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Coverage and framing of climate change adaptation in the media: A review of influential North American newspapers during 1993–2013

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ABSTRACT

The portrayal of climate change in the news has been a major focus of research over the last decade, reflecting the importance of the media in affecting public opinion and policy. This work has primarily focused on the science of climate change, impacts, and mitigation, yet our understanding on how adaptation is being profiled in the media is limited. In response to this gap, this paper quantitatively examines the coverage and framing of climate change adaptation in four influential North American newspapers between 1993 and 2013. Over the observation period, the total number of articles focusing on adaptation published each year increases, with peaks in reporting in 2007, 2012, and 2013. While adaptation has permeated news coverage, it still remains overshadowed by stories on impacts and mitigation, with increased reporting consistent with increased media attention to climate change over the last two decades. Of the newspaper articles with adaptation content ($n = 271$), the majority (53%) focus primarily on stating the need to adapt, as opposed to documenting actual preparations being undertaken for adaptation or profiling actual adaptations that have taken place. The types of adaptation being reported on are predominantly 'hard' in nature, profiling techno-engineering based responses to reduce potential climate change impacts, in contrast to 'soft' responses that seek to enhance resilience. This representation is particularly evident in reporting in 2012 and 2013. Adaptations being described in the selected newspaper articles are primarily anticipatory in nature up until 2011, after which adaptations are primarily discussed in terms of responding to extreme weather events, specifically in the context of a surge in reporting documented in response to Hurricane Sandy (2012) and flooding in Canada in 2013.

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1. Introduction

The media provides a key arena where the implications of, and response options to, climate change are presented, negotiated, and formulated (Boykoff and Boykoff, 2004; Boykoff, 2008; Carvalho, 2010; Rick et al., 2011; Moser, 2014). With the

majority of people obtaining information through newsprint, television, and the Internet, media framing creates awareness of issues linked to climate change, and establishes some responses as possible and others infeasible. Therefore, the media has considerable influence over the public's perception of climate change (Carvalho, 2010; Nerlich et al., 2010; Lyytimäki, 2011; Schmidt et al., 2013). Public perception in

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turn, affects how decision makers view and respond to risks, and while this link is complex and dynamic, media attention has been observed to open-up and direct discursive spaces for policy making in multiple contexts (Soroka, 2002; John, 2006; Walgrave et al., 2008). Dolšák and Houston (2013), for example, demonstrate a link between varying levels of legislative activity on climate change and preceding pro-policy media coverage across States in the US.

How the media portrays climate change therefore matters. Reflecting this, the last decade has witnessed a proliferation of research examining the coverage and framing of climate change in the media, with a strong focus on the science of climate change, impacts, and mitigation (Moser, 2010, 2014; Nerlich et al., 2010; Schmidt et al., 2013). Adaptation has not figured prominently in this work, and where adaptation coverage is examined it is typically as part of a broader review of climate change news coverage, primarily focused on comparing adaptation coverage with respect to mitigation (Liu et al., 2008; Lyytimäki, 2011; Asplund et al., 2013; Takahashi and Meisner, 2013). Exceptions include Moser (2011) who documents the number of adaptation focused articles in the US print media as part of a general examination of adaptation in the public sphere, and Boykoff and Yulsman (2013) who survey Indian news media coverage to examine competing visions of adaptation success. To this end, Moser (2014, p. 6) in her review of studies on adaptation coverage in the media, calls attention to a lack of empirical research, concluding that “what is missing most in adaptation media studies . . . is an in depth examination of contents, framing, and related debates. This constitutes an important research gap.”

This paper is a response to this gap, systematically examining the coverage and framing of adaptation in four influential newspapers in North America. Two main objectives structure the work: (i) To quantitatively review trends in newspaper reporting on adaptation between 1993 and 2013, and (ii) To identify and characterize the framing of adaptation and how this varies over time, focusing on the stages, types, and characteristics of adaptation being reported.

2. Methods

2.1. News media and climate change

Studies on the role of the media in affecting public and policy agendas, have identified two main pathways of influence (Liu et al., 2008). Firstly, through repeated news coverage, media coverage affects the relative salience of a particular topic, creating awareness on a particular issue (Boykoff, 2012). The increase in reporting on climate change issues in general over the last decade, for example, has been linked to increased interest in climate change among the public, in both positive and negative ways (Shehata and Hopmann, 2012). In this study, we examine the salience of adaptation reporting by documenting the annual publication of adaptation focused articles over the last decade, comparing them to general trends in reporting on climate change, and analyze various factors which affect the rise and fall of interest on adaptation in the media.

Secondly, how the media portrays a particular issue influences how the public and policy makers understand and engage with it. Work in this area has used the concept of ‘framing’ to examine the content of news coverage, where framing can be defined as the process by which broad organizing themes are selected and emphasized, elements of a story such as the scenes, their characters and actors are emphasized, and supporting documentation used (Bennett, 2002). Framing thus communicates how and why an issue should be seen as a problem, how it should be handled, and who is responsible for it (Asplund et al., 2013), and is an inherent part of human cognition for organizing and contextualizing events. Goffman for instance, explained how the media provides frames of interpretation by which people locate, perceive, identify, and label events, give meaning to them, organizing experiences and guiding actions. Similarly, Nisbet notes how audiences use frames provided by the media as interpretative short cuts to make sense of policy debates. Herein, framing can involve various conscious and unconscious decisions made by journalists and news producers, reflected in the language used in articles, tone, topic of focus, placement of certain facts and arguments, norms (e.g. balance, objectivity), treatment of uncertainty etc., and have been examined in a well-developed scholarship on the representation of climate change and other scientific issues in the media (Carvalho and Burgess, 2005; Boykoff, 2008; Liu et al., 2008; Nerlich et al., 2010; Boykoff et al., 2013; Boykoff and Yulsman, 2013). In this study, we examine framing by focusing on the stage, type, and characteristics of adaptations being profiled, allowing us to develop preliminary insights on the nature of reporting on adaptation.

2.2. Data collection

A multi-phase review strategy was employed to locate relevant English language articles published between January 1st 1993 and December 31st 2013. Firstly, we searched four influential North American broadsheet newspapers (*Globe & Mail*, *Toronto Star*, *New York Times*, *Washington Post*) in the ProQuest database for articles with a substantial focus on climate change adaptation. The selection of these newspapers was based on numerous factors, including: (i) Their national focus, with the aim of study to examine how adaptation is being profiled in newspapers with national readership; (ii) They are considered the most influential newspapers in their respective countries based on circulation, web-metrics, and influence; and (iii) They have a diverse political leaning (Rick et al., 2011; Young and Dugas, 2011; Ahchong and Dodds, 2012; 4imn.com, 2014). The two decade timeframe reflects the findings of other studies which illustrate limited newspaper attention to climate change before this period, and allows us to examine the coverage and framing of adaptation over the history of its emergence in climate policy.

Following the IPCC (2007), ‘adaptation’ was defined as adjustments in human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities, and ‘climate change’ refers to any change in climate over time, whether due to natural variability or as a result of human activity. A diversity of search terms was employed given the plurality of language

used in the media to describe ‘adaptation’ (Berrang-Ford et al., 2011; Moser, 2014), and based on initial testing of different terms, consisting: “clim* change” OR “global warming” AND adapt* OR cope OR coping OR plan OR manag* OR resilien* OR interven* OR adjust* OR modif* OR react* OR action* OR groundwork OR innovation* OR participatory OR plans OR planning OR “plan for” OR policy OR policies OR prepare OR “capacity building” OR intervention* OR acclimat*.

The initial search retrieved 23,146 articles. The title and first paragraph for each article was then reviewed to evaluate suitability for inclusion based on articles having a substantive focus on adaptation. Following screening, 517 articles were read in full, with 271 retained for analysis (see supplementary data for the full list). Exclusion of a large number of articles at the first stage primarily reflected their focus on mitigation or impacts/vulnerability.

A coding scheme was designed to systematically and quantitatively extract data on the salience and framing of adaptation. Alongside capturing basic descriptive information (e.g. year, newspaper etc.), a number of variables were collected for each article, selected based on interest in the literature on questions around how adaptation is being framed in the public sphere (e.g. Moser, 2011, 2014; Boykoff et al., 2013).

- *Adaptation stage*: to capture the varying stages of adaptations being reported, articles were coded according to Lesnikowski et al. (2011, 2013) as being ‘statements of recognition’ if they primarily acknowledged the need to adapt, commenting on the nature of adaptation and providing generic examples; as reporting ‘groundwork actions’ if they documented preparations being undertaken for adaptation, either through the building of knowledge (e.g. plans, reports, assessments) the formation of working groups (e.g. commissions, groups, departments), and/or the committing of assets (e.g. funds, materials) that are for adaptation purposes; and as ‘adaptation actions’ if they profiled actual adaptations that had taken place (e.g. built infrastructure, new/revised policies and protocols etc.). For an issue like adaptation, which remains a somewhat nebulous and poorly understood concept (Moser, 2014), understanding how the issue is being profiled in this way can give important insights for how the public is likely to view adaptation.
- *Adaptation type*: to analyze the types of adaptation profiled, distinction was made between hard, soft, and mixed adaptations. ‘Hard’ adaptations were defined as techno-engineering based responses to reduce potential climate change impacts (Hallegatte et al., 2011; Jones et al., 2012). They are capital intensive and are typically designed to respond to the specific risks posed by climate change, including the building of coastal protection measures to protect coastal communities from sea level rise, developing new reservoirs in light of changing precipitation regimes, and irrigation schemes to cope with changing precipitation regimes. ‘Soft’ adaptations were characterized as involving policy, legal, administrative, institutional, and financial interventions to reduce sensitivity to climate change and increase adaptive capacity. They include measures to enhance preparedness (e.g. early warning systems), spread risk (e.g. insurance, livelihood diversification), raise awareness (e.g. education of

at-risk populations), change behavior (e.g. land use planning), and improve decision-making (e.g. institutional enhancement). Documents had to have a predominant focus on hard or soft adaptation to be classed as such; where both hard and soft adaptations were discussed in a document, they were coded as ‘mixed.’ If it was not possible to discern how the article was being framed, the article was coded as ‘not applicable’ for adaptation type. This coding allowed us to examine if climate change adaptation reporting is consistent with media articles on natural hazard risk reduction, which has largely focused on hard interventions (Pasquare and Oppizzi, 2012), and allowed us to examine concerns in the general scholarship that adaptation is being primarily framed in terms of hard responses both in research, policy, and the public.

- *Adaptation timing*: to examine if reporting on adaptation was occurring in response to a recent extreme event (e.g. articles about adaptation written following Hurricane Sandy), articles were coded as ‘reactive’ where an event was explicitly motivating the article and framed the discussion of adaptation, and ‘anticipatory’ where adaptation was discussed in anticipation of future climate change impacts. Such information is important for understanding the determinants of adaptation coverage in the print media, and for targeting future adaptation stories by scientists and practitioners, *Adaptation scope*: to examine the geographical scope within which adaptation was being discussed, articles were coded as focusing exclusively on adaptation in North America, as focusing exclusively on adaptation outside North America, and having a focus on both.

Collectively, these variables are important for untangling what is framed as ‘adaptation’ in the public sphere, can help identify what is perceived as ‘good’ adaptation, and help delineate the terrain in which the public engages with adaptation; indeed, for many, the news is the only venue where they engage with the concept of ‘adaptation.’ This understanding is also important for those seeking to better communicate adaptation in the public sphere, which requires knowledge on what is and is not being reported.

Full text review of all included newspaper articles ($n = 271$) was conducted, whereby each article was coded using the coding scheme. Data on adaptation reporting were analyzed using the newspaper article as the unit of analysis, consistent with other studies on climate change in newsprint and more broadly in studies on adaptation identification and assessment (Ford et al., 2013; Lesnikowski et al., 2013; Berrang-Ford et al., 2014), with descriptive and inferential analyses (chi-squared) conducted in STATA 11.0 to summarize trends and association with respect to adaptation coverage and framing, and how these differ over time, by newspaper and by country. All references to statistical significance represent associations significant at the 95% confidence level using chi-squared analyses. To examine whether increased/decreased reporting on adaptation reflects broader trends in news coverage on climate change, an additional analysis was conducted to examine the proportion of total news articles on climate change in a given year had an adaptation focus. This involved a general search of the selected newspapers for all climate change focused articles using the search criteria of Ahchong

and Dodds (2012): “climate change” or “global warming” or “greenhouse gas.” Reflecting the large number of hits obtained ($n = 45,189$) articles were not checked for relevance or duplication, and were therefore compared to adaptation articles selected using a similarly simple search string of “climate change” AND “adap*” OR “cop*”; this allowed us to develop a coarse level of insight on the variance of adaptation focused articles with respect to articles in general on climate change (see supplementary materials).

3. Results

3.1. The number of stories on adaptation has increased rapidly since 2006

Fig. 1a presents the annual number of adaptation articles in newspapers between 1993 and 2013, highlighting cyclical

interest in adaptation. Superimposed on this cyclicity however, is an increase in salience of adaptation over time. Three periods of interest can be discerned in news reporting: (i) *neglect* until the late 1990s, with an average of one article per year focusing on adaptation; (ii) *intermittent interest* between 1998 and 2005, with the number of annual adaptation stories ranging from 3 to 12, with an average of 5 articles per year; and (iii) *take-off* with an increase in reporting taking place in 2006, with higher than average levels sustained afterwards, and with surges in reporting in 2007, 2012 and 2013. During this period (2006–2013), an average of 29 adaptation articles per year were published, ranging from 69 in 2013 to 15 in 2010, with 84% of all adaptation coverage occurring ≥ 2006 . More reporting on adaptation was documented in the sampled Canadian newspapers (150 stories) compared to the US newspapers (121 stories) (Fig. 1a), with reporting in newspapers from both nations following a similar pattern of cyclical interest. The Canadian *Globe & Mail* has the most

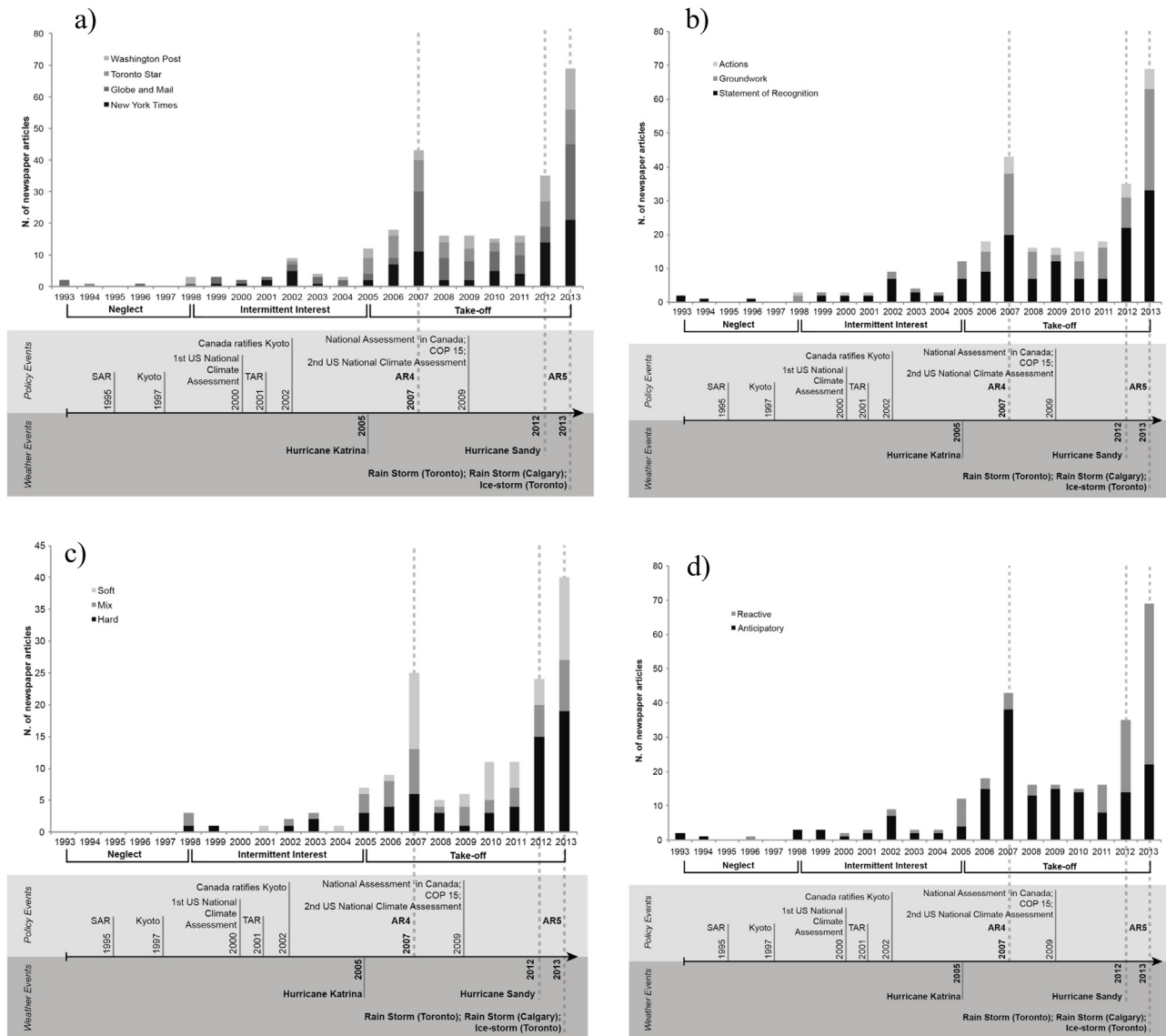


Fig. 1 – (a) Number of adaptation focused articles in selected Canadian and US newspapers 1993–2013. (b) Stage of Adaptation reported in selected North American newspapers. (c) Type of Adaptation reported in selected North American newspapers. (d) Timing of adaptation articles in selected North American newspapers.

Table 1 – Characteristics of selected newspapers.

Newspaper	Average daily circulation (print & digital)	Newspaper ranking ^c	Owner
New York Times	1.8 m (#2 in US) ^a	#1	The New York Times Company
Washington Post	474,767 (#7 in US) ^a	#2	Nash Holdings LLC
Globe & Mail	346,485 (#2 in Canada) ^b	#9 (#1 in Canada)	The Globe & Mail Inc.
Toronto Star	350,222 (#1 in Canada) ^b	#14 (#2 in Canada)	Star Media Group

^a Alliance for Audited Media (2013).

^b Newspapers Canada (2013).

^c Ranking based on the 4imn.com 2013 top 100 newspapers in North America.

adaptation stories ($n = 91$), followed by the *New York Times* ($n = 78$), *Toronto Star* ($n = 59$), and *Washington Post* ($n = 43$). The sub-analysis of how adaptation reporting compares to general climate change coverage, indicates similar cyclical interest; years of increased reporting on adaptation mirror those with increased reporting on climate change in general and vice versa. Similarly, the proportion of climate change articles with an adaptation focus ranges from 6 to 10%, consistently >8% since 2008, with the 10% of coverage documented in 2012 and 2013 (see supplementary materials) (Table 1).

The first increase in the number of articles on adaptation documented in 2007 partly reflects the release of the three working group reports of the fourth assessment, which were explicitly referred to in approximately one quarter of articles in 2007 (Table 2). In these articles, IPCC was used primarily to justify the need for adaptation (e.g. Calgary must plan now to adapt, April 8th) or in terms of profiling preparations being undertaken (e.g. Oxfam's *Adapting to Climate Change* report, May 29th). However, the release of the Summary for Policy Makers of WG 1 of the Fifth Assessment Report (AR5) on September 27th 2013 was referred to in only 3 of the articles reviewed here from 2013 (Table 2). In contrast to 2007, these articles were predominantly written to profile the report. The increase in the number of adaptation articles in 2012 and 2013 almost exclusively reflected content written in response to Hurricane Sandy (2012) and flooding in Canada (2013), with both events forming the primary entry point for 51% of all adaptation articles published in the final two years of the

time-series (see Section 4 for further analysis of the role played by such events in creating news interest in adaptation) (Table 2).

3.2. Coverage generally focuses on acknowledging the need to adapt, profiling few examples of initiatives that have actually been implemented

Newspaper articles on adaptation are primarily statements of recognition, generally arguing for the importance of adaptation as a response to climate change ($n = 144$, 53%), (Fig. 1b). This focus is the dominant framing of articles across the observation period, except in four years (1998, 2000, 2008 and 2011). The proportion of articles with a focus on statements of recognition however, has decreased over the observation period, with 68% having this focus between 1993 and 2002, compared to half from 2003 to 2013. Reporting on groundwork actions was the focus of 37% of the articles ($n = 99$), primarily appearing ≥ 2006 (89% of which ≥ 2006 , 48% ≥ 2011). A limited number of articles profile actual adaptations that have taken place (10%, $n = 28$), 90% of which have been published ≥ 2006 and 41% ≥ 2011 . Examples of articles providing coverage of all three stages of adaptation are documented in Table 3.

The Canadian newspaper articles were significantly more likely (67% vs. 33%, $p < 0.01$) to focus on providing statements of recognition on the importance of adaptation. The sampled US newspapers meanwhile, were more likely to profile actual adaptation actions (64% vs. 36%, $p < 0.01$), a function of

Table 2 – The publication date of articles written in response to specific events.

Event	Publication date of adaptation focused news article
Alberta flooding 2013 June 20th and 21st mandatory evacuation order in parts of Calgary, June 21st Bow River reaches peak flow, June 24th troops dispatched	June 27th, 29th, July 10th (2 articles), 12th, 18th (2 articles), 26th, 27th (2 articles), 29th, August 1st, 5th, November 5th
Hurricane Sandy 2012 Formed October 22nd, dissipated November 2nd, landfall in New York October 29th	2012: October 1st, November 2nd (2 articles), 3rd, 4th (2 articles), 5th, 8th, 10th, 12th, 15th, 16th (2 articles), 20th, December 7th (2 articles) 2013: January 4th, 7th, 18th, February 4th, 7th, 16th, April 27th, May 15th, 19th, June 12th (2 articles), June 13th, 14th, 15th (2 articles), July 15th, 22nd, August 13th, September 5th, October 13th, November 15th
IPCC AR5 2013 WG I SPM: 27TH September	September 26th, October 1st, 10th
IPCC AR4 2007 WGI SPM: February 2nd; WW II: April 5th; WG III: May 4th	February 2nd, 10th, 13th, March 11th, April 1st, 7th, 8th, May 29th, October 27th, November 28th

Table 3 – Examples of the application of the coding scheme.

Code	Variables	Examples
Adaptation stage	Statement of recognition	Title: <i>Leadership essential</i> Commissioner of the Environment and Sustainable Development Johanne Gelinat calls on Ottawa to develop adaptation plans for protecting and helping Canadians cope with the consequences of inescapable climate change. <i>Toronto Star</i> Sept 29, 2006
	Groundwork	Title: <i>Risk of Disease Rises With Water Temperatures</i> A report by the National Research Council concludes that the Environmental Protection Agency's storm-water program needs major overhauls to deal with increasing runoff as a result of climate change, including a more integrated permitting system based on watersheds and a focus on land use by growing municipalities. <i>Washington Post</i> Oct 20 2008
	Actions	Title: <i>Heat-wave alert system set up</i> In an effort to limit the death toll from heat waves, the City of Toronto is setting up the country's first early-warning and emergency-response plan for hot, oppressive weather that will likely increase due to climate change. <i>The Globe and Mail</i> Jun 19, 2001
Adaptation type	Hard	Title: <i>\$20 Billion Plan To Shore Up City As Climate Shifts</i> Mayor Bloomberg outlined a far-reaching plan on Tuesday to protect New York City from the threat of rising sea levels and powerful storm surges by building an extensive network of floodwalls, levees and bulkheads along its 520 miles of coast. <i>New York Times</i> Jun 12, 2013
	Mix	Title: <i>HUD Storm-Protection Competition Will Narrow Ideas Big and Small</i> The Department of Housing and Urban Development has created a contest called "Rebuild by Design" to come up with proposals to defend the coastline from New Jersey to Connecticut, from using levees to creating funding opportunities and investment strategies for coastal businesses to redevelop or relocate. <i>New York Times</i> Nov 15, 2013
	Soft	Title: <i>Warning system aims to leave no one twisting in the 300-km/h wind</i> The Weather Network set to launch a nationwide alert system for tornadoes, hurricanes and blizzards to brace Canada for future severe weather events caused by climate change. <i>Globe and Mail</i> Jun 9, 2010
Adaptation timing	Reactive	Title: <i>Storm Panel Recommends Major Changes in New York</i> In the wake of Hurricane Sandy, a new commission has been formed by Gov. Andrew M. Cuomo, charged with figuring out how New York should adapt in the long term to cope with worsening storms amid climate change and population growth. It has already recommended an extensive menu of programs. <i>New York Times</i> Jan 7, 2013
	Anticipatory	Title: <i>Three States to Require Insurers to Disclose Climate-Change Response Plans</i> Insurance commissioners in California, New York and Washington State will require that companies disclose how they intend to respond to the risks their businesses and customers face from increasingly severe storms and wildfires, rising sea levels and other consequences of climate change. <i>New York Times</i> Feb 2, 2012

reporting in the *New York Times* which published half of all action focused articles. No significant differences were found between adaptation stage and the types of adaptation profiled.

3.3. 'Hard' adaptations are more frequently discussed than 'soft' adaptations

Of the 271 articles in this study, it was not possible to discern the type of adaptation being profiled in 121, leaving 150 for analysis. Excluded articles mostly profiled statements of recognition arguing the need for and importance of adaptation, without suggesting specific ways to do so. The first article with a discernible emphasis on adaptation type was published in 1998, with most appearing in print ≥ 2006 (87%). The majority of articles where the type of adaptation was discernible, have a hard adaptation framing ($n = 63$, 42%), which is the dominant focus in 9 of 15 years where different types of adaptation are profiled. Notably from 2006 onwards, a hard framing is dominant in 5 of 9 years, particularly in 2008 (60% of articles), 2012 (63%), and 2013 (47%) (Fig. 1c); the latter two years driven by adaptations discussed in the wake of Hurricane Sandy and flooding in Canada. A focus on soft adaptations accounts for approximately one third of the articles ($n = 46$), with no articles focusing exclusively on soft adaptations appearing until 2001. 2007 and 2010 are notable years where the majority of adaptation reporting has a soft

framing (48%, 54% of year total), but was a marginal focus in 2012 (17%). A mix of both hard and soft was present in 27% of articles reviewed ($n = 41$).

Articles with a hard adaptation focus were significantly more likely to be printed in the sampled US newspapers ($p < 0.01$), primarily the *New York Times* which accounted for 54% of all 'hard' reporting, compared to one quarter of stories coming from the *Globe & Mail*, 13% from the *Washington Post*, and 10% *Toronto Star*. The two Canadian newspapers were more likely to profile soft adaptations ($p < 0.05$), with the *Globe & Mail* containing 43% of all soft adaptation content.

3.4. In 2011 there is a switch from articles profiling primarily anticipatory adaptations to reactive adaptations, driven by extreme events in 2012 and 2013

From 1993 to 2013, 61% of articles ($n = 166$) frame adaptation as being designed to reduce vulnerability/enhance resilience to future climate change (i.e. anticipatory adaptation), with 39% ($n = 105$) motivated in response to, and focusing on adaptation in the context of, a specified extreme event (i.e. reactive). Up until 2011, reporting is dominated by anticipatory adaptations, with 81% of articles occurring before this date having this framing. From 2011 onwards however, the majority of adaptation reporting (63%, $n = 76$) focuses on reactive adaptations. Indeed, 86% of all the reactive adaptation content

occurred ≥ 2006 and 73% ≥ 2011 . Hurricane Sandy and flooding in Canada (2013) is responsible for this trend (Fig. 1d). There were no significant differences in the timing of adaptations by country, newspaper, adaptation type, or stage.

3.5. Articles focus on adaptation primarily within a North American context

The majority of newspaper articles described adaptation within a North American context (71%, $n = 192$). A non-North American focus was observed in 17% of articles ($n = 46$). These articles primarily examine adaptation in developing countries, with stories also profiling adaptations taking place in other high-income nations (e.g. European ski industry, Australian water security). Articles focusing just on a North American context were more likely to have a reactive focus, driven by reporting in 2012 and 2013 ($p < 0.002$); otherwise, the framing of adaptation does not significantly differ depending on the geographic focus of stories. The dominance of North American focused content is more pronounced in later years of the timeframe, particularly in 2012 and 2013, accounting for 94% of the total coverage in both years. Up until 2008 however, there is more balanced regional coverage, with non-North American stories most common in 1998, 2001, 2002, and 2003.

4. Discussion

In this article, we systematically examine the coverage and framing of adaptation in influential North American newspapers between 1993 and 2013. As such, the findings are limited in the scope at which they are able to generate insights on how adaptation is being discussed more generally in the public sphere. Indeed, at a time of cut backs and declining sales, the influence of newspapers is declining. Nevertheless, many online news stories are often sourced from the print media, particularly the influential press sampled here, and indicate continued importance of newspapers in influencing how the public perceives climate change as a policy problem (Kirilenko and Stepchenkova, 2014). Given the difficulties of tracking adaptation coverage, and the myriad of terminology used to refer to ‘adaptation’, we may also underestimate the extent of adaptation reporting. To minimize this bias, however, we used an extensive list of key words capturing the varied ways in which adaptation is referred to in news print, and read over 23,000 newspaper articles when selecting those with an explicit focus on ‘adaptation’ for analysis.

Consistent with other studies on climate change and the media (Moser, 2011; Boykoff and Yulsman, 2013), news coverage of adaptation is cyclical, with the salience increasing significantly ≥ 2006 . Surges in adaptation reporting were documented in 2007, 2012, and 2013, with 16%, 13% and 25% of the total included articles respectively published in these years. The first surge in adaptation reporting occurs in 2007, and is partly a function of the release of IPCC AR4 which provided the framing for a quarter of the adaptation articles in this year. After 2007 there is sustained interest compared to previous years, albeit a lower level than in 2007, until 2012 and 2013 when there is a significant increase in coverage. This increase is a function of articles written in response to

Hurricane Sandy (2012) and flooding experienced in Alberta and Toronto (2013). These extremes can be viewed as critical discourse moments or focusing events, providing dramatic and observable demonstrations of vulnerability to the kinds of risks which climate change is projected to exacerbate. Furthermore, these extremes challenge the assumption that human systems are insulated from nature, and hence bringing immediacy to issues of adaptation. Indeed, short term extreme weather events of this nature have been observed to increase overall attention to climate change in the media (Corfee-Morlot et al., 2007; Schäfer et al., 2014), and have been observed to create unique policy windows to motivate adaptation at various levels of decision making (Lorenzoni et al., 2005; Tompkins et al., 2010; Berrang-Ford et al., 2011; Moser, 2011; Ford and King, 2013; Pulwarty and Sivakumar, 2014).

The importance of extremes in stimulating adaptation coverage is only evident in recent years, however, and not all extremes serve to generate adaptation attention. Hurricane Katrina (2005), for instance, was linked to only 6 newspaper articles despite the widespread framing of this event in the public sphere as a hurricane either caused by climate change or indicative of the kinds of hazards that will be more common in the future (Liu et al., 2008; Ahchong and Dodds, 2012). Indeed, prior to 2012, very few extremes were observed to generate adaptation coverage. While little work on the links between media coverage on adaptation and extremes has been conducted, and is an area of research need, we hypothesize that it is only in recent years with the acceptance of adaptation as a ‘legitimate’ policy option (see Pielke et al., 2007) that discursive space has opened for adaptation to be part of the climate change narrative; such preconditioning has allowed extreme events to direct attention to adaptation alongside mitigation. This ‘legitimacy’ reflects numerous factors including: acceptance of the inevitability of some degree of climate change, impasse on mitigation action, greater focus on adaptation through the UNFCCC process and by national governments, the lifting of the ‘taboo on adaptation’ by many NGO’s and activists, demystifying of what adaptation actually is through actions of the later and scientists to promote adaptation issues, and recognition in developed nations that adaptation is not just a developing nation issue (Dickinson and Burton, 2011; Ford et al., 2011; Moser, 2011; Khan and Roberts, 2013; Moss et al., 2013; Moser, 2014). Indeed, increasing salience of adaptation, specifically in North America, is evident in the articles reviewed here, where dominance of articles focusing on adaptation specifically in Canada and the US is observed after 2007, particularly in 2012 and 2013. Prior to 2007, a greater focus on non-North American content is evident.

The role of the IPCC in stimulating adaptation reporting is unclear. No reference was made to the Third Assessment Report (2001) in articles reviewed here, and there was no associated increase in reporting in 2001. In 2007 however, AR4 directly stimulated a quarter of articles reviewed, and a surge of reporting was also documented. While the release of the SPM of AR5 had limited impact, the release of the reports of WGII and III in 2014 was outside the timeframe of this study. Other events commonly linked to enhanced media coverage of climate change, including UNFCCC Conference of the Parties

(CoP) meetings, G8 meetings, the release of climate change films (e.g. *An Inconvenient Truth*) (Boykoff and Yulsman, 2013; Schäfer et al., 2014; Kleinschmit and Sjostedt, 2014), were not observed to have a discernible influence on adaptation coverage, and were not referred to in the articles reviewed. For example, CoP15 in Copenhagen in 2009 resulted in a widely documented spike in climate change reporting in the media globally, after which interest has decreased. CoP 15 was only indirectly referred to in the adaptation articles reviewed here, however, despite adaptation being an important theme at the COP (Liverman and Billett, 2010). Also in contrast to broader climate change reporting, since COP 15 reporting on adaptation has continued to increase. This is further indication of the recent legitimization of adaptation.

Despite increasing salience of adaptation in the media in recent years, adaptation focused content still remains minimal, however. Indeed, in the sub-analysis of all climate change focused articles published in the selected newspapers, the proportion of adaptation stories has remained low across the last twenty years, exceeding 10% only in 2012 and 2013. Similar trends are evident when comparing this dataset with analyses of reporting on climate change elsewhere (Lyytimäki, 2011; Asplund et al., 2013; Takahashi and Meisner, 2013). In the public arena then, adaptation while having now permeated newspaper coverage, is still not being discussed on the same level as other climate change topics (e.g. mitigation, impacts, science of). The implications of this are significant. A lack of interest among policy makers and the public, and confusion about what adaptation actually entails, have been widely documented and have been identified as major barriers to adaptation (Amundsen et al., 2010; Ford and Berrang-Ford, 2011; Clar et al., 2013; Moser, 2014). The limited media coverage thus further contributes to the absence of an adaptation consciousness in the public sphere.

The central organizing idea for newspaper content on adaptation is of 'hard' interventions involving techno-engineering based adaptations designed to reduce exposure to climate change impacts, particularly observable in the surge of reporting in 2012 and 2013. Investment in coastal protection measures in light of accelerated coastal erosion and storm activity, in particular, were widely reported on as an important response option in newspapers, along with stories noting the need to climate-proof infrastructure. The newspaper items on soft adaptation focused primarily on disaster risk management in the context of storm-related hazards. Reporting on actual implemented adaptations was almost absent however, in the newspaper articles reviewed.

For an emerging policy issue like adaptation, the media provides a key arena through which discursive spaces over possible solutions are publically created, debated, and bounded. Issue image has a powerful influence on shaping public understanding and policy agendas, and the overwhelming hard adaptation representation in newspaper articles frames adaptation as techno-engineering based responses. This framing is likely to reinforce existing bias toward hard adaptations in climate policy at multiple levels, reflecting, among other factors, the needs and priorities of adaptation funding schemes, the ability to directly quantify reduced exposure to climatic-risks under different climate scenarios, the prestige value and 'visibility' of capital investments, and

ease with which they can be explained to the public (Sovacool, 2011; Jones et al., 2012).

Hard interventions are a central component of adaptation, yet are not feasible in all instances given cost, uncertainty surrounding climate projections, and delayed realization of benefits to the future (Dovers, 2009; Fankhauser and Burton, 2011; Jones et al., 2012). Indeed, the peer reviewed scholarship highlights that soft interventions are often the most likely to be effective in reducing climate vulnerability by focusing on the underlying socio-economic determinants of vulnerability, cost less, bring multiple co-benefits that can be realized over short time horizons, and can be readily altered if future climate evolves differently than projected, thereby entailing fewer risks (Fankhauser and Burton, 2011; Hallegatte et al., 2011). As such, soft responses also reduce the potential for maladaptation in the long term. The hard framing prevalent in news coverage, therefore, narrows understanding of what constitutes 'adaptation.' The hard framing is further reinforced by the long history of news coverage on natural hazards. Here, despite decades of research critiquing the 'dominant paradigm', where the geography of risk is treated as synonymous with the distribution of geophysical extremes, hazards continue to be framed in the media as acts of god, departures from everyday life, with interventions largely discussed in terms of techno-engineering responses (Pasquare and Oppizzi, 2012). This persists despite the fact that disaster losses continue to increase in many regions and widespread evidence on the effectiveness of soft interventions designed to enhance adaptability (White et al., 2001; Adger et al., 2005; Pasquare and Oppizzi, 2012).

Other notable dimensions of adaptation framing include the dominance of articles arguing the need for adaptation, with few profiling actual adaptation actions. This likely reflects recent consideration of adaptation in climate policy at national to local levels. Indeed, analyses of the stage of adaptation being undertaken by national and regional governments both globally and within developed nations, indicates that adaptations are primarily at the statement of recognition and groundwork stage (Biesbroek et al., 2010; Lesnikowski et al., 2011, 2013; Reckien et al., 2014; Berrang-Ford et al., 2014). While formulating the need for adaptation is an important step in establishing the importance of an issue, and consistent with the recent permeation of adaptation into news reporting, concrete examples of adaptation can serve as powerful communication tools, particularly important for adaptation which remains a nebulous and relatively new concept in the public realm (Moser, 2014).

As one of the first studies to explicitly examine the portrayal of adaptation in the media, we acknowledge that our analysis is exploratory, and in part a call for enhanced focus on adaptation in research on climate change and the media. We also caution that more media coverage does not necessarily lead to increased adaptation efforts or increased interest in adaptation among the public and policy makers. Consistent with Boykoff and Yulsman (2013), we see media coverage as being a necessary but not sufficient condition for raising the status of adaptation in the public sphere. Given the increasing emphasis on adaptation in climate policy, understanding how the issue is being framed publically is important for scientists and practitioners, and can help inform communication and outreach efforts. Key areas for

future research for substantiating the results presented here include a broader geographic focus on adaptation in the news, analysis of diverse sources of media (e.g. social media), tracking of change in adaptation reporting over time, and analysis of the language and tone of reporting. Of particular interest is the impact, if any, of the release of IPCC AR5 WGII & III on adaptation reporting, and the extent to which future extreme events influence the coverage and framing of adaptation.

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Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at <http://dx.doi.org/10.1016/j.envsci.2014.12.003>.

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