

ABSTRACT

Title of Dissertation: A NEW JOURNALISM FOR A NEW
CLIMATE: IS SOLUTIONS JOURNALISM
THE SOLUTION?

Kathryn Abigail Thier, Doctor of Philosophy,
2023

Dissertation directed by: Dr. Xiaoli Nan, Professor, Department of
Communication

Climate change is an existential threat to humanity. Yet news warning about its risks has not typically included information about how to address it, possibly depressing support for policy action. Some scholars and practitioners suggest that an emerging reporting practice, solutions journalism, may offer an antidote. By showcasing credible, collective responses to social problems, such as climate change, solutions journalism may make progress seem possible, thereby increasing support for pro-social policies. However, little is known about climate solutions journalism, particularly its effect on audience climate action policy support. Accordingly, through content analysis and an experiment this dissertation seeks to answer two overarching and interconnected questions: 1) What is the nature of solutions journalism about climate change? and 2) How does solutions journalism about responses to climate change, compared with problem-oriented journalism, impact news audiences?

In Study 1, I undertook an inductive quantitative content analysis guided by Entman's (1993) four functions of framing. Cluster analysis of 244 text-based climate solutions news

stories published in U.S.-based outlets resulted in three previously undescribed news frames. The most prevalent frame, *the future is now*, focused on adapting to a changing climate which causes environmental problems. The next most prevalent frame, the *undeterred stewards*, described a variety of climate impacts and causes, frequently mentioned climate change's victims, and focused nearly equally on mitigation and adaptation responses. Stories emblematic of this frame featured responses led by people typically drawing on place-based identity and working cooperatively beyond partisanship. The least frequent frame, *moral mitigation*, focused on mitigation and who was responsible for both causing and addressing climate change.

Study 2 examined the effects of climate solutions journalism on preference for public-sphere policy support of climate action and climate misinformation susceptibility. I conducted a 3 (government solution vs. business solution vs. problems) x 2 (food waste vs. wildfire) + 1 (control) between-subjects online experiment among U.S adults ($N = 368$). Results showed that threat appraisals mediated the effect of solution (vs. problem) on preference for policy support, with topic-level analysis revealing the effect present for stories about climate-related wildfire, but not food waste. Additionally, political ideology moderated the effect of policy support preference in a manner consistent with solutions aversion, the idea that ideologically (in)congruent solutions bias information processing of solutions to social problems. This experiment also added to a growing body of research that solutions journalism increases audience positive affect, decreases negative affect, and increases media trust. Surprisingly, there were no evidence that several efficacy constructs mediated effects of story orientation on policy support. However, solutions journalism did decrease climate misinformation susceptibility through negative affect, but raised it through positive affect.

This dissertation provides several theoretical and practical implications. First, this study shows that climate solutions journalism is framed differently than traditional, climate journalism. In focusing mostly on climate change's negative environmental impacts, adaptation over mitigation, with little mention of causes, the most common climate solutions frame may not convey that mitigating greenhouse gas emissions is critical. Furthermore, the less frequently employed frames may better engage conservative audiences. This dissertation is the first to demonstrate that solutions journalism can increase threat appraisal, despite increasing positive affect and decreasing negative affect, and do so without depressing support for policy action. In doing so, this dissertation answers calls for solutions research guided by theory although findings suggest additional theory development is needed. In sum, this dissertation offers support to the idea that climate solutions journalism is a promising journalistic approach for the reality of the Anthropocene age.

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JOURNALISM THE SOLUTION?

by

Kathryn Abigail Thier

Dissertation submitted to the Faculty of the Graduate School of the
University of Maryland, College Park, in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
2023

Advisory Committee:

Professor Xiaoli Nan, Chair

Associate Professor Nick Joyce

Associate Professor Kang Namkoong

Associate Professor Anita Atwell Seate

Professor Sarah Oates, Dean's Representative

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Dedication

In memory of my father, Dr. David Wellin, who used science to do what was right; my paternal grandfather, Marty Wellin, who found humor everywhere as he fought for a more just world; my maternal grandmother, Freda Rosenblum, who told me my writing mattered; and to my paternal grandfather, Bernard Rosenblum, whose greatest wish was that I found meaningful work. And to the boys – Phantom, Scrap, and Gnocchi.

Acknowledgements

To my advisor, Dr. Xiaoli Nan, thank you for your ongoing guidance and the many opportunities that helped me reach this day. I learned so much from you these past four years, for which I will be forever grateful.

To my communication department committee members and professors, Drs. Kang Namkoong, Nick Joyce, and Anita Atwell Seate: In different ways, each of you expanded my thinking about theory and methodology, making me a better scholar. Thank you for every talk and believing in my research. To my committee member Dr. Sarah Oates, thank you for your willingness to share your journalism research expertise to make this project stronger.

Other scholars at UMD also impacted my doctoral journey. In my department, thank you to Drs. Brooke Fisher Liu and Jiyoun Kim, who expanded my thinking about risk, crisis, and science communication and believed in my research. I thank you for inspiring me as educators and scholars. Dr. Linda Macri of the Graduate School Writing Center, thank you for creating community, teaching me the psychology of academic writing, and for your support and kindness. From the Department of Human Development and Quantitative Methodology, thank you to Drs. Greg Hancock and Tracy Sweet. Dr. Hancock, your dedication to your field and your students is unparalleled. Dr. Sweet, thank you for your kindness.

Many UMD COMM students, current and former, helped me along the way – more than listed here. To my fellow Homoscedastics, John Leach and Saymin Lee – as Dorothy said, “you’re the best friends anybody ever had.” I could not have made it through without your unconditional friendship. Tong Lin, my academic little sister,

I'm glad we found each other. Dr. Victoria Ledford, thank you for your wonderful mentorship, advice, and friendship. Dr. Romy Wang, thank you for your mentorship, and Dr. Junhan Chen, thank you for always being there with a smile. Dr. Yuan Wang, you are a wonderful colleague and collaborator. Ashley Aragón, Ari Perez Montes, and Umisha KC, thank you for your camaraderie and support. XingMan Wu, I appreciate your dedication and good cheer helping me code for this project.

My research journey started at the University of Oregon, where Dr. Nicole Dahmen, journalist extraordinaire Brent Walth, and I took a journey to create something new about solutions and investigative journalism. Brent, thank you for listening past the unicorns and rainbows. Nicole, thank you for suggesting I write my first research article and believing I could do it, and for being my mentor and friend every step of the way through my PhD and life. Thank you to Dr. Roland Good III, my first statistics professor, who told me I had the mind for this, so I believed it. I will never forget your first lecture, which changed my mind about quantitative analysis, its power, its delights, and our responsibilities as researchers. You had me at, "Variables are just characters, characters we use to tell a story through our analyses."

Thank you to fellow solutions journalism researchers, Drs. Karen McIntyre and Kyser Lough, for welcoming me into the club and for your true friendship.

Thank you to Ruth Wellin, who provided a writing space at a critical time and to my other family members, especially my paternal grandmother, Pearl Wellin, who cheered me on along the way.

Most importantly, Thekrimt4. My daughters, Ruby and India, who sacrificed so I could pursue this path. Thank you for that and for every day showing me how much more there is to my world. And to my husband Michael, who was the first to make me see I could be a scholar. You helped me believe something new about myself and then you made it possible for me to become it. Thank you for taking care of our family so well these past four years.

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Chapter 1: Introduction and Rationale

“The need for a new climate could hardly be more urgent. The challenge for journalism is unprecedented too.” (Painter, 2019, p. 428)

Disruption and danger from climate change to nature and human civilization is more pervasive and serious than previously thought (Intergovernmental Panel on Climate Change [IPCC], 2022). Severe weather and wildfire, drought, and wildlife and agricultural disease due to climate change are proliferating (IPCC, 2022). In humans, climate change-related diseases, mental health distress, and interruption of health services are increasing, with more “ill health and premature deaths” expected in both the near and long term (IPCC, 2022, p. 15). To stave off the direst consequences, immediate adaptation to and further reductions in greenhouse gas emissions are required (IPCC, 2022). While climate-induced threats overlap with and fuel other social problems, such as inequality, poverty, biodiversity loss, land degradation, and habitat loss, responding to climate change in ways that equitably address these intersecting issues is still possible (IPCC, 2022).

Despite years of scientific warnings about the increasing threats, journalists covering climate change have failed to sustain public interest and spark systemic social change (Hackett et al., 2017; Painter, 2019). Initial challenges for climate change journalism, such as lack of editorial interest and highlighting climate skeptics in the name of (false) balance (Boykoff, 2007), have largely given way to declining trust in news media and coverage focused on conflict rather than adaptation and resilience (Painter, 2019). Globally, news audiences distrust mainstream media and tune out negative news (Newman et al., 2019), with a partisan media trust gap in the US widening due to steep declines in media trust among Republicans (Gottfried & Liedke, 2021). If the “primary purpose of journalism is to provide citizens with the information

they need to be free and self-governing” (Kovach & Rosenstiel, 2014, p. 17), news avoidance and declining media trust pose serious threats to American society, including our ability to address multi-faceted social problems such as climate change. Specifically, about one in five Americans report psychological distress due to global warming (the mechanism of climate change) with 15% reporting they attempt to avoid information about it (Leiserowitz, Maibach, Rosenthal, Kotcher, Carman, et al., 2023). While “narratives play an important role in communicating climate risks and motivating solutions” (IPCC, 2022, p. 4), the news media’s focus on climate change-provoked problems at the expense of solutions disempowers audiences from advocating for collective responses (Hackett et al., 2017). This negativity bias in climate coverage has created a “perceived solutions gap” globally (Ipos & Futerra Solutions Union, 2021, n.p.). Most critically, traditional, problem-oriented climate change news de-emphasizes “agency, hope, and efficacy” (Hackett et al., 2017, 7).

Solutions journalism, which highlights credible responses to social problems, may provide an antidote. Proponents seek to balance journalists’ negativity bias with objective stories of credible responses to social problems. Unlike light-hearted features about individuals performing one-off good deeds, solutions journalism stories detail programmatic or systematic attempts to address social ills (Lough & McIntyre, 2018; Thier, 2021). Merely providing information about wrongdoing or problems, journalism’s traditional approach, does not spark social change; news audiences need examples of responses to social problems backed by evidence (Bornstein & Rosenberg, 2016).

Initial evidence for this emerging journalistic approach suggests solutions-oriented news counteracts negativity (Overgaard, 2021a, 2021b), induces positivity (e.g., McIntyre & Sobel, 2017), increases self-efficacy (e.g., Curry & Hammonds, 2014), and restores media trust, (Thier

et al., 2021). Furthermore, journalists perceive that constructive journalism, a potentially superseding practice, may reduce susceptibility to misinformation by engaging audiences, increasing media trust, and reducing polarization (van Antwerpen, Turnbull et al., 2022).

Unpacking climate change solutions journalism is not merely academic, as news consumers, journalists, and scholars seek changes in climate change journalism. Although youth are more fatalistic about society's ability to slow climate change (Ipos & Futerra Solutions Union, 2021), they gravitate toward solutions stories, including about the environment on social media (Hutchins & Granger, 2019). More than three-quarters of the American public is interested in news not just about climate impacts, but about local, national, and international climate protection actions undertaken by communities, government, and business (Maibach et al., 2020). Shifting journalistic coverage from "apocalyptic visions" to "empowering solutions" may motivate climate protection (Guenther et al., p. 2021, p. 143), with some scholars suggesting it is imperative:

We argue that solutions journalism, defined by McIntyre (2019) as "...a more productive style of reporting that recasts social problems in terms of their possible solution," is a necessary practice for climate change reporting as society works toward abating the worst effects of climate change," Borth et al. (2021, p. 446).

Yet whether climate sustainability stories inspire efficacy and intentions to act more so than traditional problem-oriented journalism is an open question (Guenther et al., 2021). Solutions journalism research is in its infancy, and only one study has directly compared textual solutions journalism about a response to climate change with a similar problem-focused story (Thier & Lin, 2022). Additionally, research about solutions journalism suffers from a lack of theory (Lough & McIntyre, 2023). After systematically reviewing the solutions and constructive journalism literature, McIntyre herself and colleague Lough concluded:

Overall, the research was much stronger in reviewing literature than in incorporating (let alone testing) theory...solutions journalism lack[s] strong theoretical explanation for [its] effects We challenge scholars to consider theoretical explanations for the possible effects of these journalistic approaches. For example, why, theoretically, should we expect a news story focused on a response to a problem to increase self-efficacy? (2023, p. 14-15)

To answer this charge, this dissertation undertakes two studies: a content analysis of climate solutions journalism and an experiment. In the content analysis, I inductively analyze climate solutions journalism to extend framing theory about climate news. In the experiment, I incorporate theory from persuasion, health communication, political science, social psychology, and risk communication literature, to propose a parallel mediation model where solutions journalism evokes cognitive and emotional responses that in turn affect individuals' support for climate policies. In another analysis based on the solutions aversion model (Campbell & Kay, 2014), I explore how ideological identification impacts policy support effects of solutions journalism. Climate change is a highly partisan and ideological issue in the US (Pouschter et al., 2021), yet solutions-oriented journalism may reduce such polarization (van Antwerpen, Turnbull et al., 2022) and temper negative public discourse (Solutions Journalism Network [SJN], 2023a). When news audiences do not trust news media journalism cannot play its essential role in upholding democracy (Strömbäck et al., 2020). Media trust helps determine whether journalism informs, educates, and influences (Kohring & Matthes, 2007), yet it is unclear how media trust relates to audience perception of climate change coverage (Painter, 2019). Therefore, this dissertation tackles the related problems of declined media trust and fake news (Painter, 2019) in the context of climate change journalism to determine if solutions-oriented news reduces susceptibility to climate misinformation.

Despite changing approaches to journalism generally and climate change journalism specifically (Guenther et al., 2021; Painter, 2019), little is known about how climate change

solutions journalism is framed (Schäfer & O'Neill, 2018), or the effects of solutions journalism specifically about climate change on audiences. Accordingly, through content analysis and an experiment this dissertation seeks to answer two overarching and interconnected questions: 1) What is the nature of solutions journalism about climate change? and 2) How does solutions journalism about responses to climate change, compared with problem-oriented journalism, impact news audiences?

Chapter 2: Solutions Journalism Overview

History and Definition

Solutions journalism is an emerging journalism practice that emphasizes credible news stories about collective responses to social problems with the goal of offsetting news' negativity bias. While solutions journalism as a defined concept gained traction with the 2013 creation of the nonprofit Solutions Journalism Network (SJN) (Lough & McIntyre, 2023; Wenzel et al., 2018), the practice draws on long-standing journalism ideals of the social responsibility theory of the press (McIntyre & Gyldensted, 2018a, 2018b; McIntyre, Dahmen, et al., 2018, first articulated by the Hutchins Commission in 1947 (Commission on Freedom of the Press, 1947; Siebert et al., 1963). The social responsibility of the press is not just a moral ideal but a practical one, insisting that journalists consider society's best interests during news production and after media exposure (Hopkinson & Dahmen, 2021; Kovach & Rosenstiel, 2014; McIntyre, Dahmen, et al., 2018; McIntyre & Gyldensted, 2018b). Part of that consideration includes examining how journalistic coverage enhances democratic functioning. In the social responsibility theory of the press, individuals need information not just about problems but also solutions to make the best decisions for society (Hopkinson & Dahmen, 2021; Kovach & Rosenstiel, 2014; McIntyre, Dahmen, et al., 2018; McIntyre & Gyldensted, 2018b).

Still, the prevalence of problem- and conflict-focused news rose with the early 20th century professionalization of journalism (Friedland, 2003; Rosen, 1996), sparking reform movements that preceded solutions journalism. For instance, peace journalism in the 1970s proposed peaceful conflict resolution and hostility reduction as newsworthy topics for war and conflict reporters (Galtung & Fisher, 2013; Youngblood, 2021), while civic or public journalism promoted including solutions coverage with traditional issue coverage, alongside other reforms

such as increased public engagement by reporters and news outlets (Rosen, 1996; Rosenberry, 2021). Civic journalism enjoyed success at many U.S. regional newspapers particularly, but lack of a cohesive definition and philosophy contributed to its decline as a movement after the mid-2000s, although many of its practices evolved into industry standards (Rosenberry, 2021). As heir to these movements (Wenzel et al., 2018), solutions journalism echoes more recent calls by media critics that solutions are indeed newsworthy and that journalists cover them (Gans, 2010; Schudson, 2011). Furthermore, new journalistic approaches that are solutions- and audience-focused are needed in the digital, global, networked, and less hierarchical 21st-century (Hermans & Drok, 2018; Kovach & Rosenstiel, 2014). Today's online audiences consider as news content that "extends beyond the boundaries of journalism" (Swart et al., 2022, p. 16), with journalism operating in a post-truth era where different belief communities disagree agreement about basic facts and the role of journalism in society following "the collapse of the old news order" (Waisbord, 2018, p. 1866).

SJN, which is dedicated to legitimizing and spreading solutions journalism, defines the practice as "rigorous coverage" of existing responses to social problems (SJN, 2023b, para 1) with stories that exhibit four essential qualities about the solution described: 1) the response and how it operates, 2) evidence of effectiveness, 3) insight that may aid in response replication, and 4) limitations. Building on this checklist for practitioners, scholars have identified seven somewhat overlapping components associated with solutions journalism and its cousins in comparison with problem-oriented news (Thier & Namkoong, 2023), or reporting organized around a social problem and often "framed to highlight conflict" (McIntyre & Lough, 2021, p. 1559). The first key component of solutions journalism is its frame(s).

As a contextualist type of journalism (Abdenour et al., 2018), solutions stories include discussion of an underlying social problem, yet are framed as a societal “treatment recommendation” (Entman, 1993, p. 52; McIntyre & Lough, 2021). In addition to this solutions-oriented frame, solutions journalism stories by necessity embody thematic frames in emphasizing a structural, rather than a one-time, episodic response to a problem (Lough & McIntyre, 2018; Thier, 2021). The thematic theme grounds solutions journalism in “hard” news, or news about the public good or policy issues (From and Nørgaard Kristensen, 2018), rather than “soft” news about uncontextualized events (Reinemann et al., 2012). Solutions journalism also employs issue frames, by providing holistic, contextual reporting on both a problem and response and attempting to avoid polarization (Hermans & Gyldensted, 2019). As such, the form – solutions journalism - dictates the frames. In contrast, problem-oriented journalism may be organized by episodes or themes, issues or strategy (McIntyre & Lough, 2021; Thier & Namkoong, 2023). For instance, a problem-oriented story about crime could focus on a crime event (episode), place a crime or crimes in context (thematic), discuss the underlying issue (by including expert knowledge about crime) or explore political or social debate about the issue (strategy). The selection of a solutions-oriented frame is among the most critical distinctions between solutions and problem journalism, driving a story’s qualities and scope, as well as the reporting process (Thier & Namkoong, 2023).

Scholars have relied on the four qualities codified by SJN and SJN metadiscourse to characterize a broader suite of the practice’s elements. By delving into how a programmatic or social solution unfolds in response to a problem, scholars find solutions journalism (at least as idealized) to be comprehensive, contextual, and holistic (Atanasova, 2019; McIntyre, Dahmen, et al., 2018; Powers & Curry, 2019). This comprehensive scope of solutions journalism is an

essential component, whereas problem-oriented journalism is not necessarily comprehensive (Thier & Namkoong, 2023). For instance, problem-oriented journalism with an episodic or strategy frame would not provide a comprehensive explanation of a social ill. By contrast, the contextualizing of the problem and the operational “how,” plus evidence of response efficacy and limitations makes solutions journalism rigorous (McIntyre, Dahmen, et al., 2018; McIntyre & Lough, 2021) and improves accountability by “deligitimiz[ing] excuses for inaction” (SJN, 2023b, para. 3). While journalists consider solutions and investigative reporting similar in identifying social problems and seeking to explain their causes (Lough & McIntyre, 2018), content analysis reveals elements of the two practices rarely overlap in practice (Walth et al., 2019).

The reporting process for solutions journalism is presumed to follow the normative, objective ideal (Aitamurto & Varma, 2018), yet the requirements of SJN’s four qualities dictate different approaches than reporting problem-oriented journalism. The process diverges at the start when a solution, not a response, is selected for coverage (Amiel & Powers, 2019; Lough & McIntyre, 2018; McIntyre & Lough, 2021). Gathering information to answer the “how” of the response (Aitamurto & Varma, 2018, Lough & McIntyre, 2018), the evidence, the insight, and the limitations presupposes accessing different sources and asking them different interview questions. While journalists engaged in solutions journalism tend to report such reporting process changes in their reporting process (Lough & McIntyre, 2018; Powers & Curry, 2019), top-down efforts to integrate the practice in newsrooms can result in little actual change (Amiel & Powers, 2019).

Another key component of solutions journalism is its orientation, which not only prioritizes reporting on responses to social problems but also is implicitly pro-social (Abdenour

et al., 2021; Thier & Namkoong, 2023), in line with the social responsibility of the press (Abdenour et al., 2021). Despite belief that responses to social problems are newsworthy and required for the social good, journalists engaging in solutions journalism view themselves as performing a normative journalistic role (Aitamurto & Varma, 2018). In other words, solutions journalism is a new name for an old practice: objective reporting on how groups and communities respond to social ills. At the same time, in counteracting the ubiquity of negative news by increasing the prevalence of solutions-oriented news such journalists engage in new normative roles suited for today's digital, audience-centered age (Aitamurto & Varma, 2018; Kovach & Rosenstiel, 2014). SJN asserts that such news can assist people to “envision and build a more equitable and sustainable world” by providing the knowledge needed to address “crises” such as inequality, racism, extreme polarization, political dysfunction and [the] environment” (SJN, 2023a).

While SJN insists solutions journalism is not advocacy despite its reform-minded goals (SJN, 2023c), journalists debate the practice's boundaries (Lough & McIntyre, 2023; Thier & Namkoong, 2023). Some Western journalists believe solutions journalism might be advocacy, should include mobilizing information, or that journalists should serve as active societal change-makers (McIntyre & Lough, 2021; Powers & Curry, 2019), although one study reported that journalists covering African humanitarian crises felt solutions coverage was unethical (Kogen, 2019). Despite embracing a change-making role, journalists operating in independent media contexts who cover solutions do not engage in advocacy because their reporting prioritizes truth and accuracy (Ginosaur & Reich, 2022).

Solutions vs. Constructive Journalism

Defining solutions journalism by its frames, qualities, scope, purpose, orientation, boundaries, and reporting practices is challenging because of its co-emergence with a related and sometimes conflated practice, constructive journalism (Lough & McIntyre, 2023). Within the industry, distinctions result from where the practices emerged, occur, and are promoted: constructive journalism largely in northern Europe and solutions journalism in the U.S. (BBC World Service, 2016; Lough & McIntyre, 2023). Scholars argue that constructive journalism is a broader construct that includes solutions-oriented journalism (McIntyre & Gyldensted, 2018a, 2018b), are separate practices (From & Nørgaard Kristensen, 2018; Thier, 2021), or are “separate but intertwined” (Lough & McIntyre, 2023, p. 1070).

A critical difference is that one of constructive journalism’s two competing strands (Bro, 2019) explicitly relies on a social scientific rationale for its *raison d’etre* and craft routines. Specifically, constructive journalism (as conceived by practitioner-scholar Cathrine Gyldensted) employs positive psychology techniques in news processes and production. In contrast to traditional psychology’s focus on pathology and disease, positive psychology examines individual and community thriving (International Positive Psychology Association, 2017; McIntyre & Gyldensted, 2018b). Constructive journalism news production techniques drawn from positive psychology include explicitly considering audience well-being, evoking positive emotions in stories, employing depolarizing interview techniques, and focusing on solutions (McIntyre & Gyldensted, 2018b). Research about solutions stories designed to include positive emotional elements in the constructive tradition challenge comparative assessment of studies about solutions-oriented journalism more broadly.

The other strand of constructive journalism formulated by journalist Ulrik Haagerup does not draw on positive psychology and is focused more on constructive, or socially beneficial, selection and presentation of news, and how news creation affects journalists, whereas Gyldensted additionally considers how news affects audiences and may inspire social change (Bro, 2019). While Haagerup's style of constructive journalism has made strides in educating journalists and changing news products (Bro, 2019), Gyldensted's version stemming from positive psychology is the style more researched by media effects scholars.

Another crucial difference between solutions and constructive journalism is that the latter need not include coverage about responses to social problems, although such stories are typical. Constructive journalism encompasses a plethora of reporting techniques (Hermans & Gyldensted, 2019; McIntyre & Gyldensted, 2018b) that may be "implemented and combined in various ways (Hermans & Prins, 2022, p. 1078). For example, constructive journalism explicitly includes depolarizing interview techniques, which SJN promotes as strategy outside the practice of solutions journalism. Constructive journalism about solutions can include reporting on future possibilities, not just existing responses – a more speculative endeavor. As such, constructive journalism may be framed as not just solution-oriented, but also future-oriented (Hermans & Gyldensted, 2019). Although constructive reporting about solutions is objective, such stories do not adhere to SJN's four-quality typology (response and how, evidence, insight, and limitations). While constructive and solutions journalism are similarly normative (Aitamurto & Varma, 2018), constructive journalism may be action-oriented with no prohibition on mobilizing information (Hermans & Drok, 2018). In addition to normative journalistic roles (monitorial, facilitative, collaborative, and radical) outlined by Christians et al. (2009), constructive journalism offers another normative role (constructive) focused on solutions, social hope and

progress, and journalist as a change agent, with solutions journalism an example practice (Aitamurto & Varma, 2018). Debate over the active-passive continuum of journalistic roles is more pronounced in constructive than solutions journalism (Thier & Namkoong, 2023), but constructive journalism “both reinforces and challenges dominant Anglo-Saxon journalistic norms and practices” (Aitamurto & Varma, 2018, p. 696). Both Gyldensted and Haagerup stress that constructive journalism is independent journalism (personal communication October 19, 2022).

Further complicating the matter, other forms of constructive journalism share elements with solutions journalism. For instance, restorative narrative, a reporting genre focused on individual and community recovery (rather than policy or programmatic responses in solutions journalism) and resilience in response to traumatic events or crises with “solutions-based descriptions” and “inspiring emotions,” (Dahmen, 2019; Schäfer et al., 2022, p. 4) is considered a type of constructive journalism (McIntyre & Gyldensted, 2018a) or contextual reporting (Abdenour et al., 2018; McIntyre, Dahmen, et al., 2018).

This dissertation does not seek to settle whether solutions journalism is a subset of constructive journalism. Due to the recency of scholarship specifically addressing emerging practices about solutions-oriented news, this dissertation draws on all available literature pertaining to solutions orientation of news stories. Furthermore, many studies mislabel solutions and constructive news, resulting in a lack of construct clarity.¹ However, because creating a solutions-oriented news story does not require following principles of positive psychology, solutions journalism news sampled in this dissertation’s content analysis or employed as stimuli

¹As an example of the lack of clarity about the distinction between constructive and solutions journalism, Aitamurto and Varma (2018) suggest simultaneously that constructive journalism and solutions journalism are separate practices, that constructive journalism is additionally termed solutions journalism, that the two practices are similarly defined, and that constructive journalism includes solutions journalism.

in the experiment are aligned with SJN’s definition. In other words, solutions journalism contains four specific qualities in reporting on a credible response to a social problem (how the response works, evidence of effectiveness, insight, and limitations).

Industry Acceptance

Globally, solutions journalism is gaining steam within the journalism industry (Bauder, 2023; Lough & McIntyre, 2021; Nelson & Dahmen, 2023). Prominent news outlets such as The BBC’s World Service and *The Guardian* have added solutions-reporting verticals and entire regional legacy or start-up newsrooms have either revamped or debuted as solutions-only news sites (Lough & McIntyre, 2021; Nelson & Dahmen, 2013; Thier, 2021). A survey of US newspaper journalists found that they, particularly younger and female ones, highly valued three contextual practices – solutions journalism, constructive journalism, and restorative narrative – with activist beliefs in agenda setting and including solutions in coverage predicting favorable attitudes toward all three practices (McIntyre, Dahmen, et al., 2018). Although US TV news workers surveyed were largely unfamiliar with these three contextualist genres, they were more likely to practice them all than newspaper journalists (Abdenour et al., 2018). To date, SJN has engaged with more than 500 newsrooms and 20,000 journalists around the world through trainings, grants, and newsroom or journalist projects (SJN, 2023a). Faculty and students in higher education journalism courses see solutions journalism as valuable for their future professional development (Cox, 2018; Thier, 2016), with SJN announcing in 2022 solutions journalism “hubs” dedicated to advancing solutions journalism teaching, research, and service at four U.S. universities (SJN, 2022).

Audiences also appear to appreciate solutions journalism. Several experimental studies reveal that solutions journalism has positive effects on audiences’ news interest and engagement

(e.g., Dahmen et al., 2019; McIntyre, 2019, Overgaard, 2021a), with a recent survey of American news consumers surveyed finding they place a higher value on contextual, rather than traditional journalistic roles (Abdenour et al., 2021). By holistically including both social problems and responses, solutions journalism holds promise for engaging historically marginalized communities (Wenzel & Crittenden, 2021; Wenzel et al., 2018), although perceptions about solutions journalism's content and purpose differ with audience members' intersectional identities (Banjac, 2022; Wenzel et al., 2018). While solutions journalism news audiences who read such news online view such stories more and spend more time on page than on traditional stories (Lough & McIntyre, 2021), connecting this increased audience engagement to increased audience-driven revenue remains challenging (Nelson & Dahmen, 2023). However, some journalists believe audience metrics are not sophisticated enough to demonstrate the link between solutions journalism and enhanced revenue and that solutions journalism initiatives are critical to gain foundation funding for news (Nelson & Dahmen, 2023).

On the climate change beat, newsrooms are betting increasingly on solutions journalism. In the US, two major legacy print-based news outlets recently launched climate verticals - *The Washington Post's* Climate Solutions in 2019 and *The New York Times'* Climate Forward newsletter in 2017. In 2022, National Public Radio hired its first climate solutions reporter. Three of the major digital-only news outlets – Huffington Post, Vice, and BuzzFeed – significantly cover climate change in a bid to reach younger viewers and have become the most popular online news sources in the US and UK for audiences interested in environmental news (Painter, n.d.).

SJN also promotes climate solutions journalism by funding an international newsroom community of practice around business and sustainability, fellowships for solutions journalism

entrepreneurs (many who focus on climate change), and an initiative to increase science and health journalism in Africa through partnerships with local organizations and newsrooms (SJN, 2023d) SJN's goal is to "move climate journalism from the unsolvable and apocalyptic to catalyze" change (F. Warner, personal communication, April 29, 2022). SJN's Climate Beacon Newsroom Initiative began in December 2022 with nine US newsrooms to help newsrooms transform their climate solutions coverage from one-off projects to everyday practice (SJN, 2023e). Another project begun in the spring of 2022 created a 20-member climate fellows' cohort of U.S.-based journalists who will create environmental justice stories to be re-broadcast by the Public News Service to radio stations around the country. SJN's ongoing Africa Initiative, which is led by African journalists and funds newsrooms and fellows, develops curricula, and trains journalists, has created workshops and Internet courses for African journalists, as well as for the non-governmental organization African Women in Media and the United Nations Environment Programme on the African Green Stimulus Plan (AWIM, n.d.; R. Meyer, personal communication, April 21, 2022). Beyond SJN, the BBC's international charity arm BBC Action Media trained East African radio journalists in climate reporting and created free, online training about climate reporting, both of which included climate solutions journalism (BBC Media Action, 2022).

Academic Acceptance

Industry moves toward solutions reporting has piqued scholars' interest, with solutions and constructive media effects scholarship increasing rapidly since appearing in the peer-reviewed literature in 2016 (Lough & McIntyre, 2023). Initially a-theoretically driven by industry concerns, few studies rely explicitly on theory (Lough & McIntyre, 2023). Yet some have conceptually drawn on theories, such as communication infrastructure theory (e.g., Wenzel

& Crittenden, 2021; Wenzel et al., 2018), grounded theory (Konieczna, 2020; Varma, 2019), cognitive appraisal theory (e.g., McIntyre, 2020) with only a few directly testing theories (Lough & McIntyre, 2023), such as narrative transportation theory (e.g., Dahmen et al., 2019; Thier et al., 2019) and the broaden-and-build theory of positive emotions (e.g., McIntyre, 2020; Overgaard, 2021a). Advancing solutions journalism scholarship will require additional focus on theory building and theory testing (Lough & McIntyre, 2023), which this dissertation sets out to do.

The news topics and social issues addressed by solutions journalism scholars cover a range of social issues – opioid addiction (Dahmen et al., 2019; Li, 2021; Thier et al., 2021), environmental degradation (Baden et al., 2019; Overgaard, 2021a), COVID-19 (Overgaard, 2021b), graffiti and rising college tuition (McIntyre, 2019), school discipline and Native Alaskan community rehabilitation (Thier et al., 2021), sex trafficking (McIntyre & Sobel, 2017), war and peace (Baden et al., 2019), prisoner rehabilitation (McIntyre, Lough, et al., 2018), and homelessness (Dahmen et al., 2019) – with some studies reporting topic-level effects. Solutions and constructive journalism research that explicit mention climate change as the social issue in all experimental conditions is limited to a single study (Thier & Lin, 2022). The present dissertation seeks to increase solutions journalism research about the existential issue of climate change (IPCC, 2022) and extend theory about an emerging journalistic practice with potential pro-social benefits to offer theoretical and practical implications for scholars and practitioners alike.

Chapter 3: Study 1 Research Question

Framing of News

By bounding information in time and space, media helps individuals determine meaning and construct political, social, and cultural reality about issues and events. Just as the frame of a painting or photograph suggests a particular interpretation of the content, so does a media frame affect how media is processed and understood. Yet because framing may occur throughout the communicative process – within the communicator, the text, the receiver, and the culture (Entman, 1993), media framing theory lacks a shared theoretical model, resulting in theoretical and empirical vagueness (Scheufele, 1999; Vreese, 2005). One typology of framing suggests that frames may be either media frames, those used by journalists to organize information, or individual frames, individuals' stored mental schemas, with different studies employing either type as independent or dependent variables (Scheufele, 1999). Another typology suggests frames may be generic or issue-specific, or relevant to specific issues only (Vreese, 2005). Some commonly studied generic frames are strategic (i.e., strategy of political contests), episodic (focusing on a breaking news event), thematic (events placed in context), conflict, human interest, attribution of responsibility, morality, and economic consequence (Vreese, 2005).

In addition to contested conceptual definition, framing research has also been muddied by debate whether framing is its own process or part of agenda setting. Agenda setting theory (McCombs & Shaw, 1972) suggests that journalists shape citizens' political reality by selecting information and packaging it as news. By highlighting specific information and positioning that information within a news product, journalists convey to the public issues' salience and importance. In turn, this setting of the political agenda influences the salience of the public's political attitudes. Agenda setting occurs in three stages: 1) the media agenda, the priority of

issues discussed in the media, 2) the public agenda, the interaction of the media agenda with public thought which creates the public agenda, and 3) the policy agenda, as policy makers determine issue importance based on the public agenda (Littlejohn et al., 2017).

While agenda setting initially focused on how media sets the political agenda, later research delineated different agenda-setting levels (Scheufele & Iyengar, 2014). Establishing issue importance (object agenda setting) is considered a first-level effect, while determining which issue facets are important (attribute agenda setting) is a second-level effect. Third-level agenda setting (network agenda setting) occurs because objects and attributes are intertwined in media messages and individuals' conceptions, with that intertwining creating additive effects on individuals' understanding of issues discussed in the media (McCombs et al., 2014).

While some consider framing to be second-level agenda setting (e.g., McCombs et al., 2014), others (e.g., Scheufele & Iyengar, 2014; Vliegenthart, 2012) argue that agenda setting and framing stem from different processes and are different types of effects. In this view, agenda setting is a salience-based effect that occurs when salience shifts from mass media to news consumers (Scheufele & Iyengar, 2014). Framing, on the other hand, is an applicability effect, meaning a message's effect varies depending on its resonance with recipients' existing mental schemas (Scheufele & Iyengar, 2014). In other words, agenda setting tells us *what* to think about and framing tells us *how* to think about it (Littlejohn et al., 2017; McCombs & Shaw, 1972; Scheufele & Iyengar, 2014). The idea of framing as a separate process from agenda-building views framing as a process that includes frame-building by journalists and audiences and frame-setting, resulting in audience effects (Scheufele, 1999; Vreese, 2005). Media frames may be both frames within journalists' minds (journalist frames) or news frames (frames present within news content) (Engesser & Brüggemann, 2016).

Research on media framing as an applicability effect developed on two tracks from two disciplinary traditions (Scheufele & Iyengar, 2014). Stemming from psychology research, equivalence frames present logically equivalent information while emphasis frames derived from the sociological tradition organize information to provide meaning (Scheufele & Iyengar, 2014). Health communication research has often tested equivalence frames, such as gain/loss frames suggested in prospect theory (Tversky & Kahneman, 1981), whereas journalism research has typically explored emphasis frames, such as episodic/thematic and issue/strategic (Scheufele & Iyengar, 2014). The confounding of emphasis frames with variation in content has led some scholars to suggest jettisoning the term framing itself (Cacciatore et al., 2016).

In constructing news, journalists select and make salient certain aspects of a news event or issue (Entman, 1993), resulting in emphasis frames or mental schemas that influence individual and societal attitudes and behaviors (Schäfer & O’Neill, 2018; Vreese & 2005; Vreese & Lecheler, 2012). Within communication studies, two overarching definitions of frames predominate (Schäfer & O’Neill, 2018): 1) frames as a holistic organizing idea (Gamson & Modigliani, 1989), and 2) frames as arguments (Entman, 1993). The frames-as-organizing-idea approach views frames as sense-making devices for both content creators and consumers to “suggest what is at issue” (Gamson & Modigliani, 1989, p. 3). By contrast, Entman’s frames-as-argument approach proposes that frames serve one or more of four functions: “a particular problem definition, causal interpretation, moral evaluation, and/or treatment recommendation” (1993, p. 52). The frames-as-argument approach allows operationalization and measurement of communicative elements (Entman et al., 2009; Matthes & Kohring, 2008), an advantage for quantitative content analysis. This dissertation is concerned with frames constructed by media in climate solutions journalism, specifically the frames-as-arguments as outlined by Entman (1993)

as such frames may ultimately affect the audience's perception of climate change - its problematic impacts, causes, and moral issues - and how society can address it – the merits of treatment recommendations and who is morally responsible (Vreese & Lecheler, 2012).

Climate Change in the News

Analysis of climate change content in mass media and other communication has largely focused on media attention and how the issue of climate change is portrayed (Metag, 2016). Specifically, content analyses of climate change communication have employed both qualitative and quantitative approaches, with mostly frequency, framing, and narrative analyses (Metag, 2016). A review of content analyses of climate change communication has found that: 1) climate change coverage has increased over time, 2) coverage varies by country and amount of coverage varies by outlet, 3) climate change discourse helps construct identity and responsibility, and 4) climate change is conveyed through different frames and narratives (Metag, 2016).

Within framing studies of climate change communication by news media and other online content, scholars have focused on content-oriented frames predominantly, either generic frames (i.e., conflict, human interest), issue-specific or topical (Schäfer & O'Neill, 2018). Despite country-level differences, generally the dominant frames in climate change communication have regarded the (un)certainty of climate science, or economic, political, or moral aspects, with health frames rarely employed (O'Neill et al., 2015; Schäfer, 2018). In contrast to content-oriented frames, formal-stylistic frame research about the structure or formal presentation of text (Schäfer & O'Neill, 2018) of climate change media is minimal, with the exception of Hart and Feldman's (2014) content analysis of US network television news (Schäfer & O'Neill, 2018).

Journalists' own mental schemas and external forces influence how they build story frames (Scheufele, 1999), yet research about journalists' framing of climate change is extremely limited (Schäfer & O'Neill, 2018). Mostly, the studies focus on external influences on journalists' frame building. Engesser (2017) found that political ideology, level of scientific expertise, national culture and climate policy affect journalistic representations of climate change. In the US, between 1995-2006 newspaper and television journalists conveyed conflict and uncertainty about climate change science due to political and economic pressure, professional journalistic routines, and the incremental nature of scientific knowledge production (Boykoff, 2007). Regarding journalists' cognitive frames, Engesser and Brüggemann (2016) surveyed climate journalists in Germany, India, Switzerland, the UK, and the US, finding five journalist frames: 1) industrialized countries' economic policies, 2) sustainability, 3) technological optimism, 4) emerging economies' responsibilities, and 5) global ecological discourse. Following Entman (1993), journalists in this study were asked about problems, causes, and solutions. These journalists considered problems and solutions nearly equally important and identified the following solutions categories: technological approaches to reduce and eliminate CO₂ emissions, voluntary restraints and reforms by individuals and of capitalism, emission reduction by industrialized nations, binding agreements on emissions reduction, and increased climate change communication among non-governmental actors (Engesser & Brüggemann, 2016). However, studies show that coverage of climate solutions is limited. For instance, major American, British, and Australian newspapers from 1999 to 2018 reporting about climate change in the vulnerable Pacific Islands focused more on threats than responses (Shea et al., 2020). Less than half of Canadian newspaper reporting on climate health impacts from 2005 and 2015 included solutions, which could reduce support for action (King et al., 2019).

Organizational and normative changes in the journalism industry have created challenges and opportunities for reporters covering climate change, including reporting on solutions (Borth et al., 2022; Schäfer & Painter, 2021). Although economic pressures brought on by the Great Recession of 2008 led to the elimination of many science and environment reporting positions, a shift in journalistic roles from “gatekeeping” to “curating” allows today’s journalists more leeway to select and present solutions to climate change as newsworthy (Borth et al., 2022; Schäfer & Painter, 2021).

Climate Change and Solutions Coverage

When climate change first became a salient news issue in the 1980s, US and UK coverage focused on mitigating the threat, with adaptation represented in less than 1% of coverage before starting to grow in the early 2000s (Swain, 2017). Some frames resulting from coverage of climate conferences in the early 2000s suggested the need for solutions, but recent conference coverage has tended to emphasize catastrophe and not adaptation or its benefits (Swain, 2017).

While journalists covering climate change consider solutions important (Borth et al., 2021; Engesser & Brüggemann, 2016) and those engaged in solutions journalism believe the practice is suited to environmental topics (Lough & McIntyre, 2018), we know little about climate solutions journalism frames. Surveyed North American environmental journalists reported that most of their climate solutions stories focus on adaptation and resilience, followed by mitigation strategies (Borth et al., 2022) but we lack evidence that such stories actually *include* information about mitigation and adaptation. Internationally, multimodal (text and visual) framing of climate futures in major news magazines in the US, UK, Germany, and India shifted between 1980-2019 from the predominant *Global Doom* and *Local Tragedies* frames to

the “potentially empowering” *Sustainable Future* frame (Guenther et al., 2022, p. 131). The *Sustainable Future* frame, which focuses on solutions such as green technology and agricultural adaptation, began appearing in 2002 but fully developed in 2015 following the Paris Agreement, an international climate treaty (Guenther et al., 2022). The emerging emphasis on solutions is aligned with constructive journalism and may lead to increased audience efficacy and desire for protective climate action, although this requires empirical testing (Guenther et al., 2022).

While Hart and Feldman (2014) did not specifically mention solutions journalism, their content analysis of US network television news stories offers implications for solutions journalism research. They found such stories infrequently covered climate change impacts and actions (i.e., solutions) in the same broadcast, with stories about actions offering muddled efficacy messages. Furthermore, impact stories typically focused on the negative environmental consequences, whereas action stories focused on political conflict around solution implementation and included response efficacy about the action, but little self- or external/political efficacy information (Hart & Feldman, 2014). In other words, such stories portrayed climate actions as effective in dealing with climate change, but did not suggest individuals, groups, or politicians could easily make such actions a reality. This inconsistent efficacy information coupled with threat information could decrease political engagement, increase biased processing and polarization, and reduce support for policy action (Hart & Feldman, 2014).

Two studies have examined environmental coverage in solutions-oriented news outlets. Atanasova (2022) explored the synergistic coverage of climate change and COVID-19 through critical metaphor analysis of stories in the UK-based *Guardian Online* and *Positive News*, which is “committed to provide climate change coverage and practice solutions-oriented constructive

journalism” (p. 386). She found these outlets’ synergistic coverage focused on whether COVID-19 responses hold lessons for solving climate change and that such coverage most often employed “Movement” or “Colour” (i.e., Green) metaphors, rather than “War” metaphors used often in single-focus coverage about these two issues (Atanasova, 2022). Previously, she examined sustainability coverage in *Positive News*, finding consistent, positive sustainability solutions coverage which quoted a variety of sources (Atanasova, 2019). In contrast, sustainability coverage in non-constructive news outlets tends to be infrequent, negative, and reliant on government and business sources (Atanasova, 2019). In her analysis, she identified a new frame in *Positive News*’ sustainability coverage that critiqued consumerism and endless growth.

Yet understanding how climate solutions journalism from a variety of outlets, not just niche publications, is framed is critical because climate framing can either influence audience action or fatalism (Swain, 2017). As solutions journalism stories explain a social problem and suggest a thematically framed response which may influence audience attributions of responsibility (Lough & McIntyre, 2023; Thier, 2021), solutions journalism stories define problems, offer causal interpretations, highlight treatment recommendations, and perhaps include moral evaluation. In a systematic review of frames in news reporting of health risks, Dan and Raupp (2018) identify an action frame highlighting how individuals and public officials can respond to health risks, which serves the treatment recommendation framing function and “corresponds to what is currently known as solutions journalism” (p. 11). For these reasons, this content analysis of textual solutions journalism about climate change, which is a global health risk, relies on Entman’s (1993) framing definition. In other words, what “aspects of perceived reality” do solutions journalism stories about climate change present to news audiences (Entman,

1993, p. 52)? Before considering whether and how reporting about solutions to the climate crisis engenders audience efficacy and civic action, it is critical to understand the nature of such news stories. To that end, I pose the following research question:

RQ1: What frames are present in US-based textual solutions journalism stories about climate change, as outlined by Entman's (1993) four functions of framing?

Chapter 4: Content Analysis

Although scholars have identified responses to climate change in journalistic coverage (Guenther et al., 2022; Hart & Feldman, 2014), little is known about what frames result when journalists write about solutions to climate change. Therefore, this study employs an inductive, manual reductionist approach rather than deductively searching for frames previously identified in problem-oriented stories about climate change. The manual reductionist approach defines frame elements *a priori* (using Entman's 1993 definition), identifies frames via statistical reduction technique, and then names frames interpretatively (Matthes & Kohring, 2008; Schäfer & O'Neill, 2018). Below I detail sampling, coding, and analysis steps.

Sampling

The Solutions Journalism Network maintains an online database of solutions journalism stories, the StoryTracker, containing thousands of news stories about a variety of social issues. The initial sample for this study consisted of 417 news stories from the StoryTracker tagged with “climate change” as the issue area, produced by a U.S.-based news outlet, and “text” as the media type, that were published between January 2010 and August 2022. I limited stories to those published by U.S.-based outlets or in U.S. editions of non-U.S. based outlets as national news logics can be expected to affect frame types (Asp, 2014; Wessler et al., 2016). As this analysis is exploratory, I limited the sample to text-based (print and online) stories and the main text-based elements within them because climate change visuals contain additional latent meaning (Metag, 2016) and can create their own frame or multimodal frames in concert with text (Wozniak et al., 2015). Furthermore, not all solutions journalism stories include solutions visuals (Lough & McIntyre, 2018; Midberry & Dahmen, 2020) and visual solutions journalism is

composed of different elements than solutions journalism more generally (Midberry & Dahmen, 2020). I screened the sample to ensure articles conformed to the above-mentioned criteria. For instance, broadcast news re-published on the websites of TV or radio stations or articles that were reprinted book excerpts were excluded. Articles also had to be consistent with the tenets of solutions journalism as defined by SJN (display evidence of each of the four solutions journalism qualities, include mention of both the problem of climate change and a response to that problem, be independent journalism, include narrative, and be about existing responses rather than future possibilities). Finally, I assessed articles for relevance (e.g., Hart & Feldman, 2014; Wessler et al., 2016), excluding articles about solutions for environmental problems other than climate change (i.e., biodiversity loss) that did not center climate change as the driver of those problems and/or without solutions addressing climate change mitigation or adaptation.

The selection process resulted in 244 news stories about responses to climate change from 91 news outlets/sites (Table 1). I analyzed the full census of 244 news stories for the present study. The unit of analysis was the news story (headline, sub headlines, main body text) excluding photo captions or non-article audience engagement elements (i.e., suggestions to read additional related stories by that news organization).

Coding

To develop the coding instrument, I conducted a thorough qualitative review of the initial story sample, reviewed published content analyses about climate change communication and solutions journalism, and examined recent Intergovernmental Panel on Climate Change and U.S. National Oceanic and Atmospheric Administration (NOAA) reports about the causes and effects of climate change. The overarching variables coded were the four functions of framing as proposed by Entman (1993), with the problem definition, causal explanation, moral evaluation,

and treatment recommendation coded for absence ('0 = *not present*') and presence ('1 = *present*'). I grounded the *problem definition* in three areas of impact identified by NOAA – life/health, property, and economic - as well as environmental concerns. For *causal attributions*, I focused on natural causes (i.e., natural fluctuations in the Earth's temperature), the burning of fossil or other dirty fuels, deforestation, and food waste/agricultural production. During the iterative coding process, I added "other causes" to include situations such as methane leaking from water reservoirs. For *treatment recommendation* there were two overarching categories: mitigation and adaptation. Mitigation refers to efforts to arrest or stabilize greenhouse gases that drive climate change, while adaptation refers to adjusting to present or future climate impacts, including taking advantage of beneficial opportunities arising from those impacts (NASA, 2023). Initially, I included specific types of mitigation and adaptation actions as coding categories, such as carbon capture and storage, avoiding deforestation, and clean energy to mitigate greenhouse gases and rewilding, coastal hardening, livelihood diversification, and community resilience as adaptive measures. However, some categories occurred so infrequently this threatened achieving intercoder reliability. Ultimately, I coded solely for mitigation and adaptation, which can occur simultaneously (i.e., a clean energy project creates new jobs for unemployed workers). For *moral judgment*, the categories were attribution of responsibility for causing the problem and attribution of responsibility for solving the problem (Wessler et al., 2016), victims (a group/entity harmed by the problem), and moral language, either secular or religious (Hart & Feldman, 2014), or "a matter of right or wrong; or of respect or disrespect for limits, thresholds, or boundaries"? (Nisbet, 2009, p. 18). During the iterative coding process, I decided that attribution of responsibility for solving the problem should include both mention of externally or internally assigned responsibility. The full coding instrument is available in Appendix C.

I pre-tested the coding instrument on three articles from the StoryTracker with the same criteria except for news outlet origin country. To assess intercoder reliability, I tested reliability with a second coder using a random sample of 27 stories (about 11 percent) from the final census. Initial reliability estimates led us to conduct three additional rounds of coding (each with a random sample of 27 stories) before we obtained acceptable reliability.² I then coded the remaining 108 stories. For intercoder reliability, percent agreement and Gwet's AC_1 (Gwet, 2015) were calculated in RStudio using the *irrCAC* package (Gwet, 2019) and are displayed in Table 2. Gwet's AC_1 corrects for chance agreement by considering four conditions (with two coders): both coders code accurately, both code randomly, Coder A is accurate while Coder B is random, and vice versa (Riffe et al., 2019). As frame elements may occur rarely in content analysis of climate change communication (Wozniak et al., 2015), Krippendorff's alpha and other commonly used coefficients may penalize coder disagreement (Krippendorff, 2011; Quarfoot & Levine, 2016; Riffe et al., 2019; Wozniak et al., 2015). Because the data distribution within coding categories was skewed (toward absence) for many variables in the present study, using Gwet's AC_1 rather than pi, kappa, or cAlpha allowed reporting of reproducibility at a more accurate level (Riffe et al., 2019).

Analysis Methods

Consistent with a manual reductionist approach (Matthes & Kohring, 2008; Metag, 2016; Schäfer & O'Neill, 2018), hierarchical cluster analysis was employed to answer **RQ1**: *What frames are present in textual solutions journalism stories about climate change, as outlined by Entman's (1993) four functions of framing?* Unlike non-hierarchical or partition clustering

² Between the third and fourth rounds of inter-reliability testing, several variables were dropped from the study and are not reported here.

procedures, hierarchical clustering procedures do not presuppose the number of clusters in advance (Mooi & Sarstedt, 2010; Norušis, 2011), consistent with an inductive, exploratory analytical approach. I employed agglomerative hierarchical clustering, which initiates clustering at the case (i.e., story) level, rather than divisive clustering, which begins with all cases in one cluster (Mooi & Sarstedt, 2010; Norušis, 2011), as this study's purpose was to determine how framing elements from each news story in the census grouped together. Given the nature of the data, I selected a similarity (proximity) measure suited to binary variables. Specifically, I chose the matching coefficient measure which should be employed when co-absences (i.e., zero-zero matches) are as "informative" as one-one matches (Everitt et al., 2011, p. 47). I relied on the between-groups linkage method (distance between clusters is the average of all data points in each cluster), which is appropriate for various cluster patterns, creates low within-cluster variance (Mooi & Sarstedt, 2010) and can handle binary data. Following Wessler et al. (2016)'s manual reductionist content analysis of global multimodal news frames of climate change, I selected the number of clusters using the elbow criterion, as examining the "elbow" of a scree plot is an appropriate approach for determining the number of clusters when using hierarchical methods (Mooi & Sarstedt, 2010). I additionally included the first point after the elbow as data from hierarchical cluster analysis can yield imperfect guidance on cluster selection, which may also be driven by practical considerations (Mooi & Sarstedt, 2010). As in Wessler et al. (2016), I cross-tabulated the clusters with the frame elements to ascertain the structure of the clusters, which I interpret as frames.

Results

The hierarchical cluster analysis resulted in three frames: 1) *the future is now* frame 2) the *undeterred stewards* frame, and 3) the *moral mitigation* frame (Table 3 below). Following

Wessler et al. (2016, p. 430), salience of frame elements within a cluster was categorized as “somewhat salient” (20%) and “highly salient” (40% or higher). Additionally, each cluster was examined for the relative prevalence of each of the four framing functions (problem, cause, remedy, moral judgment). These elements along with qualitative examination of stories occurring within each cluster were examined to select the frame labels.

Table 3
Composition of Climate Solutions Journalism Frames by Column Percentage

Frame Elements	The Future Is Now Frame <i>n</i> = 214	Undeterred Stewards Frame <i>n</i> = 19	Moral Mitigation Frame <i>n</i> = 10
Climate Problem			
Life/Health	29.4	73.7	0.00
Property	13.6	84.2	0.00
Economic	0.30	94.7	0.10
Environment	89.7	100.00	0.70
Climate Change Cause			
Natural	0.02	0.00	0.00
Burning			
Fossil/Other Fuels	39.7	68.4	0.40
Deforestation	0.07	0.21	0.80
Food			
Waste/Agriculture	0.12	0.05	0.20
Other	0.13	0.05	0.40
Remedy			
Mitigation	0.59	0.89	100.00
Adaptation	0.89	0.95	0.70
Moral Judgment			
Causal			
Responsibility	0.18	0.47	0.90
Responsibility to			
Solve	0.14	0.42	100.00
Victims	0.32	0.95	0.30
Language	0.22	0.68	100.00

Note. Dark shading indicates at least 40% frequency in cluster. Lighter shading indicates 20% to 39% frequency in cluster. BOLD indicates exceeding the element’s cross-cluster comparison by at least 50%. Table design adapted from Wessler et al., 2016.

The vast majority (88%) of stories lie *in the future is now* frame. These stories were published in a variety of news outlets, ranging from mainstream legacy news outlets to niche publications. The highly salient elements in this frame are climate problems affecting the environment (89.7%) and a major focus on adaptation (89%), but also some focus on mitigation (59%). The burning of fossil and other dirty fuels is the only (somewhat) salient (39.7%) cause of climate change. Moral judgments related to climate change were rare, with the idea of disproportional impacts on certain groups most prevalent among moral considerations (32%). Almost somewhat salient were life/health (29.4) impacts of climate change. In summary, this frame most prominently noted environmental impacts and sometimes health impacts, focusing on adapting to climate change, more so than mitigating the crisis. The key consideration is adapting to the current and coming reality created by a well-known culprit (fossil fuels). Who is responsible for causing or solving the problem is of less concern than relaying that adaptation is already happening.

The second cluster represents far fewer stories (8%). In the *undeterred stewards* frame several categories within each of the four framing functions are highly salient, making it the most balanced across all categories of the three clusters and resulting frames. Unlike the other two clusters and frames where only environmental impacts are highly salient, all impact categories are prominently prevalent: life/health (73.7%), property (84.2%), economic (94.7), and environmental (100%). As such, this frame heavily emphasizes the problematic aspects of climate change and their variety. Regarding causes, the burning of fossil and other dirty fuels (68.4%) is highly salient with deforestation nearly somewhat salient (21%). A striking aspect of this cluster and resulting frame, unlike the other two, is that mitigation (89%) and adaptation (95%) are nearly equal in prevalence as climate remedies. All moral judgment categories are

salient with the presence of victims occurring most frequently (95%), followed by moral language (68%), moral responsibility for causing the problem (47%), and moral responsibility to solve the problem (42%). Overall, stories in this frame emphasized that climate change creates many negative impacts, including disproportionately affecting some groups, and that remedying its root causes and impacts are a moral issue. Stories in this cluster were published by mainstream, legacy outlets such as *The New York Times*, *The Los Angeles Times*, *The Christian Science Monitor* and *Rolling Stone*, solutions-oriented outlets such as *Yes! Magazine*, and local or niche publications, such as *Blavity*, *Yale Environment 360*, and *Mongabay*.

Inspection of the 19 stories in this cluster reveals responses by groups with often place-based identities central to their climate-fighting mission engaging in climate action, undeterred by wider climate polarization or identity politics. In one exemplar story, economically depressed and isolated, generally conservative Mainers “reconnect with their rich Arctic history” while “bring[ing] its traditions of environmental stewardship to bear in a region where it’s most needed” as the warming Arctic makes trade increasingly possible (Gass, 2016, paras. 2, 4). In another, state and city officials, including in Republican-dominated south Florida, create “surprising progress from surprising” places, “bypassing lagging political leadership” (Struck, 2015, paras. 5, 6). In a small Indiana town beset with climate-induced flooding, the mayor stresses that climate resiliency brings economic progress. “We didn’t argue about climate change,” he said. “We talked about Goshen,” (Edwards, 2019, para. 11). In another story, faith leaders rely on Scripture to move beyond politics to inspire climate action or counsel those with climate anxiety. The intersection of climate change and mental health is the focus of another story about mental health professionals banding together to raise the alarm about how climate change affects mental health, including heat disrupting psychiatric drug efficacy. In other stories,

indigenous groups manage forests sustainably and profitably in El Salvador or rely on indigenous knowledge to create adaptive products or approaches in Canada, India, and the Pacific islands of Kiribati. Even as groups, areas, and interest groups are disproportionately threatened, they respond from an asset-based approach tied to an identity.

A small number of stories (4%) form the third cluster, creating what I call the *moral mitigation* frame. The climate impacts addressed are environmental (70%) and economic, much less frequently (10%). All coded causes of climate change are prevalent except for natural with several highly salient - deforestation (80%), burning of fossil and dirty fuels (40%), other causes (40%) - and food waste and agricultural production somewhat salient (20%). While these stories do emphasize adaptation (70%), 100 percent of them feature mitigation actions. This cluster has the highest prevalence of moral judgment information with 90% of them attributing responsibility to groups for causing climate change and all of them (100%) for solving the problem. While all (100%) of these stories included moral language, just 30% of them cited victims of climate change, suggesting the moral focus was more on the attributions of responsibility than those affected. These stories often feature technical or financial solutions, ranging from global carbon offset trading markets to community land ownership to fines levied by indigenous guardians of sacred forests. The *moral mitigation* stories appear in legacy outlets on opposite sides of the political spectrum, such as *The Wall Street Journal* and *Mother Jones*, as well as niche publications such as *Earth Journalism Network* and *Fashionista*.

Summary of Findings

Study 1 set out to inductively determine what frames exist in solutions journalism about climate change. By highlighting a collective response to a social problem, solutions journalism inherently includes a treatment recommendation (Dan & Raupp, 2018), a condition absent in

many problem-oriented news stories. This suggests solutions journalism may result in different frames than problem-oriented journalism. As solutions journalism is an emerging practice gaining traction with academics, practitioners, and news audiences (Lough & McIntyre, 2023) and climate change is an existential threat to humanity (IPCC, 2022), understanding the nature of climate solutions journalism is a worthwhile endeavor.

Hierarchical cluster analysis resulted in three clusters, which I interpret as the following frames: 1) *the future is now* frame 2) the *undeterred stewards* frame, and 3) the *moral mitigation* frame. The overwhelming majority of stories belonged to the first frame, suggesting journalists who write about climate solutions for U.S.-based outlets largely create similarly framed news. This *future is now* frame focuses on how groups are adapting to the reality of an already changing climate. Stopping or reversing carbon emissions are also discussed, but less so than in the other two identified frames, with fossil and dirty fuels the most-mentioned cause. Moral considerations are present, but not salient.

The second and third clusters (and resulting frames) occur much less frequently at less than 10% each. The second most prevalent cluster, named the *undeterred stewards* frame, is the most holistic with more than one category in each of the four framing functions highly salient. More so than other frames identified, the *undeterred stewards* frame focuses on climate impacts. Addressing climate change through mitigation and adaptation are nearly equally important and all moral considerations are highly salient. Stories in this frame feature response actors undeterred by partisan polarization and inspired to engage by some aspect of personal identity. The least prevalent frame named *moral mitigation* all focus on mitigation, although many also include adaptive efforts. This frame includes the highest prevalence of moral judgment information, mostly about attributing responsibility for causing and solving the problem.

These previously undescribed frames add to our understanding of climate communication media frames, particularly solutions climate news. While studies have examined solutions-focused, sustainability frames in major news magazines (Guenther et al., 2021) and a constructive news outlet (Atanasova, 2019), this study is the first to examine solutions frames for climate news specifically across several types of news outlets. The finding that the most prevalent climate solutions journalism frame in U.S. text-based news focuses on adaptation followed by mitigation dovetails with what American environmental journalists report covering (Borth et al., 2021). This is a significant difference from the early days of climate coverage in the 1980s, which featured mitigation almost exclusively (Swain, 2017). However, journalists from five countries including the US own climate change frames focused almost exclusively on mitigation measures (Engesser & Brüggemann, 2016), suggesting a possible disconnect between what journalists consider climate solutions frames and what news is produced.

This study is one of the few climate content analyses to employ a manual reductionist approach (Schäfer & O'Neill, 2018). By coding “more specific, more manifest, and more easily identifiable” frame elements, rather than entire frames, and then statistically constructing the frames, this methodological approach may result in more reliable and valid results than other types of media frame content analyses (Matthes & Kohring, 2008; Schäfer & O'Neill, 2018, p. 9). In doing so, the study seeks to contribute an initial analysis of climate solutions news frames that may guide future research as society continues to grapple with the effects of a rapidly changing climate.

Limitations and Areas for Future Research

While this study is the first to explore possible frames of climate solutions journalism, several limitations must be addressed. This content analysis included only news from US-based

outlets, but news created in different national contexts might yield different results (Asp, 2014; Wessler et al., 2016). While coverage of political events, such as United Nations Climate Change Conferences, can result in similar frames across countries (Wessler et al., 2016), it can also lead to differences, especially across mediums (O'Neill et al., 2015). The inclusion of only text-based news (albeit from print and digital sources) in the present study is, therefore, an additional limitation. Similarly, findings from this study are limited to how main textual climate solutions stories elements create news frames, but visuals may add frames or create new multimodal frames in conjunction with text (Wozniak et al., 2015). Furthermore, solutions journalism visuals are different than problem-oriented visuals (Midberry & Dahmen, 2020). Future content analyses of climate solutions journalism should include news from other countries, in other mediums, and the visual elements that accompany text. Further examination of climate solutions journalism should explore in more detail the types of responses covered to determine whether they are high-impact solutions.

While the present study shows a diverse group of US, text-based news outlets have covered climate solutions journalism, this study cannot determine the prevalence of such journalism overall or in specific outlets due to the way stories are included in SJN's StoryTracker. SJN staff conduct ongoing online searches of solutions journalism, but journalists also may nominate their or others' stories for potential inclusion. These inclusion criteria yield samples unsuitable for conducting historical trend analysis. While the diversity of news outlets included in the present study's census may be celebrated by those in the journalism and environmental advocacy industries, this study cannot make overall claims about the readership, agenda setting or policy influence of US, text-based climate solutions journalism. Future

research should attempt to determine whether climate solutions journalism reaches audiences and influences a climate action agenda.

Chapter 5: Study 2 Research Questions and Hypotheses

The goal of Study 2, an experiment, in this dissertation is to examine climate change solutions journalism in comparison with problem-oriented journalism and in some cases, an irrelevant message control. Specifically, I explore the effects of climate solutions journalism on two outcomes: 1) policy support and 2) misinformation susceptibility. For policy support, I undertake two approaches. The first looks at whether the effect of climate solutions journalism on policy support occurs through several potential mediators suggested by previous solutions journalism research and drawing on theory from persuasion, health communication, political science, social psychology, and risk communication literature. The second explores whether any effects occur due to solutions aversion, a form of motivated reasoning influenced by political ideology. For misinformation susceptibility, I also examine whether an effect may be due to several mediating variables suggested in the literature. Therefore, the following hypotheses and research questions are proposed to advance those goals.

Policy Support

Policy support to address climate change can be affected by how information is framed, such as emphasizing gains vs. losses (Hurlstone et al., 2014; Spence & Pidgeon, 2010), certain values (Maibach et al., 2008; Simon et al., 2014), causal mechanisms (Simon et al., 2014), scientific certainty (Olausson, 2009), and public health (Maibach et al., 2010). News media framing generally and of climate change specifically helps influence public opinion about policy options, including the public's perception of "plausible solutions" (Olofsson et al., 2018, p. 957).

Scholars are beginning to suggest that messages focusing on solutions to mitigate or address the impacts of climate change, rather than the impacts alone, may increase support for

climate policy (e.g., Marlon et al., 2019). For instance, Dasandi et al. (2022) found that framing climate statements positively (opportunities for climate action) increased the likelihood of public support for climate policy in China, the UK, and the US, whereas negative framing (emphasizing the threats) reduced the likelihood.

Scholars distinguish between these two types of environmental policy support: private sphere, which concerns support for regulations that impact individual behavior (i.e., requirement to recycle), and public sphere, which refers to support for government regulations on businesses and other organizations (see Meijers et al., 2023). In general, the American public largely supports national policies to mitigate climate change aimed at business, industry, and government regulation (public-sphere policies) or that offer individual economic benefits (Leiserowitz, Maibach, Rosenthal, Kotcher, Goddard, et al., 2023), but support is less so for policies that require personal sacrifice (Leiserowitz, 2006), or private-sphere policies. As solutions journalism is news about programmatic responses undertaken by governments, businesses, or organizations such as nonprofits, it seems likely that such stories might encourage public-sphere, rather than private-sphere, climate policy support. In depicting existing climate solutions and detailing their efficacy, climate solutions journalism shows that collective climate actions are “plausible.”

This dissertation aims to build on emerging research focusing on climate solutions rather than actions by testing whether journalism stories, not brief statements (e.g., Dasandi et al., 2022), impact public-sphere policy support. With the exception of Thier and Lin (2022), previous solutions and constructive journalism studies have included news about climate change without mentioning climate change as the cause of negative impacts or the terms “climate change” or “global warming” (Baden et al., 2019; Overgaard, 2021a) or only in problem-oriented

news stimuli (Baden, 2019). As a politically polarized term (Coleman et al., 2022), terminology related to climate change affects news audiences' perceptions of climate change (Schuldt et al., 2017), of news credibility and newsworthiness (Feldman & Hart, 2021), and of self-efficacy, as well as willingness to take adaptive action, story agreement, news engagement, and attitudes toward adaptive actions (Coleman et al., 2022). Since climate change is an existential threat to humanity requiring immediate social action (IPCC, 2022), understanding how news about responses to climate change that explicitly mentions climate change (as in this dissertation) affects audiences' support for policy action is critical.

This dissertation employs stimuli about two climate-related topics, food waste and wildfires, that focus on mitigation and adaptation, as well as an irrelevant message control, building on Thier and Lin (2022), whose solutions stimuli concerned only adapting to climate-induced flooding. In that study, university students exposed to a story about adapting to climate-induced flooding reported increased perceived behavioral control, in turn increasing their support for climate change policy. Those authors chose a short solutions story (473 words) to reduce participant burden, although stories less than 800 words in length make up only 13% of solutions stories in SJN's online story database. In this dissertation, the solutions stimuli range in length from 1,157 to 1,439 words, much closer to the average of 1,867 in SJN's story database, to encourage ecological validity. Finally, Thier and Lin (2022) asked about policy support specifically regarding the response described in the solutions stimuli. This dissertation broadens policy support to include a range of public-sphere mitigation and adaptation measures.

Given the scant empirical evidence that climate solutions journalism increases support for policies to address climate change and lack of theoretical development of solutions journalism effects generally, we lack an understanding whether how climate solutions journalism may

improve support for climate action policy. Previous solutions journalism research shows that exposure to such stories generally leads to pro-social appraisals in comparison with exposure to problem-oriented stories. Incorporating several theories from persuasion, health, and risk communication that suggest individuals' affective and cognitive appraisal of stimuli guide their responses to stimuli, I posit that climate solutions journalism, in general, will increase preference for climate policy support by enhancing individuals' pro-social affective and cognitive appraisals. Below I detail several potential mediators of the effects of climate solutions journalism on preference for climate policy support.

Affective Appraisals

As an ongoing and seemingly intractable existential risk to humanity, human-induced climate change is perhaps the greatest threat humanity has faced, with media coverage of climate change affecting individual and societal well-being and coping abilities, and individuals' emotions (Maran & Begotti, 2021; Meininger et al., 2022). Appraisal theories (e.g., cognitive appraisal theory; Ellsworth & Scherer, 2003; Lazarus & Folkman, 1984; Scherer, 1999) suggest that individuals' cognitive appraisal of a stimulus leads to affective arousal. The nature of that arousal depends on individuals' perceived ability to cope with a situation and one's agency (Ellsworth & Scherer, 2003; Lazarus, 1966), perceived efficacy (Witte, 1992) or perceived severity or susceptibility (So, 2013). As such, "emotions are adaptive responses to the world" (Ellsworth & Scherer, 2003, p. 574).

Upon encountering a stimulus, individuals immediately and automatically experience positive or negative feelings (Leiserowitz, 2006; Slovic et al., 2007). That affective response plays a key role in individuals' judgment and decision-making (Zajonc, 1980), specifically during experiential or intuitive information processing, whereas logic and reason dominate

during analytic or rational information processing (Leiserowitz, 2006; Slovic et al., 2007). When complex judgments are required, individuals may rely on an affect heuristic, or feelings shortcut, to guide their decision-making (Slovic et al., 2007). The affect heuristic may alter risk and benefit perceptions such that positive affect engendered by perceived high benefits or low perceived risk may lead to low perceived risk and high perceived benefits, respectively (Alhakami & Slovic, 1994; Finucane et al., 2000; Slovic et al., 2007). News framing research relying on appraisal theories has found that exposure to news may elicit emotional responses (Feinholdt et al., 2017).

Affective and emotional responses have been shown to help predict climate risk perceptions and policy preferences (Leiserowitz, 2006; Lu & Schuldt, 2015, Smith & Leiserowitz, 2014), with affect explaining the most variance (20%) among all predictors in van der Linden's (2015) climate change risk perception model. According to the integrated crisis mapping model, individuals' cognitive assessments of crises give rise to emotions, with negative emotional responses influencing their crisis responses (Jin et al., 2007). Climate change has been called a "mega-crisis" (Sellnow & Seeger, 2021, p. 6), inspiring eco-anxiety that may stoke reactance toward climate-protective actions (Stanley et al., 2021). Yet in focusing on responses to social problems, solutions-oriented journalism necessarily includes efficacy information (McIntyre & Lough, 2021; Thier & Namkoong, 2023), painting a picture of the world where agency, control, and power (key components of coping potential in appraisal theories) are possible. By depicting social progress, solutions-oriented journalism is likely to induce positive affect in news audiences (McIntyre, 2020). Yet, solutions-oriented journalism simultaneously includes discussion of the underlying social ill addressed by the depicted response, meaning some level of negative affective response is also likely. Taken together, these ideas suggest that

solutions-oriented journalism about climate change specifically may provoke different affective states than solely problem-oriented, crisis-focused news, ultimately inspiring different behavior or policy preferences.

Positive Affect.

Although climate change impacts can contribute to emotional distress, depression, anger, and anxiety (Fritze et al., 2008; Stanley et al., 2021), climate change impact information can lead to positive affect (Wong-Parodi & Feygina, 2021) particularly when coupled with mention of solutions (Ettinger, 2021). While scant research about solutions-oriented journalism has examined the effects of climate change news, a growing number of studies suggest that solutions-oriented journalism induces or increases positive affect (see Lough & McIntyre, 2021). While solutions journalism is not the same as positive news, which focuses on positive topics, issue benefits, or an article's overall tone (McIntyre & Gibson, 2016), constructive journalism (which may or may not be solutions-oriented) relies on positive psychology as a theoretical framework for its news production (McIntyre & Gyldensted, 2018a, 2018b; Zhao et al., 2022). As such, constructive journalism purposely attempts to evoke positive emotions in its audience (McIntyre & Gyldensted, 2018a, 2018b) with many constructive journalism studies concurrently manipulating solutions-orientation and emotional valence, making disentangling the effects challenging (van Venrooij et al., 2021).

Perhaps unsurprisingly, constructive journalism studies which combined solutions-orientation and positive-valence frames found exposure to such stories about a variety of news issues associated with positive affect or emotional responses. Constructive news (solutions-oriented with positive emotions) increased (or led to smaller decreases in) positive affect or emotions in pre-adolescents (Kleemans, Schindwein et al., 2017), in children (Kleemans, de

Leeuw et al., 2017), among Millennials (Hermans & Prins, 2022), and general adults (Baden et al., 2019; Meier, 2018), when compared with problem-oriented, negatively-valenced stories. However, several studies examining the effects of solutions-oriented framing alone also found such stories also increased positive affect in general adult samples (Baden, 2019; Li, 2021; McIntyre, 2019; McIntyre, 2020; McIntyre & Sobel, 2017; Overgaard, 2021a, 2021b; Rusch et al., 2021) when compared with problem-oriented or other non-solutions frames.

Several studies assessing links between solutions-oriented news and positive affect or emotions have included stimuli with environmental news topics, such as plastic waste (Baden, 2019; Meier, 2018; Rusch et al., 2021), degradation of the Great Barrier Reef (Baden et al., 2019, Hermans & Prins, 2020, Overgaard, 2021a), and endangered animals (Kleemans, de Leeuw et al., 2017). Only three studies about the effects of solutions-oriented news on affect or emotion have included climate change news specifically, with one of them including climate change only as a problem-oriented stimulus, challenging inferences about frame (Baden, 2019). Schäfer et al. (2022) found that a restorative narrative (positive valence, solution included, positive coping emphasized) about climate change induced greater positive affect than problem-oriented, negative news. The only solutions journalism study about climate change found solutions journalism did not predict participants' perceived hope compared with a problem-oriented story, although participants' perceived hope was positively associated with support for collective climate action (Thier & Lin, 2022).

However, several studies offer evidence that stories about actions or possibilities to address climate change while not meeting the definitions of solutions or constructive journalism did improve perceived hope. Three studies that manipulated hope by suggesting addressing climate is possible, although not offering solutions, increased participant hope (van Zomeren et

al., 2019). In Nabi et al. (2018), participants exposed to news about potential (not actual) climate solutions and climate threats experienced greater hope than those exposed to climate threat information only, with those seeing a gain-framed solution reporting even greater hope than those seeing a loss-framed solution article. In another study, news messages about proposed carbon emission reduction that mentioned either internal, external or response efficacy of political action and climate change impacts led to hope compared with articles about the climate impacts only (Feldman & Hart, 2016). In two studies that compared news about proposed climate actions with news about proposed climate actions and impacts with impacts only, news that included actions led to higher hope, although hope was greater in the actions-only conditions than actions plus impacts conditions (Feldman & Hart, 2017; 2021). These studies examined news that differed from solutions journalism as defined by scholars and practitioners in that the stimuli did not describe a solution or discussed possible or potential solutions, rather than reporting on existing responses and in some cases did not include the response limitations.

Therefore, examining the effect of climate change solutions journalism, which detail existing solutions tempered by information about response limitations and without explicit positive content, on positive affect is critical to understand how news audiences perceive reporting on actual, ongoing responses to climate change. In this dissertation, I argue that extant research about climate change news and solutions journalism about other social issues suggest solutions journalism about climate change should predict positive audience affect. Before investigating which discrete emotions, if any, climate change solutions journalism induces, we must first explore whether climate solutions journalism leads to positive feelings more generally.

Negative Affect.

Climate change impacts can affect mental health immediately during extreme weather events, by altering the social and economic determinants of mental health, and by creating emotional distress in response to awareness of climate change as a threat (Fritze et al., 2008). Indeed, almost two-thirds (64%) of Americans report being at least “somewhat worried” (if not very worried) about global warming, with about 1 in 10 Americans reporting climate-related anxiety and/or depression, according to a recent Climate Change in the American Mind survey (Leiserowitz, A., Maibach, E., Rosenthal, S., Kotcher, J., Carman, J. et al., 2023). Negative emotional response to climate change does not require direct experience of climate impacts (Clayton & Karaszia, 2020), with many people receiving their primary climate change information from fear-inducing mass media (O’Neill & Nicholson-Cole, 2009).

Not only does traditional, problem-oriented climate change news diminish “agency, hope, and efficacy” (Hackett et al., 2017, p. 7), but focus on climate change’s negative impacts increases negative affect and emotions, such as fear (Ettinger et al., 2020; Spence & Pigeon, 2010; Wong-Parodi & Feygina, 2021). While news about climate impacts has been shown to increase fear (e.g., Feldman & Hart, 2016, 2021), news about potential climate change responses reduced fear and anger compared with news that mentioned climate impacts only (Feldman & Hart, 2018) and reduced fear among political moderates (Feldman & Hart, 2016). Similarly, Ettinger et al. (2021, p. 1) found that fear responses varied by political affiliation, with Democrats experiencing more fear than Republicans and Independents after seeing a video focused on “doom and gloom,” despite mention of potential solutions.

While only one study has assessed a possible link between solutions-oriented journalism about climate change and a negative emotion (Thier & Lin, 2022), solutions-oriented journalism

with positive emotional content about a variety of other news topics consistently has led to lower negative emotional responses or affect, including fear, anger, sadness, joylessness, compared with problem-oriented news in adults (Hermans & Prins, 2022; Meier, 2018; Overgaard, 2021a), in children (Kleemans, de Leeuw, et al., 2017; Kleemans et al., 2019), and pre-adolescents (Kleemans, Schlindwein, et al., 2017). The effect appears to hold when solutions-orientation and emotional content are separated, with van Venrooij et al. (2021) finding that both solutions-based and positive emotions-based news reduced children's negative emotions compared with a problem-oriented news story.

Several studies about solutions-oriented news or news updates without additional emotional content found solutions-oriented news led to less negative affect (Baden, 2019; McIntyre, 2019; Overgaard, 2021a; Rusch et al., 2021) compared with problem-oriented news, although one study found no difference (Li, 2021). In the context of climate change, news forms similar to solutions journalism also seem to evoke lower negative affect (Schäfer et al.; 2022), decrease fear (Feldman & Hart, 2021) or fear and anger (Feldman & Hart, 2018), and reduce fear for political liberals and moderates (Feldman & Hart, 2016). However, in the sole study about climate change solutions journalism such news did not associate with eco-anxiety (Thier & Lin, 2022). Yet, given that solutions-oriented journalism generally and solutions-oriented journalism about climate change seems to dampen audiences' negative emotional responses to discussion of social problems, this dissertation proposes that solutions journalism about climate change will reduce negative affect in comparison with problem-oriented news. Before investigating which discrete emotions climate change solutions journalism may engender, this dissertation seeks to establish whether such journalism reduces overall negative affect.

Affect and Policy Support.

Appraisal theories suggest that affective arousal to stimuli varies not only due to individuals' perceived coping abilities and efficacy (Ellsworth & Scherer, 2003; Lazarus, 1966), but also whether involvement or action is required in response (Lazarus & Smith, 1988) with the action tendency associated with the affective or emotional response influencing decision-making (Nabi, 2003). Furthermore, positive and negative emotions inspire different actions, according to Fredrickson's (2001) broaden-and-build theory that positive emotions expand action tendencies and threat response abilities, whereas negative emotions constrict action tendencies (Fredrickson, 2004). Two solutions-oriented journalism studies partially about environmental topics found support for the broaden-and-build theory on self-efficacy and news credibility (Overgaard, 2021a) and news engagement intentions (Baden et al., 2019), although Kleemans, de Leeuw et al. (2017) did not find positive affect mediated the effect of constructive news on children's inspiration to engage with the discuss social issues. And no mediating effect of emotions was found in the sole study testing climate change solutions journalism's effect on policy support, but both hope and eco-anxiety were independently positively associated with policy support (Thier & Lin, 2022).

While both positive and negative emotions or affect have proven to influence climate policy support (Feldman & Hart, 2018; Leiserowitz, 2006; Smith & Leiserowitz, 2014; Wong-Parodi & Feygina, 2021), news frames that evoke positive, approach-based emotions should enhance favorable policy perceptions for contested social issues (Feinholdt et al., 2016) such as climate change. Few studies have examined whether positive emotions evoked by news increase climate change policy support, but research links positive emotional content and efficacy information with climate change policy support. For instance, messages framed to emphasize

climate action opportunities (positive frame) increased the likelihood of policy support in participants from five countries compared with messages focused on climate threats (negative frame) (Dasandi et al., 2022). Additionally, constructive hope (belief that individuals and society can address climate change) paired with constructive doubt (skepticism that people will act) positively predicted support for greenhouse gas mitigation policies whereas false hope (wishful thinking) and fatalistic doubt (beliefs that humans cannot affect change) negatively predicted policy support (Marlon et al., 2019). Furthermore, hope appeals that evoked higher levels of hope have been shown to lead to higher interest in climate protection (Chadwick, 2015).

By showing audiences that action is occurring in response to climate threats, exposure to solutions journalism about climate change is likely to generate positive affect because such positive appraisal occurs when individuals perceive efficacy and coping possibilities (Ellsworth & Scherer, 2003; Lazarus, 1966; Lazarus & Smith, 1988). Climate solutions journalism also contains mention of climate change impacts which should lead to negative appraisal (Lazarus & Smith, 1988), but since coupled with efficacy or coping information the negative appraisal is likely to be weaker than solutions journalism focused solely on climate change's impacts or risks.

Furthermore, different climate impacts may lead to different types of appraisals. Climate impacts may be immediate or slow-moving, affect one personally or society at large, and create health, property, economic, and/or environmental problems. Thus, any effects of news about climate may vary by the specific aspect of climate change addressed. Additionally, individuals may react differently to solutions led by government or by businesses (Campbell & Kay, 2014). The solution response actor – government or business – could affect individuals' preference for policy support. Therefore, I propose the following hypotheses and research questions:

H1: Solutions journalism stories about climate change compared with problem-oriented stories about climate change, **a)** will be positively associated with positive affect, which will **b)** in turn increase preference for support for policy to address climate change.

RQ1: How, if at all, do any effects in this comparison related to positive affect vary with story topic and solution response actor?

RQ2: How do solutions journalism stories about climate change compared with both problem-oriented stories about climate change and a control message (a) associate with positive affect and (b) preference for policy support?

H2: Solutions journalism stories about climate change compared with problem-oriented stories about climate change, **a)** will be negatively associated with negative affect, which will **b)** in turn increase preference for support for policy to address climate change.

RQ3: How, if at all, do any effects in this comparison related to negative affect vary with story topic and solution response actor?

RQ4: How do solutions journalism stories about climate change compared with both problem-oriented stories about climate change and a control message (a) associate with negative affect and (b) preference for policy support?

Cognitive Appraisals

Efficacy Appraisals.

As discussed, appraisal theories posit that perceived efficacy and coping ability determine the valence and nature of affective appraisal (Ellsworth & Scherer, 2003; Lazarus, 1966; Lazarus & Smith, 1988). Further linking emotions and appraisal, the extended parallel process model

[EPPM] (Witte, 1992) posits that when threatening messages are paired with efficacy information (i.e., a solution) individuals seek to manage the danger by engaging in protective action. Conversely, threatening information by itself (i.e., a problem) induces fear and maladaptive or reactance responses. Efficacy as conceived in the EPPM is bipartite: 1) self-efficacy, the ability to perform protective behavior, and 2) response efficacy, whether the response itself is perceived to be efficacious. The EPPM was influenced, in part, by Bandura's (1977) self-efficacy theory (Hart & Feldman, 2016b), which suggests individuals will engage in behavior change when they believe they can (self-efficacy) and when they believe the behavior will lead to a desirable result (outcome expectancy). While traditional, problem-oriented climate news provokes helplessness (Hart & Feldman, 2016a; O'Neill & Nicholson, 2009), the EPPM suggests that climate news that portrays effective actions to counter climate threats should reduce fear and motivate protective action (Feldman & Hart, 2016). Furthermore, self- and collective efficacy may be enhanced vicariously, according to social cognitive theory (Bandura, 1998), with media about individuals or groups engaging in efficacious action providing the vicarious experiences that increase efficacy perceptions required for behavior change (Bandura, 2001).

While individual actions often improve health, collective efficacy (belief that individuals working in groups can effect change) is critical for public health (Bandura, 1998, 2001). Climate change is a significant health threat (Fritze et al., 2008; IPCC, 2022) that requires both individual and collective action (Nielsen, 2023), although some argue that encouraging individual behavior change erodes support for systemic actions (Hagmann et al., 2023). In defining itself as reporting about structural responses to social problems, rather than one-off stories about individual good deed doers, solutions journalism requires a thematic, not an episodic, frame (Lough & McIntyre, 2023; Thier, 2021). As such, solutions journalism focuses on responses aimed at societal, rather

than individual, progress. By providing vicarious experiences of individuals and groups working to better society, rather than themselves, and evidence of response success, such news may be expected to foster group-level types of efficacy perceptions, including group response efficacy. Yet collective forms of efficacy are less explored in media effects research, despite collective forms of efficacy serving as predictors of societal-level environmental action (Skurka et al., 2022; Hart & Feldman, 2014; Maibach et al., 2008; Skurka et al., 2022). Furthermore, collective efficacy increases climate response intentions because collective efficacy motivates self-efficacy (Jugert et al., 2016).

Extant research about solutions journalism and efficacy has focused on self-efficacy with various operationalizations, except for Wenzel et al.'s (2018) qualitative finding that such journalism inspired collective efficacy by portraying underrepresented groups more holistically. Experimental and qualitative research has found that solutions journalism stories and social media updates increase self-efficacy compared with problem-oriented news (Baden, 2019; Li, 2021; Overgaard, 2021a; Zhao et al., 2022), including for environmental topics that hint at climate change (Baden, 2019; Overgaard, 2021a). A few people interviewed by Zhao et al. (2022) said solutions journalism made them feel their individual actions could alleviate climate change.

Research about solutions photojournalism reports mixed self-efficacy effects. Solutions text paired with a solutions photo increased self-efficacy compared with solutions stories paired with a problem-oriented photo, but not when the topic was climate change (Dahmen et al., 2019). Solution-only photos increased self-efficacy compared to problem-only photos, but not when photos contained elements of the solution and the problem (Midberry et al., 2022). McIntyre,

Lough, et al. (2018) found no effect on self-efficacy for either solution-oriented or conflict-oriented stories when paired with either solution-, problem-, or neutral-oriented photos.

Scant research has examined how text-based solutions-oriented journalism about climate change impacts efficacy perceptions. The sole study specifically about textual climate solutions journalism found news about a town adapting to climate-induced flooding positively predicted perceived behavioral control (Thier & Lin, 2022), which is akin to self-efficacy (Wallston, 2001). Beyond solutions or constructive journalism studies, other research has examined whether news about climate actions influences efficacy perceptions. Coleman et al. (2022) demonstrated that news about adapting to climate change increased perceived behavioral control compared with news focused on climate change's causes, yet the adaptive framing eliminated trigger terms (i.e., "climate change," "global warming") and discussion of causes or responsibility. Drawing on the EPPM, studies testing the effects of news about potential responses to climate change threats have found such stories increased perceived individual efficacy (Hart & Feldman, 2016a), internal political efficacy, or perceived ability to politically participate regarding climate change (Hart & Feldman, 2016b), and collective efficacy (Feldman & Hart, 2021), compared with stories about negative climate outcomes. Taken together, research suggests reporting on climate actions improves individual forms of efficacy, but understanding how climate solutions journalism (news about existing, not proposed responses) affects efficacy perceptions requires further experimental inquiry. In this dissertation, I build on Thier and Lin (2022) by testing the effects of text-based solutions journalism about other climate topics (food waste and wildfires). Further, I extend solutions journalism experimental research to include group forms of efficacy perceptions as responses detailed in such stories offer societal-level outcome expectancies and require group action.

Environmental Communication and Efficacy Constructs.

The conceptualization and operationalization of efficacy in media effects scholarship suffers from a lack of clarity and consistency, with little attention paid to collective outcome expectancies despite calls by some scholars to do so in the realm of climate change communication (Skurka et al., 2022). To that end, Skurka et al. (2022) propose media effects scholars align efficacy level (institution, collective, and individual) and focus (capacity constructs vs. outcome constructs) with study goals and topics. For example, while collective efficacy and collective response efficacy both sit at the collective level, collective efficacy focuses on capacity (“To what extent can individuals come together as a collective to take action?”) while collective response efficacy focuses on outcomes (“To what extent will collective action mitigate a threat?”) (Skurka et al., 2022, p. 21). Both are relevant when considering the effects of climate change journalism on audiences and whether any efficacy perceptions mediate action-oriented outcomes.

While personal self- and response efficacy are linked to pro-climate behavioral intentions, the benefits of pro-environmental action accrue from individuals acting in concert and largely benefit society (Meijers et al., 2023). As such, collective beliefs may be more influential than individual ones in the context of collective problems like climate change (Jugert et al., 2016), with different levels of efficacy associated with stimulating different environmental actions (Meijers et al., 2023). For instance, collective action is fueled by strong group efficacy, not self-efficacy (van Zomeren et al., 2012). Meijers et al.’s (2023) typology of efficacy beliefs relevant to environmental actions suggests personal, collective, and governmental levels, as well as separates efficacy into beliefs about capability and response effectiveness, in line with Skurka et al.’s (2022) capacity vs. outcomes distinction. At the government level, government response

efficacy concerns whether government policy can effectively deal with environmental problems (Meijers et al., 2023), an efficacy type that communication scholars rarely examine (Skurka et al., 2023).

As individuals' incentive to act depends on perceptions about their ability to affect events, individually and collectively, (Bandura, 2001), it seems likely that efficacy perceptions derived from solutions stories fuel intended climate action and support for policies that require collective action. For instance, news about climate impacts decreased collective efficacy compared to news about *potential* climate actions (Feldman & Hart, 2021). Environmental psychology and risk communication research has shown perceived behavioral control and participative efficacy beliefs predicted intended collective action toward a low-carbon economy (Bamberg et al., 2015) and government response and collective response efficacy more predictive of policy support than self-efficacy, when policy support was conceived as support for reducing global warming through carbon emission reduction without mention of any policies (Bostrom et al., 2018).

While two studies have identified perceived behavioral control as a mechanism by which solutions-oriented climate news positively predicts climate policy support (Coleman et al., 2022; Thier & Lin, 2022), research has not considered whether solutions-oriented climate news affects policy support via group-level forms of efficacy. This dissertation tests whether news about societal- or group-level responses to the collective problem of climate change influences public-sphere policy support through collective, collective response, and governmental response efficacy, efficacy constructs Meijers et al. (2023) determined most predictive of environmental public-sphere policy support. Public-sphere policy - support for pro-environmental government requirements for business and industry support (Meijers et al., 2023) - sits at the intersection of

individual and collective action as individuals alone and in concert voice preference for collective action by social institutions. Also, I examine the role of individual response efficacy, or whether individual actions lead to efficacious outcomes (Kohl & Stenhouse, 2021), to broaden findings that individual capacity efficacy conceptions mediate between solutions-oriented news and policy support (Coleman et al., 2022; Thier & Lin, 2022) to individual outcome expectations.

Communication about climate risks may backfire unless the messages include climate actions and response efficacy of those actions (Meijnders et al., 2001; Myers et al., 2012). Therefore, solutions journalism climate stories should not only enhance a variety of efficacy types, but also positively predict support for climate policy through efficacy perceptions, in comparison to problem-oriented stories. Accordingly, I propose:

H3: Solutions-oriented journalism stories about climate change, compared with problem-oriented stories about climate change will be positively associated with participants' beliefs in **a)** individual response efficacy, **b)** collective efficacy, **c)** collective response efficacy, and **d)** government response efficacy, all of which will **e)** in turn increase preference for support for policy to address climate change.

Furthermore, I ask:

RQ5: What effects among the efficacy constructs vary, if at all, in this comparison with story topic and solution response actor when comparing solutions-oriented stories and problem-oriented stories about climate change?

RQ6: How do solutions journalism stories about climate change compared with both problem-oriented stories about climate change and a control message **a)** individual response efficacy, **b)** collective efficacy, **c)** collective response efficacy, and

d) government response efficacy, **e)** and in turn with preference for support for policy to address climate change?

Threat Appraisals.

Although climate solutions journalism may decrease negative affect by showing that effective climate solutions exist, such stories nonetheless include potentially distressing information about climate impacts. Such information is likely to be perceived as threatening as climate impacts create myriad types of threats (IPCC, 2022), yet no research has examined whether climate solutions journalism evokes threat. As threat is an essential component of research on fear appeals that include efficacy information (e.g., the EPPM), it is important to establish whether climate solutions journalism, in comparison with problem-oriented climate journalism, evokes threat or whether the efficacy information about the solution negates any sense of threat. Messages about threats convey threat severity and susceptibility; thus, perceived threat cognitions derived from messages include individuals' perceived threat severity and susceptibility (Witte, 1992). Accordingly, this dissertation seeks to understand whether climate solutions journalism leads to perceived threat (severity and susceptibility) and if any perceptions impact policy support. Thus, I ask:

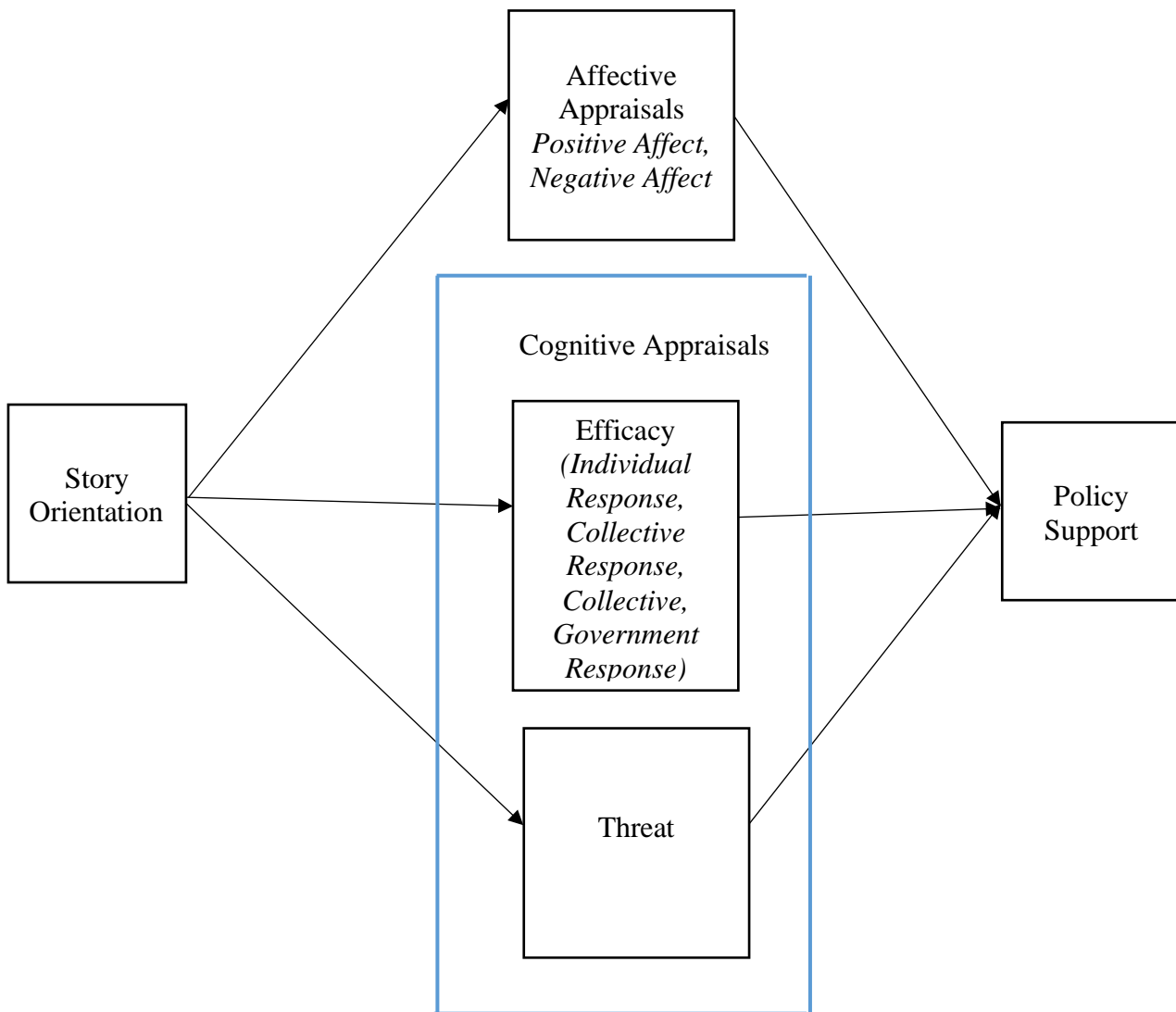
RQ7: How do solutions-oriented journalism stories about climate change impact perceived threat **a)** compared with problem-oriented stories about climate change? **b)** Are there any mediated effects? **c)** What effects vary, if at all, with story topic and solution response actor?

RQ8: How do solutions journalism stories about climate change compared with both problem-oriented stories about climate change and a control message **a)** perceived threat? **b)** Is there a mediated effect?

Research about affective and cognitive appraisals suggests affective appraisals may precede cognitive ones (e.g., Leiserowitz, 2006; Slovic et al., 2007) or that cognitive appraisals may occur first (e.g., Nabi et al., 2018; So, 2013; Witte, 1991). In addition, it is unclear whether solutions journalism engenders several of the cognitive appraisals proposed as mediators in this study. As solutions journalism effects research driven by theory is in its infancy, I propose a parallel mediation model of the effects of climate solutions journalism on preference for public-sphere policy support as portrayed in Figure 1 below.

Figure 1

Conceptual Model of Climate Change Solutions Journalism on Policy Support



Finally, to enlarge our understanding of how solutions journalism about climate change affects preference for policy support I ask:

RQ9: a) What is the total effect, if any, of solutions journalism stories about climate change compared with problem-oriented stories about climate change on preference for

public-sphere policy support to address climate change? **b)** Are there variations by story topic and solutions response actor for any direct effects?

RQ10: What is the total effect, if any, of solutions journalism stories about climate change compared with problem-oriented stories about climate change and a control on preference for public-sphere policy support to address climate change?

The Role of Political Ideology on Solutions and Climate Policy Support

Political and ideological polarization of American climate change beliefs, threat perception, and concern has deepened over time (McCright & Dunlap, 2011; Dunlap et al., 2016). Although most American voters support policies to mitigate and adapt to climate change, conservative Republicans voice the lowest support across a range of climate-friendly energy, conservation, and restoration policies, followed by liberal/moderate Republicans, moderate/conservative Democrats, and liberal Democrats (Leiserowitz, Maibach, Rosenthal, Kotcher, Goddard, et al., 2023). Additionally, American adults are ideologically divided on the effectiveness of national and international actors and actions in reducing climate change effects (Poushter et al., 2021). Such ideological differences in response to contested science issues may be the result of motivated reasoning (Luong et al., 2019), the idea that people access, construct, and evaluate beliefs to reach desired conclusions (e.g., Kunda, 1990).

Motivated social cognition studies and a meta-analysis suggest that ideological differences may largely stem from a psychological need to reduce threat, including beliefs about the role of government (Jost et al., 2003; Jost et al., 2008). Individuals whose worldview is threatened by the idea of government regulating businesses (i.e., free-market ideology) are motivated to conclude greenhouse gas mitigation is inessential, which negatively impacts pro-environmental behavior (Hornsey, 2021), decreases support for climate change mitigation and

creates boomerang effects among Republicans (Hart & Nisbet, 2012). While group-level processes, such as identification with one's political group, also influence ideologically motivated behavior, individual-level processes that affect climate change polarization stem from individuals' thinking styles and include the motivated reasoning phenomenon known as solutions aversion (Cole et al., 2023).

The solutions aversion model (Campbell & Kay, 2014) posits when solutions to social problems threaten individuals on ideological grounds, they are motivated to discount the underlying problem. Thus, an ideologically aversive policy solution may spark reactance leading to denial of scientific facts. In the context of climate change, two experiments by Campbell and Kay (2014) showed that Republicans and those with stronger free-market ideology were more likely to agree with climate science when presented with brief, non-journalistic messages about a free-market policy solution than a government-regulation solution, whereas policy type did not affect Democrats' climate science beliefs. Beyond climate change, solutions aversion studies have found liberals skeptical of intruder violence when presented with an anti-gun control message (Campbell & Kay, 2014), conservatives dismissive of COVID-19 risks after government regulation messages, and liberals less supportive of Emergency Use Authorization of COVID-19 vaccines when confronted with market-oriented solutions (Chu et al., 2021).

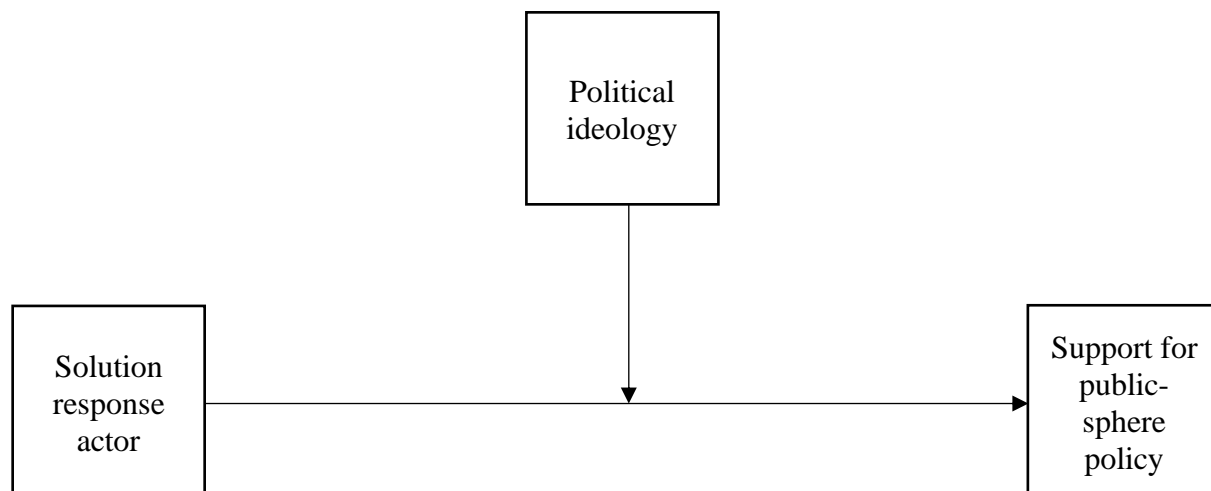
Framing messages congruent with audience ideological leanings can counter motivated rejection of science (Cole et al., 2023; Hornsey, 2021; Luong et al., 2019) and may increase pro-environmental behavior (Hornsey et al., 2016). Beyond rejection of science, the solutions aversion phenomenon can also influence policy preferences. For instance, Campbell and Kay (2014) found Republicans had greater belief in solution quality when presented with market-friendly climate change policy ideas. However, a 2016 meta-analysis found that ideology and

political identity only modestly predict climate change policy support (Hornsey et al., 2016). Solutions journalism proponents and scholars suggest that news audiences require evidence of what works as well as what does not to foster civic engagement (Baden et al., 2019), yet merely transmitting information to citizens does not necessarily guarantee policy support (Schäfer et al., 2019; Simis et al., 2016). Therefore, showcasing a solution, instead of a problem, may not be enough to stimulate policy support. Not only does science communication take place in political contexts (Scheufele, 2014), but partisan identity influences motivating reasoning about journalism, with both liberals and conservatives selectively processing climate change news (Newman et al., 2018). Therefore, I ask whether participants' political ideology moderates the effect of ideologically congruent climate solutions journalism on climate policy support preference (see Figure 2):

RQ11: Are there interactions between ideologically incongruent climate solutions (government-led vs. business-led) and participant political ideology on policy support?

Figure 2

Political Ideology as a Moderator of Solutions Type on Support for Public-Sphere Policy



Misinformation Susceptibility

Increasing political polarization and the advent of digital and social media are heightening long-standing concerns about science misinformation, including climate misinformation (Scheufele & Krause, 2019). While scholars have claimed that climate misinformation impacts people's understanding of climate science and reduced support for mitigation policies, researchers disagree about what constitutes climate misinformation (Treen et al., 2020). As with debates about misinformation in other fields, defining climate misinformation centers on whether information is true, false, or misleading and whether there is intent to deceive (Treen et al., 2020). The current study relies on Treen et al.'s (2020, p. 3) definition in their overview of online climate misinformation: "Misinformation is misleading information, that is created, and spread, regardless of whether there is intent to deceive." This dovetails with recent health misinformation definitions (Nan et al., 2023; Wang et al., 2022) that similarly exclude deception intentions as the effects may be the same whether recipients can discern a sender's intent.

Climate change misinformation includes climate skepticism, contrarianism, and denial about climate science with serious consequences for public understanding of climate science, political polarization, political action, and policy support (Treen et al., 2020). Indeed, a meta-analysis found that climate conspiracy beliefs have a significant medium-to-large negative association with acceptance of climate science, as well as science in general, and pro-environmental policy support and a small-to-medium negative effect on environmental intentions (Biddlestone et al., 2022). Although most Americans hold accurate beliefs about climate change, 16% say global warming is not occurring and 14% are not sure, 27% think the causes are mostly

natural rather than anthropogenic, and 20% think scientists disagree whether global warming is happening (Leiserowitz, Maibach, Rosenthal, Kotcher, Carman, et al., 2023).

While news has contributed to climate misinformation by providing “false balance” about scientific certainty regarding climate science in the name of journalistic objectivity, media coverage in recent years has shifted toward promoting the scientific consensus (Brüggemann & Engesser, 2017). Moreover, a recent study challenges the idea that news exposure exacerbates climate misinformation, finding instead that it increases political knowledge and information, which can build resiliency to misinformation (Altay et al., 2023). Research about countering climate misinformation has largely focused on misinformation correction (Treen et al., 2020), either “pre-bunking” or pre-emptively advising individuals about misinformation (Cook et al., 2017; van der Linden et al., 2017) or correcting it post-exposure (Benegal & Scruggs, 2018; Kahan, 2017; Lawrence & Estow, 2017). This dissertation instead focuses on whether facets related to why people believe misinformation in the first place offer an avenue for countering climate misinformation.

Affect as a Potential Mediator

Being misinformed is partially a function of individuals’ ability and motivation to discern false from accurate information (Nan et al., 2023; Scheufele & Krause, 2019). Emotional responses to information can reduce motivation to reason accurately or enhance directionally motivated reasoning (Nan et al., 2023), with negative emotions increasing susceptibility to misinformation by (Greenstein & Franklin, 2020; Porter et al., 2003; Scheufele & Krause, 2019). However, positive emotions show potential to counter motivated and biased reasoning about science issues (Wong-Parodi & Geygina, 2021; Yeo & McKasy, 2021).

As solutions journalism has been shown to increase positive affect (Baden, 2019; Li, 2021; McIntyre, 2019; McIntyre, 2020; McIntyre & Sobel, 2017; Overgaard, 2021a, 2021b; Rusch et al., 2021), climate solutions journalism may lead individuals to reason more accurately about climate misinformation, in turn decreasing their susceptibility to such misinformation. Similarly, as solutions journalism decreases negative affect (Baden, 2019; McIntyre, 2019; Overgaard, 2021a; Rusch et al., 2021), that may also motivate accurate reasoning and decrease climate misinformation susceptibility.

Media Trust as a Potential Mediator

Journalism is considered essential to democracy, yet news audiences tune out negative news (Newman et al., 2019) with a partisan media trust gap widening due to steep declines in media trust among Republicans (Gottfried & Liedke, 2021). If the “primary purpose of journalism is to provide citizens with the information they need to be free and self-governing” (Kovach & Rosenstiel, 2014, p. 17), news avoidance and declining media trust pose serious threats to American society. In 2021 among individuals surveyed in more than 20 countries, less than two-thirds trusted traditional news as a source of information, more than three-quarters were concerned about fake news, and about half of people viewed media as a divisive societal force (Edelman, 2022). At the same time, the percent of people worried about climate change rose three points in a year to 75% (Edelman, 2022). Globally, between 1981-2014 trust in the press declined the most in the US, with evidence to suggest a link between press trust and political trust especially strong in polarized societies (Hanitzsch et al., 2018). In the context of climate change, a 2021 survey of UK residents found only 30% trusted journalists as a source of climate change information, with similarly low numbers for broadsheet newspapers (37%) and broadcast media outlets (38%) (Biddlestone & van der Linden, 2021). In the U.S., registered voters as a

whole rank various news media types and outlets in the bottom half of sources they trust for climate change information with local newspapers the most trusted (10th), followed by National Public Radio (11th), local TV news (12th), national network news (13th), CNN (16th), MSNBC (17th), and the Fox News Channel (20th), with some variation by party and ideology (Leiserowitz et al., 2022).

In this time of declining media trust, solutions journalism has shown promise in restoring media trust among news audiences. In an experiment, participants who read a solutions story reported more media trust than those who read a problem-oriented story on one of three topics (Thier et al., 2021). Surprisingly, political ideology did not affect participants' story trust, although it did impact story belief (Thier et al., 2021). In another experiment, perceived news credibility increased for viewers of news updates from SJN's Facebook page compared with negative news update posts about the same topics, with positive and negative affect mediating the effect (Overgaard, 2022a). However, constructive news did not increase media trust compared to non-constructive news in another experiment, except when constructive news increased mood (van Antwerpen, Searston et al., 2022). Beyond experiments, two audience studies showed support for the idea that solutions journalism increases media trust. Readers of *The Seattle Times* solutions journalism education vertical said they trusted the paper more than readers in general (Green-Barber, 2016) and TV viewers in six American cities found solutions journalism stories more trustworthy than problem-oriented stories by virtue of their comprehensiveness and inclusion of multiple voices (SmithGeiger, 2021). While mis- and under-representation undermines media trust in disadvantaged communities and groups (Ross Arguedas et al., 2023), solutions journalism can improve media trust among people of color historically stigmatized by journalism by providing more holistic representation, particularly when the

solutions news is community-centered, engaged journalism (Wenzel & Crittenden, 2021; Wenzel et al., 2018). Reporters engaged in constructive journalism surmise that such solutions-oriented journalism may reduce susceptibility to misinformation by increasing media trust, although empirical examination is needed (van Antwerpen, Turnbull et al., 2022). Therefore, I surmise that climate solutions journalism will increase media trust, in comparison with problem-oriented climate news, in turn decreasing susceptibility to climate misinformation.

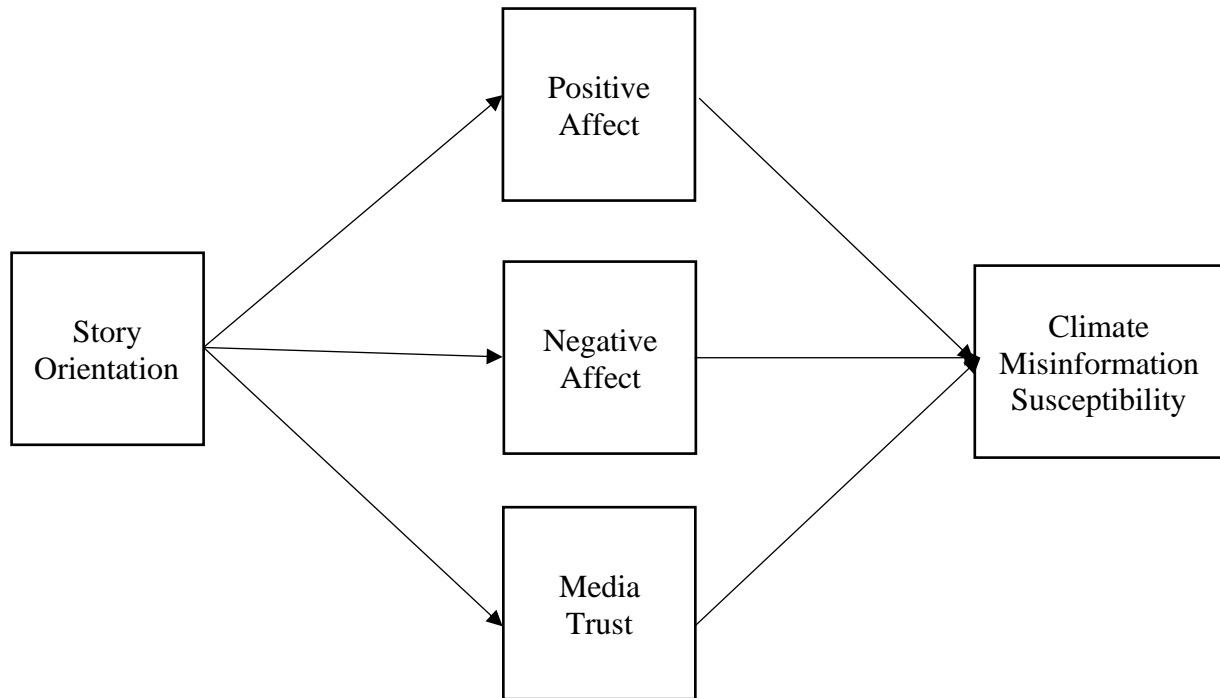
Given the lack of scholarship about solutions journalism and misinformation, I suggest a parallel mediation model of the effect of solutions journalism on climate misinformation susceptibility, as shown in Figure 3 below. Accordingly, I propose the following research question and hypothesis:

H4: Solutions journalism stories about climate change compared with problem-oriented stories about climate change will lower susceptibility to climate misinformation indirectly through a) increased positive affect, b) reduced negative affect, and c) increased media trust.

RQ12: Is the total effect of solutions journalism stories about climate change compared with problem-oriented stories about climate change on susceptibility to climate misinformation negative and statistically significant?

Figure 3

Conceptual Model of Solutions Journalism's Effect on Climate Misinformation Susceptibility



Chapter 6: Experimental Study

This study experimentally tests the effect of solutions-oriented journalism about climate change on support for policy action to address climate change and on susceptibility to climate change misinformation compared with problem-oriented journalism about climate change and an irrelevant message. First, the study tests whether several proposed mediators (H1-H3) mediate the effect of solutions-oriented journalism about climate change on support for policy action to address climate change compared with problem-oriented journalism, and whether any mediated results vary by story topic (RQ1, 3, 5, and 7). Second, the study explores the effect of solutions-oriented journalism about climate change on support for policy action to address climate change compared with problem-oriented journalism (RQ9a) and how those effects vary, if at all, by story topic and response actor (RQ9b). Also, these potential effects of climate solutions journalism are compared to both problem-oriented journalism and an irrelevant message control (RQ 2, 4, 6, 8, and 10). Third, the study aims to determine whether party-affiliation moderates any effects of support for policy action to address climate change when comparing participants exposed to a government-sponsored solution vs a business-sponsored solution (RQ11). Finally, the study tests whether the effect of solutions-oriented journalism about climate change reduces susceptibility to climate change misinformation (H4) through several proposed mediators (RQ12a-c).

Method

Design and Procedures

I conducted an online, between-subject experiment with a 3 (government solution vs. business solution vs. problems) x 2 (food waste vs. wildfire) + 1 (irrelevant message control) between-subjects experiment ($N = 368$). Including a control condition with advocacy messages

allows examination not only of their relative persuasiveness, but also whether those advocacy messages are more persuasive than no message on that subject, as well as indicate the presence of backfire effects (O’Keefe, 2023). I recruited participants on May 12, 2023, from Prolific, an online research platform, which a recent study found provides better participant data quality than Amazon Mechanical Turk, Qualtrics, and SONA (Douglas et al., 2023). Participants had to be 18 years old or older and reside in the United States. Those who consented and completed the study were paid \$4 for the approximately 19-minute study. The University of Maryland Institutional Review Board approved the study.

After consenting, participants answered pre-test questions about their beliefs in anthropogenic climate change and climate conspiracy, as well as their level of climate fatalism. For these and all other post-test constructs the exposure order was randomized at the construct block level to reduce order effects. Next, participants were exposed to one of seven news stories: 1) an unrelated message about the James Webb telescope, 2) a problem-oriented story about climate-related food waste, 3) a problem-oriented story about climate-related wildfires, 3) a solutions-oriented story about climate-related food waste where the response was led by government, 4) a solutions-oriented story about climate-related wildfires where the response was led by government, 5) a solutions-oriented story about climate-related food waste where the response was led by business, and 6) a solutions-oriented story about climate-related wildfires where the response was led by business. Participants were required to spend at least one minute on the stimuli page by the Qualtrics survey software before continuing to post-test items. Following exposure, participants answered questions about their affect while reading the story, their perceived threat, their individual response efficacy, their collective efficacy, their government response efficacy, their media trust, their public sphere policy support, and climate

misinformation susceptibility.³ Participants were then asked a series of demographic questions before being debriefed about inaccurate information mentioned in some of the climate change susceptibility items and directed to additional sources of accurate information.

Participants

I conducted an *a priori* power analysis in G*Power (Faul et al., 2009) with a Cohen's *d* effect size equal to .25, an alpha level of .05 and statistical power of .95. The analysis found that a total sample size of 341 was needed for ANCOVA. To estimate the power needed for mediation analyses, I relied on Sim et al.'s (2022) simulation study, which showed a sample size of 387 is needed to detect an average effect with power of .8 at alpha level .05 for parallel mediation models employing bootstrapping. (Sim and colleagues suggest detecting a small effect in such situations requires a sample size of 980.)

A total of 399 participants completed the study with 13 opting to return to Prolific without completing the study and one participant each timing out or not submitting a completion code. Responses that failed either the attention check ($n = 7$) or the message topic recall check ($n = 24$) or entered no data ($n = 1$) were excluded, resulting in a final sample size of 368.

Manipulation

First, I searched SJN's StoryTracker, an online database of published solutions journalism, for stories that varied the response actor (i.e., government-led or business-led) for two different aspects of climate change. Ultimately, I found stories about government-led and business-led responses to the climate impacts of food waste and wildfire. As crisis risk perceptions (Jin et al., 2007), psychological proximity (Maiella et al., 2020), and possibly personal experience of

³ I also measured private sphere policy support to pilot the measure for another study, but this variable is not included in this study's models or analyses.

climate change (Reser & Bradley, 2020) influence crisis responses such as mitigation and adaptation behavior, selecting topics with differential temporal, geographic, and even bodily risks, such as food waste and wildfires, is especially important to guard against topic-level effects. Next, I conducted an Internet search to identify text- and U.S.-based stories focused exclusively or mostly about the problematic aspects of climate-related food waste and wildfires.

For the control, I elected to include a message, rather than no message, to prioritize ecological validity as news consumers are exposed to many issues and topics as they peruse news. Finding a “neutral” news story about climate change was challenging as climate news typically includes either the negative effects of climate change or possible responses, so I selected a placebo message that neither focused on a problem or a programmatic response to a social ill. For the placebo, I chose a science story, about the James Webb telescope, because science journalism is a specialty within journalism with its own development history (Dunwoody, 2014; Guenther, 2019) and because participants’ science literacy may be different than their understanding of other social issues.

The story sources were *Grist*, the *Montana Free Press*, *npr.org*, *Reasons to be Cheerful*, *The Philadelphia Citizen* (solutions); *The New York Times* (problems); and *The Verge* (control). With the exception of the government-led food waste solution stimulus, which was created by merging elements from two separate news stories, all stimuli reflected a single news story. In some instances, I changed locations to the U.S. or eliminated explicit ideological statements. The stories ranged in length from 1,157 to 1,439 words (solutions), 323 to 696 words (problems), and 981 words (control). Because solutions stories contain information about both the problem and the response, they are necessarily longer than problem-oriented stories (McIntyre, 2019; Meier, 2018), with other solutions journalism experiments employing this approach (e.g., McIntyre &

Sobel, 2017). To additionally enhance ecological validity (Brewer & Cano, 2014), this experiment relied on actual problem-oriented news stories, rather than such stories modified from solutions stories as seen in much previous solutions journalism research (e.g., McIntyre, 2019; Thier et al., 2021; Thier & Lin, 2022). For all stories, the news source, reporter name, photos, graphics, and cutlines were removed as such elements may affect reader perceptions and bias information processing (e.g., Gibson & Zillmann, 2000; Kelly, 2019; Paul et al., 2022; Sundar & Nass, 2001). Moreover, research about visual solutions journalism has found photo orientation (solutions, problem, neutral) and photo-text orientation congruence (Dahmen et al., 2019; McIntyre et al., 2018b; Midberry et al., 2022) and photo graphicness vs. sanitization (Overgaard, 2021b) to affect audience perceptions of solutions journalism. Headlines and sub-headlines, when originally present, were maintained to increase ecological validity. All stimuli are available in Appendix D.

Measures

Mediating Variables

Positive and Negative Affect. Affective reactions to the stimuli were measured with 10 items adapted from Jin et al. (2016) and Jin et al. (2020). Participants were asked to rate the extent they experienced a series of emotions, such as “angry, irritated, annoyed” and “optimistic, encouraged, hopeful” while reading the story on a scale from 1 (Not at all) to 7 (Extremely). Principal component analysis with Direct Oblimin rotation revealed that six items loaded onto a factor referring to negative emotions (sad, angry, scared, nervous, uneasy, confused) and two items loaded onto a factor referring to positive or positive-leaning emotions (optimistic, loving, hopeful, amazed). One item cross-loaded (sympathy) and was excluded from both factors. Principal components analysis is detailed in Table 4. Negative affect (eigenvalue = 4.41,

explained variance = 49%, $\alpha = .92$) and positive affect (eigenvalue = 2.24, explained variance = 24.32%, $\alpha = .81$) displayed good reliability.

Perceived Threat. Participants rated their level of agreement or disagreement with six items adapted from Witte et al.'s (1996) Risk Diagnosis Behavior Scale on a scale from 1 = *Strongly Disagree* to 5 = *Strongly Agree*. Three items reflected participants' perceived severity of the threat of climate change (i.e., "I believe that the threat of climate change is significant") while three items measured participants' perceived climate change severity (i.e., "It is likely that I will be affected by the threat of climate change"). The six items were averaged to create a perceived threat index ($M = 4.12$, $SD = .97$, $\alpha = .91$).

Individual Response Efficacy. Participants rated their level of agreement or disagreement with three items adapted from Kohl and Stenhouse (2021) on a scale from 1 = *Strongly Disagree* to 7 = *Strongly Agree*. All items were reverse coded. A sample item is "The actions I can take are too small to help solve problems caused by climate change." Responses to the three items were averaged to create an individual response efficacy index ($M = 3.88$, $SD = 1.61$, $\alpha = .92$).

Collective Efficacy. Participants rated their level of agreement or disagreement with five items from Halpern et al. (2017) on a scale from 1 = *Strongly Disagree* to 5 = *Strongly Agree*. Sample items are "The collective action of people has a huge influence on public affairs" and "Politicians would respond to the needs of citizens if enough people demand change." The four items were averaged to create a collective efficacy index ($M = 3.87$, $SD = .70$, $\alpha = .86$).

Collective Response Efficacy. This variable was measured with four items from Kohl and Stenhouse (2021) on a scale from 1 = *Strongly Disagree* to 7 = *Strongly Agree*. The items were 1) "There is a decent chance that humanity will be able to prevent the worst effects of

climate change,” 2) “Climate change is an unstoppable process; we can’t do anything about it,” 3) “Climate change is such a complex problem; we will never be able to solve it,” and 4) “If everyone works together, we can solve problems caused by climate change” with items 2 and 3 reverse coded. Responses to the items were averaged to create a collective response efficacy index ($M = 4.85$, $SD = 1.27$, $\alpha = .83$).

Governmental Response Efficacy. Seven items were adapted from Meijers et al. (2022) which participants rated on a scale from 1 = *Strongly Disagree* to 7 = *Strongly Agree*. Sample items were “The government could effectively protect the climate by introducing stricter laws” and “The climate can be protected by raising taxes.” A governmental response efficacy index was created using the MEAN function in SPSS ($M = 4.93$, $SD = 1.46$, $\alpha = .95$).

Media Trust. Media trust was measured with 13 items from Kohring and Matthes’ (2007) 16-item media trust measure on a scale of 1 = *Strongly Disagree* to 7 = *Strongly Agree* with an “I don’t know” option. ($M = 5.24$, $SD = 0.86$, $\alpha = .90$).⁴

Dependent Variables

Support for Policy to Address Climate Change. Eight items were adapted from Meijers et al.’s (2022) public sphere environmental policy support measure which participants rated on a scale from 1 = *Strongly Disagree* to 7 = *Strongly Agree*. Sample items included “I support the government in providing funding for research related to climate change,” “I am willing to support a law that requires companies to reduce greenhouse gas emissions,” and “I support the government controlling and regulating the way industry uses climate change-inducing gases.” The scale demonstrated excellent reliability ($M = 5.66$, $SD = 1.49$, $\alpha = .98$).

⁴ Fifteen items were measured, but one was duplicated in the questionnaire so responses to the duplicated items were removed for analysis.

Climate Misinformation Susceptibility. Participants rated the reliability or unreliability of nine statements about climate change (five true) on a scale of $1 = \textit{Very Unreliable}$ to $7 = \textit{Very Reliable}$. The scale was adapted from Roozenbeek et al.'s (2020) study on susceptibility to COVID-19 misinformation with the climate statements taken from a climate misinformation study by Biddlestone and van der Linden (2021). Initial reliability was poor ($\alpha = .29$). Following Roozenbeek et al. (2020), I eliminated the true statements and created an index based on the misinformation statements only, which resulted in $\alpha = .71$. The mean was 2.83 ($SD = 1.02$).

Control Variables

Study Completion Time. Because the stimuli were different lengths, I included study completion time as a control variable to minimize the effect of stimuli length on mediating and dependent variables. The average study completion time was 19.05 minutes ($SD = 11.79$ minutes), with time spent on the study ranging from 5.38 to 94.7 minutes.

Climate Fatalism. Fatalistic beliefs about climate change have been shown to reduce individuals' climate behavior and policy response as well as moderate climate risk perception, which predicts increased behavior and policy intentions (Mayer & Smith, 2018). Therefore, participants' degree of climate fatalism was measured with one item from the Life in Transition survey II of 34 countries (European Bank for Reconstruction and Development, 2010). Participants were asked to rate their agreement or disagreement ($1 = \textit{Strongly Disagree}$ to $5 = \textit{Strongly Agree}$) with the statement "Climate change is an unstoppable process; we cannot do anything about it." The mean response was 2.27 ($SD = 1.10$).

Belief in Anthropogenic Climate Change. Following Kohl and Stenhouse (2021), participants answered whether they believed climate change is caused by: $1 = \textit{“Entirely by Natural Processes,”}$ $2 = \textit{“Mostly by Natural Processes,”}$ $3 = \textit{“About Equally by Natural$

Processes and Human Activities,” 4 = “Mostly by Human Activities,” 5 = “Entirely by Human Activities” or selecting “I Don’t Believe the Climate is Changing” as a response which was coded as 1. The mean response was 3.72 ($SD = .97$).

Climate Conspiracy Beliefs. Participants rated their level of certainty or uncertainty about four items on a scale of 1 = *Certainly Not* to 7 = *Certainly* (van Prooijen et al., 2015). Sample items are “Do you believe politicians have a vested interest in changing the facts about global warming?” and “Do you believe scientists are pressured to portray climate change differently than is actually the case?” The scale demonstrated good reliability ($M = 3.57$, $SD = 1.30$, $\alpha = .75$).

Demographic Variables. I included the following demographic variables as covariates: age, sex (female, male, intersex, no answer), gender (female, male, transgender, a gender not listed here, no answer), racial/ethnic identity (African American, Asian or Pacific Islander, Latinx or Hispanic, Middle Eastern/North African, Multi-ethnic/racial, Native American/American Indian, White/Caucasian, prefer not to answer), and political party affiliation (Republican, Democrat, Independent, Other).

Political ideology was measured with the Pew Research Center ideological consistency scale, which asks participants to choose which statement (left/right) in 10 paired statements better reflects their views (Pew Research Center, 2014). For instance, participants choose between “Government is almost always wasteful and inefficient” and “Government often does a better job than people give it credit for.” Left/liberal items were coded -1, right/conservative items were coded +1, and all other responses (both, neither, don’t know, refuse to answer) were coded 0. Scores ranged from -9 for the most liberal to +9 for the most conservative ($M = -4.32$, $SD = 4.51$, $\alpha = .87$) and were re-coded into five levels: consistently liberal (-9 to -7), mostly

liberal (-6 to -3), mixed (-2 to +2), mostly conservative (+3 to +6), and consistently conservative (+7 to +9) (Per Research Center, 2014). The entire list of measures is available in Appendix E.

Age was measured as a continuous variable. Gender but not sex was included in the analysis, with gender coded with woman as the reference group vs. male and other (including participants who selected either transgender, a gender not listed, or no answer). For race/ethnicity White/Caucasian was the reference group for all other racial/ethnic identification categories. Political party identification was coded as Democrat (vs. Republicans, Independents, and Other). Consistently liberal served as the reference group for political ideology. For hypothesis testing of problem-oriented vs. solutions-oriented journalism, I created a new “solutions” variable that collapsed the four solutions stories into one group, and the two problem stories into another group, which served as the reference.

Analytical Approach

Randomization Check.

Participants were randomly assigned to one of seven news stories: an irrelevant message about the James Webb telescope ($n = 52$), a problem story about climate change and food waste ($n = 49$), a problem story about climate change and wildfires ($n = 52$), a solutions-oriented story about climate change and food waste with government officials leading the solution ($n = 55$), a solutions-oriented story about climate change and food waste with businesses leading the solution ($n = 54$), a solutions-oriented story about climate change and wildfires with government officials leading the solution ($n = 57$), and a solutions-oriented story about climate change and wildfires with businesses leading the solution ($n = 49$). There were no significant differences between conditions regarding age ($F(6, 361) = 0.83, p = .55$), sex ($\chi(18)^2 = 21.24, p = .27$), gender ($\chi(24)^2 = 29.81, p = .19$), race/ethnicity ($\chi(42)^2 = 37.24, p = .68$), party identification

$(x(18)^2 = 8.40, p = .97)$, and political ideology ($x(42)^2 = 37.24, p = .68$). Thus, randomization was successful.

Manipulation Check and Message Recall.

As the differences in stimuli were based on intrinsic message features, this study did not include a manipulation check (O’Keefe, 2003). However, participants were asked to recall whether the story they read was about telescopes, food waste, wildfires, or a topic not mentioned in that question. Twenty-four participants who answered incorrectly were excluded from analyses. Additionally, participants were asked about the presence or absence of a solution in the story they read with 77 selecting the unexpected response. The greatest number selecting the wrong answer were assigned to the problem-food waste condition ($n = 31$), followed by those assigned to the irrelevant message about the James Webb telescope ($n = 18$). Because the problem-food waste stimulus included at least two mentions that the government could address food waste and because the irrelevant message mentioned multiple positive results from deploying the telescope, I determined that this question likely confused participants I ran analyses with and without these 77 participants in the data set and as the results were highly similar, I elected to retain those 77 participants.

Statistical Analyses

Before beginning the main analyses, I checked regression model assumptions (linearity, normality, homoscedasticity, and independence) and for the presence of multicollinearity. As part of these checks, I assessed the skew and kurtosis of all potential mediators and dependent variables, which all were with Kline ‘s (2011) benchmarks (± 3 for skewness, ± 10 for kurtosis). Also, I assessed the degree of missing data. With the exception of media trust, the level

of missing data ranged from none to 2.2%. For media trust, 19.8% of data was missing, resulting in a sample of 285 for analyses involving this construct, reducing power and challenging the interpreting of results. As this data cannot be considered missing completely at random, I ran hot-deck imputation (Myers, 2011) with covariates ideology level, sex, race, party, and gender, as well as condition as the baseline variables (Campbell et al., 2023). This resulted in a sample size of 314 (14.7% missing data).

To test the following hypotheses and research questions (H1-H4 and RQs 1, 3, 5, and 7) related to public sphere support for climate change policy and potential parallel mediation, I conducted a series of mediation analyses using PROCESS Model 4 (Hayes, 2018) in SPSS. For the hypotheses comparing solutions-oriented stories as a group to problem-oriented stories as a group, I dummy coded condition to include only the subset with solutions-oriented stories ($n = 215$) and problem-oriented stories ($n = 101$), which served as the reference, for a total sample of 316. I then created two variables: one with only participants in the food waste conditions ($n = 158$) and one with only participants in the wildfire conditions ($n = 158$), where the problem-oriented story served as the reference group. For the hypotheses comparing solutions-oriented stories and problem-oriented stories both to the irrelevant message control I employed the full sample of 368.

For RQ11, which examined potential solutions aversion, first, I re-coded the subset of data from participants who were exposed to a solutions-oriented stimuli into two groups (government-sponsored solutions vs. business-sponsored solution). I employed PROCESS Model 1 with ideology as the moderator, rather than party identification because of the overall low numbers of Republicans in this sample ($n = 18$ in government-sponsored solutions and $n = 15$ in the business-sponsored solution conditions, respectively). I ran two analyses: one where

“consistently conservative” participants were the reference group and one where “consistently liberal” participants were the reference group for ideology, with the government-led solution as the reference group for the independent variable in each.

To test H4 and RQ12, which asked about the effect of story orientation and topic on climate misinformation susceptibility and potential parallel mediation of positive affect, negative affect, and media trust I employed PROCESS Model 4. All PROCESS analyses relied on bootstrapping with 5,000 bootstrapped samples to estimate the indirect effects.

Results

Participant Characteristics

Participants' ages ranged from 18 to 92 with an average age of 37.65 ($SD = 13.22$). In terms of sex, the sample was slightly more male (53.5%, $n = 197$) than female (45.9%, $n = 169$) with one participant each selecting intersex or no answer (0.3% each). Similarly, 53% selected man for gender ($n = 195$), followed by woman (44.3%, $n = 163$), a gender not listed here (1.6%, $n = 6$), no answer (0.5%, $n = 2$), and one each for transgender and missing (0.3% each). The majority self-identified as White/Caucasian (71.7%, $n = 262$), followed by African American (9.2%, $n = 34$), Latinx or Hispanic (8.2%, $n = 30$), Asian or Pacific Islander (5.2%, $n = 19$), multi-ethnic/racial (3.5%, $n = 13$), Native American/American Indian (0.5%, $n = 2$), and Middle Eastern or North African (0.3%, $n = 1$). Five participants, or 1.5%, chose “prefer not to answer.” More than half the sample (52.4%, $n = 193$) self-identified as Democrats, followed by Independents (29.3%, $n = 108$), Republicans (13.9%, $n = 51$), and Other (4.3%, $n = 16$). Political ideology ranged from -9 to +9, or “consistently liberal” to “consistently conservative” with participants on average “mostly liberal” ($M = -4.32$, $SD = 4.51$). The majority of respondents were “consistently liberal” (42.4%, $n = 156$), followed by “mostly liberal” (26.1%, $n = 96$),

“mixed” (20.1%, $n = 74$), “mostly conservative” (7.9%, $n = 29$), and “consistently conservative” (2.4%, $n = 9$).

In comparison to 2020 U.S. Census Data, participants were slightly younger ($M = 37.65$ compared to median of 38.8 years), had fewer females (45.9%, vs. 50.8%), a higher proportion of Whites (71.7%, vs. 61.6%), a lower proportion of African Americans (9.2% vs. 12.4%), a lower proportion of Hispanic or Latino (8.2% vs. 18.7%), an higher proportion of Asian (5.2% vs. 0.6%), a lower proportion of people who identify with two or more races (3.5% vs. 10.2%), and a higher proportion of American Indians (0.5% vs. 0.01%). The sample affiliated more Democrat than the American public (52.4% vs. 29%), less Republican (13.9% vs. 27%), and less Independent (29.3% vs. 42%) (Jones, 2022). Table 5 shows a summary of sample demographic characteristics.

Descriptive Statistics

Overall, participants displayed high levels of perceived threat on average ($M = 4.12$, $SD = .97$). Among the efficacy measures, participants’ collective efficacy was relatively high ($M = 3.87$, $SD = .70$), followed by moderately high collective response efficacy ($M = 4.85$, $SD = 1.27$) and government response efficacy ($M = 4.93$, $SD = 1.46$), and approximately neutral individual response efficacy ($M = 3.88$, $SD = 1.61$). Their support for policy to address climate change was relatively high ($M = 5.66$, $SD = 1.49$).

Participants had a moderately high level of media trust ($M = 5.24$, $SD = 0.86$) and low susceptibility to climate misinformation ($M = 2.83$, $SD = 1.02$). On the pre-test covariates, participants displayed a relatively low level of climate fatalism ($M = 2.27$, $SD = 1.10$), a moderate belief in anthropogenic climate change ($M = 3.72$, $SD = .97$), and a moderate level of

climate conspiracy beliefs ($M = 3.57, SD = 1.30$). Correlations among these indicator and covariates are displayed in Table 6.

Effects of Story Orientation on Support for Policy to Address Climate Change

Solution vs. Problem-Orientation

H1 suggested that solutions journalism stories about climate change compared with problem-oriented stories about climate change, will be (a) positively associated with positive affect, which will b) in turn increase preference for support for policy to address climate change. The solutions stories were positively associated with positive affect ($b = .77, SE = .12, p < .001$) when compared with problem-oriented stories, providing support for H1a. However, there was no evidence of mediation, so H1b was not supported.

RQ1 asked how any effects related to positive affect varied with story topic and solution response actor. When both food waste solution stories were compared with the food waste problem story, both the government-led solution ($b = 1.13, SE = .19, p < .001$) and the business-led solution ($b = .80, SE = .19, p < .001$) positively predicted positive affect. However, only the government-led wildfire solution ($b = .79, SE = .19, p < .001$) positively predicted positive affect compared with the problem story.

H2 stated that solutions journalism stories about climate change compared with problem-oriented stories about climate change will (a) be negatively associated with negative affect which will b) in turn increase preference for support for policy to address climate change. Solutions journalism stories were negatively associated with negative affect compared with problem-oriented stories ($b = -.42, SE = .12, p = .001$). However, negative affect did not mediate the effect on support for policy to address climate change so H2b was not supported.

In response to RQ3, when the solutions and problem stories were compared solely to their topical counterparts, only the government-led responses negatively predicted negative affect (food waste: $b = -.52$, $SE = .20$, $p = .009$; wildfire: $b = -.51$, $SE = .20$, $p = .014$).

Regarding H3a-e, the solutions stories did not affect any of the efficacy constructs compared with the problem stories. However, government response efficacy independently predicted policy support ($b = .43$, $SE = .06$, $p < .001$). Yet one solutions-oriented story in comparison to a problem-oriented story did affect an efficacy construct (RQ5). When the solutions and problem stories were compared solely to their topical counterparts, there was a significant indirect effect of the government-led food waste solution through government response efficacy ($b = .14$, $SE = .08$, $CI [.01, .31]$) even though the story did not predict government response efficacy. Additionally, government response efficacy was independently associated with policy support in both the food waste solutions vs. problem $b = .42$, $SE = .07$, $p < .001$ and wildfire solutions vs. problem comparison $b = .46$, $SE = .07$, $p < .001$.

RQ7 concerned the role of perceived threat. Results showed that solutions-oriented stories about climate change positively predicted perceived threat ($b = .17$, $SE = .08$, $p = .030$) when compared with problem-oriented stories (RQ7a), which in turn positively predicted support for policy to address climate change ($b = .35$, $SE = .06$, $p < .001$), suggesting mediation (RQ7b). The total indirect effect via threat was $b = .06$, $SE = .03$, $CI [.01, .13]$, with a partially standardized effect size of $b = .04$, $SE = .02$, $CI [.00, .09]$.

RQ7c asked if any effects of threat varied by story topic or solution response actor. When the solutions and problem stories were compared solely to their topical counterparts neither food waste solutions story directly affected threat or indirectly affected policy support through threat in comparison with the food waste problem story. Yet, both wildfire solutions stories directly

predicted threat (government-led: $b = .26$, $SE = .12$, $p = .040$; business-led: $b = .30$, $SE = .13$, $p = .025$) and threat predicted policy support ($b = .35$, $SE = .10$, $p = .001$). The relative indirect effect of the government-led wildfire response on policy support was $b = .09$, $SE = .05$, CI [.00, .21]; the relative indirect effect for the business-led response story was $b = .10$, $SE = .06$, CI [.00, .25].

RQ9a asked about the total effect of solutions journalism stories about climate change compared with problem-oriented stories about climate change on preference for support for policy to address climate change. The total effect was not significant ($b = .13$, $SE = .07$, $p = .461$).

RQ9b asked whether, if at all, the effect of story orientation, story topic, and response actor on policy support would vary. Solutions stories had no direct effects on climate policy support whether all solutions were compared with both problems or whether either solution about food waste and either solution about wildfires were compared with their respective topical problem story. Results for the effects of solutions journalism vs. problem-oriented journalism on public-sphere policy support are detailed in Tables 7-9 and Figure 4.

Solution and Problem-Orientation vs. Irrelevant Message Control

In regards to RQ10, three of the four solutions stories directly predicted for policy to address climate change compared with the control: the business-led response to food waste ($b = .32$, $SE = .12$, $p = .008$, $c_{cs} = .22$), the government-led response to wildfires ($b = .32$, $SE = .12$, $p = .007$, $c_{cs} = .22$), and the business-led response to wildfires ($b = .33$, $SE = .13$, $p = .012$, $c_{cs} = .22$). The government-response to food waste and both problem-oriented stories had no direct effect. The overall effect of the model was not significant ($\Delta R^2 = .01$, $F = 1.9$, $p = .08$).

However, the total effect of the government-led response to food waste was significant ($b = .34$,

$SE = .16, p = .030, c_{cs} = .23$), as was the government-led response to wildfires ($b = .39, SE = .15, p = .011, c_{cs} = .27$), and the business-led response to wildfires ($b = .45, SE = .16, p = .010, c_{cs} = .28$).

Regarding RQ2a, perhaps unsurprisingly, both problem-oriented stories decreased positive affect: food waste ($b = -1.00, SE = .19, p < .001$) and wildfires ($b = -.93, SE = .18, p < .001$). Yet so did one of the solutions-oriented stories, the business-sponsored wildfire response ($b = -.56, SE = .19, p = .003$). There was no evidence of mediation (RQ2b). Also, unsurprisingly, in answer to RQ4a, both problem stories increased negative affect: food waste ($b = .82, SE = .20, p < .001$) and wildfires ($b = 1.07, SE = .19, p < .001$). All stories except the government-led food waste response increased negative affect: food waste problem-oriented ($b = .82, SE = .20, p < .001$), wildfire problem-oriented ($b = 1.07, SE = .19, p < .001$), the business-led response to food waste ($b = .57, SE = .19, p = .003$), the government-led response to wildfires ($b = .55, SE = .19, p < .001$), and the business-led response to wildfires ($b = .82, SE = .19, p < .001$). Again, there was no evidence of mediation (RQ4b).

And surprisingly, none of the stories about climate change (problem- or solution-oriented) affected threat compared to the irrelevant control (RQ9a-b). Yet similar to the models comparing solution- to problem-oriented stories, none of the stories predicted any of the measured efficacy types and both threat and government efficacy were independently positively associated with policy support (RQ6a-e). Full results for solutions journalism and problem-oriented stories vs. the control are available in Tables 10-16.

Covariates

Several covariates were significant in the models. Belief in anthropogenic climate change positively predicted negative affect, threat, government response efficacy and policy support

when solutions stories were compared to problem stories and when solutions and problem stories were compared to the control, as well as collective response efficacy when solutions and problem stories were compared to the control. Belief in anthropogenic climate change also positively predicted threat and government response efficacy for both the topical-only comparisons (food waste solutions vs. problem and wildfire solutions vs. problem) and also positively predicted collective response efficacy and policy support for the wildfire solutions vs. problem comparison. Climate fatalism negatively predicted threat and all four efficacy types when solutions stories were compared to problem stories and when both solutions and problem stories were compared to the control. It also negatively predicted individual response efficacy and collective response efficacy for both the topical-only comparisons (food waste solutions vs. problem and wildfire solutions vs. problem), government response efficacy for the food waste-only comparisons and both collective efficacy and threat for the wildfire-only comparisons. Climate conspiracy beliefs negatively predicted individual response efficacy, collective response efficacy, and government response efficacy when solutions stories were compared to problem stories and when both solutions and problem stories were compared to the control. Such beliefs also positively predicted negative affect when both solutions and problem stories were compared to the control. In the topical-only comparisons, climate conspiracy beliefs negatively predicted individual response efficacy for both food waste and wildfire comparisons, but collective response efficacy only in the food waste comparisons and government response efficacy only in the wildfire comparisons. Time spent reading the story affected individual response efficacy when solutions were compared with problems ($b = .00$, $SE = .00$, $p = .004$) and in the wildfire comparisons ($b = .00$, $SE = .00$, $p = .032$), but in both cases the effects were negligible.

Among the demographic variables, ideology (being more conservative) negatively predicted threat, collective response efficacy, government response efficacy, and public policy support when solutions stories were compared to problem stories and negatively predicted threat, government response efficacy, and policy support when all solutions- and problem-oriented conditions were compared to the control. In both topical-only comparisons, being more conservative negatively predicted government response efficacy and public support, as well as threat and collective response efficacy in the food waste-only comparisons and negative affect in the wildfire comparisons. Being Republican, Independent or another Party rather than a Democrat negatively predicted positive affect when all solutions- and problem-oriented conditions were compared to the control and in the food waste-only comparison. Being male or another gender (transgender, a gender not listed, refuse to answer) increased collective response efficacy when solutions stories were compared to problem stories and increased government response efficacy when all solutions- and problem-oriented conditions were compared to the control. Significant covariate effects are displayed in Table 17.

Solution Aversion and Climate Policy Support

RQ11 asked about interactions between political ideology and solution frame (response actor) on policy support (see Table 18). When political ideology was coded from “consistently liberal” as the reference group to “consistently conservative,” support for the government-led solutions (vs. business-led solutions) decreased. However, the story frame interacted with political ideology only for those who were the most conservative (i.e., “consistently conservative) with $b = -1.37$, $SE = .67$, $CI [-2.69, -.05]$. When ideology was coded from “consistently conservative” as the reference group to “consistently liberal,” support for the government-led solutions (vs. business-led solutions) increased. All interactions were significant

between story frame and ideology: “mostly conservative,” $b = 1.89$, $SE = .76$, $CI [.39, 3.39]$; “mixed,” $b = 1.65$, $SE = .70$, $CI [.27, 3.02]$; “mostly liberal,” $b = 1.45$, $SE = .68$, $CI [.11, 2.79]$; and “consistently liberal,” $b = 1.37$, $SE = .67$, $CI [.05, 2.69]$.

Misinformation Susceptibility

Hypothesis 4 asked whether solutions journalism about climate change compared with problem-oriented stories about climate change lowered susceptibility to climate misinformation through several proposed mediators (Figure 5). Contrary to what was predicted, positive affect indirectly increased susceptibility to climate misinformation ($b = .10$, $SE = .04$, $CI [.02, .19]$, $c_{ps} = .10$) so H4a was not supported. H4b was supported as the indirect effect of story orientation on susceptibility to climate misinformation was negative through negative affect ($b = -.06$, $SE = .03$, $CI [-.12, -.01]$, $c_{ps} = -.06$). H4c was not supported as story orientation as there was no indirect effect through media trust, although solutions journalism did increase media trust ($b = .34$, $SE = .11$, $CI [.12, .56]$). In answer to RQ12, the total effect of solutions journalism on climate misinformation susceptibility was negative, but not significantly so.

Significant effects were found for a few covariates. Climate conspiracy beliefs decreased media trust ($b = -.12$, $SE = .05$, $CI [-.22, -.02]$). Three covariates affected climate misinformation susceptibility. Belief in anthropogenic climate change decreased susceptibility ($b = -.19$, $SE = .08$, $CI [-.34, -.04]$), whereas climate fatalism ($b = .23$, $SE = .06$, $CI [.11, .35]$) and being more conservative ($b = .24$, $SE = .07$, $CI [.11, .38]$) increased it. See Table 19 for full results.

Summary of Findings

Regarding the effect of climate solutions journalism vs. problem-oriented journalism on policy support, story orientation had no direct effect, regardless of topic or whether government or

business led the response. Results did show that solutions journalism increased perceived threat, which in turn predicted climate policy support. This suggests that despite increasing positive affect and decreasing negative affect as hypothesized, climate solutions journalism still evokes perceived threat, and those perceptions drive support for policies to address climate change. However, the findings about threat occurred only in the solutions stories about wildfires (both the government- and business-led responses), indicating topical dimensions to whether climate solutions stories affect perceived threat and whether those perceptions mediate the story's effect on policy support.

Overall, the climate solutions stories did not impact any of the measured efficacy constructs, nor did efficacy mediate any effects on support, contrary to hypothesis. However, there was a significant indirect effect of the government-led food waste solution on policy support through government response efficacy. This finding suggests that for certain climate topics a response led by government can increase belief that government can effectively address the problem and that belief helps predict support for public-sphere climate policy. Additionally, government response efficacy was independently associated with policy support when solution stories were compared to problem-oriented stories and when food waste and wildfire solutions stories were compared to their respective problem stories.

When solutions stories were compared to an irrelevant message control, three of the four solutions stories directly predicted policy to address climate change. The problem stories had no effect. While it is not necessarily surprising that several of the stories about responses to address climate change increased climate policy support compared to a story that did not mention climate change at all, it is important to note that the problem-oriented climate stories had no effect on policy support compared to the control. This finding buttresses the idea that merely informing

people about the risks and negative impacts of climate change may depress support for climate action (Painter, 2019), whereas informing people about effective, credible solutions can encourage support (Marlon et al., 2019; Olofsson et al., 2018).

Regarding affect, both the problem- and solutions-oriented stories increased negative affect compared to the irrelevant message control, with one exception. As solutions stories describe not only the solution but also the underlying problem, it seems logical that both the problem- and solutions-oriented stories mentioning negative aspects of climate change would depress participants' affect compared to participants who read a neutral-to-positive story. Interestingly, each of the problem-oriented stories increased negative affect by a greater degree than their solutions topical counterparts with the wildfire problem-oriented and business-led wildfire response stories provoking the largest negative affect, respectively. These findings provide support for the idea that solutions stories increase negative affect to a lesser degree than problem-oriented stories, even though different aspects of climate change may be more distressing than others. In other words, despite discussing the problem, solution stories mitigate some of the depressive effect of informing readers about a social problem. Yet the fact that the government-led food waste story did not predict negative affect shows that some climate solutions stories may not measurably upset readers.

In terms of positive affect, only the problem-oriented stories and the business-led wildfire response stories decreased positive affect, with the effect greater for the problem-oriented stories. Again, this suggests a protective effect of solutions-oriented stories on readers' emotional state.

Despite the findings that both solutions- and problem-oriented climate stories impacted readers' emotional states, it is surprising that none of the climate change stories - all of which included negative information about climate change - did not affect perceived threat at all in

comparison with a neutral-to-positive story about a space telescope. This is especially surprising given that perceived threat was the only mediator that emerged when solutions stories were compared to problem-oriented ones.

However, as with the models comparing solution- to problem-oriented stories, neither solution- nor problem-oriented stories predicted any of the measured efficacy types when compared with the control and both threat and government efficacy also were independently positively associated with policy support. This provides additional support that there is not a relationship between solutions-oriented climate stories and individual response efficacy, collective response efficacy, collective efficacy, and government response efficacy (except for a government-led response to food waste), at least not for news about climate-related food waste and wildfires.

The more conservative participants were the less public-sphere policy support they expressed for a government-led solution. However, the aversive effect of an ideologically incongruent solution expressed in a news story appeared only for the most conservative participants (those identifying as “consistently conservative”) when the reference group for ideology was consistently liberal. When the reference group for ideology was consistently conservative, all participants’ ideology levels interacted with story frame to show an aversive effect consistent with theory. The differences may result from unequal numbers of participants who identify with each ideology level or because the scale may not be uniformly linear.

Climate solutions journalism did decrease susceptibility to climate misinformation through negative affect as predicted. This is a promising finding. Yet worryingly, climate solutions journalism increased susceptibility to climate misinformation through positive affect,

the opposite of what was hypothesized. Climate solutions did increase media trust as hypothesized, but there was no indirect effect on misinformation susceptibility.

Discussion

Study 2's goal was to test the effects of climate solutions vs. problem-oriented journalism on two dependent variables: public-sphere policy support and susceptibility to climate misinformation. The overarching design was a 3 (government solution vs. business solution vs. problems) x 2 (food waste vs. wildfire) + 1 (irrelevant message control) between-subjects, online experiment.

First, solutions stories did not directly positively predict public-sphere policy support compared with problem-oriented stories, regardless of climate topic (food waste or wildfires) or the type of group responsible for the solution. The findings mirror that of Thier and Lin (2022), which found no direct effect of solutions (vs. problem-oriented) news about climate-induced flooding and a government response. This dissertation further extends those findings as it employed more representative solutions journalism in terms of story length, actual problem-oriented news instead of problem stimuli manipulated from solutions news, as well as two additional climate-related topics. Furthermore, this dissertation offers additional insight as comparisons with an irrelevant message control revealed that many of the solutions stories directly predicted policy to address climate change, while the problem stories did not. To start, this shows that solutions stories about climate change can lead to policy support, which suggests a possible real-world effect as people consume news after encountering and selecting news about a variety of topics. Also, this dissertation adds evidence that problem-oriented climate stories may not enhance climate policy support as such stories had no effect compared to the control. This finding is in line with critiques of the deficit model of science communication (Akin &

Scheufele, 2017; Nisbet & Scheufele, 2009; Schäfer et al., 2019; Simis et al., 2016), as just conveying knowledge or informing participants about the problem of climate change through news did not lead to policy support.

Second, this experiment both confirms and extends previous solutions journalism research on affect. Solutions stories in this study increased participants' positive affect and decreased negative affect in comparison to problem-oriented stories, as found in many previous studies (i.e., Baden, 2019; McIntyre, 2019, McIntyre & Sobel, 2017; Overgaard, 2021a), even though story tone valence was not manipulated (i.e., Kleemans, Schindwein et al., 2017). By including a control, this study was able to show additionally that solutions stories increase negative affect to a lesser degree than traditional, problem-oriented journalism, an important insight into how solutions stories affect readers' emotional states. McIntyre (2019) similarly found that reading about an effective solution led to less negative affect than reading a story that did not mention a solution, but also than reading an ineffective solution. However, there was no difference in negative affect between those who read about the effective or ineffective solution or the ineffective solution and no solution (McIntyre, 2019). Taken together, these two studies offer evidence that journalistic information about an efficacious response to a social problem may be better for news consumers' emotional well-being than merely reporting on societal ills or reporting about ineffective responses.

Furthermore, the present study showed that while story topic matters in terms of affect, solutions or problem-orientation seems to matter more, with wildfire stories more predictive of negative affect than solutions stories, yet the solutions stories always less than their topical, problem-oriented counterparts. Finally, this experiment showed that solutions stories can decrease positive affect, although solutions-orientation, solution response leader, and topic is

relevant as only the business-led response to climate-induced wildfires decreased positive affect, although less so than either the problem-oriented wildfire or food waste stories.

Despite the overall robustness of the findings regarding affect, neither positive nor negative affect mediated effects of public-sphere climate policy support as hypothesized. Further research is needed to determine if protective affect induced by solutions journalism plays a role in private-sphere climate policy support or in willingness to undertake personal pro-environmental actions. Notably, Overgaard (2021a) found that in comparison with negative Facebook news posts, solutions Facebook news posts about a variety of news topics, including some environmental ones, increased positive affect and decreased negative affect, which in turn increased participants' self-efficacy. Potentially, that increased self-efficacy might lead individuals to engage in personal pro-environmental actions or express support for private-sphere policies, which affect individuals' behavior. Yet, this idea should be considered with caution as Overgaard (2021a) relied on a so-called self-efficacy measure used by Curry and Hammons (2014), a non-peer-reviewed study. Curry and Hammond's (2014) self-efficacy index - also employed in other solutions journalism peer-reviews research - includes three items: one about individual's belief they could contribute to a solution to the problem (i.e., self-efficacy), one about their belief that effective ways to address the problem exist (i.e., response efficacy), and one asking whether the article influenced their opinion of the issue.

This dissertation sought to move beyond findings linking solutions-oriented news and self-efficacy to examine mostly collective forms of efficacy as solutions journalism depicts collective responses to social problems and collective types of efficacy predict societal-level environmental action (Bostrom et al., 2019; Hart & Feldman, 2014; Maibach et al., 2008; Skurka et al., 2022), such as public-sphere climate policy support. Furthermore, collective forms of

efficacy, especially government response efficacy, are rarely examined by communication research (Skurka et al., 2022). This dissertation did not find that solutions stories about climate change predicted individual response efficacy, collective response efficacy, collective efficacy, or government response efficacy or mediate any effects on policy support, in comparison with problem-oriented stories or a control. While such types of efficacy have been shown to predict environmental public-sphere policy support (Meijers et al., 2022), exposure to a single climate solutions journalism story may not be enough to overcome individuals' prior beliefs about whether our society or government is capable of collective climate action. For instance, public trust in the federal government is near historic lows, with fewer than a quarter saying they can trust government most of the time (Pew Research Center, 2022). More than half of Americans say the country cannot solve important problems, more than three-quarters say they are not confident in the public's political decisions, 80% are dissatisfied with the country's direction, and 77% believing our economic system unfairly favors powerful interests (which could include fossil fuel companies) (Pew Research Center, 2023). Given these data, it is likely that reading one example of collective climate action may not inspire collective forms of efficacy about climate change.

However, there was a significant indirect effect of the government-led food waste solution through government response efficacy on policy support even though the story did not predict government response efficacy. More research is needed to understand whether stories about government responses to other environmental problems also can also improve public-sphere policy support through belief in government's ability to affect a response.

This dissertation also set out to measure whether solutions stories increased perceived threat as perceived threat is a critical construct in many affective and cognitive appraisal theories

used in communication research, such as the EPPM (Witte, 1992). This appears to be the first study to test whether solutions stories increase perceived threat. I found that perceived threat was indeed affected by solutions journalism and that perceived threat was the only mediating variable when solutions stories were compared to problem-oriented ones. That effect came solely from the wildfire stories, however, indicating that merely mentioning a social problem in a solutions story is not enough to evoke threat. It makes sense that participants felt that wildfires are severe and likely to affect them, whereas the threat of methane released by food waste increasing global warming is likely perceived as diffuse in impact and far off in time. Future studies should examine whether perceived threat can mediate effects of solutions stories on policy support for other social issues that the public perceives as severe and personally susceptible.

It is well known that climate change is a politicized issue (e.g., Leiserowitz et al., 2022; Pouschter et al., 2021)), yet knowledge about how climate solutions influence climate policy support is less understood. Building on Campbell & Kay (2014), which found Republicans had greater belief in solution quality when presented with market-friendly change policy ideas, this study examined whether political ideology moderated the effect of climate solutions journalism with government-led and business-led responses on policy support. Findings extend the ideas of solution aversion as those who were more conservative were less likely to prefer government-led solutions while those who were more liberal were more likely to do so.

Finally, this dissertation examined whether solutions-oriented stories about climate change compared with problem-oriented stories could decrease susceptibility to climate misinformation directly. Such stories did decrease susceptibility to climate misinformation through negative affect. These findings contradict studies that have found that negative emotions increase susceptibility to misinformation by (Greenstein & Franklin, 2020; Porter et al., 2003;

Scheufele & Krause, 2019). However, the solution stories decreased negative affect *in comparison to* problem-oriented stories. Other analyses conducted for this experiment showed that solution stories increased negative affect to a lesser degree than the problem-oriented stories. Therefore, this dissertation contributes the idea that negative emotions or feelings induced by media do not have to increase susceptibility to misinformation if they are balanced or counteracted by positive feelings. As solutions stories contain information about both a social problem and an effective response they are not wholly dispiriting. Furthermore, the solutions stories tested in this dissertation for the most part did increase positive affect, as other studies have shown (i.e., Baden, 2019). What is unclear is why solutions stories increased susceptibility to climate misinformation through positive affect, as positive emotions show potential to counter motivated and biased reasoning about science issues (Wong-Parodi & Geygina, 2021; Yeo & McKasy, 2021). Perhaps the positive feelings engendered by the story were not strong enough to have an effect. Another possibility is that the positive affect generated by the solutions stories led participants to rely on heuristic, rather than systematic processing, which led them to judge the false climate statements less critically. Also, this study examined positive affect in general, rather than discrete emotions. It may be that certain positive emotions decrease susceptibility to climate misinformation, whereas others may not. Unpacking this finding without knowing which discrete positive emotions may have been evoked is challenging yet opens up another area for future research. Although solutions news depicts social progress as occurring and working to some degree, by qualifying the successes with response limitations such stories may not spark overwhelming positivity. Comparing the effects of solutions journalism, constructive journalism (with positive content added), and positive news on susceptibility to misinformation would be a worthwhile future research direction.

Although the hypothesized effect of story orientation on susceptibility to climate misinformation through media trust was not supported, climate solutions journalism did increase media trust. This is consistent with studies that found solutions news increased story credibility (Overgaard, 2021a) and story trust and story-consistent beliefs (Thier et al., 2021). However, Overgaard (2021a) found the effect of solutions journalism Facebook posts on perceived story credibility occurred indirectly through positive affect and negative affect and directly when negative affect was in the model as a mediator. In concert, these findings suggest that solutions journalism has the potential to improve media trust depending on the topic, although the mechanism requires additional study. Why increased media trust did not reduce susceptibility to climate misinformation is puzzling. Perhaps the solutions stories increased media trust generally, but not trust in whether media reports climate news accurately.

Limitations

As with all research, this study has several limitations. First, this study employed a convenience sample recruited from the online platform Prolific which was not nationally representative. In comparison to 2020 U.S. Census Data, participants were slightly younger, more male, a lower proportion of some racial and ethnic groups, and were more Democratic. Partisan identity and ideology affect people's attitudes toward climate solutions (Campbell & Kay, 2014) and age, race, and political ideology are known predictors of susceptibility to misinformation (Nan et al., 2023). Additionally, this study only included participants residing in the U.S. Political polarization (Pennycook et al., 2022), partisan polarization toward climate change, beliefs in misinformation (Roozenbeck et al., 2020), media trust (Edelman, 2022), and personal experience of climate impacts (Thaker et al., 2023) may be different in other countries, meaning findings from this study may not generalize in other national contexts.

Second, there are drawbacks to the stimuli employed. This study included only text-based journalism and eliminated the news source and author to avoid confounding effects. Journalism in other mediums, text-based journalism that includes visuals or stories attributed to news sources and specific reporters might produce different effects. As some stories contained only headlines whereas others contained both headlines and sub-headlines (with italic text), such presentation factors could have impacted participants' reading behavior (Leckner, 2012). Furthermore, as the control story was a placebo message rather than a non-advocacy message about climate change it is possible that observed differences between the solutions stories and the problem-oriented stories compared with the control are due to topical differences (i.e., climate change vs. advances in space telescopes). While not solutions journalism, the story about the James Webb telescope contained information about solving scientific challenges, complicating the comparison between the solutions journalism and the control conditions. Finally, significant differences in story lengths between the solutions, problem-oriented, and control conditions make untangling the effect of story orientation from story length on the study outcomes more challenging.

Third, this study measured the effects of exposure to a single piece of journalism. It is possible that any observed effects might decay over time. Furthermore, repeated exposure might be required to observe certain effects, particularly in the context of climate change where attitudes have been hardened by the efforts of strategic actors (Bolsen & Shapiro, 2017). As problem-oriented climate news is more prevalent, it is possible that one exposure to an alternatively framed story might not counteract the reported depressive effects of traditional climate news.

Fourth, the sample size likely did not provide enough statistical power to detect small, mediated effects (Sim et al., 2022). Finally, in mediation analyses it is always possible that other intervening variables account for the effects on the dependent variables than what results show (Agler & De Boeck, 2017) and mediation models may not establish causal claims (Bullock & Green, 2021; Bullock et al., 2010).

Finally, the changes made to the climate misinformation susceptibility measure to account for poor internal consistency altered the nature of this measure in a way that complicates interpretation. All findings related to climate misinformation susceptibility should be considered with caution.

Chapter 7: General Discussion

Climate change is an increasingly destructive, multi-faceted threat to life on Earth (IPCC, 2022). For years, journalists have warned the public about these dangers in an attempt to spark responsive actions, but communicating grim assessments may have depressed civic engagement about the issue (Hackett et al., 2017; Painter, 2019). Simultaneously, audiences worldwide have become disenchanted with the news media's overall negativity bias (Newman et al., 2019), leading journalists and audiences to experiment with more balanced news content, such as solutions journalism (i.e., Abdenour et al., 2021; Hutchins & Granger, 2019; McIntyre & Lough, 2021). In the context of climate change, journalists face an “unprecedented” challenge to create and disseminate journalism that meets the urgency of the problem (Painter, 2019, p. 428).

Scholars have recommended solutions journalism and solutions-oriented news more generally as a such potential approach to engage audiences on climate change (Borth et al., 2021; Guenther et al., 2021; Lough & McIntyre, 2018), with news audiences seeking coverage about climate actions (Maibach et al., 2020). Additionally, journalists covering climate change consider solutions important (Engesser & Brüggemann, 2016). Therefore, understanding how climate solutions journalism is framed and what effects it has on policy support, media trust, and misinformation susceptibility should yield relevant theoretical and practical implications.

Theoretical Implications

The initial design of this dissertation relied on the frames discovered in the content analysis phase informing the experimental phase as stimuli. However, challenges with the validity of the initial content analysis sample slowed progress on that study, such that the experiment was undertaken prior to completion of the content analysis. Thus, the content analysis did not inform the experiment as expected.

Study 1

The first study in this dissertation is the first quantitative content analysis of text-based climate solutions journalism from US news outlets. As such, the findings contribute to framing theory, as previously content analyses of climate communication largely focused on media attention (Metag, 2016), content-oriented frames that are generic, issue-specific or topical (Schäfer & O'Neill, 2018) or the (un)certainty of climate science, or economic, political or moral aspects, (O'Neill et al., 2015; Schäfer & O'Neill, 2018). Formal-stylistic frame research about the structure or formal presentation of text of climate change media, as undertaken in this study, is uncommon (Schäfer & O'Neill, 2018).

The three frames identified in this content analysis reveal that climate solutions journalism is framed differently than traditional, problem-oriented climate journalism. The first main difference is that such frames all include a treatment recommendation (i.e., the solution). While it is not surprising that climate solutions journalism does in fact cover social responses to climate change, content analyses of traditional climate newspaper and broadcast coverage has found it rarely includes solutions (Hart & Feldman, 2014; King et al., 2019; Shea et al., 2020). When traditional journalism mentions climate solutions the focus is about the political and policy challenges of solution implementation, suggesting a conflict/strategy frame (Hart & Feldman, 2014). Content analysis of international news coverage of political events geared toward solutions, such as the United Nations Climate Change Conferences, reveal those stories do mention potential climate responses but remedies are only salient in one-quarter of the resulting frames (Wessler et al., 2016). International news magazine framing of climate futures has moved from *global doom* and *local tragedies* frames in the 1980s to the 2000s to a *sustainable future* frame, particularly since the 2015 Paris Agreement (Guenther et al., 2021). While Guenther et al.

(2022) state that stories belonging to that frame are in line with constructive journalism, the authors did not analyze whether such stories were indeed constructive or solutions journalism. Stories in their *sustainable future* frame mostly focused on green technologies, including how individuals can employ such measures to reduce their own carbon consumption or green their lifestyles. Although individual climate actions are important to addressing climate change (Nielsen, 2023), individualized responses are not solutions journalism.

Indeed, news about sustainability more broadly (not climate change specifically) typically frames solutions as market- or technology-driven at the expense of other responses and suggests that consumers can contribute to sustainable futures by purchasing green products (Atanasova, 2019). In contrast, a qualitative content analysis of sustainability reporting in the UK-based, constructive journalism outlet *Positive News* found that such stories resulted in *belief in the power of both the market and in science* frames, but also one that critiqued consumerism. The newly identified *value of camaraderie* frame focused on people joining together to share and fix items to reduce their environmental impact (Atanasova, 2019). Climate solutions journalism in the present study covered a range of responses, not only those driven by corporations, governments, and scientists, but also those led by marginalized groups and even several that explicitly critiqued capitalism, such as stories about queering climate activism. Future research about climate solutions journalism should quantify and qualify the specific types of solutions covered in more detail to understand whether such news tends to reinforce capitalism, a system some believe incompatible with addressing climate change (Baer, 2012).

Two of the frames identified in the present study emphasize moral judgment information, a finding with many implications. These two new frames of *undeterred stewards* and *moral mitigation* offer two additions to research that climate change discourse helps construct identity

and responsibility (Metag, 2016) and is additional evidence that solutions-oriented journalism frames about the environment may include moral judgment. One of three frames found in sustainability news from a constructive journalism outlet by Atanasova (2019) included moral evaluation: the *belief in the power of the market* frame portrayed mainstream businesses as “wasteful and unethical” in opposition to sustainable businesses (p. 705). In the present study, the *undeterred stewards* frame most highlighted victims of climate change, whereas the *moral mitigation* frame focused more on attributing responsibility for causing and solving the problem. Moral language was prevalent in both frames. Although the *undeterred stewards* frame often referenced victims of climate change stories in this frame featured groups drawing on their heritage or identify to move beyond politics to address climate change. In other words, the stories recognized the unequal impacts of climate change but did not portray individuals as powerless victims. In the context of COVID-19, solutions journalism news framed as a “bottom-up” rather than a “top-down” solution has been shown to increase support for science-based solutions (Thier & Kim, 2022). Research should examine whether climate solutions news that centers moral considerations similarly increases support for science-based climate solutions, in comparison with news about “top-down” responses.

As moral attribution for solving the problem includes both external and internal attributions of responsibility, future research should determine the prevalence of each kind of attribution, whether different types of attribution differ by frames, and whether such differences affect audience support for climate policy. Scholars should also explore in detail which groups were assigned blame for causing climate change, particularly as that element was prevalent in the *moral mitigation* frame. Climate news framed thematically has been shown to increase attribution of responsibility to the government, in turn increasing support for government climate

policy (Hart, 2011), whereas episodic framing of other health issues can cause individuals to blame themselves (Sun et al., 2016). Although solutions journalism is necessarily framed thematically (Lough & McIntyre, 2023; Thier, 2021), in an experiment climate solutions journalism did not engender attributions of responsibility compared with problem-oriented climate news, although attribution of responsibility to individuals and to government were both independently associated with climate policy support (Thier & Lin, 2022). Scholars should continue to explore whether climate solutions journalism attributes responsibility and what effects, if any, those attributions have on audiences, as a majority (70%) of American voters say businesses, government, and citizens should do more to fight global warming (Leiserowitz, Maibach, Rosenthal, Kotcher, & Goddard et al., 2023).

Understanding whether climate solutions journalism exhibits liberal or conservative moral values might help efforts to engage conservatives in climate action, as moral values positively predict Americans' willingness to address climate change (Andre et al., 2021). Framing of climate communication generally favors liberal values of harm and fairness (Roser-Renouf et al., 2023), yet conservative attitudes toward climate action are more positive when conservative values such as patriotism, respect for authority, and nature's purity are emphasized (Wolsko et al., 2016). Testing whether the *undeterred stewards* frame identified in this study, which emphasizes values related to place, identity, and cooperation and moving beyond partisanship, appeals to both liberals and conservatives can aid our understanding of how to depoliticize reception of climate news, and possibly support for climate action. Furthermore, stories in the *undeterred stewards* frame depict people working together to solve climate problems and sometimes, cooperating despite differences. Research shows that climate stories

about compromise and solutions reduce perceived bias and increase news credibility, counteracting the hostile media phenomenon which inhibits climate concern (Swain, 2017).

While this study identified new climate journalism frames, it is unclear how and whether these frames differentially affect news audiences. A meta-analysis of climate communication framing found that framing positively predicts audience issue engagement and its sub-dimensions, behavioral intentions and climate policy support, with environmental, economic, and moral aspects creating small-to-medium effects but not public health and place-based identity aspects (Li & Su, 2018). As climate solutions journalism is an emerging approach, more research about how its frames impact audiences is needed.

Study 2

The second study in this dissertation experimentally test the effects of several climate solutions stories on public-sphere policy support and misinformation susceptibility. Drawing on theory from persuasion, health communication, political science, social psychology, and risk communication literature, the experimental study seeks to answer Lough and McIntyre's (2023) call for solutions journalism research that explicitly tests theory. It does so in the context of climate change, a social issue for which action information may be more persuasive than impact information (Borth et al., 2021; Guenther et al., 2021; Marlon et al., 2019).

First, this study offers sheds light on a new mechanism that climate solutions journalism positively predicts policy support. This study is the first to demonstrate that climate solutions news evokes perceived threat and that the resulting perceived threat in turn influences public-sphere policy support. Topic-level analyses revealed the effects of perceived threat derived from news about wildfire solutions, but not food waste solutions. Scholars should continue to explore

if other climate topics engender perceived threat and if such perceptions mediate support for climate policy.

It is unclear why perceived threat mediated support for policy, a protective action, even though the solutions stories did not inspire efficacy. This dissertation proposed that efficacy perceptions induced by climate solutions stories would lead to the protective action of policy support, in line with the extended parallel process model (Witte, 1992), which several scholars suggest may explain effects of solutions-oriented news (e.g., Feldman & Hart, 2016). Even though the solutions stories in this study did not lead any proposed efficacy perceptions, solutions stories by their nature include efficacy information. It is possible that the efficacy information in the stories could not counter participants' previous beliefs about various forms of efficacy (individual response, collective, collective response, and government response), but merely viewing the information in concert with problematic aspects of climate change led participants to engage in protective action as outlined by the EPPM. Yet, it is also likely that the threat plus efficacy equals adaptive response mechanism outlined in the EPPM is not responsible for the mediating role of perceived threat. Support for the EPPM typically comes from studies about engaging in personal health actions, such as wearing sunscreen, using a condom, or having a mammogram. While climate change is a serious public health threat (IPCC, 2022; NOAA, 2023), individual climate actions are unlikely to yield personally beneficial health results. Perhaps the protective action of climate policy support is perceived as a more collective action that yields diffuse benefits. Research should continue to uncover how perceived threat may work to predict support for public-sphere climate policy.

Despite several theories, studies, and a new typology of efficacy beliefs relevant to environmental actions (Meijers et al., 2023) suggesting that several collective efficacy constructs

and individual response efficacy would predict climate policy support, those ideas were not supported by this experiment. Perhaps other climate topics besides wildfires and food waste might yield different results or perhaps single news stories are not enough to change individuals' previously held efficacy beliefs. Also, future studies with greater statistical power to detect small effects should be undertaken. Finally, some studies suggest that perceived hope is critical for generating collective forms of efficacy beliefs (Chadwick, 2015; Cohen-Chen & Van Zomeren, 2018; Marlon et al., 2019). Although another study about the effect of climate solutions journalism on policy support did not find such stories led to participant hope (Thier & Lin, 2022), future research should test whether solutions journalism predicts hope and other discrete emotions.

This study tested a parallel mediation model, but future research should consider sequential mediation possibilities. For instance, Overgaard (2021a) found that solutions news increased positive affect and decreased negative affect, which in turn increased self-efficacy. Also, emotional flow theory (Nabi, 2015) posits that fear appeals paired with efficacy information may lead to either hope and action or relief and inaction. In a test of emotional flow theory using gain- and loss-framed efficacy messages about potential climate solutions, Nabi et al. (2018) found hope mediated the effect of gain-framed efficacy messages on climate policy attitudes. Exploring the sequencing of emotions and efficacy information in actual climate solutions journalism, as well whether solutions news offers audiences relief that change is occurring, thereby depressing support for climate action, is needed.

Regarding the effects of political ideology, this dissertation extends solution aversion theory beyond rejection of the underlying science and policy quality perceptions by showing that

ideologically (in)congruent solutions also affect preference for policy support. Understanding whether these preferences vary with climate topic is a promising area for future study.

This dissertation also contributes the novel finding that climate solutions journalism can reduce susceptibility to climate misinformation. Specifically, I found that negative affect induced by media do not have to increase susceptibility to misinformation if they are balanced or counteracted by positive feelings. This potentially opens up new possibilities for countering misinformation in other contexts. However, more research is needed to understand why solutions stories increased susceptibility to climate misinformation through positive affect. Typically, positive emotions are thought to attenuate motivated and biased reasoning about science issues (Wong-Parodi & Geygina, 2021; Yeo & McKasy, 2021). Solution journalism's mix of positive and negative information, which seems to induce both positive and negative affect, provides an opportunity for scholars studying misinformation to consider how the presence of oppositely valenced affect and emotions predict misinformation susceptibility, rather than positive or negative emotion alone.

Finally, this study is among the few to demonstrate that solutions journalism leads to media trust. Qualitative approaches could help researchers understand why solutions news' story-induced positive affect increases media trust. Additionally, scholars should examine whether media trust engendered by solutions journalism increases climate risk perceptions, as trust in scientists predicts perceived health risks of climate change (Thaker et al., 2023).

Practical Implications

The two studies offer several practical implications for journalists, with the content analysis and experiment reinforcing implications in some cases. The content analysis revealed that the most common climate solutions frame barely highlights climate impacts that are not

environmental in nature, even though emphasizing how climate change impacts health (Kotcher et al., 2018) and how climate action improves health (Kotcher et al., 2021) increases issue engagement, particularly for conservatives (Maibach et al., 2023). Journalists should consider including climate health impacts more often in their climate solutions coverage. As the experiment showed that perceived threat mediated support for climate policy, increasing mention of climate impacts may also assist with issue engagement. Topical differences in whether climate solutions news activates perceived threat suggest that journalists should seek ways to make climate threats more salient for climate topics where the threats are distal, such as food waste.

Climate causes were less salient in the most common frame than the other frames. Limited reference to the causes of climate change may make understanding how climate responses work and their potential importance more challenging. Additionally, many stories mentioned causes such as carbon emissions, greenhouse gases, or deforestation, without explicitly naming them as responsible for the problem. While 61% of Americans recently surveyed believe climate change is caused by human activity, 28% say natural causes are responsible (Leiserowitz, Maibach, Rosenthal, Kotcher, & Goddard et al., 2023). Continuing to explain that human activity drives the climate crisis and explicitly linking the causes to the problem, rather than assuming readers understand the science, may help drive policy support.

Climate solutions stories tended to emphasize adaptation, rather than mitigation, although it is unclear how often these response categories co-occurred especially as adaptation can refer to benefits of mitigating climate change. For instance, building out renewable energy systems that reduce reliance on fossil fuels also may have the advantage of creating new jobs. Future research should examine how frequently mitigation and adaptation co-occur in solutions news. Regardless, journalists should be aware solutions stories tend to focus more on adaptation for

two reasons. First, learning about adaptation efforts may inspire support for mitigation (Swain, 2017). Yet, alarmingly, news coverage about adaptation may lead audiences to feel complacent that mitigation is no longer necessary (Swain, 2017). Increasing coverage of mitigation solutions or mentioning that mitigation of greenhouse gases is still required in stories focused on adaptation can help news audiences better understand how society should deal with the climate crisis.

Increasing solution stories about market solutions can also help journalists engage conservative readers on the issue of climate change. Furthermore, stories that utilize the *undeterred stewards* frame where groups engage in responses beyond polarization may also appeal to broader news audiences. Engaging conservatives through climate coverage about non-political responses may help news outlets earn back media trust, something future research should investigate. Additionally, the effect of solutions stories about government-led climate responses on policy support only decreased for the “consistently conservative,” suggesting that independents and more moderate conservatives may not be averse to reading climate solutions news. Finally, this dissertation showed that climate solutions journalism did increase media trust. Thus, media outlets seeking to rebuild trust may consider enhancing their climate solutions coverage.

Conclusions

In summary, this dissertation reveals new frames in climate journalism and shows that climate solutions news can increase support for public sphere policy through enhanced perceived threat and can reduce susceptibility to climate misinformation. This research extends framing theory, contributing to our understanding of solutions journalism. Findings build on previous solutions journalism research about affect, media trust, and climate policy support. Results also

demonstrate that effects of climate solutions journalism may depend on which aspects of climate change are reported. Findings point to the need for additional theory-driven solutions journalism research to uncover additional mechanisms by which such news exerts effects. Overall, this dissertation builds support for the idea that solutions journalism is a promising new approach for communicating the increasingly dire threat of climate change.

Appendix A: Tables

Table 1

Counts of Stories Included in Content Analysis by Publication Outlet

Outlet Name	N
<i>The New York Times</i>	19
<i>Ensia</i>	18
<i>The Guardian</i> (US edition)	14
<i>The Christian Science Monitor</i>	12
<i>Mongabay, Reasons to be Cheerful, Yes! Magazine</i>	10
<i>Yale Environment 360</i>	9
<i>Grist</i>	7
<i>The Huffington Post</i>	8
<i>Bloomberg CityLab</i>	6
<i>FastCompany, High Country News</i>	5
<i>National Geographic, OZY, The Washington Post</i>	4
<i>Montana Free Press, Politico, Quartz, Scientific American, The Colorado Sun, The Connecticut Mirror</i>	3
<i>Belt Magazine, Blavity, Civil Eats, Devex, Eos, Hothouse Solutions, Next City, Stateline, The Atlantic, The Wall Street Journal, Vice, Wired</i>	2
<i>Arizona Daily Star, Atmos, bioGraphic, Bitterroot, Bright Magazine, BuzzFeed, Charlottesville Tomorrow, Clean Energy Finance Forum, Cleveland Plain Dealer, Climate Central, Earth Island, Earth Journalism Network, El Paso Times, Energy News Network, Eugene Weekly, Fashionista, Freethink, Great Lakes Echo, GreenBiz, Honolulu Civil Beat, Indiana Environmental Reporter, Inside Climate News, Knowable Magazine, Los Angeles Times, Mashable, MIT Technology Review, Model D, Mother Jones, Ms. Magazine, National Catholic Reporter, News Deeply, Newsweek, OneEarth, Outside Magazine, ProPublica, Rolling Stone, Royal Examiner, San Jose Mercury News, Scalawag, Sojourners, Southerly, The 19th, The Arizona Republic, The Hechinger Report, The Land, The Nation, The Philadelphia Citizen, The Philadelphia Inquirer, The River, The Sacramento Bee, The Salt Lake Tribune, The Times-Picayune, Valley News, Vox, Yale Climate Connections, Yahoo! News</i>	1

Table 2*Intercoder Reliability for Content Analysis Variables*

Variable	N	PA	AC₁	CI
Response Country	244	.96	.93	(.78, 1)
Climate Problem				
Life/Health	77	.96	.93	(.78, 1)
Property	45	.96	.95	(.84, 1)
Economic	81	.93	.87	(.69, 1)
Environment	218	1	1	
Climate Change Cause				
Natural	4	1	1	
Burning Fossil/Other Fuels	102	.89	.84	(.63, 1)
Deforestation	26	.96	.95	(.84, 1)
Food Waste/Agriculture	29	1	1	
Other	32	.96	.96	(.87, 1)
Remedy				
Mitigation	154	.96	.94	(.81, 1)
Adaptation	216	.96	.96	
Moral Judgment				
Causal Responsibility	57	.93	.90	(.75, 1)
Responsibility to Solve	48	.93	.87	(.67, 1)
Victims	90	.96	.93	(.77, 1)
Language	70	.93	.87	(.69, 1)

Table 3*Composition of Climate Solutions Journalism Frames by Column Percentage*

Frame Elements	The Future Is Now Frame <i>n</i> = 214	Undeterred Stewards Frame <i>n</i> = 19	Moral Mitigation Frame <i>n</i> = 10
Climate Problem			
Life/Health	29.4	73.7	0.00
Property	13.6	84.2	0.00
Economic	0.30	94.7	0.10
Environment	89.7	100.00	0.70
Climate Change Cause			
Natural	0.02	0.00	0.00
Burning			
Fossil/Other Fuels	39.7	68.4	0.40
Deforestation	0.07	0.21	0.80
Food			
Waste/Agriculture	0.12	0.05	0.20
Other	0.13	0.05	0.40
Remedy			
Mitigation	0.59	0.89	100.00
Adaptation	0.89	0.95	0.70
Moral Judgment			
Causal			
Responsibility	0.18	0.47	0.90
Responsibility to			
Solve	0.14	0.42	100.00
Victims	0.32	0.95	0.30
Language	0.22	0.68	100.00

Note. Dark shading indicates at least 40% frequency in cluster. Lighter shading indicates 20% to 39% frequency in cluster. BOLD indicates exceeding the element's cross-cluster comparison by at least 50%. Table design adapted from Wessler et al., 2016.

Table 4*Affect: Principal Component Analysis Results (with Direct Oblimin Rotation)*

Item	Negative Emotions 47.26% variance explained	Positive Emotions 22.92% variance explained
Angry, irritated, annoyed	.755	-.064
Sad, downhearted, unhappy	.902	-.106
Scared, fearful, afraid	.920	-.067
Sympathy, concern, compassion	.507	.420
Surprised, amazed, astonished	.160	.734
Nervous, anxious, worried	.921	.003
Uneasy, apprehensive, restless	.923	-.052
Confused, perplexed, bewildered	.637	.133
Optimistic, encouraged, hopeful	-.218	.914
Loving, sentimental, warm-hearted	-.036	.883

Table 5*Participant Sample Characteristics*

	<i>N</i>	<i>%</i>	<i>M</i>	<i>SD</i>
Age	368		37.65	13.22
Sex	368			
Female	169	45.9		
Male	197	53.5		
Intersex	1	0.3		
(Prefer) no answer	1	0.3		
Gender	367			
Woman	163	44.3		
Man	195	53.0		
Transgender	1	0.3		
Gender not listed	6	1.6		
(Prefer) no answer	2	0.5		
Race/Ethnicity	368			
African American	34	9.2		
Asian/Pacific Islander	19	5.2		
Latinx/Hispanic	30	8.2		
Middle Eastern/North African	1	0.3		
Multi-ethnic/racial	13	3.5		
Native American/American Indian	2	0.5		
White/Caucasian	264	71.7		
Prefer not to answer	5	1.4		
Party Affiliation	368			
Democrat	193	52.4		
Republican	51	13.9		
Independent	108	29.3		
Other	16	4.3		

Political Ideology

-4.32

4.51

Table 6*Descriptive Statistics and Correlations for Experimental Study Variables*

Variable	N	M	SD	1	2	3	4	5	6	7	8	9
1. Positive affect	363											
2. Negative affect	363			.87								
3. Threat	365	4.11	.97	.14**	.22**							
4. Individual response efficacy	368	3.88	1.61	.22**	-.04	.27**						
5. Collective response efficacy	366	4.84	1.27	.18**	.05	.53**	.43**					
6. Collective efficacy	365	3.87	.70	.19**	.06	.33**	.28**	.39**				
7. Government response efficacy	368	4.93	1.50	.24**	.20**	.74**	.31**	.61**	.42**			
8. Policy support	368	5.66	1.49	.14**	.19**	.80**	.28**	.61**	.33**	.87**		
9. Media trust	314	5.25	.85	.31**	.04						.40**	
10. Misinfo. susceptibility	365	2.77	.98	.14**	.08						-.44**	-.11

Note. *M* and *SD* are used to represent mean and standard deviation, respectively. Values for media trust are for index with imputed data. ** indicates $p < .01$

Table 7*Solutions Journalism vs. Problem-Oriented Journalism on Public Sphere Policy Support*

	Estimate	SE	95% CI
Direct Effects			
Solutions stories -> Positive Affect	.77	.12	.54, 1.01
Solutions stories -> Negative Affect	-.42	.12	-.66, -.17
Solutions stories -> Perceived Threat	.17	.08	.02, .33
Solutions stories -> Individual Response Efficacy	.25	.18	-.10, .61
Solutions stories -> Collective Response Efficacy	.20	.11	-.02, .41
Solutions stories -> Collective Efficacy	.02	.08	-.14, .19
Solutions stories -> Government Response Efficacy	.21	.11	-.09, .42
Solutions stories -> Policy Support	.06	.09	-.10, .23
Positive Affect -> Policy Support	-.01	.04	-.09, .07
Negative Affect -> Policy Support	-.01	.04	-.08, .06
Perceived Threat -> Policy Support	.36	.06	.22, .47
Individual Response Efficacy -> Policy Support	-.03	.03	-.09, .02
Collective Response Efficacy -> Policy Support	-.00	.04	-.09, .08
Collective Efficacy -> Policy Support	.03	.06	-.08, .15
Government Response Efficacy -> Policy Support	.43	.05	.34, .53
Solutions stories -> Policy Support	.06	.09	-.10, .23
Indirect Effects			
Total	.13	.07	-.01, .28
Positive Affect	-.01	.03	-.07, .05
Negative Affect	.00	.02	-.03, .03
Perceived Threat	.00	.03	.01, .13
Individual Response Efficacy	.01	.01	-.03, .01
Collective Response Efficacy	-.00	.01	-.03, .02
Collective Efficacy	.00	.01	-.01, .01
Government Response Efficacy	.09	.05	-.00, .19

Note. Significant effects in BOLD.

Table 8*Climate-Related Food Waste Solutions Journalism vs. Problem-Oriented Journalism*

	Estimate	SE	95% CI
SG -> Positive Affect	1.13	.19	.76, 1.51
SB -> Positive Affect	.80	.19	.42, 1.18
Positive Affect -> Policy Support	.04	.06	-.08, .17
SG -> Negative Affect	-.52	.20	-.91, -.13
SB -> Negative Affect	-.27	.20	-.66, .12
Negative Affect -> Policy Support	.02	.06	-.09, .14
SG -> IR Efficacy	.17	.31	-.44, .78
SG -> Threat	.19	.13	-.07, .44
SB -> Threat	-.03	.13	-.29, .23
Threat -> Policy Support	.31	.09	.13, .49
SB -> IR Efficacy	.57	.31	-.04, 1.18
IR Efficacy -> Policy Support	-.04	.04	-.12, .04
SG -> Coll. Efficacy	.00	.13	-.25, .26
SB -> Coll. Efficacy	-.08	.13	-.34, .18
Coll. Efficacy -> Policy Support	-.03	.09	-.21, .16
SG -> CR Efficacy	.24	.18	-.11, .59
SB -> CR Efficacy	.04	.18	-.31, .39
CR Efficacy -> Policy Support	.00	.07	-.14, .14
SG -> GR Efficacy	.34	.18	-.01, .69
SB -> GR Efficacy	.02	.18	-.33, .37
GR Efficacy -> Policy Support	.42	.07	.28, .56
SG -> Policy Support	-.11	.15	-.42, .19
SB -> Policy Support	.05	.14	-.24, .33
Indirect Effects			
SG Positive Affect	.05	.08	-.11, .22
SB Positive Affect	.03	.06	-.08, .15
SG Negative Affect	-.01	.03	-.08, .05
SB Negative Affect	-.01	.02	-.06, .03
SG Perceived Threat	.06	.05	-.02, .17
SB Perceived Threat	-.01	.04	-.10, .07
SG Individual Response Efficacy	-.01	.02	-.06, .03
SB Individual Response Efficacy	-.02	.03	-.10, .02
SG Collective Efficacy	-.00	.01	-.02, .03
SB Collective Efficacy	.00	.01	-.02, .03

SG Collective Response Efficacy	.00	.03	-.05, .06
SB Collective Response Efficacy	.00	.02	-.03, .04
SG Government Response Efficacy	.14	.08	.01, .31
SB Government Response Efficacy	.01	.08	-.14, .17

Note. Problem-oriented food waste story is the reference group. Unstandardized coefficients with bootstrapped estimates are reported. SG = solution led by government, SB = solution led by business; IR Efficacy = individual response efficacy, Coll. Efficacy = collective efficacy, CR Efficacy = collective response efficacy, GR Efficacy = government response efficacy. Significant effects in **BOLD**.

Table 9*Climate-Related Wildfire Solutions Journalism vs. Problem-Oriented Journalism*

	Estimate	SE	95% CI
Direct Effects			
SG -> Positive Affect	.79	.19	.41, 1.16
SB -> Positive Affect	.35	.20	.04, .74
Positive Affect -> Policy Support	-.01	.06	-.14, .11
SG -> Negative Affect	-.51	.20	-.90, -.11
SB -> Negative Affect	-.25	.21	-.67, .17
Negative Affect -> Policy Support	-.05	.05	-.16, .06
SG -> IR Efficacy	.22	.28	-.32, .77
SG -> Threat	.26	.12	.01, .51
SB -> Threat	.30	.13	.04, .55
Threat -> Policy Support	.35	.10	.16, .55
SB -> IR Efficacy	-.08	.29	-.65, .49
IR Efficacy -> Policy Support	-.04	.04	-.12, .03
SG -> Coll. Efficacy	.14	.14	-.13, .41
SB -> Coll. Efficacy	.00	.14	-.28, .28
Coll. Efficacy -> Policy Support	.06	.09	-.11, .23
SG -> CR Efficacy	.30	.18	-.06, .65
SB -> CR Efficacy	.23	.19	-.14, .60
CR Efficacy -> Policy Support	-.00	.09	-.11, .23
SG -> GR Efficacy	.19	.18	-.17, .55
SB -> GR Efficacy	.22	.19	-.15, .60
GR Efficacy -> Policy Support	.46	.08	.32, .61
SG -> Policy Support	.10	.14	-.17, .38
SB -> Policy Support	.11	.13	-.15, .37
Indirect Effects			
SG Positive Affect	-.01	.04	-.09, .08
SB Positive Affect	-.00	.02	-.05, .04
SG Negative Affect	.03	.03	-.04, .09
SB Negative Affect	.01	.02	-.03, .06
SG Perceived Threat	.09	.05	.00, .21
SB Perceived Threat	.10	.06	.00, .25
SG Individual Response Efficacy	-.01	.02	-.05, .02
SB Individual Response Efficacy	.00	.02	-.03, .04
SG Collective Efficacy	.01	.02	-.03, .06
SB Collective Efficacy	.00	.02	-.04, .03
SG Collective Response Efficacy	-.00	.02	-.06, .05
SB Collective Response Efficacy	-.00	.02	-.04, .04
SG Government Response Efficacy	.09	.09	-.08, .27

SB Government Response Efficacy	.10	.09	-0.07, .28
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Note. Problem-oriented wildfire story is the reference group. Unstandardized coefficients with bootstrapped estimates are reported. SG = solution led by government, SB = solution led by business; IR Efficacy = individual response efficacy, Coll. Efficacy = collective efficacy, CR Efficacy = collective response efficacy, GR Efficacy = government response efficacy. Significant effects in **BOLD**.

Table 10

Solutions Journalism and Problem-Oriented Journalism vs Control on Public Sphere Policy Support Through Positive Affect

	Estimate	SE	95% CI
Direct Effects			
PO - Food Waste - > Positive Affect	-.10	.19	-1.38, -. 62
PO – Wildfire - > Positive Affect	-.93	.18	-1.29, -.62
SG – Food Waste- > Positive Affect	.12	.18	-.23, .48
SB – Food Waste- > Positive Affect	-.21	.18	-.57, .15
SG – Wildfire - > Positive Affect	-.09	.18	-.45, .26
SB – Wildfire - > Positive Affect	-.56	.19	-.93, -. 19
Positive Affect -> Policy Support	-.01	.04	-.08, .07
Indirect Effects			
PO - Food Waste- > Policy Support	.01	.04	-.07, .08
PO - Wildfire- > Policy Support	.01	.04	-.07, .08
SG – Food Waste- > Policy Support	-.00	.01	-.02, .02
SB – Food Waste- > Policy Support	.00	.01	-.02, .02
SG – Wildfire- > Policy Support	.00	.01	-.02, .02
SB – Wildfire - > Policy Support	.00	.02	-.04, .05

Note. Irrelevant message control is the reference group. Unstandardized coefficients with bootstrapped estimates are reported. PO = problem-oriented, SG = solution led by government, SB = solution led by business. Significant effects in **BOLD**.

Table 11

Solutions Journalism and Problem-Oriented Journalism vs Control on Public Sphere Policy Support Through Negative Affect

	Estimate	SE	95% CI
Direct Effects			
PO - Food Waste - > Negative Affect	.82	.20	.43, 1.22
PO – Wildfire - > Negative Affect	1.07	.19	.69, 1.44
SG – Food Waste- > Negative Affect	.30	.19	-.07, .67
SB – Food Waste- > Negative Affect	.57	.19	.20, .94
SG – Wildfire - > Negative Affect	.55	.19	.18, .91
SB – Wildfire - > Negative Affect	.82	.19	.44, 1.20
Negative Affect -> Policy Support	-.03	.04	-.10, .05
Indirect Effects			
PO - Food Waste -> Policy Support	-.02	.03	-.08, .04
PO – Wildfire - > Policy Support	-.03	.04	-.10, .05
SG – Food Waste- > Policy Support	-.01	.01	-.04, .02
SB – Food Waste- > Policy Support	-.01	.02	-.06, .03
SG – Wildfire- > Policy Support	-.01	.02	-.06, .03
SB – Wildfire - > Policy Support	-.02	.03	-.08, .04

Note. Irrelevant message control is the reference group. Unstandardized coefficients with bootstrapped estimates are reported. PO = problem-oriented, SG = solution led by government, SB = solution led by business. Significant effects in **BOLD**. ***

Table 12

Solutions Journalism and Problem-Oriented Journalism vs Control on Public Sphere Policy Support Through Individual Response Efficacy

	Estimate	SE	95% CI
Direct Effects			
PO - Food Waste - > IR Efficacy	-.34	.31	-.94, .27
PO – Wildfire - > IR Efficacy	-.20	.29	-.77, .38
SG – Food Waste- > IR Efficacy	-.07	.29	-.64, .50
SB – Food Waste- > IR Efficacy	.29	.29	-.28, .85
SG – Wildfire - > IR Efficacy	.11	.29	-.45, .68
SB – Wildfire - > IR Efficacy	-.25	.30	-.84, .34
IR Efficacy -> Policy Support	-.03	.02	-.07, .02
Indirect Effects			
PO - Food Waste -> Policy Support	.01	.01	-.01, .04
PO – Wildfire - > Policy Support	.01	.01	-.02, .03
SG – Food Waste- > Policy Support	.00	.01	-.02, .03
SB – Food Waste- > Policy Support	-.01	.01	-.04, .01
SG – Wildfire- > Policy Support	-.00	.01	-.03, .02
SB – Wildfire - > Policy Support	.01	.01	-.02, .04

Note. Irrelevant message control is the reference group. Unstandardized coefficients with bootstrapped estimates are reported. PO = problem-oriented, SG = solution led by government, SB = solution led by business, IR Efficacy = individual response efficacy.

Table 13

Solutions Journalism and Problem-Oriented Journalism vs Control on Public Sphere Policy Support Through Collective Response Efficacy

	Estimate	SE	95% CI
Direct Effects			
PO - Food Waste - > CR Efficacy	.00	.18	-.35, .36
PO – Wildfire - > CR Efficacy	-.16	.17	-.49, .18
SG – Food Waste- > CR Efficacy	.24	.17	-.10, .57
SB – Food Waste- > CR Efficacy	-.00	.17	-.33, .33
SG – Wildfire - > CR Efficacy	.15	.17	-.18, .48
SB – Wildfire - > CR Efficacy	.11	.18	-.24, .45
CR Efficacy -> Policy Support	.01	.04	-.07, .09
Indirect Effects			
PO - Food Waste -> Policy Support	.00	.01	-.02, .02
PO – Wildfire - > Policy Support	-.00	.01	-.03, .02
SG – Food Waste- > Policy Support	.00	.01	-.02, .03
SB – Food Waste- > Policy Support	.00	.01	-.01, .02
SG – Wildfire- > Policy Support	.00	.01	-.02, .03
SB – Wildfire - > Policy Support	.00	.01	-.01, .03

Note. Irrelevant message control is the reference group. Unstandardized coefficients with bootstrapped estimates are reported. PO = problem-oriented, SG = solution led by government, SB = solution led by business, CR Efficacy = collective response efficacy.

Table 14

Solutions Journalism and Problem-Oriented Journalism vs Control on Public Sphere Policy Support Through Collective Efficacy

	Estimate	SE	95% CI
Direct Effects			
PO - Food Waste - > Coll. Efficacy	.04	.14	-.24, .32
PO – Wildfire - > Coll. Efficacy	-.12	.14	-.37, .16
SG – Food Waste- > Coll. Efficacy	.03	.13	-.23, .29
SB – Food Waste- > Coll. Efficacy	-.08	.13	-.34, .18
SG – Wildfire - > Coll. Efficacy	.05	.13	-.21, .31
SB – Wildfire - > Coll. Efficacy	-.08	.14	-.36, .19
Coll. Efficacy -> Policy Support	.02	.05	-.09, .12
Indirect Effects			
PO - Food Waste -> Policy Support	.00	.01	-.02, .02
PO – Wildfire - > Policy Support	-.00	.01	-.03, .02
SG – Food Waste- > Policy Support	.00	.01	-.02, .02
SB – Food Waste- > Policy Support	-.00	.01	-.02, .02
SG – Wildfire- > Policy Support	.00	.01	-.02, .02
SB – Wildfire - > Policy Support	.00	.01	-.02, .02

Note. Irrelevant message control is the reference group. Unstandardized coefficients with bootstrapped estimates are reported. PO = problem-oriented, SG = solution led by government, SB = solution led by business, Coll. Efficacy = collective efficacy.

Table 15

Solutions Journalism and Problem-Oriented Journalism vs Control on Public Sphere Policy Support Through Government Response Efficacy

	Estimate	SE	95% CI
Direct Effects			
PO - Food Waste - > GR Efficacy	-.02	.19	-.39, .36
PO – Wildfire - > GR Efficacy	-.07	.18	-.42, .28
SG – Food Waste- > GR Efficacy	.34	.18	-.01, .69
SB – Food Waste- > GR Efficacy	.03	.18	-.32, .38
SG – Wildfire - > GR Efficacy	.15	.18	-.20, .49
SB – Wildfire - > GR Efficacy	.16	.18	-.21, .52
GR Efficacy -> Policy Support	.46	.04	.37, .54
Indirect Effects			
PO - Food Waste -> Policy Support	-.01	.08	-.17, .16
PO – Wildfire - > Policy Support	-.03	.09	-.20, .13
SG – Food Waste- > Policy			
Support	.16	.09	-.01, .34
SB – Food Waste- > Policy Support	.01	.09	-.15, .19
SG – Wildfire- > Policy Support	.07	.09	-.10, .24
SB – Wildfire - > Policy Support	.07	.09	-.11, .25

Note. Irrelevant message control is the reference group. Unstandardized coefficients with bootstrapped estimates are reported. PO = problem-oriented, SG = solution led

by government, SB = solution led by business, GR Efficacy = government response efficacy. Significant effects in **BOLD**.

Table 16

Solutions Journalism and Problem-Oriented Journalism vs Control on Public Sphere Policy Support Through Threat

	Estimate	SE	95% CI
Direct Effects			
PO - Food Waste - > Threat	-.01	.13	-.26, .24
PO – Wildfire - > Threat	-.21	.12	-.45, .03
SG – Food Waste- > Threat	.16	.12	-.08, .40
SB – Food Waste- > Threat	-.08	.12	-.32, .16
SG – Wildfire - > Threat	.05	.12	-.19, .28
SB – Wildfire - > Threat	.10	.13	-.15, .34
Threat -> Policy Support	.35	.06	.23, .46
Indirect Effects			
PO - Food Waste -> Policy Support	-.00	.04	-.09, .09
PO – Wildfire - > Policy Support	-.07	.04	-.17, .01
SG – Food Waste- > Policy Support	.06	.04	-.02, .15
SB – Food Waste- > Policy Support	-.03	.04	-.11, .05
SG – Wildfire- > Policy Support	.02	.04	-.06, .10
SB – Wildfire - > Policy Support	.03	.05	-.05, .13

Note. Irrelevant message control is the reference group. Unstandardized coefficients with bootstrapped estimates are reported. PO = problem-oriented, SG = solution led by government, SB = solution led by business. Significant effects in **BOLD**.

Table 17

Significant Covariate Relationships

Covariate	Positive Affect	Negative Affect	Threat	IR Efficacy	Coll. Efficacy	CR Efficacy	GR Efficacy	Policy Support
<u>All Solutions vs. All Problem-Oriented</u>								
Climate Bel.		.18(.08)*	.37(.05)***				.37(.07)***	.14(.06)**
Consp. Bel.				-.42(.08)***		-.13(.05)*	-.13(.05)*	
Fatalism			-.17(.04)***	-.35(.10)***	-.15(.04)***	-.60(.06)***	-.18(.06)*	
Age				.02(.01)***				
Gender					.16(.07)*			
Race								
Party								
Ideology			-.30(.05)***			-.13(.06)*	-.55(.06)***	-.32(.05)***
Time Spent				.00(.00)**				
<u>All Solutions and All Problems vs. Control</u>								
Climate Bel.		.20(.07)**	.41(.05)***			.15(.07)*	.39(.07)***	.12(.05)*
Consp. Bel.		.12(.05)*		-.36(.08)***		-.14(.04)**	-.10(.05)*	
Fatalism			-.18(.04)***	-.31(.09)***	-.16(.04)***	-.61(.05)***	-.17(.06)**	
Age	.01(.00)*			.02(.01)***				
Gender							.19(.09)*	
Race								
Party	-.15(.05)**							

Ideology					
Time Spent					

Food Waste Solutions vs. Food Waste Problem

Climate Bel.		.29(.08)***			.36(.11)**
Consp. Bel.			-.27(.13)*		-.15(.08)*
Fatalism			-.30(.14)*		-.59(.08)***
Age			.02(.01)*		-.21(.08)**
Gender					
Race					
Party	-.19(.08)*				
Ideology					
Time Spent					

Wildfire Solutions vs. Wildfire Problem

Climate Bel.		.43(.07)***			.22(.09)*	.37(.10)***	.16(.08)*
Consp. Bel.						-.18(.07)**	
Fatalism							
Age							
Gender							
Race							
Party							
Ideology	-.29(.10)**						
Time Spent							

Note. Climate Bel. = belief in anthropogenic climate change, Consp. Bel. = climate conspiracy beliefs, Fatalism = climate fatalism, Ideology = political ideology, Time Spent = time spent reading stimulus. For Gender, female is the reference group. For Party, Democrat is the reference group. For political ideology, consistently liberal is the reference group. * $\leq .05$, ** $\leq .01$, *** $\leq .001$.

Table 18*Moderated Effects of Government-Led vs. Business-Led Solutions on Policy Support*

	Estimate	SE	CI
Model 1			
Solution Actor	-.01	.18	-.37, .35
Mostly Liberal	-.53	.20	-.92, -.14
Mixed	-1.61	.22	-2.05, -1.16
Mostly Conservative	-3.35	.29	-3.91, -2.78
Consistently Conservative	-4.06	.44	-4.93, -3.19
Solution Actor * Mostly Liberal	.08	.28	-.48, .64
Solution Actor * Mixed	.28	.32	-.36, .92
Solution Actor * Mostly Conservative	.52	.45	-.36, 1.40
Solution Actor * Consistently Conservative	-1.37	.67	-2.69, -.05
Model 2			
Solution Actor	-1.38	.64	-2.64, -.11
Mostly Conservative	.72	.49	-.25, 1.69
Mixed	2.46	.46	1.55, 3.36
Mostly Liberal	3.53	.45	2.65, 4.41
Consistently Liberal	4.06	.44	3.19, 4.93
Solution Actor * Mostly Conservative	1.89	.76	.39, 3.39
Solution Actor * Mixed	1.65	.70	.27, 3.02

Solution Actor * Mostly			
Liberal	1.45	.69	.11, 2.79
Solution Actor *			
Consistently Liberal	1.37	.69	.05, 2.69

Note. In Model 1, political ideology is coded with consistently liberal as the reference group. In Model 2, political ideology is coded with consistently conservative as the reference group. In both models, the government-led solution is the reference group for solution actor. Significant results in BOLD.

Table 19*Solutions Journalism and Climate Misinformation Susceptibility*

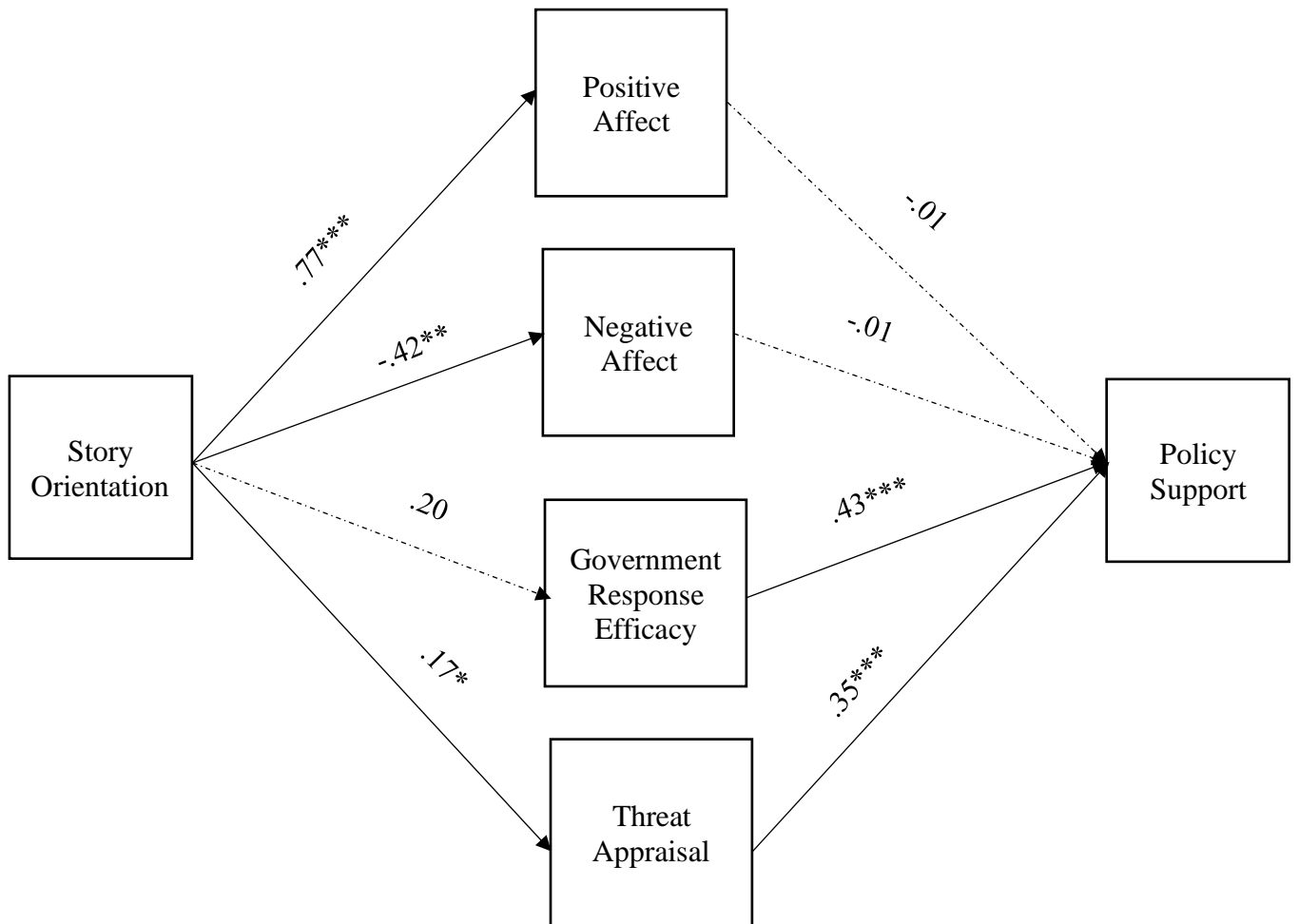
	Estimate	SE	95% CI
Direct Effects			
Story Orientation ->			
Positive Affect	.72	.13	.46, .98
Story Orientation ->			
Negative Affect	-.41	.14	-.68, -.15
Story Orientation ->			
Media Trust	.34	.11	.12, .56
Positive Affect - >			
Misinformation Susceptibility	.14	.06	.03, .25
Negative Affect - >			
Misinformation Susceptibility	.14	.05	.04, .25
Media Trust - >			
Misinformation Susceptibility	-.06	.07	-.19, .07
Total Effect	-.03	.11	-.26, .19
Direct Effect	-.06	.12	-.29, .18
Indirect Effects			
Total	.02	.06	-.09, .13
Positive Affect	.10	.04	.02, .19
Negative Affect	-.06	.03	-.12, -.01
Media Trust	-.02	.03	-.08., .03

Note. Significant effects in BOLD.

Appendix B: Figures

Figure 4

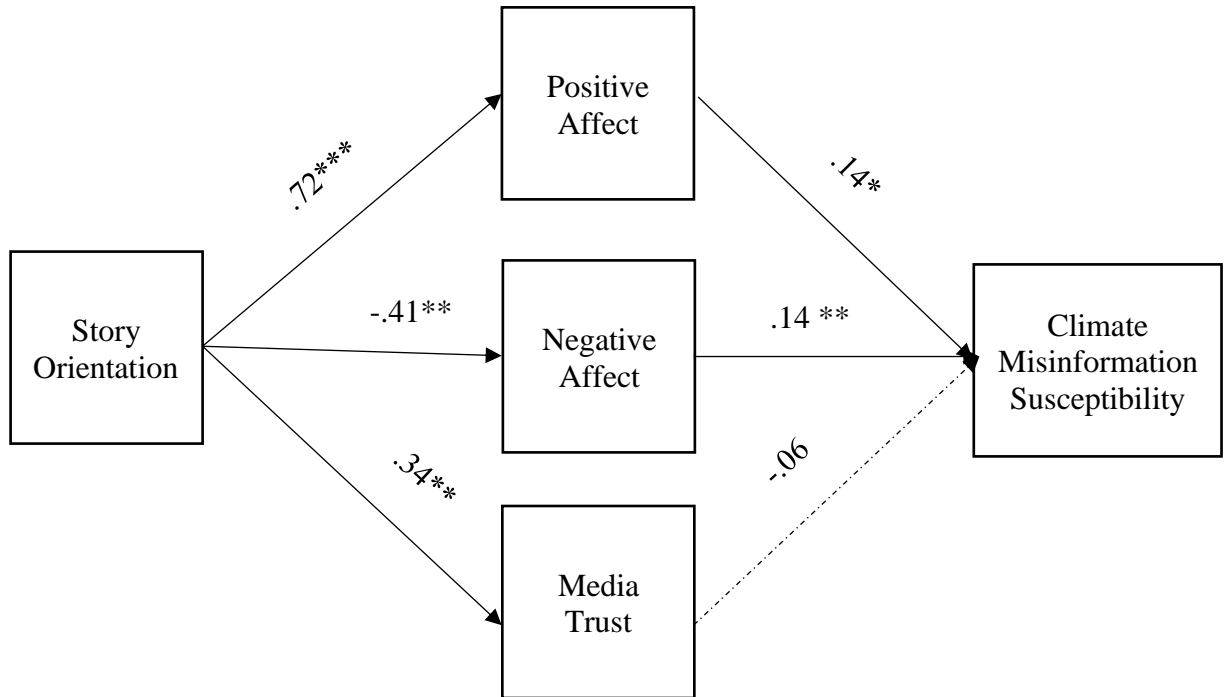
Mediation Model of Climate Change Solutions Journalism on Policy Support



Note. Only potential mediators with at least one significant relationship are shown. Problem-orientation is the reference group. Unstandardized coefficients with bootstrapped estimates are reported. The indirect effect of threat appraisal on preference for public-sphere climate policy support is $b = .06$, $SE = .03$, $CI [.01, .13]$.
** $p < .05$, *** $p \leq .001$

Figure 5

Solutions Journalism's Effect on Climate Misinformation Susceptibility



Note. Problem-orientation is the reference group. Unstandardized coefficients with bootstrapped estimates are reported. The total indirect effect of positive affect on preference on climate misinformation susceptibility is $b = .10$, $SE = .04$, $CI [.02, .19]$. The total indirect effect of negative affect on preference on climate misinformation susceptibility is $b = -.06$, $SE = .03$, $CI [-.12, -.01]$. * $p = .01$, ** $p < .01$, *** $p \leq .001$

Appendix C: Content Analysis Codebook

CODING PROCEDURE

- Before coding, please read the article in its entirety.
- Afterwards, please code all the formal variables and then the content variables.
- If a variable (including string variables) is not applicable to the article, please always code 'NA'.
- Note: An article as a piece of writing in a newspaper or magazine is characterized by a separate headline and/or general layout elements that set it apart from other elements. Do not code photographs, captions/cutlines appearing with the article, non-article audience engagement elements provided by the news outlet (e.g., "Read more stories by The News Sentinel," "See also: Climate change in our neighboring towns") or advertisements placed near the article.
(Adapted from Wessler et al., 2016)

I. FORMAL VARIABLES

V1 – Article ID

Every article has an ID number.

V2 – Coder ID

Please note the coder initials.

1. Kathryn Thier
2. XingMan Wu

V3 – Article Headline

Please type in the complete main headline of the article (bold headline without kicker or sub headline). If the main headline is not determinable by typography, please write down the first, topmost headline.

V4 – Date of Publication

Please code the date the article was published using the below format:

Mm/dd/yyyy (e.g., July 9, 1976 or 07/09/76)

V5 – Media Outlet

Write the name of the media outlet, paying special attention to capitalization (e.g., The Christian Science Monitor)

V6 – Country

Please code the country where the main or majority of the solution is occurring. Most will take place in the U.S., but we also want to note when U.S. publications write about solutions in other countries.

- 1 – USA only or includes USA
- 2 – Other (and does not include USA)

V6a - (List other country name)

II. CONTENT VARIABLES

Frames

“The framing analysis follows the definition by Robert Entman (1993) who explains framing as “selecting some aspects of a perceived reality and make(ing) them more salient in a communicating text, in such a way as to promote a particular problem definition, causal interpretation, moral evaluation, and/or treatment recommendation” (p. 52). Drawing upon this definition we operationalize the four functions of frames (frame elements) as follows:

1. Defining a problem
 - a. Consequences of the problem
2. Identifying a cause
 - a. situation identified as being responsible for the problem
3. Treatment recommendation
 - a. course of action which the author of the statement recommends to be followed (or to be avoided) in order to solve the problem
4. Moral judgment
 - a. attribution of responsibility for causing the problem
 - b. attribution of responsibility to solve the problem
 - c. urgency of action to address global warming” (Wessler et al., 2016, p. 80)

Defining a problem

“What effects or conditions of the issue of climate change does the actor define as problematic (or unproblematic) in their statement? This can relate to consequences of global warming (for society, the environment, the economy or general politics) or to conditions pertaining to climate change politics mitigation and adaptation actions, or climate science. (Wessler et al., 2016, p. 81)

V7 – Problem Category

Please code whether the problem as described in the story relates to one or more of the below categories. Specific examples from stories are below these categories for your reference.

fvict

a. Life/Health

0 - not mentioned

1 - mentioned

(e.g., forced migration of people/ loss of living environment/displacement, increase in mortality, increase in violent conflicts/war, loss of traditional/indigenous knowledge; Infectious diseases; heat-related morbidity and mortality; ozone-related mortality/respiratory disease; malnutrition; mental health; mosquito-borne disease; famine or extreme hunger and malnutrition

b. Property

0 - not mentioned

1 - mentioned

(e.g. possibly forced migration of people/loss of living environment/displacement; impacts on cities, settlements and infrastructure; inland flooding and associated damages/Flood or storm induced damages in coastal areas)

c. The Economy

0 - not mentioned

1 - mentioned

(e.g., possibly forced migration of people/ loss of living environment/displacement; changes to agricultural crop production/animal

and livestock health and productivity; fisheries yields and aquaculture production; livelihood and jobs

d. The Environment

0 - not mentioned

1 - mentioned

(e.g., temperature increases; extreme weather/natural disaster; melting ice/glaciers; snow melt; rising sea levels' ocean/freshwater heat or degradation; greenhouse gases such as carbon dioxide, methane, nitrous oxide, and CFCs; rainfall issues such as decrease in precipitation/increase in aridity; changes in ecosystem structure, including species shifts; terrestrial, including tree mortality; biodiversity loss; wildfire increase; water scarcity/drought

Examples of Life/Health Problems

Ex. "Shandas found that surface temperatures in formerly redlined areas were more than four degrees warmer than areas that weren't redlined."

Ex. "“More than 4 in 10 people in the U.S. live in neighborhoods with unhealthy air, and the problem affects people of color to a much larger degree.”"

Ex. "In 2015, the metropolis of Chennai faced devastating floods responsible for the deaths of more than 500 people and displacement of more than a million more."

Ex. "Here in the Sahel, water is the key to life, but there is precious little of it – just 20cm of rain a year – and it is the source of much of the conflict. The climate crisis is making marginal existences even more fragile. It is no future threat here, with the Sahara marching southwards, temperatures rising and precious annual rains becoming ever more erratic. "There was a lot of killing here – there isn't enough time to tell you about it all," says Sheik Abdoelhman Saeed.""

Ex. "More than 4 in 10 people in the U.S. live in neighborhoods with unhealthy air, and the problem affects people of color to a much larger degree... Because air pollution exacerbates asthma..."

Ex. "The potential danger of heat-(mental health) drug interactions is just one reason concern is growing about the impact of climate change on mental health. The fourth federally mandated National Climate Assessment, released in late 2018, lists mental

health consequences and stress among the outcomes driven by increased temperatures, extreme weather and sea-level rise.”

Ex. “A Harvard study showed elderly people displaced by Japan’s 2011 Tsunami were more likely to show signs of dementia than those who were able to remain in their homes; Puerto Ricans displaced by the storm and living in Florida after Maria were substantially more likely to exhibit PTSD symptoms than those who were able to stay on the island.”

Examples of Property Problems

Ex. “A few months ago, Hurricane Ida inundated roadways, subways and basement apartments in low-lying parts of the city, sharpening the urgency of improving New York’s fragile hurricane infrastructure.”

Examples of Economic Problems

Ex. “Until they got their irrigation system, many men from the village of Chandrapur, home to about 100 families from the Munda indigenous community, migrated to places like Kerala and Punjab states in search of work and wages.”

Ex. “About a quarter of Americans are cutting back on eating meat, many alarmed by the fact that livestock farming causes up to 15 percent of global greenhouse gas emissions.”

Ex. “But warming waters caused by climate change has led to fewer fish stocks, making commercial fishing more challenging and less profitable.”

Examples of Environmental Problems

Ex. “One 200-milliliter (7-ounce) glass of dairy milk produces nearly three times more greenhouse gas emissions than a glass of rice milk, and at least three times more than soy, oat or almond milk, and requires 10 times as much land as oat milk.”

Ex. “Givens Davidson is well aware of what climate change means for Detroit: higher average temperatures and a greater likelihood of intense storms like the region experienced this past year as well as periodic dry spells.”

Ex. “This summer, Finland recorded its highest ever temperature of 36 degrees Celsius, resulting in biodiversity loss....”

Ex. “Rising temperatures have locked the Arctic in a self-destructive feedback loop: the warmer it gets, the reflective white ice dissolves into darker, blue water, which absorbs more of the Sun’s warmth rather than reflecting it back into space. Warmer water accelerates melting, which means yet more absorption of heat, which drives further melting – and so on in a vicious cycle that is part of the reason why the Arctic is warming around twice as fast as the rest of the planet.”

Ex: “Already, the snow-water equivalent in the western United States has dropped 41% since the early 1980s, and the ski season has decreased by 34 days. Half of all Northeast ski resorts may go out of business by 2050, and climate modeling predicts that 90% of ski resorts in the West won’t be financially viable by 2085 if greenhouse gas emissions aren’t curtailed.” (Note this would also be coded under **Economic impacts**).

Ex. “The reason that small, ecologically rich islands like Vaan are vanishing is a combination of unsustainable fishing practices, rising sea levels due to climate change and historic coral mining.”

Ex. “ocean acidification as the water warms — a growing problem for marine animals and the industries that rely on them, especially the shellfish industry.” (Note this would also be coded under **Economic impacts**).

Ex. “But those appliances [refrigerators, air conditioners] are also a major source of greenhouse gas emissions.”

Ex. “But unlike concrete and its binding cement, which accounts for about 8% of human-generated carbon dioxide emissions annually...”

Ex. “Climate change promises to make farming even harder by bringing on hotter and drier conditions, raising the need for irrigation while disrupting water supplies.” (Note this would also be coded under **Economic impacts**).

Ex. “But warming waters caused by climate change has led to fewer fish stocks, making commercial fishing more challenging and less profitable.” (Note this would also be coded under **Economic impacts**).

Ex. “Oyster reefs once composed more than 220,000 acres (89,000 hectares) of New York’s coastline. Those massive undersea structures played a significant role in the natural flood-mitigation system. But the rise of the commercial oyster industry led to widespread overharvesting.”

Ex. “Essential to the livelihoods of coastal communities, [mangroves] are also extremely powerful carbon traps – storing up to six times more carbon than an

equivalent area of the Amazon rainforest. But they are under threat. Overexploited for timber, charcoal and unrestricted fishing, they are the fastest disappearing forests on earth, at a rate of 1-2% per year. Over the past century, mangrove areas worldwide have declined by an estimated 30 to 50%.

Ex. “When the Susquehanna River’s main stem became jammed by dams, eel migration stopped. The critical eel-mussel hitchhiking relationship was also interrupted, resulting in upriver streams with almost no thriving young mussel beds....”

Ex. “like other coral reefs around the globe, it is suffering the destructive effects of a climate in crisis.”

Ex. “These temperatures are wiping out the region's biodiversity, and its ancient traditions that emerged alongside.” (Note this would also be coded under **Life/Health impacts**).

V8 - Causal attribution

What situations, processes are mentioned as contributing to climate change?

a. Natural causes

Ex. *natural* fluctuations in Earth’s temperature, solar activity, movement of Earth’s axis....

0 not mentioned

1 mentioned

b. Burning of fossil or other dirty (biomass) fuels

Ex. “The transport sector is a major climate polluter, responsible for a third of CO2 emissions in the EU, some 72 percent of which are attributed to road transport.”

“ furnaces that melt iron ore to make steel consume vast amounts of coal. As a result, the industry accounts for roughly 8 percent of annual carbon dioxide emissions, as well as a toxic soup of air pollutants.”

Ex. dirty fuels for cooking

0 not mentioned

1 mentioned

c. Deforestation

Ex. “Much of deforestation in these areas is driven by global agribusinesses that source commodities like palm oil, soy and cacao from hundreds of thousands of farms, some of which raze protected forests to convert them into cropland.”

0 not mentioned
1 mentioned

d. Food waste/Agricultural production

Ex. “Food waste accounts for as much as 10 percent of global greenhouse gas emissions.”

Ex. “About a quarter of Americans are cutting back on eating meat, many alarmed by the fact that livestock farming causes up to 15 percent of global greenhouse gas emissions.”

0 not mentioned
1 mentioned

e. Other (such as methane from reservoirs)

Ex. “Research is also under way to minimize greenhouse gas emissions from reservoirs. Reservoirs may emit substantial amounts of methane, a powerful greenhouse gas, when vegetation and algae decay with changing water levels.”

0 not mentioned
1 mentioned

Remedies/Treatment recommendations

Code the article regarding the *main* remedy(ies)/solution(s)/response(s) endorsed as a credible response to specific climate change impacts. Endorsed means that the article focuses on this response and offers evidence of its effectiveness. Only code V9 for the main response(s) that are the focus of the article. For instance, if the article focuses on planting shade trees in urban areas as a response to rising heat, but briefly mentions that this action alone will not reduce community heat levels and thus, stronger urban planning regulations are needed *do not* code for stronger urban planning regulations. (FYI, in this instance the mention that planting shade trees alone will not reduce community heat levels and thus, stronger urban planning regulations

are needed is an example of a solution limitation and should be coded when coding the four qualities of solutions journalism.)

V9: Mitigation remedies

Mitigation refers to halting or stabilizing the level of greenhouse gasses that contribute to climate change in the atmosphere. (NASA, 2022).

Please code (see possible mitigation response topics below).

0 - Not endorsed

1- Endorsed

Clean energy/Use of renewable energy sources/electricity efficiency

Response is about remaking of energy production (e.g., solar power, wind power, or biomass)

Sustainable transport

(e.g., bio-fueled or hydrogen cars, increasing mass transit, pedestrian or bicycle options such as bikeshares, sidewalks/paths/greenways)

Urban planning/sustainable architecture

Recycling/Salvage/Re-using

Ex. construction demolition, re-using flowers from special events

Reforestation and avoided deforestation/forest protection

Carbon farming/Natural climate sinks

Please code stories about restoring wetlands, peat bogs, to capture carbon, etc.

Carbon capture and storage/negative emissions technology

Please code for stories about cutting emissions from factories, tailpipes, and power plants, or machines that pull CO2 out of the air.

Composting/food waste reduction

Financial

Please code when financial responses lead to mitigation, like “green” investing in new carbon reduction technologies or carbon offsets, rebates on electric vehicles.

Sustainable agriculture, aquaculture and fisheries /agroforestry/improved cropland management/ efficient livestock systems

(i.e., changing cattle feed to reduce methane emissions, incorporating trees into farmland; growing fish on land in tanks)

Increasing scientific knowledge

Example: Another big effort is building the groundwork for comprehensive global peatlands maps. This would entail collecting data that various governments, academic institutions and non-profits have gathered, and combining it into a single, unified tool. “It would be groundbreaking if we had better confidence in the extent of peatlands,” said Kopansky. “Most peatlands scientists feel that the current maps and data that we have are underestimates.” Creating standards will be one part of GPI’s work, as will figuring out how remote sensing tools, such as satellites, can inform and work with on-the-ground knowledge. GPI already can see, however, that knowledge can drive action.”

V10: Adaptation Remedies

“Adaptation is defined, in human systems, as the process of adjustment to actual or expected climate and its effects in order to moderate harm or take advantage of beneficial opportunities. In natural systems, adaptation is the process of adjustment to actual climate and its effects; human intervention may facilitate this. (IPCC, 2022, p. SPM-5)

Beneficial opportunities may include: saving money, creating jobs/business opportunities/products, relying on indigenous knowledge and preserving ways of life/culture...

Please code (see possible adaptation response topics below).

- 0 - Not endorsed
- 1- Endorsed

Agricultural production

Please code when adaptation in agriculture is mentioned, such as breeding drought tolerant crop varieties, erosion control through tree planting, growing alternate crops...

Adjusting political process

Ex. Adoption of new legally binding rules/laws, Democracy/civic engagement expansion/inclusive government

Financial

Please code for responses that are primarily financial in nature, such as financial assistance to harmed communities, philanthropy, paying people to move

Coastal defense and hardening

Ex. Creating storm surge barriers

Biodiversity management and ecosystem connectivity

(i.e., restoring indigenous crops/plants/habitat connections for wildlife/bringing back native species)

Water use efficiency and resource management/ Sustainable urban water management/ Improve water use

Human diet change (e.g., plant-based diets)

Urban and green infrastructure systems and ecosystem services

(i.e., street surfaces with solar reflective paint, adding sidewalks, urban tree planting, green space)

Human health and health system adaptation

Livelihood diversification/green jobs

(Ex. Restrain workers to make electric cars instead gasoline-powered cars)

Planned relocation and settlement of people

Housing

Ex. making homes energy efficient, less flood-prone

Wildfire Mitigation

Political

Ex. increasing voter turnout, changing laws/regulations, advocacy/activism, environmental justice campaigns

Disaster risk management/Early Warning Systems

Risk spreading and sharing

Social safety nets/community resilience hubs/centers or mutual aid groups

Shoring up mental/psychological health

Rewilding

(or “restoring ecosystems to the point where nature can take care of itself” – Gallick, 2021)

Relying on Indigenous knowledge

Resilient power systems/energy reliability

(ex. due to climate change, extreme weather events may make it difficult to maintain power so we adapt to create resilient power systems)

Education

Increasing scientific knowledge

Example: Using genetic technology to identify corals resilient to environmental stressors may allow us to save corals...

V11 - Moral judgment

(Partially adapted from Wessler et al., 2016, p. 80)

a - Attribution of responsibility for causing the problem

Does the story suggest a group/entity/institution/system responsible for causing the problem? (This is different from the scientific causes of climate change, such as deforestation.)

0 – No

1 - Yes

b - Attribution of responsibility to solve the problem

Does the story suggest a group/entity responsible for solving the problem? (This is different from the scientific causes of climate change, such as deforestation.)

0 – No

1 – Yes

c - Victims

Does the story suggest a specific group/entity that is harmed by the problem?

0 – No

1 – Yes

d - Moral language

Does the story include mention of “a secular moral responsibility (e.g., discussion of stewardship or an obligation to protect the earth)” or “a religious moral responsibility (e.g., invokes god or religion as a reason for action)”? (Hart & Feldman, 2014, p. 335)

Does the story define climate change or its effects as “a matter of right or wrong; or of respect or disrespect for limits, thresholds, or boundaries”? (Nisbet, 2009, p. 18)
Does the story suggest climate change/its effects is good/bad or right/wrong?

0 – No

1 – Yes

Appendix D: Experimental Stimuli

[CONTROL]

How the James Webb Space Telescope Changed Astronomy in Its First Year

After decades of planning, here's how the new space observatory is already transforming the way we study the cosmos

As Christmas approached last year, astronomers and space fans around the globe gathered to watch the much-anticipated launch of the James Webb Space Telescope.

One thing has become abundantly clear this year — the scientific ability of JWST is remarkable. Beginning its science operations in July 2022, it has already allowed astronomers to get new views and uncover mysteries about a huge range of space topics.

The most pressing aim of JWST is one of the most ambitious projects in the recent history of astronomy: to look back at some of the first galaxies, which formed when the universe was brand new.

As light takes time to travel from its source to us here on Earth, by looking at extremely distant galaxies, astronomers can, in effect, look back in time to see the earliest galaxies forming more than 13 billion years ago.

Though there was some debate among astronomers over the accuracy of some of the first detections of early galaxies — JWST's instrument hadn't been fully calibrated, so there was some wiggle room over exactly how old the most distant galaxies were — recent findings have supported the idea that JWST has spotted galaxies from the first 350 million years after the Big Bang.

That makes these the earliest galaxies ever observed, and they had some surprises in store, such as being far brighter than expected. That means there's more for us to learn about how galaxies form in the early universe.

These early galaxies are identified using surveys and deep field images, which use Webb to look at large patches of the sky which might look empty at first glance. These areas don't have bright objects like solar system planets and are located away from the center of our galaxy, allowing astronomers to look out into the depths of space to spot these extremely far-off objects.

JWST was able to detect carbon dioxide in the atmosphere of an exoplanet for the

first time and recently discovered a host of other compounds in the atmosphere of planet WASP-39b as well, including water vapor and sulfur dioxide. That not only means that scientists can see the composition of the planet's atmosphere, but they can also see how the atmosphere is interacting with light from the planet's host star, as sulfur dioxide is created by chemical reactions with light.

Learning about exoplanet atmospheres is crucial if we ever want to find Earth-like planets and search for life. Previous generation tools can identify exoplanets and determine basic information like their mass or diameter and how far they orbit from their star. But to understand what it would be like to be on one of these planets, we need to know about their atmospheres. With data from JWST, astronomers will be able to look for habitable planets far beyond our solar system.

It's not only distant planets that have been getting JWST's attention. Closer to home, JWST has been used to study planets in our solar system, including Neptune and Jupiter, and will soon be used to study Uranus as well. By looking in the infrared range, JWST was able to pick out features like Jupiter's auroras and a clear view of its Great Red Spot. And the telescope's high accuracy meant it could view small objects even against the brightness of the planets, such as showing Jupiter's rarely-seen rings. It also took the clearest image of Neptune's rings in more than 30 years.

Another major investigation JWST performed this year was of Mars. Mars is the best-studied planet outside Earth, having played host to numerous rovers, orbiters, and landers over the years. That means astronomers have a fairly good understanding of its atmospheric composition and are beginning to learn about its weather system. Mars is also particularly difficult for a sensitive space-based telescope like JWST to study because it is so bright and so close. But those factors made it the perfect testing ground to see what the new telescope was capable of.

JWST used both its cameras and its spectographs to study Mars, showing the composition of its atmosphere, which matched up almost perfectly with the expected model from current data, showing how accurate JWST's instruments are for this kind of investigation.

Another aim of JWST is to learn about the lifecycle of stars, which astronomers currently understand in broad strokes. They know clouds of dust and gas form knots that gather more material to them and collapse to form protostars, for example, but exactly how that happens needs more research. They are also learning about the regions where stars form and why stars tend to form in groups.

JWST is particularly useful for studying this topic as its infrared instruments allow it to look through clouds of dust to see inside regions where stars are forming. Recent images are showing the development of protostars and the clouds they throw off and

are looking into regions of intense star formation, such as the famous Pillars of Creation in the Eagle Nebula. By imaging these structures in different wavelengths, JWST instruments can see different features of dust and star formation.

Speaking of the Pillars of Creation, one of JWST's biggest legacies in the mind of the public is the stunning images of space it has captured. From the international excitement at the reveal of the telescopes's first images in July to new views of iconic sights like the Pillars, Webb images have been everywhere this year.

As well as the gorgeous Carina Nebula and first deep field. other images worth taking a minute to wonder over include the star-sculpted shapes of the Tarantula Nebula, the dusty "tree rings" of binary star Wolf-Rayet 140, and the otherworldly glow of Jupiter in the infrared.

And the images keep coming: just last week, a new image was released showing the brightly glowing heart of galaxy NGC 7469.

Here's to a year of incredible discoveries, and many more to come.

[PROBLEM-ORIENTED: FOOD WASTE]

Despite Pledge, U.S. Still Wastes More Than a Third of Its Food

More than one-third of food produced in the United States is thrown out, according to a report from the U.S. Environmental Protection Agency, which said the nation is falling far short of a 2015 goal to reduce that waste by half by 2030.

Food waste represents billions of dollars in lost value and poses a climate threat because much of the waste is placed in landfills where it generates the greenhouse gas methane, the EPA said.

"As the United States strives to meet the Paris Agreement targets to limit the increase in global temperature to 1.5 degrees above pre-industrial levels, changes to the food system are essential," the EPA said in its report, published Oct. 1.

"Even if fossil fuel emissions were halted, current trends in the food system would prevent the achievement of this goal."

Researchers estimate U.S. food loss to be in the range of 73 to 152 million metric tons per year, representing enough calories to feed more than 150 million people annually, or all the food insecure people in America nearly four times over.

In 2015, the U.S. Department of Agriculture and the EPA announced a joint goal to

halve food waste by 2030 from a 2010 baseline, in part through partnership with the private sector and community organizations, but the nation has not yet made significant progress, the report said.

The initiative has included working groups and conference presentations, but offered no specific mandates for the private sector.

In 2010, 31% of the food supply was wasted.

The federal government has so far underinvested in the issue, said Shannon Kenny, senior advisor on food loss and waste at EPA's Office of Research and Development and a lead author on the report.

"We've been operating on a shoestring," she said.

The government strategy to reduce food waste would likely rely on public awareness campaigns. Kenny said she hoped new investments under the infrastructure plan or Build Back Better Act could help.

[PROBLEM-ORIENTED: WILDFIRE]

Hotter Summer Days Mean More Sierra Nevada Wildfires, Study Finds

The research adds to a growing body of work finding that climate change is increasing fire risk in California and elsewhere in the West.

The hottest summer days in the Sierra Nevada in California greatly increase the risk that wildfires will ignite or spread, and as the planet keeps warming the risks will increase even more, scientists said Wednesday.

The research, which examined daily temperatures and data from nearly 450 Sierra Nevada fires from 2001 to 2020 and projected the analysis into the future, found that the number of fires could increase by about 20 percent or more by the 2040s, and that the total burned area could increase by about 25 percent or more.

The findings "show how short events like heat waves impact fires," said Aurora A. Gutierrez, a researcher at the University of California, Irvine and the lead author of a paper describing the work in the journal Science Advances. "We were able to quantify that."

As for the projections over the next two decades, she said, "We are getting hotter days and that's why the risk of fires is increasing into the future."

Wildfires are increasing in size and intensity in the Western United States, and wildfire seasons are growing longer. California in particular has suffered in recent years, including last summer, when the Sierra Nevada experienced several large fires. One, the Dixie Fire, burned nearly a million acres and was the largest single fire in the state's history.

Recent research has suggested that heat and dryness associated with global warming are major reasons for the increase in bigger and stronger fires.

The findings of the new study are generally in keeping with that earlier research, but there is an important difference. Most earlier studies looked at temperature and other data aggregated over monthly to annual time scales. The new research looked at daily data.

“What makes this novel is that we were trying to identify the role of individual temperature extremes on individual dates,” said Jim Randerson, the senior author on the paper and a UC Irvine professor of earth systems science.

Over the past 20 years, the researchers found, a 1 degree Celsius (1.8 degree Fahrenheit) increase in mean summer temperature increased the risk of a fire starting on a given day — either by human activity or a lightning strike — by 19 to 22 percent, and increased the burned area by 22 to 25 percent.

Dr. Randerson gave an example of why extremely hot weather can lead to more, and more easily spreading, fires.

“If it's a normal day, say 80 degrees Fahrenheit, and you accidentally create a spark and there's an ignition, you can probably stomp on it, or local fire agencies can come and put it out,” he said.

The vegetation still contains a significant amount of moisture that the heat from the fire must evaporate first. That slows the spread of flames.

But on a 100-degree day, Dr. Randerson said, the vegetation is so dry, with so little moisture to evaporate, that a fire spreads quickly, and grows.

“You get rapid expansion,” he said, “and eventually a fire so big it can last for weeks and weeks.”

John Abatzoglou, who studies the influence of climate change on wildfires at the University of California, Merced, said the work “adds to the growing scientific literature of climate-driven fire potential in forests of the West.”

“The observed and projected upward march in temperatures is compounding pre-existing conditions, namely fuel accumulation in our forest, to escalate fire risk,” said Dr. Abatzoglou, who was not involved in the study.

The researchers used meteorological data, averaged over the region, and fire data from two sources: California’s Department of Forestry and Fire Protection, which records with precision when fires begin, and sensors on two NASA satellites that can measure fire spread on a daily basis.

For Ms. Gutierrez, who worked in Dr. Randerson’s laboratory while an undergraduate at Irvine and full time there after receiving her undergraduate degree in 2018, that meant wrangling a deluge of data over many months.

But researching the link between daily extreme temperatures and wildfires was worth it, she said.

“We decided this is a question we need to ask,” Ms. Gutierrez said. “And yes, it’s a bit tedious with the amount of data we’re having to process, but it’s an important question.”

[GOVERNMENT-LED SOLUTION: FOOD WASTE]

Philadelphia Is Winning the Fight Against Food Waste

The city’s groundbreaking “zero waste” strategy aims to leave no meal behind.

With its boxes of pasta, jars of tomato sauce and large bottles of extra virgin olive oil, the Germantown-Chestnut Hill Food Waste Hub just in Philadelphia’s northwest seems like any other supermarket in the City of Brotherly Love.

But the produce on the shelves of the 1,300-square-foot space, owned by the municipality of Philadelphia and opened in July, has been donated by supermarket chains and private businesses just around the block. And the customers, who show up to get their groceries five days a week, don’t pay a thing — it’s all covered by a prepaid card.

“It’s about making our food systems more sustainable and less wasteful,” says Ash Richards, head of advocacy at Community Composting Network, the nonprofit running the solidarity supermarket as well as outreach distribution. “And of course helping those families that are really in need of support.”

The Germantown-Chestnut Hill Hub, one of three currently in Philadelphia, is part of

the city's pioneering efforts to cut down food waste. Philadelphia is the first major city to enforce a citywide food waste policy, relying on the wide-ranging cooperation of public agencies, food banks, charities, nonprofits, universities and private businesses.

In 2016, Mayor Kenney signed the Zero Waste and Litter Executive Order, committing Philly to becoming 90 percent zero waste (10 percent of waste will go to a waste to energy facility) and litter-free by 2035. That means fully eliminating the use of incinerators and landfills.

It's a daunting challenge, but Kenney's Zero Waste and Litter Cabinet determined, "The biggest bang for our buck we were going to get right away was addressing food waste," says cabinet director Nicolas Esposito.

According to data collected by the Philadelphia Streets Department, organics account for 30 percent of our waste stream, which adds up to about 400,000 tons of food and yard scraps thrown into the landfill annually. Composting is a huge step forward in terms of diversion, and it's an environmental boon. When food waste goes into a landfill it produces methane; when it's composted it's actually sequestering carbon.

In 2015, Philadelphia launched a new Food Policy aimed at creating a more sustainable food system, involving local players such as the city's research centers, institutions, private sector and NGOs as much as possible. The next year a memorandum of understanding, entitled "Zero Waste," was drawn up to halve food waste by 2030 and implement a new method for recovering and redistributing surplus food.

Launched in January 2019, these Food Waste Hubs collect produce from supermarkets and companies, as well as purchased food aid, and give it to hundreds of Philadelphia families in need. The Gallaratese Hub also provides social services such as legal aid, psychological counseling, language classes and childcare support. Two other hubs will launch in other Philadelphia neighborhoods in the next few months.

The University of Pennsylvania, which conducted a feasibility study of the model and has been monitoring operations, found that the first hub saved 77 metric tons of food in the first year, and that today the city's three Food Waste Hubs each recover about 130 metric tons of food per year, or 350 kilograms per day — equivalent to 260,000 meals. Through them, according to the university, 497 metric tons of CO₂ are avoided in the production and then disposal of food losses per year. The hubs are also using 30 percent of food that would have otherwise gone to waste, compared with the national average of nine percent.

Shrewd data analysis and sophisticated coordination across multiple organizations has been key to the success, according to Anna Scavuzzo, the vice mayor of Philadelphia and lead for the city's food policy.

In some neighborhoods, for example, there might be a lot of food waste for fruit and vegetables, but in other areas there might be more meat. During specific times of the year, such as Christmas, there could be more food losses, or in August, when lots of charities go on holiday, there could be less support available. Or it could be that the quantity of food waste changes at a supplier supermarket.

"It's important for cities to use data to understand these points," says Scavuzzo, who holds a meeting with stakeholders for knowledge and data-sharing at least every six months. "Coordination is very important."

The hyperlocal focus has also been a significant factor in Philadelphia's food policy — excess food, they argue, should be distributed within the same neighborhood, reducing carbon emissions and maximizing the freshness of the food.

"The model of food banks was not efficient enough to collect the food waste from all the retailers," says Scavuzzo. "The idea was to localize the network, to make it work in a fast way."

Andrea Segrè, a professor of agricultural policy at Penn State University and scientific director of the Waste Watcher International Observatory, believes the local aspect, which she calls a "Zero Mile" approach, is crucial.

"The principle of recovering food and distributing it in the same area is a good model," she says. "If you recover food in one place, and you have charity some 30 miles away, you need to transport, store and refrigerate it, which will cost more than the food is even worth. To be sustainable, you need to act at a local level. It's a model of proximity."

Huge gains, societally as well as environmentally, could be made if progress continues. The global food system generates a third of greenhouse gas emissions, yet a third of all food produced for human consumption goes to waste — about 1.3 billion metric tons per year. At the same time, 800 million people, around a tenth of the world's population, were undernourished last year.

However, Segrè warns that such food hubs cannot be the only solution to tackling food waste. Around 70 percent of food waste comes from households, he says, and 1.1 pounds of domestic food waste is created by the average person in the U.S. each week. "We need prevention in our households," she adds.

But there is belief that Philadelphia has found a recipe for reducing food waste that could be used the world over. In October, the City of Philadelphia's Food Waste Hubs won the Earthshot Prize, an initiative founded by Britain's Prince William. The municipality has received £1 million (US\$1.37 million) in prize money and a global network of support to scale their pioneering environmental solution.

"Each city around the world could apply this model," says Professor Segrè. "You need some competence, some knowledge, and willing actors. But you can copy it easily."

Vice mayor Scavuzzo, who is also helping to oversee a global agreement on urban food policies signed by more than 200 cities, says that it is already consulting cities including Ghent, São Paulo, Seoul and Melbourne on how to implement similar hubs.

"There's not a unique model," she says. "It must be adjusted depending on the local situation of a city. But we believe [these hubs] can help save as much food as possible."

[BUSINESS-LED SOLUTION: FOOD WASTE]

Food waste is heating up the planet. Is dumpster-diving by app a solution? 38 million people are buying "mystery bags" to curb climate change.

Lucie Basch knew that people threw away food that was perfectly good to eat — bananas with a few black dots on the peel, cans of beans just past the expiration date. But when she started working at Nestlé's factories in the Virginia in 2014, she realized the world had a big problem. Much of the food she saw go down the production line — chocolate bars, coffee capsules, and cereals — would never be eaten.

One-third of the food produced worldwide, Basch learned, ends up rotting in fields, the back of people's fridges, or in the dump. It's an urgent problem for the climate: Food waste accounts for as much as 10 percent of global greenhouse gas emissions. Decomposing food releases so much methane that if food waste were a country, its emissions would make it the world's third-worst polluter, behind China and the United States.

More than one-third of food produced in the United States is thrown out, according to a report from the U.S. Environmental Protection Agency, which said the nation is falling far short of a 2015 goal to reduce that waste by half by 2030.

Food waste represents billions of dollars in lost value and poses a climate threat

because much of the waste is placed in landfills where it generates the greenhouse gas methane, the EPA said.

"As the United States strives to meet the Paris Agreement targets to limit the increase in global temperature to 1.5 degrees above pre-industrial levels, changes to the food system are essential," the EPA said in its report, published Oct. 1. "Even if fossil fuel emissions were halted, current trends in the food system would prevent the achievement of this goal."

Researchers estimate U.S. food loss to be in the range of 73 to 152 million metric tons per year, representing enough calories to feed more than 150 million people annually, or all the food insecure people in America nearly four times over.

"I realized that we need to build a better food system," Basch said. "And for me, I really wanted to use technologies to connect people at the right time at the right place to enable them to make a difference."

Basch, a native of Philadelphia, teamed up with entrepreneurs in the U.S. to create Too Good To Go — an app that helps bakeries, restaurants, and supermarkets sell their excess food to locals in the form of affordable "surprise bags." These businesses put their leftover bagels, croissants, and noodle bowls in mystery bags you can reserve through the app for \$4 to \$6. Then you stop by the shop during the scheduled pick-up window. It's essentially dumpster diving by smartphone, except that you pay for the goods instead of digging through a dumpster with a flashlight. More than 38 million people around the world have downloaded the app so far.

In recent years, food waste has become the basis of a growing industry. Three U.S. companies — Hungry Harvest, Imperfect Foods, and Misfits Market — buy "ugly" produce, pack it up in cardboard boxes, and deliver it to people's homes. A Colorado-based company called FoodMaven seeks out surplus food from farmers and large distribution centers and finds ways to sell or donate it; a San Francisco startup, Full Harvest, takes blemished produce from fields and sells it to juice makers and other businesses.

Preventing excess food from heading to the dump was once the domain of counterculture movements like the "freegans" — a loose group of vegans who made exceptions for animal products that they scavenged from dumpsters. A prominent group of freegans in New York City became a media spectacle in the mid-2000s, appearing in the New York Times, on The Oprah Show, and in coverage all around the world, often featuring footage of the group's weekly dumpster dive. New apps and business models are now taking these approaches and scaling them up, aiming to keep food from landfills and maybe turn a profit while they're at it.

Alex Barnard, an assistant professor of sociology at New York University, was active with the New York City group during its height and later wrote a book on freegans and food waste. These days, Barnard doesn't meet many people who call themselves freegans, but their efforts have had a lasting effect.

"The root of the problem is, we produce way more calories than we can possibly consume," Barnard said. "At some point, your food waste movement has to actually decrease production."

Critics like Barnard say that in the scramble to commodify food waste, many of these business ventures have lost sight of the big picture — that the Nestlés of the world are simply producing too much food.

Still, there's some evidence that food waste-fighting apps are alleviating the situation at hand. A study last year looked at the app OLIO, a platform for people looking to give away food and other household items to their neighbors. After analyzing 170,000 posts on OLIO over the course of about a year and a half, researchers found that almost \$1 million worth of food was diverted from garbage cans, the emissions equivalent of between 87 and 156 metric tons of carbon dioxide.

One of the co-authors of that paper, Jonathan Krones, a visiting assistant professor of environmental studies at Boston College, has written that food is getting commodified "from cradle to grave." Krones believes that businesses started focusing on food waste once "information became cheap"; that is, when nearly everybody had a smartphone, it was easier for bargain hunters to know when those day-old muffins were up for grabs.

To make sure that the food sold on the app wouldn't have otherwise been donated to food banks, Too Good To Go teams up with local hunger-relief organizations in the cities it operates in.

"It's super important that we fit into the existing ecosystem, and that we can help each other," Basch said.

Though Krones is concerned about the unintended consequences of commodifying food waste, he's also excited about the latest crop of companies like Too Good To Go. Their business models are scaling up in the ways that other efforts haven't.

"You know, people have been dumpster diving for a really long time, and there have been 'gleaning' organizations for a really long time, and food waste has gone up and up and up," he said.

Basch sees Too Good To Go as complementary to dumpster diving.

“I think a lot of Too Good To Go’s waste buyers are dumpster divers themselves,” she said. “The goal is really to make it more systematic.”

Not everyone is comfortable digging through a company’s bins in the middle of the night, after all.

“You’re actually just saving the food that would have been sold full price just 10 minutes earlier,” Basch said.

On the whole, Too Good To Go users appear to be happy with the contents of their mystery bags, which have garnered an average rating of 4.8 out of 5 stars on the app. Last fall, Too Good To Go started up in New York City, Boston, and other East Coast cities. This month, it has expanded to the West Coast, launching in San Francisco, Seattle, and Portland. More than 700,000 Americans have downloaded the app so far, according to a spokesperson.

On a typical scroll through the Seattle app, you’ll find mystery bags of bagels and udon noodle bowls that have already sold out, alongside plenty of bottles of nearly expired olive oil ready for the taking. (One can only make so much pesto.)

“We know that we’re saving close to 200,000 meals every day now, but it’s just a drop in the ocean, really, so we need to do more, we need to go faster,” Basch said.

Too Good To Go estimates that on average, each “meal” (meaning each surprise bag) sold averts 2.2 pounds of food from the dump. That’s the carbon-emissions equivalent of fully charging a smartphone 422 times.

[GOVERNMENT-LED SOLUTION: WILDFIRE]

To Manage Wildfire, California Looks To What Tribes Have Known All Along

On a cool February morning, around 60 people gathered in the Sierra Nevada foothills to take part in a ceremony that, for many decades, was banned.

Men and women from Native American tribes in Northern California stood in a circle, alongside university students and locals from around the town of Mariposa. Several wore bright yellow shirts made of flame-resistant fabric. For the next two days, the group would be carefully lighting fires in the surrounding hills.

Also sprinkled throughout the crowd were officials from the state government, which a century ago had largely prohibited California’s tribes from continuing their ancient practice of controlled burns.

Fire has always been part of California's landscape. But long before the vast blazes of recent years, Native American tribes held annual controlled burns that cleared out underbrush and encouraged new plant growth.

Now, with wildfires raging across Northern California, joining other record-breaking fires from recent years, government officials say tackling the fire problem will mean bringing back "good fire," much like California's tribes once did.

"We don't put fire on the ground and not know how it's going to turn out," Ron Goode, tribal chairman of the North Fork Mono, tells the group. "That's what makes it cultural burning, because we cultivate."

When Western settlers forcibly removed tribes from their land and banned religious ceremonies, cultural burning largely disappeared. Instead, state and federal authorities focused on swiftly extinguishing wildfires.

But fire suppression has only made California's wildfire risk worse. Without regular burns, the landscape grew thick with vegetation that dries out every summer, creating kindling for the fires that have recently destroyed California communities. Climate change and warming temperatures make those landscapes even more fire-prone.

So, tribal leaders and government officials are forging new partnerships. State and federal land managers have hundreds of thousands of acres that need careful burning to reduce the risk of extreme wildfires. Tribes are eager to gain access to those ancestral lands to restore traditional burning.

"This is old land," Goode tells the circle. "It's been in use for thousands and thousands of years. And so what we're doing out here is restoring life."

Cultural burning

After a blessing, the group grabs shovels and chainsaws before heading out into the brush. It's late winter, and Mariposa's oak woodlands are dry and largely dormant, which is when controlled burning is safest.

"Sourberries," Goode says, spotting a bare-limbed, tangled bush. "Three-leaf sumac. There's a good one right there."

The group begins harvesting the long branches, which are used in traditional basket-weaving. It can take hundreds of branches to create just one piece.

Ray Gutteriez then takes a lighter to burn the plant, which encourages new growth

that produces the flexible, straight branches prized by weavers. The plant is adapted to fire. Its root stock remains intact after burning and will quickly resprout after spring rains.

"All of our basket material needs to be tended to in some way," says Gutteriez, an ecologist and member of the Wuksachi Band of Mono Indians. "So they need to be burned, and they're used to being burned. And then next year, we'll probably have sticks that are 6, 7 feet tall in one year."

The group also burns a large field, several acres across, which is choked with dead grass.

"When I was a kid, I learned from my mother," Goode says of when he first started doing cultural burning. "But my mother got in trouble when she burned because the fire department didn't want her doing what we're doing today."

History of suppression

Before 1800, several million acres burned every year in California due to both Indigenous burning and lightning-caused fires, far more than even the worst wildfire years today. Tribes used low-grade fires to shape the landscape, encouraging certain plants to grow both for tribal use and to attract game .

The arrival of Western settlers dramatically changed the fire regime.

"They came with their concepts of being afraid of fire," Goode says. "They didn't understand fire in the sense of the tool that it could be to create and what it did to help generate and rejuvenate the land. So they brought in suppression."

The U.S. Forest Service infamously had the "10 a.m. policy": to put out all forest fires by 10 a.m. the next day. Without regular fires to clear out underbrush, forests quickly became overgrown, creating the conditions for more extreme fires.

"A cultural burn is very spiritual," Keith Turner of the North Fork Mono says. "I used to fight fire for the Forest Service. And it was all about fighting fire."

Native American tribes were forcibly displaced, and their religious ceremonies were banned throughout the state by the early 1900s.

"There was actually a bounty on California Indian people," says Beth Rose Middleton Manning, professor of Native American studies at the University of California, Davis. "The governor had announced a war of extermination. So you have all that history, and it really fostered removal — settler ownership of Indigenous

lands."

Now, Goode and other tribal leaders have been reaching out to ecologists, researchers and fire agencies about the importance of Indigenous knowledge.

"I think it's really important that we don't think about traditional burning as: what information can we learn from native people and then exclude people and move on with non-natives managing the land," Middleton Manning says. "But that native people are at the forefront and leading."

Forming partnerships

With wildfires causing record-breaking destruction in the last few years, California has committed to reducing the vegetation on a half-million acres. The federal government has set a similar goal. But there's a long way to go to reach those numbers, and controlled burning can be challenging in landscapes with too much fuel.

"Fire is a very wicked problem when you have years of suppression, because the longer you don't have fire in the system, the harder it is to put it back in," says Jonathan Long, ecologist with the Forest Service's Pacific Southwest Research Station. "So what we're trying to do is get these footholds."

The hottest summer days in the Sierra Nevada in California greatly increase the risk that wildfires will ignite or spread, and as the planet keeps warming the risks will increase even more, scientists said Wednesday.

The research, which examined daily temperatures and data from nearly 450 Sierra Nevada fires from 2001 to 2020 and projected the analysis into the future, found that the number of fires could increase by about 20 percent or more by the 2040s, and that the total burned area could increase by about 25 percent or more.

The findings "show how short events like heat waves impact fires," said Aurora A. Gutierrez, a researcher at the University of California Irvine and the lead author of a paper describing the work in the journal *Science Advances*. "We were able to quantify that."

As for the projections over the next two decades, she said, "We are getting hotter days and that's why the risk of fires is increasing into the future."

In Northern California, the Karuk and Yurok tribes have partnered with the Forest Service to manage land for traditional values and wildfire management. Studies have shown that the two goals work hand in hand.

"By having these partnerships with the tribes, I think we can get that very frequent use of fire back in the system," Long says.

Jennifer Montgomery uses a drip torch, essentially a beefed-up lighter, to spread a line of fire at the corner of a field. As director of California's Forest Management Task Force, she knows the state is working against the clock to address its growing wildfire risk.

"It's an opportunity for me to see how effective cultural fire can be in addressing the issues we have around uncontrolled wildfire," Montgomery says. "The work that we did today, if a fire comes through there, it will drop down to the ground and frankly it may, given the right circumstances, just stop the fire entirely on its own."

Still, it's early days in developing these partnerships for many tribes, particularly after a long history of inequality created and reinforced by the government. Many California regional air regulators require burn permits over concerns about smoke and air pollution. Some counties offer special permits for tribes to facilitate their burns, but others don't.

Goode says he is hoping that bringing together a wide network of researchers, officials, students and tribes will help those conversations happen faster.

"I'm excited," he says, looking across the blackened field in the early evening light. "I'm elated. Because I'm looking around at what we've done. How beautiful the land is looking. And it is. It is."

[BUSINESS-LED SOLUTION: WILDFIRE]

Living With Fire: Private-sector Approaches to a Public Problem

As the threat of wildfire grows throughout the West, private firefighting companies deployed by insurance companies are stepping in.

Last November, celebrity Kim Kardashian sparked a national conversation by sharing that private firefighters had spared the \$60 million southern California home she shared with musician Kanye West from almost certain destruction by the Woolsey Fire. By the time firefighters — mostly the government-employed variety — contained the 97,000-acre fire more than a week later, it had claimed three lives, burned more than 1,600 structures, and damaged part of a nuclear reactor testing facility.

Bozeman-based Wildfire Defense Systems was one of the private firefighting resources on the Woolsey scene, its 40-plus engines charged with preventing

properties covered by its insurance-company clients from burning down.

The private firefighting model isn't new — Wildfire Defense Systems was founded in 2001 and started working with insurance companies in 2008 — but it has gained greater notice and scrutiny in the wake of the Woolsey Fire. Before the smoke had cleared, stories in *The Atlantic* and CBS questioned the fairness of the practice.

Char Miller, a professor of environmental analysis and history at Pomona College and author of *Public Lands, Public Debates: A Century of Controversy*, said he's watched the private firefighting trend develop in Malibu, California, with fascination and concern.

"It means that the elite with disposable cash can be better protected than those who depend on public agencies," he said.

Wildfire Defense Systems founder and CEO David Torgerson said he doesn't see it that way.

"Wildfire conditions are getting worse, building in the [Wildland]-Urban Interface is increasing, and resources at all levels are being strained. There is a role that the private sector can play" he said.

Last summer, Wildfire Defense Systems moved into a sprawling new two-story facility west of Bozeman with a view of the Bridger Mountains. On a recent June day, white wildfire engines emblazoned with blue "Insurance Resource" identifiers sat parked behind a locked gate, outfitted with water tanks, hoses, and structure protection materials like sprinkler systems and fire-blocking gels.

Inside, employees working on the predictive services end of the business monitored wildfires nationwide in a space that resembles a television newsroom. More than a dozen workstations face a screen that covers most of a wall. Employees track active fires and their potential to reach properties insured by their clients, and prepare a response if necessary.

When Torgerson first started this work, his firefighters would be out on assignments three months of the year.

"Now we're on task 12 months a year," Torgerson said. "Our operations never shut down."

He said Wildfire Defense Systems handles about 90 percent of the business in the U.S. insurance space, and is expanding into Europe with a recently opened office in Prague.

Wildfire Defense Systems dispatches as many as 250 firefighters (many of whom previously worked for municipal, state, or federal agencies) and 70 engines to wildfires in its 20-state coverage area during the peak of fire season. To date, Wildfire Defense Systems crews have responded to nearly 600 fires.

Torgerson's company isn't set up to provide the first resource on fires, he said — the company doesn't have that kind of geographic reach and staffing. And its objectives are different. Federal and state firefighters employed by agencies like the U.S. Forest Service and Bureau of Land Management are generally tasked with containing fires. Wildfire Defense Systems focuses on protecting client-insured structures in a fire's path.

"There isn't anything that replaces or supplants public sector services when wildfire happens," Torgerson said.

Even having worked in the insurance space for over a decade, Torgerson said, his employees still occasionally encounter friction with public firefighters.

"We're the new kids on the block, [even though] we operate in a similar organizational structure and operational structure as our government peers," he said.

Lucas Spelman, a battalion chief with the California Department of Forestry and Fire Suppression, better known as CAL FIRE, said he hasn't worked a large fire in California, where private resources are more commonly deployed than in Montana, that didn't include an insurance-related firefighting presence, and he expects their numbers to grow.

"The biggest thing for us is the accountability portion of it, and not knowing what their level of training is," Spelman said, adding that private firefighters sometimes fail to check in with public fire management teams. "Ultimately, we don't want anybody to get hurt, regardless of why they're there, [especially] given the type of fire weather behavior we've been having in the state the last five to 10 years."

A spokesman for multinational insurance giant Chubb, another Torgerson client, emailed MTFP stating that it has expanded its offerings to 18 states "to help minimize potential losses associated with wildfires" in the course of the company's decade-long partnership with Wildfire Defense Systems.

According to the National Wildfire Suppression Association, 40 percent of wildland fire suppression services nationwide are provided by private contractors, which have been active since the early 1980s due in part to policies enacted by former president Ronald Reagan, and furthered by Bill Clinton, that replaced segments of the federal

workforce with private industry. Taxpayers don't foot the bill for Wildfire Defense Systems dispatches; insurance companies do.

Like Torgerson, Windswept Wildfire owner Chris Schiefelbein has been busy. Half of his Montana City-based business resembles Wildfire Defense Systems' origins, contracting with the U.S. Forest Service and deploying engines and firefighters nationwide to work alongside public resources in traditional fire suppression.

Schiefelbein estimates Windswept Wildfire has responded to more than 500 fires since its founding 15 years ago. Eleven years ago he expanded the business to include vegetation reduction on landscapes vulnerable to wildfire, typically long before they're actively threatened. He works with private property owners and public entities on projects that cost between \$300 and \$6,000 per treated acre, depending on topography and vegetation type and density.

Business has been so good that he's adding eight to 10 additional employees to his 20-person crew. He said he's worked on about 500 fuel reduction projects, including a decade-long undertaking to cut a fuel break around the city of Helena and remove beetle-killed pine trees from the 900-acre Mount Helena City Park. Like the vast majority of Schiefelbein's projects, it's grant-supported, receiving funding from the Natural Resources Conservation Service.

Schiefelbein said he's surprised more people don't invest in such projects, given the trajectory of wildfire and development in the Wildland-Urban Interface.

"People, in general, are more reactive than proactive," he said, adding that cost and some landowners' preference for treed landscapes can play a role as well.

There does appear to be a need, though. According to data analytics and risk assessment firm Versik, 28 percent of Montana households are at high or extreme risk from wildfires, making Montana the national leader by that metric.

That could also mean that Wildfire Defense Systems and other companies will expand their footprints on Montana wildfires in the coming decades. While neither the National Interagency Fire Center nor the National Association of Insurance Commissioners tracks the number of private firefighting companies working with insurance companies, sources interviewed for this story agree it's a growing trend.

"Dave Torgerson kind of broke the mold doing the insurance program stuff, and I can see where that's going to be a real big thing in the future," Schiefelbein said. "There just [aren't] enough resources and capability for the government to protect all these homes."

Appendix E: List of Measures

Pre-test Covariates

Climate Fatalism (*from Life in Transition project (LITS-II, 2010), a joint project of the World Bank and European Bank for Reconstruction and Development*)

Please rate your agreement or disagreement with the following statement (1 – Strongly Agree to 5 – Strongly Disagree):

Climate change is an unstoppable process; we cannot do anything about it.

Belief in Anthropogenic Climate Change (*Kohl & Stenhouse, 2021; values not shown to participants*)

Do you believe climate change is caused by:

- (1) Entirely by Natural Processes
- (2) Mostly by Natural Processes
- (3) About Equally by Natural Processes and Human Activities
- (4) Mostly by Human Activities
- (5) Entirely by Human Activities
- (0) I Don't Believe the Climate is Changing.

Climate Conspiracy Beliefs (*adapted from van Prooijen et al., 2015*)

How likely or unlikely would you rate the following? (1 – Certainly Not to 7 – Certainly)

-Do you believe politicians have a vested interest in changing the facts about climate change?

-Do you believe scientists are pressured to portray climate change differently than is actually the case?

-Do you believe that research results about climate change are frequently fraudulent?

-Do you believe that climate change researchers have a vested interest in creating panic about climate change?

Mediating Variables

Affective reactions (*adapted from Jin et al., 2016; Jin et al., 2020*)

While reading the article how much, if at all, did you experience the following emotions?

(1 - Not at All to 7 - Extremely)

- Angry, irritated, annoyed
- Sad, downhearted, unhappy
- Scared, fearful, afraid
- Sympathy, concern, compassion
- Surprised, amazed, astonished
- Nervous, anxious, worried
- Uneasy, apprehensive, restless
- Confused, perplexed, bewildered
- Optimistic, encouraged, hopeful
- Loving, sentimental, warm-hearted

Perceived threat (adapted from Witte et al., 1996 - Risk Diagnosis Behavior Scale)

Please rate your level of agreement with the following statements.

(1 - Strongly Disagree to 5 - Strongly Agree)

Severity of threat

- I believe that the threat of climate change is severe.
- I believe that the threat of climate change is serious.
- I believe that the threat of climate change is significant.

Susceptibility to threat

- I am at risk of being affected by the threat of climate change.
- It is likely that I will be affected by the threat of climate change.
- It is possible that I will be affected by the threat of climate change.

Individual response efficacy (adapted from Kohl & Stenhouse, 2021; items 1, 2 and 3 reverse coded).

On a scale ranging from 1 to 7 where 1 means strongly disagree and 7 means strongly agree, how much do agree or disagree with the following statements:

- The actions I can take are too small to help solve problems caused by climate change
- Problems caused by climate change are out of my control
- Personal actions I do to address climate change won't make a difference to the problem of climate change."

Collective efficacy (Halpern et al., 2017)

On a scale ranging from 1 to 5 where 1 means strongly disagree and 5 means strongly agree, how much do agree or disagree with the following statements:

- The collective action of people has a huge influence on public affairs
- The collective action of people can improve society
- Politicians would respond to the needs of citizens if enough people demand change
- Organized groups of citizens can have enough impact on the political policies of this country
- If enough citizens got organized and demanded change, politicians would take steps to end their problems.

Collective response efficacy (*Kohl & Stenhouse, 2021, items 2 and 3 are reverse-coded.*)

On a scale ranging from 1 to 7 where 1 means strongly disagree and 7 means strongly agree, how much do agree or disagree with the following statements:

- There is a decent chance that humanity will be able to prevent the worst effects of climate change.
- Climate change is an unstoppable process; we can't do anything about it.
- Climate change is such a complex problem; we will never be able to solve it.
- If everyone works together, we can solve problems caused by climate change.

Governmental response efficacy (adapted from Meijers et al., 2022)

Please rate your level of agreement or disagreement with the following statements on a scale of 1 (strongly disagree) to 7 (strongly agree).

- The government could effectively protect the climate by introducing stricter laws.
- The climate can be protected by raising taxes.
- If government officials were to pass laws to reduce the usage of fossil fuels, it would help protect the climate.
- If the government increased subsidies for energy savings, it would be effective in reducing emissions.
- Stricter laws for energy conservation would effectively contribute to saving energy.
- Stricter legislation would be effective for climate protection.
- If the government increased taxes for using fossil fuels, it would promote clean energy.

Media trust (adapted from Kohring & Matthes, 2007)

Please rate your level of agreement with the following statements about the story you read/about the topic of [climate problem] using the below scale:
(7-point Likert scale from 1 - “Strongly Disagree” to 7 – “Strongly Agree” (plus an “I don’t know” option)).

(Selectivity of topic)

- The topic of described in the story is assigned an adequate status.
- The frequency with which [this topic] is covered is adequate.
- The topic of described in the story is covered on the necessary regular basis.

(Selectivity of facts)

- The essential points are included.
- The focus is on important facts.
- All important information regarding the topic described in the story is provided.
- All important information regarding the topic described in the story is provided.

(Accuracy of depictions)

- The information in the report would be verifiable if examined.
- The reported information is true.
- The report recounts the facts truthfully.
- The facts that I received regarding the topic described in the story are correct.

(Journalistic assessment)

- Criticism is expressed in an adequate manner.
- The journalist’s opinions are well-founded.
- The commentary regarding the topic described in the story consists of well-reflected conclusions.
- I feel that journalistic assessments regarding the topic of described in the story are useful.

Dependent Variables

Public sphere policy support (adapted from Meijers et al., 2022)

Please rate your level of agreement or disagreement with the following statements on a scale of 1 (strongly disagree) to 7 (strongly agree).

- I support policies aimed at improving climate change mitigation, adaptation, and resilience by industry.
- I am willing to support the government’s decisions in controlling the amount of energy that should be saved by organizations.

- I am willing to support the government in limiting the amount of climate change-inducing gases emitted by companies.
- I support the government controlling and regulating the way industry uses climate change-inducing gases.
- I would support policies that compel manufacturers to protect the climate.
- I support the government in providing funding for research related to climate change.
- I am willing to support a law that requires companies to reduce greenhouse gas emissions.
- I am willing to support the government in taking measures that would force organizations to reduce greenhouse gas emissions.

Susceptibility to Misinformation (*adapted from Biddlestone & van der Linden, 2021 and Roozenbeck et al., 2020*)

Please indicate whether the below headlines are True or False:

- Scientists disagree on the cause of climate change. (F)
- Scientists believe the Sun has impacted Earth's rise in temperature. (F)
- Carbon dioxide levels are tiny. They can't make a difference. (F)
- Melting an ice cube in a measuring cup full of water doesn't raise the water level, so melting icebergs cannot raise sea levels. (F)
- More than one million species are at risk of extinction by climate change (T)
- Earth had its second warmest year in recorded history in 2019 (T)
- The worst impacts of climate change could be irreversible by 2030 (T)
- Switching to jet fuel made from mustard plants would reduce carbon emissions by nearly 70% (F)
- Enough ice melted on a single day to cover Florida in two inches of water (T)

Manipulation Checks

Please select the phrase below that most accurately describes the topic of the story you read.

- Food waste
- Wildfires
- Telescopes
- A topic not mentioned here

Some articles suggest solutions to problems. Which of the following describes the presence or absence of a solution in the article you read?

- No solution
- A solution

Attention Check

Please select “somewhat agree” as your answer.

- Strongly Disagree
- Agree
- Disagree
- Somewhat Agree
- Neither Agree or Disagree
- Strongly Agree
- Somewhat Disagree

Demographic Variables

Finally, we would like to ask you a few questions about yourself.

What is your age in years?
Please enter a whole number.

What sex were you assigned at birth? (For example, on your birth certificate)

- Female
- Male
- Intersex
- No answer

What is your gender?
Please select one.

- Female
- Male
- Other
- Prefer Not to Answer

What is your racial/ethnic background?

- African American
- Asian or Pacific Islander
- Latinx or Hispanic
- Multi-ethnic/racial
- Native American/American Indian

- White/Caucasian
- Prefer Not to Answer

How would you describe your political party affiliation?

- Republican
- Democrat
- Independent
- Other

Ideological worldview (*Pew Research Center's ideological consistency scale*)

Which of the following two statements comes closer to your own views?
(Statement 1, Statement 2, Both, Neither, Don't Know, Refuse to Answer)

-Government is almost always wasteful and inefficient OR Government often does a better job than people give it credit for

-Government regulation of business usually does more harm than good OR Government regulation of business is necessary to protect the public interest.

-Poor people today have it easy because they can get government benefits without doing anything in return OR Poor people have hard lives because government benefits don't go far enough to help them live decently.

-The government today can't do much more to help the needy OR The government should do more to help needy Americans even if it means going deeper into debt.

- Blacks who can't get ahead in this country are mostly responsible for their own condition OR Racial discrimination is the main reason black people can't get ahead these days.

- Immigrants today are a burden on our country because they our jobs, housing and health care OR Immigrants today strengthen our country because of their hard work and talents

- The best way to ensure peace is through military strength OR Good diplomacy is the best way to ensure peace

- Most corporations make a fair and reasonable amount of profit OR Business corporations make too much profit

- Stricter environmental laws and regulations cost too many jobs and hurt the economy OR Stricter environmental laws and regulations are worth the cost

- Homosexuality should be discouraged by society OR Homosexuality should be accepted by society

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