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Abstract

Climate communication research has largely treated disaster coverage as event-specific and temporally bounded, obscuring how institutional ideology and hazard characteristics jointly shape the interpretive frameworks audiences use to understand climate risk. This thesis reconceptualizes climate disaster coverage as a temporally dynamic and hazard-contingent process in which news organizations' institutional alignment with distinct elite sourcing networks produces systematically different interpretations of the same physical events. Drawing on an integrated framework of framing and indexing theory, the study examined how elite newspapers construct divergent interpretations of climate-related extreme weather.

The analysis is based on a corpus of 10,069 hard-news articles published in *The New York Times* and *The Wall Street Journal* between 2000 and 2024, covering six hazard types: hurricanes, droughts, floods, wildfires, tropical storms, and heatwaves. A stratified sample of 604 articles was manually coded to establish intercoder reliability and to train a RoBERTa-based supervised classifier, which was then applied to the full dataset. Binary logistic regression models assessed outlet-level differences, hazard-specific variation, and temporal trends across five framing dimensions: causal attribution, responsibility attribution, political conflict, impact framing, and scientific uncertainty.

The findings reveal systematic and widening divergence between the two newspapers, indicating that elite journalism does not converge toward shared climate narratives even as scientific consensus strengthens. *The New York Times* is significantly more likely to attribute extreme weather to anthropogenic climate change, assign responsibility to institutional actors, and emphasize social and health consequences, whereas *The Wall Street Journal* more frequently relies on natural variability explanations and naturalized responsibility frames. Contrary to

expectations, political conflict framing is more prevalent in *The New York Times*, suggesting that in hard-news disaster reporting, political conflict reflects governance accountability debates rather than partisan ideological positioning, a distinction that simple left-right media comparisons obscure. Hazard type further moderates these patterns, with slow-onset disasters being more strongly linked to climate causation and rapid-onset disasters generating greater emphasis on immediate impacts. Anthropogenic attribution increases across both outlets over time, with a marked acceleration after the mid-2010s, while the gap between the two newspapers expands considerably, indicating deepening ideological differentiation rather than convergence.

This study makes three contributions to communication and journalism research. Theoretically, it shows that framing and indexing theory work best as complementary rather than competing frameworks. Institutional orientation shapes which causal explanations are routinely available, while elite sourcing influences which explanations gain legitimacy. Together, these forces operate multiplicatively across outlet, hazard type, and historical period. Methodologically, the study applies and validates a supervised classification pipeline combining manual annotation with RoBERTa-based modeling across 10,069 articles, demonstrating both the potential and limits of scaling theoretically grounded framing constructs computationally. Empirically, the findings show that elite journalism does not simply communicate scientific understandings of climate change and extreme weather. Instead, the two newspapers present competing interpretations of causes, responsibility, and consequences. These differences widened after the mid-2010s as attribution science advanced and political polarization around climate change intensified.

***Keywords*:** Climate change communication; media framing; indexing theory; extreme weather; disaster journalism; computational content analysis

Chapter I: Introduction

The consequences of climate change are becoming more pronounced every year as extreme weather patterns become more severe (Clarke et al., 2022). The United States is not an exception and remains one of the most vulnerable countries (Ahmadiani & Ferreira, 2021), where disasters claim lives, devastate assets, and leave deep social and economic footprints. With 27 weather and climate disasters in 2024, the National Centers for Environmental Information (NCEI) reported $182.7 billion in damage and at least 568 direct or indirect deaths, the highest number since 1980 (Smith, 2025). Along with the financial cost, extreme weather events also affect the population and healthcare provision in a substantial way (Romanello & Costello, 2024). About two-thirds of climate attribution studies between 2004 and 2018 show that climate change has contributed either to the probability or the intensity of extreme weather events (Schiermeier, 2018). In the U.S., temperatures have increased by 1.2°C (34.16°F) since 1960, causing colossal changes with widespread societal and environmental disruption (Clarke et al., 2022). According to the Fourth National Climate Assessment, average annual temperatures across the U.S. are projected to increase by approximately 2.5°F (1.4°C) between 2021 and 2050, compared with the time period between 1976 and 2005. This change will contribute to more frequent and severe extreme weather events such as hurricanes, heatwaves, and wildfires (Radeloff et al., 2018; Vose et al., 2017). These physical changes place growing pressure on communication systems, particularly journalism, which have to translate rapidly advancing scientific understanding into meaningful public knowledge.

Although the scientific consensus is that human actions are the main cause of these increasing catastrophes (Cook et al., 2016; Lynas et al., 2021), public perceptions remain divided and partisan. The science of Extreme Event Attribution (EEA) has transformed our ability to

connect individual disasters to climate change. EEA estimates the amount of anthropogenic warming that contributes to a particular disaster within several days after it takes place (Otto, 2023). Nevertheless, this scientific clarity has not been transferred to the realization among the public that there is a relationship between climate change and disasters. In a 2025 survey, nearly 60% of Americans indicated they believe that climate change is man-made, and nearly 46% said they believe that climate change will personally affect them (Leiserowitz et al., 2025), although many Americans have already experienced climate-related droughts, heatwaves, floods, wildfires, and increased occurrence of hurricanes (USGCRP, 2017). The fact that those percentages, reflecting belief in anthropogenic causation and perceived personal impact, are not higher, seems to signal a communication gap between scientific consensus and public understanding rather than a scientific evidence gap. To understand this gap, we first need to examine the interpretive mechanisms that mediate climate effects and are in most cases contested in news.

For some scholars, journalism is the main mediator of the relationship between climate science and common popular knowledge, actively contributing to the ways in which the population views, interprets and reacts to weather-related disasters (Boykoff, 2007; Moser, 2016). In situations when extreme weather is on the news agenda, journalists have critical choices to make regarding which of the two approaches to use in framing extreme weather as a natural event or a phenomenon connected with climate change. This shapes long-term public risk perception and policy support (Feldman & Hart, 2017). Elite newspapers, particularly *The New York Times* (hereafter *NYT*) and *The Wall Street Journal* (hereafter *WSJ*), are examples of agenda-setting institutions that shape how publics, policymakers, and other media outlets understand climate threats (Bolstad & Victor, 2024; Wang et al., 2024). The media structure how

climate risk enters public consciousness. Various journalism decisions combine to create common meanings by which Americans can make sense of climate crises: for example, how journalists frame disasters within broader climate narratives, which voices they give more importance to, what metaphors they employ, and how they weigh scientific certainty and uncertainty. These decisions in media are at the center of making or breaking the public's sense of whether climate-induced disasters are seen as systematic failures, politics, and even scientific discussions or inevitable natural occurrences.

There is a tendency of studies on climate journalism to concentrate on one type of disaster or a brief time period and consequently lack in-depth information about how media representations of different climate hazards vary over time (Hopke, 2019; Osaka et al., 2020). Journalistic norms, framing patterns, sourcing, and attention cycles are generally applied independently in research, lacking an integrative theoretical framework that can describe how all these components contribute to the formation of collective climate meanings (Boykoff & Boykoff, 2004; Feldman et al., 2015; Schmidt et al., 2013). Moreover, comparative studies of various ideological media sources are limited (Stecula & Merkley, 2019). This makes it hard for the audience to see clearly how ideological journalistic standards influence the coverage of climate disasters across hazards and over time. Therefore, it is necessary to have a longitudinal, cross-hazard, ideologically comparative study that would reflect the nature of climate disaster construction in the U.S. media.

That is the overarching goal of this study. More specifically, this thesis explores the coverage of six major sources of climate-driven disasters (heatwaves, droughts, wildfires, hurricanes, tropical storms, and floods) by the *NYT* and the *WSJ* over the last 25 years (2000–2024). This study focuses on five core framing dimensions widely documented in climate

communication research: (1) causal attribution, which explains how journalists interpret the causes of extreme events (Iyengar, 1991; Semetko & Valkenburg, 2000); (2) responsibility attribution, which identifies who or what is held accountable for climate impacts or policy failures (Iyengar, 1991; Olausson, 2009); (3) political conflict, focusing on partisan disagreement and ideological struggle (Bolsen & Shapiro, 2017; Merkley & Stecula, 2020); (4) impact framing, which emphasizes the environmental, economic, social, and health consequences of disasters (Feldman et al., 2015; Rebich-Hespanha et al., 2014); and (5) scientific uncertainty, which highlights doubt, disagreement, or ambiguity surrounding climate science (Boykoff & Boykoff, 2004; Painter, 2013).

While these individual dimensions have been studied separately in prior research, this study makes three novel contributions: (1) the systematic integration of all five dimensions in a single analytical model to explore the interaction and reinforcing effects of these dimensions; (2) it applies this integrated framework comparatively across six hazard types over 25 years, revealing how framing patterns vary by disaster characteristics and evolve over time; and (3) it compares two ideologically divergent elite newspapers (the *NYT* and the *WSJ*) across all five dimensions simultaneously, investigating how institutional orientation shapes the interpretive architecture of climate disaster coverage.

These five dimensions capture several key ways in which journalists interpret disasters in news coverage. Causal and responsibility attribution indicate how articles explain why disasters occur and who is held accountable. Impact framing highlights the consequences of disasters and signals their scale and urgency. It also helps audiences understand the severity and relevance of disasters (Feldman et al., 2015; Rebich-Hespanha et al., 2014). Political conflict framing shows

whether disasters are discussed within broader partisan or policy debates, while uncertainty framing reflects how journalists describe the limits or disagreements within climate science.

Scientific uncertainty framing, in contrast, reflects how news coverage addresses disagreement, limitations, or caution within climate research, which can influence public trust in climate knowledge and policy discussions (Boykoff & Boykoff, 2004; Painter, 2013).Overall, these dimensions provide a framework for comparing how elite newspapers interpret climate disasters across different hazard types, time periods, and institutional contexts.

From a theoretical perspective, this study contributes to research on climate journalism by applying a comparative framing approach to examine how attribution, responsibility, impact emphasis, scientific uncertainty, and political conflict appear in disaster reporting in elite U.S. newspapers. This approach helps clarify how journalists explain the causes and consequences of disasters, and assign responsibility in the context of climate change.

Methodologically, the study extends existing climate framing research by using computational text analysis on a large corpus of news articles spanning 25 years and multiple disaster types. This approach makes it possible to examine patterns of framing across a much larger body of news coverage than traditional manual coding alone would allow. By combining computational analysis with theoretically grounded framing categories, the study provides a systematic way to examine how climate disaster narratives vary across outlets, hazards, and time.

Combined, the findings highlight the role of journalism as an intermediary between scientific knowledge and public understanding. News organizations translate complex scientific information about climate change into narratives that help audiences interpret extreme weather events and their broader implications.

This thesis is organized into six chapters. Chapter II reviews the theoretical foundations of the study, focusing on framing and indexing theory and their relevance to climate communication. It also discusses how impact framing and scientific uncertainty appear in climate journalism, drawing on prior research on consequence framing and representations of scientific knowledge in news discourse. Chapter III presents the research questions and hypotheses guiding the analysis. Chapter IV explains the research design, including corpus construction, disaster classification, dictionary development, and frame measurement. Chapter V reports the empirical findings, organized around comparisons across disaster types, historical periods and news outlets. Chapter VI discusses the theoretical and practical implications of the findings, outlines the study's limitations, and identifies directions for future research.

Chapter II: Literature Review

Scholarship of climate communication and environmental journalism has witnessed an exponential growth over the past 30 years (Schäfer & Painter, 2020; Schäfer & Schlichting, 2014; Wetts et al., 2025). Over a similar time span, climate journalism has undergone significant transformation, especially in how news organizations interpret and report on climate-driven disasters. Journalists are grappling with how to translate complex climate science into accessible narratives while navigating the institutional routines, editorial norms, and organizational pressures that shape news production (Boykoff, 2011; Schäfer & Painter, 2020). Media choices determine how publics perceive the dangers of climate disasters, how they view the root cause of the disasters, and whether they believe that disasters are single isolated events or indicators of systematic climate change (Feldman & Hart, 2017; Merkley & Stecula, 2020).

Digital and social media have complicated climate journalism. These media platforms allow for the real-time distribution of dramatic images, testimonies of victims, and on-the-ground video footage (Houston et al., 2012). Further, sensationalized and volatile framing prevalent on digital media tend to be short-lived. Indeed, media coverage of disasters shows a sharp increase, over 60% of reporting occurs within the first month, and a sharp decrease soon, despite their long-term consequences (Houston et al., 2012; Schmidt et al., 2013). Further, this volatile framing hinders the opportunity for learning about climate policies.

Early climate journalism studies primarily investigated the formulation of journalistic norms: objectivity, balance, newsworthiness, and scientific evidence (Boykoff, 2011; Schäfer & Painter, 2020). Some earlier studies have created false balance between scientific consensus and fringe skepticism (Boykoff & Boykoff, 2004), and media reporting of weather disasters has frequently prioritized spectacles over systemic causes (Fisher, 2016; Houston et al., 2012).

More recent research reports how the patterns of media coverage are becoming more politically polarized and show institutionalized disparities (Essien, 2025; Feldman et al., 2015; Schertzer & Woods, 2025). In fact, climate communication in the U.S. has been polarized following partisan lines, with Republicans and Democrats relying on divisive media diets that anchor climate change within incompatible moral and political frameworks (Feldman et al., 2015; Nisbet, 2009). Further, media coverage frequently prioritizes immediacy and dramatization over long-term structural or scientific approaches (Matejova, 2023; Pellegrini et al., 2021). This polarization not only influences audiences' general climate attitudes but also media framing of climate change issues (Feldman et al., 2015; Merkley & Stecula, 2020).

A consistent finding in disaster journalism is the prioritization of spectacles (damage, sensationalism, human drama) over structural or scientific explanations (Pellegrini et al., 2021; Matejova, 2023). This pattern aligns with Iyengar's (1991) distinction between episodic and thematic framing. Episodic framing encourages audiences to attribute responsibility of climate crisis to individuals rather than institutions or policy structures (Fisher, 2016; Houston et al., 2012). An outcome of episodic framing is a lack of civic participation. For example, media coverage of Hurricane Katrina created some of the most provocative images of affliction, neglecting structural vulnerabilities in terms of race, poverty, and infrastructures (Fisher, 2016). The same tendency is observed in media coverage of wildfires: reporters emphasize the devastation, heroism, and community victimization more frequently than the underlying causes such as land-management issues, climate policy limitations, or resource inequality (Hopke, 2019). These tendencies shape public understanding of climate risks by focusing more on short-term consequences and neglecting long-term causality and responsibility frames.

In explaining the effects of media coverage on public understanding of climate crisis, researchers have relied mainly on the frameworks of framing, indexing and agenda-setting, which can shed light on how disasters become socially constructed news events (Bennett, 1990; Bolstad & Victor, 2024; Carvalho, 2007; Entman, 1993; Hase et al., 2021; Kirchner et al., 2024; McCombs & Shaw, 1972; Schäfer & Painter, 2020; Schertzer & Woods, 2025). These frameworks guide the conceptual foundation of this thesis. Framing theory can explain how journalists define problems, identify causes, responsibility, consequences, and uncertainty. Indexing theory clarifies how elite disagreement or elite consensus shapes the range of perspectives deemed newsworthy, especially on climate attribution or policy discussions (Bennett et al., 2008; Boykoff & Boykoff, 2004). Cumulatively, these theories form the basis of analyzing causal attribution, responsibility attribution, political conflict, impact framing, and scientific uncertainty as key interpretive dimensions in climate-disaster coverage.

These five dimensions are not completely independent of one another but rather exist as a system in a greater interpretive ecosystem. The combination of causal and responsibility attributions shapes how audiences understand what causes climate crises and who is responsible for mitigating damages. Political conflict frames can determine whether disasters are viewed as failures of governance or partisan battlegrounds. Impact framing can shape the public understanding of severity and scale of climate risks. Scientific uncertainty may influence perceptions of credibility, trust, and perceived legitimacy of climate science. These interrelated dimensions enable researchers to not only trace what climate disasters are said to be, but also how they are understood in public discourse.

Therefore, this chapter is a synthesis of the most significant theoretical traditions and empirical results that may shape five vital variables of this thesis. The following parts provide a

review of how each of the theories has been used in prior research, particularly in the context of U.S. climate-disaster coverage. This integrated review establishes a theoretical grounding for the research questions and hypotheses in Chapter III and provides the basis for the operationalization strategy detailed in Chapter IV.

Framing Theory

Framing in climate disaster reporting does not just define the viewpoints of what a crisis should focus on, but also how causality, responsibility, urgency, and political meaning is attributed to it. Thus, framing becomes the key to comprehending news representations of extreme weather events (Merkley & Stecula, 2020; Schäfer & Painter, 2020). Framing theory is a popular concept of climate journalism research that has been providing one of the most efficient tools in the understanding of media actions (Entman, 1993; Scheufele & Tewksbury, 2006). Framing is defined as selecting certain components of a reality, making them more salient, and helping define a problem, providing a causal treatment, evaluating it as moral or not, and/or prescribing a course of required actions (Entman, 1993). When it comes to extreme events caused by climate changes, frames can help perceive a disaster either as a natural exception or anomaly, a policy failure, an economic threat, or a climate crisis (Bolsen & Shapiro, 2017; Boykoff, 2011).

Since climate change involves economic structures, regulatory politics, fossil fuel accountability, and national risk management (Hulme, 2009; Nisbet, 2009), climate disaster discourse has become a politicized fight over the meaning of climate crisis (Bolsen & Shapiro, 2017; Merkley & Stecula, 2020; Schäfer & Painter, 2020). Legacy media outlets such as the *NYT* and the *WSJ* serve as institutional arenas where competing political and economic actors contest causal responsibility, policy legitimacy, and public urgency (Bennett, 1990; Bolstad & Victor,

2024; Wang et al., 2024). This indicates framing is not merely a representational tool but also an arena of ideological negotiation.

Frames determine the parameters of public discourse and assist in identifying problems, responsible actors, and solutions to the problem. Entman (1993) specifies four framing dimensions: define the problem, interpret the cause, moral evaluation, and treatment recommendation, which scholars adjust in climate communication to understand how disasters are framed using various interpretive mechanisms (de Vreese, 2005; Matthes, 2009).

The five central dimensions of framing operationalized in this thesis reflect the most consequential interpretive options that journalists may make when reporting on climate disasters: (1) causal attribution – assigning events to climate change, natural variability, or no causal option (Iyengar, 1991; Semetko & Valkenburg, 2000); (2) responsibility attribution – attributing responsibility to governments, corporations, systems, or naturalizing impacts as unavoidable (Iyengar, 1991; Olausson, 2009); (3) political conflict – embedding, disasters in partisan disagreement and ideological contestation (Bolsen & Shapiro, 2017; Merkley & Stecula, 2020); (4) impact framing – emphasizing, environmental, economic, social, or health consequences to construct severity and urgency (Feldman et al., 2015; Rebich-Hespanha et al., 2014); and (5) scientific uncertainty – foregrounding, doubt, methodological limitations, or contested evidence to shape epistemic authority (Boykoff & Boykoff, 2004; Painter, 2013). These dimensions are combined to represent the interpretation of climate disasters as a problem (causal + responsibility attribution), the construction of the problem as a disaster (impact framing), the background of political conflict (conflict framing), and the negotiation of the problem by forming claims about scientific knowledge (uncertainty framing).

In addition to content selection, framing also functions as a gatekeeping mechanism that determines whose voices, knowledge systems, and interests are elevated or minimized in disaster narratives (Carragee & Roefs, 2004; Entman, 2007). Thus, climate disaster frames can be viewed as an instrument of ideological power which has been used not only to influence interpretation, but also policy legitimacy and morality (Beck, 1992; Nisbet, 2009). Beck's (1992) concept of the risk society provides a useful structural complement to framing theory in this context. Beck argues that modern environmental hazards are not simply natural events but are shaped by industrial decisions, regulatory systems, and political structures, and that their consequences are distributed unevenly across populations. Applied to climate disaster journalism, this perspective highlights the importance of how news coverage represents the distribution of disaster impacts, particularly in terms of vulnerability, displacement, and inequality. In this sense, framing differences between news organizations may emerge not only in how disasters are explained, but also in how their consequences are socially located. This perspective aligns with Kasperson et al.'s (1988) social amplification of risk framework, which emphasizes how institutional channels shape public perceptions of risk and vulnerability. Together, these approaches suggest that impact framing, especially its social dimension, may be particularly relevant for understanding how institutional orientations influence the representation of climate disasters. Further, journalists resort to cultural symbols and metaphors that render complex issues understandable to audiences (Gamson & Modigliani, 1989). This symbolism approach affects the working of climate journalism, which often solidifies some interpretative patterns while dismissing others.

Framing effects are reinforced in indexing norms, where the media depend on authoritative political and institutional voices to frame climate discourse (Bennett, 1990; Boykoff & Boykoff, 2004). Indexing approaches support the dynamics of elite-led narrative control, in

which disputed climate explanations are refracted by institutional authorities instead of empirical consensus. This may contribute to increasing the influence of politics over scientific reasoning (Bennett, 1990; Brüggemann & Engesser, 2017).

Conservatives tend to frame climate action in economic-cost terms, whereas liberals often put it in moral and crisis terms (Nisbet, 2009). This polarization extends to disaster coverage, in which conservative outlets are less inclined to blame extreme weather for climate crisis, and left-leaning outlets highlight anthropogenic causation and urgent policy actions (Bolsen & Shapiro, 2017; Merkley & Stecula, 2020). Such an ideological polarization generates consistent partisan framing patterns, in which climate disasters are framed as natural disruptions, failure of government, threats to the economy, or climate emergency depending on the outlet's political affiliation (Essien, 2025; Merkley & Stecula, 2020; Nisbet, 2009).

Impact framing refers to the emphasis on environmental, economic, social, and health consequences, which can shape the public's risk perceptions (Rebich-Hespanha et al., 2014). When journalists foreground disaster impacts without linking them to systemic causes or policy solutions, they inadvertently construct severity while obscuring accountability. This reminds of second-level agenda setting where the media influence not only issue salience but also attribute salience (which particular features of climate disasters the media pay attention to and consider significant) (Ghanem, 1997; McCombs, 2005). Frames emphasizing threat without efficacy (actionable solutions) lower public policy support, whereas frames that combine risk with responsibility and solutions strengthen climate accountability (Feldman & Hart, 2017; Hart & Feldman, 2016). Impact framing, therefore, functions as a two-sided process: it may heighten a sense of urgency and trigger concerns (Feldman et al., 2015), or it may create a fatalistic effect

by rendering the consequences of an action to look insurmountable and overwhelming (Feldman & Hart, 2017; Smith & Joffe, 2012; Smith & Leiserowitz, 2013).

In general, U.S. media are more focused on short-term effects instead of long-term impacts (Houston et al., 2012). Even though episodic and thematic frames are not tested in this thesis, the literature has shown the importance of disaster temporality, attribution, and systemic context, which are critical in comparing long-term coverage across hazards and outlets (Fisher, 2016; Hopke, 2019; Houston et al., 2012; Iyengar, 1991). Reporting disasters in episodic manners, journalists emphasize individual pain instead of structural factors (Houston et al., 2012). Episodic frames emphasize individual anecdotes and dissuade systemic solutions (Iyengar, 1991). Fisher (2016) noticed this trend during Hurricane Katrina, where media visuals that centered on human suffering failed to attend to structural reforms. In a similar vein, Hopke (2019) found that wildfire coverage was spectacle-oriented at the expense of root cause drivers, including land management and climate change. Episodic framing may reinforce individual blame over institutional accountability, narrowing the discursive space for preventive policy intervention (Fisher, 2016; Houston et al., 2012; Iyengar, 1991).

The dominance of episodic framing is further confirmed by computational framing studies that report disaster coverage strategically prioritizes urgency, damage, and spectacles of climate disasters over root causes, accountability, and preventive action (Otto, 2023; Schäfer & Painter, 2020). This underscores the need for a longitudinal, outlet-comparative framing analysis (Merkley & Stecula, 2020; Schäfer & Painter, 2020). This thesis treats framing as measurable ideological signals: operationalizing frame strength, prominence, and specificity to assess how two elite U.S. newspapers frame climate disasters by hazard types and time periods. Specifically,

to the thesis focuses on causal attribution, responsibility attribution, political conflict, impact framing, and scientific uncertainty.

Indexing Theory

Indexing theory provides a structural explanation of how journalistic practices are shaped by power relations among political elites. The theory, as first proposed by Bennett (1990) and subsequently developed by Bennett et al. (2008), states that news content tends to "index" or align with the spectrum of debate among political elites. When elites agree, journalists recreate the agreement as an objective reality and leave out other differing views. Disagreement among elites causes news outlets to expand the spectrum of viewpoints. This dynamic puts the governmental, corporate and institutional actors in a position of authority where they can control the discourse at the expense of the voices of scientists, activists and affected communities who react to political debates rather than set the agenda themselves (Bennett et al., 2008; Hallin, 1986).

In climate journalism, indexing manifests through sourcing practices, which favor political and institutional subjects over scientists or community members, and amplify narratives of political conflict while minimizing scientific consensus (Boykoff & Boykoff, 2004; Schäfer & Painter, 2020). The outcome is an epistemic structure in which climate knowledge is concentrated on political and economic elites, controlling the knowledge and perception of the masses and alternative accounts of environmental hazards.

A large body of research shows how elite-centered sourcing patterns produce systematic representational inequalities. Governmental, political, and business authorities dominate coverage of climate issues, while scientific experts and everyday citizens are underrepresented (Olausson, 2009; Wetts, 2020). One consequence of this practice is the emergence of false

balance, in which journalistic adherence to objectivity norms leads to disproportionate attention to climate skeptics despite the broad scientific consensus on climate change (Boykoff & Boykoff, 2004). By presenting skeptical voices alongside mainstream scientific findings as if they carried equal weight, news coverage can create the impression that climate science remains deeply contested. This imbalance can obscure the strength of scientific agreement, reduce explicit climate attribution in reporting, and encourage audiences to interpret extreme weather events as unrelated to climate change. Such a false balance has formed a sort of illusion of scientific uncertainty, suppressed explicit climate attribution, and shaped public perceptions of extreme events as not linked to climate change. Scholars have shown that this pattern is not an accidental professional error but an indexing effect: as political elites become split on the issue of climate policy, journalists tend to reflect that division by giving skeptical voices the space to exist within the bounds of a legitimate debate (Brüggemann & Engesser, 2017; Merkley & Stecula, 2020).

There is an ongoing tension between responsibility framing and elite-sourcing practices: elite-driven narratives prompt to individualize responsibility, obscure structural forces, and lead to public fatalism (Feldman et al., 2015; Iyengar, 1991; Olausson, 2009). This asymmetry can cause certain voices to be selectively amplified and others to be silenced, affecting the confidence of people in science (Essien, 2025; Proctor & Schiebinger, 2008). The hierarchical sourcing influences the choice of people who can arrive at credible knowledge and the interpretations that will be distributed as credible (Schäfer & Painter, 2020). Even though the declining popularity of false balance approaches in the last 10 years happened as the attribution science developed and interpretative climate journalism became more popular, the legacy remains (Brüggemann & Engesser, 2017; Painter, 2013). Conversely, impact framing in

situations where the sourcing is controlled by economic or governmental elites might focus on the financial expenses and damage to infrastructure and downplay the environmental harm or social susceptibility.

Indexing effects are complicated and multi-faceted. They vary in terms of disaster categories, political moments, and organizational ideologies. For instance, the presence of political elites' disagreement over significant climate-related policy debates can further widen the scope of political conflict frame and increase the degree of scientific uncertainty. Whereas elite consensus can help constrain overt attribution of disasters to anthropogenic climate change and reduce the set of factors to blame. Likewise, in a situation whereby business elites control the sourcing process in cases of disaster coverage, impact framing might highlight economic failure and exclude environmental or health effects. This demonstrates the necessity of a longitudinal, outlet-comparison analysis, which can be carried out by computational analysis on a scale (Baden & Stalpouskaya, 2020; Otto, 2023).

Overall, in this thesis, indexing theory served as a structural lens for understanding whose voices shape causal explanations, how responsibility is distributed or evaded, how political conflict comes to climate discourse, and how scientific uncertainty becomes elevated or marginalized. By connecting sourcing hierarchies to the five framing dimensions of the study, indexing theory provided a foundational account of how power relations and elite discourse structure the representational boundaries of climate-change coverage.

Theoretical Gaps

Despite rapid growth in scholarship on climate communication and disaster journalism, significant gaps continue to limit a comprehensive understanding of how news organizations represent climate-driven extreme weather events (Domínguez-Rodríguez et al., 2025; Schäfer &

Painter, 2020; Wetts, 2025). Some studies have produced valuable insights into attention cycles, hazard-specific coverage, sourcing inequalities, and ideological polarization. But there are four enduring gaps restricting systematic understanding of the ways that climate disasters are framed across hazards, over different time periods, and across ideologically divergent media institutions. These gaps reflect conceptual fragmentation in how scholars integrate material, institutional, and temporal dimensions into unified models of climate-disaster representation.

Gap 1: Lack of Cross-Hazard Focus

One limitation of the existing literature is its strong focus on individual disaster types. Many studies examine specific hazards such as hurricanes, wildfires, droughts, or floods, often selected because of their political significance or visual prominence in news coverage (Clarke et al., 2022; Houston et al., 2012; Liu et al., 2009; Schäfer & Painter, 2020; Schmidt et al., 2013). These studies provide useful insights into how particular events are reported. However, it remains unclear whether the framing patterns they identify are unique to those hazards or reflect broader patterns in disaster reporting.

Without systematic comparison across different hazards, it is difficult to determine whether variations in framing, sourcing, or political emphasis arise from the characteristics of the disasters themselves or from institutional routines within news organizations (Clarke et al., 2022; Houston et al., 2012; Liu et al., 2009; Schäfer & Painter, 2020; Wetts, 2020).

This gap raises an important question: do news organizations interpret climate-related disasters differently depending on the type of hazard, or do they rely on similar interpretive approaches across disasters? Existing research provides limited evidence to answer this question.

Gap 2: Limited Longitudinal Analysis

Another significant gap is the temporal scale of analysis. Many climate-disaster studies do not focus on long periods of history, but within short time frames, such as days or weeks around instances of extreme weather events. Some studies show the volatility of disaster coverage, with intense spikes followed by rapid declines (Houston et al., 2012; Schmidt et al., 2013). Few studies have had longitudinal approaches to track how framing and sourcing patterns evolve over multiple decades. Liu et al. (2009), for example, found that there were strong peaks in congressional and media attention to climate change in the U.S. between 1969 and 2005, but failed to maintain the same attention over the following years. More recent studies suggest that digital platforms bring these processes to hyper-volatile bursts of attention (Domínguez-Rodríguez et al., 2025).

Overall, systematic longitudinal research comparing multiple disaster types across extended periods remains limited (Djerf-Pierre, 2012; Schäfer & Painter, 2020; Wetts, 2020). As a result, we know little about whether journalistic coverage of climate disasters has intensified, diversified, polarized, or stabilized over time.

Gap 3: Fragmented Theoretical Application

Another theoretical gap is related to the use of various theoretical frameworks of framing, indexing/sourcing, and agenda-setting applied in isolation. Framing research has extensively analyzed the prevalence of risks, uncertainty, conflict, and justice frames (Entman, 1993; Olausson, 2009; Schäfer & Painter, 2020). Sourcing studies report elite political and corporate dominance and the marginalization of scientific experts and affected communities (Boykoff & Boykoff, 2004; Guenther et al., 2023; Kirchner et al., 2024; Nielsen, 2024; Wetts, 2020). This siloed approach overlooks: (1) the dominance of elite sources, which limits the ability to frame causality and responsibility; (2) the cycles of attention, which precondition the possibility of

particular frames to be formed or continue; and (3) the interplay of hazard features with institutional routines in creating patterns of narrative.

Few studies incorporate these frameworks to investigate how interpretive (framing), structural (indexing), and temporal (agenda-setting) theories interact to shape climate-disaster narratives. Without integrative models, the field lacks a systematic account of how news organizations construct climate disasters through interconnected representational processes.

Gap 4: Limited Comparison Across Ideologically Varying Media Outlets

A final gap is that of institutional comparison. Extensive studies focus on a single outlet or compare overtly partisan media outlets. Fewer studies have examined how the elite and agenda-setting news sources that have divergent ideological orientations depict climate disasters differently. Ideological orientation shapes: (1) causal attributions (e.g., policy failure vs. natural factors); (2) responsibility assignments (e.g., governmental accountability vs. environmental unpredictability); (3) voice hierarchies (e.g., scientific experts vs. business actors); and (4) political contestation within disaster narratives (Bolsen & Shapiro, 2017; Merkley & Stecula, 2020). Since the *NYT* and the *WSJ* have different ideological orientations (e.g., science-emphasizing vs. business-oriented; regulation supportive vs. regulation skeptical), a comparative study of how the two media outlets covered the disasters provides a critically important avenue to examine the influence of institutional orientation in the presentation of climate narratives.

Filling in the Gaps

Together, these limitations create a fragmented understanding of climate journalism. Hazard-specific analyses inhibit comparative insight; short-term coverage studies obscure long-term representational evolution; theoretically isolated approaches prevent a comprehensive explanation; and limited institutional comparison masks the role of ideological orientation in

shaping public interpretation of climate risks. A natural result is a research landscape that overrepresents episodic frames, elite sources, and short-lived attention, while underexploring structural causality, long-term patterns, and institutional diversity.

This thesis fills these gaps by constructing an integrative analytical approach to analysis that is based on framing theory, indexing theory, and agenda-setting theory. Using computational text analysis, this thesis examined how national elite newspapers with distinct ideological orientations have represented six major categories of climate-related disasters between 2000 and 2024.

This research design allows for: (1) a cross-hazard comparison of framing patterns; (2) a longitudinal analysis of representational change over 25 years; (3) an institutional comparison between ideologically divergent elite outlets; (4) multi-dimensional frame measurements (causal attribution, responsibility attribution, political conflict, impact framing, and scientific uncertainty); and (5) integration of structural and temporal dynamics through attention cycles and elite sourcing patterns. This approach provides a systematic understanding of how material hazard features, institutional positioning, and temporal context jointly shape climate-disaster narratives in two elite U.S. media outlets.

Core Framing Dimensions in Climate Disaster Coverage

Building on the theories of framing, indexing, and agenda-setting, this section elaborates on the five key dimensions by which climate disasters are constructed in news discourse. This section aims to identify which interpretive options define climate disaster coverage and why each dimension matters for public understanding and policy formation.

All the dimensions represent separate though interrelated dimensions of disaster representation. Responsibility attribution lays the blame on governments, corporations,

political/societal systems, or views climate change effects as something beyond human control. Political conflict entangles calamities in partisan disagreement and ideological struggle. Impact framing focuses on environmental, economic, social, or health impacts. Scientific uncertainty foregrounds uncertainty, or disputed evidence. All five these dimensions act as an operation of the interpretive architecture of climate journalism. They are ideological cues about how the media manage the clash of interests. Since these dimensions differ systematically among news outlets (reflecting institutional ideology), among hazards (reflecting material characteristics), and over time (reflecting scientific advances and political polarization), they provide a useful analytic base in this thesis.

(1) Causal Attribution in Climate Disasters

Causal attribution, how journalists explain the causes of extreme weather events, is one of the most impactful dimensions in climate journalism. Under-attribution is a longstanding trend of U.S. media where the reporting of a disaster does not make a connection to anthropogenic climate change even when attribution science shows such a connection is likely accurate (Boykoff, 2011; Painter, 2013). Studies on hurricanes, wildfires, and heatwaves has consistently been done, but journalists tend to consider the tragedy as a natural disaster, often overlooking its connection to climate change (Anderson & Hoffman, 2020; Hopke, 2019; Osaka et al., 2020). Causal attribution is more frequently observed in tropical storms than in droughts and more often in progressive media outlets than in conservative ones (Bolsen & Shapiro, 2017; Merkley & Stecula, 2020). The emergence of Extreme Event Attribution (EEA) science has led to unprecedented opportunities of accurate causal reporting (Otto, 2023), but research indicates that journalists are not able to convert attribution results into convincing narratives (Linden et al., 2022; Schäfer & Painter, 2020). This translation gap leads to poor or unstable causal cues in

news materials, restricting understanding of the association between disasters and climate change (Feldman & Hart, 2016).

Attribution is also shaped by ideological media logics: left-leaning news media outlets like the *NYT* are more prone to affirming climate causation, whereas right-leaning news media outlets like the *WSJ* infer to natural variability, general uncertainty, or economic cost (Feldman et al., 2015; Merkley & Stecula, 2020). These partisan trends demonstrate that causal attribution is not only a scientific issue, but also a framing tool politicized by media ideologies.

(2) Responsibility Attribution

Responsibility attribution examines how journalists assign accountability for climate-related harms. In disaster reporting, there is a conflict between the personalization of responsibility and the attribution of responsibility to governments, corporations, and regulatory institutions (Iyengar, 1991; Olausson, 2009). Many governments have failed in their efforts for mitigation, preparedness, or emergency responses (Olausson, 2009; Pellegrini et al., 2021). Nevertheless, media frames usually do not pinpoint regulatory or policy failures and instead describe damage and recovery in a neutral fashion (Feldman et al., 2015). Corporate and fossil-fuel industry responsibility remains muted in media coverage. Studies show that legacy media are hesitant to assign disaster severity to long-term emission consequences, energy policy choices, or industry lobbying (Schäfer & Painter, 2020; Wetts, 2020), which may hinder structural reforms. Since attribution patterns differ across ideological media sources, responsibility framing can help illuminate how climate disasters are framed in American journalism.

(3) Political Conflict

Climate change has been turned into one of the most politically polarized topics in the U.S., with political conflict framing being the most significant characteristic of climate journalism (Feldman et al., 2015; Nisbet, 2009). U.S. news coverage tends to highlight the conflict between Democrats and Republicans, liberals and conservatives, federal and state policymakers (Feldman et al., 2015; Merkley & Stecula, 2020). This framing shifts attention away from scientific consensus and toward ideological contestation, reducing the space for deliberative public discourse on climate change (Nisbet, 2009).

Conservative media, particularly the *WSJ*, have often portrayed climate action as economically burdensome, scientifically uncertain, or politically motivated, reflecting the influence of climate skepticism and industry-linked perspectives (Boykoff, 2007; Wetts, 2020). By contrast, outlets such as the *NYT* tend to emphasize policy urgency, failures of governance, and the broad scientific agreement on climate change (Bolsen & Shapiro, 2017; Merkley & Stecula, 2020). Research in climate communication suggests that these differences reflect broader ideological framing patterns, with conservative narratives more frequently focusing on regulatory costs and economic consequences, while liberal narratives stress environmental risk and collective responsibility (Nisbet, 2009).

Political conflict frames have substantial consequences. They amplify polarization and diminish bipartisan collaboration (Bolstad & Victor, 2024). They also interplay with indexing practices where journalists count on political elites as the main source when addressing climate debates (Bennett, 1990; Merkley & Stecula, 2020). Since the *NYT* and the *WSJ* represent different ideological domains of U.S. political communication, a political conflict frame analysis

is necessary to examine how climate disasters become entrenched into a partisan meaning system.

(4) Impact Framing: Constructing Consequences and Severity

Impact framing refers to how journalists portray the consequences of climate-driven disasters across environmental, economic, social, and health dimensions (Feldman et al., 2015; Rebich-Hespanha et al., 2014). Studies reveal that legacy media place much emphasis on destruction, human suffering, deaths, economic damage and infrastructure destruction, which have impacts on how people think about severity and risk of climate disasters (Houston et al., 2012; Rebich-Hespanha et al., 2014; Smith & Joffe, 2012). Impact framing also intersects with affective dimensions of climate crises, especially threat perception (Smith & Leiserowitz, 2013). Impact frames, by focusing on devastating impacts, human suffering or chain reactions, mobilize affective actions (Smith & Joffe, 2012).

Impact framing has been shown to influence the urgency, vulnerability, and protection action perceptions of audiences (Hart & Feldman, 2016; Smith & Joffe, 2012). Frames which emphasize catastrophic outcomes may increase threat perceptions and decrease perceived control (Feldman et al., 2015). On the other hand, impact narratives, combined with a sense of responsibility or policy action, may enhance climate governance support (Hart & Feldman, 2016). Business-oriented media outlets such as the *WSJ* may prioritize economic losses and market disruptions, while media outlets, such as the *NYT*, with stronger environmental coverage traditions may emphasize environmental degradation, public health consequences, or social vulnerability (Rebich-Hespanha et al., 2014).

(5) Scientific Uncertainty

Scientific uncertainty has been one of the most influential and controversial frames in climate journalism. A well-known example of this framing practice is false balance, where journalists give disproportionate attention to voices that reject climate science despite the overwhelming scientific consensus (Boykoff & Boykoff, 2004). Presenting these positions as equally credible can create the impression that scientific disagreement remains widespread. Research shows that such coverage reduces perceptions of scientific agreement and weakens public support for climate action (McCright, 2007).

Although explicit false-balance practices have declined over time, uncertainty continues to appear in other forms. Journalists sometimes emphasize the methodological limits of climate science or its difficulty in making precise long-term predictions (Painter, 2013). Recent studies also found that some mainstream news coverage continues to highlight doubts about climate forecasts, scientific evidence, and the effectiveness of climate policies (Merkley & Stecula, 2020; Wetts, 2020). This framing may make news audiences less supportive of climate policies, and more divided on them (Shehata & Strömbäck, 2013).

While skepticism frames have sharply declined since the 2010s, they persist in certain outlets, such as the *WSJ*, that serve conservative economic interests (Boykoff, 2011; Wetts, 2020). For this reason, scientific uncertainty can be an analytical variable for comprehending how elite newspapers negotiate climate information, legitimize causal claims, and signal epistemic authority or doubt. This dimension is particularly important for comparing the *NYT* and the *WSJ*, given documented differences in how these outlets construct scientific authority, balance competing claims, and navigate attribution science in climate disaster coverage (Merkley & Stecula, 2020).

Chapter III: Research questions and hypotheses

Drawing on the integrated theoretical framework developed in Chapter II, this chapter operationalizes how the *NYT* and the *WSJ* have constructed climate disasters across five framing dimensions: causal attribution, responsibility attribution, political conflict, impact framing, and scientific uncertainty.

The research questions are organized into four clusters that address the gaps identified in Chapter II:

Cluster 1 tests outlet-level ideological differences across all five dimensions.

Cluster 2 examines hazard-specific variation, to determine whether media framing reflects disaster characteristics or demonstrates uniform journalistic routines.

Cluster 3 tracks temporal evolution of climate disaster articles from 2000 to 2024, testing whether attribution has increased, uncertainty has declined, and political conflict has intensified.

Cluster 4 explores interaction effects among outlets, hazard types, and time.

Collectively, these questions translate theoretical predictions into testable hypotheses about how two elite U.S. newspapers have portrayed climate-induced extreme weather over the last 25 years.

Cluster 1: Outlet-Level Framing Differences

RQ1: How do *The New York Times* and *The Wall Street Journal* differ in their use of causal attribution (explicit anthropogenic attribution, hedged attribution, natural-variability attribution, or causal silence) when reporting on climate-related disasters?

Research shows that science-focused, center-left media outlets establish more direct cause-and-effect relationships between climate change and extreme weather conditions (Boykoff, 2011; Brüggemann & Engesser, 2017). The IPCC findings and expert evaluations are continually

incorporated into the *NYT* and are making explicit attribution more typical of its reporting (Schäfer & Painter, 2020). This means that the anthropogenic attribution of climate change will be higher in the *NYT* than in the *WSJ* since news outlets with scientific consensus emphasize human-caused climate change more clearly.

H1: *The New York Times* will exhibit higher levels of anthropogenic attribution than *The Wall Street Journal*.

Business-oriented and conservative-leaning outlets often emphasize natural climatic variation or do not refer directly to climate when reporting extreme events (Feldman et al., 2015; Merkley & Stecula, 2020). Attribution frames of natural variability attribute disasters not to the effect of warming caused by anthropogenic emissions, but to long-term climatic cycles, El Niino, or phenomena that have occurred historically and on a regular basis (IPCC, 2018; Schiermeier, 2018; Stott et al., 2015). Such framing usually refers to meteorological historical record, cyclic variations or statistical precedence to imply that present extremes are within the range of the natural climate variation. Outlets can reduce the science consensus on human-induced warming and decrease the perceived relatability of the science of attribution by placing disasters into natural oscillation patterns (Painter, 2013; Otto, 2023). Recent research shows that the explanations of natural variation and the resulting focus on historical cycles or climatic uncertainty are more common in conservative media ecosystems, where it serves to spread responsibility and enhance ideological doubt of climate science (Bolstad & Victor, 2024; Schertzer & Woods, 2025). Research also indicates that the *WSJ* employs a higher amount of hedging and deemphasizes anthropogenic causality than left-leaning publications do (Bolsen & Shapiro, 2017). As a result, the *WSJ* will likely use more natural-variability explanations and causal silence than the *NYT*.

H2: Natural-variability attribution and causal silence will occur more frequently in *The Wall Street Journal* than in *The New York Times*.

RQ2: How do *The New York Times* and *The Wall Street Journal* assign responsibility for climate-related disasters across actor responsibility, diffuse or systemic responsibility, naturalized responsibility, or no responsibility attribution?

Evidence shows that left-leaning and evidence-based sources are more prone to reporting governmental, corporate and systemic activities as the causes of climate-related risks (Boykoff, 2011; Carvalho, 2007). The policy background, infrastructure weaknesses, and institutional responsibility are common in the coverage of climate-disaster issues in the *NYT* (Schäfer & Painter, 2020). Consequently, it is reasonable to expect that the *NYT* will allocate a greater number of actor-level and system-level responsibility than the *WSJ*.

H3: *The New York Times* will demonstrate higher levels of actor and system-level responsibility attribution than *The Wall Street Journal*.

Research found that conservative or business-oriented media outlets are more likely to frame extreme weather events as natural phenomena rather than as outcomes of policy failures or broader systematic issues (Feldman et al., 2015; Merkley & Stecula, 2020). Consistent with this pattern, the *WSJ* tends to downplay structural accountability and emphasizes natural causes, a framing that aligns with skepticism toward regulatory responses to climate change (Bolsen & Shapiro, 2017). Therefore, responsibility is more likely to be attributed to natural causes in the *WSJ* than in the *NYT*.

H4: Naturalized responsibility will occur more frequently in *The Wall Street Journal* than in *The New York Times*.

RQ3: How frequently does political conflict framing appear in climate-disaster coverage in *The New York Times* and *The Wall Street Journal*?

Political conflict framing is more common in outlets where policy debates, regulatory battles, and partisan disagreements shape climate discourse (Feldman et al., 2015; Stecula & Merkley, 2019). The *WSJ* frequently anchors climate and disaster coverage within political and economic arguments, emphasizing disputes over regulation, federal responses, and partisan positions (Merkley & Stecula, 2020). Because right-leaning and business-oriented media outlets tend to highlight conflict more than science-oriented media outlets, the *WSJ* is expected to show higher levels of political conflict framing than the *NYT*.

H5: Political conflict framing will appear more frequently in *The Wall Street Journal* than in *The New York Times*.

RQ4: How frequently do impact frames (environmental, economic, social, or health-related consequences) appear in climate-disaster reporting in *The New York Times* and *The Wall Street Journal*?

Impact framing can vary across news outlets depending on editorial priorities and audience expectations. General-interest newspapers such as the *NYT* often focus on environmental damage and public health consequences when reporting on climate-related disasters (Houston et al., 2012; Schäfer & Schlichting, 2014). Business-oriented outlets such as the *WSJ*, in contrast, tend to pay greater attention to economic losses, market disruptions, and broader financial implications of disasters (Brüggemann & Engesser, 2017; Feldman et al., 2015).

These differences suggest that coverage in the *NYT* is more likely to discuss environmental and health impacts, whereas reporting in the *WSJ* is more likely to focus on economic and market consequences.

H6: *The New York Times* will exhibit a higher emphasis on environmental and public health impacts, while *The Wall Street Journal* will emphasize economic and market impacts, reflecting distinct audience priorities and editorial orientations.

RQ5: How frequently does scientific uncertainty framing appear in climate-disaster coverage in *The New York Times* and *The Wall Street Journal*?

Scientific uncertainty framing appears more frequently in media outlets that highlight debate, regulatory caution, or skepticism toward climate policy (Bolsen & Shapiro, 2017; Feldman et al., 2015). In coverage of extreme weather events with economic implications, the *WSJ* has often drawn attention to scientific disagreement, uncertainty, or limitations in climate models (Merkley & Stecula, 2020).

By contrast, the *NYT* tends to place greater emphasis on the scientific consensus surrounding climate change and is less likely to foreground uncertainty when the evidence is well established (Schäfer & Painter, 2020). Based on these patterns, the researcher expects the *WSJ* to employ scientific uncertainty framing more frequently than the *NYT*.

H7: Scientific uncertainty framing will appear more frequently in *The Wall Street Journal* than in *The New York Times*.

Cluster 2: Hazard-Type Variation

RQ6: How do the five framing dimensions (causal attribution, responsibility attribution, political conflict, impact framing, and scientific uncertainty) vary across disaster types (hurricanes, wildfires, floods, droughts, heatwaves, and tropical storms)?

H8: Framing patterns will differ significantly across disaster types because of variations in attribution confidence, visibility, and political salience.

Different climate-related hazards have distinct scientific, visual, and political features that shape how journalists report on them. Slow-developing hazards such as heatwaves and droughts often have stronger scientific attribution signals. Because the link between these events and anthropogenic warming is more clearly established, news coverage is more likely to mention climate change directly when discussing them. By contrast, rapid-onset disasters such as hurricanes and floods involve more complex atmospheric processes, which can make explicit attribution less common in journalistic narratives (Otto et al., 2018; Stott et al., 2015).

The level of political attention also varies across hazard types. Highly visible disasters, especially wildfires and hurricanes, often become focal points for political debate and therefore generate greater levels of political conflict framing in news coverage (Fischer et al., 2021; Schäfer & Painter, 2020). Hazards with lower attribution certainty, including floods and tropical storms, are more likely to be discussed in terms of scientific uncertainty (Pellegrini et al., 2021).

In addition, the immediate physical consequences of rapid-onset disasters tend to shape reporting practices. Events that produce sudden destruction and visible damage often lead journalists to emphasize human and material impacts (Houston et al., 2012). Finally, some hazards draw attention to institutional decisions and governance failures. Floods that expose infrastructure weaknesses. Wildfires, linked to land-management decisions, can prompt journalists to assign responsibility to public agencies or policymakers (Carvalho, 2007). Together, these hazard characteristics explain why framing patterns are expected to differ significantly across disaster types.

H8a: Slow-onset hazards with high attribution confidence (e.g. heatwaves, droughts) will exhibit higher anthropogenic attribution than rapid-onset hazards with complex causal pathways (e.g. hurricanes, floods).

H8b: Highly visible, politically salient hazards (e.g. wildfires, hurricanes) will exhibit higher political conflict framing than less visible hazards (e.g. droughts, heatwaves).

H8c: Hazards with lower attribution confidence or complex multi-causal dynamics (e.g. floods, tropical storms) will exhibit higher scientific uncertainty framing than hazards with clear anthropogenic signals (e.g. heatwaves, droughts).

H8d: Rapid-onset hazards with immediate catastrophic impacts (e.g. hurricanes, wildfires, floods) will exhibit higher impact framing emphasis than slow-onset hazards (e.g. droughts, heatwaves).

H8e: Hazards associated with clear governance failures or infrastructure vulnerabilities (e.g. floods, wildfires) will exhibit higher responsibility attribution than hazards perceived as primarily meteorological (e.g. heatwaves, droughts).

Cluster 3: Temporal Evolution (2000–2024)

RQ7: How do the five framing dimensions evolve over time across both newspapers from 2000 to 2024?

Over the past two decades, climate science has advanced rapidly, particularly in extreme-event attribution, enabling more confident and timely assessments of how human activities influence specific hazards (Otto et al., 2018; Stott et al., 2015). As scientific consensus strengthened, news coverage increasingly incorporated explicit climate attribution and relied less on uncertainty frames, reflecting a broader shift away from earlier “balance” or skepticism-oriented reporting (Boykoff, 2011; Schäfer & Painter, 2020). During the same period, U.S.

climate politics became more polarized, with partisan divisions widening and policy debates becoming more contentious (Feldman et al., 2015; Merkley & Stecula, 2020). This political shift has led journalists, especially in national outlets, to devote more attention to partisan disagreement and regulatory conflict in climate-disaster stories. Therefore, these trends support expectations of increasing explicit attribution and political conflict as well as declining scientific uncertainty in coverage from 2000 to 2024.

H9: Anthropogenic attribution will increase significantly over time between 2000 and 2024, reflecting advances in attribution science and stronger scientific consensus.

H10: Scientific uncertainty will decline significantly over time between 2000 and 2024.

H11: Political conflict will increase significantly over time between 2000 and 2024 as climate change becomes more polarized in U.S. political discourse.

Cluster 4: Outlet × Hazard × Time Interactions

RQ8: How do outlet ideology, disaster types, and historical periods jointly shape framing patterns in *The New York Times* and *The Wall Street Journal*?

Ideological gaps between news outlets have widened, especially in coverage of high-visibility disasters such as wildfires and hurricanes, as climate change has become a politically polarized issue in the U.S. (Feldman et al., 2015; Merkley & Stecula, 2020). Studies show that left-leaning media outlets are more explicit in their climate attribution and policy interpretations. On the flip side, right-leaning media outlets have strengthened conflict framing and continued to emphasize regulatory or political disagreement (Brüggemann & Engesser, 2017; Schäfer & Painter, 2020). Recent advances in climate attribution science have strengthened the evidence of linking some hazards to anthropogenic warming more than others. As attribution studies have become more precise, journalists have increasingly distinguished among hazard types when

explaining extreme weather events in news coverage (Otto et al., 2018; Pellegrini et al., 2021). At the same time, political polarization surrounding climate change has deepened in many media environments. These developments suggest that both media outlet differences and hazard-specific framing patterns may become more pronounced across the 2000–2024 period.

H12: Media outlet differences in causal attribution and political conflict framing will widen over time between 2000 and 2024, particularly for highly visible, politically contested disasters (e.g. wildfires, hurricanes), as climate polarization intensifies and media outlets reinforce distinct ideological positions.

H13: Hazard-specific framing differences will become more pronounced over time between 2000 and 2024, as scientific knowledge, political conflict, and climate-risk communication evolve.

The research questions and hypotheses translate the study's theoretical framework into empirically testable expectations about how two elite U.S. newspapers reported on climate-related disasters over a specific period of time. The analysis examined variation in framing across news outlets, hazard types, and historical periods.

One set of questions addressed ideological differences between media outlets. These questions assess whether the two newspapers differ in their use of the five framing dimensions examined in this study: causal attribution, responsibility attribution, political conflict, impact framing, and scientific uncertainty. A second set focused on variation across hazard types to determine whether framing patterns are shaped primarily by the characteristics of particular disasters or by broader journalistic routines.

The study also considers how these patterns change over the 25-year period covered in the analysis. Examining temporal change makes it possible to observe how disaster narratives

evolve, as attribution science develops and political polarization around climate change intensifies. In addition, the analysis investigates how outlet ideology, hazard type, and historical context interact to influence the way climate-related disasters are presented in news coverage.

Chapter IV: Method

Guided by an integrated framework of framing theory, indexing theory, and agenda-setting theory, this chapter discusses a mixed-methods design to examine how the *NYT* and the *WSJ* frame climate-related extreme weather events from 2000–2024. The study analyzes six hazards: heatwaves, wildfires, tropical storms, hurricanes, floods, and droughts. It uses corpus-scale computational measures alongside stratified manual coding for validation and interpretive depth. In this chapter, five core framing dimensions, causal attribution, responsibility attribution**,** political conflict**,** impact framing, and scientific uncertainty are operationalized.

Research Design

The study adopted a longitudinal comparative design to investigate how climate disasters are represented in news coverage of two U.S. media outlets. The analysis encompassed six hazard types, two national elite newspapers, and a 25-year period. This research design allowed the researcher to examine three factors that might have shaped disaster narratives in media. First, hazards differ in their material characteristics including onset speed, visual visibility, and the degree of scientific confidence linking them to anthropogenic climate change. Second, media organizations operate within different institutional and editorial logics (the *NYT*'s center-left, science-oriented positioning vs. the *WSJ*'s business-oriented, center-right editorial orientation). Third, representations of climate disasters may change over time as scientific knowledge evolves and political debates surrounding climate change intensify, particularly around moments such as IPCC assessment cycles and the Paris Agreement 2015 (Clarke et al., 2022; Schäfer & Painter, 2020; Stecula & Merkley, 2019; Stott et al., 2015).

This study combined computational and interpretive methods to examine these patterns. Computational analysis was first used to identify linguistic indicators associated with the five framing dimensions across the full corpus of articles. This step was followed by stratified manual coding.

Manual coding performs two important roles. It helps verify whether the computational indicators accurately capture the intended framing categories. It also allows closer examination of ambiguous passages and framing patterns that automated methods may overlook or classify inconsistently (Denzin, 2017; van der Meer & Verhoeven, 2013; Jacobi et al., 2018; Veltri & Atanasova, 2015).

Together, these approaches make it possible to compare coverage across hazard types, news outlets, and time periods while connecting the study's theoretical framework to observable patterns in the text.

Media Selection

Two newspapers were selected for this study: the *NYT* and the *WSJ*. Both outlets are nationally influential and frequently shape policy debates and intermedia agendas in the United States (Anderson, 2017; Boykoff & Boykoff, 2004; Schmidt et al., 2013; Schäfer & Painter, 2020).

The *NYT* has extensive reporting resources and a long-standing commitment to environmental and science journalism. These institutional characteristics make it more likely that climate disasters are interpreted through explicit attribution to climate change, broader discussions of systemic responsibility, and detailed reporting on social and environmental impacts (Brüggemann & Engesser, 2017; Schäfer & Painter, 2020; Wetts et al., 2025).

The *WSJ* provides an important point of comparison. As a leading financial newspaper serving corporate and business audiences, its coverage often emphasizes economic implications, regulatory debates, and market-oriented perspectives in environmental reporting (Elsasser & Dunlap, 2013; Stecula & Merkley, 2019).

Examining these two media outlets allowed the researcher to assess how editorial orientation and institutional positioning influence causal explanations, responsibility attribution, political conflict framing, impact emphasis, and references to scientific uncertainty in climate disaster coverage (Carvalho, 2007). Focusing on these influential newspapers also addresses the limited number of systematic cross-outlet comparisons noted in previous research while concentrating on media organizations that play a significant role in shaping national discourse (McCombs & Shaw, 1972; Scheufele & Tewksbury, 2006).

Hazard Types

This study examined six climate-related extreme weather events: heatwaves, wildfires, tropical storms, hurricanes, floods, and droughts. These hazards were selected because they are widely studied in climate attribution research and frequently appear in policy and public debates (Clarke et al., 2022; Otto, 2023; Stott et al., 2015). Including multiple hazards makes it possible to compare rapid-onset, highly visible events such as hurricanes and wildfires with slower-onset hazards such as droughts and heatwaves. This contrast allows the researcher to assess whether the physical characteristics of disasters influence how journalists construct narratives about climate risk (Hopke, 2019; Houston et al., 2012).

Scientific attribution also varies across these hazards. Heatwaves and droughts often show stronger and more direct links to anthropogenic warming, whereas hurricanes and tropical storms involve more complex causal processes that combine thermodynamic intensification with

atmospheric circulation dynamics (Clarke et al., 2022; Stott et al., 2015). These differences provide an opportunity to examine whether the clarity of scientific attribution affects how journalists assign causal explanations and responsibility across hazards and news outlets. Examining multiple hazard types also addresses a limitation in earlier research, which has often focused on single disaster events rather than broader cross-hazard patterns.

Data Collection Procedure

Articles for this study were retrieved from Factiva, a global news database that provides full-text access to the *NYT* and the *WSJ*. Using a large commercial archive allows the collection of longitudinal media data and is consistent with established practices in climate communication research (Boykoff, 2007; Chetty et al., 2015; Schmidt et al., 2013).

The study period covers January 1, 2000 through December 31, 2024. This 25-year window captures the development of extreme event attribution research, key international climate policy milestones, and the growing societal impacts of climate-related disasters (Clarke et al., 2022; Otto, 2023).

To ensure comparability between the two media outlets, the researcher applied several database filters. Searches were limited to English-language articles published in the United States. This restriction avoided the inclusion of international editions or translated material that may not reflect the domestic framing of climate issues.

Hazard-specific search queries were then used to retrieve relevant articles:

- Heatwaves: “heatwave” OR “heat wave” OR “extreme heat” OR “heat dome” OR “excessive heat”
- Wildfires: “wildfire” OR “forest fire” OR “bushfire”
- Tropical storms: “tropical storm” OR “cyclonic storm”

- Hurricanes: “hurricane” OR “storm surge” OR “named storm”
- Floods: “flood” OR “flooding” OR “flash flood” OR “river flood” OR “urban flood” OR “coastal flood”
- Droughts: “drought” OR “dry spell” OR “water shortage” OR “water crisis” OR “megadrought”

Searches were conducted separately for each year and for each hazard–outlet combination because Factiva restricts bulk downloads. The retrieved articles were exported as Rich Text Format (RTF) files, which preserve key metadata such as the headline, publication date, section, byline, word count, and full article text. RTF files were selected instead of PDF because they allow more reliable programmatic extraction of textual data for computational analysis (Veltri & Atanasova, 2015).

Data Processing and Corpus Construction

RTF files were converted into structured datasets using custom Python scripts. Each article was assigned standardized metadata fields, including article ID, outlet, publication date, publication year, section, hazard query, headline, word count, and full text.

Several cleaning procedures were applied to ensure that the dataset contained only relevant news articles. Duplicate records were removed at the initial stage. Exact duplicates were identified by matching headlines and publication dates. Near-duplicate articles were detected using cosine similarity based on TF-IDF vectors and were excluded when similarity scores exceeded 0.95.

Genre filtering was then applied to restrict the dataset to institutional news reporting. Editorials, opinion columns, letters to the editor, reviews, and magazine features were excluded. Only hard news and feature reporting from standard news sections were retained. This approach focuses the analysis on routine journalistic production rather than commentary, consistent with prior framing research (Boykoff, 2007; Russill & Nyssa, 2009; Shoemaker & Reese, 2013).

Metaphorical uses of hazard terms were also removed. Articles containing figurative expressions such as “flood of immigrants” or “wildfire of rumors” were identified through pattern matching and then manually verified before exclusion.

Each remaining article was assigned a single primary hazard category. When an article matched more than one hazard query, classification followed three criteria: priority of hazard keywords in the headline, frequency of hazard terms in the body text, and manual review when necessary.

Before computational analysis, the corpus was standardized through several preprocessing procedures. These included lower-case conversion, removal of boilerplate text, sentence segmentation, tokenization, and lemmatization using the spaCy English language model. Punctuation was removed while preserving scientific units, and common stopwords were filtered using an expanded NLTK stopword list that included frequently occurring newsroom terms.

All analyses were conducted in Python 3.12.2 using standard data science libraries, including pandas, numpy, and scikit-learn. A fixed random seed was applied to ensure reproducibility.

The initial Factiva search returned 55,874 articles. After filtering non-relevant sections, 21,662 records remained. Deduplication reduced the dataset to 14,122 unique articles. Following genre filtering and the removal of records with missing publication dates, the final analytical corpus consisted of 10,069 hard-news articles.

The dataset included 5,181 articles from the *NYT* and 4,888 from the *WSJ*. Hazard distribution within the corpus was as follows: hurricanes: 3,995, droughts: 1,929, floods: 1,529, wildfires: 1,171, tropical storms: 790, and heatwaves: 655. This corpus provides consistent coverage of climate-related disasters over a 25-year period. Compared with earlier studies that focus on single disaster events, the dataset enables systematic analysis of long-term patterns in climate disaster reporting (Schmidt et al., 2013; Schäfer & Painter, 2020).

Operationalization of Variables

The five framing dimensions draw on established research in climate communication, news framing, and disaster reporting (Boykoff & Boykoff, 2004; Entman, 1993; Feldman et al., 2015; Iyengar, 1991). Because framing often appears through narrative context, interpretive language, and subtle cues within news stories, it cannot always be identified reliably through automated keyword detection alone.

To address this challenge, the study began with manual content analysis to define the conceptual boundaries of each framing variable. Computational text analysis was then applied to extend these validated categories to the full corpus. Using both approaches made it possible to preserve conceptual accuracy while examining a large dataset of news articles across a 25-year period.

Measurement

Framing refers to the ways journalists define problems, identify causes, assign responsibility, and highlight consequences within news coverage (Entman, 1993). These interpretive elements often appear indirectly through narrative emphasis, contextual cues, and subtle linguistic signals. As a result, simple keyword counts are not sufficient to capture framing patterns. Manual coding is therefore used to identify the presence of frames within the articles.

Once the coding scheme was developed and tested for intercoder reliability, the validated categories were applied to the full corpus using supervised text classification. This approach is widely recommended in computational communication research, which emphasizes validating human-coded constructs before scaling them through automated analysis (Boukes et al., 2019; Grimmer & Stewart, 2013).

To construct the training dataset, a stratified sample of 604 articles was selected for manual coding. Stratification ensured representation across both newspapers included in the study, the six categories of climate-related hazards, and five temporal periods between 2000 and 2024.

Coding reliability was assessed using Cohen's kappa. Consistent with established benchmarks in communication research, values of $\kappa \geq .70$ were treated as the minimum acceptable threshold for reliable coding (Lombard et al., 2002).

Framing indicators were coded at the article level using binary presence or absence values. Frames were not treated as mutually exclusive, since a single article may contain multiple interpretive elements. For instance, a story may attribute a disaster partly to climate change while also referencing natural variability or scientific uncertainty. Treating frames as co-occurring

patterns rather than exclusive categories follows established approaches in framing research (Entman, 1993; Semetko & Valkenburg, 2000).

Causal Attribution

Causal attribution refers to whether a news article links an extreme weather event to climate change or explains the event through other causes. Previous research shows that climate coverage often distinguishes among explicit anthropogenic attribution, uncertain climate influence, natural variability explanations, and cases in which no causal explanation is provided (Antilla, 2005; Boykoff & Boykoff, 2004; Painter & Ashe, 2012). These distinctions parallel scientific approaches to event attribution, which differentiate between clear anthropogenic signals and explanations based on natural variability or uncertain causal mechanisms (Rahmstorf, 2004).

Each article was coded using three binary indicators: explicit anthropogenic attribution, uncertain climate attribution, and natural-variability attribution. The indicators were not treated as mutually exclusive because journalistic narratives may present multiple causal explanations within a single article.

Explicit attribution was coded when an article clearly stated that climate change caused or intensified the event, using phrases such as “caused by climate change,” “made more likely,” or “driven by warming.” Uncertain attribution was coded when climate change was mentioned as a possible contributing factor through expressions such as “may have,” “might have,” or “could have contributed.” Natural attribution was coded when the event was explained primarily through natural climate variability or atmospheric conditions, including references to phenomena such as El Niño or La Niña without linking the event to climate change.

Articles that did not include any causal explanation received a value of zero across all indicators. Intercoder reliability for the coding procedure was assessed using Cohen's κ, with values of $\kappa \geq .70$ treated as acceptable.

Responsibility Attribution

Responsibility attribution refers to whether news coverage assigns responsibility for the impacts or management failures associated with an extreme weather event. The concept draws on Iyengar's (1991) distinction of individual and structural responsibility and on responsibility indicators identified in framing research (Semetko & Valkenburg, 2000). In disaster reporting, responsibility may be attributed to specific actors, broader institutional systems, or natural forces.

Coding was conducted using three binary indicators: explicit actor responsibility, diffuse or systemic responsibility, and naturalized responsibility. Explicit actor responsibility was coded when the article clearly identified individuals, organizations, industries, or government agencies as responsible for preventable outcomes such as inadequate preparation, ignored warnings, or failures in disaster response.

Diffuse responsibility was recorded when responsibility was implied through references to structural weaknesses, such as aging infrastructure, institutional vulnerability, or governance limitations, without identifying a specific actor. Naturalized responsibility was recorded when disaster impacts were portrayed as unavoidable or beyond human control.

Articles that contain no responsibility cues received a value of zero across all indicators. Figurative language was coded only when it clearly implies accountability. Intercoder reliability was assessed using Cohen's kappa, with values of $\kappa \geq .70$ treated as the minimum acceptable threshold.

Political Conflict

Political conflict refers to whether an article presents climate change or an extreme weather event as part of political disagreement or ideological contestation. Research in climate communication shows that U.S. news coverage frequently frames climate issues through partisan conflict, highlighting disagreements among political actors, parties, and advocacy groups (Boykoff & Boykoff, 2007; Feldman et al., 2017; Merkley & Stecula, 2020). This dimension is particularly relevant for comparing the *NYT* and the *WSJ*, which often differ in how they portray political debate around climate issues.

An article received a value of one when it contains clear references to partisan conflict or ideological division. Such cases included stories that describe disagreements between Democrats and Republicans, portray climate issues as part of broader ideological disputes, highlight conflicts among political actors over causes or policy responses, or connect events to legislative debates, elections, or government strategy. Articles that do not contain these references received a value of zero.

Political metaphors were excluded unless they directly involved identifiable political actors or ideological positions. Intercoder reliability for this variable was assessed using Cohen's kappa, with $\kappa \geq .70$ treated as the minimum acceptable threshold.

Impact Framing

Impact framing captures whether a news article emphasizes the consequences of an extreme weather event. Prior research shows that news coverage often focuses on the tangible impacts of climate-related disasters as a way to communicate their severity and societal relevance (Boykoff & Boykoff, 2007; Feldman et al., 2015; Hart & Feldman, 2016).

Coding used a binary presence or absence indicator. Articles received a value of one when they describe consequences of the event in environmental, economic, public health, or social terms. Examples include ecosystem damage, destruction from wildfires, infrastructure losses, economic disruption, heat-related illness, respiratory impacts, mortality risks, displacement, housing loss or disproportionate effects on vulnerable populations. Any substantive reference to damage, loss, harm, or disruption qualified as an impact reference.

Articles received a value of zero when they describe the event primarily in meteorological or observational terms without discussing its consequences. Figurative use of impact-related language was excluded unless they refer to concrete environmental, economic, social, or health outcomes. Intercoder reliability was evaluated using Cohen's κ, with $\kappa \geq .70$ (Lombard et al., 2002).

Scientific Uncertainty

Scientific uncertainty refers to whether an article emphasizes limits, disagreement, or ambiguity in scientific knowledge related to climate change or the extreme weather attribution. Research has shown that some news coverage highlights scientific uncertainty by presenting climate science as contested or unresolved (Antilla, 2005; Boykoff & Boykoff, 2004; Corbett & Durfee, 2004; Zehr, 2000). Earlier reporting practices sometimes amplified uncertainty through "balance-as-bias," where journalists juxtaposed scientific consensus with skeptical viewpoints (Boykoff & Boykoff, 2004). Later studies also found that uncertainty cues appeared more frequently in some media outlets, including the *WSJ* (Painter, 2013; Painter & Ashe, 2012).

Uncertainty framing was coded based on the presence or absence of references to scientific uncertainty. A value of one was assigned when an article mentions disagreement among scientists, questions the reliability of climate models, states that evidence is inconclusive,

or suggests that causal relationships remain uncertain. Uncertainty cues may also appear in quotations that emphasize methodological limitations or contested attribution findings. To be coded as present, the uncertainty must refer specifically to climate science, attribution research, or projected climate impacts.

A value of zero was assigned when the article presents scientific knowledge as well established or broadly agreed upon. Neutral statements noting that research is ongoing were not coded unless they framed the science as unclear or contested. Non-scientific uses of uncertainty were excluded. Intercoder reliability for this variable was assessed using Cohen's kappa, with values of $\kappa \geq .70$ treated as the minimum acceptable threshold.

Manual Coding Procedure

From the cleaned dataset of 10,069 articles, a stratified subsample of 604 articles was selected for manual coding. Stratification ensured representation across hazard type, news outlet, and give year time periods between 2000 and 2024. This design preserves variation across disasters, institutional contexts, and historical moments and strengthens the external validity of longitudinal content analysis (Neuendorf, 2017; Riffe et al., 2019).

Each article was coded for the presence or absence of 12 framing indicators representing the five conceptual domains examined in the study. Coding followed a structured instrument documented in the Climate Disaster Final Coding Workbook. The codebook specifies conceptual definitions, inclusion and exclusion criteria, and decision rules for each indicator. The coding scheme operationalizes core functions of framing theory, including problem definition, causal interpretation, and responsibility attribution, while maintaining explicit textual criteria to ensure replicability (Entman, 1993; Krippendorff, 2004; Neuendorf, 2017).

Frames were treated as non-exclusive categories. Multiple framing elements can appear in a single article, reflecting prior research showing that different interpretive packages often coexist within the same news narrative (Boykoff, 2007; Matthes & Kohring, 2008). Coding decisions were based on observable textual evidence rather than inferred authorial intent.

Intercoder Reliability

To assess the reliability of the coding instrument, intercoder reliability testing was conducted on a randomly selected subset of 90 articles, representing approximately 15% of the manually coded sample (Neuendorf, 2017; Wimmer & Dominick, 2014; Xu et al., 2023). The primary researcher coded all 604 articles, while a second trained coder independently coded the reliability subset using the finalized codebook and without access to the original coding decisions.

Intercoder reliability was calculated using Cohen's kappa, which adjusts for chance agreement and is appropriate for nominal variables (Cohen, 1960; Neuendorf, 2017). Across the 12 framing indicators, kappa values ranged from .72 to .92. According to commonly used benchmarks, values above .70 indicate substantial agreement and values above .80 indicate strong agreement (Landis & Koch, 1977; Wimmer & Dominick, 2014). These results indicate that the coding instrument produces consistent and replicable coding decisions.

Any disagreements between coders were discussed and resolved before finalizing the labeled dataset. The reconciled coding results constitute the reference dataset used for supervised classification in the subsequent computational analysis (Jacobi et al., 2018; Xu et al., 2023).

Table 1. Intercoder Reliability by Framing Dimension (N = 90 articles)

Framing Dimension	Cohen's κ	Agreement Level
Causal: Anthropogenic	0.88	Strong
Causal: Hedged	0.72	Substantial
Causal: Natural Variability	0.85	Strong
Resp: Actor	0.87	Strong
Resp: Systemic	0.83	Strong
Resp: Naturalized	0.79	Substantial
Political Conflict	0.91	Strong
Impact: Environmental	0.92	Strong
Impact: Economic	0.89	Strong
Impact: Social	0.81	Strong
Impact: Health	0.84	Strong
Scientific Uncertainty	0.76	Substantial

Computational Scaling of the Validated Instrument

Manual coding established the framing categories used in this study. After the coding scheme was validated, supervised multi-level machine learning was used to apply the same measurement framework to the full corpus of 10,069 climate-disaster articles. This approach allows human-defined theoretical constructs to be extended to large text collections while maintaining consistency in measurement (Boukes et al., 2019; Grimmer & Stewart, 2013).

The manually coded dataset (N = 604 articles) served as the training foundation for the classification model. The labeled data was divided into training (70%), validation (15%), and held-out test (15%) subsets using multi-level stratified sampling. This procedure preserves the distribution of each indicator across data splits, which is important when working with multi-label data that contains uneven class frequencies (Sechidis et al., 2011). Positive-class prevalence among the 12 indicators ranged from 13.7% (Causal_Hedged) to 81.5%

(Causal_NaturalVariability). This imbalance makes evaluation metrics that equally treat categories particularly important.

Because several framing elements can appear within the same article, the classification task was implemented using a multi-label format. Each indicator was predicted independently, reflecting the conceptual logic of the coding scheme and prior research showing that frames frequently co-occur within the same news narrative (Entman, 1993; Matthes & Kohring, 2008).

Full newspaper articles often exceed the input limits of transformer models (Devlin et al., 2019). To address this constraint, long articles were divided into overlapping text segments using a sliding-window segmentation approach. Each segment was classified separately, and segment-level predictions were aggregated into a single article-level prediction using a top-k pooling procedure. This approach allows framing cues that appear later in an article to influence the final classification (Sun et al., 2019; Yang et al., 2016).

Because the dataset contains substantial class imbalance, macro-averaged F1 was selected as the primary evaluation metric. Macro-F1 assigns equal weight to each indicator and therefore prevents high-frequency categories from dominating the overall performance (Zhang & Zhou, 2014). Micro-averaged F1 was also calculated to provide an aggregate measure of predictive accuracy across all label instances.

On the validation dataset, macro-F1 using a uniform threshold of 0.50 was 0.7195. After optimizing thresholds separately for each indicator, macro-F1 increased to 0.7492, indicating improved calibration across categories with different base rates (Lipton et al., 2014).

Evaluation on the fully held-out test set produced a macro-F1 of 0.73 and a micro-F1 of 0.81. In interpreting the results, macro-F1 is emphasized because it treats each indicator equally and ensures that less frequent but theoretically important constructs, such as

Scientific_Uncertainty, are not overshadowed by more common frames such as impact framing (Zhang & Zhou, 2014).

Per-label precision, recall, F1, and support values are reported in Table 2 for transparency. Performance was strongest for concrete thematic constructs such as Impact_Environmental, Impact_Economic, and Resp_Actor. Moderate performance was observed for Political_Conflict and Causal_NaturalVariability. Lower scores appeared for more interpretive indicators, including Causal_Hedged and Scientific_Uncertainty. These categories depend more heavily on contextual interpretation and rhetorical nuance. Similar patterns have been reported in previous computational framing studies, where abstract interpretive constructs are harder to detect automatically than explicit topical cues (Grimmer & Stewart, 2013; Jacobi et al., 2018).

Table 2: RoBERTa Automated Classifier Performance by Framing Label

Framing Label	Prev. (%)	Precision	Recall	F1	Threshold
Causal: Anthropogenic	14.2	.78	.72	.75	.45
Causal: Hedged*	13.7	.61	.68	.64	.38
Causal: Natural Variability	81.5	.91	.88	.89	.55
Resp: Actor	70.3	.83	.79	.81	.50
Resp: Systemic	58.1	.75	.72	.73	.48
Resp: Naturalized	64.9	.79	.76	.77	.52
Political Conflict	30.4	.71	.68	.69	.43
Impact: Environmental	61.7	.84	.81	.82	.50
Impact: Economic	79.8	.88	.85	.86	.52
Impact: Social	66.2	.79	.76	.77	.49
Impact: Health	28.5	.74	.70	.72	.46
Scientific Uncertainty*	22.3	.65	.60	.62	.41

Note. Macro-F1 = .73; micro-F1 = .81. Asterisks (*) denote lower-performing labels subjected to robustness checks. Prev. = training-set prevalence.

After validation, the trained model was applied to the full dataset of 10,069 articles using the same preprocessing, segmentation, and calibrated thresholds. The output is a binary prediction matrix (10,069 × 12) indicating the presence or absence of each framing indicator. This dataset forms the basis for the subsequent longitudinal, cross-outlet, and cross-hazard analyses.

Measurement Validity and Limitations

Although supervised classification enables framing analysis across thousands of articles, automated detection depends heavily on the quality and reliability of the manually coded training data (Grimmer & Stewart, 2013; Jacobi et al., 2018). The model learns patterns present in the labeled examples rather than independently identifying conceptual meaning. For this reason, the validity of the training dataset is central to the reliability of the scaled analysis (Boukes et al., 2019).

Performance on the held-out test set shows variation across framing dimensions. Indicators associated with explicit topical cues were detected with higher accuracy than more interpretive categories. This pattern is consistent with prior research demonstrating that abstract and context-dependent constructs are more difficult to operationalize computationally than overt lexical signals (Grimmer & Stewart, 2013; van Atteveldt et al., 2021).

Model outputs are therefore interpreted in relation to their validated performance levels. Substantive conclusions focus on patterns that appear consistently across both the manually coded sample and the computational estimates. The overall macro-F1 score of .73 falls within the range commonly reported in supervised content-analysis applications in communication research, where values between .70 and .80 are generally considered acceptable given the conceptual complexity of framing constructs (Boukes et al., 2019; Jacobi et al., 2018).

Future work could improve performance for epistemic categories such as hedged attribution and scientific uncertainty by expanding the manually coded dataset or incorporating ensemble modeling approaches. Domain-adaptive pretraining has also been shown to improve classification of low-frequency or context-dependent categories (Ruder, 2019; Zhang & Zhou, 2014). Despite these limitations, the present performance levels provide a defensible basis for large-scale analysis across outlets, hazards, and time periods.

Statistical Analysis Strategy

The unit of analysis in all statistical tests is the individual news article. After supervised classification, each article in the dataset (N = 10,069) was represented as a binary vector across 12 framing indicators. These indicators constitute the dependent variables in the statistical models.

Because the indicators are binary, the analysis relies on logistic regression. This model estimates the probability that a particular frame appears in an article given a set of explanatory variables. Logistic regression is widely used in communication research that analyzes content-analysis data (Hosmer et al., 2013; Long & Freese, 2014). Model coefficients are reported in log-odds, and odds ratios are provided to facilitate interpretation.

Outlet-Level Comparisons (RQ1–RQ5; H1–H7)

To test differences between NYT and WSJ, separate logistic regression models were estimated for each framing indicator. The media outlet served as the primary independent variable and was coded as $NYT = 1$ and $WSJ = 0$. These models estimate whether the probability of frame presence differs systematically between the two newspapers.

For descriptive transparency, bivariate relationships were first examined using chi-square tests of independence (Agresti, 2013). Logistic regression models were then used to estimate

adjusted effects while controlling for hazard type and publication year where theoretically appropriate.

Hazard-Type Variation (RQ6; H8–H8e)

To evaluate cross-hazard differences, hazard type was included as a categorical predictor using dummy-coded indicators. Logistic regression allows estimation of differences in frame probabilities across hazard categories while holding other variables constant (Hosmer et al., 2013). Planned contrasts were used to test theoretically derived comparisons, including rapid-onset versus slow-onset events and hazards characterized by high attribution confidence versus those involving more complex causal mechanisms.

Longitudinal Change (RQ7; H9–H11)

Temporal dynamics were examined using both continuous-year specifications (2000–2024) and categorical five-year intervals. Modeling time as a continuous predictor allows estimation of directional changes in frame probability over time (Singer & Willett, 2003), whereas period-based models capture potential non-linear shifts associated with major scientific and political milestones.

All regression models include year controls and proportional adjustments to account for variation in publication volume across periods. This approach ensures that observed trends reflect changes in framing rather than fluctuations in the number of articles published in different years.

Interaction Models (RQ8; H12–H13)

To assess whether outlet differences vary across hazard types and historical periods, interaction terms were introduced (Outlet × Hazard; Outlet × Year; Outlet × Hazard × Year). Including interaction terms allows the analysis to evaluate conditional effects and is appropriate

when theoretical expectations involve contextual moderation (Brambor et al., 2006). Significant interactions were further examined using marginal effects and predicted probabilities to facilitate interpretation (Long & Freese, 2014).

Model Diagnostics and Reporting

All models were estimated in Python using the statsmodels package (version 0.14.0). Robust standard errors were applied where appropriate to account for potential heteroskedasticity (Long & Ervin, 2000). Statistical significance was evaluated at $\alpha = .05$ using two-tailed tests.

Model fit statistics, including AIC and pseudo-R^2, are reported to facilitate model comparison (Hosmer et al., 2013). Multicollinearity diagnostics were examined using variance inflation factors, and all values remained below commonly accepted thresholds (O'Brien, 2007).

Robustness and Sensitivity Checks

The outlet-level analyses were first re-estimated using only the manually coded subset of articles (N = 604). The direction and magnitude of the results were consistent with those obtained from the full dataset, suggesting that the automated classifications did not substantially distort the underlying patterns.

The analyses were then repeated after removing the lowest-performing indicators, including Causal_Hedged and Scientific_Uncertainty. The main findings remained unchanged, indicating that the overall conclusions are not driven by categories with lower classification accuracy.

Finally, alternative decision thresholds were applied during classification to assess whether the observed outlet and temporal patterns were sensitive to calibration choices. The results remained stable across threshold specifications, increasing confidence that the reported patterns are not artifacts of model tuning (Grimmer & Stewart, 2013; Boukes et al., 2019).

Ethical Considerations and Reproducibility

All data used in this study come from publicly available archival newspaper content. Because the analysis relies exclusively on published materials, the research does not involve human subjects and complies with institutional guidelines governing studies based on public documents.

All preprocessing, classification, and statistical analyses were performed in Python (version 3.12.2). Random seeds were fixed to ensure that the computational procedures are reproducible (Peng, 2011). Replication materials are available from the author upon request.

Chapter V: Results

Corpus Overview and Descriptive Statistics

The final analytic corpus consisted of 10,069 articles published between 2000 and 2024. Articles were drawn from the *NYT* and the *WSJ* and covered six disaster categories: hurricanes, droughts, floods, wildfires, tropical storms, and heatwaves.

By disaster type, hurricanes constituted the largest proportion of coverage (n = 3,995; 39.7%), followed by droughts (n = 1,929; 19.2%), floods (n = 1,529; 15.2%), wildfires (n = 1,171; 11.6%), tropical storms (n = 790; 7.8%), and heatwaves (n = 655; 6.5%). The 2005–2009 period contained the largest number of articles (n = 3,331), reflecting elevated hurricane coverage during that time period.

All multivariate models reported below control for disaster-type composition using dummy variables (reference category = drought) and include a mean-centered calendar year covariate.

RQ1: Causal Attribution Framing

RQ1 examined whether media outlet identity predicts variation in causal attribution framing in climate-disaster coverage. To address this question, a series of binary logistic regression models were estimated for each causal dimension—explicit anthropogenic attribution, hedged attribution, natural-variability attribution, and causal silence. In each model, the media outlet (*NYT* = 1, *WSJ* = 0) served as the primary predictor, with disaster-type dummies (reference = drought) and a mean-centered calendar year included as controls. HC3 robust standard errors were applied.

H1 — Anthropogenic Causal Attribution (NYT > WSJ)

Controlling for disaster type and publication year, media outlet identity is a strong and statistically significant predictor of explicit anthropogenic attribution. *NYT* articles exhibit 5.50 times higher odds of including anthropogenic attribution relative to *WSJ* articles (*OR* = 5.50, 95% *CI* [4.58, 6.60], $p < .001$; McFadden $R^2 = .19$). This represents a substantively large outlet effect and indicates that nearly one-fifth of the variance in anthropogenic framing is accounted for by the model. Diagnostic checks indicate no multicollinearity concerns (all *VIFs* < 2.0), confirming model stability.

Descriptive prevalence rates corroborate the model-based finding: anthropogenic attribution appears in 14.55% of *NYT* articles compared to 4.01% of *WSJ* articles (difference = +10.54pp; $z = 18.09$, $p < .001$; Cohen's $h = .38$). The logistic results demonstrate that this divergence persists independently of hazard composition and temporal distribution. The effect therefore reflects a systematic editorial orientation rather than structural differences in coverage portfolios. H1 is strongly supported.

H2a — Natural-Variability Attribution (WSJ > NYT)

A parallel logistic model indicates that *NYT* articles have significantly lower odds of invoking natural-variability attribution relative to *WSJ* articles (*OR* = 0.36, 95% *CI* [0.26, 0.49], $p < .001$; McFadden $R^2 = .14$). Because *OR* < 1 indicates lower *NYT* odds, this result confirms that *WSJ* coverage more strongly privileges meteorological or natural explanations.

Descriptively, natural-variability framing appears in 98.77% of *WSJ* articles and 96.62% of *NYT* articles. Although this difference is statistically significant ($z = 7.14$, $p < .001$), the magnitude of the difference is small ($\Delta = 2.15$ percentage points; Cohen's $h = .15$), reflecting the near-ceiling prevalence of this frame in both outlets. Although the absolute difference is modest

due to near-ceiling prevalence in both outlets, the multivariate model confirms a statistically reliable and structurally consistent outlet effect. H2a is supported.

H2b — Causal Silence (WSJ > NYT)

Contrary to prediction, the logistic model indicates that *NYT* articles have higher odds of causal silence relative to *WSJ* articles (*OR* = 2.34, 95% *CI* [1.39, 3.95], $p = .001$; McFadden $R^2 = .07$). This reverses the hypothesized direction.

Descriptively, causal silence occurs in 1.08% of *NYT* articles compared to 0.41% of *WSJ* articles ($z = -3.89$, n.s. in the predicted direction; $h = -.08$). However, because causal silence appears in fewer than 2% of articles in either outlet, its substantive influence on overall framing patterns is minimal. The reversal therefore does not meaningfully alter the broader attribution landscape. H2b is not supported.

Exploratory — Hedged Attribution

An additional logistic model examined hedged attribution—language acknowledging climate change as a possible but not definitive causal factor. *NYT* articles exhibit 2.21 times higher odds of including hedged attribution relative to *WSJ* articles (*OR* = 2.21, 95% *CI* [1.96, 2.51], $p < .001$; McFadden $R^2 = .18$).

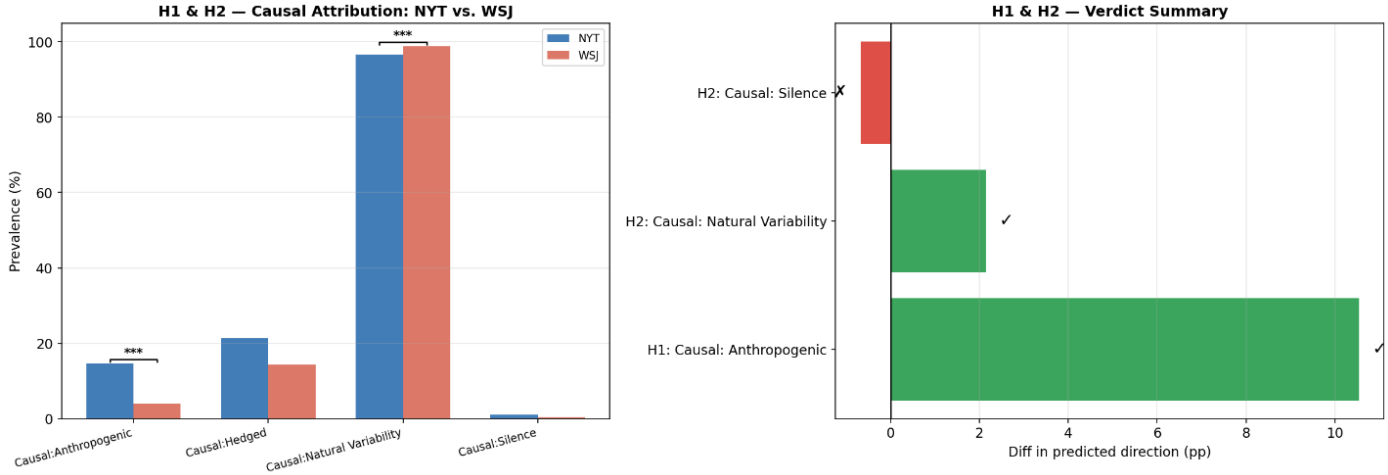
Descriptive prevalence aligns with the model: hedged attribution appears in 21.4% of *NYT* coverage versus 14.2% of *WSJ* coverage ($z = 9.30$, $p < .001$). This indicates that *NYT* coverage not only increases categorical anthropogenic attribution but also more frequently situates disasters within probabilistic climate frameworks.

Table 3. Logistic Regression Predicting Causal Attribution Frames (RQ1).

Label	*OR*	95% *CI* Lo	95% *CI* Hi	*p*	McFadden R^2
Causal: Anthropogenic	5.50	4.58	6.60	< .001	0.19
Causal: Hedged	2.21	1.96	2.51	< .001	0.18
Causal: Natural Variability	0.36	0.26	0.49	< .001	0.14
Causal: Silence	2.34	1.39	3.95	.001	0.07

Note. OR = odds ratio; CI = confidence interval; Lo = lower; hi = high. Outcome variable indicates whether the frame is present in the article. The predictor variable is outlet identity (NYT = 1, WSJ = 0). All models control for disaster-type dummy variables (reference category = drought) and a mean-centered calendar year. HC3 robust standard errors were used. N = 10,069.

Figure 1. Causal Attribution Framing: NYT vs. WSJ Prevalence (left) and Verdict Summary (right).



Answering RQ1

The logistic models provide a clear and internally coherent answer to RQ1. Outlet identity is a powerful and consistent predictor of causal framing orientation across the attribution spectrum. *NYT* coverage is substantially more likely to employ explicit anthropogenic attribution and hedged climate-relevant language, whereas *WSJ* coverage overwhelmingly privileges natural-variability explanations. These differences persist after controlling for disaster type and

time, indicating that they reflect systematic editorial positioning rather than compositional or temporal artifacts.

Importantly, both outlets almost always provide some form of causal explanation; the divergence lies not in the presence versus absence of attribution, but in the type of causal logic normalized. The *NYT* integrates disasters into a broader climate-change interpretive framework, while the *WSJ* constructs them primarily as meteorological phenomena. As a result, audiences encounter structurally different explanatory narratives regarding the origins of climate-related disasters.

RQ2: Responsibility Attribution Framing

RQ2 examines whether media outlet identity predicts variation in responsibility attribution across five dimensions: actor responsibility, systemic responsibility, a combined actor-or-systemic indicator, naturalized responsibility, and responsibility silence. For each outcome, binary logistic regression models were estimated with the media outlet (*NYT* = 1, *WSJ* = 0) as the primary predictor, controlling for disaster-type dummies (reference = drought) and mean-centered calendar year. HC3 robust standard errors were applied.

H3 — Actor and Systemic Responsibility (NYT > WSJ)

Actor Responsibility

Outlet identity is a statistically significant predictor of actor-level responsibility attribution. Controlling for disaster type and year, *NYT* articles exhibit 2.43 times higher odds of assigning responsibility to identifiable actors relative to *WSJ* articles (*OR* = 2.43, 95% *CI* [2.07, 2.85], $p < .001$; McFadden $R^2 = .06$).

Descriptively, actor responsibility appears in 94.69% of *NYT* articles compared to 87.36% of *WSJ* articles (difference = +7.34pp; z = 12.94, $p < .001$; Cohen's $h = .26$). Although

both outlets frequently invoke actors, the logistic model confirms that *NYT* coverage embeds identifiable agency more systematically.

Systemic Responsibility

A parallel model indicates that *NYT* coverage also assigns responsibility to systemic or structural factors at significantly higher rates. *NYT* articles have 1.82 times higher odds of systemic attribution relative to *WSJ* articles (*OR* = 1.82, 95% *CI* [1.64, 2.03], $p < .001$; McFadden $R^2 = .05$).

Descriptive prevalence mirrors this pattern: systemic responsibility appears in 84.19% of *NYT* coverage versus 76.90% in *WSJ* (difference = +7.29pp; $z = 9.26$, $p < .001$; $h = .18$).

Combined Indicator: Actor or Systemic Responsibility

To capture the broader embedding of human or institutional agency, a combined indicator (actor OR systemic) was estimated. This model produces the clearest outlet divergence. *NYT* articles exhibit 4.78 times higher odds of including some form of human or structural responsibility relative to *WSJ* articles (*OR* = 4.78, 95% *CI* [3.77, 6.06], $p < .001$; McFadden $R^2 = .11$).

Descriptively, 98.11% of *NYT* articles include actor or systemic attribution compared to 91.61% of *WSJ* articles (difference = +6.50pp; $z = 14.89$, $p < .001$; $h = .31$). The model indicates that *NYT* coverage nearly universalizes human or institutional agency in disaster narratives. H3 is supported across all sub-dimensions.

H4 — Naturalized Responsibility (WSJ > NYT)

Naturalized responsibility framing, depicting disasters as purely natural phenomena detached from human accountability, was modeled next. The logistic regression indicates that *NYT* articles have substantially lower odds of employing naturalized framing relative to *WSJ*

articles (*OR* = 0.47, 95% *CI* [0.43, 0.52], $p < .001$; McFadden $R^2 = .06$). Because *OR* < 1 reflects lower *NYT* odds, this confirms that *WSJ* coverage more frequently naturalizes disaster causation.

Descriptively, naturalized framing appears in 80.24% of *WSJ* articles compared to 66.51% of *NYT* articles (difference = +13.73pp in the predicted direction; $z = 15.54$, $p < .001$; $h = .31$). Substantively, *WSJ* articles exhibit approximately double the odds of invoking naturalized responsibility relative to *NYT* coverage. H4 is supported.

Responsibility Silence

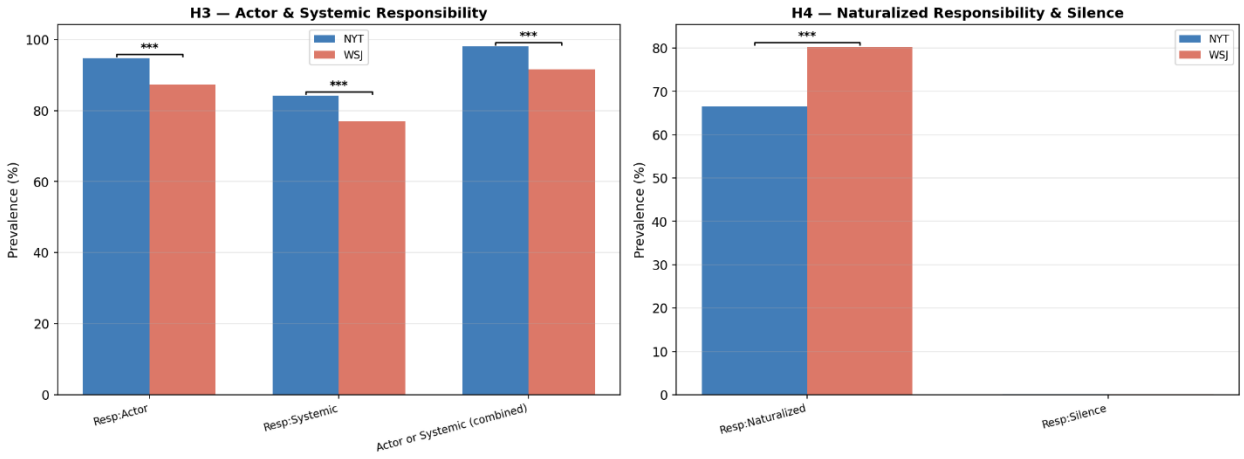
Responsibility silence is rare in both media outlets and does not exhibit a statistically significant outlet effect after adjustment (*OR* = 2.87, 95% *CI* [0.79, 10.37], $p = .108$; McFadden $R^2 = .07$). Given the low prevalence and wide confidence interval, interpretive weight is limited.

Table 4. Logistic Regression Predicting Responsibility Attribution Framing (RQ2).

Label	*OR*	95% *CI* Lo	95% *CI* Hi	*p*	McFadden R^2
Resp: Actor	2.43	2.07	2.85	< .001	0.06
Resp: Systemic	1.82	1.64	2.03	< .001	0.05
Resp: Actor or Systemic (combined)	4.78	3.77	6.06	< .001	0.11
Resp: Naturalized	0.47	0.43	0.52	< .001	0.06
Resp: Silence	2.87	0.79	10.37	.108	0.07

Note. *OR* > 1 indicates NYT has higher odds; *OR* < 1 indicates WSJ has higher odds. Models control for disaster-type dummy variables (reference category = drought) and a mean-centered calendar year. HC3 robust standard errors were used. $N = 10{,}069$. *n.s.* = not significant.

Figure 2. Responsibility Attribution Framing: NYT vs. WSJ



Answering RQ2

The logistic models provide a coherent and consistent answer to RQ2. Outlet identity significantly predicts responsibility framing orientation across all substantive dimensions. *NYT* coverage systematically foregrounds human and institutional agency, both at the level of identifiable actors and broader structural systems, whereas *WSJ* coverage more frequently naturalizes disasters as phenomena detached from human accountability.

These differences persist after controlling for disaster type and temporal trends, indicating that they are not artifacts of hazard composition or historical period. Rather, they reflect stable outlet-level orientations toward responsibility attribution.

In practical terms, *NYT* readers are more likely to encounter disaster narratives embedded within governance and policy frameworks implying accountability, while *WSJ* readers are more likely to encounter narratives emphasizing natural causation. RQ2 is therefore answered by demonstrating a consistent divergence in how the two outlets construct accountability in climate-related disaster coverage.

RQ3: Political Conflict Framing

RQ3 examines whether outlet identity predicts variation in political conflict framing in climate-disaster coverage. A binary logistic regression model was estimated with political conflict framing (present = 1) as the dependent variable and media outlet (*NYT* = 1, *WSJ* = 0) as the primary predictor. Disaster-type dummies (reference = drought) and mean-centered calendar year were included as controls. HC3 robust standard errors were applied.

H5 — Political Conflict Framing (WSJ > NYT)

H5 predicted that *WSJ* coverage would more frequently employ political conflict framing than *NYT* coverage. The logistic model indicates that this prediction is not supported and is reversed in direction.

Controlling for disaster type and year, *NYT* articles exhibit 1.73 times higher odds of including political conflict framing relative to *WSJ* articles (*OR* = 1.73, 95% *CI* [1.58, 1.90], $p < .001$; McFadden $R^2 = .03$). Because *OR* > 1 indicates higher *NYT* odds, the result directly contradicts the hypothesized direction (*WSJ* > *NYT*).

Descriptive prevalence aligns with the model. Political conflict framing appears in 36.11% of *NYT* articles compared to 24.98% of *WSJ* articles (difference = +11.13pp favoring NYT; $z = -12.10$ in the *WSJ*-directional test, $p = 1.00$; Cohen's $h = -.24$). The magnitude of the effect corresponds to a small-to-medium difference.

Although the McFadden R^2 value (.03) indicates modest explanatory power, the outlet coefficient remains statistically robust, confirming a systematic divergence independent of hazard composition and temporal distribution.

Disaster-Type Disaggregation

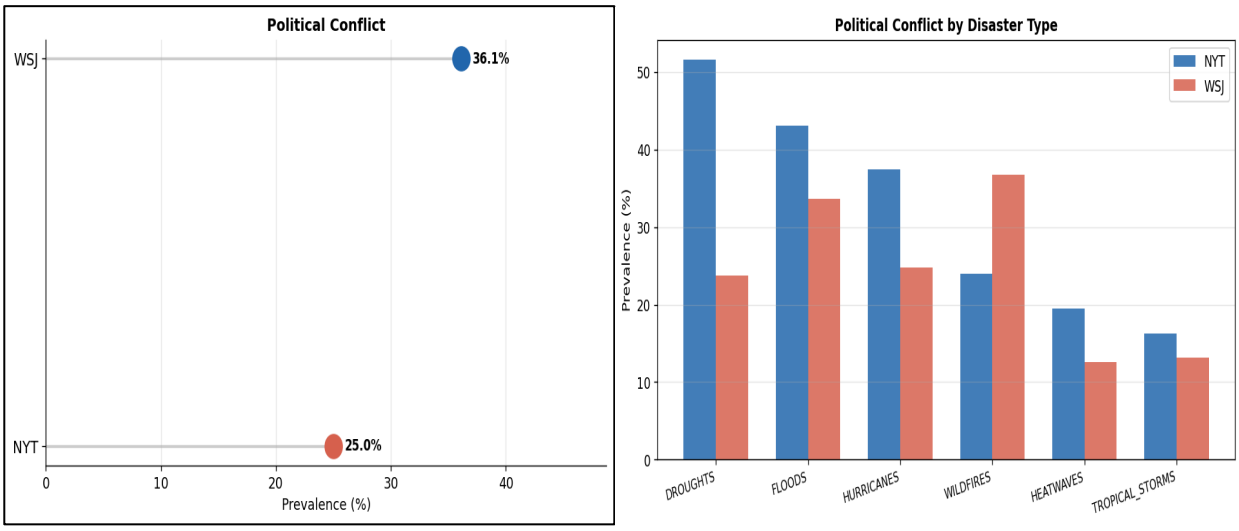
Disaggregated prevalence rates indicate that *NYT* political conflict framing exceeds *WSJ* framing across all six disaster categories. The largest disparity occurs in drought coverage (*NYT*: 51.2%; *WSJ*: 23.3%), but the directional pattern is consistent across hazard types. This uniformity suggests that the outlet effect is not driven by a specific event category but reflects a stable editorial orientation toward embedding disaster reporting within political or governance disputes.

Table 5. Logistic Regression Predicting Political Conflict Framing (RQ3).

Label	*OR*	95% *CI* Lo	95% *CI* Hi	*P*	McFadden R^2
Political Conflict	1.73	1.58	1.90	< .001	0.03

Note. *OR* > 1 = *NYT* higher odds. H5 predicted *OR* < 1 (*WSJ* > *NYT*); the result is in the opposite direction. Controls: disaster-type dummies + year_c. HC3 robust standard errors were used. *N* = 10,069.

Figure 3. Political Conflict Framing: *NYT* vs. *WSJ* (left) and Disaster-Type Breakdown (right).



Answering RQ3

The logistic model provides a clear and statistically stable answer to RQ3. Political conflict framing is a substantial feature of climate-disaster reporting in both media outlets, but it is significantly more prevalent in *NYT* coverage than in *WSJ* coverage. This divergence persists after controlling for disaster type and publication year, indicating that it reflects outlet-level framing orientation rather than compositional differences in hazard coverage.

The reversal of H5 refines the theoretical expectation underlying RQ3. Political conflict framing does not align with conservative editorial positioning; instead, it appears more closely associated with the extent to which disaster coverage is embedded within policy, governance, and institutional debates. In this respect, the *NYT* reporting more consistently integrates disasters into broader political discourse, whereas the *WSJ* coverage exhibits comparatively lower politicization within disaster narratives.

RQ3 is therefore answered by demonstrating that political conflict framing is common in elite U.S. media outlets' disaster coverage but is more strongly institutionalized in *NYT* reporting than in *WSJ* reporting.

RQ4: Impact Framing

RQ4 examined whether outlet identity predicts variation in impact framing across four dimensions: environmental, health, economic, and social consequences. For each outcome, binary logistic regression models were estimated with the media outlet (*NYT* = 1, *WSJ* = 0) as the primary predictor, controlling for disaster-type dummies (reference = drought) and mean-centered calendar year. HC3 robust standard errors were applied.

H6a: Environmental and Health Impact — NYT > WSJ

The logistic regression model indicates that media outlet identity is a strong predictor of environmental impact framing. Controlling for disaster type and year, *NYT* articles exhibit 1.89 times higher odds of including environmental impact framing relative to *WSJ* articles (*OR* = 1.89, 95% *CI* [1.72, 2.08], $p < .001$; McFadden $R^2 = .17$).

Descriptively, environmental impact framing appears in 68.60% of *NYT* articles compared to 54.30% of *WSJ* articles (difference = +14.30pp; $z = 14.75$, $p < .001$; Cohen's $h = .30$). The model confirms that this divergence persists independently of hazard composition and temporal variation.

A parallel model indicates that *NYT* coverage also assigns greater emphasis to public health consequences. *NYT* articles exhibit 1.92 times higher odds of including health impact framing relative to *WSJ* articles (*OR* = 1.92, 95% *CI* [1.75, 2.11], $p < .001$; McFadden $R^2 = .08$).

Descriptive prevalence is consistent with this result: health framing appears in 35.88% of *NYT* coverage compared to 24.92% of *WSJ* coverage (difference = +10.96pp; $z = 11.94$, $p < .001$; $h = .24$).

Together, these findings support H6a and indicate that *NYT* coverage more frequently foregrounds ecological degradation and public health consequences in disaster reporting.

H6b — Economic Impact (WSJ > NYT)

H6b predicted that *WSJ* coverage would emphasize economic impacts more frequently. The logistic regression does not support this prediction. Controlling for disaster type and year, the outlet coefficient is non-significant (*OR* = 0.81, 95% *CI* [0.61, 1.08], $p = .143$; McFadden $R^2 = .03$). Descriptively, economic impact framing is nearly universal in both outlets (*NYT*: 97.90%; *WSJ*: 98.12%), with a negligible difference (+0.22pp; $z = 0.79$; $h = .02$). The near-ceiling

prevalence of economic framing indicates that economic consequences constitute a baseline feature of disaster coverage rather than a distinguishing editorial emphasis. H6b is not supported.

Exploratory Analysis: Social Impact Framing

An exploratory model examined social impact framing. Media outlet identity emerges as a highly consequential predictor. *NYT* articles exhibit 9.27 times higher odds of including social impact framing relative to *WSJ* articles (*OR* = 9.27, 95% *CI* [8.26, 10.40], $p < .001$; McFadden $R^2 = .22$).

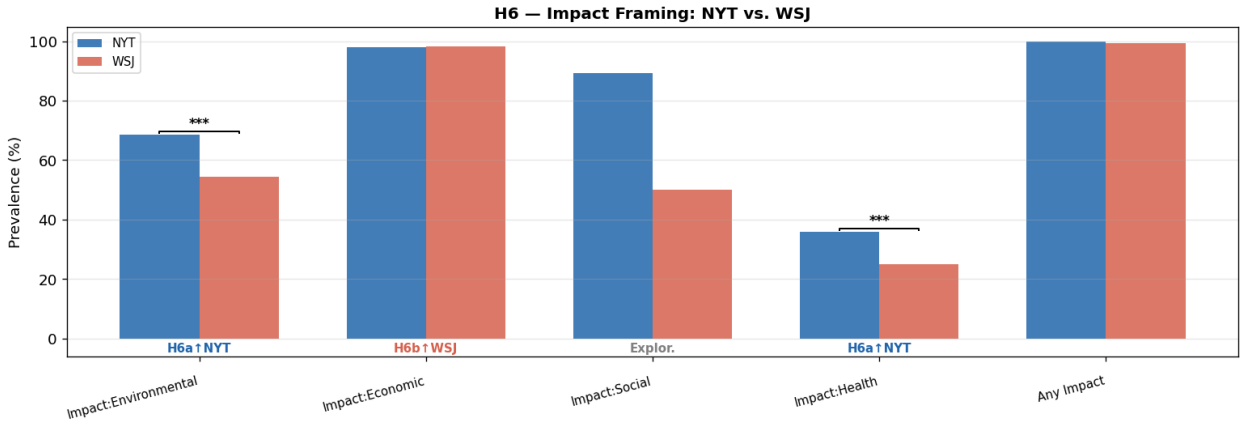
Descriptively, social impact framing appears in 89.31% of *NYT* articles compared to 50.04% of *WSJ* articles (difference = +39.27pp; $z = 43.07$, $p < .001$; $h = .90$), representing a very large effect size. This is the largest outlet-level divergence observed within the impact framing cluster and indicates a systematic difference in the degree to which disaster coverage incorporates community-level and distributive consequences.

Table 6. **Logistic Regression Predicting Impact Framing (RQ4).**

Label	*OR*	95% *CI* Lo	95% *CI* Hi	*P*	McFadden R^2
Impact: Environmental	1.89	1.72	2.08	< .001	0.17
Impact: Health	1.92	1.75	2.11	< .001	0.08
Impact: Economic	0.81	0.61	1.08	.143	0.03
Impact: Social (exploratory)	9.27	8.26	10.40	< .001	0.22
Any Impact	4.29	1.67	11.04	.003	0.08

Note. *OR* > 1 = NYT higher odds; *OR* < 1 = WSJ higher odds. H6b predicted *OR* < 1 for Economic; result is non-significant. Controls: disaster-type dummies + year_c. HC3 robust standard errors were used. $N = 10{,}069$. $p < .01$; $p < .001$.

Figure 4. Impact Framing by Sub-Type: *NYT* vs. *WSJ*



Answering RQ4

The logistic models provide a differentiated answer to RQ4. Impact framing is pervasive across both outlets, but the type of impact emphasized differs systematically.

NYT coverage is significantly more likely to foreground environmental degradation, public health consequences, and, most prominently, social and community-level effects. *WSJ* coverage does not exhibit a distinctive emphasis on economic impacts, as such framing is nearly universal in both outlets.

Thus, the divergence in impact framing concerns salience rather than presence. Economic consequences function as a shared baseline across outlets, whereas environmental and social consequences constitute the primary axes of differentiation. RQ4 is therefore answered by demonstrating that outlet identity significantly shapes which dimensions of disaster impact are made most visible to audiences.

RQ5: Scientific Uncertainty Framing

RQ5 examines whether media outlet identity predicts variation in scientific uncertainty framing in climate-disaster coverage. A binary logistic regression model was estimated with scientific uncertainty (present = 1) as the dependent variable and outlet (*NYT* = 1, *WSJ* = 0) as

the primary predictor. Disaster-type dummies (reference = drought) and mean-centered calendar year were included as controls. HC3 robust standard errors were applied.

H7 — Scientific Uncertainty Framing (WSJ > NYT)

H7 predicted that *WSJ* coverage would employ scientific uncertainty framing more frequently than *NYT* coverage. The logistic regression model does not support this prediction. Controlling for disaster type and year, the outlet coefficient is statistically non-significant and substantively null (*OR* = 1.01, 95% *CI* [0.92, 1.11], $p = .842$; McFadden $R^2 = .04$). The odds ratio approximates unity, indicating no meaningful difference between outlets once compositional and temporal factors are accounted for. Because H7 predicted OR < 1 (*WSJ* > *NYT*), the observed *OR* ≈ 1.00 directly contradicts the hypothesized direction and fails to reach statistical significance.

Bivariate Comparison

At the descriptive level, scientific uncertainty framing appears in 23.28% of *WSJ* articles and 24.96% of *NYT* articles (difference = 1.68pp in the hypothesized direction; $z = 1.97$, $p = .024$, one-tailed; Cohen's $h = .04$). Although statistically significant under a directional *z*-test, the effect size is substantively negligible ($h < .10$).

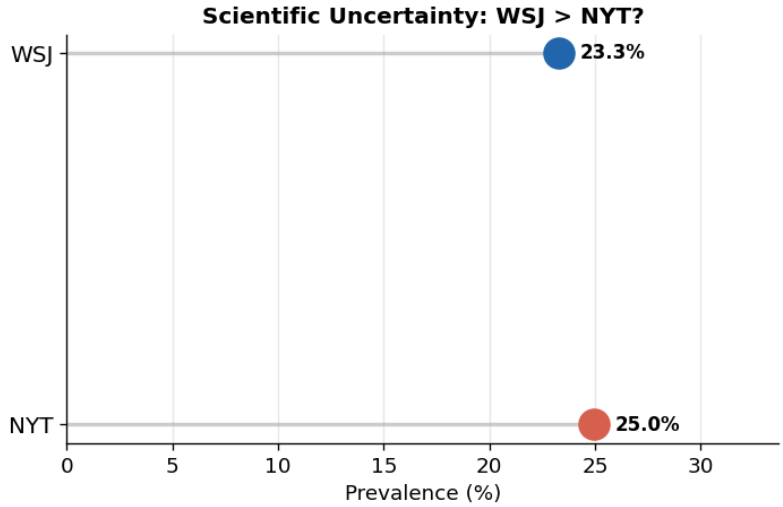
The disappearance of the effect in the multivariate model indicates that the small raw difference is attributable to differences in disaster-type composition rather than to a systematic editorial orientation toward uncertainty.

Table 7. Logistic Regression Predicting Scientific Uncertainty Framing (RQ5).

Label	OR	95% CI Lo	95% CI Hi	P	Sig.	McFadden R^2
Scientific Uncertainty	1.01	0.92	1.11	.842	n.s.	0.04

Note. H7 predicted *OR* < 1 (*WSJ* > *NYT*); the result is *OR* ≈ 1.00, non-significant. Controls: disaster-type dummies + year_c. HC3 robust standard errors were used. $N = 10{,}069$.

Figure 5: Scientific Uncertainty Framing: *WSJ* vs. *NYT*



Answering RQ5

The logistic model provides a clear answer to RQ5. Scientific uncertainty framing appears in approximately one-quarter of climate-disaster articles in both outlets, and outlet identity does not significantly predict its use after controlling for disaster type and year.

This null result is theoretically informative. It indicates that outlet divergence in climate-disaster coverage does not manifest through differential invocation of scientific uncertainty. Instead, as demonstrated in RQ1 and RQ2, divergence is expressed primarily through causal attribution and responsibility framing. Scientific uncertainty appears to function as a routine epistemic feature of disaster reporting rather than as an outlet-specific ideological marker.

RQ5 is therefore answered in the negative: the *NYT* and *WSJ* do not systematically differ in their use of scientific uncertainty framing.

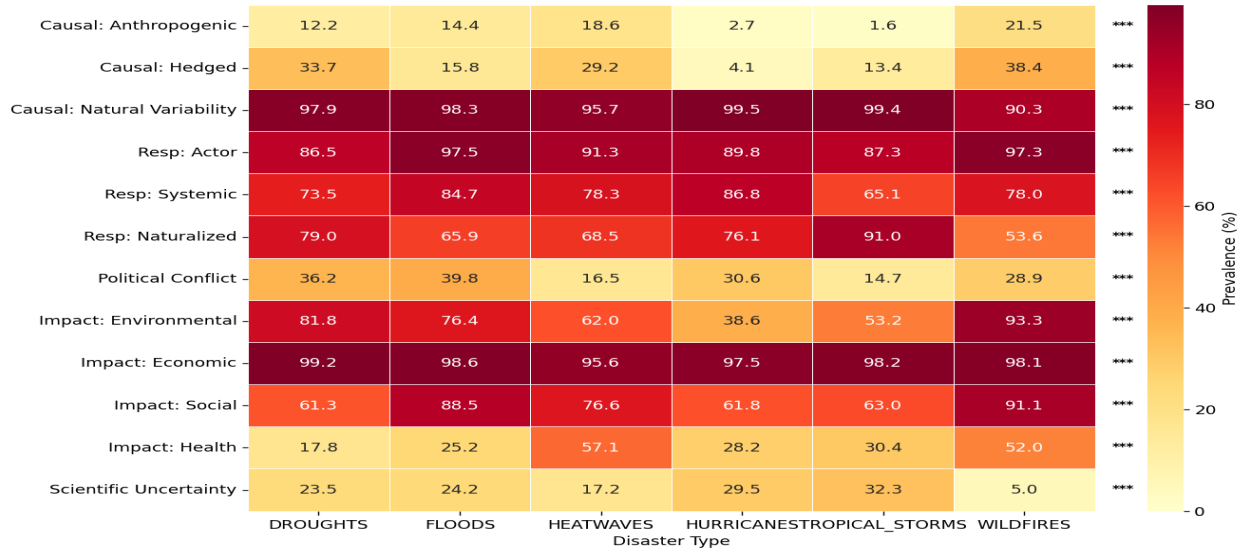
RQ6: Framing Variation by Disaster Type

RQ6 examines whether framing patterns vary systematically across disaster types and whether theoretically motivated contrasts (H8a–H8e) are supported. To address this question, binary logistic regression models were estimated for each framing dimension, with disaster type

as the primary predictor. Models included outlet and mean-centered calendar year as covariates. HC3 robust standard errors were applied.

An omnibus test of the disaster-type block confirms that hazard category significantly predicts variation across all twelve framing dimensions (all $p < .001$), establishing disaster type as a structural determinant of framing patterns.

Figure 6. Framing Prevalence (%) by Disaster Type



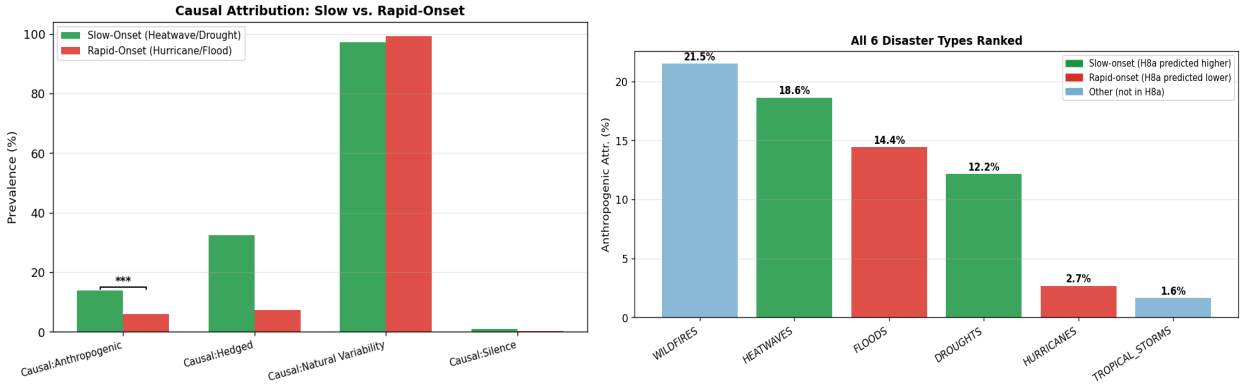
H8a: Causal Attribution and Disaster Onset Speed

H8a predicted that slow-onset hazards (heatwave, drought) would exhibit higher anthropogenic attribution than rapid-onset hazards (hurricane, flood). The logistic model confirms that disaster type significantly predicts anthropogenic attribution (hazard-type block $p < .001$; McFadden $R^2 = .10$). Grouped contrasts indicate that slow-onset disasters have significantly higher odds of anthropogenic attribution relative to rapid-onset disasters. Descriptively, anthropogenic attribution appears in 13.82% of slow-onset articles compared to 5.94% of rapid-onset articles (difference = +7.88pp; $z = 11.89$, $p < .001$; Cohen's $h = .27$).

Across all six disaster categories, attribution prevalence ranks as follows: wildfire (21.5%) > heatwave (18.6%) > flood (14.4%) > drought (12.2%) > hurricane (2.7%) > tropical storm (1.6%). Bonferroni-corrected post-hoc comparisons confirm that hurricane and tropical storm attribution rates are significantly lower than all other categories (all corrected $p < .001$).

Exploratory modeling of hedged attribution reveals an even stronger pattern: 32.55% in slow-onset versus 7.33% in rapid-onset coverage ($z = 29.34$, $p < .001$; $h = .67$), indicating that probabilistic climate linkage is especially sensitive to hazard temporality. H8a is supported.

Figure 7. Anthropogenic Causal Attribution: Slow vs. Rapid-Onset Disasters and Full Category Ranking.



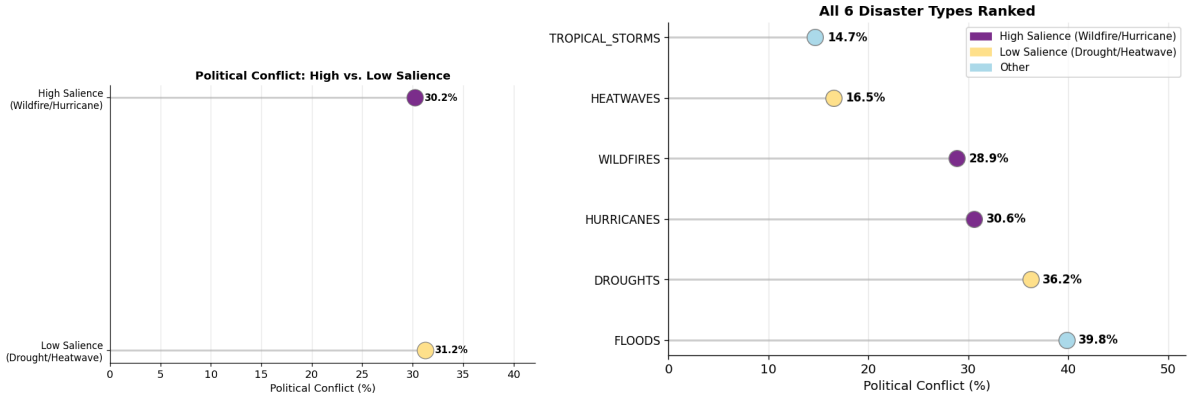
H8b: Political Conflict and News Salience

H8b predicted that high-salience disasters (wildfires, hurricanes) would exhibit higher political conflict framing than low-salience disasters (droughts, heatwave). The logistic model indicates that hazard type predicts political conflict overall (block $p < .001$), but the grouped high- versus low-salience contrast is not significant. Descriptively, political conflict appears in 30.2% of high-salience disasters and 31.2% of low-salience disasters (difference = −1.03pp; $z = -0.93$; $h = -.02$).

Across categories, political conflict is highest for floods (39.8%) and droughts (36.2%), rather than wildfires (28.9%) or hurricanes (30.6%). The pattern suggests that political conflict

framing is driven more by governance entanglement than by media visibility or spectacle. H8b is not supported.

Figure 8. Political Conflict Framing: High vs. Low Salience, with Full Category Ranking.

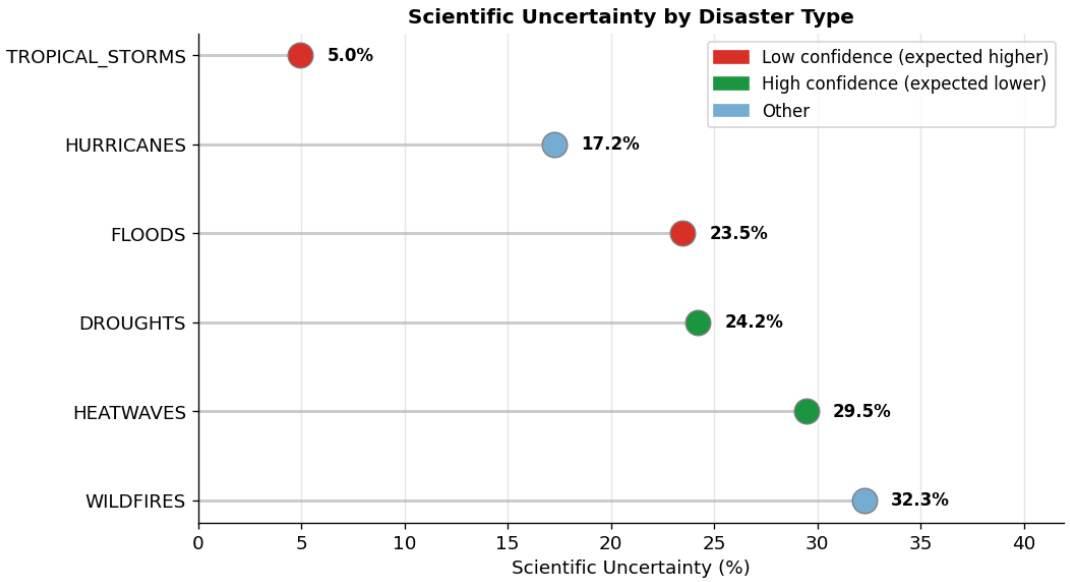


H8c: Scientific Uncertainty by Attribution Confidence

H8c predicted that hazards with lower attribution confidence (floods, tropical storms) would exhibit higher scientific uncertainty framing than hazards with clearer anthropogenic signals (heatwaves, droughts). The logistic hazard-type block is significant ($p < .001$), indicating that uncertainty framing varies by disaster category. However, the distribution does not align with the hypothesized confidence grouping. Uncertainty framing prevalence: Wildfires (32.3%) > Heatwaves (29.5%) > Hurricanes (17.2%) > Tropical Storms (5.0%).

Although the omnibus contrast is significant ($z = 4.11$, $p < .001$), the pattern does not map cleanly onto the attribution-confidence framework. Elevated uncertainty in early heatwave coverage likely reflects the historical development of extreme-event attribution science during earlier study years. H8c receives partial support at the omnibus level but not in the predicted directional structure.

Figure 9. Scientific Uncertainty Framing by Disaster Type.



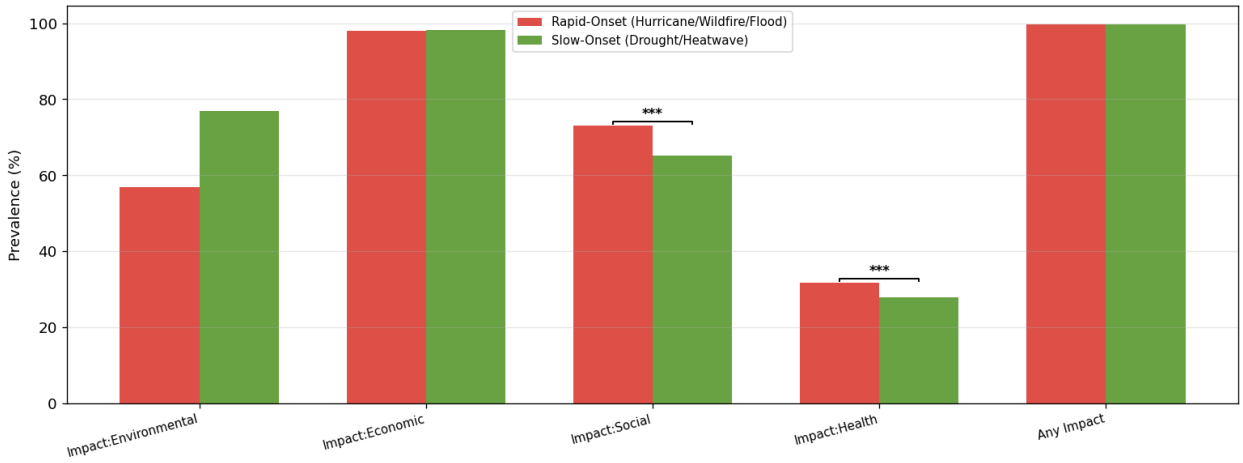
H8d: Impact Framing and Disaster Onset

H8d predicted that rapid-onset disasters would exhibit higher impact framing. The logistic models indicate domain-specific patterns:

- Social impact: higher in rapid-onset disasters (73.04% vs. 65.21%; $z = 7.44$, $p < .001$; $h = .17$).
- Health impact: higher in rapid-onset disasters (31.65% vs. 27.79%; $z = 3.62$, $p < .001$; $h = .08$).
- Environmental impact: significantly reversed, higher in slow-onset disasters (76.78% vs. 56.82%; difference = −19.96pp; $z = -17.79$; $h = -.43$).
- Economic impact: near-universal (~98%) with no meaningful variation.

Thus, impact framing responds to different dimensions of disaster temporality. Rapid-onset events foreground immediate human consequences, whereas slow-onset events generate ecological degradation narratives. H8d is partially supported, with a substantive reversal for environmental impact.

Figure 10. Impact Framing: Rapid vs. Slow-Onset Disasters



H8e: Responsibility Attribution and Governance Context

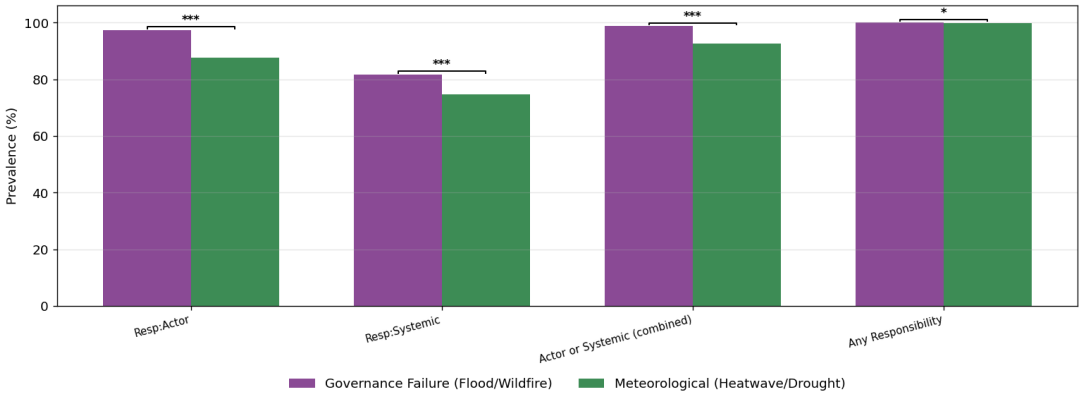
H8e predicted that governance-failure disasters (e.g. floods, wildfires) would exhibit higher actor and systemic responsibility than meteorologically driven disasters (e.g. heatwaves, droughts).

The logistic models strongly support this prediction (hazard-type block $p < .001$).

- Actor responsibility: 97.44% (governance) vs. 87.73% (meteorological); $z = 13.56$; $h = .39$.
- Systemic responsibility: 81.78% vs. 74.69%; $z = 6.25$; $h = .17$.
- Actor or systemic combined: 98.81% vs. 92.53%; $z = 11.31$; $h = .34$.

Although “any responsibility” reaches statistical significance, ceiling effects limit substantive interpretation. H8e is supported, with governance embeddedness emerging as a strong structural predictor of responsibility attribution.

Figure 11. Responsibility Attribution: Governance Failure vs. Meteorological Disasters.



Answering RQ6

The logistic models establish that disaster type functions as a systematic moderator of framing patterns across all 12 dimensions. However, the mechanisms underlying this variation are domain-specific rather than uniform.

Three structured patterns emerge:

- Causal attribution responds to climate-attribution plausibility and hazard temporality. Slow-onset disasters and wildfires are significantly more likely to be embedded within anthropogenic causal narratives.
- Responsibility attribution responds to governance embeddedness. Disasters linked to identifiable regulatory or institutional systems elicit substantially higher actor and systemic responsibility framing.
- Impact framing responds to temporal and ecological profiles. Rapid-onset events foreground immediate social and health consequences, whereas slow-onset events foreground environmental degradation.

Political conflict and scientific uncertainty do vary across hazards, but not in accordance with simple salience or attribution-confidence heuristics.

RQ6 is therefore answered by demonstrating that disaster type operates as a meaningful structural moderator of framing logic in climate-disaster reporting. Hazard category does not merely describe events; it shapes which causal, responsibility, and impact narratives are activated within coverage.

RQ7: Temporal Trends in Framing

RQ7 examined whether key framing dimensions evolve systematically over time between 2000 and 2024. To test temporal change, binary logistic regression models were estimated with mean-centered calendar year (year_c) as the focal predictor. All models control for outlet and disaster-type dummies. HC3 robust standard errors were applied. Pearson correlations between annual prevalence and year are reported as descriptive supplements.

Figure 12: Temporal Trends in Causal Anthropogenic Attribution (H9), Political Conflict (H10), and Scientific Uncertainty (H11), 2000–2024.

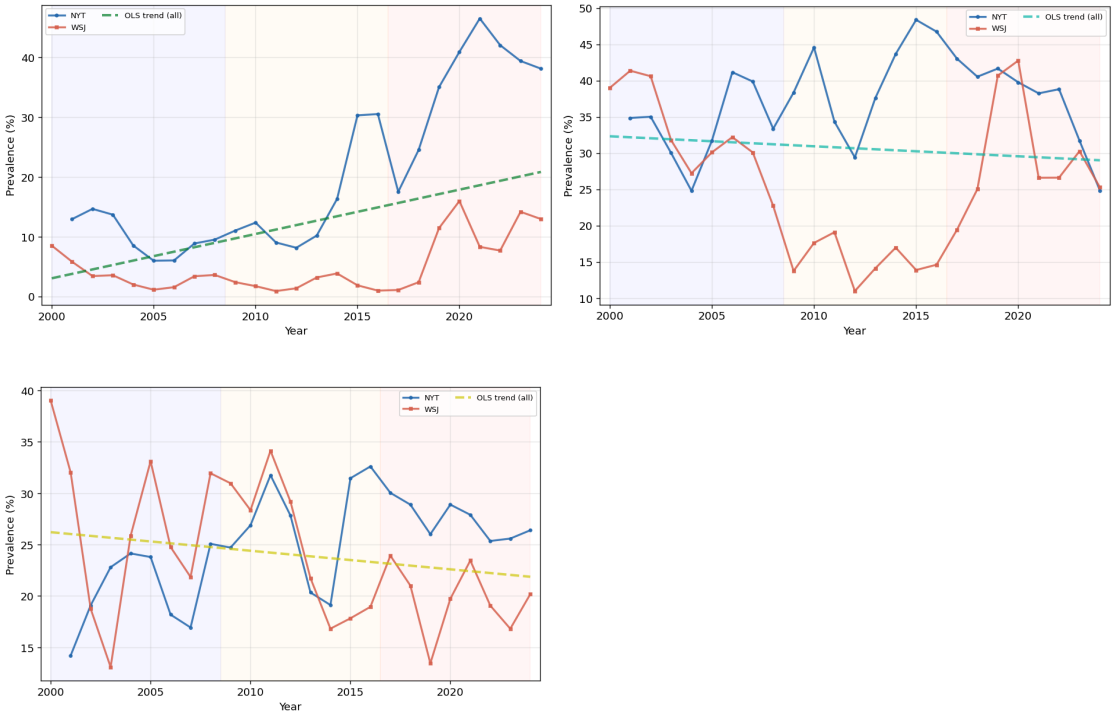
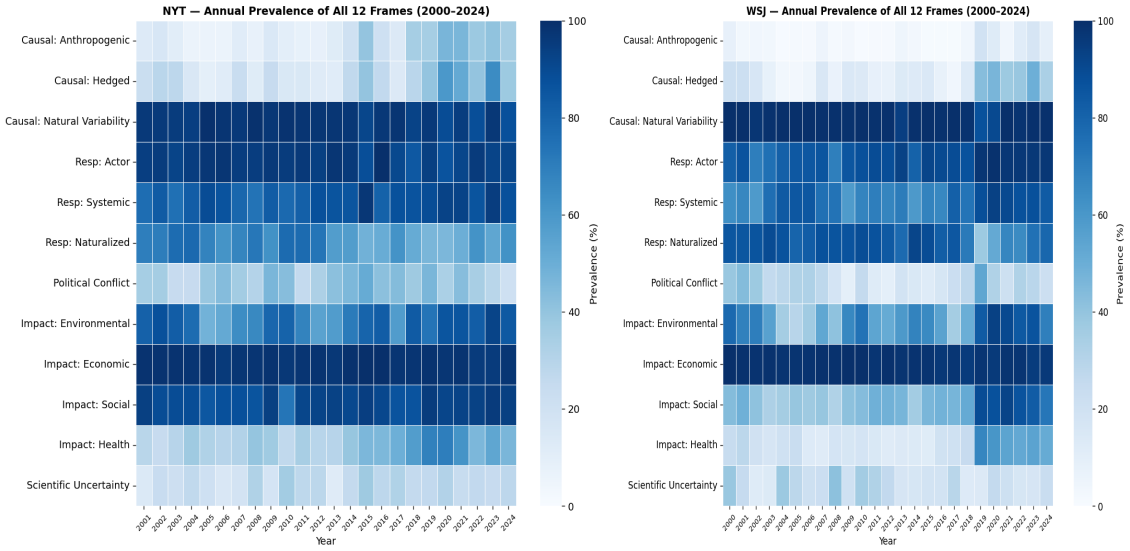


Figure 13. Full Temporal Profile: Annual Prevalence of All 12 Framing Dimensions, *NYT* vs. *WSJ*.



H9: Anthropogenic Attribution Will Increase Over Time

H9 predicted a positive temporal trend in anthropogenic causal attribution. The logistic year-trend model strongly supports this prediction. In the combined sample, each additional year is associated with a 9.7% increase in the odds of anthropogenic attribution (*OR*/year = 1.097, $p < .001$; McFadden $R^2 = .19$). In the *NYT*-only model, the annual increase is 10.4% (*OR*/year = 1.104, $p < .001$). The *WSJ* exhibits a smaller but positive slope. Pearson correlations corroborate the model-based result: Combined corpus: $r = +.65$ ($p < .001$). *NYT*: $r = +.81$ ($p < .001$). *WSJ*: $r = +.50$ ($p = .006$)

Time-series inspection indicates relatively low and stable attribution from 2000–2012, followed by a sustained rise beginning in the mid-2010s. *NYT* anthropogenic attribution exceeds 40% in the early 2020s, whereas WSJ attribution rose more modestly to approximately 13% by 2024.

The pattern is consistent with major scientific and policy milestones, including IPCC AR5 (2013–2014), the Paris Agreement (2015), and the institutionalization of event attribution science. H9 is strongly supported.

H10: Scientific Uncertainty Will Decline Over Time

H10 predicted a negative temporal trend in scientific uncertainty framing. The logistic model does not support this prediction. In the combined corpus, the per-year odds ratio is slightly above unity (*OR*/year = 1.010, $p = .024$), indicating a marginal upward rather than downward trend. The *NYT*-only model shows a more pronounced positive slope (*OR*/year = 1.034, $p < .001$), while the *WSJ* slope is non-significant.

Pearson correlations align with this result: Combined corpus: $r = -.20$ (*n.s.* for predicted negative direction). *NYT*: $r = +.40$ ($p = .027$, one-tailed for positive direction). *WSJ*: $r = -.35$ (*n.s.*)

Visual inspection reveals substantial year-to-year volatility without a consistent secular decline.

Thus, scientific uncertainty framing does not diminish alongside growing scientific consensus. Instead, uncertainty references appear episodic and, in the case of the *NYT*, modestly increasing over time. H10 is not supported.

H11: Political Conflict Will Increase Over Time

H11 predicted a positive temporal trend in political conflict framing. The combined logistic model, however, does not support this prediction (*OR*/year = 1.002, *n.s.*). The *NYT*-only

model shows a modest positive slope (*OR*/year = 1.016, $p < .001$), whereas the *WSJ* model remains non-significant.

Pearson correlations further indicate the absence of a consistent upward trajectory: Combined corpus: $r = -.14$ (*n.s.*); NYT: $r = +.08$ (*n.s.*); WSJ: $r = -.19$ (*n.s.*).

The annual series exhibits fluctuation rather than monotonic increase. Political conflict framing appears event-contingent, with spikes corresponding to legislative and electoral cycles rather than a sustained upward trend. H11 is not supported at the combined corpus level.

Table 8. Temporal Trend Results for Framing Variables (H9–H11).

H	Label	*r* (*NYT*)	*r* (*WSJ*)	*r* (Both)	*OR*/yr (Both)	*OR*/yr (*NYT*)	Verdict
H9	Causal: Anthropogenic	+.81***	+.50**	+.65***	1.097***	1.104***	Supported
H10	Sci. Uncertainty (decline pred.)	+.40*	−.35	−.20	1.010*	1.034***	Not Supported
H11	Political Conflict (rise pred.)	+.08	−.19	−.14	1.002	1.016***	Not Supported

Note. r = Pearson correlation (annual framing prevalence vs. calendar year); *OR*/yr = per-year odds ratio from logistic regression controlling for outlet and disaster-type dummies (HC3 robust SE). H10 predicted a negative trend (decline); H11 predicted a positive trend (increase). For H10, the *NYT* showed a significant positive trend (r = +.40*), opposite to the predicted decline; *WSJ* (r = –.35) and Both (r = –.20) were non-significant negative trends. For H11, all correlations were non-significant (*NYT*: r = +.08; *WSJ*: r = –.19; Both: r = –.14), though the *NYT*-only odds ratio was significant (OR/yr = 1.016***). * $p < .05$; ** $p < .01$; *** $p < .001$ (one-tailed in predicted direction).

Answering RQ7

The year-trend logistic models provide a differentiated answer to RQ7. Only anthropogenic attribution exhibits a clear, sustained, and statistically robust upward trajectory between 2000 and 2024. Both newspapers increasingly incorporate anthropogenic causal framing, though the magnitude and acceleration are substantially greater in the *NYT*. In contrast,

scientific uncertainty framing does not decline over time, and political conflict framing does not increase monotonically. Both dimensions fluctuate without stable directional change.

Thus, temporal evolution in climate-disaster reporting is domain-specific. The most consequential transformation is the steady expansion of anthropogenic causal attribution. Political and epistemic framing dimensions remain comparatively stable and event-contingent. The primary historical shift in disaster coverage during this period is the normalization of anthropogenic causal attribution, particularly within *NYT* reporting.

Outlet Divergence and Hazard-Specific Spread (RQ8, H12–H13)

RQ8 asked how outlet ideology, disaster type, and historical period jointly shape framing patterns. Addressing this interactive question requires moving beyond main effects to estimate interaction structures. Logistic regression models were specified including media outlet, disaster type, historical period, and their interaction terms. All models control for mean-centered year where appropriate and use HC3 robust standard errors.

Three historical periods were examined: 2000–2008 (Bush administration), 2009–2016 (Obama administration), and 2017–2024 (Trump and Biden administrations). Three-way interaction heatmaps further decompose the outlet × disaster × period interaction structure.

H12: Widening Outlet Divergence Over Time

H12a — Anthropogenic Attribution Gap

H12a predicted that the *NYT–WSJ* divergence in anthropogenic attribution would widen across historical periods. The interaction model confirms that outlet divergence intensified across periods, though not in a linear fashion. The media outlet × period interaction indicates that the magnitude of the *NYT* coefficient is substantially larger in Period 3 relative to Period 1.

Descriptive period-specific gaps illustrate the magnitude of this change:

- Period 1: +7.0pp (*NYT* 9.6% vs. *WSJ* 2.6%)
- Period 2: +9.9pp (*NYT* 11.8% vs. *WSJ* 1.9%)
- Period 3: +27.3pp (*NYT* 36.2% vs. *WSJ* 8.9%)

The nearly fourfold expansion from Period 1 to Period 3 indicates substantial divergence. A restricted analysis focusing only on wildfire and hurricane-related articles yielded the same directional pattern (+3.9pp → +7.4pp → +20.1pp), confirming that divergence is not attributable to changing hazard composition.

However, the continuous media outlet × year interaction term is non-significant (OR = 0.996, p = .74), indicating that divergence does not follow a steady incremental trajectory. Rather, the pattern is consistent with a stepwise intensification concentrated in the post-2015 period. H12a is supported.

H12b: Political Conflict Gap

H12 also predicted widening divergence in political conflict framing in the direction *WSJ* > *NYT*. The interaction models do not support this prediction. Across all periods, the *NYT* maintained higher levels of political conflict framing.

Period-specific gaps:

- Period 1: *NYT* +4.6pp
- Period 2: *NYT* +22.7pp
- Period 3: *NYT* +8.0pp

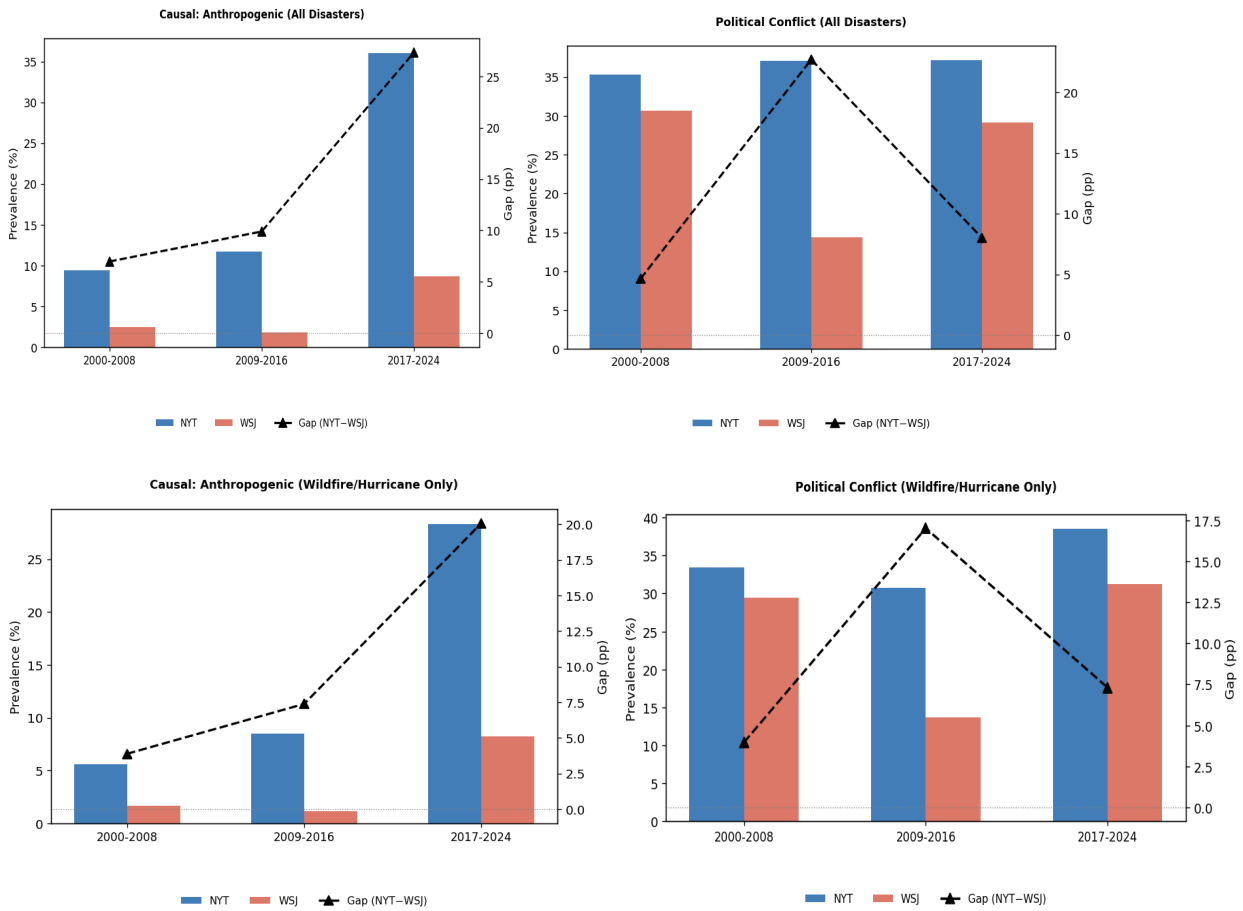
The largest divergence occurred during Period 2, driven primarily by a decline in *WSJ* political conflict framing. Although the outlet × year interaction coefficient reaches statistical significance (OR = 1.020, p = .004), the effect size is modest and does not reverse the structural direction of the gap. H12b is not supported.

Table 9. Period-by-Period Outlet Divergence Between *The New York Times* and *The Wall Street Journal*.

Label	Sample	Period	*NYT* %	*WSJ* %	Gap	*z*
Causal: Anthropogenic	All	2000–2008	9.6%	2.6%	+7.0pp	9.54***
Causal: Anthropogenic	All	2009–2016	11.8%	1.9%	+9.9pp	10.98***
Causal: Anthropogenic	All	2017–2024	36.2%	8.9%	+27.3pp	15.96***
Causal: Anthropogenic	WF/Hurr	2000–2008	5.6%	1.7%	+3.9pp	5.32***
Causal: Anthropogenic	WF/Hurr	2009–2016	8.5%	1.1%	+7.4pp	5.66***
Causal: Anthropogenic	WF/Hurr	2017–2024	28.8%	8.7%	+20.1pp	9.46***
Political Conflict	All	2000–2008	33.4%	30.6%	−4.6pp	−3.35***
Political Conflict	All	2009–2016	35.5%	14.8%	−22.7pp	−14.40***
Political Conflict	All	2017–2024	35.9%	28.9%	−8.0pp	−3.96***

Note. Gap = *NYT* % minus *WSJ* % (positive values indicate *NYT* higher; negative values indicate *WSJ* predicted direction for Political Conflict was *WSJ* > *NYT*, so negative gap is hypothesized). WF/Hurr = restricted to Wildfire and Hurricane articles only. *** $p < .001$ (one-tailed in each respective hypothesized direction).

Figure 14. Outlet Divergence Across Three Periods: Anthropogenic Attribution and Political Conflict (All Disasters and Wildfire/Hurricane Only).



H13: Widening Hazard-Specific Framing Spread

H13 predicted that cross-hazard framing variance would increase across periods. To assess this, logistic models were estimated with disaster type interacted with period, and cross-hazard dispersion was examined via standard deviation and range of predicted probabilities.

Anthropogenic Attribution

Cross-hazard standard deviation:

- Period 1: 5.45pp
- Period 2: 4.15pp
- Period 3: 13.79pp

Range expands from 13.9pp (P1) to 38.6pp (P3).

The expansion is driven by sharp increases in heatwave and wildfire attribution during Period 3, while hurricane and tropical storm attribution remain comparatively low.

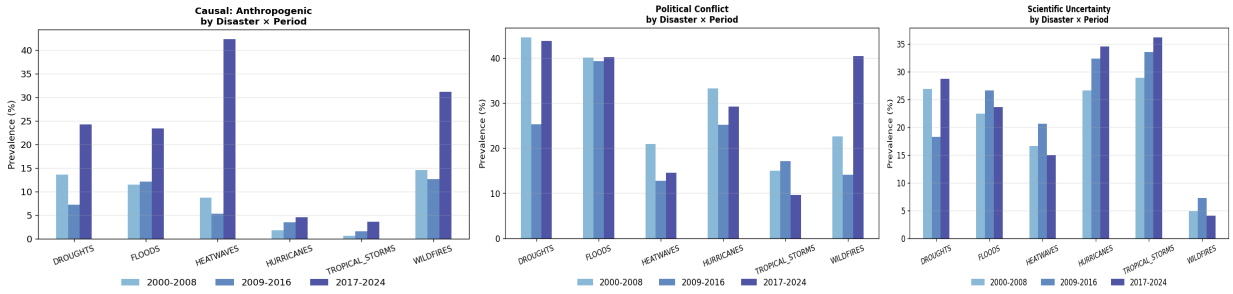
Political Conflict

Cross-hazard standard deviation increases from 10.68pp (P1) to 13.26pp (P3), with wildfires emerging as particularly politicized in Period 3.

Scientific Uncertainty

Standard deviation increases from 8.28pp (P1) to 11.25pp (P3), reflecting increasing tropical storm uncertainty and relative stability in wildfire uncertainty. Across dimensions, disaster type becomes a stronger moderator of framing outcomes over time. H13 is supported.

Figure 15. Hazard-Specific Framing Spread Across Three Periods.



Three-Way Interaction: Outlet × Disaster × Period

The full interaction models (outlet × disaster × period) clarify the multiplicative structure of divergence.

Anthropogenic Attribution

The most pronounced pattern is asymmetric post-2016 acceleration in *NYT* coverage:

- Heatwaves (Period 3): *NYT* 61.7% vs. *WSJ* 19.4%
- Wildfires (Period 3): *NYT* 50.8% vs. *WSJ* 18.9%

- Droughts (Period 3): *NYT* 50.6% vs. *WSJ* 10.2%

The widening aggregate outlet gap is distributed across multiple hazard categories, rather than confined to a single disaster type.

Political Conflict

The *WSJ* exhibited a non-linear trajectory: relatively high in Period 1, decline in Period 2, partial recovery in Period 3. The *NYT*, however, maintained greater stability across periods. This suggests that the *WSJ* political conflict framing is more responsive to partisan political cycles, whereas the *NYT* framing reflects more consistent embedding within governance discourse.

Figure 16. Outlet × Disaster × Period Interaction: Causal Anthropogenic Attribution (*NYT* vs. *WSJ*, 2000–2024).

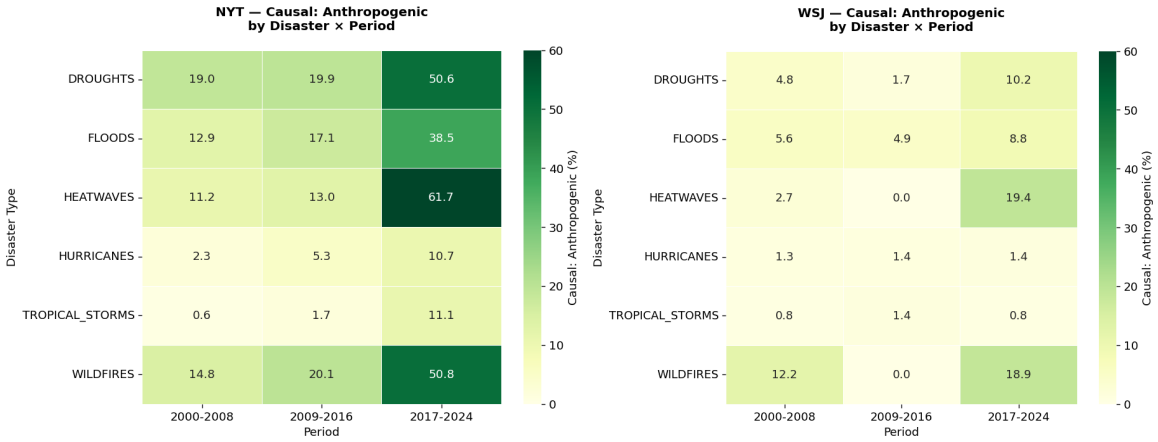
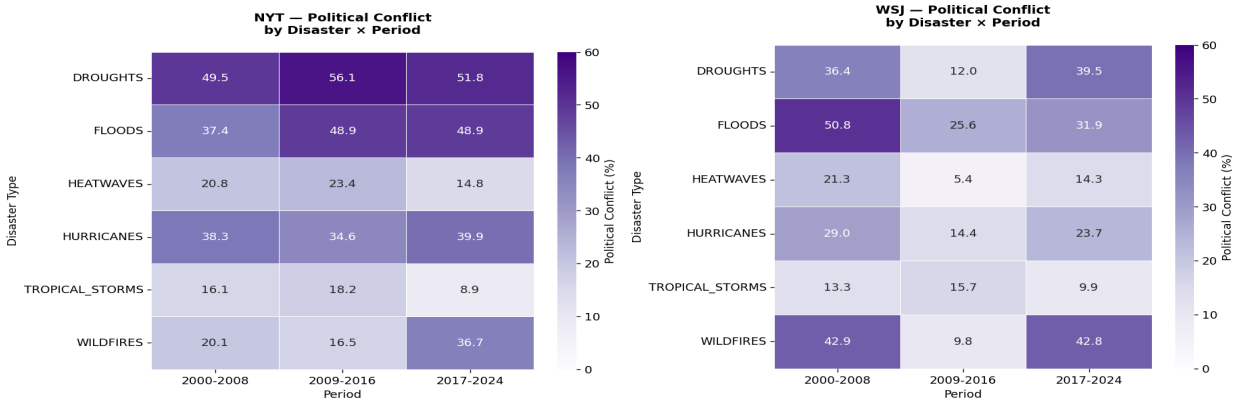


Figure 17. Outlet × Disaster × Period Interaction: Political Conflict Framing (*NYT* vs. *WSJ*, 2000–2024).



Answering RQ8

The interaction models provide a structured answer to RQ8. First, outlet divergence intensified over time for anthropogenic attribution, particularly after 2015. Ideological differentiation in causal framing has expanded rather than stabilized. Second, hazard-specific differentiation has increased. Disaster type exerts a stronger moderating influence in Period 3 than in earlier periods. Third, the highest levels of anthropogenic attribution occurred at the intersection of the *NYT* outlet, climate-visible hazards (heatwaves, wildfires), and the post-2015 period. The *WSJ* followed the same structural pattern but at consistently lower levels.

Thus, framing outcomes are shaped multiplicatively rather than additively. Outlet orientation establishes baseline tendencies; disaster type conditions susceptibility to particular frames; and historical period amplifies or attenuates these effects. Over the 25-year span examined, these interactive dynamics have intensified, producing widening ideological divergence and greater hazard-specific specialization in climate-disaster reporting.

Robustness Checks

To evaluate the stability and validity of the reported findings, three robustness checks were conducted: (1) replication using the manually coded subset, (2) exclusion of lower-performing automated labels, and (3) assessment of classification threshold sensitivity. Together, these checks assessed whether the primary outlet effects are artifacts of automated classification performance, modeling specification, or threshold selection.

Check 1: Manual-Coded Subset Replication (N = 604)

To assess whether automated RoBERTa classifications reproduce human-coded outlet comparisons, the core logistic regression models were re-estimated using the 604 manually annotated articles with gold-standard labels.

Across eight focal framing dimensions, the direction of the outlet odds ratio (*NYT* relative to *WSJ*) was consistent with the full-corpus automated results for seven dimensions. Importantly, five of these seven directionally consistent dimensions retained statistical significance despite the substantial reduction in sample size and corresponding loss of statistical power.

Beyond directional consistency, effect magnitudes remained comparable across automated and manual models. For all theoretically central dimensions, Anthropogenic Attribution, Actor Responsibility, Naturalized Responsibility, Environmental Impact, and Health Impact, the 95% confidence intervals overlapped across automated and manual estimates. No core hypothesis shifted from statistically significant to not under manual coding. Where significance was attenuated (e.g., Political Conflict), the direction and approximate magnitude of the effect remained stable, indicating power sensitivity rather than structural instability.

The sole directional inconsistency occurred for Scientific Uncertainty (manual OR = 0.88 vs. automated OR = 1.01). The manual estimate trends in the direction predicted by H7 (WSJ > NYT), whereas the automated estimate approximates unity. Neither estimate reaches statistical significance, but this discrepancy warrants cautious interpretation. Given the relatively low classifier performance on this dimension (F1 = .62) and the divergence between manual and automated estimates, the null result for H7 should be interpreted as inconclusive rather than definitive. Accordingly, this study does not provide strong evidence of an outlet difference in scientific uncertainty framing, but it also cannot establish equivalence between the two outlets.

Overall, the manual replication demonstrates that the automated classification pipeline reproduced human-coded outlet effects with strong directional and substantive stability. The central theoretical contrasts are robust to measurement source.

Table 10. Robustness Check 1: Comparison of Automated and Manual-Coded Outlet Odds Ratios.

Label	*OR* (Full; *N*=10,069)	*OR* (Manual; *N*=604)	Directionally Consistent
Causal: Anthropogenic	5.50***	4.07***	Yes
Causal: Natural Variability	0.36***	0.39	Yes
Resp: Actor	2.43***	2.06*	Yes
Resp: Naturalized	0.47***	0.66*	Yes
Political Conflict	1.73***	1.33	Yes
Impact: Environmental	1.89***	1.96***	Yes
Impact: Health	1.92***	1.95***	Yes
Scientific Uncertainty	1.01 (95% CI [0.92, 1.11], p = .84)	0.88	No

Note. All models control for disaster-type dummies and year_c. HC3 robust SE. OR = outlet odds ratio (*NYT* relative to *WSJ*). For the Manual column (N=604), ORs without asterisks indicate p > .05 (e.g., Causal: Natural Variability OR = 0.39, n.s.; Political Conflict OR = 1.33, n.s.; Scientific Uncertainty OR = 0.88, n.s.). * $p < .05$; *** $p < .001$; *n.s.* = not significant.

Check 2: Exclusion of Lower-Performing Labels

A sensitivity analysis excluding the two lowest-performing automated labels (Causal: Hedged, *F1* = .64; Scientific Uncertainty, *F1* = .62) was conducted to evaluate whether classification performance variability influenced the primary conclusions.

Re-estimating the outlet models without these dimensions produced no change in the direction or statistical significance of any remaining hypothesis tests. Odds ratios and confidence intervals for all central framing dimensions remained substantively identical. This confirmed that lower-performing labels do not drive or distort the reported outlet effects.

Check 3: Classification Threshold Sensitivity

Automated classification thresholds were determined per label based on validation-set F1 optimization (e.g., Anthropogenic Attribution threshold = 0.45). Full threshold sensitivity

analysis using continuous probability scores was not possible because raw probability outputs were not retained in the analytical dataset.

However, indirect validation is provided by the close correspondence between automated full-corpus estimates (e.g., Anthropogenic Attribution: *NYT* = 14.6%, *WSJ* = 4.0%; *OR* = 5.50, $p < .001$) and manual-subset estimates (*OR* = 4.07, $p < .001$). The preservation of both direction and magnitude across measurement approaches suggests that threshold selection does not materially alter substantive conclusions. Future work may extend this analysis by conducting probability-based threshold perturbation tests, but current evidence indicates strong classification stability.

Robustness Summary

Combined, the three robustness checks provide convergent evidence that the primary findings are not artifacts of automated classification, label performance variability, or modeling specification.

Core outlet effects, particularly those related to anthropogenic attribution, responsibility framing, and environmental and health impacts, remain directionally and substantively stable under manual coding replication and sensitivity testing. Null findings (e.g., Scientific Uncertainty divergence) remain null across specifications.

Accordingly, the reported results demonstrate measurement reliability and structural robustness. The observed outlet differences reflect systematic framing patterns rather than methodological artifacts.

Table 11. Summary of Hypothesis Tests Across Research Questions (RQ1–RQ8; H1–H13).

RQ	H	Prediction	Key Result	Verdict
RQ1	H1	Anthropogenic attribution: *NYT* > *WSJ*	*OR* = 5.50***; *z* = 18.09***	Supported
RQ1	H2a	Natural variability: *WSJ* > *NYT*	*OR* = 0.36***; *z* = 7.14***	Supported
RQ1	H2b	Causal silence: *WSJ* > *NYT*	*OR* = 2.34** (reversed); *z n.s.*	Not Supported
RQ2	H3	Actor & systemic responsibility: *NYT* > *WSJ*	*OR* = 2.43*** / 1.82***	Supported
RQ2	H4	Naturalized responsibility: *WSJ* > *NYT*	*OR* = 0.47***; *z* = 15.54***	Supported
RQ3	H5	Political conflict: *WSJ* > *NYT*	*OR* = 1.73*** (NYT higher)	Not Supported
RQ4	H6a	Environ. & health impact: *NYT* > *WSJ*	*OR* = 1.89*** / 1.92***	Supported
RQ4	H6b	Economic impact: *WSJ* > *NYT*	*OR* = 0.81 *n.s.*	Not Supported
RQ5	H7	Scientific uncertainty: *WSJ* > *NYT*	*OR* = 1.01 *n.s.*; *z* = 1.97*	Marginal
RQ6	H8	Framing varies by disaster type	All 12 dims, K-W $p < .001$	Supported
RQ6	H8a	Anthropogenic higher in slow-onset	*z* = 11.89***; *h* = .27	Supported
RQ6	H8b	Political conflict higher in hi-salience	*z* = −0.93 *n.s.*	Not Supported
RQ6	H8c	Scientific uncertainty higher in low-confidence	*z* = 4.11*** (partial)	Partially
RQ6	H8d	Impact higher in rapid-onset	Social, Health (supported); Environ (not supported).	Mixed
RQ6	H8e	Resp. higher in governance disasters	*z* = 13.56***; *h* = .39	Supported
RQ7	H9	Anthropogenic attribution rises	*r* = +.65***; *OR*/yr = 1.097***	Supported
RQ7	H10	Scientific uncertainty declines	*r* = −.20 *n.s.*; *OR*/yr = 1.010*	Not Supported
RQ7	H11	Political conflict rises	*r* = −.14 *n.s.*; *OR*/yr = 1.002 *n.s.*	Not Supported
RQ8	H12	Outlet gap widens over time	Anthropogenic: +7→+27 percentage points; Political conflict: no widening	Partial
RQ8	H13	Hazard spread widens over time	Standard deviation increases from Period 1 to Period 3	Supported

Note. OR = odds ratio (*NYT* relative to *WSJ*) estimated from binary logistic regression models with HC3 robust standard errors controlling for disaster-type dummy variables and a calendar-year trend. *z* = one-tailed *z* test statistic. *r* = Pearson correlation coefficient (annual prevalence vs. calendar year). *h* = Cohen's *h*. Significance levels: $p < .05$, $p < .01$, $p < .001$. † Marginal result: the *z* test is statistically significant ($p = .024$), but the *OR* is not statistically significant after covariate adjustment. Mixed indicates that the hypothesis is supported for some subdimensions but not others.

Altogether, the results show a consistent and structured divergence in how climate-related disasters are framed, driven primarily by outlet ideology, disaster characteristics, and temporal dynamics. Coverage in the *NYT* is significantly more likely to attribute disasters to anthropogenic causes, emphasize systemic and institutional responsibility, and highlight environmental and health impacts, whereas the *WSJ* more often frames disasters in naturalized terms and downplays structural accountability. At the same time, framing is not uniform across events. It systematically varies by disaster type, with slow-onset events and wildfires more likely to be linked to climate change, governance-related disasters more likely to invoke responsibility frames, and rapid-onset events more likely to emphasize immediate social and health consequences. Over time, anthropogenic attribution has increased, but shifts in political conflict and scientific uncertainty remain limited, suggesting selective evolution rather than a wholesale transformation of climate journalism. Overall, these findings indicate that disaster coverage is shaped less by scientific consensus alone and more by the interaction between media ideology, event characteristics, and evolving narrative practices, producing uneven and sometimes competing interpretations of climate risk.

Chapter VI: Discussion

The findings demonstrate that climate disaster reporting in two elite U.S. newspapers and over a specific period of time is shaped by an interplay of institutional orientation, hazard characteristics, and the gradual development of scientific attribution research, a configuration this study terms the interpretive architecture of climate journalism (Entman, 1993; Nisbet, 2009). Rather than merely describing events, coverage in these two outlets actively constructs different versions of the same disasters, assigning different causes, different responsible actors, and different consequences, in ways that are stable across 25 years and six hazard types, indicating that these are institutional patterns rather than event-driven editorial choices. This functions as what Gamson and Modigliani (1989) describe an interpretive package that organizes public meaning around disasters. By systematically comparing framing patterns across the two media outlets, hazards, and a 25-year period, this study shows how these interpretive processes structure the way climate risks enter public consciousness, and how journalism mediates between scientific knowledge and public understanding in ways that carry real consequences for risk perception and policy support (Feldman & Hart, 2017; Schäfer & Painter, 2020).

Outlet identity emerged as a consistent predictor across causal attribution, responsibility attribution, impact emphasis, and political conflict framing, yet the findings also complicate straightforward ideological explanations. The anticipated association between conservative editorial orientation and elevated political conflict framing did not appear in the expected direction, and the two outlets showed no meaningful difference in scientific uncertainty framing. This suggests that journalistic routines, professional norms, and audience expectations constrain ideological expression in hard news reporting in ways that simple left–right distinctions cannot capture (Boykoff & Boykoff, 2004; Brüggemann & Engesser, 2017; Schäfer & Painter, 2020). These results point to a layered process in which institutional context, material hazard

characteristics, and the evolving state of climate attribution science jointly shape how extreme weather events are interpreted. This extends framing and indexing theory by demonstrating that their effects are domain-specific, multiplicative rather than additive, and conditioned by the physical and temporal features of disasters themselves (Bennett, 1990; Entman, 1993; Otto, 2023).

Outlet-Level Ideological Divergence: Institutional Orientation and Interpretive Structure

The most consistent pattern in the analysis is that outlet identity predicts framing orientation across all five dimensions after controlling for hazard type and publication year, meaning these differences cannot be explained by what disasters each outlet happened to cover or when. This is the defining empirical signature of interpretive architecture: not that the outlets make different editorial choices on individual stories, but that their framing tendencies are structurally stable across decades, hazard categories, and political moments.

This study uses the term interpretive architecture to describe this pattern because architecture captures something that analyses of individual frames typically miss: framing choices do not occur in isolation but are assembled from interlocking elements, sourcing habits, editorial priorities, professional norms, and audience expectations, that hold together as a durable structure across time, hazard types, and political contexts (Entman, 1993; Schäfer & Painter, 2020; Shoemaker & Reese, 2013). Just as a building's architecture shapes what is possible within it, a news organization's interpretive architecture shapes which causal explanations are routinely offered, which actors are granted responsibility, and which dimensions of disaster impact are treated as newsworthy. In the context of climate disasters, this architecture does not simply reflect ideology in a direct or mechanical way. Rather, it mediates between institutional positioning, journalistic routines, and the evolving state of scientific knowledge, producing

coverage patterns that are recognizable across decades and disaster types while remaining responsive to specific political and scientific developments (Boykoff, 2011; Carvalho, 2007; Nisbet, 2009).

What the interpretive architecture concept adds beyond standard framing analysis is an explanation of why outlet differences persist across such varied conditions. Individual frames shift with events; architecture does not. The *NYT* does not suddenly adopt naturalized responsibility framing during a hurricane, nor does the *WSJ* suddenly foreground social vulnerability during a heatwave. The stability itself is the finding.

Causal Attribution: Interpreting the Origins of Climate Disasters

The results for causal attribution (RQ1) provide evidence of divergence between the two outlets. After controlling for hazard type and publication year, articles in the *NYT* are 5.5 times more likely than those in the *WSJ* to include explicit anthropogenic attribution. The effect is substantively large and explains a notable share of the variance in framing (McFadden $R^2 = .19$). This finding supports H1 and is consistent with earlier research showing that science-oriented outlets more frequently incorporate findings from the IPCC and other scientific assessments when explaining extreme weather events (Boykoff, 2011; Brüggemann & Engesser, 2017; Schäfer & Painter, 2020).

From a framing perspective, this pattern reflects the process that Entman (1993) describes as the selection and emphasis of particular aspects of reality. When the *NYT* repeatedly links extreme weather events to anthropogenic climate change, disasters are placed within a broader narrative that highlights human activity as a key driver. This way, disasters are presented not simply as isolated meteorological events but as part of a wider climate system shaped by industrial emissions and long-term warming trends (Hulme, 2009; Nisbet, 2009). Over time, the

repeated use of this narrative functions as what Gamson and Modigliani (1989) describe as an interpretive package, a condensed symbolic framework, built from metaphors, catchphrases, and visual images, that provides audiences with a familiar lens through which to make sense of complex and contested public issues such as climate change.

Coverage in the *WSJ* followed a different pattern. The outlet showed a stronger reliance on natural-variability attribution (H2a supported; OR = 0.36). In these stories, disaster explanations often emphasize meteorological oscillations such as El Niño, historical climate cycles, or statistical variability in weather patterns. This framing presents extreme events as outcomes of natural climatic processes rather than the result of human activity. Similar tendencies have been observed in prior research on conservative media coverage of climate change, where references to natural variability sometimes function as a discursive strategy that diffuses anthropogenic responsibility (Merkley & Stecula, 2020; Painter, 2013).

Indexing theory (Bennett, 1990) provides one possible explanation for this pattern. When influential political or economic elites question attribution science, news coverage may reflect those debates rather than independently adjudicating the underlying scientific evidence. In such contexts, journalistic narratives tend to mirror the range of elite discourse surrounding climate policy and scientific interpretation, not because journalists lack independent judgment, but because professional norms of balance and source authority lead reporters to treat elite skepticism as a legitimate position worthy of coverage, even when it conflicts with the broader scientific consensus (Bennett et al., 2008; Boykoff & Boykoff, 2004). As a result, the boundaries of what counts as a credible causal explanation in disaster reporting are shaped less by the state of attribution science than by the range of positions held by politically and economically powerful actors.

Another notable finding is that the *NYT* also showed significantly higher levels of hedged attribution (OR = 2.21). Hedged attribution refers to cases where climate change is presented as a contributing factor, but the causal relationship is expressed probabilistically rather than definitively. This style of explanation reflects the growing influence of attribution science, which often communicates results in terms of probability or increased likelihood rather than direct causation (Otto, 2023). The difference between the outlets therefore suggests that the *NYT* tended to operate within a probabilistic scientific framework, while the *WSJ* more often avoided linking specific disasters to climate change. As a result, readers of the two outlets are exposed to different epistemic frameworks for interpreting the relationship between climate change and extreme weather. Research in science communication suggests that acknowledging probabilistic uncertainty can enhance credibility rather than weaken it (Fischhoff, 2013).

The unexpected failure of H2b does not substantially change this overall pattern. The *NYT* showed slightly higher levels of causal silence than the *WSJ*, although this difference is minimal in practical terms. Causal silence appears in fewer than 2% of articles in either outlet. Both newspapers therefore provide some form of causal explanation in the vast majority of cases. The key difference lies not in whether causation is discussed but in which type of explanation becomes dominant. The *NYT* consistently anchored disasters within an anthropogenic climate framework, while the *WSJ* more often explained the same events through meteorological or natural variability terms. This means that readers of the two outlets encounter structurally different explanatory words, one in which extreme weather is a symptom of a warming climate driven by human activity, and another in which it is primarily a product of natural atmospheric processes. The divergence is therefore not about silence versus explanation,

but about which causal logic is normalized as the default interpretation of climate-related disasters (Entman, 1993; Merkley & Stecula, 2020; Painter, 2013).

Responsibility Attribution: Accountability Versus Naturalization

The results for responsibility attribution (RQ2) revealed another clear difference between the two newspapers. Articles in the *NYT* were 4.78 times more likely than those in the *WSJ* to include some form of human or institutional responsibility, combining both actor-based and systemic attribution. In contrast, the *WSJ* was significantly more likely to portray disasters as events that occur beyond human control (OR = 0.47 for naturalized responsibility). These results support H3 and H4 and are consistent with previous studies showing that left-leaning outlets tend to emphasize governance accountability, whereas conservative outlets more often frame disasters as natural phenomena (Iyengar, 1991; Olausson, 2009; Feldman et al., 2015).

From a framing perspective, the pattern observed in the *NYT* reflected a narrative that situates disasters within broader institutional contexts. When coverage identified governments, regulatory agencies, or industries as responsible for preventable harms, events were interpreted as a problem of governance rather than simply a natural occurrence. This type of interpretation resembles what Iyengar (1991) described as thematic framing, where news coverage connects specific events to larger systemic conditions and potential policy responses. By contrast, episodic framing focuses mainly on the immediate event and its victims without linking the disaster to broader structural causes. The higher presence of actor and systemic responsibility in the *NYT* therefore suggests that its disaster coverage more frequently adopted thematic interpretations. Previous research has shown that thematic framing can increase public support for structural climate policies (Fisher, 2016; Hart & Feldman, 2016).

Coverage in the *WSJ* followed a different pattern. Naturalized responsibility appeared more frequently in this outlet, occurring in 80.24%of articles compared with 66.51% in the *NYT*. When disasters are described primarily as natural or unpredictable events, the role of institutions and policy decisions becomes less visible. In this sense, naturalization responsibility may reduce the perceived relevance of political or regulatory accountability. Scholars such as Proctor and Schiebinger (2008) describe this dynamic as an "agnotological effect," which explains that natural explanations can shift attention away from systemic vulnerabilities or human decisions.

Indexing theory provides a compelling structural lens for interpreting this pattern. Bennett (1990) argues that news coverage tends to reflect the range of viewpoints expressed by dominant political and economic elites. Prior research suggests that business-oriented outlets such as the WSJ more frequently engage with economic and market-oriented actors, whose discourse often emphasizes regulatory costs and economic risk over institutional accountability (Wetts, 2020; Brüggemann & Engesser, 2017). From this perspective, the higher prevalence of naturalized responsibility framing in the WSJ can be understood as consistent with the types of elite discourse that are more likely to be represented in its coverage. The observed effect (OR = 0.47) therefore aligns with indexing-based expectations about how sourcing structures can shape responsibility attribution patterns in news reporting.

Impact Framing: Whose Consequences Count?

The analysis of impact framing (RQ4) reveals another clear difference between the two newspapers. Articles in the *NYT* are significantly more likely to emphasize environmental (OR = 1.89), health (OR = 1.92), and social consequences of climate disasters (OR = 9.27). The difference is especially large for social impacts. Nearly 90% of *NYT* articles mentioned social

consequences, compared with about half of the articles in the *WSJ* (89.31% versus 50.04%). This represents the largest outlet divergence observed in the study.

Coverage in the *NYT* frequently highlighted the social consequences of disasters, including community displacement, housing loss, and disproportionate impacts on vulnerable populations. This style of reporting aligns with what Rebich-Hespanha et al. (2014) describe as consequence framing that focuses on distributional justice. Rather than treating disasters only as physical events, these narratives emphasize how climate hazards affect communities differently depending on certain factors such as income, geography, and social inequality.

Beck's (1992) risk society framework provides a useful theoretical lens for interpreting this pattern. Beck argues that the central political question in risk societies is not whether hazards occur but who bears their consequences, and that this distribution is shaped by institutional power and social structure rather than natural occurrence. The NYT's substantially higher emphasis on social impact framing (89.31%) suggests an editorial tendency to foreground the distributional consequences of disasters, where events are interpreted in relation to vulnerability, displacement, and inequality. By contrast, the WSJ's lower emphasis on social impact framing (50.04%) indicates a comparatively reduced focus on these dimensions, with greater attention to economic and material consequences. In conjunction with Kasperson et al.'s (1988) social amplification of risk framework, these patterns suggest that the two outlets differ not only in how they frame disasters, but also in how they represent who is most affected by them.

In contrast, the lower prevalence of social impact framing in the *WSJ* suggests a different editorial emphasis. Coverage in this outlet more often focused on the physical and economic consequences of disasters, while references to social vulnerability or inequality appeared less frequently. This difference reflects the institutional orientations of the two outlets, with the *WSJ*

anchoring consequence framing more strongly in economic and market terms, a pattern consistent with prior research on business-oriented media framing (Elsasser & Dunlap, 2013; Stecula & Merkley, 2019).

One finding, however, shows strong similarity between the outlets. Economic impact framing is nearly universal in both newspapers. Economic consequences appear in 97.90%of *NYT* articles and 98.12% of *WSJ* articles, and the difference is not statistically significant. This ceiling effect indicates that economic losses, including infrastructure damage, insurance costs, and business disruption, represent a common baseline of disaster reporting across ideological lines. Houston et al. (2012) make a similar observation in their analysis of U.S. disaster coverage.

The differences appear when reporting moves beyond this baseline. Both outlets reported the economic costs of disasters, but the *NYT* more frequently expanded the narrative to include environmental and social consequences, whereas the *WSJ* was less likely to extend coverage in those directions. This pattern suggests that the divergence between outlets lies in how the scope of disaster consequences is constructed, with the *NYT* more likely to situate disasters within broader social and environmental contexts, and the *WSJ* more likely to maintain a narrower focus on economic impact. These differences reflect stable institutional variations in how the two organizations define the boundaries of disaster relevance in their coverage (Carvalho, 2007; Feldman et al., 2015).

Theoretical Reconsideration: The Unexpected Findings

Two findings in this study diverge from the original expectations. The first concerns H5, which predicted that the *WSJ* would display higher levels of political conflict framing. Instead, the results show the opposite pattern. The second involves H7, which expected the *WSJ* to use

scientific uncertainty framing more frequently than the *NYT*. The analysis finds no meaningful difference between the outlets on this dimension.

Rather than weakening the theoretical framework developed in Chapter II, these results help clarify how ideological orientation operates in practice. Results suggest that outlet ideology does not influence every dimension of disaster framing in the same way. Some aspects of coverage, such as causal attribution or responsibility, appear strongly associated with institutional orientation. Others seem more constrained by professional journalistic norms that shape how hard news is reported. In this sense, the findings indicate that framing processes in disaster journalism reflect both ideological positioning and shared newsroom conventions.

Political Conflict Framing: NYT, Not WSJ, as the Political Arena

H5 predicted that the *WSJ* would employ political conflict framing more frequently than the *NYT*. This expectation was based on prior research suggesting that conservative and business-oriented outlets tend to highlight partisan disagreements over climate policy (Feldman et al., 2015; Merkley & Stecula, 2020). The results show the opposite pattern. Articles in the *NYT* were 1.73 times more likely to include political conflict framing, and this difference appears across all six disaster types examined. The gap is especially large in drought coverage, where 51.2% of *NYT* articles contain political conflict framing compared with 23.3% in the *WSJ*. This result is notable because droughts are not usually associated with high levels of political attention.

This finding suggests that political conflict framing may function differently in disaster reporting than it does in general climate coverage. Earlier studies have assumed that conservative outlets emphasize political conflict as part of broader debates over climate science and policy (Boykoff, 2007; Bolsen & Shapiro, 2017). In the present study, however, political conflict in the *NYT* often appeared in discussions of government response, emergency management, or

regulatory responsibility following disasters. In these cases, political conflict reflects debates over institutional performance rather than disputes over the scientific basis of climate change.

Indexing theory (Bennett, 1990) offers a more structurally grounded lens for interpreting this pattern. Rather than treating political conflict framing as a direct product of editorial preference, indexing theory suggests that news content reflects the range and character of elite discourse to which journalists have access. Prior research indicates that business-oriented outlets such as the WSJ often rely more heavily on economic and market-oriented elites, whose discourse may emphasize regulatory costs and economic implications rather than explicit partisan conflict (Brüggemann & Engesser, 2017; Merkley & Stecula, 2020). By contrast, general-interest outlets such as the NYT more frequently engage with political, regulatory, and advocacy actors, whose discourse is more explicitly embedded in governance accountability and policy debate. From this perspective, the higher level of political conflict framing observed in the NYT may reflect differences in the structure of elite discourse being indexed, rather than a simple editorial choice to emphasize or avoid conflict.

Coverage in the *WSJ* followed a different pattern. Disaster reporting in this outlet more frequently emphasized economic consequences or natural variability, which left less space for discussions of policy disagreement or governance debates. Political conflict may appear more often in opinion or editorial sections, which were excluded from this analysis, than in the hard news reporting examined here. This interpretation is consistent with Carragee and Roefs's (2004) argument that framing does not only shape how issues are represented but also which political disagreements become visible in public discourse.

Scientific Uncertainty: A Shared Epistemic Baseline

The results for H7 show no meaningful difference between the *NYT* and the *WSJ* in the use of scientific uncertainty framing once disaster type and year are considered (OR = 1.01, p = .842). This finding contrasts with earlier research, suggesting that conservative or business-oriented outlets sometimes emphasize uncertainty or false balance in climate coverage (Boykoff & Boykoff, 2004; Painter, 2013; Wetts, 2020). In the present analysis, uncertainty framing appears at similar rates in both outlets.

One possible explanation relates to the time span of the dataset. The study covers the period 2000 to 2024, during which climate science became increasingly consolidated and major scientific institutions issued stronger assessments regarding anthropogenic warming (Brüggemann & Engesser, 2017; Schäfer & Painter, 2020). Earlier phases of climate reporting often featured more visible debates over the scientific consensus. If the analysis had focused only on those earlier years, differences between outlets might have been more pronounced. By the 2020s, however, broader professional norms appear to have reduced the degree to which uncertainty framing varies across major news organizations in hard news coverage. This interpretation is consistent with Brüggemann and Engesser's (2017) findings that many outlets, including conservative ones, have moved away from explicit denial in news reporting, even if more critical perspectives remain visible in opinion commentary.

The absence of an outlet difference does not mean that scientific uncertainty is absent from the dataset. Roughly one quarter of articles in both newspapers include some form of uncertainty framing, and this uncertainty appears at comparable levels across outlets. Both newspapers refer to methodological limitations, probabilistic projections, and the complexity of attribution science in similar proportions. This pattern suggests that uncertainty framing may

function as a shared epistemic baseline within hard news disaster reporting. Journalistic expectations surrounding accuracy, sourcing, and evidence appear to limit the extent to which uncertainty is differentially emphasized across outlets, even when their editorial orientations diverge (Schäfer & Painter, 2020).

Hazard-Specific Framing: Material Disaster Characteristics as Structural Moderators

The results for RQ6 show that disaster type plays an important role in shaping framing patterns across the 12 indicators examined in this study. The overall hazard-type block is statistically significant (all $p < .001$), indicating that framing varies systematically depending on the type of disaster being reported.

These differences suggest that journalists do not frame all climate disasters in the same way. Instead, the characteristics of the hazard itself appear to influence how events are described and interpreted. Factors such as how quickly a disaster develops, how clearly it can be linked to climate change, how closely it is tied to government response, and how visible its effects are may shape the narratives that appear in news coverage of extreme weather.

Causal Attribution and Attribution Science Alignment

The results for H8a show that slow-onset disasters, specifically heatwaves and droughts, are more likely to include anthropogenic attribution than rapid-onset disasters such as hurricanes and floods. This pattern suggests that journalistic explanations partly reflect differences in the scientific confidence surrounding these hazards. In the attribution literature, researchers generally report stronger and more consistent anthropogenic signals for slow-onset thermal hazards. Long-term warming trends make these events easier to connect statistically to climate change. Rapid-onset disasters, by contrast, involve more complex atmospheric dynamics that make causal attribution less straightforward (Clarke et al., 2022; Stott et al., 2015).

Wildfire coverage shows the highest rate of anthropogenic attribution among all hazard categories (21.5%), which deserves particular attention. Wildfires represent a hybrid hazard in which several climate-related factors, including longer fire seasons, drier vegetation, and higher temperatures, increase overall risk. Because these links have become more clearly established in the scientific literature (Fischer et al., 2021; Otto, 2023; Stott et al., 2015), journalists appear increasingly willing to connect wildfire activity to climate change in their reporting.

In contrast, hurricane and tropical storm coverage showed the lowest levels of anthropogenic attribution, at 2.7% and 1.6% respectively. This pattern aligns with previous research showing that tropical cyclone dynamics are difficult to attribute to climate change at the level of individual events. Storm behavior is shaped by multiple interacting processes, including thermodynamic intensification and atmospheric circulation patterns (Otto, 2023; Schiermeier, 2018).

This gap between scientific complexity and journalistic explanation has been noted in earlier studies. Linden et al. (2022) argue that journalists often struggle to translate probabilistic attribution findings into clear narratives for general audiences. The present results suggest that this translation challenge may be especially pronounced for hurricanes. Although these disasters dominate media attention, their causal links to climate change are harder to communicate with the same clarity that exists for hazards such as heatwaves or wildfires.

Responsibility Attribution and Governance Embeddedness

The results for H8e show that hazards associated with visible governance systems, particularly floods and wildfires, are more likely to include actor and systemic responsibility framing than hazards that are primarily meteorological, such as heatwaves and droughts. This pattern suggests that responsibility framing is activated not by disaster severity alone, but by the

degree to which a hazard is structurally embedded in identifiable governance systems, when clear institutional actors, policy decisions, or regulatory failures are visible in the disaster narrative, journalists have concrete reference points for assigning accountability (Iyengar, 1991; Olausson, 2009).

Flood events often generate reporting about infrastructure, including levee maintenance, urban drainage systems, and emergency management responses. These elements provide journalists with clear reference points for evaluating whether government agencies or planning decisions contributed to the disaster. Wildfires create similar opportunities for responsibility narratives. News coverage frequently examines land management practices, controlled burn policies, and long-term fire suppression strategies. Because these hazards involve identifiable policy decisions and institutional actors, they lend themselves more readily to discussions of accountability.

As a result, heatwaves tend to generate fewer accountability narratives in news coverage. This study extends that observation by showing that the deficit in heatwave accountability narratives is not simply a function of media attention cycles but also reflects a structural feature of how governance embeddedness shapes responsibility framing across hazard types, a pattern that persists after controlling for outlet identity and publication year (Hopke, 2019; Houston et al., 2012).

Impact Framing Variability Across Hazard Types

The results for H8d indicate that impact framing differs across disaster types, but not in the simple way the researcher originally expected. Rapid-onset disasters tend to generate more social and health impact framing, whereas slow-onset disasters more often emphasize

environmental consequences. This pattern suggests that the temporal dynamics of hazards influence how journalists describe their effects.

Rapid-onset disasters such as hurricanes, floods, and wildfires produce immediate and highly visible human consequences. News coverage frequently highlights evacuations, injuries, displacement, and emergency medical responses. These dramatic and time-sensitive developments naturally draw attention to social and health impacts during the initial reporting cycle.

Slow-onset disasters follow a different trajectory. Droughts and prolonged heatwaves develop gradually and often produce consequences that become visible over time. Journalistic coverage of these hazards therefore tends to focus more on ecological effects, including crop failure, habitat degradation, and biodiversity loss. These environmental consequences often emerge through sustained reporting rather than through the immediate aftermath of a single event.

The higher prevalence of environmental impact framing for slow-onset disasters (76.78%) compared with rapid-onset disasters (56.82%) adds a layer to this interpretation. Hazards that unfold over longer periods may give journalists more time to develop broader environmental narratives that extend beyond the immediate assessment of damage.

Temporal Evolution: The Normalization of Anthropogenic Attribution

The temporal analysis (RQ7) indicates that climate disaster reporting in the two media outlets included in this study has changed noticeably over the 25 years covered in this research. One clear trend is the increasing presence of anthropogenic causal attribution in the *NYT*. A similar pattern appears in the *WSJ*, although the increase is smaller. The results provide strong support for H9. Across the combined dataset, each additional year is associated with a 9.7%

increase in the odds that an article includes anthropogenic attribution (OR/year = 1.097, $p < .001$). The change is even more pronounced in the *NYT*, where the annual increase reaches 10.4%. Combined, these findings suggest that references to human-driven climate change have become progressively more common in disaster reporting over time.

Attribution Science as Journalistic Infrastructure

The increase in anthropogenic attribution was not evenly distributed across the entire period. Between 2000 and roughly 2012, attribution levels remained relatively low and stable. Beginning in the mid-2010s, however, the trend became noticeably stronger. This timing corresponds with several important developments in climate science and global climate governance. The release of the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (2013–2014), the adoption of the Paris Agreement in 2015, and the rapid development of Extreme Event Attribution research all contributed to a growing scientific capacity to link specific disasters to climate change (Otto, 2023).

By the early 2020s, anthropogenic attribution appeared in more than 40% of disaster articles in the NYT. This represents a clear shift in how the relationship between climate change and extreme weather is articulated in elite news coverage. The pattern supports the argument advanced in Chapter II that media framing evolves alongside developments in scientific knowledge and political institutions (McCombs, 2005; Schmidt et al., 2013), while also indicating that this evolution is not uniform across outlets, with some organizations incorporating advances in attribution science more rapidly than others.

As attribution science became more established, it provided journalists with clearer and more accessible evidence connecting individual disasters to climate change. In this sense, attribution research has become a routine reference point in disaster reporting. Scientific findings

about extreme events increasingly serve as part of the informational infrastructure that journalists use when explaining the causes of disasters.

The Stability of Uncertainty and Political Conflict Framing

The lack of support from the results for H10 and H11 also requires interpretation. Earlier research suggested that scientific uncertainty in climate coverage should decline as climate science becomes more established, while political conflict framing should increase as climate politics becomes more polarized. Neither pattern appears clearly in disaster reporting analyzed for this study.

One explanation may lie in the difference between general climate coverage and event-driven disaster journalism. Much of the prior literature examines climate change as a longterm political issue. Disaster coverage, however, is organized around specific events such as hurricanes, floods, or wildfires. When journalists report on these events, the primary task is to describe what happened, who was affected, and what response efforts are underway. This reporting context leaves less space for extended debates about scientific uncertainty or ideological conflict. However, the data from this study does not support the expectation that uncertainty framing would decline because of this, suggesting that the relationship between reporting context and uncertainty framing is more complex than this explanation implies.

A more convincing explanation lies in the professional norms that govern hard news reporting. Journalistic conventions of accuracy, sourcing, and evidence-based writing constrain how much uncertainty or ideological conflict can be foregrounded in disaster coverage, regardless of outlet orientation (Boykoff & Boykoff, 2004; Schäfer & Painter, 2020). As climate science has become more consolidated, uncertainty references appear to have shifted from ideological signals to routine epistemic qualifications, acknowledging the complexity of

attribution science without challenging the broader scientific consensus (Brüggemann & Engesser, 2017). Similarly, political conflict in disaster coverage tends to be triggered by specific governance failures or policy confrontations rather than by the broader arc of climate polarization. This might explain why no steady upward trend appears across the 25-year period examined in this study.

Interaction Effects: Multiplicative Rather Than Additive Framing Logic

The interaction results (RQ8) add an important layer to the interpretation of the above findings. They show that outlet ideology, hazard type, and historical period do not shape disaster coverage separately. Instead, the way climate disasters are framed depends on how these factors combine with one another. In other words, framing patterns vary across different pairings of news outlet, disaster type, and time period.

The interaction results do more than demonstrate that multiple factors shape disaster framing; they clarify the conditions under which ideological divergence becomes most pronounced. The largest outlet differences emerge when institutional orientation, hazard types with stronger attribution signals, and later time periods coincide. Under these conditions, attribution rates diverge substantially between the *NYT* and the *WSJ* in ways that are not visible in main-effect analyses. This pattern indicates that framing differences are not simply additive but depend on the combination of outlet characteristics, hazard properties, and historical context.

Widening Ideological Divergence in Causal Attribution

The results for H12a show that the difference between the *NYT* and the *WSJ* in anthropogenic attribution has grown substantially over time. During the early period of the dataset (2000–2008), the gap between the outlets is relatively small at about 7%. By the most recent period (2017–2024), the difference increases to more than 27%. In other words, the gap

between the two outlets becomes almost four times larger. This change suggests that the outlets have not simply maintained different baseline levels of climate attribution. Instead, their coverage appears to have moved in different directions as attribution science developed. The *NYT* increasingly connects disasters to anthropogenic climate change, whereas the *WSJ* adopts this framing more slowly.

Scientists and policy experts frequently cited in the *NYT* have moved toward stronger attribution claims, while business and political elites who appear more often in the *WSJ* coverage have tended to express greater caution.

The widening gap is especially visible after 2015. This timing coincides with a period of intensified political debate about climate policy in the United States. The adoption of the Paris Agreement in 2015 and the subsequent U.S. withdrawal in 2017 contributed to a more polarized political environment around climate change (Feldman et al., 2015; Merkley & Stecula, 2020). The different trajectories observed in the *NYT* and *WSJ* coverage may therefore reflect broader divisions among political and institutional elites during this period.

Hazard-Specific Framing Spread Across Time

Support for H13 shows that differences in framing across disaster types have grown over time. In the early period of the dataset (2000–2008), anthropogenic attribution varies only modestly across hazards, with a standard deviation of 5.45%. By the most recent period (2017–2024), this variation increases to 13.79%. In other words, attribution patterns become more uneven across disaster types.

The change is largely driven by sharp increases in attribution for heatwaves and wildfires in the most recent years, while attribution in hurricane and tropical storm coverage remains relatively low.

One explanation for this pattern lies in the uneven development of attribution science across hazards. Extreme event attribution research has advanced most rapidly for thermal hazards, where the signal of anthropogenic warming is clearer and the statistical methods are well established. As a result, journalists covering heatwaves and wildfires now have stronger scientific evidence linking these events to climate change (Otto, 2023; Stott et al., 2015). For hurricanes and tropical storms, attribution remains more complicated because multiple atmospheric processes influence storm formation and intensity. This scientific uncertainty may make journalists more cautious about making direct climate connections.

The interaction analysis also shows that the strongest anthropogenic attribution appears when three conditions coincide: the *NYT* coverage, hazards with clearer attribution signals such as heatwaves and wildfires, and the period after 2015. In these cases, attribution rates exceed 50-60% of articles. This pattern suggests that, for some hazards and time periods, journalists are increasingly incorporating attribution science into disaster reporting. However, this shift is much more visible in one outlet than the other.

Theoretical Contributions

This study contributes to climate journalism research in several ways. The most foundational contribution is theoretical integration. Rather than applying framing and indexing theories separately, this study shows how these two perspectives work together. Framing theory explains how journalists construct explanations for disasters. Indexing theory explains whose voices shape those explanations (Bennett, 1990; Entman, 1993). Treating these frameworks as complementary rather than competing makes it possible to examine how institutional orientation, source selection, and historical context simultaneously shape the way climate disasters are reported in the two media outlets included in this study. The findings extend this theoretical

integration by showing that these influences operate jointly rather than independently, producing patterned differences in disaster coverage that are stable across hazards and time.

A related contribution is the current study's multidimensional framing approach. Much prior research examines one or two framing dimensions at a time. By measuring causal attribution, responsibility attribution, political conflict, impact framing, and scientific uncertainty together, the analysis reveals something that narrower studies cannot: ideological differences between outlets are real, but uneven. The *NYT* and the *WSJ* diverge sharply on some dimensions, particularly causal attribution and social impact framing, while converging on others, particularly economic impact and scientific uncertainty. This uneven pattern suggests that shared professional norms constrain ideological expression in some areas of reporting more than others (Boykoff & Boykoff, 2004; Schäfer & Painter, 2020).

Two specific findings deserve attention because they run against expectations from prior research. Political conflict framing appears more frequently in the *NYT* than in the *WSJ*, which reverses the anticipated pattern. Also, the two outlets show no meaningful difference in scientific uncertainty framing. Together these results suggest that in hard news disaster reporting, political conflict tends to reflect governance debates and institutional accountability rather than partisan positioning, while uncertainty framing functions as a routine journalistic practice rather than an ideological signal (Brüggemann & Engesser, 2017; Carragee & Roefs, 2004).

The present study also extends the theoretical conversation beyond framing and indexing theory by drawing on Beck's (1992) concept of the risk society. Beck argues that modern environmental hazards are not simply natural events. They are shaped by industrial development, regulatory decisions, and political choices, and their consequences are distributed unevenly across communities. The findings here are consistent with that argument. The large divergence

between the two outlets in social impact framing, the largest outlet difference observed in the study, suggests that news organizations emphasize different dimensions of climate-related disasters. The NYT is considerably more likely to highlight community displacement, unequal vulnerability, and public health consequences, while the WSJ more often emphasizes economic and financial impacts. These differences do not necessarily reflect disagreement about the occurrence of disasters themselves. Rather, they reflect different ways of interpreting and presenting their social significance. By consistently foregrounding community vulnerability, the NYT aligns more closely with Beck's view that environmental risks are socially distributed and experienced unevenly (Beck, 1992; Rebich-Hespanha et al., 2014). The WSJ, by focusing more heavily on economic consequences, presents a different understanding of who is affected and why those effects matter. Connecting these empirical patterns to Beck's framework and to the social amplification of risk literature (Kasperson et al., 1988) helps explain how media institutions shape public understandings of climate risk by emphasizing different causes, consequences, and dimensions of vulnerability.

Finally, this study makes a methodological contribution. By combining manual coding with a supervised RoBERTa classifier, the analysis scales a theoretically grounded measurement framework to 10,069 articles across 25 years. The classifier performs well across most framing dimensions (macro-F1 = .73; micro-F1 = .81), and the automated results closely track the patterns found in the manually coded sample. This close correspondence suggests that computational methods, when carefully validated against human coding, can extend the reach of framing research without sacrificing conceptual precision (Grimmer & Stewart, 2013; Jacobi et al., 2018).

Practical Implications for Climate Journalism

The results from this study suggest that attribution journalism in climate disaster reporting is uneven across media institutions. Differences in editorial orientation, source networks, and audience expectations appear to influence how strongly news coverage links extreme weather events to climate change. These differences matter because they shape how audiences understand climate risks and how disaster narratives enter public discussion about climate policy.

One implication concerns the persistent gap in anthropogenic attribution between the *NYT* and the *WSJ*. Rather than narrowing over time, this gap has widened across the 25-year period examined in this study. Readers of the two media outlets therefore encounter different explanations for the same disasters. The *NYT* more frequently connected extreme weather events to anthropogenic climate change, while the *WSJ* more often presented disasters primarily through meteorological explanations. These differences matter because attribution reporting links individual events to broader climate processes. From a democratic standpoint, access to clear explanations of climate risk is important for informed debate about climate policy. Patterns of attribution in disaster coverage therefore remain an important indicator of journalistic practice that media scholars and press critics may continue to monitor.

The findings also highlight a gap in disaster coverage itself. Heatwaves are widely recognized as the deadliest form of extreme weather in the United States (Vaidyanathan et al., 2020), yet they receive less sustained coverage than more visually dramatic hazards such as hurricanes or wildfires. Because heatwaves often develop gradually and produce fewer dramatic images, they attract less immediate media attention despite their severe public health consequences. Journalism training programs and editorial guidelines may benefit from greater

emphasis on sustained reporting about slow-onset hazards of which the impacts are significant but less visually obvious.

Another implication concerns the representation of social consequences in disaster reporting. The current study found a substantial difference between the outlets in their attention to social impacts of disasters (*NYT*: 89.31%; *WSJ*: 50.04%). Coverage that highlights displacement, community vulnerability, and unequal exposure to risk helps audiences understand how disasters affect different populations. When these dimensions receive less attention, news coverage presents a narrower picture of the social consequences of extreme weather. Editors, journalism educators, and science communicators may therefore consider ways to incorporate social vulnerability perspectives into disaster reporting while maintaining the economic and policy analysis that different outlets emphasize.

The temporal findings also show that anthropogenic attribution has increased most rapidly in the *NYT* coverage after 2015. This pattern suggests that attribution science is becoming more visible in disaster reporting in some elite news contexts. At the same time, the slower increase in attribution framing in the *WSJ* coverage indicates that this shift is not uniform across the media landscape. For journalists, attribution researchers, and science communicators, this pattern suggests that translating attribution science into news coverage may require different approaches, depending on the institutional context of each outlet.

Limitations and Future Research

The researcher needs to acknowledge several limitations of this study. The analysis is restricted to two elite national newspapers in the United States, which limits the generalizability of the findings. Regional newspapers, television news, digital-native outlets, and partisan media ecosystems may produce framing patterns that differ from those observed here. Future research

should extend this framework to a broader range of news organizations to assess how institutional diversity shapes climate disaster narratives across the media landscape.

The study also relies on a corpus drawn exclusively from Factiva, which archives full-text articles but does not capture multimedia elements such as photographs, graphics, or video. Visual framing is an important dimension of disaster coverage that text-based analysis cannot address (Rebich-Hespanha et al., 2014; Smith & Joffe, 2012). Future work that incorporates visual content alongside textual analysis would provide a more complete picture of how disasters are represented in news coverage.

A third limitation concerns the performance of the automated classifier on certain framing dimensions. Hedged attribution and scientific uncertainty showed lower classification accuracy than more concrete categories such as economic or environmental impact. One methodological caveat bears on the strength of this interpretation. The automated classifier for scientific uncertainty performed at F1 = .62, the lowest among all framing indicators, and the manual-coded subset produced an OR of 0.88 favoring WSJ > NYT, directionally consistent with H7 but not statistically significant at N = 604. The divergence between manual and automated estimates suggests that uncertainty framing may be more difficult to detect reliably using automated methods, particularly when expressed through subtle linguistic cues such as hedging and probabilistic language. Accordingly, the apparent convergence between outlets on this dimension should be interpreted cautiously. The present findings are better understood as inconclusive rather than as strong evidence of equivalence in scientific uncertainty framing.

Finally, the present study examined framing at the article level, which does not capture variation within articles or differences across story placement, length, and prominence. Front-page disaster coverage may follow different framing logics than inside-section reporting. Future

research could examine how story placement and editorial prominence interact with the framing patterns identified here.

Conclusion

This thesis examined how two ideologically distinct elite newspapers in the United States framed climate-related disasters across six hazard types and 25 years. The *NYT* more consistently linked disasters to anthropogenic climate change, foregrounded governance and accountability, and highlighted social consequences. The *WSJ*, on the other hand, more often explained the same events in meteorological terms and anchored consequences within economic frameworks. Two findings complicated simple ideological explanations: political conflict framing appeared more frequently in the *NYT*, and the two outlets showed no meaningful difference in scientific uncertainty framing. The gap in anthropogenic attribution between the outlets has also widened considerably since the mid-2010s, suggesting that divergence in elite climate disaster reporting is deepening rather than narrowing.

The theoretical implications of these findings go beyond what framing research has typically addressed. Framing, indexing, and agenda-setting theory are more productive when treated as complementary rather than competing frameworks. Institutional orientation establishes which explanations are routinely available in a news organization's coverage. Elite sourcing networks condition which explanations receive legitimacy. Developments in attribution science and political polarization amplify or constrain these tendencies over time (Bennett, 1990; Entman, 1993; McCombs & Shaw, 1972).

The interaction of these forces produces framing patterns that are multiplicative rather than additive. No single factor fully explains the differences observed between the outlets. It is the combination of who is reporting, what kind of disaster is being covered, and when in the political and scientific timeline the coverage occurs that shapes how a disaster is ultimately interpreted for audiences.

The findings also raise a question that framing research alone cannot fully answer: what is at stake when news organizations construct climate disasters so differently? Beck's (1992) *risk society* framework offers a potential answer. Beck argues that modern environmental hazards are not simply natural events. They are produced through industrial decisions, regulatory choices, and political structures, and their consequences fall unevenly across populations.

The empirical patterns observed here support this argument in concrete terms. The largest outlet divergence in the study appears in social impact framing. The *NYT* is nearly twice as likely as the *WSJ* to highlight community displacement, unequal vulnerability, and distributional consequences. This is not a minor editorial difference. It reflects two fundamentally different constructions of what a disaster is, who it harms, and who bears responsibility for it.

As Kasperson et al. (1988) argue, the institutional channels through which hazard information flows shape how the public perceives and responds to risk. This study shows that those channels do not amplify risk uniformly and that the divergence between them has grown larger over the period examined.

What this ultimately means is that journalism does not merely transmit information about climate-related hazards. Through choices about causation, responsibility, and consequence, news organizations shape how climate risks are interpreted and understood by audiences. Different outlets make different aspects of climate risk more visible while giving less attention to others, producing competing understandings of the same events. As extreme weather becomes more frequent and severe, understanding how these interpretations are constructed and why they differ systematically across institutions remains an important task for communication research.

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APPENDIX

CODEBOOK

This codebook defines the framing indicators used in the manual content analysis and supervised machine learning classification of climate disaster coverage published in *The New York Times* and *The Wall Street Journal* between 2000 and 2024. Coding was conducted at the article level using binary indicators (0 = Absent, 1 = Present).

The coding framework was designed to measure five major framing dimensions:

1. Causal Attribution
2. Responsibility Attribution
3. Political Conflict
4. Impact Framing
5. Scientific Uncertainty

The manually coded dataset was subsequently used to train supervised machine learning models for large-scale classification of the full corpus.

2. Framing Dimension 1: Causal Attribution

Causal attribution framing refers to how articles explain the causes, intensification, or origins of climate-related disasters.

Operational Indicator	Coding criteria
Anthropogenic Attribution	References to greenhouse gases, carbon emissions, fossil fuels, anthropogenic warming, or direct statements linking climate change to disaster severity
Hedged Attribution	Use of probabilistic or cautious language such as “may,” “could,” “possibly,” or “scientists suggest”
Natural Attribution	References to El Niño, La Niña, atmospheric oscillation, natural variability, or historical climate cycles

Example Indicators:

- "Driven by climate change"
- "Human-caused warming intensified the wildfire"
- "Scientists say climate change may have contributed"
- "The storm was linked to natural variability in ocean temperatures"

Dominant Frame Rule

Each causal attribution indicator was coded independently using binary values (0 = absent, 1 = present). For dominant-frame analysis, the following precedence hierarchy was applied:

Anthropogenic Attribution → Hedged Attribution → Natural Attribution

3. Framing Dimension 2: Responsibility Attribution

Responsibility attribution framing refers to how articles assign accountability for disaster impacts, preparedness failures, policy shortcomings, or recovery outcomes. This dimension captures whether responsibility is attributed to specific actors, broader institutional systems, or unavoidable natural forces.

Operational Indicator	Coding criteria
Actor Responsibility	FEMA, governors, mayors, corporations, utilities, or officials associated with blame, failure, delay, inaction, or mismanagement
Systemic Responsibility	References to institutional weakness, aging infrastructure, zoning systems, governance failure, or structural vulnerability
Naturalized Responsibility	References portraying disasters as unavoidable, beyond human control, or acts of nature

Example Indicators

- "Officials failed to respond quickly enough"
- "Aging infrastructure worsened flood damage"

- “The wildfire was an unavoidable natural disaster”

4. Framing Dimension 3: Political Conflict

Political conflict framing refers to the extent to which climate disasters are presented as sites of partisan, ideological, or policy-based disagreement.

Operational Indicator	**Coding criteria**
Political Conflict	Legislative disputes, partisan disagreement, electoral implications, ideological polarization, or policy conflict related to climate change or disaster governance

Inclusion Criteria

- Democratic-Republican disagreement
- Climate policy disputes
- Legislative conflict
- Electoral implications related to climate governance

Exclusion Criteria

Generic political metaphors such as “political firestorm” or “storm of controversy” were excluded unless directly connected to climate policy, disaster governance, or identifiable political actors.

5. Framing Dimension 4: Impact Framing

Impact framing refers to the types of consequences emphasized within climate disaster coverage. This dimension captures whether articles emphasize environmental, economic, social, or health-related consequences.

Operational Indicator	Coding Criteria
Environmental Impact	Habitat destruction, biodiversity loss, ecosystem disruption, species displacement, ecological damage, or water contamination
Economic Impact	Insurance loss, infrastructure damage, market disruption, crop loss, business interruption, or financial cost
Social Impact	Evacuation, migration, homelessness, housing loss, displacement, or community disruption
Health Impact	Mortality, injury, respiratory illness, heat stroke, trauma, mental health consequences, or waterborne disease

Example Indicators

- "Thousands of residents were displaced after the storm"
- "Wildfires destroyed critical ecosystems"
- "Insurance costs increased sharply after the hurricane"
- "Heat-related illnesses rose across the region"

6. Framing Dimension 5: Scientific Uncertainty

Scientific uncertainty framing refers to the degree of epistemic doubt, disagreement, or ambiguity surrounding climate science or disaster attribution. This dimension captures whether the article emphasizes uncertainty in scientific evidence, attribution models, or expert interpretation.

Operational Indicator	Coding Criteria
Scientific Uncertainty	References to inconclusive evidence, scientific disagreement, uncertainty in attribution models, contested findings, or limitations of climate science

Inclusion Criteria

- "Scientists remain uncertain"
- "Evidence remains inconclusive"
- "Researchers disagree about attribution"
- "Climate models have limitations"

Exclusion Criteria

General references to ongoing research or forecast uncertainty were excluded unless explicitly framed as uncertainty regarding climate science or disaster attribution.

7. Decision Rules and Reliability

1. The unit of analysis was the full article.
2. Coding decisions were based on explicit textual evidence.
3. Headlines, leads, body text, and conclusions were evaluated collectively.
4. Multiple framing indicators could be coded within the same article.
5. Metaphorical uses of disaster terminology (e.g., "wildfire of rumors," "flood of criticism") were excluded.
6. Articles were coded at the article level rather than paragraph or sentence level.
7. Intercoder reliability was assessed using Cohen's κ. Following communication research conventions, scores of .70 or higher were considered acceptable reliability thresholds.

8. Sample Coding Example

Article Excerpt	Coding Decision
"Scientists said rising greenhouse gas emissions intensified the severity of the hurricane season."	Anthropogenic Attribution = 1
"Researchers cautioned that climate change may have contributed to the flooding."	Hedged Attribution = 1
"Officials faced criticism over delayed evacuation planning and inadequate infrastructure preparation."	Actor Responsibility = 1; Systemic Responsibility = 1
"Republican lawmakers opposed expanded federal climate adaptation funding."	Political Conflict = 1
"Thousands of residents were displaced after the storm destroyed homes and disrupted local communities."	Social Impact = 1
"Researchers stated that evidence linking the storm directly to climate change remains inconclusive."	Scientific Uncertainty = 1