CLIMATOLOGY

Extreme weather events and the politics of climate change attribution

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The consequences of climate change are becoming increasingly visible in the form of more severe wildfires, hurricanes, and flooding. As the science linking these disasters to climate change has grown more robust, it has led to pressure on politicians to acknowledge the connection. While an analysis of U.S. Congressional press releases reveals a slight increase in politicians' willingness to do so, many remain hesitant. Why? We hypothesize that climate change attribution can backfire, harming politicians' popularity and undermining their ability to adapt to the visible manifestations of climate change. We conduct an original survey experiment on a representative sample of American adults and show that when a politician links wildfires to climate change, Republicans perceive the official as less capable of addressing weather-related disasters. In addition, Republicans become less supportive of efforts to protect against similar disasters in the future. Our findings shed light on the potential trade-offs of conveying the link between climate change and its impacts.

INTRODUCTION

The past few years have witnessed a string of historic weather-related disasters, including devastating wildfires in Australia, apocalyptic flooding in Germany, and deadly heat waves across Europe. As these disasters multiply, a scientific consensus has coalesced around the conclusion that the rise in extreme weather events is a direct consequence of human-induced climate change (*1*, *2*). The growing visibility of climate change's effects offers politicians with what seems to be an opportunity. Whereas climate change has often been portrayed as an international problem with future ramifications (*3*), attributing current, local disasters to climate change has the potential to make climate change feel both more temporally pressing and geographically immediate, two characteristics that ought to bolster support for action on mitigation (*4*–*6*). In addition, even for politicians who may be less interested in mitigation efforts, blaming wildfires or floods on a phenomenon that predominantly represents an international failure might help divert attention away from local failures, such as insufficient forest management (a Republican talking point following the 2020 California wildfires) or poorly maintained infrastructure.

Nevertheless, many politicians have shown a continued unwillingness to link severe weather events to climate change, with such reticence emerging as a point of contention during the 2019–2020 Australian bushfires. During those fires, the Australian Prime Minister was broadly criticized for his refusal to discuss climate change as a factor in the fires' severity, and one junior lawmaker went so far as to explicitly deny any connection between the ongoing conflagration and global warming (*7*). Even some policymakers whom one might expect to embrace the opportunity to highlight the consequences of climate change have, at times, shown an unexpected hesitancy to do so. For example, in a press release announcing that California had secured federal funding for its wildfire response and recovery effort, Democratic Governor of California, Gavin Newsom, omitted any mention of the role that climate change had played in these fires (*8*). Perhaps even more telling, in Newsom's candidate statement for governor, issued in the run-up to the 2021 vote to recall him (an effort spearheaded by Republicans), Newsom stated that his administration was "investing in solutions for our most pressing challenges—homelessness, education, infrastructure, and wildfires." Notably absent from this statement was any acknowledgement of climate change or the fact that it has been a central factor in exacerbating the wildfires that Newsom's administration has ostensibly prioritized addressing.

None of this is to say that all politicians avoid making the connection between extreme weather events and climate change. As we will show through observational data on U.S. Congressional press releases, there has been some increase in politicians' tendency to reference climate change in connection with severe weather events, and while politicians like Newsom sometimes seem to deliberately avoid mentioning climate change in connection with extreme weather events, at other times, they are more forthcoming. Nevertheless, there remains a degree of wariness in many political quarters when it comes to connecting these two phenomena. We seek to understand whether such wariness is warranted and, more generally, to investigate whether climate change attribution can help politicians increase support for their response to extreme weather events and for the policies that will be necessary to address an increase in weather-related disasters in the future.

To answer these questions, we implemented a survey experiment, which we fielded in two waves to nationally representative samples of eligible American voters. The first wave was distributed in July 2021 to 3103 respondents. The second was distributed in October 2021 to 6071 respondents. Both survey experiments and all of the analyses included in the body of the paper were preregistered and received prior approval from Stanford and Princeton Universities' Institutional Review Boards (IRBs) (see Evidence in Governance and Politics (EGAP) registration ID: 20210628AC and Open Science Framework (OSF) preregistration DOI: 10.17605/OSF.IO/5Q3AU; also see Stanford IRB protocol: 59948 and Princeton IRB protocol: 13528). Across both waves of the survey, respondents were exposed to a short vignette about the 2020 wildfires in the Western United States, followed by a statement, which we directly modeled on a real statement issued by a politician from one of the impacted states. In

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the control version, the politician discussed the effect of the wildfires and the need for action without mentioning the role of climate change; in the treatment version, the politician offered the same statement but additionally noted the role that climate change had played in contributing to the severity of the wildfires.

Our results suggest that politicians' frequent hesitance to link natural disasters to climate change may be a prudent political choice, at least in the United States. Specifically, we find that among Republican respondents, those who saw the version of the politician's statement that mentioned climate change viewed that politician as less capable of addressing future wildfires and less sympathetic toward wildfire victims, relative to those who saw the control version. Perhaps our most notable result is that Republicans who saw the reference to climate change also became less likely to support an energy tax intended to "protect against future wildfires and other natural disasters," suggesting that climate change attribution may directly undermine climate change adaptation. While these negative effects are concentrated among conservative respondents, the weaker and generally nonsignificant effects among Democrats and Independents suggest that, on the margin, attributing weather-related natural disasters to climate change may be a losing political proposition with voters.

While previous work has explored the polarization of climate policy in the United States (*9*, *10*), with some work suggesting that exposing Republicans to messaging on climate change may make them more resistant to climate action (*11*–*13*), our findings reveal that linking climate change to extreme weather events additionally makes Republicans less supportive of the attributing politician and less willing to back adaptation efforts that we otherwise might not expect to evoke a strong partisan response. In other words, linking weather-related disasters to climate change may have the perverse effect of undermining politicians' ability to respond to those disasters.

Our research offers several important contributions. First, we provide the first comprehensive evaluation of the degree to which politicians have been willing to attribute extreme weather events to climate change over time. Although there has been some limited work looking at media coverage linking climate change and extreme weather events (*14*, *15*), we are unaware of any prior research that has sought to systematically capture political rhetoric attributing severe weather events to climate change or that has sought to evaluate how this has changed as the science has improved.

Second, we contribute to a growing debate surrounding the advisability of linking weather-related disasters to climate change. Despite the recent blitz of news articles forcefully highlighting the connection between extreme weather events and global warming, as well as a growing chorus of voices urging politicians to be more explicit about this connection, our findings suggest that there are concrete political trade-offs to doing so. Last, our work adds to a growing body of research investigating the determinants of public opinion around climate change issues (*16*–*18*), revealing a previously unexplored way in which climate change framing can produce an unexpected and undesirable backlash effect.

The science and politics of attribution

A revolution in "attribution science" has enabled scientists to conclude that recent weather events, such as droughts, heat waves, wildfires, and storms, have increased in severity and intensity due to climate change (*2*, *19*, *20*). This conclusion has been prominently echoed in recent reports by the internationally influential, Intergovernmental Panel on Climate Change (IPCC), which has expressed increasingly greater certainty about the connection between climate change and extreme weather, with the 2018 IPCC report marking a landmark in the forcefulness with which this conclusion was reached (*1*).

The increase in scientific consensus means that advocates of climate action no longer need to refer exclusively to predictions about the future to engender action. It also means that skeptics of climate change have less room to create doubt in the public mind about whether climate change is happening. How might this affect the politics of climate change?

An expanding group of scholars has sought to evaluate how politics might change as the consequences of climate change become ever more visible, with a variety of recent studies evaluating the impact of severe weather events on affected individuals' beliefs (*21*–*25*) and voting behaviors (*26*) around climate change. Yet a related question to how extreme weather events affect individuals' perceptions of climate change is how politicians' framing of these events influences voter perceptions of politicians' ability to respond to climate-related disasters, as well as voters' willingness to contribute to this response. Considering that elite framing plays a central role in public belief formation (*27*) and considering that politicians increasingly need to encourage not only policies that prevent more climate change in the future but also policies that respond to the consequences of climate change today, the drivers and consequences of politicians' framing of extreme weather events is an important area of study.

Although there are several apparent benefits to politicians of linking extreme weather events to climate change, we suspect that, in the U.S. context, the risks may outweigh them. Specifically, because there is a substantial partisan divide in the United States over climate change, we hypothesize that attributing a disaster to climate change could prime Republicans on their partisan identities, leading them to view efforts to combat future disasters through a negative, partisan lens, thus directly undermining support for future disaster adaptation and mitigation efforts. In addition, we hypothesize that climate change attribution could backfire on the politician herself via several interrelated mechanisms. First, to the extent that Republicans believe that blaming a severe weather event on climate change is misguided, it could lead them to believe that the attributing politician does not have a good understanding of the true causes of such occurrences and will be ineffective at preventing these events in the future. Second, because of the negative, partisan association of climate change for Republicans, the politician's reference to it may act less as a signal of scientific understanding and more as a cue of ideological divergence (*28*). This, in turn, could make Republicans see the politician as less likable, and, to the extent that individuals want to believe that their own beliefs and ideologies are "correct," this is also likely to make the politician seem less knowledgeable and/or competent. Last, the reference to climate change may simply elicit an emotional reaction among Republicans. Past research has shown that emotions provide individuals with a quick lens through which to interpret new events or information (*29*), and since climate change is likely to have a negative emotional association for more conservative respondents, they may then be inclined to view a politician who is mentioning climate change in response to a natural disaster in a negative light across the board.

On the flip side, because climate change is more likely to be viewed as a scientific fact among Democrats (and as less partisan) and because Democrats are likely to already think of extreme

weather events as linked to climate change, making this link explicit is less likely to affect their preferences, thereby offering politicians seeking to build a winning reelection coalition little upside from climate change attribution. Predicting these reactions, many politicians will have incentives to avoid linking disasters to climate change, even if such a link is scientifically warranted.

The willingness to attribute

To understand the incentives that U.S. politicians do or do not have to engage in climate change attribution, it is useful first to map out what the state of attribution looks like among American policymakers and how this has evolved as the science linking climate change to extreme weather events has improved. We, therefore, began by compiling a dataset of press releases by members of the U.S. Congress that would allow us to measure the degree of climate change attribution over time (2009–2020). Although only one potential corpus of political rhetoric, press releases offer an ideal and well-established means of evaluating elite rhetoric toward voters, given that these publications are directly targeted at constituents, represent substantial monetary investments, and have been shown to be strong signals of political agendas (*30*, *31*). Our dataset contains all available press releases about extreme weather events in the specified time period. We used this dataset to determine which of the press releases also referenced climate change (see section S3.1 for details and for examples of climate change attribution in weather-related press releases).

Figure 1 shows the evolution of climate change attribution by party membership. While both parties have somewhat increased their level of attribution, even among the greener Democratic party and following the definitive 2018 IPCC report (indicated with a vertical red line), the percentage of climate references never actually reaches 20%. Moreover, the vast majority of extreme weather-related press releases do not reference climate change at all, an observation that holds regardless of extreme weather event type (see section S3.2).

The press releases introduce a puzzle: Why have politicians largely refrained from climate change attribution even as the science linking climate change and weather-related disasters has improved? Our answer to this puzzle focuses on politicians' need to appeal to voters. While it is well understood that politicians may also seek to cater to special interest groups and party donors, suggesting that not all political rhetoric is voter targeted, a substantial literature in American politics and observable behavior by politicians (such as investments into assessing the popularity of political messages among constituents) suggests that politicians care deeply about how constituents view their communications.

We thus ask: How do voters' perceptions of politicians change when politicians highlight the connection between severe weather events and climate change? In addition, when politicians highlight the link between these two phenomena, does this make voters more or less supportive of efforts to combat the immediate impacts of climate change?

RESULTS

Assessing the consequences of climate change attribution

To answer these questions, we first fielded a survey experiment in July 2021 to a nationally representative sample of 3103 American adults. In the experiment, we presented all respondents with a short description of the devastating 2020 wildfires that tore across the Western United States. We chose to focus on these wildfires, because this was a case in which climate change attribution occurred at an unusually high rate (see section S3.2) and because there is a robust consensus that recent fires in California were exacerbated by severe drought conditions that were spurred by climate change (*32*, *33*).

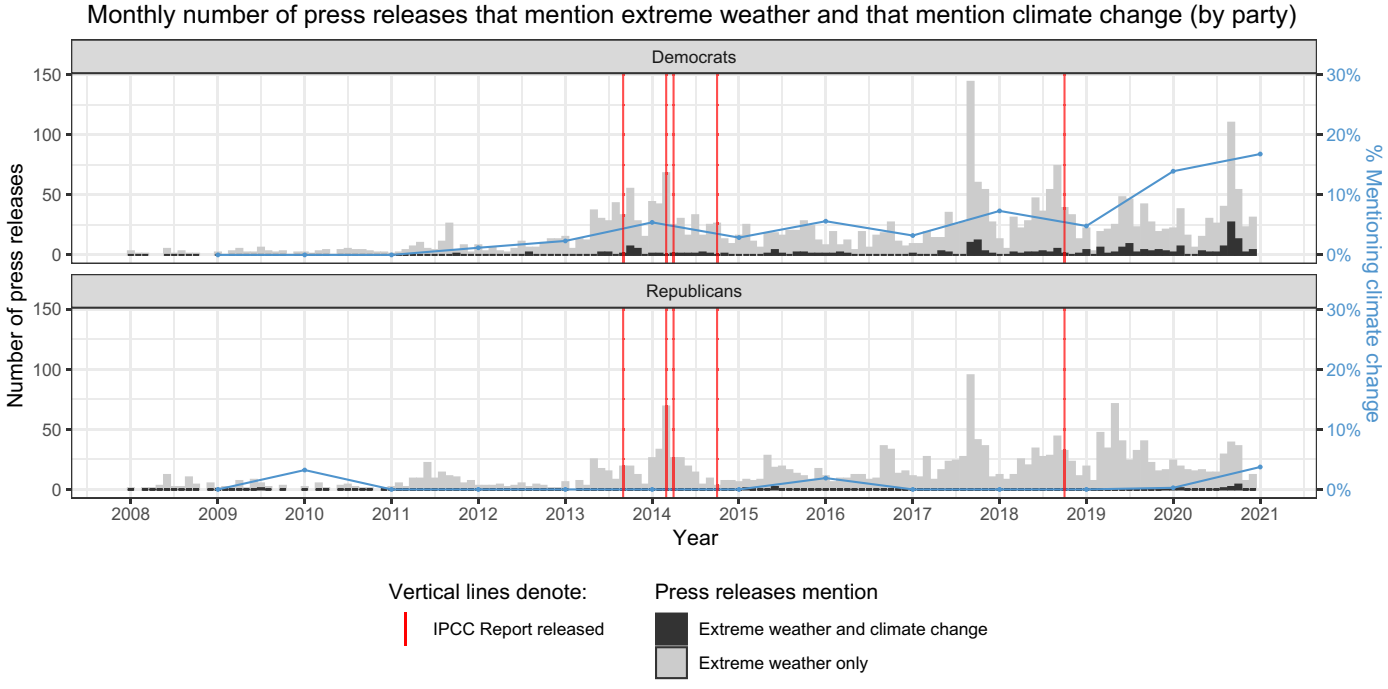

Fig. 1. Climate change attribution in weather-related press releases.

The brief description of the fires was followed by a statement, which we truthfully told respondents was based on a real statement made by a politician in one of the impacted states. We deliberately designed the statement to be as close as possible to the language used by politicians during these wildfires in their communications with constituents, thus ensuring a realistic treatment. The first wave of the survey (unlike the second) did not reveal any additional information about the politician (a longer discussion and justification for the research design can be found in section S2). Half of our respondents saw a version of the political statement that made no reference to climate change. The other half saw the same statement, except now it included additions that explicitly linked the wildfires to climate change. The political statement is reproduced below, with the treatment additions bracketed:

> "We are no stranger to wildfires in our great state, but the wildfires this year have been particularly severe[, partially as a result of climate change]. We need to work together to fight these fires now, support our communities in the aftermath, and later work to prevent future devastation[from climate change]. In meeting the immediate challenge of the fires that are already burning, we are enormously grateful to the federal firefighters who are risking their lives to save life and property, and to the disaster response officials who are working day and night to assist families who have lost everything. But, we can do more."

After respondents read this statement, they saw a series of questions. The first set of questions gauged respondents' views of the politician's competence and likeability. We asked how confident respondents were that the politician (i) would work to prevent future wildfires, (ii) has a good understanding of wildfires and their causes, and (iii) will be an effective advocate for federal disaster relief. For each of these three questions, respondents could choose from "extremely confident" to "not confident at all." We also asked respondents how sympathetic or unsympathetic they thought the politician was toward those affected by the fires.

Second, we probed respondents' support for a tax that was intended to protect against future wildfires. This question read "The government is considering imposing an energy tax to protect against future wildfires and other natural disasters. This tax is projected to increase the average American household's energy bill by 10%-20%. How likely would you be to support this new tax?"

Our survey design allows us to assess several related questions. First, we wanted to know whether voters view a politician who partially attributes the 2020 wildfires to climate change as more or less competent. Considering that scientists generally agree that recent California fires were made worse by climate change (*32*, *33*), one might expect an educated, rational respondent to view a politician who acknowledges the connection between these fires and global warming as one who has a solid understanding of wildfires and will be more cognizant of the necessary steps that must be taken to prevent such fires in the future. One might also think that voters would view a politician who understands that climate change has contributed to wildfires as more informed, which, in turn, may make such an individual a better advocate for his or her constituents. By contrast, under our hypotheses, we would expect a divergence between Republican and Democratic respondents, whereby Republicans view a politician who references climate change as less competent than a politician who does not.

Second, using the question on the politician's level of sympathy, we wanted to establish whether voters find the politician's reference to climate change to be inappropriate or off-putting. One could imagine a rational voter viewing a politician who references climate change as equally or more competent than one who did not, but such a voter still might perceive a reference to climate change in the context of a human tragedy as politically motivated and/or insensitive.

Last, using the energy tax question, we sought to evaluate the effect of climate change attribution on respondents' support for adaptation efforts that could help protect against the future ramifications of climate change. Considering that the tax was presented as something that the government, more broadly, was considering and given that the tax was pitched not as a solution to climate change but as a response to future disasters, we wanted to see whether any negative reactions to attribution might also spill over into a broader backlash against policies intended to address the problem of extreme weather events.

Findings from the first wave of survey

Table 1 presents summary statistics from the first wave of the survey for our main outcome variables in the control condition by respondents' party. Across all outcomes, lower numbers reflect more negative views among respondents (i.e., lower confidence in the politician, lower perceived sympathy by the politician, and lower support for a tax). The summary statistics give us a sense of the baseline, pretreatment differences between respondents. We can see that, on average, Democrats are more likely to express confidence in the politician's understanding of wildfires, her ability to prevent future wildfires, and that she will be an effective advocate for federal disaster relief. Similarly, Democrats are more likely to see the politician as sympathetic toward victims and to express support for the energy tax. These pretreatment differences may partially reflect the fact that the states most affected by the fires skew Democratic.

Figure 2 presents our first set of results. The figure shows the effect of the treatment on perceptions of the politician's competence. We show the estimated treatment effects for the full sample while also showing the subgroup effects on those that self-identify as Republican, Democrat, or Independent. Error bars denote 95% (dotted lines) and 90% (solid line) confidence intervals.

The results show that, while the average treatment effects are statistically indistinguishable from zero, this aggregate effect hides substantial heterogeneity by party. Specifically, the top of Fig. 2 shows that Republicans, when treated, expressed less confidence in the politician's understanding of wildfires. The coefficient is −0.13 on a three-point scale, representing 18% of an SD decrease in the outcome. For the average Republican respondent, this is equivalent to a move from between "somewhat confident" and "extremely confident" to somewhere between "somewhat confident" and "not confident at all". Treated Republicans were also 0.12 points less confident that the politician would work to prevent future wildfires, also representing 18% of an SD decrease in the outcome. For the average Republican respondent, this is equivalent to a move from between "somewhat confident" and "extremely confident" to somewhere between "somewhat confident" and "not confident at all". Similarly, Republicans felt less confident that the politician would be an effective advocate for federal disaster relief, although this result is noisy and not statistically significant, something which may be attributable to the fact that, at the time this was fielded, the federal government, across both executive and legislative branches, was mostly Democratic.

Table 1. Summary statistics for outcome variables in the control condition.

Party		Democrat			Republican	
Variable	***N***	**Mean**	**SD**	***N***	**Mean**	**SD**
How confident are you that the politician:						
(0 = not confident at all; 2 = extremely confident)						
has a good understanding of wildfires and their causes?	733	1.297	0.671	587	1.061	0.713
will work to prevent future wildfires?	733	1.293	0.64	587	1.111	0.684
will be an effective advocate for federal disaster relief?	733	1.342	0.626	587	1.126	0.644
How sympathetic or unsympathetic did the politician seem toward those impacted?						
(0 = extremely unsympathetic; 4 = extremely sympathetic)	733	3.188	0.833	587	2.974	0.892
How likely would you be to support the new tax?						
(0 = extremely unlikely; 4 = extremely likely)	732	2.347	1.209	586	1.433	1.296

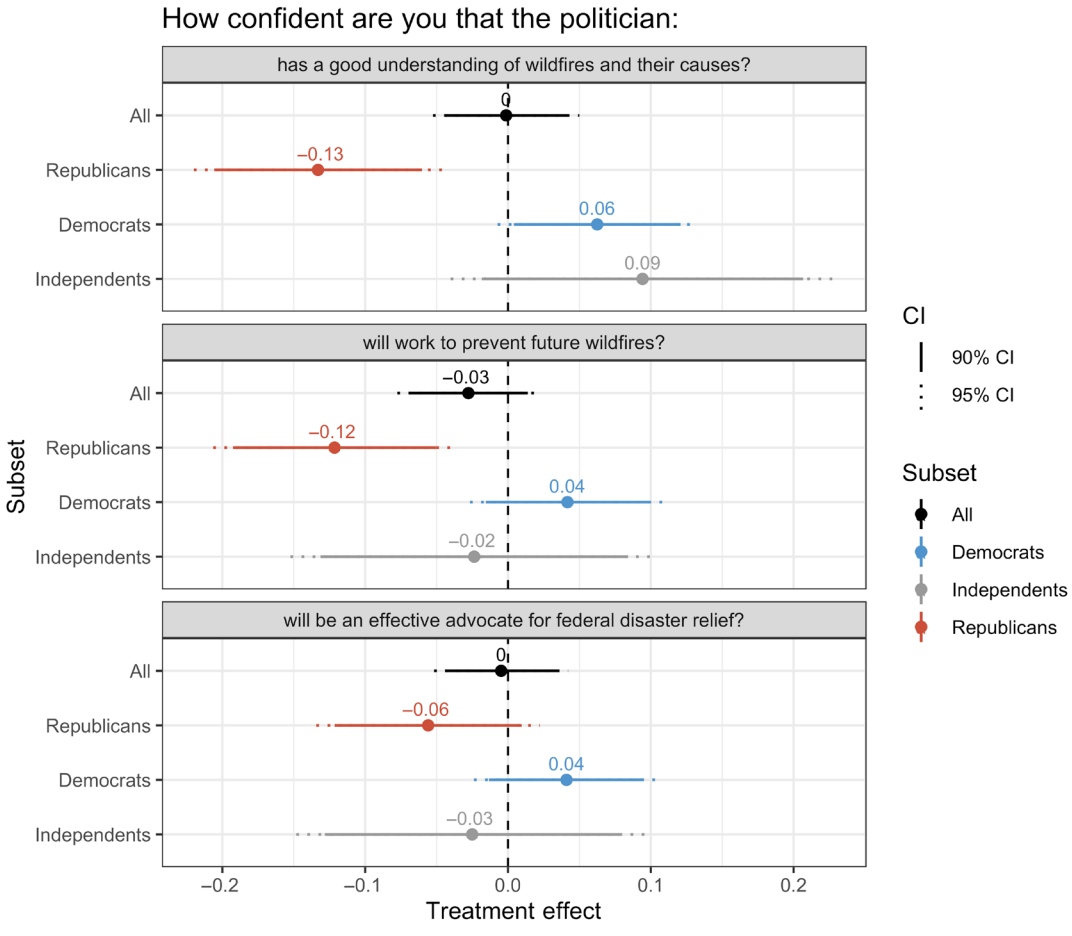

Fig. 2. Treatment effect on confidence in politician. This figure presents the effect of our treatment on the full sample and by respondents' party identification. All three variables are on a three-point scale ranging from 0 (not confident at all) to 2 (extremely confident). All regressions use OLS and control for respondent's gender, income, race, and level of education. CI, confidence interval.

As shown in section S5 (S5.7 and S5.8), we find the same negative backlash effects among Republicans even when subsetting to those who believe that climate change is happening and to those who have a high degree of engagement in climate change news. This suggests that the backlash effect is not being driven solely by respondents who have poor knowledge about or a lack of belief in climate change.

Whereas Republicans respond to the climate change treatment by viewing the politician more negatively, these effects are not mirrored among Democrats or Independents. Instead, we see small and inconsistent effects among Independents and a weakly positive effect of the treatment on Democrats, although the coefficients for Democrats are consistently smaller than for Republicans and do not reach conventional levels of significance.

We next turn to how the treatment affected respondents' perception of the politician's sympathy toward those affected. The results, shown in Fig. 3, reveal that now the average treatment effect is negative, with respondents viewing a politician who mentions climate change in connection with the wildfires as less sympathetic toward the victims of those fires. Yet when we look at this by subgroup, we see that this effect is almost entirely driven by Republicans, who take on a substantially more negative view of the politician's levels of sympathy when that politician references climate change as a contributor to the fires. The coefficient here is −0.18 on a five-point scale, representing 20% of an SD decrease in the outcome. For the average Republican respondent, this means a move from between "neither sympathetic nor unsympathetic" and "somewhat sympathetic" downward toward "neither sympathetic nor unsympathetic". The coefficient for Democrats is almost exactly zero, meaning that this is not simply about all voters thinking that the politician is using the wildfires to posture or make an insensitive political point. Rather, this effect is concentrated among Republicans.

Last, we turn to the effect of the climate change treatment on support for a tax intended to help address future wildfires, presented in Fig. 4. Again, the treatment looks notably different by subgroup. Whereas the effect for Republicans is strongly negative and statistically significant (16% of an SD decrease in the outcome), meaning treated respondents become less supportive of a tax meant to help communities adapt to future wildfires, the effect for Democrats is only slightly negative and not statistically significant.

Findings from the second wave of survey

Our first set of results shows that when politicians link extreme weather events to climate change, it produces a broad backlash effect among Republican respondents, one that affects both these respondents' views of the politician herself and respondents' willingness to pay a tax intended to help protect against future disasters. Notably, we do not find a commensurate increase in support for the politician or willingness to pay this tax among Democrats or Independents. These findings are an important contribution to our understanding of the politics of climate change attribution. We know that citizens look to elites, such as politicians, to help them interpret the world around them (*27*). We also know that politicians are motivated by the desire to retain office. Our results suggest that in Republican-leaning or competitive districts, politicians could actually harm their reelection chances if they attempt to attribute or otherwise connect weather-related disasters to climate change. Perhaps even more perverse, linking weather-related disasters to climate change seems to undermine individuals' willingness to support policies intended to address extreme weather events in the future, a particularly concerning outcome given that if climate change continues, then extreme weather events are projected to increase in severity going forward (*1*).

At the same time, one potential critique of our results is that respondents are simply inferring the politician's party based on whether that politician does or does not mention climate change. Considering that we know from our press release data that Republican politicians are less likely to engage in climate change attribution in practice, this would represent a logical conclusion and thus might suggest that respondents are not so much reacting to attribution as they are to their assumptions about the politician's party identification. To evaluate this possibility, we replicated our survey experiment in October 2021, except now we randomized whether the politician was identified as a Democrat or a Republican (the new version was fielded to double the respondents to retain equivalent power). As seen in Figs. 5 to 7, across every outcome described in the previous section, Republicans continued to exhibit a strong, consistent backlash effect, regardless of whether the politician was identified as a Republican or a Democrat, allaying concerns that our initial results were due to respondents inferring the politician's party. Our new experiment similarly found broadly consistent results for

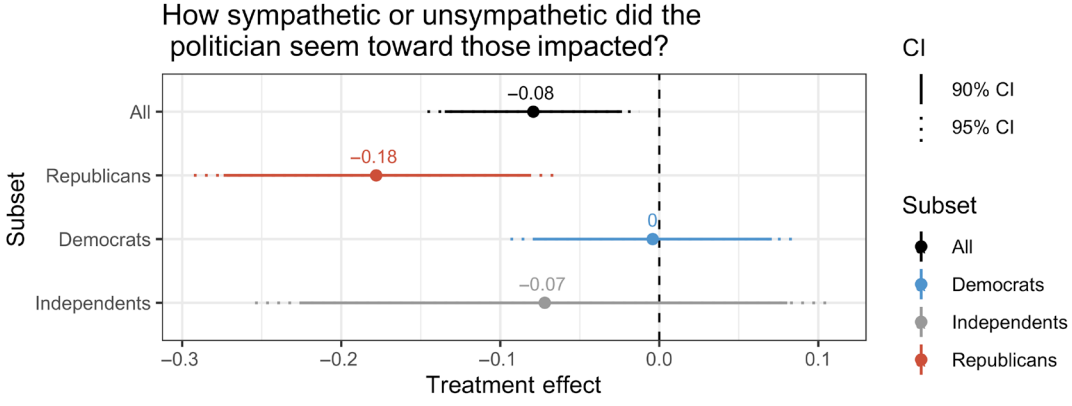

Fig. 3. Treatment effect on perception of politician's sympathy. This figure presents the effect of our treatment on the full sample and by respondents' party identification. For the dependent variable, a value of 0 denotes "extremely unsympathetic," while a value of 4 denotes "extremely sympathetic." All regressions use OLS and control for respondent's gender, income, race, and level of education.

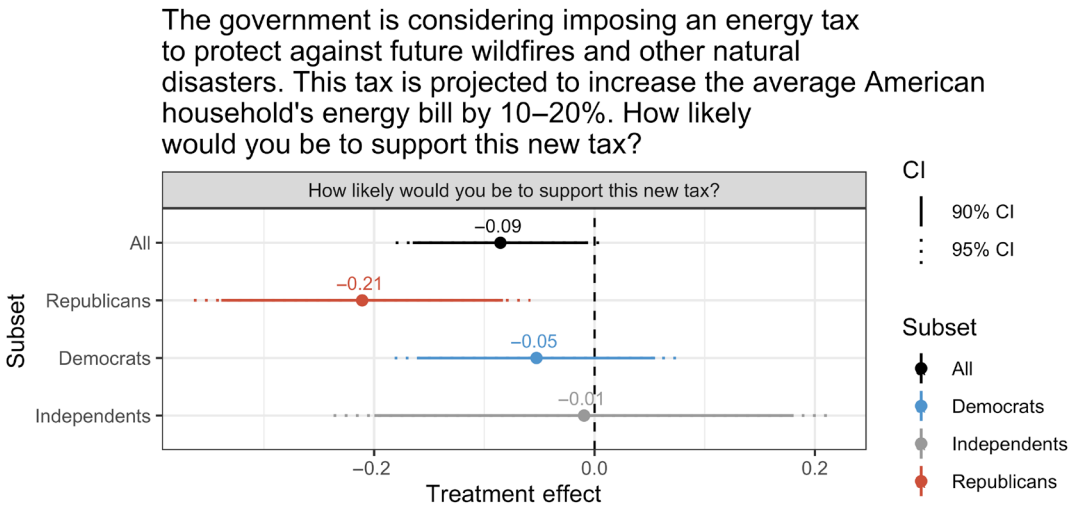

Fig. 4. Treatment effect on support for energy tax. This figure presents the effect of our treatment on the full sample and by respondents' party identification. The dependent variable is the respondent's likelihood of supporting the tax. A value of 0 denotes "extremely unlikely," while a value of 4 denotes "extremely likely." All regressions use OLS and control for respondent's gender, income, race, and level of education.

Democratic respondents, such that the treatment generally led to weakly positive results that were smaller than the commensurate Republican results and did not reach the level of significance. There were two exceptions to this. First, in the updated version, treated Democrats thought that both Democratic and Republican politicians had a better understanding of wildfires and their causes than untreated Democrats, and this was significant at the 95% confidence level, offering some small support for a valence effect among Democrats. Likewise, we found that treated Democratic respondents were more likely to support a wildfire tax when the politician was a Republican, though the positive effect size was smaller than the negative effect size for Republicans, and this effect did not hold when the politician was a Democrat, making us wary of strong interpretations.

The consistency of our results across the two survey waves adds robustness to our initial findings and ensures that they are not merely due to respondents making assumptions about the politician's party. However, it is important to note that this does not mean that respondents are inferring nothing about the politician's ideology from the treatment. As discussed previously, we expect that a combination of partisan priming and ideological signaling helps account for the backlash effects among Republican respondents. Yet what the second wave of our survey crucially shows that the first wave could not is that these backlash effects hold regardless of whether the politician is or is not a copartisan. This, therefore, drives home the dangers to politicians of either party, who need to win over some Republican voters, of engaging in climate change attribution.

We also used the second wave of our survey to probe the mechanism behind our results a bit more, particularly why we see so little positive movement across the board among treated Democrats. To this end, we asked respondents whether they thought wildfires in the United States would be more or less common in the next decade than in the past decade, with outcome options of "less common" (coded 0), "neither more nor less common" (coded 1), or "more common" (coded 2). Our expectation was that if we were correct and Democrats were not updating from the treatment, given existing priors, then we should see no effect of treatment on Democrats. The results are shown in Fig. 8. Because they do not substantially differ by whether the politician was a Republican or a Democrat, we pool them for ease of interpretation (the separated versions can be found in section S6.4.3). As expected, we do find that treated Democrats look practically identical to untreated Democrats (although considering that the average pretreatment response for Democrats in our sample was 1.62 with an SD of 0.6, this could be partially attributable to a ceiling effect). Yet we also find something that we had not anticipated: Treated Republicans decided that wildfires would be less common in the future than untreated Republicans. What might account for this?

We believe that there are two possible explanations. These explanations may also shed additional light on the mechanism driving the Republican backlash against the tax to prevent future wildfires. The first possibility is that, in addition to eliciting an emotional response and offering ideological cues about the politician, the treatment also leads to what is known as "motivated reasoning"—the notion that new information is filtered through existing preconceptions and partisan goals, thus shaping how that information is interpreted (*34*, *35*). The second possibility is that Republicans are simply engaging in partisan cheerleading or insincere shows of partisan solidarity. Notably, there has been some debate in recent years over whether motivated reasoning causes true factual updating or simply cheap talk (cheerleading), whereby partisans profess factual beliefs that they do not really hold (*36*, *37*), a debate we are unable to resolve here.

To elaborate, the average baseline belief among untreated Republicans was closest to an expectation that wildfires would be more common in the future (the average untreated Republican in our sample had a value of 1.443 on a 0 to 2 scale). Thus, if motivated reasoning is at play, then it would appear that, once it is suggested that the increase in fires is due to climate change, a suggestion that presumably conflicts with Republicans' partisan priors, Republicans revisit their original assumptions. They then decide that the seeming increase in fires must be due to chance. Alternatively, if this is a case of partisan cheerleading, then it suggests that, when presented with the

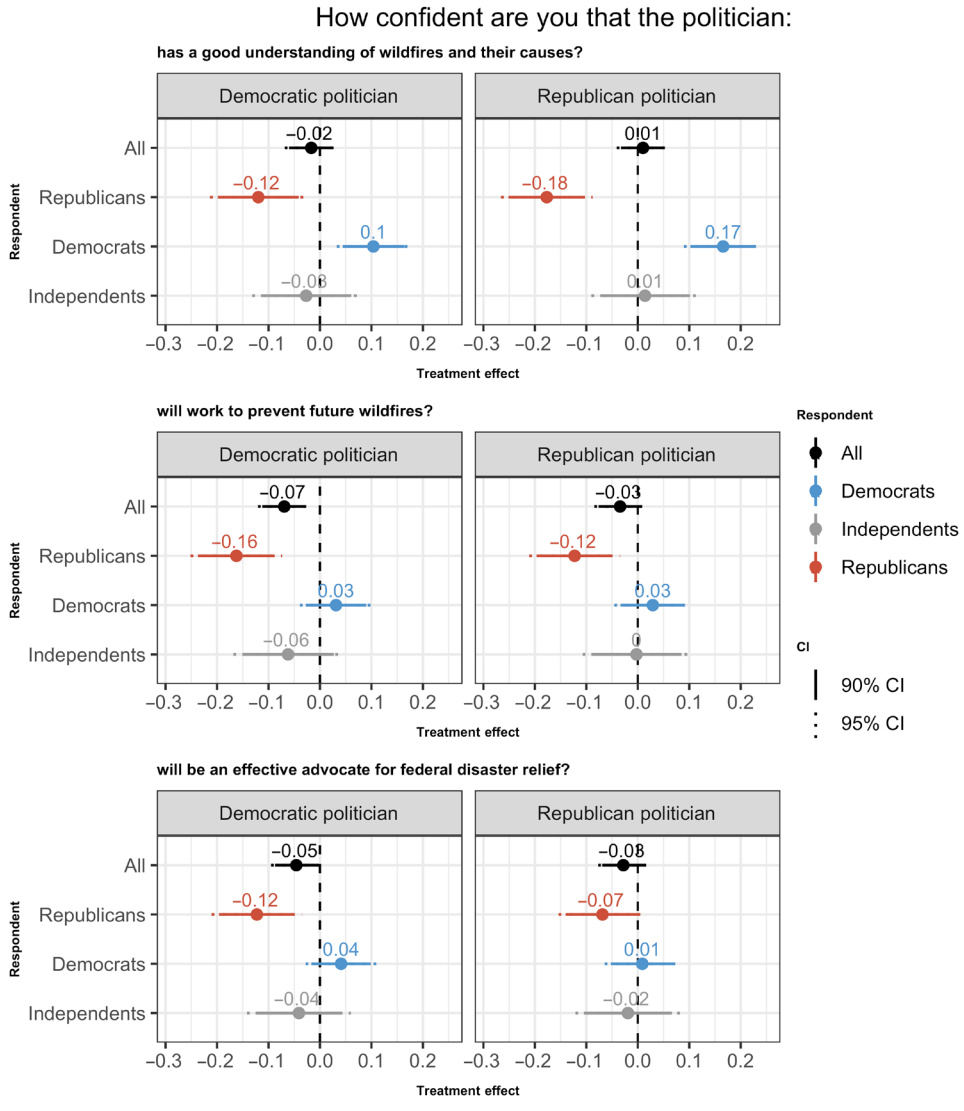

Fig. 5. Treatment effect on confidence in politician by the party of politician (second wave). This figure presents the effect of our treatment on the full sample and by respondents' party identification, split by the party identification of the politician. All three variables are on a three-point scale ranging from 0 (not confident at all) to 2 (extremely confident). All regressions use OLS and control for respondent's gender, income, race, and level of education.

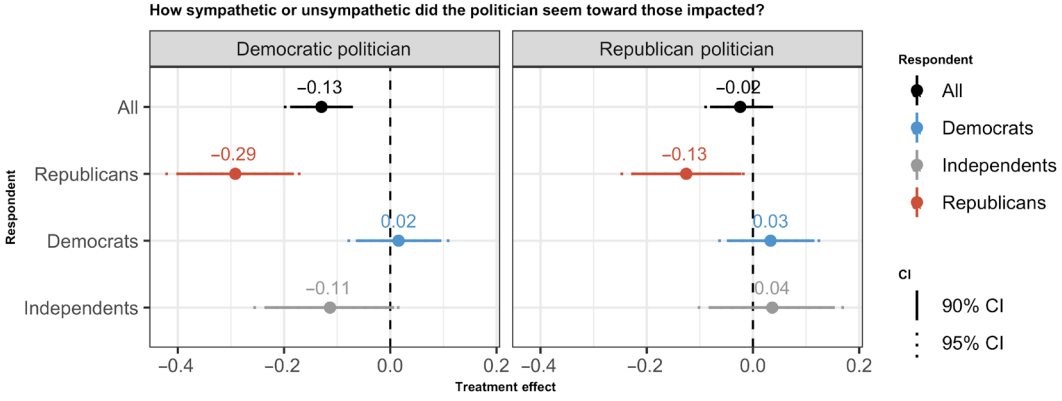

Fig. 6. Treatment effect on perception of politician's sympathy by the party of politician (second wave). This figure presents the effect of our treatment on the full sample and by respondents' party identification, split by the party identification of the politician. Each panel presents the treatment effect on the full sample and by subgroups of respondents' party identification. The dependent variable is on a five-point scale ranging from 0 (extremely unsympathetic) to 4 (extremely sympathetic). All regressions use OLS and control for respondent's gender, income, race, and level of education.

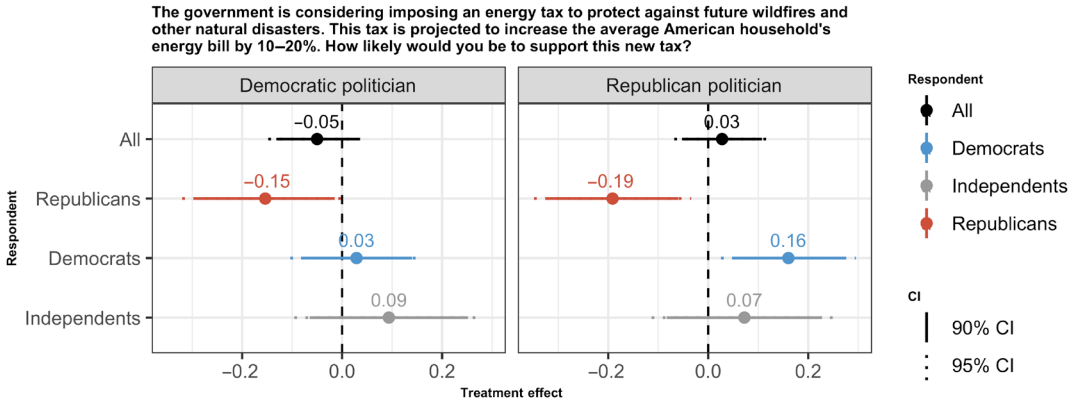

Fig. 7. Treatment effect on support for energy tax by the party of politician (second wave). This figure presents the effect of our treatment on the full sample and by respondents' party identification, split by the party identification of the politician. Each panel presents the treatment effect on the full sample and by subgroups of respondent party identification. The dependent variable is on a five-point scale ranging from 0 (extremely unlikely) to 4 (extremely likely). All regressions use OLS and control for respondent's gender, income, race, and level of education.

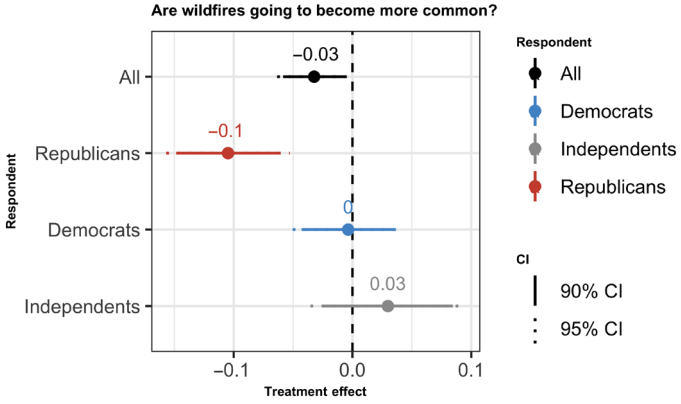

Fig. 8. Treatment effect on beliefs about wildfire frequency. This figure presents the effect of the treatment on the full sample and by respondents' party identification. The dependent variable is the respondents' belief about how frequent wildfires will become in the next 10 years. The values range from 0 (less common) to 1 (neither more nor less common) to 2 (more common). All regressions use OLS and control for respondent's gender, income, race, and level of education.

climate change treatment, Republicans retain their original beliefs, but take this question as an opportunity to express the party line.

Similar dynamics are likely at play when it comes to the wildfire tax. Specifically, when asked about their support for a wildfire tax, it seems likely that the treatment either makes Republicans determine that such a tax is less necessary than they might otherwise have thought, since wildfires are not going to be a more common event going forward (motivated reasoning), or it causes Republicans to oppose the tax out of a pure desire to express disapproval of something now viewed in a negative, partisan way (partisan cheerleading). While we are unable and do not purport to adjudicate between these two explanations, the implication from the perspective of the politician determining whether to acknowledge a link between extreme weather events and wildfires is effectively identical. In either case, drawing attention to the role of climate change reduces support for policies aimed at addressing future fires (while also undermining support for the politician herself). Perversely, this backlash may occur despite a sincere effort on the part of the politician to point out that there are likely to be more wildfires in the future and hence a greater need for policies to address them going forward.

Is there any good news for climate change attribution?

The results thus far paint a fairly pessimistic picture of the political benefits of climate change attribution. Yet an outstanding question is whether, even if climate change attribution backfires on the politician herself while undermining efforts for adaptation, it might nevertheless be a net positive when it comes to support for climate change mitigation. Given that the primary argument for attribution is precisely that it could make the public more supportive of efforts to reduce greenhouse gases, we wanted to evaluate whether this was the case. To do so, we added two new questions into our second wave that touched on climate change preferences. These questions came after respondents had already finished responding to questions about the politician and the wildfire tax, an ordering that was intended to ensure that asking about climate change did not treat respondents unintentionally. The first question that we asked was modeled after the original wildfire tax question, except now we told respondents to imagine that, instead of funding wildfire prevention, the goal of the tax was to reduce the emissions that contribute to climate change. The second question offered respondents a list of personal steps that they could take to reduce their own carbon footprint, and for each action, respondents were asked how likely they would be to take it. Options included using public transit or biking to work, reducing home energy use, taking fewer flights, buying carbon offsets, and considering purchasing an electric vehicle. The respondents' attested willingness to engage in each action was then added together to produce a score, with higher numbers indicating a greater willingness to take positive action to reduce emissions.

While we leave the full results to the Supplementary Materials for the sake of space, they unfortunately do not offer much evidence that attribution bolsters support for climate action. Instead, the treatment had weak and inconsistent effects on both Democrats and Republicans. At the same time, for reasons discussed in section S6.4.1, we shy away from interpreting this as compelling evidence against any benefit of attribution and instead take it to suggest that, in line with the rest of the paper's findings, the upside to attribution is not as obvious or clear-cut as sometimes suggested.

DISCUSSION

This paper has explored the politics of attributing weather-related disasters to climate change. We showed that, even as the science connecting these two phenomena has improved, politicians' willingness to acknowledge the relationship publicly has increased only slightly, with the change almost entirely concentrated among Democrats. Such continued reticence introduces a puzzle: Why do politicians remain so hesitant to link weather-related disasters to climate change? More generally, we sought to understand the political trade-offs of making this connection, as this might help inform the decisions of politicians going forward. Our results are both surprising and somewhat disturbing.

We find that politicians who link weather-related natural disasters like wildfires to climate change are viewed by Republicans as less understanding of wildfires and their causes, less likely to work to prevent future wildfires, and less sympathetic toward those affected by the wildfires. In addition, seeing a statement linking wildfires to global warming also makes Republicans less willing to support a tax intended to protect against future wildfires and other natural disasters. Moreover, although the effects that we found are concentrated among those who self-identify as Republican, we did not find a consistent or commensurately positive, countervailing effect among Democrats or Independents. On the plus side, the lack of backlash among Democrats likely suggests that our findings are not driven by respondents broadly viewing references to climate change in the wake of a disaster as political posturing or as otherwise inappropriate at a time when the focus should be on victims. At the same time, the fact that politicians do not significantly improve their image among Democrats when they reference climate change, combined with the fact that climate change attribution does not offer a clear win for encouraging climate action, suggests that, particularly for those politicians in competitive or Republican-leaning districts, climate change attribution not only is a potentially ineffective strategy but also is a politically dangerous one.

This paper adds to the growing body of literature aimed at understanding how the politics of global warming will change as its visible manifestations become more readily apparent. Amid a rising trend of news sources loudly proclaiming the link between extreme weather events and climate change, our findings instill a note of caution. Whereas the science linking weather-related disasters and global warming may be increasingly clear, the politics of doing so remains murky.

MATERIALS AND METHODS

Our survey sample was recruited by Lucid and fielded using the online Qualtrics platform. Lucid provides a nationally representative sample of the U.S. adult population, balanced on gender, age, race, and geographic region. As mentioned in the introduction, the survey was fielded in two waves. Both waves were approved by the IRBs of both Princeton and Stanford Universities. The first wave was launched in July 2021 to 3103 respondents. The second was launched in October 2021 to 6071 respondents. Random assignment was used for the treatment.

While section S5.2 shows the results all held with an ordered logit, all results presented in the body of the paper are estimated using the following Ordinary Least Squares (OLS) model

$$Y_i = \beta_0 + \tau \text{Treated}_i + \mathbf{X}_i' \phi + \epsilon_i \quad (1)$$

Where Y_i is an ordinal response variable recording respondent i's views, such that lower numbers reflect more negative or less supportive views (i.e., lower confidence in the politician, lower perceived sympathy by the politician, or lower support for a tax). β_0 is an intercept term. Treated is a binary variable that denotes whether the respondent was presented with the version of the prompt that mentions climate change. $\mathbf{X}_i$ is a vector of controls (and ϕ is the associated coefficient vector) including the respondent's gender, level of income, race, and whether they are college educated. We included controls in the main analysis to reduce variance in the estimated treatment effects for the primary analysis. However, we also show in sections S5.4 and S6.2 that the results are the same when controls are dropped.

Results presented in the paper are unweighted, as our randomized treatment and large sample sizes ensure that our subgroup treatment effects are not an artifact of having too few respondents in any given subgroup. This is consistent with work showing that unweighted sample average treatment effects from nationally representative samples collected by prominent survey firms should be sufficient (*38*). Nonetheless, we do also replicate our main results using weighted samples in section S5.9 and find that the results hold.

SUPPLEMENTARY MATERIALS

Supplementary material for this article is available at https://science.org/doi/10.1126/sciadv.abo2190

REFERENCES AND NOTES

1. IPCC, "Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty" (Technical Report Intergovernmental Panel on Climate Change, 2018).
2. J. T. Abatzoglou, A. P. Williams, Impact of anthropogenic climate change on wildfire across western US forests. *Proc. Natl. Acad. Sci. U.S.A.* **113**, 11770–11775 (2016).
3. S. M. Gardiner, A perfect moral storm: Climate change, intergenerational ethics and the problem of moral corruption. *Environ. Value.* **15**, 397–413 (2006).
4. S. D. Brody, S. Zahran, A. Vedlitz, H. Grover, Examining the relationship between physical vulnerability and public perceptions of global climate change in the United States. *Environ. Behav.* **40**, 72–95 (2008).
5. K. Levin, B. Cashore, S. Bernstein, G. Auld, Overcoming the tragedy of super wicked problems: Constraining our future selves to ameliorate global climate change. *Policy. Sci.* **45**, 123–152 (2012).
6. D. Sprinz, T. Vaahtoranta, The interest-based explanation of international environmental policy. *Int. Organ.* **48**, 77–105 (1994).
7. R. McGuirk, "Australian PM's leadership criticized during wildfire crisis," *AP News*, 8 January 2020.
8. G. Newsom, "California Secures Presidential Major Disaster Declaration to Support Wildfire Response and Recovery Efforts," *Office of the Governor Gavin Newsom*, 24 August 2021.
9. S. E. Kim, J. Urpelainen, The polarization of American environmental policy: A regression discontinuity analysis of Senate and House votes, 1971–2013. *Rev. Policy Res.* **34**, 456–484 (2017).
10. S. E. Kim, J. Urpelainen, Environmental public opinion in U.S. states, 1973–2012. *Environ. Polit.* **27**, 89–114 (2018).
11. J. Zhou, Boomerangs versus javelins: How polarization constrains communication on climate change. *Environ. Polit.* **25**, 788–811 (2016).
12. P. S. Hart, E. C. Nisbet, Boomerang effects in science communication: How motivated reasoning and identity cues amplify opinion polarization about climate mitigation policies. *J. Commun. Res.* **39**, 701–723 (2012).
13. P. S. Hart, L. Feldman, Would it be better to not talk about climate change? The impact of climate change and air pollution frames on support for regulating power plant emissions. *J. Environ. Psychol.* **60**, 1–8 (2018).
14. D. J. Davidson, A. Fisher, G. Blue, Missed opportunities: The absence of climate change in media coverage of forest fire events in Alberta. *Clim. Change* **153**, 165–179 (2019).
15. M. Lahsen, G. de Azevedo Couto, I. Lorenzoni, When climate change is not blamed: The politics of disaster attribution in international perspective. *Clim. Change* **158**, 213–233 (2020).
16. P. J. Egan, M. Mullin, Climate change: U.S. public opinion. *Annu. Rev. Polit. Sci.* **20**, 209–227 (2017).

17. F. G. Gaikwad Nikhar, D. Tingley, *Creating Climate Coalitions: Mass Preferences for Compensating Vulnerability in the World's Two Largest Democracies* (American Political Science Review, Forthcoming, 2022); www.cambridge.org/core/journals/american-political-science-review/article/creating-climate-coalitions-mass-preferencesfor-compensating-vulnerability-in-the-worlds-two-largest-democracies/77D49DA72F822938891228EE516DF578.
18. D. Tingley, M. Tomz, International commitments and domestic opinion: The effect of the Paris Agreement on public support for policies to address climate change. *Environ. Polit.* **29**, 1135–1156 (2020).
19. P. Naveau, A. Hannart, A. Ribes, Statistical methods for extreme event attribution in climate science. *Annu. Rev. Stat. Appl.* **7**, 89–110 (2020).
20. S. C. Herring, M. P. Hoerling, J. P. Kossin, T. C. Peterson, P. A. Stott, Explaining extreme events of 2014 from a climate perspective. *B. Am. Meteorol. Soc.* **96**, S1–S172 (2015).
21. P. Bergquist, C. Warshaw, Does global warming increase public concern about climate change? *J. Theor. Polit.* **81**, 686–691 (2019).
22. J. Brooks, D. Oxley, A. Vedlitz, S. Zahran, C. Lindsey, Abnormal daily temperature and concern about climate change across the United States. *Rev. Policy Res.* **31**, 199–217 (2014).
23. C. Demski, S. Capstick, N. Pidgeon, R. G. Sposato, A. Spence, Experience of extreme weather affects climate change mitigation and adaptation responses. *Clim. Change* **140**, 149–164 (2017).
24. T. Deryugina, How do people update? The effects of local weather fluctuations on beliefs about global warming. *Clim. Change* **118**, 397–416 (2013).
25. L. Whitmarsh, Are flood victims more concerned about climate change than other people? The role of direct experience in risk perception and behavioural response. *J. Risk Res.* **11**, 351–374 (2008).
26. C. Hazlett, M. Mildenberger, Wildfire exposure increases pro-environment voting within democratic but not republican areas. *Am. Polit. Sci. Rev.* **114**, 1359–1365 (2020).
27. M. Gabel, K. Scheve, Estimating the effect of elite communications on public opinion using instrumental variables. *Am. J. Polit. Sci.* **51**, 1013–1028 (2007).
28. C. Kendall, T. Nannicini, F. Trebbi, How do voters respond to information? Evidence from a randomized campaign. *Am. Econ. Rev.* **105**, 322–353 (2015).
29. G. E. Marcus, Emotions in politics. *Annu. Rev. Polit. Sci.* **3**, 221–250 (2000).
30. J. Grimmer, A Bayesian hierarchical topic model for political texts: Measuring expressed agendas in Senate press releases. *Polit. Anal.* **18**, 1–35 (2010).
31. J. Grimmer, S. Messing, S. J. Westwood, How words and money cultivate a personal vote: The effect of legislator credit claiming on constituent credit Allocation. *Am. Polit. Sci. Rev.* **106**, 703–719 (2012).
32. A. P. Williams, J. T. Abatzoglou, A. Gershunov, J. Guzman-Morales, D. A. Bishop, J. K. Balch, D. P. Lettenmaier, Observed impacts of anthropogenic climate change on wildfire in California. *Earth's Future* **7**, 892–910 (2019).
33. M. Goss, D. L. Swain, J. T. Abatzoglou, A. Sarhadi, C. A. Kolden, A. P. Williams, N. S. Diffenbaugh, Climate change is increasing the likelihood of extreme autumn wildfire conditions across California. *Environ. Res. Lett.* **15**, 094016 (2020).
34. Z. Kunda, The case for motivated reasoning. *Psychol. Bull.* **108**, 480–498 (1990).
35. C. S. Taber, M. Lodge, Motivated skepticism in the evaluation of political beliefs. *Am. J. Polit. Sci.* **50**, 755–769 (2006).
36. J. G. Bullock, A. S. Gerber, S. J. Hill, G. Huber, Partisan bias in factual beliefs about politics. *Q. J. Polit. Sci.* **10**, 519–578 (2015).
37. M. C. McGrath, Economic behavior and the partisan perceptual screen. *Q. J. Polit. Sci.* **11**, 363–383 (2016).
38. L. W. Miratrix, J. S. Sekhon, A. G. Theodoridis, L. F. Campos, Worth weighting? How to think about and use weights in survey experiments. *Polit. Anal.* **26**, 275–291 (2018).
39. R. Brutger, J. D. Kertzer, J. Renshon, D. Tingley, C. M. Weiss, *Abstraction and Detail in Experimental Design* (American Journal of Political Science, Forthcoming, 2022); https://onlinelibrary.wiley.com/doi/abs/10.1111/ajps.12710.
40. D. Vogel, Trading up and governing across: Transnational governance and environmental protection. *J. Eur. Public Policy* **4**, 556–571 (1997).
41. ProPublica, *ProPublica Congress API* (ProPublica Inc., 2021).
42. U.S. Census Bureau, *American Community Survey*, 2020.
43. Pew Research Center, *Party Identification Among Registered Voters 1994–2019 (Detailed Tables)*, 2019.

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