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# Intersectional climate perceptions: Understanding the impacts of race and gender on climate experiences, future concerns, and planning efforts

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## ABSTRACT

Climate change impacts are intensifying social inequalities locally and globally. Exposure to climate risks, as well as the ability to prepare for and recover from them, are affected by complex power structures. An expanding body of literature uses an intersectional lens to explicate a more nuanced understanding of how co-constituted power structures manufacture differential climate vulnerabilities. Despite the increasing focus on intersectional approaches to institutionalized climate planning, there are limited quantitative studies examining how the co-constituted processes of being racialized and gendered influence climate change perceptions in the United States. In contribution to these conversations, we examine how race and gender together shape experiences of climate impacts, perceptions of future risk, and desires for adaptation actors in Austin, Texas. Using a survey of Austin area households, we explored climate perceptions including residents self-reported experience of four types of climate events, assessment of changing climate risks, overall climate change concerns, and desires for resilience actions by a variety of actors. Our research suggests that race and gender, income levels, and political party are related to which climate events people report experiencing, their perception of changes to various climate risks, their overall climate concern, and their support for various climate adaptation actors.

## 1. Introduction

Approximately 80% of U.S. residents live in urban areas, which have experienced escalating climate events that affect human health and well-being, economic security, and infrastructure reliability (Miller et al., 2018; Shonkoff et al., 2011; Solecki and Rosenzweig, 2022; Stone Jr et al., 2021; Sweet and Park, 2014; USGCRP, 2018). Climate change is often presented as a politically

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contentious issue; however, public opinion polls show that 72% of U.S. residents think global warming is happening, 65% think it has, or will, cause immediate harm to U.S. residents, and 60% feel local governments should take action (Yale, 2021). There is substantial variation in how local governments engage in climate planning and their motivations to do so are often influenced by multiple factors, including the desire to demonstrate political leadership, adequate planning resources and capacities, previous extreme weather impacts, and responses to public opinion and activism (Shi et al., 2015; Yeganeh et al., 2020). Regardless of the factors at play, the number of U.S. cities developing and implementing climate adaptation plans has doubled in the past decade (Lyles et al., 2017; Wheeler, 2008; Zoll, 2021a).

Increasingly, city-led climate adaptation plans acknowledge uneven climate vulnerabilities and engage with climate equity or justice frameworks to understand and address those disparities (Diezmartínez and Short Gianotti, 2022; Schrock et al., 2015; Woodruff, 2018). Despite the increasing attention to vulnerability and justice, most climate adaptation plans tend to bypass deeper analyses of how climate vulnerability is manufactured (Meerow et al., 2019; Shi et al., 2016; Zoll, 2021a). In contrast, disaster and planning scholars have documented how systems of oppression drive climate vulnerabilities (Goldsmith et al., 2022; Jacobs, 2019; Ribot, 2014) and have advocated for intersectional approaches to institutionalized climate or disaster planning (Amorim-Maia et al., 2022; Jacobs, 2019; Osborne, 2015). However, limited quantitative studies examine how the co-constituted processes of being racialized and gendered influence climate change perceptions and subsequent support for climate planning in the United States (Ballew et al., 2020; McCright and Dunlap, 2011).

To address this gap, we analyze a city-wide survey of 1215 residents to answer our overarching research question, "how do the processes of being racialized and gendered shape climate perceptions in Austin, Texas?" Four sub-questions guide this work. First, how do race and gender together influence perceptions of climate impacts including poor air quality, extreme heat, flooding, and drought? Second, how do race and gender impact assessments of shifting climate risks related to poor air quality, extreme heat, flooding, and heavy rain? Third, how do race and gender affect overall climate concern? Fourth, how do race and gender shape preferences for some governmental and/or non-governmental adaptation actors over others? We use OLS and logistic regression models to answer these questions.

Our research found that race and gender, income levels, and political party are related to which climate events people report experiencing, their perception of shifting climate risks, their overall climate change concern, and their support for climate adaptation projects by various actors. Specifically, we documented that despite being less likely to report experiencing a climate event when compared to white men, people of color and white women have higher levels of concern for future climate change impacts, even while holding income, education, age, political party, and reported climate experiences constant. This contrast was especially evident for Black women, who were less likely to report experiencing multiple climate impacts but expressed the highest level of climate concern. Drawing from broader literatures including critical race studies, climate justice planning, and climate perception research, we situate these findings and discuss their contributions to scholarship and planning practice interventions that seek to better understand how systems of racism and patriarchy shape climate perceptions (Amorim-Maia et al., 2022; Jacobs, 2019; Sultana, 2022; Vinyeta et al., 2016).

## 2. Theory

Urban climate events like flooding, excessive heat, wildfires, and extreme storms disproportionately impact low-income households, women, people experiencing disabilities, youth and seniors, and people of color (Cutter et al., 2003; English et al., 2013; Hsu et al., 2021; Rufat et al., 2015; Thomas et al., 2013). Disparate exposure to climate risks, unequal abilities to prepare for extreme events, and asymmetrical recovery trajectories are driven by various and co-constituted systems of oppression (Jacobs, 2019; Ribot, 2014). Scholars have theorized how systems like racial capitalism, colonialism, patriarchy, heteronormativity, and ableism influence how people in the United States are exposed to climate change, perceive future threats, and envision actions to reduce harm (Agathangelou, 2021; Goldsmith et al., 2022; Hardy et al., 2017; Jampel, 2018; Rivera, 2022; Vinyeta et al., 2016). This is complemented by research describing innovative acts of refusal and survival against environmental violence rooted in intersectional understandings of oppression and liberation (Mersha, 2018; Ranganathan and Bratman, 2021; Yazzie, 2018).

Intersectionality was coined by Kimberlé Crenshaw (1989), but captures longstanding Black feminist thought and activism that explicates how racism and patriarchy are co-constituted and often articulating with capitalism and heteronormativity to produce what Patricia Hill Collins termed a "matrix of domination" (Collins, 2008; Combahee River Collective, 1983; Crenshaw, 1991; Hooks, 2000; Taylor, 2017; Truth, 1851). A core argument of this work is that attempts to essentialize oppression to simply racism, or simply patriarchy, will inevitably flatten our understanding of complex and interconnected systems and how those function together to produce social inequalities (Collins, 2008; Crenshaw, 1991; Jacobs, 2019). For example, Barbara Ransby's (2006) research provided insights into how racism, patriarchy, and capitalism together created financial, political, and physical precarity for Black women before Hurricane Katrina, which was then amplified by the storm, and subsequently led to inequitable recovery processes. She also described the activism and community care work led by Black women following the storm in efforts to provide immediate and long-term recovery and safety (Ransby, 2006). Intersectionality provides a constructive lens to understand how multiple systems of oppression shape identities, experiences, outcomes, and liberation (Collins, 2008; Combahee River Collective, 1983; Crenshaw, 1991; Jacobs, 2019).

In recent urban planning efforts, there are calls to incorporate more intersectional approaches to climate adaptation planning, especially in focusing on climate justice or equity (Amorim-Maia et al., 2022; Jacobs, 2019; Osborne, 2015). Climate justice activism and scholarship are not monolithic bodies of thought or action. However, there is general agreement that those least responsible for climate change will face the greatest impacts and therefore should lead the development of mitigation and adaptation responses and be

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prioritized in investments to reduce harm (Newell et al., 2021). These same principles surface in city-led climate adaptation plans that engage with climate justice or equity (Meerow et al., 2019; Schrock et al., 2015; Zoll, 2021a). However, equity or justice-focused climate adaptation plans predominantly rely on overarching concepts of "vulnerable" residents or communities with limited specificity about how vulnerability is driven by systems of oppression and the implications of that for climate justice actions (Meerow et al., 2019; Schrock et al., 2015; Zoll, 2021a). Additionally, researchers have noted that attention to equity or justice often does not translate into tangible or physical actions but is instead tied to outreach, engagement, and education efforts to increase climate awareness and community preparedness (Meerow et al., 2019; Schrock et al., 2015; Zoll, 2021a). However, significant research demonstrates that "vulnerable" communities have the highest climate awareness and concern (Ballew et al., 2019; Benegal and Holman, 2021a, 2021b; McCright and Dunlap, 2011).

Survey research on climate change experiences, awareness, and risk has found differences along race and gender lines (Ballew et al., 2019; Cox et al., 2014; Goldberg et al., 2020; Macias, 2016a, 2016b; McCright and Dunlap, 2011). For example, a 2017 study found that women were more likely to believe that climate change is a serious problem, impacts people, and requires significant actions to prevent harm (Pearson et al., 2017). Survey analysis by Ballew et al. (2019) indicates that people of color also have a stronger belief that global warming is occurring and poses significant risks. Multiple studies have noted that Black and Latinx survey respondents exhibit the highest climate change concern (Ballew et al., 2019; Cox et al., 2014; Goldberg et al., 2020; Macias, 2016a, 2016b). Other research has found what is termed the "white male effect" where white men are often the least concerned about environmental issues generally and climate change specifically (Albright and Crow, 2019; Flynn et al., 1994; Goldberg et al., 2020; Kahan et al., 2007; McCright and Dunlap, 2011; Satterfield et al., 2004). Offered explanations for these differences include higher or lower levels of social capital (Goldberg et al., 2020), political ideology (Schuldt and Pearson, 2016), racial resentment (Benegal, 2018), sexism (Benegal and Holman, 2021b), and egalitarian or individualistic belief systems (Goldberg et al., 2020; McCright, 2010). Others have suggested the changes required to adequately mitigate and adapt to climate change fundamentally challenge existing systems like white supremacy, patriarchy, and capitalism, which threaten the status and power from which white men benefit. Therefore they are more likely to express disbelief and advocate against meaningful action (Benegal and Holman, 2021b; Benegal and Holman, 2021a).

Current research on intersectional approaches to understanding climate perceptions is often based on national surveys (Ballew et al., 2020; McCright and Dunlap, 2011) or treats race and gender as separate variables (Albright and Crow, 2019; Yazar et al., 2021; Yazar and York, 2022). While national surveys provide information on broad climate beliefs and policy support, they do not account for regional variation that may be influenced by socio-demographic patterns, local climate and weather conditions, and cultural characteristics (Howe et al., 2015; Kahan et al., 2012; McCright and Dunlap, 2011). Additionally, they may have limited relevance to place-based climate planning given the need for planners to be responsive to residents. Here, we build on these bodies of research by investigating how the co-constituted processes of being racialized and gendered influence climate change perceptions in Austin, Texas. Austin is one of the most rapidly growing cities in the United States (Frey, 2022), is inhabited by racially and socioeconomically diverse communities (City of Austin, 2021a), and is also poised to experience increasing extreme climate events (Hayhoe, 2014). We suggest our study can contribute to current climate policy debates in Austin while offering lessons for similar rapidly expanding climate-sensitive regions and broader research on intersectional approaches to climate planning research and practice.

## 3. Research design

### 3.1. The study area

Austin residents face escalating climate-amplified extreme weather events including excessive heat, flooding, and drought, which may reproduce social inequalities, especially along race, gender, and class lines (City of Austin, 2021b; Hayhoe, 2014). Austin's social and built landscapes have been fundamentally configured through historical and ongoing racial and economic segregation (Busch, 2016; Huggins, 2017; Tretter et al., 2022; Tretter and Adams, 2012; Zoll, 2021b). City-led and private segregation practices emerged in Austin in the 1890s following Reconstruction and included racial deed covenants that segregated housing choices (Busch, 2016). The patterns that emerged from those practices were codified by the city's first comprehensive plan and zoning ordinances in 1928, which institutionalized Black and white segregation on the east and west sides respectively (Busch, 2016). This was quickly reinforced by redlining and segregated public housing in the 1930s and then further amplified in the 1950s and 1960s through urban renewal projects in east Austin (Busch, 2017). This included building Interstate 35 in the same location as East Avenue, which had unofficially served to delineate white spaces in the west from Black and Latinx neighborhoods in the east (Busch, 2017).

While the east side is now rapidly gentrifying (Long, 2016; Tang and Ren, 2014; Tretter et al., 2022; Way et al., 2018), the impacts of historical and ongoing racism are highly visible between east and west Austin across a host of social outcomes including economic segregation, life expectancy, asthma rates, lack of leisure time, income, and wage gaps (Centers for Disease Control and Prevention, 2022; EPA, 2015; Pickard et al., 2015). Similar patterns of inequality exist for disproportionate flood exposure, unequal heat risks, and overall vulnerability to climate change (Bixler et al., 2021; Preisser et al., 2022; Prudent et al., 2016; Seong et al., 2022; Tretter, 2016; Zoll, 2021b). Unequal climate risks are connected to how segregation practices were influenced by environmental risks and in turn shaped environmental inequalities for things like tree canopy cover, parkland extent and condition, and impervious surfaces (Bixler et al., 2021; EPA, 2015; Thomas, 2021; Tretter and Adams, 2012).

In response to long-standing racial and environmental injustices and prolonged community activism demanding justice, the City of Austin took a racial equity approach to develop the 2021 Climate Equity Plan (City of Austin, 2021b). The plan centers racial equity as a core component of the city's climate mitigation efforts (City of Austin, 2021b). While a comprehensive climate adaptation plan has not been developed, the City has created resilience strategies for city-owned buildings and operations (City of Austin, 2018). They also

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have developed extensive actions related to flood mitigation (City of Austin, 2021c; City of Austin, 2016; City of Austin, 2015), and increased efforts to reduce extreme heat impacts (City of Austin, 2021d). Previous flood resilience plans and actions did not acknowledge or address environmental racism or injustices, but current planning efforts show some indication this is shifting (City of Austin, 2021b; Lieberknecht, 2023; Rendon et al., 2021; Zoll, 2021b). Understanding how Austin residents perceive climate risks, future concerns, and desired adaptation actors can complement ongoing planning processes and inform future adaptation efforts.

### 3.2. Survey approach

To investigate how the co-constituted processes of being racialized and gendered influence climate change perceptions, we designed, administered, and analyzed data from a cross-sectional survey of randomly selected residents (n = 1215) in the Austin metropolitan area. Survey data were generated as part of the IRB-approved 2020 Austin Area Community Survey. The 2020 survey is the most recent iteration of a longitudinal set of seven surveys (2004, 2006, 2008, 2010, 2015, 2018, and 2020) under the Austin Area Sustainability Indicators project (www.austinindicators.org), which measures sustainability and quality of life indicators in the Austin region. The 2020 survey was the first to ask specific questions about climate risk experiences and perceptions and therefore the only sample used in this analysis.

Surveys were completed by Consumer Research International (CRI), which uses computer-assisted telephone interviewing software and a computer-generated random dial approach to call both landlines and mobile phones. The phone surveys were conducted both in Spanish and English and combined telephone (75%) and web-based panel procedures (25%) to reach 1215 completed surveys, a figure that was targeted to meet a +/-3% margin of error for the Austin area (2.28 million estimated 2020 population). The research team set quotas for Latinx and 18–24-year-old respondents to ensure a demographically representative sample (Callegaro and DiSogra, 2008). This analysis relies on a subset of respondents who provided race and gender demographics (N = 1089).

### 3.3. Data

### 3.3.1. Dependent variables

We evaluated four sets of dependent variables assessing experiences of climate impacts, risk perception, overall climate concern, and desires for adaptation actors. For climate impacts and risk perception, our analysis followed the City of Austin's assessment of the most consequential climate impacts and subsequent prioritization of planning efforts centered on excessive heat, extreme rainfall, flooding, poor air quality, and drought (City of Austin, 2021b; Hayhoe, 2014).

*Climate impacts:* While there is conflicting evidence, some research suggests that experiences with frequent or extreme climaterelated events can impact perceptions of climate risk and overall concern (Akerlof et al., 2013, 2015; Brody et al., 2008; Kuang and Liao, 2020; Rudman et al., 2013). Additionally, disaster, hazard, and climate research studies have shown that climate risks are often unevenly distributed, with low-income households, women, and communities of color experiencing the most consequential effects (Cutter et al., 2003; English et al., 2013; Hsu et al., 2021; Rufat et al., 2015; Thomas et al., 2013). To understand household experiences with climate impacts, we asked: "*Has your household or neighborhood experienced (flooding, extreme heat, drought, or days with poor air quality) in the last ten years*?" Answers were recorded for each of the four climate risks and coded as dichotomous variables, with one for yes and zero for no.

*Climate risk perceptions*: Perceptions of climate risks can influence general climate change attitudes, beliefs, and actions (Ballew et al., 2019; Goldberg et al., 2020; Pearson et al., 2017). Evidence implies that risk perceptions can vary by race, gender, educational attainment, and political party (Ballew et al., 2021; Goldberg et al., 2020). Participants estimated changing extreme weather and associated risks by answering, "*In your community over the last five years, has (flooding, extreme heat, heavy rain, and poor air quality) increased, decreased, or stayed the same*?" Answers were re-coded as dichotomous variables, with one for increased and zero for decreased or stayed the same (Grassi et al., 2007).

*Climate concern:* Measures of general climate concern have been shown to influence public support for, or opposition to, climate action and subsequent adoption of climate policies by local governments (McCright, 2008; O'Connor et al., 1999; Rudman et al., 2013; Sharp et al., 2011; Zahran et al., 2006). Race and gender often correlate with climate concern and general environmental awareness (Benegal, 2018; Goldberg et al., 2020; Macias, 2016b; Xiao and McCright, 2012). We measured overall climate change concern by asking, "On a scale of 1 to 10, with 1 being not concerned and 10 being extremely concerned, how concerned are you about climate change?" Answers were maintained as a 1 to 10 continuous variable.

Adaptation actors: Despite declining levels of trust in government and social institutions (Brenan, 2021; Zamintes, 2022) residents rely on government agencies, NGOs, and community groups (actors) to create and enact climate policies because the complexity of climate science, the scale of the problem, and costs far exceed what individual households can manage (Cologna and Siegrist, 2020). Recent evidence demonstrates that escalating climate impacts erode public trust in government (Carroll et al., 2011; Edgeley, 2022; Kumagai et al., 2006; Miller, 2016; Nicholls and Picou, 2013; Paveglio et al., 2015). However, a 2022 study suggests that changes in trust following climate-related disasters vary between federal, state, and local entities (Giordono et al., 2022). Research also demonstrates that support for government interventions is influenced by race, gender, class, and political party and similar dynamics emerge during and following disaster events (Eisenman et al., 2007; Henkel et al., 2006; Marschall and Shah, 2007; Verba et al., 2003). To assess the desirability of various climate actors, we asked, "To what extent (very involved, somewhat involved, not so involved, not involved at all) do you think (federal government, state government, local government, NGOs, and community groups) should be actively involved in recommending or implementing policies for community resilience and disaster preparedness and recovery?" Answers were re-coded as dichotomous variables. Responses indicating that an entity should be somewhat involved or very involved were coded as one.

## Table 1

Descriptive statistics of the survey items.

Has your household or neighborhood experienced this natural hazard in the last ten years? (0 = No, 1 = Yes)							
	Mean	SD	Min	Max	Yes (%)	No (%)	
Flood	0.35	0.48	0	1	35	65	
Extreme Heat	0.69	0.46	0	1	69	31	
Drought	0.69	0.46	0	1	69	31	
Air Quality	0.41	0.49	0	1	41	59	

Climate risk	
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In your community over the last five years, has the following increased, decreased, or stayed the same? (1 -Decreased, 2-Stayed Same, 3-Increased) Mean SD Min Max Yes increased (%) No decreased or stayed the same

	Mean	00	wiiii	mux	res increased (70)	(%)
Flooding	2.07	0.70	1	3	28	72
Extreme heat	2.6	0.55	1	3	64	36
Heavy rain	1.88	0.71	1	3	20	80
Poor air quality	2.28	0.70	1	3	41	59

## Climate concern

 On a scale of 1 to 10, with 1 being not concerned and 10 being extremely concerned, how concerned are you about climate change?

 Mean
 SD
 Min
 Max

 Concern
 7.2
 3.08
 1
 10

## Adaptation actors

To what extent do you think (group) should be actively involved in recommending or implementing policies for community resilience and disaster preparedness and recovery? (1-Not involved at all, 2- Not so involved, 3-Somewhat involved, 4-Very involved)

	Mean	SD	Min	Max	Yes involved (%)	No not involved (%)
Federal government	2.89	1.00	1	4	72	28
State government	3.15	0.95	1	4	80	20
Local government	3.29	0.93	1	4	85	15
NGOs	3.08	0.88	1	4	84	16
Community groups	3.19	0.87	1	4	94	6
Race and gender	Count	Percent				
Black Woman	39	4				
Black Man	24	2				
Latina Women	137	13				
Latino Man	104	10				
Other POC Woman	58	5				
Other POC Man	48	4				
White Woman	450	41				
White Man	229	21				
Income (HUD Income Levels)	Count	Percent				
Low Income	527	46				
Medium-Income	258	23				
High Income	353	31				
Political party	Count	Percent				
Republican	274	23				
Democrat	421	36				
Independent	302	26				
Other	178	15				
Education	Count	Percent				
Less than Bachelor's degree	697	57				
Bachelor's degree or above	521	43				
Urban	Count	Percent				
Urban	325	30				
Non-urban	754	70				
	Mean	SD	Min	Max		
Age	50.85	20.19	18	94		

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Answers that an entity should not be so involved or not involved at all were coded as zero.

### 3.3.2. Independent variables

*Race and gender*: Our primary focus in this study was examining how co-constituted processes of being racialized and gendered influence climate change perceptions in Austin, Texas. Previous research has shown race and gender influence climate concern (Benegal, 2018; Goldberg et al., 2020; Stokes et al., 2015), assessment of climate risks (Ballew et al., 2021; Goldberg et al., 2020), and desire for climate policy or action (Giordono et al., 2022). Here, we obtained demographic and gender information from survey respondents. We coded race and ethnicity into four categories: Black, Latinx, white, and other people of color. Due to a small number of people who identified as Asian American, Native American, Native Hawaiian, or Other Pacific Islander, and more than one race or ethnicity, we grouped these respondents into an "other people of color" category. We acknowledge that racialization and racism likely impact these groups differently and combining them may flatten important nuances (Zuberi and Bonilla-Silva, 2008). Gender was coded as men and women. We then combined these two categorical variables to create eight total groups: Black women, Black men, Latina women, Latino men, other women of color, other men of color, white women, and white men. White men served as the reference category.

Drawing from previous research looking at the role of race and gender in climate perceptions, we included six control variables: income, age, political party, education, urban residents, and previous experience with climate impacts. These variables have documented relationships with risk perception, climate concern, and desire for intervention (Egan and Mullin, 2012; Goldberg et al., 2020; Howe et al., 2015; Lindell and Hwang, 2008; McCright, 2010; McCright and Dunlap, 2011; Olofsson and Rashid, 2011; Satterfield et al., 2004; Yazar and York, 2022).

We created *income* categories using HUD's median family income (MFI) definitions for Austin (City of Austin, 2021e) based on respondents' household income and household size. Categories include low-income households (below 80% MFI), medium-income (81%–120% MFI), and high-income (above 120% MFI). *Age* was self-reported and left as a continuous variable. *Political party* categories included Republican, Democrat, Independent, or other, with other as the reference category. We re-coded *education* level to a dichotomous variable with Bachelor's degree or higher as one and below a Bachelor's degree as zero. Participants indicated if they lived in urban, suburban, rural changing to suburban, or rural locations, which we re-coded as *urban* residents and the remaining groups as non-urban residents, with non-urban as the reference category.

Lastly, we included additional control variables based on previous experiences with extreme climate events. As mentioned above, there are mixed results describing the relationships between individual climate impacts and shifting climate concern (Akerlof et al., 2013, 2015; Brody et al., 2008; Kuang and Liao, 2020; Rudman et al., 2013). For models assessing if a risk has increased or decreased, we included a binary variable indicating if participants reported experiencing that same climate risk. For example, in modeling the likelihood of a respondent thinking flooding has increased in the past five years, we included the binary flood experience variable indicating if they experienced flooding in the past ten years or not. For the climate concerns model, we created a *climate impacts* variable with a zero to four scale based on the total "yes" responses to the climate impact questions, "*Has your household or neighborhood experienced (flooding, extreme heat, drought, or poor air quality) in the last ten years*?" Descriptive statistics are available in Table 1.

## 3.4. Analytical approach

We built logistic and ordinary least squares (OLS) regression models to assess how race and gender influence climate change perceptions including residents' experience of four types of climate events, assessment of changing climate risks, overall climate change concerns, and desires for resilience actions by a variety of actors. We evaluated collinearity using variance inflation factor scores (VIF) for each model, and all values were below five, which is within acceptable levels (James et al., 2013). OLS models were tested for heteroscedasticity using a Breusch-Pagan test, and robust standard errors were applied when indicated. Results are reported at the (p < 0.10) significance level. Analysis was conducted using R Studio (RStudio Team, 2020).

## 4. Results and discussion

Our study found nuanced relationships between race and gender and the respondent's reported impacts, risks, concerns, and adaptation actor preferences. Our discussion focuses on these relationships, but we note our control variables for income, political party, and education aligned with findings from existing research (Goldberg et al., 2020; Howe et al., 2015; McCright, 2010; McCright and Dunlap, 2011; Olofsson and Rashid, 2011; Satterfield et al., 2004).

### 4.1. Experiences with climate impacts

To understand how race and gender influence perceptions of climate impacts, we asked participants if their household or neighborhood faced a climate event over the past ten years and found respondents had varying experiences. Almost 70% noted their neighborhood faced extreme heat (69%) and drought (69%), followed by poor air quality (41%), and flooding (35%). Logistic regression models indicated Black men, white women, and other women of color were more likely to report exposure to poor air quality. For the remaining climate-related events (extreme heat, drought, and flooding), people of color were less likely to report an event compared to white men. More specifically, there were lower incidences of Black women experiencing flooding and drought than other groups. Similarly, Latinx men and women were less likely to report experiencing droughts and extreme heat. Other men of color

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were less likely to report experiencing floods and droughts.

Household income exhibited a negative relationship with climate events, while age, location, and political party were also predictive of climate impacts. Compared to lower-income households, higher-income residents were less likely to experience flooding and extreme heat, while medium-income respondents reported fewer flooding events. Age positively correlated with poor air quality and droughts, while living in an urban area had a negative relationship with droughts but a positive relationship with poor air quality. Republican respondents were less likely to report experiencing drought, heat, and poor air quality events (Table 2).

Our regression models evaluating climate impacts yielded some surprising results. Outside of exposure to poor air quality, we found that white women and people of color were less likely to report experiencing other climate-related events compared to white men. Regression models showing Black men, white women, and other women of color have a higher likelihood of reporting poor air quality partially aligns with research showing that people of color and women have higher exposure to air pollution in cities (Cox et al., 2014; Downey, 2005; Evans and Kantrowitz, 2002; Grineski et al., 2015; Hackbarth et al., 2011; Johnson, 2002; Rosenbaum, 2008; Tie-fenbacher and Hagelman III, 1999). However, non-statistically significant findings for Black women and Latinx men and women contradict similar scholarship showing higher air pollution exposure for Latinx and Black residents generally, and Black and Latina women more specifically (Mikati et al., 2018; Rachel and Jesdale, 2006; Tessum et al., 2021).

Similarly, our findings that Black women were less likely to experience a flood event in their neighborhood and that Latinx men and women reported fewer extreme heat events were unexpected. A large body of research demonstrates disproportionate exposure to, or impacts from, flood and heat risks for Black and Latinx urban residents broadly in the United States (Hsu et al., 2021; Rufat et al., 2015; Schwarz et al., 2021; Witze, 2021; Zanocco et al., 2022) and in Austin (Prudent et al., 2016; Seong et al., 2022; Tretter, 2016; Zoll, 2021b). However, studies examining the relationships between race and gender in the cases of flood and heat impacts are often more nuanced. For example, men across all races and ethnicities have the highest mortality rates from extreme heat events and flooding in the United States (Jonkman and Kelman, 2005; Tellman et al., 2020; Vaidyanathan et al., 2020). At the same time, women, especially Black and Latina women, often face more difficult recovery processes following flood events (Cutter et al., 2003; Enarson et al., 2018; Enarson and Fordham, 2000; Otto et al., 2017). Our findings may support existing research noting inconsistent relationships between gender and climate impacts in the United States (Nardone et al., 2020; O'Neill et al., 2003; Rufat et al., 2015) and point towards future research to investigate differences across the risk, impact, and recovery stages of flood and heat events.

Results suggesting white men were more likely to experience drought impacts were less surprising. Austin frequently has droughts, but water conservation requirements are the most common impact, with zero recorded connections with mortality, hospitalizations, or property loss (City of Austin, 2021c). Drought-related water restrictions occur relatively uniformly across the region, but the negative relationship between drought impacts and Black women, Latinx men and women, and other men of color could be correlated with the social and material outcomes of segregation practices in west Austin. Decades of official and *de facto* segregation concentrated wealthier white residents in west Austin and also shaped the built environment which resulted in a higher number of single-family homes, significantly larger lot sizes, greater tree canopy, more golf courses, and more extensive parklands (City of Austin, 2021a; EPA, 2015). West Austin also has higher *per capita* domestic water use likely related to home and yard size (EPA, 2015). Together these factors may increase the visibility of drought impacts for white residents and increased visibility may affect impact perception (Breyer et al., 2018; EPA, 2015; Mullin and Rubado, 2017; Prelog and Miller, 2013). Additionally, there is some evidence showing potential gender differences in drought awareness, which could be tied to gendered occupations and household responsibilities where men are more likely to work in agriculture or outdoor labor and may have more yard care activities as a household responsibility (Harris et al., 2016).

### Table 2

Logistic regression models answering "Has your household or neighborhood experienced this natural hazard in the last ten years?" (0 = No, 1 = Yes). Results are presented as odds ratios.

	Flood	Drought	Heat	Air Quality
White Women	0.95	1.07	0.97	1.71***
Black Men	0.64	0.61	1.73	2.90**
Black Women	0.20***	0.33***	0.71	0.72
Latinx Men	0.81	0.58**	0.54**	1.17
Latinx Women	1.00	0.48***	0.53**	1.34
Other POC Men	0.45*	0.45**	0.79	1.82
Other POC Women	1.03	1.53	1.20	1.89*
Medium-Income	0.71**	1.19	0.79	1.05
Higher-Income	0.58***	0.94	0.62***	0.96
College Graduate	0.96	1.10	1.07	0.94
Age	0.99	1.03****	1.01	1.01**
Urban	0.96	0.67**	1.13	1.52***
Independent	0.84	0.82	0.75	0.81
Democrat	0.97	0.96	1.25	1.14
Republican	1.04	0.48***	0.51***	0.45****
Constant	1.12	1.21	2.82***	0.40***
Observations	966	969	985	958
Log Likelihood	-610	-536	-571	-627
Akaike Inf. Crit.	1252.00	1104.00	1174.00	1285.00

Note: \*p < 0.1; \*\*p < 0.05; \*\*\*p < 0.01.

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### 2012; Terry, 2009).

Our climate impact results partially contradicted established research on uneven urban climate vulnerabilities in the United States (Rosenzweig et al., 2018; Thomas et al., 2019; USGCRP, 2018) and in Austin (Bixler et al., 2021; Prudent et al., 2016; Seong et al., 2022; Tretter, 2016; Zoll, 2021b). Our results could reflect an on-the-ground reality that challenges our understanding of who is more likely to experience a climate-related event in Austin. They could also reflect Austin's changing demographics, especially in the east side of town, which has higher flood and heat risks (Bixler et al., 2021) and was predominantly home to Black and Latinx communities starting in the 1920s but began to be gentrified by predominantly wealthier white residents in the early 2000s (Tang and Ren, 2014; Tretter et al., 2022; Way et al., 2018; Mueller and Dooling, 2011; Ranganathan and Bratman, 2021; Schrock et al., 2015; Shokry et al., 2020). Between 2000 and 2020, the percent of white residents living in the neighborhoods just east of Interstate Highway 35, a historical racial dividing line, increased by 100–600% and median household income has more than doubled (Mueller et al., 2018; City of Austin, 2023a), indicating that wealthier white residents could be moving into higher climate risk areas. There is limited research about where former east Austin residents are being displaced to and how that changes climate vulnerability (Tang and Ren, 2014).

Two other possible explanations emerge from critical race studies. First, people of color, especially women of color, may underreport impacts because they face greater immediate and generational environmental injustices which may normalize poor baseline environmental conditions and therefore may not register as an impact unless it is catastrophic (Gao et al., 2022; Gee and Payne Sturges Devon, 2004; Sansom et al., 2019). Conversely, white men may have lower thresholds for what constitutes harm because of the relative safety and security afforded to them through both their race and gender (Geronimus et al., 2006; Sansom et al., 2019). For example, a recent study by Sansom et al. (2019) in Houston, Texas found that white men were more likely to report negative health outcomes from flooding and living near toxic facilities when compared to men and women of color, despite living in the same neighborhood and facing the same level of impacts. Second, scholars in critical race studies have theorized a concept of white victimization (Bonilla-Silva, 2013; Omi and Winant, 2014). Core to this argument is the suggestion that a growing social acknowledgment of racism and efforts to adjudicate harms are often countered by white claims of mistreatment, negative impacts, or damages as a way to invalidate demands to dismantle white supremacy and to recapture any material or social benefits that were being directed to people of color (Bonilla-Silva, 2013; Omi and Winant, 2014). An easily legible example of this concept is the long-standing challenges to affirmative action based on claims that it is "reverse racism" (McKinney, 2003). While these are harder to explicitly demonstrate with our survey approach, other research has found racial resentment impacts climate perceptions (Benegal, 2018).

Two implications arise for future research from our climate impact analysis. First, additional quantitative and qualitative research could provide further insights into the relationships between race and gender, and climate events. For example, our survey did ask if people experienced displacement, financial loss, hospitalization, or other comparable measures, but these questions were only asked if respondents first indicated they had experienced a climate event. Future surveys could ask all respondents these questions, which may help unpack a more nuanced understanding of climate impacts. However, responses to those questions may also be influenced by race, gender, citizenship, and financial position. For example, lower-income households may be less likely to seek medical attention. Here, qualitative research would be useful in understanding how people conceptualize a climate event and if they consider their neighborhood as impacted or not. Additionally, the survey did not define the spatial extent of a neighborhood. Studies suggest that "neighborhood" is a subjective measurement that can be influenced by race, gender, age, education, parental status, and residential longevity (Charreire et al., 2016; Coulton et al., 2013; Guest and Lee, 1984). Providing an explicit spatial extent may help control for different conceptualizations of neighborhood impacts.

Second, we need more research and community engagement to understand how spatial shifts in urban residential patterns influence exposure to climate risks, as well as the implications of those shifts on urban plans and policies that center climate justice or broader reparative planning approaches. For example, a growing body of research investigates ecological or climate gentrification, which connects increases in property values to green, sustainable, or climate resilience investments (Anguelovski, 2016; Anguelovski et al., 2019; Keenan et al., 2018; Shokry et al., 2020). However, limited research explores successful approaches to ensuring that ongoing and future gentrification does not create an additional form of injustice where climate adaptation projects reduce risks in a specific location but benefit new residents instead of the lower-income communities of color that lived there (Anguelovski, 2016; Ranganathan and Bratman, 2021; Shokry et al., 2020; Wolch et al., 2014). For example, Austin has centered racial equity in the 2021 Climate Equity Plan (City of Austin, 2021b) and current strategies indicate the city will undertake a similar approach to climate adaptation efforts (Lieberknecht, 2023; Rendon et al., 2021). If the city targets physical climate resilience investments in the east side with the dual goals of addressing climate risks and attempting to remedy decades of disinvestment, those benefits may go to new residents and not the communities who have historically incurred the most harm if they have been displaced, or are eventually displaced, by gentrification. Research on planning efforts to couple place-based climate justice investments with anti-displacement policies is an important area for future study. We are not suggesting that lower-income communities of color should stay in climate-vulnerable locations, but instead supporting the call for robust research on ensuring climate justice adaptation projects benefit intended communities.

### 4.2. Perceptions of changing climate risks

To understand how race and gender impact assessments of shifting climate risks, we asked respondents if climate risks have increased in their community over the past five years, and except for extreme heat, most residents said climate risks have decreased or stayed the same. Approximately 64% of residents think extreme heat days have increased, while 59%, 72%, and 80%, estimate that poor air quality, flooding, and heavy rain have stayed the same or decreased from 2015 to 2020. Regression models assessing respondents' perception of changing climate risks (extreme heat, flooding, heavy rain, and poor air quality) found that white women,

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Black men, Latinx men and women, and other women of color were more likely to think extreme heat impacts have increased over the past five years compared to white men. White women and other women of color were also more likely to think air quality had worsened. Race and gender were not statistically significant for heavy rain or flooding.

Income was only statistically significant for flooding, indicating medium-income households were less likely to think flood risks have increased. Age was negatively correlated with heavy rain and flooding indicating that older respondents were less likely to think heavy rains or flood risks have increased. Having a college degree had the opposite impact on the same risks, where college graduates were more likely to think that heavy rains or flood risks have increased. We found that political party influenced the assessment of changing risks, with Republican respondents being less likely to think any climate risk (heat, air quality, heavy rain, and flooding) increased, whereas Democrat respondents were more likely to think heat and air quality risks had increased. In each model, participants who experienced the analogous climate event were more likely to think that risk increased over the past five years. For example, people who reported experiencing extreme heat events were more likely to think extreme heat had increased (Table 3).

The perceptions of increasing extreme heat and poor air quality follow Austin's 2015–2020 data on days over 100 °F and days where the air quality index was over 50 (Adams, 2022; City of Austin, 2022; Centers for Disease Control and Prevention, 2022; EPA, 2018). Similarly, the non-significant findings for flooding and heavy rain align with slight decreases in recorded flood events and days with over 1 in. of rain in Austin between 2015 and 2020 Centers for Disease Control and Prevention, 2022; NOAA, 2020). Therefore, our regression models for shifting risks suggest that white women and people of color more accurately assessed changes in extreme weather when compared to white men. Other studies have found similar results indicating underestimations of changes in extreme heat and air pollution by men (Akerlof et al., 2013; Ruddell et al., 2012), by white residents (Marlon et al., 2021; Ruddell et al., 2012; Yazar et al., 2022; Yazar et al., 2021), and by white men (Johnson, 2002; McCright and Dunlap, 2011).

## 4.3. Overall climate change concern

To assess how race and gender affect overall climate concern, we asked participants to rank their concern between 1 and 10. We found a relatively high level of concern (mean = 7.2, sd = 3.08), with 9% of respondents indicating they were not concerned (1 on a 1-10 scale) and 39% saying they were extremely concerned (10 on a 1-10 scale). Our OLS model suggests that race and gender influence overall climate concern where all groups, except for Black men, expressed a higher level of concern compared to white men. Here, the coefficient for Black men also indicated a moderate but higher level of concern compared to white men, but was not statistically significant. In the climate concern model, age and income were not statistically significant, but a college degree, urban residence, and previous climate impacts all were positively related to the level of concern. As with previous models, there were statistically significant relationships with political party, with Republican respondents having lower climate concerns and Democrats having the opposite relationship. (Table 4).

Our findings that all other social groups had higher levels of climate change concern compared to white men even while holding income, education, age, climate impacts, and political party constant align with other research on the "white male effect". The "white male effect" describes how white men are often the least concerned about environmental issues broadly and climate change specifically

### Table 3

Logistic regression models	answering "In your	community over the	e last five years,	has the following increase	l, decreased	, or stayed the same?	"" (0 =
Decreased or stayed the same	me, $1 =$ Increased).	Results are present	ed as odds ratio	s.			

	Heat	Heavy Rain	Flood	Air Quality
White Women	1.57**	0.87	1.01	1.67**
Black Men	4.71*	0.24	0.77	0.94
Black Women	2.13	0.39	0.70	1.00
Latinx Men	3.37****	1.25	0.73	0.99
Latinx Women	2.59***	0.95	0.90	1.47
Other POC Men	1.11	0.81	0.63	1.30
Other POC Women	2.00*	1.34	1.09	2.04*
Medium-Income	0.88	0.76	0.66**	0.80
Higher-Income	1.09	0.95	0.99	1.01
College Graduate	0.88	1.41*	1.42**	1.16
Age	1.00	0.98***	0.99*	0.99
Urban	0.91	1.28	1.07	1.15
Independent	1.03	0.91	0.81	1.02
Democrat	2.15***	0.99	1.05	1.55*
Republican	0.48***	0.52**	0.37****	0.61*
Heat Impact	4.48****			
Flood Impact		2.42****	2.78****	
Air Quality Impact				6.10****
Constant	0.39**	0.46**	0.51*	0.26****
Observations	949	917	903	844
Log Likelihood	-515	-438	-503	-476
Akaike Inf. Crit.	1064.00	909.00	1039.00	987.00

Note: \*p < 0.1; \*\*p < 0.05; \*\*\*p < 0.01.

### Table 4

OLS model answering "On a scale of 1 to 10, with 1 being not concerned and 10 being extremely concerned, how concerned are you about climate change?"

	Robust SE
White Women	0.820****
Black Men	0.11
Black Women	1.29***
Latinx Men	1.19****
Latinx Women	1.07****
Other POC Men	1.29***
Other POC Women	1.19***
Medium-Income	-0.18
Higher-Income	0.13
College Grad	0.61****
Age	0.00
Urban	0.48**
Independent	0.48
Democrat	1.73****
Republican	-1.54****
Climate Impacts	0.39****
Constant	5.17****
Observations	887
R2	0.291
Adjusted R2	0.278
Residual Std. Error	2.540 (df = 870)

Note: p < 0.1; p < 0.05; p < 0.01.

(Albright and Crow, 2019; Ballew et al., 2020; Flynn et al., 1994; Kahan et al., 2007; McCright and Dunlap, 2011; Satterfield et al., 2004). For example, studies by McCright and Dunlap (2011) and Ballew et al. (2020) both found that when comparing conservative white men against all other respondents they have lower concerns for climate change and are less likely to support climate policy.

Interestingly, our results indicated that Black women were the least likely to report experiencing a climate impact, yet they had one of the highest levels of climate concern. Multiple survey studies have found that Black and Latinx survey respondents are more concerned about climate change (Ballew et al., 2019; Cox et al., 2014; Goldberg et al., 2020; Macias, 2016a, 2016b). Similar analyses have also found that women tend to have higher levels of climate change concern (McCright, 2010; McCright and Sundström, 2013; Selm et al., 2019; Xiao and McCright, 2012). However, limited research examines the impacts of race and gender together on climate concerns outside of studies on white men compared to all other groups (Ballew et al., 2020; McCright and Dunlap, 2011). Those studies often aggregate other social groups as binary opposites. Meaning white men compared to everyone else, or white men in contrast to white women, and men and women of color. By disaggregating these groups, our research suggests that counter to the "white male effect" there may be a "Black woman effect," where Black women express higher levels of climate concern even when not perceiving significant climate impacts and shifting risks for themselves.

In this study, we do not intend to reify or naturalize concepts of race and gender. Instead, we suggest that this dichotomy of white men being more likely to report experiencing climate impacts but having the lowest level of climate concerns could be indicative of how whiteness rearticulates access to power through both claiming individual harm while simultaneously refuting collective impacts (Benegal, 2018; Harris, 1993; Lipsitz, 1995). Others have theorized that white men have a vested interest in avoiding any meaningful climate change policy because even the most basic efforts to mitigate or adapt would require restructuring the economy, which currently keeps them in relative positions of power and dominance (Benegal and Holman, 2021a; DeSante and Smith, 2020; Feygina et al., 2010). Further, theories and activism associated with climate justice often call for the dismantling of white supremacy, colonialism, imperialism, racial capitalism, patriarchy, heteronormativity, and other systems of oppression, all of which represent major threats to those systems and the people that benefit from them (Maynard and Simpson, 2022; Ranganathan and Bratman, 2021; Rice et al., 2021; Whyte, 2016).

Conversely, finding that Black women were the least likely to report climate impacts while expressing the highest levels of concern may suggest ways in which Black feminism evidences practices of community concern, care, and the envisioning of a more just and safe future (Harris, 1993; Hartman, 1997; Jacobs, 2019; McKittrick and Woods, 2007). While only one aspect of Black feminist thought, scholars have articulated an "ethics of care," as an important concept that embodies a long history of Black women enacting politics of care for self, family, and community to counter anti-Black oppression and violence (Collins, 2008; Combahee River Collective, 1983; Nash, 2019). An ethics of care has been theorized as emerging from a value system held by Black women that centers empathy, emotion, and connectedness (Collins, 2008) which informs community organizing around notions of mutual responsibility for collective survival (Gumbs et al., 2016; Nash, 2019). Perhaps the Black women effect in our study is the result of a greater attention to connectedness, mutual responsibility, and collective survival and how those are intertwined with climate change and action.

These insights may be useful for climate scholarship in thinking about how racism and patriarchy surface in how we assess and interpret our understanding of public opinion on climate change and policy justifications. This complements other research approaches

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examining how racism and patriarchy function in the creation of climate-vulnerable spaces and communities (Arvin et al., 2013; Jacobs, 2019; Maynard and Simpson, 2022), the inequitable access to physical adaptation projects (Anguelovski et al., 2016; Elliott et al., 2020; Gould and Lewis, 2018; Lieberknecht and Mueller, 2023; Mach et al., 2019; Shokry et al., 2020; Zavar and Fischer, 2021), unjust climate planning processes (Anguelovski et al., 2016; Grove et al., 2020a, 2020b), and abandonment during climate disasters (Brand and Baxter, 2020; García-López, 2018; Gonzalez-Sobrino, 2018; Woods, 2010). Our project did not do this, but further efforts to consider how other co-constituted systems of oppression are being rearticulated through climate change and local responses may lend further insights into how we collectively address these challenges.

## 4.4. Support for adaptation actors

To evaluate how race and gender shape preferences for some governmental and/or non-governmental adaptation actors over others, we asked participants how involved different actors should be in climate resilience programs and efforts. We found an overall high level of support, with the highest level for community group involvement (94%) followed by local government (85%), NGOs (84%), state government (80%), and federal agencies (72%). Our logistic regression models suggested that support varied by race and gender. We found that white women were more likely to support NGO involvement, while Black men and Latina women were less likely to support local government actions. Although federal agencies had the lowest levels of support, our regression models indicated that Black women and Latino men were more likely to support federal government programs compared to white men.

Income was only statistically significant for NGO involvement and had a positive relationship. College education and age were positively correlated with a greater likelihood of support across all resilience actors, except for age for NGO support. Urban residence was only a significant predictor for federal government support and demonstrated a positive relationship. Political party was not statistically significant in any of the models. Lastly, we found that previous experience with a climate event increased the likelihood of supporting resilience actions by community groups, NGOs, and local government (Table 5).

Existing research documents the increasing public demand for climate policy but few studies have evaluated public support for climate adaptation projects by various actors (Fairbrother, 2022; Yale, 2021). Our research suggests that regardless of perceived impacts, assessment of shifting risks, or overall climate concern, Austin residents expressed a high level of support for climate resilience programs. The survey did not ask respondents to specify the types of involvement or the actions they support. Future in-depth analyses on desired policy options, actors, and roles in climate adaptation efforts could provide insights into resident preferences regarding how climate policies are designed and implemented. While not as detailed, our findings did indicate that while the city has not developed a comprehensive climate adaptation plan, residents are overwhelmingly supportive of adaptation actions by various actors, including the city.

Race and gender influenced support for resilience policies and actions by different organizations. The overall support was highest for community group involvement (94%), but we did not find statistically significant differences by race and gender. Non-significant findings could be related to individuals self-selecting into community groups that have similar geographies, identities, values, and theories of change, which may engender a higher level of trust and support when compared to government agencies with fewer commonalities because of their broader remit (Chamlee-Wright and Storr, 2009; Reininger et al., 2013; Spialek et al., 2016). Local

### Table 5

Logistic regression models answering "To what extent do you think (group) should be actively involved in recommending or implementing policies for community resilience and disaster preparedness and recovery?" (0 = Not involved at all or Not so involved, 1 = Somewhat involved or Very involved). Results are presented as odds ratios.

	Community Groups	NGOs	Local Gov	State	Fed
White Women	1.57	1.81**	0.85	0.98	1.30
Black Men	0.71	1.49	0.19***	0.67	0.92
Black Women	1.17	1.54	0.64	1.24	4.54**
Latinx Men	0.79	1.18	0.80	1.14	1.75*
Latinx Women	0.64	0.97	0.39***	0.78	1.15
Other POC Men	1.02	0.79	0.50	0.39**	0.90
Other POC Women	2.48	1.74	0.66	1.53	1.81
Medium-Income	1.43	1.09	0.79	0.94	1.18
Higher-Income	1.31	1.50*	1.03	1.26	1.27
College Graduate	1.74**	1.65**	2.11****	1.47**	1.35*
Age	1.01*	1.00	1.01**	1.02***	1.02****
Urban	1.01	0.84	1.25	0.99	1.37*
Independent	1.04	1.02	1.31	0.93	0.93
Democrat	0.79	0.91	1.17	0.88	0.91
Republican	0.71	0.72	0.83	0.89	0.80
Climate Impacts	1.16**	1.23***	1.18**	1.06	1.06
Constant	1.93	1.89	1.89	1.56	0.64
Observations	878	878	887	889	885
Log Likelihood	-337	-370	-345	-422	-509
Akaike Inf. Crit.	707.00	775.00	725.00	877.00	1052.00

Note: \*p < 0.1; \*\*p < 0.05; \*\*\*p < 0.01.

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government actions had the second highest overall support (85%), but Black men and Latina women were less likely to support local government involvement compared to white men. Conversely, while still having relatively high levels of support, the federal government was the least supported (72%), but Black women and Latino men were more likely to support resilience actions by federal agencies.

Our split findings for Black and Latinx residents by gender further emphasize the importance of disaggregating racial and ethnic groups and partially aligns with existing research. For example, a recent study by Giordiona and colleagues found that trust in local and state government was more likely to increase following climate-related disaster events and that improved trust was associated with increased climate policy support (Giordono et al., 2022). However, they noted that trust only increased for white residents and women while policy support only increased for women (Giordono et al., 2022). Other evidence shows divergent political trust trajectories following disasters with lower-income people of color exhibiting the largest decreases in political trust (Eisenman et al., 2007; Henkel et al., 2006; Marschall and Shah, 2007; Miller, 2016; Nicholls and Picou, 2013; Verba et al., 2003). A recent study by Reinhardt (2019) found that following hurricanes, Black women have the least amount of political trust compared to Black men and white men and women. These studies evaluate relationships between socio-demographics, climate impacts, and trust; however, fewer studies unpack support for specific actors (Fairbrother, 2022; Yale, 2021). Our study contributes to this gap; however, we did not assess the relationships between climate impacts and trust or trust and support for local resilience actors. Future research could explore these potential links.

## 5. Conclusion

Exposure to climate risks, as well as the ability to prepare for and recover from them, are affected by complex power structures. How cities understand and address interlocking and co-constituted power structures will likely influence how just and equitable our efforts to mitigate and adapt to climate change will be. Our research indicates that race and gender, income levels, and political party are all related to the climate events people report experiencing, their perception of shifting climate risks, their overall climate change concern, and their support for climate adaptation actors. Five major insights emerged from this research.

First, our analysis of flood and heat impacts yielded surprising results that contradict existing quantitative research in Austin and community reports. Unpacking if these results are indicative of a fundamental misunderstanding of climate risks in the city, gentrification, differing perceptions of impacts, white victimization, or other explanations could have significant impacts on research and policy. For example, differing perceptions of impacts may influence future survey design. For local policy, understanding if gentrification is shifting climate risk exposure has implications for how cities address climate justice.

Second, our findings expand existing climate perception research on the "white male effect" with the concept of the "Black woman effect." Our results found that Black women expressed the highest levels of climate concern even when not perceiving significant climate impacts and shifting risks for themselves or their neighborhoods. We suggest this supports work by scholars like Fayola Jacobs who has advocated for a Black feminist approach to disaster research and practice (Jacobs, 2019). Jacobs (2019) articulates the need to center community knowledge in conceptualizing risk, understanding oppression and its effects, and proposing solutions as fundamental to challenging power structures that create disaster vulnerability and injustices. Further efforts to understand how Black feminism could deepen existing urban climate justice theory and practice could be especially insightful in extending current notions of procedural, distributive, and reparative justice to incorporate practices of community care and liberation (Collins, 2008; Jacobs, 2019; Ransby, 2006).

Third, despite varying levels of climate impacts and overall concern, there was overwhelming support for climate action in Austin. However, our analysis highlighted lower levels of support for local government involvement by Black men and Latinx women. This could result from general distrust between local governments and Black and Latinx residents and offers important reflection opportunities for local governments wanting to repair, rebuild, and gain trust as local climate adaptation efforts are designed and implemented. Additionally, the high level of support for adaptation efforts by local community groups offers a pragmatic suggestion for the City of Austin and other local government entities to partner with community groups but to ensure that those groups are from multiple neighborhoods and demographics and are accountable to the residents they claim to represent. This finding may also have implications for private foundations and the work they support, as targeted funding to community groups may amplify outcomes for urban climate justice.

Fourth, while not an initial focus of this research, respondents' political party exhibited significant correlations with reported impacts from climate events, assessment of increasing climate risks, and overall climate concerns, which may support research documenting the continued politicization of climate perceptions (Ballew et al., 2021; Benegal, 2018; Schuldt and Pearson, 2016). Just as we are currently seeing a more visible backlash from the far right who are openly targeting LGBTQIA+ rights, abortion access, and "critical race theory," we should similarly anticipate backlash to local climate justice efforts (Councilor, 2020; Ray, 2022; Stephens, 2022). Understanding where this is already happening and how local planners, politicians, and communities are responding may have crucial lessons especially as climate justice approaches to city-led planning continue to grow.

Fifth, our overall analytical approach and results can support climate justice efforts in Austin and cities like it. A key component of climate justice planning efforts is authentic engagement with groups at the highest risk from climate change, namely lower-income residents, communities of color, people experiencing disabilities, youth, and the elderly. Authentic engagement recognizes that groups subjected to marginalization are the experts in their daily lives, structural challenges, and appropriate solutions. It also recognizes that power and oppression impact people and places in unique and specific ways and understanding these differences is an important component in undoing those systems. Our efforts to examine race and gender together highlight several policy avenues that deserve additional attention and targeted engagement. For example, our findings that people of color, especially Black women,

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exhibited the most accurate assessments of shifting climate risks and the highest level of climate concern may suggest that education campaigns that are typically targeted for communities of color are unnecessary for those social groups. Additionally, complementing traditional spatial analysis of climate vulnerabilities with surveys and targeted community engagement offers an important opportunity to ground truth and triangulate different forms of knowledge. Lastly, accounting for, and attending to, the intersectional drivers of climate vulnerability may provide for adaptation efforts that work on both immediate and structural changes necessary to address some of the roots of our current climate crisis. Undertaking that work may require that planners prioritize, pay, and share power with priority communities, and cities will need to budget the time, finance, and capacity necessary to manage those processes appropriately. Ultimately, our paper provides insights into how research centering intersectional experiences can inform local plans, policies, and programs to address climate injustices, but these will need to be refined, expanded, and augmented in climate planning research and practice.

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## CRediT authorship contribution statement

Deidre Zoll: Conceptualization, Methodology, Data curation, Formal analysis, Writing – original draft, Writing – review & editing. R. Patrick Bixler: Data curation, Writing – review & editing, Funding acquisition, Supervision. Katherine Lieberknecht: Writing – review & editing, Funding acquisition, Supervision. J. Amy Belaire: Writing – review & editing, Funding acquisition, Supervision. Auva Shariatmadari: Formal analysis, Writing – review & editing. Shalene Jha: Writing – review & editing, Funding acquisition, Supervision, Supervision, Project administration.

### **Declaration of Competing Interest**

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests.

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## Data availability

Data will be made available on request.

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