CLIMATE CHANGE AND GLOBAL WARMING IN THE MEDIA: A CONTENT

ANALYSIS OF THE MEXICAN NEWSPAPER *EL UNIVERSAL*

A Thesis

by

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ABSTRACT

The amount of coverage the media dedicate to climate change, along with how they frame the issue, can influence audience awareness, perception, and understanding of climate change. These aspects of climate change coverage have varied among countries, and few studies have analyzed coverage by Mexican media.

This study analyzed 1047 climate change stories published by the Mexican newspaper *El Universal* from 2007 and through 2015. Three research questions were addressed: (1) If the amount of climate change coverage in *El Universal* varied over time, with what events, if any, did these changes appear to be associated? (2) What frames has *El Universal* used in its stories about climate change? (3) If *El Universal* attributed information to specific sources, what sources did it identify? Stories analyzed were identified and accessed through the LexisNexis database.

Spikes in numbers of stories published were associated with highly visible United Nations climate change conferences. Coverage increases also coincided with climate-related impacts and domestic climate policy events. Correspondingly, the frames most commonly used regarded climate policy and climate-related impacts on Mexico. Frames that focused on raising awareness of climate change also were relatively common, whereas frames focusing on the scientific basis, solutions, and economics of the issue were relatively uncommon. Frames of skepticism, or denial, toward climate science were rarely used. The most commonly identified source of information overall was the government. In stories with frames focusing on the scientific basis for climate change, expert scientists were used extensively.

A marked correspondence exists between the frames most and least used in *El Universal'*s climate change stories and the findings of past research on Mexicans' understanding of the issue: surveys suggest Mexicans are relatively unaware of aspects such as the scientific basis and solutions for climate change. Media such as *El Universal* could play key roles in covering climate change in a way that informs the public about these complex but important aspects.

DEDICATION

To science journalists and other science communicators in Mexico—and worldwide—because what they do involves an enormous responsibility for nurturing a delicate, complex, and important relationship between science and the public.

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CHAPTER I

INTRODUCTION AND LITERATURE REVIEW

Climate change poses various global and regional risks, and Mexico is highly vulnerable. The changing climate will disturb precipitation patterns, temperature, and sea level worldwide. Among Mexico's main concerns in the face of climate change are extreme weather events and sea level rise, both of which are expected to worsen due to climate change (Intergovernmental Panel on Climate Change [IPCC], 2013). Experts anticipate that changes in the climate will lead to more frequent and intense extreme weather events in Mexico (Magaña et al., 2004). They also expect that sea level rise will put Mexico's coasts under water (Secretaría de Medio Ambiente y Recursos Naturales, 2009). These environmental changes may endanger Mexico's people and infrastructure. Climate change impacts may also threaten the country's rich wildlife, natural resources, and agriculture.

The Mexican government has expressed concern about the country's susceptibility to climate change. The *Secretaría de Medio Ambiente y Recursos Naturales* (Mexico's Secretariat of Environment and Natural Resources), or SEMARNAT, reported in 2009 that the country's mean temperature could rise between 2°C and 4°C by 2080—a change that could dangerously affect the environment. In 2014, Mexico's *Instituto Nacional de Ecología y Cambio Climático* (National Institute of Ecology and Climate Change), or INECC, made similar projections. The SEMARNAT also expects warmer sea surface temperatures. This warming could lead to more intense hurricanes, as well as flooding due to sea level rise along the Gulf of Mexico and the Pacific coast (SEMARNAT, 2009). Researchers have also

emphasized Mexico's high vulnerability to climate change impacts resulting in extreme weather events (Monterroso & Conde, 2015). These natural hazards associated with climate change mean high susceptibility to events such as hurricanes for millions of people in and near Mexico's coastlines (Monterroso & Conde, 2015).

Climate change will likely also influence Mexico's agriculture and biodiversity. The SEMARNAT reported that rainy seasons might be shorter in central regions and areas near the Gulf of Mexico. They also expect prolonged and extreme droughts to significantly reduce Mexico's water resources (SEMARNAT, 2009). Among other impacts, such a water shortage will likely put the agricultural sector in Mexico under critical water stress. The SEMARNAT also reported that the country's agricultural land could shrink by about 40 percent by 2050, and that by 2100 agricultural expenses related to mitigating and adapting to climate change could cost between 15 and 22 percent of Mexico's gross domestic product (2009). In addition, water shortages and warmer temperatures will affect Mexican flora and fauna, with over 50 percent of the country's vegetation and wildlife shifting distribution due to regional climate change (SEMARNAT, 2009).

When any given issue has high impacts on a particular region, media from that region increase coverage of that issue (Schmidt et al., 2013). Also, research suggests that the lay public learns about climate change mostly from the mass media (Boykoff & Roberts, 2007). Schmidt et al. (2013) noted that climate change seemed more newsworthy in countries with more susceptibility to climate-related risks. Therefore, one could argue that because climate change poses an imminent threat for Mexico, Mexican media are likely to emphasize climate change impacts, particularly those on the country's natural resources, ecology, and economy.

Media Attention to Climate Change

The literature on media coverage of climate change includes a wide range of studies on coverage in several countries. Studies on trends in climate change reporting in various countries show that coverage has increased dramatically since the early 2000s (Arcilla-Calderon et al., 2015; Gifford et al., 2017). However, as Arcilla-Calderon et al. (2015) indicate, it is difficult to compare media coverage in different countries. Comparisons are difficult given the diversity of editorial cultures worldwide, the relevance of climate change for each country, and the different research approaches. Nevertheless, to better understand how media worldwide cover climate change, it is useful to identify similarities and differences among media from various countries and how particular events might be associated with differences in their coverage.

In U.S. mass media, coverage of climate change first appeared in 1930 in the *New York Times* and more markedly in other publications in the 1950s with stories on impacts of human-caused climate change on the planet (Boykoff & Roberts, 2007). After that period, low levels of media attention to climate science followed, despite scientific reports heavily focusing on the issue through the 1960s and 1970s (Boykoff & Roberts, 2007). Then, climate change appeared again in the public eye in the late 1980s with coverage of scientific reports, climate-related extreme events, and policy discussions (Moser, 2010). One of the earliest events that attracted significant media attention in the United States occurred in 1988 and focused on NASA scientist James Hansen, who delivered a stern testimony to the U.S. Congress about global warming and its underlying causes. Boykoff and Roberts (2007) state this dramatic event triggered a spike in media coverage during a time when a record-breaking heat and drought hit the United States. The timing of the drought helped to contextualize the

concept of global warming for audiences in a way that scientific findings alone had been unable to do (Boykoff & Roberts 2007). Another important event for climate science coverage in the late 1980s and onward was the formation of the Intergovernmental Panel on Climate Change, or IPCC, in 1988 (Boykoff & Roberts, 2007). The IPPC is a United Nations-sponsored international body that assesses the science related to climate change and its impacts on the planet.

Another period of considerable increase in climate change coverage in several countries was around 2007 (Gifford et al., 2017). This increase aligned with the release of the IPCC Fourth Assessment Report, or AR4, which at the time was the most comprehensive synthesis of climate change science (Union of Concerned Scientists, n.d.). Further, *An Inconvenient Truth,* a highly popular documentary film released in 2006, provided the media with hooks and context to frame climate change. Al Gore, Vice President of the United States from 1993 to 2001 and one of the world's most visble climate change activists, wrote and starred in *An Inconvenient Truth*. This film catalyzed increased climate-related coverage in news, business, and entertainment sections (Boykoff, 2010; Boykoff & Roberts, 2007). The film was so influential worldwide that Al Gore—along with the IPCC—won the Nobel Peace Prize in 2007 for raising awareness of anthropogenic climate change (Nobelprize.org, 2007).

Climate change coverage worldwide declined after 2007 and increased again in 2009 around the time of the United Nations Climate Change Conference of the Parties (COP) in Copenhagen (Gifford et al., 2017). Boykoff (2010) explains that 2009 was a pivotal year for climate change in the media, with attention showing stark increases worldwide around the widely anticipated Copenhagen conference. The Copenhagen talks were among the most important negotiations concerning climate change, and news focused on a wide range of

topics (science, business, politics, and society) related to climate change, how to mitigate it, and what mitigating it meant for international and domestic policy (Boykoff, 2010). Another important event in 2009 was the so-called "Climategate," a controversy over hacked emails from top climate scientists in the United Kingdom. Climate "skeptics" (those denying and attacking the scientific legitimacy of climate science) misused the hacked emails to suggest that researchers manipulated data supporting climate research (Carrington, 2011; Union of Concerned Scientists, n.d.).

Despite increases and decreases in coverage over the years, Boykoff states, climate change has remained a topic with relatively limited space in the media. In particular, climate change has received much less coverage than subject areas such as health, medicine, business, crime, and government (Boykoff, 2010). Mazur and Lee (1993) argue that public concern about environmental issues can change according to the amount of news about them people receive, regardless of how the media portray the issue.

Climate Change and Framing

How the media present climate change might influence public understanding of it. Climate change is an issue with complex dynamics, including scientific, policymaking, and socioeconomic components. Therefore, climate change stories can focus on various topics. Because the topics emphasized in climate change stories can influence how people understand the issue, it is important to analyze how the media portray climate change.

One way to analyze how the media communicate climate change is to look at the frames included in climate change stories. As is the case with other topics and issues in journalism, the media communicate climate change through frames that help to contextualize and explain the content. Although the concept of framing is difficult to define, frames are the

narratives, messages, and angles that a story includes to give meaning to a certain issue. In other words, frames are themes within messages that contextualize an issue (Scheufele, 1999; Trumbo, 1996). Numerous definitions exist of frames and framing (de Vreese, 2005; Entman et al., 1993; Entman, 2009).

In this study, I used the definition of frames by Trumbo (1996), who stated the "themes that emerge in media representation of an issue can be called *frames*." A story focusing on the melting of glaciers due to climate change would include a different frame than a story on sustainable technology to mitigate climate change. The frame of the former story might be termed *effects,* while that of the latter might be termed *solutions.* Although both frames focus on climate change, they communicate about it in a particular way and focus on a different aspect of the issue. Depending on their scope and complexity, stories may include more than one frame.

Framing entails selecting certain aspects of a given issue and making them more apparent with the purpose of achieving any or all of the following purposes: (1) defining, (2) interpreting, (3) evaluating, and (4) offering a solution to a problem (Entman, 1993; Entman et al., 2009; Matthes, 2009). Early theories of framing argued that people learn to make sense of complex and unfamiliar issues through frames (Entman et al., 2009). When deciding how to best appeal to an audience, communicators construct frames that resonate with the audience and reduce the complexity of an issue (de Vreese, 2005; Entman, 1993; Shoemaker & Reese, 1991; Scheufele & Tewksbury, 2007).

Frames are then present in most forms of communication. In science communication, including science journalism, frames can help interpret the cautious and complex language used in the scientific community (Boykoff & Roberts, 2007; Scheufele & Tewksbury, 2007).

Frames also have been shown to directly influence understanding of concepts such as the environment, technology, and risk (Boykoff & Roberts, 2007; Weingart et al., 2000). Scholars state that framing plays a key role in how people process complex information (Entman, 1993; Nelson & Oxley, 1999; Scheufele & Tewksbury, 2007).

Influences on Climate Change Coverage

To better understand framing, scholars have indicated that research should focus on specific factors that may influence it (Scheufele & Tewksbury, 2007). When framing stories, journalists constantly conform to internal constraints like time and space, as they have only a certain amount of space to publish stories or time to cover various stories simultaneously (Boykoff & Roberts, 2007). Internal factors that also influence frame building include publication ownership and culture (for example, conservative versus liberal media) and journalists' training (Boykoff & Roberts, 2007). External factors known to have influenced climate change framing include extreme weather events, which journalists often link to climate change despite scientific uncertainty about the relationship of the climate with such events. Hurricane Katrina, for example, resulted in a wave of climate change coverage in the United States in 2005 (Boykoff & Roberts, 2007). Other factors that might influence coverage include publications' budgets. Newspapers that rely on revenue generated by advertising might be less inclined to report on environmental issues such as climate change if most of the advertising features businesses known to harm the environment (Boykoff & Roberts, 2007). Media can also be biased when they are government-owned. Such is the case in Russia, where the government profits largely from petroleum industries known to worsen climate change (Smith, 2016). The Russian government controls the media, which have omitted important climate change stories (Poberezhskaya, 2014).

In addition, the sources of information used for reporting on climate change may influence framing. Previous research has found that journalists use various sources of information when reporting about climate change. Wilson (2000) found that in the 1980s and 1990s, environmental reporters consulted mostly scientists as primary sources of information. However, legislators and interest groups have also been known to inform reporters and turn climate change into a highly politicized and sometimes controversial issue (Trumbo, 1996). In the United States, for example, corporations have promoted misinformation campaigns to discredit climate science (Goldenberg, 2016).

Climate Change Coverage Around the World

A growing number of studies have analyzed media coverage of climate change in various countries. In a cross-national study, Schmidt et al. (2013) found that climate change has received increasing coverage on all continents. Across 27 countries, factors influencing media attention included susceptibility to climate change impacts, highly visible policy efforts, and carbon dependency (Schmidt et al., 2013). Dispensa and Brulle (2003) stated that U.S. media have tended to misrepresent the issue of global warming more than less carbon-dependent nations. Grundmann and Scott (2012) found that climate skepticism is highly visible in U.S. and French media, where political personalities often serve as the leading information sources on climate science.

Further research is needed in order to fully explore and answer key questions about media coverage of climate change, especially as few studies have focused on developing and emergent countries (Arcilla-Calderon et al., 2015; Schmidt et al., 2013). One may expect to find differences in media coverage of climate change on a country-by-country basis (Brossard et al., 2004). Organized by region, the following subsections of this review focus

on climate change coverage around the world.

United States and Canada

Two major themes are evident in U.S. and Canadian coverage of climate change: the impacts of climate change and scientific controversy or skepticism (Brossard et al., 2004). A relationship is evident between U.S. media attention and events such as the heated congressional testimony of NASA scientist James Hansen in 1988, with markedly less coverage before and after that event (Trumbo, 1996). Boykoff and Roberts (2007) also observed attention increases in 1997, along with advertising campaigns in the United States opposing negotiations for the Kyoto Protocol, which is an important agreement for international regulation of human-emitted greenhouse gases causing global warming. Studies also have shown coverage increases in 2006 with the release of *An Inconvenient Truth* and the U.K. Government's *Stern Review on the Economics of Climate Change*, one of the most comprehensive reports on climate change impacts on the world economy (Boykoff & Roberts, 2007). Studies of Canadian media show coverage increases over time as well (Ahchong & Dodds 2012; Trumbo, 1996; Young & Dugas, 2011).

Other shifts over time in both Canadian and American media include narratives that discuss climate change more and more in the context of politics and the economy and decreasingly in terms of its impacts on the planet (Trumbo, 1996; Young & Dugas, 2011). Further, Trumbo (1996) observed a decline in use of scientists as information sources in American media, accompanied by an increased use of politicians and special interests. In Canada, environmentalist groups and businesses have increased as information sources, while academic experts and governmental sources have become less prominent (Young & Dugas, 2011).

It is difficult to determine whether scientists became less dominant information sources for climate change stories because of their own choice or because the media neglected them (Trumbo, 1996). This lack of input from expert scientists in the media may have translated into poor communication of the scientific community's understanding of climate change. Boykoff and Roberts (2007) states that since 1995, U.S. media often have framed the narrative around skepticism toward the legitimacy of climate science, despite U.S. and worldwide consensus that climate change indeed exists. On the other hand, Canadian media rarely have used skeptical framing with regard to climate change. Nevertheless, Canadian coverage has shifted focus from the scientific basis of climate change to its impacts, politics, and economics (Young & Dugas, 2011).

Europe

Given Europe's diverse culture, coverage of climate change has not been uniform throughout its countries. Brossard et al. (2004) analyzed the French media, which in general use few sources and rarely employ dramatic or sensationalistic frames. Some scholars have argued that French journalism tends to be heavily opinion-based (Kuhn, 1995). Because the French media use relatively few information sources, their stories may present few perspectives from interest and business groups (Brossard et al., 2004). Grundmann and Scott (2012) state that climate skepticism is highly visible in French media. In addition, the French media have focused heavily on climate conferences like the ones in Kyoto, Rio de Janeiro, and Berlin (Brossard et al., 2004).

Research suggests that media in Spain, Finland, and the United Kingdom include climate skepticism in their reporting. In the United Kingdom, the media contain a high level of sensationalistic frames, with narratives of impending catastrophe due to climate change

(Doulton & Brown, 2009). U.K. media also have been observed to frame developing countries as helpless in the face of climate change (Doulton & Brown, 2009). Other studies have found skeptical frames in U.K. media (Boykoff & Mansfield, 2008). Comparative studies have shown that the only other country with more skeptical frames toward climate science and effective policy is the United States (Painter & Ashe, 2012).

Finland (Lyytimäki, 2011) and Spain's (Arcilla-Calderon et al., 2015) media also have been observed to have a moderate presence of climate skepticism, although coverage of climate change has sometimes been scarce. Finnish media have undergone a shift, from focusing almost solely on scientific issues in the times leading to the release of the IPCC Fourth Assessment Report in 2007, to occasionally covering issues such as the Climategate controversy. Lyytimäki & Tapio (2009) state that these shifts signify increased focus on societal, political, and economic aspects of climate change. In Spain, the media have increasingly dedicated coverage to climate change in international and policy-related contexts (Fernández-Reyes et al., 2015). German media have been observed to communicate climate change very accurately (Schäfer et al., 2013; Weingart et al., 2000). The German media also have increased climate change coverage around the times of extreme events (such as floods) and international conferences where climate change is a major focus (Schäfer et al., 2013). Further, Swedish, Portuguese, and Greek media also have been observed to accurately present scientific consensus about climate change (Carvalho & Pereira, 2008; Gkiouzepas & Botetzagias, 2015; Olausson, 2009). Whereas Swedish media have focused often on adaptation and mitigation measures, Greek media also have focused on scientific findings and reports, energy, ecology, and meteorology (Gkiouzepas & Botetzagias, 2015; Olausson, 2009).

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Media from other European countries have covered climate change differently than the previously discussed nations. For instance, coverage in the Netherlands has shown pessimism and incredulity regarding climate change impacts (van Oene, 2010). In Norway, newspapers have presented contrasting frames, both supporting and criticizing established climate science (Ryghaugh et al., 2011). In Italy, contrasting frames also have been evident. Conservative Italian media have included frames of skepticism, whereas Italian liberal media have done the opposite (Pasquaré & Oppizzi, 2012).

Russia

Russia, whose media are mostly government-owned, has been reported as having bias that prevents climate change to be objectively discussed. In a content analysis of the Russian media, Poberezhskaya (2014) states:

> Whilst the scholars studying media coverage of climate change struggle to find explanations for why journalists write about climate change in a sensational manner, why these journalists devote the same space and time to the arguments of the minority of climate sceptics and so on, in the Russian case, one might say the problem is more serious – why is the debate on climate change still only taking 'baby steps' in entering public discourse?

After Russia abandoned the binding targets of the Kyoto Protocol, the Russian media unequivocally praised Russian officials for their efforts to protect the nation's economy (Poberezhskaya, 2014). Poberezhskaya argues that the government's influence on the media is prominent because perspectives by Russian leaders are rarely questioned in the media. When the government refused to take actions to reduce carbon emissions, the media ignored the issue altogether instead of discussing the implications of such decisions (Poberezhskaya

2014). This lack of focus on climate change, Poberezhskaya states, also has been evident during climate-related events such as heat waves.

Asia

The literature includes various studies on climate change coverage in Asia. Tolan (2007) argues that Chinese media are particularly interesting because most Chinese publications belong to the government, which oversees and scrutinizes their coverage. For the most part, Chinese coverage includes only scientific and technical reports from Western media without contextualization or explanation of scientific jargon (Tolan, 2007). Additionally, Tolan states that Chinese media report about impacts on remote regions like the Arctic and about regional impacts such as glacier melting in Tibet. However, in such cases the Chinese media report without discussing the causes for climate change (Tolan, 2007). Further, stories discussing China's leading role as a carbon emitter were rare. When present, these stories criticized industrialized countries contributing to climate change (Tolan, 2007; Painter & Ashe, 2012). In addition, interviews with Chinese journalists suggest they rarely access climate change information from non-government sources and often lack knowledge about climate science and policy (Shanahan, 2009).

Studies of Japanese media coverage of climate change show coverage increase associated with highly visible international events such as the Kyoto protocol and the release of the IPCC Fourth Assessment Report in 2007 (Sampei & Aoyagi-Usui, 2009). Asayama and Ishii state that media attention in Japan peaked soon after the Kyoto Protocol came into effect, and that coverage focused largely on conflict-associated international policy events such as the United States backing out of the accords (2012). Further, Japanese media have increasingly used dramatic frames that link extreme weather events to projections outlined by

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IPCC reports. However, these stories have not discussed gaps in knowledge regarding how these events are associated with climate change (Asayama & Ishii 2012).

Similar to Japanese media, South Korean media have paid high attention to climate change during international policy events, particularly the 2009 United Nations Climate Change Conference in Copenhagen (Lee, 2013). However, South Korean media appear to have presented vague and inaccurate information about climate change and its impacts (Lee et al., 2013). Some studies of South Korean coverage suggest the media present climate change as a human-caused phenomenon that threatens the entire planet, although doing so with a focus on policymaking and economic opportunities in alternative technology (Yun et al., 2012). Yun et al. state (2012) that South Korean media access climate change information mainly from governmental sources.

In India, analysis of three major newspapers found that the media devoted almost no space to climate skepticism (Billett, 2010). Indian stories focused largely on climate change impacts, including monsoon disruption and Himalayan glacial melt (Billett, 2010). Indian media, like those in other developing countries, has criticized both the lack of international policy to mitigate climate change and the negative implications such policies would have for their country's development (Billett, 2010; Boykoff 2010).

In my search of the English-speaking literature, I found substantially fewer studies on climate change coverage in the Middle East. Research on English-speaking media from Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates revealed varying coverage from country to country. According to Freeman's study of English-speaking Middle Eastern media (2016), most stories focus on science and educational aspects, international politics, and the economics of climate change. In addition to these topics, stories discuss

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energy resource management, land and resource conservation, and the weather. Freeman (2016) states that such findings suggest that reporters in the countries under study were aware of the complex issues involved in climate change. Additionally, most stories have touched on solutions involving international treaties and public and private sector policy, while almost none have focused on the causes of climate change (Freeman, 2016). Freeman also states that Middle Eastern media have sought climate change information mostly from scientists, with government officials being their second most common source. It is particularly interesting that given the carbon-intensive economies of the Middle East, English-speaking media in that region seem to exclude skepticism toward climate change (Freeman, 2016). This is because a country's carbon dependency has been known to influence coverage of climate change in its media (Schmidt et al., 2013). For example, media from carbon-intensive economies such as Australia, the United States, and Russia have been known to contain skepticism toward climate change (Boykoff & Roberts, 2007; Grundmann & Scott, 2012; Poberezhskaya, 2014; Schäfer et al., 2013). In the Middle East, Freeman (2016) notes, media occasionally indicate interest in alternative technologies to diversify energy portfolios.

Research on media in other Asian countries, such as Vietnam, has revealed sporadic and inconsistent coverage of climate change (Shanahan, 2009). In Bangladesh, most of the framing has focused on natural disasters, the scientific basis of climate change, and climate-related impacts on agriculture and public health (Miah et al., 2011). In Sri Lanka, journalists have said they lack a solid understanding of climate change and that they seek information mostly from international news agencies, science magazines, and nongovernmental organizations (Shanahan, 2009).

Latin America

The literature contains a moderate amount of information about coverage of climate change in Latin America. Arcilla-Calderon et al. (2015) analyzed media from 18 Latin American countries and found that most coverage either expressed concern toward climate change or adopted no position on the issue. A small proportion of these stories portrayed climate change as a non-urgent problem that required no action.

Studies on media in countries such as Brazil show similarities with both Spanish-speaking Latin America and other large, carbon-dependent countries. Brazilian media have emphasized political solutions, economic challenges, and scientific consensus about the anthropogenic nature of climate change (Painter & Ashe, 2012; Zamith et al., 2012). Further, Brazilian coverage often emphasized the inconvenience and cost of dealing with climate change (Zamith et al., 2012).

Media in countries with significantly less marked carbon footprints have covered climate change differently than carbon-dependent economies like Brazil. For example, Argentinean, Chilean, Colombian, and Peruvian media have criticized more firmly the lack of international policy, rarely including skeptical frames in their reporting and markedly including dramatic frames to emphasize climate change impacts and demand action (Dotson et al., 2012; Takahashi, 2011; Zamith et al., 2012). Further, Argentinean media have focused largely on conflicting positions in international policymaking, especially emphasizing the importance of industrialized countries in reducing carbon emissions (Mercado, 2012). In Chile, the media also have been observed to emphasize the country's vulnerability to climate change impacts as well as business opportunities in green technology (Hasbún, 2014). In Peru, the media have focused heavily on ecology, constructing narratives about climate

change around the effects of climate change on important Peruvian natural assets such as Andean glaciers (Takahashi, 2011).

In addition to the literature previously discussed, studies exist that have used interviews with journalists to explore climate change coverage in Latin America and the Caribbean. In Jamaica, for example, journalists rarely cover climate change (Shanahan, 2009). Interviewed Jamaican journalists have said when climate change appeared in the news, it was mostly thanks to international newswires or because of extreme weather in the country. Shanahan (2009) reported similar observations from interviews of Honduran journalists.

Oceania

My research of the literature disclosed fewer studies of climate change coverage in Oceania than in the Americas, Asia, and Europe. Australian media showed a striking increase in coverage between 1990 and 2009, with international and domestic policy events (G8 summits, Kyoto talks, national elections) triggering media attention (Speck, 2011). The findings also suggest that Australian media rarely use dramatic frames around extreme weather events. Further, skepticism toward the scientific basis and cause of climate change persists in Australian media, and it has been suggested that this framing results from a journalistic culture that values the newsworthiness of conflict (Schäfer et al., 2013). Speck (2011) also argues that skepticism is likely to prevail in Australia mostly because of a lack of public understanding of scientific probability and uncertainty (Speck, 2010). Scholars have also noted that Australian media have increasingly leaned toward political framing because events such as policy changes or international conferences seem more important for their audiences than stories explaining the scientific basis of climate change. For example, IPCC

reports that have received much more attention in other parts of the world have received relatively low attention in Australian media (Howard-Williams, 2009; Speck, 2010). In addition, the lack of focus on causes and impacts of climate change suggests that Australian media portray climate change as an issue with low relevance for their audience (Howard-Williams, 2009). Further, Howard-Williams (2009) has observed that other Oceanic countries show patterns of climate change coverage similar to Australia's, with the exception of New Zealand, which has shown a large focus on the scientific basis of climate change (Howard-Williams, 2009).

Africa

In searching for literature about climate change coverage in Africa, I found even sparser information than for Oceania, with limited content about only a few African countries (Mozambique, Nigeria, South Africa, Swaziland, and Zambia). Two main messages from these studies are the following: (1) countries that contribute the most carbon emissions leading to climate change should take stronger action in mitigating efforts; and (2) the African media can seldom afford to cover climate change (Shanahan, 2009; Tagbo, 2010). Nigerian and South African media have not covered climate change much even around important events such as the Copenhagen conference and the so-called Climategate controversy (Tagbo, 2010). In covering climate change, media in these countries use mostly international wire services and focus largely on international politics. Tagbo (2010) states this reliance on wire services may make it difficult for African audiences to learn about the impacts of climate change in a regional context. Further, African editors have said that although important, climate change is a relatively new subject that has low priority when compared with pressing issues with which the media and the public are more familiar and

concerned (Shanahan, 2009). Also, African journalists have expressed cynicism in covering climate change, arguing that it makes sense to spend time and resources covering it only when natural disasters or other significant events occur (Shanahan, 2009). Tagbo (2010) argues that such low levels of media attention suggest that journalists and the public have poor understanding of climate change and its impacts on Africa (Tagbo, 2010).

Research Objectives

My review of the literature disclosed only one study on climate change coverage by Mexican media. In that study, Gordon et al. (2010) analyzed climate change coverage from 2004 to 2006 in *Reforma*, one of Mexico's most influential, dominant, and widely circulated newspapers. Although *Reforma*'s coverage increased during international conferences, Gordon et al. (2010) state that *Reforma* reporters may not necessarily think of climate change as the most important issue in the paper. Additionally, Gordon et al. (2010) indicate that the most frequent frames with regard to climate change in *Reforma* are those focusing on ecology, science, and impacts, while framing focusing on climate skepticism is nearly absent.

The study by Gordon et al. represents a first step toward better understanding climate change reporting in Mexico. However, because the Mexican media also include other major newspapers, further research is warranted to fill gaps of knowledge about climate change coverage in Mexico. My thesis therefore explores coverage by *El Universal*, another major Mexican newspaper. Founded almost 100 years ago in the midst of the Mexican Revolution, *El Universal* has remained a leading newspaper, with some of the largest circulation numbers (Padrón Nacional de Medios Impresos, n.d.) and online readers (Pérez-Stadelmann, 2014) in the country.

This study of *El Universal* provides an exploratory analysis of how Mexican media

cover climate change. Such an analysis is important because the media play key roles in informing the public about issues such as climate change (Wilson, 1995). Because the amount and type of information readers receive affect their understanding of an issue, this study analyzed coverage and framing of climate change by *El Universal.* My research also identified the sources to which *El Universal* attributes information when reporting on climate change. Describing these source types may prove valuable for analysis of frames in Mexican media. This is because the types of frames included in stories may vary according to the types of sources used in covering climate change. For example, in other countries corporations have been associated with frames focusing on climate skepticism. Further analysis of frames-and-source relationships can shed light on how elements other than the media themselves might influence coverage—and thus public understanding—of climate change in Mexico.

In brief, I analyzed three main aspects of coverage of climate change: (1) amount of coverage, (2) framing, and (3) sources of information. More specifically, my research questions were the following:

RQ1: If the amount of climate change coverage in *El Universal* varied over time, with what events, if any, did these changes appear to be associated?

RQ2: What frames has *El Universal* used in its stories about climate change?

RQ3: If *El Universal* attributed information to specific sources, what sources did it identify?

CHAPTER II

METHOD

This thesis is an exploratory study of how *El Universal,* one of Mexico's most highly influential newspapers, covered climate change and climate-change-related issues from 2007 to 2015. Using content analysis, I (1) observed if and how *El Universal'*s coverage of climate change varied over time, (2) analyzed *El Universal'*s framing of climate change, and (3) identified information sources *El Universal* cited in its stories on climate change. In addition to gathering information to address the three research questions, I identified story types (news, feature, or editorial) for all stories.

Data

I used the LexisNexis database to identify and retrieve stories about climate change published by *El Universal* between January 1, 2007, and December 31, 2015. LexisNexis corporation offers one of the most extensive databases of electronically accessible journalistic documents. Use of its ample repository of international newspaper stories proved to be the most efficient method to access hundreds of *El Universal'*s archived stories. Initially, I had planned to retrieve as many stories as possible that had been published before December 31, 2015. However, *El Universal'*s stories prior to 2007 were inaccessible through LexisNexis and other databases. Nevertheless, the selected period of study includes events of significance for climate change. I expected these events to show associations with changes in *El Universal'*s coverage and framing of the topic. For example, I expected the 2010 United

Nations Climate Change Conference of the Parties, which was hosted in Mexico, to be associated with coverage increases in *El Universal*.

I created my dataset by searching in LexisNexis for stories that included one or both of following Spanish terms *cambio climático* (climate change) and *calentamiento global* (global warming). To ensure inclusion of as many stories as possible and to omit duplicates, I conducted three searches in Lexis Nexis, for: (1) all stories including only the term *cambio climático*, (2) all stories including only the term *calentamiento global*, and (3) all stories including both terms. I conducted those searches for each year from 2007 through 2015. Although the terms climate change and global warming are not meant to be synonymous, I chose to use both Spanish terms as indicators for gathering data because reporters in Mexico and elsewhere have been known to use them interchangeably to refer to climate change in general. Because some stories on the topic might not have included either of those terms, it is possible my search did not disclose all stories. However, it should be noted that in stories without direct mention of climate change or global warming, the topic is unlikely to be the main subject.

To select stories for my data sample, I adopted the approach used by Zamith et al. (2012) in their study of climate change coverage in South American and US newspapers. In that study, all pieces were screened and included in the sample only if they were (1) about climate change and its effects or (2) about other issues to which climate change is linked explicitly and principally within the story. Using this approach, I excluded pieces that mentioned climate change or global warming briefly and without making the topic a central focus in the story. An example of an excluded piece was a story mainly focusing on the opening of a new museum in Mexico City, where a climate change exhibit was listed

amongst the museum's other exhibits. I also excluded stories that used the term(s) out of context. An example was a story briefly mentioning global warming in its lead as a way to introduce summer fashion trends. I conducted the preliminary screening of all pieces retrieved from LexisNexis. An option to exclude a story also was available during the coding process.

Because of the initial screening, the number of stories retrieved from LexisNexis differed from the number actually included in this study. A preliminary search in LexisNexis yielded 1852 stories. However, my final dataset included 1047 stories. My sample comprised several types of stories, including news articles, features, and editorials. The stories were downloaded from LexisNexis as plain text without visuals, and the stories used in this study were not translated from Spanish to English.

Coding

As per **Research Question #1**, one of the main objectives of the coding process was to provide the foundation for analyzing whether and how *El Universal*'s climate change coverage varied over time. I recorded the date of publication for each story in my dataset. Doing so allowed me to count the stories published within a given month or year and to visualize display publication trends over the entire period of study and individually for each year using Excel's and LexisNexis' chart tools. I then used these visualizations to see whether changes in coverage corresponded with climate-change-related events on a timeline that I created.

In line with **Research Question #2,** another main coding component was identifying frames. The frames I searched for were adapted from those in Gordon et al.'s analysis of global warming coverage in *Reforma,* another highly influential newspaper in Mexico

(2010). For this study, I initially classified each story as having one or more of the following frames: awareness, conflict, economics, impact, policy, science, science and technology (S&T) solutions, and miscellaneous. Table 1 below includes brief definitions and examples of these frames, which are more fully explained in **Appendix A**. I read all stories and assigned one or more frames to each. The frames assigned were those with the greatest emphasis throughout the story. The "miscellaneous" classification was given to frames that, because of their apparent lack of relationship to any listed theme, were unable to be classified under the major frames used in this study. An example of a story with a miscellaneous frame was a 2014 news article about survey findings on Mexicans' perceptions of climate change.

Table 1. Operational Definitions of Frames, adapted from Gordon et al. (2010).

Frame	Definition	Example
Awareness	Focuses on the importance of climate change or its impacts in a way that raises awareness or educates audiences	Content explaining why climate change is one of the greatest challenges in the world
Conflict	Focuses on conflicts or controversies regarding the science of climate change	Content focusing on claims that climate change is a hoax or is not anthropogenic
Economics	Focuses on economic benefits, perils, or changes due to climate change	Content covering climate change effects on economics of agricultural sector
Impact	Focuses on climate-change-related effects on the planet	Content that explicitly links a catastrophic hurricane to climate change
Policy	Focuses on political events or governmental agenda changes directly related to climate change	Content focusing on new legislation passed to reduce carbon dioxide emissions
Science	Focuses on information about the science of climate change	Content explaining how the climate has changed since ancient times
S&T Solutions	Focuses on new developments to mitigate and adapt to climate change	Content about a new car engine designed to reduce carbon dioxide emissions

Table 1 Continued**.**

Note: *If frames other than those described above were identified, they were marked as "miscellaneous" and briefly described. At the end of the coding process, all frames classified as miscellaneous were screened again to be possibly assigned to an existing frame or to be conclusively marked as miscellaneous.*

In addition to coding for frames, I identified sources of information cited. Doing so was the main objective of **Research Question #3.** To address this question, I used operationalizations similar to those of Brossard et al. (2004). In their study, Brossard et al. assigned sources to the following categories: academics and scientists, business/industry groups, economists, environmental groups, non-expert/citizen sources, unnamed experts or officials, and other. Table 2 below provides brief definitions and examples of the categories of sources used in the current study. Further, sources of information were classified as national, foreign, or both. **Appendix A** includes more detail and operational definitions used for source characterization.

Table 2. Operational Definitions of Sources of Information.

Source Type	Example
Activist	Person who actively participates in events to advocate for mitigating climate change
Business group (or member thereof)	Person(s) who support or oppose climate change legislation because of the impacts on his/her business
Expert scientist	A scientist with expertise in climate or Earth sciences
Governmental agency (or member thereof)	Official from a government agency
Non-governmental organization (or member thereof)	Official from an NGO
Non-expert authority	Influential person, such as a president or the Pope

Table 2 Continued**.**

Source Type	Example
Non-expert Scientist	A scientist with expertise in fields other than climate science or a relevant area of Earth science
Social scientist	An economist, political scientist, or sociologist

Note: *If sources of information other than those described above were identified, they were marked as "miscellaneous" and briefly described. At the end of the coding process, these sources were screened again and either assigned to a type of source or conclusively marked as "miscellaneous." When information was presented without citing a source, or when a source was stated but it was unclear which category the source belonged to, the "unknown" classification was assigned.*

Coding Procedure and Data Analysis

      I coded all stories in the data sample. To reduce bias in this study, two other coders classified a subset of stories from the same sample. I was labeled Coder A, and the other coders were labeled Coders B and C. Because many stories needed to be coded, Coders B and C classified a representative subset of stories. This subset was created by randomly selecting 10% of all stories in the entire sample with Microsoft Excel's sorting feature. Coders B and C are both journalists who are native speakers of Spanish from Chile. I am a native speaker of Spanish from Mexico. One of the coders and I have taken courses in science communication and climate change, and the third coder was familiar with climate change terminology. Our backgrounds helped ensure that the appropriate codes were selected.

      This study's coding tool was an online questionnaire created specifically to collect the data for the current study. I created this tool using the online data collection software Qualtrics. Use of the online tool helped enable the three coders, who resided in different

locations, to participate without difficulty. A copy of the questions used in the coding tool and a link to the interface as presented to all coders are available **(Appendix B)**.

To help ensure coding reliability and consistency among all coders, results from each coder were compared several times before, during, and after the final coding process. I trained Coders B and C to understand the approach and operational definitions in this study. During informal training exercises, all coders classified stories from the Mexican newspaper *Reforma* and compared results. After the second coding exercise, we observed an agreement percentage of 75%. Coders resolved disagreements through discussion. After the third exercise, coding was 95% in agreement. For this study, intercoder reliability was formally assessed using Krippendorff's alpha, which scholars identify as a standard measure for reliability (Hayes and Krippendorff, 2007). I computed Krippendorff's alpha using the IBM Statistical Analysis Software Package as instructed by Hayes and Krippendorff (2007). Krippendorff's alpha was computed for questions concerning frame and source identification. These aspects of the coding, which concern **Research Questions #2 and #3,** were more susceptible to disagreement between coders. Intercoder reliability was not computed for dates of publication, which concern **Research Question #1,** as this part of the coding did not entail judgment.

CHAPTER III

RESULTS

I conducted a content analysis to explore how *El Universal*, one of the most

influential newspapers in Mexico, covered climate change from 2007 to 2015. This study

began with a search for all *El Universal* stories on climate change and global warming

between 2007 and 2015, resulting in 1852 stories. From that search, only stories that referred

explicitly to climate change were selected. Thus, the final sample included 1047 stories. Each

story was classified as a news article, editorial (or other opinion piece), or feature article.

Coding Reliability

I coded all stories in the data sample, and two other coders classified a representative

subset of stories comprising 10% of the entire sample. I used Krippendorff's alpha, a

standard measure of reliability (Hayes and Krippendorff, 2007), to compute intercoder

reliability between all coders. These computations yielded acceptable Krippendorff's alphas

(over 0.67). For coding for media frames, Krippendorff's alpha was 0.88. For the type of

source, Krippendorff's alpha was 0.90. For determining whether the source was domestic or

international, Krippendorff's alpha was 0.86.

Percent agreement also was calculated. I calculated these agreements separately

between Coders A and B, as well as Coders A and C. For coding media frames, percentage

agreement was 90% between Coders A and B, and 84% between Coders A and C. For the

type of source, agreement was 92% for both Coders B and C with Coder A. For determining

whether the source was domestic or international, agreement was 98% between Coders A and B, and 84% between Coders A and C.

General Findings

News articles were considerably more common than editorials and features in all years except 2007 (Figure 1). Of the 1047 stories analyzed, 899 were news articles, 80 were editorials, and 60 were features. Also, 825 stories included only the term *cambio climático* (climate change), 88 included only the term *calentamiento global* (global warming), and 134 included both terms.
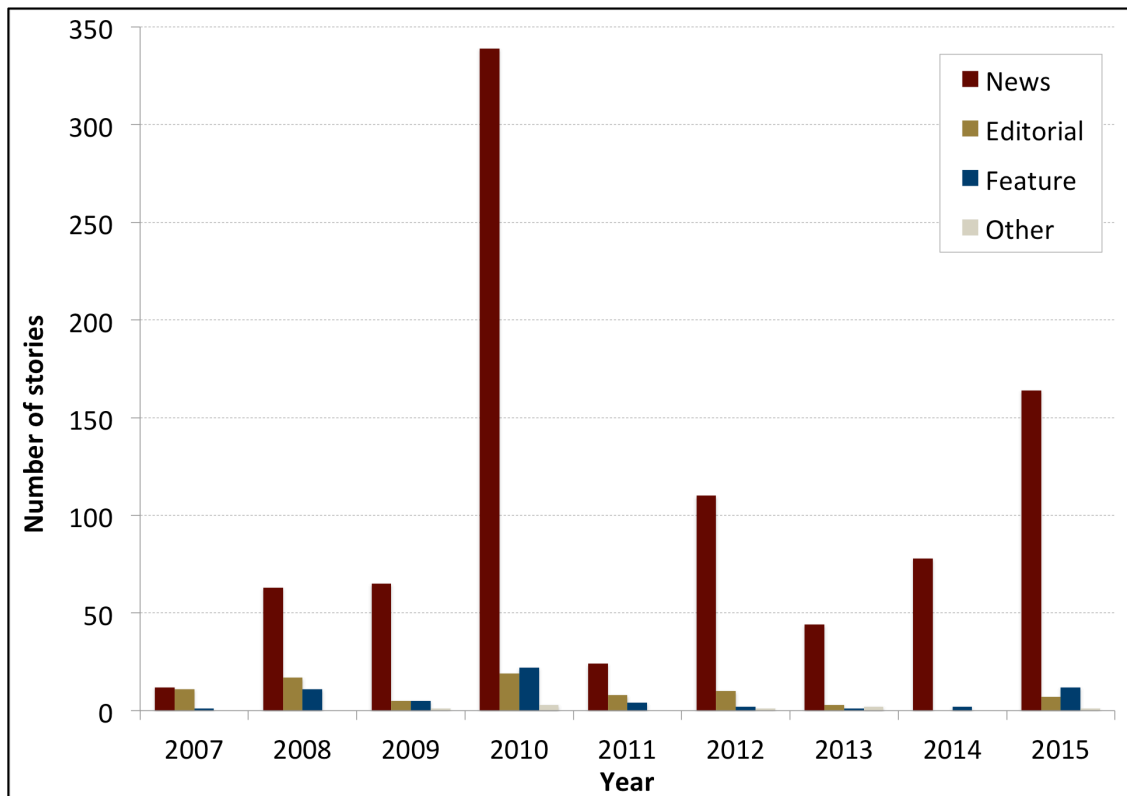

Figure 1. Types of Climate Change Stories in *El Universal*, 2007–2015.

Most stories were between 300 and 799 words long. In descending order of frequency, the distribution of story lengths was 300–499 words (n=446), 500–799 words (n=308), 200–299 words (n=136), over 800 words (n=111), and less than 199 words (n=46).

I also determined whether stories presented climate change in domestic (including regional) or international contexts. Many more stories covered climate change in a domestic context only (n=554) than in the international context alone (n=59). A total of 388 stories covered the issue in both the national and international contexts. For 46 stories, it was unclear whether the scope was domestic or international.

Media Attention

The numbers of stories published varied from year to year (Table 3). The year with most stories was 2010, with 383 stories. Other years had considerably fewer stories. The year with the least stories was 2007, with 24 stories.

Table 3. Climate Change Stories Published Per Year in *El Universal*, 2007–2015.

Year	Stories
2010	383
2015	184
2012	123
2008	91
2014	80
2009	76
2013	50
2011	36
2007	24

Numbers of stories per month were also determined (Figure 2). For the first three quarters of 2010, the numbers of stories resembled those in other years with high coverage.

However, in the fourth quarter, when the United Nations Climate Change Conference of the Parties (COP) took place in Mexico, the number of stories was approximately 7.5 times as high as the average for the same period in the other years. Events that were accompanied by marked increases in number of stories were UN climate change conferences in 2007, 2009, 2010, and 2015; a Green Fund initiative by the Mexican government in 2008; and an extreme drought in 2011 and 2012.
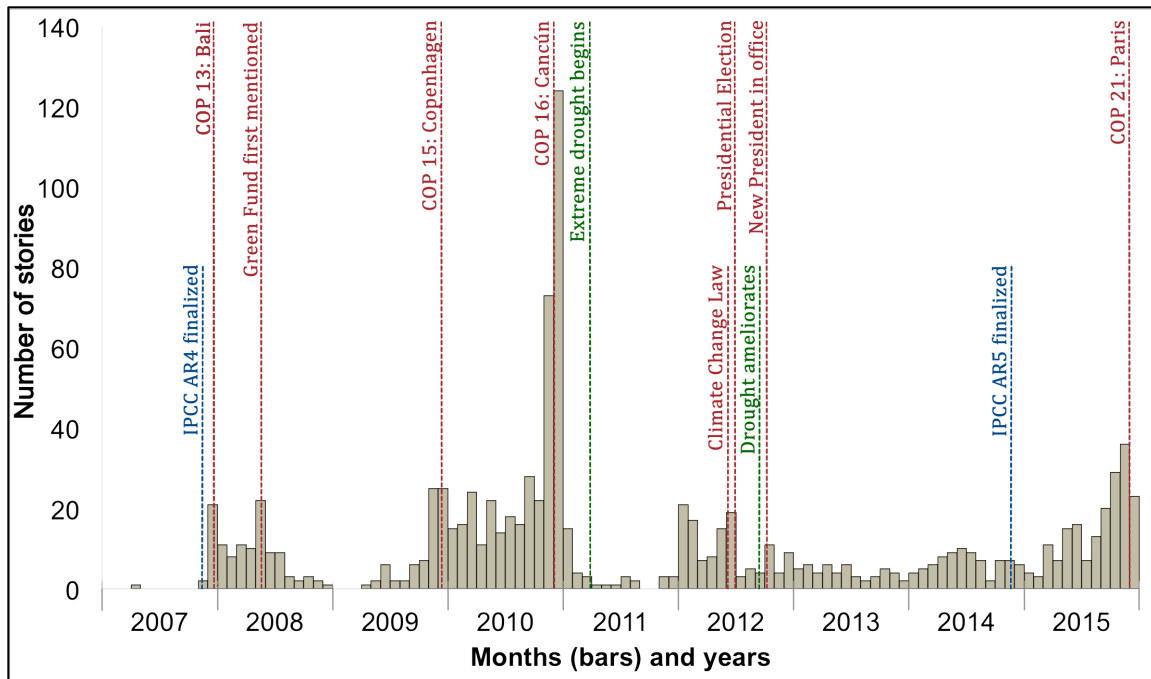
Figure 2. Numbers of Climate Change Stories Published in *El Universal,* 2007–2015. Red markers indicate times when policy-related events such as UN Climate Change Conferences of the Parties (COPs) overlapped with increases in climate change coverage. Green markers indicate climate-change-related environmental events associated with coverage increases. Blue markers indicate completion and release times of the Intergovernmental Panel on Climate Change Fourth and Fifth Assessment Reports (IPCC AR4 and AR5).

Framing

For the study period as a whole, the policy and impact frames were most common (Table 4). They were also the most common in all types of stories, although in editorials and features other frames were relatively more common than in news stories (Figure 3). The policy frame was observed in 532 stories, and the impact frame was observed in 359 stories. The third most common frame was awareness, observed in 136 stories. Table 5 presents examples of content falling into each frame.

Table 4. Occurrences of Frames in *El Universal'*s Climate Change Stories, 2007–2015.

Frame	Occurrence
Policy	532
Impact	359
Awareness	136
Economics	94
S&T Solutions	84
Science	57
Miscellaneous	51
Conflict	9
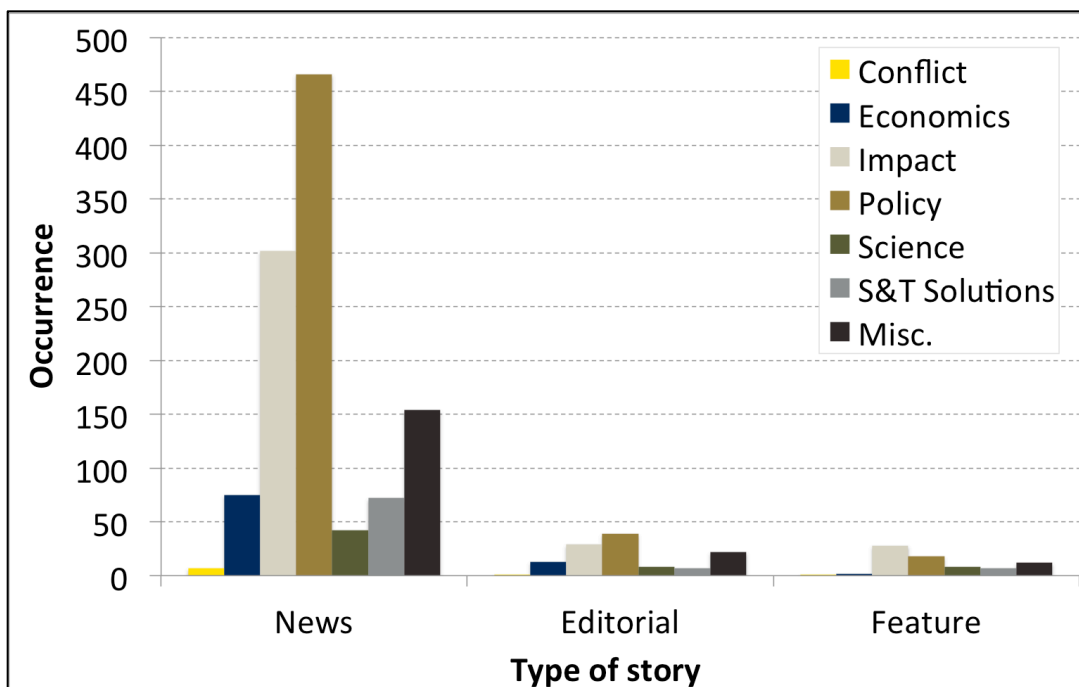
Figure 3. Occurrences of Frames in *El Universal'*s Climate Change News, Editorial, and Feature Stories, 2007–2015.

Table 5. Examples of Content Falling Into Various Frames in *El Universal*'s Climate Change Stories, 2007–2015.

Frame	Example
Awareness	A composer releases an album with ecological themes to raise awareness of the dangers of climate change and the need for international agreements.
Conflict	Oil and gas corporation ExxonMobil is reported to have financed groups that promote climate skepticism.
Economics	Former Mexican president Felipe Calderón promotes a Green Fund initiative in which countries would contribute funds to protect the environment and minimize impacts of climate change.
Impact	The Mexican secretary of health says the increased number of dengue cases in 2007 was due to floods caused by climate change.
Policy	The Government of Mexico City presents an official Climate Action Plan, which focuses on adaptation and mitigation efforts to face climate-related vulnerability.
Science	The Intergovernmental Panel on Climate Change Fourth Assessment Report attributes over 90% of climate change to human activity.
S&T Solutions	Advances in biotechnology could help offset increased agricultural demands associated with climate change and overpopulation.

Table 5 Continued.

Frame	Example
Miscellaneous	Because of the increasing importance of climate change, the National Institute of Women says Mexican women should consider careers in climate policy and finance.

Occurrences of frames in individual years resembled the relative occurrences for the period as a whole (Figure 4). The policy frame was most common and the impact frame was second most common in 2007, 2008, 2009, 2010, 2014, and 2015. The impact frame, followed by the policy and awareness frames, was the most common in 2011, 2012, and 2013. Stories often included more than one frame. Therefore, more frames than stories were identified.
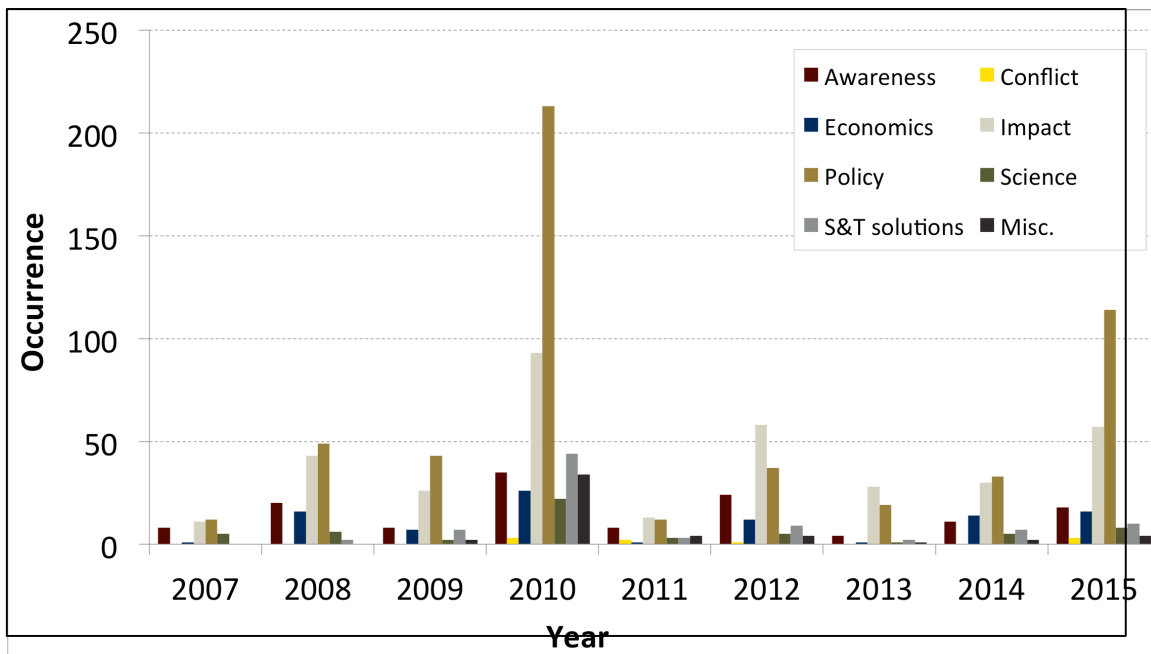
Figure 4. Distribution of Frames in *El Universal*'s Climate Change Stories, 2007–2015.

I also determined whether frames were included in stories that discussed climate change with domestic, international, or combined scope (Figure 5). Stories including the impact, S&T solutions, and miscellaneous frames generally discussed climate change in a domestic context only. Stories with the policy, economics, and science frames generally focused on both domestic and international contexts. Stories seldom mentioned climate change in an international context alone.
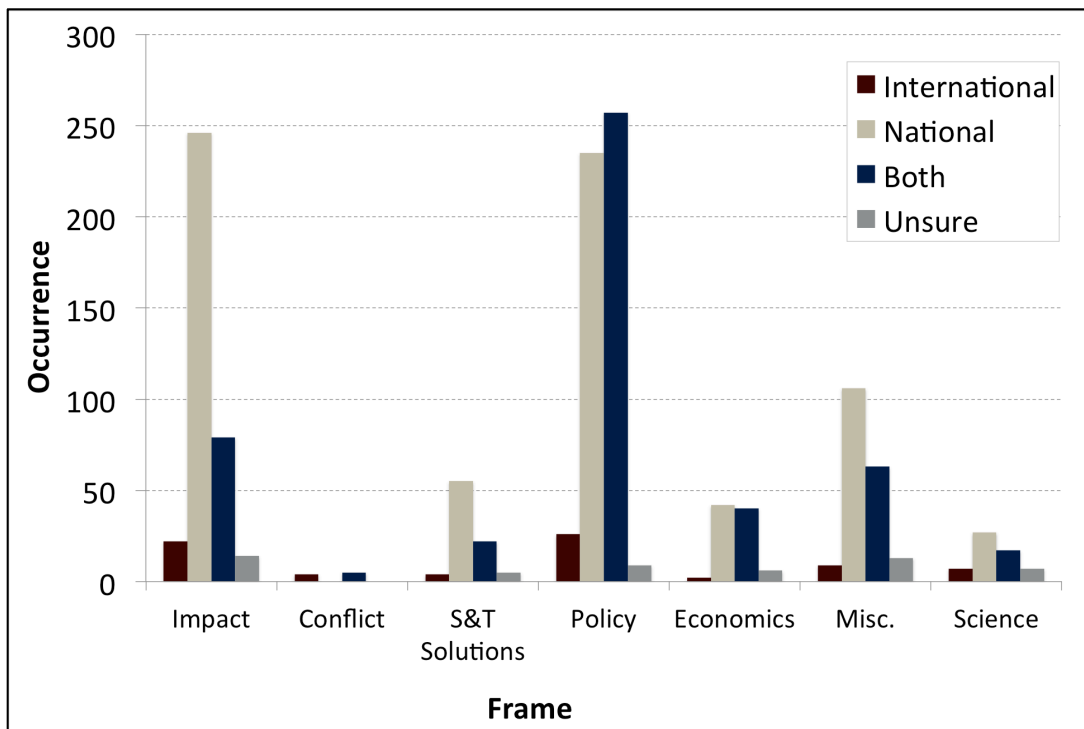
**Figure 5.** Distribution of Frames in *El Universal'*s Climate Change Stories with Domestic, International, or Combined Scope, 2007–2015.

Sources of Information

Information sources that were explicitly stated in the stories were also identified (Table 6). By far, the most commonly identified source of information was governmental

agencies, observed in 617 stories. The least commonly identified source was activists. In 93

stories, no information source was explicitly stated. Examples of sources found appear in

Table 7.

Table 6. Occurrence of Source Types in *El Universal'*s Climate Change Stories, 2007–2015.

Type of Source	Occurrence
Gov't agency	617
Non-expert authority	169
Expert scientist	118
NGO	107
Unknown	93
Business group	61
Miscellaneous	44
Non-expert scientist	42
Social scientist	26
Activist	15

Table 7. Examples of Information Sources Identified in *El Universal'*s Climate Change Stories, 2007–2015.

Source type	Example
Activist	Mexican indigenous activist Simona Gómez López; Guatemalan indigenous activist Dolores Sales.
Business group	CEMEX, a Mexican multinational building materials company.
Expert scientist	Mario Molina, atmospheric and environmental chemist and Nobel laureate; Vicky Pope, atmospheric scientist at U.K. Met Office.
Governmental agency	Mexico's Federal Electricity Commission; U.S. agencies such as NASA and the National Oceanic and Atmospheric Administration.
Non-governmental organization	Mexican NGO Revolutionary Confederation of Workers and Farmers; World Wild Fund for Nature; Greenpeace.
Non-expert authority	Mexico City Mayor Marcelo Ebrard; U.S. president Barack Obama.
Non-expert scientist(s)	A Canadian computer scientist who used amphibious robots to photograph coral reef damage associated with climate change.

Table 7 Continued**.**

Source type	Example
Social scientist(s)	Political analyst David Ibarra Muñoz; British economist Nicholas Stern.
Miscellaneous	Filmmaker Fernando Rovzar; *El Universal*, via findings of a climate-change-related survey.

Stories often included more than one source type. The most common source type combinations were non-expert authority/government agency (n=114), expert scientist/government agency (n=16), and non-expert scientist/expert scientist (n=10).

Sources were solely Mexican in 666 stories, solely international sources in 171 stories, and both Mexican and international in 125 stories. Whether a source was Mexican or international could not be determined in 85 stories.

Associations between source types and frames also were identified (Figure 6). Almost every frame was associated with the governmental agency source type. Only for the science frame were expert scientists about as common a source as government agencies.
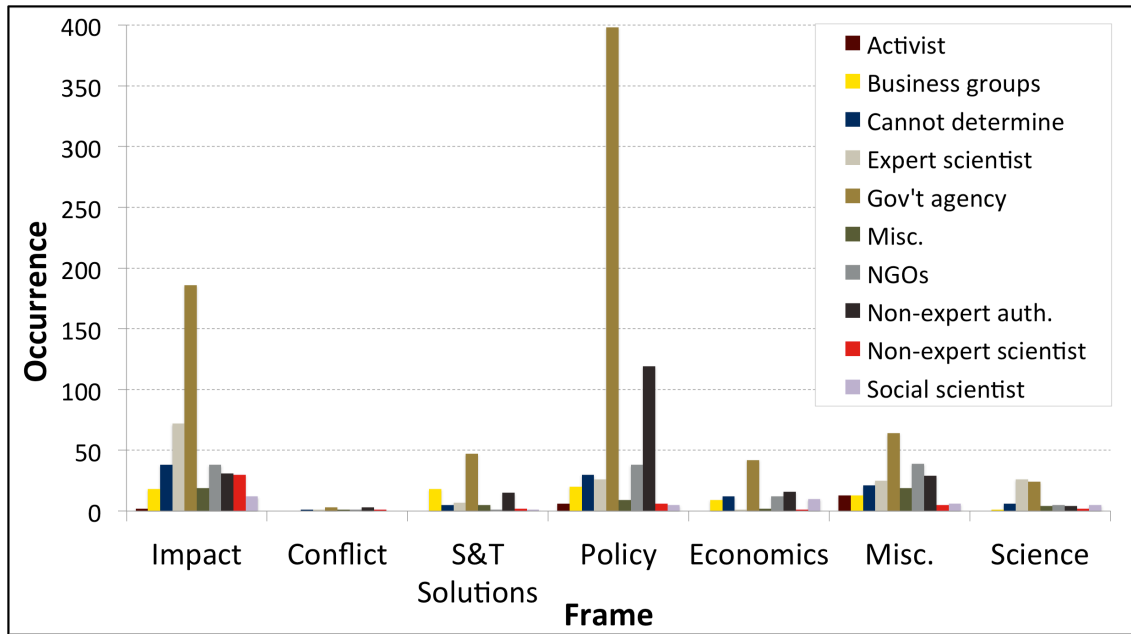
Figure 6. Distribution of Frames and Source Types in *El Universal'*s Climate Change Stories, 2007–2015.

Associations between sources and story types were also analyzed (**Appendix C**). Government sources were the most used in all types of stories. For news articles, the next two most common sources were business groups and expert scientists. In editorials and other opinion pieces, the next two were miscellaneous sources and expert scientists. For features, the next two were expert scientists and miscellaneous sources (such as celebrities, journalists, and laypeople).

CHAPTER IV

DISCUSSION

This study had the main objective of exploring how *El Universal,* one of Mexico's most influential and highly circulated newspapers, has covered climate change. I therefore analyzed *El Universal'*s coverage of, or attention to, climate change during 2007 through 2015. My analysis addressed the following research questions:

RQ1: If the amount of climate change coverage in *El Universal* varied over time, with what events, if any, did these changes appear to be associated?

RQ2: What frames has *El Universal* used in its stories about climate change?

RQ3: If *El Universal* attributed information to specific sources, what sources did it identify?

This analysis could be valuable in understanding the relationship between media such as *El Universal* and Mexicans' views and understanding of climate change. Recent surveys suggest that Mexicans find climate change an interesting topic (Franco et al., 2015) and perceive global warming as a grave threat to Mexico (Centro de Estudios Sociales y de Opinión Publica [CESOP], 2014; Otero, 2011). And scholars have contended that the media can influence public understanding of climate change (Boykoff & Roberts, 2007).

In this chapter, I will discuss my findings and their implications with respect to my research questions and conclusions of past research.

RQ1: If the Amount of Climate Change Coverage in *El Universal* Varied Over Time, With What Events, If Any, Did These Changes Appear to Be Associated?

Most of *El Universal'*s increases in coverage have been associated with international relations and policy-related events such as United Nations climate change conferences (Figure 2). This observation resembles those made with regard to several regions of the world, including Asia, Europe, North America, and Oceania, where coverage spikes have coincided with high-profile international and national climate policy events (Gifford et al., 2017; Schmidt et al., 2013).

*El Universal'*s coverage of climate change between 2007 and 2015 resembled that by other newspapers around the world. Gifford et al. (2017) observed a decline in climate change coverage in other countries after 2007, followed by an increase overlapping with the Copenhagen United Nations Climate Change Conference of the Parties (COP) in December 2009. A similar coverage spike was observed for other countries around the time of the Paris COP in November and December 2015 (Gifford et al., 2017). In *El Universal,* considerable coverage increases also coincided with the Copenhagen and Paris conferences. In addition, *El Universal* did not increase coverage around the dates of high-profile scientific events such as the release of the Fourth and Fifth Assessment reports by the Intergovernmental Panel on Climate Change (IPCC) (Figure 2). Relatively low levels of attention toward scientific reports on climate change have also been observed in other countries, including the United States (Boykoff & Roberts, 2007), Canada (Young & Dugas, 2011), and Australia (Howard-Williams, 2009; Speck, 2010). In contrast, media in countries such as China and Finland have focused almost exclusively on scientific issues (Lyytimäki & Tapio, 2009; Tolan, 2007). *El Universal'*s reporting of climate change could be improved by dedicating more

coverage to important scientific assessments and issues. This is because climate change is a global and complex challenge that demands cutting-edge science and effective international policy. Reporting heavily on politics but not science (or vice versa) may present readers with an unbalanced or limited view of climate change.

Held in Mexico in 2010, the Cancún COP overlapped with the largest spike of climate change coverage (Figure 2). Indeed, *El Universal* published a relatively high number of stories on climate change during all of 2010. However, stories published in early 2010 did not focus exclusively on the Cancún conference in December. Several of those stories discussed aspects of climate change other than the conference in Cancún and included frames other than policy (Figure 4). Events such as the Cancún talks seem to have served as months-long news pegs for stories about climate change and its socioeconomic, scientific, and technological implications. Other high-profile conferences such as the 2007 Copenhagen and 2015 Paris summits may also have made *El Universal* more attentive to the non-policy implications of climate change.

Climate Change in El Universal: 2007–2015

*El Universal'*s attention to climate change varied over time (Figure 2), with peaks in 2010 and 2015, and lows in 2007 and 2011. In the following paragraphs, implications of these and other coverage changes are discussed in chronological order.

I found considerably fewer stories for 2007 than for other years. In 2007, the number of stories per month varied more than in other years with relatively few stories. For example, in 2007 nearly all stories were published in December. This anomaly could be associated with indexing errors from either *El Universal* or LexisNexis, the database used for collecting stories. This is a possible explanation, given that some indexing irregularities were noticed

throughout the data sample. For example, some 2009 and 2010 stories listed no headline. Because only 24 stories were observed in 2007—with 21 of them published in December— perhaps some studies published earlier in 2007 were missing from LexisNexis.

Another possible explanation for the low level of coverage in 2007 could be that *El Universal* paid little attention to climate change then. The IPCC AR4, a pivotal document for climate science that received considerable coverage in other countries after being completed in 2007, received little attention from *El Universal.* In their study of the similarly influential Mexican newspaper *Reforma,* Gordon et al. (2010) stated that Mexican journalists seemed somewhat uninterested in global warming. It would be difficult to know whether *El Universal*'s journalists were in fact uninterested in the issue. However, similar to those for *Reforma* from 2004 through 2006, my findings for *El Universal* show relatively low attention to climate change in 2007.

If lack of interest was the underlying cause for the low coverage throughout most of 2007 in *El Universal*, the coverage spike in December could probably be attributed to the 2007 COP in Bali, Indonesia. That conference was noteworthy because it produced the Bali Action Plan for decision-making needed to address climate change beyond the expiration of the Kyoto Protocol (United Nations Framework Convention on Climate Change [UNFCCC], 2014), a 1997 agreement to begin international regulation of greenhouse gas emissions (UNFCCC, 2014). The coverage spike in late 2007 is important because it demonstrates how high-profile policy-related events may have increased coverage in *El Universal.* Even in 2007, a year with very climate change coverage, a highly visible and policy-related event was associated with increased coverage.

A sharp coverage increase occurred in May 2008 (Figure 2). This increase might have been associated with an international policy initiative proposed by the Mexican president at the time, Felipe Calderón Hinojosa. The initiative was known as the "Green Fund." It proposed financial incentives for climate change adaptation projects and reduction of greenhouse gas emissions, particularly in developing countries (The Economist, 2009; The World Bank, 2010). Calderón's Green Fund initiative may have served as a news peg in a similar way that high-profile climate conferences seem to have served in 2010 and 2015.

Coverage decreased after mid-2008, but a noticeable spike occurred in late 2009 (Figure 2). The Copenhagen COP in December 2009 is likely the reason for this spike. The event drew substantial attention from media worldwide (Gifford et al., 2017; Zamith et al., 2012). This conference was widely anticipated and is considered to have included some of the most important negotiations in international climate policy. During the Copenhagen talks, international leaders negotiated to reach agreements first mapped in the Bali Action Plan in 2007 (UNFCCC, 2014). However, the negotiations fell short of reaching the anticipated international agreement to reduce greenhouse gas emissions (Vidal et al., 2009). Another event that may have increased *El Universal'*s coverage of climate change in 2009 was the UN World Environment Day, an annual event, held every June 5 since 1973,that *El Universal* covered in June 2009. This event was hosted in Mexico in 2009, with a theme of tackling climate change (United Nations Environment Programme, 2015). In contrast, an example of a climate-change-related event in 2009 that attracted media attention in many countries (Zamith et al., 2012) without doing so markedly in *El Universal* was the so-called "Climategate," a controversy over hacked emails incorrectly—but intentionally—used to suggest researchers had manipulated data (Carrington, 2011; Union of Concerned Scientists,

n.d.). In my research, I found no mention of the controversy. Reasons for this lack of attention to Climategate and skepticism in general in Mexico can be numerous, but one could be that skeptical and denialist campaigns against climate science have been more commonly associated with English-speaking countries (Mooney, 2014).

With a markedly high number of stories, 2010 was the year with most coverage from *El Universal* (Table 3). The 2010 Cancún COP in Mexico likely influenced this coverage peak. The number of climate change stories increased sharply around the time the conference began in November and declined sharply with its conclusion in December (Figure 2). Also, *El Universal'*s headlines in late 2010 focused substantially on the Cancún summit. The unusually high level of coverage from *El Universal* was no surprise, as holding a climate change conference in Mexico was highly likely to increase the topic's relevance for readers and reporters. The coverage peak may also be associated with ease of reporting, since Mexican journalists may have had increased access to climate-related information because of the conference. For example, the Mexican government, the predominant source of information in *El Universal'*s climate change stories (Table 4), may have facilitated access to information before and during the conference. In addition, perhaps source materials in Spanish were more available in conjunction with this conference than with previous such conferences, which may have made content more accessible for Mexican reporters.

In other countries, coverage increases have coincided with highly relevant climate conferences (Gifford et al., 2017). However, coverage around the time of the Cancún talks in 2010 increased much more markedly in *El Universal* than in newspapers in other countries. In November and December 2010, *El Universal* published 197 climate change stories. Other Latin American newspapers published far fewer climate change stories during that period. In

their database of geographically diverse highly circulated newspapers, Gifford et al. (2017) included *La Nación* from Argentina, *El Mercurio* from Chile, and *El Nacional* from Venezuela. Together, these newspapers published only 17 climate change stories in November and December 2010. The same database shows that in the United States, coverage from *Los Angeles Times*, the *New York Times*, *USA Today*, the *Wall Street Journal,* and the *Washington Post* averaged 79 stories for that same period (Gifford et al., 2017). Coverage lower than *El Universal*'s during the Cancún summit also has been recorded for newspapers in Canada and the United Kingdom (Gifford et al., 2017).

El Universal's coverage spike in 2010 serves as an example of how local events may increase climate change coverage. Another example of this influence could be coverage changes in 2012. After low coverage in 2011, coverage in early, mid-, and late 2012 spiked several times (Figure 2). These changes may have occurred because 2012 was an eventful year for environmental matters in Mexico. Before leaving office in November 2012, President Calderón led the passing of Mexico's General Law of Climate Change, which was intended to guarantee governmental involvement in creating policies for climate change adaptation and mitigation (Instituto Nacional de Ecología y Cambio Climático, 2012). Further, an exceptional drought that had hit northern Mexico beginning in 2011 began to ameliorate in 2012 (Servicio Meteorológico Nacional, n.d.). Because of the Climate Change Law and the exceptional drought, climate-related topics may have seemed more relatable to reporters and readers. Schmidt et al. (2013) have suggested that local events influence media attention, and factors such as extreme events (regional droughts or floods) have been known to increase climate change coverage (Boykoff & Roberts, 2007). Indeed, mentions of

extreme drought, water scarcity, and the Climate Change Law dominated *El Universal's* headlines in its climate change stories in 2012.

The number of climate-change stories in *El Universal* was high in 2012 despite the occurrence of a presidential election, which might have competed for media attention. This finding contrasts with that by Gordon et al. (2010), who found low levels of climate change coverage in *Reforma* in the election year 2006 and speculated that attention to the election detracted from that to climate change. Although climate change coverage by *El Universal* did decrease around the time of the election (Figure 2), overall it was relatively high in 2012 (Table 3). Perhaps the Climate Change Law and sate-wide drought in 2012 helped allow climate change to compete successfully for media attention.

El Universal had no major coverage spikes in 2013 and 2014. Gifford et al. (2017) recorded comparably steady coverage from other countries during that period. *El Universal's* relatively steady coverage of climate change in 2013 and 2014 could perhaps explain why the numbers of editorials and features published during that period also were relatively low. During times in which no major events seem to have caused marked coverage spikes, the topic of climate change may have been relatively less attention-worthy. This reduced attention may have resulted in fewer journalists using climate change as their topic in editorials, other opinion pieces, and feature stories.

I observed a major coverage spike in November and December 2015. This spike resembles what Gifford et al. (2017) observed for media worldwide. The stark coverage increase is likely associated with the Paris COP, another highly anticipated conference, which concluded with the Paris Agreement. This agreement established the ambitious goal of preventing global warming from causing some of the most serious impacts on the planet,

such as the melting of the Greenland and Antarctic ice sheets (UNFCCC, 2016; Davenport et al., 2015). The Paris talks seemed to have gradually increased *El Universal'*s coverage in late 2015 (Figure 2). Further, I had initially speculated that Pope Francis' encyclical on the environment, a document released in June 2015 that emphasized the implications of climate change (Yardley & Goodstein, 2015), would be associated with increased coverage in *El Universal.* I expected this association because of Mexico's heavily Catholic background, but my findings do not support that relationship.

Given the observed relationships between *El Universal*'s coverage and climate-related events*,* it may be pertinent to ask whether the topic of climate change can be made relevant, newsworthy, and interesting to reporters and readers without the occurrence of high-profile events or high-impact natural phenomena. Familiarizing people with a subject like climate change, which involves complicated dynamics of human-caused change and variability in the Earth system, is not particularly easy. This might be especially true for Mexico, a country troubled by a failing economy, organized crime, and extensive governmental corruption. For Mexicans—readers and reporters included—climate change might be perceived not just as a difficult topic but also as a topic of lower priority than other pressing issues.

RQ2: What Frames Has *El Universal* Used In Its Stories About Climate Change?

Past research indicagtes that media coverage may influence an audience's perception of an issue (Schmidt et al., 2013). Because *El Universal* may have played a role in informing the Mexican public about climate change, the way in which the newspaper framed climate issues should be considered.

The most commonly used frames found in *El Universal'*s climate change stories regarded policy-related issues (policy frame) and the apparent consequences of climate change (impact frame). The third most common frame was awareness, characterized as focus on the importance of climate change or its impacts in a way that raises awareness or educates audiences. Gordon et al. (2010) also observed extensive use of policy and impact frames in their study of *Reforma*. Predominance of policy-related frames also has been observed in countries such as Argentina (Zamith et al., 2012), Australia (Speck, 2011; Howard-Williams, 2009), Brazil (Painter & Ashe, 2012; Zamith et al., 2012), Canada (Young & Dugas, 2011), Chile (Dotson et al., 2012), Colombia (Zamith et al., 2012), France (Brossard et al., 2009), Peru (Takahashi, 2011), Spain (Fernández-Reyes et al., 2015), South Korea (Yun et al., 2012), and the United States (Trumbo, 1996). In English-speaking Middle Eastern media, Freeman (2016) also found a heavy focus on international relations. This heavy emphasis on policy seems reasonable, given that addressing climate change will continue to require effective national and international policy. Nevertheless, *El Universal* and other newspapers should be careful not to focus too heavily on climate change politics. This is because doing so might inaccurately present climate change as an almost exclusively political issue. *El Universal* should probably increase its focus on other aspects of climate change, such as addressing the uncertainty in the causality of natural hazards and anthropogenic climate change. Readers might also benefit from learning more about how to act to mitigate and adapt to the impacts of climate change. These aspects could be discussed using science, solutions, and economics frames.

In *El Universal,* the impact frame predominated over all other frames in 2011, 2012, and 2013. This emphasis on climate change impacts is likely associated with the occurrence

of an extreme drought in Mexico in 2011 and 2012. For example, in 2012 many stories discussed water scarcity and drought. Media known to have focused heavily on impact frames include those in Argentina (Zamith et al., 2012), Chile (Dotson et al., 2012; Hasbún, 2014), Colombia (Zamith et al., 2012), India (Billett, 2010), the Netherlands (van Oene, 2010), Peru (Takahashi, 2011), and the United Kingdom (Doulton & Brown, 2009). Extensive focus on impact frames has been found to coincide with climate-related events such as glacier melt in the Peruvian Andes (Takahashi, 2011) and catastrophic floods in India (Billett, 2010).

In analyzing how *El Universal* framed climate change, it may be useful to compare how frame use varied over time (Figure 4). During years when major coverage spikes did not coincide with a climate conference (2011, 2012, 2013, and 2014), use of the policy frame decreased and use of the impact frame increased. In other words, stories included impact frames more often during years in which *El Universal* did not increase coverage as result of a major climate conference. For example, the impact frame was most commonly used in 2012 (Figure 4), when no major climate conference appears to have increased coverage (Figure 2). Further, use of the awareness frame increased slightly in 2012. This increase might have occurred because of the coverage of the Cancún conference in 2010 and the ongoing drought in 2011 and 2012. Both events probably made climate change a new and relevant topic to be explained and emphasized for *El Universal'*s audience. Because the frequencies of all other frames were much lower than those of the policy, impact, and awareness frames, meaningful differences among them from year to year could not be observed.

Analysis of when *El Universal'*s framing was domestic, international, or both in scope (Figure 5) shows similarities to media in other countries. In *El Universal,* stories

including impact frames more often focused on domestic contexts. Similarly, climate-change-related stories in other countries have often focused on events occurring in those countries: Bangladesh (Miah et al., 2011), India (Billett, 2010), Japan (Asayama & Ishii 2012), and Peru (Takahashi, 2011).

*El Universal'*s noticeable emphasis on climate change's impacts on Mexico, with stories that contextualize climate change effects at national and regional levels, may be proving useful in raising awareness and educating audiences about the threats of climate change. *El Universal'*s readers are likely to be more interested in impacts on Mexico's people, nature, and infrastructure than on impacts on distant or unfamiliar places. Discussing these impacts could increase engagement with climate change and turn the issue into something more relevant to people and important to consider every day. This is because such reporting shows ways in which climate change can directly affect their lives as well as ways to avoid contributing to the problem. However, *El Universal'*s readers might benefit from increased focus on impacts on places other than Mexico. Doing so will likely help readers understand the complexity of changes in the climate system, which are expected to result in different impacts on different regions of the world. For example, while some regions may experience longer droughts associated with climate change, other regions may experience more intense rains.

In addition, *El Universal* frequently included policy frames when discussing events happening in Mexico and outside of the country. Media from many other countries reporting heavily on highly visible policy events also have framed climate change with an international scope (Schmidt et al., 2013). When discussing climate change policy, *El Universal* seems to show appropriate balance between events in Mexico and those occurring elsewhere. Focusing

on international relations can help readers understand climate change as an increasingly complex challenge that requires global collaboration. Covering the Mexican government's climate-related initiatives can help readers understand Mexico's role in this collaboration.

The conflict frame, indicating skepticism toward climate science, rarely appeared in *El Universal* (Table 4). It remained relatively uncommon even in 2010 and 2011, when other rarely used frames such as science and technology solutions received a substantial increase in coverage. My findings, along with those of Gordon et al., (2010), who found that *Reforma* seldom emphasized skepticism-related frames, suggest that climate skepticism is rare in Mexican media. Scholars have found similar results for such countries as Germany (Schäfer et al., 2013; Weingart et al., 2000), Greece (Gkiouzepas & Botetzagias, 2015), India (Billett, 2010), Portugal (Carvalho & Pereira, 2008), and Sweden (Olausson, 2009). Little focus on skepticism has also been found in Middle Eastern (Freeman, 2016) and Argentinean, Chilean, Colombian, and Peruvian (Dotson et al., 2012; Takahasi, 2011; Zamith et al., 2012) media.

Scarcity of the conflict frame in Mexico presents a noticeable contrast with U.S. media, which have often covered skepticism toward climate change science (Brossard et al., 2004). While other countries, such as Australia (Schäfer et al., 2013) and the United Kingdom (Boykoff & Mansfield, 2008), also have focused heavily on skepticism, the contrasts between Mexican and American media are particularly interesting. This is because Mexican culture is often influenced by the United States, which is not just a neighbor but also a major world power. The cultural impact of the United States shows no signs of influence when it comes to climate denial.

In addition, climate skepticism has been common in countries with largely carbon-dependent economies such as Brazil (Schmidt et al., 2013; Painter and Ashe, 2012; Zamith et al., 2012). Mexico seems to be unusual in that it is a major carbon-dependent economy (U.S. Energy Information Administration, 2016) where the media rarely focus on climate skepticism. The lack of skepticism may reflect in part Mexico's high vulnerability to extreme weather events and sea level rise, which are expected to worsen due to climate change (Intergovernmental Panel on Climate Change, 2013; Magaña et al., 2004; Secretaría de Medio Ambiente y Recursos Naturales, 2009). Combined with Mexicans' reported trust in scientists and academics (Franco et al., 2015), this vulnerability to climate change impacts could make the validity of climate science seem undeniable. The fact that campaigns against climate science have spread mostly in English-speaking countries also may be associated with this lack of skepticism (Mooney, 2014).

Perceptions of Climate Change in Mexico

Scholars have contended that people learn about complex issues through frames in the media (Entman, 2009) and that communicators use those frames in their stories to help explain complicated issues (Entman 1993; Nelson & Oxley, 1999; Scheufele & Tewksbury, 2007; Shoemaker & Reese, 1991; de Vreese, 2005). The similarities between my findings and those of Gordon et al. (2010) about *Reforma* highlight some possible associations between media coverage and public understanding of climate change in Mexico. Might the high recurrence of impact frames in the media be related to public concerns about climate change? Could the low focus on climate skepticism in Mexican media be associated with the reported concern about climate change impacts in Mexico (CESOP, 2014)? Could the low

focus on scientific and solutions frames be associated with Mexicans' limited understanding of the science of climate change (Franco, et al., 2015; Otero, 2011)?

Recent surveys show that Mexicans are concerned about climate change. In June 2014 the *Centro de Estudios Sociales y de Opinión Publica* (Center for Social Studies and Public Opinion) of the Mexican Congress published findings from a survey of public opinion on climate change and global warming. The report states that 81% of those surveyed said they thought global warming was a very serious threat to Mexico. An additional 13% said the threat was somewhat serious, and only 5% considered the threat not serious (CESOP, 2014). In addition, 86% of those surveyed said they were very worried about the role of humans in harming the environment, and 9% said they were somewhat worried. Further, findings from a survey from the National Autonomous University of Mexico suggest that while most Mexicans lack basic understanding of science, they consider climate change to be among the most interesting science topics (Franco et al., 2015). When comparing public attitudes of Mexicans with those in countries where skeptical frames have been common in the media, the differences are striking. For example, in the United States only 33% of those surveyed in 2013 said they considered global warming a very serious problem, another 32% said it was somewhat serious, 13% said it was not serious, and 20% said it was not even a problem (Pew Research Center, 2015). These differences in perceptions in Mexico and the United States might reflect at least in part the differences observed in media coverage of climate change.

El Universal also conducted a survey on climate change perceptions in 2011, following the Cancún COP. Nearly 97% of the surveyed people said they believed climate change was occurring, although only about 25% of them seemed to understand much about its causes. This limited understanding of the basis for climate change might be associated

with limitations in media coverage. For example, *El Universal* published relatively few stories including the science frame, operationalized for this study as focus on information about the science of climate change (Table 4). A spokesperson for Greenpeace Mexico stated that the main takeaway from *El Universal'*s survey was that the Mexican people are at least aware of climate change (Otero, 2011). Conservation biology expert José Sarukhán wrote an opinion article with similar remarks about this survey. An expert reviewer for the IPCC Third Assessment Report and a regular opinion article contributor in *El Universal*, Sarukhán emphasized that it was necessary for the public to receive clear, accurate, and accessible information to fully understand the causes of atmospheric warming (Sarukhán, 2011). Given Sarukhán's remarks, it is interesting to find that *El Universal* often included frames that raised awareness about climate change while seldom emphasizing the scientific basis for the ongoing changes in the climate.

Because *El Universal'*s use of the science and technology solutions frame remained relatively low over time, it is not unexpected that Mexicans seemed mostly unaware of actions that can help mitigate climate change (Otero, 2011). However, it should be noted that stories with the awareness frame in *El Universal* often mentioned solutions, although doing so without emphasis on climate science. Perhaps, given that Mexicans seem to be aware of the problem but not of what causes it and how to address it, *El Universal* should more strongly emphasize frames that discuss the scientific basis of and possible pathways for minimizing the impacts of climate change. Given the key role of green technologies in climate change mitigation, and considering that these technologies also offer business opportunities that would stimulate the economy, *El Universal* could also focus more strongly on solutions frames.

RQ3: If *El Universal* Attributed Information to Specific Sources, What Sources Did It Identify?

This study also aimed to determine types of sources of information included in *El Universal'*s climate change stories. This analysis of sources is important in order to consider whether, and if so how, choice of sources may have shaped stories. Such an analysis could serve as a foundation of future studies on agenda setting in Mexico.

Previous research has found that journalists use various sources of information when reporting about climate change. Wilson (2000) found that in the 1980s and 1990s, environmental reporters consulted mostly scientists as primary sources of information. However, reporters also have been known to use legislators and interest groups, turning climate change into a politicized and sometimes controversial issue (Trumbo, 1996). In several media outlets in Latin America and Spain, climate change stories have included scientists, government officials, and intergovernmental organizations as sources of information (Arcilla-Calderon, 2015).

Analysis of sources used in *El Universal'*s stories shows results similar to those found for media in other countries. The information source cited most extensively in *El Universal* was the government or its agencies. The second most widely used source was non-expert authorities, which included presidents, diplomats, political personalities, and highly visible activists. Instances where governmental organizations served as the main source of information have been found in many Latin American countries (Arcilla-Calderon, 2015), as well as in countries such as China (Tolan, 2007) and South Korea (Yun et al., 2012). Canadian media also have commonly used governmental sources, although use of such sources has decreased and use of environmental and business groups has increased (Young

and Dugas, 2011). In the United States and France, sources characterized in this study as non-expert authorities have often been used as information sources (Grundmann & Scott, 2012).

In addition to analyzing sources of information independently, this study identified associations between information sources and frames (Figure 6). Government sources were extensively used in all frames except the science frame, in which expert scientist sources were mainly used. Although the science frame was relatively rare, it appropriately was associated largely with use of expert scientists as sources. The only frame in which business groups were commonly used was the science and technology solutions frame. Perhaps this association occurred because climate change mitigation is often associated with business opportunities in alternative technologies. For example, in Chile (Hasbún, 2014) and the Middle East (Freeman, 2016), climate change coverage has often emphasized business opportunities in green technology. Business groups have been a more common source in the United States, where corporations have been known to support misinformation on climate change (Goldenberg, 2016). The rare inclusion of business groups as sources of information in *El Universal* may be associated with its low focus on climate skepticism.

Identifying sources of information was difficult. Sometimes, sources could not be identified, and sometimes one source was classified under two categories. For example, atmospheric scientists from government agencies were classified as both expert scientists and members of a governmental agency. This combination may help explain the finding that both scientist sources and government sources were common in stories with the science frame (Figure 6). The most widely observed combination was non-expert authority and government agency. This combination often resulted when the president of Mexico or other political

personalities appeared as sources of information. Those sources were classified as both non-expert authorities and members of the government because they are highly visible personalities who are in the government. Other examples of such personalities are Marcelo Ebrard, Mexico City mayor and Chair of the World Mayors Council on Climate Change, and Mexican president Felipe Calderón Hinojosa.

Associations between source type and story type also were identified. In *El Universal*, editorials (and other opinion pieces) did not tend to use one source type over another, and features cited expert scientists and governmental agencies most often as their main sources of information. Identifying sources in editorials and features was particularly difficult. In total, 26% of the editorials and 25% of the features cited no specific information sources, whereas only 6% of news stories lacked identifiable sources. A possible reason for some of this difference is that whereas the news stories in *El Universal* were written by professional reporters, the opinion articles in this newspaper tended to be written by individuals such as economists, natural scientists, and political scientists. Contributors of these pieces could have indeed presented their own ideas without presenting sources for them, while news reporters likely did opposite: reported facts and linked them to specific sources, in keeping with journalistic norms. For feature articles, perhaps a tendency to follow literary rather than journalistic traditions resulted in less emphasis on identifying information sources.

There are important implications of the types of sources used by *El Universal*. Scholars have contended that Latin American media use mainly government officials to report on climate change (Zamith et al., 2012). My findings suggest that *El Universal* also uses the government heavily for climate information. Using non-governmental sources may not be a practical approach for climate change reporting in Mexico for two reasons. First,

almost all people outside of the government probably lack resources and information about climate change. Second, reporters may have limited access to or limited familiarity with non-governmental sources. Given that many of *El Universal'*s stories covered climate policy, political reporters (as opposed to science journalists) probably covered many climate change stories. As such, it seems likely that those reporters had more relationships or familiarity with governmental sources than with scientific experts.

In covering climate change, using expert scientists more as sources of information could be valuable. This might be true particularly for frames such as the awareness frame. Because surveys suggest that Mexicans trust scientists (Franco et al., 2015), climate scientists might have a platform with increased authority to delve into and explain the intricacies of climate change and the Earth system, and how they relate to Mexico and its people in various regions. In addition, perhaps using expert scientists more frequently in the impact frame could help avoid sensationalism. More use of scientists as sources also could aid in accurately portraying the degree of uncertainty regarding causal relationships between climate change and climate-related events such as extreme weather and drought. In *El Universal'*s impact frames, expert scientists were far from being the most frequently used source. Using expert scientists more as sources could have helped in providing more robust information about the real implications of climate change, as opposed to superficially—and possibly inaccurately—reporting on its impacts. Ways to promote use of such sources may include providing lists of scientists willing to talk with journalists, training such scientists and journalists to interact with each other, and emphasizing more science communication in the training of Mexican journalists and in professional development activities for them.

Research Limitations

The methods used for this study had some limitations. I searched only for stories with the terms *cambio climático* (climate change) and *calentamiento global* (global warming), and so I may have omitted stories on climate change that did not include those terms. In addition, the database did not specify whether a story was published online, in print, or in both forms. These details are an important aspect to consider because form of publication may have implications for stories' content and structure.

Another limitation concerns how the awareness frame was classified. When downloading the entire dataset to an Excel spreadsheet, Qualtrics (the software used to code all stories) assigned both the "miscellaneous" and "awareness" frames to stories that should have been marked as having only the "awareness" frame. I corrected this error by meticulously editing the spreadsheet and removing the "miscellaneous" frame from entries in which it should not have appeared. However, I could not separate the frames from cross tabulations of data used in determining associations such as frames and whether stories had domestic or international scopes. However, this limitation does not affect the overall findings of the study. This is because cross tabulations were not directly used to address the study's main research questions. Further, when analyzing data using cross tabulations (Figures 4, 5, & 6), 73% of what Qualtrics marked as miscellaneous was indeed the awareness frame (Table 4).

Opportunities for Further Research

While this study's results should not be taken as representative of all Mexican media, they can serve as a starting point for future research. *El Universal* is widely circulated in print and online, but it is only one newspaper of many in Mexico. To obtain a more thorough

picture of Mexican climate change coverage, other national, regional, and local newspapers should be studied. Also, because Mexicans obtain information from a variety of media, studies of climate change coverage in other types of Mexican media could be worthwhile. These media include television, radio, websites, and social media. Further, this study's findings can serve as a foundation for future studies of media coverage of climate change and public understanding of the issue in Mexico. In order to further explore understanding and communication of climate change in Mexico, findings from other studies on Mexican media could be associated with findings from studies looking at how Mexicans' view and understand climate change. Finally, in part to explore whether changes in *El Universal*'s climate change coverage were associated with factors other than the ones discussed in this study, future studies could look into the overall number of stories published by *El Universal* over time and what topics those stories addressed.

CHAPTER V

CONCLUSION

Expert scientists and the Mexican government have expressed concern about the impacts of climate change on the country (Instituto Nacional de Ecología y Cambio Climático, 2014; Magaña et al., 2004; Secretaría de Medio Ambiente y Recursos Naturales, 2009). The Mexican public has been reported to share similar concerns (Centro de Estudios Sociales y de Opinión Publica, 2014; Otero, 2011). Because the media can influence public understanding of climate change (Boykoff & Roberts, 2007), *El Universal* can inform and educate readers about climate change and its impacts. The types of information *El Universal* published seem to have been influenced by various types of events and sources of information used to cover the topic. Because of its influence and status, *El Universal* also can influence coverage by other publications in the country, particularly smaller, regional newspapers. In this study, I explored climate change reporting by *El Universal*, specifically to analyze coverage changes over time and identify frames and information sources used to cover climate-change-related issues.

The greatest increases in coverage occurred around the times of the highly visible United Nations climate change conferences, which have focused on international climate policy. Another event associated with increased climate coverage was an extreme drought hitting Mexico in 2011 and 2012. No major coverage increases were associated with scientific events, such as the releases of the Fourth and Fifth Assessment Reports by the Intergovernmental Panel on Climate Change. Because of their direct impact on and relevance

to Mexico, the extreme drought season in 2011 and 2012 and the UN conference hosted in Cancún in 2010 were likely responsible for the increased numbers of stories published in 2010 through 2012.

Because the greatest increases in coverage coincided with policy- and impact-related events, it is no surprise that the policy and impact frames were the most used. Coverage associated with policy frames focused on such events as international conferences, changes in domestic laws, and governmental initiatives to mitigate and adapt to climate change. The content within impact frames varied, focusing on topics such as droughts, hurricanes, and heat waves. Content associated with the awareness frame, which also was extensively used, included statements by high-profile personalities calling for action in the face of the changing climate. The frame focusing on climate skepticism (conflict) was rarely used in *El Universal*. Also observed in the major newspaper *Reforma* (Gordon et al., 2010), the scarcity of climate skepticism might distinguish Mexican media from media of other carbon-heavy economies, where certain media focus heavily on climate skepticism (Nuccitelli, 2013). It is probably not a coincidence that the relative amounts of attention received by most frames correspond with reported views toward climate change in Mexico: Most Mexicans are aware of and worried about climate change, but they lack understanding of the basis of and solutions for it (Centro de Estudios Sociales y de Opinión Publica, 2014; Otero, 2011).

In analyzing the types of information sources cited, as well as the frames with which they were associated, I found that most sources explicitly identified in the stories were governmental. This use of governmental sources parallels the overwhelming use of the policy frame. Other commonly used sources were non-expert authorities who are considered opinion leaders in climate change despite their lack of expertise in climate science. An

example of such a source was then-president and non-scientist Felipe Calderón, a strong advocate of policies to mitigate and adapt to climate change. Further, whereas the governmental source type was present in most frames, expert scientists were used widely mainly in science frames. The most commonly used source in science and technology solutions frames was business groups.

In my review of the literature, I found only one study that extensively looked at climate change communication in the Mexican media. Although the current study should not be taken as a comprehensive representation of how the Mexican media cover climate change, its findings can improve understanding of climate change reporting in Mexico. Further, analyzing the stories used in this study at a deeper level could help to evaluate the scientific accuracy of *El Universal*'s climate change stories. Such analysis could help promote high-quality science journalism in Mexico, which in turn may help increase Mexicans' understanding of climate change and how to deal with it.

As an observational study, the current research did not identify direct relationships between *El Universal*'s climate change coverage and Mexicans' understanding of the issue. However, a noticeable correspondence was found between the frames emphasized in *El Universal* and public perceptions of climate change in Mexico. Perhaps media such as *El Universal* have shaped what Mexicans know about climate change and how they feel about it. Should the media in Mexico emphasize more climate change science and solutions frames, perhaps Mexicans would know more about the scientific basis of and solutions for climate change. Knowing these scientific aspects may help Mexicans adopt and promote lifestyles that help mitigate climate change on a local scale. Increased scientific knowledge also may motivate Mexicans to demand that their authorities implement national and international

climate policies. On a global scale, these policies could help address climate change and its impacts.

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OPERATIONAL DEFINITIONS

Stories for data
  o Stories used for this study will include stories of any length and in any section of the paper (front page vs. back page). These stories may also be referred to as articles, and they will include stories such as features and editorials.

Operationalizations for RQ2: What Frames has *El Universal* used in its stories about climate change?

• **Awareness**
  o Inclusion of information that emphasizes the importance of climate change and its impacts in a way that seems to intend to raise awareness or educate people about the issue. This content, however, does not delve into scientific explanation of the basis for changes in the climate system or the repercussions of such changes on the planet.
    ▪ **Example:** Content explaining why climate change is one of the world's most pressing challenges and urging people to act to mitigate it

• **Science**
  o Inclusion of information regarding the scientific principles, or new developments, research, and/or applications in science leading to better understanding of climate change. Coders will look for sentences focusing on new discoveries in geosciences and other natural sciences pertaining to climate change.
    ▪ **Example:** Content explaining how Mexico's southern areas, which have more vegetation than the north, could be correlated with cooler temperatures.

• **Conflict**
  o Inclusion of information that depicts conflict or controversy between any entities about the validity of the science of climate change. An article will be included in this category if it mentions the possibility that climate change is not occurring or that man-made processes are not causing it.
    ▪ **Example:** Content focusing on claims that climate change is a hoax and is not anthropogenic

• **Impact**
  o Inclusion of information about the effects or influence climate change has, will have, or could have on the planet. These effects could pertain to natural resources,

people, flora, fauna, natural processes, natural hazards, droughts, sea level rise, and extreme weather events. Note, however, that these effects could be both positive AND negative.

- **Example:** Content about long droughts periods, frequent hurricanes, or glacier melting due to climate changes.
- **Example:** Content about how extreme changes in weather actually help certain species to survive

- **Science and technology solutions**
  - Inclusion of information regarding alternative science and technology such as wind energy, solar energy, clean energy/fuel, or new technologies devised to combat climate change.
    - **Example:** Content about how a new car engine is designed to emit less pollutants.

- **Policy**
  - Inclusion of information that centers on policy or political entities (such as world leaders, presidents, legislators, or other representatives of government agencies). These issues could also focus on changes to national and/or international agenda and regulations, international treaties, or national policies.
    - **Example:** Content talking about an emissions cutting policy proposed by the senate, the president, or local governmental officers.

- **Economics**
  - Inclusion of information that pertains to economic benefits, perils, or changes in the economy due to climate change.
    - **Example:** Content that mentions a decrease in maize production and sales in Mexico as a result of global warming.

- **Other?**
  - If coders find frames other than those described above, coders will mark the frame as "miscellaneous" and will use a short description to classify that frame. At the end of the coding process, I will compare all frames under the miscellaneous classifications and possibly will classify them accordingly.

Characterizations for RQ3: If *El Universal* attributed information to specific sources, what sources did it identify?

Sources of information
(If unsure, coders will mark down "other" and include the name of the source of information in the blank field.)
- **Expert scientist(s)**
  - **Example:** A scientist with expertise in climate or Earth science

- **Non-Expert Scientist(s)**
  - **Example:** A scientist with expertise in fields other than Earth science, like a

cosmologist

- **Social scientist(s)**
  - o **Example:** Economists, political scientists, or sociologists

- **Non-expert authority**
  - o **Example:** Influential people, like a president, the Pope, or other non-scientists who may know about climate change

- **Business group (or members thereof)**
  - o **Example:** People who may be heavily interested in climate change legislation possibly because of the implications for his or her business.

- **Governmental agency (or members thereof)**
  - o **Example:** Officials from government agencies providing information about climate change

- **Non-governmental organization (or members thereof)**
  - o **Example:** Officials from NGOs providing information about climate change

- **Climate change activist(s)**
  - o **Example:** People who actively participate in events to advocate for the mitigating climate change

Characterizations for last question in coding tool: What was the scope of this piece?

- o **Foreign**
  - ▪ Select if story focuses on issues happening or revolving around countries other than Mexico
    - • **Example:** An article about how climate change affects polar animals (because Mexico has none of those animals)
- o **Domestic**
  - ▪ Select if story focuses on issues happening or revolving around Mexico
    - • **Example:** An article attributing floods caused by extreme weather events in Mexico. **NOTE:** that the extreme weather event should be directly linked to climate change

- o **Domestic and Foreign**
  - ▪ Select if story focuses on issues happening or revolving around Mexico and other countries
    - • **Example:** An article on how climate change affects sea level rise, sea surface temperature, and ocean acidity, and explaining those changes could affect not only Mexican seas but oceans worldwide

- **Example:** An article about what the Paris Agreement resulting from the UN Climate Change Conference of the Parties in 2015 means for Mexico and the rest of the world
  - o **Neither**
    - ▪ Select if story focuses on any given place
      - **Example:** An article that covers a new device or scientific discovery without emphasizing its effects for Mexico or any other country.

APPENDIX B

CODING SHEET

(Original Spanish/English version used for coding. Interactive tool available online at:
https://tamu.qualtrics.com/SE/?SID=SV_3WM7xda9asi647P.)

¿Quién esta codificando?
- Roberto
- Iveliz
- Esteban

¿En qué fecha se publicó esta nota?
- Mes_____
- Día_____
- Año_____

¿Identifique el titular de la nota: _____

¿Qué tipo de articulo es este?
- Noticia
- Editorial o columna de opinión
- Articulo especial (feature)
- Otro_____

¿Qué términos incluye la nota?
- Cambio climático
- Calentamiento global
- Ambos
- Ninguno
  - *(Si se selecciona "ninguno", la nota deberá ser excluida del estudio)*

Si crees que la nota NO debería ser parte de este estudio, por favor selecciona esta opción para ayudarnos a identificar y excluir la nota.
- Debería ser excluida

Si la sección de la publicación se especifica en la nota, indicar:
- Portada
- Contraportada
- Cuerpo de noticias
- No especificada

¿Qué tan larga (en palabras) es la nota?
- Menos det199
- 200-299
- 300-499

- o 500-799
- o Más de 800

Selecciona la cuestión (issue) del cambio climático más enfatizada en la nota.
Es preferible seleccionar la cuestión que tiene un énfasis obviamente mayor. En caso que la nota enfatice mayormente mas de una cuestión, seleccionar cuantas sean necesarias.
- o Science
- o Impact
- o Science and Technology Solutions
- o Conflict
- o Policy
- o Economics
- o Other_____

¿Cuál es el énfasis de la cuestión en esta nota? Selecciona más de una opción si es necesario de acuerdo a donde se encuentra el énfasis al "cambio climático" y/o "calentamiento global."
- o Present in headline
- o Present in lead
- o Outstanding focus
- o Present
- o NOT present

¿A qué tipo de fuentes de información se les atribuyen los datos o detalles en la nota?
- o Extranjera
- o Local
- o Extranjera y local
- o NO especifica

¿Cómo describirías a las Fuentes de información?
- o NO especifica
- o Científico experto
- o Científico no experto
- o Científico social
- o Autoridad no experta
- o Grupos (o sus miembros) de negocio o industriales
- o Agencias (o sus miembros) gubernamentales
- o ONG o sus miembros
- o Activistas del cambio climático
- o Otro_____

¿Cuál es el enfoque de la nota?
- o Extranjero
- o Local
- o Extranjero y local
- o No especifica

(English coding sheet)

82

Who's the coder?
- Roberto
- Iveliz
- Esteban

What date was this story published?
- Month_____
- Day_____
- Year_____

Identify the headline for this story: _____

What terms did the story include?
- Climate change
- Global Warming
- Both
- Neither
   - *(If coder selects neither, the story should be excluded from the study)*

What type of story is this?
- News story
- Editorial
- Feature
- Other_____

What terms does the story include?
- Climate Change
- Global Warming
- Both
- Neither

If you think this story should not be part of the study, please select this option so that we can identify and exclude the story.
   - It should be excluded

If the story's section is specified in the story, please choose:
   - Front page
   - Back page
   - News body
   - NOT specified

How long is the story (in words)?
   - Less than 199
   - 200-299
   - 300-499
   - 500-799

o   More than 800

Select the climate change frame with most emphasis throughout the story. It is preferable to select the issue with most emphasis. In case the story emphasized more than one of the proposed issues, select as many as necessary.
o   Science
o   Impact
o   Science and Technology Solutions
o   Conflict
o   Policy
o   Economics
o   Other_____

How marked is the emphasis about climate change in this story? Select more than once choice if needed, according to where you find the terms, "climate change" and/or "global warming."
o   Present in headline
o   Present in lead
o   Outstanding focus
o   Present
o   NOT present

To what sources of information are reporters attributing information in the story?
o   Domestic
o   Foreign
o   Both
o   NOT specified

How would you describe the sources of information present in the story? Select more than one choice if needed.
o   NOT specified
o   Expert scientist(s)
o   Non-expert scientist
o   Social scientist(s)
o   Non-expert authority
o   Business group (or members thereof)
o   Governmental agency (or members thereof)
o   NGOs
o   Climate change activists
o   Other_____

**What is the scope of the story?**
o   Foreign
o   Domestic
o   Foreign and domestic
o   NOT specified

ADDITIONAL FIGURES
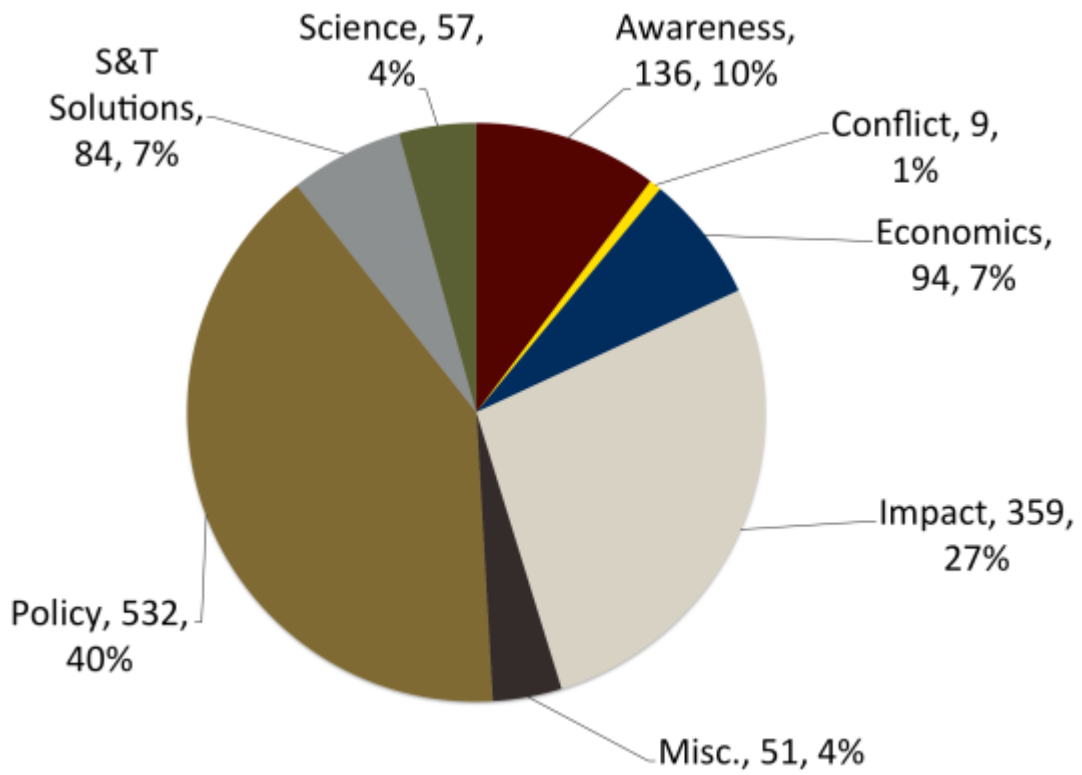
Frames in *El Universal*'s Climate Change Stories, 2007-2015
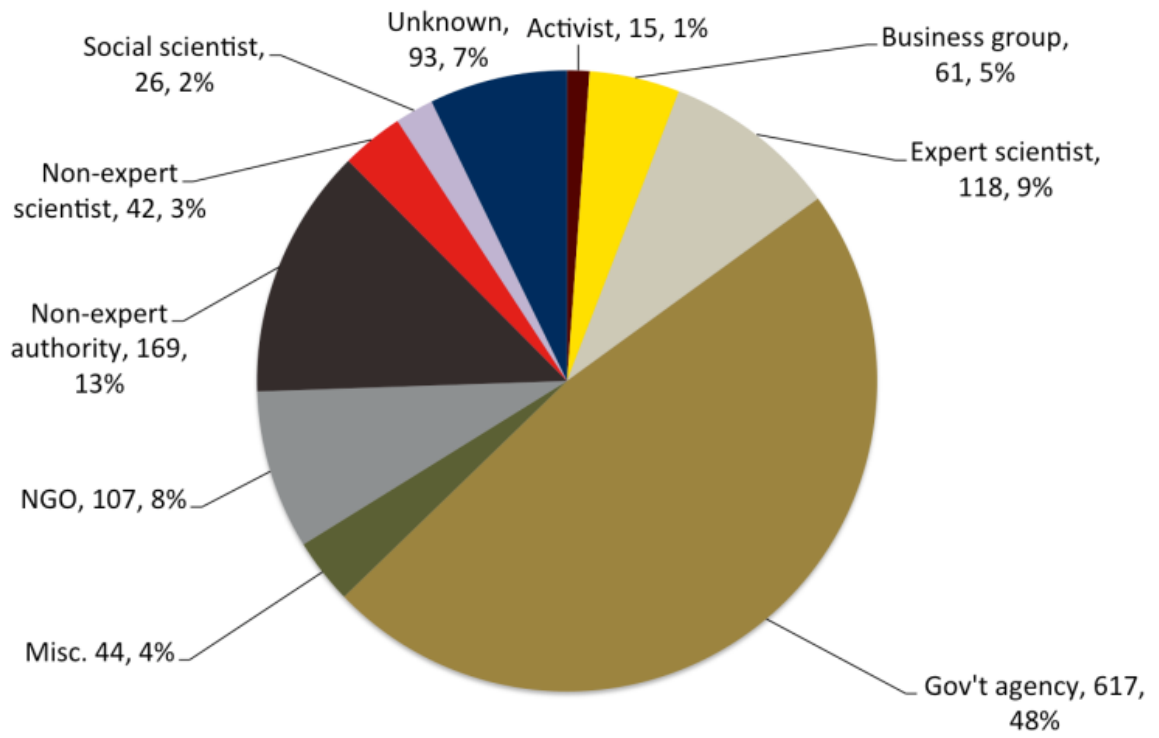
Source Types in *El Universal*'s Climate Change Stories, 2007-2015
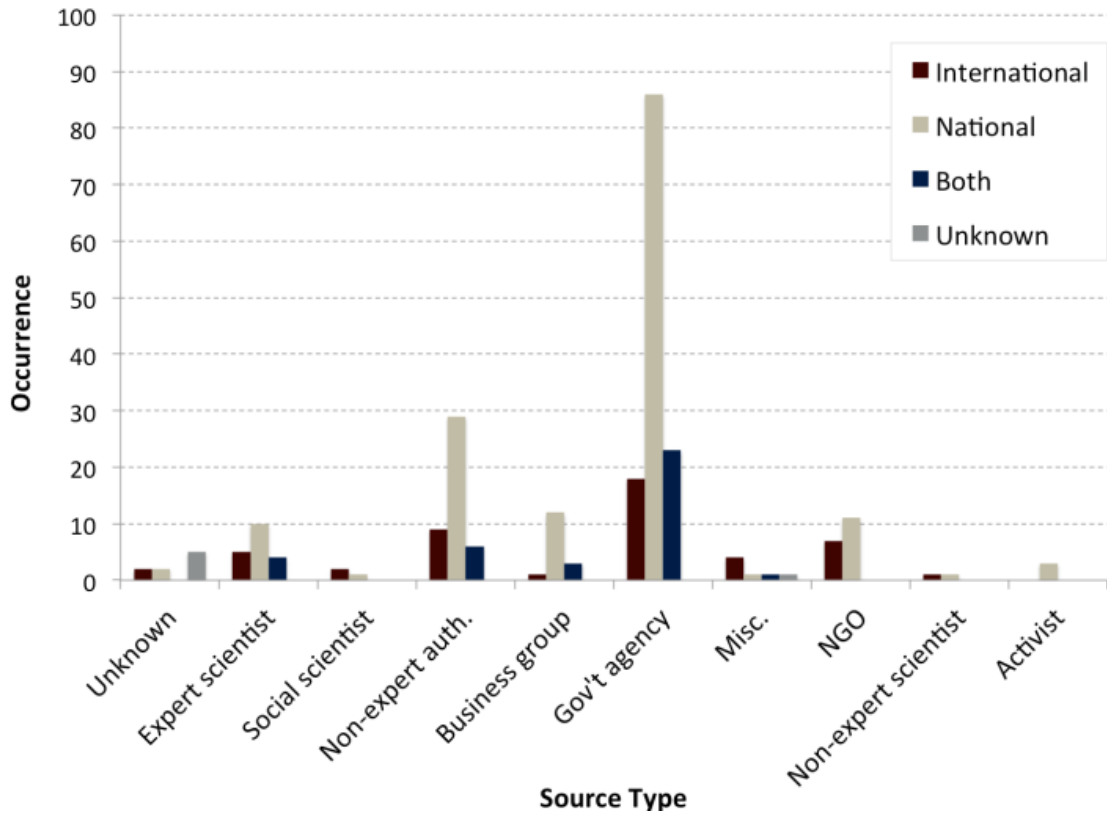
Source Types in *El Universal*'s Climate Change Stories, 2007-2015

APPENDIX D

ADDITIONAL TABLES

Year	News	Editorial	Feature	Other	TOTAL
2007	12	11	1	0	24
2008	63	17	11		91
2009	65	5	5	1	76
2010	339	19	22	3	383
2011	24	8	4		36
2012	110	10	2	1	123
2013	44	3	1	2	50
2014	78	0	2	0	80
2015	164	7	12	1	184

Occurrences of Types of Climate Change Stories in *El Universal*, 2007–2015

		Select the climate change frame with most emphasis throughout the story. It is preferable to select the issue with most emphasis. In case the story emphasized more than one of the proposed issues, select as many as necessary.						
		Conflict	Economics	Impact	Policy	Science	S&T Solutions	Misc.
What type of story is this?	News	7	75	302	466	42	72	154
	Editorial	1	13	29	39	8	7	22
	Feature	1	2	28	18	8	7	12
	Other	0	0	2	2	0	0	2

Occurrences of Frames in El Universal's Climate Change News, Editorial, and Feature stories, 2007–2015

		Select the climate change frame with most emphasis throughout the story. It is preferable to select the issue with most emphasis. In case the story emphasized more than one of the proposed issues, select as many as necessary.						
		Impact	Conflict	S&T Solutions	Policy	Economics	Misc.	Science
	Int'l	22	4	4	26	2	9	7
What's the scope of the story?	**Nat'l**	246	0	55	235	42	106	27
	Both	79	5	22	257	40	63	17
	Unsure	14	0	5	9	6	13	7

Distribution of Frames in *El Universal's* Climate Change Stories with Domestic, International, or Combined Scope, 2007–2015

		Select the climate change frame with most emphasis throughout the story. It is preferable to select the issue with most emphasis. In case the story emphasized more than one of the proposed issues, select as many as necessary.						
		Impact	**Conflict**	**S&T Solutions**	**Policy**	**Economics**	**Misc.**	**Science**
How would you describe the sources of information?	**Activist**	2	0	0	6	0	13	0
	Business groups	18	0	18	20	9	13	1
	Cannot determine	38	1	5	30	12	21	6
	Expert scientist	72	1	7	26	1	25	26
	Gov't agency	186	3	47	398	42	64	24
	Misc.	19	1	5	9	2	19	4
	NGOs	38	1	1	38	12	39	5
	Non-expert auth.	31	3	15	119	16	29	4
	Non-expert scientist	30	1	2	6	1	5	2
	Social scientist	12	0	1	5	10	6	5

Distribution of Frames and Source Types in *El Universal's* Climate Change Stories, 2007–2015

	Climate change	Global Warming	Both	TOTAL
2007	12	3	9	24
2008	65	11	15	91
2009	51	7	18	76
2010	333	26	24	383
2011	11	12	13	36
2012	113	5	5	123
2013	40	5	5	50
2014	64	6	10	80
2015	136	13	35	184

Distribution
Sample in ***

	Policy	Impact	Awareness	Economics	S&T solutions	Science	Misc.	Conflict
2007	12	11	8	1		5		
2008	49	43	20	16	2	6		
2009	43	26	8	7	7	2	2	
2010	213	93	35	26	44	22	34	3
2011	12	13	8	1	3	3	4	2
2012	37	58	24	12	9	5	4	1
2013	19	28	4	1	2	1	1	
2014	33	30	11	14	7	5	2	
2015	114	57	18	16	10	8	4	3

Distribution of Frames in *El Universal's* Climate Change Stories, 2007–2015

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2007				1							2	21
2008	11	8	11	10	22	9	9	3	2	3	2	1
2009				1	2	6	2	2	6	7	25	25
2010	15	16	24	11	22	14	18	16	28	22	73	124
2011	15	4	3	1	1	1	3	2			3	3
2012	21	17	7	8	15	19	3	5	4	11	4	9
2013	5	6	4	6	4	6	3	2	3	5	4	2
2014	4	5	6	8	9	10	9	7	2	7	7	6
2015	4	3	11	7	15	16	7	13	20	29	36	23

Monthly Distributions of Climate Change Stories Published in *El Universal*, 2007–2015

		What type of story was this?				
		News article	Editorials	Features	Other	Unknown
How would you describe the source of information?	Activist	13	0	2	0	0
	Business groups	48	6	6	0	0
	Cannot determine	57	21	15	1	1
	Expert scientist	93	8	16	0	1
	Govt. agency					
	Misc.	25	13	6	0	0
	NGOs	94	7	6	0	0
	Non-expert auth.	159	5	4	1	0
	Non-expert scientist	32	4	4	0	2
	Social Scientist	14	9	2	1	0

Associations Between Sources of Information and Story Types in *El Universal*'s Climate Change Stories, 2007–2015