My Drought is Different from Your Drought: A Case Study of the Policy Implications of Multiple Ways of Knowing Drought

ELLEN KOHL
Department of Geography, Texas A&M University, College Station, Texas

JOHN A. KNOX
Department of Geography, University of Georgia, Athens, Georgia

(Manuscript received 14 October 2015, in final form 13 June 2016)

ABSTRACT

This paper explores the relationship between scientific operationalizations of drought and the politics of water management during times of drought. Drawing on a case study of the 2007–09 drought in Georgia in the southeastern United States, this paper examines how multiple ways of knowing drought were produced, circulated, and utilized by stakeholders. Moreover, this paper explores the policy implications of these multiple ways of knowing drought. Data were drawn from archival research, direct observation, and semi-structured interviews with members of the green industry (self-identified members of the urban agricultural sector); state environmental regulators; and local governmental officials. Data were analyzed to examine the interplay between science and politics. This paper highlights the intersections of drought management policy and 1) scale and operationalization of drought; 2) how stakeholders know drought; and 3) societal context within which knowledge of drought is produced, circulated, and utilized. This research demonstrates how stakeholders can leverage the complexity of drought to pursue their political goals and change the way water is managed during times of drought. Even in instances where there are different knowledges of drought, stakeholders can still change the societal context, as the green industry did in Georgia in 2009. This paper argues that scientists and policymakers who work on drought management need to consider how knowledges of drought are coconstituted through interactions between science, nature, and society.

1. Introduction

When is a drought not a drought? It was in Georgia in early October 2011. The director of the Georgia Environmental Protection Division (EPD), charged by state law with determining local and state responses to drought, maintained a nondrought schedule for outdoor water use across the entire state. Concurrently, the U.S. Drought Monitor (USDM), a weekly map of drought conditions produced by the National Oceanic and Atmospheric Administration (NOAA), U.S. Department of Agriculture, and National Drought Mitigation Center (NDMC), classified 75% of Georgia under a category of severe or extreme drought (Fig. 1).1

These contradictory designations of drought exemplify multiple ways of knowing drought. Droughts are complex and multifaceted. They are operationalized differently (Dracup et al. 1980; Kallis 2008; Quiring 2009; Wilhite and Glantz 1985). In this paper, we examine divergent

---

1 The USDM is a blend of objective and subjective assessments, combining Palmer indices with soil moisture, streamflow, and precipitation data, as well as input from more than 350 contributors nationally and a team of lead authors composed of 11 experts, many of them climatologists, from around the United States who “use their best judgment to reconcile any differences in what different sources are saying” (USDM 2016). The USDM’s own website stresses that the product “isn’t a strictly quantitative product, and that the community of drought observers lends credibility to the state-of-the-art blend of science and subjectivity that goes into the map” (USDM 2016).
epistemologies, that is, political and scientific ways of knowing drought. We argue that stakeholders’ production, circulation, and utilization of knowledge of drought is influenced by 1) scale and operationalization of drought, 2) how they know drought, and 3) societal context.

Through a contextual case study analysis, we examine how stakeholders utilized their knowledges of drought during Georgia’s so-called “100-year drought” in 2007–09 to pursue their political goals by lobbying the Georgia legislature for the passage of House Bill (HB) 1281. We focus on the members of the green industry, a self-identified group dependent on garden, lawn, landscaping, irrigation, and plant maintenance for their economic livelihood, in Athens–Clarke County (ACC). ACC is located in northeastern Georgia. HB 1281, introduced in February 2008 and signed into law on 14 May 2008, changed water management in Georgia during subsequent times of drought (Bulloch et al. 2008; Vote Smart 2008).

We begin our analysis by situating our research within the theoretical framework of political ecology, highlighting the role of political ecology of scale, stakeholder perceptions of natural disasters, and the politicization of science in water governance. Political ecology and related research has firmly established that the relationships between utilization science and decision-making are socially situated and highly political (Demeritt 2006). Yet, these analyses often focus on questions of climate change, with far less attention on particular manifestations of a changing climate at relatively localized scales. Next, we review the course of Georgia’s

---

2 Drought conditions across Georgia beginning in the summer of 2007 were sensationalized as the “100-year drought” by media outlets, politicians, and the general public. As Campana et al. (2012) demonstrate, the title of 100-year drought was not necessarily warranted (i.e., dependent on the definition and metric of drought, and inconsistent with how extreme events are defined scientifically).

3 ACC is also referred to as green growers or the urban agriculture sector. In this paper, we use the term green industry to reflect the primary way that research participants self-identified.
2007–09 drought to provide context for our case study. We then explain our qualitative methods and use our empirical data to demonstrate the policy outcomes resulting from stakeholders’ knowledge of drought and the societal context within which these knowledges are produced, circulated, and utilized. In conclusion, we discuss initial effects of HB 1281 and reflect on the importance of understanding how stakeholders’ knowledge of drought and the societal context influence policies.

2. Theoretical framing

The management of water is both scientific and political (Budds 2009; Bulkeley 2005; Cohen 2012; Himley 2008; Ioris 2012; Kaika 2005; Norman et al. 2012; Perreault and Bridge 2009; Reed and Bruneel 2010; Swyngedouw 2004). The complexity of water governance is amplified during times of scarcity, as perceptions of water and water availability are coconstructed through the absence of water (Clarke-Sather 2012). Political and economic decisions can be catalyzed that might not have occurred in the absence of a water scarcity discourse (Swyngedouw 2004). By framing water management during times of drought within political ecology, we contest the notion that scientific measures of drought are value neutral. Instead, we focus on how stakeholders pursue their political goals through the production, circulation, and utilization of multiple ways of knowing drought.

Sarewitz (2004, p. 385) argues that “scientific inquiry is inherently and unavoidably subject to becoming politicized in environmental controversies.” This is not necessarily because scientists use their research for political ends. Instead, it reflects the complexity of nature. Scientists take multiple approaches framed by multiple disciplines, which produces multiple knowledges. This reflects the line of inquiry used, not the validity of the knowledge produced. These multiple knowledges can, and often are, strategically used to pursue political goals. While some see science as linear, neutral, and objective, research in science technology studies (STS) and the politicization of science highlight the interconnectedness of science, values, and politics (see Bimber and Guston 1995; Cozzens and Woodhouse 1995; Jasanoff et al. 1995; Martin and Richards 1995; Pielke 2006; Sarewitz 1996, 2004). Cozzens and Woodhouse (1995, p. 541) go so far as to argue that “there is in principle no way to separate science from values in any policy area, that any line drawn is artificial, temporary, and convenient to the purposes of the person or group drawing the line.”

The ways we know drought, like other environmental knowledges, are “multiple, complex, and situated” (Goldman and Turner 2011, p. 19). Drought science itself is not objective. Sociopolitical considerations impact the choices of measurements used to quantify drought, where these measurements are taken, and what thresholds are associated with drought severity. These decisions coconstitute the knowledge of drought. These knowledges are developed, circulated, and utilized within environmental politics (Goldman and Turner 2011). Researchers using a political ecology, STS, and closely related approaches have established the porous nature between science and policies (Demeritt 2001, 2006; Goldman and Turner 2011; Sarewitz 1996, 2004). Within political ecology, much of the research on the coconstituted and interactive nature of environmental knowledges has been in the context of climate change (Burnham et al. 2016; Brace and Geoghegan 2011; Demeritt 2001, 2006; Hulme 2008; Popke 2016; Rice et al. 2015).

Climate change is often defined and politicized in purely scientific language. Moreover, there exists a definitional ambiguity where climate change is “simultaneously a reality, an agenda, a problem and a context” (Brace and Geoghegan 2011, p. 285). Additionally, there are different local experiences of climate change and relationships between people and places over time. This necessitates a reimagining of climate change (Burnham et al. 2016; Hulme 2008; Rice et al. 2015). Hulme (2008, p. 10) contends this can be accomplished by “dissolving the strained boundaries between Nature and Culture, by revealing that knowledge and scale are co dependent, by disclosing the spatial contingencies of climate change knowledge.” This process does not negate scientific knowledge, nor does it overprivilege experiential or place-based knowledge, but “instead, it requires that we be attuned to the ways that scientific and nonscientific ways of knowing develop political significance through their interactions” (Rice et al. 2015, p. 254). In this paper, we look at the knowledge politics of shorter-term, flash-point moments of ecological change through our attention to drought. We further research on how environmental knowledge produced, circulated, and utilized through our attention to drought, a local, immediate, and shorter-term environmental phenomenon.

The concept of scale is fundamental to any discussion of political ecology and knowledge production, circulation, and utilization. Political ecology of scale “incorporates the key precepts of the politics of scale—scale as socially constructed, relational, contingent, and contested—into an existing framework [of political ecology] that highlights power relations and a dialectical approach toward nature-society relations” (Neumann 2009, p. 404). When applied to questions of water governance during times of drought, the political ecology of scale highlights how the interrelationship of power relations, institutional framings, and scalar constructions of water governance (Norman et al. 2012) can be used to
make environmental problems seem to appear and disappear (Kurtz 2003). It is therefore necessary to consider which scale water is managed on, as well as what constitutes the environment to be managed (Budds 2009; Cohen 2012; Herbert et al. 2013; Ioris 2012; Poteete 2012).

The political ecology of scale influences the operationalization of drought, as well as who has the authority to govern water. These issues are particularly salient given that hydrological systems often span multiple social-political units, and water flows do not stop and start at political boundaries. The relationships between the physical geographies of water and administrative structures of water governance are products of dynamic social and political processes (Budds and Hinojosa 2012). The rescaling of social, political, and economic institutions can have direct impacts on the relationship between people who rely on water and the water resources they rely on (Clarke-Sather 2012). This is influenced by those with the power to make management decisions, as well as perceptions of who has power to make management decisions (Kohl 2013).

Scale also plays an important role in the construction of climate knowledge. Knowledge on climate change is often universalized on global scales, even though it is manifestations are different across scales and in different spatial contexts. Moreover, “climates do not travel well between scales” (Hulme 2008, p. 7). The same can be said about drought, given that drought is a deviation from the normal; what people experience and expect influences their cultural context of knowledge production. Burnham et al. (2016) contend that local understandings of climate change are grounded in lived realities. They are shaped not only by local factors, but also by observations and interactions between sociocultural networks on a regional, national, and global scale. When value is placed on people’s everyday experience of climate change, a more diverse set of epistemologies on climate change emerge (Rice et al. 2015). By looking at drought through these same processes, we highlight the diverse ways of knowing drought and how these processes are translated into policy.

There is growing interest in the relationship between stakeholders, scientific knowledge, and policy related to 1) the science-policy interface (Dilling and Lemos 2011; Dilling et al. 2015; Feldman and Ingram 2009; Huntjens et al. 2011; Meadow et al. 2015; White et al. 2008), 2) perceptions of climate change (Bellamy and Hulme 2011; Hernandez et al. 2015; Klos et al. 2015; Lujala et al. 2015; Saleh Safi et al. 2012), and 3) extreme weather events (Demuth et al. 2011; Sippel et al. 2015).4 With the exception of Dessai and Sims (2010) and Russell-Verma et al. (2015), there has been little research that specifically examines how the general public’s knowledge of drought influences policy decisions. Dessai and Sims (2010) examined how individual’s perceptions of drought and climate change translate into behavioral changes. Russell-Verma et al. (2015) used public comments from online news articles to explore drought mitigation preferences and the factors that influence these preferences. By examining these processes through the lens of political ecology, we build on this research with specific attention to the relationship between knowledges of drought and policy implications.

Our focus in this paper is on how stakeholders strategically use knowledges of drought to pursue their political goals. As Demeritt (2006, p. 473) argues through his analysis of political controversies surrounding climate science in the United States, “one reason that science is so often in the firing line in environmental politics is that all too often policy decisions are legitimated in purely technical terms, leaving opponents with only scientific grounds for contesting policies that they oppose for other reasons.” In the case of water governance during drought, within the scientific community there are multiple ways of knowing and quantifying drought (Quiring 2009). Wilhite and Glantz (1985) identify four main types of drought: meteorological, agricultural, hydrological, and socioeconomic.5 How drought is operationalized can be influenced by the scale at which drought is measured, the analytical measurements of drought, the modes of physical measurement, how drought is defined quantitatively and qualitatively, and the drought indices used. These multiple ways of knowing drought can be used by stakeholders to pursue their political goals. To examine the political ramifications of these processes, we now turn to our case study of Georgia’s 2007–09 drought.

3. Management decisions and responses to the 2007–09 drought

In spring 2007, EPD began implementation of a drought management plan developed and approved in 2003 (Zeng and Kim 2011). A level 2 drought was declared in northeastern Georgia by the State of Georgia

---

4 By science-policy interface, we mean the ways scientific data are strategically employed in policy processes.

5 Meteorological drought measures dryness relative to “normal” conditions and is based on quantitative measures of precipitation. Agricultural drought measures impacts on crops and their water demands versus water availability or topsoil moisture. Hydrological drought measures surface and subsurface water supplies. Socioeconomic drought “deals with drought in terms of supply and demand, tracking the effects of water shortfall as it ripples through socioeconomic systems” (NDMC 2016b).
on 18 April 2007. At the state level, drought declarations were made based on U.S. Standardized Precipitation Index (SPI), reservoir levels, groundwater levels, and streamflow levels at previously determined sites around the state (Georgia EPD 2003). ACC, which at that time was legally bound to implement a drought declaration and outdoor watering schedule that was at least as restrictive as EPD, also began implementing their drought management plan.

EPD and ACC continued to monitor drought indices throughout the summer. Drought conditions worsened. On 17 September 2007, ACC declared a level 4 drought based on the Palmer drought severity index (PDSI), streamflow of the Middle Oconee River, and water levels at Bear Creek Reservoir near Athens, Georgia. Bear Creek Reservoir is ACC’s backup water source (Fig. 2). ACC implemented a total outdoor water-use ban to achieve the required percentage usage reduction for level 4 drought. Eleven days later, on 28 September 2007, EPD issued a total outdoor water-use ban for 61 counties in North Georgia, including ACC. The 2003 Georgia state drought plan monitored drought based on NOAA Climate Divisions. Measurements were taken at locations selected to represent conditions within each Climate Division (Fig. 3). Within Climate Division 2, where ACC is located, EPD measured the precipitation deficit over 3 months (SPI-3), 6 months (SPI-6), and 12-month period (SPI-12).

---

6 The State of Georgia operationalizes drought severity on a scale of 1 to 4, with 1 being the least severe and 4 being the most severe. ACC operationalizes drought severity on a scale of 1 to 5, with 1 being the least severe and 5 being the most severe. Each drought management plan indicates thresholds corresponding to specific drought declarations. Georgia’s plan directly aligns these drought declarations to outdoor water-use responses ranging from restrictive watering (level 1) to an all-out watering ban (level 4). ACC’s plan indicates minimum consumption reduction goals associated with each level of drought severity. It has a five step plan (steps A–E) to achieve these reductions, beginning with minimally restrictive outdoor water use to a total outdoor water ban with restricted indoor use based on emergency need (Georgia EPD 2003; Athens–Clarke County Code 2008).

7 SPI quantifies precipitation deficit and deviation from normal conditions (McKee et al. 1993). It can be computed for multiple time scales usually ranging from 1 to 24 months. In Georgia, SPI is calculated over a 3-month (SPI-3), 6-month (SPI-6), and 12-month period (SPI-12).

8 The PDSI “is calculated based on precipitation and temperature data, as well as the local Available Water Content (AWC) of the soil” (NDMC 2016a).

9 Climate divisions, established in 1895, characterize long-term and large-scale climatic features or anomalies. There are 344 divisions in the contiguous United States. They cover the total area of each state and, in most cases, follow counties’ political boundaries (Guttman and Quayle 1996).
12 months (SPI-12); reservoir levels at Lake Lanier and Lake Allatoona; and streamflows of the Etowah River at Canton, Georgia, and the Chestatee River near Dahlonega, Georgia (Fig. 3).

Concerns about the drought increased throughout October. At the 4 October 2007 ACC city commissioner meeting, County Manager Alan Reddish publicly expressed concern that without precipitation Bear Creek Reservoir would run out of water by 21 December 2007. He reported that although water consumption had decreased by 20% as a result of the outdoor watering ban and voluntary conservation, existing supplies still could not meet remaining demand. He recommended that the city commission implement step F of their drought management plan, which calls for water rationing if the drought conditions persisted through 21 November 2007 (Athens Banner Herald Staff 2007).

Further state-level restrictions were placed on local water providers. On 20 October 2007, Governor Sonny Perdue declared a state of emergency for 85 Georgia counties (Cook 2007). Three days later, on 23 October 2007, Governor Perdue ordered 61 Georgia counties experiencing level 4 drought conditions to reduce their water consumption by 10% from winter averages (GA OG 2007). Local water providers were not told how to achieve this reduction, only that it must be achieved by 1 November 2007 (Shelton 2007).

While many citizens and business voluntarily reduced their water consumption, others articulated concern about the economic impacts of the drought management decisions. These concerns reflected their different ways of knowing drought. Members of the Georgia Green Industry Association (GGIA) were among the most vocal regarding negative economic impacts of watering restrictions. Although green industry operations were exempt from the outdoor water-use ban, they claimed customer demand dropped sharply as a result of the well-publicized drought. While consumers were allowed to water new plants, seed, or turf during installation, and for a subsequent 30 days to allow plants to establish themselves, many consumers did not want to invest in new landscaping they might not be able to maintain if the drought continued.

The results of a survey conducted by Flanders et al. (2008) supported green growers’ claims of economic hardship because of continuing water shortages. Between August 2007 and March 2008, 231 full- and part-time jobs associated with greenhouse and nursery production were lost, along with 584 jobs associated with landscaping. The green industry reported regional losses of $25.3 million during that time period (Flanders et al. 2008). The survey did not indicate if these trends were solely a result of outdoor water restrictions. There were likely other economic factors, primarily the 2007–09 U.S. economic recession and associated slowdown in new construction that also contributed to these economic hardships. Regardless, members of the green industry pointed to ACC’s management decisions during the drought, and not the economic recession, as the cause of their economic hardship. They felt they were forced to sacrifice their economic livelihood while other industries were not asked to make similar sacrifices.

GGIA actively lobbied on the state level to reduce watering restrictions. On 6 February 2008, at the Georgia Agribusiness Council’s legislative breakfast, Governor Perdue announced that water bans would be eased throughout affected counties. This allowed for limited outdoor watering three days a week, with the approval of the governing body responsible for managing local water supplies. State requirements for a 10% water-use reduction remained in effect, and local water suppliers were responsible for deciding whether they could meet this mandate while easing outdoor watering restrictions (Shelton 2008).

Georgia HB 1281, cosponsored by six members of the Georgia House of Representatives, was brought to a vote two weeks later. It was signed into law by Governor Perdue on 14 May 2008. The primary sponsor of HB 1281 was Terry England. England owns a farm supply store and is therefore a member of the green industry. The bill was designed to prohibit local government restrictions on outdoor water use during periods of drought that are more restrictive than those imposed by
the state without certain approval, to provide that political subdivisions may be exempted from outdoor watering restrictions imposed by the state (Bulloch et al. 2008).

In other words, what HB 1281 did was require that local outdoor water restrictions align with those of the state unless a petition was granted by EPD for more or less stringent outdoor water usages. Prior to the passage of HB 1281, the 2003 state drought management plan required that local water suppliers impose outdoor watering restrictions that were at least as restrictive as the state. Local water suppliers could impose outdoor watering requirements that were more restrictive than the state, as ACC did in 2007. The bill eliminated this flexibility. It did not provide guidelines, funds, or dedicated staffing for EPD to respond to requests from local water providers to implement more or less outdoor water usage.

4. Methods

We drew on qualitative research collected in Georgia during 2007 and 2008 to analyze the relationship between stakeholders’ knowledge of drought and their pursuit of political goals. The case study examined the interactions between ACC’s local government, Georgia’s state government, and the members of the northeast Georgia (NEGA) GGIA. Data were drawn from archival research, observation, and semistructured interviews with the goal of triangulating multiple sources and different historical, behavioral, and attitudinal perspectives to assure the validity of the data collected (Yin 2003, p. 98).

Archival data included newspaper articles, editorials, and letters to the editors from the Athens Banner-Herald (ACC’s local daily newspaper based in Athens, Georgia) and the Atlanta Journal-Constitution (Georgia’s largest newspaper, based in Atlanta, Georgia). Newspaper articles and editorials were compiled using keyword searches for “drought” and “Georgia” from April 2007 to May 2008. Press releases and executive orders from the offices of Governor Perdue and Lieutenant Governor Casey Cagle; EPD publications related to the drought; transcripts of County Commissioner meetings; video archives of mayor and commission meetings; information provided on ACC’s public utilities website; and local, state, and regional drought management policies that impacted ACC from this time period were also compiled and analyzed.

The qualitative researcher conducted direct observations by attending Nega GGIA monthly meetings from October 2007 to December 2008, as well as the GGIA annual meeting in 2008. She also attended and observed ACC commission meetings and special sessions related to the drought. Meeting minutes, communications via e-mail on the NEGA GGIA LISTSERV, and publications developed by NEGA GGIA were also collected.

Finally, 24 semistructured interviews were conducted with representatives of EPD, ACC elected and appointed officials, members of the Upper Oconee Basin Water Authority (UOBWA), and members of NEGA GGIA (see Table 1). Research participants were chosen using purposeful selection, by identifying participants to achieve “representativeness or typicality of the setting, individuals, or activities selected” (Maxwell 2005, p. 89). The snowball method, where research participants identified other potential research participants, was used to expand the interview sample beyond initial contacts (Yin 2003). State and local officials directly involved or influential in water management during times of drought were contacted via e-mail and phone. In ACC, of the 14 people contacted, 10 were interviewed. Obtaining interviews with state officials proved more difficult than obtaining interviews with local officials. Three state-level officials were interviewed: Tim Cash (responsible for overseeing EPD’s drought response), Dr. Carol Couch (EPD director), and State Representative Terry England (author of HB 1281). Publically available information from state officials, such as speech transcripts and press releases, was used to supplement interview data. Interviews with members of the green industry were arranged with the assistance of the NEGA GGIA president. Interviewees were chosen to represent the diversity of that organization’s membership.

A semistructured interview approach allowed for questions to be tailored to reflect the interviewee’s role and affiliation. A specific set of questions were asked, but a level of flexibility was maintained so the qualitative researcher could adapt the line of questioning based on interviewee responses (Dunn 2005). Questions addressed

<table>
<thead>
<tr>
<th>Interview participants</th>
<th>Number of interview participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Georgia officials</td>
<td>3</td>
</tr>
<tr>
<td>Elected</td>
<td>1</td>
</tr>
<tr>
<td>Appointed/career</td>
<td>2</td>
</tr>
<tr>
<td>ACC officials</td>
<td>10</td>
</tr>
<tr>
<td>Elected</td>
<td>8</td>
</tr>
<tr>
<td>Appointed/career</td>
<td>2</td>
</tr>
<tr>
<td>NEGA GGIA members</td>
<td>9</td>
</tr>
<tr>
<td>Nursery wholesalers</td>
<td>5</td>
</tr>
<tr>
<td>Nursery retailers</td>
<td>2</td>
</tr>
<tr>
<td>Landscapers</td>
<td>1</td>
</tr>
<tr>
<td>Irrigation specialists</td>
<td>1</td>
</tr>
</tbody>
</table>
1) development of state and local drought management plans, 2) limitations of the implementation of these plans, 3) community impacts of these plans, 4) state and local government interactions during the implementation of these plans, and 5) the role the green industry in influencing the implementation of these plans. All interviews except one were recorded and transcribed by the qualitative researcher. One interview participant declined to have their interview recorded; instead, detailed notes were taken during the interview. Per Institutional Review Board guidelines, state and local officials were given the option of anonymity. All other interviewees were given pseudonyms.

Initial data analysis consisted of organizing and reducing data using NVivo coding software around the themes of 1) group identity, 2) definition/explanation of problems, 3) perception of other actors or entities, 4) optimal outcome, and 5) scope and direction of influence. All archival material, field notes, personal correspondences, and interview transcripts were analyzed and coded together. The written materials were read through the lens of political ecology to pull out narratives and common themes that arose from the data. All the material was coded using post hoc and ad hoc coding categories. Post hoc coding categories, such as meteorological drought, political drought, and shifting blame from state to local government were developed based on the project’s theoretical framework. Ad hoc coding categories, such as lack of rain, government mismanagement, population growth, and lack of water storage arose based on the reading of the materials. The coding categories were used to determine patterns, similarities, and differences that arose in how knowledges of drought were produced, circulated, and utilized, and the policy implications of these processes.

5. Findings

a. The political ecology of scale in operationalizing drought

Drought declarations in Georgia are made by the EPD and by the governing body responsible for managing local water supplies. Georgia’s statewide drought management plan operationalizes drought and outlines responses to drought declarations. It also requires that all subsidiary water providers develop local or regional drought management plans as a prerequisite for obtaining withdrawal permits. When state and local officials calculate drought severity, they follow their drought management plans. ACC falls under the purview of three drought management plans: the 2003 Georgia Drought Management Plan, the UOWBA Drought Management Plan, and ACC Drought Management Plan.10 The Georgia and ACC drought management plans operationalize drought differently.11 This, in and of itself, is not problematic. State and local approaches reflect different management considerations. Moreover, this represents the coproduction of knowledge of drought. The state and ACC utilize knowledges of drought to reflect their political and management needs. Challenges arise when different drought declarations are made. The members of NEGA GGIA used this production of knowledge at multiple scales to pursue their own political goals (Kohl 2013).

ACC drinking water is drawn primarily from the Middle Oconee River. When the Middle Oconee is too low for safe withdrawals, drinking water for ACC is drawn from its backup source, Bear Creek Reservoir. As stipulated in their drought management plan, ACC operationalizes drought based on the PDSI, streamflow at the Middle Oconee River, and Bear Creek Reservoir levels (Fig. 2). The state of Georgia operationalizes drought within climate divisions. In climate division 2, which includes ACC and 19 other counties in north-central Georgia, EPD measures SPI-3, -6, and -12; streamflows on the Etowah and Chestatee Rivers; and reservoir levels of Lakes Lanier and Allatoona (Fig. 2). None of these locations are directly linked to drinking water supplies in ACC.

While there is much debate as to whether the SPI or PDSI represents a more accurate drought severity index, in this case, it is noteworthy that SPI and PDSI represent different knowledges of drought severity (Guttman 1998). The PDSI quantifies moisture status and SPI quantifies precipitation deficit. Furthermore, PDSI and SPI rely on different climatological and hydrological indices. In certain situations, the PDSI and SPI can lead to different quantifications of drought. For example, during the height of the drought in October 2007, both PDSI and SPI-12 indicated that climate division 2 was “extremely dry,” but SPI-3 indicated that conditions were “severely dry” (Fig. 4). Even greater disparities occurred during the March 2008, when PDSI indicated severely dry conditions, SPI-12 indicated extremely dry conditions, and SPI-3 indicated near-normal conditions...

10 The UOWBA is a consortium of representatives of Oconee County, Jackson County, Barrow County, and ACC (Fig. 2). All four counties depend on Bear Creek Reservoir. The UOWBA regulates Bear Creek Reservoir.

11 The ACC and UOWBA drought management plans operationalize drought in the same way. The difference in the two plans is that UOWBA only sets water usage reduction goals associated with drought declarations but does not indicate how these goals should be met. The ACC plan lays out actions to be taken to meet water reduction goals.
As a result, ACC and the State of Georgia were in a position to issue different drought declarations for the same time period, based on different frameworks they use to operationalize water availability. This is in itself unsurprising. The PDSI and PSI represent different knowledges of drought. What is noteworthy in this context is how these knowledges are circulated and utilized. This impacts how stakeholders know drought, particularly when they are not well versed in the nuances of how drought can be operationalized. It can also have ramifications when

---

**Fig. 4.** (a) SPI-3 drought indicator through the end of October 2007, (b) SPI-12 through the end of October 2007, and (c) PDSI for October 2007 [adapted from the National Integrated Drought Information System (2008a,b)].
these multiple knowledges of drought are utilized to influence policy and water management decisions.

The utilization of multiple knowledges of drought raised management challenges during the course of the 2007–09 drought. For example, during the week ending 12 September 2008, ACC was experiencing a level 2 drought based on the ACC drought management plan’s operationalization of drought. During the same time period, based on Georgia’s drought management plan’s operationalization of drought, ACC was experiencing a level 4 drought. Since ACC was required to have a drought declaration at least as restrictive as that of the

Fig. 5. (a) SPI-3 drought indicator through the end of March 2008, (b) SPI-12 through the end of March 2008, and (c) PDSI for March 2008 [adapted from the National Integrated Drought Information System (2008a,b)].
state, they were required to maintain a level 4 drought declaration. This was the case even though local conditions, which are contingent on the conditions at locations ACC relies on for their drinking water, reflected the necessity for a less stringent drought declaration. In this case, the multiple ways of knowing drought at the local and state level impeded the ability of decision-makers in ACC to manage their water.

b. Knowing drought

The ways we know drought are not limited to the operationalization of drought. They are also influenced by the societal context in which stakeholders make sense of drought. This became evident when interviewees were asked to identify the factors that led to the current water situation. The term “drought” was intentionally not used so interviewees were not biased to climatological conditions. When asked what factors led to the current water situation, all 24 interviewees indicated below-normal rainfall was a significant cause of the drought. Six indicated that meteorological drought conditions were the only cause of the drought. According to EPD Assistant Branch Chief Tim Cash, it was “historic drought. Pure and simple.” For Cash and the other governmental officials who solely indicated climatological causes, they know drought based on historic, place-based, meteorological patterns. In contrast, none of the members of the green industry identified below-average rainfall as the sole cause of the water situation. Instead, they identified nonmeteorological factors such as population growth, increased water demand, limited storage or the need for more reservoirs, lack of conservation, and poor planning as factors that exacerbated existing meteorological drought conditions. Unlike governmental officials, members of the green industry know drought through an interaction between climatological and societal processes.

Eight interviewees identified population growth as a contributing factor to North Georgia’s water shortages. For them, drought was an interaction between human demand for water and available water supplies. ACC Commissioner Doug Lowry summed up these concerns: “drought, exacerbated by development is what it is. It’s a natural phenomenon, the drought, and it’s just made worse by the development...Development itself...that’s fine, but the intensity [of development] here in Clarke [ACC], is really what’s caused the problem.” Population has increased significantly across northern Georgia over the past three decades. ACC’s population increased by almost 50% between 1980 and 2014, from 74,498 to 120,938 (U.S. Census Bureau 2015). When participants identified increased population as a contributing factor to decreased water supplies, they often coupled it with concerns that development has not been accompanied by effective planning. According to one member of the green industry (green industry member #5), “what’s happened over probably the last twenty years, the North Georgia area has rapidly grown, but our infrastructure, i.e., our water supply, has not grown with our infrastructure.”

Another way of knowing drought reflects available water supplies. All the members of the green industry interviewed contended that storage capacity, specifically lack of reservoirs, was a main factor contributing to water shortages. In contrast, only three governmental officials, one of whom is also a member of the green industry, identified lack of water storage as an issue. As one member of the green industry (green industry member #3) recounted, “We met a couple from Bakersfield, CA... So I’m like, ‘How much rain did you get?’ And she said, ‘Well, over the past year, about 7 inches.’ She said, ‘How much did you get?’ I said, ‘Well our drought year was 31 inches,’ and she just laughed she said ‘you know you don’t have a drought problem, you have a water retention problem.’” The cultural context and situated local knowledge of water influenced these two women’s knowledges of drought. For green industry member #3, the circulation across space and time informed her production of knowledge.

Members of the green industry produced and circulated knowledge of drought that reflected the interaction between the operationalization of drought and their socioeconomic context. Just as Burnham et al. (2016) demonstrate with climate change, subjective experiences lead to partial and situated knowledges of drought. For many, their ways of knowing drought were multiple and changed over time. This complexity is reflected in a member of the green industry’s attempt to explain their situation: “The drought, not just the drought but, I guess the dynamics between the drought and the water supply and the shaping of the politics” (green industry member #2). It was at the juncture of shaping politics where the members of NEGA GGIA focused their attention.

c. Changing the societal context: HB 1281

When individuals know drought in different ways, the policy solutions they offer often reflect these ways of knowing drought. For example, for those who know drought as a lack of adequate storage, their policy solution is the building of more reservoirs. For those who know drought as an interaction between population growth and water supplies, their solutions focus on quelling and managing development. The members of the green industry did not have a universal way of knowing drought, nor did they agree on one specific
approach to drought management. What they did agree
on was what they saw as hostile local societal context
within which knowledge of drought was produced, cir-
culated, and utilized.

Prior to the passage of HB 1281, 88% of green in-
dustry members interviewed, but only 20% of state and
local officials interviewed, believed local authorities had
more power in water management decisions (Kohl
2013). This perceived concentration of political power
with the local government was a problem for the mem-
bers of NEGA GGIA. As a member of the green in-
dustry explained, it is “precisely because of ACC that
[HB] 1281 even exists. Because they were being so much
more stringent, restrictive than the state because they, I
think, because they were allowed to be” (green industry
member #6). For the members of the green industry, the
actions of ACC reflected a way of knowing drought that
was antithetical to their own. Additionally, ACC’s ac-
tions created a societal context they believed was hostile
and therefore needed to be changed. They did this
through their pursuit of HB 1281.

While the idea for tying local drought declarations
directly to state drought declarations was not new, the
passage of HB 1281 was remarkably swift. “It really
happened amazingly quickly, it had some resistance,
obviously, from the Association of [Georgia] Water
Professionals, and the county commissioner association
[Association County Commissions of Georgia] and all,
but it dropped... when Gov. Perdue had already come
out and said we need to provide some relief for these
people [green industry]” (green industry member #2).
Moreover, “the green industry was very involved in
getting the bill passed, and they continued to stay in-
volved in the process of the governor signing it, and then
implementation of it” (Terry England). While there was
opposition to HB 1281 primarily from local water sup-
pliers, the Association County Commissioners of
Georgia, and the Georgia Municipal Association, this
opposition was overwhelmed by the “very vocal... in-
volvement, a lot of involvement by the landscaping
industry” (Tim Cash).

Through the passage of HB 1281, the members of the
green industry changed the societal context within which
knowledge of drought is produced, circulated, and uti-
лизed. By requiring local water providers to be tied di-
rectly to EPD’s drought declarations, HB 1281
privileges the knowledge of drought produced at the
broad scale using the criteria determined by the state
drought management plan. Moreover, by routing water
restrictions through the director of EPD, drought is
determined by a single official appointed by Georgia’s
governor rather than by local officials who are, in many
cases, elected by the public.

6. Discussion: The initial consequences of HB 1281

a. The drought of 2011

The implications of the passage of HB 1281 on the
production, circulation, and utilization of the knowledge
of drought became evident during Georgia’s 2011
drought. During the summer of 2011, according to the
U.S. Drought Monitor, southwestern Georgia reached
levels of exceptional drought. Equivalent declarations
of drought were not made by the state. HB 1281 now
prohibited local water suppliers from implementing
more restrictive watering rules than those officially
mandated by the state. Local water suppliers could
request a variance from EPD. Americus, located in
southwestern Georgia, requested such a variance to
protect their local water supply. The request was re-
ceived at EPD on 17 June 2011. A response was not is-
issued until 22 July 2011—35 days after the request was
made. At that time, the request was granted. This 35-day
delay occurred despite the stipulation in HB 1281 that
EPD must respond within 5 days. Other responses by
EPD to variance requests were more rapid, but the case
of Americus indicates that EPD-level oversight can lead
to extended delays in local response to drought in some
circumstances.

In a 2 September 2011 article in the Athens Banner-
Herald on the current drought category in relation to
low rainfall and high temperatures during the preceding
summer, EPD spokesman Kevin Chambers was quoted
as saying that “just because it’s dry out there doesn’t
mean it’s appropriate to go to more restrictive outdoor
watering levels” (Aued 2011). This represents a new
way of knowing drought, one grounded in politics, not in
the operationalization of drought. In that same article,
the state climatologist was quoted as saying that the
summer was the hottest and the eighth-driest in Athens
since record-keeping began; the assistant state clima-
tologist was quoted as saying that an anticipated La Niña
pattern “puts us in a worse situation next year for sure.”
It is interesting to note that four days later, on 6 Sep-
tember 2011, the university-employed state climatolo-
ist and assistant state climatologist of Georgia were
replaced with EPD employees by executive order of the
governor.12

The existence of drought was contested in fall 2011 by
EPD, the agency empowered by HB 1281 to make de-
cisions at all levels regarding drought response. The
assessment of a drought situation by the state climato-
logist and assistant state climatologist, who were

12 The spouse of the second author was the assistant state cli-
matologist of Georgia.
university employees, was also contested publicly by an EPD spokesperson. Replacing a university-based-and-employed state climatology office with EPD officials, who answer to the director of the agency, had the result, intentional or not, of further consolidating the state’s influence on the production, circulation, and utilization of the knowledge of drought.

b. June 2015 regulations

In 2010, Georgia legislators approved the Water Stewardship Act, which was designed to create specific regulations for water use. Initial draft regulations met with “mixed reactions” in March 2015, ranging from “pleased” (Chris Manganiello, policy director of the Georgia River Network, an environmental advocacy organization) to “concerned” (Georgia agricultural interests; Jones 2015a). The regulations were approved in their final form at the end of June 2015 and elicited a mirror image of reactions, with agribusiness interests pleased and environmental interests concerned. Environmentalists’ concerns centered on the multifaceted ways of knowing drought: “‘All drought declarations should be based on scientific criteria. However, this rule does not require use of sound science,’ said . . Manganiello. . . ‘Instead, a drought declaration is ultimately in the hands of an agency director whose decision making may be clouded by politics’” (Jones 2015b). The Georgia Rules and Regulations (2015), as amended, state that the director of EPD shall monitor climatic indicators and water supply conditions as needed to assess drought occurrence and severity, and its impact upon the ability of permittees that are public water systems to provide adequate supplies of water and avoid or relieve local water shortages. Such indicators and conditions may include but may not be limited to the following: (a) Precipitation; (b) Streamflow; (c) Groundwater; (d) Reservoir Levels; (e) Soil Moisture; (f) Short Term Climate Predictions; (g) U.S. Drought Monitor; and (h) Water Supply Conditions.

The lack of reference to SPI, PDSI, Palmer drought hydrologic index (PDHI), or other established drought indices in the document, as well as the repeated use of the word “may,” provide the director of EPD with considerable latitude to declare a drought. This further expands the societal context that privileges the knowledges of drought produced, circulated, and utilized at the state level.

7. Conclusions

Drought, like other environmental phenomena, cannot be understood solely through scientific investigation. Instead, it is coconstituted through the interactions between science, nature, and society. At the science–policy interface, it is necessary to dissolve the boundaries between nature and culture in the production, circulation, and utilization of environmental knowledges (Goldman and Turner 2011; Hulme 2008). In this paper, we demonstrate that for drought this necessitates attention to 1) scale and operationalization of drought, 2) different ways of knowing drought, and 3) the societal context within which these processes occur. Like climate change, the definitional ambiguity of drought and the spatial situated experiences of drought influence how people know drought (Brace and Geoghegan 2011; Burnham et al. 2016; Rice et al. 2015). Unlike climate change, drought can be a short-term, flash-point experience. In the case of the 2007–09 drought, while stakeholders had experienced previous droughts, the policy responses to this drought had economic repercussions for the members of the green industry. While it is unclear what was the cause of these economic influences—solely water management decisions, or more likely, the interaction between the economic downturn due to the recession and water management decisions—during the 2007–09 drought members of the green industry identified drought management policy as the cause of their economic concerns. As we demonstrated, while they possessed different knowledges of drought, they were unified in their epistemology that drought was not solely a climatological phenomenon and the societal context within which political knowledges of drought were being produced had to be changed. Through their successful pursuit of HB 1281, they changed the societal context within which subsequent knowledges of drought were produced, circulated, and utilized.

Through this case, we advocate for the political and academic engagement with the knowledges of drought and other short-term local environmental knowledges. As scientific engagement with drought becomes more sophisticated, policy implications and debates will not simplify, they will become more complex (Pielke 2006; Sarewitz 2004). As was the case in Georgia, multiple knowledges can have policy implications and therefore need to be considered as one component of the science–policy interface. Since knowledge is not produced in a vacuum, it is necessary that research at the interface of knowledge production and policy reflect on-the-ground realities.

Acknowledgments. We thank Nik Heynen, Hilda Kurtz, Andy Herod, Pam Knox, Jenn Rice, and Rachel Will for their constructive comments on this research; Pete Campana for assistance and insights into his research; and Taylor Johnson for his assistance with the maps.
REFERENCES


Georgia Rules and Regulations, 2015: Drought indicators and triggers. Rules and Regulations of the State of Georgia, Department 391, Chapter 391-3, Subject 391-3-30, Rule 391-3-30-04.


Shelton, S., 2007: Perdue: Cut water use 10%; Local utilities must pay up if they don’t meet Perdue’s mandate, but they choose which customers to squeeze. Atlanta Journal-Constitution, 24 October, 1A.

——, 2008: Drought: Perdue relaxes water rules; outdoor use: Pools, gardens, landscapes get a break, but only where local officials agree. Atlanta Journal-Constitution, 7 February, 1A.


