Available online at www.sciencedirect.com

ScienceDirect

Current Opinion in Environmental Sustainability

The effects of weather experiences on climate change attitudes and behaviors

Matthew Ryan Sisco[a,b]

Understanding how experiences with weather affect attitudes and behaviors related to climate change supports our efforts to mitigate and adapt to climate change. A variety of studies have reported evidence of notable effects of weather experiences on climate attitudes, while other studies have found null effects. This review overviews recent research that has contributed further evidence regarding the effects of weather experiences on climate attitudes and behaviors. Studies on three accounts of mechanisms by which these effects may occur (affect activation, issue salience, and psychological distance) and three categories of potential moderators (media attention, motivated reasoning, and event attribution) are discussed. Lastly, recent work on how weather experiences may create climate policy windows is reviewed and general conclusions are presented.

Addresses
[a] Columbia University, 1190 Amsterdam Avenue, MC5501, New York, 10027 NY, United States

[b] Princeton University, Center for Policy Research in Energy and the Environment, Robertson Hall, Princeton, 08540 NJ, United States

Corresponding author: Sisco, Matthew Ryan (ms1548@princeton.edu)

Current Opinion in Environmental Sustainability 2021, **52**:111–117

This review comes from a themed issue on **Climate decision-making**

Edited by **Diana Reckien**, **Rachael Shwom** and **Catherine Vaughan**

For a complete overview see the Issue and the Editorial

Available online 21st October 2021

Received: 06 October 2020; Accepted: 23 September 2021

https://doi.org/10.1016/j.cosust.2021.09.001

Introduction

We need widespread changes in human behavior to avoid severe consequences of climate change [1]. Humanity as a whole has struggled to take sufficient action against climate change for a variety of reasons, including psychological obstacles [2]. Scholars have identified experiences with extreme weather events as having the potential to motivate climate change mitigation and adaptation behaviors [3–6]. This short review discusses research on the effects of weather experiences (WE) on climate attitudes and behaviors.

More than 100 studies to date have examined the effects of weather experiences (WE) on climate change attitudes and behaviors (here 'attitudes' refers broadly to climate change attention, attitudes, concerns, and beliefs). Some studies have reported evidence of notable effects of WE on climate attitudes and behaviors (e.g. Refs. [7–10]), while other studies have found null effects (e.g. Refs. [11–15]). The mixed results in the literature are difficult to reconcile due to a wide variety of methodological approaches, various idiosyncratic types of WE studied (e.g., hurricanes, heat waves, etc.), and different human populations studied [3]. Some recent research has contributed further evidence on the effects of WE on climate attitudes and behaviors. Other new research has investigated the questions of *how* and *under what conditions* WE can have effects. A main contribution of this review is its focus on these questions, that is, potential mechanisms and moderators. The mechanisms and moderators discussed here are those that this review found to have been investigated to date, but are not an exhaustive list of those that are possible.

In this review, recent research that generally examines the effects of WE on climate attitudes and behaviors is discussed in the section 'The effects of weather experiences', with subsections that discuss the topic in progressively greater depth and breadth. Three potential mechanisms by which these effects may occur (affect activation, increasing issue salience, and decreasing psychological distance) and research germane to them are overviewed in the section 'Mechanisms of the effects of weather experiences'. Three categories of potential moderators (media attention, motivated reasoning, and event attribution) of WE' effects on climate attitudes are reviewed in the section 'Moderators of the effects of weather experiences'. Lasly, in the section 'Windows for climate policy action generated by weather events', recent work on the potential for WE to open policy windows to advance climate mitigation and adaptation policies is considered, and concluding remarks are offered in the final section. This review focuses primarily on studies published in the past two years and aims to provide a concise view of current research on the effects of WE on climate attitudes, rather than a comprehensive overview.[1]

[1] For details on the systematic search for papers and inclusion criteria used, see Appendix A.

The effects of weather experiences

Detecting abnormal weather

Past research has shown that people can accurately detect some abnormal weather events, but often can be aided by information that conveys objective accounts of weather abnormalities [16–20]. Shedding more light on this question, Wang and Lin [21] report that Chinese participants correctly perceived a strong typhoon event as abnormal, but only marginally detected abnormally hot summer temperatures as unusual. Marlon *et al.* [12] find that Floridians were able to detect changes in precipitation, but were unable to detect five-year increases in temperatures. They suggest that individuals might not reliably detect long-term changes in climate patterns, thus expert interpretations may be helpful to the public.

Effects of temperature abnormalities

Weather experiences come in a variety of forms, and much research has focused on if experiences with temperature abnormalities affect climate attitudes. Effects of changes in temperatures, which are usually quantified as temperature abnormalities (differences from historical averages) rather than untransformed temperature measurements, have been documented in several studies (e.g., Refs. [8,9,22,23]). Looking at this phenomenon with a wide geographic scope and time range, Bergquist and Warshaw [24••] conducted an analysis aggregating 170 U.S. polls fielded from 1999 to 2017. They report that climate concern modestly responds to annual changes in state-level temperatures. Similarly, but with a focus on twelve European countries, Damsbo-Svendsen [25•] found that temperature abnormalities of two standard deviations can strengthen climate opinions by 0.5–1% in European populations. Larcom *et al.* [26] looked at the association between experiencing extreme temperatures and self-reported pro-environmental behaviors in U.K. citizens following a heatwave and found a positive but not statistically significant relationship.

Effects of weather events beyond temperature abnormalities

Evidence that weather experiences beyond temperature abnormalities affect climate attitudes has also been reported [27–30]. Several recent papers have examined the effects of flood experiences in additional depth. Albright and Crow [31] analyzed survey data from six Colorado communities that were previously flooded, and find that the perceived extent of neighborhood and community damage was positively associated with belief in climate change. They find little evidence that the extent of personal flood damage experienced affected climate attitudes. The effects of wildfires have also been studied in recent work [32,33••]. Lacroix *et al.* [32] report that exposure to forest fires is correlated with higher climate risk perceptions, especially for individuals with stronger perceptions of scientific agreement on climate change. Shao and Hao [34] examined associations between experienced climate extremes (i.e., heat, precipitation, and drought events which were extreme but not necessarily abnormal for each area and time of year) and self-reported concern about climate change using a nationally representative dataset from 2016 and found no evidence of a significant association. Cutler *et al.* [35] similarly did not find evidence of an association between climate extremes and belief in climate change in a separate U.S. nationally representative survey dataset.

Behavioral effects of weather experiences

The majority of research to date has focused more on what affects attitudes than on what affects behaviors. Ultimately, changes in behavior are needed to mitigate and adapt to climate change [36]. To study this, analyzing direct measurements of behavior is useful as self-reports of behaviors can be inaccurate [37]. In a meta-analysis of factors motivating adaptation behaviors, van Valkengoed and Steg [38] find experience with a variety of natural hazards to have a small positive association with behaviors on average, with substantial heterogeneity across studies.

A few papers to date have directly measured behavioral outcomes of WE. For example, Osberghaus and Demski [39] analyzed the effects of flood experiences on internet searches about green electricity in Germany. They find a positive effect of flood experiences for moderately affected regions, but report that the effect drops to zero when damage is very high. Osberghaus and Demski suggest this inverted-U pattern may be due to budget constraints resulting from greater damage or from psychological mechanisms such as denial or fatalism. Choi *et al.* [40] examined some aggregate behavioral measures in the form of Google searches about climate change and purchases of carbon-intensive companies' stocks. They find that both of these measures of aggregate behaviors are positively associated with abnormally high temperatures.

Hazlett and Mildenberger [33••] examined the effects of experiences with wildfires on votes for climate-related policy measures. They find that proximity to wildfires increased support by five to six percent for those living in Democratic-voting areas in the direct vicinity of wildfires, while the effect diminished to near zero beyond a distance of 15 km. These notably large effects on political outcomes may indicate there is substantial potential that is ordinarily unrealized for leveraging abnormal weather events to affect behavior. Most past studies look at effects that occur naturally, that is, resulting from matter-of-course media coverage and individual attention to WE. However, during an election cycle there can be large communication efforts discussing recent WE to draw public attention to climate change. Such strategical leveraging of WE may result in substantially larger impacts on climate attitudes and behaviors than would ordinarily manifest.

Mechanisms of the effects of weather experiences

The findings discussed so far that WE can positively affect climate attitudes and behaviors lead to the questions of what the underlying mechanisms and moderators of these effects are. In this section, literature organized by three potential mechanisms is reviewed. In the section 'Moderators of the effects of weather experiences', three potential moderators that past research has investigated are discussed.

Affect activation

It has been posited that experiencing affect associated with climate change (in other words, affect activation) is an important prerequisite to climate risk perceptions and climate behaviors [5]. Past research has brought forth some confirming evidence of this [41,42]. Experiences with extreme weather can elicit emotional responses [43]; therefore affect activation may be an important mechanism of the effect of WE.

Shedding light on the role of affect, Bergquist *et al.* [44] conducted surveys with Florida residents before and after Hurricane Irma in 2017. They asked participants how strongly they felt different negative emotions when they thought about climate change and found that participants reported stronger negative emotions toward climate change after the hurricane, in addition to willingness to pay higher taxes for the sake of the environment. They conducted an exploratory mediation analysis and report that higher negative emotions were associated with increased willingness to pay for some participants.

Demski *et al.* [43] conducted a similar mediation analysis using survey data from U.K. residents concerning a major flood event. They find that negative emotions mediated the effects of flood experiences on increased behavioral intentions to adapt to and mitigate climate risks. Interestingly, emotions did not similarly mediate the significant effect of flood experiences on increased policy support. This indicates that support for climate change policies may be less affect-driven.

In a conceptually related project, Ogunbode *et al.* [45] analyzed survey data collected after severe flooding in the U.K. They find that citizens' coping abilities moderate the relationship between flooding experiences and negative emotions and thereby attenuate the link between flooding experiences and climate change mitigation intentions. Ogunbode *et al.* use the term the 'resilience paradox' to describe the finding that psychological resilience to experiencing extreme weather events can translate to curtailed motivation to take action on climate change.

This shows that the role of emotions is more complex than serving as simple pathways to desired outcomes, thus more research is needed to provide a full view of the role of affect activation [46].

Issue salience

Another way that WE may affect climate attitudes and behaviors is by increasing the salience of the issue to the public [47]. Issue salience is the extent to which climate change is particularly noticeable or top of mind to the public. Boudet *et al.* [48•] recently conducted a comparative-case analysis of 15 communities that underwent extreme weather events. They show these events prompted community discussions about the events' links to climate change in 9 out of 15 communities. Demski *et al.* [43] also find evidence that weather experiences can have effects on climate attitudes through increasing the salience of the issue of climate change.

Psychological distance

The psychological distance of climate change is sometimes cited as a reason for the lack of concern and action on climate change in the public [49]. Psychological distance is a construct composed of spatial distance, temporal distance, social distance, and certainty that an event will occur [50]. Directly experiencing impacts of weather events may lessen the sense of distance to climate impacts, making the issue of climate change feel closer to home. Ogunbode *et al.* [51] find that citizens who were directly affected by a flood showed higher climate change concern compared to those who experienced local flooding but were not directly affected (e.g., damage to personal property). In a study of 10 U.S. communities that experienced extreme weather events, Zanocco *et al.* [52] report that personal harm moderated the relationship between ideology and climate attitudes, indicating that conservatives who feel personally harmed are more likely to support climate policies. Reckien and Petkova [53] similarly find in a sample of New York City residents that being previously harmed by extreme weather events strongly predicted participants' sense of climate adaptation responsibility. In contrast, Lujala and Lein [54] report that Norwegian participants who underwent a natural hazard event were less concerned about climate change compared with those without such experiences.

Moderators of the effects of weather experiences

Media attention

As described above, people appear able to detect some abnormalities in weather they experience, but not all. Media coverage of weather events may be necessary in some cases for WE to affect climate attitudes and behaviors [55,56]. Consistent with this, Carmichael *et al.* [11] report significant positive associations between public perceptions of climate change and quarterly news media coverage of it. Examining the tendency for media to respond to weather abnormalities, Pianta and Sisco [57] analyzed news coverage of climate change in the

countries of the European Union from 2014–2019. They show that temperature abnormalities significantly predict increased media coverage of the issue. Since media attention to climate change can substantially influence climate attitudes [58], the varied responsiveness of the media to different weather events could be a reason for the mixed results found in the literature on the size of WE' effects on climate attitudes and behaviors. Some research has begun examining how and when journalists decide to draw connections between climate change and extreme weather events [59,60].

Motivated reasoning

Several studies have shown that prior climate attitudes and partisanship are associated with the recall of past WE and the effects of WE on climate attitudes [16,32,61–63]. This phenomenon is often described as motivated reasoning, where past beliefs and motivations to confirm them lead to biased processing of information to uphold those beliefs [64,65]. In the case of climate change, past beliefs can be strongly associated with partisanship, with liberal ideological views positively correlating with belief in climate change [66]. Along these lines, Lyons *et al.* [13] find that self-reported experiences with droughts and polar vortex events are positively associated with Democratic political orientation. Howe [67] shows similar evidence that prior beliefs about climate change have large positive effects on perceptions of seasonal temperatures in a national sample of Norwegian citizens.

Attribution of events

Another potential precondition for WE to affect climate attitudes is individuals attributing the cause of the events to climate change. Citizens heterogeneously attribute extreme weather events to being caused by climate change for several reasons [68]. Ogunbode *et al.* [69] find that personal experience with flooding only predicted perceived threat from climate change and climate mitigation responses for individuals who subjectively attributed the flooding to climate change. Hoogendorn *et al.* [70] show that attribution of climate change to human causes is associated with perceived consequences of hurricanes experienced by people.

Windows for climate policy action generated by weather events

Research on the effects of WE on climate attitudes, and the mechanisms and moderators related to them, generates knowledge that can be used to strategically encourage climate behaviors. An important way that this may manifest is by leveraging occurrences of WE as windows for policy action. Providing some guidance on this, Giordono *et al.* [71•] studied the cases of 15 communities who experienced extreme weather events to see under which conditions climate policy adoption occurs after events. They suggest that a necessary condition for policy adoption to occur is a high level of impact from the weather event experienced. The findings of Hazlett and Mildenberger [33••] that wildfire exposure can increase votes for climate policies, discussed above, also illuminate promising potential for WE to galvanize public support for climate policies.

Conclusion

Much research on the effects of WE on climate attitudes and behaviors has been undertaken to date. Past papers have employed a wide variety of operational definitions of weather experiences, dependent variables, study populations, and research designs which has likely led at least in part to the overall mixed results observed [3,4,72]. Recent research focused on in this review has continued shedding light on the potential for WE to impact climate attitudes and behaviors, plausible mechanisms by which this can operate, and possible moderators that determine if effects of WE on climate attitudes manifest.

In sum, a variety of WE appear to have potential for affecting climate attitudes and behaviors. A main contribution of this review is its organization of recent literature into potential mechanisms and moderators of relationship between WE and climate attitudes and behaviors. Three plausible mechanisms include affect activation, issue salience, and psychological distance. Some variables seem to moderate the effects of WE on climate attitudes including media attention to weather events, pre-existing climate attitudes, and attribution of events to climate change.

Several future directions may add novel perspectives on the effects of WE. It could be beneficial for future work to involve more qualitative methodologies, as has also been called for in past reviews [3,4]. Some research on how WE affect climate attitudes has been conducted with non-Western populations, but it still represents a minority of the literature. More work could be done with culturally diverse samples to show which findings are generalizable across cultures and how WE can affect climate attitudes and behaviors across the global population [3]. To date, research has primarily examined the naturally occurring effects of WE on climate attitudes and behaviors. It may be fruitful for future research efforts to systematically evaluate the potential for strategically leveraging WE to motivate climate action in the public.

Conflict of interest statement

Nothing declared.

Acknowledgement

This research was funded by the cooperative agreement NSFSES-1463122 awarded to the Center for Research on Environmental Decisions.

Declaration of Competing Interest

The authors report no declarations of interest.

Appendix A. Article Search Method

Articles to be included in this review were found primarily through searching the Google Scholar database. I created and used the following Boolean search:

('climate change' OR 'global warming') AND ('attitude' OR 'behavior' OR 'belief' OR 'concern' OR 'worry') AND ('weather' OR 'temperature' OR 'hurricane' OR 'flood' OR 'hail' OR 'storm' OR 'heat' OR 'wildfire' OR 'tornado' OR 'wind' OR 'cold' OR 'drought').

All papers in the first 25 pages of search results (ordered by relevance) were considered to be included in this review. Papers were also found by examining the references of relevant papers found in the search. To be centrally included in this review, papers needed to meet the following inclusion criteria:

a) Be published in a peer-reviewed academic journal (I did not include conference publications or opinion pieces).
b) Examine the effects of experiences with extreme or abnormal weather on measured climate change attitudes, beliefs, or mitigation/adaptation behaviors generally construed.
c) Be published after September 1st, 2018 and before September 1st, 2020 (the end date of the search for papers to include).

References and recommended reading

Papers of particular interest, published within the period of review, have been highlighted as:

- • of special interest
- •• of outstanding interest

1. Rosenzweig C *et al.*: **Attributing physical and biological impacts to anthropogenic climate change**. *Nature* 2008, **453**:353-357 http://dx.doi.org/10.1038/nature06937.
2. Weber EU: **What shapes perceptions of climate change? New research since 2010**. *Wiley Interdiscip Rev Clim Change* 2016, **7**:125-134 http://dx.doi.org/10.1002/wcc.377.
3. Howe PD, Marlon JR, Mildenberger M, Shield BS: **How will climate change shape climate opinion?** *Environ Res Lett* 2019, **14** http://dx.doi.org/10.1088/1748-9326/ab466a.
4. Reser JP, Bradley GL: **The nature, significance, and influence of perceived personal experience of climate change**. *Wiley Interdiscip Rev Clim Change* 2020, **11**:1-28 http://dx.doi.org/10.1002/wcc.668.
5. Weber EU: **Experience-based and description-based perceptions of long-term risk: why global warming does not scare us (yet)**. *Clim Change* 2006, **77**:103-120 http://dx.doi.org/10.1007/s10584-006-9060-3.
6. Ruiz I, Faria SH, Neumann MB: **Climate change perception: driving forces and their interactions**. *Environ Sci Policy* 2020, **108**:112-120 http://dx.doi.org/10.1016/j.envsci.2020.03.020.
7. Li Y, Johnson EJ, Zaval L: **Local warming: daily temperature change influences belief in global warming**. *Psychol Sci* 2011, **22**:454-459 http://dx.doi.org/10.1177/0956797611400913.
8. Egan PJ, Mullin M: **Turning personal experience into political attitudes: the effect of local weather on Americans' perceptions about global warming**. *J Polit* 2012, **74**:796-809 http://dx.doi.org/10.1017/S0022381612000448.
9. Hamilton LC, Stampone MD: **Blowin' in the wind: short-term weather and belief in anthropogenic climate change**. *Weather Clim Soc* 2013, **5**:112-119 http://dx.doi.org/10.1175/WCAS-D-12-00048.1.
10. Sisco MR, Bosetti V, Weber EU: **When do extreme weather events generate attention to climate change?** *Clim Change* 2017, **143**:227-241 http://dx.doi.org/10.1007/s10584-017-1984-2.
11. Carmichael JT, Brulle RJ, Huxster JK: **The great divide: understanding the role of media and other drivers of the partisan divide in public concern over climate change in the USA, 2001–2014**. *Clim Change* 2017, **141**:599-612 http://dx.doi.org/10.1007/s10584-017-1908-1.
12. Marlon JR, Van Der Linden S, Leiserowitz A, Howe PD, Woo SHL, Broad K: **Detecting local environmental change: the role of experience in shaping risk judgments about global warming**. *J Risk Res* 2019, **22**:936-950 http://dx.doi.org/10.1080/13669877.2018.1430051.
13. Lyons BA, Hasell A, Stroud NJ: **Enduring extremes? Polar vortex, drought, and climate change beliefs**. *Environ Commun* 2018, **12**:876-894 http://dx.doi.org/10.1080/17524032.2018.1520735.
14. Sun Y, Han Z: **Climate change risk perception in Taiwan: correlation with individual and societal factors**. *Int J Environ Res Public Health* 2018, **15** http://dx.doi.org/10.3390/ijerph15010091.
15. Shepard S, Boudet H, Zanocco CM, Cramer LA, Tilt B: **Community climate change beliefs, awareness, and actions in the wake of the September 2013 flooding in Boulder County, Colorado**. *J Environ Stud Sci* 2018, **8**:312-325 http://dx.doi.org/10.1007/s13412-018-0479-4.
16. Broomell SB, Winkles J-F, Kane PB: **The perception of daily temperatures as evidence of global warming**. *Weather Clim Soc* 2017, **9**:563-574 http://dx.doi.org/10.1175/wcas-d-17-0003.1.
17. Hasan MK, Kumar L: **Comparison between meteorological data and farmer perceptions of climate change and vulnerability in relation to adaptation**. *J Environ Manage* 2019, **237**:54-62 http://dx.doi.org/10.1016/j.jenvman.2019.02.028.
18. Abid M, Scheffran J, Schneider UA, Elahi E: **Farmer perceptions of climate change, observed trends and adaptation of agriculture in Pakistan**. *Environ Manage* 2019, **63**:110-123 http://dx.doi.org/10.1007/s00267-018-1113-7.
19. Shrestha UB, Shrestha AM, Aryal S, Shrestha S, Gautam MS, Ojha H: **Climate change in Nepal: a comprehensive analysis of instrumental data and people's perceptions**. *Clim Change* 2019:315-334 http://dx.doi.org/10.1007/s10584-019-02418-5.
20. Lee TM, Markowitz EM, Howe PD, Ko CY, Leiserowitz AA: **Predictors of public climate change awareness and risk perception around the world**. *Nat Clim Change* 2015, **5**:1014-1020 http://dx.doi.org/10.1038/nclimate2728.
21. Wang X, Lin L: **The relationships among actual weather events, perceived unusual weather, media use, and global warming belief certainty in China**. *Weather Clim Soc* 2018, **10**:137-144 http://dx.doi.org/10.1175/WCAS-D-17-0058.1.
22. Zaval L, Keenan EA, Johnson EJ, Weber EU: **How warm days increase belief in global warming**. *Nat Clim Change* 2014, **4**:143-147 http://dx.doi.org/10.1038/nclimate2093.
23. Fownes JR, Allred SB: **Testing the influence of recent weather on perceptions of personal experience with climate change and extreme weather in New York state**. *Weather Clim Soc* 2019, **11**:143-157 http://dx.doi.org/10.1175/WCAS-D-17-0107.1.
24. •• Bergquist P, Warshaw C: **Does global warming increase public concern about climate change?** *J Polit* 2019, **81**:686-691 http://dx.doi.org/10.1086/701766

The authors conducted an analysis aggregating over 400 000 responses from 170 polls fielded from 1999 to 2017. They find that climate concern modestly responds to annual changes in state-level temperatures. The authors conclude that a warming climate will continue to cause public concern to grow, but will not on its own yield a consensus about the threat of climate change.

25. • Damsbo-Svendsen S: **How weather experiences strengthen climate opinions in Europe**. *West Eur Polit* 2020, **44**:1604-1618 http://dx.doi.org/10.1080/01402382.2020.1792731
This paper sought to examine the Local Warming Effect in twelve European countries. It reports evidence of this phenomenon manifesting in European populations, specifically reporting that temperature abnormalities of two standard deviations strengthen climate opinions by 0.5–1%.

26. Larcom S, She PW, van Gevelt T: **The UK summer heatwave of 2018 and public concern over energy security**. *Nat Clim Change* 2019, **9**:370-373 http://dx.doi.org/10.1038/s41558-019-0460-6.

27. Whitmarsh L: **Are flood victims more concerned about climate change than other people? the role of direct experience in risk perception and behavioural response**. *J Risk Res* 2008, **11**:351-374 http://dx.doi.org/10.1080/13669870701552235.

28. Spence A, Poortinga W, Butler C, Pidgeon NF: **Perceptions of climate change and willingness to save energy related to flood experience**. *Nat Clim Change* 2011:46-49 http://dx.doi.org/10.1038/nclimate1059.

29. Konisky DM, Hughes L, Kaylor CH: **Extreme weather events and climate change concern**. *Clim Change* 2016, **134**:533-547 http://dx.doi.org/10.1007/s10584-015-1555-3.

30. Cutler MJ: **Class, ideology, and severe weather: how the interaction of social and physical factors shape climate change threat perceptions among coastal US residents**. *Environ Sociol* 2016, **2**:275-285 http://dx.doi.org/10.1080/23251042.2016.1210842.

31. Albright EA, Crow D: **Beliefs about climate change in the aftermath of extreme flooding**. *Clim Change* 2019, **155**:1-17 http://dx.doi.org/10.1007/s10584-019-02461-2.

32. Lacroix K, Gifford R, Rush J: **Climate change beliefs shape the interpretation of forest fire events**. *Clim Change* 2020, **159**:103-120 http://dx.doi.org/10.1007/s10584-019-02584-6.

33. •• Hazlett C, Mildenberger M: **Wildfire exposure increases pro-environment voting within democratic but not republican areas**. *Am Polit Sci Rev* 2020:1-7 http://dx.doi.org/10.1017/S0003055420000441
The authors examine the effects of experiences with wildfires on votes for climate-related policy measures. They find that proximity to wildfires increased support by 5–6% for those living in the direct vicinity of wildfires, while the effect dropped to near zero beyond a distance of 15 km. Importantly, they report the effects are concentrated in Democratic-voting areas.

34. Shao W, Hao F: **Approval of political leaders can slant evaluation of political issues: evidence from public concern for climate change in the USA**. *Clim Change* 2020, **158**:201-212 http://dx.doi.org/10.1007/s10584-019-02594-4.

35. Cutler MJ, Marlon J, Howe P, Leiserowitz A: **Is global warming affecting the weather?' Evidence for increased attribution beliefs among coastal versus inland US residents**. *Environ Sociol* 2020, **6**:6-18 http://dx.doi.org/10.1080/23251042.2019.1690725.

36. Steg L: **Limiting climate change requires research on climate action**. *Nat Clim Change* 2018, **8**:759-761 http://dx.doi.org/10.1038/s41558-018-0269-8 Nature Publishing Group.

37. Nederhof AJ: **Methods of coping with social desirability bias: a review**. *Eur J Soc Psychol* 1985, **15**:263-280 http://dx.doi.org/10.1002/ejsp.2420150303.

38. van Valkengoed AM, Steg L: **Meta-analyses of factors motivating climate change adaptation behaviour**. *Nat Clim Change* 2019, **9**:158-163 http://dx.doi.org/10.1038/s41558-018-0371-y.

39. Osberghaus D, Demski C: **The causal effect of flood experience on climate engagement: evidence from search requests for green electricity**. *Clim Change* 2019, **156**:191-207 http://dx.doi.org/10.1007/s10584-019-02468-9.

40. Choi D, Gao Z, Jiang W: **Attention to global warming**. *Rev Financ Stud* 2020, **33**:1112-1145 http://dx.doi.org/10.1093/rfs/hhz086.

41. Leiserowitz A: **Climate change risk perception and policy preferences: the role of affect, imagery, and values**. *Clim Change* 2006, **77**:45-72 http://dx.doi.org/10.1007/s10584-006-9059-9.

42. Van Der Linden S: **The social-psychological determinants of climate change risk perceptions: towards a comprehensive model**. *J Environ Psychol* 2015, **41**:112-124 http://dx.doi.org/10.1016/j.jenvp.2014.11.012.

43. Demski C, Capstick S, Pidgeon N, Sposato RG, Spence A: **Experience of extreme weather affects climate change mitigation and adaptation responses**. *Clim Change* 2017, **140**:149-164 http://dx.doi.org/10.1007/s10584-016-1837-4.

44. Bergquist M, Nilsson A, Wesley Schultz P: **Experiencing a severe weather event increases concern about climate change**. *Front Psychol* 2019, **10**:1-6 http://dx.doi.org/10.3389/fpsyg.2019.00220.

45. Ogunbode CA, Böhm G, Capstick SB, Demski C, Spence A, Tausch N: **The resilience paradox: flooding experience, coping and climate change mitigation intentions**. *Clim Policy* 2019, **19**:703-715 http://dx.doi.org/10.1080/14693062.2018.1560242.

46. Chapman DA, Lickel B, Markowitz EM: **Reassessing emotion in climate change communication**. *Nat Clim Change* 2017, **7**:850-852 http://dx.doi.org/10.1038/s41558-017-0021-9.

47. Bromley-Trujillo R, Poe J: **The importance of salience: public opinion and state policy action on climate change**. *J Public Policy* 2020, **40**:280-304 http://dx.doi.org/10.1017/S0143814X18000375.

48. • Boudet H, Giordono L, Zanocco C, Satein H, Whitley H: **Event attribution and partisanship shape local discussion of climate change after extreme weather**. *Nat Clim Change* 2020, **10**:69-76 http://dx.doi.org/10.1038/s41558-019-0641-3
The authors conducted a comparative-case analysis of 15 communities that underwent extreme weather events. They find that community discussions involved the events' connections to climate change in about half of the communities, especially those that are more Democratic and/or highly educated.

49. Spence A, Poortinga W, Pidgeon N: **The psychological distance of climate change**. *Risk Anal* 2012, **32**:957-972 http://dx.doi.org/10.1111/j.1539-6924.2011.01695.x.

50. Liberman N, Trope Y: **The psychology of transcending the here and now**. *Science (80-.)* 2008, **322**:1201-1205.

51. Ogunbode CA, Doran R, Böhm G: **Individual and local flooding experiences are differentially associated with subjective attribution and climate change concern**. *Clim Change* 2020, **162**:2243-2255 http://dx.doi.org/10.1007/s10584-020-02793-4.

52. Zanocco C, Boudet H, Nilson R, Flora J: **Personal harm and support for climate change mitigation policies: evidence from 10 U.S. communities impacted by extreme weather**. *Glob Environ Change* 2019, **59** http://dx.doi.org/10.1016/j.gloenvcha.2019.101984.

53. Reckien D, Petkova EP: **Who is responsible for climate change adaptation?** *Environ Res Lett* 2019, **14** http://dx.doi.org/10.1088/1748-9326/aaf07a.

54. Lujala P, Lein H: **The role of personal experiences in Norwegian perceptions of climate change**. *Nor Geogr Tidsskr* 2020, **74**:138-151 http://dx.doi.org/10.1080/00291951.2020.1731850.

55. Schäfer MS, Ivanova A, Schmidt A: **What drives media attention for climate change? Explaining issue attention in Australian, German and Indian print media from 1996 to 2010**. *Int Commun Gaz* 2014, **76**:152-176 http://dx.doi.org/10.1177/1748048513504169.

56. Shanahan J, Good J: **Heat and hot air: influence of local temperature on journalists' coverage of global warming**. *Public Underst Sci* 2000, **9**:285-295 http://dx.doi.org/10.1088/0963-6625/9/3/305.

57. Pianta S, Sisco MR: **A hot topic in hot times: how media coverage of climate change is affected by temperature abnormalities**. *Environ Res Lett* 2020, **15** http://dx.doi.org/10.1088/1748-9326/abb732.

58. King G, Schneer B, White A: **How the news media activate public expression and influence national agendas**. *Science* 2017, **358**:776-780 http://dx.doi.org/10.1126/science.aao1100.

59. Hopke JE: **Connecting extreme heat events to climate change: media coverage of heat waves and wildfires**. *Environ Commun* 2020, **14**:492-508 http://dx.doi.org/10.1080/17524032.2019.1687537.

60. Painter J, Osaka S, Ettinger J, Walton P: **Blaming climate change? How Indian mainstream media covered two extreme weather events in 2015**. *Glob Environ Change* 2020, **63**:102119 http://dx.doi.org/10.1016/j.gloenvcha.2020.102119.

61. Zanocco C, Boudet H, Nilson R, Satein H, Whitley H, Flora J: **Place, proximity, and perceived harm: extreme weather events and views about climate change**. *Clim Change* 2018, **149**:349-365 http://dx.doi.org/10.1007/s10584-018-2251-x.

62. Howe PD, Leiserowitz A: **Who remembers a hot summer or a cold winter? The asymmetric effect of beliefs about global warming on perceptions of local climate conditions in the U.S**. *Glob Environ Change* 2013, **23**:1488-1500 http://dx.doi.org/10.1016/j.gloenvcha.2013.09.014.

63. Myers TA, Maibach EW, Roser-Renouf C, Akerlof K, Leiserowitz AA: **The relationship between personal experience and belief in the reality of global warming**. *Nat Clim Change* 2013, **3**:343-347 http://dx.doi.org/10.1038/nclimate1754.

64. Kunda Z: **The case for motivated reasoning**. *Psychol Bull* 1990, **108**:480-498 http://dx.doi.org/10.1037/0033-2909.108.3.480.

65. Druckman JN, McGrath MC: **The evidence for motivated reasoning in climate change preference formation**. *Nat Clim Change* 2019, **9**:111-119 http://dx.doi.org/10.1038/s41558-018-0360-1.

66. Mccright AM, Dunlap RE: **The politicization of climate change and polarization in the American public's views of global warming, 2001-2010**. *Sociol Q* 2011, **52**:155-194 http://dx.doi.org/10.1111/j.1533-8525.2011.01198.x.

67. Howe PD: **Perceptions of seasonal weather are linked to beliefs about global climate change: evidence from Norway**. *Clim Change* 2018, **148**:467-480 http://dx.doi.org/10.1007/s10584-018-2210-6.

68. Hamilton-Webb A, Naylor R, Manning L, Conway J: **'Living on the edge': using cognitive filters to appraise experience of environmental risk**. *J Risk Res* 2017, **22**:303-319 http://dx.doi.org/10.1080/13669877.2017.1378249.

69. Ogunbode CA, Demski C, Capstick SB, Sposato RG: **Attribution matters: revisiting the link between extreme weather experience and climate change mitigation responses**. *Glob Environ Change* 2019, **54**:31-39 http://dx.doi.org/10.1016/j.gloenvcha.2018.11.005.

70. Hoogendoorn G, Sütterlin B, Siegrist M: **The climate change beliefs fallacy: the influence of climate change beliefs on the perceived consequences of climate change**. *J Risk Res* 2020, **23**:1577-1589 http://dx.doi.org/10.1080/13669877.2020.1749114.

71. Giordono L, Boudet H, Gard-Murray A: **Local adaptation policy**
• **responses to extreme weather events**. *Policy Sci* 2020:609-636 http://dx.doi.org/10.1007/s11077-020-09401-3
The authors analyze 15 cases where communities experienced extreme weather events to study the conditions wherein policy adoption occurs in the wake of such events. They find that a high-impact event is a necessary condition for policy adoption to result.

72. Howe PD: **Extreme weather experience and climate change opinion**. *Curr Opin Behav Sci* 2021, **42**:127-131 http://dx.doi.org/10.1016/j.cobeha.2021.05.005.