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Coping with scarcity: The construction of the water conservation imperative in newspapers (1999–2018)

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1 **Coping with scarcity: the construction of the water conservation imperative in newspapers**
2 **(1999-2018)**

3
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14 **Highlights**

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17 - We analyze the success story of water conservation as a drought mitigation tool.
18 - We conduct a quantitative textual analysis of press articles published in Arizona.
19 - The press supports water conservation as the main adaptation strategy to water scarcity.
20 - Water conservation is framed as a non-mandatory imperative and as a new lifestyle.
21 - It operates as a consensual solution for the future of urbanization in arid lands.
22

23
24 **Abstract**

25
26 As water-stressed areas are expanding worldwide due to climate change, water conservation has
27 become an important tool for managing water resources in drought contexts. Within a political
28 ecology framework, our research questions the success story of water conservation. To do so, we
29 conducted a quantitative textual analysis of 520 daily local press articles dealing with drought and
30 water issues in Phoenix and Tucson (Arizona, USA). Using two lexicometric software, our
31 analysis traces the rise of the water conservation narrative in the press. Our results show how
32 newspapers can become an instrument of public policies to work towards their social acceptance.
33 Moreover, water conservation is framed as a consensual tool. It reassures that threats associated
34 with water scarcity will be successfully managed to sustain urban growth in arid regions. In this
35 sense, water conservation operates following a logic of fix, in line with the successive hydrosocial
36 fixes that helped the development of arid lands and does not question inherited power structures
37 in water management.
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39 **Keywords:** water scarcity; water conservation; newspapers; discourse; political ecology
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42 **1. Introduction**
43

44 According to the World Meteorological Organization (2016; 2020), on a global scale, the
45 part of lands affected by severe droughts has doubled between the 1970s and 2000, and five times
46 as many territories could experience extreme droughts in 2050. Scientists thus predict an increase
47 in aridity: on one hand, in the drylands, the water deficit is worsening; on the other hand, the arid
48 climate zone tends to expand and could cover half of the Earth's surface by the end of the 21st
49 century (Huang *et al.*, 2017). By 2050, with a global climate warming of 1.5°C, 178 million people
50 are projected to live in drylands highly vulnerable to water stress and intense droughts (IPCC,
51 2020).

52 In this context, multiple studies have questioned how droughts are represented in the media,
53 and especially in newspapers (Changnon and Easterling, 1989; Haughton, 1998; Degaetano, 1999;
54 Sonnett *et al.*, 2006; Tänzler *et al.*, 2008; Bell, 2009; Paneque Salgado and Vargas Molina, 2015;
55 Madruga de Brito *et al.*, 2020). The press continues to play a key role in informing the general
56 public about environmental issues (Boykoff and Boykoff, 2007; Boykoff, 2009; Bohensky and
57 Leitch, 2014; Comby *et al.*, 2014). Indeed, if we consider risks communication (Wakefield and
58 Elliott, 2003), drought raises a particular challenge as it is a slow onset hazard that does not
59 necessarily attract the direct attention of event-oriented media (Wilkins and Patterson, 1990;
60 Sonnett *et al.*, 2006), but also because it is the object of competing definitions (Whilite and
61 Glantz, 1985; Lloyd-Hughes, 2013; Wilhite and Pulwarty, 2017). Because of competing
62 understandings of drought - an event diffused in time and space that affects different types of non-
63 human (i.e., meteorological, hydrological, agricultural, and ecological drought) and human (i.e.,
64 socioeconomic drought) actors with different levels of intensity-, it is of utmost importance to
65 understand the discursive and thus the socio-cultural context in which meaning is given to this
66 phenomenon (Greene, 2021).

67 To discuss how newspapers shape the definition of drought and display the problems that
68 drought represents, many scholars have adopted a Foucauldian approach (Foucault, 1972; 1980)
69 focusing on the politics of environmental discourses (Hajer, 1995; Dryzek, 1997) and inspired by
70 the critical discourse analysis (Fairclough, 2001; Richardson, 2007). This approach considers
71 discourses as they operate as “knowledge regimes” (Adger *et al.*, 2001), the making of which
72 implies power struggles so that one discursive configuration can gain dominance over the other.
73 Understanding how media discourses prioritize certain perspectives and understate others is indeed
74 critical as media coverage has the potential to amplify or attenuate risk issues and therefore
75 influence public perception (Kasperson *et al.*, 1988; Church *et al.*, 2017, Flint *et al.*, 2019).

76 In this perspective, understanding the construction of a dominant discourse makes it
77 possible to elucidate the political choices associated with it, in our case the range of solutions
78 available to mitigate or adapt to environmental risks, implemented through particular public
79 policies and institutional arrangements (Hajer and Versteeg, 2005; Rinne and Nygren, 2016).
80 Previous research on drought discourses has focused on the importance of documenting the
81 framing of drought as it influences public perceptions, decision-making, and practices. Our
82 research proposes to reverse the approach and i) to focus on how media discourses frame solutions
83 to environmental issues and ii) to unveil the “complex webs of interests, ideologies, and power”

84 (Molle, 2008: 132) at the origins of the emergence of such solutions. Following a political ecology
85 approach, in that it focuses on discourses as revealing asymmetrical power relations (Adger *et al.*,
86 2001; Svarstad and Benjaminsen, 2017; Parks, 2018) and tackles the questioning of scientific
87 arguments mobilized in the implementation of environmental public policies (Forsyth, 1996; 2003;
88 Kull, 2004), we propose to look at the solution that is now favored worldwide as the main tool for
89 drought mitigation: water conservation, i.e. the reduction in water loss and water use through
90 mainly demand-management (March *et al.*, 2013; Maggioni, 2014; Vickers, 2017). Water
91 conservation has been indeed gaining momentum over water supply management strategies, such
92 as reservoirs building, inter-basins transfers, new technologies (i.e., desalination) or non-
93 conventional water resources (e.g., greywater and rainwater uses). How to explain the success
94 story of water conservation, from a notion coined by experts belonging to the technical and
95 academic world to a notion that can now be found on every street corner, especially in American
96 desert cities (Figure 1)? How did this notion become an imperative rarely challenged, even though
97 it relies on the efforts of individuals, who are made responsible for the imbalance between water
98 supply and demand?

99 Our objective is to retrace the construction of the water conservation narrative, defined as
100 a “social construction about a specific case [i.e., drought mitigation]” (Benjaminsen and
101 Svarstad, 2008, p.51) to understand how it has become a dominant strategy since the early 2000s.
102 Water conservation corresponds to a shift from highly centralized water management dominated
103 by experts (Gleick, 2002) to the integration of multiple stakeholders, and in particular of water
104 users asked to reduce their water uses (Brooks, 2007; Brooks and Holtz, 2009). Thus, the
105 implementation of water conservation aims largely at changing people’s behavior regarding water
106 consumption and relies strongly on public outreach and participatory awareness campaigns
107 (Wutich *et al.*, 2014; Liang *et al.*, 2018; Boyer *et al.*, 2020). For example, water providers can
108 directly mobilize the local newspapers in which advertisements are published encouraging users
109 to monitor their consumption (Howarth and Butler, 2004). In this regard, it has been shown that
110 inhabitants well informed through news media tend to enact conservation behaviors (Dolnicar *et al.*
111 *et al.*, 2012; Quesnel and Ajami, 2017; Moglia *et al.*, 2018). In this paper, we focus instead on what
112 is said about water conservation, and by whom, in the press, as it is a dimension of the public
113 sphere (Habermas, 1974; 1989), a deliberative space that potentially engages opposing viewpoints
114 that affect civic and community life. We seek to pay closer attention to what different actors want
115 to see happen, in pursuit of which goals and by which means (Rinne and Nygren, 2016).

116 We analyzed the water conservation discourse in local daily newspapers published in
117 Phoenix and Tucson (Arizona, USA). Both cities constitute key study sites for examining the
118 profound consequences of climate change on water resources in arid lands (Bolin *et al.*, 2010;
119 Zuniga-Teran and Staddon, 2019). As they are tackling global changes effects on already over-
120 allocated water resources, Phoenix and Tucson can be considered as laboratories where technical
121 and political responses are first elaborated that may be of interest to other cities facing similar
122 problems (Megdal and Forrest, 2015; Hondula *et al.*, 2019). In those two desert cities, drought has
123 become the dominant environmental explanation (Forsyth, 2003) to water scarcity issues and water

124 conservation has become a “nirvana concept” – a concept quickly integrated into public policies
125 that represent a source of satisfaction for most of the stakeholders (Molle, 2008) – as it lies at the
126 core of Arizona’s strategy to reassure that threats associated to drought will be successfully
127 managed to sustain growth in this booming region of the U.S. (Hirt *et al.*, 2008; 2017). Based on
128 a corpus of 520 articles published between 1999 and 2018 in the *Arizona Republic* (Phoenix) and
129 the *Arizona Daily Star* (Tucson), this research proposes a quantitative textual analysis of the water
130 conservation narrative.

131 To understand how water conservation was constructed in the press as a consensual
132 imperative for coping with water scarcity, we address three main questions: i) how much attention
133 does water conservation get in the press when it comes to water and drought issues? ii) who are
134 the actors involved when it comes to promote water conservation through newspapers and what
135 are their relationships (conflictual vs. cooperative)? iii) as water conservation remains a difficult
136 concept to define (Baumann *et al.*, 1984; Butler and Memon, 2005; Brooks, 2006), which
137 interpretation does the press contribute to making as dominant?

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142 2. Materials and methods

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144 2.1 Water conservation in Arizona desert cities

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146 Global changes have already profound consequences for the climate of the American
147 Southwest and its over-allocated water supplies. As a result, the region is a key site for exploring
148 ways to manage worsening droughts and pressures on water resources, especially in urbanized arid
149 lands (Bolin *et al.*, 2010; Hondula *et al.*, 2019).

150 Phoenix and Tucson in Arizona are amongst the fastest growing cities in the United States
151 (Benites-Gambirazio, 2016; US Census, 2019). Located in the arid Sonoran Desert, their growth
152 is closely tight to the availability of water supplied by local aquifers and large infrastructures
153 (dams, aqueducts, canals) built during the 20th century in the Colorado River Basin (Kupel, 2003)
154 following a Promethean and extractivist approach to natural resource development (Worster, 1985;
155 Sheridan, 2012) (Figure 2). In Arizona, the water conservation imperative was first formalized in
156 1980 through the Groundwater Management Act (GMA), considered at the time as a leading
157 innovation. The law, by defining objectives for the sustainable management of groundwater – then
158 Arizona's main water supply – changed the state's relationship to water resources (Connall, 1982;
159 Jacobs and Holway, 2004; Poupeau *et al.*, 2016). Groundwater is since then considered a non-
160 renewable resource to be protected. The Colorado River water transported by the Central Arizona
161 Project (CAP) has however become central as it is classified as a renewable water resource (Bernat
162 *et al.*, 2020). The GMA created a new state water agency, the Arizona Department of Water
163 Resources (ADWR), which supervises five Active Management Areas (AMAs) in which all uses
164 of groundwater are quantified and regulated. This law places water demand management at the

165 core of its objectives and defines an ambitious water conservation program to be carried out by the
166 various users of the resource in Arizona, to limit and eventually eliminate pumping from the
167 aquifers (Colby and Jacobs, 2007).

168 The conservation goals are set at the scale of the AMA where decennial management plans
169 provide requirements and guidelines. We will focus here on municipal water uses in Phoenix and
170 Tucson AMAs. As early as 1984, the first management plan required a “reasonable reduction in
171 per capita use” with a threshold of 140 gallons per person per day. It presented the following
172 guidelines for undertaking demand management (Phoenix AMA, 1984; Tucson AMA, 1984):
173 restriction of water deliveries to “turf-related facilities” (e.g., sports fields; golf courses); the
174 prohibition of groundwater delivery for large private swimming pools and large private
175 recreational ponds or lakes; the need to reduce leaks and water loss in local distribution systems;
176 the need to implement efficient irrigation practices (e.g., drip irrigation, irrigation controllers);
177 need to promote the planting of low water use vegetation; need to support low water use plumbing
178 devices development (Phoenix AMA, 1984; Tucson AMA, 1984). The most recent documents
179 (Phoenix AMA, 2016; Tucson AMA, 2016) organize water conservation around three main axes:
180 i) reducing per capita water consumption; ii) encouraging the use of best available water
181 conservation practices; iii) maximizing the efficient use of all water supplies. Finally, the
182 documents highlight that public information and education programs are essential to the success
183 of urban water conservation programs. As the ADWR and most municipal water utilities like to
184 point out, Arizona's major cities have seen their populations grow steadily while the amount of
185 water use per capita has declined. For example, from 267 gallons per capita per day (GPCD) in
186 Phoenix and 168 gallons GPCD in Tucson in 1984, these figures have decreased to 202 and 130
187 gallons respectively in 2015 (Tucson AMA, 1984; 2016; Phoenix AMA, 1984; 2016). This gradual
188 decrease in municipal water consumption can be explained by municipal landscaping (i.e.,
189 xeriscaping programs) and plumbing ordinances (e.g., install reduced-flow plumbing fixtures)
190 adopted in the 1980s and 1990s and extensive information and education campaigns regarding
191 drought and conservation in the 1990s and 2000s (Larson *et al.*, 2009; Hirt *et al.*, 2017).

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193 2.2. A corpus of articles from the regional daily press

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195 We examine discourse patterns regarding water conservation through analyses of articles
196 published in Arizona's two major newspapers, namely the *Arizona Republic* and the *Arizona Daily*
197 *Star*. The *Arizona Republic*, based in Phoenix, is owned by Gannett Company and is the state's
198 main newspaper. From a daily circulation of 574,798 in the early 2000s (Sonnett *et al.*, 2006), the
199 *Arizona Republic* is today down to an average of 130,000 daily copies in a region - Central Arizona
200 - with a total population of over 4 million. However, it is important to note here that its digital
201 version is regularly consulted by many subscribers. General readers can consult for free up to five
202 articles a month. Since its inception in 1890, the newspaper has consistently supported Republican
203 candidates until the 2016 presidential election, when it ran in favor of Hillary Clinton. Based in
204 Tucson, the *Arizona Daily Star*, now with an average daily circulation of 106,436, covers the
205 Southern Arizona region with a population of 1,3 million. The newspaper was founded in 1877 by

206 L.C. Hughes, an elected Democrat who became the 11th governor of the Arizona Territory in the
207 late 19th century. The editorial line of the newspaper has always been closer to the Democratic
208 party. Both newspapers have environmental journalists covering local and regional issues, and
209 reporting on events triggered by weather conditions (e.g., drought, extreme heat, heavy rain, and
210 flash floods). The analysis of the local press makes it possible to assess what is considered
211 newsworthy (Dispensa and Brulle, 2003): what kind of events (natural hazards or management
212 decisions) are likely to interest readers.

213 The political divergences mentioned above does not significantly impact environmental
214 coverage as both newspapers contribute to re-affirm perceptions about the necessity of growth for
215 political and economic reasons (Christopher, 2008; Poupeau *et al.*, 2016). However, Phoenix and
216 Tucson face two different hydro-geographic situations: located at the confluence of several local
217 watersheds, Phoenix has access to a more diversified water resource through the Salt and Verde
218 River hydraulic system; Tucson's supply, in the Santa Cruz watershed, relies on water from the
219 Central Arizona Project for more than 80% and is directly threatened by shortages on the Colorado
220 River (Megdal and Forrest, 2015). How newspapers reflect on drought and water issues depends
221 less on their political inclinations than on the importance of regional particularities in terms of
222 water resources.

223 Our study period begins in January of 1999 and ends in December 2018. January 1999
224 corresponds to the eve of the intense drought which has shaped the last 20 years in the Southwest
225 and before public awareness of drought began to grow, especially from 2002 onwards (Sonnnett *et*
226 *al.*, 2006). We consulted online databases ProQuest and Access World News. To focus on how the
227 emergence of severe drought has affected perceptions of water and decisions on water issues in
228 Arizona, we identified news article through keyword searches and selected all articles containing
229 the term "water" (main subject) along with "drought" (all text). These keywords allowed us to
230 collect a sufficiently large number of articles that show a diversity of objects, situations, and
231 problems reported in the press. We had previously tried more targeted queries (e.g., "water
232 +conservation") which left out too many articles. A total of $N=520$ articles published between
233 January 1999 and December 2018 were identified. This corpus has a total of 622,126 words. The
234 distribution of articles through time is uneven (Figure 3), with peaks corresponding to periods of
235 severe drought. The first peak corresponds to the period of a severe to extreme drought affecting
236 more than 80% of Arizona between 2002 and 2005; after a year of relief in 2006, 70% of Arizona
237 is then under a severe drought alert until 2008 (according to the U.S. Drought Monitor¹); the second
238 peak (2014-2018) corresponds to the prolonged drought effects on Lake Mead, the principal
239 reservoir supplying the region (Figure 2), reaching a low level and threatening water users with a
240 shortage. The year 2018 is marked by the Drought Contingency Plan (DCP) negotiations, overseen
241 by the US Bureau of Reclamation (USBR) with the goal of establishing a regional and long-term
242 drought strategy.

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244 *2.3 Data analysis*

¹ See US Drought Monitor's data for Arizona here: <https://www.drought.gov/states/arizona>

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First acquired in pdf format, we formatted the 520 articles for analysis with two open-access software allowing quantitative textual analyses (Lebart *et al.*, 1998; 2019): IRaMuTeQ (Ratinaud, 2009; Chaves *et al.*, 2017) and TXM (Heiden, 2010). They both work in relation to the R software (R Core Team, 2018) which enables different processing and statistical analysis of texts. IRaMuTeQ and TXM both provide pre-processing tools such as lemmatization (i.e., grouping inflected forms together as a single base form) or the calculation of word frequency in the corpus. In contrast with content analysis or with a qualitative study of texts, the quantitative textual analysis allows the interpretation phase to be performed after the procedure, following an explanatory sequential mixed method. IRaMuTeQ and TXM both allow users, with just one click, to return to the text in order to observe the actual occurrences in context, and thereafter to construct qualitative interpretations.

IRaMuTeQ divides the corpus into text segments (i.e., segments of homogeneous size while respecting as much as possible the structure of the language, clauses or whole sentences of 40 words on average) and performs a top-down approach for hierarchical clustering as developed by Reinert for his ALCESTE method (1983; 1990) to analyze the corpus's lexical structure (Cottet *et al.*, 2015; Comby *et al.*, 2019; Adam *et al.*, 2020). Developed since the 1980s, the classification algorithm has proven robust. It produces a dendrogram displaying a certain number of clusters and specifying the percentage of text segments in each cluster. The clustering tree is inductive and proceeds directly from the data. Each cluster is associated with a list of lemmas ranked according to their Chi-squared values, from the highest scores on top of the list to the lowest (to express the strength of the link between one lemma and the cluster) (Marpsat, 2010). Each cluster can then be run through a similarity analysis. This calculation is based on graph theory and more specifically, on the Fruchterman-Reingold algorithm (1991) using co-occurrences. It aims at studying proximity and relationships between components (the lexical forms) of a set (the considered cluster) using a maximum tree (Ratinaud and Marchand, 2012).

If the top-down clustering reveals the main “lexical worlds” structuring the entire corpus, the similarity analysis shows a given cluster's internal organization.

Both these statistical treatments rely on the co-occurrence analyses of specific lexical forms (Lebart *et al.*, 1998). Through TXM, we conducted a more detailed analysis of all the co-occurrences happening throughout the corpus, for different text sections of different lengths. Moreover, TXM offers tools to apprehend the diachronic dimension of the corpus's textual content and allows full-text search techniques. This allows for retracing the emergence and the evolution of narratives, as they describe changes in public perceptions of water scarcity issues (Molle, 2008; Whitfield *et al.*, 2015; Leong, 2021). In the results part below, we combine these quantitative analyses with a qualitative approach thanks to different quotations. We retrieved most quotations thanks to TXM's “concordances” function that makes it possible to perform a query on a “pivot” word which allows a content analysis of what precedes and follows a term or expression.

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3. Results

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3.1 The growing importance of the water conservation narrative

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The agora of the regional daily press is highly sensitive to local concerns and provides insight into issues over time (Spencer and Triche, 1994; Comby *et al.*, 2014; 2019). Thus, with the newspaper corpus, we can examine the process through which narratives are constructed to understand why environmental policies end up assuming a particular shape (Roe, 1994; Lockwood, 2011). In the corpus, the lemmas “conservation” (n=709), “conserve” (n=223) and “save” (n=278) appear 1,210 times. Figure 4 shows how the use of the lemmas “conservation” and “save” evolves between 1999 and 2018 throughout the corpus. We observe a particularly strong progression of the term “conservation” between 1999 and 2007: from a single occurrence of the word “conservation” in 1999, we count 112 in 2005 – the peak year for the word “conservation” in the corpus – and then 60 times in 2007. The progressive entry into a period of drought from 2002 onwards lies in the background of this increase. In March 2003, Arizona Governor Janet Napolitano (Democrat; 2003-2009) launched the Arizona Governor's Drought Task Force, bringing together water managers and members of the local legislature. In 2004, their work led to the publication of the *Arizona Drought Preparedness Plan*, which created the Drought Interagency Coordinating Group providing the Governor with twice-yearly reports on the status of drought and water resources. Starting in 2004, the drought and the Arizona Governor's actions brought to the forefront the water conservation measures recommended by the Groundwater Management Act and the Active Management Areas management plans, which had been relatively ignored until then.

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The top-down method for hierarchical classification shows how two main poles structure the clustering tree: i) the first emphasizes water management (Clusters 1; 2; 3; 6); ii) the second is organized around biophysical issues associated with the availability of water resources (Clusters 4 and 5) (Figure 5).

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Within these two overarching poles, clusters are assembled into subgroups.

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Among the clusters centered on management issues, clusters 3 (“mead”; “cap”; “colorado”) and 2 (“interior”; “secretary”; “state”) form a subgroup as they are both tackling water management at the level of the state of Arizona and of the entire Colorado River Basin through large-scale hydraulics. Each corresponds to a different facet of water management. Cluster 3 corresponds to the empirical and technical dimensions of water management in the Colorado basin to avoid a shortage: “foot”; “acre”; “shortage”. Cluster 2 refers to the political aspect (“agreement”; “deal”; “negotiation”) of water management.

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Clusters 6 and 1 are related to the implementation of water policies at the local level as it involves local actors (cluster 6: “public”, “director”, “group”) and affects local development orientations (cluster 1: “groundwater”, “pump”, “well”, “county”). They also articulate two

325 different aspects of water governance. Indeed, cluster 6 focuses on the governance aspect of water
326 management at the local level (public policies, relations, and cooperation with other actors such as
327 universities, institutes or associations). Cluster 1 focuses on the operational side, especially
328 through land-use planning, and the challenge of water resource scarcity in the context of rapid
329 urban growth. It shows a tension between residential and municipal uses (“city”; “home”) and
330 agricultural uses (“farm”; “crop”; “rural”).

331 Finally, the clusters that address biophysical issues are divided into two sub-themes.
332 Cluster 5 relates to the observation and measurement of climatic and meteorological events
333 (“winter”; “snow”; “runoff”) that condition the availability of the water resource. Cluster 4 is more
334 concerned with the water needs of ecosystems (“fish”; “canyon”; “tree”).

335 This top-down classification highlights an opposition between two visions of water
336 management: 66.1% of the text segments see it as a techno-managerial issue, handled by large
337 technocratic institutions; 33.9% see it much more from the perspective of environmental protection
338 and of scientific attention to climate change. We note that the word “conservation” does not belong
339 to the environmental lexical world in the corpus but rather strongly contributes to characterize
340 cluster 6. This lexical cluster focuses on water conservation as a management tool. It contains the
341 main elements of the demand management toolbox: a set of public policies (“public”; “policy”)
342 that gives rise to information dissemination and environmental education campaigns (“campaign”;
343 “education”) and that aims to transform individual practices (“person”) in order to implement
344 environmentally acceptable options for water management. 18.9% of the corpus’s text segments
345 deal directly with water conservation as a new strategy for water management. According to this
346 graph, with 18.9% of the text segments, it is the second most important theme structuring the
347 corpus (after climate considerations in cluster 5).

348

349 *3.2 Collective efforts towards innovative solutions?*

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351 *3.2.1 A diversity of stakeholders*

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353 According to the results presented above, the inclusion of new actors in water
354 management contributes strongly to the characterization of water conservation practices. Figure
355 6 therefore shows the actors who appeared more than 100 times in the local newspapers' articles
356 dealing with water and drought. There is a strong domination of governmental actors, at the
357 federal, state, county and city levels. The world of science is also important, through the mention
358 of universities, scientists, researchers and especially hydrologists. Two major types of large-
359 scale water consumers are well represented: farmers and developers. We also note the
360 importance of inhabitants and their individual water consumption through the occurrences of
361 “resident”, “homeowner” and “family”.

362 To analyze more precisely the set of actors involved in water conservation, and especially
363 the roles they can play, Figure 7 shows the graph of the similarity analysis based on cluster 6.
364 This tree clearly shows the four major actors of conservation: the ADWR which provides the

365 general framework (“resources”-“department”); the municipal level which represents the scale
366 at which public water conservation policies are implemented (“city”); different types of groups
367 which are concerned by the measures (“group”) and finally the individual scale (“person”).

368 We see that the theme of water conservation is linked to strong words like “force”, “act”,
369 “effort”. It requires the implementation of creative solutions as shown by the frequent co-
370 occurrences of “conservation” with “create” and “idea”. The figure also highlights the issue of
371 financing water conservation programs: “money”, “fund”.

372 The network of words around “resource” indicates on the one hand the existence of a
373 “problem” and a “crisis” whose stakes would be “growth” and “development”, but also mentions
374 the need to put in place “solutions”. This part of the graph highlights a collaboration between
375 public actors and universities.

376 The network that takes shape around the word “city” translates to the existence of an
377 “issue” that is open to discussion in the deliberative instances mentioned: “council”; “board”.
378 The lexical fields of the question and the proposition dominate, as both can be submitted to the
379 civic debate.

380 The co-occurrences of the word “group” show two kinds of groups involved in water
381 conservation: on the one hand, those concerned with environmental issues, associated with the
382 presence of strong verbs such as “fight”, “protect”, “support”; and, on the other hand, groups
383 with business-related interests.

384 Finally, the branches formed around the co-occurrence of “conservation” and “person,”
385 indicates not only the importance of the individual scale but above all the extent to which the
386 issue is that of a change in mentalities: “change”; “know”; “think”; “live.” It is interesting to
387 note that the word “future” stands out, setting a vision of a horizon that individuals and
388 communities should strive to reach.

389

390 3.2.2 *From conflictual to cooperative relations?*

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392 The qualitative analysis shows that the corpus includes the mentions of more than 15
393 environmental organizations. Among the most frequently mentioned, we find the Sierra Club,
394 followed by the Center for Biological Diversity and The Nature Conservancy. The relationship
395 between associations and other stakeholders is expressed in two ways. The first, conflictual, has
396 ancient roots and aims to denounce the environmental impacts of large hydraulic infrastructures.
397 For example, in 2002, for the 100th anniversary of the U.S. Bureau of Reclamation in charge of
398 developing the arid west since the beginning of the 20th century, a journalist writes in the *Arizona*
399 *Republic* (06/17/2002): “not everyone will be celebrating the agency's work tonight. Activists from
400 more than 80 environmental groups have planned a counter-event to protest what they believe is
401 a legacy of ecological neglect at best and wholesale destruction at worst.”

402 The other dimension however is that of cooperation, as this extract from an article
403 presenting the USBR’s *Colorado River Basin Water Supply and Demand Study* in 2012
404 illustrates: “The report includes four scenarios for dealing with the shortage. One, offered by the

405 *states and water users, relies on large-scale projects such as pipelines to complement conservation*
 406 *and reuse in filling the gap. Another, presented by environmental groups, favors conservation,*
 407 *storing water in an aquifer above Lake Powell and relatively low-energy desalination of brackish*
 408 *groundwater. The other two scenarios either combine those proposals or use their points of*
 409 *overlap” (12/13/2012, AZ Republic). This last extract shows the participatory and integrated*
 410 *management dimension of water conservation. Compared to the excerpts from the early 2000s,*
 411 *there has been an evolution of water management from a highly conflictive field to the inclusion*
 412 *of and collaboration with environmentalist groups in decision-making.*

414 3.3 Promoting a water conservation lifestyle

416 This final part of the analysis looks at the framing of water conservation across the entire
 417 press corpus. Table 1 shows the most frequent co-occurrences of the word “conservation”. This
 418 table describes water conservation primarily as an incentive strategy (“promote”; “encourage”;
 419 “push”) that involves communication (“message”; “campaign”) and education efforts.
 420 Furthermore, we see in Table 1 that the terms “ethic”, “culture” and “lifestyle” are frequent co-
 421 occurents of conservation. The government of J. Napolitano originated this rhetoric of water
 422 conservation as a new “lifestyle” that still prevails today: “*we need to develop that culture of*
 423 *conservation (that Gov. Janet Napolitano has urged)” says an Arizona Republic’s article on*
 424 *08/28/2005 (see also the weight of “napolitano” in Figure 5, cluster 6). The ambition, and even the*
 425 *challenge, of water conservation lies in changing the habits and practices of the inhabitants towards*
 426 *water. Indeed, for decision-makers, it seems very important not to alert, nor to frighten. Their goal*
 427 *is rather to propose a new model and convince individual water users that conservation is*
 428 *preferable: “saving water is also a lifestyle change for many people. It requires many to*
 429 *consciously change their habits. It takes a strong leader to coax those changes from voters who*
 430 *like wide, green lawns or long, hot showers” (AZ Republic, 07/01/2005). As shown by this excerpt,*
 431 *there is a dimension of social acceptance, and more broadly a political stake tied to the proposal*
 432 *of water conservation.*

433 Table 1 also shows that the word “specialist” appears in third position in the list of water
 434 conservation’s co-occurents. Indeed, the carriers of this message are the water conservation
 435 specialists who work for the water utilities at the municipal level. Their main task is to implement
 436 demand-management measures on the technical (leak management, water use data processing) and
 437 social sides (information, education) (Hamilton, 2013). Our press corpus presents 40 interviews
 438 conducted with water conservation specialists.

439 Surprisingly, Table 1 presents both the words “voluntary” and “effort” but also the words
 440 “mandatory” and “imposes” which are completely opposite. A query around the term “mandatory”
 441 in the TXM concordances function shows that if the word is totally absent from the corpus in 1999,
 442 2000 and 2001, it appears 9 times in 2002, 11 times in 2003, then 17 times in 2004 to drop to 5
 443 times in 2005. Between 2008 and 2015, in a period of respite from drought conditions, the word
 444 is no longer mentioned. We can see that the word “mandatory” refers 41 times to the fact that
 445 water conservation measures are not mandatory. For example, in August 2002, a water district

446 office manager in North Phoenix tells the *Arizona Republic*: “All we can do is beg and plead for
447 people to stop watering lawns. District bylaws don’t allow mandatory restrictions” (08/23/2002).

448 Actually, the word “mandatory” refers only 24 times to the fact that water conservation
449 measures are mandatory, including in California, in Southern Nevada, in Colorado, in Flagstaff in
450 Northern Arizona, and once in Oro Valley, a suburb of Tucson in 2007. Indeed, throughout the
451 corpus, “mandatory” measures are seen as very negative and limiting. In the following excerpt,
452 mandatory water conservation measures lie among the “disasters” - between water shortages and
453 ravaged farms - that could affect Arizona residents as an effect of the drought: “Climate experts
454 say even a reasonably normal winter could ease the drought’s effects, but a dry one, on top of all
455 the other dry ones, would trigger new disasters: water shortages, mandatory conservation, ruined
456 farms and ranches, despoiled forests and wildfires” (01/19/2003, AZ Republic).

457

458

459

460 **4. Discussion**

461

462 *4.1 Water conservation: for the seek of the common good*

463

464 The analysis of media discourse has proven quite efficient in reconstructing discursive
465 trajectories and political strategies associated with them (Burke *et al.*, 2015; Duffy, 2016; Comby
466 *et al.*, 2019). Indeed, news media coverage of natural risks often follows regulatory events and
467 political actions (Hurlimann and Dornicar, 2012; Wei *et al.*, 2015). Since the early 2000s and the
468 political reaction of Gov. Janet Napolitano to the 2002 drought, water conservation has gradually
469 become the watchword for water decision-makers in Arizona as they are confronted with rapidly
470 declining reservoirs and uncertainty about long-term water supplies. The media’s interest for
471 politics and policies can be interpreted as following two different logics. First, it works within an
472 Habermasian realm which considers the press as supposed to “support reflection and value on
473 policy choice” (Baker, 2002: 148) and to support the search for a general agreement on common
474 good (Benson, 2009). Second, as discourses embody power in the way they help make people
475 more compliant and governable (Foucault, 1980), we can push the interpretation further and
476 conclude that the importance of political decisions in the newspapers can be explained by their
477 reliance on government information sources but also by the need to govern the population, and
478 thus to convince it of the validity and legitimacy of the decisions taken. The press becomes an
479 instrument of public policies and their social acceptance.

480 Consistent with the results of studies conducted by Sonnett *et al.*, (2006) or Addo *et al.*, (2019),
481 most of the sources quoted in our daily press corpus are official sources, especially from
482 government at different levels (federal, state, county, city) and from universities. They correspond
483 to “meaning-making institutions” (Browne and Keil, 2000) that contribute to set narratives with
484 the ability to be realized, not because of the “correctness of [their] assumptions” but because of
485 the power position of those communicating (Whitfield *et al.*, 2015: 134). These protagonists have
486 enough legitimacy and credibility to present themselves as the protectors of a sustainable and

487 responsible development and, most importantly, to define what is common good and to closely
488 associate water conservation with it. Finally, in doing so, they are also able to construct as
489 ignorance the failure to behave accordingly to their definitions (Cher, 2019).
490 The importance of the vocabulary of the “lifestyle” or of the “cultural change” that is required with
491 water conservation shows that the challenge is to modify city dwellers’ habits. Acculturated by
492 this new narrative of Arizona’s desert cities as champions of water conservation, residents are
493 more likely to be gradually convinced that they must change their habits. The objective is to shape
494 a reasonable water user, following the principle of the eco-citizen. The success of the water
495 conservation lifestyle is therefore largely based on the individual scale and the involvement of
496 individuals who must be convinced, without being frightened. Implementing the water
497 conservation lifestyle allows to achieve two objectives: i) postpone or avoid the risk dimensions
498 (i.e., water shortage) associated with the drought; ii) continue to sell the quality of life that makes
499 the region attractive, promoted as a lifestyle destination since the 1920s (Hirt *et al.*, 2008; Schipper,
500 2008; Sheridan, 2012). However, this strategy helps individualizing responsibility for the current
501 ecological crisis. The guilt-inducing small gestures imperative makes it indeed possible to avoid
502 questioning the viability of limitless capitalist urbanization in the desert (Davis, 2002; Boyer *et*
503 *al.*, 2020; O’Neill and Boyer, 2020).

504

505 4.2. *A process of depolitization*

506

507 With water conservation, it seems that the logic of adaptation takes precedence over that of
508 mitigation of global environmental changes. In a sense, the actors seem to have given up discussing
509 the chosen development models (e.g, mega oasis cities in the desert) that strongly contribute to the
510 imbalance between water resource availability and demand. Given the emphasis in the press corpus
511 on biophysical issues (Clusters 4 and 5) that condition the availability of the water resource, the
512 problem of water scarcity is presented as a natural phenomenon in Arizona. First, this natural fact
513 is the one of aridity which characterizes the region, the Sonoran Desert. Second, the “natural”
514 phenomenon which explains the difficulties faced by water managers in the 21st century is more
515 and more – since the 2010s – presented as climate change. Thus, our results highlight clearly how
516 water scarcity is explained primarily by natural causes. Such an observation is in line with the
517 work of K. Bakker (1999; 2000) in the United Kingdom and especially M. Kaika (2003) in Greece,
518 which has shown that drought has served as “the 'ferment' for (...) political-economic
519 transformations” (p.919) towards a more neoliberal direction (Edwards, 2013).

520 This discourse, which places great emphasis on “natural” factors and climate change, borrows
521 from the typical “blame it on nature” rhetoric identified by E. Swyngedouw (2011) in other case
522 studies with similar large water infrastructures projects (e.g, Spain; Ecuador). This rhetoric aims
523 to legitimize and make socially acceptable the political and economic orientations chosen for water
524 management, which very often take the form of hydrosocial fixes (Swyngedouw, 2013). According
525 to E. Swyngedouw, a hydrosocial fix is achieved through the displacement of water resource
526 management from an arena that has become conflictual (i.e., water supply management) to the

527 point of slowing down the processes of accumulation, production and consumption to new political
528 spaces (i.e., the ones framing demand management) for water resources management issues. It is
529 therefore a question of adapting the system each time and reproducing “a development trajectory”
530 (Swyngedouw, 2013: 262). Demand management allows indeed for a scalar fix (Smith, 1984;
531 Brenner, 1998; Harvey, 2001; Cohen and Bakker, 2014) since the solution envisaged consists of
532 changing scales, from national and regional scales to a local (municipality) or even micro-local
533 scale (home; individual). Molded with environmental concerns on the preservation of resources,
534 water conservation also operates as a socio-ecological fix (Eckers and Prudham, 2017). It intends
535 changes in the modes of regulation at the origin of new landscapes (especially xeriscapes through
536 the water conservation lifestyle) (Figure 8), in the ways water circulates in the city (e.g, through
537 upgraded water fixtures) and new social configurations: the turn towards more cooperation and
538 collaboration in a post-conflict context (Fleck, 2016). Other findings have therefore shown that
539 more than a political choice, water conservation is framed as a necessity to ensure the survival and
540 flourishing of desert cities (Poupeau *et al.*, 2018). Therefore, the idea is to make it a consensual
541 practice articulated around a win-win principle between environmentalists, water managers, and
542 developers. From a political ecology perspective, such a depoliticization of water issues is
543 questionable but can also be explained by a pragmatic strategy in the context of the increasingly
544 polarized political spectrum, a trend observed worldwide. In Arizona, as the region is still
545 culturally and politically attached to individual freedoms (Altheide et Johnson, 2011; Ross, 2011),
546 the social acceptance of water conservation must perhaps go first through this depoliticization
547 process of the ecological challenged of desert cities.

548

549 *4.3 Building consensus: from environmentalist fights to “unholy alliances”*

550

551 The quantitative textual analysis we conducted shows that water conservation belongs mainly
552 to the lexical world of administrative and technical water management. This result highlights how
553 the press is defining water conservation within an administrative rationalist framework. According
554 to Dryzek (1997), the environmental discourse of “administrative rationalism” offers to solve
555 problems through bureaucracies of experts and managers. He notes that administrative rationalism
556 has close similarities with the conservationist discourse that emerged in the U.S. in the late 19th
557 century and argued for the careful, rational management of natural resources (Hays, 1959; Brulle,
558 1996). Following this model, the administrative state is in charge of issuing water conservation
559 mandates (e.g., the Groundwater Management Act of 1980; the successive AMA management
560 plans), water managers are implementing specific water conservation measures (e.g., the water
561 conservation specialists at the municipal levels), and scientists and advocacy groups’ role is to
562 communicate the rationale on why water conservation is so important. This model is therefore far
563 from new and is implemented according to a top-down logic, strongly supervised by the
564 institutions. Thus, water conservation does not challenge power structures in place. In the contrary,
565 while environmental organizations have opposed large infrastructures and their management by
566 centralized and bureaucratic agencies, the press corpus shows that water conservation functions as

567 a compromise and allows a new cooperation movement between water managers and
568 environmental organizations. The strategy of water managers in Arizona has proven to be
569 successful worldwide, and some of the discursive tools developed are being mobilized in other
570 English-speaking drylands (e.g., in Australia, in South Africa) (Boyer *et al.*, 2020).

571 In our analysis, the text segments dealing specifically with water conservation are
572 characterized by the diversity of the actors mentioned. This diversity reflects that the
573 implementation of demand management follows a governance-based model (Brooks, 2006)
574 defined as a neutral, optimistic, managerial vision of collective action. Following Adger *et al.*
575 (2001), the administrative rationalist discourse seems also to join the typical “managerial
576 discourse” on the environment in that water conservation is depicted as a win-win solution for, on
577 the one hand, actors fighting for the health of ecosystems and, on the other hand, proponents of
578 economic growth. However, water managers and political decision-makers do not seem to
579 incorporate views of the environment that consider water as more than a material commodity vital
580 for economic growth. Water conservation is even accepted only insofar as it is not hostile to
581 Arizona’s growth (Sheridan, 2012; O’Neill *et al.*, 2018). This political alliance between water
582 managers, political decision-makers and environmentalists can therefore be seen as “unholy” or
583 “strange” (Swyngedouw *et al.*, 2002). For example, it is interesting to note that in the corpus, we
584 do not really find trace of any alternative propositions (e.g., controlling growth, massive turn
585 towards rainwater harvesting or greywater reuse, etc.): the press most often echoes the popular
586 detestation of restrictive water conservation measures (Hughes, 2012; Inskip and Attari, 2014);
587 the regulation of land use and the limitation of urban sprawl, requested by many since the 1970s
588 (Logan, 1995; Gober *et al.*, 2013) is not mentioned. Indeed, similar findings (Swyngedouw *et al.*,
589 2002) analyze this form of activism involved with dominant institutions as working only towards
590 social acceptability of top-down policies which contributes to closing down the emergence of
591 alternatives.

592

593 *4.4 Epilogue: in Arizona, despite water conservation, the water shortage has come*

594

595 Due to drought conditions that have lasted since the early 2000s, in Spring 2021, the level of Lake
596 Mead has reached 1070 ft., its lowest level in history. On August 16, 2021, the Federal Bureau of
597 Reclamation has announced the first ever water shortage on the Colorado River, which is 36% of
598 Arizona’s state water supply (USBR, 2021). Their hydrological model even predicts that the
599 reservoir level will drop below 1050 ft. by April 2023. By 2022, Arizona is expected to lose 20%
600 of its water supply. More recently, Arizona newspapers have been mentioning solutions
601 reactivating the paradigm of water supply management, such as an inter-basin transfer from the
602 Mississippi River. Such projects are indeed more newsworthy than the progressive effort to change
603 people’s habits. Our study could be completed to test the following hypothesis: in the event of a
604 crisis, the paradigm of water conservation - composed of a multitude of expedients whose
605 definition remains vague - is slowly put away as climate change and emergency justify the return
606 to large infrastructure projects (Crow-Miller *et al.*, 2017). Indeed, in various regions of the world,

607 recent analyses have shown the role of the climate discourse in the reframing of mega-projects
608 (Ahlers *et al.*, 2015 in Eastern Himalaya; Warner *et al.*, 2017 in Ecuador; O'Neill, 2020 in
609 California; Flaminio, 2021 in Australia).

610

611

612 **5. Conclusion**

613

614 Our results show that in the past 30 years water conservation has gained attention in the media, as
615 a drought management and water governance tool. Through the press, among other media – social
616 media are also particularly mobilized in the framing of water conservation (Boyer *et al.*, 2020) –
617 water conservation is defined as a successful and optimistic solution to fix the water scarcity issue,
618 exacerbated by the recurrence of droughts. Indeed, it functions as a consensual solution supported
619 by government actors that brings together different types of stakeholders who can work together
620 to sustain urban water security in a drier world. This consensus is made possible by the integration
621 of environmental issues into water conservation which is now widely considered as a “good” way
622 to address ecological issues in water management (Gleick, 2002; Savenjie and Van Der Zaag,
623 2002; Moglia *et al.*, 2018). As a result, this consensual version of water politics avoids rethinking
624 and reconsidering the power structures organizing water management, especially since this would
625 imply questioning a complex set of actors, devices, investments, and infrastructures that are
626 characterized by a certain inertia and path dependency. It proposes a weak sustainability model
627 that emphasizes the least economically and socially costly solutions: in particular, water
628 conservation focuses mainly on moderating water users demand and thus participates in the
629 individualization of responsibility in mitigating global environmental change impacts on society.
630 Thus, our study shows that the dominant discourse of water conservation does not propose a shift
631 in development paths in a manner that would foster greater resilience against climate change.
632 These results on water issues could also certainly apply to other topics related to global
633 environmental change, such as energy alternatives to reduce greenhouse gas emissions or changes
634 in agricultural practices to preserve biodiversity.

635

636

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1073 frequency. napolitano = Arizona Governor (2003-2009).

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Figure 8: Xeriscape Demonstration Garden in Glendale (Phoenix Metro Area) (Photo by first author, June 2018).

List of tables

Table 1: Cooccurrences of the lemma “conservation”. The co-frequency is the number of encounters that occur between the co-occurents and the occurrences of the query. The co-occurrence score is an indicator determining the probability of association. The mean distance indicates the physical distance between two words. For example, in the text, the word “reuse” is often more than 2.5 words away from the word “conservation”.