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The Geography of Trust: Climate Shocks and Electoral Competition in Europe

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Abstract

Climate shocks are becoming more frequent and costly, yet their consequences for electoral competition remain contested. Existing work has focused primarily on whether climate shocks redirect support toward green parties by raising the salience of climate policy. We argue that climate shocks shape political party competition primarily by shaping voters' retrospective evaluations of government performance. Political trust determines how voters interpret that signal. Where trust in institutions is low, hardship confirms preexisting perceptions of elite neglect: incumbents lose votes and populist challengers, particularly on the radical right, gain support by framing disaster as evidence of institutional betrayal. Where trust is high, voters extend goodwill to incumbents navigating difficult circumstances, leaving support largely unaffected. We test these claims using subnational monthly data on party vote shares, political trust, and exogenous heatwave and drought events across 230 regions in 24 European countries between 1996 and 2020. Incumbent losses in low-trust regions reach ten percentage points after heatwaves and sixteen after extreme dry spells; populist gains reach five and twelve points respectively. We find only weak and inconsistent evidence of shifts toward green parties, suggesting that the dominant political dynamic following climate shocks is driven by institutional grievance rather than climate issue salience.

Keywords: climate shocks, green parties, political conflict, populist party support, democracy

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Climate change represents a defining challenge of the 21st century, increasingly disrupting human and ecological systems through more frequent and costly extreme weather events such as heat waves, floods, droughts, and wildfires. While these costs are especially salient in the Global South, recent evidence shows that European countries are highly exposed as well. The summer of 2026 brought record-breaking heat and drought to Western Europe, with temperatures reaching 42.5°C in France and wildfires forcing evacuations in Greece and prompting emergency responses as far north as England. These are not isolated episodes: extreme heat alone caused more than 61,000 deaths across Europe in the summer of 2022 (Ballester et al. 2023), and weather- and climate shocks cost the European Union (EU) more than €700 billion between 1980 and 2023, including €162 billion between 2021 and 2023 alone.[1] These disasters strain not only public and private budgets, but human health, agricultural livelihoods, and security (Bednar-Friedl et al. 2023).

As such damages and threats to human security intensify, they are expected to have significant effects on democratic politics. When disasters strike, voters punish the governments in charge (Malhotra and Kuo 2008; Bovan et al. 2018; Gasper and Reeves 2011; Achen and Bartels 2016; Balcazar and Kennard 2024; Gualtieri et al. 2026). While such shocks rarely bode well for incumbents, their implications for broader patterns of electoral conflict are less clear. Some studies find that climate shocks heighten the salience of climate change, increasing electoral support toward green parties (Kronborg et al. 2024; Pianta and Rettl 2022; McAllister and Bin Oslan 2021; Hoffmann et al. 2022; Damsbo-Svendsen 2024; Devereux et al. 2023);[2] others find no systematic effect (Garside and Zhai 2022; Hilbig and Riaz 2024; Wappenhans et al. 2024), or even a backlash against environmental protections (Lockwood 2018; Huber et al. 2021; Berker 2024; Buzogány and Mohamad-Klotzbach 2021; Marquardt and Lederer 2022; Fiorino 2018, 2022; Bosetti et al. 2025).[3]

Our paper contributes to these findings by locating the mechanism linking climate shocks to party competition elsewhere: climate shocks change how voters judge the institutions meant to protect them, rather than how much they prioritize climate policy, and preexisting political trust shapes which way voters' judgment falls. Because this mechanism runs through blame for institutional failure, its electoral beneficiary does not need to be a party that campaigns on climate policy but one that is able to convert institutional failure into political grievance. In low-trust regions, where voters already regard governing institutions with suspicion, this creates fertile ground for populist parties in particular, whose signature strategy is to frame hardship as evidence of elite betrayal, amplifying incumbent losses and channeling them into grievance-driven electoral gains. In high-trust regions, voters extend greater goodwill to incumbents and don't necessarily interpret the negative consequences as signals of government incompetence.

To test the empirical implications of our argument, we conduct a subnational analysis of electoral support for political parties across 230 regions in 24 European countries between 1996 and 2020. Our study combines two distinct data innovations. First, we leverage fine-grained meteorological data on extreme weather events measured at the regional level on a monthly basis. By precisely

[1] European Environment Agency. 2024. "Economic losses from climate-related extremes in Europe." https://www.eea.europa.eu/en/analysis/indicators/economic-losses-from-climate-related.

[2] Related studies find that climate shocks increase public support for green policies at least in the short term (Baccini and Leemann 2021; Milner and Gazmararian 2026; Arias and Blair 2024; Gazmararian and Milner 2026).

[3] Climate shocks can also affect voter turnout (Zelin and Smith 2023; Marsh 2023).

capturing within-country variation in climate shocks in the months immediately preceding elections, and by relying on exogenous meteorological indicators rather than reported disaster impacts, we are able to isolate the causal effect of two dominant types of climate shocks (heatwaves and extreme dry spells) in a way that is plausibly exogenous to regional political and economic conditions and avoids the endogeneity of damage-based measures. We focus on these two hazards because they impose the most diffuse and hard-to-compensate costs in the European context: heatwaves are the leading weather-related cause of mortality in Europe, while dry spells strike agricultural economies directly (Bednar-Friedl et al. 2023, 1875). Neither lends itself to the straightforward insurance-based buffering that can blunt the political fallout of, say, flood damage, making the adequacy of institutional protection more directly legible to voters. Second, we introduce novel subnational data on political trust that captures important within-country variation in citizens' confidence in governing institutions: governments, legislatures, and political parties.[4] By combining these two datasets with subnational electoral returns for political parties, we are able to assess not only whether voters respond to climate shocks at the ballot box, but also how that response, and with it the direction of political competition, varies across the uneven geography of political trust.

Our findings show that climate shocks have broad implications for political competition in European democracies, shaping not only which parties win and lose, but the terms on which electoral conflict is organized. How climate shocks translate into electoral outcomes is shaped by pre-existing levels of political trust in a region. In low-trust regions, incumbent vote share falls by as much as ten percentage points after heatwaves and sixteen after extreme dry spells, while populist vote share rises by as much as five and twelve percentage points, respectively. In high-trust regions, by contrast, incumbents are insulated from these losses and, in some specifications, gain support, while the populist effect attenuates to zero and turns negative for extreme dry spells. These patterns are robust to a battery of specification checks, including tests addressing the potential reverse causality in political trust, placebo tests that reveal no pre-trends, formal sensitivity analysis for unobserved confounding, and alternative disaster measures. In an empirical extension, we also explore whether climate shocks affect green party support differentially in high and low trust regions. We find only weak and inconsistent evidence that these dynamics extend to green parties. This underlines existing research that green party support is less driven by voters' evaluations of institutional competence rather than through shifts in issue priorities.

Our findings extend previous work on climate change and democratic politics by examining the conditions under which climate shocks influence electoral outcomes beyond the sanctioning of incumbent parties (Cremaschi and Stanig 2024; Healy and Malhotra 2009), adding depth to our understanding of shifts in political conflict in Europe (Kriesi et al. 2012; Broz et al. 2021; Beacham et al. 2024). Much of this work has emphasized material conditions (such as compensation or government relief) as the key mechanism moderating voters' responses to climate shocks. We complement this work by shifting attention to socio-tropic explanations. Unlike compensation, which operates after a disaster strikes, political trust is a stable baseline orientation toward governing institutions that shapes how voters interpret whatever response they receive

[4] Unlike the timing and location of extreme weather, trust is not randomly distributed across regions so we cannot interpret the interaction as a causal effect of trust itself. Our estimates identify how an exogenous shock affects electoral outcomes across regions that differ in pre-existing trust levels, and the interaction captures effect heterogeneity rather than a causal moderating effect.

(Hetherington 2018; Fairbrother et al. 2025). Even where compensation is generous, low-trust voters may remain skeptical of its fairness or adequacy; and even where it falls short, high-trust voters may extend goodwill to incumbents navigating difficult circumstances. Political trust operates upstream of material responses, filtering the political meaning voters attach to climate shocks and their aftermath.[5] Together, these insights offer a more complete account of how environmental crises reshape political conflict in democratic societies.

By highlighting the conditions under which climate change may increase support for populist parties, our findings speak to research on the rise of populism, which has focused on the effect of populism on climate attitudes and policies (Huber et al. 2021; Berker 2024; Buzogány and Mohamad-Klotzbach 2021; Marquardt and Lederer 2022; Lockwood 2018).[6] Despite growing interest, research has only begun to ask whether climate shocks affect support for populist parties. The closest precedents examine adjacent phenomena such as the electoral backlash to green policies (Voeten 2024) or to local geophysical disasters such as earthquakes (Cerqua et al. 2023), but the electoral consequences of climate shocks themselves, and the regional conditions under which they fuel populist gains, remain largely unexamined across a broad comparative setting. Our findings highlight that broader realignments in political conflict are not only driven by globalization (Kriesi et al. 2008, 2012), but also by climate change.

Our findings also speak to the divergent results in the literature on climate shocks and green party support that we discuss above. Our findings support other research that finds that climate shocks may not reliably activate the issue that has been assumed to be the operative channel. In our data, green parties gain only under narrow, hazard-specific conditions. If the more systematic political response to climate shocks occurs on the incumbent-populist axis, that would help explain why the search for a stable green party effect has produced such mixed results.

Finally, we use novel subnational data on political trust, linked to time- and location-specific records of exogenous extreme weather events. Most existing studies of climate change and electoral politics rely on country-level data or highly localized data from single-country case studies (Baccini and Leemann 2021; Garside and Zhai 2022; Kronborg et al. 2024; Balcazar and Kennard 2024; Cerqua et al. 2023), an approach that has many advantages but masks considerable within-country variation in both climate exposure and the political contexts in which shocks occur. By constructing a dataset at the subnational level and leveraging monthly within-country variation in exogenous extreme weather events, we can isolate the localized and temporally precise effects of climate shocks while controlling for national-level factors, substantially improving causal identification. Climate shocks do not respect administrative boundaries, and their effects are experienced unevenly across regions

[5] Our robustness checks confirm that trust retains its explanatory power when controlling for proxies of government compensation capacity, including EU regional funding, suggesting that the two mechanisms are empirically as well as theoretically distinct (Appendix D-3). In addition, in Appendix A-1 we provide evidence that political trust tends to be relatively stable over time and is not driven by the immediate effects of climate shocks. Rather, average patterns of political trust in the EU vary systematically with broader macro-economic trends, as has been documented in previous research (Foster and Frieden 2021). Additionally, climate shocks have no systematic effect on political trust, in correlational analyses (see Appendix A-3) and event study specifications regressing the trust score on lagged climate shocks (results are available upon request).

[6] The work on climate change and populism is based on a broader literature on populism (Norris and Inglehart 2019; Mudde 2004, 2007; Mudde and Rovira Kaltwasser 2013, 2018; Broz et al. 2021; Schraff and Pontusson 2023; Bale and Rovira Kaltwasser 2021; Wiesehomeier et al. 2024; Rodrik 2021; Colantone and Stanig 2019).

within countries, making comparative subnational analysis essential for understanding how they reshape political competition (Putnam 2001; Broz et al. 2021; Schraff and Pontusson 2023).

Argument

Climate-related extreme weather events have wide-ranging consequences, including economic fallout, social disruption, physical harm, and mental health effects (IPCC 2023). In Europe, these burdens are felt acutely and unevenly. Heatwaves are Europe's deadliest weather-related hazard, killing more than 61,000 people in the summer of 2022 alone, disproportionately among the elderly (Ballester et al. 2023); extreme dry spells hit farming communities just as directly, eroding harvests and household income across regions where agriculture anchors the local economy. The summer of 2026 displayed both dynamics at once: record heat cut Europe's grain harvest by roughly nine million tons, an estimated €2 billion in lost revenue, while in Southern Germany, forage shortages forced farmers to slaughter livestock ahead of schedule as the harvest itself risked total loss.[7] Even wealthier European societies are not insulated from such shocks: the 2021 flooding in Germany's Ahr and Erft valleys, which killed almost 200 people, destroyed entire towns, and caused damages exceeding €30 billion,[8] and the 2018 Swedish wildfires that devastated large rural areas, illustrate the compounding costs extreme weather can inflict.[9]

These events are politically consequential not only because of the material damage they cause, but because they expose the limits of institutional protection. When climate shocks overwhelm communities, voters make collective judgements about whether governing institutions have adequately prepared for and responded to foreseeable risks, and governments that are seen to have failed this test tend to pay an electoral price (Malhotra and Kuo 2008; Bovan et al. 2018; Gasper and Reeves 2011; Achen and Bartels 2016; Balcazar and Kennard 2024; Healy and Malhotra 2009; Gaikwad et al. 2022; Cerqua et al. 2023). Our argument builds on this insight: climate shocks undermine support for incumbents not because voters blame them for the events themselves, but because disasters serve as focusing events that make institutional failures visible and politically salient. Electoral backlash should therefore be conditioned by the level of political trust that prevails in a region.

Political trust, defined as citizens' basic evaluative and affective orientation toward government institutions and officials (Citrin and Stoker 2018), shapes how voters interpret government performance in the aftermath of a disaster. Political trust captures loyalty to the regime and its core institutions rather than support for incumbents or specific policies (Devine 2024; Devine and Valgarðsson 2024; Easton 1975), and it is a relatively stable, slow-moving disposition rather than a short-term reaction to specific events. Political trust is formed through accumulated experience with institutions over long periods, through childhood socialization, repeated interactions with the state, and community-level norms, rather than through any single disaster or relief effort (Hetherington

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7 Energy and Climate Intelligence Unit (ECIU). 2026. "June Heatwave Knocks €2 Billion off European Harvest Prospects," press release; APA. August 14, 2026. "German Farmers' Union has warned of a risk of complete crop loss in the country's southern regions"

8 *Deutsche Welle*. August 10, 2021. "German leaders agree on €30 billion for flood-hit regions." https://www.dw.com/en/german-floods-leaders-agree-on-30-billion-reconstruction-fund/a-58822602.

9 SMHI (2018). "Juli 2018 - Långvarig hetta och svåra skogsbränder." https://www.smhi.se/klimat/ klimatet-da-och-nu/manadens-vader-och-vatten-sverige/manadens-vader-i-sverige/juli-2018-langvarig-hetta-och-svara-skogsbrander-1.137248.

2018; Devine and Fairbrother 2026). It tends to cluster spatially and persists over time within regions, reflecting deep-rooted differences in institutional quality, historical legacies, and social capital (Putnam 1993).[10] Because it forms over long periods and through processes largely independent of any single event, political trust shapes how voters interpret climate shocks and their aftermath far more than climate shocks reshape it.

In regions where political trust is high, voters are more likely to extend goodwill to incumbents, attributing failures to the inherent difficulty of managing unprecedented crises rather than to incompetence or indifference. Trust acts as a cushion: even when disaster responses fall short, high-trust voters may tolerate them as sincere and well-meaning efforts under difficult circumstances and remain oriented toward the existing political system rather than turning against it. In regions where political trust is low, however, voters who already regard governing institutions with suspicion are far more likely to interpret the negative consequences of extreme weather events as confirmation of a deeper pattern of elite neglect and state failure. It is therefore not simply the objective adequacy of a government's response that drives political backlash, but how that response is perceived and interpreted through the lens of pre-existing distrust. Even well-intentioned responses may fail to reassure low-trust voters who perceive them as insufficient, unfairly distributed, or politically motivated.

Citizens also judge governments on whether they have taken appropriate steps to reduce risk in the first place; repeated disasters that reveal poor planning or failed investment in mitigation can deepen this sense of institutional failure (Gasper and Reeves 2011). In low-trust contexts, these collective perceptions translate more readily into electoral punishment, as voters who have little faith in the system to begin with find their doubts confirmed and their willingness to sanction incumbents intensified.

Hypothesis 1: *Incumbent party vote shares decline after climate shocks, especially in regions where political trust is low.*

While many voters respond to climate shocks by punishing incumbents, electoral dissatisfaction does not occur in a vacuum. Climate shocks can reshape patterns of party support and create opportunities for other political parties to gain support.

In low-trust regions, populist parties are especially well positioned to benefit. Their success lies in mobilizing grievances and translating hardship into political anger (Fomina and Kucharczyk 2016; Grzymala-Busse 2019; Norris and Inglehart 2019). Climate shocks provide ideal terrain for these narratives precisely in contexts where citizens already regard governing institutions with suspicion. When trust in political institutions is low, voters are predisposed to interpret government responses to disasters as evidence of indifference or incompetence rather than efforts to protect the public. Populists thrive in precisely these contexts. They do not compete over technocratic competence or long-term planning, but instead focus on blame and betrayal, promising swift retribution and a break

[10] Regions in Southern and Eastern Europe, for instance, have consistently lower levels of institutional trust than Scandinavian regions (Ejrnæs et al. 2024) although political trust also fluctuates with larger macro-economic shifts and in response to changing political contexts, especially between people's formative years and adulthood (Foster and Frieden 2021; Devine and Valgarðsson 2024).

with a corrupt status quo (Mudde 2004, 2007; Hawkins et al. 2019; Huber et al. 2021; Bosetti et al. 2025). They use anti-elite and anti-system rhetoric to channel frustration into support, portraying themselves as the only authentic representatives of "the people" against an unresponsive political class (Mudde 2004). In low-trust regions, where voters already feel that the system protects some while abandoning others, this rhetoric finds fertile ground (Schraff and Pontusson 2023). Populists are not judged by the realism of their climate solutions, but by their emotional resonance and their promise to challenge corrupt institutions (Foa 2021; Schwörer and Fernández-García 2024). It is not the occurrence of a shock alone that drives populist gains, but the activation of pre-existing distrust that leads voters to interpret the shock as further evidence of a system that has failed them.

The case of the 2024 Valencia floods illustrates this dynamic. Following the disaster, the far-right party Vox capitalized on public anger over the perceived inadequate response from both regional and national governments. Vox framed the disaster as a symbol of state neglect, criticizing the government's failure to warn residents and provide timely relief, and positioned itself as the defender of "abandoned" citizens, invoking an anti-elite logic that resonated with voters who had lost confidence in the established institutions. This strategy contributed to a rise in Vox's national polling support from 10.5% to 13.8% in subsequent surveys.[11]

To gain from the negative consequences of climate shocks, populist parties do not even have to politicize climate change in itself; they can focus on politicizing the economic and financial suffering of citizens that remains (seemingly) unaddressed by their governments.[12]

Hypothesis 2: *Populist party vote shares increase after climate shocks, particularly in regions where political trust is low.*

The populist party family is not monolithic. A growing literature on populist crisis exploitation has focused almost exclusively on the radical right, documenting its distinctive reliance on attributing blame for adverse events to the political establishment (Moffitt 2015; Hinterleitner et al. 2024). This orientation extends to a documented propensity to discredit elites through misinformation: across 26 democracies, radical-right populism is the strongest party-level predictor of spreading misinformation, a pattern not found for left-wing populism (Törnberg and Chueri 2026). Left populism's anti-elitism, by contrast, is directed primarily at economic elites rather than the governing institutions a disaster-as-state-failure narrative implicates (March and Mudde 2005). The two wings also relate differently to the substance of climate shocks: whereas the radical right is consistently associated with climate skepticism and the denial of anthropogenic climate change, no comparable link exists for the radical left (Bosetti et al. 2025). This matters because a party that rejects the climate framing can still exploit a disaster as evidence of state failure, sidestepping the climate question entirely, a repertoire less naturally available to left populists who tend to accept the climate premise and compete on policy. These differences are likely to produce a corresponding

[11] The Financial Times. "Spain warns far right is exploiting anger over climate disasters." 27 January 2025. https://www.ft.com/content/55991101-9501-4c20-bf2a-5404bcb67e35?syn-25a6b1a6=1. Accessed: 18 July 2026.

[12] Although not our focus, one could argue that populist parties would even have incentives to de-emphasize the role of climate change as it provides a more convenient exogenous scapegoat for incumbents. By highlighting economic or financial suffering in a region, without being explicit about the real culprit, populist parties have a greater likelihood of attributing more blame to the government.

electoral asymmetry following climate shocks.[13] While we group populists in the main analysis, we probe these possible divergences directly by estimating effects for each wing separately in an empirical extension.

Our argument, centered on how political trust conditions the attribution of blame for institutional failure, suggests that trust conditions whether a climate shock reads as a government failure (low trust) or a misfortune (high trust). As such, it does not straightforwardly extend to predict a corresponding shift toward other political parties that emphasize climate policy as a political program, such as green parties. Green parties' appeals center on prevention, sustainability, and structural reform (Abou-Chadi 2016; Han and Finke 2023). Their messaging frames climate change as a long-term policy problem requiring ambitious mitigation and adaptation and reinforces the urgency of climate action without undermining confidence in democratic institutions. A shift toward green parties is less related to attributions of competence or failure of incumbents, but an affirmative judgment that climate policy specifically should be prioritized.

A parallel literature proposes that climate shocks heighten the salience of environmental issues and redirect support toward parties advocating ambitious climate action, particularly among the affluent, urban, and highly educated constituencies that green parties typically draw from and who are already predisposed to prioritize environmental protection (McAllister and Bin Oslan 2021; Hazlett and Mildenberger 2020; Hoffmann et al. 2022; Schumacher 2014; Kenny 2020; Duijndam and van Beukering 2021). This salience-based account is conceptually distinct from the competence-based mechanism we develop for incumbent and populist parties: it operates through a shift in policy priorities rather than through the attribution of blame or credit. This raises the question of whether our argument extends to green parties, as they typically put emphasis on climate policy. One could argue that green party support is more likely to shift in high trust regions where voters may be more perceptible to see climate shocks not as an institutional failure but as a signal that mitigation and adaption is important. Whether this channel operates in our data, and whether political trust moderates it in the way it moderates blame attribution, is accordingly an open empirical question rather than a hypothesis derived from our framework. We examine it descriptively below but treat any patterns we find as an exploratory test of this alternative account rather than confirmation of our central argument.

Research Design

We examine the impact of climate shocks on political conflict across 230 subnational jurisdictions in 24 European democracies over the 1996 to 2020 period.[14] The sub-national units in our analysis are located at the second level in the Nomenclature of Territorial Units for Statistics (NUTS2). The NUTS2

[13] In addition, the radical right is by far the more prevalent and electorally successful populist family in our period, contesting and winning votes in a larger number of regions than the radical left (Rooduijn et al. 2024).

[14] We have data on all relevant covariates for the following countries: Austria, Belgium, Bulgaria, Croatia, Czechia, Denmark, Finland, France, Greece, Hungary, Ireland, Italy, Lithuania, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Spain, Sweden, Switzerland, Turkey, and the UK. In some countries, like Cyprus, Estonia, Latvia, and Malta, there are no NUTS1 and NUTS2 divisions, implying that our observations are at the country level. Germany has no trust data at the NUTS2 level.

level comprises 800,000-3 million inhabitants and has been shown to be a meaningful level to capture opinion change (Milner 2021; Colantone and Stanig 2018).

Our empirical strategy is based on the following ordinary least squares (OLS) regression model:

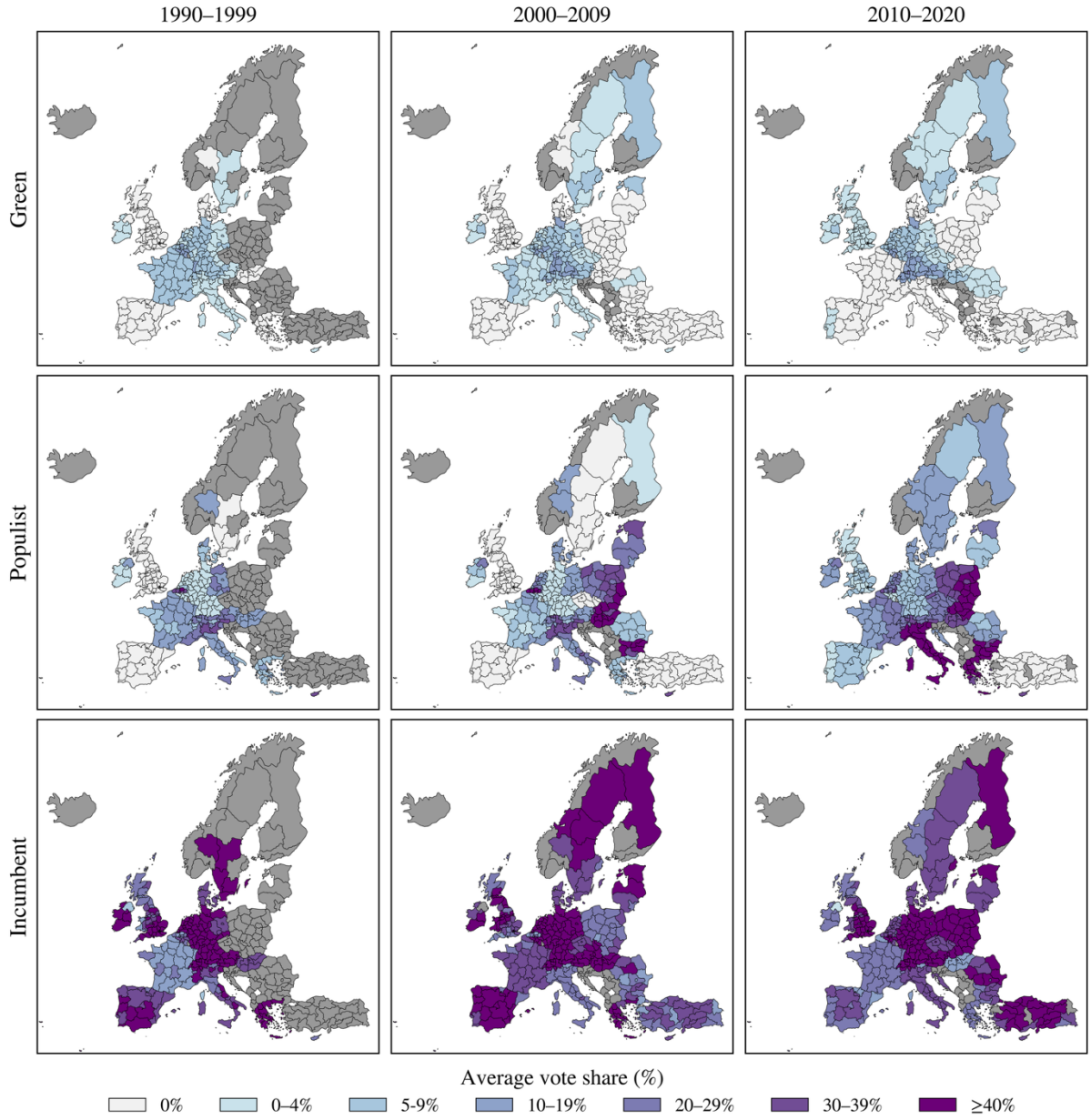
$$\Delta Vote\ Share_{icm} = \alpha + \beta_1 Climate\ Shock_{icm-1} + \beta_2 Political\ Trust_{ict} + \beta_3 (Climate\ Shock * Political\ Trust)_{ict} + \delta_{ict} + \varpi_c + \upsilon_t + \varepsilon \quad \text{(eq. 1)}$$

where β_1 is the main coefficient of interest, measuring the effect of climate shocks on vote shares in region *i,* clustered in country *c* and in parliamentary election month *m*. Standard errors are clustered by country *c* and parliamentary election month *m*. Using country and year fixed effects ensures that time-invariant variables (e.g., geographic or institutional) are controlled for and that the effects of time-varying variables are estimated relative to the country mean. β_2 is the coefficient for the effect of political trust in region *i*, country *c*, and year *t*, and β_3 is the coefficient for the interaction between climate shocks and political trust, which we index $_{ict}$ to match *Political Trust*, since both operate at the region-country-year level, but *Political Trust* is only observed yearly and not monthly. δ_{ict} is a vector of socioeconomic controls, ω_c are country fixed effects, v_t are year fixed effects, and ϵ is a normally distributed error term. We describe all variables in Appendix A-1, and present descriptive statistics in Appendix A-2.

The dependent variable, Δ*Vote Share*, is measured as the percentage point change in the share of votes that each party receives in each NUTS2 region *i* in a given election month *m*, compared to the vote shares in the previous election. Data are from Schraff et al. (2023). We code Δ*Vote Share* for incumbent parties to analyze our expectation that climate shocks should lead to a reduction in the support of the incumbent party (Hypothesis 1). To identify all political parties that are part of the coalition government in the election month, we use the "Variety of Party Identity and Organization (V-Party)" government support variable (*v2pagovsup*). To measure Δ*Vote Share* for populist parties (Hypothesis 2), we use data from Roodujin et al. (2024). Our main analysis groups all populist parties together to estimate their overall electoral response to climate shocks. As discussed above, however, the grievance mechanism may not operate evenly across the two wings, and we therefore also estimate effects for far-left and far-right populists separately in Appendix C-3.

Figure 1 illustrates vote shares for political parties across regions and over time. Because we will explore the effects on green parties in an empirical extension, we present the descriptive information here as well. The maps reveal substantial variation in vote shares both between and within countries, as well as differences in vote shares between the party families across time. The top three panels show green parties remain comparatively small over time. Average regional support declined from 4 percent in the 1990s to 2.6 in the 2000s and remained low at 2.7 percent in the 2010s. Populist parties have expanded considerably over time. Average regional populist support rose from 10.8 percent in the 1990s to 15.3 percent in the 2000s and reached 23 percent in the 2010s. As the same time, the number of regions with populist support exceeding 40 percent increased from one region in the 1990s to 44 regions in the 2010s, with particularly strong concentrations in parts of Greece, Italy, and Eastern Europe. Incumbent parties' regional vote shares have consistently been around 36-39 percent, with support declining modestly over time.

Figure 1. Vote shares in parliamentary elections, by NUTS2 region and time period



Note: Calculated using data from the Comparative Manifesto Project (Lehmann et al. 2024), PopuList (Rooduijn et al. 2024), and the EU-NED database (Schraff et al. 2023). Votes by residents outside the respective countries are not included. Missing data shaded in grey.

Our primary explanatory variable is *Climate Shock*. We focus on two shock types that are plausibly exogenous: the number of heatwave days and the occurrence extreme dry spells.[15] Both variables capture the most politically salient and economically consequential climate hazards in the European

[15] Besides heatwaves and dry spells, floods are among the most destructive climate-related disasters in Europe (Bednar-Friedl et al. 2023, 1878–80) but are difficult to capture with exogenous meteorological data. Extreme precipitation is an imperfect proxy, as heavy rainfall is only one among many events that can cause floods, and whether it translates into flooding depends on intervening factors including soil saturation, topography, drainage infrastructure, and event duration that are themselves potentially endogenous to local governance and land-use decisions (Merz et al. 2021; Berghuijs et al. 2019). We therefore exclude precipitation-based measures from the main analysis, but we present results using EM-DAT disaster data, which includes precipitation-based flood events, in Appendix D-10.

context through distinct mechanisms. Heatwaves are the leading cause of mortality among climate-related extreme weather events in Europe, disproportionately affecting elderly and vulnerable populations, and imposing mounting costs on public health systems, labor productivity, and energy infrastructure (Ballester et al. 2023). Addressing heatwave vulnerability requires longer-term structural investments in building stock, cooling infrastructure, and public health capacity rather than ex-post financial compensation, making the perceived inadequacy of state protection more politically legible to voters. Dry spells and drought conditions especially strike agricultural economies, destroying crops, reducing household income, and destabilizing rural livelihoods in regions where farming remains central to local economic life.[16] Utilizing both measures also allows us to explore whether the effects hold for both discrete, rapid-onset climate shocks (heatwaves) and slower-moving climate shocks (extreme dry spells).

The variable *Heatwaves* is measured as the number of days per month with extreme heat, defined as at least three consecutive days with >99th percentile temperature, from the ERA5. This measure was aggregated to the NUTS2 level by the Copernicus Climate Change Service (C3S), Climate Data Store (2024). It indicates heatwaves, one of the most dangerous disaster types in Europe (Bednar-Friedl et al. 2023, 1875–78). The variable *Extreme Dry Spells* is calculated from a time series of precipitation and temperature, together with fixed parameters related to the soil or surface characteristics at each location. We aggregated the measures from the 0.25*0.25 grid level to the NUTS2 level. We observe the occurrence of extremely dry soil conditions when the *scPDSI* is at or below -4, in at least one "square" within the NUTS2 region in a month prior to the election month (Barichivich et al. 2023; Van Der Schrier et al. 2013).[17]

Based on these variables, we calculate whether an extreme event was present during the month prior to an election. We use the month prior to an election because citizens tend to make voting decisions under the impression of climate shocks that just happened (Baccini and Leemann 2021), and that effects of climate shocks on the political salience of climate risks and support for climate policies tend to last at least a month but not much longer (Arias and Blair 2024; Egan and Mullin 2012; Konisky et al. 2016). In Appendix D-8, we show that the effects are robust to different pre-electoral time frames. We dichotomize the variable because NUTS2 regions are quite small and the occurrence of disasters a rare event.[18]

Figures 2 and 3 show the average intensity of heatwave exposure and the frequency of extreme dry spells across NUTS2 regions by decade. Most regions experience little or no extreme heat, but clusters emerged in Southern Europe and Turkey during the 2000s and became more pronounced in parts of France and Southern Europe during the 2010s. Extreme dry spells are also relatively rare and unevenly distributed. Exposure in the 1990s were concentrated in parts of Southern and Eastern Europe, whereas by the 2010s, episodes of severe drought became more geographically dispersed,

[16] Dry spells are measured using the self-calibrating Palmer Drought Severity Index (scPDSI), which uses a combination of precipitation, evapotranspiration, vegetation coverage and snowpack data calibrated to within the most recent observed climate conditions of an area (Wells et al. 2004; Van Der Schrier et al. 2013; Barichivich et al. 2023).

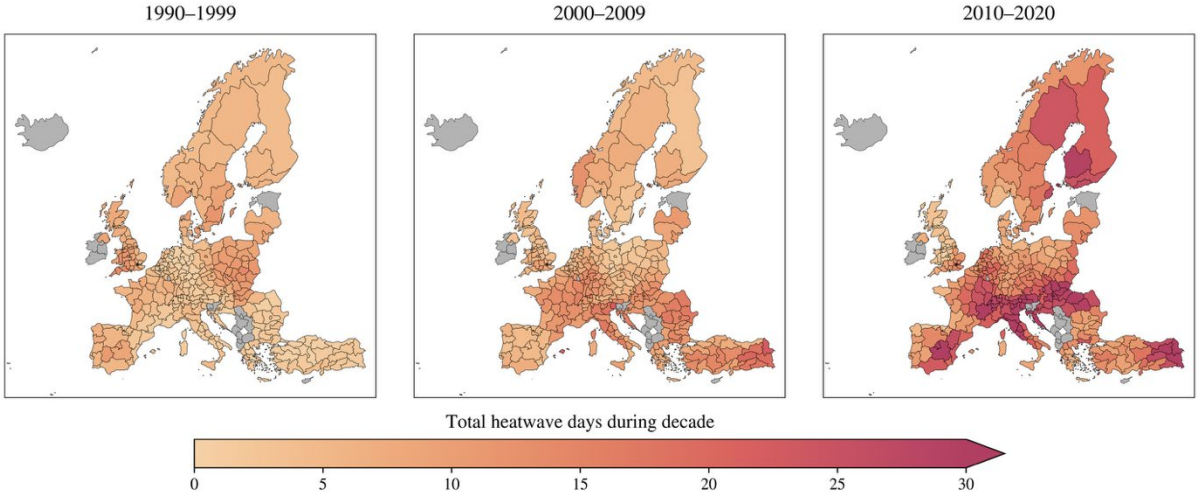
[17] That is, because dry spells are slow-moving shocks, and not discrete events, our measure capture its peak.

[18] These variables are skewed, as severe events are rare. For heatwaves, they are recorded at the 95% percentile and for droughts, at the 90% percentile (see Appendix A-6).

particularly across parts of Northern, Southern, Central and Eastern Europe, including Croatia, Romania, and Slovakia.

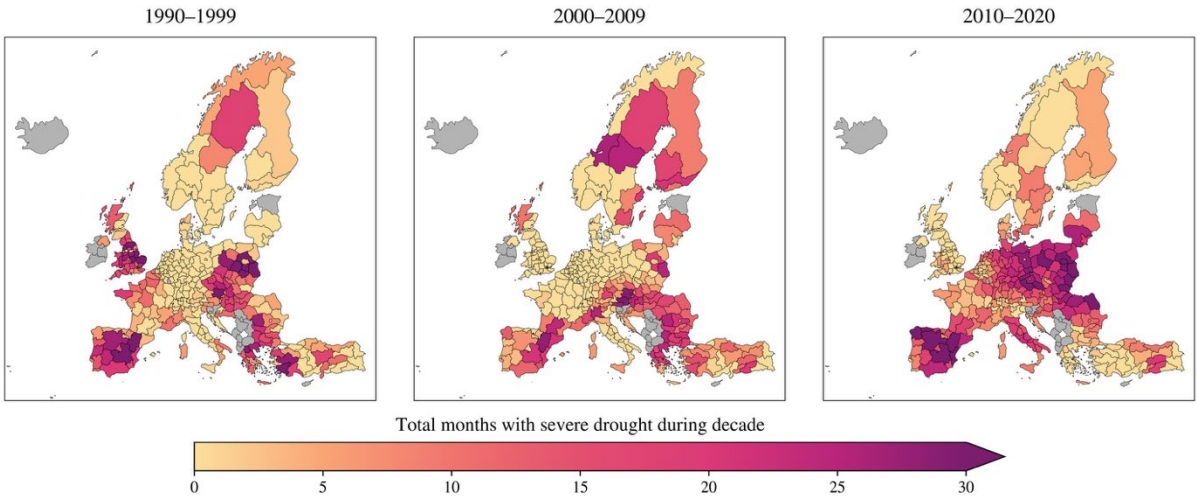
These variables provide fine-grained, monthly data on extreme weather events at the subnational level, allowing us to measure climate shocks in the period immediately preceding each election. Crucially, they are exogenous to political and economic conditions, reducing concerns about reverse causality. One limitation is that they are conservative measures: extreme weather events do not always translate into serious economic costs, meaning that some observations may capture shocks with limited political consequences. We therefore also report results using disaster data from EM-DAT in Appendix D-10 (Delforge et al. 2025).

Figure 2. Number of heatwave days, by NUTS2 region and time period



Note: Calculated using data from ERA5 (Copernicus Climate Change Service (C3S) and Climate Data Store (CDS) 2024). Missing data shaded in grey.

Figure 3. Months with extreme dry spells, by NUTS2 region and time period



Note: Calculated using data from Barichivich et al. (2023). Missing data shaded in grey.

We posit that the political consequences of climate shocks affect voting behavior differently in regions with different levels of political trust. Measuring political trust at the subnational level is

notoriously difficult. Most existing studies rely on national-level survey data, masking considerable within-country variation in citizens' confidence in governing institutions. While valuable, these approaches are limited in their geographic precision and often not comparable across contexts. We overcome this limitation by drawing on the SUB-TRUST database (Dellmuth and Jonsson 2025), which provides subnational measures of trust in various political institutions across European regions.[19]

Political trust is calculated in two steps. First, we measure the share of residents in region *i* of country *c* in election year *t* who express trust in political parties, national parliament, and the national executive government.[20] Figure 4 illustrates the average percentage of trust in national government, national parliament, and political parties, separately for each decade and across NUTS2 regions. Across the three indicators, political trust is generally higher in Northern Europe, particularly Denmark, Finland, Sweden, Norway, and Switzerland, as well as Turkey, compared to the rest of countries included in our sample. Trust in political parties is consistently the lowest, averaging around 21-23 percent. By contrast, trust in national government declined from an average of 45 percent in the 1990s to 40 percent in the 2010s, while trust in the national parliament fell more sharply from 53 percent to 39 percent over the same period.[21]

While political trust varies most between countries, it is not reducible to a country fixed effect. Country fixed effects leave 49% of the variance in trust in national government, 30% for national parliament and 34% for political parties, corresponding to residual standard deviations of 12, 11, and 8 percentage points. This remaining variation is mostly temporal rather than spatial: region fixed effects remove only slightly more (43%, 27% and 28% remain), so stable differences between regions of the same country are small and most within-country variation comes from trust changing between elections. Our models with country fixed effects therefore identify the moderating role of trust from within-country changes over time, holding constant time-invariant national characteristics such as state or compensation capacity.

Figure 4. Average political trust, by NUTS2 region and time period

[19] The estimates are generated using multilevel regression and poststratification and represent the average levels of trust in each institution within a subnational region-year. Appendix B provides details on how the measures are created and validated.

[20] The database harmonizes survey questions drawn from thirteen major cross-national surveys covering European populations: Asia Europe Survey (2000-2001), Balkan Barometer (2016-2017), Eurasia Barometer (2016), Eurobarometer (1997-2020), European Quality of Life Survey (2003-2016), European Social Survey (2002-2020), European Values Survey (1990-2021), Flash Eurobarometer (2018), International Social Survey Program (1990-2020), Latinobarometer (1996-2013 [including for our purposes Spain]), Life in Transition Survey (2016), Pew Global Attitudes (2017; 2020), and World Value Survey (1990-2022). All surveys include questions asking how much confidence or trust respondents place in given institution. To ensure comparability across surveys that use different response scales, original responses were recoded into a binary measure: responses indicating complete trust or quite a lot of trust were coded as 1, while responses indicating rather little trust or no trust at all were coded as 0, with non-responses and missing values excluded. Appendix Table B1 provides a list of survey series sampling the European countries in our study, along with examples of common survey questions and dichotomization of response categories.

[21] Note that the colour scale visually removes the within country variation (see Appendices A-4 and A-5 for line graphs by country, underlining level differences between regions).



Note: SUB-TRUST measures, derived for the sample of 24 countries in the analysis (Dellmuth and Jonsson 2025).

In a second step, we use three-year moving averages to estimate a latent factor using principal-component factor analysis, calculated on the basis of lagged trust at *t*−1, *t*−2, and *t*−3, and then extract a variable containing each observation's predicted score on the retained factor.[22] Values below zero indicate below-average trust, whereas values above zero indicate above-average trust. This moving average is the main moderator in the regression analyses. It is, in line with our conceptualization, slow-moving over time (Appendix A-4).

In line with existing work, we keep our main specifications parsimonious but include gross domestic product (GDP) per capita in million Euro in the pre-observation period from the Ardeco database (Auteri et al. 2024), averaged over the years 1990-1995. Achen and Bartels (2008) argue that

[22] We also created an additive index with these three variables, which is almost perfectly correlated with the factor solution (Pearson's r=0.999, N=919). Scale reliability is very high (α=0.924). Compared to the full sample of 1,498 observations, the number of observations drops due to missing trust data for some regions.

changes in real income in election years can contribute to long-term partisan realignments (see also Mayhew 2002); and Heal and Malhotra (2009) control for national growth rate in personal income. As it might be endogenous to climate shocks, we use a pre-observation measure as a baseline. We also include age groups, as is usual in subnational analyses of voting (e.g. Autor et al. 2024; Kim and Margalit 2021).

Empirical Findings

Before turning to our main estimation results, we present a descriptive comparison of political party vote shares across NUTS2 regions that experience climate shocks and those that do not, for different levels of pre-existing political trust. Figure 5 plots mean incumbent party vote shares (top graph) and populist party vote shares (bottom graph) in low versus high climate shock situations, both in low trust environments (left subgraph) and high trust environments (right subgraph).

Figure 5. Party vote shares by climate shock occurrence and levels of political trust

Note: The figure plots mean party vote shares and 95% confidence intervals by climate shock occurrence (shock versus no shock), separately for two shock types (heatwave days and extreme dry spells) and across low- and high-trust regions. Regions are classified as low-trust if their trust score falls below the sample median and high-trust if it falls at or above the median. Vote shares are in raw percentages. The top graph presents results for incumbent parties and the bottom graph presents results for populist parties.

Two patterns emerge. First, incumbent party vote share tends to fall after a climate shock in low-trust regions, whereas in high-trust regions incumbents are largely insulated and, in the case of dry spells, appear if anything to gain. Second, populist vote share rises markedly after climate shocks in low-trust regions, for both heatwaves and dry spells, while high-trust regions show no comparable increase. These patterns are consistent with our argument that the geography of political trust shapes how climate shocks affect electoral competition. We now turn to our main statistical results that allow us to control for potential confounding factors.

Figures 6 presents our main results from an estimation of eq. 1 in graphical form for incumbent parties (top graph) and populist parties (bottom graph).[23] We present the results for type of shocks side by side. Numerical results in tabular form are presented in Appendix C.

The results provide support for our argument. For incumbent parties (top graph), the marginal effect of climate shocks rises monotonically with political trust. In low-trust regions, shocks significantly reduce incumbent vote share by as much as ten percentage points following heatwaves and as much as sixteen following extreme dry spells. In high-trust regions the effect reverses, with shocks modestly increasing incumbent support. This conditional pattern supports Hypothesis 1. The reversal is consistent with our argument that trust governs whether voters read a disaster as evidence of governmental failure or as a misfortune for which the incumbent is not held culpable.

Figure 6. Marginal effect of climate shocks on party vote shares, conditional on political trust

[23] Appendix A-3 presents the bivariate correlations for the variables included in the main model specifications, to assess potential multicollinearity. Additionally, we have calculated the variance inflation index (VIF), which is at 2.44 on average (*N*=919), indicating no concern for multicollinearity.

Note: Marginal effects with 95% confidence intervals. Panels are based on separate regression models reported in Appendix Table C1. Dependent variable is Δ*Vote Share* for political parties. The graph presents results for incumbent parties (top graph) and populist parties (bottom graph), and for heatwave days (left subgraph) and extreme dry spells (right subgraph) separately. We use ordinary least squares (OLS) estimations with high-dimensional fixed effects for countries and years, controlling for GDP per capita in the pre-observation period. Robust standard errors, clustered at the level of NUTS2 regions.

For populist parties (bottom graph), the marginal effect of climate shocks declines with political trust, supporting Hypothesis 2. In low-trust regions, shocks significantly raise populist vote share by as much as five percentage points after heatwaves and twelve after dry spells. In high-trust regions the effect attenuates to zero and turns negative in the specification that uses extreme dry spells. The findings provide support for the grievance dynamics that benefit populists are activated specifically where trust in institutions is already low, precisely the regions in which incumbents lose the most. The symmetry between the incumbent and populist panels is consistent with a decline of support for governing parties and an increase in support for populist challengers in low-trust contexts.

The populist result pools far-left and far-right populist parties. When we disaggregate the two families (Appendix Table C-3), we find that the trust-conditioned effect is driven by the radical right: the marginal effect of climate shocks on far-right vote share rises in low-trust regions for both climate shock measures, while the corresponding effect for the far left is indistinguishable from zero for droughts. This asymmetry is consistent with the differential fit between the two families and the grievance mechanism we describe above. The radical right's anti-elite repertoire is directed at the political establishment and the perceived failure of government to protect its citizens (precisely the frame a climate disaster activates) and it can mobilize this grievance without engaging the question of climate change itself. The anti-elitist rhetoric in left-wing populism, by contrast, targets economic rather than governing elites and is tied to a pro-climate policy stance, leaving it less able to convert disaster-driven discontent into the anti-system mobilization that climate shocks afford the political right. We caution, however, against over-interpreting the far-left null in relation to droughts: far-left populist parties are less prevalent and electorally smaller in our sample, so the disaggregated models are estimated on considerably less variation, and we cannot fully distinguish the behavioral asymmetry from limited statistical power.

Robustness

One inferential challenge in our analysis is related to how political trust is measured. Unlike the timing and location of extreme weather events, trust is not randomly distributed across regions, so our interaction estimates capture effect heterogeneity rather than a causal effect of trust itself: they identify how an exogenous shock affects electoral outcomes across regions that differ in pre-existing levels of trust, not whether trust causes those differences.

One related concern is that climate shocks might alter trust levels, confounding the interaction. We don't find support for this possibility. Trust scores are relatively stable over time and correlate with broader macroeconomic trends rather than with the occurrence of climate events (Appendix A-1; Foster and Frieden 2021), and climate shocks have no systematic effect on trust in either correlational analyses (Appendix A-3) or event study specifications regressing the trust score on lagged climate shocks.

Trust may also proxy for the baseline partisan composition of a region rather than for citizen orientations toward institutions. For example, low-trust regions tend to have higher pre-existing populist vote shares,[24] which raises the possibility that the interaction term captures a tendency for populist strongholds (rather than low-trust regions specifically) to respond more strongly to shocks. Controlling for lagged party vote shares, which absorbs any such baseline tendency, leaves the results unchanged (Appendix D-13).

One might also worry that trust proxies for a region's institutional or fiscal capacity to compensate disaster victims. The correlation between trust and GDP per capita is moderate (r = 0.51), and between trust and EU funding negative (r = –0.23), suggesting the two are empirically distinct.[25] Moreover, following Cinelli and Hazlett (2020), we simulate how strong an unobserved capacity confounder would need to be to overturn our conclusions, and show it would need to explain substantially more variance in vote shares than pre-observation-period GDP already does, which is an implausible threshold (Appendix D-3).

Second, we conduct a jackknife analysis, re-estimating the main results by dropping one NUTS2 region at a time (Appendix D-1). The results are not sensitive to any single region, underscoring robustness even given the skewed distribution of climate shock variables.

Third, we add socio-economic controls, first-differenced unemployment and inflation rates from the Ardeco database (Auteri et al. 2024), to address concerns about macroeconomic confounding. While the main analyses already include baseline GDP and age categories, and the dependent variable is estimated in changes rather than levels, these additional controls leave the results unchanged (Appendix D-2).

Fourth, we test whether the trust-conditioned effect is itself moderated by three regional characteristics. We find that climate concern does moderate the interaction: populist parties gain in low-trust regions after either shock type especially when average climate concern is low, while

[24] The trust score is weakly correlated with incumbent vote shares (r=0.215; N=931) and populist vote shares (r=–0.324; N=931).

[25] The relevant potential confounder is pre-shock compensation capacity, not realized ex post compensation: realized compensation follows the shock and scales with its severity, so controlling for it would absorb part of the electoral effect we are estimating. GDP and EU regional funding capture the capacity a region had in place before any shock occurred, which is why we use them rather than post-shock relief measures. Future research could examine whether realized post-shock compensation conditions these electoral effects, though comparable region-level data on disaster relief expenditures across European countries remain scarce.

incumbents lose in low-trust regions after heatwaves particularly where climate concern is low (Appendix D-4, D-5, D-6). By contrast, tertiary education share does not systematically moderate the interaction (Appendix D-4), and fossil fuel industry share shows limited effects, significant only in the heatwave models (Appendix D-4, D-7).

Fifth, we exclude Switzerland, a direct democracy, to test whether the results are sensitive to atypical voting systems. They are not (Appendix D-8).

Sixth, we examined whether the effects of climate shocks last by testing leads and lags. We test cumulative disaster occurrence lags (up to 6 months prior to an election month) for both dependent variables, and then disaster occurrence lags up to 6 months prior to an election month and leads up to 3 months after an election month. The results are robust and we see that the interaction effects between climate shocks and trust attenuate slightly over time for the cumulative lags, for instance, for heatwave shocks and trust on populist vote shares from the third month before the election. The leads are insignificant as we would expect (Appendix D-9).

Seventh, we draw on EM-DAT disaster data as an alternative shock measure (Delforge et al. 2025). While EM-DAT measures may be partially endogenous to political and institutional context, they capture events that are by definition economically costly and socially disruptive. The EM-DAT models recover the same trust-conditioned pattern across both outcomes, though with less precision for incumbent vote shares than our exogenous meteorological measures (Appendix D-10).

Eighth, some of the effects for populist party vote shares could be driven by their presence in a government coalition. We control for incumbency status, and find that the results are robust (Appendix D-11)

Ninth, we re-estimate the models excluding the 1990s, where data coverage is sparser. The results hold (Appendix D-12).

Is the Effect of Climate Shocks on Green Party Support Moderated by Political Trust?

As we discussed above, our argument operates through voter beliefs about institutional competence or failures. By contrast, green party votes are more likely driven by issue salience rather than institutional blame or support. However, one could argue that issue salience is more likely to be activated in high trust regions where voters are less concerned about institutional failures. Here we extend our empirical analysis to explore this possibility. Our main dependent variable is Δ*Vote Share* for green parties based on information from the Comparative Manifesto Program (CMP) data set (Lehmann et al. 2024). Figure 7 presents the results.

Figure 7. Marginal effect of climate shocks on green party vote shares, conditional on trust

Note: Marginal effects with 95% confidence intervals. Panels are based on separate regression models reported in Appendix E-1. Dependent variable = Δ Vote share for green parties. The graph presents results for green parties for heatwave days (left subgraph) and extreme dry spells (right subgraph) separately. Ordinary least squares (OLS) estimations with high-dimensional fixed effects for countries and years, controlling for GDP per capita in the pre-observation period. Robust standard errors, clustered at the level of NUTS2 regions.

The graph shows that the results for green parties are weaker and confined to a single hazard. Following heatwaves or extreme dry spells, the marginal effect is statistically indistinguishable from zero across the entire trust range. One possibility is that green parties have increasingly been part of coalition governments, which might dilute any effect. The results in Appendix E-11 explore this possibility and indicate that the null results are not driven by potential losses of incumbent green parties after climate shocks. The green party findings are also generally insignificant across the robustness checks reported in Appendix E, with two exceptions. First, the jackknife results for green party vote shares show that the coefficient of the interaction terms is statistically insignificant across regions (Appendix E-2). Second, the coefficient of the three-way interaction with climate concerns for green parties with heatwaves and droughts, respectively, is insignificant (Appendix E-6).

These findings suggest that green party support is not driven by the geography of political trust and further mirror the mixed findings about climate shocks and green party voting in the literature. While more research is necessary, they suggest that climate shocks do not tend to activate climate concerns across a broad swath of voters but that voters view their consequences through the lens of government and institutional competence.

Conclusion

This paper examines how climate change-induced extreme weather events influence political conflict in European democracies. We build on the standard result on incumbent punishment to develop a broader argument: climate shocks catalyze electoral realignments that reshape patterns of political competition, and the direction of these realignments is systematically conditioned by the level of political trust in affected regions. Where trust in governing institutions is low, climate shocks

activate and amplify pre-existing grievances, driving voters away from incumbents and toward populist challengers that frame disasters as evidence of elite neglect and systemic failure. It is thus not the occurrence of climate shocks alone, but the political trust environment in which they strike, that determines how they reshape electoral competition.

Our empirical analysis, drawing on novel subnational data on political trust and exogenous meteorological climate shocks across Europe, provides strong support for this argument. We find that climate shocks lead to a decline in support for incumbent parties, with this effect most pronounced in low-trust regions where voters are quickest to interpret inadequate disaster responses as confirmation of institutional failure. Populist parties gain most in these same low-trust environments, where climate shocks activate grievance-based mobilization and anti-system sentiment finds fertile ground. Together, these findings demonstrate that political trust explains why the same climate shock can produce such divergent political outcomes, fueling populist surges in some regions while reinforcing incumbent party support in others.

Our findings therefore point to a broader transformation in the structure of political conflict in Europe that warrants further investigation. Scholars have documented the rise of a new integration-demarcation cleavage pitting cosmopolitan, pro-globalization constituencies against more economically and culturally defensive ones as a consequence of globalization. Our results suggest that climate change may increasingly crystallize this divide into a distinct axis of competition, with political trust serving as the fault line along which this polarization runs.[26] That green parties do not appear to benefit from climate shocks provides further evidence that, against hopeful expectations, climate shocks are not likely to activate climate concerns, but that they are viewed by citizens through the lens of government and institutional competence.

Our findings are only a first step into understanding the effects of climate change on political conflict in democracies. An interesting avenue to explore would be to assess the conditions under which climate shocks may affect green voting or the support of other mainstream parties in opposition. In addition, as we discussed in the text, post-shock compensation could condition some of the effects we present in this analysis. Finally, our data provides support that exogenous weather events affect party vote share, but it does not allow us to analyze individual vote decisions that underly the relationship. Future research could focus on exploring these causal mechanisms that relate shocks to the related discourse and individual voter decisions.

As climate shocks become more frequent and severe, and as public confidence in governing institutions continues to vary sharply across European regions, the dynamics we document are likely to intensify. Regions where trust has already eroded face a compounding risk: each disaster makes voters more receptive to populist appeals and less likely to support the kind of long-term, coordinated climate governance that green parties advocate. The lack of green policy initiatives, stifled in such political climates, are bound to further increase the likelihood of future disasters. In this way, climate change does not merely exacerbate existing political grievances; it may fundamentally reconfigure the dimensions along which democratic competition is organized, with

[26] That green parties do not consistently benefit from these developments even in high trust environments is a finding that is in line with other research, and worth exploring in future research.

the geography of political trust shaping whether environmental crisis becomes a catalyst for reform or a resource for anti-system mobilization.

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Supporting Information for

"The Geography of Trust: Climate Shocks and Electoral Competition in Europe"

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Appendix A. Data description

A-1. List of variables, descriptions, and sources

Variable	NUTS2-level measures	Source
Incumbent vote share	Percentage point change in incumbent parties' vote share between t-*1* and t*0*. Recoded based on the V-party codebook, where 0 and 1 indicate support and official representation in government; we recode to: 1=Party supports government as junior or senior partner in government, 0=Party does not support government.	(Lindberg et al. 2022; Schraff et al. 2023)
Green vote share	Percentage point change in green parties' vote share between t-*1* and t*0*.	(Lehmann et al. 2024; Schraff et al. 2023)
Populist vote share	Percentage point change in populist parties' vote share between t-*1* and t*0*.	(Rooduijn et al. 2024; Schraff et al. 2023)
Heatwave (L1)	Measure of the number of days per month with extreme heat, defined as at least three consecutive days with >99th percentile temperature, from the Copernicus Climate Change Service (C3S), Climate Data Store (CDS). The final measure is the number of extremely hot days in the month prior to an election.	(Copernicus Climate Change Service (C3S), Climate Data Store (CDS) 2024)
Drought (L1)	Based on the scPDSI, observed in 0.25*0.25 latitude*longitude squares on a grid, of which there are multiple in each NUTS2 region. In the main models, droughts are observed when the scPDSI measurement is below -4 (severe). The interim measure is a binary indication of at least one square within the NUTS2 region experiencing severe droughts in a given month, and the final measure the occurrence of such an extreme event in the month prior to an election (=1) and 0 otherwise.	(Barichivich et al. 2023)
Trust score	Factor derived from one-factor solution factor analysis with principal component extraction, based on three post-stratified NUTS2-year level measures of trust in national government, trust in the national legislature, and trust in political parties (see Appendix C for details about the post-stratification).	(Dellmuth and Jonsson 2025a)
GDP (base)	Pre-observation period baseline gross domestic product (GDP) in million Euro per capita (logged) in 1995.	(Auteri et al. 2024)
Age 20–39	Percentage of inhabitants in this age group	(Eurostat 2026)
Age 40 59	Percentage of inhabitants in this age group	

Age 60 79	Percentage of inhabitants in this age group	
Age 80 plus	Percentage of inhabitants in this age group	

A-2. Descriptive statistics

Variable	Min	Mean	Max	SD	N
Δ Incumbent Party Vote Share	-52.420	-0.995	64.720	17	857
Δ Populist Party Vote Share	-33.690	2.589	48.050	10.850	919
Δ Green Party Vote Share	-11.870	0.276	13.020	2.505	919
Heatwave	0	0.108	6.845	0.598	919
Drought	0	0.097	1	0.296	861
Trust score	-1.502	0.009	2.791	0.968	919
GDP (pre-observation period)	6.620	9.041	11.140	1.018	919
Age 20-39	18.600	27.270	40.700	3.405	919
Age 40-59	11.900	27.380	33.800	2.318	919
Age 60-79	4.400	18.430	27.900	3.385	919
Age 80 plus	0.600	4.609	9.700	1.553	919

A-3. Correlations between the independent variables

		1.	2.	3.	4.	5.	6.	7.	8.
1.	Heatwave	1							
2.	Drought	-0.009	1						
3.	Trust score	0.104	-0.119	1					
4.	GDP	0.026	-0.244	0.357	1				
5.	Age 20-39	-0.013	0.015	0.163	-0.374	1			
6.	Age 40-59	0.041	0.015	-0.237	0.192	-0.459	1		
7.	Age 60-79	0.056	0.075	-0.238	0.180	-0.719	0.383	1	
8.	Age 80 plus	0.031	0.039	-0.246	0.430	-0.780	0.435	0.762	1

A-4. Distribution of trust score variable across regions, countries, and over time

Note: Based on a factor analysis of three-year moving averages of trust in government, in national legislatures, and in political parties. Values below zero indicate below-average trust, whereas values above zero indicate above-average trust (see Table A1).

A-5. Distribution of trust score variable across regions, countries, and over time

Note: Based on the measures of % trusting in government, in national legislatures, and in political parties (see Table A1).

A-6. Distribution of climate variables

Note: Heatwave data from ERA5, defined as the sum of the occurrence of at least three consecutive days with >99th percentile temperature. Measured at the NUTS3 level and aggregated to NUTS2. Drought occurrence in at least one square in the NUTS 2 region. See Appendix Table A1.

Appendix B. Post-stratified trust measures

The political trust variables (trust in political parties, national parliament, and national government) are drawn from the SUB-TRUST database (Dellmuth and Jonsson 2025a), which provides estimates

of trust in the national government, in political parties, and in the national legislature at the subnational level. The estimates are generated using multilevel regression with post-stratification (MrP) based on globally estimated models and represent the average levels of trust in each institution within a region-year. The advantage of this data is that it draws trust data from a large number of surveys to provide subnationally representative estimates. We use data for the 23 European countries included in our study.[27] For the sake of transparency, we compile information about the survey series included from the SUB-TRUST documentation (Table B-1).

The trust estimates in SUB-TRUST are based on survey questions measuring confidence or trust in each political institution. Table B-1 provides the list of survey series sampling the 23 European countries included in our paper for the years 1996-2020 and which include measures of trust in the national government, national legislature, and political parties. Common question wordings include: "How much confidence/trust do you have in [institution]?" and "Do you tend to trust or not trust [institution]?"[28] Original response scales are harmonized by recoding as a binary indicator of positive trust to ensure comparability across survey items and enable more robust estimation in sparsely sampled region-years. Responses indicating trust (e.g., "just about always" or "most of the time," or high values on 0–10 trust scales) are coded as 1, while remaining substantive responses were coded as 0. "Don't know," refusals, and other non-responses are treated as missing and excluded.

B-1. List of survey series sampling the 23 European countries, years 1996-2020

Survey	Source	Example survey question	Example response scale recoding
Asia Europe Survey (2000-2001)	Inoguchi, Takashi. *Asia Europe Survey (ASES): A Multinational Comparative Study in 18 Countries, 2001* [Dataset]. Ann Arbor, MI: Inter-university Consortium for Political and Social Research [Distributor]. https://doi.org/10.3886/ICPSR22324.v1.	How much confidence do you have in [institution]?	A great deal (1), quite a lot (1), not much (0), none at all (0)
Balkan Barometer (2016-2017)	Regional Cooperation Council. *Balkan Barometer Public Opinion Survey, 2016; 2017* [Datasets]. https://www.rcc.int/balkanbarometer/results/2/public.	How much trust do you have in [institution]?	Totally trust (1), tend to trust (1), tend not to trust (0), totally distrust (0)
Eurasia Barometer (2016)	ICSR-Eurasia Barometer. *Eurasia Barometer, 2016* [Dataset]. https://office.eurasiaba	How much trust do you have in [institution]?	7. Greatest trust (1), 6. (1), 5. (1), 4. (0), 3. (0), 2. (0), 1. no trust (0)

[27] For Germany, only NUTS1-level data are available and the country was therefore excluded from our analysis.

[28] Refer to the respective source survey documentation files for exact survey question wording and response scales. For a complete overview of the surveys included in SUB-TRUST, see Dellmuth and Jonsson (2025b).

	rometer.org/projects/eurasia-barometer.		
Eurobarometer (1997-2020)	European Commission and European Parliament, Brussels. *Eurobarometer,* 48.0; 51.0; 54.1; 55.1; 57.1; 59.1; 61; 63.4; 65.2; 67.2; 69.2; 71.1; 71.3; 72.1; 73.4; 75.3; 74.1; 77.3; 79.3; 81.2; 83.1; 83.3; 85.2; 87.3; 89.1; 91.5; 93.1*, 1997-2020* [Datasets]. GESIS Data Archive, Cologne [Distributor]. https://www.gesis.org/en/eurobarometer-data-service#c122024	How much trust do you have in [institution]?	Tend to trust (1), tend not to trust (0)
European Quality of Life Survey (2003-2016)	European Foundation for the Improvement of Living and Working Conditions. (2018). *European Quality of Life Survey: Integrated Data File, 2003-2016, 3rd Release* [Dataset]. European Foundation for the Improvement of Living and Working Conditions, UK Data Service. SN: 7348. http://doi.org/10.5255/UKDA-SN-7348-3.	How much do you personally trust [institution]?	10. Trust completely (1), 9. (1), 8. (1), 7. (1), 6 (1), 5 (0), 4. (0), 3. (0), 2. (0), 1. Do not trust at all (0)
European Social Survey (2002-2020)	European Social Survey. *ESS Rounds 1-10: European Social Survey, 2002-2020* [Datasets]. Sikt – Norwegian Agency for Shared Services in Education and Research, Norway – Data Archive and distributor of ESS data for ESS ERIC. https://www.europeansocialsurvey.org.	On a scale of 0-10, how much do you personally trust [institution]?	10. Complete trust (1), 9. (1), 8. (1), 7. (1), 6 (1), 5 (0), 4. (0), 3. (0), 2. (0), 1. (0), 0. No trust at all (0)
European Values Study (1990-2021)	European Values Study (EVS). *European Values Study, Wave 2-5, 1990-2021* [Datasets]. GESIS Data Archive, Cologne. [Distributor]. https://www.gesis.org/en/european-values-study	How much confidence do you have in [institution]?	A great deal (1), quite a lot (1), not very much (0), none at all (0)
Flash Eurobarometer (2018)	European Commission, Brussels. *Flash Eurobarometer: Public Opinion in the EU Regions*, 472, 2018 [Dataset]. GESIS Data Archive, Cologne [Distributor]. https://www.gesis.org/en/eurobarometer-data-service/data-and-documentation/flash-eb.	How much trust do you have in [institution]?	Tend to trust (1), tend not to trust (0)

International Social Survey Programme (1990-2020)	ISSP Research Group. International Social Survey Programme: Religion I - ISSP 1991; Religion II - ISSP 1998; Citizenship - ISSP 2004; Religion Around the World Study of the 2008; Religion III - ISSP 2008; Environment III - ISSP 2010; Citizenship II – ISSP 2014; Religion IV - ISSP 201; Environment IV - ISSP 2020 [Datasets]. GESIS, Cologne [Distributor]. https://www.gesis.org/en/issp/data-and-documentation.	How much confidence do you have in [institution]?	Complete confidence (1), a great deal of confidence (1), some confidence (0), very little confidence (0), no confidence at all (0)
Latinobarometer (1996-2013)	Corporación Latinobarómetro. *Latinobarómetro, Rounds, 1996-2013* [Datasets]. https://www.latinobarometro.org/latContents.jsp.	How much confidence do you have in [institution]?	A lot (1), some (1), a little (0), no confidence (0)
Pew Global Attitudes Survey (2017; 2020)	Pew Research Center. *Pew Global Attitudes Survey, Spring 2017; Fall 2020* [Datasets]. https://www.pewresearch.org/datasets/.	How much do you trust [institution] to do what is right?	A lot (1), somewhat (1), not much (0), not at all (0)
Life in Transition Survey (2016)	European Bank for Reconstruction and Development (ERBD). *Life in Transition Survey III, 2016* [Datasets]. https://www.ebrd.com/what-we-do/economic-research-and-data/data/lits.html	To what extent do you trust [institution]?	Complete trust (1), some trust (1), neither trust nor distrust (0), some distrust (0), complete distrust (0)
World Values Survey (1990-2022)	Haerpfer, C., Inglehart, R., Moreno, A., Welzel, C., Kizilova, K., Diez-Medrano J., M. Lagos, P. Norris, E. Ponarin & B. Puranen (eds.) (2014). *World Values Survey, Wave 2-7 (1990-2022)* [Datasets]. Madrid, Spain & Vienna, Austria: JD Systems Institute & WVSA Secretariat. https://www.worldvaluessurvey.org/WVSContents.jsp.	How much confidence do you have in [institution]?	Always (1), most of the time (1), some of the time (0), never (0)

Note: SUB-TRUST includes estimates from MrP models, which regress dichotomised and harmonized binary indicators of having trust in a given institution (=1 and 0 otherwise). "Don't know," refusals, and other non-responses were treated as missing and excluded from estimation.

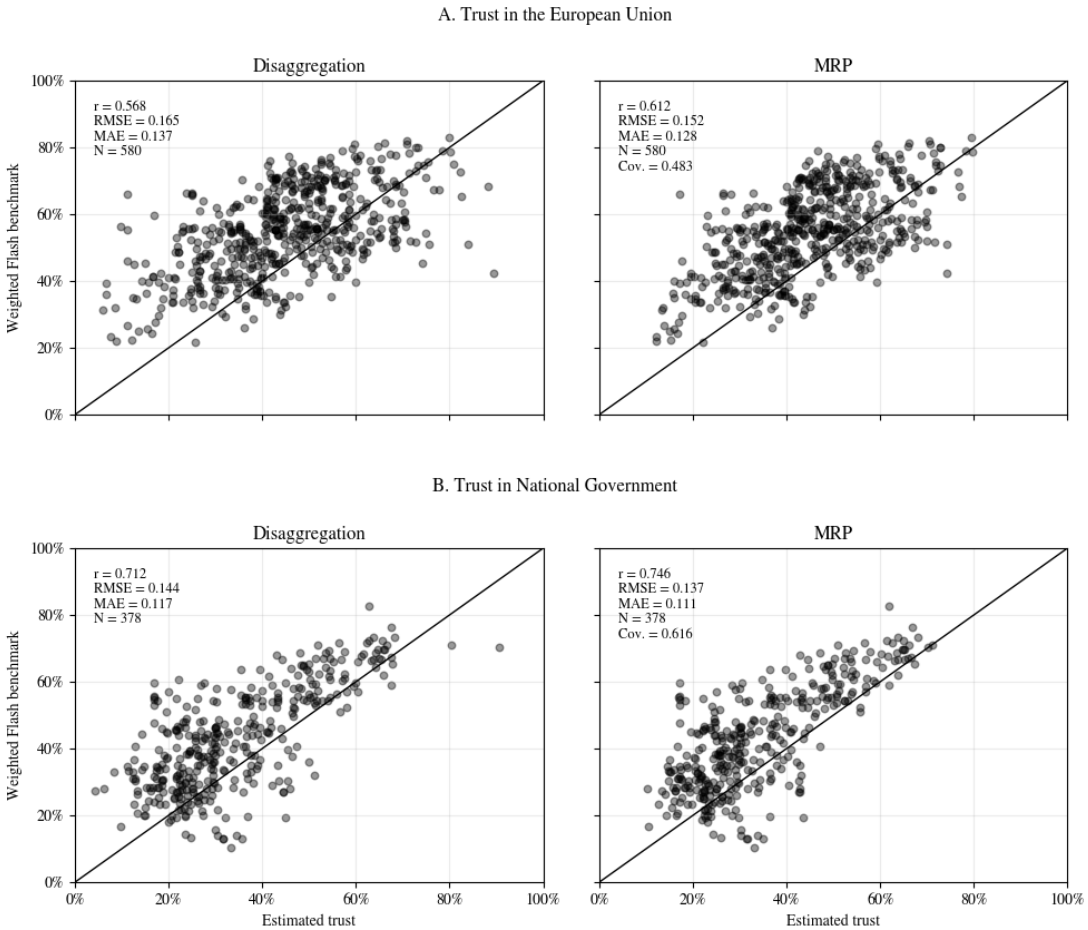
SUB-TRUST variables are calculated using MrP, a common method for small area opinion estimation, as direct estimates from simple aggregation from the individual to the subnational level are unreliable especially when the number of observations is small (Gelman and Little 1997; Leemann and Wasserfallen 2020, 2017; Warshaw and Rodden 2012). SUB-TRUST excludes regions with less than 20 observations and fits a multilevel model that regresses the outcome measure on a set of demographic characteristics and other covariates to generate small area predictions. Post-stratification is then applied by using weights based on census data containing the joint distributions of age and gender for each country subdivision obtained from national statistical offices, Eurostat, and IPUMS International (Dellmuth and Jonsson 2025a).

We validate the subnational trust estimates to underscore that the trust averages are appropriate for our analysis. To this end, we externally validate the MrP estimates against Flash Eurobarometer *Public Opinion in the EU Regions* survey data, which are designed to be representative at the subnational level.[29] The *Public Opinion in the EU Regions* surveys are conducted at the regional level across EU member states and include a measure of trust in the national government for 2018 and 2021. It also includes a measure of trust in the EU for 2012, 2015, 2018, and 2021. We therefore include both trust in the EU and trust in the national government in the validation exercises, allowing direct comparison with corresponding estimates from the SUB-TRUST dataset. The Flash Eurobarometer surveys ask respondents whether they "tend to trust" or "tend not to trust" a given institution.

We re-estimated the estimates for the validation indicators and years after excluding the corresponding Flash Eurobarometer observations from the estimation sample because the Flash Eurobarometer surveys contribute to the SUB-TRUST database. This ensures that the benchmark surveys provide an independent assessment of model performance. We then perform the validation (Figure B-2). The external validation indicates that MrP estimates consistently outperform disaggregation for both trust indicators (in national government and the EU), underlining confidence in the SUB-TRUST indicators. Figures B-3 and B-4 show that these improvements are concentrated in region-years with fewer than 100 respondents. As sample sizes increase, differences between MrP and disaggregation become negligible. This underlines that SUB-TRUST provides valid and robust subnational estimates of political trust useful for our analysis.

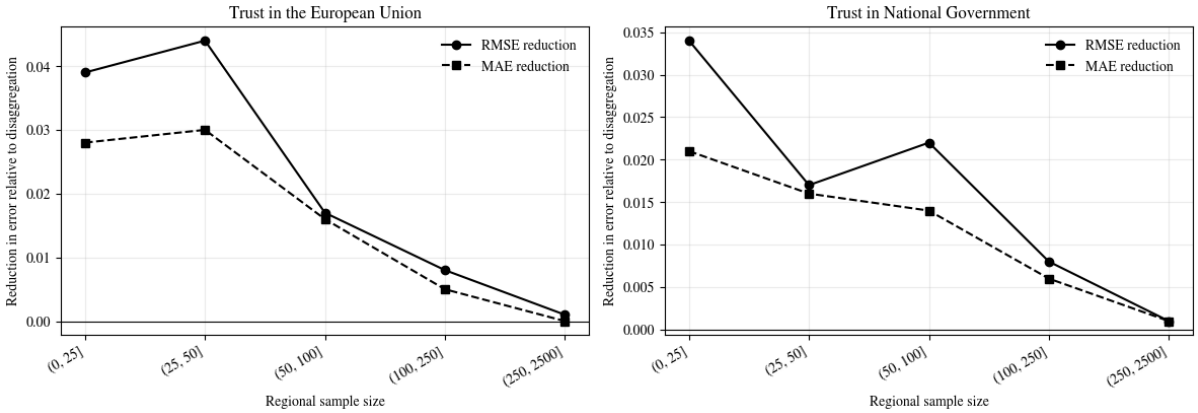
[29] Lipps and Schraff (2021) perform a similar exercise using Flash Eurobarometer *Public Opinion in the EU Regions* values as a benchmark to test the performance of MrP against other model specifications and techniques.

B-2. External validation of trust estimates against weighted Flash Eurobarometer benchmarks



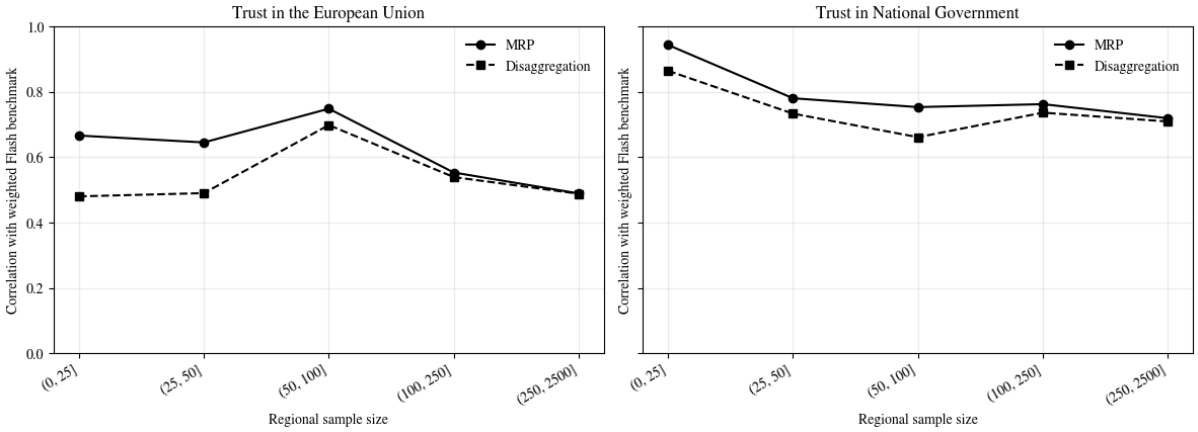
Note: Panels compare MRP and disaggregation estimates against weighted Flash Eurobarometer benchmarks for trust in the European Union and trust in national government. Each point is a subnational region-year. Diagonal line indicates perfect agreement with the weighted Flash Eurobarometer benchmark. r=Pearson correlation; RMSE=Root mean squared error; MAE=Mean absolute error; Cov.=interval coverage: the proportion of region-years for which the 95% MRP interval overlaps the approximate 95% Flash Eurobarometer interval.

B-3. MRP error reduction by regional sample size



Note: Positive values indicate lower error for MrP than for direct disaggregation.

B-4. MRP correlation improvement by regional sample size



Note: Higher values indicate greater correlation between estimated values and weighted Flash Eurobarometer benchmark values.

Appendix C. Numerical results of figures in main analysis

C-1. Regression of incumbent vote shares, with and without interaction terms

	(1)	(2)	(3)
Heatwave days (L1)	-2.346		0.233
	(1.316)		(1.202)
Trust score	4.420**	5.225***	5.281***
	(1.330)	(1.238)	(1.321)
Heatwave days (L1) × trust score	3.341**		
	(1.177)		
Base GDP	-1.662	-0.018	-0.254
	(1.658)	(1.863)	(1.761)
Age 20-39	-0.481	-0.946**	-0.932**
	(0.311)	(0.331)	(0.334)
Age 40-59	1.218***	1.433***	1.352***
	(0.300)	(0.356)	(0.366)
Age 60-79	-1.175**	-1.471***	-1.495***
	(0.397)	(0.389)	(0.401)
Age >80	1.016	0.705	0.576
	(0.627)	(0.653)	(0.667)
Drought (L1)		-0.454	-2.430
		(2.440)	(2.483)
Drought (L1) × trust score		9.329***	
		(2.595)	
Constant	10.856	9.927	14.810
	(10.006)	(12.806)	(12.819)
N	857	802	802
adj. R^2	0.397	0.394	0.381

Note: Dependent variable = Δ Vote share for incumbent parties. Ordinary least squares (OLS) estimations with high-dimensional fixed effects for countries and years. Robust standard errors, clustered at the level of NUTS2 regions, in parentheses. ~ p ≤ 0.05, ** p ≤ 0.01, *** p ≤ 0.001. The number of observations drops in Model 3 due to missing observations for drought for some regions.

C-2. Regression of populist vote shares, with and without interaction terms

	(1)	(2)	(3)
Heatwave days (L1)	1.879**		0.737
	(0.601)		(0.664)
Trust score	-2.180**	-2.055**	-2.312***
	(0.669)	(0.624)	(0.654)
Heatwave days (L1) × trust score	-1.398**		
	(0.441)		
Base GDP	-1.344	-1.003	-0.886
	(0.968)	(1.048)	(1.045)
Age 20-39	-0.244	-0.231	-0.275
	(0.227)	(0.253)	(0.254)
Age 40-59	0.122	0.093	0.149
	(0.141)	(0.163)	(0.173)
Age 60-79	-0.826***	-0.752**	-0.772**
	(0.236)	(0.240)	(0.241)
Age >80	1.660***	1.336**	1.374**
	(0.476)	(0.511)	(0.503)
Drought (L1)		2.875*	
		(1.223)	
Drought (L1) × trust score		-4.319**	
		(1.415)	
Heatwave days (L1)			4.173**
			(1.363)
Constant	25.529***	22.663**	21.452**
	(5.688)	(7.432)	(7.810)
N	919	861	861
adj. R^2	0.419	0.426	0.421

Note: Dependent variable = Δ Vote share for populist parties. Ordinary least squares (OLS) estimations with high-dimensional fixed effects for countries and years. Robust standard errors, clustered at the level of NUTS2 regions, in parentheses. ~ p ≤ 0.05, ** p ≤ 0.01, *** p ≤ 0.001. The number of observations drops in Model 3 due to missing observations for drought for some regions.

C-3. Regression of populist vote shares, with left and right populism

	(1)	(2)	(3)	(4)	(5)	(6)
	Far Left			Far Right		
Heatwave days (L1)	0.130		-0.418*	0.736		-0.369
	(0.362)		(0.196)	(0.766)		(0.816)
Trust score	0.405	0.230	-0.742*	-1.992***	-2.006***	-1.392*
	(0.323)	(0.317)	(0.359)	(0.563)	(0.531)	(0.679)
Heatwave days (L1) × trust score	-0.529*			-1.173***		
	(0.260)			(0.325)		
Base GDP	-0.018	0.037	0.353	-0.593	-0.296	0.267
	(0.271)	(0.251)	(0.650)	(0.423)	(0.501)	(1.019)
Drought (L1)		1.092	0.655		2.260*	2.753*
		(0.569)	(0.699)		(0.910)	(1.112)
Drought (L1) × trust score		1.113			-2.694**	
		(0.596)			(0.946)	
Age 20-39			0.384*			-0.206
			(0.159)			(0.266)
Age 40-59			-0.598***			0.011
			(0.112)			(0.148)
Age 60-79			0.726***			-0.249
			(0.194)			(0.191)
Age >80			-0.793			0.497
			(0.420)			(0.486)
Constant	0.091	-0.475	-7.061	7.517*	4.545	7.000
	(2.396)	(2.215)	(4.229)	(3.806)	(4.499)	(7.046)
N	974	914	861	974	914	861
adj. R^2	0.222	0.215	0.244	0.407	0.405	0.378

Note: Dependent variable = Δ Vote share for populist parties. Ordinary least squares (OLS) estimations with high-dimensional fixed effects for countries and years. Robust standard errors, clustered at the level of NUTS2 regions, in parentheses. ~ $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$. The number of observations drops in Model 3 due to missing observations for drought for some regions.

Appendix D. Robustness checks

D-1. Jackknife changes in interaction effects

Note: Each point shows the coefficient when one NUTS2 region is dropped. VS=vote shares. Jackknife is a leave-one-out strategy of the estimation of a parameter to assess bias (Nisbet et al. 2018). This re-estimates the relationship between the interaction terms tested in the main analysis (see Appendix C) and regime support excluding one region at a time. The models are generally not sensitive to dropping regions.

D-2. Marginal effect of climate shocks on vote with additional socio-economic controls

Note: Marginal effects with 95% confidence intervals. Panels are based on separate regression models reported in Appendix C. Dependent variable = Δ Vote share for incumbent parties (top graph) and populist parties (bottom graph). Ordinary least squares (OLS) estimations with high-dimensional fixed effects for countries and years, controlling for GDP per capita in the pre-observation period, four age groups (age 20-39, 40-59, 60-79 and over 80), Δ inflation, unemployment rates, and employment in agriculture. Robust standard errors, clustered at the level of NUTS2 regions. Full results available upon request.

D-3. Results from omitted variable bias simulation for party vote shares

Bound	R2dz.x	R2yz.dx	Coef.	S.E.	t(H0)	Lower CI	Upper CI
Heatwaves							
1.00x Δ EU funding	0.0066	0.0051	2.2335	0.9063	2.4645	0.4535	4.0134
2.00x Δ EU funding	0.0132	0.0101	2.1061	0.9070	2.3221	0.3248	3.8874
3.00x Δ EU funding	0.0198	0.0152	1.9779	0.9077	2.1790	0.1951	3.7606
Drought							
1.00x Δ EU funding	0.0001	0.0058	10.4812	2.6154	4.0074	5.3436	15.6188
2.00x Δ EU funding	0.0003	0.0117	10.4276	2.6079	3.9984	5.3048	15.5504
3.00x Δ EU funding	0.0004	0.0175	10.3740	2.6004	3.9894	5.2660	15.4820

Note: Estimations of the coefficient of the interaction term, based on the main model specifications in Appendix C-1 (Incumbent Party Vote Share) when including Δ EU funding as a hypothetical confounder, which are one to three times stronger than prior to transformations. Full results available upon request. Estimations based on the approach described by Cinelli and Hazlett (2020).

Bound	R2dz.x	R2yz.dx	Coef.	S.E.	t(H0)	Lower CI	Upper CI
Heatwaves							
1.00x Δ EU funding	0.0070	0.0011	-1.7087	0.6190	-2.7605	-2.9242	-0.4932
2.00x Δ EU funding	0.0140	0.0022	-1.6653	0.6208	-2.6824	-2.8845	-0.4462
3.00x Δ EU funding	0.0210	0.0033	-1.6216	0.6227	-2.6041	-2.8444	-0.3988
Drought							
1.00x Δ EU funding	0.0036	0.0012	-2.8206	1.6942	-1.6649	-6.1480	0.5068
2.00x Δ EU funding	0.0071	0.0025	-2.7332	1.6962	-1.6114	-6.0645	0.5981
3.00x Δ EU funding	0.0107	0.0037	-2.6454	1.6982	-1.5578	-5.9806	0.6897

Note: Estimations of the coefficient of the interaction term, based on the main model specifications in Appendix C-2 (Populist Party Vote Share) when including two hypothetical confounders, employment share in agriculture (%, lag 1 year) and EU funding (log, lag 1 year), which are one to three times stronger than prior to transformations. Full results available upon request. Estimations based on the approach described by Cinelli and Hazlett (2020).

D-4. Coefficients of three-way interaction terms

Dependent variable	Incumbent vote share	Populist vote share
Heatwave days, trust, and climate concern	-0.003* (0.001), *N*=587	0.001* (0.000), *N*=646
Drought severity, trust, and climate concern	-0.011** (0.004), *N*=562	0.003* (0.001), *N*=618
Heatwave days, trust, and tertiary education	0.042 (0.212), *N*=704	0.013 (0.103), *N*=764
Drought severity, trust, and tertiary education	-0.191 (0.287), *N*=665	0.135 (0.143), *N*=722
Heatwave days, trust, and greenhouse gas emissions from fossil fuel sectors	0.101 (0.066), *N*=695	-0.049* (0.021), *N*=757
Drought severity, trust, and greenhouse gas emissions from fossil fuel sectors	-0.226 (0.153), *N*=664	0.121 (0.118), *N*=723

Note: Marginal effects, with standard errors in parentheses. Panels are based on separate regression models reported in Appendix C, but including a three-way interaction term. Dependent variable = Δ Vote share for incumbent parties (Colum 1) and populist parties (Column 2). Ordinary least squares (OLS) estimations with high-dimensional fixed effects for countries and years, controlling for GDP per capita in the pre-observation period and four age groups (age 20-39, 40-59, 60-79 and over 80). Robust standard errors, clustered at the level of NUTS2 regions. Full results available upon request. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

D-5. Three-way interaction between climate concern, trust, and climate shocks on populist party vote share

Note: Low concern (P10), medium concern (P50), and high concern (P90). Marginal effects with 95% confidence intervals. Panels are based on separate regression models reported in Appendix Table C-3, but including a three-way interaction term with the respective climate shock variable. Dependent variable = Δ Vote share for populist parties. Ordinary least squares (OLS) estimations with high-dimensional fixed effects for countries and years, controlling for GDP per capita in the pre-observation period, and four age groups (age 20-39, 40-59, 60-79 and over 80). Robust standard errors, clustered at the level of NUTS2 regions. Full results available upon request.

D-6. Three-way interaction between climate concern, trust, and climate shocks on populist party vote share

Note: Low concern (P10), medium concern (P50), and high concern (P90). Marginal effects with 95% confidence intervals. Panels are based on separate regression models reported in Appendix Table C-3, but including a three-way interaction term with the respective climate shock variable. Dependent variable = Δ Vote share for populist parties. Ordinary least squares (OLS) estimations with high-dimensional fixed effects for countries and years, controlling for GDP per capita in the pre-observation period, and four age groups (age 20-39, 40-59, 60-79 and over 80). Robust standard errors, clustered at the level of NUTS2 regions. Full results available upon request.

D-7. Three-way interaction between industry emissions, trust, and heatwave days on populist vote share

Note: Marginal effects with 95% confidence intervals. Panels are based on separate regression models reported in Appendix Table C-3, but including a three-way interaction term. Dependent variable = Δ Vote share for populist parties. Ordinary least squares (OLS) estimations with high-dimensional fixed effects for countries and years, controlling for GDP per capita in the pre-

observation period, and four age groups (age 20-39, 40-59, 60-79 and over 80). Robust standard errors, clustered at the level of NUTS2 regions. Full results available upon request.

D-8. Marginal effect of climate shocks on vote shares, without Switzerland

Note: Marginal effects with 95% confidence intervals. Panels are based on separate regression models reported in Appendix C. Dependent variable = Δ Vote share for incumbent parties (top graph) and populist parties (bottom graph). Ordinary least squares (OLS) estimations with high-dimensional fixed effects for countries and years, controlling for GDP per capita in the pre-observation period and four age groups (age 20-39, 40-59, 60-79 and over 80). Robust standard errors, clustered at the level of NUTS2 regions. Full results available upon request.

D-9. Event study for heatwaves and party vote shares, with and without leads

Note: Marginal effects with 95% confidence intervals. Panels are based on separate regression models reported in Appendix C. Dependent variable = Δ Vote share for incumbent parties (top graphs) and populist parties (bottom graphs). Ordinary least squares (OLS) estimations with high-dimensional fixed effects for countries and years, controlling for GDP per capita in the pre-observation period, and four age groups (age 20-39, 40-59, 60-79 and over 80). Robust standard errors, clustered at the level of NUTS2 regions. Full results available upon request.

D-10. Marginal effect of EM-DAT disasters on party vote shares

Note: Marginal effects with 95% confidence intervals. Panels are based on separate regression models reported in Appendix C. Dependent variable = Δ Vote share for incumbent parties (left graph) and populist parties (right graph). Ordinary least squares (OLS) estimations with high-dimensional fixed effects for countries and years, controlling for GDP per capita in the pre-observation period and four age groups (age 20-39, 40-59, 60-79 and over 80). Robust standard errors, clustered at the level of NUTS2 regions. Full results available upon request.

D-11. Marginal effect of climate shocks on populist vote shares, with dummy controlling for whether populist parties are part of the government

Note: Marginal effects with 95% confidence intervals. Panels are based on separate regression models reported in Appendix C. Dependent variable = Δ Vote share for populist parties. Ordinary least squares (OLS) estimations with high-dimensional fixed effects for countries and years, controlling for GDP per capita in the pre-observation period and four age groups (age 20-39, 40-59, 60-79 and over 80). Robust standard errors, clustered at the level of NUTS2 regions. Full results available upon request.

D-12. Marginal effect of climate shocks on party vote shares, excluding the 1990s

Note: Marginal effects with 95% confidence intervals. Panels are based on separate regression models reported in Appendix C. Dependent variable = Δ Vote share for incumbent parties (top graph) and populist parties (bottom graph). Ordinary least squares (OLS) estimations with high-dimensional fixed effects for countries and years, controlling for GDP per capita in the pre-observation period and four age groups (age 20-39, 40-59, 60-79 and over 80). Robust standard errors, clustered at the level of NUTS2 regions. Full results available upon request.

D-13. Marginal effect of climate shocks on party vote shares, controlling for baseline vote shares

Note: Marginal effects with 95% confidence intervals. Panels are based on separate regression models reported in Appendix C. Dependent variable = Δ Vote share for incumbent parties (top graph) and populist parties (bottom graph). Ordinary least squares (OLS) estimations with high-dimensional fixed effects for countries and years, controlling for GDP per capita in the pre-observation period and four age groups (age 20-39, 40-59, 60-79 and over 80). Robust standard errors, clustered at the level of NUTS2 regions. The top panel controls for incumbent vote shares and the bottom panel for populist vote shares. Full results available upon request.

Appendix E. Green Party Results

E-1. Regression of green parties' vote shares, with and without interaction terms

t	(1)	(2)	(3)
Heatwave days (L1)	0.151		0.155
	(0.120)		(0.138)
Trust score	-0.789***	-0.640***	-0.669***
	(0.157)	(0.143)	(0.148)
Heatwave days (L1) × trust score	0.028		
	(0.107)		
Base GDP	0.244	0.098	0.118
	(0.190)	(0.161)	(0.165)
Age 20-39	0.138***	0.111**	0.106**
	(0.039)	(0.036)	(0.037)
Age 40-59	-0.109**	-0.103**	-0.105**
	(0.033)	(0.039)	(0.039)
Age 60-79	0.157***	0.132**	0.129**
	(0.045)	(0.046)	(0.046)
Age >80	-0.027	-0.035	-0.032
	(0.080)	(0.078)	(0.077)
Drought (L1)		-0.238	-0.231
		(0.231)	(0.200)
Drought (L1) × trust score		-0.093	
		(0.221)	
Constant	-5.469**	-3.103*	-3.085*
	(1.676)	(1.420)	(1.437)
N	919	861	861
adj. R^2	0.521	0.495	0.496

Note: Dependent variable = Δ Vote share for green parties. Ordinary least squares (OLS) estimations with high-dimensional fixed effects for countries and years. Robust standard errors, clustered at the level of NUTS2 regions, in parentheses. ~ p ≤ 0.05, ** p ≤ 0.01, *** p ≤ 0.001.

E-2. Jackknife changes in interaction effects (green parties)

Note: Each point shows the coefficient when one NUTS2 region is dropped. VS=vote shares. Jackknife is a leave-one-out strategy of the estimation of a parameter to assess bias (Nisbet et al. 2018). This re-estimates the relationship between the interaction terms tested in the main analysis (see Appendix C) and regime support excluding one region at a time.

E-3. Marginal effect of climate shocks on green vote shares, depending on political trust, with additional socio-economic controls

Note: Marginal effects with 95% confidence intervals. Panels are based on separate regression models reported in Appendix E-1. Dependent variable = Δ Vote share for green parties. Ordinary least squares (OLS) estimations with high-dimensional fixed effects for countries and years, controlling for GDP per capita in the pre-observation period, four age groups (age 20-39, 40-59, 60-79 and over 80), Δ inflation, unemployment rates, and employment in agriculture. Robust standard errors, clustered at the level of NUTS2 regions. Full results available upon request.

E-4. Results from omitted variable bias simulation for green vote shares

Bound	R2dz.x	R2yz.dx	Coef.	S.E.	t(H0)	Lower CI	Upper CI
Heatwaves							
1.00x Δ EU funding	0.0070	0.0011	-1.7087	0.6190	-2.7605	-2.9242	-0.4932
2.00x Δ EU funding	0.0140	0.0022	-1.6653	0.6208	-2.6824	-2.8845	-0.4462
3.00x Δ EU funding	0.0210	0.0033	-1.6216	0.6227	-2.6041	-2.8444	-0.3988
Drought							
1.00x Δ EU funding	0.0036	0.0012	-2.8206	1.6942	-1.6649	-6.1480	0.5068
2.00x Δ EU funding	0.0071	0.0025	-2.7332	1.6962	-1.6114	-6.0645	0.5981
3.00x Δ EU funding	0.0107	0.0037	-2.6454	1.6982	-1.5578	-5.9806	0.6897

Bound	R2dz.x	R2yz.dx	Coef.	S.E.	t(H0)	Lower CI	Upper CI
Heatwaves							
1.00x Δ EU funding	0.0070	0.0011	0.0665	0.1074	0.6190	-0.1444	0.2774
2.00x Δ EU funding	0.0140	0.0023	0.0588	0.1077	0.5458	-0.1528	0.2704
3.00x Δ EU funding	0.0210	0.0034	0.0511	0.1081	0.4726	-0.1611	0.2633
Drought							
1.00x Δ EU funding	0.0036	0.0020	-0.0172	0.2730	-0.0632	-0.5534	0.5189
2.00x Δ EU funding	0.0071	0.0039	-0.0349	0.2732	-0.1276	-0.5714	0.5017
3.00x Δ EU funding	0.0107	0.0059	-0.0525	0.2734	-0.1922	-0.5895	0.4844

Note: Estimations of the coefficient of the interaction term, based on the main model specifications in Appendix E-1 when including two hypothetical confounders, employment share in agriculture (%, lag 1 year) and EU funding (log, lag 1 year), which are one to three times stronger than prior to transformations. Estimations based on the approach described by Cinelli and Hazlett (2020).

E-5. Coefficients of three-way interaction terms

Dependent variable	**Green vote share**
Heatwave days, trust, and climate concern	0.000*** (0.000), *N*=646
Drought severity, trust, and climate concern	0.000 (0.000), *N*=618
Heatwave days, trust, and tertiary employment	0.007 (0.020), *N*=764
Drought severity, trust, and tertiary employment	0.027 (0.017), *N*=722
Heatwave days, trust, and greenhouse gas emissions from fossil fuel sectors	-0.000 (0.005), *N*=757
Drought severity, trust, and greenhouse gas emissions from fossil fuel sectors	0.019 (0.026), *N*=723

Note: Marginal effects, with standard errors in parentheses. Panels are based on separate regression models reported in Appendix E-1, but including a three-way interaction term. Dependent variable = Vote share for green parties. Drought enters these models as a binary indicator; the reported coefficient is for the interaction with drought = 1. Ordinary least squares (OLS) estimations with high-dimensional fixed effects for countries and years, controlling for GDP per capita in the pre-observation period and four age groups (age 20-39, 40-59, 60-79 and over 80). Robust standard errors, clustered at the level of NUTS2 regions. Full results available upon request. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001\Delta$

E-6. Three-way interaction between climate concern, trust, and climate shocks on green party vote share

Note: Low concern (P10), medium concern (P50), and high concern (P90). Marginal effects with 95% confidence intervals. Panels are based on separate regression models reported in Appendix E-1, but including a three-way interaction term with the respective climate shock variable. Dependent

variable = Δ Vote share for green parties. Ordinary least squares (OLS) estimations with high-dimensional fixed effects for countries and years, controlling for GDP per capita in the pre-observation period, and four age groups (age 20-39, 40-59, 60-79 and over 80). Robust standard errors, clustered at the level of NUTS2 regions. Full results available upon request.

E-7. Three-way interaction between industry emissions, trust, and heatwave days on green party vote share

Note: Marginal effects with 95% confidence intervals. Panels are based on separate regression models reported in Appendix Table E-1, but including a three-way interaction term. Dependent variable = Δ Vote share for populist parties. Ordinary least squares (OLS) estimations with high-dimensional fixed effects for countries and years, controlling for GDP per capita in the pre-observation period, and four age groups (age 20-39, 40-59, 60-79 and over 80). Robust standard errors, clustered at the level of NUTS2 regions. Full results available upon request.

E-8. Marginal effect of climate shocks on green party vote shares, without Switzerland

Note: Marginal effects with 95% confidence intervals. Panels are based on separate regression models reported in Appendix E-1. Dependent variable = Δ Vote share for green parties. Ordinary least squares (OLS) estimations with high-dimensional fixed effects for countries and years, controlling for GDP per capita in the pre-observation period and four age groups (age 20-39, 40-59, 60-79 and over 80). Robust standard errors, clustered at the level of NUTS2 regions. Full results available upon request.

E-9. Event study for heatwaves and green party vote shares

Note: Marginal effects with 95% confidence intervals. Panels are based on separate regression models reported in Appendix E-1. Dependent variable = Δ Vote share for green parties. Ordinary least squares (OLS) estimations with high-dimensional fixed effects for countries and years, controlling for GDP per capita in the pre-observation period, four age groups (age 20-39, 40-59, 60-79 and over 80), Δ inflation, unemployment rates, and employment in agriculture. Robust standard errors, clustered at the level of NUTS2 regions. Full results available upon request.

E-10. Marginal effect of EM-DAT disasters on green vote shares

Note: Marginal effects with 95% confidence intervals. Panels are based on separate regression models reported in Appendix E-1. Dependent variable = Δ Vote share for green parties. Ordinary least squares (OLS) estimations with high-dimensional fixed effects for countries and years, controlling for GDP per capita in the pre-observation period and four age groups (age 20-39, 40-59, 60-79 and over 80). Robust standard errors, clustered at the level of NUTS2 regions. Full results available upon request.

E-11. Marginal effect of climate shocks on green party vote shares, with dummy controlling for whether green parties are part of the government

Note: Marginal effects with 95% confidence intervals. Panels are based on separate regression models reported in Appendix E-1. Dependent variable = Δ Vote share for green parties. Ordinary least squares (OLS) estimations with high-dimensional fixed effects for countries and years, controlling for GDP per capita in the pre-observation period and four age groups (age 20-39, 40-59, 60-79 and over 80). Robust standard errors, clustered at the level of NUTS2 regions. Full results available upon request.

E-12. Marginal effect of climate shocks on green party vote shares, excluding the 1990s

Note: Marginal effects with 95% confidence intervals. Panels are based on separate regression models reported in Appendix Table E-1. Dependent variable = Δ Vote share for green parties. Ordinary least squares (OLS) estimations with high-dimensional fixed effects for countries and years, controlling for GDP per capita in the pre-observation period and four age groups (age 20-39, 40-59, 60-79 and over 80). Robust standard errors, clustered at the level of NUTS2 regions. Full results available upon request.

E-13. Marginal effect of climate shocks on green party vote shares, including baseline vote shares

Note: Marginal effects with 95% confidence intervals. Panels are based on separate regression models reported in Appendix Table E-1. Dependent variable = Δ Vote share for green parties. Ordinary least squares (OLS) estimations with high-dimensional fixed effects for countries and years, controlling for GDP per capita in the pre-observation period and four age groups (age 20-39, 40-59, 60-79 and over 80). Robust standard errors, clustered at the level of NUTS2 regions. Full results available upon request.

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