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Cows, Climate and the Media

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Introduction

With the shift toward large-scale concentrated animal feeding operations (CAFOs), media coverage of livestock production has focused on issues ranging from livestock-borne diseases to worker's rights to greenhouse gas (GHG) emissions. The latter is particularly important given growing evidence for anthropogenic climate change and its connection to livestock production (Steinfeld et al., 2006). Continued public uncertainty about anthropogenic climate change, however, threatens the adoption and enforcement of appropriate mitigation and adaptation policies (Leiserowitz, 2006; Boykoff, 2007). As media representations of climate science have in part fueled climate skepticism, analysis of how the media portrays different climate-related issues is required if scientists and policymakers are to improve their engagement and communication with the public. Doing so will help secure broader-based public support for climate policy. Yet despite livestock production's sizeable contribution to GHG emissions, academic literature lacks systematic media content analysis of how the media cover the livestock-climate change connection. This chapter addresses this gap by comparing media coverage of livestock production's contribution to climate change with broader coverage of other livestock-related issues. This is followed by a deeper analysis of how the media has represented the livestock-climate change connection.

The food system's contribution to climate change is often framed in terms of food miles. However, the global transportation sector emits less than livestock production, which contributes up to 18% of world GHG emissions and accounts for nearly 80% of all agriculture-related

emissions (Steinfeld et al., 2006). Deforestation associated with grazing and feed production (e.g. corn and soy) underpins livestock's climate change impact (Gill, Smith, and Wilkinson, 2010). Additionally, livestock's digestive systems and manure produce GHGs such as nitrous oxide and methane (Steinfeld et al., 2006). CAFOs also have large heating, cooling, lighting, ventilation and waste disposal energy demands, which also increase GHG emissions (Lappé and McKibben, 2010).

Cattle (including beef cattle and dairy cows sent to slaughter) are the largest livestock-based source of GHG emissions. These emissions vary considerably according to type of animal, method of production and the geography of where the animals are raised and slaughtered. The livestock industry faces growing pressure to mitigate these emissions and has responded with an array of preventative and 'end of pipe' approaches that further intensify the livestock production process (Clemens and Ahlgrimm, 2001), while allowing them to continue to expand operations and sell more meat. In concert with the livestock production industry, bioengineering and pharmaceutical firms have developed measures such as increasing animal productivity through improved genetics, greater use of growth hormones, antibiotics, steroids, disease control, controlled grazing and altering animal feeds. 'End of pipe' measures include better manure management and use of manure or litter for biogas production. The industry warns that 'productivity-enhancing technologies' are necessary for limiting deforestation and GHG emissions from beef production (Capper and Hayes, 2012).

Livestock production's impacts are not limited to climate change, but include additional environmental, public health, socio-economic and animal welfare costs. Other environmental impacts associated with intensive beef production include water pollution and water use, biodiversity and aquatic system threats, air pollution and land degradation (Gerbens-Leenes, Nonhebel, and Ivens, 2002; Mallin and

Cahoon, 2003; Koneswaran and Nierenberg, 2008; Emel and Neo, 2011). Livestock production consumes nearly three-quarters of all agricultural land globally, as well as 8 percent of total water use (Steinfeld et al., 2006, xxii).

Livestock production and consumption each have their respective public health impacts. CAFOs are responsible for public and worker health issues associated with increasingly antibiotic-resistant bacteria and the spread of infectious diseases, including influenza (Gilchrist et al., 2007). Increased meat consumption has been linked with health maladies including obesity, cancer, heart disease and diabetes (Chao et al., 2005; Micha, Wallace, and Mozaffarian, 2010; Michaelowa and Dransfeld, 2008).

Industrial beef production is representative of the wave of corporate consolidation in the broader meat industry. Four corporations (Tyson Foods, JBS, Cargill and National Beef) produce approximately 80 percent of the beef products sold in the US. Concerned scholars write of the industry's close interconnections with government subsidies, financialization, industry group advertising, (e.g. 'Beef, it's what's for dinner') and pharmaceutical companies (Bonanno et al., 1994; Morgan, Marsden, and Murdoch, 2006). Specific socio-economic concerns include family versus corporate ownership of farms, living wages and livelihoods for farmers and farm workers, sourcing food 'locally', and supply chain transparency. In theoretical parlance, differences between beef production systems parallel those of ecological modernization and agro-ecology (Marsden and Sonnino, 2005): that is, sustainability through intensification and efficiency as opposed to sustainability through reimagined (and reconstituted) urban and rural food provisioning networks that attempt to undo social and economic inequalities.

Last but not least, CAFOs create significant animal welfare issues. Concerns over animal welfare relate to cases of slaughterhouse animals so injured or sick that they cannot stand up unassisted (so-

called 'downer' animals) and conditions that deprive animals of social interaction, limit time outdoors, restrict normal behaviors and result in a range of serious health and behavioral problems (Mader, 2003; West, 2003)

Media coverage of these issues contributes to public awareness and can support or impede structural changes such as developing more sustainable food systems and policies that address the wide range of impacts of livestock production. Despite widespread media coverage of livestock-related issues and growing scientific evidence linking meat production and climate change, systematic content analysis of this relationship in media coverage has been surprisingly minimal.

This chapter extends previous research that combines actor-network theory (ANT) with framing theory to develop the basis for 'story-networks' - networks of actants and artifacts that shape how a media report or 'story' is framed (Lee et al., 2014). We do this by coding livestock-related articles from a major US newspaper, the *Los Angeles Times*, over the 1999 through 2010 period to understand how various actants and artifacts shaped different story-networks. Specifically, we address the following questions:

- 1 What livestock-related themes did the *Los Angeles Times* cover from 1999-2010?
- 2 How did coverage of these themes change over this period?
- 3 Which actors (human or nonhuman) contributed towards news coverage of livestock-climate change related issues and how did they do so?
- 4 How were these stories framed?

The chapter illustrates how distinctive story-networks emerge, framing the livestock-climate change linkage as either an issue to be addressed through technological innovation, individual lifestyle choices, or policy action. In these story-networks, varying configurations of actants and artifacts were involved, including the cattle themselves. We conclude

the chapter by reflecting on our theoretical approach and directions for future research.

Climate change, livestock and the media: Frameworks for understanding

This section reviews media analysis studies and introduces framing theory and ANT. These theoretical frameworks provide the foundation for the 'story-network' concept, which we use to describe how different configurations of actors and artifacts create narratives for media stories. This framing solidifies these narratives in different stories through repeated messaging over time. News stories and their characteristics are thus influenced not only by the media but also by the actors and artifacts involved in generating the news. Broadly, this reflects the socially constructed nature of knowledge. This refers to how scientific knowledge of environmental issues such as climate change is not insulated from politics – the political ecology of knowledge. The practice of science, often taken for granted as objective, instead involves a web of social relations which not only generates its own politics, but is open to influence from the politics it often seeks to inform (Demeritt, 2001). As a result, the nature of knowledge is molded by the power relationships within and among the groups involved in its production and the users of knowledge. While our focus is on the media and not on formal scientific knowledge, the political nature of knowledge production readily applies and informs our exposition of the following theoretical frameworks.

Media Analysis and Framing Theory

Media analyses focus on how mass media shapes public perceptions and attitudes. Their findings illuminate how media's ability to shape public perception depends on how it chooses its primary sources and frames its stories (Bennett, 1996; Goodman and Goodman, 2005). Several studies have examined climate change media coverage and found it reflects and influences short-term public concern about the issue (Carvalho and Burgess, 2005; Sampei and Aoyagi-Usui, 2009;

Trumbo, 1996). Media analyses have also found that the media sometimes convey inaccurate information, possibly to balance two sides of a story. Antilla (2005) concluded the media would sometimes cite climate skeptics to appear journalistically balanced, often giving undue weight to sensational, less scientific approaches and exaggerating the extent to which issues were debated (Bennett, 1996; Goodman and Goodman, 2005).

Media analyses have also sought to explain temporal changes in the coverage of issues like climate change. Downs (1972) theorized changes in coverage by arguing that public attention to an issue consists of: '1) the pre-problem stage;' '2) alarmed discovery and euphoric enthusiasm;' '3) realizing the cost of significant progress;' '4) gradual decline of intense public interest;' and '5) the post-problem stage,' where public interest in the problem is low, but higher than at the beginning (Downs, 1972, pp. 39-40). Though frequently cited, scholars have criticized Downs's model for failing to account for the media's agency in determining news coverage. Boykoff and Boykoff (2007) argue that professional norms in journalism, including personalization, dramatization, novelty and balance (often confused for objectivity) also shape media coverage. Though actual news content undoubtedly plays a role, these norms lead to the emergence of particular narratives and frames that influence public perceptions of the issues being covered.

Other studies not only examine potential cyclicity in media coverage, but also illustrate how narratives and discourses employed by the media change over time. Subsequent work (Trumbo, 1996; McComas and Shanahan, 1999; Carvalho and Burgess, 2007) suggested that climate change coverage follows a cyclical pattern, similar to Downs's theory, that is augmented by the media's construction of different narratives over time: during the early stages of the cycle, the media most frequently covered articles grounded in science that highlight the need for political reform. These articles frequently linked major

scientific findings to climate change-related events, such as massive US-wide heat waves. Scientists were most often quoted during this upswing of attention. Next, politicians and industry became more involved actors in media reports of climate change, often lending moral judgments and providing solutions (Trumbo, 1996; Carvalho and Burgess, 2007). Articles then began to depict controversy among scientists over climate change, which is suggestive of media attempts to maintain journalistic balance and create drama (McComas and Shanahan, 1999). At the end of the cycle, the media started to frame the issue in terms of the large investment costs and behavioral change burdens required to mitigate climate change, leading to a gradual decline in attention (Trumbo, 1996; McComas and Shanahan, 1999; Carvalho and Burgess, 2007).

To our knowledge, only Neff et al. (2009) have examined media coverage of livestock-climate change linkages over time. They analyzed stories in 16 major US newspapers from 2005 to 2008 and concluded that although coverage of food-climate change connections increased over time, it did not reflect the scale of the food system's effects on climate change. This coverage focused on food in general rather than specific food system components. The study found that articles initially allocated responsibility to individuals but over time shifted towards business and government, suggesting a growing salience of food system-climate change impacts for political leaders, experts and advocacy groups. The study did not attempt to identify how different stakeholders might have influenced the newspaper coverage.

Research shows how framing shapes public perceptions and attitudes. Framing theory helps us understand how information is presented and which aspects are included or omitted. Iyengar (1994) divided frames into episodic and thematic framing. Stories framed episodically examine one 'episode,' rather than the larger processes at work. For example, prior studies demonstrate that episodic media coverage of

health problems (e.g. obesity) often blames individuals' eating behavior rather than structural or genetic reasons (Saguy and Almeling, 2008; Borra and Bouchoux, 2009). In contrast, thematically framed stories provide contextual information about an issue, such as the policies that have made fats and sugars more affordable and readily available. Thematic stories tend to build broad-based public concerns (Iyengar, 1994; Wallack et al., 1999) or create pressure for institutional reform (Wallack et al., 1999; Dorfman, Wallack, and Woodruff, 2005), thereby attributing responsibility to government or society. Although few news stories are purely episodic or thematic, one type is usually predominant in each story (Iyengar, 1994).

Framing also refers to the narratives news stories employ and reflects how public understandings of different issues are cognitive and cultural (Goffman, 1974). Understanding this aspect of framing helps us understand how the media shape opinion (Entman, 1993; Scheufele, 1999). Gamson et al. (1992) suggest that media framing is influenced by social actors with stakes in different social realities presented by the media. Trumbo (1996) suggests that framing is dictated by the ability of different parties to communicate messages and the media's discretion in choosing which sources to use. We later employ ANT to make these interactions more nuanced and explicit.

Different frames involve different themes, sources and actors. Here, we use 'theme' to refer to the general subject area the media chooses to align its stories with. For example, articles about CAFOs could highlight themes such as animal rights issues, workers' rights, or health and nutrition, depending on the angle and sources employed. A manufacturer can be generous for providing a low-priced item or, conversely, be irresponsible for cutting costs on pollution abatement. Frames shape our understanding of who is responsible; they direct the public to pressure certain responsible parties (Wallack et al., 1999). By studying livestock-related stories, we can understand how news is framed and, accordingly, who is made responsible.

Actor-Network Theory

ANT was developed in the 1980s by Bruno Latour, Michel Callon and John Law (Law, 1998; Callon and Latour, 1981; Latour, 1993) and views the world as comprising multiple actor-networks that are heterogeneous, complex and dynamic (Castree, 2002). This perspective breaks down traditional dualistic boundaries (e.g. nature/culture, structure/agency) that shape how most knowledge is constructed. Actor-networks include assemblages of human and nonhuman actants, which can include everything from people and plants to institutions and scientific research. Networks are made 'real' not necessarily by actants' intrinsic properties but by actants' positions relative to each other. Actor-networks' success depends on the ability to enroll other actants through translation: an actor's ability to exert authority over another in speech or action (Callon and Latour, 1981).

ANT's potential to transcend nature-society dualism partly explains its allure. It helps resist such dualisms by providing a relational vocabulary, providing neutral ground between natural and social sciences (Ivakhiv, 2002). Nature is understood as neither 'natural' nor 'social' but as a hybrid. ANT is therefore 'co-constructionist', seeking to identify how relations and entities come into being together (Murdoch, 1997). ANT also challenges how we think about actants with respect to power. We generally conceive power based on what we perceive to be intrinsic resources and liabilities of these actants. ANT turns this conception on its head by ascribing power not to the actants themselves but to the links that bind actants and entities together (Murdoch, 2000).

ANT can augment framing theory by identifying actants, who they influence and what artifacts they use to enroll other actants in their story-networks. In this chapter, actants include humans, animals and objects that have agency in shaping story-networks by contributing to or having a stake in the events or circumstances covered by the media. We distinguish between these three using the terms 'actors', 'animal actants', and 'artifacts', respectively.

ANT differs from traditional communication models (Shannon and Weaver, 1949; Berlo, 1960) that consider the process to be linear and one in which the media reframes existing information for the public. Couldry (2008) highlights that ANT can blur dualistic boundaries between media institutions and broader society and show how media power is spatially dispersed in actor-networks. However, ANT's treatment of power, especially between actants, has been critiqued as insufficient (Castree, 2002; Fine, 2005). In particular, 'social' rather than 'natural' actants have been demonstrated to have more 'power' (Castree, 2002) - through a surplus of money, for example (Massey, 1993; Hudson, 2001 quoted in Fine, 2005).

This critique is important when considering media discourses as outcomes of contestation among different actants (Gamson et al., 1992). Better understanding these outcomes requires a version of ANT that interrogates power more subtly and explicitly. In addition to actants' individual characteristics, their positions within networks, network structure and the type and terms of their connections are important in determining the kinds of power exerted and the outcomes of actant interaction (Rocheleau, 2011; Rocheleau and Roth, 2007). Similarly, Hobson (2007) suggests that animal agency is shaped by their placement in different networks, i.e. their relationships with other actants.

In our analysis of livestock-climate change articles, we draw upon these elaborations on ANT and framing theory to conceptualize news stories as 'story-networks' - webs of actants and artifacts with different degrees of power to influence stories' framing and their communicated messages. The media is an actant that others have to pass through and, thus, is intrinsically endowed with power. However, the story-network's actants are also vital; they shape the story's framing, its different themes and the sources that inform it, thus shaping the meaning of events for the broader public. Our research seeks to understand what kinds of messages are reaching the public about

livestock and climate change. To this end, we combine ANT and framing theory to identify and examine key actants associated with different frames and themes. The relationships between actants explain the story-network; we focus on the ways in which different actants exert power and how this influences the framing of the story.

Methodological approach

Our methodological model assumes story-networks comprise multiple actants and the media. Different degrees and types of power held by each actant shape these networks and interact with the media to shape news articles. We identify the key actants in media coverage of livestock issues and assess how frequently they are cited or referenced, using them as gateways into the actor-networks underlying different news stories. We draw conclusions about how actants' relationships to each other and the media affect their representation. Finally, we assess whether and how these effects interact with the media to impact how articles frame livestock-climate change issues.

Specifically, we examined newspaper articles in the *Los Angeles Times*. This newspaper was selected for three reasons. First, the *Times* is a major national media outlet, with a searchable online archive. Second, California is the nation's leading agricultural state, making its media sensitive to issues affecting that sector. Third, focusing on a single media source helped to some extent hold constant differences in editorial philosophy and strategy. We used electronic search engines to identify articles, determined their annual frequency and quantified different coded actants. To keep the amount of data manageable, we systematically searched for livestock-focused, full-text news articles and editorials of any length (except for letters to the editor) published between January 1, 1999 and December 31, 2010, excluding articles that only tangentially referred to livestock. We selected these years as they span a period when scientific awareness of livestock-climate change linkages was growing steadily.

We identified six themes from reading the articles:

- 1 climate change;
- 2 animal welfare;
- 3 workers' rights and safety;
- 4 human health and nutrition (including food safety);
- 5 environmental impacts (excluding climate change); and
- 6 business and technology.

We tabulated the total number of articles in each theme for each of the study period's 12 years to identify trends and changes in issue coverage over time. As our aim was to explore how the media portrayed livestock-climate change connections, we focused most on articles in the climate change theme.

To understand what voices livestock-related articles exposed the public to and which voices influenced the livestock-climate change discourse, we quantified three types of actants quoted or mentioned in the *Los Angeles Times*. We termed human actants as 'actors', defining actors as human individuals or organizations that had a stake in, or would be affected by, the event that led to the article. All human actors also received another code based on their affiliation. These included 'state', 'private sector', 'academic', 'industry association' (i.e. associations representing the livestock industry's interests) or 'public interest' (including non-governmental organizations and other members of civil society).

We also counted animals, both when the media portrayed them as having agency and when they were mentioned in general. Lastly, we included key nonhuman actants (for example, a new piece of legislation, or a journal article); these were termed 'artifacts'. We coded and counted actants once, even if they were mentioned multiple times in an article. Following Iyengar (1994), we also coded each article as episodic or thematic. To identify how the media represented livestock-climate change linkages, we identified the actants that referenced these linkages. We coded those that acknowledged the linkages as a

problem as 'positive', those that acknowledged only some of the linkages or did not necessarily view climate change as a problem as 'neutral', and those that expressed skepticism over livestock's climate change impacts as 'negative'. All coding was done using Atlas.ti software (Scientific Software Development, 2012).

We divide our findings into four areas: changes in the frequency of livestock-related articles over time, the number and types of actants we identified in climate change articles, how these articles were framed and different actants' attitudes to climate change–livestock linkages.

Media themes over time

Our analysis of coverage by general theme reveals that livestock-related articles in the *Los Angeles Times* from 1999–2010 (Figure 12.1) most commonly focused on human health (175), followed by animal welfare (105), environmental impacts (41), business and technology (36), workers' rights and safety (30) and climate change (19). The annual article total increased from 14 in 1999 to 72 in 2010, suggesting an overall increase in media interest in livestock-related issues. Workers' rights and safety and climate change were the only themes to end the period without an overall increase in article frequency.

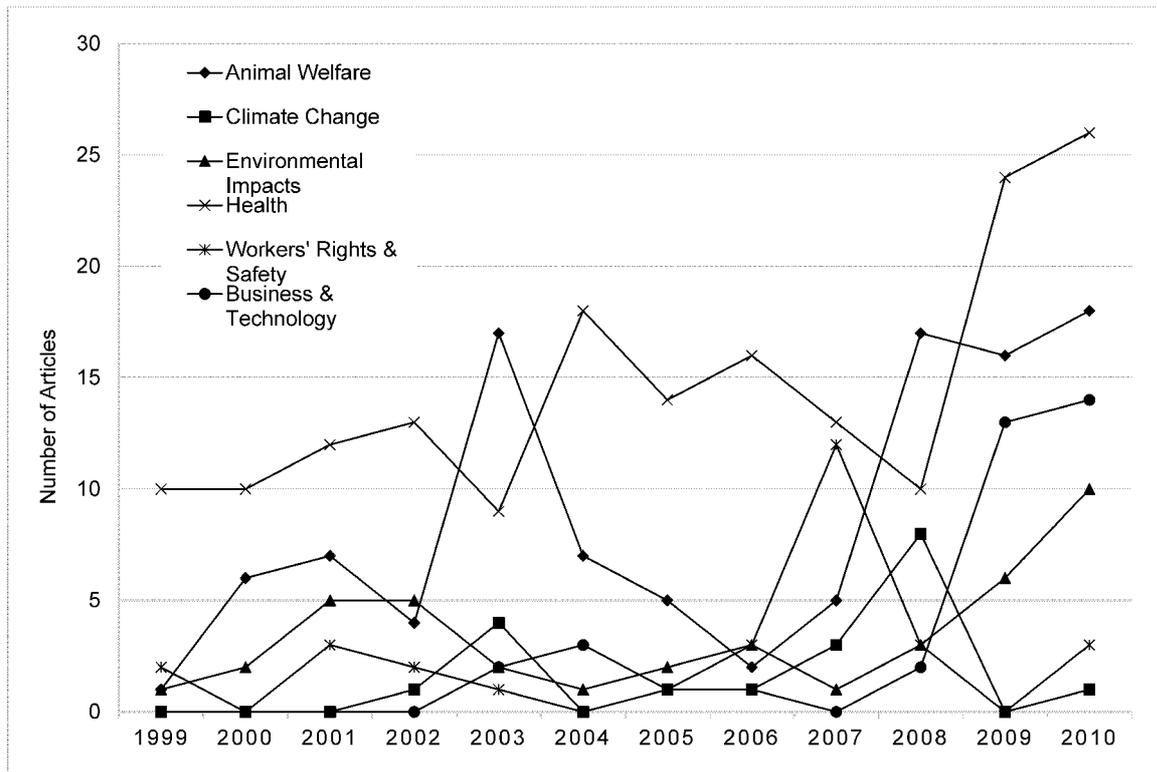
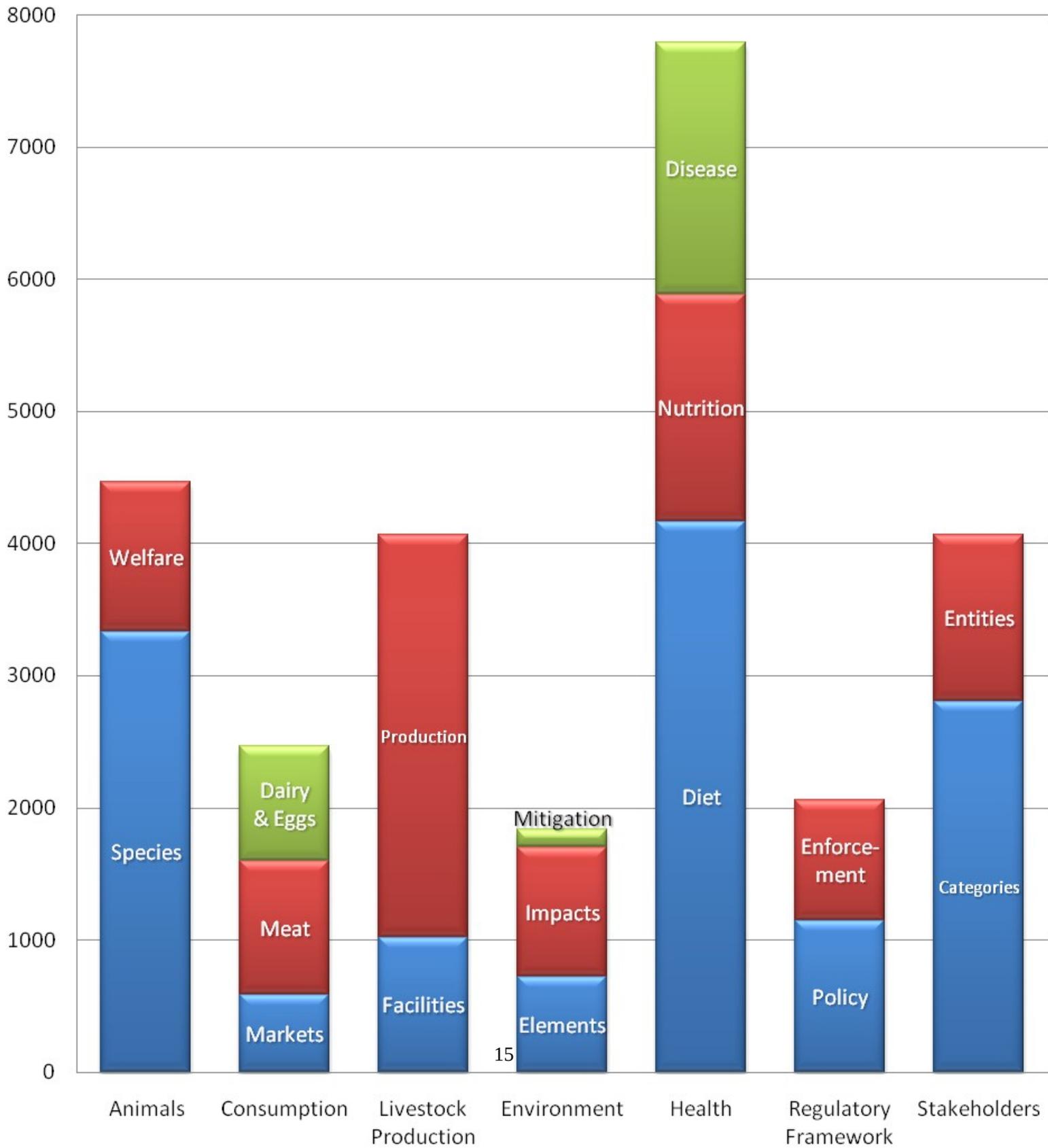


Figure 12.1 Annual number of articles by theme.

Articles on environmental impacts primarily focused on water pollution and waste from livestock production, although in 2009 and 2010 there was notable growth in articles covering sustainable agriculture trends (e.g. urban backyard chicken farming). Animal welfare articles covered animal rights activism (notably People for the Ethical Treatment of Animals) and associated legislation, with peaks in 2003 and 2008. Health articles were the most temporally consistent, generally discussing nutrition (including diets and certain foods' nutritional impact), food-borne illnesses and food product recalls. Workers' rights and safety articles were consistently low-frequency except for a peak in 2007; they featured changes in labor and immigration policy and their impact on immigrant farm workers and employers. Business and technology articles covered government deliberation over genetically modified food standards and the impacts on American livestock businesses of mad cow disease and Japanese bans on American beef. Although consistently low at first, coverage took off in 2009 and 2010, focusing on rapidly rising costs of meat and the recession-induced

competitive tactics of large meat retailers, such as fast food restaurants.

Distribution of Topics and Sub-Topics over Ten Year Period



in this theme. Next most frequent were public interest actors, such as environmental NGOs (nongovernmental organizations) and livestock industry associations (11 percent each). Private sector actors, mainly food services and energy companies, comprised 10 percent. Academics represented 8 percent of all actants and were cited in connection with their research on livestock's climate change impacts and mitigation. Animals comprised 28 percent of all actants and were almost evenly split among those animals mentioned generally and those to which the media assigned agency. Artifacts in the climate change theme made up the remainder (15 percent) and included studies and reports, technologies such as biogas energy and grass-based feeding strategies, new policies and a documentary.

Framing analysis

The climate change articles can be roughly divided into three categories; each solidifies a different facet of the livestock-climate change nexus for the public. The first category of articles (n=6) emphasized technological innovations for climate change mitigation (e.g. bioengineering of feed and cattle and manure biodigestion). The second category (n=4) highlighted carbon footprint-reducing individual lifestyle changes, such as eating less beef and buying locally. The third category (n=9) focused on climate change regulations and legislation. Table 12.1 shows how the actants identified (and their subtypes) were distributed among these three categories.

Table 12.1 Proportional distribution of actants in climate change theme by type and story-network.

Actant types		No. of actants by story-network				% of total actants	% of actants by story-network		
		Technology	Lifestyle	Policy	Total		Technology	Lifestyle	Policy
State		7	3	9	19	18	37	16	47
Livestock industry association		2	1	8	11	11	18	9	73
Academic		5	3	-	8	8	63	38	-
Animal	General animal	9	3	2	14	13	64	21	14
	Animal actor	4	9	2	15	14	27	60	13
Private sector	Energy utility	2	1	-	3	3	67	33	-
	Beef / dairy company	2	-	-	2	2	100	-	-
	Energy technology / services	1	1	-	2	2	50	50	-
	Food services company	-	2	-	2	2	-	100	-
	Car company	1	-	-	1	1	100	-	-
Public interest	Environmental NGO	1	-	5	6	6	17	-	83
	Social justice NGO	1	-	1	2	2	50	-	50
	Business development NGO	1	-	-	1	1	100	-	-
	Consumer advocacy group	-	-	1	1	1	-	-	100
	Public policy think tank	-	-	1	1	1	-	-	100
Artifact	Study / report	1	3	2	6	6	17	50	33
	CC mitigation technology	3	-	-	3	3	100	-	-
	Policy	-	-	3	3	3	-	-	100
	Consumer practice	-	2	-	2	2	-	100	-
	Beef production technology	-	1	-	1	1	-	100	-
	Film	-	1	-	1	1	-	100	-
Total		40	30	34	104	100			

Episodic stories comprised 32 percent of the climate change articles. The low percentage contrasts with Iyengar's (1994) finding that typical news stories are episodic. Half of the technology and lifestyle articles were episodic; these highlighted specific actors' development of mitigation technologies, or individuals' actions or responses concerning lifestyle changes. The sole episodic policy article covered Tom Vilsack's appointment as Secretary of Agriculture, focusing on his track record and expected agricultural policy. Artifacts commonly featured in episodic articles included technology (processes, equipment) and items individuals easily relate to, such as diets.

Thematic technology and lifestyle articles provided more background than episodic articles on technological innovation or behavioral change and involved more academic, state and public interest actors. Thematic policy articles discussed legislative issues and mainly referenced state actors. They often featured academics in connection with their research and NGO representatives who advocated or expressed support for certain reforms, often referring to their own research. Common artifacts in thematic stories included academic studies and reports, new technologies and techniques for farming that might be incorporated into legislation.

Attitudes of actants to the climate change–livestock linkage

Many articles made statements or quoted actors acknowledging the linkage between livestock and climate change as problematic (54 percent; coded as positive). Most were academics that discussed emissions data, GHG-reduction approaches and livestock's contribution to climate change. Just one private sector actor supported the linkage: Bon Appétit Management Co., a self-described sustainable food services company (Weiss, 2008).

State actors often referenced livestock-climate change connections; these were about half positive and half neutral. Different sectors and levels of the government tended to disagree whether the

connection warranted action. For example, then California Attorney General Jerry Brown threatened to sue the Environmental Protection Agency (EPA) for not regulating GHG emissions from farm equipment, aircraft and ships (Sahagun, 2008).

Our study supports Trumbo's (1996) analysis of a decade of climate change coverage in five major US newspapers, which suggests that the private sector would downplay or disregard the connection's significance, as most private sector actors acknowledged the linkage by emphasizing opportunities involving end-of-pipe mitigation strategies such as manure-based energy generation. However, they did not address indirect sources of emissions (e.g. deforestation), which require systemic changes (e.g. curtailing livestock production), or necessarily acknowledge livestock production as a problematic cause of climate change. These actors were therefore identified as neutral (27 percent).

Trumbo (1996) suggests that governmental support of climate change policies follows a cycle where support for such policies wanes as the costs become clearer. Our findings suggest this varies by level of government. For example, several articles highlighted California's leadership in implementing state-led climate initiatives despite the costs. In contrast, other contemporaneous articles discussed politicians' use of economic arguments to oppose federally proposed climate change policies. The following header is an apt example: 'Of greenhouse gases and greenbacks, Senate debate on a proposal to impose pollution regulations is likely to center on the financial stakes' (Simon, 2008).

Actors coded as having negative attitudes (19 percent) were generally livestock industry members and either publicly questioned livestock's climate change impacts (Shogren, 2003) or lobbied against climate change legislation. For example, the industry responded to an EPA report on livestock's climate and air pollution impacts by immediately criticizing the costs of possible pollution

fees (Associated Press, 2008). This illustrates how industry might disregard climate change and instead focus on and distort the costs of proposed reforms. Government's tendency to back down when faced with such opposition (Trumbo, 1996) presents obstacles to structural reforms. This places greater responsibility for climate change mitigation on individuals and NGOs.

Discussion

Given livestock production's major contribution to climate change (Koneswaran and Nierenberg, 2008; Steinfeld et al., 2006), the scarcity of climate change-themed articles in relation to the other themes we identified is disturbing. It is unclear whether this is due to (1) a perception that such stories do not sell newspapers, (2) a paucity of newsworthy material related to this theme, or (3) climate change advocates being ineffective at building relationships with the media. Our study provides some evidence for the last possibility. Only half of the actants (primarily academics) in the theme acknowledged the climate change–livestock linkage, although media attempts at journalistic balance may have been responsible. Also supporting (3) is that academics were not only the minority in the climate change theme, but also in the animal welfare, workers' rights and safety and environmental impacts themes.

Why news coverage of climate change–livestock issues after 2008 suddenly declined remains unclear. The 2009 'Climategate' controversy¹ may have affected the legitimacy of climate change science in the American public's eyes, at least in the short term. Another possibility is that the Great Recession drew attention toward economic issues. Nevertheless, our findings suggest that academics and other climate change advocates could build closer relationships with media, using strategies such as press releases or collaborating to produce educational material with mainstream appeal.

We divided the climate change articles into three categories: technology, lifestyle and policy. Each category can be considered a

group of story-networks that share similar configurations of actants and reflect a specific narrative about climate change. Different configurations of actants in relation to each other (and to the media) provide each group of story-networks their common characteristics, enabling their identification as a distinct category within the livestock–climate change nexus. These categories are stabilized through repetition and reproduction, in the process shaping public understandings of what should be done about livestock and climate change.

Story-networks in the technology category, for example, included private sector actants (e.g. energy utilities, beef producers and food service companies) in addition to several artifacts (e.g. the technologies they developed and the studies they relied upon). These artifacts reveal the enrollment of other actants (e.g. scientists), who were not prominent in the story but nonetheless instrumental in developing the technology. Additionally, by mitigating bovine climate change impacts, private sector actors exerted a ‘taming’ effect² on cattle, their manure, microbes and other actants involved in the release of greenhouse gases. Stuart (2011) described how such actants occasionally destabilize (i.e. threaten the legitimacy of) the industrial food system with disease outbreaks; these actants’ contribution to climate change constitutes a similar, but less direct destabilization that nonetheless requires ‘taming’. Media’s focus on mitigation technologies, however, draws attention away from actants responsible for organizing individual animals into CAFOs and multiplying their individual emissions, consumers demanding cheap beef, government subsidies for cattle feed production and actants driving indirect impacts such as land-use change. These actants are in fact the root causes of livestock-linked climate change, but escape responsibility in the media, as we shall see next.

By shifting blame to bovine digestive systems and by deploying GHG mitigation technology, this story-network configuration helps preserve a hegemonic industrial livestock production system. Certain articles played up animals' agency in causing climate change by focusing on their inherent biological properties, i.e. their digestive systems and direct emissions from manure. Human actants' roles (e.g. demand for meat, deforestation, CAFOs) received far less attention. In contrast, media in health-related story-networks rarely blamed the biological characteristics of animals for causing heart disease and other meat-related health conditions. Articles that represented animals as actants placed responsibility for GHG emissions on livestock and discussed production-oriented technological fixes rather than food system level reform. Other scholars have also observed such responsibility shifting in the industrial food system (Stuart, 2011; Gouveia and Juska, 2002).

Lifestyle-focused stories provided another example of a network configuration that yields a different interpretation of what should be done. Though the media continued to mention animals' agency, climate change mitigation became a matter of individual consumer choice: either eat less meat or switch to 'greener' alternatives such as grass-fed beef. These story-networks suggested that consumers exert economic power over private sector actants. For instance, Bon Appetit's promotion of a low-carbon diet was a response to increased consumer concern about the climate. Consumer awareness can be linked to actants like the United Nations Intergovernmental Panel on Climate Change, which urged consumers to reduce meat consumption and suggested governments start campaigns to reduce national meat consumption (Los Angeles Times, 2008).

However, the absence of such national campaigns, reflected by this category's minimal number of state actors, suggests continued government subsidies for meat production. The beef lobby's

strength (Los Angeles Times, 2007) reflects the continuation of economic power forged by private sector-state relations. These actant connections lead to the reaffirmation of faith in markets, thereby obscuring needed system-level food production reforms. There is a tendency for climate change mitigation to be framed as a matter of individual choice, when in fact structural change through democratic participation and political leadership is equally, if not more important (Maniates, 2002).

Story-networks in the policy category involved two-way connections between state and livestock industry actors. Pro-mitigation state-level actions pressure industry by enrolling academic studies on climate change and promoting end-of-pipe reduction policies. Industry actants respond through lobbyists by threatening to block such policies unless they are watered down. These oppositional efforts center the debate on the economic costs of reform, thereby enrolling consumers accustomed to low beef prices and those employees dependent on the livestock industry. As a result, policy and legislation articles focused primarily on the economic costs and benefits of climate change mitigation, detracting from the needed industrial food system reforms. As noted already, this is consistent with Trumbo's (1996) analysis concerning waning government support for climate change mitigation over time. There is also some evidence to support McComas and Shanhan's (1999) finding that media narratives towards the end of climate change media coverage cycles emphasize the costs of mitigation amidst increasing politicization of the issue. This is reflected in how six of the eight policy-oriented articles were written in 2008.

The media shape story-networks through the act of investigation and by marshaling actants in the service of a story. Story-networks are shaped by the journalist's interests, the actants whose interests are at stake and the demands of the general audience. Despite the prominence of the three categories discussed above, some articles

briefly problematized the entrenched industrial livestock production system. For example, one article stated:

Cows lived in harmony with the atmosphere for thousands of years. Then humans developed a taste for the animals and their dairy products and nature's equilibrium was disturbed. Simple barnyard creatures were transformed into agents of climate change, not by their own doing, but because people dramatically multiplied their numbers so they would produce more milk, cheese and meat.

(Polakovic, 2003)

Nonetheless, the article reverted to discussing promising technologies for reducing individual animals' emissions, rather than discussing industry structure. The article's title, *Getting the Cows to Cool It*, aptly reflects this shift of responsibility.

The configuration of actants in a story-network shapes how responsibility is allocated (Gouveia and Juska, 2002) and predisposes a story to episodic or thematic framing. Technology and lifestyle-oriented stories are easier to frame episodically; the opposite is true for policy articles. However, by influencing the media's perception of how best to sell a story, the public can strongly influence the story's ultimate framing. Although media may portray certain actants as responsible for change, change is also attributable to other actants in the story-network. Illustrative of this is how consumer concern over climate change prompted Bon Appetit's apparent game-changing promotion of a low-carbon diet (Weiss, 2008).

Besides animal welfare, climate change articles had a higher proportion of episodic articles than other themes. Episodic stories primarily covered technology and lifestyle change, thereby framing climate change mitigation as a matter of individual choice and action. Emphasizing organic or local food purchasing as a lever for change (Pollan, 2010) is an example of this. Due to the schism in the American public's opinion towards climate change (Leiserowitz, 2006), presenting livestock-climate change issues in terms of

individual choice and action rather than employing a normative, policy-oriented approach is arguably the least controversial option. In general, our findings reflect Neff et al.'s (2009) discussion of contrasts in media between framing climate change mitigation as individual choice versus institutional responsibility. Episodic articles may be easier to relate to and, in theory, be better for raising awareness of livestock–climate change interactions. However, this may not be the most appropriate strategy. Portraying climate change mitigation as a matter of individual choice is problematic, as already discussed, since this may undermine the importance of structural change. Therefore, the media should frame climate change–livestock linkages at both individual and system levels.

About half the time, animals were portrayed as actants with agency in the climate change theme versus more general references where the media did not explicitly assign them agency. However, even when the media did not treat animals as actants, human actors occasionally spoke on their behalf, providing animals with a proxy voice. ANT enables us to recognize this as an example of nonhuman actants exerting their influence through their respective actant networks. This is clearest in the campaigns of animal rights activists, but a livestock industry association member provides a more subtle example: 'It's a natural process that a ruminant animal goes through ... There's not much you can do about it. If you want to control methane emissions in the world, controlling it from cows has to be pretty low on the totem pole' (Polakovic, 2003). This statement illustrates how man's dependency on their domesticated relationship with cows allows the latter to enroll human actors in their defense against disproportionate blame for climate change. It is ironic however, that the very same relationship is also responsible for multiplying the once limited agency of individual animals in causing climate change.

This example reveals the complexity of actant relations in story-networks and catalyzes a deeper examination and untangling of nonhuman actants' roles in the making of news, as well as the contrasting effects different actants may have on reader perceptions and behavior. Ultimately, this may shift public perceptions and behavior of the livestock-climate change connection. A possible effect might be to unite the interests of animal rights and welfare activists and climate change advocates. ANT, by emphasizing both nonhuman and human actants, can be used to introduce even greater nuance to our understandings of the media. Used in conjunction with framing theory, ANT provides a foundation for the story-network approach. This permitted us to highlight how it is not just the media, but also the interaction of various actants in power-infused relationships that help attribute responsibility to different actors in society.

Conclusion

More research investigating relationships between the media and livestock-climate change-related actants is necessary. Additional research could expand the geographic range of this study, which focused on one newspaper. Although a national media outlet, the *Los Angeles Times* concentrates much of its coverage on Southern California. It is also a relatively liberal newspaper in terms of editorial policy. Future studies could focus on additional newspapers and locations to understand how coverage of the issue varies by geography and political alignment. Online news articles, readers' comments and their integration with social media provide rich future data sources for understanding how media portrayals of livestock and climate change affect public perceptions and attitudes.

It would also be beneficial to investigate relationships between the media and different actants to explain how these relationships have developed over time and how media framing influences public opinion and behavior. ANT allowed us to identify and quantify the

key actants involved in news generation. As each actant is a network unto itself, the relative influence of each actant can be assessed by tracing the components of actants' individual networks. Ethnographic and institutional work would expand our understanding of how networks of actants evolve and shape the media.

By combining ANT with framing theory, we provide the theoretical framework and language of story-networks to understand and describe media content, to identify key actants and their linkages within the articles and to reveal how journalists obtain their information and from whom. When combined with framing theory, ANT allowed us to link key actants with each article's framing and content, shedding light on why certain frames or biases may exist. Although we attempted to bring both living and non-living actants into the analysis, we focused primarily on human actants. Further research should therefore delve deeper into the role of nonhuman actants, especially animals.

Notes

- 1 This involved an email hacking at the University of East Anglia's Climatic Research Unit, leading to allegations that scientists had manipulated climate change data to suppress critics. Subsequent investigations found no evidence of fraud or misconduct.
- 2 Gouveia and Juska (2002, 375) employ 'taming' as a metaphor that describes an actor's exertion of power over another that captures 'the coercive nature of disciplining technologies deployed ... to manufacture consent among humans and non-humans.'

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