Who is concerned about climate change when forests are burning? Evidence from Swedish forest fires

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Abstract: I examine how individuals update their environmental attitudes in response to climate events using the extensive Swedish forest fires in 2018. Political scientists have suggested that motivated reasoning contributes to political divergence in environmental attitudes over time. It remains empirically unclear whether the growing prominence of climate events could potentially widen or bridge these political divides in attitudes. I document rising environmental concerns following the fires. The extent of these increases was weakly influenced by the intensity of local fires but strongly affected by individuals' prior beliefs. Left-leaning individuals exhibited stronger prior concerns and experienced a significant escalation in their degree of concerns relative to right-leaning individuals. The growing disparity in concerns suggests that climate events exacerbate political polarization in environmental attitudes rather than mitigate it. Additionally, exposure to climate change news did not contribute to the political polarization of concerns, strengthening the interpretation that motivated reasoning shapes beliefs.

Keywords: political polarization; climate extremes; forest fires; environmental attitudes; climate change concerns

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1. Introduction

Driven by human-induced climate change, extreme weather events have become more frequent and severe (Stern, 2008; Dietz and Stern, 2008; IPCC, 2022), which has profound impacts on our society.[1] Despite the pressing need for climate action, there are few climate policies in place globally, to a great extent due to a lack of public support for such policies. Research has shown that climate change beliefs are essential in generating public support for policies mitigating climate change impacts and reducing pollution (Millner and Ollivier, 2016). As highlighted by Nordhaus (2019), the first step in addressing climate change is to help people understand the link between extreme climate events and global warming.

Meanwhile, the increasing prevalence of climate events has the potential to raise awareness of climate risks and other environmental hazards. Salience is often used by psychologists to describe how contrasting and unexpected stimuli can capture our attention, and it can shape our beliefs and influence our decision-making in a "what you see is all there is" heuristic manner (Enke, 2020; Bordalo et al., 2022). Previous research has shown that the extent of exposure to extreme weather events, such as proximity to such events, is linked to pro-environmental attitudes (Spence et al., 2011; Akerlof et al., 2013; Herrnstadt and Muehlegger, 2014; Dai et al., 2015; Konisky et al., 2016; Lacroix et al., 2020).

Another mechanism that can play an important role in belief formation is motivated reasoning. When forming beliefs, we typically consider both the accuracy of the information and how desirable its implications are, and may ignore information that conflicts with our existing beliefs to avoid cognitive dissonance (Bénabou and Tirole, 2016). Motivated reasoning, where people selectively choose and interpret information to support their prior beliefs, can lead to confirmation bias (Mullainathan and Washington, 2009; Eil and Rao, 2011; Zimmermann, 2020; Drobner, 2022). Such selective responses to new information make us likely to underweight information that conflicts with our prior beliefs.

Consequently, the presence of motivated reasoning in belief formation is likely to result in a polarization of public opinions. Political polarization in environmental beliefs, such as concerns about climate change, has been well-documented and some researchers attribute it to motivated reasoning (McCright and Dunlap, 2011; Guber, 2013; Meyer, 2019). Political scientists have suggested that climate events could make climate risk more salient even for climate deniers and potentially ease polarization, while motivated reasoning predicts a growing divergence in beliefs. Egan and Mullin (2017) noted that the impact of climate extremes on political polarization is an open empirical issue that is still rather unexplored.

This paper examines how individuals update their environmental attitudes in response to the 2018 Swedish forest fires. In 2018, Sweden experienced the most devastating forest fires since 1900, resulting in a temporary 37% increase in support for the Swedish Green Party from May to August (Pollofpolls.se, 2020).[2] Meanwhile, the share of individuals who identified environmental problems as one of the top three societal issues also rose by 69% (from 11.6 to 19.7 percentage points), after declining each year since 2011.

[1] A substantial literature has evaluated the scope of climate-related damages (e.g., Ouattara and Strobl, 2013; Carleton and Hsiang, 2016; Diaz, 2016; Martinich and Crimmins, 2019).
[2] The support increased from 4.1 to 5.6 percentage points.

As the severity of the fires varied substantially across different regions of the country, to investigate the role of salience, I exploit the variation in fire intensity across space and examine whether the impacts of the fires on environmental attitudes depend on the extent of local areas burned across municipalities. I estimate a difference-in-differences type of regression specification with interaction terms comparing environmental attitudes before and after the fires in municipalities with different fire intensities. Economists often use distance to and intensity of events to measure the level of exposure and salience (Shayo and Zussman, 2011; Currie et al., 2015; Djourelova, 2023).

Additionally, this paper explores the role of motivated reasoning by examining the heterogeneity of the fire effects across groups of individuals with varying levels of preexisting environmental attitudes. To measure the effects of fires on attitudes by prior attitudes, I compare environmental concerns before and after the fires for individuals supporting parties with different degrees of initial environmental concerns. I focus on the party-level variation in concerns over time to provide insights into whether extreme climate events alleviate or intensify political polarization. Party affiliation is also one of the strongest predictors of environmental attitudes both in the U.S. (Hornsey et al., 2016; Egan and Mullin 2017) and in Europe (Tjernström and Tietenberg, 2008; McCright et al., 2016; Ziegler, 2017).

My main result is that individuals supporting parties with higher initial concerns about environmental issues and climate change exhibited a greater concern increase compared to those who were less concerned previously. Notably, the increase in concern gap between individuals with different levels of initial concerns was substantial, with a 55% increase for environmental concerns and 68% for climate change concerns. Furthermore, my study suggests that extreme climate events exacerbate political polarization in environmental concerns, with left-leaning individuals exhibiting greater initial concerns and a significant escalation in the degree of concern following the fires relative to right-leaning individuals. However, there is no evidence that the fires affected support for a higher carbon tax on petrol. My results are not driven by shifts in party support over time or differential pre-trends in attitudes across parties. Moreover, the heightened polarization in environmental attitudes does not reflect a general shift in political leanings during the 2018 elections.

In an exploration of the role of media, I first find that relative to initially less concerned individuals, individuals with greater initial concerns were exposed to morning newspapers containing more climate change content. Throughout 2018, their exposure to climate change news also increased more, leading to heightened polarization in climate news exposure. However, this greater increase in exposure does not contribute to the rise in concerns after the fires once conditioning on prior concerns. These findings suggest that news exposure is not the channel through which prior concerns affected changes in concerns. This reinforces the interpretation that motivated reasoning along partisan lines shapes differential reactions to natural disasters.

I only find some smaller variation in forest fire effects across individuals residing in areas with different amounts of local fires. These results remain when using alternative measures of the climate impacts related to the forest fires such as heat waves and low precipitation. Thus, motivated reasoning played a greater role than salience in shaping attitude responses to the climate damages.

My findings are important for several reasons. Firstly, they provide the first empirical evidence of how climate disasters impact political polarization in environmental attitudes. Previous

research has primarily focused on establishing an association between extreme weather events and pro-environmental attitudes or voting (Myers et al., 2013; Herrnstadt and Muehlegger, 2014),[3] with only a few studies providing causal evidence (Goebel et al., 2015; Gagliarducci, et al. 2019; Hazlett and Mildenberger, 2020).[4] My paper goes further by exploring the mechanism driving these belief shifts, presenting evidence of how motivated reasoning shapes beliefs in response to such events. Moreover, the extensive 2018 fires were both unexpected and had a significant impact on the salience of climate risks. This sets it apart from previous work that examined recurring fires (Hazlett and Mildenberger, 2020) and studies that used temperature abnormalities (Egan and Mullin, 2012; Deryugina, 2013; Herrnstadt and Muehlegger, 2014) to investigate their impacts on environmental attitudes. Additionally, it complements the study by Gagliarducci et al. (2019) by providing insights into how the public updates their beliefs in response to climate disasters. Notable, unlike Goebel et al. (2015), who examined the impact of distant disasters in other countries, my study offers evidence of the direct impacts of local disasters on attitudes.

Second, my paper relates to the literature on belief polarization by examining its mechanisms and causes. Despite extensive theoretical work exploring how individuals form beliefs when presented with new data, empirical evidence on belief polarization in response to new information is limited.[5] Early economic models in Bayesian learning suggest that individuals' beliefs will converge with new information over time (Blackwell and Dubins, 1962), yet recent research demonstrates that exposure to new data can increase polarization in the short run due to the overweighting of prior beliefs (Dixit and Weibull, 2007). This divergence in beliefs can persist in the long run if there is a small amount of uncertainty (Acemoglu et al., 2016). My findings provide new empirical evidence on belief polarization in the context of climate change. I also add to the growing literature studying the formation of beliefs about climate change and support for climate policies (Tjernström and Tietenberg, 2008; Malka et al., 2009; Ziegler, 2017; Druckman and McGrath, 2019).

Third, my findings suggest that individuals' concerns about the environment and worries about climate change do not always translate into support for climate policies. This takeaway aligns with recent studies on support for carbon taxes, which reveal that various factors beyond climate change concerns significantly influence public support for such policies, such as perceived environmental effectiveness, the redistribution dimension, and self-interest (Fairbrother et al., 2019; Douenne and Fabre, 2022).

Finally, my paper relates to recent studies in economics using year-to-year fluctuation in temperature and precipitation to identify climate impacts on agricultural productivity (Deschenes and Greenstone, 2007), economic growth (Dell et al., 2012; Waldinger, 2022), and

[3] Myers et al. (2013) investigated the relationship between personal experiences of global warming and the perceived certainty of climate change. Herrnstadt and Muehlegger (2014) employed Google search intensity data as a proxy for the salience of climate change to examine the effect of short-run weather abnormality on searches for "climate change". They also found a correlation between the voting records of U.S. congressional members on environmental issues and local unusual weather in their home states.

[4] Goebel et al. (2015) found that support for the Green party increased in Germany after the Japanese 2011 Fukushima nuclear disaster. Gagliarducci et al. (2019) documented that congress members representing districts impacted by hurricanes are more inclined to support bills promoting environmental regulation in the year following the disasters. Hazlett and Mildenberger (2020) used distance to wildfire locations to demonstrate that fire exposure increases support for pro-environmental ballot measures in democratic-voting areas in California.

[5] Su (2021) uses survey data to examine how individuals update beliefs based on information with political significance. The author finds that individuals are more likely to discredit and reject new information when it challenges their preexisting beliefs.

mortality (Barreca et al., 2015). It also adds to the broader literature studying the consequences of natural disasters and extreme weather events in terms of health, economic and social outcomes, and risk perception. Economists have examined the impacts of the Fukushima disaster on subjective well-being (Rehdanz et al., 2015), the effects of Indonesian forest fires on physical health in Singapore (Sheldon and Sankaran, 2017), the economic activities in response to typhoons in China (Elliott et al., 2015) and floods in 1868 cities globally (Kocornik-Mina et al., 2020). Other studies found that disasters change people's risk and time preferences (Callen, 2015; Cameron and Shah, 2015; Hanaoka et al., 2018), and encourage pro-social behaviors and political engagement (Cassar et al., 2017).

The remainder of the paper is organized as follows: Section 2 provides the background. Section 3 describes the data and Section 4 provides graphical evidence. Section 5 presents the empirical strategy and Section 6 reports results. Section 7 concludes.

2. Background

Sweden is a country with a vast forest coverage of 23.2 million hectares, representing more than half of its total land area of 40.7 million hectares (Swedish Forest Agency, 2014). Forest fires are the primary cause of forest damage as they account for over 80% of the damages yearly (Swedish Civil Contingencies Agency, 2020). In 2018, unprecedented wildfires ravaged the country, with approximately 25,000 hectares of forests being destroyed, making it the most destructive fire year since 1900 (Drobyshev et al., 2012; Swedish Forest Agency, 2020). The 2014 forest fires were also severe and resulted in the second worst forest damages during the past twenty years with burned areas amounting to 15,000 hectares (Swedish Forest Agency, 2020).

In this paper, I focus on the year 2018 as the treatment year to measure the effects of forest fires for two main reasons. First, it was the year with the largest fires, and I expect a significant impact on public opinion about climate change and environmental issues. Second, the 2014 fire damages were mainly due to a single wildfire in Västmanland county and affected areas with low population density.[6] In contrast, the 2018 fires were caused by around 60 wildfires across the country, affecting a broader population and providing a larger variation in residents' exposure to local fires across municipalities (Lidskog et al., 2019).

Figure 1 provides fire intensity maps for Sweden, illustrating the extent of fire activity in each municipality during the year of extensive fires (2018), the year before and after (2017 and 2019), and the median year 2011-2017 (municipal-specific median year). Overall, there was a significant increase in burned areas in 2018 compared to 2017, 2019, and the period 2011-2017. The pattern was particularly pronounced in north-middle Sweden (The counties of Jämtland, Dalarna, and Gävleborg).

In 2018, Swedish media extensively covered the incidents of forest fires that occurred across the country. Panel A of Figure 2 demonstrates that the number of articles mentioning the Swedish words "forest fires" spiked in July 2018. To investigate public interest in forest fires, I plot the monthly search activities of "forest fires" from Google Trends for the same period in panel B. The national search frequency was the highest in July 2018 and the second highest in

[6] Forest fires in Västmanland 2014 started in Surahammar municipality and spread to three neighboring municipalities of Sala, Fagersta, and Norberg.

July 2014, while other months show a relative frequency around or below 10% of the search magnitude in July 2018. Thus, forest fire events in the summer of 2018 attracted wide public attention in Sweden.

3. Data

3.1 Forest fire and opinion data

I combine opinion survey responses on environmental issues with forest fire statistics. The data on forest fires were obtained from the Swedish Civil Contingencies Agency (MSB) and includes information on total burned forest areas for each fire incident.[7] I merge forest fire data at the municipal level with the repeated cross-sectional data on environmental opinions from 2011 to 2020.

The data on environmental attitudes were collected through yearly waves of opinion surveys conducted by the Society Opinion Media (SOM) Institute at Gothenburg University. The SOM surveys are nationally representative and cover various topics with a focus on political opinions and media usage. These surveys have been conducted every year since 1986 and many questions are frequently repeated over time. As the surveys always begin in September and are finalized in December or January of the following year, environmental attitudes that were affected by the extensive fires during the summer (June-August) of 2018 should already be reflected in the 2018 data. The sample consists of individuals aged 16 to 85 who were surveyed from 2011 to 2020, with each survey interviewing between 9,000 and 22,500 people per year. In total, 173,900 individuals were interviewed, with response rates ranging from 48% to 60% each year. The original sample comprised 85,380 observations, but missing values for political orientation and demographic variables were excluded, and respondents supporting non-major Swedish parties (the Pirate Party and other small parties) were dropped, resulting in a final dataset of 66,539 observations. This sample contains data on forest fires, political orientation, environmental attitudes, and demographics. The summary statistics are presented in Table A1 in the Appendix.

The outcome variables are derived from questions asked continuously from 2011 to 2020:

Environmental concerns: To account for trade-offs between concerns about the environment and other issues in Swedish society, I use the following open question: "Which issues or problems do you feel are the most important in Sweden today? Please state a maximum of three issues."[8] Based on the responses, a dummy variable was created with a value of one if the respondent mentioned at least one issue related to environmental concerns and zero otherwise. This outcome variable captures general concerns about environmental issues including climate

[7] In parts of the analysis, I use the share of burned forest land for each municipality. This variable is obtained by dividing total burned forest areas by the size of forest land in the municipality in 2018. Data on forest land are provided by Statistics Sweden (SCB) with measurements every five years since 1990. Given that data for forest land in 2018 is unavailable, I use the closest available measurement from 2015.

[8] The SOM institute categorized the responses into 352 different groups among which 17 are related to the environment. They are the following: nature conservation, agricultural policies, pollution, littering, climate questions, emission allowances, marine environment, environmental tax, international environmental agreements, sustainable society, natural disasters, energy, nuclear power plants, wind power, renewable energy, nuclear waste, and energy price.

change, as well as the priority respondents attach to it. Approximately 17.9% of respondents identified environmental issues among their top three concerns (see Table A1 in the Appendix).

Climate change concerns: I use the question: "Looking at the current situation, what do you think is the biggest concern for the future? – Change in the Earth's climate." Respondents were asked to rate their level of concern on a 4-point scale, and the responses were re-coded so that higher values indicate greater concern.

Carbon tax support: I elicited this from the following question: "Below is a number of proposals that have appeared in the political debate. What is your opinion on each of them? – Increase the CO_2 tax on petrol." Respondents rated their answers on a 5-point scale, ranging from (1) very bad proposal to (5) very good proposal.

While carbon taxes are generally considered effective tools for reducing emissions and addressing externalities associated with climate change policies (Nordhaus, 2019), the main hurdle to implementing these policies lies in the lack of public support. Furthermore, it remains uncertain whether climate events will significantly affect public opinion on these policies. Therefore, this outcome variable is highly relevant, potentially providing valuable insights into Swedish attitudes toward climate change policies.

The SOM data also provides information on respondents' party preferences through the question: "Which party do you like the best today?" I select all the parties that received at least 3% of the votes in the 2014 general election. This resulted in nine major parties, and based on the survey responses, I generate nine dummies, each corresponding to respondents' support for a particular party.[9] Additionally, the SOM surveys also include questions about respondents' demographic characteristics, such as their age, sex, education, and social and economic backgrounds.

Each year, the SOM data is collected through multiple parallel sub-surveys, each using different questionnaires. Moreover, the number and structure of these sub-surveys have also varied across years, with five sub-surveys in use between 2014 and 2015 and six since 2016. The questions used to generate dependent variables for this paper are sometimes featured in different sub-surveys, resulting in some observations missing certain outcome variables. Therefore, in the analysis, I restrict my data to different sub-samples depending on which outcome is used.[10]

3.2 Complementary data

In addition to opinion and forest fire data, I construct a municipal panel covering monthly precipitation and temperature in 2018, based on hourly data from nearly 600 weather stations

[9] The nine major parties and their respective levels of support in SOM data are: (1) the Left Party (7.8%), (2) the Social Democrats (29.4%), (3) the Centre Party (8.7%), (4) the Liberal Party (6.0%), (5) the Moderate Party (22.9%), (6) the Christian Democrats (4.7%), (7) the Green Party (6.8%), (8) the Sweden Democrats (12.6%), and (9) the Feminist Initiative (1.1%).

[10] Sub-sample 1 consists of 34,118 observations and includes only respondents who answered questions about their environmental concerns. Sub-sample 2 consists of 24,546 observations and includes only respondents who answered questions about their climate change concerns. Sub-sample 3 consists of 23,047 observations and includes only respondents who answered questions about their attitudes towards a higher carbon tax.

located across Sweden. The original data are provided by the Swedish Meteorological and Hydrological Institute (SMHI).

Furthermore, I use the Swedish Media Archives[11] to retrieve statistics on climate change-related news released by major Swedish media outlets between 2011 and 2018. Specifically, I search the database for the keyword "climate change" in Swedish (singular or plural) and extract the annual counts of articles between 2011 to 2018. Subsequently, I create a climate news variable representing the number of articles related to climate change for each newspaper. Then, I pair them with the SOM data based on the question designed to elicit respondents' news-reading preferences. The matched dataset includes the respondents' choices of primary morning newspapers, alongside a climate news exposure variable corresponding to the climate news count of that newspaper.[12] One potential concern is that the share of individuals reading printed newspapers is relatively low compared to the use of other media types. However, according to the Media Barometer report, the numbers are considerable, with 38% of Swedes reading printed daily newspapers and 29% opting for digital daily newspapers (Mediebarometern, 2018). In my dataset, the share of individuals reading morning newspapers is 50% in 2018.

4. Graphical analysis

4.1 Fire exposure

The impact of forest fires on environmental attitudes can be different across the country depending on the intensity of local fires. For descriptive purposes, I divide the municipalities into two groups based on fire intensity using the municipal median in 2018 (23745 square meters[13]) as the cut-off. Figure 3 illustrates average burned areas at the municipal level from 1998 to 2020 across three different samples: the whole sample, large-fire municipalities, and small-fire municipalities. In 2018, average burned areas reached its highest point since 1998, at approximately 0.8 square kilometers. Moreover, there was a significant difference of about 1.67 square kilometers between the averages of the two subgroups, demonstrating a substantial gap in fire intensity.

Figure 4 illustrates the resulting territorial division into large- and small-fire municipalities, where the large-fire group comprises 140 out of 277 municipalities.[14] Nearly 65% of respondents lived in large-fire municipalities.

The evidence presented above highlights a drastic increase in fire activities and damage in 2018, especially for the large-fire municipalities. Figure 5 shows that despite a decreasing trend in environmental concerns since 2011, there was a sharp increase in 2018. A naive estimate, using the difference in average concerns between 2017 and 2018, suggests an increase of 69%

[11] This is the largest digital news archive in the Nordic region, containing daily newspapers, magazines, business press, as well as editorial web news and broadcasts.
[12] In total, 213 newspapers were mentioned in SOM between 2011 and 2018, and I managed to match 115 of them with a climate news count. Beside all morning newspapers, two most read evenging print news papers are included: Aftonbladet and Expressen.
[13] Given that the area of one soccer field is 7140 square meters, the municipal median of burned areas in 2018 (23745 square meters) roughly corresponds to the size of three soccer fields.
[14] Sweden has a total of 290 municipalities, but for this exercise, only 277 municipalities are included due to the absence environmental attitude data from 13 small municipalities in 2018.

(from 0.116 to 0.197). Assuming random timing of fires in 2018, this estimate can be interpreted as a causal effect of forest fires on environmental concerns. However, the estimate only provides a lower bound of the effect, as it does not account for time trends in concerns. Had there been no fires in 2018, environmental concerns would likely have followed the previous trend and continued to decline. The same increasing pattern in concerns is observed for both large- and small-fire municipalities, albeit at different rates. As the gap in concerns between the two groups widened slightly in 2018, environmental concerns might have been differently affected depending on the intensity of local fires.

To explore effect heterogeneity across the country in a continuous manner, Figure 6 plots the relationship between the municipal change in environmental concerns from 2017 to 2018 and the logarithm of municipal burned areas in 2018. The figure suggests that any relationship must be weak.

4.2 Party and prior beliefs

Party affiliation is a crucial factor in explaining the variation in public beliefs about climate change, with studies indicating that liberals and individuals aligning with left-leaning parties are more likely to express concerns (Egan and Mullin, 2012; Ziegler, 2017) and support government intervention and environmental policy measures (McCright et al., 2014). Political scientists suggest that the complex scientific nature of climate change can make it difficult for individuals to form their own judgments about its evidence and impacts, leading them to rely on mental shortcuts such as parties' environmental policies (Egan and Mullin, 2017).

Figure 7 depicts the average environmental concerns for respondents with different party preferences over time. In 2018, most supporters of major parties have a rapid increase in their levels of concern. The increase is particularly significant for those who support center-left parties (e.g., the Green Party) and relatively small for those who support the right-leaning parties (e.g., the Christian Democrats). However, environmental concern for those supporting the extreme right-wing party, the Sweden Democrats, remains nearly flat over time, despite the fires in 2018. The widening gap in concerns between left- and right-leaning parties in 2018 suggests that fires can exacerbate political polarization in environmental concerns.

The effects of forest fires on environmental attitudes may vary among people with different initial views on climate change and environmental issues. Research shows that individuals tend to engage in motivated reasoning when forming their beliefs about climate change, meaning that they selectively update information that supports and reinforces their initial beliefs. As I focus on the political dimension of environmental concerns, I aggregate the concerns by party preferences.[15] Figure 8 shows a strong positive association between the increase in environmental concerns and the initial concerns in 2017. The graphical evidence suggests that individuals with varying levels of prior concerns differentially update their beliefs after the 2018 forest fires. Notably, those who expressed higher levels of concern before the 2018 fires more significantly increased their levels of concern afterward. Furthermore, the graph highlights the growing political polarization in concerns between right- and left-leaning individuals after the fires.[16]

[15] Moreover, as I use repeated cross-sectional surveys, I do not follow the same individuals over time, disenabling the possibility to identify past concerns of an individual perfectly.

[16] The color coding in Figure 8 follows the GAL-TAN scale (Green/Alternative/Libertarian-Traditional/Authoritarian/Nationalist), which is a scale used by political scientists to determine party positions in terms of their views on social and cultural values. For instance, authoritarian parties favour order, tradition and

It is possible that the 2018 fires could have caused individuals to alter their party affiliation and support parties that were previously more pro-environment. To investigate this possibility, Figure 9 plots the change in shares of supporters for each party against the party's initial level of concern in 2017. As there is no relationship between these two variables, this exercise suggests that while fires influenced individuals' views on environmental issues, they were not sufficient for shifting their party preferences. Although support for the Green Party increased during the summer, the increase was short-lived (Pollofpolls.se, 2020). Furthermore, diverging attitudes across parties appear not to be driven by compositional changes in party support.

Although Figure 7 suggests that the polarizing effects of the fires lasted until at least 2020, this interpretation should be made with caution due to Greta Thunberg and her school strikes for the climate that became worldwide famous and influential in 2019. Figure 10 shows the Swedish Google search volume of Greta Thunberg and the figure suggests that her campaign did not pick up pace until 2019. The 2018 SOM surveys were conducted from September 2018 to January 2019, and I will focus on 2018 as the post-treatment year since separating fire effects from Greta Thunberg effects becomes impossible after that in my setting.

4.3 Exposure to climate change news

Recent studies highlight the connection between climate beliefs and exposure to climate change news (Chinn et al., 2020). Potentially, divergence in news coverage could contribute to the polarization of public attitudes toward environmental issues. Figure 11 plots climate change news coverage of the primary newspapers read by respondents from different parties over time. We see a general increase in climate news exposure over time. Moreover, newspapers favored by left-leaning readers exhibited a considerably greater number of climate change-related articles in comparison to those favored by right-leaning readers in most years. Figure 12 shows the party-level relationship between climate change exposure in 2017 and concerns in 2017, the year before the fires. The positive correlation suggests that news exposure causes disparities in concerns across parties or that supporters of different parties choose news outlets reporting news in line with their pre-existing views.

Systematic patterns in the climate coverage during 2018 might have played a role in explaining the polarization of attitudes along party lines following the forest fires. To explore this, Figure 13A plots change in climate news exposure 2017-2018 against concerns in 2017, and Figure 13B plots concern change against exposure change. We see a positive relationship in both panels. This means that individuals from initially concerned parties were exposed to a larger increase in climate news following the fires and the concerns of those individuals subsequently also increased more. This pattern is consistent with the view that differentially increasing climate news exposure is the channel through which the concern polarization between parties increased. We will devote a subsection in the results section to investigating this hypothesis.

stability and libertarian parties favor abortion, divorce, and same-sex marriage rights. It has been argued that this scale better reflects European Union party positions than the traditional left-right scale. For Sweden, the conservative right-wing parties (SD, KD, M) are TAN, whereas remaining liberal, center, and left-wing parties are GAL.

5. Empirical strategy

When examining the effects of the 2018 forest fire on environmental attitudes, I restrict the dataset to observations from 2017 to 2018. There are several advantages to this approach. First, by creating two-year comparisons of attitudes, I can better isolate the effects of the fires from other factors that may have influenced attitudes over a longer period. Second, it allows me to use the association between party preferences and attitudes in 2017 to predict 2018 prior beliefs at the party level. Finally, dropping the year after 2018 is important given the rising prominence of Greta Thunberg in 2019.

To evaluate heterogeneous forest fire effects on environmental attitudes by fire exposure and initial environmental beliefs, I apply a regression equation with interaction terms:

$$Y_{impt} = \alpha + \beta\,(Fire_m * Y2018_t) + \delta\big(Prior_p * Y2018_t\big) + \mu_t + \theta_m + \sigma_p + \boldsymbol{\gamma'}\boldsymbol{X_{impt}} + \epsilon_{impt}, \qquad (1)$$

where the dependent variable (Y_{impt}) represents one of the three environmental attitude measures for individual i residing in municipality m supporting party p in year t. ϵ_{impt} is an idiosyncratic error term. $Fire_m$ denotes fire exposure, calculated as the logarithm of the municipal burned forest areas in 2018 for the municipality in which the respondent lives (290 unique values). $Prior_p$ denotes prior beliefs constructed as the level of concerns at the party level in 2017 (9 unique values). I use environmental beliefs at the party level in 2017 to predict respondents' prior beliefs based on their party preferences in 2018.[17] $Y2018_t$ is the year 2018 dummy. $Fire_m * Y2018_t$ and $Prior_p * Y2018_t$ are the interaction terms. β and δ are the heterogeneous effect parameters of interest. I include uninteracted party fixed effect σ_p, municipal fixed effect θ_m, and year fixed effects μ_t. $\boldsymbol{X_{impt}}$ represents a set of sociodemographic dummy covariates for gender (3 groups), age (3 groups), education (3 groups), household income (6 groups), citizenship (3 groups), urban-rural residential area (4 groups), family class (4 groups), and area of upbringing (5 groups). This specification corresponds to a difference-in-differences specification with the interaction terms being continuous treatment variables.

The identifying assumption is that the attitudes of any higher-fire municipalities would have developed similarly to any lower-fire municipalities if the higher-fire municipalities counterfactually had been exposed to lower fires in 2018. In a related manner, I require that the attitudes of any higher-prior group would have developed similarly to that of any lower-prior group if the higher-prior group counterfactually had been exposed to the level of motivated reasoning experienced by the lower-prior group. Thus, I require a continuous version of the parallel trends assumption in regressions with binary interaction or treatment variables. Unlike previous related studies, I have data starting several years before fire events. Thus, I can test the assumption by analyzing whether pre-treatment trends are parallel in years where everyone experienced no fire effects. This allows me to make stronger causal claims.

It is possible to think of the interaction terms in Eq. (1) as continuous treatment intensity variables in a difference-in-differences setting (Callaway et al., 2021). I refrain from doing so for three reasons. First, as everyone has a prior it is unclear which value $Prior_p$ should take in the case of zero treatment intensity and effect, although the flat development of environmental

[17] Technically, I regress environmental concerns on a set of party dummies using 2017 data, i.e., $Y_{imp,2017} = \alpha + \sum_{p \in P} \beta_p\, \sigma_p + \epsilon_{imp,2017}$. I then predict prior beliefs in 2018 based on $Prior_p = \hat{\alpha} + \sum_{p \in P} \hat{\beta}_p\, \sigma_p$.

concerns for Sweden Democrats over time in Figure 7 suggests that they might serve as a fully untreated comparison group. Second, local fires have spillover effects; even if some people experienced no municipal fires, potentially serving as a fully untreated control group, they probably react to fires in adjacent municipalities or even the total amount of fires at the national level. As we can see in Figure 3, although small-fire municipalities experienced close to no local fires, their environmental concerns went up sharply in 2018. Third, both varying treatment intensities and varying responses to the same treatment intensity can cause heterogeneous effects. Attributing all variation in effects to variation in treatment intensity alone requires the assumption of homogenous responses to a given treatment intensity across treatment intensity levels, which is a rather strong assumption in many applications.[18] An implication of not making the identifying assumptions of the continuous difference-in-differences method is we only estimate the magnitude of effect heterogeneity. For the total effect, the interpretation of the before-after estimate of a 69% increase in concerns (see Figure 5) as a causal effect requires the stronger assumption of random timing of the fires.

As is often the case when a treatment happens at a certain point in time, subsequently observed consequences may have been caused by other concurrent events. Thus, it is challenging to rule out the possibility that potential heterogeneous effects by local fires are due to other concurrent events with varying effects across municipalities. When it comes to concurrent heat and low rainfall, this is less of a problem as I primarily use local fires as a proxy for broader climate-related damages. I will also use temperature and precipitation as alternative measures of these impacts. A related concern is that other information shocks in 2018, national or global ones, that might have differentially impacted individuals with different prior beliefs. As shown by Figure 14, climate crisis was not widely covered by Swedish news outlets during the first half of 2018. Global and European temperatures and heat waves were not particularly extreme in 2018 compared to surrounding years,[19] but the Intergovernmental Panel on Climate Change did release a special report on the impacts of global warming of 1.5 degrees Celsius above pre-industrial levels in October 2018. I cannot rule out that this influential report caused or contributed to divergence in attitudes by prior beliefs, or that it reinforced heterogeneous concern effects by prior beliefs due to the fires. Nevertheless, such a potential scenario aligns with the hypothesis that new climate information has varying effects on people due to motivated reasoning. In the results section, I will investigate whether broader political divergence in attitudes in 2018 may confound my estimates, as well as the role of media coverage of climate change in 2018.

6. Results

6.1 Main results

Table 1 reports the main results. I report estimates of δ and β, i.e., the interaction term coefficients, in Eq. (1). The outcome variables are environmental concerns in columns (1)-(4), climate change concerns in columns (5)-(8), and carbon tax support in columns (9)-(12). I report results from specifications including only the interaction term for prior belief (columns

[18] It is also a somewhat philosophical question whether those with different priors were exposed to the same national fire treatment intensity but reacted differently, or whether the same national fires led to different treatment intensities in terms of information that conflicted with prior beliefs to different extents.

[19] However, some countries in addition to Sweden suffered from unusually strong heat waves or fires. In Japan, 22,000 people were hospitalized with heat strokes. In California, increased demand of air conditioning led to extensive power outages. Furthermore, Greece and Australia also witnessed devastating heat waves and fires.

1, 5, and 9), only the interaction term for fire exposure (columns 2, 6, and 10), both interaction terms (columns, 3, 7, and 11), and both interaction terms plus demographic covariates (columns 4, 8, and 12).

The estimated heterogeneous effects of the 2018-fires on environmental concerns by prior beliefs are statistically significant across specifications (columns 1-4). The point estimate of 0.546 in the preferred specification (column 4) indicates that an initial concern gap between two parties of one percentage point is enlarged to 1.546 percentage points, i.e., by about 55%, after the fires. This implies that the fires increased the initial concern gap between the Green Party and the Swedish Democrats from 43.7 percentage points in 2017 (46.7% for the Green Party and 3.0% for the Sweden Democrats) to 67.5 percentage points in 2018. The magnitude of this effect is substantial.

I also find statistically significant effect heterogeneity by prior beliefs for climate change concerns (columns 5-8). The point estimate of 0.684 indicates that for a party with one level higher initial concerns about climate change than another party, the fires in 2018 enlarge that gap in concerns to 1.68, i.e., by 68%.

The more pronounced impacts for groups of individuals who hold stronger pro-environmental views before the fires indicate that people tend to update environmental beliefs in a way that is consistent with their initial beliefs to avoid cognitive dissonance. Thus, the findings suggest that motivated reasoning plays a key role in belief updating. As initial concerns about the environment and climate change were nearly perfectly correlated with GAL-TAN positions, the widening gaps in concerns also imply heightened political polarization in concerns along those dimensions. Thus, rather than narrowing the gap in concerns, fires exacerbate political polarization. These results are in line with the findings of Hazlet and Mildenberger (2020) showing that exposure to fires in California leads to increased support for pro-environmental ballot measures in democratic-voting areas.

In contrast, there is no evidence that forest fires differentially affect preference for a higher carbon tax depending on prior beliefs. People's concerns about the environment do not necessarily predict their policy views and greater beliefs in climate change are not necessarily translated into support for carbon tax policies. This takeaway touches upon the current debate on climate policies and their political support. Recent studies show that support for carbon and other environmental taxes not only depends on beliefs about the environmental issues addressed by the taxes, but also on trust in a country's politicians and political system, the perceived environmental effectiveness of the taxes, redistribution effects, and self-interest (Fairbrother et al., 2019; Douenne and Fabre, 2020; Douenne and Fabre, 2022).

Additionally, the effects of forest fires on environmental attitudes do not seem to vary significantly by fire exposure, except for climate change concerns. The estimated effect for climate change concerns is 0.022 in the preferred specification (column 8). To illustrate the magnitude of this effect, I split the municipalities into large- and small-fire groups based on the size of the fires, as depicted in Figures 3 to 5, and calculate the average log burned areas for each group. The difference between the two averages is 3.00 in 2017. Thus, the 2018 forest fires increase climate change concerns in the large-fire group by 0.066 (3.00*0.022) more relative to the small-fire group. The effect is rather small considering that the standard deviation of climate change concerns is 0.764.

In the Appendix, I report sensitivity tests and show that my results are robust to the following: (1) inclusion of data from a longer pre-treatment period, (2) measuring party preferences using the stated vote in the last election, and (3) alternative measures of climate impacts related to the forest fires such as other functional forms of burned areas, heat waves (high temperatures), and low precipitation.

6.2 Placebo tests of pre-treatment trends

To check the validity of the identifying assumption, I provide evidence from placebo tests where I counterfactually placed treatment in years before 2018. As an example, I hypothetically assume 2017 was the treatment year and use data from 2016-2017 to estimate the placebo effects. These exercises correspond to tests of the parallel trends assumption and I anticipate statistically insignificant estimates in most placebo years, except possibly for 2014 and 2015, as large fires raged in some municipalities in 2014.

Figure 15 shows the main estimates along with the placebo estimates for our three outcome variables. Panels A and B show that the estimated effects by prior in the treatment year 2018 stand out from the placebo estimates. Most of the estimated placebo effects by prior beliefs from 2012 to 2017 are not statistically different from zero, except for several of the 2014 and 2015 estimates. For two out of three outcomes (Panels A and C), we see a positive effect by initial level of concern in 2014, but this was followed by a similar-sized fallback in 2015. Given that there were some extensive fires in 2014, these estimates are interpreted as fire-induced effects rather than clean placebo effects. However, the 2014 fires did not have any broader attitude impacts, not only because of the fallback effects by priors in 2015, but also as those fires did not change average concerns much (see Figure 5). For the estimated placebo effects by fire intensity in Panels D-F, the estimated null effects in 2018 do not deviate from the placebo effects across all attitude measures. Overall, Figure 15 suggests that our 2018 estimates are not driven by differential pre-treatment trends between individuals with different levels of initial concerns or residing in areas with different amounts of local fires in 2018, supporting the validity of the identifying assumption.

6.3 Heterogeneous effects by socio-demographic characteristics

Previous studies suggest that socio-demographic characteristics also shape environmental beliefs (Tjernström and Tietenberg, 2008; Dai et al., 2015; Ziegler, 2017; Douenne and Fabre, 2020). Threats of climate change are considered to be distant, abstract, and disputed, which requires people to have some analytical skills to understand them. Education could provide analytical skills used for processing and interpreting information related to climate change and environmental hazards. Different driving habits can lead to diverging attitudes towards carbon tax on petrol between urban and rural areas. Recent school strikes for the climate show that age can be an important factor affecting beliefs about climate change. Additionally, women express greater concerns and have stronger beliefs in climate change than men (McCright and Dunlap, 2011).

To explore belief polarization along socio-demographic lines, I replace party preferences with education, age, income, sex, and city-rural variables in predicting prior beliefs, and then apply the regression specification in Eq. (1). Table 2 shows that the estimate of effect heterogeneity by prior beliefs is statistically significant for environmental concerns, but not for climate change concerns (unlike for political polarization) and carbon tax attitudes. Thus, I find evidence of socio-demographic polarization effects only for environmental concerns. The

results support the conclusion drawn by Egan and Mullin (2017) that demographic factors account for less variation in individuals' levels of concern about climate change than party preferences.

6.4 Concerns about other issues

Swedish general elections were held in late September 2018 after the forest fires. One could worry that estimated polarization effects reflect a general political divergence in attitudes in that election year. If the estimated fire effects by prior beliefs reflect a general shift in political leanings during the election that coincides with the fire effects, opinions about other social issues that divided Swedish parties should also diverge further. I test this hypothesis by using opinions about other social issues that divided Swedish parties as placebo outcomes in Eq. (1). The issues of immigration and integration were at the forefront of the election debates and were considered to be the most important issues by the Swedish voters, and I emphasize opinions about these issues.

Using the question asking respondents about their top three current concerns in society, I create three dummy variables representing concerns about immigration, integration, and the labor market, respectively. The immigration outcome captures concerns related to refugees, immigrants, and immigration policies. The integration outcome includes concerns about integration policy, racism, and segregation. The labor market outcome reflects concerns about the labor market and its associated policy measures, including unemployment, youth unemployment, work environment, vacation, unemployment benefits, reduction of working hours, and a variety of other labor-market issues. In addition to these three outcomes, I also include another six opinion questions measured on a four- or five-point scale. See Table A1 in the Appendix for summary statistics on the placebo outcomes.

Table 3 presents the results using placebo outcomes. The interaction term estimates for prior beliefs are not statistically significant. Thus, my main results on political polarization in environmental concerns do not merely reflect contemporary polarization in other concerns.

6.5 The role of media

I now investigate whether varying exposure to climate change news following the fires can explain the estimated heterogeneous effects by prior beliefs. In Table 4, I replace the environmental attitude outcome in Eq. (1) with climate news exposure. The estimated effects by prior beliefs are statistically significant across all types of priors based on different environmental attitudes. The results indicate that individuals from parties with stronger prior beliefs experienced a more significant increase in exposure to climate news. Given that we saw that those with stronger prior beliefs also had greater initial climate news exposure in Figure 11 before, this also implies increased political polarization in news exposure. Consequently, newspaper reading is a plausible mechanism through which forest fires shape environmental attitudes.

To shut down the climate news exposure channel, in Table 5, I include climate news exposure as an additional control variable in Eq. (1) with environmental attitudes as outcome variables. The estimated effects of climate news exposure are small and not statistically significant. However, the estimated heterogeneous effects by prior beliefs are robust and similar to the main estimates in Table 1. Thus, exposure to newspapers featuring a more substantial increase in climate change content has no effect for readers from parties with the same levels of prior

concerns. But varying levels of prior concerns matter even among individuals from parties exposed to the same media coverage of climate change. Therefore, I rule out that differential increases in exposure to climate news are the channel through which the forest fires have varying effects on environmental attitudes across individuals with different party preferences.

7. Conclusion

I examined how individuals update their environmental attitudes in response to climate events using the extensive 2018 forest fires in Sweden. The amount of local fires varied substantially across municipalities allowing me to explore the role of salience. I also investigated the role of motivated reasoning by estimating the heterogeneity of the fire effects across groups of individuals with different preexisting environmental attitudes.

I find that the forest fires increased average environmental concerns by 69%. These effects were more pronounced for individuals who were initially more concerned about the environment. Notable, these individuals tend to support left-leaning parties. Thus, the forest fires exacerbate political polarization in environmental concerns. My estimates imply that an initial concern gap between parties is widened by 56% after the fires. However, while I find similar results for climate change concerns, the estimated patterns do not persist when it comes to support for a higher carbon tax on petrol. The investigation of the role of media shows that the fires also heightened political polarization in individuals' exposure to climate change news. However, this polarization in climate new exposure did, intriguingly, not contribute to the polarization in attitudes. Furthermore, I only find some smaller variations in forest fire effects across areas with different amounts of local fires.

My results have important implications. They show that while extreme weather events linked to climate change can raise environmental awareness and create more pro-environmental attitudes, they also increase political polarization. Motivated reasoning makes it difficult to use information to convince groups of people who are less concerned about the environment and climate change. Furthermore, environmental and climate change concerns do not necessarily translate into support for effective and efficient environmental policies. Thus, highlighting the negative consequences of climate change alone may not be enough to shift public opinion more broadly in favor of expensive climate policies.

Figures and tables

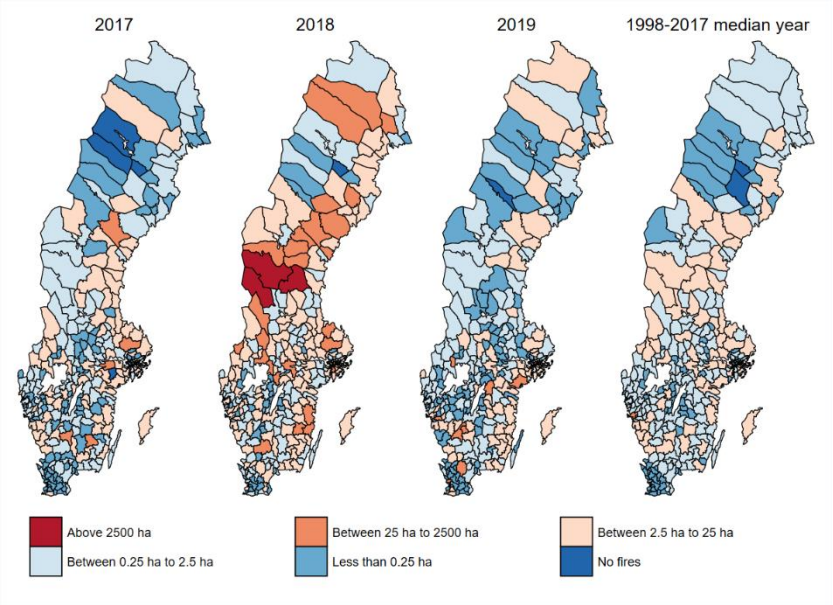

Figure 1. Forest fire activity.

Notes: Forest fire intensity is measured in terms of total burned areas in hectares at the municipal level. In the last intensity map, the municipal-specific median year between 1998 and 2017 was selected for each municipality separately.

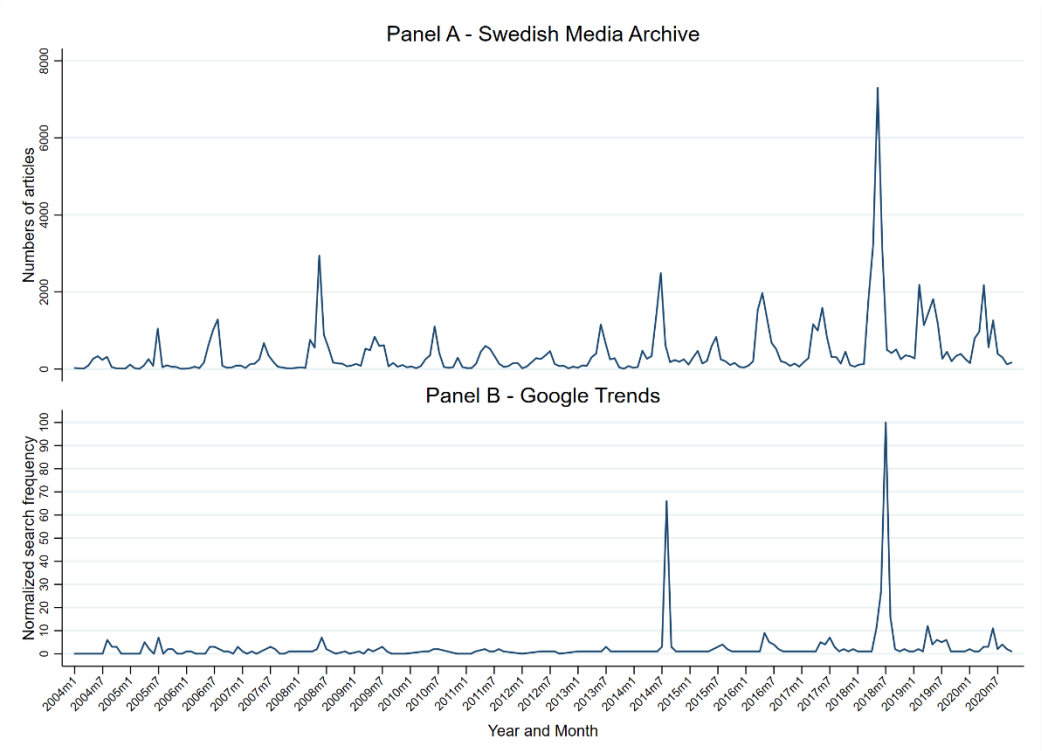

Figure 2. Media coverage and Google search frequency of "forest fires".

Notes: Panel A illustrates the monthly frequency of articles mentioning "forest fires" in Sweden between January 2004 and July 2020, sourced from the Swedish Media Archive. Panel B illustrates the normalized monthly Google search frequency of "forest fires" in Sweden during the same period.

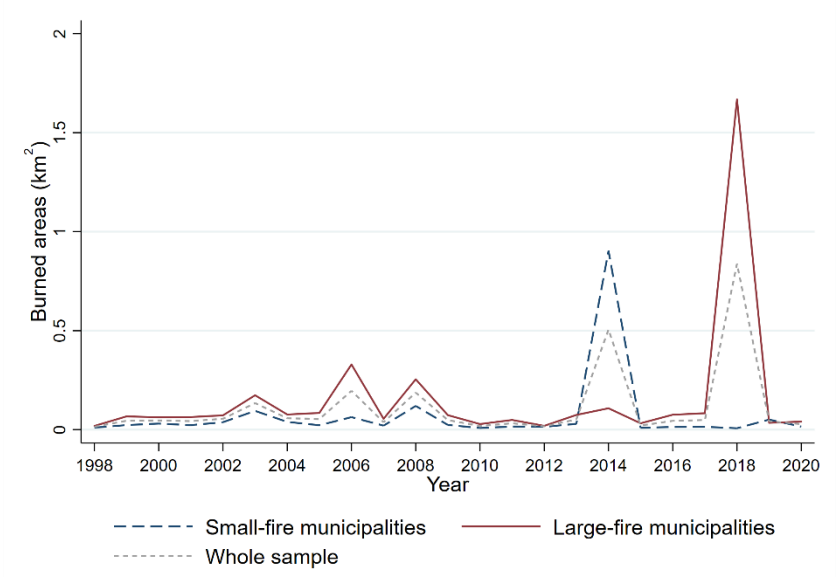

Figure 3. Average municipal burned areas from 1998 to 2020.
Note: The municipal median in 2018 is used to group the small- and large-fire municipalities.

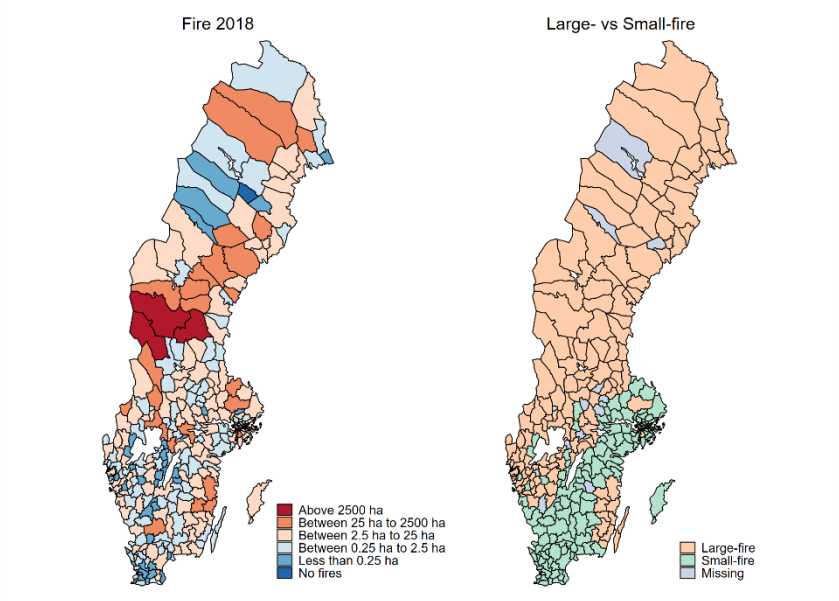

Figure 4. Map of large- and small-fire municipalities.
Note: The fire intensity map in 2018 is shown in the left figure and the division into small- and large-fire municipalities is shown in the right figure.

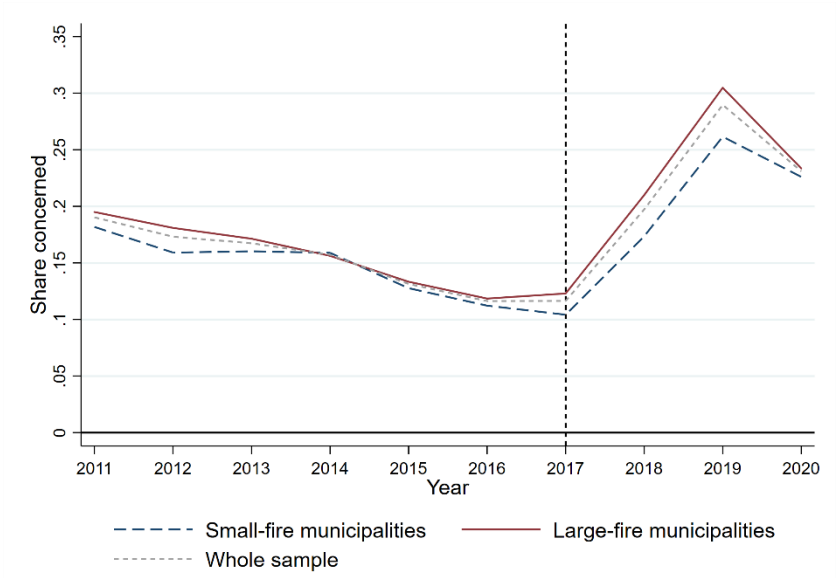

Figure 5. Environmental concerns in municipalities with large and small fires.

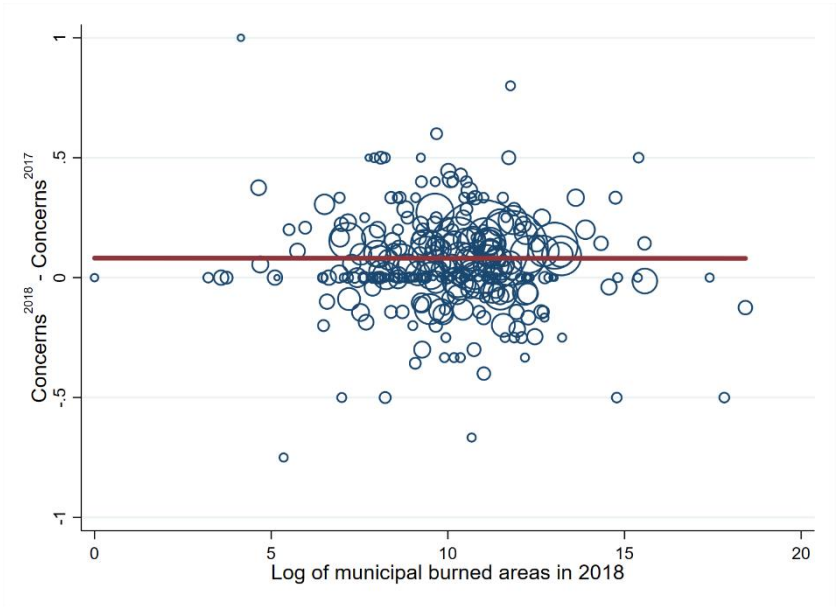

Figure 6. Municipal changes in environmental concerns 2017-2018 and burned areas in 2018.
Note: Each circle represents a municipality with the size depending on municipal respondents in 2018.

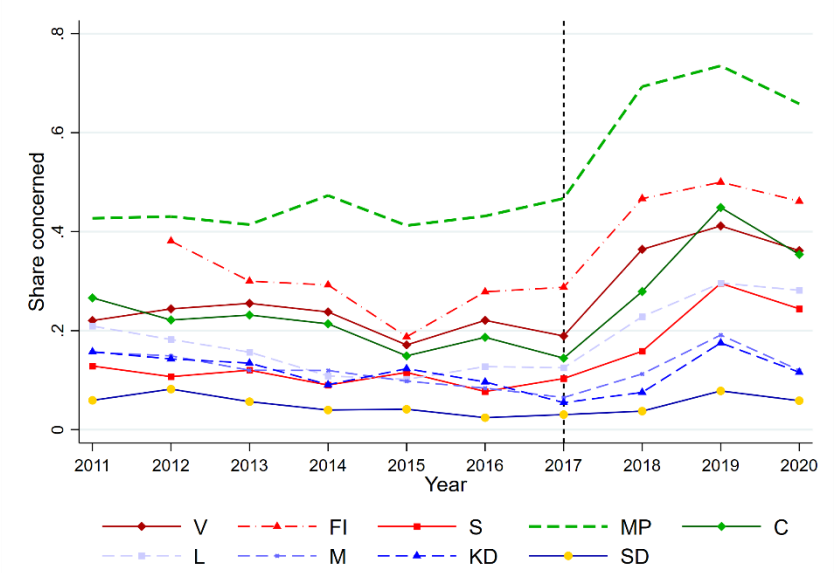

Figure 7. Environmental concerns for individuals supporting different parties over time

Note: The major Swedish political parties (based on the 2014 general election) are the following: the Green Party (MP), the Feminist Initiative (FI), the Left Party (V), the Social Democratic Party (S), the Centre Party (C), the Liberal Party (L), the Moderate Party (M), the Christian Democrats (KD), and the Sweden Democrats (SD).

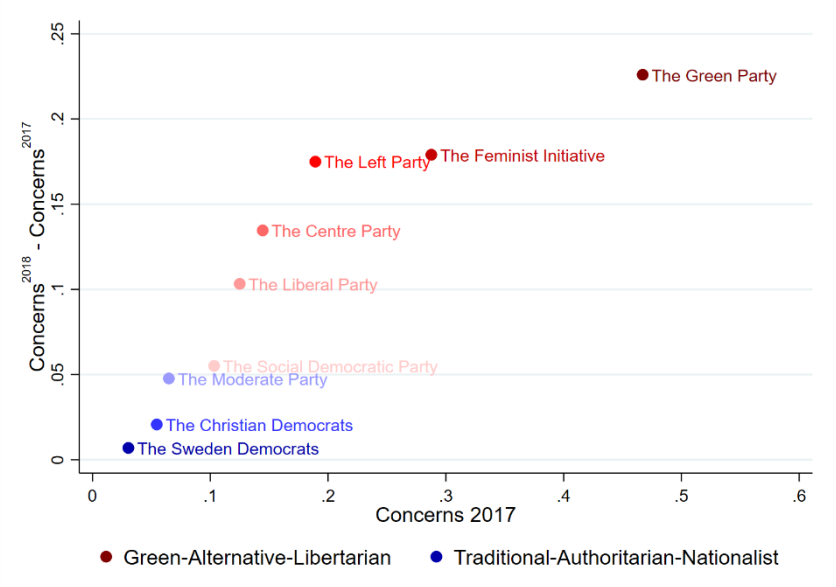

Figure 8. Change in environmental concerns and initial concerns in 2017 by parties.

Note: The plotted data points are color-coded to reflect the parties' GAL-TAN positions based on data from the Chapel Hill Expert Survey (Svensson, 2019), with darker blue meaning more TAN and darker red meaning more GAL.

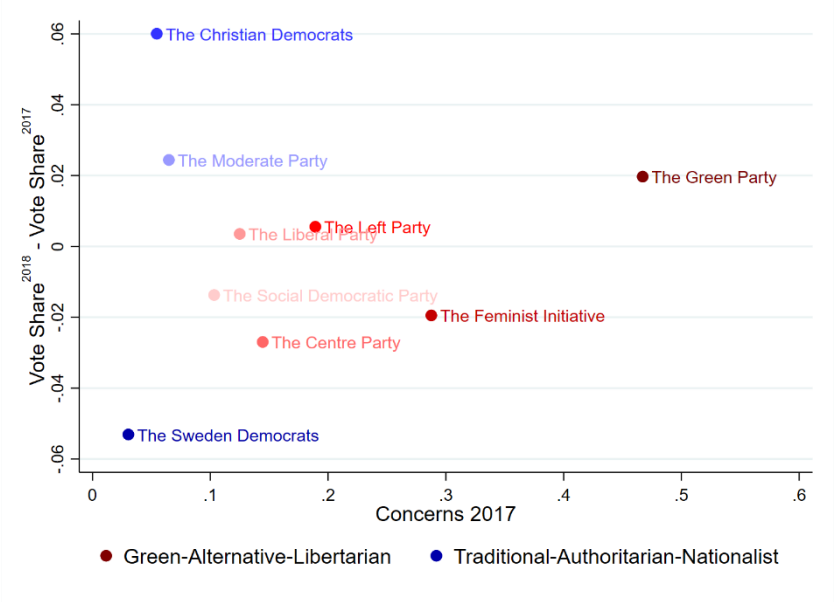

Figure 9. Changes in party support and initial concerns in 2017 by parties.

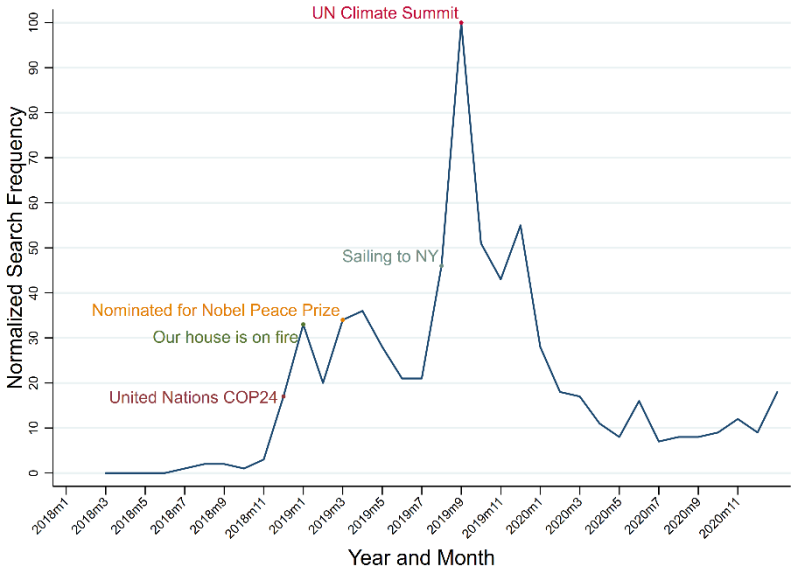

Figure 10. Monthly Google search frequency of "Greta Thunberg" in Sweden.

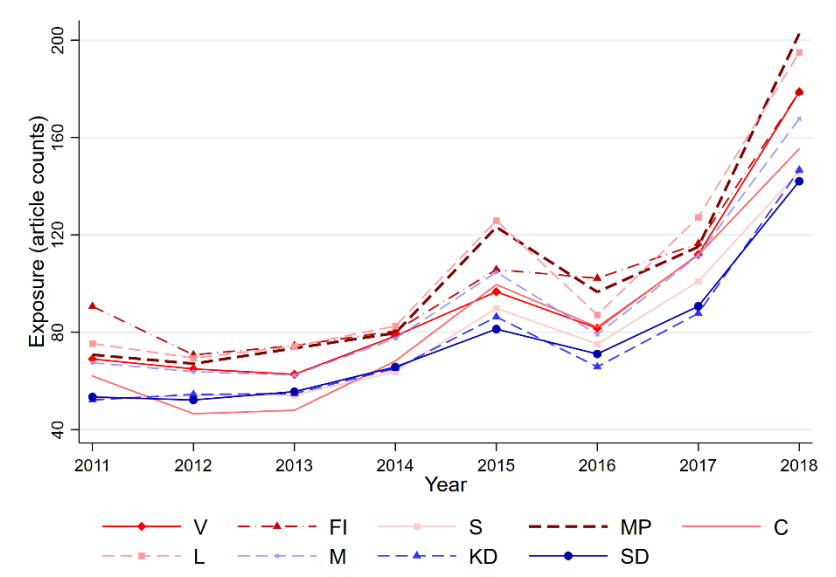

Figure 11. Exposure to climate news by party over time

Note: The y-axis scale indicates the yearly number of articles mentioning "climate change" among daily printed morning newspapers read by respondents who support different parties.

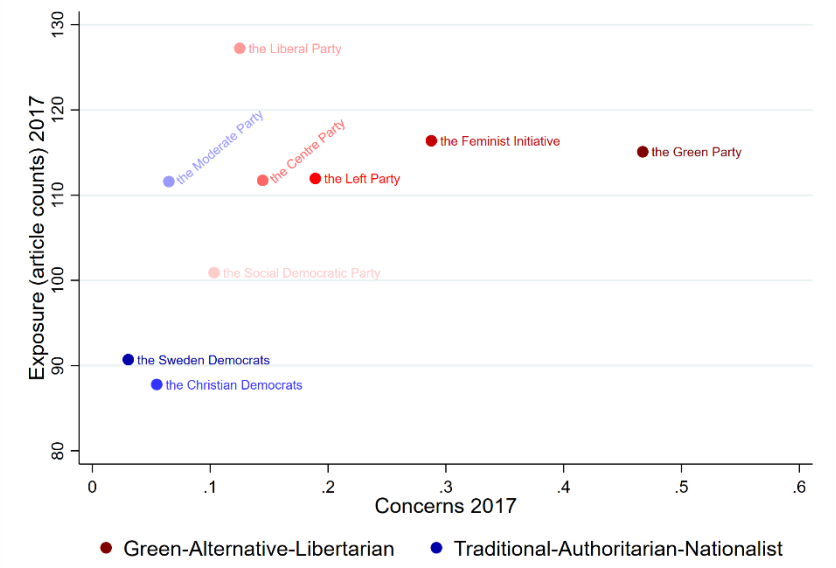

Figure 12. Exposure to climate news and initial environmental concerns in 2017 by parties.

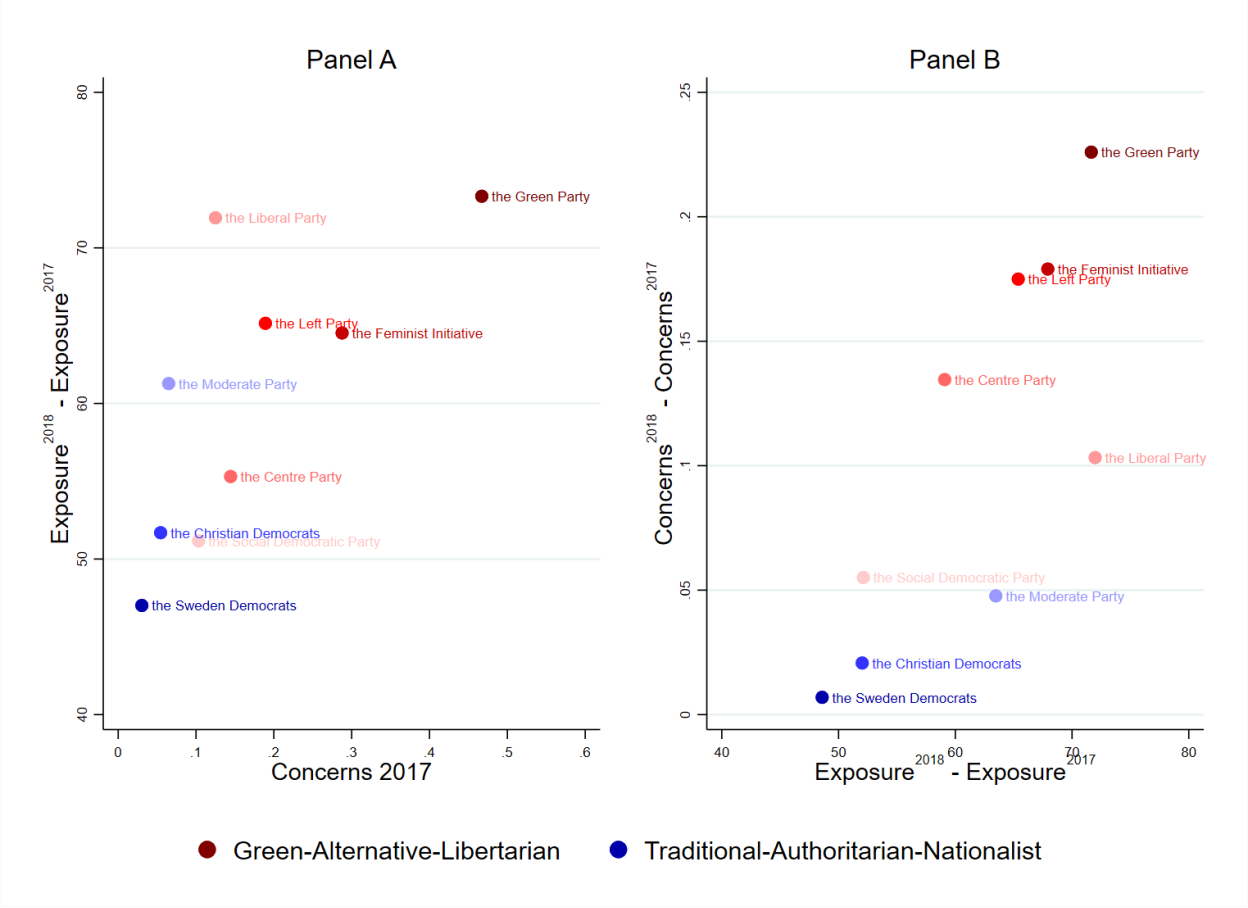

Figure 13. Initial concerns in 2017 and changes in climate news exposure and concerns

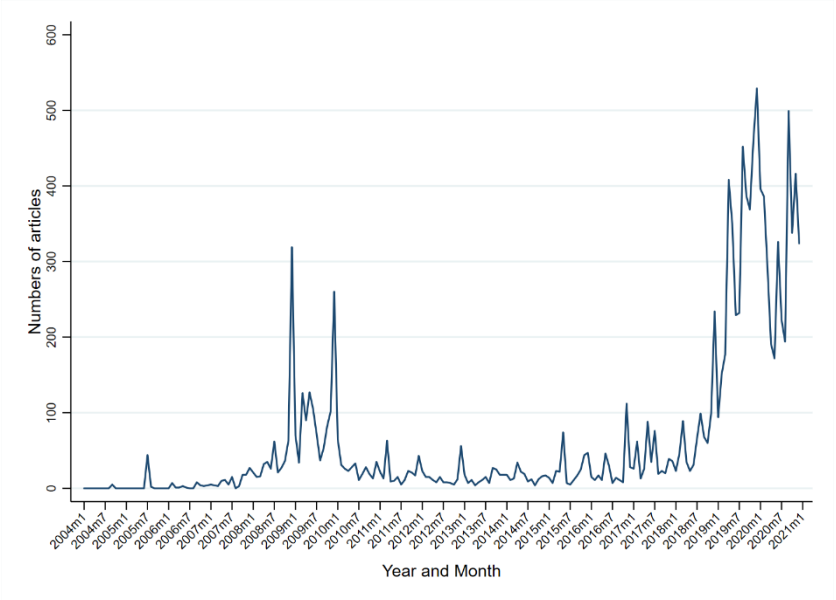

Figure 14. Media coverage of "climate crisis".

Notes: Figure illustrates the monthly frequency of articles mentioning "climate crisis" in Sweden between January 2004 and December 2020, sourced from the Swedish Media Archive.

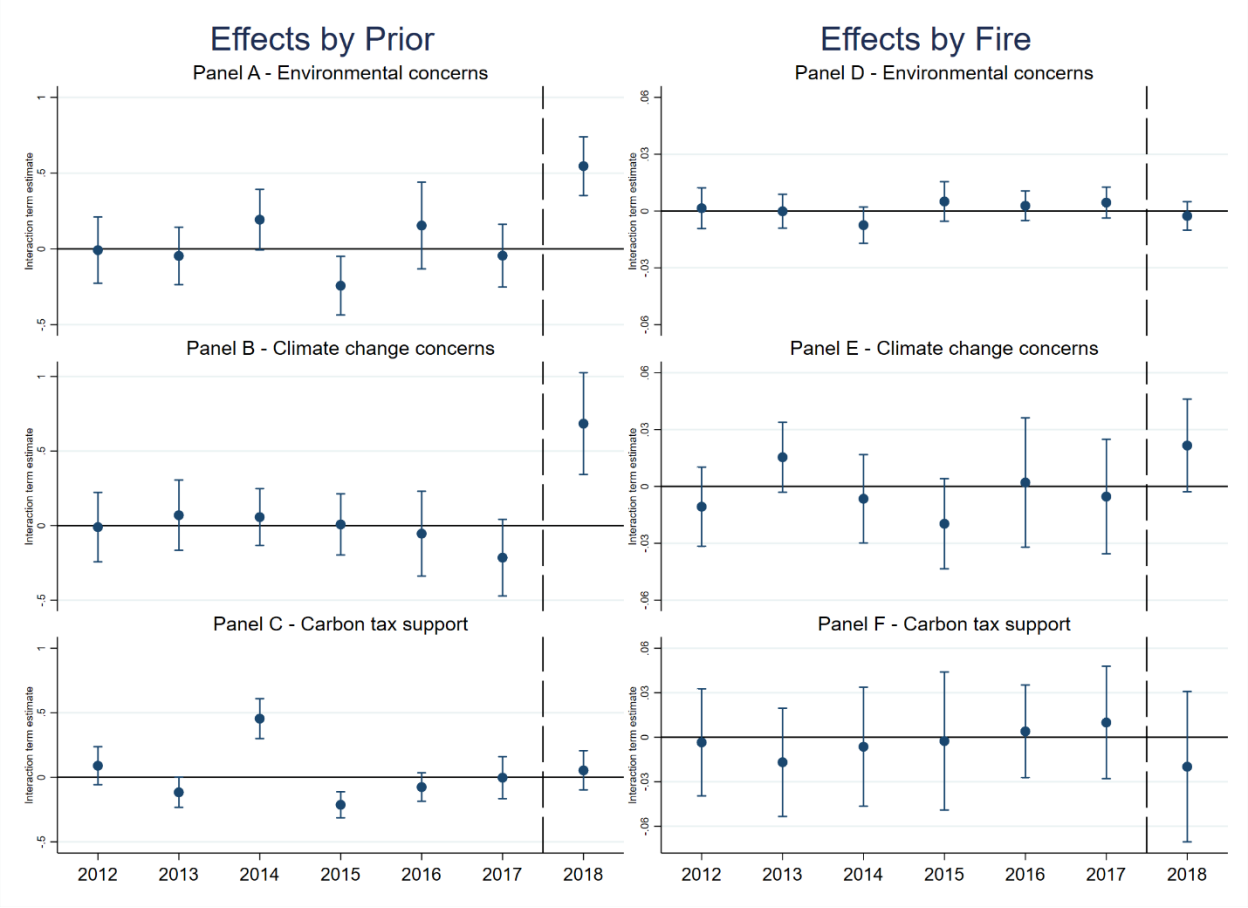

Figure 15. Estimates with placebo treatments placed in different years.

Notes: Regressions are based on Eq. (1) but with placebo treatment year assigned to each year 2012-2017, one at a time. The estimates of the interaction terms are presented with 95% confidence intervals. Each point estimate in one figure is from a separate regression using data from the placebo treatment year and the preceding year.

Table 1. Main regression estimates of heterogeneous effects on environmental attitudes by prior and fire exposure

Outcome	Environmental concerns				Climate change concerns				Carbon tax support			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Prior*Y2018	0.573***		0.556***	0.546***	0.661***		0.658***	0.684***	0.027		0.064	0.054
	(0.086)		(0.088)	(0.099)	(0.155)		(0.159)	(0.173)	(0.091)		(0.092)	(0.077)
Fire*Y2018		0.000	-0.002	-0.003		0.029**	0.024*	0.022*		-0.010	-0.016	-0.020
		(0.005)	(0.004)	(0.004)		(0.013)	(0.013)	(0.012)		(0.027)	(0.025)	(0.026)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Party FE	Yes		Yes	Yes	Yes		Yes	Yes	Yes		Yes	Yes
Municipal FE		Yes	Yes	Yes		Yes	Yes	Yes		Yes	Yes	Yes
Demographics				Yes				Yes				Yes
Observations	7,466	7,466	7,466	7,466	4,202	4,202	4,202	4,202	2,794	2,794	2,794	2,794

Notes: Regressions are based on Eq. (1). Environmental concerns are a dummy variable and the other variables are measured on a five-point scale. Table A1 in the Appendix provides summary statistics, and the data section provides detailed descriptions. Environmental beliefs (the outcome) at the party level in 2017 are used to predict respondents' prior beliefs based on their party preferences in 2018. Standard errors clustered at the municipality level are reported in parentheses. ***, **, and * denote 1, 5, and 10 percent significance levels, respectively.

Table 2. Estimates of heterogeneous effects by demographics

Outcome:	(1) Environmental concerns	(2) Climate change concerns	(3) Carbon tax support
Prior*Y2018	0.674***	-0.077	-0.098
	(0.135)	(0.128)	(0.083)
Fire*Y2018	-0.002	0.025**	-0.016
	(0.004)	(0.012)	(0.026)
Year FE	Yes	Yes	Yes
Party FE	Yes	Yes	Yes
Municipality FE	Yes	Yes	Yes
Demographics	Yes	Yes	Yes
Observations	7,466	4,202	2,794

Notes: Regressions are based on Eq. (1). Prior beliefs are predicted based on socio-demographic variables (age, education, income, sex, and city-rural residence) using 2017 data. Standard errors clustered at the municipality level are reported in parentheses. ***, **, and * denote 1, 5, and 10 percent significance levels, respectively.

Table 3. Estimates using placebo outcomes.

Outcome:	(1) Concerns, immigration	(2) Concerns, integration	(3) Concerns, labour market	(4) More private healthcare	(5) Support higher taxes	(6) Support lower taxes	(7) Concerns, number of refugees	(8) Concerns, organized crime	(9) Concerns, increased inequality	(10) Concerns, worse welfare	(11) Forbid profit in HC, E, SC
Prior*Y2018	0.113	-0.113	-0.014	-0.193	0.393	-0.602	0.245	-0.362	0.400	-0.069	0.057
	(0.093)	(0.110)	(0.062)	(0.487)	(0.570)	(0.464)	(0.434)	(0.306)	(0.261)	(0.398)	(0.505)
Fire*Y2018	0.008	-0.005	0.000	-0.005	0.005	-0.030	-0.016	-0.012	-0.004	-0.017	-0.007
	(0.005)	(0.005)	(0.004)	(0.029)	(0.018)	(0.022)	(0.017)	(0.016)	(0.017)	(0.015)	(0.033)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Party FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Muni FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Demographics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7,466	7,466	7,466	2,719	2,715	2,782	2,788	2,831	2,790	2,750	2,786

Notes: Regressions are based on Eq. (1) but with other outcomes reflecting opinions on various social issues. Prior is predicted using environmental concerns (as in Table 1, columns 1-4). The outcomes are indicator variables in columns (1)-(3) and measured on a four- or five-point scale in columns (4)-(11). In column (11), the outcome is the opinion about profit prohibition in healthcare, education, and social services. Table A1 in the Appendix provides summary statistics. Standard errors clustered at the municipality level are reported in parentheses. ***, **, and * denote 1, 5, and 10 percent significance levels, respectively.

Table 4. Estimates of heterogeneous effects on climate news exposure.

Outcome:	Climate news exposure		
Prior	(1) Environmental concerns	(2) Climate change concerns	(3) Carbon tax support
Prior*Y2018	62.314***	30.530***	13.134***
	(15.208)	(10.175)	(3.264)
Fire*Y2018	-0.427	-0.493	-0.512
	(1.454)	(1.439)	(1.432)
Year FE	Yes	Yes	Yes
Party FE	Yes	Yes	Yes
Municipality FE	Yes	Yes	Yes
Demographics	Yes	Yes	Yes
Observations	9,014	9,014	9,014

Notes: Regressions are based on Eq. (1) but with climate news exposure as the outcome variable. Standard errors clustered at the municipality level are reported in parentheses. ***, **, and * denote 1, 5, and 10 percent significance levels, respectively.

Table 5. Estimates with news exposure as an additional control variable

Outcome:	(1) Environmental concerns	(2) Climate change concerns	(3) Carbon tax support
Prior*Y2018	0.487***	0.683***	0.032
	(0.129)	(0.174)	(0.106)
Fire*Y2018	-0.002	0.022*	-0.020
	(0.004)	(0.012)	(0.026)
Climate news exposure	0.001	0.000	0.002
	(0.001)	(0.002)	(0.006)
Year FE	Yes	Yes	Yes
Party FE	Yes	Yes	Yes
Municipality FE	Yes	Yes	Yes

Notes: Regressions are based on Eq. (1) as in Table 1 but with climate new exposure at the party level as an additional control variable. Standard errors clustered at the municipality level are reported in parentheses. ***, **, and * denote 1, 5, and 10 percent significance levels, respectively.

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Appendix

Table A1 reports summary statistics. In the remainder of this section, I report results for the following sensitivity tests: (1) using data from 2011-2018, (2) measuring party preferences using stated votes in the last election, (3) measuring climate events using the share of burned forest land, temperature, or precipitation.

Using pre-data from before 2017 could have upsides in the main regression (Eq. 1) if 2017 was an atypical pre-treatment year. Moreover, prior beliefs could be predicted accounting for party-specific trends over time, as Figure 7 does show a weak decreasing trend in environmental concerns for certain parties. In Table A2, I add pre-treatment data year by year down to 2011 and use them both for predicting priors and in the main regression. When predicting prior beliefs, I allow linear party-specific time trends in attitudes. The estimated effect heterogeneity by priors remains statistically significant and is close to the main estimates (reproduced in column 7) for environmental and climate change concerns. For carbon tax attitudes, most effects are not statistically significant, except when incorporating data from before 2014. The estimated effect heterogeneity by fire exposure remains mostly statistically insignificant.

For election years, the SOM surveys contain a question asking respondents which party they voted for in the national, regional, and municipal elections. As a sensitivity test, I replace the party support variable with stated votes in the last election. Since elections are held every fourth year and 2018 is an election year, I use 2014 as the pre-treatment year instead of 2017. Table A3 reports the results. The main conclusions from the main results remain, although the point estimates now differ a bit. However, given that some extensive fires raged in the country in 2014, we think this year is not an ideal pre-treatment year to use, and that the point estimates in Table A3 are downward biased.

In a final set of sensitivity tests, I use alternative measures of the climate impacts related to fires in 2018, including the share of municipal forest land burned in 2018, and temperature and precipitation in June-August 2018. It has been documented that the widespread fires in 2018 resulted from heatwaves and minimal rainfall throughout that summer, creating exceptionally dry conditions and severe droughts (Wilcke, et al., 2020). In Table A4, the estimated effect heterogeneity by the alternative measures of the severity of climate events remains statistically insignificant, except sometimes for climate change concerns as in the main results.

Table A1. Summary statistics

	Mean	Std. Dev.	Min	Max
Main dependent variables:				
Environmental concerns	0.179	0.383	0	1
Climate change concerns	3.301	0.764	1	4
Carbon tax support (for a higher tax)	2.712	1.258	1	5
Main independent variables:				
Fire – Logarithm of municipal burned areas plus one in 2018	10.416	1.865	0.000	18.421
Fire – Municipal burned areas in 2018 (hectares)	39.400	458.438	0.000	10,006.768
Fire – Large fires in 2018	0.649	0.477	0	1
Fire – Share of municipal burned forest land in 2018 (percent)	0.118	0.242	0.000	2.114
Temperature June-August 2018 (degree Celsius)	18.227	1.339	10.744	19.967
Precipitation June-August 2018 (100 mm)	1.456	0.391	0.654	3.050
Climate news exposure (number of articles in the main morning paper)	401	445	0	1,376
Political orientations:				
The Left Party	0.078	0.267	0	1
The Social Democrats	0.294	0.456	0	1
The Centre Party	0.087	0.282	0	1
The Liberal Party	0.060	0.237	0	1
The Moderate Party	0.229	0.420	0	1
The Christian Democrats	0.047	0.211	0	1
The Green Party	0.068	0.252	0	1
The Sweden Democrats	0.126	0.332	0	1
The Feminist Initiative	0.011	0.106	0	1
Demographics:				
Education – Low	0.150	0.357	0	1
Education – Medium	0.418	0.493	0	1
Education – High	0.431	0.495	0	1
Gender – Woman	0.514	0.500	0	1
Gender – Men	0.485	0.500	0	1
Gender – Other	0.002	0.040	0	1
Age – Young	0.212	0.409	0	1
Age – Mid-life	0.319	0.466	0	1
Age – Old	0.469	0.499	0	1
Household income – Very low	0.116	0.320	0	1
Household income – Low	0.110	0.313	0	1
Household income – Medium	0.247	0.431	0	1
Household income – High	0.192	0.394	0	1
Household income – Very high	0.296	0.456	0	1
Swedish Citizenship – Yes	0.935	0.247	0	1
Swedish Citizenship – No	0.030	0.169	0	1
Swedish Citizenship – Double	0.036	0.185	0	1
Residential area – Rural	0.144	0.351	0	1
Residential area – Village	0.189	0.392	0	1
Residential area – City	0.494	0.500	0	1
Residential area – Metropolitan area	0.173	0.378	0	1
Upbringing – Rural area	0.218	0.413	0	1
Upbringing – Village	0.287	0.452	0	1
Upbringing – City	0.245	0.430	0	1
Upbringing – Metropolitan area	0.173	0.378	0	1
Upbringing – Other countries	0.077	0.267	0	1
Family class – Blue-collar	0.398	0.489	0	1
Family class – Farmers	0.029	0.169	0	1
Family class – White-collar	0.491	0.500	0	1
Family class – Entrepreneurs	0.082	0.275	0	1
Placebo outcomes:				
Concerned about immigration	0.280	0.449	0	1
Concerned about integration	0.146	0.353	0	1
Concerned about the labor market	0.228	0.419	0	1
Support more extensive healthcare privatization	2.452	1.181	1	5
Support higher taxes	2.544	1.163	1	5
Support lower taxes	3.133	1.248	1	5
Concerned about the consequences of large number of refugees	2.894	0.921	1	4
Concerned about organized crime	3.208	0.789	1	4
Concerned about increased inequality	3.030	0.798	1	4
Concerned about worsened welfare	2.971	0.788	1	4
Support profit prohibition in healthcare, education, and social services	3.761	1.346	1	5

Notes: Sample size varies across dependent variables: 34,118 observations for environmental concerns, 24,546 observations for climate change concerns, and 23,047 observations for carbon tax support. For other variables, I report the summary statistics for the observations without missing values in the environmental concerns variable.

Table A2. Extending the pre-treatment period

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Pre-fire period:	2011-2017	2012-2017	2013-2017	2014-2017	2015-2017	2016-2017	2017
	Panel A. Environmental concerns						
Prior*Y2018	0.698***	0.680***	0.652***	0.651***	0.585***	0.484***	0.546***
	(0.066)	(0.067)	(0.069)	(0.073)	(0.067)	(0.080)	(0.099)
Fire*Y2018	0.002	0.001	0.001	0.001	0.000	-0.000	-0.003
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)
	Panel B. Climate change concerns						
Prior*Y2018	0.412***	0.397***	0.400***	0.457***	0.503***	0.720***	0.683***
	(0.068)	(0.071)	(0.078)	(0.096)	(0.107)	(0.186)	(0.173)
Fire*Y2018	0.006	0.009	0.007	0.011	0.017*	0.018	0.022*
	(0.008)	(0.008)	(0.008)	(0.009)	(0.009)	(0.011)	(0.012)
	Panel C. Carbon tax support						
Prior*Y2018	0.192***	0.170***	0.148***	0.075	0.084	0.056	0.054
	(0.054)	(0.054)	(0.056)	(0.071)	(0.061)	(0.055)	(0.077)
Fire*Y2018	-0.018	-0.015	-0.010	-0.008	-0.008	-0.011	-0.020
	(0.016)	(0.016)	(0.017)	(0.018)	(0.019)	(0.020)	(0.026)

Notes: Regressions are based on Eq. (1) with an extended pre-treatment period. The post-treatment year 2018 is always included. Prior beliefs are predicted using the extended pre-treatment period allowing for party-specific linear time trends. Standard errors clustered at the municipality level are reported in parentheses. ***, **, and * denote 1, 5, and 10 percent significance levels, respectively.

Table A3. Using stated votes instead of party preferences

Outcome:	Environmental concerns			Climate change concerns			Carbon tax support		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Election	Municipal	Regional	National	Municipal	Regional	National	Municipal	Regional	National
Prior*Y2018	0.349***	0.299***	0.290***	0.262***	0.255**	0.162*	-0.075	-0.133	-0.013
	(0.119)	(0.093)	(0.085)	(0.093)	(0.102)	(0.092)	(0.083)	(0.082)	(0.077)
Fire*Y2018	0.005	0.005	0.009*	0.005	0.005	0.008	0.018	0.000	0.011
	(0.005)	(0.005)	(0.005)	(0.011)	(0.011)	(0.011)	(0.026)	(0.027)	(0.026)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Party FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Municipal FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Demographics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5,164	5,161	5,368	4,595	4,624	4,763	2,254	2,242	2,354

Notes: Regressions are based on Eq. (1) with stated votes used to determine party position and with data from 2014 and 2018. Standard errors clustered at the municipality level are reported in parentheses. ***, **, and * denote 1, 5, and 10 percent significance levels, respectively.

Table A4. Using alternative measures of climate impacts

	Environmental concerns			Climate change concerns			Carbon tax support		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Prior*Y2018	0.541***	0.545***	0.545***	0.678***	0.693***	0.698***	0.045	0.049	0.048
	(0.099)	(0.099)	(0.099)	(0.169)	(0.172)	(0.173)	(0.079)	(0.077)	(0.077)
Firesh*Y2018	0.034			0.241**			0.086		
	(0.026)			(0.104)			(0.158)		
Temp*Y2018		0.006			0.038**			-0.011	
		(0.006)			(0.017)			(0.033)	
Precip*Y2018			-0.002			0.006			-0.004
			(0.022)			(0.081)			(0.109)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Party FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Municipal FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Demographics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7,466	7,466	7,466	4,202	4,202	4,202	2,794	2,794	2,794

Notes: Regressions are based on Eq. (1) but with alternative climate impact variables instead of fire exposure. Firesh is the share of burned forest land at municipal level in 2018 in percent, Temp is municipal average temperature in degree Celsius in June-August 2018, and Precip is municipal average precipitation in 100 mm in June-August 2018. Standard errors clustered at the municipality level are reported in parentheses. ***, **, and * denote 1, 5, and 10 percent significance levels, respectively.