Experience, Narratives, and Climate Change Beliefs

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Abstract

Linking the location and timing of FEMA-declared disasters to large-scale electoral survey data, we study how the experience of a natural disaster affects climate change beliefs, and how experience interacts with ideology. Contrary to the predictions of standard learning models, we find evidence for divergence in beliefs – exposure to the same disaster event increases stated climate change and environmental concerns among liberals, but decreases them among conservatives, widening the ideological gap by 11-17%. We further provide evidence of conflicting ideological media discourse on climate change in the aftermath of disasters by applying GPT as a novel text annotation approach. Our findings are consistent with natural disasters making the debate around climate change and partisan cleavages on this issue more salient and further polarizing initial beliefs.

Keywords: Climate change, narratives, salience, mass media, political polarization

JEL codes: Q54, D72, Z18, H84

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1 Introduction

Climate change is one of the greatest challenges faced by humanity today. Tackling this challenge requires broad consensus and concerted action within and across nations. Yet, in several countries, vast ideological divisions in views regarding the existence, urgency and effects of climate change persist. In the U.S, climate change and the environment stand out as two of the issues on which Democrats and Republican disagree most in terms of policy priority.[1] Moreover, this disagreement has been increasing steadily over the past two decades. According to data from Gallup, the gap in the share of Democrats and Republicans who believe that "the effects of global warming have already begun", has climbed from 13 percentage points in 2001 (61% vs. 48%), to 53 percentage points in 2021 (82% vs. 29%).[2]

These trends in beliefs appear puzzling against the backdrop of increasingly evident manifestations of the effects of climate change in the form of more frequent and severe natural disasters (heatwaves, wildfires, hurricanes) – a phenomenon climate science has unambiguously linked to the rise in global temperatures (IPCC 2014). To the extent that the occurrence of a disaster signals the effects of climate change, standard models of learning would predict that this common signal should lead climate change beliefs to converge (Blackwell and Dubins 1962; DeGroot 1974). Yet, convergence may be impeded by the ambiguity of the signal – the attribution of any individual disaster to climate change is still scientifically challenging and politically controversial, and disasters often trigger conflicting public discourse about their causes.

In this paper, we study empirically how disaster occurrence affects (1) climate change beliefs, and (2) the media discourse around climate change.

[1] According to a 2020 survey by the Pew Research Center, the level of partisan disagreement regarding the urgency of climate change and the environmental policy is highest across a range of issues including the economy, immigration, healthcare, and gun policy (`https://www.pewresearch.org/politics/2020/02/13/as-economic-concerns-recede-environmental-protection-rises-on-the-publics-policy-agenda/`). Partisan cleavages in climate change beliefs, though generally less pronounced than those in the US, also exist in other countries such as Australia, Canada, Germany, and the UK (`https://www.pewresearch.org/short-reads/2015/11/06/the-u-s-isnt-the-only-nation-with-big-partisan-divides-on-climate-change/`).

[2] A similar trend applies to the belief that "global warming will pose serious threats in one's own lifetime" (`https://news.gallup.com/poll/343025/global-warming-attitudes-frozen-2016.aspx`).

We start by providing evidence for the premise that individuals interpret the causes of disasters through an ideological lens. We elicit own beliefs and perceptions of others' beliefs regarding the cause of a specific disaster event (hurricane Ian hitting Florida in 2022) in a Prolific survey of 200 liberal and 200 conservative respondents. In unprompted open-ended questions, we find a liberal-conservative gap of 21-41 percentage points in the likelihood of associating the event with climate change, or in naming climate change as its likely cause. We also find that respondents are very much aware of this gap – about 70% believe that a respondent with an opposing ideology would disagree with them on the question whether the event was caused by climate change or by nature's unpredictability. The Prolific survey additionally allows us to validate the measures of self-reported environmental concerns available in electoral surveys – we show that they are highly correlated with a real-stakes choice to donate to a carbon reduction charity rather than other causes.

In the second part of the paper, we turn to studying the impact of natural disasters on climate change beliefs in a large-scale observational setting. To this end, we link the exact start date and location of all disasters declared by the Federal Emergency Management Agency (FEMA) to individual climate change and environmental beliefs expressed in the Cooperative Election Study (CES). Our empirical strategy leverages variation in the exact timing of CES respondents' exposure to a disaster –as we compare the beliefs of respondents who experience a disaster in the four weeks before being surveyed to those of respondents who experience a disaster in the four weeks after being surveyed. In our most demanding specification, we further restrict the comparison to respondents in the same location and surveyed in the same wave - thus subject to the same local events – and identify the effect of disaster experience solely off the idiosyncrasies in the timing of the survey relative to that of the disaster event. Crucially, in addition to estimating the average effect of disaster experience, we allow this effect to vary depending on respondents' ideology.

The results suggest not only lack of convergence in climate change beliefs in response to disaster exposure, but a striking divergence of beliefs along ideological lines. Exposure to a local disaster *increases* climate change and environmental concerns by 1.4-2.6 percentage

points among liberal respondents, but *decreases* these concerns by 2.5-2.6 percentage points among conservative respondents.[3] As a result, the gap in climate change beliefs between liberals and conservatives widens by 11% and the gap in preference for the environment vs. jobs widens by 17%. These results are robust to finer definitions of ideology or political affiliation and are not explained by heterogeneity in the effect of disasters by socio-economic characteristics such as age, education or income. Consistent with local disasters temporarily increasing the salience of climate change, the effects realize on-impact but tend to decay over the course of 4-5 weeks, and spill-over from directly-affected counties to unaffected neighboring ones with diminishing magnitude as the distance from the event increases. Furthermore, splitting up our estimates by the political makeup of the respondent's county, we find evidence for a mediating role of exposure to opposing political views. The effects are if anything more pronounced for respondents who are in the ideological minority in their county of residence (i.e. for conservatives in Democrat counties), compared to those in the majority (i.e. for conservatives in Republican counties).

In the third part of the paper, we explore the role of mass media in raising the salience of climate change and ideological divisions on the issue. Specifically, we study the evolution of climate change coverage in local newspapers before and after the occurrence of a local disaster, and in cable TV before and after the occurrence of national-interest disasters. In both cases, we find that the number of news stories discussing climate change increase significantly in liberal outlets but not in conservative ones, despite equal increases in the volume of disaster-related coverage. We also study the implied causal relationship between the two issues. To quantify this nuanced aspect of coverage, we develop and apply a text annotation method based on GPT's large language model, overcoming limitations of natural language processing in this task. We find that liberal media are more likely to suggest a causal link between the disaster and climate change, while conservative media are more likely to negate such a link or to express skepticism by using a sarcastic tone. Taken together, our results suggest that the conflicting media discourse on the causes of disasters may mediate the polarizing

[3] We also find positive effects for moderates, though only statistically significant for the question on preference for the environment over jobs.

effect of disaster exposure on climate change beliefs. Two patterns of heterogeneity point to a direction of causality from media coverage to public opinion (and against the reverse). First, as discussed above, we find that the effect on climate change beliefs is more pronounced for respondents in the local ideological minority. To the extent that local media caters to the majority of its audience, this heterogeneity is inconsistent with a direction of causality going from changes in public opinion to changes in coverage. Second, we find no effect on climate change beliefs in counties with low media penetration (i.e., those without a locally headquartered newspaper). Thus, the polarizing effects we document arise only when local media is present.

This paper relates to several strands of literature. First, it contributes to previous work on the link between exposure to natural disasters or extreme weather events and environmental attitudes or behaviors. This literature has produced mixed evidence, with some studies finding a significant positive impact (Hazlett and Mildenberger 2020; Deryugina 2013; Baccini and Leemann 2020; Rüttenauer 2021), a mixed or qualitatively small positive impact (Konisky et al. 2016; Bergquist and Warshaw 2019), and others finding no effect (Marquart-Pyatt et al. 2014; Carmichael et al. 2017).[4] Unlike many of these previous studies, our design identifies short-run effects in the immediate aftermath of disaster exposure, and models explicitly heterogeneity by individual ideology. We are therefore able to uncover effects that would be masked in a coarser empirical strategy or with more aggregate outcomes. In particular, we find that liberals and conservatives move in opposite directions that cancel each other in the average.

Our work also relates to previous research on how political ideology affects environmental attitudes and behaviors. For example, in a recent study on attitudes toward climate policies in twenty countries, Dechezleprêtre et al. (2023) document that, together with education, political leaning is one of the strongest predictors of views on climate action, with left-leaning respondents being generally more supportive in most countries. Hornsey et al. (2016) present consistent results on the centrality of political ideology and party affiliation as determinants

[4]See Howe et al. (2019) for a review of this literature.

of climate change beliefs based on a meta-analysis of studies from various disciplines. Other work suggests that political views affect not just support for climate policies but also economic decisions related to environmental considerations. For example, Bernstein et al. (2022) find that Republicans are significantly more likely than Democrats to own houses exposed to sea level rise, and Costa and Kahn (2013) find that conservatives are less responsive than liberals to energy conservation nudges.[5] We contribute to this literature by studying the process of belief updating after a natural disaster rather than the cross-section of beliefs. We document that the link between ideology and climate attitudes established by the previous literature is further intensified rather than mitigated by the experience of natural disasters.

More broadly, the paper adds to a series of recent evidence of how exposure to the same politically salient signal can polarize political views. For example, Baysan (2022) finds a polarizing effect of exposure to the same political campaign in a field experiment in Turkey. Yousaf (2021) documents a widening partisan gap over gun control policies in the aftermath of US mass shootings. Schneider-Strawczynski and Valette (2021) find that the salience of the issue of immigration in French media is associated with polarization in views about immigration, and Colussi et al. (2021) find that the salience of Muslim minorities in Germany is associated with an increase in extremist voting on both sides of the political spectrum. Theoretical scholarship has related such phenomena to different mechanisms such as preferences for cognitive consistency or confirmation (Lord et al. 1979; Cotton 1985; Rabin and Schrag 1999; Baliga et al. 2013), limited memory or attention (Fryer Jr et al. 2019; Che and Mierendorff 2019), or mistrust in information sources (Gentzkow et al. 2023). Our paper contributes to this literature by adding new evidence of divergence in climate change beliefs in the context of natural disasters. Differently from most previous studies, we provide evidence for the role of mass media in this process.

Finally, our paper contributes to a growing body of work on narratives, i.e., the causal accounts people employ to make sense of reality (Shiller 2017, 2020; Eliaz and Spiegler 2020; Andre et al. 2022). We focus on narratives on the causal relation between disasters and

[5]Fairweather et al. (2023) on the other hand find similar effects of flood risk information provision on home search and buying behavior in Republican and Democrat areas.

climate change, and study how they mediate the individual experience of natural disasters. From an empirical standpoint, our analysis is also novel in that it uses GPT's large language model to measure implied causal connections and their negation in news reports, overcoming the limitations of standard natural language processing approaches in capturing nuanced causal links.

The remainder of the paper is organized as follows. Section 2 discusses the data on natural disasters, news coverage and public opinion on climate change. Section 3 presents the analysis of public opinion on climate change in the aftermath of natural disasters. Section 4 presents the analysis of the media discourse in the aftermath of natural disasters. Section 5 concludes.

2 Data

Our analysis combines data on natural disaster occurrence, survey data on environmental attitudes and beliefs regarding the causes of natural disasters, data on news coverage of natural disasters and climate change in local newspapers and cable news.

Natural disasters. We use data on all 2,585 disasters recorded by the Federal Emergency Management Agency (FEMA) between January 2000 and June 2021.[6] For each disaster, the data include the set of counties affected by the event, and the start date of the disaster in each county. Importantly, our analysis uses the county-specific start date of the disaster event, and not the date of disaster declaration which is often announced with a lag. The dataset also includes information on whether the disaster was associated with an "Emergency Declaration" or a "Major Disaster Declaration." In the former case, FEMA assistance merely supplements state and local efforts and may not exceed $5 million, while in the latter case the President deems the severity of the disaster to be beyond the combined capabilities of

[6]FEMA disaster declarations follow a 2-step procedure. First, the state's governor must carry out a damage assessment for affected counties and evaluate the amount of state funds that can be allocated for evacuation, relief and reconstruction. The governor then files in a request to the office of the President of the United States who declares a state of emergency for some or all of the counties.

state and local governments to respond. We use this distinction to proxy for disaster severity. In addition, for most disasters we observe the dollar amount granted by FEMA under two of its main relief programs.[7] We use this information to identify the most severe disasters likely to attract interest at the national level. We perform minimal manipulations on this dataset such as dropping events with missing information on the affected counties, and removing events related to Covid-19.

Climate change beliefs: CES Our main source of data on environmental attitudes is the Cooperative Election Study (CES). The CES is a nationally representative repeated cross-section conducted around congressional elections with a sample size of up to 50,000 respondents per year. Sample sizes are smaller in non-election years. In addition to its large sample size, the CES has the advantage of including information on respondents' exact location (i.e., county of residence), the date each survey was completed, as well as the respondents' self-reported ideology and political affiliation.[8] The survey includes two questions that capture broad beliefs about climate change and the environment with answers on a 5-point scale:

1. *"From what you know about global climate change or global warming, which one of the following statements comes closest to your opinion?"*, asked in the survey years 2006-2007 and 2009-2012. Answers are on 5-point scale from "climate change not occurring" (=1) to "immediate action necessary" (=5);

2. *"Some people think it is important to protect the environment even if it costs some jobs or otherwise reduces our standard of living. Other people think that protecting the*

[7] These programs are: i) the Individual Housing program which is targeted towards damage mitigation and reconstruction of private property, and ii) the Public Assistance program which delivers funds to assist local communities in rebuilding damaged public infrastructure, such as roads, schools and other community buildings.

[8] We also use data from Nationscape, a 18-month electoral survey conducted around the 2020 Presidential elections. In contrast to the CES, Nationscape does not include information on the respondent's county of residence, but only on the electoral district, a much coarser spatial unit. Rather than using continuous opinion scales on climate change, Nationscape asks two binary questions – support or opposition to a cap on carbon emissions, and support or opposition to large technological investment to protect the environment. Because of these limitations in time-span, geographic detail, and scale of responses, we use the CES data for our main analysis. That said, we obtain results that are qualitatively similar, though less precisely estimated, using the Nationscape data.

environment is not as important as maintaining jobs and our standard of living. Which is closer to the way you feel, or haven't you thought much about this?", asked in the survey years 2006-2008, 2010, 2012 and 2013. Answers are on 5-point scale ranging from "jobs much more important" (=1) to "environment much more important" (=5).

After 2014 the CES asks the following "support" / "oppose" questions on more narrow issues related to environmental regulation: "Raise fuel efficiency from 25 to 35 mpg," "Strengthen EPA enforcement of the Clean Air and Water acts," "Require states to use a minimum amount of renewable fuels," "Allow the EPA to regulate carbon dioxide emissions".[9]

Attribution of disasters to climate change: Prolific survey To shed light on the causal associations people make between the occurrence of natural disasters and climate change, we conduct a survey of 200 self-identified conservatives and 200 self-identified liberals on the platform Prolific. While the Prolific sample is not constructed to be representative of the overall US population, in Table B1 we show that survey participants on Prolific have similar demographic characteristics and similar climate change beliefs as CES respondents, with the exception of higher education, income and employment rates. We elicit beliefs about the causes of disasters by first showing participants a 1-min long video depicting the devastation caused by hurricane Ian in Fort Myers, Florida, in September 2022. The video contains minimal factual information on the disaster and does not mention or allude to the topic of climate change. We then ask open-ended questions regarding the associations that came to the respondents' mind and their opinion on the cause of the disaster depicted in the video. We also ask a multiple choice version of the same question, where the choices are (a) climate change, or (b) nature's unpredictability. In addition to stating their own beliefs, we ask respondents to guess the answer of a randomly chosen respondent with opposite ideology.

To investigate the extent to which stated beliefs are correlated with behavior, we ask respondents to chose a charity we will make a donation to on their behalf among the fol-

[9]Figure B1 presents the geographic coverage of the CES estimation sample, i.e. the set of counties that contain at least one respondent surveyed up to 4 weeks before or up to 4 weeks after the start date of a local FEMA-declared disaster event. This sample contains both Republican and Democrat counties – the average Republican vote share in the 2012 Presidential election was 57%.

lowing options: (a) the animal protection charity The Humane Society of the US, (b) the environmental charity Carbon180, and (c) the cancer charity Prostate Cancer Foundation. Finally, we ask two questions on self-reported climate change and environmental concerns formulated identically to those in the CES.

Media: local newspaper coverage. We collect the text of disaster and climate change related articles published in US daily newspapers between January 2000 and June 2021. We combine data from two sources: Newsbank, which covers 989 newspapers, and Proquest, which covers an additional 236 newspapers.[10]

To identify articles on climate change, we query all articles that include the phrase "climate change" or "global warming" in the headline or in the full text. About 1 million articles satisfy this condition. To identify articles on natural disasters, we query all articles that include at least one of a series of disaster-specific keywords (e.g., "hurricane", "flood", etc.). Table B2 report the full list of such keywords. About 9.4 million articles that match this criterion. For each article we record the publication date and the full text. We also collect information on the county where each newspaper is headquartered using the information available from the database (for Newsbank) or by performing manually searches based on the newspaper's name, state, and town or city (for Proquest). We use this information to approximate the local market served by each newspaper.[11]

Media: Cable news coverage. Regarding news coverage on cable TV channels, we use data from the GDELT Television Archive. The archive includes the transcripts (derived from closed captions) of newscasts on CNN, MSNBC, and Fox News for the period 2009-2021, organized into 15-second long snippets. Following the same approach described for newspapers, we identify the snippets related to climate change as those containing either

[10] In practice, we obtained a "walled garden" access of Newsbank articles that match our keywords of interest. Proquest articles matching our queries were similarly collected using institution access to TDM Studio, an interface developed by Proquest to search its full article archive. Both entailed first building searchable folders containing newspaper articles before recursively parsing and extracting article information including the article's full text.

[11] We exclude national newspapers, such as the New York Times, USA Today and the Wall Street Journal, for which the notion of local market does not apply.

"climate change" or "global warming", and those related to disasters as those containing at least one disaster-specific keyword. Overall, we find 76,691 snippets on climate change and 164,072 on disasters. In addition, we are interested in identifying those news segments that talk about climate change and disasters in close proximity. To capture these cases, we back out the text of the entire one-minute long segment containing the snippets of interest.[12] We find 5,237 segments containing both climate change- and disaster-related keywords.

3 Disasters and climate change beliefs

3.1 Motivating Evidence: Prolific survey

Attribution of disasters to climate change. We start by presenting the results of our online survey aimed at eliciting beliefs about the causes of natural disasters. Table I reports the share of liberal and conservative respondents who mention climate change or global warming in response to questions about their associations or beliefs about the cause of hurricane Ian. The shares are marginal effects conditional on respondents' age, gender, education and income, thus comparing respondents with different ideology holding other characteristics constant. When asked an open-ended question about the associations that came to mind while watching a 1-min long video of the devastation caused by Ian, 24% of liberal respondents and only 1.6% of conservative respondents mention climate change (column 1). When asked an open-ended question about the cause of the depicted disaster, 48% of liberals and 5.8% of conservatives mention climate change (column 2). When we present "climate change versus" versus "nature's unpredictability" as multiple choice options, these shares increase slightly to 62% and 12.8% respectively (column 3). Finally, we elicit perceptions about others' beliefs on the causes of the disaster.[13] Only 9% of liberals guess that a randomly matched conservative respondent named climate change as a cause of the

[12] We do so by retrieving the one-minute transcript corresponding to any snippet matching our "climate change" or "global warming" query by crawling the Television Archive URL links associated to these snippets. The URL links are provided as an element of the response when querying the GDELT Television Archive API.

[13] This question is incentivized – respondents get the chance to win a $100 gift-card if their guess is correct.

disaster. Conversely, 86% of conservatives guess that a randomly matched liberal respondent named climate change as a cause of the disaster. Overall, these findings support the view that prior ideological beliefs provide a different lens for interpreting the same disaster experience. Moreover, the vast majority of people are aware of the stark ideological division in views on the causes of disasters.

Validation of self-reported measures of environmental concerns. In addition to revealing how views on the causes of disasters correlate with ideology, the Prolific survey allows us to validate measures of stated beliefs on climate change and the environment. Specifically, besides the measures discussed above, we include scales of climate change and environmental concerns formulated identically to those in the CES, as well as a tangible behavioral outcome – the choice to make a donation to a climate change cause versus other causes. Table II reports the pairwise correlations of climate change donations with each of the belief measures elicited in the survey, controlling for respondents' ideology and socio-economic characteristics. The relationship between stated beliefs and the choice to donate to an environmental organization is always positive and significant. Associating hurricane Ian with climate change increases the likelihood of donating to an environmental organization by 21-31 percentage points, and a 1-point increase in reported concern about climate change or the environment (on a 5-point scale) is associated to an increase of 6-10 p.p. This confirms that stated beliefs, including self-report measures such as those available from the CES, are highly correlated with real-stakes behavior.

3.2 Effects of disaster exposure on climate change beliefs – CES

Having established that liberals and conservatives differ in their interpretations of the causes of disasters, and having validated the measures of climate change beliefs available from the CES, we turn to the analysis of the analysis of climate change beliefs stated in the CES, linked to the location and timing of FEMA-declared disasters.

Descriptive evidence. We start by comparing descriptively the distribution of beliefs on climate change and the environment between respondents surveyed in the four weeks after a local disaster and those surveyed in the four weeks before. Figure I presents the distribution of these variables separately by respondent ideology. There is an evident partisan divide in opinions on these issues. The median liberal respondent believes that immediate action on climate change is necessary (=5 on a 5 point-scale) and that the environment is more important than jobs (=4), while the median conservative respondent believes that more research is necessary before we take action on climate change (=3) and that jobs are more important than the environment (=2). Following a disaster, this difference appears to increase: the distribution for liberal and moderate respondents shifts slightly to the right (i.e., towards more pro-environmental opinions), while conservatives shift, if anything, slightly to the left (i.e., towards less pro-environmental opinions).

Empirical strategy. To formally test the effect of disaster experience we estimate specifications of the following form:

$$Outcome_{ict} = \alpha + \beta Post_Disaster_{ct} + \psi_{m(t)} + \phi_{c,y(t)} + \theta' X_i + \epsilon_{ict}, \tag{1}$$

where $Outcome_{ict}$ is a survey response by individual i, in county c, in week t; $Post_Disater_{ct}$ is a dummy variable equal to 1 if the respondent is surveyed up to 4 weeks *after* a local disaster and equal to 0 if the respondent is surveyed up to 4 weeks *before* a local disaster; $\psi_{m(t)}$ are year-month FEs, $\phi_{c,y(t)}$ are county times survey-year FEs, X_i is a vector of respondent controls, and ϵ_{ict} is the error term. Standard errors are clustered by county, or alternatively by state in order to allow for spatial correlation of disaster occurrence at a higher geographic level.

This specification compares climate change beliefs between respondents interviewed before and after the occurrence of a local disaster. County $\times$ Survey-year FEs further limit the comparison to individuals interviewed in in the same county and in the same year, who differ only in the timing of the interview relative to the timing of the disaster. The identifying

assumption is that, conditional on observables, the time a particular respondent is surveyed is quasi-random relative to the start date of the disaster.

To test the hypothesis that disaster experience affects people with different political views in different ways, we further allow the coefficient β to vary by respondent's ideology:

$$\begin{aligned} Outcome_{ict} = \alpha &+ \beta_L(Post_Disaster_{ct} \times Liberal_i) \\ &+ \beta_M(Post_Disaster_{ct} \times Moderate_i) \\ &+ \beta_C(Post_Disaster_{ct} \times Conservative_i) \\ &+ \psi_{m(t)} + \phi_{c,y(t)} + \theta' X_i + \epsilon_{ict}, \end{aligned}$$

where $Liberal_i$, $Moderate_i$ and $Conservative_i$ are indicators for the self-reported ideology of respondent i.[14]

Balance. A potential concern with comparing responses before and after a local disaster is that the event may affect the implementation of the survey in a systematic way correlated with ideology. Two features of the setting alleviate this concern. First, the CES is administered online and thus not directly disrupted by local logistical issues. Second, the majority of disaster events in the FEMA data are of moderate severity and rarely involve displacement of population.[15] Nonetheless, to insure that our comparison is balanced, in Table A1 we compare the characteristics of individuals surveyed before and after a local disaster (i.e., control vs. treatment group). While treated respondents are somewhat fewer (17,800 vs. 19,300), significantly younger (-1.8 years), and report lower income (-0.26 points on a 12-point scale) than non-treated ones, we find no significant differences when it comes to gender, education and, crucially, political ideology or party affiliation. In Table A2 we show in more detail and conditional our preferred set of controls that disasters have no effect on the distribution of respondents' ideology. We account for any bias arising from differences in response rates across respondents with different socio-economic characteristics by controlling

[14] The main effects of respondent ideology are included in the vector X_i.

[15] As we will show later, our main results also hold in the subsample of less severe FEMA events.

for age, gender, education and income in all subsequent specifications.

Main Results. Tables III presents the main regression results, estimated on the sample of about 16,000 respondents surveyed in the four weeks before or after a local disaster. The specifications in columns (1) and (4) include respondent-level socio-economic controls, county and year-month FEs; in columns (2) and (5) we introduce state × survey-year fixed effects; finally, the most demanding specification, in columns (3) and (6), includes county × survey-year fixed effects. In line with the descriptive results in Figure I, we find a robust increase in climate change concerns of about 0.07 points among liberals, and a robust decline of about 0.120 points among conservatives (measured on a 5-point scale). The pattern is similar for preferences for the environment over jobs with an increase of 0.14 points among liberals and a decline of 0.11 points among conservatives. Interestingly, we find consistently positive effects for moderates, though significant only for preferences for the environment over jobs.[16]

In Figure II we decompose these effects further by replacing the 3-point ideology scale by a more detailed 5-point scale, or alternatively – by a 7-point party affiliation scale. We present, for each ideological category, the coefficient corresponding to its interaction with a Post-Disaster indicator conditional on respondent controls (incl. the main effects of ideology or party affiliation), year-month, and county-year FEs. This decomposition confirms that the effect of disasters on environmental concerns is systematically positive for liberal/Democrat respondents and negative for conservative/Republican respondents. It also suggests that the effects are more muted at the very extremes of the ideological distribution (consistent with floor/ ceiling effects).

Robustness checks. We perform several tests to probe the robustness of these results. First, one potential concern is that our results reflect heterogeneity in the effect of disasters

[16] In Table A3 we examine the effects of disaster experience on support for specific environmental regulations – raising fuel efficiency from 25 to 35mpg, granting certain regulatory authorities to the EPA, or requiring states to use a minimum amount of renewable fuels. We find no effect of disaster exposure on an index of all four regulatory questions, nor any heterogeneity by respondent ideology. Our interpretation of this null result is that respondents may make a connection between disasters and the general issue of climate change and the environment, but not necessarily with individual environmental regulations. The null effect may also indicate a lack of familiarity with specific regulatory issues and their effect on the environment.

by socio-economic characteristics correlated with ideology, rather than by ideology itself. To tackle this issue, we explicitly control for such heterogeneity by augmenting our main specification to include the interaction of the post-disaster dummy with age, education, gender, or income. This is a rather compelling test given that each of these variables is stronly correlated with ideology. Figure A1 shows that including these controls has virtually no impact on the baseline estimates.

Second, to account for the ordered nature of the dependent variables, we estimate an ordered probit model instead of the linear model in our baseline specification. The results, shown in the top panel of Figure A2, indicate that all the effects are similar in magnitude and, if anything, more precisely estimated. Alternatively, in the lower panel of the same figure we estimate linear probability models for the binary outcomes of supporting some climate action or immediate climate action, or believing that the environment is more important or much more important than jobs. We obtain similar results, confirming that the findings are not an artifact of functional form assumptions. Finally, in Figure A3 we show that the results are robust to clustering standard errors by state rather than by county, accounting for potential spatial correlation in the occurrence of disaster events.

Effects by time and distance to the event. To investigate the dynamics of the effects documented above we estimate event-study specifications of the form:

$$Outcome_{ict} = \alpha + \sum_{k\in[-6,-2]} \beta_k \times Disaster_{ck} + \sum_{k\in[0,6]} \beta_k \times Disaster_{ck} + \psi_{m(t)} + \phi_{c,y(t)} + \theta' X_i + \epsilon_{ict}, \tag{2}$$

where $Disater_{ck}$ is a dummy variable equal to 1 if the respondent is surveyed in week k relative to the start date of a disaster in county c and 0 otherwise. The omitted category is the week prior to the start of a disaster (k=-1). Here we consider the sample of all survey respondents, including the never-treated.

Figure III presents the results of this specification separately for liberals, moderates, and conservatives. The event-studies suggest that the effects materialize about a week following

the disaster start date with no evidence of anticipation, and persist for up to four to five weeks.

We also investigate to what extent the occurrence of a disaster in a given location affects respondents' attitudes in neighboring locations. To this end, we redefine the treatment as an indicator equal to one if a disaster occurred in a neighboring county in the four weeks prior to the survey, and equal to zero if a disaster occurred in a neighboring county in the four weeks prior to the survey. To isolate the effect of the indirect exposure, we only consider respondents in counties not directly affected by any event. The results, presented in Figure IV, indicate that the indirect experience of disasters also has a polarizing effect on attitudes towards climate change and the environment. This effect tends to decay with distance, as attested by the smaller and less precise estimates for disasters affecting second-degree neighbors relative to those affecting first-degree neighbors.[17] Overall, the temporal and geographic pattern of the effects suggests that climate change beliefs change when and where discussions around disasters' causes are likely most salient.[18]

Role of exposure to opposing beliefs. To investigate whether the divergence in beliefs is related to a clash between such discussions and respondents' ideological priors, we test how the effects vary by the political make-up of the affected area. In particular, we distinguish between the effects of disaster occurrence on the beliefs of respondents who are in the local political minority vs. those in the majority, splitting the sample at the median Republican vote-share in the most recent presidential election.[19] To the extent that members of the local political minority are more likely to clash with the opposing dominant narrative, one would expect the backlash effect to be stronger for them. The results, presented in Table IV, support this hypothesis. For both climate change concerns and preferences for the environment vs. jobs, the backlash for conservatives is larger and significant only in counties with a Democratic

[17]This result is consistent with previous findings regarding the spatial effects of wildfires (Hazlett and Mildenberger 2020) and floods (Rüttenauer 2021; Gallagher 2014) on environmental attitudes and behaviors.

[18]The temporary nature of the effects also points against a mechanism in which the disaster event helps individuals learn the policy positions different parties take on climate change and sort accordingly.

[19]The median Republican vote share is 48%. We obtain very similar results splitting the sample at the threshold of 50% Republican vote share.

majority. For liberals, the positive effect is significant in both groups of counties, but larger and more precise in Republican counties (though we can not reject pair-wise equality of the coefficients in the two sub-samples).

Heterogeneity by disaster characteristics. Finally, we explore how the effect of disaster experience varies depending on the characteristics of the event. To simplify the presentation of these results, in Figure A4 we focus on an index that aggregates climate change concerns and preferences for the environment over jobs. In panel (a), we estimate the effect of disaster experience separately for disasters of different severity, as proxied by the type of declaration reported by FEMA. We distinguish between the default category of emergency declaration and a major disaster declaration, which grants further aid if the damage is deemed severe. We find similar effects for both declaration types in terms for both significance and magnitude. In panel (b), we distinguish between the effects of hurricanes and storms (which account for over 80% of the data), and other disaster types. Our baseline result is preserved in the sub-sample of hurricanes and storms, while we find no significant effects in the smaller sample of other disaster types. Finally, in panel (c) we explore the role of past disaster experience. We split the sample by the median number of disasters the county of the respondent has experienced over the past 5 years. Interestingly, we find that the divergence in climate change beliefs is more pronounced in situations with below-median past disaster experience, while the effects on both sides of the belief distribution tend to attenuate if the county has experienced many disasters in the past. This result further supports the interpretation that belief divergence is more likely when the signal is ambiguous, and that it may attenuate as evidence accumulate.

4 Disasters and the news coverage of climate change

A large literature has demonstrated the role of exposure to slanted media coverage in shaping beliefs on policy-relevant issues (DellaVigna and Kaplan 2007; Martin and Yurukoglu 2017, e.g.), including beliefs on climate change and the environment (Ash et al. 2023). In this section, we explore the role media coverage may play in the divergence of climate change

beliefs in the immediate aftermath of a disaster. Specifically, we hypothesize that by voicing conflicting narratives about the causes of the disaster, media coverage may make ideological divisions on climate change more salient.

4.1 Local newspapers

As a first suggestive test of the role of media in this context, in Table V we examine whether the effect of disaster experience differs depending on the presence of local newspapers. To do so, we use information on the universe of US daily newspapers available from the Editor & Publisher 2010 yearbook. Following the literature (Gentzkow and Shapiro 2010; Djourelova et al. 2023), we consider as local to a county all newspapers headquartered in that county. That this is a good approximation for most US newspapers is confirmed by the fact that, for the median paper, the HQ county accounts for about 80% of total circulation. We estimate the effect of local disasters separately for counties with no local newspapers and for counties with one or more newspapers. Our findings indicate that the polarizing effect of disaster experience only holds in the latter subsample. For conservative respondents in particular, we can reject the null-hypothesis of equal effects in the two sets of counties (p-value = 0.070 for climate change concerns, 0.027 for environment versus jobs).We find similar effects when comparing counties with one newspaper and counties with two or more newspapers.

Second, we document how disasters and climate change are covered in liberal and conservative media in the aftermath of a disaster event, analysing (i) the volume of coverage of these issues before and after disaster occurrence, and (ii) the tone of coverage conditional on both issues making it to the news. Local newspapers

To analyze the dynamics of local newspapers' coverage, we emply a similar strategy to before: we compare the volume of coverage of the two topics before and after the newspapers' market is hit by a disaster event. We proxy the political leaning in a newspapers' market by the Republican vote share in the county of the newspapers' HQ in the most recent presidential election.[20] Specifically, we estimate regressions of the form:

[20]This choice is motivated by the strong association between the ideological slant of a newspaper and the

$$Coverage_{nct} = \alpha + \beta_D(Post_Disaster_{ct} \times Dem_{ct}) + \beta_R(Post_Disaster_{ct} \times Rep_{ct}) + \psi_{m(t)} + \phi_{n,y(t)} + \epsilon_{nct},$$

where $Coverage_{nct}$ is the IHS-transformed number of articles related to disasters or to climate change published by newspaper n, headquartered in county c, in week t; $Post_Disaster_{ct}$ is a dummy variable which takes value 0 in the four weeks *before* a disaster and 1 in the four weeks *after* a disaster; $\phi_{n,y(t)}$ and $\psi_{m(t)}$ are newspaper-year and month fixed effects respectively, and ϵ_{nct} is the error term. We allow the effect of $Post_Disaster_{ct}$ to vary depending on the political leaning of the newspapers' market by interacting $Post_Disaster_{ct}$ with dummies for above- and below-median Republican vote share in county c and year t – Rep_{ct} and Dem_{ct}. We cluster standard errors by county.

Table VI presents the results of this specification. We find that disaster-related news in local newspapers increase by about 30% in the aftermath of a local event. The magnitude of the effect is similar for newspapers headquartered in Republican and Democratic counties. However, there is substantial heterogeneity in news coverage of climate change, which increases significantly in newspapers in Democratic counties (+2.3%) but not in newspapers in Republican counties.[21]

Figure V illustrates the dynamics of the effect for disaster-related news (panel a) and for climate change news (panel b) separately for newspapers in Democratic counties and in Republican counties. In both groups we observe a sizable increase in coverage of disasters which starts in the week after the onset and lasts for at least six weeks. Coverage of climate change on newspapers in Democratic counties increases significantly in the 2-3 weeks after the event, while there is no detectable effect for newspapers in Republican counties.

In addition to the number of articles about climate change published in the aftermath of disasters, we are interested in understanding how they talk about the topic and, in partic-

political make-up of the market they serve documented, among others, by Gentzkow and Shapiro (2010).

[21] Recent work by Mastrorocco et al. (2023) documents a similar effect for local TV coverage around the occurrence of extreme temperature events.

ular, whether they make or negate a causal connection between climate change and natural disasters. Quantifying this aspect is challenging since implied causal connections are difficult to capture with standard text analysis techniques and manual annotation is costly for large corpora such as ours. We therefore turn to a new annotation method using the ability of large language models - namely openai's GPT-engine - to infer subtle meanings from text. We focus on the set of articles that include both disaster- and climate change-related keywords and that are published in the four weeks after the onset of a disaster in the newspaper's HQ county. 8,361 articles satisfy these criteria. For each article, we prompt GPT to answer four questions:[22] (i) Does the articles imply that there is a causal connection between climate change and extreme weather?, (ii) Does the article negate a causal connection between extreme weather events and climate change?, (iii) Does the article say that climate change is an important issue?, (iv) Does the article use sarcasm when discussing the issue of climate change?

Appendix B.2 provides examples of the resulting annotation. To validate this method, we compare the answers provided by the GPT-engine to those provided by two independent research assistants for a random sample of 300 articles. Figure B2 shows that the agreement between GPT and a given human annotator is very similar to the agreement between two human annotators. We measure agreement by an accuracy score, i.e. the ratio of answers that are classified identically by the GPT-engine and by the human annotator over the number of total answers. This lends confidence in the reliability of the method for this specific annotation task.[23]

Figure VI presents the relationship between each of the four measures of content and the Republican vote share in the newspaper's HQ county. Panels (a) and (b) show that the share of articles maintaining that climate change is important and implying a causal connection between climate change and disasters decreases the more Republican is the area served by

[22] In practice, we prompt GPT to act as a text annotator. We list the questions it will be asked to answer for each news report, and ask it to return answers as "yes", "no" or "not discussed/not sure/conflicting". In our main results we group the latter two categories together but we obtain similar results excluding segments coded as "not discussed/not sure/conflicting."

[23] See Gilardi et al. (2023) and Törnberg (2023) for validation of GPT's annotation task performance in other contexts.

the newspaper. In contrast, panel (c) and panel (d) indicate that the share of articles that negate a causal connection between climate change and disasters and that use a sarcastic tone when talking about climate change increases the more conservative is the newspaper's audience. These findings indicate that local disasters trigger different narratives depending on the slant of the news outlet.

4.2 Cable news

Finally, we analyze the coverage of disasters and climate change on cable TV. Since news content on cable channels is not differentiated by location, we focus on large disasters that have attracted national coverage. In particular, we look at news coverage of large disasters on CNN, MSNBC and Fox News in the weeks before and after each event. To minimize the overlap between the period after one disaster and before another, we focus on the 10 disasters that received most relief funds by FEMA between 2009 and 2021 (the period for which TV data are available).This includes: Hurricane Irene (August 2011), Hurricane Isaac (August 2012), Hurricane Sandy (October 2012), Hurricane Harvey, Hurricane Irma & Hurricane Maria (August & September 2017), Hurricane Florence & Hurricane Michael (September & October 2018), Hurricane Laura (August 2020) and the 2017 and 2018 Californian wildfires.

Panel (a) of Figure VII shows the volume of news coverage of disasters and climate change respectively - measured by the number of 15-sec snippets that include the relevant keywords - in the four weeks before and after the onset of the disaster. It is clear that news coverage of the disaster increases dramatically after the event starts and that this pattern is similar for CNN, MSNBC and Fox News. A different picture emerges for the coverage of climate change. Though the level of pre-disaster coverage is slightly higher on Fox News than on the other channels, after the event the number of segments on climate change more than double on CNN and MSNBC but remain unchanged on Fox News.

We also explore qualitative differences between channels in how they cover climate change and its link with disasters. To this end, we apply the same procedure described above for newspapers to the 5,237 TV segments that include both disaster and climate change keywords

within a minute from each other.[24] The results are shown in panel c) of Figure VII. They indicate that, compared to CNN and MSNBC, Fox News is significantly less likely to report that climate change is an important issue and to suggest a causal connection between climate change and natural disasters. In contrast, it is much more likely to explicitly negate this connection, and to use sarcasm when discussing climate change. The differences are sizeable, ranging between 10 and 30 percentage points depending on the outcome.

Taken together, our findings document vast partisan differences - both quantitative and qualitative - in the stand that national media take when reporting on the issue of climate change and its connection to natural disasters.

4.3 Discussion

To explain divergence in beliefs, theoretical work highlights the role of conflict between the signal and prior beliefs, which can trigger backlash through, e.g., strong preferences for cognitive consistency (Rabin and Schrag 1999; Baliga et al. 2013), or through distrust in the source of information (Gentzkow et al. 2023). The fact that the divergence effect we document is if anything stronger for respondents in the local ideological minority is consistent with these interpretations – in that case individuals may be more likely to be confronted by an interpretation of the causes of the disaster that clashes with their beliefs. The results presented in sections 4.1 and 4.2 further suggest a possible role of mass media in this process, as liberal and conservative media offer different interpretations of the causes of disasters and their relation to climate change.

Our results also suggest a direction of causality from media coverage to beliefs rather than the reverse. First, the fact that we do not find evidence of divergence in counties with low penetration of local media (i.e., no locally headquartered newspaper) suggests that the divergence effect may be mediated by media exposure. Second, to the extent that local media caters to the local ideological majority in their audience, we would expect that demand-driven changes in coverage align with changes in the views of the majority. Instead, we find

[24] As for newspapers, we validate the quality of the annotations by GPT against a human benchmark (Appendix figure B3).

if anything more pronounced changes in the views of respondents in the ideological minority. This evidence appears more consistent with a clash between respondents' prior ideology and the local discourse driving the effects.

5 Conclusion

This paper has documented a polarizing effect of disaster experience on views on climate change and the environment. Using large scale survey data linked to the universe of disaster events declared by FEMA, we find robust evidence that liberal respondents express greater concerns about climate change and the environment in the aftermath of a local disaster, while conservative respondents show the opposite effect. In other words, not only do individuals interpret the same experience differently depending on their prior ideological beliefs, but they also update their climate change beliefs in opposite directions as they witness the same event. The finding of belief divergence contradicts the predictions of standard models of learning. It is however consistent with disaster occurrence making ideological disagreements on climate change more salient by triggering conflicting media discourse around the disasters' causes.

These results have direct implications for climate change policy and activism. First, our results imply that attempts to raise climate change awareness or draw broad climate policy support in the immediate aftermath of natural disasters may be ineffective due to conservative backlash. Second, our findings imply that the strong politicization of the issue of climate change is a first-order hurdle in achieving consensus on its existence and urgency.

Our findings speak to the broader debate about issue polarization. As we demonstrate, ideological gaps in beliefs can be sustained and even increase as signals relevant to the issue emerge, and more so when the signals raise the salience of ideological divisions.

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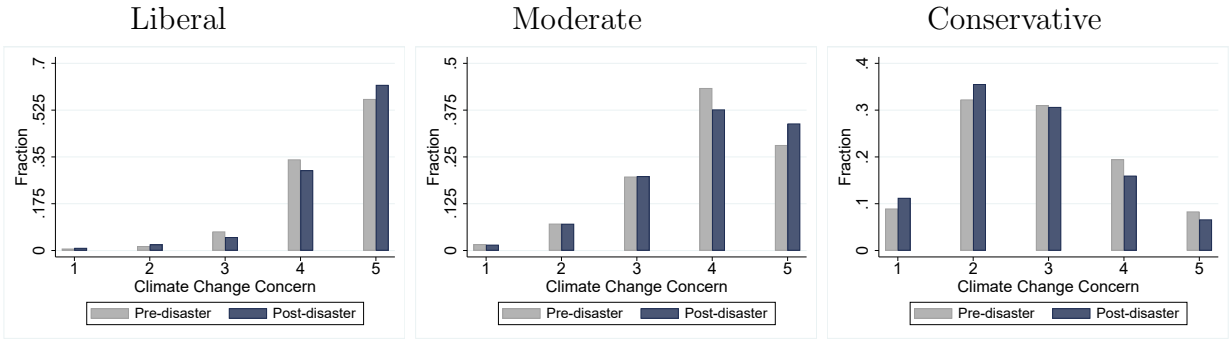
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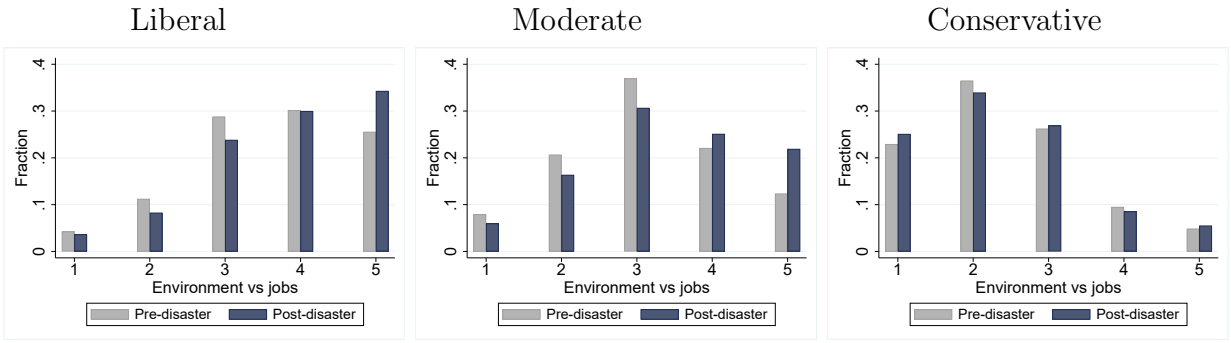
6 Figures

Figure I: Climate change / environmental concerns: Distribution pre- and post- a local disaster

(a): Climate change concerns



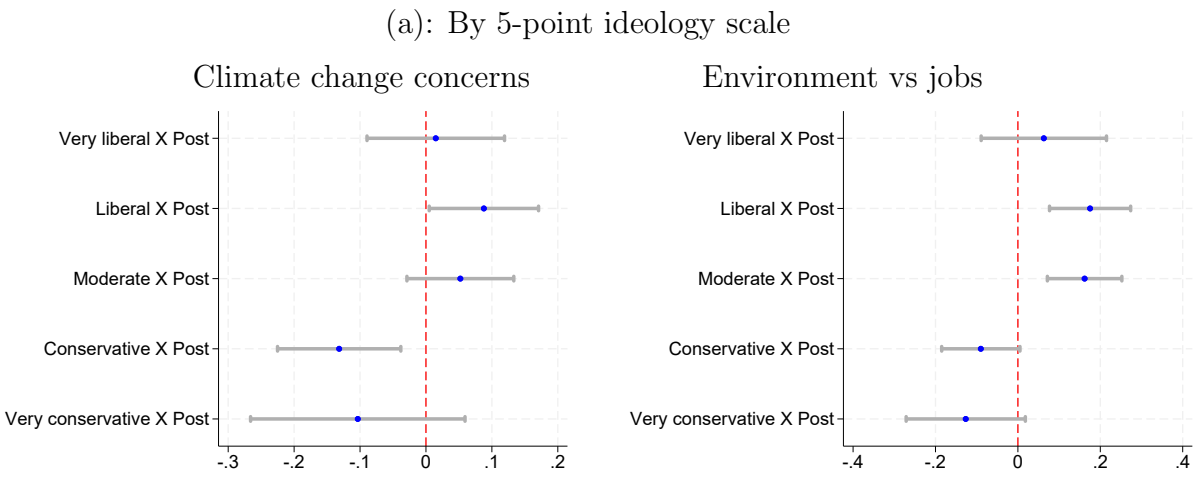
(b): Environment vs jobs



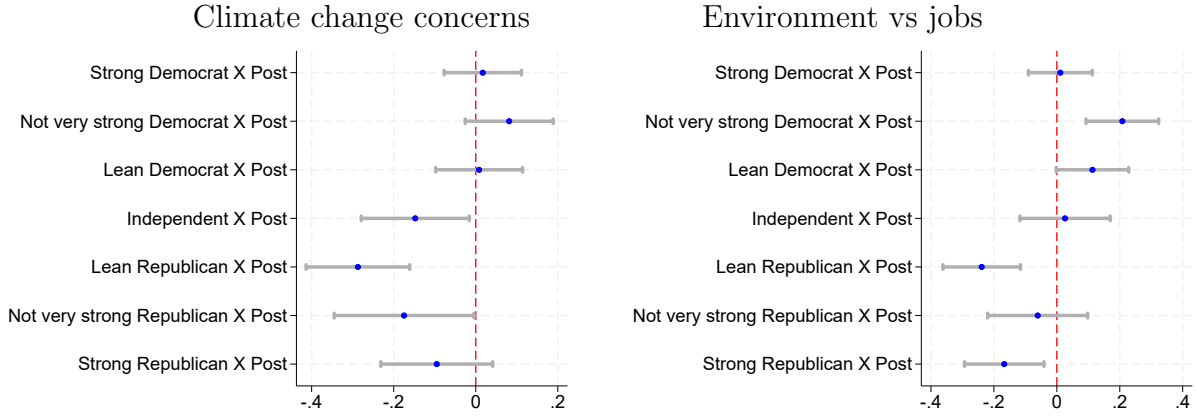
Notes: Distribution of climate change concerns (panel a) and preference for the environment over jobs (panel b) by respondent ideology. Gray bars indicate the distribution among respondents surveyed in the 4 week period prior to a local disaster occurrence. Dark blue bars indicate the distribution among respondents surveyed in the 4 week period after a local disaster occurrence.

Figure II: Disaster occurrence and climate change / environmental concerns: Estimates by detailed ideology and party affiliation

(a): By 5-point ideology scale



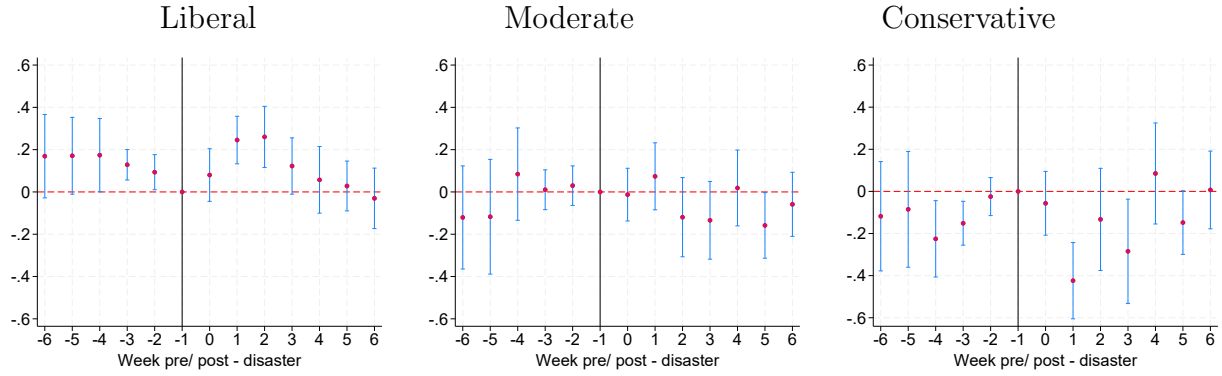
(a): By 7-point party affiliation



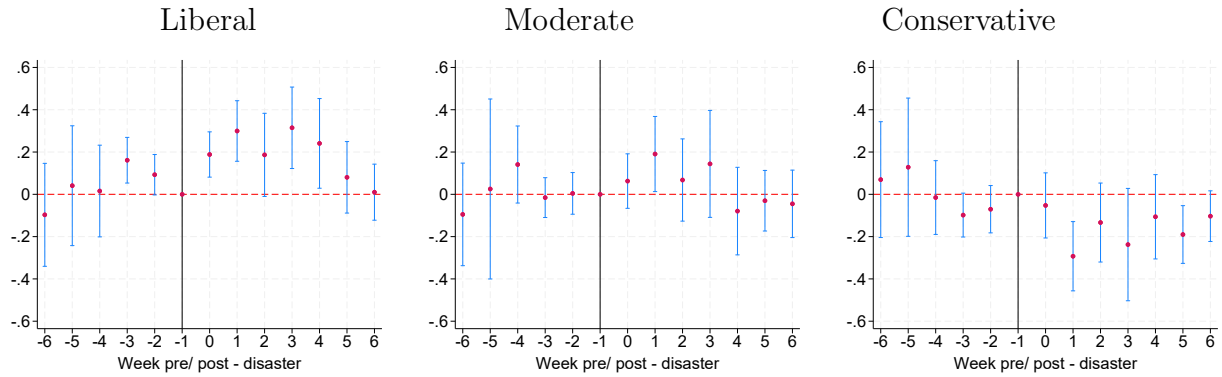
Notes: Point estimates and 95% confidence intervals from a regression of climate change concerns/ preference for the environment over jobs on the interaction of a full set of categories for respondents' ideology (panel a) or party affiliation (panel b) with an indicator for being surveyed after a local disaster. The sample includes respondents surveyed up to 4 weeks before or up to 4 weeks after a local disaster. All specifications control for respondent characteristics, including the main effects of 5-point ideology/ 7-point party affiliation category, year-month and county × survey year FEs. Standard errors clustered by county.

Figure III: Disaster occurrence and climate change / environmental concerns: Event studies

(a): Climate change concerns

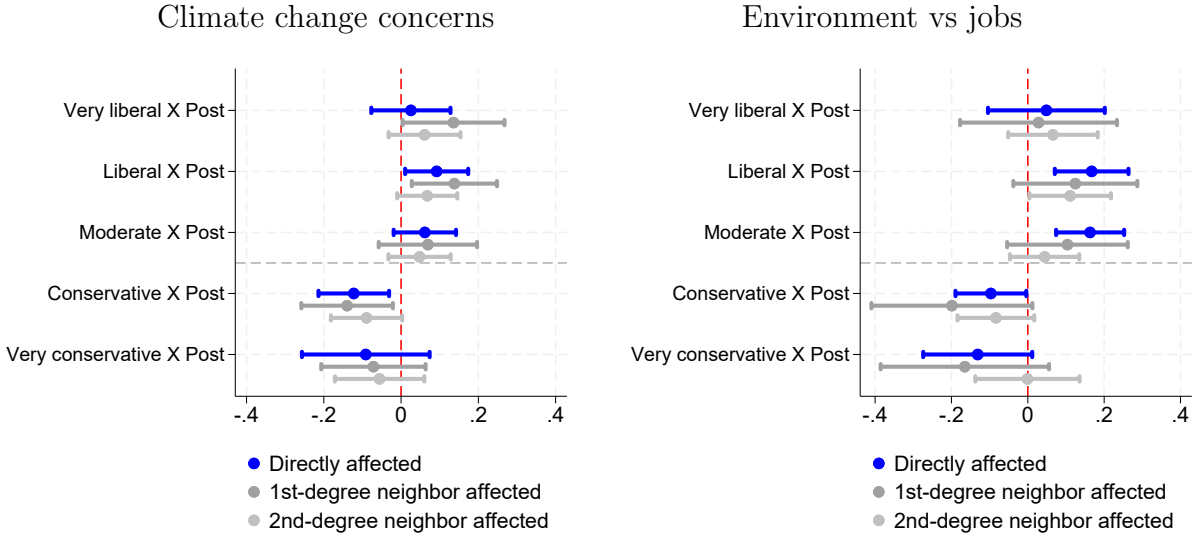


(b): Environment vs jobs



Notes: Event study estimates for the effect of local disaster occurrence on climate change concerns (panel a) and preferences for the environment over jobs (panel b), by respondent ideology. Each figure corresponds to the subsample of respondents with the respective self-reported ideology. All specifications control for respondent characteristics, year-month and county × survey year FEs. The omitted category is the week prior to the disaster start date in the respondents' county. Standard errors clustered by county.

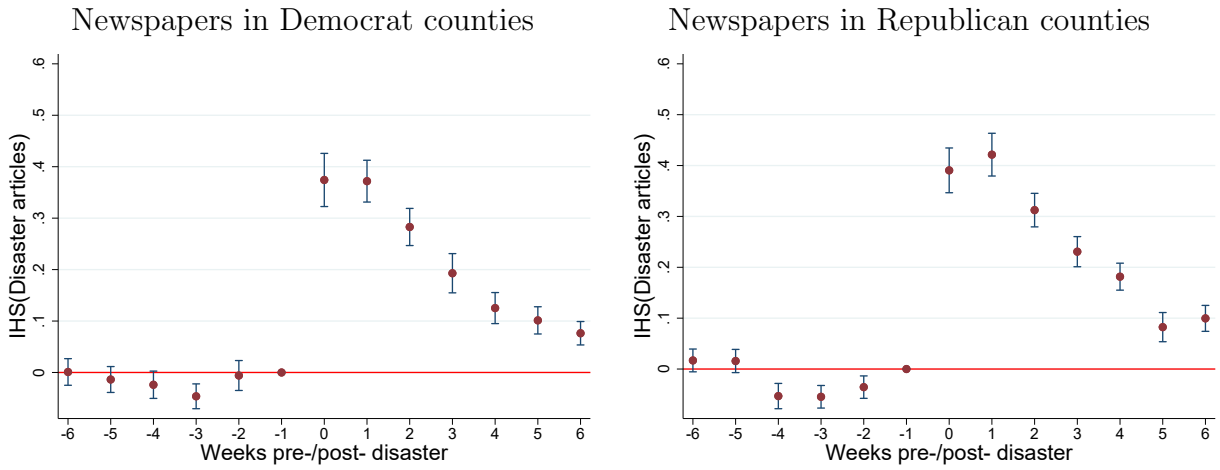
Figure IV: Disaster occurrence and climate change / environmental concerns: Spillovers



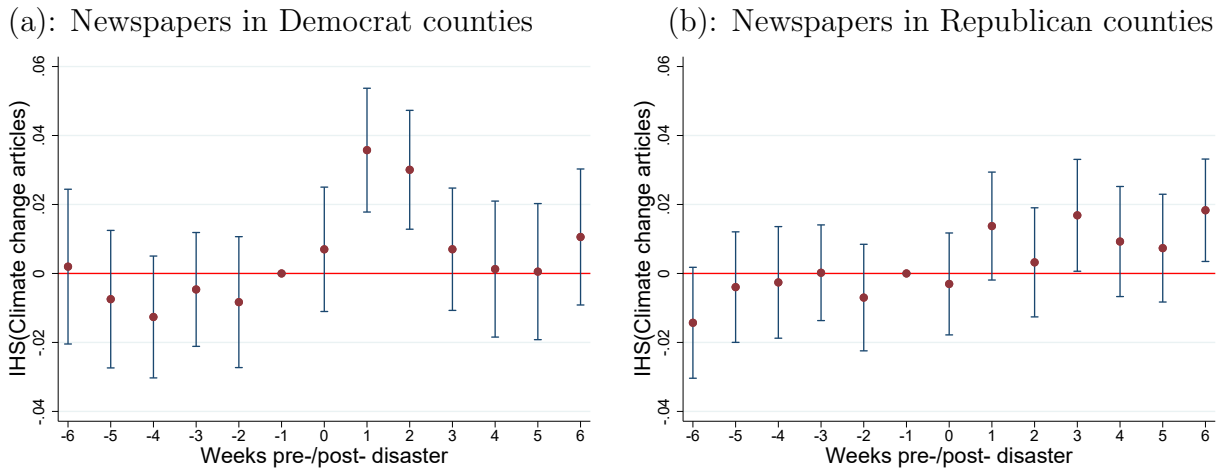
Notes: Point estimates and 95% confidence intervals from a regression of climate change concerns/ preference for the environment over jobs on the interaction of a full set of categories for respondents' ideology with (i) an indicator for disaster occurrence in the respondents' county, or (ii) an indicator for disaster occurrence in a neighboring county. The sample includes respondents surveyed up to 4 weeks before or up to 4 weeks after a disaster in the respective geographic area, and excludes directly affected respondents in case (ii). All specifications control for respondent characteristics, including the main effects of 5-point ideology, year-month and county × survey year FEs. Standard errors clustered by county.

Figure V: Local news coverage of disasters and climate change: Event studies

(a): Disaster coverage



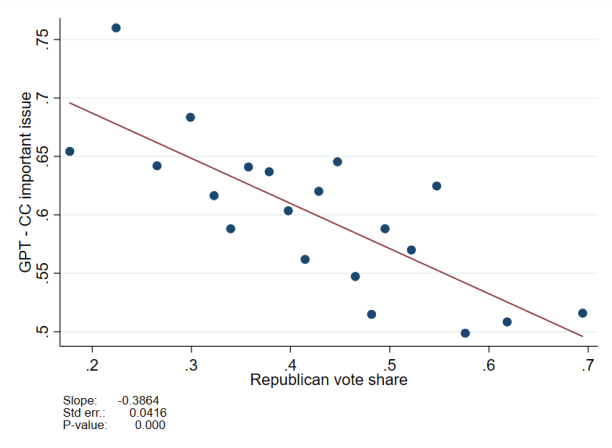
(b): Climate change coverage



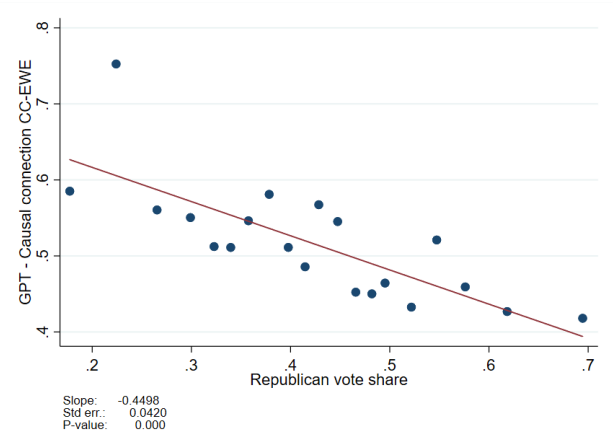
Notes: Event-studies for the effect of local disaster occurrence on disaster and climate change related coverage in local newspapers. The dependent variable is the IHS-transformed number of disaster related articles (panel a) or climate change related articles (panel b) by newspaper and week. Time zero corresponds to the start week of a FEMA disaster in the county of the newspapers' HQ and the omitted category is the week prior to the start date. All specifications control for year-month and newspaper × year FEs. Standard errors clustered by county.

Figure VI: Local news coverage of disasters and climate change: GPT content analysis

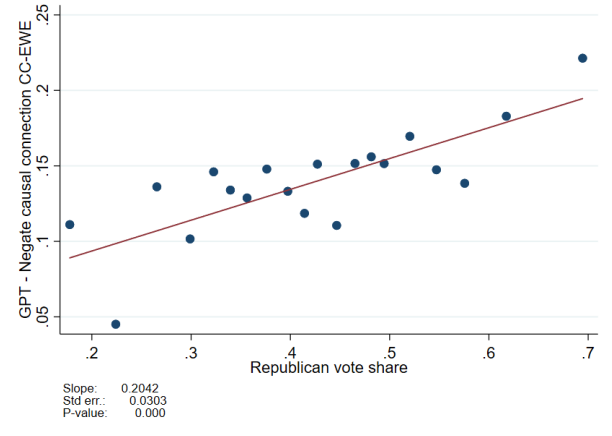
(a): Climate change important



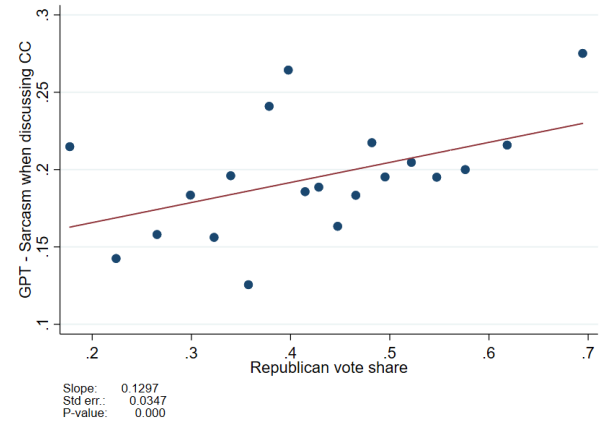
(b): Causal connection



(c): Negate causal connection



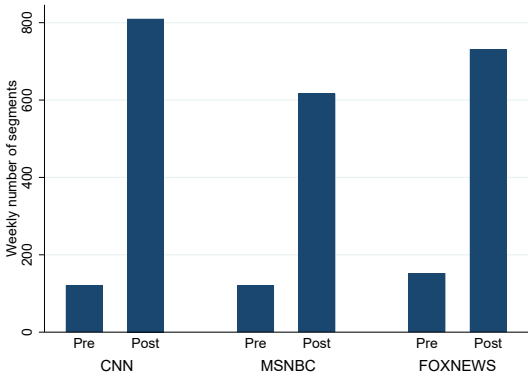
(d): Sarcasm



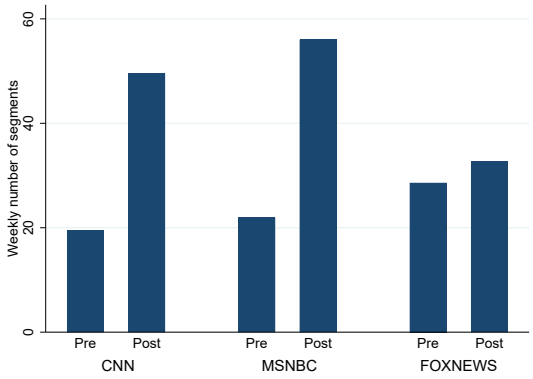
Notes: Binscatter plots for the relationship between the Republican vote share in a newspaper's HQ county and GPT's annotations of the articles related to disasters and climate change published by that newspaper in the 4 weeks after a local disaster.

Figure VII: Cable news coverage of disasters and climate change

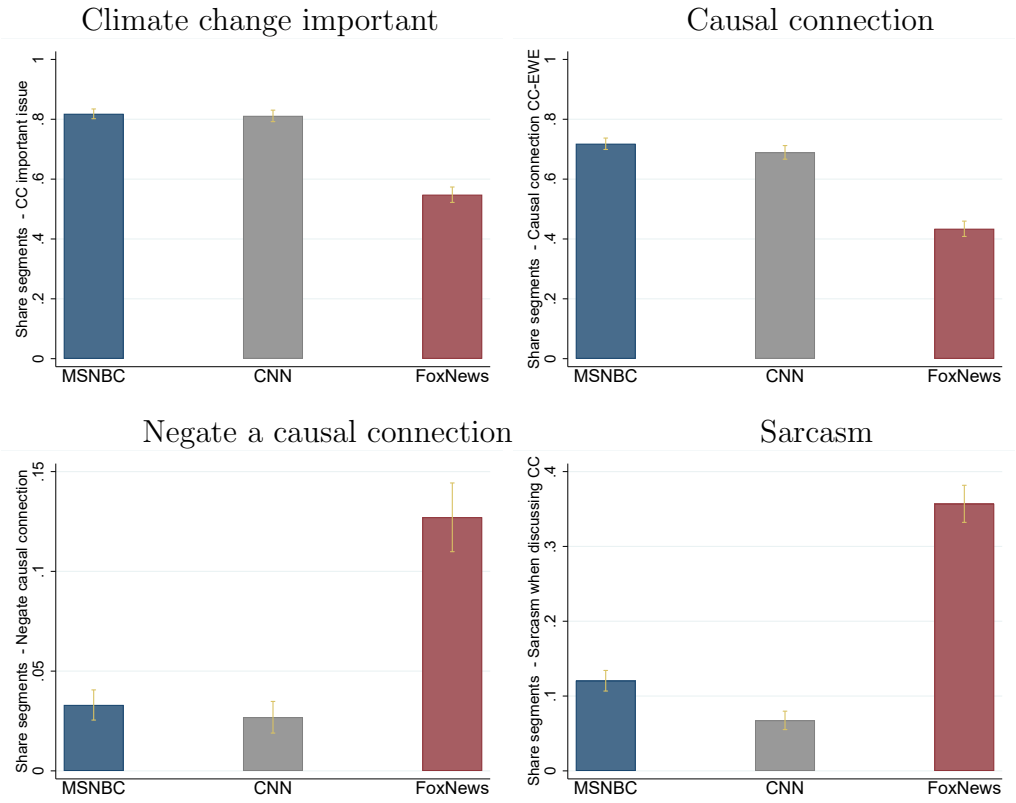
(a): Volume of disaster coverage



(b): Volume of climate change coverage



(c): Tone of coverage in segments mentioning both disaster- and climate change related keywords: GPT annotation



Notes: Volume of coverage of disasters (panel a) and climate change (panel b) on cable TV, comparing the 4 weeks before and 4 weeks after the occurrence of a major national-interest disaster. Major disasters are defined as the top 10 non-overlapping disaster events declared by FEMA that receive the most relief funding in the period 2009-2021.

7 Tables

Table I: Idelogoy and attribution of disasters to climate change (Prolific survey)

Climate change mentioned/ selected?	(1) Open-ended association	(2) Open-ended cause	(3) Multiple choice cause – own	(4) Multiple choice cause – opposing ideology
Liberal	0.240***	0.480***	0.621***	0.087***
	(0.030)	(0.035)	(0.037)	(0.022)
Conservative	0.016	0.058***	0.128***	0.864***
	(0.014)	(0.019)	(0.026)	(0.026)
Respondent controls	Yes	Yes	Yes	Yes
Observations	405	404	361	361

Notes: Respondent ideology and measures of attribution of disasters to climate change. Marginal effects controlling for age, gender, college degree and income. Significance levels: * p < 0.1, ** p < 0.05, *** p < 0.01.

Table II: Stated beliefs and climate change donations (Prolific survey)

	(1)	(2)	(3)	(4)	(5)
	Climate change donation				
Climate change mentioned:					
Open-ended association	0.210***				
	(0.079)				
Climate change mentioned:					
Open-ended cause		0.285***			
		(0.060)			
Climate change selected:					
Multiple-choice cause			0.306***		
			(0.060)		
Climate change concerns (5-point scale)				0.099***	
				(0.019)	
Environment vs jobs (5-point scale)					0.055***
					(0.018)
Conservative	-0.287***	-0.214***	-0.181***	-0.159***	-0.243***
	(0.046)	(0.049)	(0.055)	(0.059)	(0.055)
Respondent controls	Yes	Yes	Yes	Yes	Yes
Observations	405	404	361	404	404
R^2	0.18	0.22	0.23	0.20	0.17

Notes: Regressions of an indicator for choosing to donate to a climate change cause (*Carbon180*) on measures of stated climate change beliefs/ associations. Respondent controls include age, gender, college degree and income. Significance levels: * p < 0.1, ** p < 0.05, *** p < 0.01.

Table III: Disaster occurrence and climate change / environmental concerns

	(1)	(2)	(3)	(4)	(5)	(6)
	Climate change concerns					
Post-Disaster	-0.022	-0.020	-0.017			
	(0.034)	(0.035)	(0.035)			
Liberal × Post-Disaster				0.075**	0.075**	0.070*
				(0.037)	(0.038)	(0.038)
Moderate × Post-Disaster				0.057	0.059	0.060
				(0.041)	(0.041)	(0.042)
Conservative × Post-Disaster				-0.123***	-0.125***	-0.128***
				(0.047)	(0.048)	(0.049)
Respondent controls	Yes	Yes	Yes	Yes	Yes	Yes
County FEs	Yes	Yes	No	Yes	Yes	No
Month-Year FEs	Yes	Yes	Yes	Yes	Yes	Yes
State× Survey-Year FEs	No	Yes	No	No	Yes	No
County× Survey-Year FEs	No	No	Yes	No	No	Yes
Observations	13,980	13,970	13,926	13,031	13,022	12,979
Number of counties	529	528	519	511	510	501
R^2	0.09	0.09	0.10	0.36	0.36	0.37
Mean dep. var.	3.72	3.72	3.72	3.72	3.72	3.72
	(1)	(2)	(3)	(4)	(5)	(6)
	Environment vs jobs					
Post-Disaster	0.023	0.028	0.033			
	(0.033)	(0.034)	(0.034)			
Liberal × Post-Disaster				0.124***	0.127***	0.129***
				(0.045)	(0.045)	(0.045)
Moderate × Post-Disaster				0.152***	0.159***	0.162***
				(0.046)	(0.046)	(0.046)
Conservative × Post-Disaster				-0.129***	-0.124***	-0.124***
				(0.045)	(0.045)	(0.045)
Respondent controls	Yes	Yes	Yes	Yes	Yes	Yes
County FEs	Yes	Yes	No	Yes	Yes	No
Month-Year FEs	Yes	Yes	Yes	Yes	Yes	Yes
State× Survey-Year FEs	No	Yes	No	No	Yes	No
County× Survey-Year FEs	No	No	Yes	No	No	Yes
Observations	15,065	15,056	15,058	14,059	14,050	14,052
Number of counties	559	559	559	540	540	540
R^2	0.08	0.08	0.09	0.25	0.25	0.25
Mean dep. var.	3.07	3.07	3.07	3.07	3.07	3.07

Notes: Effect of local disaster occurrence on 5-point scale climate change concerns (upper panel) and 5-point scale preference for the environment over jobs (lower panel). The sample consists of respondents surveyed up to 4 weeks before or up to 4 weeks after a local disaster. *Liberal*, *Moderate* and *Conservative* denote categories of self-reported respondent ideology on a 3-point scale. Respondent controls include age, gender, college degree, income, and indicators for ideology. Standard errors are clustered by county. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table IV: Heterogeneity by Republican vote-share

	Democrat counties	Republican counties	Democrat counties	Republican counties
	(1)	(2)	(3)	(4)
	Climate change concerns		Environment vs jobs	
Liberal × Post-Disaster	0.058	0.120	0.115**	0.191**
	(0.045)	(0.075)	(0.053)	(0.089)
Moderate × Post-Disaster	0.079	0.029	0.162***	0.186*
	(0.048)	(0.082)	(0.051)	(0.096)
Conservative × Post-Disaster	-0.155**	-0.076	-0.168***	-0.032
	(0.065)	(0.074)	(0.057)	(0.080)
Respondent controls	Yes	Yes	Yes	Yes
Month-Year FEs	Yes	Yes	Yes	Yes
County × Survey-Year FEs	Yes	Yes	Yes	Yes
Observations	8,962	4,009	9,246	4,788
Number of counties	175	336	176	367
R^2	0.33	0.42	0.21	0.32
Mean dep. var.	3.81	3.51	3.11	2.99
Test for equality of coefficients				
Liberal × Post-Disaster	(1) vs (2): p-val=0.48		(3) vs (4): p-val=0.46	
Moderate × Post-Disaster	(1) vs (2): p-val=0.59		(3) vs (4): p-val=0.87	
Conservative × Post-Disaster	(1) vs (2): p-val=0.46		(3) vs (4): p-val=0.17	

Notes: Effect of local disaster occurrence on climate change and environmental concerns: heterogeneity by Republican vote share in the respondent's county. The sample consists of respondents in counties with below-median (columns 1 and 3) above-median Republican vote share in the most recent presidential election (columns 2 and 4), surveyed up to 4 weeks before or up to 4 weeks after a local disaster. *Liberal*, *Moderate* and *Conservative* denote categories of self-reported respondent ideology on a 3-point scale. Respondent controls include age, gender, college degree, income, and indicators for ideology. Standard errors are clustered by county. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table V: Heterogeneity by the presence of a local newspaper

	0 newspapers	>=1 newspapers	0 newspapers	>=1 newspapers
	(1)	(2)	(3)	(4)
	Climate concerns		Environment vs jobs	
Liberal × Post-Disaster	0.049	0.069*	0.024	0.138***
	(0.081)	(0.041)	(0.096)	(0.051)
Moderate × Post-Disaster	-0.040	0.085*	0.067	0.187***
	(0.085)	(0.046)	(0.090)	(0.052)
Conservative × Post-Disaster	0.031	-0.167***	0.063	-0.159***
	(0.096)	(0.053)	(0.087)	(0.050)
Respondent controls	Yes	Yes	Yes	Yes
Month-Year FEs	Yes	Yes	Yes	Yes
County × Survey-Year FEs	Yes	Yes	Yes	Yes
Observations	2,963	10,016	2,979	11,073
Number of counties	202	299	216	324
R^2	0.37	0.37	0.27	0.25
Mean dep. var.	3.69	3.73	3.01	3.08
Test for equality of coefficients				
Liberal × Post-Disaster	(1) vs (2): p-val=0.83		(3) vs (4): p-val=0.29	
Moderate × Post-Disaster	(1) vs (2): p-val=0.19		(3) vs (4): p-val=0.25	
Conservative × Post-Disaster	(1) vs (2): p-val=0.07		(3) vs (4): p-val=0.03	

Notes: Effect of local disaster occurrence on climate change and environmental concerns: heterogeneity by the presence of a local newspaper. The sample consists of respondents in counties with no newspaper HQs (columns 1 and 3) versus ones in counties with at least one newspaper HQ (columns 2 and 4), surveyed up to 4 weeks before or up to 4 weeks after a local disaster. The dependent variable is a 5-point scale of climate change concerns in columns (1) and (2) and a 5-point scale of preference for the environment over jobs in columns (3) and (4). *Post-Disaster* is an indicator equal to one in the 4 weeks after the start date of a local disaster. *Liberal*, *Moderate* and *Conservative* denote categories of self-reported respondent ideology. Respondent controls include age, gender, college degree, income, and indicators for ideology. Standard errors are clustered by county. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table VI: Local news coverage of disasters and climate change

	(1)	(2)	(3)	(4)
	IHS(Disaster articles)		IHS(Climate change articles)	
Post-Disaster	0.311***		0.008	
	(0.014)		(0.005)	
Newspaper HQ in Democrat county × Post-Disaster		0.300***		0.023***
		(0.018)		(0.008)
Newspaper HQ in Republican county × Post-Disaster		0.320***		-0.006
		(0.018)		(0.006)
Month-Year FEs	Yes	Yes	Yes	Yes
Newspaper × Year FEs	Yes	Yes	Yes	Yes
Observations	61,787	61,715	61,787	61,715
Number of newspapers	1,089	1,086	1,089	1,086
R squared	0.87	0.87	0.70	0.70
Mean dep. var.	1.93	1.93	0.47	0.47

Notes: Effect of local disaster occurrence on the newspaper coverage of disasters and climate change. The sample is restricted to the 4 before and the 4 weeks after the start date of a local disaster. *Democrat_county* and *Republican_county* denote counties with below- and above-median Republican vote share in the most recent presidential election. Standard errors clustered by county. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

A Appendix: Additional Results

Table A1: Balance in respondent characteristics (CES)

	(1) Pre-Disaster	(2) Post-Disaster	(3) Difference
Age	50.682	48.820	-1.862***
	(16.590)	(16.934)	(0.537)
Male	0.464	0.456	-0.008
	(0.499)	(0.498)	(0.008)
College degree	0.460	0.452	-0.008
	(0.498)	(0.498)	(0.012)
Income category (12-point scale)	6.407	6.151	-0.257***
	(3.196)	(3.206)	(0.086)
pid3==Democrat	0.424	0.412	-0.012
	(0.494)	(0.492)	(0.012)
pid3==Republican	0.309	0.311	0.002
	(0.462)	(0.463)	(0.008)
pid3==Independent	0.267	0.277	0.010
	(0.443)	(0.448)	(0.009)
ideo3==Liberal	0.314	0.301	-0.013*
	(0.464)	(0.459)	(0.007)
ideo3==Moderate	0.344	0.344	0.001
	(0.475)	(0.475)	(0.006)
ideo3==Conservative	0.342	0.355	0.013
	(0.474)	(0.479)	(0.008)
Observations	19,293	17,839	37,132

Notes: Balance in CES respondent characteristics: Respondents surveyed up to 4 weeks before a local disaster, versus ones surveyed up to 4 weeks after a local disaster.

Table A2: Balance in the distribution of respondent ideology (CES)

	(1) Very liberal	(2) Liberal	(3) Moderate	(4) Conservative	(5) Very conservative
Post-Disaster	-0.010	0.006	0.007	-0.001	-0.002
	(0.009)	(0.010)	(0.012)	(0.010)	(0.008)
Respondent controls	Yes	Yes	Yes	Yes	Yes
County× Survey-year FEs	Yes	Yes	Yes	Yes	Yes
Year-Month FEs	Yes	Yes	Yes	Yes	Yes
Observations	30,261	30,261	30,261	30,261	30,261
Number of counties	1,008	1,008	1,008	1,008	1,008
R^2	0.08	0.07	0.06	0.08	0.09
Mean dep. var.	0.11	0.20	0.35	0.23	0.11

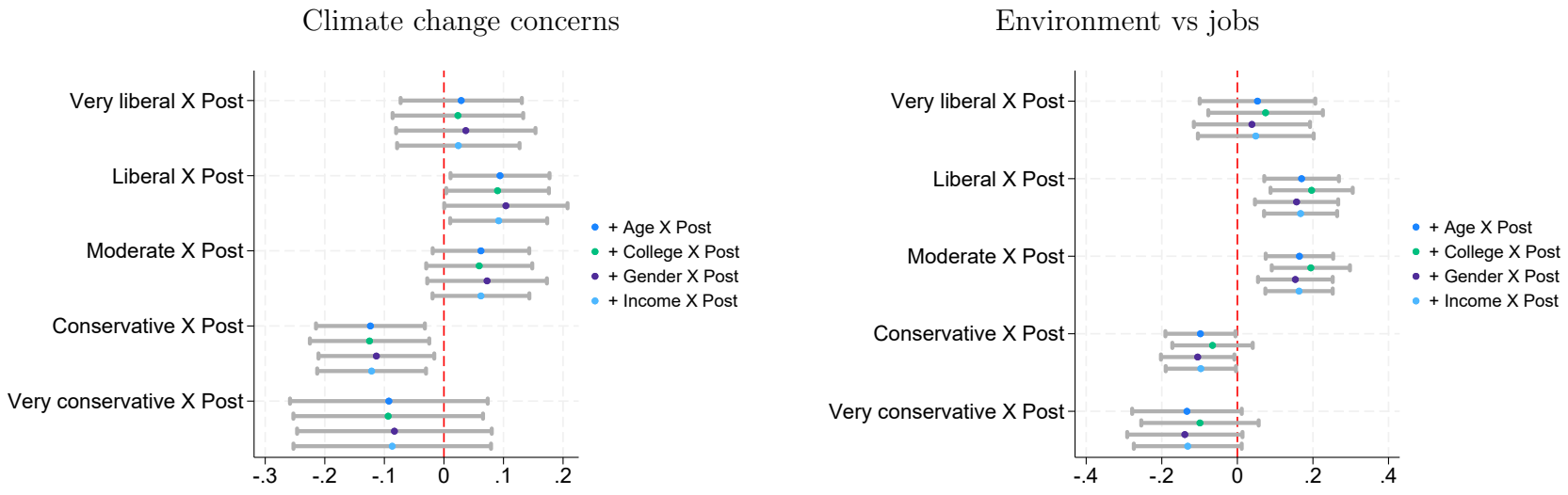
Notes: Balance in the distribution of CES respondent ideology. The sample consists of respondents surveyed up to 4 weeks before or up to 4 weeks after a local disaster. *Post-Disaster* is an indicator equal to one in the 4 weeks after the start date of a local disaster. Respondent controls include age, gender, income and indicator for college degree. Standard errors clustered by county.

Table A3: Disaster occurrence and views on environmental regulations

	(1)	(2)	(3)	(4)	(5)	(6)
	Index of support for environmental regulations					
Post-Disaster	0.026	0.055	0.054			
	(0.044)	(0.060)	(0.064)			
Liberal × Post-Disaster				-0.147	-0.117	-0.118
				(0.096)	(0.103)	(0.102)
Moderate × Post-Disaster				-0.018	0.009	0.012
				(0.056)	(0.066)	(0.071)
Conservative × Post-Disaster				0.125	0.155	0.158
				(0.105)	(0.113)	(0.118)
Respondent controls	Yes	Yes	Yes	Yes	Yes	Yes
County FEs	Yes	Yes	No	Yes	Yes	No
Month-Year FEs	Yes	Yes	Yes	Yes	Yes	Yes
State× Year FEs	No	Yes	No	No	Yes	No
County× Year FEs	No	No	Yes	No	No	Yes
Observations	14,956	14,955	14,900	13,932	13,931	13,875
Number of counties	611	611	603	589	589	581
R^2	0.11	0.11	0.12	0.32	0.32	0.33
Mean dep. var.	0.04	0.04	0.05	0.05	0.05	0.05

Notes: Effect of local disaster occurrence on a standardized index of support for environmental regulations. The sample consists of respondents surveyed up to 4 weeks before or up to 4 weeks after a local disaster. *Liberal*, *Moderate* and *Conservative* denote categories of self-reported respondent ideology on a 3-point scale. Respondent controls include age, gender, college degree, income, and indicators for ideology. Standard errors are clustered by county. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

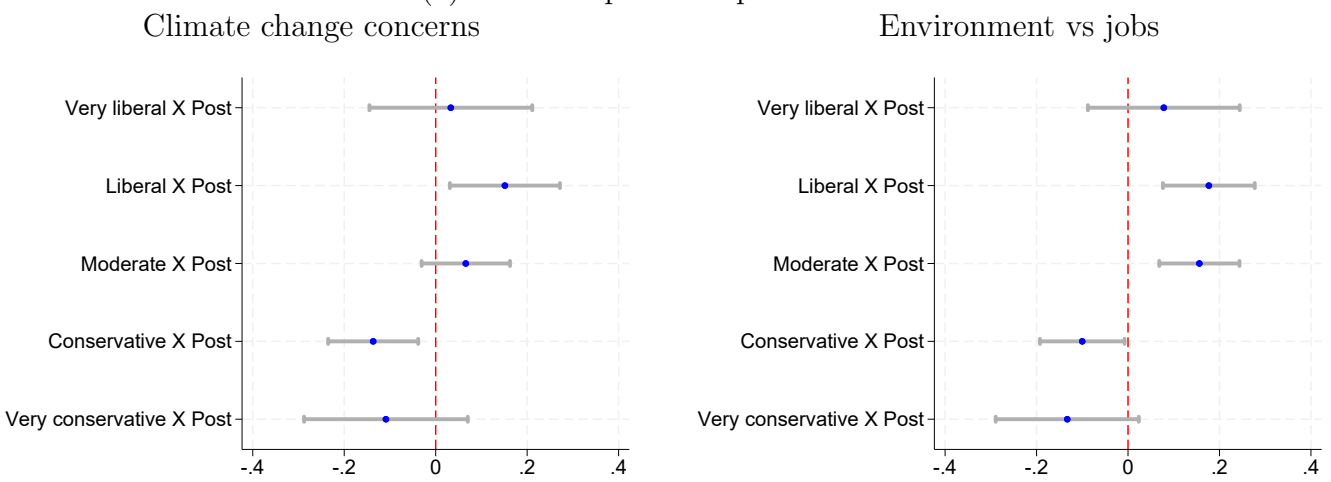
Figure A1: Robustness: Additional controls for respondent characteristics × Post-Disaster



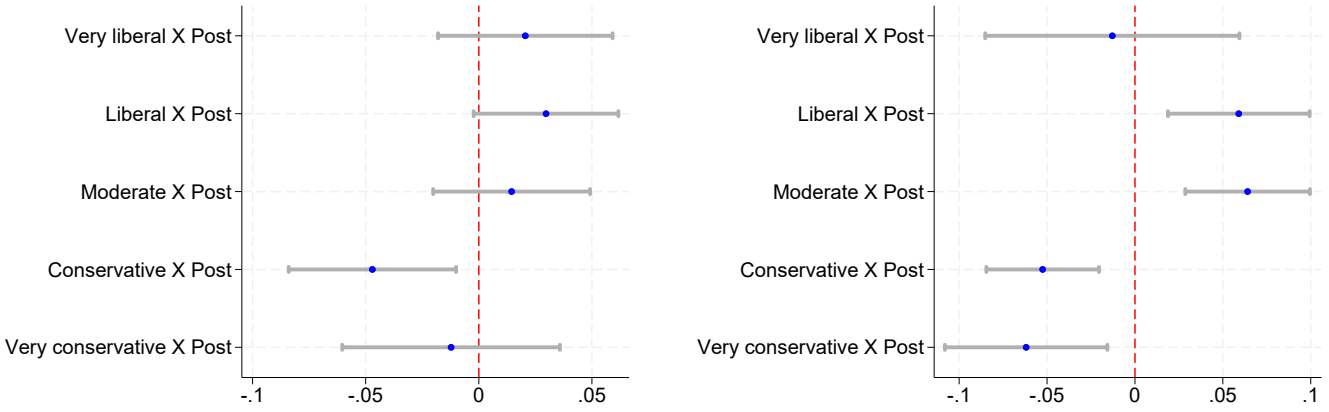
Notes: Point estimates and 95% confidence intervals from a regression of climate change concerns/ preference for the environment over jobs on the interaction of a full set categories for respondents' ideology with an indicator for being surveyed after a local disaster. Each coefficient corresponds to our baseline specification augmented with the interaction of a respondent-level covariate with an indicator for post-disaster. The sample includes respondents surveyed up to 4 weeks before or up to 4 weeks after a local disaster. All specifications control for respondent characteristics, including the main effects of 5-point ideology, year-month and county × survey year FEs. Standard errors clustered by county.

Figure A2: Robustness: Alternative functional forms

(a): Ordered probit: 5-point scale

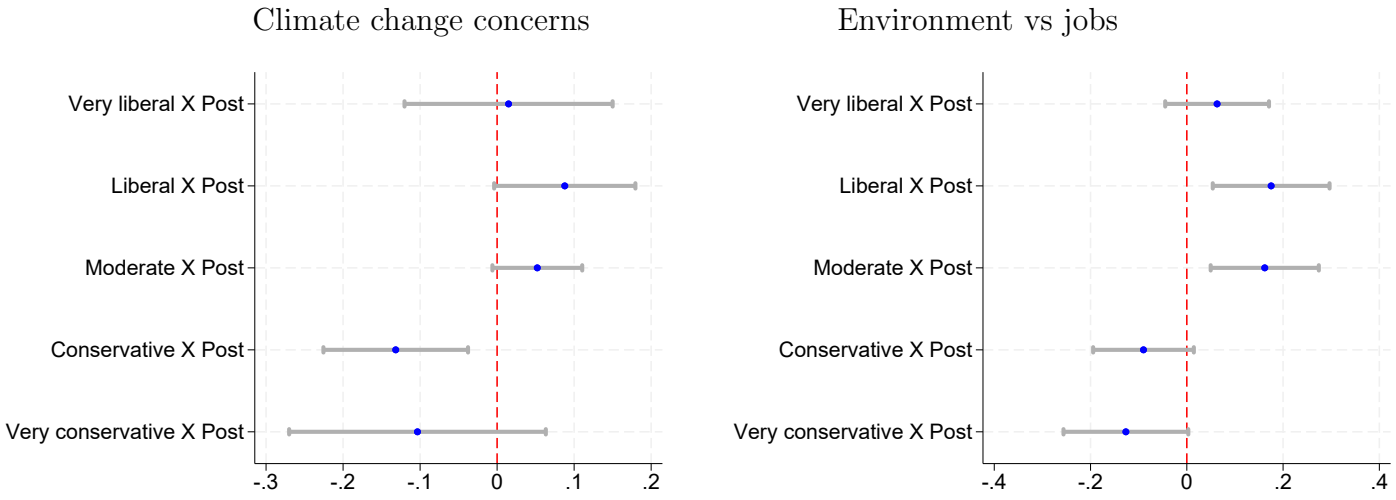


(b): Linear probability: Dummy for support for climate action/ environment more important than jobs



Notes: Point estimates and 95% confidence intervals from a regression of climate change concerns/ preference for the environment over jobs on the interaction of a full set categories for respondents' ideology with an indicator for being surveyed after a local disaster. Panel (a) presents the results of an ordered probit model using the 5-point scale dependent variables, and panel (b) presents the results of a linear probability model with outcomes recoded to 1 for answers in the range [4,5], and 0 for answers in the range [0,3]. The sample includes respondents surveyed up to 4 weeks before or up to 4 weeks after a local disaster. All specifications control for respondent characteristics, including the main effects of 5-point ideology, year-month and county × survey year FEs. Standard errors clustered by county.

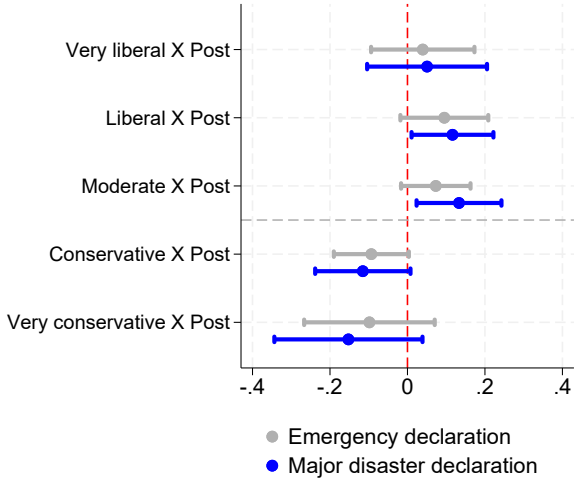
Figure A3: Robustness: Standard errors clustered by state



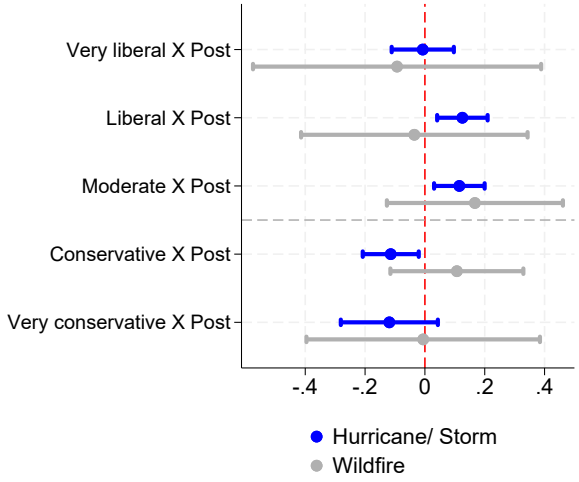
Notes: Point estimates and 95% confidence intervals from a regression of climate change concerns/ preference for the environment over jobs on the interaction of a full set categories for respondents' ideology with an indicator for being surveyed after a local disaster. The sample includes respondents surveyed up to 4 weeks before or up to 4 weeks after a local disaster. All specifications control for respondent characteristics, including the main effects of 5-point ideology, year-month and county × survey year FEs. Standard errors clustered by state.

Figure A4: Disaster occurrence and climate change concerns: Heterogeneity

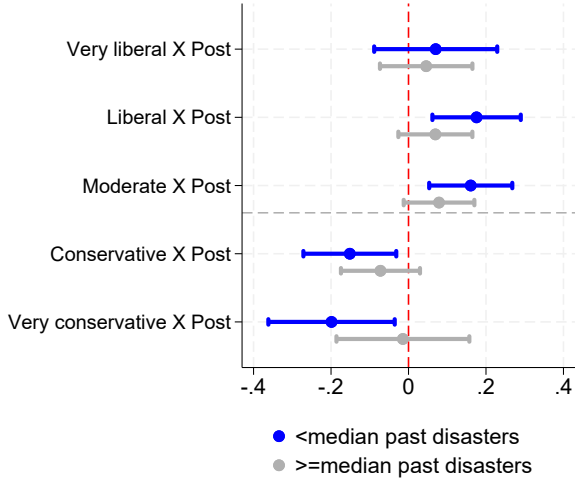
(a): By declaration type (disaster severity)



(b): By disaster type



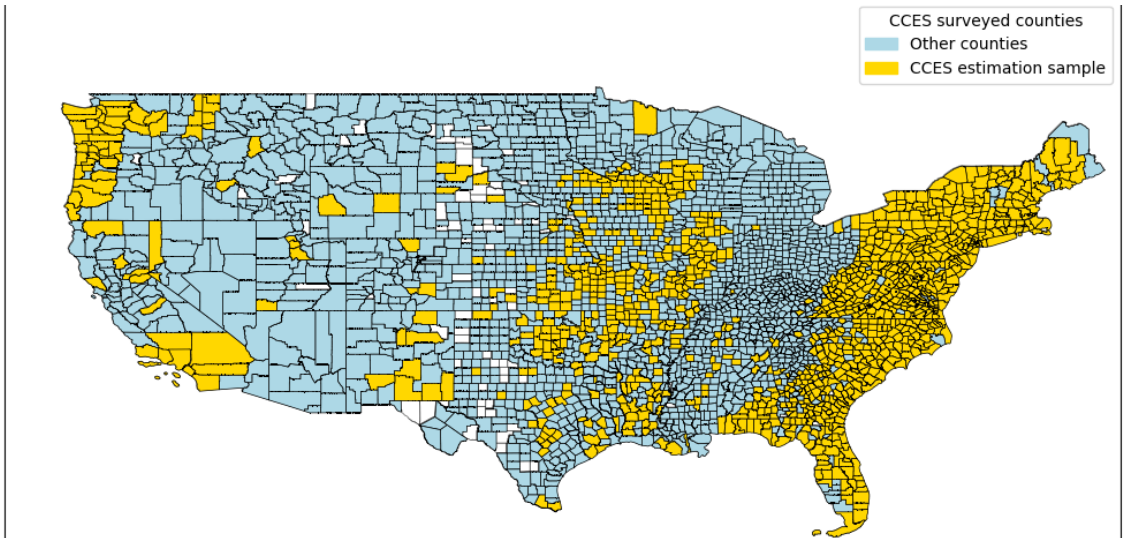
(c): By past disaster experience



Notes: Point estimates and 95% confidence intervals from a regression of an index of climate change concerns/ preference for the environment over jobs on the interaction of a full set categories for respondents' ideology with an indicator for being surveyed after a local disaster. The sample includes respondents surveyed up to 4 weeks before or up to 4 weeks after a local disaster. Each panel presents a sample split by the characteristics of the event or of the affected county: by declaration type in (panel a), by disaster type (panel b) and by the number of past disasters occurred in the county over the past 5 years (panel c). All specifications control for respondent characteristics, including the main effects of 5-point ideology, year-month and county × survey year FEs. Standard errors clustered by county.

B Appendix: Data

Figure B1: Coverage of the CES estimation sample



Notes: Map of US counties in the CES estimation sample, i.e. containing respondents surveyed up to 4 before or 4 weeks after a local FEMA-declared disaster.

Table B1: Comparison of the characteristics of Prolific respondents to CES respondents

	(1) CES Liberal	(2) Prolific Liberal	(3) CES Conservative	(4) Prolific Conservative
Age	46.48	39.19	49.16	47.02
Male	0.42	0.37	0.45	0.46
College degree	0.54	0.64	0.33	0.59
Income	64.54	69.13	54.88	75.59
Climate change concerns (5-point scale)	4.49	4.84	2.75	3.08
Environment vs jobs (5-point scale)	3.79	4.16	2.35	2.55

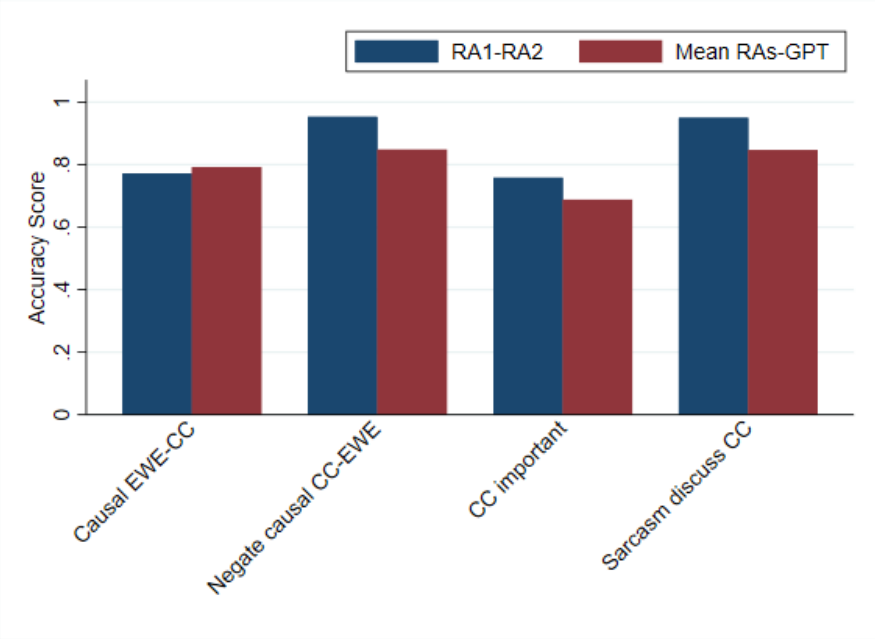
Notes: This table compares the socio-economic characteristics and stated climate change beliefs of Prolific respondents to those in the nationally-representative CES data.

Table B2: Disaster-related keywords

Disaster type	Keywords
Cold & snow	blizzard, coldwave, cold wave, extreme cold, snowstorm, snow storm, winterstorm, winter storm
Drought & heat	drought, extreme heat, extreme hot, heatwave, heat wave
Earthquake & volcano	earthquake, volcano, volcanic
Fire	bushfire, bush fire, forest fire, wildfire, wild fire, wild-fire
Flood	flood
Hurricane	hurricane, cyclone
Landslide	avalanche, landslide, land slide, mudslide, mud slide, rockfall
Storm	coastal storm, hailstorm, hail storm, superstorm, super storm, tornado, typhoon, windstorm, wind storm
General	extreme weather, natural disaster

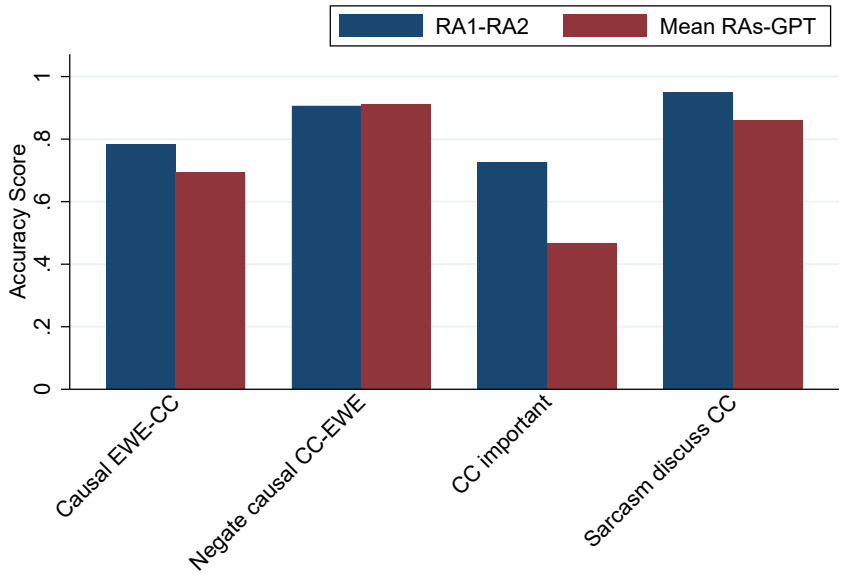
B.1 Validation of GPT annotations

Figure B2: Newspaper coverage of disasters and climate change: GPT validation



Notes: Accuracy of human and GPT annotations of newspaper articles. The accuracy score is defined as the number of identical annotations across coders over the number of annotated articles.

Figure B3: Cable TV coverage of disasters and climate change: GPT validation



Notes: Accuracy of human and GPT annotations of cable TV segments. The accuracy score is defined as the number of identical annotations across coders over the number of annotated segments.

B.2 GPT Annotation: Examples

- **San Jose Mercury News, Sept. 16th, 2020.**
  "Sadly, these wildfires and the devastation they cause are utterly predictable," [Senator Kamala] Harris said, speaking alongside Gov. Gavin Newsom on the edge of a school playground melted by the Creek fire [...]. . Her visit came a day after President Trump met Newsom in Sacramento for a wildfire briefing. While Trump continued to blame California and Western states for failing to aggressively clear the forests of "matchsticks" of fallen trees, Democratic nominee Joe Biden attacked the president as a "climate arsonist" in denial of a warming planet that is intensifying the blazes."

  GPT's annotations:
  Causal connection: Yes.
  Negate causal connection: No.
  Climate change is an important issue: Yes.
  Sarcasm: No.

- **Madera Tribune, Sept. 19th, 2020.**
  "The wildfires that have burned thousands of acres and destroyed thousands of lives can be attributed to decades of poor forest management. In the 1980s and 1990s, environmental groups convinced like-minded judges to rule in favor of eliminating logging and many other forms of forest management. Climate change is also blamed by some for contributing to the cause of the wildfires. The blame game in the middle of a crisis is rarely productive. After the fires are contained is time to point fingers and assign blame. Those responsible should be severely punished for the catastrophic wildfires, turning California into a wasteland of charred branches and piles of ashes."

  GPT's annotations:
  Causal connection: No.
  Negate causal connection: Yes.
  Climate change is an important issue: Yes.
  Sarcasm: Yes.

- **MSNBC, February. 11th, 2010.**
  "- Joining us now is Emmy award winner and scientist Bill Nye. [...] Can you explain in layman's terms whether a snowstorm disproves global warming?
  - Well first of all it doesn't, no. But let me remind you that global warming was the first term for this phenomenon that we now can call climate change so it's very reasonable that a snowstorm in Washington that's this severe is a result of climate change.
  - Is it consistent to have extreme weather conditions like big storms or even seasonal appropriate storms and to have the kind of climate change that's been forecasted and discussed by most of the reputable scientists in the world ?
  - I know what you're driving at Rachel. Yes, this would be consistent with such a thing."

  GPT's annotations:

Causal connection: Yes.
Negate causal connection: No.
Climate change is an important issue: Yes.
Sarcasm: No.

- **Fox News, February. 9th, 2010.**
  "Tonight's meltdown brought to you by the DC snow storm that dumped two feet of snow on Washington over the weekend causing thousands of power outages and keeping many home from work today. The most severe winter storm in years which would seem to contradict Al Gore's hysterical global warming theories. Also ironic given a couple of years ago Robert F. Kennedy Jr. was sounding the alarm about the lack of snow in the area lamenting snow is so scarce that most Virginia children don't own a shred. [...] I bet the snow even kept Al Gore's jet from taking off."

  GPT's annotations:
  Causal connection: No.
  Negate causal connection: Yes.
  Climate change is an important issue: No.
  Sarcasm: Yes.