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Global Environmental Change 16 (2006) 95–113
Global Environmental Change
www.elsevier.com/locate/gloenvcha

Drought and declining reservoirs: Comparing media discourse in Arizona and New Mexico, 2002–2004

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Received 18 January 2005; received in revised form 9 November 2005; accepted 14 November 2005

Abstract

Media discourses about drought impacts on lakes and reservoirs in Arizona and New Mexico between 2002 and 2004 are compared to show how discursive contexts shape the framing of drought in temporal and spatial scales. Discursive contexts in the two states are shaped by their cultural and political histories and the differential development of water delivery infrastructures. Quantitative mapping of keywords in the states' main newspapers shows how New Mexico experienced more conflict and Arizona more surprise about the drought. Qualitative case studies link these patterns to variation in framing between the states. In particular, the shorter temporal scale in New Mexico is linked to a greater sense of emergency, while the longer temporal scale in Arizona reflects the buffering of urban populations from drought through water delivery infrastructure. The finer spatial scale in Arizona, focusing on urban concerns, reflects an established infrastructure of reservoirs while the broader spatial scale in New Mexico, incorporating both rural and urban concerns, reflects a less developed physical infrastructure and greater prevalence of water rights conflicts. This study illustrates the usefulness of a multifaceted approach to the study of media discourse.

Keywords: Drought; Discourse; Framing; Content analysis; Newspapers; Temporal and spatial scales

1. Introduction

Discourses are commonly understood as patterns of language use situated in historical and social contexts (Fairclough, 1995; Foucault, 1972; Hajer, 1995). These patterns of talk and writing influence how problems are conceptualized and communicated because they make some concepts and themes more readily available and understandable than others. Competing efforts at defining, or framing (Benford and Snow, 2000; Gamson and Modigliani, 1989; Goffman, 1974) an issue are therefore importantly shaped by existing discursive contexts, and these in turn are shaped by political, economic, infrastructural, cultural, and physical factors. To understand the framing of an issue then, it is necessary to consider not only the patterns of language use surrounding an issue, but also how these patterns themselves are shaped by various contextual factors.

Understanding discursive context is especially important for "slow-onset hazards" such as drought (Wilkins and Patterson, 1990) because such hazards are diffuse in time and space, and are therefore particularly open to competing definitions of problems and solutions (Redmond, 2002; Wilhite and Buchanan–Smith, 2005; Wilhite and Svoboda, 2000; Wilhite and Glantz, 1985). Nowhere is this more true than in the western United States, where drought is a recurring feature of an already dry landscape. Droughts occurring over the past two decades "have exposed major vulnerabilities in both human and natural systems" and

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doi:10.1016/j.gloenvcha.2005.11.004

have challenged water managers with "the often conflicting demands arising from consumptive needs, agriculture, energy production, recreation, environmental and species preservation, and flood protection" (Dole, 2003, p. 9). These trends have prompted efforts to develop a national drought policy (National Drought Policy Commission, 2000) as well as various state drought plans, such as those in the desert southwest states of Arizona and New Mexico (Jacobs et al., 2005).

In all of these planning efforts, it is necessary to understand the interconnection of biophysical and social criteria for defining drought and its impacts (Wilhite and Buchanan-Smith, 2005). The capacity to develop multi-faceted evaluations of drought impacts provides crucial information for developing drought monitoring and forecasting capabilities at local to national levels (see Hayes et al., 2005; Svoboda et al., 2002; Steinemann et al., 2005). In this paper we show how physical, cultural, and political aspects of discursive context shape the framing of drought impacts on lakes and reservoirs, which represent a wide array of the contemporary values and uses of water in the region and beyond. We do this through a comparison of newspaper discourse in Arizona and New Mexico during the ongoing drought of 2002–2004. Although both states have been in a comparably severe drought throughout the time period of this study, their physical, cultural and political differences have created different opportunities and limits for understanding drought impacts on surface water supplies.

The analysis offered in this paper combines elements of discourse analysis and content analysis in order to examine how variations in media content are embedded within wider contexts. From discourse analysis we take a qualitative and historical approach to situating media content within political, economic, infrastructural, cultural, and physical contexts (Fairclough, 1995). From content analysis we take a systematic and quantitative approach to the identification of relevant texts and the mapping of discursive contexts (Roberts, 1997). Our combination of these two approaches was accomplished through an iterative building of quantitative and qualitative models and understandings by the research team in our meetings during the course of the project. Our perspective is broadly comparative, where a dialogue between theory and evidence is a central concern rather than either top-down deduction or bottom-up induction (Ragin, 2000).

In the sections that follow, we first give an overview of how framing and discursive contexts are linked, and show how types of environmental discourse and definitions of drought vary in temporal and spatial scales. We then outline the various contexts which shape discourse in Arizona and New Mexico, summarizing climatological data which shows the severity of the current drought and then showing how the political and cultural histories of the two states have shaped the role of surface water in the states' water supply systems. Given these contexts, we then explain our selection of newspaper texts and methods of analysis. Correspondence Analysis is used to illustrate how the states' main newspapers differ in the words they use to describe problems and solutions related to drought and water supply. These patterns in word usage are interpretively linked to differences in the temporal and spatial framing of drought, shown in the way drought problems and solutions are discussed in newspaper texts and in differences in reporting about water rights conflicts and rural-urban contrasts.

2. Framing and discourse in context

Our approach to the analysis of media discourse about drought is centered on the concept of "framing" (Benford and Snow, 2000; Gamson and Modigliani, 1989; Goffman, 1974). Frames are central organizing ideas, and the process of framing describes attempts by social actors to promote a core idea or way of thinking about some issue, including ways of defining and responding to a problem. Efforts at framing an issue in the media occur in parallel with competition to achieve "standing," or "gaining the status of a media source whose interpretations are directly or indirectly quoted" (Ferree et al., 2002, p. 86).

Within a framing perspective, three general factors influence the success of actors promoting frames and trying to achieve standing (Gamson and Modigliani, 1989). First, actors have different amounts and types of *resources* which they can use in their efforts to promote their framings, including material resources, social ties, or particular types of knowledge. Second, the production of media discourse is influenced by *routines* involved in news production, including cycles of news production in media organizations and norms and other constraints on journalistic work. Third, framing is more successful if it achieves *resonance* with popular understandings and cultural knowledge.

The first two factors, resources and routines, are common in studies of framing and social construction. Strong versions of this approach argue that social problems only exist through the activity of claims-makers (Spector and Kitsuse, 2001). Others place more emphasis on media routines and other "principles of selection" that characterize public arenas (Hilgartner and Bosk, 1988). The role and conceptualization of cultural resonance has been more complicated, being conceptualized in various ways as cultural resources (Williams, 1995) or discursive opportunity structures (Ferree et al., 2002). In our review of environmental communication research, we first examine the role of resources and routines in the production of media discourse and then consider the role of cultural resonance.

2.1. Resources and routines in environmental reporting

A common finding in media studies is that various types of "official" sources—from government, industry, universities—tend to achieve the most representation in the

media. Official sources tend to have material and organizational resources which help them achieve standing in the media, as well as the legitimacy and credibility associated with recognized public institutions. Official sources, whether they be scientists or politicians or other experts, are all to some extent distanced from non-expert local-level environmental understandings (Adger et al., 2001; Freudenburg et al., 1996), and the voices of the lay public are often absent from the popular media (Cottle, 2000). Media routines contribute to the dominance of these resource-rich actors in the news. Journalists in news-gathering organizations work on tight deadlines and have limited time for researching breaking news, so there is an institutionalized need for a steady supply of timely and credible information. Official sources, because of their resources, are often able to provide a much needed "information subsidy" (Gandy, 1982).

The framing of a story depends in large part on who is given standing and allowed to speak in the media text. For example, Stallings (1990) finds two types of articles in news coverage of a bridge collapse in New York: (1) specific accounts which blame nature, in the form of rain and flooding, for undermining bridge supports, and (2) more general accounts of bridge collapses as a public problem with human causes, in the form of improper inspections. Stallings argues that the choice of physical or social causes of bridge collapse is related to choice of information sources in the media, with politicians blaming nature and offering more optimistic and adaptive framings, while scientists point to social causes and offer more pessimistic or "big picture" perspectives. The framing of issues is also affected by the norm of "balancing" opposing views in the news. This norm can lead to outcomes such as the misreporting of scientific consensus about global climate change due to an overemphasis on the arguments of skeptics (Boykoff and Boykoff, 2004).

These studies confirm a linkage between the resources of information sources, routines of news production, and framing of issues in media discourse, but the linkage of frames to specific actors is not always a one-to-one correspondence. Studies of environmental discourse have shown how diverse and shifting sets of actors form into "discourse coalitions" (Hajer, 1995), results-oriented groups who are united only in supporting the same framing of a problem. Adger et al. (2001) illustrate how issues in global environmental change are framed within a dominant "managerial" discourse or a challenging "populist" discourse. The first is promoted by representatives of the state, industry and some scientists, and the latter by environmentalists and some scientists. Browne and Keil (2000) outline a similar set of discourses in examining coalitions concerned with water and pollution management in Los Angeles.

2.2. Environmental discourses and cultural resonance

The framing of environmental issues by information sources and media organizations takes place within a structure of discursive opportunities, or "the framework of ideas and meaning-making institutions in a particular society" (Ferree et al., 2002, p. 62). Resonance describes, in part, the fit (or lack of fit) between a particular frame and this wider discursive context. The perceived consistency of the frame or the credibility of its proponents may influence the success of framing efforts directly, but other factors are specific to the discursive context: the fit between a frame and perceptions of empirical reality, relevance to everyday experience, and consonance with popular cultural knowledge (Benford and Snow, 2000; Snow and Benford, 1988). Popular knowledge can be thought of as "cultural resources" which actors draw upon in advancing frames (Williams, 1995).

Discursive contexts are shaped at a very basic level by the amount of attention given to an issue. Although environmental conflicts have a long history in the US (Neuzil and Kovarik, 1996), public attention to environmental issues has grown significantly since the 1960s. Ungar's (1999) study of network television news shows a steady increase in coverage of extreme weather events in the US from 1968 to 1996. Among other weather events, drought does not have as clear a trend over time, but Ungar does note that the drought of 1988 produced more stories than the drought of 1977. This later drought also generated three times more news coverage than the heat wave of the same year. The growing attention given to climate-related issues provides more opportunities but perhaps also more obstacles to framing efforts.

Discursive context is commonly understood as being formed primarily by cultural models and values (Kempton et al., 1995) which provide bases of understanding on which framings can build. It is also shaped however by aspects of physical and social context which directly impact the lived experiences of potential media audiences. For example, ranchers use impacts on their operations and water supply (Dagel, 1997) as well as political and economic considerations (Eakin and Conley, 2002) in defining drought. Social and technological infrastructure has been found to reduce perceptions of drought vulnerability among farmers in the Southwest (Vásquez-León et al., 2002), providing them with a sense of being buffered from drought impacts (Vásquez-León et al., 2003). A study of New York City water supplies similarly finds that as reservoir capacity increased from the late 1940s to the 1990s, there was a steady decrease in news articles about mitigation strategies and more emphasis on conservation (Degaetano, 1999). Framings of drought are therefore shaped not only by cultural understandings but also by physical, political, economic, and other factors.

3. Temporal and spatial scales in definitions of drought

The connection between framings of drought and various aspects of context can be understood as variations in temporal and spatial scales. Definitions of scale are often subject to contestation, and Brown and Purcell (2005, p. 611)

argue that researchers should investigate "how the relationships among scales are continually socially produced, dismantled, and re-produced through political struggle" (see also, e.g., Marston, 2000). The battles of discourse coalitions can be seen as competitions over scale (cf. Adger et al., 2001): while managerial discourse focuses on short-term political and technological solutions within a relatively small spatial scale of political jurisdiction, populist discourse focuses on longer-term causes and impacts within wider spatial and ecological scales. A communal discourse (Browne and Keil, 2000) can be seen as focusing on longer-term environmental impacts in the relatively small spatial scale of community, while an expert discourse (Stallings, 1990) combines relatively long time horizons with a wide spatial scale.

Variations in scale, like frames, are important because they help create expectations about climatic events by focusing attention on some aspects and not others. As Streets and Glantz (2000, p. 98) report, "policymakers and the public are frequently surprised by events that may not be surprising to the expert." The reason for this is that politicians and managers tend to frame environmental problems more narrowly than scientific experts and environmental advocates. For example, a survey of water managers in Arizona found that few engaged in planning more than five years into the future and many believed their systems to be relatively impervious to climate impacts (Carter and Morehouse, 2003). For most, the main strategy they identified for dealing with drought was simply drilling more wells, but this view overlooks the longer-term impacts of groundwater pumping on surface water supplies (see, e.g., Glennon, 2002). Another study of water institutions in Arizona found that flexibility in water management exists in Arizona, but is based on a relatively narrow idea of the degree of variability in the region's climate (Morehouse and Carter, 2001).

While Brown and Purcell argue that the analysis of scale should be primarily political, asking "which political interests pursue which scalar arrangements" (2005, p. 611), in this study we aim to show how such pursuit of interest takes place within larger physical and social contexts which shape the discursive field. For example, the Arizona water managers expressing the highest degree of confidence in their water supplies were the relatively few who had access to several sources of water: from the Central Arizona Project, the Salt River Project, and from groundwater (Carter and Morehouse, 2003). Research on perceptions of drought indicates that definitions vary over time and by region, in addition to the influence of social location, so the study of drought should investigate the interconnection of multiple criteria of definition in order to facilitate evaluation of the actual biophysical and societal impacts of individual drought occurrences (Wilhite and Buchanan–Smith, 2005).

In an effort to organize definitions of drought, the US National Drought Mitigation Center created a typology, differentiating meteorological, agricultural, and hydrological drought and linking these to economic, social and environmental impacts (National Drought Mitigation Center, 2003). Meteorological drought is based on insufficient rainfall, agricultural drought describes impacts on farming and ranching, hydrological drought refers to impacts on water supply more generally, and societal drought indicates economic and social impacts stemming from the other levels of drought. What counts as a drought in this scheme is determined both by water supply and by social factors such as agricultural production regimes, water supply infrastructure, urban and industrial water use patterns, and attendant social and economic dependencies on these.

Fig. 1 arranges these definitions of drought within a two-dimensional space defined by temporal and spatial scales. In this figure, temporal scale varies from relatively short or immediate time frames to relatively long periods within which drought impacts develop. Spatial scale ranges from the relatively fine scale of local impacts, such as a particular city, to the relatively broad scale where impacts are assessed for whole regions, including both cities and rural areas. The placement of the four types of drought in this figure suggests the sequential way in which a severe drought unfolds over time and space, beginning with relatively local and immediate shortages of rainfall, continuing with impacts on agriculture and water supply more generally, and ending with wide-ranging social impacts which are due to the ongoing existence of the other types of drought conditions. In the rest of this paper, we use temporal and spatial scales to relationally compare media discourse about drought impacts on lakes and reservoirs in Arizona and New Mexico.

4. Climatic context of the current drought

In the US southwest, semiarid to arid conditions prevail and the average precipitation across the region ranges from

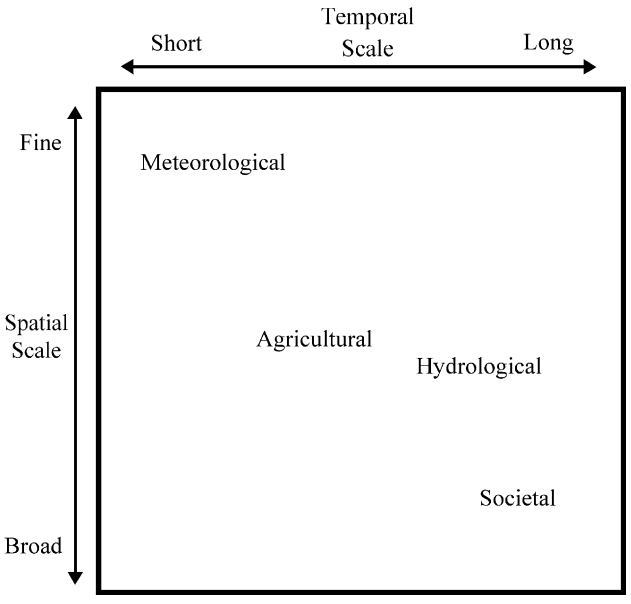

Fig. 1. Temporal and spatial scales in framings of drought.

five to 19 inches annually, with high seasonal, interannual, and longer-term variability. During the 27 months of the study time frame, January 2002–2004, the Southwest experienced some of the most severe drought conditions in the instrumental record. Tree-ring records of winter precipitation (November–April) show few years as dry as 2002 during the last 1000 years in Arizona (Ni et al., 2002), while similar reconstructions for New Mexico show many winters as dry as 2002, and many periods as dry or drier than 1999–2003 (Institute for the Study of Planet Earth, n.d.).

Extended periods of drought, defined as moisture deficits below long-term averages, may be found throughout the region's instrumental and paleoclimate records (Sheppard et al., 2002). The past 1000 years in Arizona have featured droughts of multiple year duration in almost every century; the winter droughts of the early 1400s, late 1500s, late 1600s and late 1700s were especially deep (Salzer and Kipfmueller, 2005). Droughts lasting close to 20 years occurred across the broader realm of the Colorado Plateau from 991 to 1005, 1435 to 1450, 1571 to 1593, and 1952–1972. Over the past half century, temperatures reached and sustained levels not seen in the paleoclimate record for the region. Recent paleoclimatic work by Cook et al. (2004) emphasizes that particularly severe sustained drought episodes occurred during periods of higher temperatures, such as the Medieval Warm Period of the 1400s. Given contemporary trends toward higher temperatures in the region, the specter looms that more severe and spatially extensive droughts could occur again.

Across the US Southwest, the 1952–1957 drought exceeded in intensity the more famous 1930s drought (see Swetnam and Betancourt, 1998; Redmond, 2003; Woodhouse, 2003). A comparison of the 1950s drought to a dendrochronological record extending back to 136 BC (Grissino-Mayer, 1996) indicates that, while no droughts occurring in the Southwest over the past 3 centuries exceeded the 1950s drought, several more severe droughts occurred over the longer record, notably the severe sustained drought of the late 1500s (Stockton and Jacoby, 1976; Woodhouse, 2003). Climate records also indicate drought conditions occurring throughout the historical period, including episodes from 1850 to 1905, 1846 to 1848, 1770 to 1825, and 1728 to 1730 (Sheppard et al., 2002; Meko and Graybill, 1995; Meko et al., 1993). The drought which began in 2002 in the Southwest may therefore not be the most extreme in the long-term record, but it has been significant in its effects on surface water supply in the region. See Fig. 2 for a map showing major rivers and reservoirs in Arizona and New Mexico.

Drought conditions severely affected the Colorado River reservoirs during the years 2000–2004, due to consistently below-average winter snowpacks in the Colorado River Basin states. Lake Powell was reduced to its lowest reservoir storage since the 1970s, and by May 2004 Lake Mead was at its lowest level since March 1968. As of mid-2005, higher winter and summer precipitation had begun to raise water levels, though it will require several years of above-average precipitation to fully refill the reservoirs. If the rapid rates of decline experienced in these reservoirs

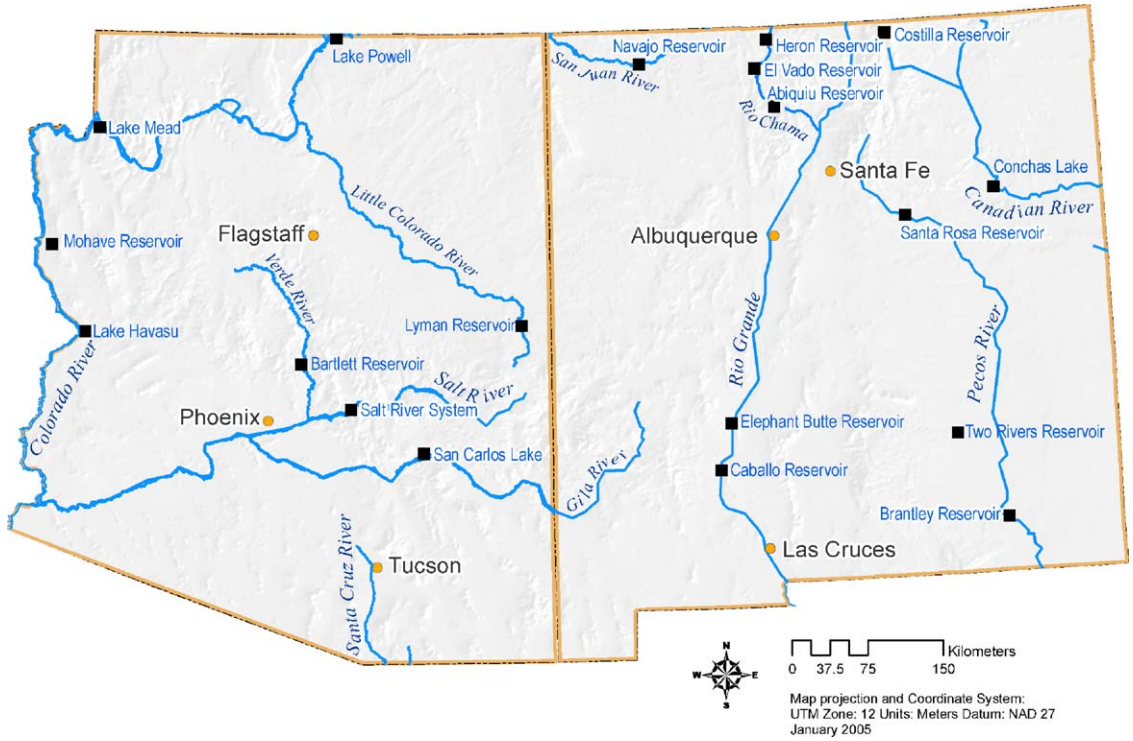

Fig. 2. Major rivers and reservoirs of Arizona and New Mexico.

during the years 2000–2004 had continued, Lake Powell would have reached "dead pool" status in four years (spring, 2008) and Lake Mead would have reached "dead pool" status in 6.5 years (late summer, 2010) (Larry Martinez, USDA–NRCS, personal communication). Tree-ring reconstructions of streamflow in the Colorado River Basin, which supplies much of the water allocated for Arizona irrigators and cities, suggest that 1999–2004 flow is the seventh lowest in the past 500 years (Piechota et al., 2004). Reservoir levels in the Salt-Verde River watersheds, which supply surface water to metropolitan Phoenix, also declined dramatically during the study period. As a result, SRP reduced water deliveries to metropolitan Phoenix for an unprecedented three consecutive calendar years. Beginning in 2002, low reservoir levels in these watersheds resulted in ecosystem changes that favored habitat for the endangered Southwest willow flycatcher in areas formerly submerged. SRP managed the situation by offsetting the impacts of filling the reservoir on the flycatchers' habitat by purchasing habitat in other locations (Salt River Project, n.d.).

In New Mexico, the seven Rio Grande River Basin reservoirs declined by close to 50% during the study period (USDA–NRCS National Water and Climate Center, n.d.). Especially dramatic was the decline of Elephant Butte reservoir, the largest in the state. The reservoir, which brimmed with water following the 1997–98 El Niño (94% of capacity), was reduced to a mere 11% of capacity by June 2004. These declines prompted New Mexico Governor Bill Richardson to reinvigorate New Mexico's drought planning process, including an aggressive project to rid the state's riparian areas of water-guzzling salt cedar trees. Nonetheless, in 2002 and 2003, as New Mexico water managers attempted to conserve water in reservoirs, stretches of the Rio Grande ran dry, threatening the once abundant silvery minnow, a now endangered Rio Grande fish species. A protracted court battle between Federal judges, New Mexico politicians, and environmentalists dominated the headlines, as reservoir releases for silvery minnow survival were pitted against society's needs for drinking and irrigation water.

Other drought-related impacts suffered by both states during the study period included catastrophic wildfires, such as the June 2002 Rodeo-Chediski fire, which burned close to 500,000 acres in northern Arizona. Concomitant with the fire was a drastic increase in forest acreage devastated by the effects of drought and bark beetles in both states. The bark beetle epidemic is cited as the worst in 50 years in New Mexico's piñon pine forests (USDA Forest Service, 2004a), and the worst ever in Arizona (USDA Forest Service, 2004b), and was due in part to the weakening of forests because of the drought. Along with these reports were numerous stories of drought impacts on wildlife, including devastating losses of endangered Sonoran pronghorn (Tobin, 2004), as well as reports of severe impacts on rangelands and the ranching industry. Breshears et al. (2005) found that this most recent drought, combined with anomalously high temperatures and high precipitation from roughly 1978–1995, produced devastating regional-scale vegetation die-off, reaching rates as high as 90% in high-elevation study sites.

5. Water history and infrastructure in the desert southwest

Humans have supported agriculture and industry through water delivery technologies for thousands of years in New Mexico and Arizona. The history of efforts to buffer against water scarcity includes construction of irrigation works by native peoples, development of water institutions under the acequia rules of Spanish settlers in New Mexico, Anglo-American engineering of dams and other holding facilities, and complex institutional mechanisms such as the Rio Grande Compact and the Colorado River Compact (Pulwarty et al., 2005; Getches, 2003, 1993; Carter and Morehouse, 2003; Brown and Ingram, 1987; Reisner, 1986). Although often lumped together as part of the "Desert Southwest," the two states have differed historically in the methods used to obtain and deliver water, the scope of irrigation, and the use of water delivery projects, as well as in culture, politics, economy and history. These differences have shaped the development of water infrastructure.

5.1. Acequias and state centralization in New Mexico

Use of New Mexico's major rivers, the Rio Grande and Pecos, has changed dramatically throughout the region's history. Native Americans settled along the rivers and dug the first irrigation channels, but New Mexico's modern history of water use has been shaped more dramatically by the Spanish settlers who entered the region in the late seventeenth century. These settlers established *acequia* communities, systems of water apportionment which blended Roman, Arabic and Native American traditions. Built around community irrigation ditches, the *acequia* communities focused on local control of water apportionment and the *cabildos*, or municipal councils, were the sole water management authority in settled areas. By law, settlements were to be established in fertile areas, an ecologically based practice that kept environmental impacts at a minimum (Rivera, 1998, p. 2–5). Although New Mexico uses the prior appropriation doctrine, which favors senior water rights (see below), the acequia system institutionalized ways of balancing competing water claims.

As political and economic power changed from Spanish to Mexican and finally American authority, water use practices in acequia communities remained largely the same, even if political control did not. The 1836 Mexican Constitution known as the *Siete Leyes* (Seven Laws) centralized both government and water management, abolishing the cabildos as a decision-making entity (Baxter, 1997, p. 44). The centralization of water management continued after 1846 under United States governance, and

especially after the arrival of the railroad and attendant population boom in the late 1800s. Legislation of February 24, 1887 provided for the incorporation of irrigation companies, and while legislative debates over the construction of large reservoirs were ongoing, the Reclamation Act of 1902 set aside federal funds for reclamation projects and allowed the U.S. Secretary of the Interior to enter into contracts for the construction of works (Clark, 1987, pp. 58–66, 79, 107–108).

In the early twentieth century reservoirs were built and water apportionment further centralized. The new water code of 1907 created the post of Territorial Engineer (which became the State Engineer in 1912) who was vested with the authority to approve new irrigation projects and allocate water within the state in accordance with the prior appropriation doctrine. In 1929, the State Engineer also became the state's commissioner of the Rio Grande Compact, which coordinated use of Rio Grande water with Texas and Mexico (Clark, 1987, pp. 219–220). The Compact stated that New Mexico could not impound any water in upstream reservoirs whenever there was less than 400,000 acre-feet (af) of water in the Elephant Butte reservoir. This requirement puts New Mexico in double jeopardy in drought years: with dwindling supplies in Elephant Butte reservoir, the downstream delivery requirement creates an inability to store water in newer upstream reservoirs which are larger and deeper than those constructed before the Compact.

The search for more water supplies in New Mexico has included increased exploitation of groundwater. Major metropolitan areas such as Albuquerque and Santa Fe have pumped groundwater for many years, but the aquifers are extremely slow to refill and are quickly being depleted due to a significant imbalance between extraction and recharge rates. USGS reports that approximately one half of the total population of New Mexico depends on groundwater resources in the middle Rio Grande Basin (USGS Fact Sheet FS-031-96), yet some Albuquerque city production wells have declined more than 100 feet in recent years, and USGS studies indicate that the Santa Fe Group aquifer system (which supplies Albuquerque) is not being recharged by the Rio Grande to the extent once thought. With every drop of in-state surface water already allocated, growing cities such as Albuquerque and Santa Fe began looking for new sources of surface water.

A proposed solution was the San Juan-Chama Diversion Project, which would use tunnels and ditches to transfer Colorado River water to New Mexico, utilizing allocations from the Compact of 1922 and a 1948 agreement between the Upper Basin states (Wyoming, Colorado, Utah and New Mexico) (Gelt, 1997). The project proposed moving water from the San Juan River, a tributary of the Colorado, through Bureau of Reclamation (BOR) infrastructure into Heron Reservoir, through the Chama network, and eventually into the Rio Grande. Although the project had few buyers when it began, a lion's share of the water is now allocated to the City of Albuquerque (48,200 af) and the Middle Rio Grande Conservation District (20,900 af) (Bureau of Reclamation, n.d.). The San Juan-Chama Diversion Project marks New Mexico's first attempt at a major surface water delivery system. While the San Juan-Chama Project has increased surface water availability in New Mexico, and extensive groundwater pumping continues, the state's growing population still encounters water shortages with relative regularity.

The drought years of the mid-1990s prompted New Mexico to draft an Emergency Drought Plan in 1996 and a Drought Plan in 1999 that expanded and replaced it (New Mexico Drought Planning Team, n.d.). The 1999 plan outlined information-gathering efforts that included precipitation monitoring, vulnerability assessment, impact assessment and drought response. In addition, the plan identified both long and short-term activities to highlight problem areas and develop partnerships between state and local agencies in order to minimize impacts. The drought plan was most recently revised in 2003. By providing a systematic description of drought mitigation processes, the drought plans have acted as a catalyst for drought awareness and planning on the local level. The drought planning process can therefore be seen as the latest chapter in New Mexico's changing water history, illustrating the complex situation where state-wide plans must articulate with a history of local decision-making. Despite the centralization of water bureaucracies, local-level control remains important in New Mexico because acequia communities "have survived essentially intact into the modern era…on the upper Rio Grande" (Rivera, 1998, pp. 27–28). The disjunct between state and local processes has lead to an explosion of water disputes across the state.

5.2. *Prior appropriation and decentralization in Arizona*

As in many other areas of the West, people in premodern Arizona relied on surface or near-surface water flows that could be captured and channeled to crops and other uses. Highly sophisticated irrigation systems were developed in Arizona by the Hohokam, Anasazi, and Sin Agua Indians, and were appropriated by early Spanish and Mexican inhabitants, as well as by Anglo settlers arriving in the mid-1800s. Major influxes of Anglos during the 1849 gold rush and after the Civil War, as well as migration flows associated with Mormon expansion in the second half of the nineteenth century, established many of the water source-oriented settlement patterns still seen today. Phoenix began as an agricultural settlement that drew water from the Salt River, and Mormon farming communities emerged in places such as St. Johns, Mesa, and St. David where surface flows were available (Sheridan, 1995).

In the 18th and 19th centuries, Arizona was part of the New Mexico territory, but was relatively peripheral to the development of territorial governance in Santa Fe. Unlike New Mexico, no highly structured and regulated acequia system emerged in Arizona to influence development of water law and management. The prior appropriation doctrine determined surface water rights allocations without

any kind of community allotment mechanisms, and water law remained undeveloped until the mid-twentieth century. Even then, Arizona never resorted to the kind of institutionalized power relations that produced the powerful "water czar" position embodied by New Mexico's State Engineer. Instead, regulation of water extraction and use was diffused among local private and public authorities.

Expansion of agricultural and mining activities in Arizona during the mid-1800s, together with intensification of contests over rights to water, led to adoption of the doctrine of "prior appropriation" in Arizona as the primary institutional mechanism for regulating water allocations. First applied to settling mining claims, the doctrine states that the first person to legally claim the water has first right to as much water as could be beneficially used; all other users receive a water right based on the order in which their claim was established. Over the years, continued contests over water allocations has prompted changes in the definition of one of the key phrases of the doctrine, "beneficial use." Today, legally recognized beneficial uses may include, in some cases, instream and riparian rights, including water allocated to protect endangered species and their habitats.

Whereas prior appropriation applied to surface water rights, the advent of pump technologies in the oil industry of the early 20th century (see Kupel, 1986) radically changed the water equation: anyone who could afford to dig a well and lift the water to the surface had an equal right. As more and more wells were dug and more and more water was pumped out of aquifers, groundwater exploitation captured not only relatively shallow water tables but also deeper "fossil" groundwater that received relatively little recharge—compared to withdrawal rates—from precipitation or runoff events. It seemed as though water extraction was limited only by the availability of the water itself and the cost of energy necessary to run the pumps.

Extraordinary post-World War II population growth led to growth in demand for water from both the municipal/industrial and agricultural sectors. As water tables began to drop, concern grew about how growth could be sustained with the limited water resources in the state. A study carried out at the end of World War II led to designation of "critical groundwater basins" in the Phoenix, Tucson, and Prescott metropolitan areas, as well as in heavily farmed areas of Pinal County (lying between Phoenix and Tucson), and in the Joseph City and Douglas areas. By the early 1970s, groundwater overdraft in some locations had grown by as much as 600 feet and began posing problems such as land fissuring, declining water quality, and escalating pumping costs (ADWR, 2000).

As the pressures increased, powerful lobbies emerged to persuade the federal government to build a canal for delivering Colorado River water to the central portion of the state. In an era of declining finances to support large-scale infrastructure projects, the federal government required that before the Central Arizona Project (CAP) canal would be approved, the state would have to provide clear proof that it had its groundwater overdraft problem under control. The result, hammered out in closed-door sessions headed by Governor Bruce Babbitt, was the Groundwater Management Act of 1980 (GMA) (Arizona Water Resource (AWR), 2000). The GMA formally designated the Arizona Department of Water Resources (ADWR) as the administrative arm responsible for water policy in Arizona and created regional water management areas.[1] In these areas, relatively strict policies were set in place to govern management of groundwater. As for the rest of the state, governance over water resource management remained largely unchanged, except for rules regarding registration and spacing of water wells.

Most recently, ADWR became the lead agency charged with convening a multi-agency Drought Task Force, in order to create the first-ever drought plan for the state. However, at the present time the agency's ability to influence water supply and demand is substantially reduced due to its limited geographical mandate and to its strained financial and human resources (ADWR, 2002). The need for extension of elements of the departments regulatory authority throughout the state was expressed in a report by the Auditor General's office (Norton, 1999), but the contemporary political climate in the state has not been conducive to making changes in the existing legal arrangements. Arizona's draft drought plan, recently issued by the Drought Task Force, identifies local authorities as the primary agents for developing and enforcing any water management rules that may be needed to cope with water shortages in the non-AMA areas. Given the high level value placed on individualism among many residents of the state, this strategy reflects political realities more than hydrologic realities, for the areas that least need extra regulation are the AMAs—which are already governed by state law—while the impacts of drought are most heavily concentrated in rural areas where state regulation is weak at best.

6. Discourse/content analysis

6.1. Media text data

We examine framing and discourse patterns in the two states through analyses of articles in the states' main

[1]The GMA identified four active management areas (AMAs), encompassing the urban areas of Prescott, Phoenix and Tucson as well as the agricultural areas of Pinal County, and two irrigation non-expansion areas (INAs) in the Joseph City and Douglas areas. Pinal County's inclusion as one of the AMAs is related to heavy pressure from agricultural pumping on aquifer resources. Unlike the other four AMAs, which must attempt to balance supply and demand, Pinal County water use is defined as "planned depletion," meaning that water may continue to be pumped so long as future potential for municipal and industrial development is not impaired (refer to the Pinal AMA Management Plans, available on the ADWR web site, http://www.adwr.state.us.gov). Today, ADWR governs five Active Management Areas (AMAs): the Tucson AMA was divided to create a separate governance unit encompassing the most populous portion of Santa Cruz County, which lies on the US-Mexico border. A third INA was also added, encompassing the Harquahala Valley.

newspapers, the Arizona Republic and the Albuquerque Journal. These newspapers are based in the largest cities within their respective states, and represent the dominant newspaper voices in their states. The Arizona Republic is owned by Gannett Company and has an estimated circulation of 574,798 in a state with a total population over 5.7 million. The Albuquerque Journal is privately owned and has an estimated circulation of 150,787 in a state with a total population of over 1.4 million.[2] Although Arizona politics has traditionally favored Republicans and New Mexico politics has tended to favor Democrats, both newspapers endorsed Bush for President in 2000 and 2004.

The relationship between media content and public knowledge of environmental risks is a topic of research in its own right (Corbett and Durfee, 2003; Harrison and Burgess, 1994; McCallum et al., 1991; Wakefield and Elliott, 2003). We cannot tell how audiences will understand news stories from analyses of content alone. Rather, our aim is to investigate what might be called the "public transcript" (Scott, 1990) of political power as represented in mainstream news media. Although Scott developed his ideas of public and hidden transcripts to describe face-to-face interactions in situations of extreme domination, such as slavery, these ideas can be transposed into modern societies where what is public and what is hidden in political life is often determined by the amount of coverage issues get in the media (Thompson, 1995). The representation of issues in the transcripts of major newspapers gives a strong yet indirect indication of how these issues are discussed in public discourse more generally.

Our study period begins in January of 2002, when popular awareness of drought was beginning to grow, and ends in May of 2004. The climatological data presented above show this to be a period of severe drought in both states. Within this span, three time periods were selected to capture distinct moments in the evolution of drought-related news coverage. These time periods correspond to the beginnings of winter rainy seasons in November: (1) from January 2002 to November 2002 is the initial public recognition of the drought problem, with November providing a low-point in overall coverage, (2) from December 2002 to November 2003 is a second wave of drought coverage, and (3) from December 2003 to May 2004 is a period of relatively low-level coverage of drought.

Relevant news articles were identified through keyword searches in online databases. To focus on how drought has affected surface water supplies, we selected all articles containing the term "drought" along with either "reservoir" or "lake." This selection excludes many other articles which report on drought, especially as it impacts rivers, but focuses the analysis on sites—i.e., lakes and reservoirs—where many different interests (political, economic, ecological, agricultural, and recreational) intersect. We note that a study focusing on river flows, groundwater issues, or endangered species might generate different conclusions. A total of $N = 607$ articles between January 2002 and May 2004 were identified, acquired in text format, and formatted for analysis with Atlas.ti 4.2 software. Atlas.ti is a program that enables both quantitative and qualitative analysis of text data by organizing texts into a database and enabling keyword searches which can then be output as either tables or lists for further analysis.

6.2. Quantitative and qualitative method

In the first part of our text analysis, we use data from keyword searches to map discursive contexts. We began by generating a list of problem terms (e.g. emergency, danger, crisis) and solution terms (e.g. decrease, mitigate, response), to capture variations in the framing of drought. Included in problem-defining terms are indicators of social conflict (e.g. controversy, dispute, oppose) and solution-oriented terms include indicators of infrastructure (e.g. commission, regulate, organize). This group of related words can be thought of as a semantic field, the analysis of which can help identify variations in language usage across mediated public arenas (see Sonnett, 2006).

A thesaurus was used to identify important variants of the key concepts we were interested in, resulting in an initial list of 104 words. Within the Atlas.ti program, each word was searched as a root to capture variants of the words (for example, "argu" nets argue, arguing, argued, argument). We used Atlas.ti to identify which articles used which keywords anywhere in the text. In order to map the discursive contexts of Arizona and New Mexico over our three time periods, we examined the number of articles containing each keyword within the three time periods for each newspaper. This produced a table with six newspaper-times in the columns (two newspapers by three time periods) and a row for each keyword, the cells of the table containing the number of articles in each newspaper-time with each keyword.

We use Correspondence Analysis (Greenacre and Blasius, 1994; Weller and Romney, 1990) to produce a quantitative map which shows the clustering of keywords in particular newspaper-times. Correspondence Analysis is a factor-analytic method (also known as canonical correlation) which extracts latent dimensions of variation within a table of data. Like factor analysis, it assigns a number or "weight" to each item in a table (i.e. for each row, or each column) according to how much each item groups with other items. Correspondence Analysis differs from standard factor analysis in that factors can be computed for both rows and columns of a table. Each successive factor is additive, meaning it explains variance

[2]Circulation figures are from the Audit Bureau of Circulations website, http://www.accessabc.com/reader/top150.htm, accessed 10/27/05, and are based on estimates from March 2005. Circulation figures should be approached with caution, especially given recent scandals over inflated circulation figures at a number of newspapers—see, for example, James P. Miller, June 20, 2004, "Sales Scandals Rattle Newspaper Business; Circulation Hyping May Harm Industry," Chicago Tribune. Population figures are from the U.S. Census, www.census.gov, accessed 10/27/05, and are based on census estimates for 2004.

remaining in a table after previous factor scores are removed, and each factor is defined on both positive and negative ends of the scale, providing a measure of "oppositions" in the table. By convention, the first two factors of a Correspondence Analysis are used to plot row and column elements into a common geometric space, producing a visual model which groups row and column elements which are associated with each other. A pseudo-R^2 describing the fit of the visual model is calculated by adding together the percentage of total X^2 (Chi-square, a measure of variance) represented by the first two factors. We used UCINET 5.0 software to perform the analyses.

The correspondence map was refined through several iterations in meetings of the research team, where we would decide on terms to add to the list or to remove from the map. From our initial list of 104 terms we narrowed the list to 52, allowing for a much clearer picture of differences between the two states (See Appendix A for the final data matrix). We removed terms which were redundant because they showed the same pattern as other terms in our map, or which had very few cases and could therefore be considered outliers, or which crowded the center of the map indicating they had no strong relationship with any of the region-time periods.[3] We added terms that were deemed important based on readings of the article texts and understandings of the wider discursive context.

The qualitative part of our analysis was constructed in tandem with the correspondence map. We compare the framing of drought in the two newspapers by examining variations in the temporal and spatial scales of definitions and responses to drought, and relating these variations to the wider discursive contexts of the two states. We do this through a reading of each newspaper's special series on the drought, comparing how the two newspapers differ in the framing of problems and solutions to drought. We also examine coverage of water rights conflicts and the representation of drought as an urban and/or rural problem, relating the framing of these issues to spatial scales. We begin our analysis in the next section with the map of discourse patterns.

7. Mapping discourse in the two states

Fig. 3 shows the use of problem and solution words in the Arizona (AZ) and New Mexico (NM) newspapers in three different time periods (2002, 2003, 2004). Problem words are represented by triangles and solution words are represented by circles. The first correspondence factor (on the horizontal axis) accounts for 32.0% of the X^2 variation in the table, and the second factor (on the vertical axis) accounts for 21.7% of the X^2 variation, giving this map a pseudo-$R^2 = 0.537\%$ or 53.7% of the variance in the data table. Note that three other correspondence factors are needed to reconstruct all of the variance in the table, but each of these factors explains a decreasing percentage of X^2 and builds cumulatively on the first two factors. For example, the third factor differentiates AZ2002 and a group of keywords running through the center of the map, from AZ2003 and an arc of words stretching from the upper right to the lower right. In other words, much of what this factor shows is already captured by the relative positioning of AZ2002 and AZ2003 by the first two factors.

The correspondence map is a space of oppositions, so that keywords and newspaper-years that are located in the same direction from the origin point (0,0) are more closely associated, while those located opposite each other across the origin point are negatively associated. Although points in the correspondence map can be interpreted as locations on the horizontal and vertical axes, it is also possible to draw other axes of interpretation based on points in the plot (Goodman, 1996). In this figure we draw four axes for interpretation, stretching from the origin point through both the earliest, and latest, newspaper-years (AZ2002, NM2002, AZ2004, and NM2004). The strength of association between keywords and these newspaper-years is indicated by projecting perpendicular lines from keyword markers to these axes. The further on the positive end of the axis a keyword intersects, the more closely associated with that newspaper-time period, and the further on the negative end of the axis indicates negative association.

Fig. 4 compares the intersection of keywords along axes drawn through AZ2002 and NM2002. These axes show that drought was framed quite differently in the two states in 2002. For example, on the positive side of the New Mexico 2002 axis, many problem words indicating conflict are grouped together, including disagree, argu, oppos, fight, and controversy. Other problem-defining terms in this quadrant are emergency, panic, and danger. Solution terms include order, decrease, restrict, and ordinance. These patterns show how drought coverage in New Mexico began with a focus on conflict and extreme problem definitions, requiring urgent actions in response. In contrast, Arizona discourse in 2002 is associated with only a few conflict words (rival and dispute). Problem-defining terms such as surprise, alarm, and alert, also appear as well as surplus and persist. Although these terms also indicate a serious problem, they are more about surprise at drought conditions. Solution terms include response, mandate, regulate, allocate, adjust, supervise, organize, and policy. Taken together, Arizona's discourse on drought in 2002 is about surprise and organizational response, and features much less conflict than in New Mexico.

It is also evident from the map in Fig. 3 above that New Mexico discourse shifted considerably in later years, while Arizona discourse remained much the same. Here we see that New Mexico reporting in 2004 features words like conflict, differ, and agree, but these are much less intense

[3]Keywords removed from the list (N = 52): adapt, agency, agree, allot, answer, arrang, authorit, bureau, chang, control, curb, curtail, deficit, deny, difficult, diminish, direct, dominat, ease, effect, evaporat, excess, extra, fear, govern, lack, limit, moderat, necess, obligat, operat, protect, question, recharg, reclaim, reduc, relief, require, resist, resolv, rule, shortfall, signal, solv, stress, struggl, surviv, techn, usage, want, warn, water.

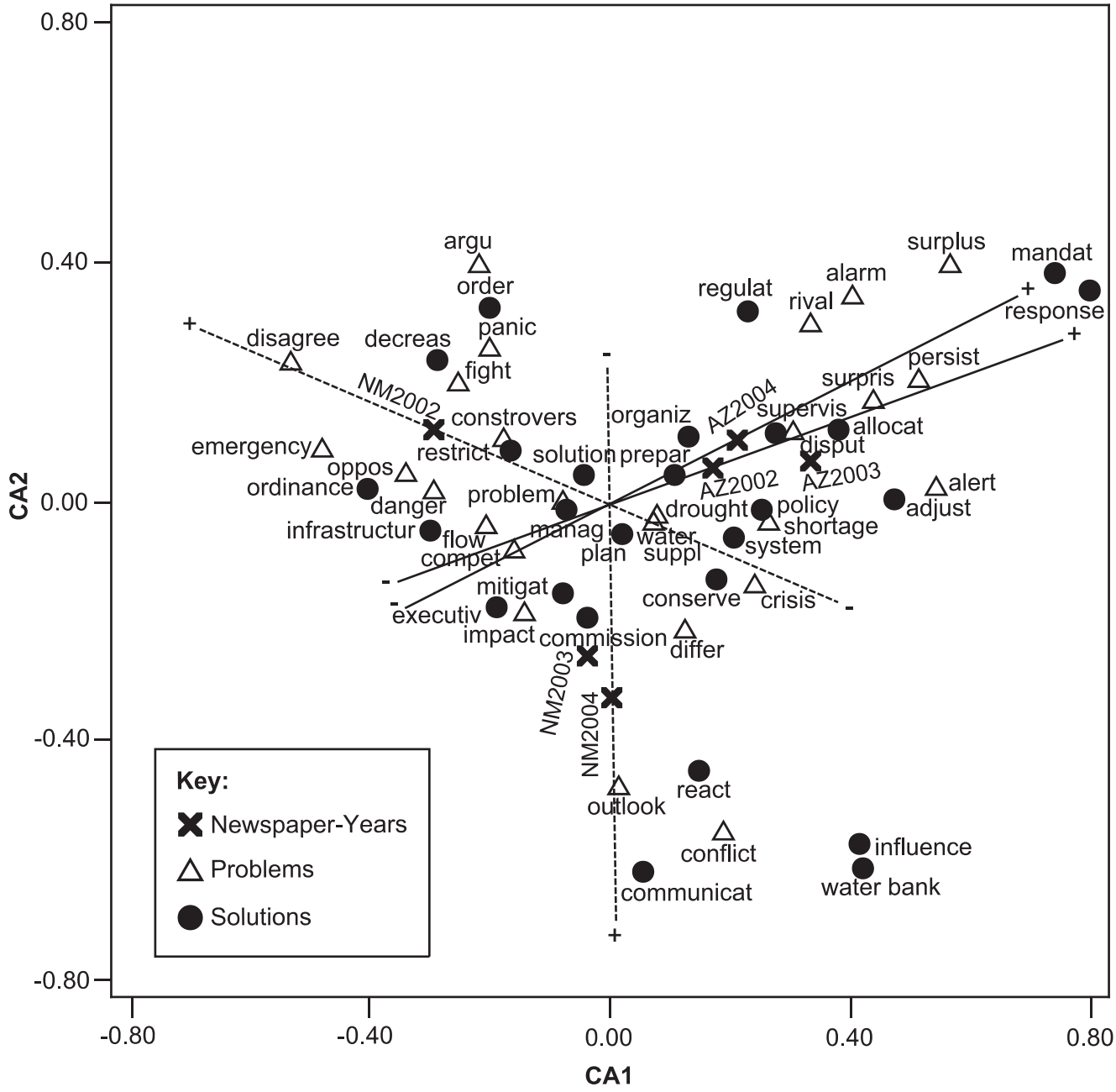

Fig. 3. Drought Discourse in the Arizona Republic and the Albuquerque Journal, 2002–2004 (Correspondence Analysis).

than in 2002 reporting. Problems tend to be defined by relatively mild words such as outlook, diminish, and impact, and solution terms include communication, influence, and reaction. In all, New Mexico's discourse is still engaged in conflict, but this conflict appears to be institutionalized in communication procedures, such as might be found in acequia associations. On the other hand, Arizona in 2004 remains very similar to Arizona in 2002, using various terms indicating alarm and organizational response. The concentration of terms such as mandate and response, as well as adjust, allocate, regulate, and supervise are associated with the management of an established water infrastructure. In contrast, the opposite end of the axis includes the terms infrastructure, executive, and commission. These terms indicate explicit discussion of infrastructure and political decision making, corresponding to New Mexico's less developed water infrastructure.

The findings from this map of discursive contexts shows how discourse in New Mexico focuses on infrastructure and planning processes, and features much conflict that is informed by the acequias which provide a basis for community involvement in water rights disputes. On the other hand, discourse in Arizona reflects the existence of established surface water delivery systems that buffer urban populations from recognizing drought impacts and apparently obviate the need for extensive community

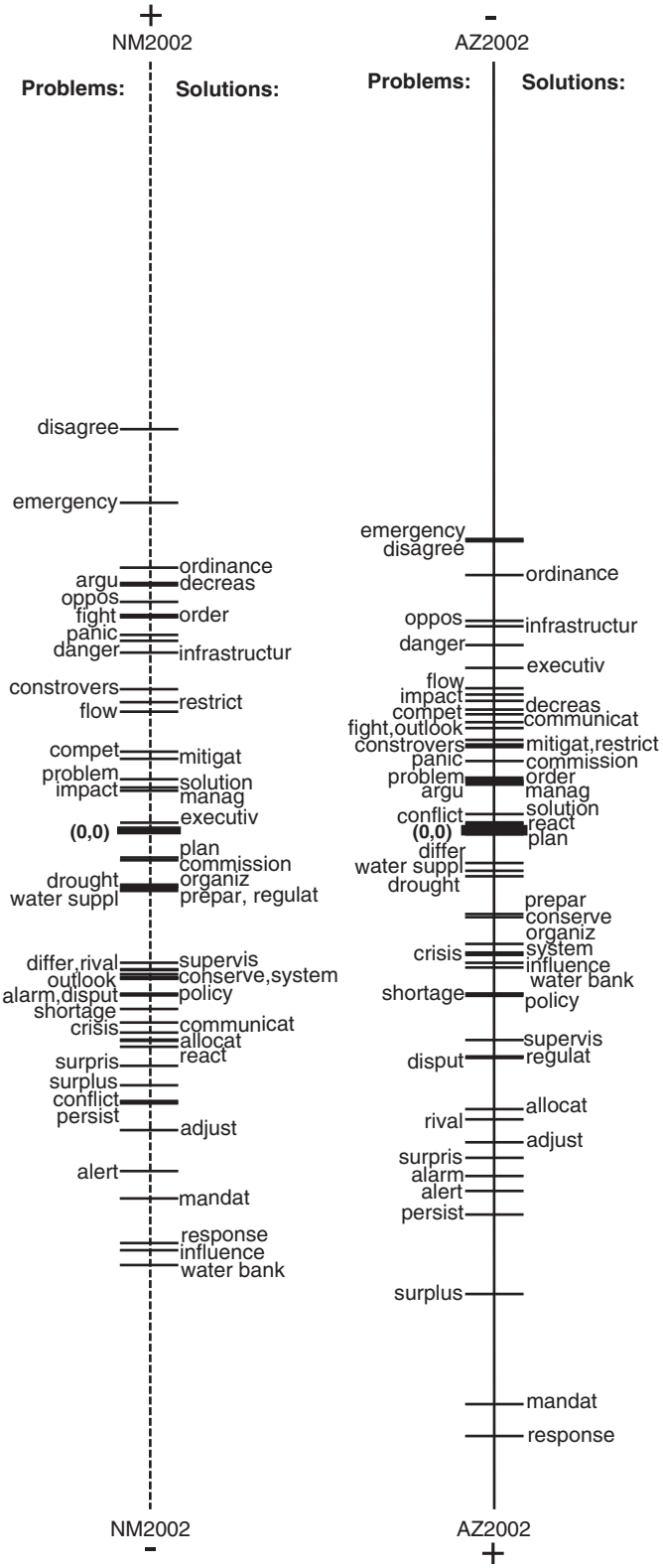

Fig. 4. Comparison of keywords for problems and solutions, Arizona and New Mexico, 2002.

involvement. In the next section we examine how these broad differences in discursive contexts are evidenced in newspaper texts, showing how framing varies in temporal and spatial contexts.

8. Framing drought in temporal and spatial scales

In this section we compare news coverage in the Arizona Republic and the Albuquerque Journal through a reading

of article texts. First we examine the salience of drought and how it is defined in temporal scales, focusing on the time horizon of problems and solutions. Second we examine how water rights conflicts are portrayed in each newspaper, relating this reporting to contrasts in reporting on rural and urban water users.

8.1. Drought surprises and drought emergencies

The immediacy of drought as a problem was perceived differently in the Arizona Republic and the Albuquerque Journal in part due to differences in infrastructure and planning in the two states. Arizona cities were buffered from drought impacts by water from the Central Arizona Project (CAP) canal, and drought planning did not begin in earnest until after 2002. In New Mexico by contrast, cities were still building infrastructure for water delivery and the drought planning process was already well underway by 2002. Consequently, reporting in Arizona reflected surprise over drought seriousness and tended to take a longer term view of drought problems and solutions, while reporting in New Mexico reflected a sense of emergency and the more immediate need to secure water supplies.

Water managers in Arizona recognized how infrastructure buffered residents from drought impacts. CAP Deputy General Larry Dozier commented: ''It's hard to imagine the Phoenix metropolitan area without reclamation projects…Here we are in the midst of one of the worst droughts in history and central Arizona hardly notices'' (Arizona Republic; June 17, 2002). Because of this buffering, drought is perceived as unexpected: ''Droughts take us by surprise, but they're a regular part of our climate'' (Arizona Republic; June 30, 2002). Policy makers and water managers are the most surprised (cf. Streets and Glantz, 2004), for example CAP board member ''James Hartdegen admits he was surprised to see water rank as high as it did in The Arizona Republic's 2002 election issues poll, but he hopes it means Arizonans are paying closer attention to how one of the state's most critical resources is managed'' (Arizona Republic; June 18, 2002). Even experts are seen to focus on short-term impacts however, as shown in the newspaper's paraphrase of Phoenix water conservation specialist Kent Newland: ''there's no immediate risk of rationing because groundwater and CAP supplies are still plentiful'' (Arizona Republic, March 31, 2002).

The buffering of urban population centers from drought allowed managers, if they thought about it at all, to consider drought issues in terms of a relatively long time frame. Grady Gammage, a lawyer and board member of the CAP, said ''When you build dams and infrastructure of the magnitude [Arizona cities] have, it may be you don't fully realize for 40 or 50 years how critical it is because of the cyclical nature of weather'' (Arizona Republic; Jan 20, 2003). A letter to the editor similarly asks ''What is it about the word ''drought'' that people in this Valley don't understand?…Add an inexcusable lack of planning by the state to the typical consume-as-usual attitude of Valley residents and big surprise! You have the recipe for disaster'' (Arizona Republic; May 29, 2002).

Some policy-makers in smaller communities pushed for shorter-term actions that would address longer-term vulnerability to drought. Williams City Manager Dennis Wells, for example, observed: ''If we can survive this current drought and develop more underground sources, it bodes well for Williams' future'' (Arizona Republic; Jan 20, 2003). Statewide drought planning, while addressing immediate needs to alleviate water shortages in certain rural areas, placed a stronger emphasis on longer-term strategies. A 2004 headline announces, ''How to Take Surprise out of Drought: State Task Force Seeking More Climate Monitoring'' (Arizona Republic; March 11, 2004), and quotes University of Arizona researcher and task force member Kathy Jacobs as saying ''We hope that next time we have a drought, we're not surprised.''

New Mexico also experienced some surprise at drought conditions, but the cause was the weather rather than infrastructure: ''New Mexico is always full of surprises in the spring,'' Murray said. ''It can go dry or it can start raining. Two months and we'll know the story'' (Albuquerque Journal; Feb. 8, 2003). Drought in New Mexico was instead conceptualized more as an emergency than as a surprise. An article with the headline, ''State Going To Drought Emergency'' (Albuquerque Journal; April 26, 2002) reports that ''Governors in Colorado, Montana, Wyoming, Utah and Arizona have made similar drought emergency declarations this month.'' These emergency declarations were made in different contexts however, and the buffering of Arizona cities meant that the emergency declaration received less attention in the major political and population centers. In New Mexico by contrast, the drought emergency was linked to numerous related issues, such as restrictions on fireworks, emergency retrofit programs for low-flush toilets, proposed bans on new construction, the release of federal money for responding to drought impacts, the drilling of emergency wells, and the health of endangered species. The sense of emergency was found in basic worries about water supply: ''Communities and individuals are calling the state Emergency Management Bureau asking for help because they are worried their drinking water will run out'' (Albuquerque Journal; May 19, 2002).

The diversion and storage of surface water was seen as an insurance policy against shortages in New Mexico, but in contrast to Arizona, discussions focused on the continuing and very immediate need to build water delivery adequate infrastructure. The nearly complete San Juan Chama Diversion Project was supported by nearly all politicians in the state, and Bureau of Reclamation commissioner John W Keys III argued that ''New Mexico can't live without [the San-Juan Chama Project]…I don't see a good alternative to it…We can't live without these storage facilities'' (Albuquerque Journal; May 21, 2003). Albuquerque mayoral candidate Ike Pino homed in on a

closely related institutional issue, proposing that "the city should be seeking to make the San Juan-Chama water rights perpetual" (Albuquerque Journal; Feb, 17, 2002). At the same time, conflicts erupted over the allocation of surface water supplies from existing reservoirs. As discussed below, the protracted controversy over the silvery minnow contributed to the sense of emergency: "New Mexico asked an appeals court Thursday to put an emergency stop to a federal judge's order that water be released from Heron Reservoir to keep the Rio Grande wet for the silvery minnow" (Albuquerque Journal, October 11, 2002). Dispassionate expert opinion also reflected New Mexico's dilemma, as illustrated by hydrologist Amy Lewis's comments on the immediate problems of drought mitigation: "We're at our limit…We have some options, but they're all pretty painful. Nothing's going to be easy and make everybody happy" (Albuquerque Journal; June 15, 2003). Where Arizona had the relatively luxury to consider longer-term impacts and responses to drought, New Mexico was forced to respond to a bundle of urgent short-term problems.

8.2. *Water rights conflicts and rural-urban contrasts*

Drought impacts can be assessed not only in terms of temporal scale, but also in terms of spatial scale. Our analysis of the Albuquerque Journal and Arizona Republic revealed a notable difference between these newspapers: the Arizona Republic's focus was largely on urban water commentary, while the Albuquerque Journal reported more broadly on both urban and rural issues. Thus, a significant portion of the Republic's coverage occurs at the relatively fine scale of urban water issues, focusing particularly in the greater Phoenix area, and the availability of Colorado River water delivered via the Central Arizona Project and Salt and Verde River water delivered via the Salt River Project. The Albuquerque Journal, by contrast, addresses the much broader spatial scale of rural water issues in the state.

The narrow spatial scale in Arizona reporting arises from several intersecting factors. The greater Phoenix area relies to a significant extent on a sophisticated water delivery system to move surface water from large reservoirs on the Colorado, Salt, and Verde Rivers to area customers. The severity of drought conditions over the 2002–2004 time span led to drastic depletion of water in these reservoirs and raised questions about how to operationalize existing—but previously untested—institutional arrangements for allocating increasingly scarce supplies. These questions rose to the highest political levels in the city, which is also the state capital, and helped to focus the news agenda around urban water issues. In the context of water resources provided by reservoirs and lakes, rural water issues were therefore reported mostly when they affected urban access to water supplies. For example, in April and May 2004 the SRP and Phoenix pursued legal action against farmers in the Verde Valley for illegally drawing water from the Verde River, and the Republic reported that, "If the Verde continues to lose water to the drought or illegal users, the SRP and the cities it serves fear they will lose a critical source of water" (AZ Republic; April 28, 2004).

New Mexico, by contrast, was forced to cope with serious water shortages in rural and urban areas alike. Discourse about drought-related water shortages ranged from the need to build additional water delivery infrastructure, to negotiating human versus environmental uses, to sharing water shortages between urban and rural users. Litigation over water allocations that threatened the extinction of an endangered species, the silvery minnow, highlights how seriously the drought affected New Mexico. The small and uncharismatic silvery minnow had been protected by the Endangered Species Act (ESA), but language in the ESA allows for species extinction under extraordinary circumstances. However, such decisions require approval from a designated committee, sometimes called the "god squad."

The Albuquerque Journal's attention to rural issues increased markedly in the wake of the silvery minnow debates in late summer 2002. In this case, preserving the silvery minnow required releasing water from an already-low reservoir, at the expense of both urban and rural users of that water. Remarking on one of the silvery minnow court decisions, New Mexico State Engineer Tom Turney stated "It looks disastrous for the cities. It looks disastrous for the Indian Pueblos...You can't manage a river for one sole entity or stakeholder. It has to be managed for many needs" (Albuquerque Journal; Sept. 20, 2002). From a farmer's perspective, "It's no different than them [BoR] coming into your office and saying 'we need your computer for the silvery minnow and taking it" (Corky Herkenhoff, quoted in Albuquerque Journal; April, 20, 2002).

Although not a dominant contributor to the gross domestic product (GDP) of either Arizona or New Mexico, agriculture remains the largest water user in both states, and often holds very senior water rights. The Albuquerque Journal's framing of agriculture's economic role, and its position relative to the large and growing dominance of urban economic activity, reveals how stresses between the two sectors were exacerbated by drought conditions across New Mexico. The Albuquerque Journal contrasted the historical role of agriculture to contemporary urban dynamics, noting that some water rights "go back to the 1800s and back then agriculture was the only industry" (Albuquerque Journal; June 8, 2003, quoting Colorado Department of Agriculture Commissioner Bob McLavey), while at the same time reporting that in cities like Albuquerque, "It's a struggle to maintain the water flow," (Albuquerque Journal; July 26, 2002, quoting Jim Wilbur, Albuquerque Collaborative Programs Manager).

The Journal noted however that solutions that shift water from agricultural to urban uses have costs: "people blithely say farming is in decline and all we have to do is move water from agriculture to cities...If we do that, it will

dry up...entire communities in New Mexico'' (John Brown, director of the New Mexico Water Dialogue, quoted in Albuquerque Journal; June 29, 2003). Agriculturally based acequia associations provide an important counterpoint to claims of agriculture's inevitable demise in New Mexico. While acequia members were strongly affected by the drought, they continued to have a voice in state water politics and were recognized as ''an important part of the region's culture'' (Albuquerque Journal; June 1, 2003). Even the State Engineer acknowledged that ''the acequias feel pretty impassioned. This is a tradition, a culture and a way of life'' (Tom Turney, quoted in Albuquerque Journal; April 27, 2002). The Journal's broader attention to both urban and rural issues, compared to the Arizona Republic, can therefore be seen as a product of both physical and cultural infrastructure for the delivery of surface water.

9. Discussion

The framing of drought in the Arizona Republic and the Albuquerque Journal differs considerably, reflecting variations not only in the natural aspects of climatic conditions and the physical infrastructure of surface water delivery, but also in the social and cultural institutions prevalent in each state. Newspaper coverage by the Albuquerque Journal reveals the extent to which drought conditions produced contests over water resources in both urban and rural areas of New Mexico, revealing underlying insufficiencies in water infrastructure to meet rapid population growth (see, e.g., Liverman and Merideth, 2002). In Arizona, by contrast, newspaper coverage addressed potential drought impacts on (mainly urban) surface water supplies, but communicated little evidence of an emergency situation. As we noted above, this lower level of concern correlates well with the buffering provided by large-scale surface water projects and innovations in water institutions (including mechanisms such as banking water in underground aquifers), which mainly address potential water shortage problems in the large urban areas (see, Jacobs et al., 2005).

The recent drought required New Mexico to respond in very tangible ways, ranging from infrastructure development to institutional change and litigation, to rural and urban conflict over water resources. Drought therefore tended to be framed in a broader spatial scale but a finer temporal scale, reflecting the need to deal with urgent water supply issues which involved both rural and urban interests. The immediacy of drought issues contributed to the pattern we found of changing discursive contexts in New Mexico between 2002 and 2004. On the other hand, discourse about drought in Arizona tended toward an opposite configuration of temporal and spatial scales. Drought was framed in relatively long time scales, due in part to the existence of substantial institutional mechanisms and infrastructure for managing water resources, particularly in the fast-growing urban areas in the central regions of the state. These arrangements buffer urban residents—and agriculturalists whose water might be called upon to meet urban demand should extended severe drought occur—from deleterious drought impacts. This system, however, contributes to a widespread lack of public awareness about drought and related lack of concern about water conservation.

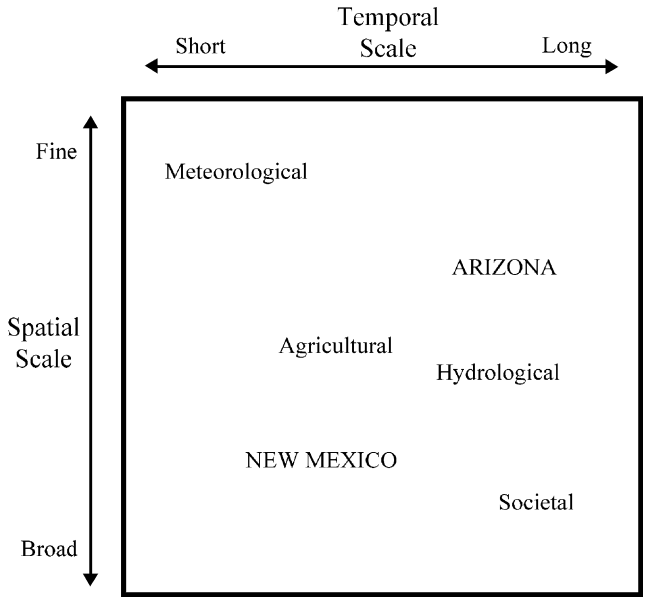

Fig. 5. Temporal and spatial scales in framings of drought.

Fig. 5 places the dominant framings of drought in Arizona and New Mexico in different regions of the theoretical space defined by variation in temporal and spatial scales.

10. Conclusion

Drought is a fact of life in the US Southwest. Studies of the region's climatic patterns show considerable temporal and spatial variability, but arid to semiarid conditions, interspersed with anomalously rainy or drought periods, remain the defining characteristic. The region has long taken measures to buffer against drought impacts, particularly with regard to surface water supplies, but some sectors and areas remain highly vulnerable to severe sustained drought. Ranchers and rural communities are among the most at risk in both states. In this study we have shown how the framing of the environmental issue of drought varies in both temporal and spatial scales, and how these variations are linked to discursive contexts in the two southwestern states of Arizona and New Mexico. In the construction of this study we have drawn on research from a variety of academic disciplines and methodological persuasions, and in conclusion we consider how our study can contribute to these various endeavors.

The basic framework of our study involved discourse and content analysis, centered on the concept of framing. The academic literature on framing is large and diverse, and prone to disputes about the theoretical status of the concept of ''framing'' as well as the proper approach to

conducting studies informed by this concept (Entman, 1993; D'Angelo, 2002). Building on recent work which connects framing processes to wider discursive structures (Ferree et al., 2002), we have shown in this paper how the concept of framing can be useful when clearly situated within discursive contexts. We drew on discourse analysis because it highlights the need to situate meaning-making processes in wider socio-cultural contexts (such as the respective demands and contributions associated with agricultural versus urban development activities), as well as reminding researchers of how discourses are internally structured within these contexts. Content analysis emphasizes the need for a systematic approach to the identification of texts and the quantitative mapping of discursive contexts. We believe that these approaches can be usefully combined through a mixture of quantitative and qualitative methods and that this and similar approaches can be useful for generating insight about a wide range of environmental and social problems.

We also link environmental discourses and framing to variations in temporal and spatial scales, building on work that identifies types of environmental discourse (Adger et al., 2001; Browne and Keil, 2000; Hajer, 1995). We propose that framings of drought as meteorological, agricultural, hydrological or societal (Wilhite and Buchanan-Smith, 2005) can be systematized by considering temporal scale (short or long) and spatial scale (fine or broad). Our analysis revealed that discourse in the two states varied in both of these scales, and these variations can be linked to the discursive contexts which shape popular knowledge and concern and therefore cultural resonance. For example, water policy in both Arizona and New Mexico must take account of legal institutions designed to apportion water across state and national boundaries but the precise mechanisms differ between the two states (see, e.g., Getches, 2003). In our study, the role of water delivery infrastructure and of the organization of urban-rural relations helped shape the scales at which drought was framed. Research on environmental discourse could be expanded by further systematizing the ways in which temporal and spatial scales vary, and by developing better methods of matching frame characteristics to the contexts which shape discursive opportunities (see for example Nevarez's (1996) study of the framing of a California state water project, which showed how drought conditions intersect with political and social realities to create discursive opportunities).

In both states, slow realization of the seriousness of actual and potential drought impacts constitutes a discursive obstacle that can probably only be bridged by activities of scientists and other experts who have high public credibility. The statements and activities of these individuals, for example as participants in New Mexico and Arizona drought planning activities, and in their interactions with news media, provide important avenues for foregrounding information about drought processes, conditions, and impacts, as well as reasons why the public should take drought conditions seriously. Such foregrounding occurs through framing activities that present drought in relatively broad temporal contexts and highlight not only short-term impacts, but also long-term consequences of continuing growth and development in a context of limited water supplies. The success of this longer-term framing for entering policy and media discourse is influenced by discursive contexts which influence both the perspectives of news sources as well as the popular knowledge of media audiences. Scientists, environmental advocates, and informed water management specialists see public inattention to the drought as an ongoing and significant issue, one that poses a barrier to proactive water resource (and drought) planning.

Our findings also have implications for policy discourse around drought and related environmental issues, such as the silvery minnow controversy in New Mexico and the willow flycatcher issue in Arizona. By demonstrating a link between the framing of drought and these types of discursive contexts, we hope to show how variations in framing cannot be reduced to the interests and representations of discrete policy actors. While previous studies have linked types of media information sources with differences in framing (Stallings, 1990), we show how discursive contexts also shape framing at a more general level in media discourse. The minnow and the flycatcher, for example, served as proxies for larger and longer-running contests over allocating water for environmental protection and sustainability and, by extension, to support the growing recreation and tourism sectors in both states. These kinds of debates are shaped by both biophysical and social contexts in addition to political interests.

We wish to note that drought stress is traditionally experienced first in rural areas and smaller cities lacking multiple water resource options. Because these areas and livelihoods are not linked to major surface water resources, e.g. lakes and reservoirs, they do not appear in our dataset. An analysis of news articles that focused on precipitation or on groundwater would certainly have identified more stories in Arizona which focus on broader spatial scales. We also note that our study focuses on the main newspapers in each state, based in major urban areas, and suggest that a study of media from rural or less-urban areas might give different amounts of representation to different kinds of voices. Despite these limitations, the differences we find in the two newspapers' discourses suggest that it is important for those attempting to influence policy discourse to be cognizant of the ways in which their framing implies temporal and spatial scales, and to try to assess how these scales fit with contextual factors influencing the success of framing efforts.

Acknowledgments

This project was supported with funding from the US National Oceanic and Atmospheric Administration (NOAA) through the Climate Assessment for the Southwest (CLIMAS) project at the Institute for the Study of Planet Earth (ISPE), University of Arizona, Tucson, AZ.

Appendix A. Number of articles containing framing keywords.

Keyword	AZ2002	AZ2003	AZ2004	NM2002	NM2003	NM2004	Total
Adjust	5	6	1	2	4	0	18
Alarm	4	2	3	2	1	0	12
Alert	4	4	2	1	3	0	14
Allocat	13	20	10	12	9	3	67
Argu	3	10	7	23	5	0	48
Commission	9	13	5	19	21	3	70
Communicat	0	3	0	2	3	2	10
Compet	5	5	2	11	10	0	33
Conflict	0	9	1	4	10	3	27
Conserve	38	42	15	38	40	15	188
Constrovers	1	2	2	5	3	0	13
Crisis	7	14	3	9	11	3	47
Danger	29	25	9	81	39	10	193
Decreas	5	5	0	13	2	2	27
Differ	28	24	9	25	37	6	129
Disagree	1	2	1	9	3	0	16
Disput	3	3	4	3	2	1	16
Drought	129	119	51	158	113	37	607
Emergency	12	4	8	44	17	4	89
Executiv	8	7	0	15	13	2	45
Fight	13	16	6	42	11	5	93
Flow	31	32	20	88	49	16	236
Impact	13	14	4	29	19	10	89
Influence	5	2	2	0	3	4	16
Infrastructur	4	1	2	8	5	1	21
Manag	58	48	25	99	56	22	308
Mandat	14	21	6	5	1	1	48
Mitigat	6	1	0	4	5	0	16
Oppos	9	3	3	19	10	1	45
Order	18	22	11	54	13	2	120
Ordinance	1	3	0	8	2	2	16
Organiz	7	8	2	9	4	2	32
Outlook	4	3	3	5	8	4	27
Panic	8	0	0	6	2	0	16
Persist	7	20	4	8	4	2	45
Plan	68	61	32	96	74	21	352
Policy	11	18	4	13	9	5	60
Prepar	18	15	5	19	13	3	73
Problem	39	28	12	60	33	12	184
React	3	3	0	2	5	1	14
Regulat	7	8	3	8	3	0	29
Response	12	18	5	3	1	1	40
Restrict	30	22	7	55	23	8	145
Rival	7	4	3	4	2	0	20
Shortage	17	26	12	19	20	5	99
Solution	8	16	3	22	12	3	64
Supervis	10	7	1	6	4	1	29
Surplus	3	7	3	3	1	0	17
Surpris	22	18	8	10	9	1	68
System	38	40	18	36	35	12	179
Water bank	2	5	3	0	8	2	20
Water suppl	35	41	19	53	37	14	199

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