



Magnifying Focusing Events: Global Smoke Plumes and International Construal Connections in Newspaper Coverage of 2020 Wildfire Events

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As climate policy focusing events, wildfires are distinct from hurricanes, floods, and tornados because they also result in the release of massive smoke plumes that contribute to the concentration of atmospheric carbon. However, unlike melting glaciers, wildfires may be easier to dismiss as individual acts of human error, spontaneous acts of mother nature, and/or necessary ecological processes of agricultural renewal. This paper presents a mixed-methods analysis of 150 international and domestic English language newspaper articles related to wildfire events occurring in Australia, Canada, Germany, Greece, Italy, Spain, the United Kingdom, and the United States during the year 2020. The analysis examines how news coverage of wildfire events might focus or diffuse attention to international climate policy and anthropogenic global warming. The quantitative findings provide evidence to suggest that 30% of wildfire coverage is attributed to climate change. However, qualitative analysis suggests that climate change is acknowledged as a blame frame that is often only inferentially attributed to anthropogenic origins. The mixed-methods analysis finds that only 6% of news coverage related wildfire events to emission contributions. The analysis of these exemplar articles suggests that the international travel of wildfire smoke may serve as a focusing event from which to emphasize wildfires as both a consequence of and contributor to, global warming. Findings indicate that environmental coalitions and scientific experts' engagement with the press are integral to creating frames that link the increasing frequency, duration, and range of wildfire events to climate policy needs.

Keywords: extreme weather events, newspaper coverage, climate change, wildfires, focusing events, public policy, narrative framing

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INTRODUCTION

While images of melting ice are causally associated with increasing temperatures, and rising sea levels readily correspond to flood events occurring along coastlines, the causal chain between climate change and wildfires is less immediately observable and the occurrence of wildfire events is less geographically predetermined. As the public and policy makers experience the increasing threat of wildfire danger, understanding the connections between extreme weather events and global warming and climate change (GWCC) will be necessary to enact solutions at the appropriate local, regional, and national levels. Birkland (1998) described how human-caused disaster events like oil spills and nuclear contamination can be used to create focusing events that direct attention to problems

with environmental policy in ways that energize public calls for change. However, unlike other human-caused disaster events, it may be more difficult to articulate the complex connections between the frequency of extreme weather events, global patterns of climate change, and the need for robust environmental policy commitments.

While hurricanes, tornados, and flood events are expected to increase as a consequence of increased anthropogenic emissions, wildfires are the only extreme weather event that directly contributes to the concentration of carbon and greenhouse gasses in the atmosphere. Not only are wildfires more likely as a consequence of climate change, but wildfires themselves contribute to nearly one fifth of annual atmospheric carbon emissions (van der Werf et al., 2017). The frequency, range, and duration of wildfires is forecasted to increase, and become more difficult to contain, in developed nations whose populations were previously less directly affected by changing global climate conditions (Ferris et al., 2013). In a high-emissions scenario, a *New England Journal of Medicine* report predicts that “the frequency of wildfires will substantially increase over 74% of the global land mass by the end of this century” (Xu et al., 2020, 2,178–2,179). Developed nations are responsible for 76% of historic emissions (Baumert et al., 2005) and “90% of the climate breakdown” (Hickel 2020, e403). Theories of public policy suggest that news media coverage in these markets would direct attention to the climate-linkages of such events, energize the public, and exclaim the need for climate policy action.

In public policy parlance, *focusing events* are uncommon occurrences that happen suddenly and present harm to a particular community. Scholars have described how focusing events draw attention to the problems, policies, and politics associated with the multiple streams approach to understanding public policy (Birkland 1998; Bishop 2014; Alimi and Maney 2018). Kingdon (2010) described how advocacy coalitions mobilize around focusing events and Baumgartner and Jones (2009) described how coalitions and interest groups often strategically wait for “policy windows” to open in the wake of disaster events. However, given the complexity of attributing factors and the immediate sensationalism of wildfire devastation, it may be more difficult for news media frames to explain the causal connections between increasing wildfire events and GWCC.

In contrast to distant images of climate change, wildfire events present localized and often sensationalized disaster scenes that draw attention to local burning ordinances and regional forestry management resources. Unlike images of oil-soaked wildlife and melting glaciers, news reports of wildfires may be easier to dismiss as spontaneous acts of mother nature, necessary ecological processes of agricultural renewal, or individualized acts of human error and mismanagement. While wildfires exemplify a number of dynamic connections to GWCC, news media coverage of wildfire events has a long history that predates public attention to climate change. The longstanding frames associated with the media coverage of wildfires may make it difficult to identify and explain the causal connections between climate change and the increasing geographic range and intensity of wildfire events.

In an effort to examine how media coverage frames wildfire events, this paper analyzes 150 internationally and domestically circulated English language newspaper reports from 2020 that covered wildfire events occurring in Australia, Canada, Germany, Greece, Italy, Spain, the United Kingdom, and the United States to discern how media responses might focus or diffuse attention to climate policy and GWCC. A thematic content analysis identifies the frames used to create causal linkages between wildfire events and climate policy and examines exemplar frames that effectively demonstrate wildfire events’ capacity to serve as focusing events. In an effort to better understand the contemporary news framing of wildfire events, this paper first reviews the literature associated with media, public policy, and extreme weather events. Second, this paper turns toward a narrative policy framework to guide a mixed-methods analysis of newspaper coverage of wildfires. After examining the results, this paper concludes with recommendations for climate scientists and news journalists.

MEDIA, EXTREME WEATHER EVENTS, AND PUBLIC POLICY

Previously, agenda setting theories associated with “punctuated equilibrium” and the “spiral of silence” postulated that individuals whose beliefs fell outside of the norm would be pressured to conform to convention and acquiesce to the force of public opinion (McCombs and Shaw 1972; Noelle-Neumann 1993; Boushey 2012). These theories imply that the overwhelming scientific consensus surrounding GWCC should be reflected in news coverage of extreme weather events. However, the role of the news media as an agent of political socialization has changed considerably in the time since these foundational theories were conceptualized. Moller et al. (2018, 445) find that, “due to the changing and fragmented media environment of the 21st century, the influence of the media on political participation has changed.” Given the relatively low barrier to entry associated with social media, the proliferation of fake news, and the growing distrust of media industries (Tsftati 2010; Gottfried et al., 2019)—these agenda setting theories and models of public policy no longer exhibit the same explanatory power. Consequently, policy makers’ formulations of focusing events may need to be retooled to consider how differences in framing may precipitate policy outcomes.

Birkland (1998) noted that environmentalists were able to capitalize on focusing events like oil spills and nuclear contamination but found that environmental disasters perceived as natural received less attention. As members of the public become aware that the increasing frequency and severity of hurricanes is a consequence of GWCC, it is expected that media coverage of hurricanes will shift to reflect the complex meteorological attributions and frame mega storms as “focusing events” that open “policy windows” and encourage robust climate policy change. There is some evidence this is beginning to happen. Yilmaz and Can (2020) suggest that while global weather and climate information were previously limited to technical and academic interests, it is now more common to

find media coverage of international climate events included in the public news agenda.

Attributing wildfire events to climate change requires an understanding of complex scientific factors that may be more difficult to cover than the immediate and sensational reports of landscape destruction and personal loss. Wildfires risk becoming associated with “policies without publics” or issues whose problem frames are overly technical and do not have advocacy coalitions dedicated to influencing policy action (May 1991). When limited to highly technical discussions of forest management practices or only associated with the immediate proximate causes, news narratives are unlikely to frame wildfires as extreme weather events increasing in frequency as a result of GWCC. Public understanding and response to the increasing risk of wildfires will continue to be a complex enterprise that necessitates policy learning. Given that some wildfires are started by natural processes, human error, and arson, it would be a false reduction to frame every wildfire event as a consequence of climate change. Rather than simplify wildfire narratives, it is increasingly important that news coverage explain how climate change makes it more difficult to contain wildfire events. As the frequency, duration, and expected range of wildfires expands to threaten communities in developed countries, it is expected that wildfire events will direct attention to public policies related to forestry management and climate policy. As connections are made between the local experience of wildfire events and changing global climate conditions, news coverage has an opportunity to frame wildfire events as focusing events that illustrate the dynamic effects of GWCC.

News Coverage of Wildfire Events

As a principal provider of consequence information, news media coverage is an integral element in connecting the dots between the frequency and proximity of wildfire events in developed nations and the conditions of GWCC. There are several ways in which news media coverage can distort attributions between wildfire events and GWCC. In the context of increasing temperature anomalies and predictions of extreme weather events, the evidence appears to confirm the impact of media polarization, suggesting that attributions of GWCC divide along partisan lines of division (Feldman et al., 2012; Hmielowski et al., 2013; McCright and Dunlap, 2016; Carmichael and Brulle 2018). Bose and Moran (2018) argue that “narratives have created the pre-existing beliefs and notions within which people will go on to view a focusing event when it arises” and suggest that “media narratives play a large part in the push for policy change” adding, “narratives have been shaping the way people view events and policy for years.” Notably, media coverage of wildfire events has a long history that predates public discussions about climate change. Sisco et al. (2017) found that effects are usually larger immediately after events when compared to directly before. They suggest that this may be a consequence of the event’s impact, but also speculate that, “it could be when media attention increases after an event hits, that drives up the event’s effect on attention to climate change.” However, familiar narratives of brave fire fighters battling to regain control of windswept flames and/or local understandings of ecology and prescribed burning may

contribute to frames that present the illusion that the public can control wildfire events. For these reasons, news media coverage may magnify or distort attributions that inform public opinion and moderate support for climate policy responses to worsening wildfire conditions in developed nations.

Given the number of wildfire events that have impacted the Australian bush, it is not surprising that much scholarly attention to media coverage of wildfire events is related to Australia. Whittaker and Mercer (2004) analysis of media coverage and policy documents associated with the 2002–2003 fire season in Victoria found conflicting frames associated with “conservationist”, “ruralist”, and “wide use” discourses associated with prescribed burning and noted that a common feature across the various frames was the effort to ascribe blame. Altangerel and Kull (2013) qualitative analysis of news coverage associated with the 2008 Australian parliamentary inquiry into wildfire hazard reduction in Victoria found that individuals “build their arguments with the use of selective framing” and argued that media often appealed “only to the facts and examples that support their position.” A recent *Nature* editorial (2020) calls on Australia to transcend these partisan divisions: “the country’s politicians delayed meaningful action through a wasted decade of arguments over whether human activities are causing climate change in the face of overwhelming scientific evidence that they are.” Anderson et al. (2018) examined over 400 Australian news stories, editorials, and opinion pieces and found that more than half ascribed blame to fuel reduction policies, while less than 3% of news stories examined considered climate change as having had an impact on the fires. While scholars of public policy have suggested that scientific consensus might contribute to the agenda and mobilize policy learning in association with focusing events, Anderson et al. (2018, 937) find that “each succeeding fire reinvigorated the opponents of environmentalism.” Reviewing Swedish media coverage of international wildfire events occurring on three continents, Berglez and Lidskog (2019) speculate that “strong support for the IPCC (Intergovernmental Panel on Climate Change) “at home” ought to increase the likelihood of climate change being mentioned in the reporting about foreign fires.” However, their thematic analysis finds a number of frames that continue the tendency to portray climate change as a partisan issue and indicates that partisan perceptions can limit the effectiveness of attributions between climate change and wildfire events in ways that preclude international climate policy commitments. These instances of counter framing demonstrate how alternative coalitions and preexisting ideological frameworks might distort and diffuse the potential that wildfire events are framed as climate change focusing events.

Although climate scientists have long described the relations between GWCC and the increasing prevalence of extreme weather events, Yilmaz and Can (2020, 6,247) note that “people have started to gain awareness thanks to the dissemination of information in the press.” However, as media “manufacture controversy” and present climate change as a partisan issue, the news frames shift away from discussions of fact and feature considerations of contrasting opinion (Ceccarelli 2011). In a review of nearly six hundred *New York Times* news articles, Romps and Retzinger (2019, 6) find that “basic climate

facts appear . . . with vanishingly small frequencies” and note that “the vast majority of climate-change news articles contained none of the five basic climate facts.” As a consequence of limited public understanding, the facts presented around extreme weather events like heatwaves and wildfires do not always include clear attributions to GWCC and can even be distorted in ways that increase public confusion and decrease support for climate policy (Zaval et al., 2014). With an acknowledgement of increasing media fragmentation, it is expected that media sources will continue to reflect the widening political divisions associated with GWCC in their coverage of extreme weather events (Bolin and Hamilton 2018).

Moreover, as news events, wildfires may be particularly difficult to attribute to GWCC. The Smith (1989) analysis of television coverage of the 1988 Yellowstone Park wildfires suggests that forest fires are often covered in a “stylized and stereotyped way” that emphasizes the role of “brave firefighters” over and above the environmental consequences of the event. Yell (2010) analysis of media coverage of the 2009 Black Saturday brushfires found that “the coverage, whether in the print or electronic media, was characterized by an intensity of affective expression and affective imagery.” Similarly, Morehouse and Sonnett’s (2010) review of wildfire coverage in four US newspapers from 1999 to 2003 found that “news coverage of wildland fire has tended to focus largely on the drama and damages of fire events” often ignoring the complex role of fire ecology and instead emphasizing frames of “devastation, human hardship, community disruption, fleeing animals, and analogies to war.” However, they identify a minor shift in coverage that increased attention to scientific knowledge and more clearly associated climate influences with wildfire risks and existing forest management policies at the national level. As wildfires in developed countries illustrate the realities of GWCC in closer proximity and with greater frequency, political divisions are expected to manifest dissonance and necessitate new “framing contests” that influence public policy outcomes.

COMPARING WILDFIRE NARRATIVES IN MEDIA COVERAGE

The Advocacy Coalition Framework (ACF), and the model of the Multiple Streams Approach (MSA), suggest that as issues enter a “problem stream” they receive attention and momentum that directs them into a “policy stream” where solutions are developed in the “politics stream” with resolutions ultimately codified into public policy (Birkland 1998; Kingdon 2010). However, rather than a progression through neatly ordered streams, research suggests that there may be opinion latency feedback loops not previously considered by ACF and MSA approaches rooted in agenda-setting theories. Nohrstedt and Weible (2010) call for increasing attention to post-crisis debates noting contests between frames and counter-frames significantly influence policy beliefs. Jones and McBeth (2010) developed a Narrative Policy Framework (NPF) that presents a structural approach to examining the components of narrative frames. In extending the NPF, Crow and Lawlor (2016) argue that “by systematically

analyzing the use of framing and narrative construction within policy debates, scholars can begin to understand how the decisions that media actors make in selecting stories, framing those stories, and constructing narratives matter to policy outcomes.” Linking the NPF to an examination of focusing events, Bose and Moran (2018) report that “the power of narratives must be taken seriously when critically analyzing focusing events.” In order to examine how news narratives associated with wildfires frame attributions to GWCC and impact commitments to international climate policy, this paper examines newspaper articles related to wildfire events that occurred in 2020 and compares their recurring frames and frequently occurring themes.

For the purposes of this analysis, 150 newspapers were selected from Australia, Canada, the United Kingdom, the United States and European news outlets more broadly. This paper uses purposive sampling to identify an archive of texts from which to conduct a mixed-methods analysis of newspaper coverage related to wildfire events in 2020. The articles identified represent an exhaustive search and purposeful sample of international and domestic English language newspaper articles about wildfire events occurring in 2020, with bulletins and public commentary excluded from analysis. The examination of texts discerned whether the articles were covering domestic wildfires events or otherwise represented coverage of an international wildfire event. The 150 newspaper articles represent a purposive sample of domestic and international coverage from developed countries that are most responsible for contributions to climate change, including Australia, the United States, and the United Kingdom. The addition of coverage related to wildfire events in Canada and across Europe expands the sample to include several developed nations responsible for commitments to international climate policy accords like the Paris Agreement. Research suggests that newspapers are uniquely informative media that characterize disaster focusing events. Steelman et al. (2015) argue that “because of the more in-depth coverage and more complex gatekeeper role, newspapers may be seen as more trustworthy than other media sources.” Where television coverage and social media are often focused on evacuation plans and disaster zone coverage, newspapers serve to explain the causes and address relevant policy issues.

The 150 articles selected for analysis reflect an exhaustive search from a 1-year period and exhibited analytic saturation with all of the thematic findings confirmed through substantial repetition. The combination of quantitative and qualitative modes of analysis enabled a process of methodological triangulation that brings together the results of two measures to better examine a larger area of consideration. Entman (1993) describes framing as the selection of some aspect of a perceived reality to make it more salient. In an effort to better understand the way wildfires were framed in news media coverage, the analysis of text included a quantitative examination of news media narratives characterization of wildfire events and attributions to climate change. A quantitative content analysis examined each newspaper article to identify whether the origins of wildfires, changing climate conditions, and consequences or

related concerns associated with wildfires were included in news coverage. Beyond frequency, the qualitative analysis explores the way particular aspects of wildfires were made meaningful. Questions guiding the qualitative analysis of selection and salience in wildfire coverage included:

- What blame frames are used to explain the origins of wildfire events?
- How are changing environmental conditions described in news narratives of wildfire events?
- Does the proximity of population centers to wildfire consequences shape the frames used in news narratives of wildfire events?

RESULTS

Results overall indicate that attributions to climate change were more frequent than discussions of the natural origins or direct human causes of wildfire events. Among the 150 articles examined, 30% (46) attributed the origins of wildfire activity to changing climatic conditions. An emphasis on the human origins of the fire, by arson or accident, appeared in 10% (16) of the articles examined and a discussion of the natural origins appeared in 6% (9) of the articles (see **Supplementary Appendix S1**). Perhaps this confirms the Yilmaz and Can (2020) finding that news media coverage is becoming more attentive to changing global weather patterns. However, at only 30% of the sample, overall attributions to climate change remain smaller than the 34% (52) of newspaper articles that attributed wildfires to local weather conditions and the 34% that detailed the economic costs of wildfire events (see **Supplementary Appendix S2**). Moreover, many of these attributions to climate change were only inferentially associated with anthropogenic causes. While 17% (26) of the articles noted problems associated with high temperatures and acknowledged the increasing frequency and duration of wildfire events, only 6% (10) of the articles examined detailed the dynamic contributions wildfires make to atmospheric carbon concentrations. Where coverage of policy issues was included in the sample, it was more often focused on local and regional policy solutions [21% (32)] than discussions of national or international climate policy solutions [5% (8)] (see **Supplementary Appendix S3**).

The quantitative findings suggest that even if coverage of extreme weather events is increasingly attributed to climate change, it remains necessary to articulate the contributions wildfires make back to atmospheric carbon concentrations and global warming more broadly. Although the quantitative analysis recorded international and domestic news sources distinctly, no significant differences between the proximity of news publication to a wildfire event and how that event was framed are observed in the sample. No study of news materials from 2020 is exempt from factors related to the COVID-19 pandemic that impacted a wide range of global processes in late February and continued throughout the remainder of the year. In the articles examined, 6% related wildfire activity and prevention with coronavirus concerns. Rather than use the quantitative data to

make comparative claims about each country's media, the quantitative findings serve to substantiate the qualitative findings and direct attention to the themes identified. The thematic analysis is organized in three parts and uses exemplar articles to respond to the questions guiding the qualitative analysis.

Blame-Frames

Results of the mixed methods analysis suggest there are three dominant blame-frames. First, and most common, are those frames that present wildfire events as a consequence of increasing temperatures and extended periods of drought (34%). This blame-frame leave readers to infer associations with GWCC but does not clearly explicate the causal connections to climate change and thus risks being more easily dismissed as localized phenomena. The second blame-frame more clearly relates wildfire events to broader changing climatic conditions (30%). And the third identifies the human (10%) or natural (6%) origins of wildfire events without additional consideration to climate conditions. Notably, even among those frames that observe connections to climate change, the explanations that link the causal attributions between extreme wildfire events and worsening climatic conditions remain underdeveloped. At best, climate change is framed as a reason for worsening wildfire events. However, the contribution wildfires make to climate change is not included in these frames. Only 6% of the news narratives examined in detail the complex contributions wildfires make to global warming. Blame-frames that identify human activities, like recreational vehicle use and untended campfires, as the sole cause for wildfires simplify the origins. Similarly simplistic, those narratives that implicate climate change as the cause of a wildfire event continue to ignore that these events are also themselves contributing to emissions and accelerating feedback loops. Each of these three blame-frames is subject to narrative constructions that introduce policy solutions ranging from local wildlands management to international climate policy agreements. However, in this examination, the narratives that focused the blame-frame on initial human ignition were the least likely to address the broader anthropogenic blame associated with GWCC.

In many instances, the origins of ignition constituted a salient frame and the articles took up consideration of natural causes or an investigation of the initial human origins associated with arson or carelessness. A local paper from Colorado Springs cites the Fire Information Coordinator for the Rocky Mountain Area Coordination Center as saying, "80% of forest fires are human-caused"¹. However, an emphasis on the natural conditions or human origins of initial ignition ignores the global pattern of changing conditions and increasing range, frequency, and intensity of wildfire activity. An Australian news report details the effects of an illegal campfire on Fraser Island and cites police officers' arrest of four individuals. While

¹Buchmier, Brandon. July 1, 2020. "Crews Fighting Wildfire Northwest of Colorado Springs. *The Gazette*. para. 4

the article acknowledges “native vegetation in proximity then caught alight and started a wildfire” and explains that “the blaze consumed about 87,000 ha of land”², it does not relate the rapid spread of the fire to increasingly dry and unseasonal temperatures associated with climate change. Although the four individuals responsible for lighting the campfire can be blamed for the devastation, this narrative framing misses an opportunity to address the underlying conditions that heighten the risk of extreme wildfire events. Another Australian press article more effectively associates the rapid spread and difficulty of containing the Fraser Island fire with “strong dry northerly weather conditions and highly flammable vegetation types” but requires willing readers to infer the connection between these conditions and climate change³. In other instances, where climate change is mentioned, it is less clearly attributed to anthropogenic emissions. An article in *The Daily Telegraph* details a report by the Royal Commission into National Disaster Arrangements and refers to a list of 80 policy recommendations including fuel reduction measures, logistics support for disaster response teams, and clearer emergency warning and detection systems. The article cites the report and notes, “extreme weather had already become more frequent and intense because of climate change, with further warming over the next 20–30 years ‘inevitable’”⁴. In instances where policy recommendations are detailed, focus is more often directed toward regional land management policies and local fire mitigation strategies than toward a consideration of domestic environmental regulations and/or international climate policy. By directing attention toward the human ignition of wildfires and omitting larger connections to climate policy, these first two blame-frames distort wildfires causal connections to global warming and ignore worsening climatic conditions brought on by anthropogenic warming.

In other instances, climate change was more directly attributed to worsening wildfire events but expert details associated with causal reasoning were omitted in favor of a discussion of partisan framing. Partisan frames were particularly apparent in media coverage associated with the United States. A *New York Times* article cites then-candidate Joe Biden declaring that western fires would become “more common, more devastating, and more deadly” if Trump won a second term⁵. The article describes international climate policies as a point of divide between the two candidates and describes Biden’s pledge to rejoin the Paris climate agreement while noting President Trump’s casting doubt over the science associated with climate change and his active efforts to weaken federal environmental regulations. Although

partisan news frames involve references to policy action and include causal inferences related to GWCC, they have limited potential to leverage focusing events because they are perceived as controversial and debatable.

Changing Climate Conditions

In addition to increasing temperatures and declining seasonal precipitation, there are other important intervening factors that often necessitate media attention and direct focus towards local and regional policy solutions. Across Europe, one of the reasons for changing climate conditions is associated with land abandonment. An article in the *M2 Presswire* notes that the Mediterranean is particularly susceptible to wildfires as “an ageing population and the abandonment of traditional farming and forestry activity has led to extensive unmanaged lands. The result is an increase in flammable biomass in shrublands that can be easily ignited.”⁶ These changing conditions necessitate agroforestry practices that remove ground-level vegetation through farming practices like livestock grazing. Such practices may not immediately be associated with international climate policies or broader patterns of GWCC. Another article observes Scotland’s “increased risk of fires due to recent warm weather” alongside “increased amount of vegetation on the ground” as reasons for recent wildfire events⁷. While both articles direct attention toward the causal associations between wildfires and changing environmental conditions, these articles, and a dominant majority of the articles examined, did not identify narratives associated with blame and circumvented discussions of the origins. In these instances, the scientific expertise associated with land abandonment, peatlands distinctive burning characteristics, and/or consideration of agroforestry practices frames the changing climatic conditions as a regional problem distinct from changing global conditions.

In instances where climate change is effectively linked with increased wildfire risk, the science is rarely associated with policies that would reduce emissions or improve environmental conditions. An article in the *Edmonton Journal* (2020), a Canadian regional newspaper publication, cites a scientist who directly “puts the blame on human-caused climate change”⁸. However, in its description of climate models and projections, the article is framed as if to objectively evaluate the science and includes passages with the scientist describing the limitations of modeling efforts. Another article describes data from the Copernicus Climate Change Service (C3S) indicating that “the combination of pollutants emitted makes wildfires responsible for far greater air pollution than industrial emissions” and notes that the speed of land recovery can vary significantly—noting that burnt peatlands and areas of permafrost can take centuries to

²Antrobus, Blake, and Evin Priest. December, 2020. “Four Charged with Lighting Campfire Alleged to Have Sparked Massive Fraser Island Wildfire.” *News.com.au*, para. 9

³Clarke, Chris, and Tobias Jurss-Lewis. 2020. ““We Could’ve Lost the Island”: Fires Relies at Taking Over Fraser Fire Fight.” *The Courier Mail*, para. 8

⁴Silmalis, Linda. October, 2020. “Bushfire Victims Slam Royal Commission”: “A Lot of Hot Air and Arse-Covering.” *The Daily Telegraph*, para. 14

⁵Thomas, Ken. September 15, 2020. “Biden, Trump Take Dueling Approaches to Wildfires; President Cites Poor Forest Management, Expresses Doubt About Role of Climate Change, While Biden Says Four More Years of Trump Would Worsen Natural Disasters.” *Wall Street Journal*, para. 2

⁶“Wildfire Risk Can be Reduced with Agroforestry.” January, 2020. *M2 Presswire*

⁷Donnelly, Dylan. April, 2020. “Scotland Wildfires: Shocking Pictures Show Flames Raging Across Clydebank.” *The Express*, para. 11

⁸Weber, Bob. May, 2020. “Federal Scientists Predict High Wildfire Risk; Hot Dry Weather Expected to Increase Danger Throughout Western Canada.” *The Edmonton Journal*, para. 10

recover from wildfire events⁹. These articles describe climate change models and observe changing conditions correlated with increasing wildfire activity to examine the science itself or detail policies that are specific to fire mitigation strategies but fail to draw direct links to domestic or international climate policy. In another example, an *AFP International Text Wire* cites the governors of three states in the Western United States identifying causal connections between wildfire events and climate change. Washington Governor, Jay Inslee, is quoted as saying, “we’re living in a new world . . . The conditions are so dry and are so hot because the climate has changed”. However, the article then turns toward a discussion of under-resourced firefighters¹⁰.

A rare exception provides an exemplar of media coverage connecting wildfires to GWCC. Richard Dixon, director of Friends of the Earth Scotland writes an article for *The Scotsman’s* Inside Environment column and succinctly explains the changing conditions of wildfire events and the connections to anthropogenic GWCC. The short passage effectively demonstrates that the causal linkages between changing climate conditions and wildfires are not necessarily too complex for news narratives to capture. Dixon writes:

The average level of carbon dioxide in the atmosphere is increasing year-on-year as we burn more fossil fuels and lose more forest, so while the graph undulates it climbs ever upwards. . . . Forests on fire are a double whammy. As the trees burn, they release a short-term pulse of carbon dioxide to the atmosphere, accelerating climate change—the last thing we need.¹¹

The article goes on to describe the human death toll, wildlife consequences, and economic costs of wildfires in Australia. In another exception, a *New York Times* article cites the lead author of *The Lancet* report, “Climate action is a prescription for health” and observes the report calls for “national governments to make drastic reductions in emissions in the next 5 years” adding from *The Lancet’s* findings, “these next 5 years will be pivotal”¹². In both of these instances, connections to global changes are clear, a discussion of the anthropogenic contributions is emphasized, and urgent policy action is encouraged. Although under-represented in the findings, these frames effectively use scientific expertise related to anthropogenic factors of global warming and increasing wildfire risks to present the need for urgent policy action. Given their limited occurrence, they can hardly be described as a dominant frame. However, in the qualitative analysis, they are exemplary frames of strategic magnification because they demonstrate the possibility for such concise connections to be made in news media coverage of wildfires. Moreover, they indicate the importance of environmental coalitions and scientific experts’ engagements with the press as these

represent the only frames that distinctly address anthropogenic contributions to climate change when discussing wildfires events and environmental policy needs.

Proximity and Consequences

Previous research suggests that proximity to an extreme weather event or firsthand experiences with the consequences of extreme weather events should increase willingness to address GWCC (Li et al., 2011; Spence et al., 2012; Akerlof et al., 2013). However, the qualitative examination does not find a significant difference in local, regional or domestic news reports of wildfire events. The qualitative analysis suggests that international coverage of wildfire events may offer construal comparisons and discuss wildfires as both a consequences of, and contributors to, GWCC. This challenges existing theories associated with psychological proximity and construal distance, but might also be because international news frames are more likely to discuss GWCC as a global phenomenon.

Frames associated with the consequences, including economic costs and human casualties, illustrate spaces for greater connection to GWCC and could be more effectively framed to identify the need for climate policies that protect from wildfire losses. A *Wall Street Journal* article notes that 34 individuals had died in wildfires in the United States by September of 2020 with several fires still burning at the time of coverage¹³. The article details several business owners’ losses and describes entire towns that were destroyed by fast moving wildfires. However, the only mention of climate change and environmental policy is when the article details the political tension between California Governor Gavin Newsom and state officials seeking to improve coordination with federal government officials to encourage forest management and risk mitigation efforts. In addressing these governing stakeholders the article notes, “Mr. Trump has repeatedly denied climate change and called it “a hoax””¹⁴, before returning the article to its focus on the consequences of wildfire activities and noting the numbers of acres burned and human lives lost in California, Oregon, and Washington.

When comparing national and international coverage of wildfire events and causal climate change connections, there is no clear indication that one was more likely than the to develop frames linking the economic costs or casualties associated with wildfire events to broader climate change concerns. When considering media coverage and comparisons across the countries examined, there is no clear indication that proximity to wildfire events influenced the news reports likelihood to frame wildfires as a climate policy focusing event. Underscoring the importance of advocacy coalitions and scientific communication, instances where the consequences of wildfire events were framed to magnify connections to climate change often came from interviews with representatives from environmental organizations and/or scientific experts that were quoted in the coverage. A regional Vancouver, Washington newspaper cites

⁹“Will Extreme Wildfires Become the Norm of Tomorrow.” January 3, 2020. *Asia News Monitor*, para. 10

¹⁰Edelson, Josh. September, 2020. “‘Devastation’: Wildfires Ravage Western United States.” *AFP International*, para. 7

¹¹Dixon, Richard. January, 2020. “Inside environment.” *The Scotsman*, para. 2

¹²Sengupta, Somini. December 3, 2020. “Hotter Planet Already Poses Fatal Threats, Report Finds.” *New York Times*, para. 10

¹³Elinson, Zusha, and Alica A. Caldwell. September 16, 2020. “West Coast Fires Fueled by Winds as Dangers Continue; Blazes Tear Through Small Towns; ‘It Looks Like a Bomb Went Off.’” *Wall Street Journal*

¹⁴Elinson and Caldwell. 2020. “West Coast Fires . . . ”

experts at the Center for Climate and Energy Solutions to succinctly explain the connection: “Research shows that changes in climate that create warmer, drier conditions, increased drought, and a longer fire season are boosting these increases in wildfire risk. Warmer temperatures and drier conditions can help fires spread and make them harder to put out”¹⁵. The article goes on to note the 97 percent peer scientific consensus associated with anthropogenic GWCC and reports that a “drastic reduction in the burning of fossil fuels is necessary to keep the planet inhabitable”.

Although a number of articles detailed the economic costs and casualties associated with wildfire events, these consequences were not often presented as dominant frames. While examples of personalized narratives and firsthand accounts of wildfire devastation and climate migration challenges were present in the sample, these were less common than expected. A minor frame that emerges from the analysis is the industry amplification of the enormous financial costs associated with wildfires. Especially in the United States, wildfire events create considerable stress for insurance companies who end up paying for losses associated with many extreme weather events. A *New York Times* article details a \$13.5 billion-dollar settlement that the nation’s largest utility company has agreed to pay to wildfire victims in California¹⁶. This settlement reflects \$36 billion in claims from home and business owners who suffered losses in the 2017–2018 wildfires. Although the article does not provide any blame-frames or use scientific experts to discuss changing climate conditions, the article does consider the policy shortcomings that have left victims struggling to receive assistance and unable to access a fair settlement. As wildfire events become more frequent and risk impacting larger population centers and urban areas, it may be expected that media frames will increase causal associations with GWCC. Moreover, as insurance companies are faced with enormous claims from extreme weather events related to GWCC, it may be the case that they will put increased pressure on policymakers to implement climate policies that reduce the risk and mitigate the costs and consequences of wildfires. Research indicates that wildfire victims can only expect to recover 10% of their financial losses (Rossiello and Szema 2019). Framing insurance companies as stakeholders in media narratives about wildfire policies may ensure that wildfire reforms are not dismissed as “policies without publics”. Further, as larger population centers in developed nations are impacted by wildfire events, “climate refugees” may aspire to exert influence as public stakeholders with firsthand experiences of climate change.

Global Smoke Events and Construal Connections

One of the magnifying frames associated with the consequences of wildfire events is related to considerations associated with wildfire smoke. In the sample of international and domestic news

media coverage of wildfire events, 30% of the articles detailed the consequences of wildfire smoke. Articles identifying the connection between climate change and wildfire smoke could direct attention to the smoke’s contributions to global carbon emissions, discuss the individual health effects of breathing increased atmospheric carbon, and/or detail the travel of massive smoke plumes across borders. Appearing often, these comparative construal frames reached levels of saturation in the qualitative analysis; consider an article in the *National Post* titled, “Blame Canada: B.C. wildfires cause of air pollution alerts in New York City”¹⁷ which notes that health advisory warnings in the US were triggered by western Canadian wildfires. The article also notes that “the impacts of wildfire smoke, both regionally and at long distances, will become increasingly important in the coming years, with the number and severity of wildfires predicted to increase with climate change.” Another article, with the plumes going the other direction, titled “Wildfire smoke chokes Canada’s Western skies” reports that wildfires in the Western United States caused maximum air pollution levels in British Columbia. The article cites a meteorologist observing, “the current smoke event and other recent smokey periods in the province are directly linked to climate change” concluding “every year here we’re now seeing a smoke event”¹⁸. In a longitudinal analysis of print media in Australia, Germany, and India—Schäfer et al. (2014) find that “weather and climate characteristics are not important drivers of issue attention in all countries.” However, the findings in this study suggest that, as massive wildfire events emit considerable plumes of smoke into the sky and air quality becomes a concern among neighboring populations, news media will be an essential resource for public safety and these characteristics will become increasingly important drivers of attention. Research estimates the annual global mortality rate attributed to landscape fire smoke exposure to be 339,000 deaths (Johnston et al., 2012). However, when examining the correlations between media coverage of air quality concerns and wildfire events, Cisneros and Schweizer (2018) note that more often than not, “media sources failed in predicting smoke impacts” noting that they were correct only 32% of the time. If wildfires are to be effectively framed as climate change focusing events, media narratives will need to acknowledge that the massive smoke plumes release greenhouse gas emissions and demonstrate how the travel of these plumes across borders are a visual representation of those countries that have a disproportionate responsibility for climate change. As wildfire events multiply and grow more intense, the travel of these plumes is expected to continue impacting cross-border communities and invite considerations of international climate policy attention.

One interesting finding is that narratives reflecting construal connections across international borders may serve as focusing events to direct greater attention to global warming and climate policies. Social scientists use construal level theory to explain how

¹⁵“Reminder of Climate Change Blows Into Country.” September 9, 2020. *The Columbian*, para. 6

¹⁶Penn, Ivan, and Peter Eavis. January, 2020. “PG and E Says it’s Guilty in 84 Deaths from Fire.” *The New York Times*, p. B. 1

¹⁷“Blame Canada: B.C. Wildfires Cause of Air Pollution Alerts in New York City.” February 6, 2020. *National Post*, para. 15

¹⁸Austen, Ian. September 14, 2020. “Wildfire Smoke Chokes Canada’s Western Skies.” *New York Times*, para. 11

psychological distance increases subjects' tendency to make sense through abstraction in ways that can diffuse accountability and preclude effective action (Trope and Liberman 2010). Wakslak and Trope (2009) found that presenting events as uncertain and improbable increased psychological distance and Spence et al. (2012) found that those with lower psychological distance exhibited higher concern about GWCC. Brody et al. (2008) demonstrated a statistically significant but marginal correlation between the amount of financial damage and human fatalities caused by weather events and an individual's perceived risk of climate change. This previous research suggests that proximity to extreme weather events should heighten subjects concern with GWCC. Foundational research in psychology supports this expectation, indicating that individuals are more motivated to act when stimuli are perceived as occurring in closer proximity (McCrea et al., 2008). And indeed, it appears that wildfires and massive smoke events may have presented an opportunity for construal connections that traversed borders. A *Toronto Star* article titled "Australian wildfires draw attention to Canada's climate policies" directly attributes Australia's increasing threat of wildfires with the repeal of climate policies aimed at reducing greenhouse gas emissions. The article cites Catherine Abreu, the executive director of Climate Action Network Canada, speaking about Australian fire management and climate governance. She exclaims, "They're experiencing some of the worst climate impacts in the world and they have a climate-denying government that is failing to protect people against those impacts" and the author of the article adds, "Canada isn't immune from the same situation, with Conservatives campaigning in the last federal election on a rollback of key federal climate policies"¹⁹. These international policy comparisons recast the blame-frames and instead direct attention to responsibilities for global climate conditions and present effective environmental governance as an obligation of developed nations' responses to extreme weather events. However, it should be noted—that these comparative claims perpetuate a blame-frame of a different sort whereby countries are pitted against one another or otherwise disparaged for doing too little to reduce the global impacts of climate change. Future research should examine whether these comparative associations are more likely to influence readers to support climate policy action and consider how global smoke plumes challenge construal connections of proximity associated with extreme weather events.

Recommendations for News Media and Public Policy Practitioners

Research from the Yale Program on Climate Change Communication finds that the proportion of the population overall that expects wildfires to impact humans as a result of global warming more than doubled, from 26 to 54% between October 2014 and April 2020 (Roser-Renouf, et al., 2021). This

research suggests that even as stories increasingly attribute the origins of wildfire events to climate change, there remains a number of frames that may distort attention to climate policy. The triangulation of the quantitative data and qualitative findings illuminates several recommendations for news media industry experts and public policy practitioners communicating with journalists. As news media continue to address extreme weather events, they should aspire to frame wildfires as both a consequence of, and contributor to, climate change. The findings from the mixed-methods analysis of newspaper coverage of wildfires occurring in developed countries indicate that although wildfires are sometimes framed as a consequence of global warming, they are seldom recognized as dynamic contributors to global emissions. News media narratives should examine the complex contributions wildfires make to greenhouse gas emissions and account for the historical and international contributions to atmospheric carbon made by developing countries. Findings from the qualitative analysis identified exemplar instances of focusing event frames that demonstrated the possibility of succinctly explaining complex feedback loops associated with wildfire events and GWCC.

Additionally, this research challenges some of the previous findings which suggest that personal experience with an extreme weather event may be the most impactful. In the news narratives examined, frames associated with local weather conditions were often used without attribution to climate change. Alternatively, coverage associated with the international travel of smoke plumes caused by wildfires served to create two important frames related to wildfire events and climate change. The first frame functioned to provide an international account of responsibility for the concentration of atmospheric carbon represented by hazy skies. The second frame functioned to direct attention to the increasing size and growing danger of wildfire events occurring across the globe. Both frames function as construal connections that news media coverage should continue to explore in stories that examine the broader historical responsibility for global warming and unique contemporary contributions attributed to wildfire events. As a visual blight, the coverage of international smoke plumes traveling across borders may act as a proxy for developed countries' historically disproportionate contributions to GWCC and serve as an imperative for assessing health consequences and responsibility. This said, it is important to note that forest fires constitute only one-fifth of the annual emissions released by fossil fuel use (van der Werf et al., 2017).

If news media experts turn from individualized blame to collective responsibility, it will be necessary to identify new stakeholders. The qualitative analysis of news coverage provided in this paper suggests that insurance companies and utilities providers may be constituents of new "advocacy coalitions" that are uniquely positioned to direct conversations about the need for robust climate policies that would mitigate the increasing threat of personal injury and property losses. Indeed, the previously mentioned *New England Journal of Medicine* report notes that "the cost savings associated with reduced mortality and morbidity from exposure to PM2.5 and ozone is estimated to be 1.40 to 2.45 times as high as the cost of reducing carbon emissions" (Xu et al., 2020, 2,180). As extreme weather

¹⁹Ballingall, Alex. January 6, 2020. "Australian Wildfires Draw Attention to Canada's Climate Policies." *The Toronto Star*, para. 5–8.

events cost utility companies, insurance underwriters, and climate refugees billions of dollars in property losses, news media narratives should include representatives from these groups to frame addressing and mitigating the consequences of climate change as an economic imperative. Beyond the immediate economic consequences, a Brookings Institution report finds that “the most significant cost of wildfires is not the material losses they cause or the price of fighting them, but the impact that wildfire emissions have on climate change” (Ferris et al., 2013, 13). Using a valuation of the contemporary social cost of carbon (SCC) at \$51 per metric ton, the 2020 wildfires in California alone released \$5.7 billion worth of carbon into the air (with an estimated 112 million metric tons of CO₂ released) (California Air Resources Board, 2020). As the social impacts and financial costs associated with wildfire events become harder to ignore, it is expected that new advocacy coalitions will have an opportunity to frame climate policy focusing events.

Finally, this study confirms previous research that finds that the majority of media coverage surrounding wildfire events discusses few of the relevant and related scientific facts (Romps and Retzinger 2019). In the articles examined, there were few instances where wildfires were explicitly blamed on anthropogenic climate change. In instances where anthropogenic GWCC was cited as a causal reason for wildfire events, a close analysis of the coverage identified two blame-frames. The first related wildfires to partisan politics and positioned global warming as a polarizing policy issue. The second blame frame presented discussions of scientific and technical expertise but omitted considerations of policy action. Notably, narratives using the second frame were subject to the influence of the first. Consequently, blame-frames which examined scientific causality as a nonpartisan observation of fact were much less frequent in the news coverage. News media are encouraged to avoid politicizing wildfire events and should aspire to link climate science with policy to address the ways that changing climate conditions may be mitigated by effective policy interventions. When examining changing local conditions and policy considerations, the findings suggest that it is too easy for news narratives to direct attention away from global patterns of climate change and the types of policies that are necessary for substantial emissions reductions. Instead, by comparing countries policy responses and detailing the frequency and severity of wildfire events across the globe, it may be possible to frame wildfires as focusing events. However, to do so, public-private partnerships and knowledge sharing collaborations like those sponsored by the George Mason University Center for Climate Change Communication or the Yale Program on Climate Change Communication will be increasingly important.

Limitations and Directions for Future Research

Although media coverage from several developed countries was included in this analysis, the paper cannot make comparative claims between each nation’s media responses. The aim of this paper is not to distinguish the wildfire frames used by each country to determine which is the most likely to identify

attributions to GWCC. Instead, the aim of the paper was to identify how narratives of wildfire events in 2020 were circulated in international and domestic news coverage with attention to how the framing of wildfire events magnified or distorted developed nations’ focus on climate change attributions and international climate policy commitments. Although only a small frequency of newspaper coverage connected concerns with the corona virus and wildfire events (6%), these stories provided important public emergency response and evacuation information, directed important attention to concerns related to firefighter health and operating protocols, and identified concerns about exacerbated respiratory health issues for COVID patients impacted by wildfire events. Future research might consider the distinctive role that newspaper coverage plays in providing urgent public health and safety information. However, given the exceptional circumstances of a global pandemic and the accelerating rate of extreme weather events, it may be necessary to recognize the comparative limitations of temporally limited research.

While future research should consider a comparative and longitudinal content analysis of national and international media coverage to distinguish national differences in news coverage of wildfire events, such a study would be challenged by a number of factors. In addition to challenges associated with language transcription and coding, an international sample of local and regional news sources would require the ability to access news materials that may not be readily archived or accessed in international databases. Moreover, given that nations are differentially impacted by wildfires each year it would be particularly difficult to collect a recent and representative sample and misleading to aggregate and compare repeated samples. As it is, Canadian wildfires are underrepresented in this study because the extremes of the 2020 wildfire season in Canada were mitigated by above-average precipitation levels in many of the most susceptible regions. Additionally, instances of wildfire coverage are not uniformly covered in the news and, in the modern 24-h news cycle, can easily be interrupted by other unrelated “breaking news” events. A comparative and quantitative analysis would be challenged to effectively generate a statistically significant and equivalent sample of texts for each nation.

This paper expanded its qualitative analysis to include English language European news outlets as instances of wildfire events and the corresponding coverage were relatively few in the United Kingdom when compared to Australia and the United States which had record fire activity in 2019–2020. While this expansion effectively substantiates the analysis of qualitative frames circulating in developed nations, it does not create a representative sample of wildfire coverage. Although the findings reached qualitative saturation and considerable repetition was observed, the selection of newspapers articles examined only represents traditional media coverage in domestically and internationally circulated newspapers. In particular, future research may make a more concerted effort to access local area news publication. Given previous research associated with construal level theories and extreme weather events, it is possible that local media coverage is likely to

identify climate change as a cause of wildfire activity in the wake of an extreme wildfire disaster event (Li et al., 2011; Akerlof et al., 2013). However, in the instances of local newspapers that were included in the analysis, proximal connections to climate change were not observed with greater frequency. Instead, local media frames were vital resources for information related to localized issues and less likely to provide the depth of coverage observed in national or international newspapers. Future research may make a more concerted effort to examine local news coverage.

CONCLUSION

Theories of public policy, including the ACF and MSA, assume that the frequency and severity of extreme weather events will drive focusing events that shift public attention and direct considerations of climate policy (Alimi and Maney 2018; Baumgartner and Jones 2009; Birkland 1998; Bishop 2014; Kingdon 2010; Schwabe 2017). Construal theories of psychology suggest that the proximity to, and firsthand consequences of, extreme weather events will increase attributions to climate change. These theories imply that wildfires might serve as focusing events to open “policy windows” that precipitate public demand and policy responses. A qualitative examination of newspaper coverage and narrative framing suggests that media responses magnify wildfires as incidents that may nudge climate policy or distort the likelihood that they serve as a climate policy focusing event. The findings show that the frequency and severity of these events cannot be relied upon as sufficient framing devices that direct focus towards international climate policy. Although there are indications that climate change is discussed with greater frequency, the anthropogenic association of blame remains largely inferential and, in these instances, climate change functions as a reductive explanation for blame. This paper identified a select few rare exemplars that effectively explained the causal linkages between changing climatic conditions and increased wildfires in ways that presented an urgent need for policy action. While much less common, the existence of these narratives in the media coverage of wildfires demonstrates the potential for frames that magnify attributions to GWCC and open “policy windows” associated with international climate policy in future media coverage.

However, the analysis shows that when wildfire events are framed in association with individualized narratives of blame or regional climate changes, the newspaper coverage is more likely to attend to “policies without publics” and detail technical concerns about local land management policies and proximal impacts (May 1991). In these instances, a reductive framing of the blame and limited description of the changing climatic conditions leaves a void in which the frames blur, or are actively distorted, and the likelihood of a wildfire event functioning as a focusing event is mitigated. As Alimi and Maney (2018, 780) found, “not all transformative events are focusing events.” Given the prevalence of these blurred narratives and the inferential complexities associated with climate change attributions, it may be that newspaper coverage is missing an opportunity to frame wildfire events as dynamic GWCC focusing events. Existing frames and the politicization of climate change may be contributing to policy windows being simply stuck shut, notwithstanding attention to the

increasing frequency, extended duration, and expanded range of wildfire events. In either case, public attention to wildfire events does not appear to direct policy action as predicted by ACF theories and MSA approaches.

Research shows that if significant climate policy changes are not made by 2050 the risk of fire danger will be considerably exacerbated across many developed parts of the world. The *New England Journal of Medicine* notes optimistically; “if immediate climate change–mitigation steps are taken to limit the global mean temperature increase to 2.0°C or 1.5°C above the preindustrial level, then 60% or 80%, respectively, of the increase in wildfire exposure could be avoided” (Xu et al., 2020, 2,178–2,179). Whether the media lead this turn by framing extreme weather events as focusing events related to climate policy or whether governing bodies heed scientific experts’ advice and adopt these measures independently is outside the scope of this analysis. Nevertheless, the media coverage of wildfires and the narrative framing associated with climate change conditions surrounding their increasing presence will be important to creating new advocacy coalitions that champion these causal connections, with the possible effect of loosening stuck policy windows and jumpstarting processes envisioned under ACF or MSA models of public policy. The battle lines on climate are hardening with increased potential for policy fatigue and issue polarization. In response, and as new stakeholders face increasing costs and risk, deliberate and strategic frame changes must be deployed in the coverage of wildfires events to focus news narratives on the need for developed countries large-scale accountability and climate action.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/**Supplementary Material**, further inquiries can be directed to the corresponding author.

AUTHOR CONTRIBUTIONS

The author confirms being the sole contributor of this work and has approved it for publication.

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