In the Eye of the Storm: Hurricanes, Climate Migration, and Climate Attitudes*

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August 18, 2023

Abstract

Climate disasters raise the salience of climate change's negative consequences, including climate-induced migration. Policy action to address climate displacement is especially contentious in the U.S., where weak support for tackling climate change intersects with high opposition to immigration. Do climate disasters foster receptivity toward climate migrants and broader willingness to combat climate change? To study this question, we leverage the occurrence of Hurricane Ian during fielding of a pre-registered survey in autumn 2022. Hurricane exposure increased concern about and support for policies to address climate migration. Hurricane exposure also increased support for climate action and belief in anthropogenic climate change. Effects of hurricane exposure cross-cut partisanship, education, age, and other important correlates of climate attitudes, but decay within six months. Together, these results suggest that climate disasters may briefly increase favorability toward climate migrants and climate policy action, but are unlikely to durably mobilize support even in severely-impacted areas.

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Introduction

How does personal experience of climate change shape political attitudes and behavior? Since 2017, climate disasters in the U.S. have displaced 500,000 people, killed 4,500, and caused $765 billion in damages (Krieger, 2022). Worldwide, disasters take a daily toll of 12,000 people displaced, 115 killed, and $202 million in infrastructural damage (Douris and Kim, 2021). These costs underscore the pressing consequences of climate change for political, social, and economic well-being. By rendering climate change visible and immediate, disasters may help overcome barriers to climate action. A burgeoning literature examines the effects of these disasters on climate attitudes (Whitmarsh, 2008; Egan and Mullin, 2012; Bergquist and Warshaw, 2019), mitigation (Baccini and Leemann, 2021) and adaptation policies (Healy and Malhotra, 2009), and pro-environment voting (Hazlett and Mildenberger, 2020; Garside and Zhai, 2022), consumption (Spence et al., 2011), and collective action (Boudet et al., 2020).

We extend this literature by offering the first exploration of how climate disasters shape attitudes on climate-induced migration. This represents a central question for climate and migration policymaking given the massive expected scale of climate-driven displacement. Rigaud (2018) anticipate 143-million climate migrants worldwide by 2050. Likewise, Xu et al. (2020) estimate that 1.5-billion people may be climate-displaced from the Global South by 2070. At this scale, aggressive climate mitigation may be the only way to avert mass displacement (Marotzke, Semmann and Milinski, 2020). While most contemporary climate migration occurs in the Global South, developed countries are also vulnerable. Several million Americans have been displaced by environmental disasters since 2005.

Understanding climate migration attitudes and how these are affected by climate disasters is also theoretically important. First, evidence suggests climate migrants are viewed distinctly from other categories of migrants like refugees (Spilker et al., 2020; Arias and Blair,

2022). Disentangling the microfoundations of attitudes on *climate migration* contributes to broader theory-building about the social-psychological underpinnings of migration attitudes (Verkuyten, Mepham and Kros, 2018), and to our understanding of the generalizability of models of migration attitudes (Hainmueller and Hopkins, 2014). Second, climate migration attitudes are distinct from belief in anthropogenic climate change or support for climate action (Arias and Blair, 2022). By studying attitudes on climate migration, mitigation, and science in one setting, this paper helps clarify common causes of these beliefs. This effort is important for crafting general theories of climate attitudes, which requires integrating research about climate change beliefs with broader attention to perceptions of climate change's human impacts (Hornsey et al., 2016).

Third, our analyses bear on a larger literature on disaster exposure and retrospection, which considers whether citizens respond rationally to exogenous, random phenomena like hurricanes (e.g., Gasper and Reeves, 2011; Heersink, Peterson and Jenkins, 2017). If people are reflexively-influenced by events beyond politicians' control, "blind" retrospection might short-circuit democratic accountability (Achen and Bartels, 2016; Busby, Druckman and Fredendall, 2017), incentivizing politicians to eschew optimal policies (Healy and Malhotra, 2009; Bechtel and Hainmueller, 2011). Existing scholarship offers relevant evidence on myopia in climate change mitigation (Stokes, 2016) and adaptation policymaking (Bechtel and Mannino, 2021; Anderson, DeLeo and Taylor, 2023), but has not considered climate migration. We offer new evidence on citizens' responses to climate displacement following disasters—responses that shape policies on preparedness, relief, and migrant-host integration.

To assess the causal effect of disaster exposure on attitudes toward climate migration and climate change, we leverage a pre-registered, difference-in-differences design enabled by Hurricane Ian. Ian made landfall in Florida on September 28, 2022, and caused mass devastation. The storm was the third costliest disaster in U.S. history, killing 155 people,

displacing more than 50,000, and causing \$113 billion in damages (Krieger, 2022).[1] Hurricane Ian interrupted a high-frequency survey we fielded in Florida, Louisiana, Texas, and North Carolina between August 11–October 28, 2022. Pairing our representative survey with remotely-sensed, climatological microdata, we estimate the causal effect of Hurricane Ian on five main outcomes: (1) the salience and importance of climate migration; (2) support for policies to assist climate migrants; (3) the salience and importance of climate change; (4) support for policies to address climate change; and (5) climate science beliefs. We also fielded a follow-up survey in March 2023 to probe the durability of Hurricane Ian's impacts.

We document several important findings. First, hurricane exposure heightened the salience of climate migration and support for policies to assist climate migrants. In severely-impacted counties, these positive effects lasted at least one month, and cross-cut partisanship, gender, education, age, and other important correlates of climate attitudes. Second, hurricane exposure increased the perceived importance of and willingness to tackle climate change. Respondents in hard-hit areas became more supportive of costly policies for climate adaptation and mitigation. Evidence from voting on climate-related ballot initiatives in Florida corroborates our attitudinal finding. Third, hurricane exposure increased belief in climate science, including acknowledgement of climate change's anthropogenic causes and link to hurricanes. Fourth, the effects of hurricane exposure were short-lived. A survey six months after Hurricane Ian revealed no persistent effects. This suggests that while disasters may open brief windows for climate action, they are unlikely to mobilize durable shifts.

This research article thus makes three major contributions to the broader literature. First, we offer the only evidence that climate disasters mobilize support for policies to address climate migration. Shifting attention to climate displacement is of critical importance since its near-term scale is large and the microfoundations of public opinion on climate

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[1]Ian was the deadliest storm in Florida since 1935, the deadliest U.S. hurricane since Katrina in 2005, and the costliest disaster of 2022.

migration are poorly understood (Spilker et al., 2020; Arias and Blair, 2022). By demonstrating the mobilizing effect of climate disasters on climate migration attitudes, this article extends findings from other settings about how personal and familial trauma can mobilize pro-social migration attitudes (Hartman and Morse, 2020; Williamson et al., 2021). Our evidence is consistent with a political-psychological model of attitude-formation based on visceral experiences that has only recently been applied in climate scholarship (Egan and Mullin, 2012, 2017). Our findings also suggest citizens respond rationally to disasters, increasing political pressure to address the causes and consequences of extreme climatic events through sensible policymaking (Gasper and Reeves, 2011; Ashworth, Bueno de Mesquita and Friedenberg, 2018), at least in the short-term. Second, we study the consequences of disasters in a hard case—the American South—which is at severe risk from climate change, but remains a bastion of climate-skeptic, anti-immigration politics. Studying the impact of hurricanes in a setting where climate skepticism intersects with immigration opposition illuminates key barriers to and possibilities for climate migration policymaking. Third, by leveraging a pre-registered, quasi-experimental design, we contribute causal evidence about the effect of climate disasters on climate beliefs.[2] This is important because mixed evidence on the consequences of climate change for political attitudes and behavior owes largely to measurement differences across studies (Howe et al., 2019). Credible research designs are needed to identify viable pathways for pro-climate policymaking and coalition-building.

Public Opinion on Climate Change

Existing research identifies three major correlates of climate attitudes: demographics, risk perceptions, and personal experiences (Hornsey et al., 2016; Egan and Mullin, 2017). In addition to shaping individual perceptions about climate mitigation, these factors also af-

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[2]See also e.g., Hazlett and Mildenberger (2020).

fect whether and how individuals attribute extreme weather to the effects of climate change (Ogunbode et al., 2019). Among the U.S. public, partisanship, education, and gender are the strongest demographic predictors of climate beliefs. The effect of partisanship is unsurprising given polarization of elite rhetoric and trust in science (McCright and Dunlap, 2011). Numerous studies show political liberals are more supportive of climate change mitigation (Boudet et al., 2020; Hazlett and Mildenberger, 2020). Similarly, women (Leiserowitz, 2006; Bush and Clayton, 2023) and better educated individuals (Hornsey et al., 2016) are more likely to believe in climate change and support mitigation efforts.

Beyond demographics, risk perceptions—subjective judgments of threat—also influence climate attitudes. Given the long-standing, diffuse threat posed by climate change, values and worldviews powerfully shape climate risk perceptions (Leiserowitz, 2006). For instance, people who value hierarchical social organization are less supportive of climate mitigation (Hornsey et al., 2016). Likewise, empaths are more supportive of action to address climate displacement (Arias and Blair, 2022). Beyond affect, risk perceptions are also shaped by geographic vulnerability and personal experiences. In particular, experiences of extreme weather are generally associated with increasing belief in climate change (Brody et al., 2008; Bergquist and Warshaw, 2019; Howe et al., 2019; Sambrook et al., 2021). In this paper we focus on the attitudinal consequences of Hurricane Ian.

Attitudinal Consequences of Climate Disasters

How do experiences with the effects of climate change—such as extreme weather and climate disasters—affect climate attitudes? A large literature on this question yields mixed findings (Howe et al., 2019); however, on balance most evidence suggests exposure to climate disasters increases climate concern and support for pro-climate policies.

For one, experiences of climate disasters underscore the high relative costs of climate change for affected populations. By concretizing otherwise abstract risks (Weber, 2006;

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Konisky, Hughes and Kaylor, 2016), extreme storms and disasters focus attention on the dire and immediate consequences of unmitigated climate change. Put differently, through direct personal experience, beliefs about climate change and its associated costs become more certain (Myers et al., 2013). In this way, physical vulnerability to the effects of climate change increases climate risk perceptions (Brody et al., 2008).

The occurrence of extreme weather can also prime climate-related issues, increasing their salience in individuals' minds (Joireman, Truelove and Duell, 2010; Zanocco et al., 2018) and broader public discourse (Boudet et al., 2020). By forcing people to reflect on the consequences of climate change and anchoring peoples' perceptions of those consequences to their own lived experiences, climate disasters may foster pro-climate opinion. Exposure to diverse disasters—including wildfires (Hazlett and Mildenberger, 2020), heatwaves (Egan and Mullin, 2012; Zaval et al., 2014), floods (Demski et al., 2017), and hurricanes (Bergquist, Nilsson and Schultz, 2019; Sloggy et al., 2021)—fosters belief in and support for mitigating climate change. Moreover, these effects obtain at the individual and community levels (Bergquist and Warshaw, 2019). Individuals without direct experiences of climate disasters but who reside in climate-vulnerable localities also become more supportive of climate mitigation as a result of their physical proximity to climate-related threats (Brody et al., 2008).

Nor does personal experience with climate disasters only affect climate *attitudes*; research also finds that climate disasters shape political *behavior*. For example, floods (Spence et al., 2011) and air pollution (Whitmarsh, 2008) increase engagement in climate mitigation actions like energy-saving. Recent work further suggests that exposure to climate disasters increases the likelihood of voting for pro-environmental candidates, parties, and ballot initiatives (Hazlett and Mildenberger, 2020; Baccini and Leemann, 2021; Visconti, 2022). For instance, flooding in Germany in 2021 increased voting for the Green Party, which attracted new supporters from competing parties in inundated areas (Garside and Zhai, 2022).

To be sure, the consequences of extreme weather for climate attitudes are not wholly positive. The impacts of disasters are often substantively small (Brody et al., 2008; Whitmarsh, 2008; Hornsey et al., 2016). In addition, public support for mitigation after climate disasters may not translate to decisive policy action (Rowan, 2022). Numerous obstacles inhibit climate policymaking despite broad favorability, including concentrated opposition from cost-bearing populations (Stokes, 2016; Gaikwad, Genovese and Tingley, 2022), national legislative gridlock (Anderson, DeLeo and Taylor, 2023), and biased media reporting and consumption (Molder and Calice, 2023). In the U.S., partisanship also exerts an important moderating effect on the relationship between disaster exposure and climate attitudes. Boudet et al. (2020) and Hazlett and Mildenberger (2020) find that climate disasters exert a greater pro-environment effect in Democratic areas, where preexisting public opinion is more supportive of mitigation. Indeed, disasters may even prompt an anti-climate backlash if partisan-motivated reasoning leads citizens to reject politicians' subsequent pro-climate appeals (Hai and Perlman, 2022). Still, meta-analytic evidence suggests that exposure to extreme weather generally mobilizes pro-climate attitudes (Howe et al., 2019).

Retrospection After Climate Disasters

Positive effects of exposure to extreme weather on pro-climate attitudes are consistent with a rational, Bayesian updating process. People form climate opinions on the basis of probabilistic judgments about whether prevailing climatic phenomena reflect normal conditions or anthropogenic warming (Deryugina, 2013). Through this process, extreme weather increases mass concern and attribution of disasters to climate change rather than natural meteorological patterns (Akerlof et al., 2013). Retrospection—the ability to recall, evaluate, and change beliefs and behavior accordingly—underpins this process.

Retrospective evaluation in the wake of climate disasters has important implications for disaster relief and preparedness, democratic accountability, and our understanding of voter

rationality. For one, disasters often spur affected communities to reflect on policymakers' broader performance. Because disaster response is informative about incumbent quality (Ashworth, Bueno de Mesquita and Friedenberg, 2018), rational publics regard climate disasters as politically-relevant, and act to reward or punish politicians on the basis of their post-storm actions. For example, voters only punish incumbents for controllable disaster damage (Healy and Malhotra, 2010), and pay close attention to mitigatory policy responses and politicians' defined roles when attributing responsibility (Gasper and Reeves, 2011).[3] Recovery is a natural priority for victims engaged in rational updating after climate disasters. However, a myopic, short-term focus on post-disaster relief can distort long-run climate policymaking. Greater electoral rewards for relief than preparedness undercut political incentives for investment in climate policies that could reduce long-run disaster incidence (Healy and Malhotra, 2009). Potentially durable effects of post-disaster assistance on incumbent support, which stem from lingering voter gratitude, exacerbate this short-sighted focus on relief over readiness (Bechtel and Hainmueller, 2011). Still, climate disasters should mobilize pro-environment attitudes and beliefs if affected individuals engage in rational (albeit myopic) retrospection in their aftermath.

A competing perspective pioneered by Achen and Bartels (2016) suggests that people engage in "blind" retrospection, irrationally punishing politicians for events—like droughts, shark attacks, and unexpected sporting losses—beyond their control.[4] More specifically, by worsening individuals' moods (Busby, Druckman and Fredendall, 2017) and subjective well-being (Healy, Malhotra and Mo, 2010), and inducing post-traumatic stress (Marsh, 2023), climate disasters can provoke unwarranted backlash against policies and policymakers misattributed as responsible.[5] For instance, following the 1927 Mississippi Flood, President Hoover

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[3]MacKuen, Erikson and Stimson (1992) and Arndt, Jensen and Wenzelburger (2021) extend this logic to public evaluations of economic performance.

[4]Fowler and Montagnes (2015) and Fowler and Hall (2018) offer evidence against "blind" retrospection.

[5]Disasters may alternatively induce an unwarranted increase in support for incumbents, as affected voters

suffered a large decrease in voteshare in inundated counties, despite distributing substantial post-disaster aid (Heersink, Peterson and Jenkins, 2017).[6] Weak (Brody et al., 2008; Hornsey et al., 2016) or demobilizing consequences (Hai and Perlman, 2022) of climate disasters on climate attitudes could reflect "blind" retrospection, since rational disaster victims should support stronger climate mitigation efforts.

Recency Bias and Effect Persistence

How long-lasting are the effects of climate disasters on climate attitudes? Scholars on both sides of the rational versus "blind" retrospection debate argue that effects are likely to be short-lived. For example, Achen and Bartels (2016, p. 136) suggest that "whatever the voters learn in natural disasters has a very short half-life." Expectations of short-term effects reflect a more general human tendency known as recency bias—a systematic propensity to discount older information. Because making judgments about abstract, slow-moving phenomena like climate change is cognitively taxing, people rely on heuristics to simplify opinion-formation (Kahneman, Slovic and Tversky, 1982). Placing a premium on new, salient experiences and information when making judgments is one common heuristic with ample observational (Arndt, Jensen and Wenzelburger, 2021) and experimental support (Fudenberg and Peysakhovich, 2014). For instance, studies of economic voting (Nordhaus, 1975; Healy and Lenz, 2014) and political communication (Chong and Druckman, 2010), reveal the primacy of recent over chronologically-distant conditions in attitude-formation. Unsurprisingly, then, pro-climate attitudinal effects of climate disasters typically decay within a matter of weeks or months after extreme weather (Egan and Mullin, 2012; Konisky, Hughes

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blindly "rally" (Ramos and Sanz, 2020).

[6]Retrospection may also be tinted by partisan bias. Heersink et al. (2022) find disaster victims punish out-partisan but not co-partisan incumbents.

and Kaylor, 2016).[7] In rare cases where effects appear durable, persistence is attributable to disaster relief, and specifically voter gratitude for the distribution of post-storm aid (Bechtel and Hainmueller, 2011).[8] This may give incumbent politicians long-term electoral advantages among disaster-victimized populations, but is unlikely to mobilize lasting pro-climate opinion.

Climate Disasters and Climate Migration

While much academic and policy attention is paid to public opinion on migration (Hainmueller and Hopkins, 2014) and climate change generally (Egan and Mullin, 2017), little work considers public opinion on climate displacement.[9] To be sure, interdisciplinary scholars have recognized important dynamics related to climate migration.[10] Lawyers have theorized how climate migrants could be integrated into international migration conventions (McAdam, 2012), and political theorists have weighed the moral obligations states have vis-à-vis the climate-displaced (Draper, 2022). Likewise, economists and demographers have studied the effects of climate change on migration (Hunter, Luna and Norton, 2015), and conflict scholars have examined tensions between climate migrants and hosts (Reuveny, 2007; Bhavnani and Lacina, 2015; Koubi et al., 2018).[11] However, systematic analyses of public opinion on

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[7]Reminding people of long-run weather conditions can further erode the influence of salient, short-term fluctuations (Druckman, 2015).

[8]Another potential reason for opinion stability is biased information-seeking (Druckman, Fein and Leeper, 2012). For instance, if victims of climate disasters subsequently sought news about anthropogenic climate change, this could cause longer-lasting pro-climate effects of disaster exposure. We lack data to test this channel, but highlight it as an important angle for future research.

[9]Helbling (2020), Spilker et al. (2020), and Arias and Blair (2022) are important exceptions.

[10]We define climate migrants as people "who, for compelling reasons of sudden or progressive changes in the environment that adversely affect their lives or living conditions, are obliged to leave their habitual homes, or choose to do so, either temporarily or permanently, and who move either within their country or abroad" (Brown, 2008).

[11]Section A.1 surveys literature on how climate change causes migration.

climate-induced migration are rare. In particular, we offer—to the best of our knowledge—the first study on how climate disasters affect attitudes on climate migration. This is crucial because environmental disasters are the leading cause of climate-related displacement globally, and because public opinion on climate migrants is central to understanding the prospects for their integration in receiving communities (Obokata, Veronis and McLeman, 2014).

Climate Migration Attitudes

As discussed above, large literatures study public attitudes on climate change (e.g., Egan and Mullin, 2017) and migration (e.g., Hainmueller and Hopkins, 2014), though specific attitudes on *climate migration* are less well understood, particularly in the U.S. case.[12] This represents an important gap because attitudes about climate migration are distinct from belief in anthropogenic climate change or support for climate mitigation (Arias and Blair, 2022). For instance, Helbling (2020) finds similar levels of support for climate migrants among climate-skeptic and environmentalist-minded individuals. This implies a difference between climate migration attitudes and broader views on climate science.

Extending classical models from migration scholarship, prominent research expects mass opposition to climate migrants (Marotzke, Semmann and Milinski, 2020). According to this perspective, public hostility is motivated by hosts' egocentric concerns about labor market and welfare competition with the climate-displaced (Reuveny, 2007; McIntosh, 2008), or sociotropic concerns about migrants' impacts on receiving communities' broader cultural and economic well-being (Hopkins, 2012; Bhavnani and Lacina, 2015). An emerging counter-perspective emphasizes how humanitarian considerations (Bansak, Hainmueller and Hangartner, 2016), and especially perceptions of responsibility (Verkuyten, Mepham and Kros, 2018), shape migration attitudes. Arias and Blair (2022) find broad public favorabil-

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[12]But see Arias and Blair (2022). Helbling (2020) considers attitudes in Germany, while Spilker et al. (2020) study opinion in Kenya and Vietnam.

ity toward climate migrants, and show that this positive view is rooted in mass perceptions that climate migrants are involuntarily displaced. Because the disasters that cause climate migration are beyond their control, people fleeing these disasters are viewed as deserving of empathy and support.

Theory

We draw on this latter account, and wed it with insights from aforementioned scholarship on the attitudinal effects of disaster exposure to understand how climate disasters shape *climate migration* attitudes, in addition to general climate beliefs.[13] We specifically consider exposure and attitudes in the context of Hurricane Ian. Though prior studies have examined a variety of climatic events, relatively little work considers hurricanes (but see Bergquist, Nilsson and Schultz, 2019; Sloggy et al., 2021). This is important because individuals respond differently to different types of climatic phenomena (Howe et al., 2019). Moreover, hurricanes are the leading cause of climate displacement in the U.S.

We argue that personal experiences with climate disasters like hurricanes sharpen risk perceptions and make climate change's impacts more concrete. While climate migration and climate change are conceptually abstract, hurricanes are tangible. Because hurricanes create substantial migratory pressures, they are particularly likely to spur mass evaluations of climate displacement. People in the path of the storm must weigh the costs and risks of fleeing versus remaining, while those in storm-adjacent regions must consider how their communities will respond to potential influxes of climate-displaced individuals (Hopkins, 2012).

Empathy undergirds favorability toward climate migrants (Arias and Blair, 2022), and personal exposure to displacement-inducing storms is particularly likely to stimulate em-

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[13]Our hypotheses were pre-registered through OSF (section B).

pathic perspective-taking. In much the way that displacement experiences mobilize pro-social refugee attitudes (Hartman and Morse, 2020; Williamson et al., 2021), we expect hurricane victims to reflect on their disaster experiences and become more supportive of policies to benefit climate migrants. Importantly, a mobilizing effect of hurricanes on climate migration attitudes is also consistent with rational retrospection. After disasters, victims in climate-affected regions should be more conscious of future climate displacement-related risks, and hence more supportive of ameliorative policies.[14]

> H_1: **Hurricane exposure increases public support for policies to address climate-driven migration.**

While Americans' broader climate opinion is sticky (McCright and Dunlap, 2011), we argue that personal experiences with hurricanes should also shock these attitudes, increasing support for climate mitigation and belief in anthropogenic climate change. Hurricanes represent a salient manifestation of the risks posed by unmitigated global warming. The severe damage they cause should concretize the high relative costs of climate change for individuals exposed. Rational voters in climate-affected communities should also reward mitigatory policies that reduce the effects of climate change (Gasper and Reeves, 2011), and especially the risks of future hurricanes.

> H_2: **Hurricane exposure increases public support for climate change mitigation and adaptation policies, and belief in climate science.**

While we did not pre-register hypotheses about the durability of these effects, literature on recency bias (e.g., Nordhaus, 1975; Arndt, Jensen and Wenzelburger, 2021) suggests attitudinal consequences of Hurricane Ian are likely to decay quickly. We offer exploratory evidence on this question.

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[14]We also pre-registered an expectation that hurricane experience increases migration intentions. We test this in Figure A-5, and find that Hurricane Ian increased future migration intentions, but not near-term migration planning.

A Quasi-Experiment on Hurricane Exposure

To test our theory, we administered a pre-registered survey on Lucid—a well-known, online platform (Coppock and McClellan, 2019)—during 2022's Atlantic hurricane season.[15] Our survey targeted four states most vulnerable to hurricanes: Florida, Louisiana, Texas, and North Carolina.[16] We used quota sampling to obtain a respondent pool from these states that approximates the adult population of the U.S. with respect to census benchmarks for race, ethnicity, gender, and age (Table A-1).[17] Given this design, effects may not generalize to the U.S. population as a whole. Still, this particular sample is interesting and important: individuals in the focal states are swing voters cross-pressured by climate change and migration. This makes ours a hard case in which to detect positive effects of hurricane exposure on climate opinion.

From August 11–October 28, 2022, we fielded a weekly, cross-sectional survey (≈ 250 respondents) across these states.[18] This timeframe represents the historically most active period of hurricane season, and we (correctly) anticipated that our survey would be interrupted by a storm. Over the study's duration, we captured 3,202 respondents geolocated to the four states of interest. Following our pre-registration plan, we filtered out respondents who finished in the top and bottom deciles of survey duration, or who reported ages less than 18 or greater than 99. This left a final sample of 2,563 respondents. Figure 1 maps the

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[15]We discuss ethics in section A.2, where we also offer more details on Lucid's procedures. Section B describes our pre-analysis plan.

[16]Per our registration, we initially targeted respondents in Florida, Louisiana, and Texas. Our protocol indicated that when forecasts suggested possible landfall in additional states, we would add target areas to the sample. Based on Hurricane Ian's forecast tracks, we increased the sample size across target states, and added respondents in North Carolina.

[17]The main estimates are weighted to national census benchmarks. Figure A-7 confirms all results are robust whether estimates are unweighted or weighted to state-level benchmarks instead.

[18]Per our protocol, we increased the sample size to roughly 200 respondents per day in the days around Hurricane Ian.

distribution of these respondents.

Figure 1: Geographic Distribution of Survey Respondents
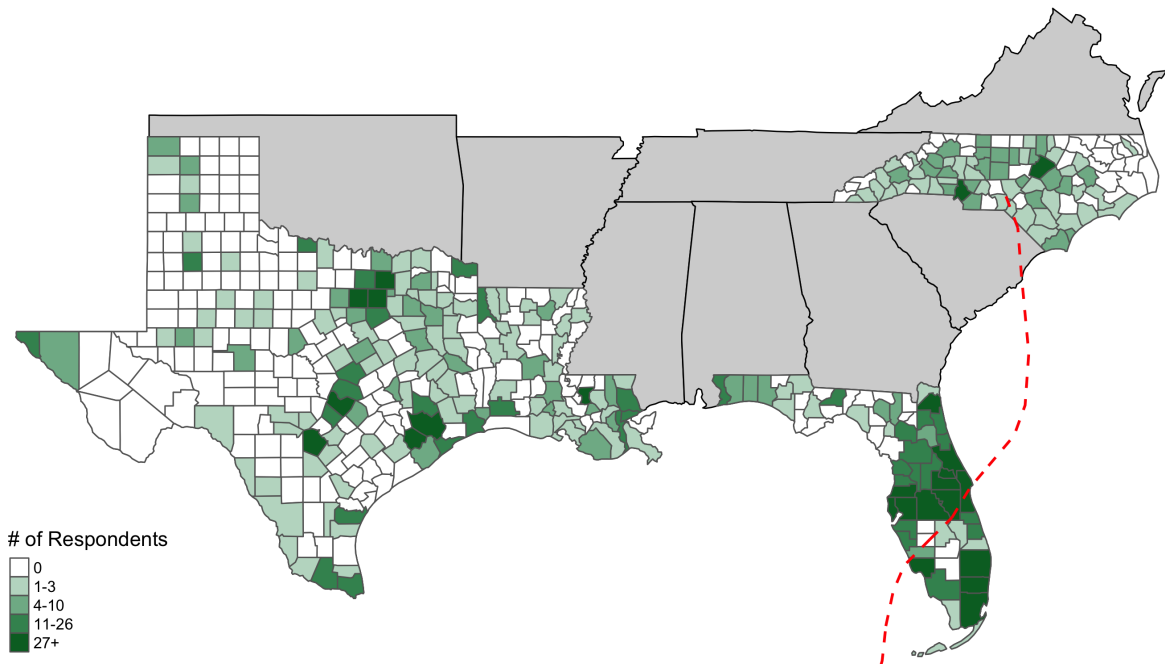
Note: The dashed red line marks Hurricane Ian's eyepath.

We also fielded an exploratory, follow-up survey from March 7–10, 2023. This follow-up was administered using the same specifications as the original survey, and was designed to measure the durability of Hurricane Ian's impacts. In the follow-up wave, we captured 847 respondents geolocated to the focal states. Applying the same filters on duration and age from the main sample gave a final follow-up sample of 715 respondents (Figure A-10).

In our surveys, respondents were first asked a demographic battery to gather information on relevant traits and beliefs. Subsequently, outcome variables were measured, with question order randomized across respondents. Appendix C reports the questionnaire. We study 27 items (Table 1) related to seven focal concepts of interest: (1) issue importance of climate migration ($\alpha = 0.57$); (2) policy action on climate migration ($\alpha = 0.74$); (3) issue importance of climate change ($\alpha = 0.72$); (4) policy action on climate change ($\alpha = 0.76$);

Table 1: Coding of Dependent Variables

Index	Constituent Items	Index	Constituent Items
Issue Importance of Climate Migration	Addressing Climate Migration is a Top Priority Climate Migration is a Serious Problem Climate Migration Will Have a Serious Impact During My Life	**Climate Change Mitigation Policies**	Carbon Tax Tax to Fund Clean Energy Restrictions on Fossil Fuel Extraction Stricter Fuel Efficiency Standards
Policy Action on Climate Migration	Tax Increase to Resettle Internal Climate Migrants Tax Increase to Resettle International Climate Migrants Vote for a Politician Who Promised to Address Climate Migration U.S. Should Do More to Help Climate Migrants International Community Should Do More to Help Climate Migrants	**Climate Change Adaptation Policies**	Protecting Military Bases from Climate Impacts Strengthening Coastlines Flood Retrofitting Raising Streets and Installing Pumping Stations Requiring Weather-Proofed Windows
Issue Importance of Climate Change	Addressing Climate Change is a Top Priority Climate Change is a Serious Problem Climate Change Will Have a Serious Impact During My Life	**Science of Climate Change**	Human Activities Cause Climate Change Climate Change Causes Hurricanes Climate Change Worsens Hurricanes
Policy Action on Climate Change	Tax Increase to Fund Programs to Reduce Climate Change Vote for a Politician Who Promised to Reduce Climate Change U.S. Should Do More to Help Climate Migrants International Community Should Do More to Help Climate Migrants		

Note: We measure respondent agreement with constituent item statements. We then aggregate these responses into corresponding indices using inverse covariance-weighting. Items are theoretically-linked to corresponding, indexed concepts. Principal component analyses lend confidence to the theoretically-motivated categorization scheme we employ by confirming items load on a common dimension.

(5) climate mitigation policies ($\alpha = 0.90$); (6) climate adaptation policies ($\alpha = 0.90$); and (7) belief in climate science ($\alpha = 0.70$). For each concept, we asked three to five questions designed to elicit theoretically-relevant opinions.[19] As specified in our pre-analysis plan, we combined related items into summary indices, which organize our findings and reduce multiple inference concerns. Each index is the average of standardized outcomes weighted by the inverse covariance matrix (Anderson, 2008).[20] Cronbach's α (reported above) and principal component analyses (Table A-13) confirm our indices are reliable and unidimensional.

Our survey did not include an experimental manipulation. Rather, we leverage a quasi-experiment posed by Hurricane Ian, which made landfall in Florida on September 28, 2022. Because the storm's exact track and severity were determined by meteorological conditions, Ian constitutes a plausibly exogenous shock to attitudes. Balance and equivalence tests (Figures A-1 – A-2) bolster this claim, revealing few demographic differences between hurricane-exposed and unaffected respondents. These tests offer encouraging evidence against selective

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[19]We analyze index items individually in Figure 4. These tests are inherently noisier and less powerful than our index-based tests (Anderson, 2008, p. 1484).

[20]Results with mean effects indices are substantively similar (Table A-14).

attrition, for instance as a result of differential, hurricane-induced out-migration.[21]

We define hurricane exposure at the county-level using microdata on Ian's eyepath, windswath, and storm surge (Figure 2), which we combine into an index.[22] We validate our exposure index in Figure 3, which shows our measure is highly-correlated with self-reported hurricane exposure, but not exposure to other climate disasters. A one standard deviation (sd) increase in exposure to Hurricane Ian increased self-reports of hurricane experience by 16-19 percentage points (pp). We also confirm that our hurricane exposure measure is associated with personal familiarity with hurricane-induced displacement (Table A-4). After Hurricane Ian, respondents in affected counties became 3.2pp more likely to report knowing someone who had moved because of a hurricane.

Our difference-in-differences approach compares respondent attitudes in exposed and unexposed counties before and after landfall. The identifying assumption is that in the absence of Hurricane Ian, exposed and unaffected counties would experience common trends in outcomes. In Figures A-3 – A-4 we provide graphical evidence of parallel pre-trends in event studies. That outcomes are consistently parallel in the pre-treatment period builds confidence in the design. Formally, we estimate a least-squares equation:
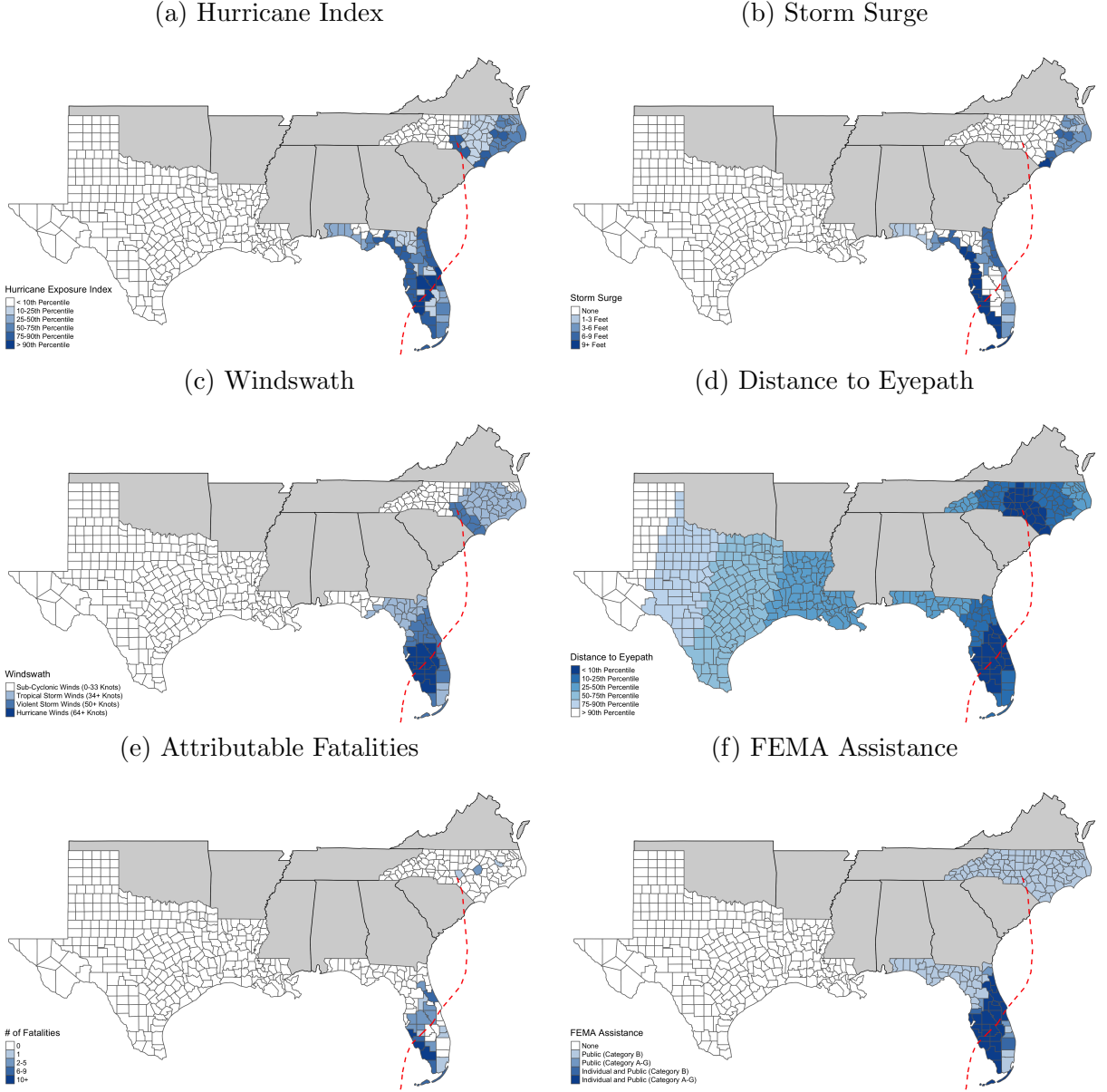
$$Y_{i,c,t} = \alpha_c + \beta_t + \delta(\text{Hurricane Exposure}_c) \times (\text{Post}_t) + \gamma(X_i) + \epsilon$$

where i indexes respondents, c indexes counties, and t indexes the survey date. $Y_{i,c,t}$ are

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[21] We study hurricane-induced displacement in Figure A-5. One potential cause for concern is that more climate-skeptic respondents were displaced by Hurricane Ian. We are sanguine that this is not the case for two reasons. First, given the close correlation between climate skepticism, partisanship, and education in the U.S. (McCright and Dunlap, 2011), we would expect post-storm imbalances on partisanship (more Democrats) and education (more highly educated) if climate-skeptic respondents attrited. Second, Riad, Norris and Ruback (1999) show a plurality of non-evacuees from Hurricanes Hugo and Andrew cited anti-science (e.g., disbelieving storm forecasts) reasons for remaining. This suggests hurricanes are more likely to displace pro-climate than climate-skeptic individuals, which would bias against our findings.

[22] Results are robust to different operationalizations of exposure (Tables A-8 – A-12). Because exposure varies across counties, not respondents, effects are interpretable as county-level average shifts. Substantively, increasing hurricane exposure one standard deviation from the median corresponds with moving from an unaffected county to a county with tropical storm-force winds and 3-6 feet of storm surge.

Figure 2: Mapping Hurricane Ian

(a) Hurricane Index

(b) Storm Surge

(c) Windswath

(d) Distance to Eyepath

(e) Attributable Fatalities

(f) FEMA Assistance

Note: In panel (a), bins represent percentiles of the hurricane exposure index for values greater than the minimum of the index. The dashed red line marks the eyepath of Hurricane Ian.

climate attitudes, α_c are county fixed effects, β_t are date fixed effects, and X_i is a vector of individual-level covariates. We interact Hurricane Exposure$_c$, a time-invariant measure of county-level storm severity, with Post$_t$, an indicator for dates on or after landfall. Consti-

Figure 3: Validating the Hurricane Exposure Measure
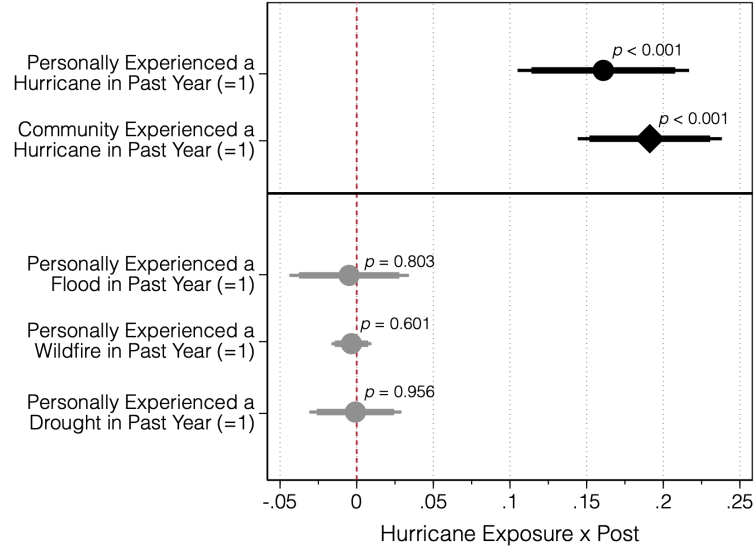
Note: Bars are 90 and 95% confidence intervals. Exposure is a continuous, z-standardized index combining information on Hurricane Ian's eyepath, windswath, and storm surge. Estimations include covariates from Table 2. The dashed red line marks 0. Full tabular results are in Tables A-2 – A-3.

tutive terms of the interaction do not appear separately because they are fully absorbed by county and time fixed effects.[23] The coefficient δ captures the extent to which Hurricane Ian induced a differential change in attitudes in exposed counties relative to counties unaffected by Hurricane Ian. This estimate represents the causal effect of Hurricane Ian exposure on climate attitudes. ϵ are heteroskedasticity-robust, county-clustered standard errors. Estimates are scaled using sampling weights.[24]

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[23]County fixed effects (α_c) absorb the constitutive term Hurricane Exposure$_c$, and date fixed effects (β_t) absorb the constitutive term Post$_t$.

[24]Sampling weights are constructed by entropy balancing on national benchmarks for age, gender, race, education, and partisanship. Unweighted estimates and estimates weighted to demographic benchmarks of the sampled states are substantively similar (Figure A-7).

Results

Our survey returns a rich set of results, which corroborate our core expectations. In Table 2 we present the main findings across our seven focal outcomes. The hurricane exposure index and all outcome indices are z-standardized, so effects are readily interpretable as standard deviation shifts. We observe large, distinguishable positive effects of hurricane exposure on pro-climate attitudes. All covariates are in the expected direction, increasing confidence in our specifications. Moreover, the effects of hurricane exposure we document are substantively important compared with demographic traits known to shape Americans' climate attitudes, like partisanship, education, age, and gender.

Table 2: Hurricane Exposure and Climate Attitudes

	Climate Migration		Climate Change		Climate Change Policies		Science of Climate Change
	(1) Issue Importance	(2) Policy Action	(3) Issue Importance	(4) Policy Action	(5) Mitigation	(6) Adaptation	(7) Science
Hurricane Exposure x Post	0.097***	0.100***	0.127***	0.115***	0.099**	0.117**	0.144***
	(0.034)	(0.038)	(0.036)	(0.041)	(0.042)	(0.050)	(0.033)
Republican	-0.071	-0.208***	-0.371***	-0.327***	-0.124	0.078	-0.218***
	(0.060)	(0.060)	(0.070)	(0.071)	(0.084)	(0.073)	(0.078)
Democrat	0.387***	0.564***	0.421***	0.525***	0.534***	0.508***	0.458***
	(0.056)	(0.045)	(0.061)	(0.068)	(0.087)	(0.081)	(0.079)
Woman	-0.050	-0.128**	0.008	-0.051	-0.127***	-0.087*	-0.066
	(0.043)	(0.049)	(0.048)	(0.046)	(0.041)	(0.046)	(0.042)
High School Graduate	0.153	0.086	0.146	0.307***	0.013	0.164	0.167
	(0.098)	(0.128)	(0.110)	(0.116)	(0.131)	(0.146)	(0.107)
College Graduate	0.174	0.255**	0.222**	0.461***	0.077	0.173	0.236*
	(0.113)	(0.113)	(0.109)	(0.120)	(0.124)	(0.142)	(0.121)
Age	-0.004**	-0.014***	-0.004**	-0.006***	-0.017***	-0.015***	-0.011***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.002)
Observations	2563	2563	2563	2563	2563	2563	2563
AIC	6730.863	6352.160	6538.499	6479.597	6340.321	6550.146	6557.760
Exposure Measure:	Index	Index	Index	Index	Index	Index	Index
PARAMETERS							
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Date of Survey FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: * p <.10, ** p <.05, *** p <.01. Robust, county-clustered standard errors are in parentheses. Post is an indicator for all dates on or after September 28, 2022, when Hurricane Ian made landfall. Exposure is a continuous, z-standardized index combining information on Ian's eyepath, windswath, and storm surge. Estimates are scaled using sampling weights.

Results in columns 1-2 bear on hypothesis 1—the effect of hurricane exposure on climate migration attitudes. We estimate that a one standard deviation increase in exposure to Hurricane Ian increased the perceived issue importance of climate migration (0.097sd), and endorsement of policy action to support climate migrants (0.1sd). In the ten most-affected counties in our sample—home to 3.3 million swing voters in two electorally-important states—respondents' perceived issue importance of and support for policy action on climate migration increased nearly one-third of a standard deviation after Hurricane Ian, relative to respondents in unaffected counties.[25] Demographic covariates can also help us interpret the substantive importance of Hurricane Ian. Intuitively, Democrats attach more importance to climate migration (0.387sd) and are more supportive of policy action to assist climate migrants (0.564sd). These estimates accord with ample evidence on Democrats' pro-climate (Egan and Mullin, 2017) and pro-migrant attitudes (Hainmueller and Hopkins, 2014). Hurricane Ian's impact on climate migration beliefs is substantively meaningful given the importance of party identification—the storm's effect was 17–25% as large as the effect of Democratic partisanship.

In columns 3-7 we test hypothesis 2, examining broader climate attitudes. Consistent with work documenting a positive impact of climate disasters on support for climate action (e.g., Egan and Mullin, 2012; Bergquist and Warshaw, 2019), we find that a one standard deviation increase in exposure to Hurricane Ian increased the perceived importance of climate change (0.127sd) and support for climate policy action (0.115sd). In terms of specific climate policies, Ian mobilized support for mitigation (0.099sd) and adaptation measures (0.117sd). We also find that a one standard deviation increase in storm exposure increased belief in climate science (0.144sd). In the ten most-affected counties, Hurricane Ian catalyzed respondents' pro-climate opinion by 0.31–0.45sd across these outcomes, relative to respon-

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[25]The ten most-affected counties in our sample are Lee, Charlotte, Brevard, Highlands, Osceola, and Polk in Florida; and Moore, Richmond, Robeson, and Scotland in North Carolina.

dents in unexposed counties. Compared to Democratic partisanship, the effects of hurricane exposure are striking. Across these outcomes, Ian's effect was 19–31% as large as the effect of Democratic identification. Given how difficult it is to shift Americans' partisan-rooted climate attitudes (McCright and Dunlap, 2011), this is a noteworthy finding, and illustrates the intensity of hurricane experience.
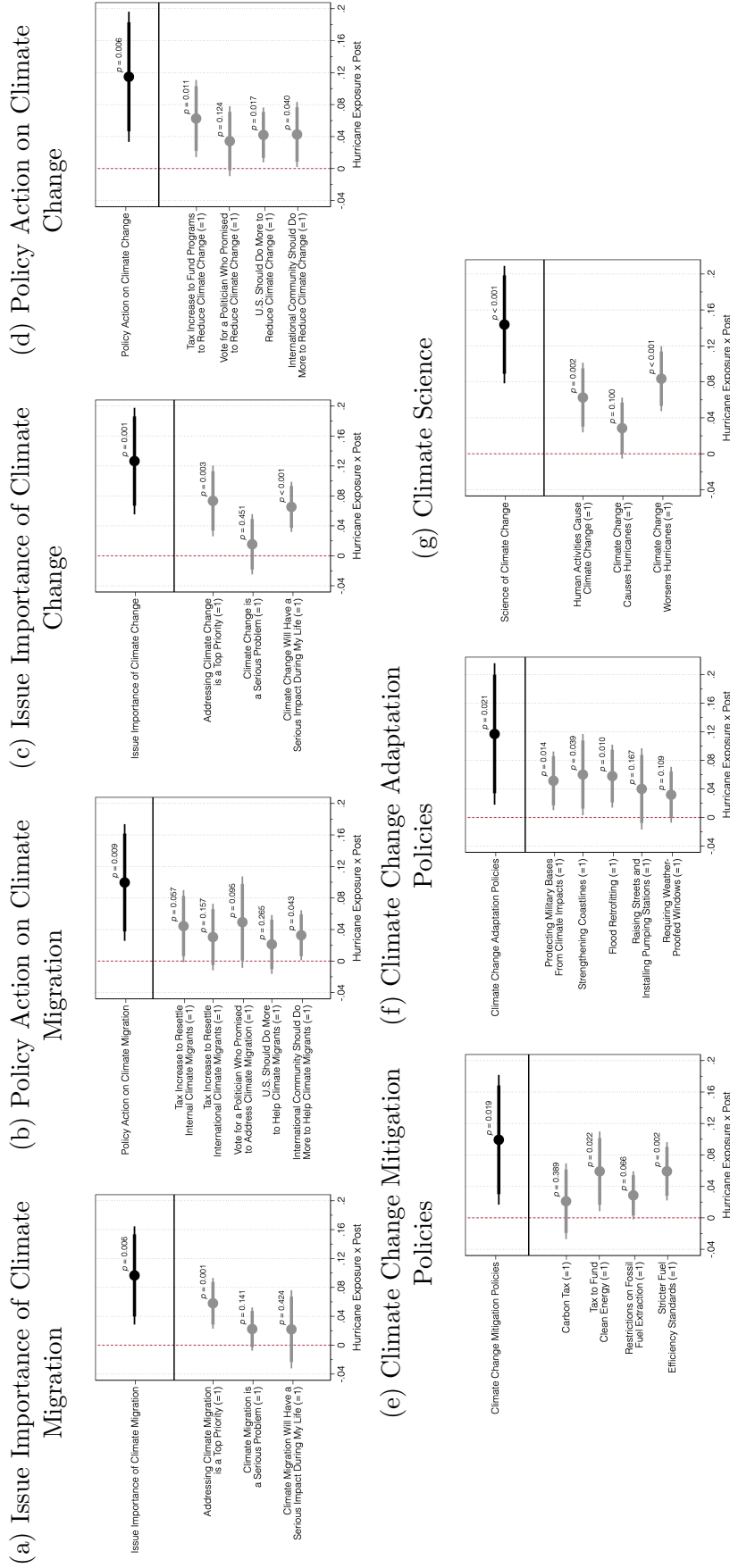
Constituent Items

Our primary dependent variables are composite indices that aggregate many individual survey items into theoretically-relevant concepts. These indices afford several advantages, including mitigating multiple inference concerns (Anderson, 2008, p. 1484). Nevertheless, we recognize that items comprising our indices may themselves be substantively interesting. Taking the same specifications described in Table 2, we examine constituent items and depict results in Figure 4. In all panels, black estimates represent the benchmark index effects from Table 2, while gray estimates denote effects of hurricane exposure on constituent items. All items are coded dichotomously, so gray estimates are interpretable as percentage point shifts.

In panels 4a – 4b we study climate migration outcomes. A one standard deviation increase in hurricane exposure increased respondent perceptions that addressing climate migration was a top priority (5.8pp). Hurricane Ian also made respondents more supportive of tax increases to resettle internal climate migrants (4.4pp), more favorable toward politicians who promised to help climate migrants (4.9pp), and more supportive of international cooperation to assist climate migrants (3.3pp). In sum, we find robust evidence that Hurricane Ian mobilized favorable attitudes on climate displacement, heightening its salience and support for costly policies to benefit the climate-displaced.

Panels 4c – 4f study the impacts of hurricane exposure on items that comprise the main climate change indices. Hurricane Ian increased agreement that addressing climate change

Figure 4: Hurricane Exposure and Climate Attitudes

(a) Issue Importance of Climate Migration

(b) Policy Action on Climate Migration

(c) Issue Importance of Climate Change

(d) Policy Action on Climate Change

(e) Climate Change Mitigation Policies

(f) Climate Change Adaptation Policies

(g) Climate Science

Note: Bars are 90 and 95% confidence intervals. Estimates show the effect of hurricane exposure on attitudes. Exposure is a continuous, z-standardized index combining information on Hurricane Ian's eyepath, windswath, and storm surge. Black markers denote focal indices, while gray markers denote constituent indicator variables that comprise each index. Black estimates are scaled such that effects are interpretable as standard deviation shifts. Gray estimates are scaled such that effects are interpretable as percentage point shifts. Estimations include covariates from Table 2. The dashed red line marks 0. Full tabular results are in Tables D-8 – D-14.

is a top priority (7.3pp) and perceptions that climate change has serious impacts (6.5pp). Exposure also increased support for tax increases to address climate change (6.3pp), and agreement that the U.S. (4.2pp) and international community (4.3pp) should do more to reduce climate change. In terms of mitigation, hurricane-exposed respondents became more supportive of clean energy investments (5.9pp), restrictions on fossil fuel extraction (2.9pp), and tighter fuel efficiency standards (5.9pp). On adaptation, Hurricane Ian increased support for climate-proofing military bases (5.1pp), strengthening coastlines (6pp), and flood retrofitting (5.8pp). Finally, panel 4g reveals that hurricane exposure increased acknowledgment of climate change's anthropogenic causes (6.3pp) and the link between climate change and hurricane severity (8.4pp).

Political Behavioral Impacts

One natural concern is that our main estimates represent effects of Hurricane Ian on respondents' opinions, but not political behavior. Indeed, extant work on disaster exposure tends to study attitudinal or behavioral consequences in isolation (e.g., Deryugina, 2013; Visconti, 2022). Analyses that bridge this divide offer a path forward for understanding total effects of climate disasters. Did Hurricane Ian's mobilizing effect on pro-climate opinion shape real-world behavior of the storm's victims?

To explore this question, we exploit a novel opportunity in Florida, the state most severely-impacted by Ian. Florida's general election was held on November 8, 2022, roughly five weeks after Hurricane Ian made landfall, and one week after our initial survey ended. We assemble official data on ballot initiatives and candidate voteshare for the cross-section of Florida counties in the 2022 general election to offer descriptive evidence on hurricane exposure and voting.[26] Formally, we estimate:

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[26] These analyses are exploratory, and were not pre-registered.

$$Y_c = \alpha_e + \delta(\text{Hurricane Exposure}_c) + \gamma(X_c) + \epsilon$$

where c indexes counties, and e indexes emergency commands—the multi-county regions within which hurricane response was organized by the Florida government. Y_c are vote outcomes, α_e are emergency command fixed effects, and X_c is a vector of county-level covariates. The coefficient δ captures the correlation between county-level hurricane exposure and general election voting. ϵ are heteroskedasticity-robust, county-clustered standard errors.

When Florida voters went to the polls, they considered three legislatively-referred state constitutional amendments, including one climate-related proposal. Specifically, voters were asked to approve an amendment that would prohibit tax assessors from taking flood-proofing improvements into consideration when determining assessed property values.[27] This proposal represented a tax break for homeowners invested in flood mitigation. The amendment required a 60% supermajority to pass, and ultimately failed.

Table 3: Hurricane Exposure and Voting on Florida Ballot Initiatives

|	% Approve Flood Mitigation Tax Break			Supermajority for Flood Mitigation Tax Break (=1)			Supermajority for Other Ballot Initiatives (=1)	
	(1) Voteshare	(2) Voteshare	(3) Voteshare	(4) Supermajority	(5) Supermajority	(6) Supermajority	(7) Commission	(8) Homestead
Hurricane Exposure	0.009***	0.008***	0.005**	0.109***	0.114***	0.085***	0.041	0.058
	(0.002)	(0.002)	(0.002)	(0.023)	(0.023)	(0.028)	(0.030)	(0.040)
Observations	67	67	67	67	67	67	67	67
AIC	-242.649	-245.552	-288.569	57.811	59.445	42.853	-1.157	64.941
Exposure Measure:	Index	Index	Index	Index	Index	Index	Index	Index
PARAMETERS								
Trump Won in 2020	No	Yes	Yes	No	Yes	Yes	Yes	Yes
2022 Primary Turnout	No	Yes	Yes	No	Yes	Yes	Yes	Yes
Emergency Command FE	No	No	Yes	No	No	Yes	Yes	Yes

Note: * p <.10, ** p <.05, *** p <.01. Robust, county-clustered standard errors are in parentheses. Exposure is a continuous, z-standardized index combining information on Ian's eyepath, windswath, and storm surge. Full tabular results are in Table A-6.

However, as revealed in Table 3, hurricane exposure had an important influence on

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[27]Other amendments proposed abolishing the Florida Constitution Revision Commission and extending the Homestead property tax exemption for public service workers.

climate-related voting. A one standard deviation increase in exposure to Hurricane Ian correlated with a 0.5-0.9pp increase in voteshare for the tax break. In terms of the supermajority threshold, severely-affected counties were 8.5-11.4pp more likely to reach 60% approval. These results dovetail with extant evidence on pro-environmental voting (Hazlett and Mildenberger, 2020; Baccini and Leemann, 2021), and with our survey-based finding that Ian caused increasing support for climate adaptation, and specifically flood retrofitting. Moreover, the effect of hurricane exposure on support for ballot initiatives was specific to the climate-related amendment voters considered. Columns 7-8 of Table 3 show that Hurricane Ian had no distinguishable impact on the likelihood of a county passing other amendments.

Figure 5: Hurricane Exposure and Voting in Florida
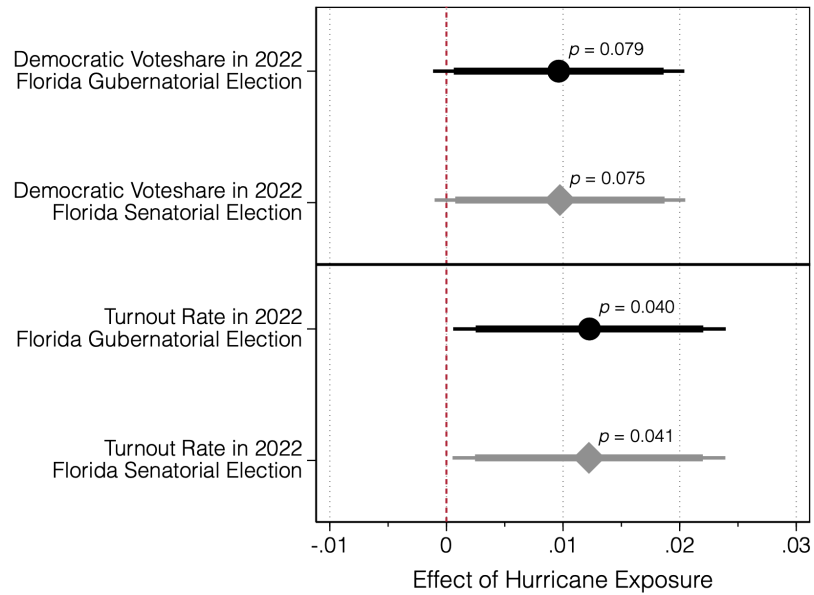
Note: Bars are 90 and 95% confidence intervals. Estimates show the correlation between hurricane exposure and voting. Exposure is a continuous, z-standardized index combining information on Hurricane Ian's eyepath, windswath, and storm surge. Black markers denote gubernatorial voting, while gray markers denote U.S. Senatorial voting. Estimations include covariates from column 3 of Table 3. The dashed red line marks 0. Full tabular results are in Table A-7.

Apart from shaping ballot measure voting, we also consider the association between

hurricane exposure and candidate voteshare (Garside and Zhai, 2022; Visconti, 2022). During Florida's election, the two major races were for state governor and U.S. Senator. In the gubernatorial contest, incumbent Republican Ron DeSantis voiced climate-skeptic and anti-immigrant views, while challenger Democrat Charlie Crist touted his pro-environment record. Similar dynamics unfolded in the Senatorial race between Republican Marco Rubio and Democrat Val Demings. Given DeSantis's and Rubio's climate-skeptic stances, pro-climate Florida voters should exhibit a Democratic preference. We confirm this relationship in the top panel of Figure 5, which depicts the correlation between hurricane exposure and Democratic voteshare. A one standard deviation increase in county-level exposure to Hurricane Ian was associated with a 1pp increase in Democratic voteshare in the gubernatorial and Senatorial elections. The bottom panel of Figure 5 probes a potential mechanism underlying this effect—political mobilization of pro-climate voters. We find that Hurricane Ian exposure was correlated with a 1.2pp increase in voter turnout in the general election, suggesting the storm fostered (pro-climate) political engagement in affected counties.

Robustness

Returning to our main attitudinal results, we probe robustness in a variety of additional specifications, all of which corroborate the large, positive effect of Hurricane Ian on climate opinion. In Tables A-8 – A-12 we explore a number of alternative measures of hurricane exposure, including components of our index (e.g., windswath, storm surge) and a binary decomposition of the index, which takes a value of 1 for counties above the median and 0 otherwise. Whereas our main index captures the county-level *intensity* of Hurricane Ian, this binary measure averages over substantive, scale effects of hurricane severity.

Second, in Tables A-13 – A-14 we verify that similar results emerge using alternative outcome indices constructed by principal component analysis or by averaging constituent

items. Third, we confirm that the estimates hold while matching hurricane-exposed and un-exposed respondents on demographic covariates (Table A-15). Fourth, while the regressions include pertinent controls, we confirm that the estimated effects are robust to incorporating a broader array of covariates, like race and religiosity (Table A-16). Fifth, we find that the main effects are robust to alternative error clustering (Tables A-17 – A-18), sampling weights (Figure A-7), and estimators (Table A-19).

For omitted time-varying variables to bias our estimates, they must vary daily across counties. Three relevant confounders stand out: local politics, migration, and hurricane-induced displacement. We lack daily information on these covariates, so instead draw on pre-treatment measures. In Table A-20 we incorporate these pre-hurricane, county-level controls flexibly by interacting them with date fixed effects. To capture local politics we take the county-level Republican voteshare from the 2020 Presidential election. To capture migration trends we take 2021 county-level net migration rate. To capture hurricane-related displacement, we study data from Waze, a traffic-mapping application. Before Ian, Waze partnered with the Florida government to track evacuation-related road hazards. We use these data to estimate the population-normalized intensity of hurricane-induced traffic before landfall. Results are robust to accounting for these potential confounders.

A number of supplemental tests also extend our core analyses. In Table A-21 we exploit Hurricane Ida, the strongest hurricane of 2021, as a placebo. Hurricane Ida made landfall in Louisiana a year before our survey, and caused significant damage from coastal Texas to the Florida Panhandle. Counties exposed to Ida should be similar to counties exposed to Ian, but we should not observe an effect of Ian on areas previously impacted by Ida. Re-estimating the core specifications while studying Ida exposure confirms this. Additionally, in Figure A-9 we test whether the main effects decay monotonically with distance from Hurricane Ian's eyepath. Although hurricanes affect large areas—Hurricane Ian reached a maximum diameter of 500 miles—their destructive power is greatest along the eyepath. Work

by Hazlett and Mildenberger (2020) finds climate disasters often have highly-localized pro-climate effects. We find that most effects are large and precise in counties along Hurricane Ian's eyepath, but decay by 100-500 miles of distance from the eyepath. These tests bolster evidence that the storm's destructive impacts drove pro-climate attitudinal effects.

Heterogeneous Effects

Do the effects of Hurricane Ian vary across demographic subgroups? Identifying how key traits moderate the impact of hurricane exposure is central for understanding the mechanisms by which climate disasters shape attitudes, and for understanding how political coalitions for pro-climate policymaking might be formed after disasters. We pre-registered tests for hetero-geneous effects across many theoretically-relevant dimensions, and focus on two particularly crucial traits—partisanship and income—in Table 4.[28]

In the top panel of Table 4 we study how respondent partisanship shapes responsiveness to Hurricane Ian. To do so, we repeat the core specifications from Table 2, while subsetting the sample to Democrats and Republicans respectively. Recent work suggests that disasters only induce pro-climate behavior in Democratic areas (Hazlett and Mildenberger, 2020). In contrast, we find little systematic evidence of heterogeneity by individual partisanship. Republicans' and Democrats' attitudes on climate migration and climate change are equally responsive to hurricane exposure. The only heterogeneous effect we document is greater responsiveness of Republicans' beliefs in climate science: whereas exposure to Hurricane Ian had virtually no effect on Democrats' beliefs in climate science, a one standard deviation increase in exposure increased Republicans' beliefs by 0.22sd. This likely owes to a ceiling effect among Democrats, whose baseline belief in climate science is much greater than that

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[28]Tables A-22 – A-26 study heterogeneity in the effect of Hurricane Ian by gender, education, age, past disaster exposure, race, religiosity, empathy, home ownership, migration status, and strength of community ties. In addition to these pre-registered tests, we also conduct exploratory tests for heterogeneity by county-level Republican voteshare in the 2020 presidential election, and by county-level migration rate in 2021.

Table 4: Heterogeneous Effects of Hurricane Exposure on Climate Attitudes

	Panel A: Heterogeneity by Partisanship						
	Climate Migration		Climate Change		Climate Change Policies		Science of Climate Change
	(1) Issue Importance	(2) Policy Action	(3) Issue Importance	(4) Policy Action	(5) Mitigation	(6) Adaptation	(7) Science
Democrats (n = 897)	0.100 (0.073)	0.087* (0.052)	0.093 (0.058)	0.102 (0.071)	0.155** (0.066)	0.185** (0.075)	0.006 (0.071)
Republicans (n = 883)	0.071 (0.063)	0.077 (0.057)	0.136** (0.053)	0.101 (0.063)	0.079 (0.053)	0.058 (0.068)	0.220*** (0.043)
Difference	**0.029** **(0.097)**	**0.011** **(0.077)**	**-0.042** **(0.079)**	**0.001** **(0.095)**	**0.076** **(0.085)**	**0.128** **(0.101)**	**-0.214**** **(0.083)**

	Panel B: Heterogeneity by Income						
	Climate Migration		Climate Change		Climate Change Policies		Science of Climate Change
	(1) Issue Importance	(2) Policy Action	(3) Issue Importance	(4) Policy Action	(5) Mitigation	(6) Adaptation	(7) Science
Low Income (n = 1250)	0.120** (0.056)	0.143** (0.063)	0.234*** (0.042)	0.204*** (0.056)	0.168*** (0.047)	0.216*** (0.075)	0.262*** (0.051)
High Income (n = 1185)	0.027 (0.060)	0.003 (0.051)	0.018 (0.067)	0.008 (0.053)	-0.015 (0.055)	-0.061 (0.041)	-0.014 (0.040)
Difference	**0.093** **(0.082)**	**0.139*** **(0.081)**	**0.216**** **(0.078)**	**0.196**** **(0.077)**	**0.183**** **(0.073)**	**0.277**** **(0.087)**	**0.276**** **(0.065)**

PARAMETERS							
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Date of Survey FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Demographic Covariates	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: * $p < .10$, ** $p < .05$, *** $p < .01$. Robust, county-clustered standard errors are in parentheses. Post is an indicator for all dates on or after September 28, 2022, when Hurricane Ian made landfall in the United States. Exposure is a continuous, z-standardized index combining information on Hurricane Ian's eyepath, windswath, and storm surge. Demographic covariates are partisanship, education, gender, and age. Estimates show the effect of Hurricane Exposure x Post in sub-samples defined by the respective trait denoted in the panel title. Full tabular results are in Tables A-22 and A-25.

of Republicans. In general, then, we find evidence that the pro-climate impacts of Hurricane Ian cross-cut partisanship.[29] Pro-environment views may be mobilized on both sides of the

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[29]We extend these tests in Table A-26, where we consider county-level rather than individual-level partisanship. These tests are exploratory and less informative than our tests using respondent partisanship. In particular, tests for partisan heterogeneity using county-level voteshares cannot be solely attributed to partisan preferences. Many other factors correlated with Republican voteshare—like income and race—also vary across counties that Trump won or lost in 2020. The effects of Hurricane Ian on climate migration issue importance and policy action, and climate change issue importance were greater in counties that Trump lost in 2020. Still, we find no evidence of partisan heterogeneity for the majority of outcomes using county-level

aisle following large-scale climate disasters.

In the bottom panel of Table 4 we study how respondent income shapes responsiveness to Hurricane Ian. For these tests we split the sample at the median of income, and repeat the core specifications from Table 2 for low- and high-income subsamples. Considering income differences in the effect of climate disasters is critical for three reasons. First, the world's poor are disproportionately climate-vulnerable, facing heightened food insecurity and physical risk from extreme weather (Hallegatte, 2015). Second, as a consequence of their disproportionate vulnerability, low-income people face the greatest climate-related migratory pressures (Rigaud, 2018), but are least able to afford displacement to climate-resilient communities. For instance, during hurricanes, low-income individuals are less able to afford evacuating, and more likely to rely on public shelters for housing assistance (Riad, Norris and Ruback, 1999). Third, as a result of sociotropic, nativist concerns, poor climate migrants face the staunchest backlash from receiving communities (Marotzke, Semmann and Milinski, 2020).

We find that compared with high-income respondents, low-income respondents' climate attitudes are consistently more responsive to hurricane exposure. A one standard deviation increase in exposure to Hurricane Ian increased low-income respondents' pro-climate opinions by 0.12–0.26sd across all outcomes. The difference in effect sizes between low- and high-income respondents is large and distinguishable for six of seven core outcomes. Together, these findings are strongly suggestive of rational retrospection. Climate disasters are most impactful in shaping beliefs of individuals most vulnerable to climate change, least able to afford moving from severely-impacted areas, and most reliant on public assistance in the event of displacement.

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voteshares.

Effect Persistence

Are the effects of hurricane exposure durable? Previous work suggests climate disasters have short-lived consequences (Egan and Mullin, 2012; Konisky, Hughes and Kaylor, 2016). As discussed above, one prominent explanation for temporal decay in disasters' effects is recency bias (Kahneman, Slovic and Tversky, 1982). Climate disasters may mobilize a rapid spike in pro-climate opinion in the short-run before new developments attenuate their catalyzing effects, causing attitudes to revert to baseline levels. Yet, Hurricane Ian was a devastating storm with lingering infrastructural impacts. The intensity of storm damage in Ian-affected counties could render the main effects durable.

Our original survey ran for four weeks after Hurricane Ian made landfall, allowing us to probe short-run effect persistence. Event study estimates (Figures A-3 – A-4) reveal that the main effects of interest all persisted for at least the first month after landfall. Our political behavioral results (Table 3, Figure 5) also comport with this finding. Florida voters in counties more severely-impacted by Hurricane Ian were more supportive of pro-climate proposals and candidates in the general election five weeks after landfall.

To further assess effect persistence, we fielded an exploratory follow-up survey in March 2023 (Figure A-10), roughly six months after Hurricane Ian. Results from this follow-up are depicted in Figure 6, alongside baseline estimates from Table 2. Corresponding with previous studies, we find that the effects of hurricane exposure attenuate in our follow-up survey.[30] Whereas the main effects were large and precise for at least one month after Hurricane Ian, all effects of hurricane exposure become null by six months post-storm. Our design is unable to reveal precisely when the effects of Hurricane Ian attenuated between our original and follow-up surveys, but the relatively short-lived effects we document accord with existing findings on climate attitudes (e.g., Egan and Mullin, 2012) and recency bias (e.g., Nordhaus,

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[30]Table A-28 confirms the effects hold when follow-up respondents are included in the main sample.

Figure 6: Effects of Hurricane Exposure in a Six-Month Follow-Up
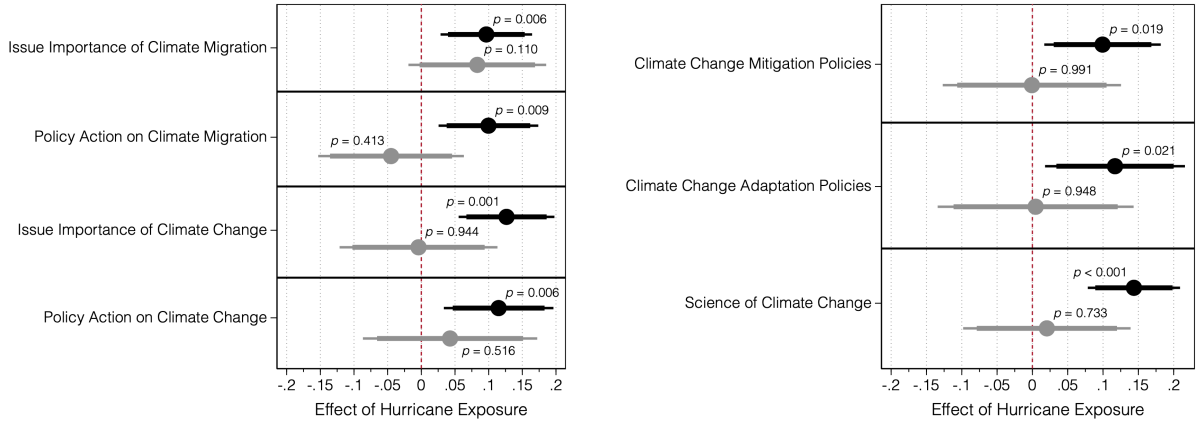
Note: Bars are 90 and 95% confidence intervals. Exposure is a continuous, z-standardized index combining information on Hurricane Ian's eyepath, windswath, and storm surge. Black markers denote estimates from the main sample (Table 2). Gray markers are coefficients from the follow-up sample fielded in March 2023, and represent the correlation between hurricane exposure and attitudes. Estimations include covariates from Table 2. The dashed red line marks 0. Full tabular results are in Table 2 (black estimates) and Table A-27 (gray estimates).

1975). Probing precisely how durable effects of disaster exposure are remains an important avenue for future research.

We also explore heterogeneity in effect persistence.[31] Two especially relevant dimensions that could impact the durability of Ian's effects are the occurrence of additional disasters, and provision of post-disaster relief. To assess the first possibility we study how exposure to a subsequent, late-season hurricane—Nicole—moderated Ian's effects. Hurricane Nicole made landfall in Florida on November 10, 2022, two weeks after our initial survey ended. Although Nicole was a much weaker storm than Ian, it impacted similar areas, affecting portions of Florida and North Carolina (Figure A-11). Multiple disaster exposure could magnify the effects of Hurricane Ian by reinforcing the pressing need for climate mitigation, or blunt effects of Ian by distracting public attention (Arndt, Jensen and Wenzelburger,

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[31]Statistical power is limited given the smaller sample size of our follow-up survey.

2021) and muting climate risk perceptions among doubly-victimized populations (Leppold et al., 2022). In Table A-29 we find suggestive evidence of the latter. The persistence of Hurricane Ian's pro-climate effects is greater among respondents exposed to Hurricane Ian but not Hurricane Nicole than among respondents exposed to both storms.

To test how post-storm aid shaped the persistence of Hurricane Ian's effects, we assemble data on individual and public assistance distributed by the Federal Emergency Management Agency (FEMA) in areas impacted by Hurricane Ian. At the time of our follow-up survey, FEMA had already disbursed more than $1.5 billion in relief to Ian's victims. We lack information on whether respondents themselves had received assistance, but define an indicator for counties that had received federal aid by the time of our follow-up. Disaster relief may foster effect persistence by generating voter gratitude (Bechtel and Hainmueller, 2011), or it may undermine effect persistence by inducing beneficiaries to focus myopically on recovery over mitigation (Healy and Malhotra, 2009). Disaster relief that enables victims to remain in their original communities, for instance by funding home repairs, may also undercut specific support for policies to benefit climate migrants. Climate-induced migratory pressures are greater for individuals exposed to hurricanes and who have not received federal relief that could make staying feasible.[32] Consistent with this logic, Table A-30 reveals that the positive effect of Hurricane Ian on climate migration attitudes was longer-lasting for respondents in counties that had yet to receive federal relief. This finding underscores a tradeoff for pro-environment policymakers responding to disasters—providing relief aid improves victims' welfare but potentially undermines the durability of disasters' pro-climate effects.

We leverage rich demographic data from our follow-up survey—as in Table 4—to further consider whether effects are more durable among various population subgroups (Tables A-31 – A-35). These tests reveal scant evidence of heterogeneity in the persistence of Hurricane

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[32]In our follow-up sample, the effect of Hurricane Ian on respondent perceptions that climate change increased their future likelihood of moving was 14.9pp greater (p-value = 0.096) for those in counties that had not received disaster relief than those in counties that had received relief.

Ian's effects across demographic traits. In sum, we find relatively short-lived effects of Hurricane Ian on victims' climate attitudes. This suggests that while climate disasters open brief windows for policy action on climate migration and climate change, political opportunities are fleeting. Public officials interested in climate mitigation may be able to advance the pro-climate agenda by seizing on public favorability in the aftermath of disasters; however, policymaking timelines are often slower than disaster-induced surges of mass support. Discordance between electoral timetables and windows-of-favorability around disasters constrain prospects for major climate policy advances as a result of climate disasters. Still, pro-environment policymakers may be able to leverage favorable public opinion. As our behavioral results (Table 3; Figure 5) suggest, climate disasters can mobilize pro-climate voters and benefit pro-climate candidates when they occur in temporal proximity to elections. Policymakers should also take repeat disasters and post-disaster relief into consideration, and target population subgroups for whom disasters have longer-lasting effects. Communities with single (rather than multiple) disaster exposure, and that do not receive post-disaster relief, represent one potential pro-climate coalition.

Conclusion

Public attitudes on climate migration and climate change bear crucially on policymaking in the U.S. In particular, popular opinion shapes the prospects for integrating climate-displaced people into host communities, and the feasibility of political progress on climate mitigation. The scale of climate displacement is large and growing, yet, the microfoundations of climate migration beliefs remain poorly understood. Existing evidence suggests that these beliefs are distinct from broader climate or migration attitudes (Arias and Blair, 2022), making opinion on climate migration theoretically-interesting and empirically-relevant. We advance scholarship by offering a unified framework for understanding how climate disasters shape

attitudes on climate change and climate migration. To the best of our knowledge, ours is the first study to consider how disasters—the leading cause of climate-related displacement worldwide—impact relevant mass beliefs.

We specifically study how a severe climate disaster, Hurricane Ian, shaped public opinion in the Republican-dominated American South. Our study focuses on attitudes in four Southern swing states, where climate-skeptic and anti-immigrant politics intersect, and where voters are cross-pressured by climate change and migration. Using a pre-registered, quasi-experimental design, we find that climate disasters mobilize favorability toward climate migrants and support for tackling climate change. In counties more severely impacted by Hurricane Ian, respondents became more supportive of policies to assist the climate-displaced, more supportive of policy action to mitigate climate change, and more willing to acknowledge core tenets of climate science. These attitudinal effects also appear to translate to political behavior. Exposure to Hurricane Ian was correlated with support for pro-climate proposals and candidates in Florida's 2022 general election. Together, these results are consistent with rational, rather than "blind," retrospection among disaster-affected populations. Experience of Hurricane Ian concretized risks of climate change and climate displacement, spurring support for relevant, ameliorative policies.

In contrast to some prior research, we also find that the mobilizing effects of hurricane exposure cross-cut partisanship. This salutary finding suggests it may be possible to forge broad-based coalitions of support for climate action in the wake of disasters, even in highly-polarized settings like the U.S. Additionally, our results call attention to the particular importance of vulnerable, low-income populations in climate advocacy and policymaking. We find that the pro-climate effects of Hurricane Ian were greatest for low-income respondents. These individuals are at the greatest risk from climate change, and hence face the greatest climate migratory pressures. Yet, low-income people also confront unique obstacles when weighing displacement as a response to climate change. Poor individuals are

least able to afford migrating, and tend to face the greatest backlash from hosts when they are climate-displaced. Thus, policymakers and climate activists should consider prevailing socioeconomic inequalities when designing disaster response and preparedness policies and climate advocacy campaigns. Doing so is key for ensuring impoverished disaster victims are afforded equitable options for climate adaptation, and for enabling safe and dignified migration among those victims who opt to flee.

Unfortunately, pro-climate effects of climate disasters are temporally-limited, constraining politicians' abilities to leverage up-swings in pro-climate opinion to implement major climate policies. We find that Hurricane Ian's effects lasted at least one month, but decayed within six months. Our design is unable to identify precisely how long Ian's effects lasted, and this represents an important priority for future research. The relatively short-term consequences of Ian we document are consistent with recency bias, a human tendency to discount older information and experiences when forming opinions (Kahneman, Slovic and Tversky, 1982). Still, by boosting public support, hurricanes do open brief windows-of-opportunity within which climate action is possible. Election-time climate disasters may be particularly likely to generate concerted pro-climate political mobilization.

Finally, this paper underscores the pressing need for further research on climate-induced migration. Unpacking the interrelationship between beliefs about climate displacement and climate change is critical for crafting unified theories of climate-related opinion, and for clarifying canonical models of migration attitudes. Future studies should examine the generalizability of our findings in other contexts like the Global South, where climate displacement is greatest. Another fruitful avenue for research concerns the provision of post-disaster relief. How does disaster assistance shape migration decisions of climate victims and their reception by host communities? Third, work is needed to understand multiple disaster exposure. While repeated disasters may magnify support for climate action, repeat climate victims could also become accustomed to extreme weather in a manner that undercuts pro-climate

attitudinal and behavioral effects. In sum, urgent action is needed to address the challenges posed by climate change, and specifically climate-induced migration. Our findings should inform theory-building and climate advocacy strategies, and offer insights for practitioners developing comprehensive climate mitigation policies.

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