

## **Drought-related media analysis from Andalusia and São Paulo**

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### **ABSTRACT**

Drought risk is a complex phenomenon that leads to different interpretations, public understanding of causes, consequences and adaptation strategies and, therefore, different responses. To date, and despite the rise of social media, mass media are still the main way through which society receives information about drought, mainly owing to accessibility and periodicity. Media content analysis can be useful not only for identifying the relevant stakeholders in debates about definition and management but also for monitoring the evolution of key issues over time. This work presents a methodology to systematise drought-related media content analysis. The methodology has been tested in two widely different case studies: The Autonomous Community of Andalusia in Spain and the Metropolitan Area of São Paulo in Brazil, which were recently exposed to drought. Results show that the methodology is applicable to different settings, regardless of the number of media outlets and the news stories analysed. The paper incidentally also shows the resistance to the paradigm shift in terms of drought management measures, where in both cases traditional measures based on increasing water availability continue to predominate over the measures of risk planning and mitigation.

### **KEYWORDS**

Drought; media content analysis; methodology; Andalusia; São Paulo

#### **1. Introduction**

Research focused on understanding different perceptions of complex phenomena such as climate change and natural risk is well known, and it has become increasingly important in the recent literature (Brown et al., 2018; Dessai & Sims, 2010; Galway, 2019; Hamilton et al., 2018; Kichamu et al., 2018; Libarkin et al., 2018; Madrigano et al., 2018; Monirul et al., 2017; Xu et al., 2018). Several authors have argued for the value of qualitative and quantitative analysis, especially regarding discourse and contents, as a useful method to comprehend the way facts are understood and communicated by the different stakeholders in a given debate (Alonso et al., 2012; Cotton & Stevens, 2019; Flick, 2014). ‘Drought can be defined as a deficiency of precipitation from expected or “normal” that, when extended over a season or longer period of time, is insufficient to meet the demands of human activities’ (Wilhite, 1992, p. 81). However, drought as a risk (as discussed in this paper) refers to the effect that the decreased rainfall may have on the

available water resources trying to keep up with the demand (Vargas & Paneque, 2019). In particular, the complexity and uncertainty that are consubstantial to drought risk make this debate especially susceptible to the emergence of different perceptions, definitions and solutions (Sonnnett et al., 2006; Wilhite & Buchanan-Smith, 2005; Wilkins & Patterson, 1990). Drought risk is mainly analysed in terms of its socio-economic implications (impact, damage, loss). In this way, these natural and recurrent events may (or may not) lead to shortages in water supply. This largely depends on both the magnitude of the phenomena and the volume of demand, as well as of the water management and exploitation systems in place (Vargas & Paneque, 2017). Growing demand leads many exploitation systems to suffer from significant water imbalances, generating situations of water scarcity the origin of which (climatic or human) is difficult to establish (Van Loon et al., 2016). Furthermore, as pointed out by some authors, temporal and geographical limits of drought are diffuse and difficult to determine (Hisdal et al., 2004; Wilhite & Glantz, 1985, 2000; Wilhite et al., 2014). Consequently, the understanding of drought is not a simple process. Policies aimed at managing drought always trigger major controversies concerning the most appropriate measures and their scope, and how to account for damages. This often results in conflict between policy makers, managers, users and other stakeholders. When a period of drought occurs, the debate on the management of drought and water resources more broadly comes to the fore, and the perception and opinion of different stakeholders gain public prominence (Paneque & Vargas, 2015).

The study of public perceptions of drought can contribute to the successful implementation of drought adaptation strategies. An understanding of the public's sensitivity to and conceptualisation of causes, effects and solutions, has the potential to help define what can be done, who is going to do it, who will benefit from it, and how it will be evaluated. Much recent work revolves about the perception of drought risk, involving different disciplines and methodologies – e.g. interviews (Aldunce et al., 2017); questionnaires' and focus groups (Bryan et al., 2019); and mass media analysis (Paneque & Vargas, 2015; Pita, 1985).

The research presented in this paper focuses on media-content analysis. This analysis consists of applying various techniques to a document-based dataset with the aim of producing indicators – quantitative or qualitative – which allow for systematic inferences about the characteristics of the messages conveyed by said documents to be drawn. As pointed out by Cuvaradic (2002), media content analysis is open to different interpretive frameworks, understood as linguistically structured perspectives, from which social manifestations can be described and assessed. Regarding the use of the media, Wolf (1994) argues that: (i) the media remains the main channel of information used by the population to gather information in almost every field – including drought – despite the rise of social media, mainly due to accessibility and periodicity; (ii) the media has a direct effect in setting the public agenda, or the issues that are considered a priority for a particular society at a given time; (iii) the media influences the social representations of reality (e.g. with the recreation of certain stereotypes and social roles); and, (iv) the media can create 'public opinion', by disseminating certain opinions and by acting as one of the systems

used by individuals to gauge the opinion of the majority. That is ideas have been corroborated in subsequent works: Sonnett et al. (2006); Dotson et al. (2012); Kirilenko and Stepchenkova (2012); Schäfer et al. (2016); Church et al. (2020).

The proposed methodology has been tested in two different study cases: the Autonomous Community of Andalusia, in Spain, and the Metropolitan Area of São Paulo, in Brazil. Both regions were recently exposed to a drought episode (2015–2017 and 2014–2015, respectively) and are in contexts (Southern Europe and Latin America) for which climate change models predict an increase in the frequency and intensity of drought (IPCC, 2014). Therefore, facing drought will be a major challenge in both regions in the future. Contextual, social and political differences between both study cases help to test the methodology both at a local/urban scale (big city, in this case) and at a regional scale and also in cases where the majority uses are urban supply, and in which are agri- culture. Useful research on drought-related discourse through the media have already been carried out and used as a reference in both countries: Brazil (Checco, 2018; Colussi & Miguel, 2015; Millington, 2018) and Spain (Bayés et al., 2003; Paneque & Vargas, 2015; Pita, 1985; Ruíz Sinoga & Leon, 2010). However, no systematic methodology has been found to undertake this type of drought analysis, and this is the main objective of this research.

## **2. Methodology**

A systematic and both qualitative and quantitative methodology is proposed. This methodology is based on: (i) the setting of a series of questions to understand the keys issues of media discourse on drought (who, what, who says what), which will both feed and guide the detailed analysis; and, (ii) the use of a research protocol supported on the use of Computer-Aided Qualitative Data Analysis Software (CAQDAS) to complete the analysis, answer these questions and rise others.

### *2.1. Analytical questions: who, what, and who says what?*

We propose a methodology based on three main questions: (i) The first question aims to know who is taking part in the debate and who is not. The participation or not of certain stakeholders will also determine the presence or omission of certain issues and sensitivities in the media, which will impact public opinion. (ii) The second question is what is said. For this, we suggest to focus on the characterisation of drought risk (causes, consequences and the measures that are set forth to deal with it) to know which are the topics that dominate drought-related media debates. This question will allow us to know what issues are being focused on by the media and, therefore, what are the issues that reach the population; (iii) Finally, once we have identified stakeholders and key issues, the final step is to examine the relationship between them, that is, who says what.

#### **2.1.1. Analysis based on CAQDAS**

Drought is a phenomenon that stretches over time and which receives substantial media coverage. As a result, the analysis that we propose needs to deal with large volumes of information. We have relied on the use Computer-Aided Qualitative Data Analysis Software (CAQDAS). This type of software emerged within the framework of Glaser and Strauss's (1967) Grounded Theory, and it gives researchers a tool to undertake tasks that were previously carried out manually in a more efficient way. The software helps the interpreter by speeding up some of the processes involved in the analysis and qualitative interpretation of texts. Specifically, we used Atlas.ti 7.0 software, which offers a series of tools which expedite the process of qualitative analysis. This is a very useful tool for identifying character chains or data segments in a large variety of combinations, but the researcher must predefine the codification mode and the target data segments (Friese, 2012). When correctly used, Atlas.ti makes for a swifter and easier systematisation of data. Similarly, the framing of data and documents, which come in different formats into an integrated structure homogenises the information and increases the reliability of the results, especially in the conceptual stages of the analysis. Finally, the method facilitates the recording of the whole process, allowing for the target codes and concepts to be altered. This makes the procedure more transparent and more amenable to reliability tests (Friese, 2013). The work stages are presented in Figure 1.

The first step is to collect the data. The analysis was limited to drought-related news stories connected with urban water supply published by daily mass media. For each study case news stories related to drought and the urban water supply systems were selected. In São Paulo (Brazil), for the period 2013–2015, a total of 374 news stories were compiled. The media selected were the two main regional newspapers, *Folha de São Paulo* (thereafter *Folha*) and *O Estado de São Paulo* (thereafter *Estadão*).

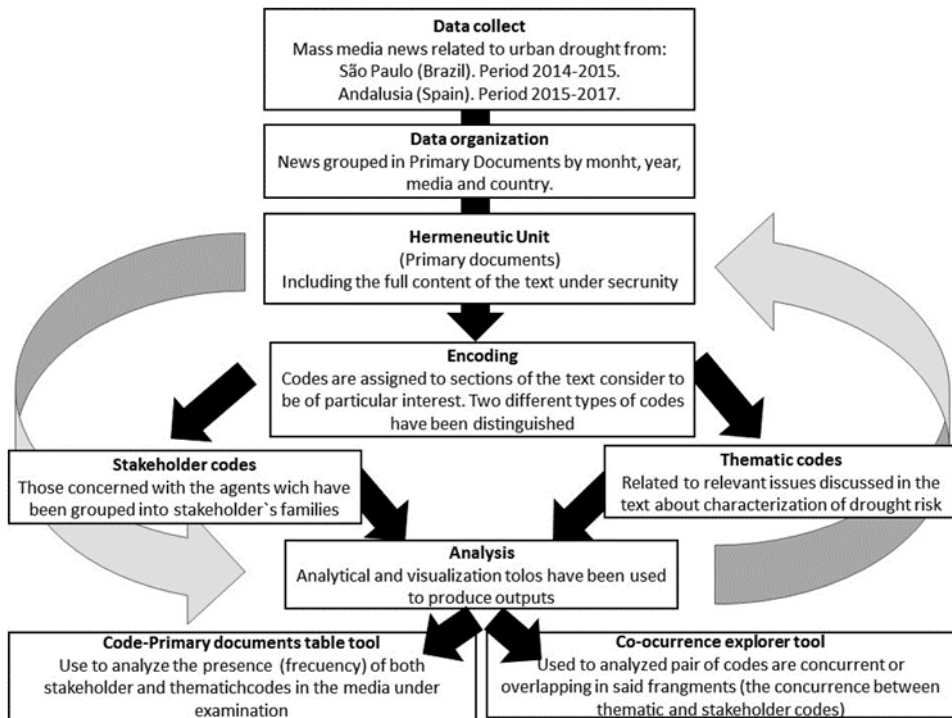


Figure 1. Work stages. Source: Author's own.

In Andalusia, a total of 149 news stories were compiled for the period 2015–2017. In this case, news items were filtered through the national and international media open access database iConoce. The media selected were El Correo de Andalucía, ABC Andalucía and the publishers Grupo Joly. In both cases, the media selected met two criteria: they are the most widely circulated media outlets, and they cover the whole regions under study (the state of São Paulo in Brazil and the Autonomous Community of Andalusia respectively). Owing to the high number of news stories collected, we organised them prior to their analysis into groups, according to country, media, year and month of publication. This resulted in one unified document with all the news stories published in the same month and year by each media outlet. These documents are referred to as 'Primary documents'. These were later ingrained into a 'Hermeneutic Unit' which is the intelligent 'container' which keeps a record of all data (Friese, 2012). Afterwards, we grouped different 'Primary documents' in different 'Primary documents Families': a family with all the primary documents pertaining to Sao Paolo news and a family with all the primary documents pertaining to Andalusia. The great advantage of grouping 'Primary documents' into 'Primary documents Families' is that they can be analysed separately and therefore make it easy to extract data, statistics and indicators for a specific section of the data.

This is followed by an encoding process, that is, the assigning of codes or labels to sections of text which are of interest. The generation of codes is a feedback-led process. We started from an initial list of codes and as the analysis progressed, these were modified and edited, including emergent issues (i.e. research and knowledge, clergy ...) and removing irrelevant ones for the analysis. Encoding is a crucial step because the results of the

subsequent analysis will depend on it. For the purpose of our analysis, we have made a distinction between two different types of codes: those connected with the stakeholders and the so-called 'thematic codes', which are related to relevant issues discussed in the texts. Family codes in Atlas.ti are groups of objects that present some common feature. These groups can be useful to organise the data as well to select and filter the components that meet certain characteristics in a quick and easy way (Friese, 2013). Atlas.ti contains multiple powerful, dedicated analytical tools which help to make sense of the data once it is coded. The most significant among these are: query tool,<sup>1</sup> super codes,<sup>2</sup> co-occurrence explorer,<sup>3</sup> code-primary document tables.<sup>4</sup> The following describes the tools used to answer each of the questions posed.

### 2.1.2. Stakeholder analysis

Analysis of the frequency with which stakeholders feature in the news stories, using the 'codes - Primary documents table tool', leading to frequency analysis on family codes. This yields the relative weight of each 'Stakeholder family', if any of them takes part in the debate or is focused on, and which of them are absent.

### 2.1.3. Analysis of key issues

This also made use of 'Codes-Primary documents table tool'. It allows for the identification of the most recurrent topics and also how each one of these major topics are characterised (causes, consequences, measures set forth to mitigate the situation). Owing to the high number of news stories dealing with technical matters, we decided to create a category of thematic codes called 'technical notes'. The intention of this analysis is to know which topics and messages are the most recurrent in drought-related news, and how drought risk is characterised in the media and presented to public opinion.

### 2.1.4. Relationship between stakeholders and key issues

In order to answer this question, we have used the co-occurrence explorer. Co-occurrence happens when two codes are either encoding the same quotation or part of that quotation. The aim of this is to detect the co-occurrence and overlapping of 'stakeholders codes' and 'thematic codes' in different items (in this case, text fragments). The co-occurrence explorer allows for the frequency of the co-occurrence between two codes to be quantified, that is, to calculate how often two codes co-occur. The concurrence index (C-coefficient-c), which indicates the strength of the relation between the two codes may have a value between 0 (codes do not co-occur) and 1 (these two codes co-occur in all cases). C-coefficient is calculated as follows:

$$c = \frac{n_{12}}{(n_1 + n_2)} - f$$

where  $n_{12}$  is the co-occurrence frequency of two codes  $c_1$  and  $c_2$ ;  $n_1$  is the occurrence frequency of  $c_1$ ;  $n_2$  is the occurrence frequency of  $c_2$ .

The aim of this step is to know how each stakeholder characterises drought risk in terms of causes consequences and measures.

### **3. Study cases**

#### **3.1. 2015–2017 drought episode in Andalusia (Spain)**

Andalusia is an Autonomous Community located in southern Spain. It comprises a total area of 87,597 km<sup>2</sup> (17.3% of the country's total) and had a population of 8,379,820 in 2018 (INE, 2018). Andalusian water management is articulated through six river basin districts: Guadalquivir River Basin (GRBD) and Segura River Basin (SRBD) are inter-community river basin districts, that is, they extend to more than one Autonomous Community and therefore they are under the management of the central government; Guadiana River Basin (GdRBD) is a trans-boundary river basin the management of which is shared between the Spanish central government and the Portuguese government, according to the terms signed in the Albufeira agreement. Finally, intra-community river basins districts, currently under the management of the Andalusian regional government are Cuencas Mediterráneas Andaluzas River Basin District (CMARBD), Guadalete–Barbate River Basin District (GBRBD) and Tinto–Odiel–Piedras River Basin District (TOPRBD) (Figure 2). Each of these River basin districts is divided into different exploitation systems which can be agricultural, urban or mixed, depending on the structure of water demand. However, the administration of urban water supply systems – which is the subject of analysis of this paper – falls to the local governments. Andalusia has 789 municipalities and most of them manage urban water supply through commonwealths or consortiums which comprise several municipalities. Regarding water use, agriculture accounts for 81.2% of water consumption in Andalusia, compared to the 15% and 3% used for urban and industrial purposes respectively. As such, the latest episodes of drought (1941–1945, 1979–1983, 1990–1995, 2005–2008 and 2015–2017) have chiefly affected the agricultural sector but also the urban and industrial sectors.

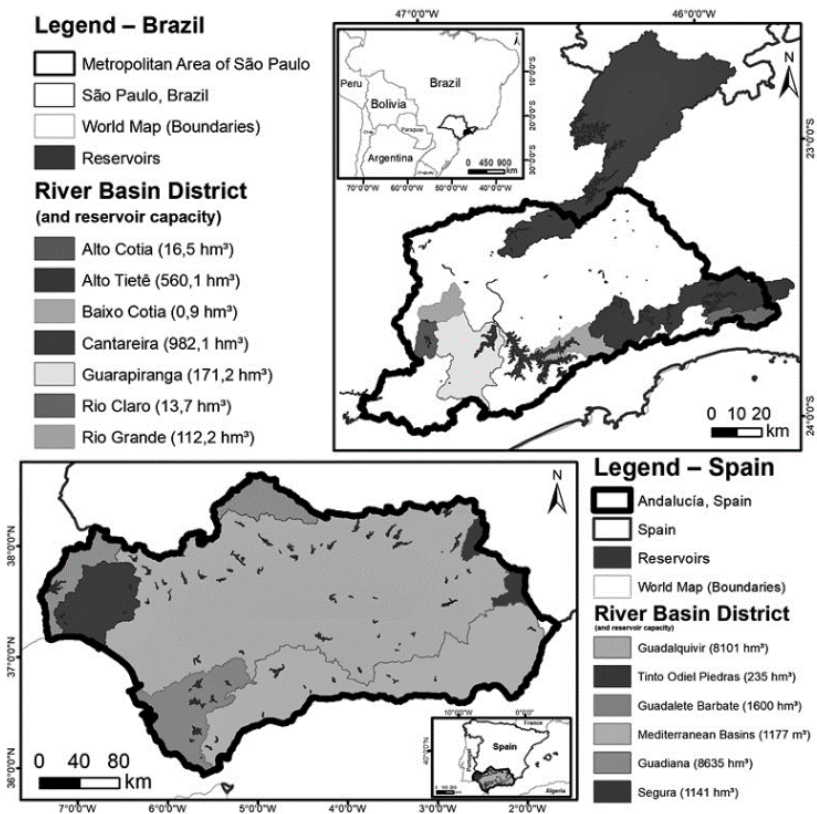


Figure 2. Study case's location. Source: Author's own.

During the period 2015–2017, annual precipitation in Andalusia was below the average of the series 1995–2017 in all three years. In 2015 and 2017, average precipitation in the whole of Andalusia barely reached half the annual average (Junta de Andalucía, 2018). This meteorological drought was not as long or severe as previous episodes (2004–2008) and its impact on water reserves was less pronounced. The minimum level reached by Andalusian water reservoirs was 46%, whereas in the previous drought episode they reached 30%. Rainfall during the early months of 2018 contributed to mitigate hydrological drought. Despite this, urban supply in many municipalities suffered frequent water shortages. This was especially the case with municipalities that are not connected with major supply systems, which have less robust urban supply networks.

### 3.2. 2013–2015 drought episode in the metropolitan area of São Paulo (MAPS)

The Metropolitan Area of São Paulo (MAPS) is the most populated metropolis in the southern hemisphere, and it plays a key role for the Brazilian economy. This region is located in south-eastern Brazil and comprises 39 municipalities, among them the city of São Paulo, which underwent intense urban development during the twentieth century, leading to the emergence of a large area with features of a megacity and an estimated population of more than 21 million (Brazilian Institute of Geography and Statistics, Instituto Nacional de Geografia e Estatística, IBGE, 2018). This resulted in the construction of a complex integrated metropolitan system for urban water supply, which

includes several dams and six major production and distribution systems, which allow for the storage of a large volume of water resources during the rainy season.

The Cantareira System stands out, for producing 33 thousand litres of water per second, enough to supply about half of the population (SABESP, 2018), and for its location, in the hydrographic basin of the Piracicaba, by the northern hydrographic boundary of the metropolis. The remaining systems are located in the watershed of the Alto Tietê – which according to Whately and Diniz (2009) is one of the hydrographic basins with a lower water allowance per capita in Brazil. As such, the urban supply of São Paulo is heavily reliant on the Cantareira System.

In São Paulo, rainfall variability is becoming the major source of risk, leading to an increasing emphasis on the frequency, duration and intensity of drought events (Obregón et al., 2014; Winsemius et al., 2018). Although the metropolis is especially vulnerable to heavy rains and floods, drought is also a problem with significant impact on residents, chiefly water shortages in urban supply, as during the last episode, which took place between 2013 and 2015 (Coelho et al., 2016; Milano et al., 2018). Specifically, low rainfall turned into hydrological drought nearly depleting the Cantareira System, which would have compromised the urban supply of the metropolis, as illustrated in the precipitation and stored water chart. The system was forced to use its technical reserves – the so-called Volume Morto ('dead volume') (Porto et al., 2014). This scenario, together with the uncertainties and difficulties of predicting rainfall in near-tropical regions, triggered a series of problems for the population in nearly all urban districts and cities in the metropolitan areas, such as water shortages and other associated phenomena.

#### **4. Analysis and results**

Figure 3 presents the number of news analysed in Brazil and in Andalusia.

In the metropolis of São Paulo, a total of 374 news stories involving drought and urban water supply systems were identified for the analysis. The monthly news distribution chart between 2013 and the late austral summer of 2015 reveals a considerable increase in news coverage over time, especially after February 2014, and a decrease after March 2015. In Andalusia, a total of 161 news stories related to drought and urban supply systems were identified and analysed; The analysis of the news stories published each year within the study period (2015–2017) reveals a noticeable increase in media coverage over time. A mere 5 news stories (3.3%) were published in 2015, while 36 (24.1%) were published in 2016 and 108 (72.5%) in 2017.

Differences between São Paulo and Andalusia may be explained by various factors: the drought episode undergone by São Paulo was one of the most severe in recent times, whereas in Andalusia the drought episode did not last long enough for it to have a similar kind of impact in the media. On the other hand, in São Paulo they are dealing with a single urban supply system, while in Andalusia several mixed exploitation systems, which serve both urban and agricultural needs, coexist.

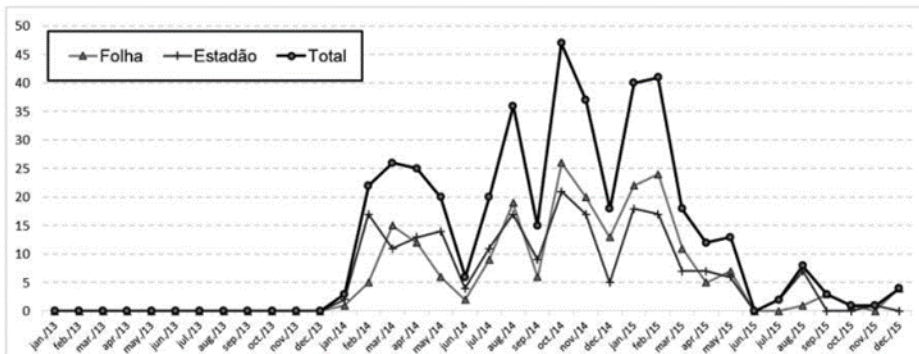
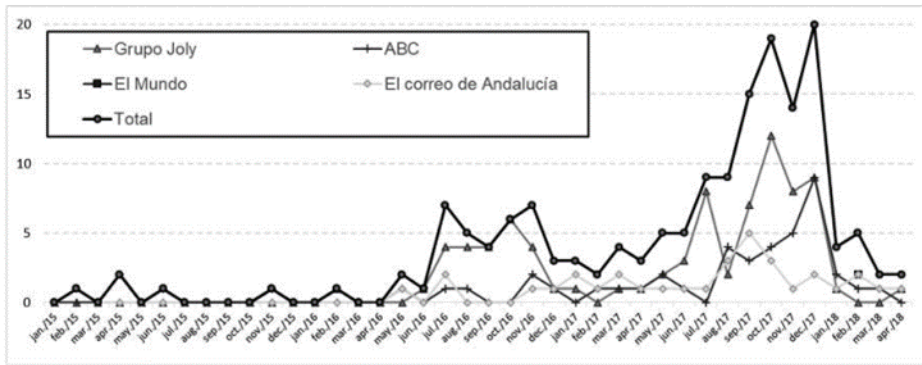


Figure 3. Number of news related to urban water supply systems in Andalusia (above) and São Paulo (bellow). Source: Author’s own.

Many of the newsstories published in Andalusia, therefore, had to do with agricultural uses of water, and they were excluded from the analysis. Despite these differences, similar patterns emerge, such as the increase in the frequency of news stories as the phenomenon progresses, and the virtual disappearance of them once rain resumes. This reveals the media approach to drought and highlights the fact that debates about the management of water resources coincide with times of hydrological stress, abating during ‘normal’ periods.

#### 4.1. Stakeholder analysis

Given the large number of news stories featuring stakeholders, it was considered pertinent to group news stories into ‘Stakeholder’s family codes’. Since the target of the analysis is urban water supply, we have excluded news stories which feature representatives of the agricultural sector insofar as they examine causes, consequences and measures with reference to their sector alone (Table 1).

This preliminary approach highlighted the absence from the media of some stakeholders which are in fact part of the debate: international organisations, agrarian organisations, industrial and business organisations, trade unions, etc. In contrast, the presence of the clergy is to be stressed. Figure 4 shows the number of appearances of each stakeholder family.

Table 1. Stakeholder codes in Andalusian news: family codes and primary codes within. Source: Author’s own.

Family code	Primary Codes (Andalusia)
Neighbourhood and consumer organisation	Consumer association
River basin administrations	Guadalquivir River Basin administration, Tinto-Odiel-Piedras administration, Guadalete-Barbate administration, Cuecas Mediterráneas Andaluzas River Basin administration
Environmental organisations	Ecologistas en acción, Fundación Nueva Cultura del Agua Urban water supply companies ACUAMED, GIASHA, EMASESA, ALJARAFESA, Consorcio de Aguas Plan Écija, Consorcio de Aguas Sierra Sur, AEOPAS, Aguas del Huesna
Experts	AEMET, Centro Meteorológico de Málaga, Universidad de Alicante, Universidad de Málaga, Foro Ingeniería para la excelencia, Observatorio para la sostenibilidad, Universidad de Sevilla
Central Government	Ministerio de Agricultura, Pesca, Alimentación y Medio Ambiente, Delegación de Gobierno en Córdoba, Comité de gestión de sequía
Regional Government	Área de gestión del dominio público hidráulico, Delegado de Gobierno de la Junta
Local Government	Gobierno local Sevilla, Gobierno local Málaga, Gobierno local Casariche, Gobierno
Journalist	Journalist
Political parties	Partido Popular (PP), Podemos, Partido Socialista Obrero Español (PSOE)

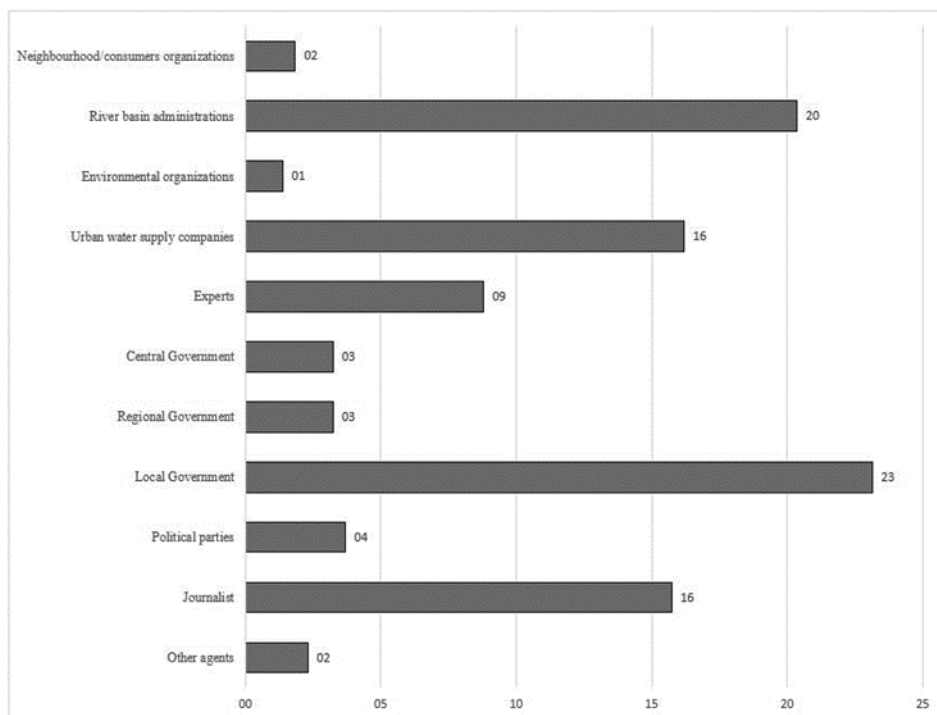


Figure 4.

Frequency with which 'Stakeholder's family codes' feature in news stories in Andalusia (%). Source: Author's own.

In the case of São Paulo the number of stakeholders was even higher than in Andalusia. As such, they were grouped into 12 'Stakeholder's family codes' as shown in Table 2.

In contrast to the Spanish case, it was necessary to include the 'Companies and Commercial Organisations' family code, aggregating the industrial and business organisations. The trade unions and religious organisations, although present in the newspaper news, did not play a significant role and were included in Other Agents. Figure 5 shows the frequency with which each stakeholder family features in the news stories published in São Paulo.

In both cases (Andalusia and São Paulo), water supply companies are very present in the media (18.2% in Andalusia and 23.5% in Brazil). In Andalusia, river basin management cadres and the local governments, which deal with urban supply, also have a strong media presence (20.4% and 23.1%, respectively). In São Paulo, it is the Regional Government that is most present in the media (25.1%). The main difference between both cases concerns users (1.9% in Andalusia and 9% in São Paulo) and editorial articles (15.7% in Andalusia and 6.5% in São Paulo). Of note is the scarce presence of environmental organisations (1.4% in Andalusia and 1.9% in São Paulo) and other agents with the ability to present a different view on causes, consequences and measures, and thus to enrich the debate.

#### 4.2. Analysis of key issues

To this analysis, we created four thematic family codes to cluster the main key issues: causes: when a stakeholder refers to the impact of drought; measures: when a stakeholder refers to measures to deal with drought; and finally technical notes: when a stakeholder refers to data to characterise the situation. This last cluster was created because we found that in many news stories stakeholders refer to some type of data (reservoirs, rainfall, indicators, etc.) but do not evaluate it. We used the same codes in both case studies. Family codes, primary codes and their descriptions are presented in Table 3

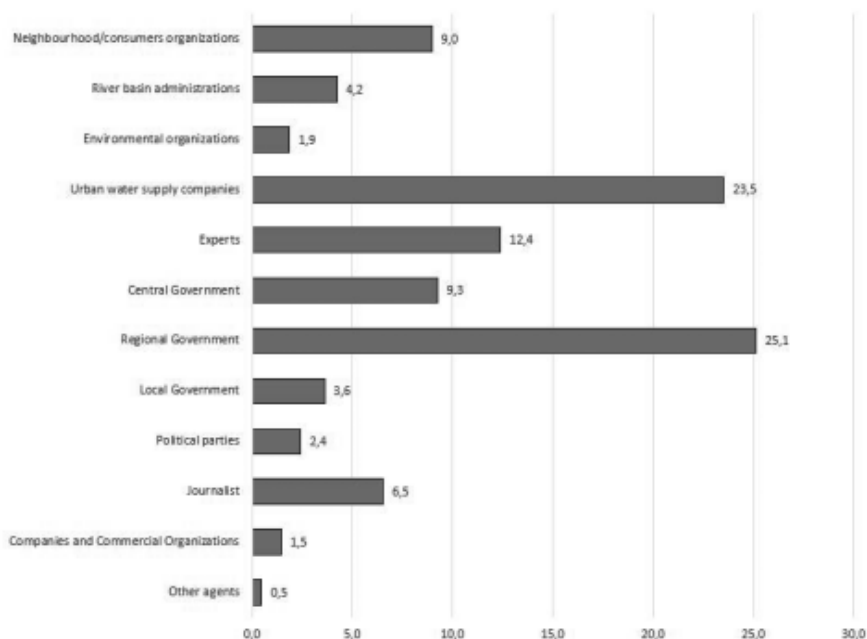


Figure 5. Frequency with which ‘Stakeholder’s family codes’ feature in the news stories published in São Paulo (%). Source: Author’s own.

Table 2. Stakeholder codes found in São Paulo’s news: family codes and primary codes within. Source: Author’s own.

Family code	Primary Codes (São Paulo)
Neighbourhood and consumer’s organisations	Comerciantes, Moradores, População, Síndico de condomínio, Condomínio, Líder comunitário
River basin administrations	Comitê de bacias, Consórcio das Bacias dos rios PCJ (Consórcio PCJ), Comitê

Anticrise, Comitê da Bacia Hidrográfica do Alto Tietê (CBH-AT), Comitês das Bacias Hidrográficas dos Rios Piracicaba, Capivari e Jundiá (Comitê PCJ)

Environmental organisations      Ambientalistas, Greenpeace, ONG Águas Claras, ONG Mão Cooperadora, ONG SOS

Mata Atlântica, ONG Aliança pela Água, Proteste, SOS Mata Atlântica, The Nature Conservancy, World Wildlife Fund (WWF)

Urban water supply companies      Companhia de Saneamento de Minas (Copasa), Empresa Metropolitana de Águas e

Energia (EMAE), Serviço Autônomo de Água e Esgoto (SAAE), SABESP, Sociedade de Abastecimento de Água e Saneamento (SANASA)

Experts

Associação Brasileira de Engenharia Sanitária do Estado de São Paulo (ABES), Centro Nacional de Monitoramento e Alertas de Desastres Naturais (Cemaden), Companhia Ambiental do Estado de São Paulo (CETESB), Conselho Mundial da Água, Climatempo, Datafolha, Especialistas, Centro Universitário FEI, Instituto Agrônomo de Campinas (IAC), Instituto Brasileiro de Defesa do Consumidor (IDEC), Instituto Federal de Educação, Ciência e Tecnologia de São Paulo (IFSP), Instituto Nacional de Meteorologia (INMET), Instituto Nacional de Pesquisas Espaciais (INPE), Instituto Socioambiental (IS), Mackenzie, National Aeronautics and Space Administration (NASA), Conselho Federal da Ordem dos Advogados do Brasil (OAB), Organização Meteorológica Mundial (OMM), Organização Mundial da Saúde (OMS), Organização das Nações Unidas (ONU), Pontifícia Universidade Católica (PUC), Somar Meteorologia, Stanford University, UFABC, UFMG, UFRGS, UFRJ, UFSCAR, UNESP, UNICAMP, UNIFESP, UNIMEP, Universidade

de Mogi das Cruzes, USP

Federal Government (Central)      Agência Nacional de Águas (ANA), Agência Nacional de Energia Elétrica (ANEEL),

Presidente (Dilma Rouseff), Governo Federal, Ministério do Meio Ambiente (MMA), Ministério Público Federal (MPF), Ministério da Agricultura, Ministério da Ciência e Tecnologia, Ministério da Integração Nacional, Operador Nacional do Sistema Elétrico (ONS), Superior Tribunal Federal (STF), Tribunal de Contas da União (TCU)

State Government (Regional)      Assembleia Legislativa do Estado de São Paulo (ALESP), Agência Reguladora de

Saneamento e Energia do Estado de São Paulo (ARSESP), Companhia Energética de São Paulo (CESP), Departamento de Águas e Energia Elétrica (DAEE), Departamento Estadual de Investigações Criminais

(DEIC), Governador (Geraldo Alckmin), Governo Estadual, Ministério Público Estadual (MPE), Polícia Militar de São Paulo (PM-SP), Secretaria de Saneamento e Recursos Hídricos do Estado de São Paulo, Secretaria da Educação, Secretaria da Saúde, Secretaria de Turismo, Secretaria do Meio Ambiente; Secretaria Estadual de Ambiente do Rio de Janeiro, Tribunal de Justiça do Estado de São Paulo (TJ-SP)

Local Government  
de Emergências

Câmara Municipal de São Paulo, Centro de Gerenciamento

Climáticas - São Paulo (CGE), Defesa Civil, Prefeito (Fernando Haddad), Governo Municipal, Secretaria de Educação, Secretaria de Saúde

Journalist

Journalist

Political parties

Democratas (DEM), Partido Humanista da Solidariedade (PHS), Partido do Movimento Democrático Brasileiro (PMDB), Partido Progressista (PP), Partido Social Democrático (PSD), Partido da Social Democracia Brasileira (PSDB), Partido Socialismo e Liberdade (PSOL), Partido dos Trabalhadores (PT), Partido Verde (PV),

Companies and  
Commercial  
Organisations

Associação Brasileira de Indústria Têxtil e de Confecção (ABITC), Associação Comercial de São Paulo (AC-SP), Associação Paulista de Empresas de Consultoria e Serviços em Saneamento e Meio Ambiente (APECS), Robert Bosch GmbH (BOSCH), Centro das Indústrias do Estado de São Paulo (Ciesp), Commins, Empresários, Federação das Indústrias do Estado de São Paulo (FIESP), General Motors, Honda, Hyundai, Moody's, Nova Operan, Rhodia, Servmar, Scotiabank, Tecsonda, Toyota, União da Indústria de Cana de Açúcar (UNICA).

Other agents                      Comissão Pastoral da Terra (CPT-CNBB), Sindicato do Setor Imobiliário (SECOVI-SP), Sindicato que representa os postos de combustíveis do Estado de São Paulo (SINCOPESTRO), Sindicato dos Trabalhadores em Água, Esgoto e Meio Ambiente de São Paulo (SINTAEMA)

A preliminary analysis of the frequency in which each one of the ‘Thematic code families’ (or key issues) appears is presented in Figure 6 (Andalusia) and Figure 7 (São Paulo).

Family code	Primary codes	Description
Causes pointing to	Natural causes	A stakeholder refers to the causes of drought and its effects natural causes, such as decreasing rainfall, increasing temperatures, evapotranspiration, the catastrophic power of nature, etc
	Management failures	A stakeholder refers to the causes of drought and its effects pointing to causes management failures, be it insufficient infrastructure, poor planning, lack of awareness, lack of investment, etc
	Other type of causes	Other type of causes
Consequences	Social	A stakeholder refers to the impossibility of meeting demands, demanding restrictions on water use
	Economic	A stakeholder refers to economic losses due to drought
	Environmental	A stakeholder refers to environmental damage due to drought
	Other type of consequences	A stakeholder refers to other kind of consequence
Measures alternative emergency	Tank trucks	A stakeholder refers to tank trucks or other kind of supply system
	Drought planning	A stakeholder refers to drought planning as a tool to deal with drought
	Economic penalties	A stakeholder refers to the need to strengthen administrative sanctions for the misuse of water during drought
	Awareness and watersaving	A stakeholder refers to drought awareness and the need to save water as a solution to deal with drought
	Emergency laws	A stakeholder refers to emergency laws to face drought
	Infrastructures	A stakeholder refers to the need of new infrastructures to increase water supply (e.g. reservoirs, transfers, desalination plants)
	Research and Knowledge	A stakeholder refers to the need to improve drought- and water supply-related research to prevent and mitigate the impact of drought
	Normative changes	A stakeholder refers to the need to introduce changes in

		water and drought management policies
	Efficiency improvements	A stakeholder refers to improvements on water efficiency as a solution to drought
	New water wells	A stakeholder refers to the opening of new water wells as a solution to drought,
	Urban water supply restriction	A stakeholder refers to water supply restrictions for some uses in order to save water (as a measure, not as a consequence or impact)
	Water reuse	A stakeholder refers to reusing water in some circumstances as a solution to drought
Technical notes	Other kind of measures of solution to drought	A stakeholder refers to other kind of rainfall levels
	Precipitation	A stakeholder refers to
	Reservoirs drought	A stakeholder refers to reservoir levels to characterise drought

Drought indicators and scenarios

Other type of technical notes A stakeholder refers to drought indicators or scenarios derived from drought planning A stakeholder refers to other items to characterise drought

Table 3. Thematic codes: Family codes, primary codes and description. Source: Author's own.

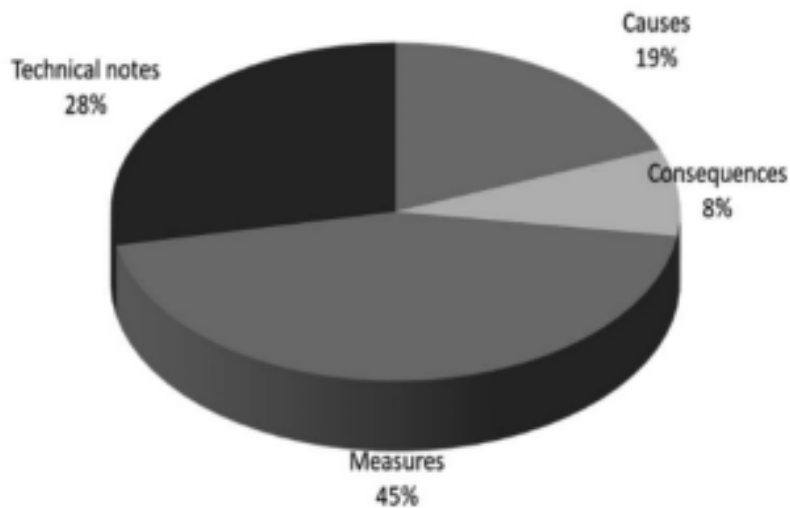


Figure 6. Frequency with which 'Thematic's family codes' feature in drought- and urban water supply system-related news stories in Andalusia. Source: author's own.

As Figure 6 illustrates, most of the news stories (45%) refer to measures being proposed to address drought; in second place, 28% of the news stories analysed include technical notes, while 19% of them deal with the causes behind drought; finally, only 8% refer to impacts or consequences.

Figure 7 illustrates the low frequency values reached by technical notes (4%) in relation to the whole dataset, which is revealing of the nature of Brazilian newspapers. The news which assesses the causes of drought (16%) were published mainly at the early stages of the historical series, while mentions to consequences (29%), being more frequent throughout, become especially so towards the end of the series. However, the most prominent item concerned measures adopted to deal with the drought (51%), accounting for over half of the total index.

The detailed frequency results within each 'Thematic family code' are detailed in Figure 8 (Andalusia) and Figure 9 (São Paulo).

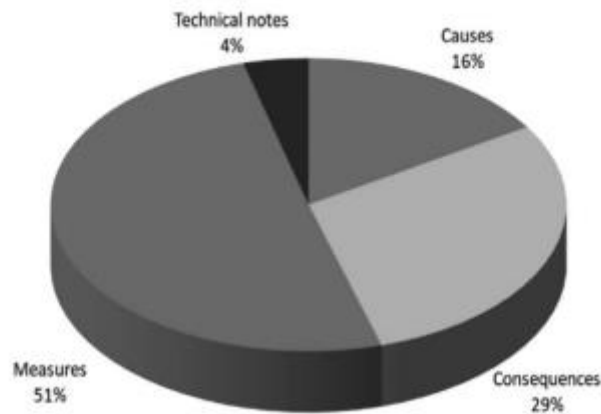


Figure 7. Frequency with which 'Thematic's family codes' featured in drought- and urban water supply system-related news stories published in the São Paulo region. Source: author's own.

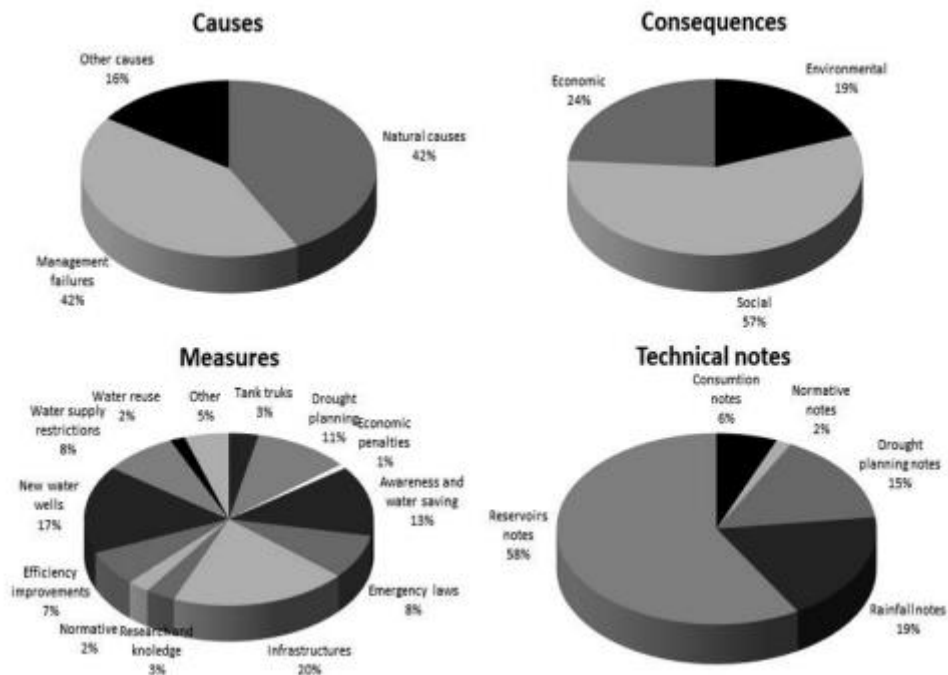


Figure 8. Frequency with which thematic primary codes feature within each Thematic family code (causes, consequences, measures and technical notes) in drought- and urban water supply systems-related news stories published in Andalusia. Source: author's own.

Regarding causes, there is an equal number of news stories about natural causes and management failures (42%). 'Natural causes' refer to low rainfall and high temperatures as only causes of drought and of its potential impacts. 'Management failures' refer to man-made choices that increase the risk of drought, chiefly poorly maintained and underinvested urban water supply infrastructures. Weak drought planning and preparedness is also often highlighted among management failures, as is poor water management, mainly owing to overuse by agriculturalists. Other causes (16%) include climate change and the expected increase in the frequency and severity of drought episodes as a result (IPPC, 2014).

Concerning consequences, most news stories deal with 'Social consequences' (57%), mainly the lack of resources to meet the urban demand and, therefore, restrictions in supply. Also related to supply restrictions are references to 'Economic consequences' (24%) for businesses and industries supplied by the same distribution networks. 'Environmental consequences' feature in 19% of news stories within this family. This news stories refer to the deterioration of groundwater quality because of decreasing rainfall and underground infiltration. The number of references to environmental consequences can be regarded as insignificant.

Measures is the most recurrent 'Thematic family code' in the news analysed. Within this family, most of the news (20%) refer to the need to build new infrastructures (reservoirs, desalination plants and new inter-river basin water transfers). Opening 'New water wells' (17%) is also a common topic.

Regarding 'Technical notes', most of the news refer to reservoirs (58%) or rainfall levels (19%) to characterise drought episodes, while 15% of the news stories make reference to drought planning indicators, index thresholds and scenarios, and 6% are technical notes on the evolution of urban water consumption.

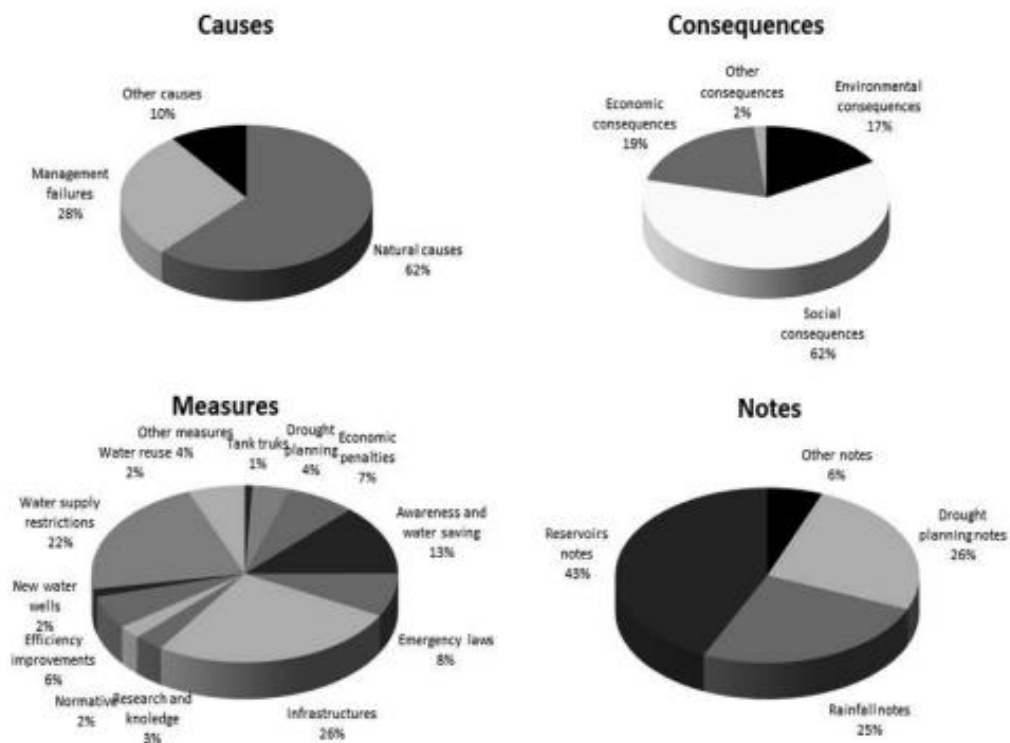


Figure 9. Frequency with which thematic primary codes feature within each Thematic family code (causes, consequences, measures and technical notes) in drought- and urban water supply systems-related news stories published in São Paulo. Source: author's own.

The family code assigned to the causes of drought is dominated by news stories in which a stakeholder explains the phenomenon on account of 'Natural causes' (62%); especially common are quotations that blame drought (the most severe episode in recent decades) to low rainfall. 'Management failures' (28%) also features in a relatively high number of news stories, often to argue for the lack of planning of water supply companies, especially because the region has a wet tropical climate and there is almost always plenty of water, but poor management of water resources increases the risk of drought. 'Other Causes' features in barely 10% of news stories. Consequences were largely assigned to thematic primary code 'Social consequences' (62%), which generally reported shortcomings in urban water supply, i.e. water restrictions caused by low pressure on the water supply pumps, which are under the control of water companies. In addition, 'Economic consequences' (19%) and 'Environmental consequences' (17%) feature in a very similar number of news stories; Measures is also in São Paulo the most recurrent 'Thematic Family Code Among these, 'Infrastructures' (26%) and 'Water supply restrictions' (22%) were the most common, highlighting the construction works demanded by drought and requesting measures to restrict water supply in favour of the city's inhabitants.

To summarise, while the Andalusian media blame the situation on both natural causes and poor management (42% in both cases), in São Paulo natural causes are blamed in 62% of cases, and only 28% of news stories mention bad management as a cause. Concerning consequences, social consequences are clearly predominant (57% in Andalusia and 62% in São Paulo), chiefly concerning drinking water supply restrictions, followed by economic consequences (28% in Andalusia and 19% in São Paulo). We must also point out that the media coverage of environmental consequences is significant in both settings (19% in Andalusia and 17% in Sao Paolo), mostly in connection with water quality, but also with the negative impact of drought in some ecosystems. This stands in sharp contrast with the scarce media presence of ecologist organisations. On the other hand, measures are the most recurrent topic in both cases (45% in Andalusia and 51% in São Paulo), including measures to increase water supply, especially through the construction of new infrastructures (20% in Andalusia and 26% in São Paulo). In Andalusia, in addition, there is some mention of the need for appropriate drought planning (11%), in pursuance of the guidelines set out by the (largely unheeded) Hydrological Plan Act of 2001 (art. 27), which demands the preparation of drought management plans in each river basin and urban water supply system.

#### 4.3. Who says what? Relationship between stakeholders and key issues

Table 4 illustrates the results of co-occurrence analysis between 'Stakeholder's family codes' and 'Thematic codes', according to the co-occurrence explorer in Andalusia. The columns show the C-index, which indicates the strength of the relationship between

the two codes. Significant co-occurrences, which are those in which  $F \geq 8$  (both codes co-occur in at least 5% of quotations) and  $C\text{-index} \geq 0.1$ , are shaded in grey. This rule allows us to focus the analysis only on recurrent co-occurrences and thus outline the hegemonic messages. 'River basin administration' and 'Urban water supply companies' co-occur most strongly with 'Measures' (0.15; 0.17) and 'Technical notes' (0.21; 0.1); 'Experts' do so with 'Technical notes' (0.12); 'Local Government' with 'Causes' (0.13) and 'Measures' (0.39); and, finally, 'Journalists' with 'Causes' (0.15) and 'Technical notes' (0.27).

Regarding the causes of drought, 'Local Government' and 'Journalists' present significant co-occurrences. However, while 'Journalists' co-occur with 'Natural causes' (0.19), that is, with the decrease in rainfall as a factor that increases the risk of drought, 'Local Government' co-occurs

with 'Management failures' (0.11), mainly in connection with poorly maintained and underinvested urban water supply infrastructures.

'River basin administrations' co-occur with measures related to 'Drought planning' (0.13) and the enactment of 'Emergency laws' (0.14). 'Local Government' yields high co-occurrence values with 'Infrastructures' (0.12), 'New water wells' (0.23) and 'Water supply restrictions' (0.14). 'Political parties' do not present high co-occurrence values with measures in general; they do so with a specific measure: 'Infrastructures' (0.28). Concerning 'Urban water supply systems', despite presenting high co-occurrence values with 'Measures' in general, they yield no high co-occurrence values with any of them in particular. Finally, regarding technical notes, 'River basin administration' presents high co-occurrence values with 'Drought planning technical notes' (0.18), that is, they refer to drought conditions according to the objective criteria (indices, indicators, thresholds and scenarios) set forth in prevailing drought plans. In addition, they present a high co-occurrence

Table 4. Co-occurrence table between 'Stakeholder's family codes' and 'Thematic codes' in the news published in Andalusia. Source: author's own.

	1	2	3	4	5	6	7	8	9	10
Causes	0.02	0.02	0.02	0.09	0.11	0.02	0.13	0.02	0.06	0.15
Consequences	0.1	0.02	0	0	0	0	0	0.1	0.04	0.08
Measures	0.02	0.15	0.02	0.17	0.05	0.03	0.32	0.03	0.06	0.01
Technical notes	0	0.21	0.02	0.1	0.12	0.04	0	0.03	0	0.27
Causes										
Natural causes	0	0.02	0	0.04	0.05	0.04	0.06	0	0.03	0.19
Management failures	0.04	0.02	0.04	0.08	0.05	0	0.11	0.04	0.03	0.04
Other causes	0	0	0	0.05	0.13	0	0.02	0	0.07	0
Consequences										
Environmental	0	0	0	0	0	0	0	0.1	0	0.03
Social	0.07	0	0	0	0	0	0.09	0	0	0.07
Economical	0.13	0	0	0	0	0	0.02	0	0	0
Measures										
Tank trucks	0	0	0	0	0	0	0.06	0	0	0.03
Drought planning	0	0.13	0	0.07	0.07	0	0.03	0	0	0
Economic penalties	0	0	0	0	0	0	0.02	0	0	0

Awareness and water savings	0.06	0	0	0.11	0.06	0	0.07	0		
0	0									
Emergence Laws	0	0.14	0	0	0	0.13	0	0	0.06	
0										
Infrastructures	0.04	0.09	0.04	0.09	0.02	0	0.12	0.03	0.28	0.02
Research and knowledge	0	0	0.17	0.03	0.05	0	0	0	0.1	
0	0									
Normative	0	0.02	0	0	0.05	0.11	0	0	0	0
Efficiency improvements	0	0	0	0.1	0	0	0	0.05	0	
0	0									
New water wells	0	0.04	0	0.06	0	0	0.23	0	0	
0										
Water supply restrictions	0	0	0	0.02	0	0	0.14	0		
0	0									
Water reuse	0	0	0	0	0	0	0.11	0	0	
Other measures	0	0	0	0.02	0	0	0.02	0	0	
0										
Technical notes										
Consumption	0	0	0	0.11	0	0	0	0	0	0
Normative	0	0	0	0	0	0	0	0	0	0.03
Drought planning	0	0.11	0	0	0.04	0.06	0	0	0	0
0.07										
Rainfall	0	0.02	0.07	0	0.29	0	0	0	0.07	
Reservoirs	0	0.18	0	0.07	0.02	0.07	0	0.05	0	0.24

Notes: 1. Neighbourhood/consumers' organisation; 2. River basin administrations; 3. Environmental organisations;

4. Urban water supply companies; 5. Experts; 6. Central Government; 7. Local Government; 8. Regional Government;

9. Political parties; 10. Journalists.

value with 'Reservoirs level technical notes' (0.18). Also of note are the co-occurrence between 'Experts' and 'Rainfall level technical notes' (0.29), largely owing to due to the frequent mention of AEMET, and the high co-occurrence value of the relationship between 'Journalists' and 'Reservoir level technical notes' (0.24).

Table 5 illustrates the results of co-occurrence explorer tool between 'Stakeholder's family codes' and 'Thematic codes' in São Paulo.

The general analysis of code family 'Cause' yields high co-occurrence values between causes of drought and 'Journalists' (0.12), 'State Government (Regional)' (0.13) and, especially, 'Expert' (0.17). Regarding consequences, the relationship with codes 'State Government (Regional)' (0.11), 'Expert' (0.15) and 'Urban water supply companies' (0.19) yields high values, while the values presented by its relationship with 'Neighbourhood or consumers' organisations' is especially high (0.39). The measures taken during the episode were strongly related to 'State Government (Regional)' (0.49) and to 'Urban water supply companies' (0.38). Also concerning measures 'Central Government' (0.18) and 'Expert' (0.15) presented significant co-occurrence values. 'Technical Notes' were significantly related to 'Journalists' (0.19).

Table 5. Co-occurrence table between 'Stakeholder's family codes' and 'Thematic codes' in the news published in São Paulo's news.

	1	2	3	4	5	6	7	8	9	10	11
Causes	0.04 0.01	0.09	0.02	0.16	0.17	0.05	0.02	0.13	0.02	0.12	0.03
Consequences	0.39 0.04	0.03 0.01	0.02	0.19	0.15	0.05	0.05	0.11	0.03	0.09	
Measures	0.02 0.01	0.06 0.01	0.02	0.38	0.15	0.18	0.06	0.49	0.04	0.02	
Technical notes	0 0	0.03 0	0	0.03	0.05	0.01	0.02	0.02	0	0.19	
Causes											
Natural causes	0.02 0.02	0.05 0	0	0.12	0.12	0.04	0.01	0.1	0.01	0.11	
Management failures	0.06 0.06	0.04 0	0.02	0.11	0.04	0.02	0.09	0.03	0.03	0.03	0.03
Other causes	0 0	0.03 0.08	0	0.04	0.06	0.01	0	0.01	0.02	0	0.01
Consequences											
Environmental	0 0	0.06 0	0.05	0.05	0.03	0.16	0.02	0.04	0.02	0.01	0.05
Social	0.42 0	0.02	0.01	0.18	0.07	0.04	0.05	0.08	0.02	0.07	0
Economical	0.16 0.16	0.13 0.07	0.02	0.03	0.04	0.04	0.03	0.01	0.04	0.04	0.04
Other	0 0	0	0	0.01	0	0.02	0	0.01	0.05	0.01	0



Reservoirs	0	0.04	0	0.02	0.01	0.01	0.03	0.01	0	0.08
	0	0								

Notes: 1. Neighbourhood/consumers' organisations; 2. River basin administration; 3. Environmental Organisations; 4. Urban water supply companies; 5. Experts; 6. Central Government; 7. Local Government; 8. Regional Government; 9. Political parties; 10. Journalist; 11. Comp. and Com. Organisations; 12. Other agents.

Concerning the causes behind the drought episode at hand, significant co-occurrence values exist with stakeholder codes 'Urban water supply companies' (0.12) and 'State Government (Regional)' (0.10), who were the main proponents of the thesis that the phenomenon had mainly natural causes, some- times with broad media support ('Journalist' – 0.11) and also the occasional support of an 'Expert' (0.12). However, the 'River basin administrations' (0.11), which do not always fall in line with the state government of São Paulo, and which is more concerned with environmental issues, tended to highlight management failures and poor planning, sometimes also with the support of experts, presenting a co-occurrence value of 0.90. Other causes did not show high co-occurrence values with any family code. Thematic codes involving measures yielded several relatively high co-occurrence values, including with 'Awareness and water savings', 'Urban water supply companies' (0.12) and 'State Government (Regional)' (0.11). This highlights the legitimacy of both social actors to demand a reduction in public water consumption, especially considering that they are mainly responsible for managing water resources in the study area. In relation to this, 'State Government (Regional)' and 'Infrastructure' also yielded a high co-occurrence value (0.23) for the duration of the drought. 'Emergency Laws' (measures) and 'Federal Government (Central)' presented the highest co-occurrence value (0.16) which is a reflec- tion of the Brazilian political system based on a centralised legislature. As a result, 'Water supply restrictions' presented a relatively high co-occurrence value with three stake- holder's family codes: 'Urban water supply companies' (0.17), 'State Government (Regional)' (0.16) and 'Federal Government' (0.13), that is, management institutions which insisted on explaining drought mainly with reference to natural causes and which adopted measures to restrict to the population's water supply in São Paulo; in the media, this resulted in several reports concerning shortcomings in domestic water supply during what became known as the 2014–2015 water crisis. Regarding 'Technical Notes', no high co-occurrence values were recorded.

Concerning topics (Thematic family codes), there is a substantial difference in the fre- quency of technical notes (28% in Andalusia and 4% in Sao Paolo). In Andalusia, technical notes predominantly deal with reservoir levels (58%), which are chiefly related to resource management, rather than with precipitation levels, especially during the early stages of drought episodes. However, these news simply report on reservoir levels, without framing these data in their spatial and chronological context. Without this contextual information, it is difficult for the citizen to interpret these data correctly and can trigger social alarm even when the situation does not warrant it.

## 5. Conclusions

The way a problem is perceived and interpreted determines the way it is approached. Natural risks are, by their very nature, always an event in the future. As such, natural risk planning involves dealing with a problem that does not yet exist. This introduces an important factor of uncertainty, which introduce perceptions and interpretive frame- works into the calculation. For

this reason, media content analysis allows us to analyse and understand the different interpretive frameworks at play in a given complex debate, for example about drought and can contribute to designing successful adaptation strategies.

Specifically, the identification and analysis of hegemonic discourses, which capture the most media attention, helps to understand drought management policies as well as to present it to public opinion effectively. Ultimately, social endorsement or rejection of a certain set of measures largely depends on how hegemonic discourses are constructed, developed and presented to public opinion. Hegemonic discourses are those which have the longest reach beyond their generators and, as a result, those which receive the most media attention, shaping policy and proposing solutions. In fact, as demonstrated by Feitelson (2002), Metha (2005), discourses can be constructed and deployed to shape public understanding of water management-related issues, opening political solutions and pointing towards the most appropriate policies.

Challenges for content analysis as a method for assessing climate change and hazards arise from the lack of comparability of the various studies that exist (Metag, 2018). The results of this work show that the proposed methodology is a valuable tool for drought-related media content analysis. Despite the contextual differences (climatic, social and political), and those that are inherent to the media under analysis, the target has been met: to understand the different interpretive frameworks at play in the media. Therefore, the methodology allows us to systematise drought-related media

content analysis, creating the opportunity to compare the approach to drought in different regions, and also the evolution of interpretive frameworks over time.

Results help to understand the barriers to modifications in water and drought management and drought, especially in Sao Paulo where the causality of drought continues to be attributed largely to natural causes (62%). Along the same lines, the paper shows the resistance to the paradigm shift in terms of drought management measures, where in both cases the measures of increasing water availability continue to predominate over the measures of risk planning and mitigation.

This paper also reinforces the importance of mass media for content analysis on hazards and especially on droughts. In the context of the boom of social media, mass media keeps on providing coverage and follow-up on these types of events when they appear and progress. It provides the necessary spaces in which narratives are most clearly developed and continues to have an important political influence. This type of work can be completed with a more specific analysis of information from social media.

## Notes

1. Query tool allows the researcher to formulate search requests that are based on combinations of codes using one or a combination of different operators, Boolean, semantic and proximity operators (Friese, 2013).
2. A Super Code differs from a standard code. A standard code is directly linked with the quotations to which it is associated, while a Super Code is a stored query, thus provides an

answer to a question (in the best case) that typically consists of several combined codes (Friese, 2013).

3. The Co-occurrence explorer provides frequency of co-occurrence and a coefficient measuring the strength of the relation is calculated. (Friese, 2013).

4. The Codes-Primary-Document Table contains the frequency of codes across documents. Aggregated counts based on code and primary document families are also available (Friese, 2013).

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