




Extreme weather events and public attention to climate change in Australia

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1 Introduction

As climate change causes severe weather events to become more frequent and intense, the public's experience of these extreme episodes has the potential to drive greater awareness about the climate crisis, which could, in turn, increase pressure for more ambitious policy action (Konisky et al. 2016; Myers et al. 2013). This could theoretically occur if these episodes are able to serve as 'focusing events', during which activists and policymakers can capitalise on heightened public attention to implement stronger policies (Birkland 2006).

While there is a growing body of research on the role that focusing events can play in this regard (see, e.g. Herrnstadt and Meuhlegger 2014; Konisky et al. 2016; Sisco et al. 2017), key questions remain around the nature and conditions of this heightened attention, its longevity, how it applies in different societies, and how these attention cycles may be changing over time. Aiming to fill in some of these gaps, our study focuses on the Australian context (which has been largely ignored to date) and seeks to understand how different *types* of extreme weather events might impact this 'attention cycle' (Downs 1972) differently in terms of intensity and longevity and whether or not these extreme events are garnering more 'climate attention' in recent years.

To that end, our study regressed the Google Trends Intensity Index for the search terms 'climate change' and 'global warming' in the months immediately following three different types of extreme weather events (bushfires, floods, and storms) in Australia between 2008 and 2020. We found that, in Australia, heightened attention to climate change following an

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extreme weather event tended to be positive, but rather short-lived, and there were notable differences in the intensity and duration of this attention depending on the type of weather event. Major bushfires tended to generate the greatest longevity and relatively significant intensity; extreme storms had the greatest intensity but very little longevity, while major flooding events did not appear to generate statistically significant attention to climate change. Our study further indicated that, despite an increased tendency for the media to associate extreme weather with climate change over the past decade, the level of 'climate attention' following extreme events does not appear to be significantly increasing over time. In the following sections, we explain our methodology and results and briefly reflect on how these findings contribute to discussions around Australian climate policy.

2 Method

The Google Trends Search Intensity Index was used as a proxy for national attention to climate change. This tool tracks the frequency of given search terms used on Google across varying demographics relative to all other searches during a particular period, revealing social patterns whilst remaining cautious of possible inconsistencies (Stephens-Davidowitz 2014). The relative search frequency standardises measures of attention occurring within a state, facilitating accurate comparisons across periods and locations (Herrnstadt and Meuhlegger 2014).¹ For our study, it was assumed that if/when people's attention to climate change increases during and/or after an extreme event, they are more likely to research it on Google. To gauge the relative frequency and intensity of this attention, we used the search terms 'climate change' and 'global warming' at the state-month-year level from 2008 to 2020, mitigating population differences across Australia's states. The empirical model (outlined below) links extreme weather events with Google Trends search intensity and controls for changes across state, year, and month. Data for these extreme events was collected from the federal government's Australian Disaster Resilience Knowledge Hub, which defines extreme weather as 'severe, unseasonal weather episodes that rank at the extremes of historical distribution since reliable records have been kept' (AIDR 2023). For this analysis, bushfires, floods, and storms were selected as the variables, along with an additional dummy variable of 'transport disasters'.

2.1 Measuring attention to climate change

The results were constructed into panel data to examine the correlation between attention to climate change and varying types of extreme weather events across multiple states and territories over time.² Extreme weather events are separated by state, month, year, and type

¹ It is important to note that, despite its rapid adoption as a data source among scholars in numerous disciplines over the past decade, concerns have been raised about some of the quality dimensions of Google Trends data Cebrián and Domenech (2023). Note that although these issues do not invalidate Google Trends as a data source for social and economic analyses, more research is required to understand the scope and determinants of certain inconsistencies. For an overview of some of the limitations that have been documented over the past several years, see Supplemental Appendix B.

² This panel data can be accessed as part of the Supplementary Information associated with this article (see Supplemental Appendix A).

of disaster to capture attention to climate change in a state, during a given month, and during/after a certain type of extreme weather event within that state. Due to the nature of data availability, weather events were recorded at 1-month intervals instead of more sensitive ones like daily or weekly intervals. To denote extreme weather events, 1 is noted for each month that an event occurs in a state, and 0 is noted for months with no event. Events that continued for more than 1 month (or, for example, began towards the end of the month and crossed over into the next month) are noted a 1 for each month that the event occurred based on the dates indicated in the AIDR Knowledge Hub, such as the Black Summer Bushfires of 2019/2020. Between 2008 and 2020, there were 89 extreme weather events recorded across all Australian states and territories (AIDR 2023).

The baseline statistical model is presented below:

$$Y_{smt}^0 = X^0 + \beta_1^0 \text{Bushfires}_{smt} + \beta_2^0 \text{Floods}_{smt} + \beta_3^0 \text{Storms}_{smt} + \beta_4^0 \text{Transport}_{smt} + \alpha_s^0 + \delta^0 t + \tau^0 m + \epsilon_{smt}^0$$

where s indexes states, m indexes months, and t indexes years. Y is concerned with Google search intensity for climate change, global warming, and climate change and global warming. A is the fixed effect for states and territories, δ is a fixed effect for years, τ is a fixed effect for months, and ϵ is the error term.

To determine the temporal lag (0–6 months) of attention after an extreme weather event, the following statistical model was used:

$$Y_{smt}^i = X^0 + \beta_1^i \text{Bushfires}_{smt} + \beta_2^i \text{Floods}_{smt} + \beta_3^i \text{Storms}_{smt} + \beta_4^i \text{Transport}_{smt} + \alpha_s^i + \delta^i t + \tau^i m + \epsilon_{smt}^i$$

This model substitutes 0 for i , where i denotes the number of months after an extreme weather event ($i \in 1, 2, 3, 4, 5, 6$). This allows to test for a lag in Google search intensity after m months.

2.2 Limitations

This methodology does not allow us to completely isolate the specific role that extreme weather events play in influencing the shifting attention cycle. In Australia, climate change has played a uniquely prominent role in political discourse over the past 20 years as part of an ongoing partisan and cultural saga often referred to as the ‘climate wars’ (Wilkinson 2020). As a result, occasional flare-ups around climate politics have been a consistent feature of the national discussion during the period we assessed, and extreme weather events cannot be fully isolated from these incidents. Nor can they be fully isolated from background influences, like the fact that extreme weather events are more likely to take place during summer months—a time during which, according to recent studies, interest in climate change tends to be higher on its own (Lang 2014; Ray et al. 2017) and during which multiple overlapping extreme events may be occurring across the country. Additionally, our methodology measures the *frequency* of extreme events, but not the relative *intensity* or national prominence of any given event, which may be crucial in understanding relative changes in attention. Finally, more localised data was neither attainable nor feasible for this study, but is a welcomed avenue for further research.

3 Results

Figure 1 illustrates the relationship between different types of extreme weather events and changes in attention to climate change in the 6 months following an extreme weather event.

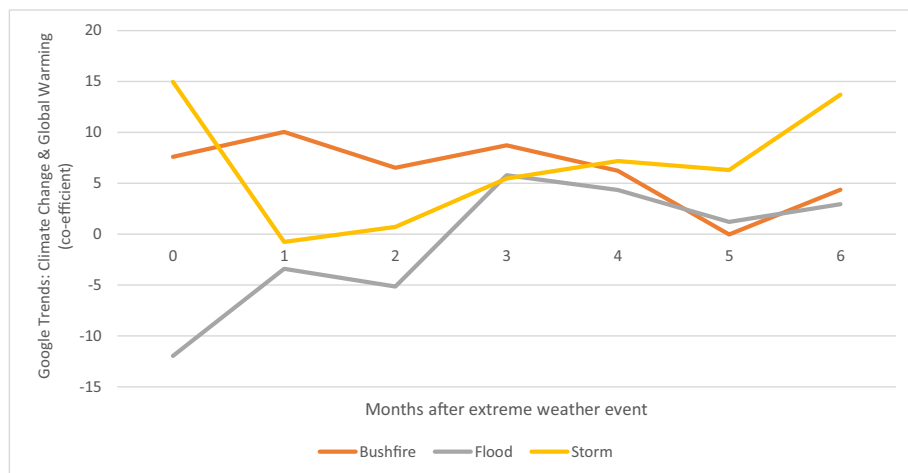


Fig. 1 Attention to climate change following extreme weather in Australia (6-month lag)

3.1 Bushfires and climate attention

Our data showed that there was a positive correlation between bushfires and Google searches for climate change and global warming from the month of a fire until 4 months after. During the month of the fire, there was a positive correlation as searches increased 7.6 intensity units. One month after the onset of the fire, searches increased to 10.04 intensity units and significance increased to 0.004. The search intensity and significance in months 2 through 4 slowly reduced, eventually becoming negative again in month 5. While search intensity and significance trend upward in month 6, this is likely unrelated to the original fire in question.

3.2 Extreme storms and climate attention

Google searches for climate change and global warming during the month of an extreme storm increased by 14.9 intensity units, and the level of significance increased to 0.009. One month after the storm, however, searches plummeted to -0.8 . In the following months, searches increased slightly, but remained insignificant, and were likely unrelated to the original storm in question. These results suggest that public attention to climate change is highest and strongest during the month of an extreme storm, with attention rapidly diminishing after just 1 month.

3.3 Extreme floods and climate attention

Finally, following a major flooding event, changes in search intensity for climate change and global warming were statistically insignificant and erratic. During the month of a flood, there was actually a slightly negative correlation with Google search intensity, and this remained the case in months 1 (-3.4 units) and 2 (-5.1). Although the relationship becomes positive in month 3, it is not statistically significant and very likely unrelated to the original flooding event in question. This apparent lack of association between climate change and floods accords with existing survey data which suggest that Australians are more likely think of climate change in terms of its penchant to cause hotter, drier conditions, and are less apt to associate it with wetter weather (Australia Institute 2022).

3.4 The connection between climate attention and extreme weather throughout the 2010s

We further sought to understand how these trends might be changing over time, particularly given the presence of studies which highlight the role that the media has played in underscoring the connection between extreme weather and climate change in more recent years (Anderson et al. 2018; Carmichael and Brulle 2017). For instance, in the Australian context, it could be argued that the Black Saturday bushfires of 2009 featured a much weaker climate change framing by the media than the Black Summer bushfires of 2019–2020. Here, it would be reasonable to assume that the ‘climate attention’ garnered by extreme weather events might be growing over time as the media increasingly underscores this connection. Interestingly, however, our data does not seem to highlight this type of trend in any significant way (see Fig. 2—for legibility purposes, floods were omitted from this figure given their apparent lack of impact on climate attention). While extreme storms and bushfires do show a consistent correlation with upticks in national climate attention over time, it is not apparent that these upticks became more pronounced over the course of the 2010s. And while the Black Summer bushfires correlate with an exceptional uptick in climate attention, this is no less true of the Black Saturday bushfires a decade earlier.³

4 Discussion

4.1 Summary of findings

The above results suggest that, in Australia, heightened attention to climate change following an extreme weather event tends to be positive but quite short lived, and that there are key differences in the intensity and duration of this attention depending on the type of weather event. Heightened attention following a bushfire appears to have the greatest longevity and statistically significant increases in intensity; extreme storms appear to have the greatest intensity but very little longevity, while major flooding events do not appear to generate statistically significant attention to climate change. We found, moreover, that despite a growing trend within the media over the past decade to underscore the connection between extreme weather and climate change, it is not obvious that extreme weather events are generating more climate attention in recent years.

4.2 Implications for climate policy in Australia

Australia is a particularly interesting country in which to think about extreme weather and climate attention. As a historical climate laggard with some of the highest per capita emissions, least ambitious national climate policies, highest per capita fossil fuel

³ The highest attention point in Fig. 2 was November/December 2009, when the federal Liberal Party experienced a bruising leadership spill over climate policy, resulting in the installation of Tony Abbott as the party's new leader.

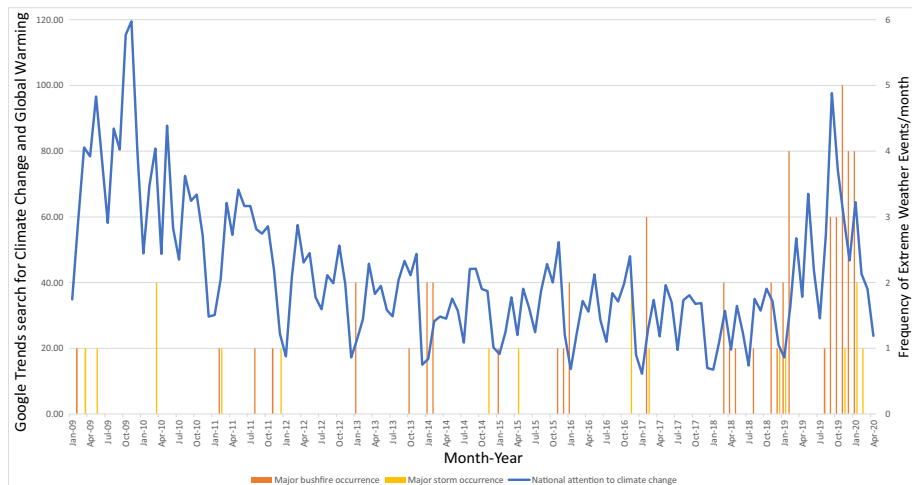


Fig. 2 From ‘Black Saturday’ to ‘Black Summer’: national climate attention following major storms and bushfires in Australia, 2009–2020

exports, and most polarised views on climate action (MacNeil 2021), the increased frequency of extreme weather events across the country could potentially serve as a much-needed catalyst for national climate progress, as Australia continues to serve as the world’s ‘petri dish’ for climate change (Goodell 2011). Yet studies like this underscore that increased climate ambition is not guaranteed to be a natural outgrowth of these destructive episodes. If extreme weather events in Australia do enhance the ‘issue attention cycle’ around climate and thereby create space for greater policy action, our study indicates that such attention is quite short lived and not always as intense as one might assume. This is to say nothing of the numerous existing studies from other jurisdictions which suggest that, even *if* these events can sufficiently capture people’s attention, they will not necessarily change their opinions or strengthen their appetite for policy action (Howe et al. 2019). This raises the more complex question of how policy actors can increase the intensity and duration of public attention to climate change following extreme events and translate that attention into a sustained appetite for policy action. While recent studies have helpfully emphasised the need to increase public ‘climate literacy’ through a variety of means to help citizens understand the links between these events and climate change (see, e.g. Lee et al. 2015), this is an area of inquiry that will require significant further research and attention if these destructive episodes are ever to become a major driver of climate progress.

Supplementary Information The online version contains supplementary material available at <https://doi.org/10.1007/s10584-023-03601-5>.

Data Availability The dataset used in this research is available from the author on request.

Declarations

Ethics approval This article does not contain any studies with human or animal participants performed by any of the authors.

Consent to participate Not applicable.

Consent for publication Not applicable.

Competing interests The authors declare no competing interests.

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