood adaptation decision making. *Current Opinion in Environmental Sustainability*, 51, 1–6. <https://doi.org/10.1016/j.cosust.2021.01.001>
- Eisenman, T. S., Flanders, T., Harper, R. W., Hauer, R. J., & Lieberknecht, K. (2021). Traits of a bloom: A nationwide survey of US urban tree planting initiatives (TPIs). *Urban Forestry & Urban Greening*, 61, 127006. <https://doi.org/10.1016/j.ufug.2021.127006>
- Fainstein, S. (2010). *The just city*. Cornell University Press.
- Fernandez, A., Black, J., Jones, M., Wilson, L., Salvador-Carulla, L., Astell-Burt, T., & Black, D. (2015). Flooding and mental health: A systematic mapping review. *PLoS One*, 10(4), e0119929. <https://doi.org/10.1371/journal.pone.0119929>
- Fischer, F. (1993). Citizen participation and the democratization of policy expertise: From theoretical inquiry to practical cases. *Policy Sciences*, 26(3), 165–187. <https://doi.org/10.1007/BF00999715>
- Fischer, F. (2000). *Citizens, experts, and the environment*. Duke University Press.
- Fitzgerald, J. (2022). Transitioning from urban climate action to climate equity. *Journal of the American Planning Association*, 88(4), 508–523. <https://doi.org/10.1080/01944363.2021.2013301>
- Florida, R., & Mellander, C. (2018). The geography of economic segregation. *Social Sciences*, 7(8), 123. <https://doi.org/10.3390/socsci7080123>
- Fraser, N., Honneth, A., & Golb, J. (2003). *Redistribution or recognition? A political-philosophical exchange*. Verso.
- Goldstein, D. (2015). Climate-adaptive technological change in a small region: A resource-based scenario approach. *Technological Forecasting and Social Change*, 99, 168–180. <https://doi.org/10.1016/j.techfore.2015.04.014>
- Guardaro, M., Messerschmidt, M., Hondula, D. M., Grimm, N. B., & Redman, C. L. (2020). Building community heat action plans story by story: A three neighborhood case study. *Cities*, 107(102886), 102886. <https://doi.org/10.1016/j.cities.2020.102886>
- Haefner, M., & Hellman, D. (2020). The social geometry of collaborative flood risk management: A hydrosocial case study of Tillamook County, Oregon. *Natural Hazards*, 103(3), 3303–3325. <https://doi.org/10.1007/s11069-020-04131-4>
- Hahn, M. B., Kemp, C., Ward-Waller, C., Donovan, S., Schmidt, J. I., & Bauer, S. (2020). Collaborative climate mitigation and

- adaptation planning with university, community, and municipal partners: A case study in Anchorage, Alaska. *Local Environment*, 25(9), 648–665. <https://doi.org/10.3390/ijerph192214645>
- Hardy, R. D., Milligan, R. A., & Heynen, N. (2017). Racial coastal formation: The environmental injustice of colorblind adaptation planning for sea-level rise. *Geoforum*, 87, 62–72. <https://doi.org/10.1016/j.geoforum.2017.10.005>
- Hart, C. (2018). *Doing a literature review*. Sage Publications.
- 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.org/10.1177/0308518X17707525>
- Hayhoe, K. (2014). *Climate change projections for the City of Austin: Draft report*. ATMOS Research and Consulting.
- Hemmerling, S. A., Barra, M., Bienn, H. C., Baustian, M. M., Jung, H., Meselhe, E., Wang, Y., & White, E. (2020). Elevating local knowledge through participatory modeling: Active community engagement in restoration planning in coastal Louisiana. *Journal of Geographical Systems*, 22(2), 241–266. <https://doi.org/10.1007/s10109-019-00313-2>
- Hemmerling, S. A., DeMyers, C. A., & Carruthers, T. J. (2022). Building resilience through collaborative management of coastal protection and restoration planning in Plaquemines Parish, Louisiana, USA. *Sustainability*, 14(5), 2974. <https://doi.org/10.3390/su14052974>
- 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>
- Klinsky, S., & Mavrogianni, A. (2020). Climate justice and the built environment. *Buildings and Cities*, 1(1), 412–428. <https://doi.org/10.5334/bc.65>
- Knapp, C., Poe, J., & Forester, J. (2022). Repair and healing in planning. *Planning Theory & Practice*, 23(3), 425–458. <https://doi.org/10.1080/14649357.2022.2082710>
- Koslov, L., Merdjanoff, A., Sulakshana, E., & Klinenberg, E. (2021). When rebuilding no longer means recovery: The stress of staying put after Hurricane Sandy. *Climatic Change*, 59, 1–16. <https://doi.org/10.1007/s10584-021-03069-1>
- Kreslake, J. M. (2019). Perceived importance of climate change adaptation and mitigation according to social and medical factors among residents of impacted communities in the United States. *Health Equity*, 3(1), 124–133. <https://doi.org/10.1089/heq.2019.0002>
- Krippendorff, K. (2018). *Content analysis: An introduction to its methodology* (4th ed.). Sage Publications.
- Kumasaka, O., Bronen, R., Harrington, E., Knox-Hayes, J., Laska, S., Naquin, A., Patrick, A., Peterson, K., & Tom, S. (2021). Planning for resettlement: Building partnerships for, by, and with indigenous peoples. *GeoJournal*, 87(S2), 307–327. <https://doi.org/10.1007/s10708-021-10518-y>
- Lee, C. A. (2019). Engaging non-citizens in an age of uncertainty: Lessons from immigrant-serving nonprofits in Los Angeles County. *Journal of the American Planning Association*, 85(3), 271–286. <https://doi.org/10.1080/01944363.2019.1616318>
- Lieberknecht, K. (2022). Community-centered climate planning: Using local knowledge and communication frames to catalyze climate planning in Texas. *Journal of the American Planning Association*, 88(1), 97–112. <https://doi.org/10.1080/01944363.2021.1896974>
- Lieberknecht, K. (2023). Leading with local knowledge: Climate adaptation, local knowledge, and participation in Austin, Texas' network of plans and the co-designed climate navigators' tool and process. *Journal of Planning Education and Research*. Advance online publication. <https://doi.org/10.1177/0739456X2211144>
- Lieberknecht, K., & Mueller, E. J. (2023). Planning for equitable climate relocation: Gaps in knowledge and a proposal for future directions. *Journal of Planning Literature*, 38(2), 229–244. <https://doi.org/10.1177/08854122221147696>
- Lindblom, C. E., & Cohen, D. K. (1979). *Usable knowledge: Social science and social problem solving* (Vol. 21). Yale University Press.
- Lyles, W., & Stevens, M. (2014). Plan quality evaluation 1994–2012: Growth and contributions, limitations, and new directions. *Journal of Planning Education and Research*, 34(4), 433–450. <https://doi.org/10.1177/0739456X14549752>
- MacQueen, K. M., McLellan, E., Kay, K., & Milstein, B. (1998). Codebook development for team-based qualitative analysis. *Cam Journal*, 10(2), 31–36. <https://doi.org/10.1177/1525822X980100020301>
- Maldonado, J. K., Shearer, C., Bronen, R., Peterson, K., & Lazrus, H. (2014). The impact of climate change on tribal communities in the US: Displacement, relocation, and human rights. In J. K. Maldonado, B. Colombi, & R. Pandya (Eds.), *Climate change and indigenous peoples in the United States: Impacts, experiences and actions* (pp. 93–106). Springer. <https://doi.org/10.1007/s10584-013-0746-z>
- Malloy, J. T., & Ashcraft, C. M. (2020). A framework for implementing socially just climate adaptation. *Climatic Change*, 160(1), 1–14. <https://doi.org/10.1007/s10584-020-02705-6>
- Marino, E., & Ribot, J. (2012). Special issue introduction: Adding insult to injury: Climate change and the inequities of climate intervention. *Global Environmental Change*, 22(2), 323–328. <https://doi.org/10.1016/j.gloenvcha.2012.03.001>
- Martin, A., Coolsaet, B., Corbera, E., Dawson, N. M., Fraser, J. A., Lehmann, I., & Rodriguez, I. (2016). Justice and conservation: The need to incorporate recognition. *Biological Conservation*, 197, 254–261. <https://doi.org/10.1016/j.biocon.2016.03.021>
- Meyer, M., Hendricks, M., Newman, G., Horney, J., Berke, P., Masterson, J., Sansom, G., Cousins, T., Van Zandt, S., & Cooper, J. (2018). Participatory action research: Tools for disaster resilience education. *International Journal of Disaster Resilience in the Built Environment*, 9(4-5), 402–419. <https://doi.org/10.1108/IJDRBE-02-2017-0015>
- Montgomery, A. C., & Crittenden, K. S. (1977). Improving coding reliability for open-ended questions. *Public Opinion Quarterly*, 41(2), 235–243. <https://doi.org/10.1086/268378>
- Moser, S. C. (2021). Waves of grief and anger: Communicating through the “end of the world” as we knew it. In I. J. Ajibade & A. R. Siders (Eds.), *Global views on climate relocation and social justice: Navigating retreat* (pp. 31–43). Routledge.
- Mukherjee, D., & Sanyal, S. (2021). Trauma-informed approach to climate change. In *Handbook of climate change management: Research, leadership, transformation* (pp. 5173–5187). Springer International Publishing.
- Nelson, M., Ehrenfeucht, R., Birch, T., & Brand, A. (2022). Getting by and getting out: How residents of Louisiana's front-line communities are adapting to environmental change. *Housing Policy Debate*, 32(1), 84–101. <https://doi.org/10.1080/10511482.2021.1925944>

- Nelson, M., Ehrenfeucht, R., & Laska, S. (2007). Planning, plans, and people: Professional expertise, local knowledge, and governmental action in post-Hurricane Katrina New Orleans. *Cityscape*, 9(3), 23–52.
- Neuendorf, K. A. (2017). *The content analysis guidebook*. Sage Publications.
- Newman, S., Carroll, M., Jakes, P., & Higgins, L. (2014). Hurricanes and wildfires: Generic characteristics of community adaptive capacity. *Environmental Hazards*, 13(1), 21–37. <https://doi.org/10.1080/17477891.2013.841090>
- Norris, F. H., Friedman, M. J., Watson, P. J., Byrne, C. M., Diaz, E., & Kaniasty, K. (2002). 60,000 disaster victims speak: Part I. An empirical review of the empirical literature, 1981–2001. *Psychiatry*, 65(3), 207–239. <https://doi.org/10.1521/psyc.65.3.207.20173>
- Peters-Guarin, G., McCall, M., & 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>
- Poe, J. (2022). Theorizing communal trauma: Examining the relationship between race, spatial imaginaries, and planning in the US South. *Planning Theory*, 21(1), 56–76. <https://doi.org/10.1177/14730952211014563>
- Preston, B. L., Westaway, R. M., & Yuen, E. J. (2011). Climate adaptation planning in practice: An evaluation of adaptation plans from three developed nations. *Mitigation and Adaptation Strategies for Global Change*, 16(4), 407–438. <https://doi.org/10.1007/s11027-010-9270-x>
- Prudent, N., Houghton, A., & Luber, G. (2016). Assessing climate change and health vulnerability at the local level: Travis County, Texas. *Disasters*, 40(4), 740–752. <https://doi.org/10.1111/disa.12177>
- Raymond, C. M., Fazey, I., Reed, M. S., Stringer, L. C., Robinson, G. M., & Evely, A. C. (2010). Integrating local and scientific knowledge for environmental management. *Journal of Environmental Management*, 91(8), 1766–1777. <https://doi.org/10.1016/j.jenvman.2010.03.023>
- Saharia, M., Kirstetter, P. E., Vergara, H., Gourley, J. J., Hong, Y., & Giroud, M. (2017). Mapping flash flood severity in the United States. *Journal of Hydrometeorology*, 18(2), 397–411. <https://doi.org/10.1175/JHM-D-16-0082.1>
- Saladyga, T., & Standlee, A. (2018). Historical drivers and contemporary perceptions of wildfire in a post-industrial rural landscape. *Fire*, 1(2), 33. <https://doi.org/10.3390/fire1020033>
- Sansom, G., Berke, P., McDonald, T., Shipp, E., & Horney, J. (2016). Confirming the environmental concerns of community members utilizing participatory-based research in the Houston neighborhood of Manchester. *International Journal of Environmental Research and Public Health*, 13(9), 839. <https://doi.org/10.3390/ijerph13090839>
- Schwartz, R. M., Gillezeau, C. N., Liu, B., Lieberman-Cribbin, W., & Taioli, E. (2017). Longitudinal impact of Hurricane Sandy exposure on mental health symptoms. *International Journal of Environmental Research and Public Health*, 14(9), 957. <https://doi.org/10.3390/ijerph14090957>
- Shi, L. (2021). From progressive cities to resilient cities: Lessons from history for new debates in equitable adaptation to climate change. *Urban Affairs Review*, 57(5), 1442–1479. <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>
- Silver, A., & Grek-Martin, J. (2015). “Now we understand what community really means”: Reconceptualizing the role of sense of place in the disaster recovery process. *Journal of Environmental Psychology*, 42, 32–41. <https://doi.org/10.1016/j.jenvp.2015.01.004>
- Stern, M. J., Hurst, K. F., Brousseau, J. J., O’Brien, C., & Hansen, L. J. (2023). Ten lessons for effective place-based climate adaptation planning workshops. *Climate*, 11(2), 43–56. <https://doi.org/10.3390/cli11020043>
- Sullivan, E., Goidel, K., Brown, S. E., Kellstedt, P., & Horney, J. A. (2021). Do hazard mitigation plans represent the resilience priorities of residents in vulnerable Texas coastal counties? *Natural Hazards*, 106(3), 2337–2352. <https://doi.org/10.1007/s11069-021-04545-8>
- Suškevičs, M., Hahn, T., Rodela, R., Macura, B., & Pahl-Wostl, C. (2018). Learning for social-ecological change: A qualitative review of outcomes across empirical literature in natural resource management. *Journal of Environmental Planning and Management*, 61(7), 1085–1112. <https://doi.org/10.1080/09640568.2017.1339594>
- Tengö, M., Austin, B. J., Danielsen, F., & Fernández-Llamazares, Á. (2021). Creating synergies between citizen science and Indigenous and local knowledge. *BioScience*, 71(5), 503–518. <https://doi.org/10.3390/cli11020043>
- Tretter, E. M., & Adams, M. (2016). The privilege of staying dry: The impact of flooding and racism on the emergence of the “Mexican” ghetto in Austin’s low-eastside, 1880–1935. In S. Dooling (Ed.), *Cities, nature and development* (pp. 187–205). Routledge.
- Tretter, E. M., Mueller, E. J., & Heyman, R. (2022). YIMBYISM, the environment, and the remaking of race and class coalitions in Austin, TX. *International Journal of Urban and Regional Research*, 46(2), 312–318. <https://doi.org/10.1111/1468-2427.13066>
- United Nations Office for Disaster Risk Reduction. (n.d). *Preparedness*. <https://www.undrr.org/terminology/preparedness>
- Urban Sustainability Directors Network. (2017). *Equitable, community-driven climate preparedness planning*. https://www.usdn.org/uploads/cms/documents/usdn_guide_to_equitable_community-driven_climate_preparedness_high_res.pdf
- U.S. Census Bureau. (2021). *New vintage 2020 population estimates available for nation, states, counties and Puerto Rico Commonwealth*. <https://www.census.gov/newsroom/press-releases/2021/vintage-2020-population-estimates.html>
- Van Herzele, A. (2004). Local knowledge in action: Valuing non-professional reasoning in the planning process. *Journal of Planning Education and Research*, 24(2), 197–212. <https://doi.org/10.1177/0739456X04267723>
- Van Zandt, S., Peacock, W. G., Henry, D. W., Grover, H., Highfield, W. E., & Brody, S. D. (2012). Mapping social vulnerability to enhance housing and neighborhood resilience. *Housing Policy Debate*, 22(1), 29–55. <https://doi.org/10.1080/10511482.2011.624528>
- Wachinger, G., Renn, O., Begg, C., & Kuhlicke, C. (2013). The risk perception paradox: Implications for governance and communication of natural hazards. *Risk Analysis*, 33(6), 1049–1065. <https://doi.org/10.1111/j.1539-6924.2012.01942.x>
- Wall, T. U., McNie, E., & Garfin, G. M. (2017). Use-inspired science: Making science usable by and useful to decision makers.

Frontiers in Ecology and the Environment, 15(10), 551–559. <https://doi.org/10.1002/fee.1735>

Way, H. K., Mueller, E., & Wegmann, J. (2018). *Uprooted: Residential displacement in Austin's gentrifying neighborhoods and what can be done about it*. The University of Texas at Austin. <https://hdl.handle.net/2152/114835>

Webber, S. (2016). Climate change adaptation as a growing development priority: Towards critical adaptation scholarship. *Geography Compass*, 10(10), 401–413. <https://doi.org/10.1111/gec3.12278>

Woodruff, S. C., Meerow, S., Stults, M., & Wilkins, C. (2022). Adaptation to resilience planning: Alternative pathways to prepare for climate change. *Journal of Planning Education and Research*, 42(1), 64–75. <https://doi.org/10.1177/0739456X18801057>

Woodruff, S. C., & Stults, M. (2016). Numerous strategies but limited implementation guidance in US local adaptation plans. *Nature Climate Change*, 6(8), 796–802. <https://doi.org/10.1038/nclimate3012>

Yarina, L., Mazereeuw, M., & Ovalles, L. (2019). A retreat critique: Deliberations on design and ethics in the flood zone. *Journal of Landscape Architecture*, 14(3), 8–23. <https://doi.org/10.1080/18626033.2019.1705570>

Yusuf, J. E., Rawat, P., Considine, C., Covi, M., St John, B., Nicula, J. G., & Anuar, K. A. (2018). Participatory GIS as a tool for stakeholder engagement in building resilience to sea level rise: A demonstration project. *Marine Technology Society Journal*, 52(2), 45–55. <https://doi.org/10.4031/MTSJ.52.2.12>

Ziervogel, G., Pelling, M., Cartwright, A., Chu, E., Deshpande, T., Harris, L., Hyams, K., Kaunda, J., Klaus, B., Michael, K., & Pasquini, L. (2017). Inserting rights and justice into urban resilience: A focus on everyday risk. *Environment and Urbanization*, 29(1), 123–138. <https://doi.org/10.1177/095624781668690>

Zoll, D. (2021). Climate adaptation as a racial project: An analysis of color-blind flood resilience efforts in Austin, Texas. *Environmental Justice*, 14(4), 288–297. <https://doi.org/10.1089/env.2021.0034>